

# DAMPER ACTUATORS

SPRING RETURN, ELECTRONIC FAIL-SAFE,  
FIRE & SMOKE AND NON-SPRING RETURN ACTUATORS

- Extensive torque offering (18 in-lb to 360 in-lb), a vast selection of actuators for a wide range of applications.
- Low power consumption provides higher efficiency and smaller transformer sizing.
- Minimum torque guaranteed over entire specified operating range, no loss in performance due to temperature or supply voltage.
- MFT is available giving the user the flexibility to customize and adapt a single actuator to various controllers and applications.
- Fail-safe position can be set 0-100% in 10% increments manually or by using the PC Tool offering a wide range of fail-safe positions (only available on Electronic Fail-Safe actuators).
- Belimo FS Actuators are UL555 and UL555S listed with U.S. damper manufacturers.

## Applications

Belimo actuators are designed for use in a wide variety of HVAC damper applications. For active smoke control systems, Belimo introduced the proportional FSAF24-SR for stairwell, under-floor and other pressurization applications. With our comprehensive torque range, vast selection, and the ability to direct mount or mount on standard damper shafts or jackshafts, solutions are available for fire and smoke actuator dampers, control dampers, air handlers, economizer units, VAV terminal units, fan coil units, fan shutters, and unit ventilators.



# Retrofit Applications

Replace virtually any non-direct coupled actuator with a high quality solution from Belimo.

- Solve any application - Widest range of mounting brackets and accessories
- Reduce installation cost – By resizing the damper you can select from many Belimo series of actuator types and torque ranges 18 to 360 in-lb.

**K4-2 US**  
Standard for AF, AM and NM series actuators

- Eases installation – Only two nuts to tighten
- Increased flexibility – 1/2" to 1.05" capacity  
Centered on: 1/2", 3/4" and 1.05" shafts
- Reduced cost - No need to purchase separate accessories

**K4-1) Clamp** with ZDB Angle of Rotation Limiter

**IND-AF2 US** Position Indicator (optional)

**ZG-DC2** Damper Clip

**ZG-DC1** Damper Clip

**ZG-100** Universal Mounting Bracket

**ZG-108** Universal Mounting Bracket

**ZG-110** Mounting Bracket

**ZG-106**

**ZG-107**

**ZG-108**

**ZS-150** Weather Shield

**ZS-100** Weather Shield

**ZS-260** Explosion Housing

**NEMA 4X** Housings

**ZS-260** Explosion Proof Housing

**ZG-102** Multiple Actuator Mounting Bracket

**ZG-AF US** Crankarm Adaptor Kit

**KH8** Universal Crankarm with KG8 Balljoint

**KG-8** 90° Ball Joint

**KH-AF** Crankarm

**ZG-106/ZG-107** Mounting Bracket

**OTHER HOUSINGS**

AF... ZG-106

AF... ZG-107

AF... ZG-108

AF... ZG-108

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## Why Choose Belimo?

# A CLOSER LOOK...

### DAMPER ACTUATORS

- Extensive product range.
- Specific retrofit offerings.
- Small dimensions in relation to torque.
- Microprocessor-controlled brushless DC motor increases actuator life span and reliability & provides constant running time (most actuators).
- Cut labor costs with simple direct coupling.
- Check damper position easily with clear position indication.
- Overload-proof throughout rotation.
- Temporary restrictions in damper movement will not change actuator operation. Actuator returns to normal operation when restriction is remove.
- Built-in or add-on mechanical stops to adjust angle of rotation.
- Built-in auxiliary switch is easy to use, offers feedback or signal for additional device (-S models).
- Need to change control direction?  
Do it easily with a simple switch on actuator housing.

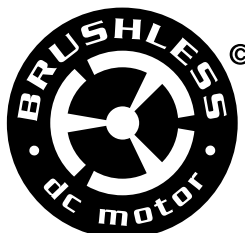
- Rugged housings withstand rough handling in the mechanical room.
- Double insulated – no need for separate ground. A Belimo exclusive (on 120/230V models, and all models with built-in auxiliary switches.)
- Automatically compensates for damper seal wear, ensuring tight close off.

### SPRING RETURN AND ELECTRONIC FAIL-SAFE

- Reverse mount for clockwise or counterclockwise fail-safe. (spring return)
- Selectable fail-safe position on all electronic fail-safe models
- Manual override crank speeds installation EF, AFB, AF and NFB Series.
- 3 ft. appliance cable standard and conduit connector eases installation.
- The power of choice – Belimo's Customized actuator range offers longer cable lengths and mechanical clamping options.

### NON-SPRING RETURN

- More mounting flexibility – LM accepts 3/4" dia. shafts, NM, AM & GM mounts to 1.05" dia. jackshafts.
- Linear stroking actuators with extensive control responses and lengths (4", 8" and 12")
- 360 degree actuators with extensive control responses and 0 to 330 degree operating angle with accessory or default endless rotation.
- Optional external auxiliary switch(es) or position feedback potentiometer modules – same modules for all non-spring return actuators!
- Manual override push button.
- Compatible to discontinued models.
- The power of choice – Belimo's Customized actuator range offers longer cable lengths, NEMA 2/IP54 terminal strip covers, mechanical clamping options, and programming options.

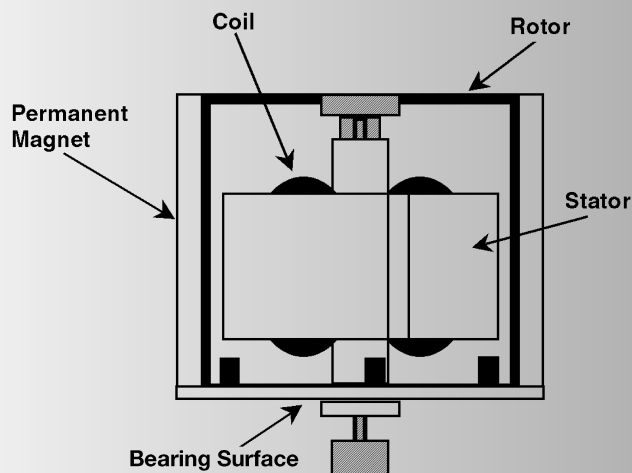


## Brushless DC Motor Technology

Belimo new generation actuators employ state-of-the-art halomo sensorless, brushless DC motor technology. The halomo technology was developed exclusively by Belimo's Technology division and enables Belimo to offer the high quality of brushless DC motor technology inside all actuator models in the new generation.

With the increase in product lifespan and quality the LM series creates a new level of expectation for actuators installed in VAV applications.

- Only **ONE** moving part!
- No brushes to wear out
- Position feedback is generated by ASIC
- Overload proof; uses integrated end stop filtering
- Running noise is reduced to absolute minimum



# Feature and Benefits

## Spring Return Actuators



### Retrofit and Non-Direct Coupled Linkage Solutions

Belimo offers the widest range of mechanical accessories for the replacement of competitive products as well as for the unique installation.

*Give us a call with your application problem.*

### Specialized Control Signal Retrofit Solutions

#### Honeywell Series 90, 0-135 $\Omega$ , use:

Model	Torque
AFB24-MFT95, AFX24-MFT95	180 in-lb
AMX24-MFT95	180 in-lb

#### Barber Colman - MP..., 6-9V, use:

Model	Torque
LF24-MFT-20 US	35 in-lb
LF24-MFT-S-20 US	35 in-lb

#### Staefa Control - 0-20 v. phasecut, use:

Model	Torque
AF24-PC US	133 in-lb
AMX24-PC	180 in-lb

**NOTE:** All control signals above available in non-spring return models.

### Economizer Applications

Need a replacement for your existing Honeywell economizer actuator?

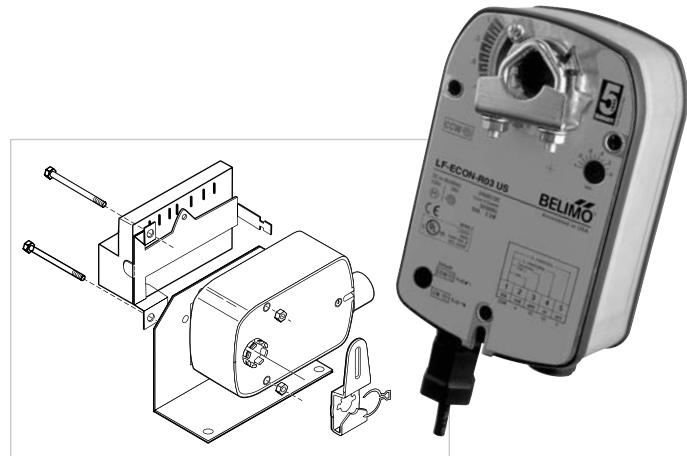
#### LF24-ECON-R03 US

Control: 3 k $\Omega$  NTC Type 10 thermistor includes a built-in min position potentiometer. Replaces: Honeywell M7415 foot mounted economizer actuator.

#### LF24-SR-E US

Control: 2 to 10 VDC includes a built-in min position potentiometer. Replaces: Honeywell M8405 foot mounted economizer actuator.

Use the **ZG-ECON1** mounting kit to place the LF24-ECON-R03 US or LF24-SR-E US and logic module in the same plane as the M7415/M8405 foot mounted actuator.



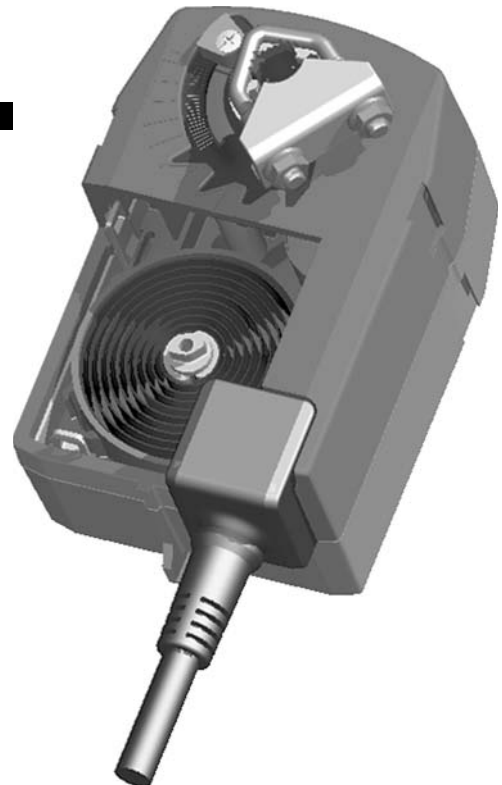
### TF Series 18 in-lb Spring Return Actuator

#### The Quality Compact Spring Return Solution

Cost-effective compact actuators and reliable spring return fail-safe are no longer mutually exclusive ideas. Now Belimo's TF series delivers both.

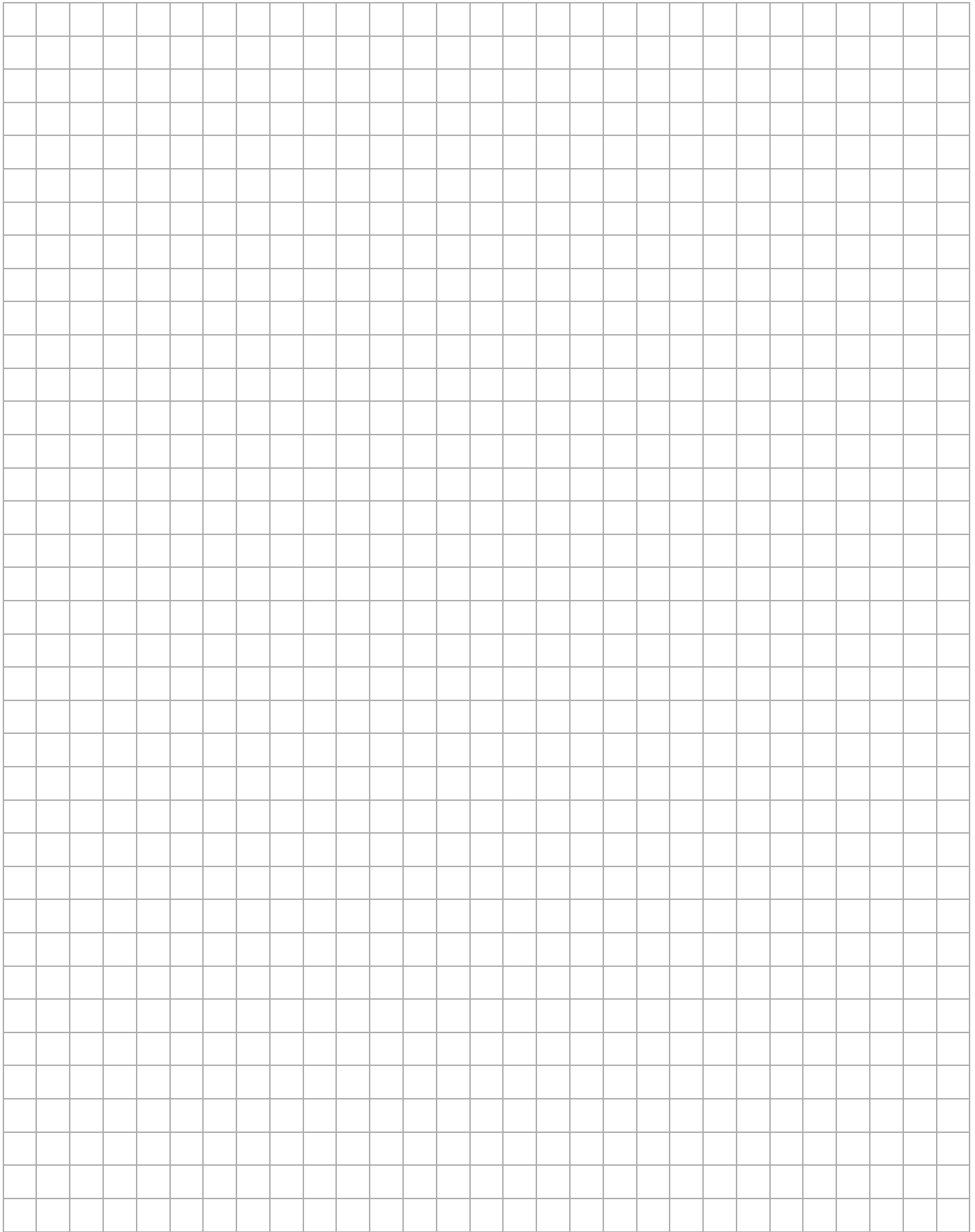
#### Quality Mechanical Failsafe

Belimo has integrated its proven power spring technology into the TF series. The Belimo spring return system provides constant torque to the damper, with and without power applied – a Belimo innovation. Other lower torque products use stall-in-place motors with external springs or electric components that do not match the reliability of the Belimo system. A TF actuator provides installers and engineers with a reliable actuator certain to return to the fail-safe position during a power loss.



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The “10 questions” method for sizing and selection shown below is recommended as the best method for your actuation requirements. Use the “Application Data” column in this chart as a worksheet to help in the selection process. This data, along with the “Actuator Product Range” charts on Section 1 and 2 allow for the best selection of a Belimo actuator.

APPLICATION INFO		*APPLICATION DATA
<b>1</b> What is the total area of the damper?	 Combine the areas	_____ sq.ft.
<b>2</b> Opposed blade or Parallel blade control construction?	<p><math>L'' \times W'' = \text{Total sq inches}/144 = \text{total sq feet}</math></p> <p>Opposed Blade w/o seals 3 in-lb/sq feet <input type="checkbox"/> Opposed Blade</p> <p>Opposed Blade w/ seals 5 in-lb/sq feet</p> <p>Parallel Blade w/o seals 4 in-lb/sq feet <input type="checkbox"/> Parallel Blade</p> <p>Parallel Blade w/ seals 7 in-lb/sq feet</p>	
<b>3</b> Are there blade and edge seals on the damper?	<p>This will impact the proper selection as the seals add resistance requiring more torque. If unknown, use a worst case scenario, parallel blade with seals.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>4</b> For the damper in question, what does the manufacturer specify as the torque rating?	<p>If this information is not available refer to the “typical damper requirements and sizing” chart below.</p>	_____ in-lb/sq.ft.
<b>5</b> What is the air velocity, static pressure, or design CFM?	<p>Systems above 1,000 FPM require additional actuator torque</p>	_____ W.G. _____ CFM _____ FPM

ACTUATOR REQUIREMENTS		*APPLICATION DATA
<b>6</b> Is fail-safe actuation required?	<p>Consider the application. Is the actuator and/or damper exposed to outside air? If yes, use spring return.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>7</b> What is the supply voltage to the actuator?	<p>Do you need a step down transformer?</p> <p>If replacing an oil immersed gear train actuator, is the transformer in the defective actuator? You may need to purchase one.</p>	<input type="checkbox"/> 24 VAC <input type="checkbox"/> 120 VAC <input type="checkbox"/> 230 VAC
<b>8</b> What is the control signal to the actuator?	<ul style="list-style-type: none"> <li>• 2 position</li> <li>• Floating point</li> <li>• Modulating</li> <li>• Sequencing</li> <li>• “Non-standard” voltage signals</li> </ul> <p>This will be a critical component to the selection of an actuator. Consider the ...MFT actuator product range and the flexibility of its application.</p>	<input type="checkbox"/> On/Off <input type="checkbox"/> Floating Point <input type="checkbox"/> 2-10 VDC <input type="checkbox"/> 0-10 VDC <input type="checkbox"/> 4-20 mA <input type="checkbox"/> PWM _____ range <input type="checkbox"/> Other (MFT)
<b>9</b> Can you direct couple to a damper shaft?	<p>Direct-coupling has become the industry standard. Some retrofit applications do not allow direct coupling. Refer to the Belimo “Mounting &amp; Methods Guide” for application details.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No, see accessories page
<b>10</b> Are there additional accessories required?	<p>For example, some applications require the addition of an auxiliary switch for proof of position; a retrofit application may require an additional mounting bracket and linkage kit. We advise that you identify these needs prior to leaving the job site or ordering products.</p>	<input type="checkbox"/> No <input type="checkbox"/> Yes, see accessories section or actuator series for details

## Typical Damper Requirements and Sizing

Square Damper (with square shape):  $ft = h \times w / 144$ ; (h= height, w= width, in inches)

EXAMPLE: Damper Area (8 ft) x Rated Torque Loading of Damper (4 in-lb/ft) = Total in-lb Required (32 in-lb) Belimo LF 35 in-lb actuators/LM 45 in-lb actuators

Damper Blade Type	Torque Loading in-lb/ft		
	< 1000 FPM	1000-2500 FPM	2500-3500 FPM
Parallel blade/edge seals	7 (Typical)	10.5	14
Opposed blade/edge seals	5 (Typical)	7.5	10
Parallel blade/no edge seals	4	6	8
Opposed blade/no edge seals	3	4.5	6
Round	10	14	20

## Control Signal Overview

Belimo actuators are compatible with many control inputs and all direct digital control (DDC) systems. There are many signals to select from with today's controllers.

What does 'on/off', 'open-close', '3-point', 'tri-state', 'floating point', 'proportional modulation', 'phase cut', 'PWM' or 'MFT' mean?

Belimo will help you understand more on this control signal jungle with a quick overview.

**On/Off or Open-Close:** The actuator is able to drive either to its full open position, or to its full closed position. The same indication is used for spring return type actuators. Where the actuator will drive to its full open position and spring return to its zero position. This can also be reversed.

**3-point, Tri-State, Floating Point:** The actuator has both clockwise (CW) and counter-clockwise (CCW) control inputs. One drives the actuator to its open, the other to its close position. If there is no signal (Null point) on either input the actuator simply stays in its last position.

**Proportional Control:** The actuator drives proportional to its control input and modulates throughout its angle of rotation. This control type is usually a variation of VDC. Common values are:

0-10 VDC      2-10 VDC

It is common to also have a 0-20 or 4-20 mA output from a controller. This can be very easily converted to 0-10 VDC or 2-10 VDC with a 500 Ω resistor.

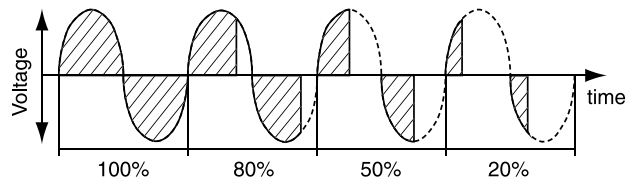
**Pulse Width Modulation (PWM):** The actuator drives to a specified position according to a pulse duration, the "length" of signal. The pulse can originate from a dry contact closure or a triac sink or source controller. An example of PWM control:

Time base: 0 to 10 seconds

Output pulse: 5 seconds

Actuator position: 50%

**Phasecut:** An actuator drives depending on the power result of a remaining wave. This signal type cuts the amplitude of the wave and the actuator recognizes this signal as a proportional movement.



**Multi-Functional Technology (MFT):** This technology was developed by Belimo for incorporation into our damper and valve actuator. MFT provides the ability to program characteristics of the actuator. Some of the key characteristics to change are:

**CONTROL INPUT**

selectable On/Off, VDC, PWM or Floating point

**MOTION VALUES**

selectable Running time adjustment

**FEEDBACK**

selectable feedback values

E	F	X	24	-MFT	-S	N4
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### Torque Rating

E = 266 in-lb  
 A = 180 in-lb  
 A = 133 in-lb  
 N = 90 in-lb  
 L = 35 in-lb  
 T = 18 in-lb

### Actuator Type

F = Spring Return

### Options

Blank = None  
 A = No Position Feedback  
 B = Basic  
 C = Fast Running  
 X = Customized

### Power Supply

24 = 24 VAC/DC\*  
 120 = 120 VAC\*\*  
 230 = 230 VAC  
 UP = 24 to 240 VAC\*\*\*

### Control

Blank = On/Off  
 -3 = Floating Point  
 -SR = 2-10 VDC  
 -PC = 0 to 20 Volt (Phasecut)  
 -ECON-RO3 = 3 k $\Omega$  NTC Type 10 Thermistor  
 -MFT = Multi-Function Technology  
 -MFT95 = 0 to 135  $\Omega$   
 -MFT-20 = 6 to 9 VDC 20 VDC Power Supply

-S = Built-in Auxiliary Switch  
 US N4  $\blacklozenge$

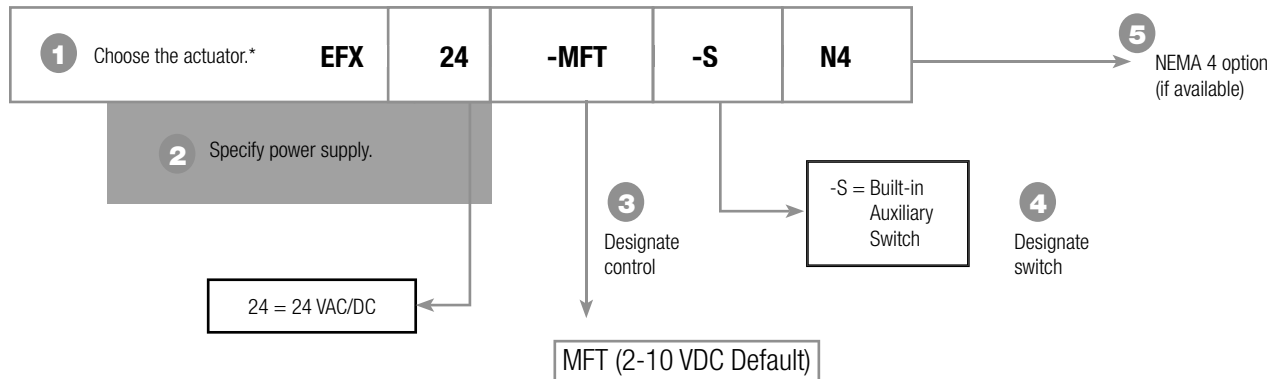
$\blacklozenge$  NEMA 4 option on select models

\*TF24-3(-S) US is 24 VAC only.

\*\*EF and TF series have 100 to 240 VAC nominal power supply.

\*\*\*24 to 125 VDC





## Ordering Example



**5** Complete Ordering Example: EFX24-MFT-S N4

\* All functions and options are not available with all versions



		Running Time(s)		Power Supply			Power Consumption		Control Input			Control Input MFT		Position Feedback	Auxiliary Switches	NEMA 4								
		Motor Drive, (Default) (Variable with MFT, fully programmable by Belimo or in field)	Spring Return	24 VAC +/- 20%, VDC +/- 10%, 50/60 HZ	24 to 240 VAC +10%/- 20%, 50/60 HZ	24 to 125 VDC +/- 10%	120 VAC +/- 10%	230 VAC +/- 10%	VA Rating, Transformer Sizing	Wattage Running (Holding)	On/Off	2-10 VDC (Default) 4-20 mA (w/500 Ω Resistor)	0-20 V Phasecut	3 kΩ NTC Type 10 Thermistor	Honeywell Series 90, 0-135 Ω	On/Off	Floating Point	Start and Span adj., Start 0.5 to 30 VDC, Span 2.5 to 32 VDC	PWM adj., 0.02 to 50.0 Seconds	2-10 VDC (Default)	VDC Variable, Start 0 to 8, Span 2 to 10 VDC	2 SPDT, 3 A (0.5 A inductive) @250V	2 SPDT, 7 A (2.5 A inductive) @ 250V	NEMA 4 Option (part # + N4) Example: EFB24 N4
 <p><b>EFB Series</b> 270 in-lb [30 Nm] Approx. 66 sq. ft.**</p>	EFB24†	75	<20♦	•				16	9.5 (4.5)	•														•
	EFB24-S†	75	<20♦	•				16	9.5 (4.5)	•														•
	EFB120†	75	<20♦		•	•		21	9.5 (4.5)	•														•
	EFB120-S†	75	<20♦		•	•		21	9.5 (4.5)	•														•
	EFB24-SR†	95	<20♦	•				14	8 (4.5)		•													•
	EFB24-SR-S†	95	<20♦	•				14	8 (4.5)		•													•
	EFB24-MFT†	60...150 (150)	<20♦	•				16	9.5 (4.5)					•	•									•
	EFB24-MFT-S†	60...150 (150)	<20♦	•				16	9.5 (4.5)					•	•									•
 <p><b>AFB Series</b> 180 in-lb [20 Nm] Approx. 45 sq. ft.**</p>	AFB24†	<75	20♦	•				7.5	5.0 (2.5)															•
	AFB24-S†	<75	20♦	•				7.5	5.0 (2.5)															•
	AFBUP†	<75	20♦		•			8.5*	7.0 (3.5)	•														•
	AFBUP-S†	<75	20♦		•			8.5*	7.0 (3.5)	•														•
	AFB24-SR	95	<20♦	•				8.5	5.5 (3.0)		•													•
	AFB24-SR-S	95	<20♦	•				8.5	5.5 (3.0)		•													•
	AFB24-MFT†	70...220 (150)	<20♦	•				10	7.5 (3.0)		•			•	•									•
	AFB24-MFT-S†	70...220 (150)	<20♦	•				10	7.5 (3.0)		•			•	•									•
 <p><b>AF Series</b> 133 in-lb [15 Nm] Approx. 33 sq. ft.**</p>	AF24 US†	150	<20	•				10	5.0 (1.5)	•														
	AF24-S US†	150	<20	•				10	5.0 (1.5)	•														•
	AF120 US†	150	<20		•			11	8.0 (3.0)	•														•
	AF120-S US†	150	<20		•			11	8.0 (3.0)	•														•
	AF230 US†	150	<20			•		11	8.5 (3.0)	•														•
	AF230-S US†	150	<20			•		11	8.5 (3.0)	•														•
	AF24-SR US†	150	<20	•				10	6.0 (2.0)		•													•
	AFA24-SR US†	150	<20	•				10	6.0 (2.0)		•													•
	AF24-ECON-R03 US†	95	<20	•				10	6.0 (2.5)				•											•
	AF24-PC US†	150	<20	•				10	6.0 (2.5)			•												•
	AF24-MFT†	75...300 (150)	<20	•				10	6.0 (2.5)		•			•	•									•
	AF24-MFT-S†	75...300 (150)	<20	•				10	6.0 (2.5)		•			•	•									•
 <p><b>NFB Series</b> 90 in-lb [10 Nm] Approx. 22 sq. ft.**</p>	NFB24	<75	20♦	•				8.5	6.0 (2.5)	•														•
	NFB24-S	<75	20♦	•				8.5	6.0 (2.5)	•														•
	NFBUP	<75	20♦		•			6.5*	6.0 (2.5)	•														•
	NFBUP-S	<75	20♦		•			6.5*	6.0 (2.5)	•														•
	NFB24-SR	95	<20♦	•				6	3.5 (2.5)		•													•
	NFB24-SR-S	95	<20♦	•				6	3.5 (2.5)		•													•
	NFB24-MFT	40...220 (150)	<20♦	•				9	6.5 (3.0)		•			•	•									•
	NFB24-MFT-S	40...220 (150)	<20♦	•				9	6.5 (3.0)		•			•	•									•

♦ <60 seconds @ -22°F [-30°C].

† Dual mounting on a single shaft (on/off wired in parallel), -SR [AF only] and -MFT [EFB, AFB and AF only] wired master slave. Please call Belimo customer service for details.



\* 8.5 VA for 120 VAC; 7 VA for 24 VAC, 18 VA for 240 VAC.

\*\* Parallel blade without edge seals and 1000 FPM air velocity.

# Product Range

## Standard Spring Return Actuator






		Running Time(s)		Power Supply		Power Consumption		Control Input				Control Input MFT			Position Feedback	Auxiliary Switches				
		Motor Drive, (Default) (Variable with MFT, fully programmable by Belimo or in field)	Spring Return	24 VAC +/- 20%, VDC +/- 10%, 50/60 HZ	120 VAC +/- 10%	230 VAC +/- 10%	VA Rating, Transformer Sizing	Wattage Running (Holding)	On/Off	Floating Point	2-10 VDC (Default) 4-20 mA (w/500 Ω Resistor)	3 kΩ NTC Type 10 Thermistor	6 - 9 VDC, 20 VDC Output Voltage	On/Off	Floating Point	Start and Span adj., Start 0.5 to 30 VDC, Span 2.5 to 32 VDC	PWM adj., 0.02 to 50.0 Seconds	2-10 VDC (Default)	VDC Variable, Start 0 to 8, Span 2 to 10 VDC	1 SPDT, 3 A (0.5 A inductive) @250V
 <p><b>LF Series</b> 35 in-lb [4 Nm] Approx. 8.5 sq. ft. *</p>	LF24 US	<40 to 75	<25♦	●		7	5.0 (2.5)	●												
	LF24-S US	<40 to 75	<25♦	●		7	5.0 (2.5)	●											●	
	LF120 US	<40 to 75	<25♦		●	7.5	5.5 (3.5)	●												●
	LF120-S US	<40 to 75	<25♦		●	7.5	5.5 (3.5)	●												●
	LF230 US	<40 to 75	<25♦			7	5.0 (3.0)	●												●
	LF230-S US	<40 to 75	<25♦			7	5.0 (3.0)	●												●
	LF24-SR US	150	<25♦	●		5	2.5 (1.0)			●							●			●
	LF24-SR-S US	150	<25♦	●		5	2.5 (1.0)			●							●			●
	LF24-SR-E US	150	<25♦	●		5	2.5 (1.0)			●							●			●
	LF24-3 US	150	<25♦	●		5	2.5 (1.0)		●											●
	LF24-3-S US	150	<25♦	●		5	2.5 (1.0)		●											●
	LF24-ECON-R03 US	95	<25♦	●		5	2.5 (1.0)				●						●			●
	LF24-MFT US	75...300 (150)	<25♦	●		5	2.5 (1.0)			●				●	●	●	●	●	●	●
	LF24-MFT-S US	75...300 (150)	<25♦	●		5	2.5 (1.0)			●				●	●	●	●	●	●	●
LF24-MFT-20 US	150	<25♦	●		6	3.5 (1.5)					●		●	●	●	●	●	●	●	
LF24-MFT-S-20 US	150	<25♦	●		6	3.5 (1.5)					●		●	●	●	●	●	●	●	
LFC24-3-R US	90	<25♦	●		5	2.5 (1.0)		●											●	
LFC24-3-S US	90	<25♦	●		5	2.5 (1.0)		●											●	
 <p><b>TF Series</b> 18 in-lb [2 Nm] Approx. 4.5 sq. ft. *</p>	TF24 US	<75	<25♦	●		5	2.0 (1.3)	●											●	
	TF24-S US	<75	<25♦	●		5	2.0 (1.3)	●												●
	TF120 US	<75	<25♦		●	5	2.5 (1.3)	●												●
	TF120-S US	<75	<25♦		●	5	2.0 (1.3)	●												●
	TFC120-S US	<30	<25♦		●	6	3.0 (1.5)	●												●
	TF24-SR US	95	<25♦	●		4	2.0 (1.0)			●										●
	TF24-SR-S US	95	<25♦	●		4	2.0 (1.0)			●										●
	TF24-3 US	95	<25♦	●		4	2.5 (1.0)		●											●
	TF24-3-S US	95	<25♦	●		4	2.5 (1.0)		●											●
	TF24-MFT US	75...300 (150)	<25♦	●		4	2.5 (1.0)			●			●	●	●	●	●	●	●	●

♦ <60 seconds @ -22°F [-30°C].

\* Parallel blade without edge seals and 1000 FPM air velocity.

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		Custom Options	Running Time(s)		Power Supply			Power Consumption		Control Input		Control Input MFT				Position Feedback	Auxiliary Switches	NEMA 4							
		10 ft (3m) or 16 ft (5m) cable	Motor Drive, (Default) (Variable with MFT, fully programmable by Belimo or in field)		Spring Return	24 VAC +/- 20%, VDC +/- 10%, 50/60 HZ	24 to 240 VAC +10%/- 20%, 50/60 HZ	24 to 125 VDC +/- 10%	120 VAC +/- 10%	230 VAC +/- 10%	VA Rating, Transformer Sizing	Wattage Running (Holding)	On/Off	2-10 VDC (Default)	4-20 mA (w/500 Ω Resistor)	Honeywell Series 90, 0-135 Ω	On/Off	Floating Point	Start and Span adj., Start 0.5 to 30 VDC, Span 2.5 to 32 VDC	PWM adj., 0.02 to 50.0 Seconds	2-10 VDC (Default)	VDC Variable, Start 0 to 8, Span 2 to 10 VDC	2 SPDT, 3 A (0.5 A inductive) @250V	NEMA 4 Option (part # + N4) Example: EFX24-S N4	
 <b>EFX Series</b> 270 in-lb [30 Nm] Approx. 66 sq. ft.**	EFX24†	●	75	<20♦	●					16	9.5 (4.5)	●													
	EFX24-S†	●	75	<20♦	●					16	9.5 (4.5)	●											●	●	
	EFX120†	●	75	<20♦			●		●	21	9.5 (4.5)	●											●	●	
	EFX120-S†	●	75	<20♦			●		●	21	9.5 (4.5)	●											●	●	
	EFX24-SR†	●	95	<20♦	●					14	8 (4.5)		●											●	●
	EFX24-SR-S†	●	95	<20♦	●					14	8 (4.5)		●											●	●
	EFX24-MFT†	●	60...150 (150)	<20♦	●					16	9.5 (4.5)			●	●									●	●
EFX24-MFT-S†	●	60...150 (150)	<20♦	●					16	9.5 (4.5)			●	●									●	●	
 <b>AFX Series</b> 180 in-lb [20 Nm] Approx. 45 sq. ft.**	AFX24†	●	<75	20♦	●				7.5	5.0 (2.5)	●													●	
	AFX24-S†	●	<75	20♦	●				7.5	5.0 (2.5)	●													●	●
	AFXUP†	●	<75	20♦		●			8.5*	7.0 (3.5)	●													●	●
	AFXUP-S†	●	<75	20♦		●			8.5*	7.0 (3.5)	●													●	●
	AFX24-SR	●	95	<20♦	●				8.5	5.5 (3.0)		●												●	●
	AFX24-SR-S	●	95	<20♦	●				8.5	5.5 (3.0)		●												●	●
	AFX24-MFT†	●	70...220 (150)	<20♦	●				10	7.5 (3.0)		●		●	●									●	●
AFX24-MFT-S†	●	70...220 (150)	<20♦	●				10	7.5 (3.0)		●		●	●									●	●	
AFX24-MFT95†	●	70...220 (150)	<20♦	●				10	7.5 (3.0)			●											●	●	
 <b>NFX Series</b> 90 in-lb [10 Nm] Approx. 22 sq. ft.**	NFX24	●	<75	20♦	●				8.5	6.0 (2.5)	●													●	●
	NFX24-S	●	<75	20♦	●				8.5	6.0 (2.5)	●													●	●
	NFXUP	●	<75	20♦		●			6.5	6.0 (2.5)	●													●	●
	NFXUP-S	●	<75	20♦		●			6.5	6.0 (2.5)	●													●	●
	NFX24-SR	●	95	<20♦	●				6	3.5 (2.5)		●												●	●
	NFX24-SR-S	●	95	<20♦	●				6	3.5 (2.5)		●												●	●
	NFX24-MFT	●	40...220 (150)	<20♦	●				9	6.5 (3.0)		●		●	●									●	●
NFX24-MFT-S	●	40...220 (150)	<20♦	●				9	6.5 (3.0)		●		●	●									●	●	

♦ <60 seconds @ -22°F [-30°C].

† Dual mounting on a single shaft (on/off wired in parallel), -SR [AF only] and -MFT [EFX and AFX only] wired master slave. Please call Belimo customer service for details.

\* 8.5 VA for 120 VAC; 7 VA for 24 VAC, 18 VA for 240 VAC.

\*\* Parallel blade without edge seals and 1000 FPM air velocity.

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# Nomenclature

## Electronic Fail-Safe Actuator

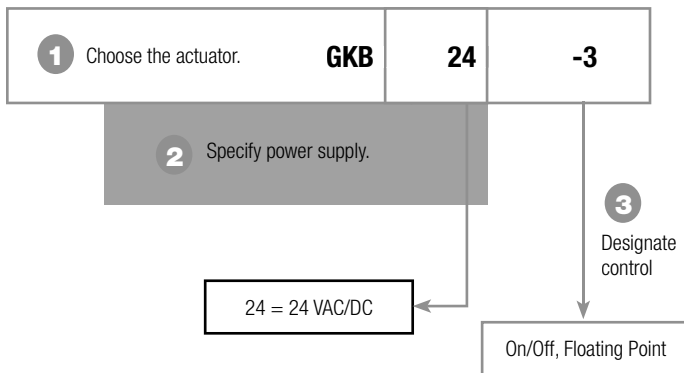


GK		B	24	-MFT
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Torque Rating	Speed	Version	Power Supply	Control
GK = 360 in-lb*	Q = Quickest Running	B = Basic	24 = 24 VAC/DC**	-3 = On/Off, Floating Point
AHK = 101 lbf*	Blank = Normal Speed	X = Customized		SR = 2-10 VDC
NK = 54 in-lb*				-MFT = Multi-Function Technology

\*\*GK...24-3 is 24 VAC only.

### Ordering Example



**4** Complete Ordering Example: GKB24-3

\* All functions and packaging are not available with all versions

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## Standard Electronic Fail-Safe Actuator Product Range

		Running Time(s)		Power Supply	Power Consumption		Control Input		Position Feedback	Add-On		NEMA 4
		Motor Drive	Fail-Safe	24 VAC +/- 20%, VDC +/-10/+20%, 50/60 HZ	VA Rating, Transformer Sizing	Wattage Running (Holding)	On/Off	Floating Point	2-10 VDC (Default) 4-20 mA* (w/500Ω Resistor)	2-10 VDC (Default)	S1A or S2A	Potentiometer
<b>GKB Series</b> 360 in-lb [40 Nm] Approx. 90 sq. ft.	GKB24-3	150	35	●	21	12 (3)	●	●		●	●	●
	GKB24-SR	150	35	●	21	12 (3)		●	●	●	●	●
<b>NKQB Series</b> 54 in-lb [6 Nm] Approx. 12 sq. ft.	NKQB24-1	4	4	●	22	11 (3)	●			●	●	
	NKQB24-SR	4	4	●	22	11 (3)		●	●	●	●	

## Custom Electronic Fail-Safe Actuator Product Range

		Custom Options	Running Time(s)	Power Supply	Power Consumption		Control Input	Control Input MFT	Position Feedback	Add-On	NEMA 4								
		10 ft (3m) or 16 ft (5m) cable	Motor Drive, (Default) (...-MFT US, 35 to 300 sec., fully programmable by Belimo or in field)	Fail-Safe	24 VAC +/- 20%, VDC +/- 10%, 50/60 HZ	VA Rating, Transformer Sizing	Wattage Running (Holding)	On/Off	Floating Point	2-10 VDC (Default) 4-20 mA* (w/500Ω Resistor)	On/Off	Floating Point	Start and Span adj., Start 0.5 to 30 VDC, Span 2.5 to 32 VDC	PWM adj., 0.02 to 50.0 Seconds	2-10 VDC (Default)	VDC Variable, Start 0 to 8, Span 2 to 10 VDC	S1A or S2A	Potentiometer	NEMA 4 Option (part # + N4) Example: GKX24-3 N4
<b>GKX Series</b> 360 in-lb [40 Nm] Approx. 90 sq. ft.	GKX24-3	●	150	35	●	21	12 (3)	●	●										●
	GKX24-SR	●	150	35	●	21	12 (3)		●										●
	GKX24-MFT	●	95-150 (150)	35	●	21	12 (3)			●	●	●	●	●	●	●	●	●	●
<b>AHKX Series</b> 101 lbf [450 N force]	AHKX24-MFT	●	95-150 (150)	35	●	22	11 (3)			●	●	●	●	●	●	●	●	●	
<b>NKQX Series</b> 54 in-lb [6 Nm] Approx. 12 sq. ft.	NKQX24-1	●	4-10 (4)	4	●	22	11 (3)	●											●
	NKQX24-SR	●	4-10 (4)	4	●	22	11 (3)		●										●
	NKQX24-MFT	●	4-10 (4)	4	●	22	11 (3)			●	●	●	●	●	●	●	●	●	

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FS	L	F	120		-S	US
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**Fire and Smoke**

**Torque Rating**

A = 133 in-lb  
 N = 70 in-lb  
 L = 30 in-lb

**Actuator Type**

F = Spring Return

**Power Supply**

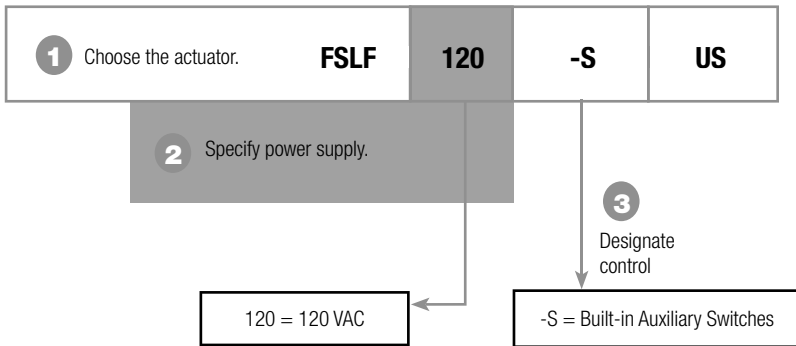
24 = 24 VAC  
 120 = 120 VAC  
 230 = 230 VAC

**Control**

Blank = On/Off  
 -SR = 2-10 VDC  
 -BAL = 3-position




-S = Built-in Auxiliary Switches

**Ordering Example**



4 Complete Ordering Example: FSLF120-S US

\*FSAF is 24 VAC/DC

		Running Time(s)		Power Supply			Power Consumption	Control Input	Auxiliary Switches	
		Motor Drive	Spring Return	24 VAC (FSAF - 24 VAC/DC)	120 VAC	230 VAC	VA Rating	On/Off	2 SPST	2 SPDT
 <p><b>FSAF Series</b> 133 in-lb [15 Nm] Approx. 16 sq. ft. @ 250°F</p>	FSAF24 US	<75	<20	●			10	●		
	FSAF24-S US	<75	<20	●			10	●	●	
	FSAF120 US	<75	<20		●		11	●		
	FSAF120-S US	<75	<20		●		11	●	●	
	FSAF230 US	<75	<20			●	12	●		
	FSAF230-S US	<75	<20			●	12	●	●	
	FSAF24-SR US	<75	<20	●			11	2-10 VDC		
	FSAF24-SR-S	<75	<20	●			11	2-10 VDC		●
	FSAF24-BAL	<75	<20	●			10	3-Position		
	FSAF24-BAL-S	<75	<20	●			10	3-Position		●
 <p><b>FSNF Series</b> 70 in-lb [8 Nm] Approx. 12 sq. ft. @ 350°F</p>	FSNF24 US	<15	<15	●			27	●		
	FSNF24-S US	<15	<15	●			27	●		●
	FSNF120 US	<15	<15		●		27	●		
	FSNF120-S US	<15	<15		●		27	●		●
	FSNF230 US	<15	<15			●	27	●		
	FSNF230-S US	<15	<15			●	27	●		●
 <p><b>FSLF Series</b> 30 in-lb [3.5 Nm] Approx. 4 sq. ft. @ 350°F</p>	FSLF24 US	<15	<15	●			5	●		
	FSLF24-S US	<15	<15	●			5	●	●	
	FSLF120 US	<15	<15		●		18	●		
	FSLF120-S US	<15	<15		●		18	●	●	
	FSLF230 US	<15	<15			●	17	●		
	FSLF230-S US	<15	<15			●	17	●	●	

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<b>LM</b>	<b>C</b>	<b>B</b>	<b>24</b>	<b>-3</b>	<b>-T</b>
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**Torque Rating**

GM = 360 in-lb  
 AM = 180 in-lb\*\*  
 NM = 90 in-lb\*\*  
 LM = 45 in-lb\*\*  
 CM = 18 in-lb  
 AH = 101 lbf\*\*  
 LH = 34 lbf\*\*  
 LU = 27 in-lb

**Speed\***

Q = Quickest  
 Running  
 C = Fast  
 Running  
 No Designation  
 = Normal Speed  
 (LMB24-3)

**Version\***

B = Basic  
 X = Customized

**Power Required\***

24 = 24 VAC/DC,  
 50/60 Hz  
 120 = 100 to  
 240 VAC,  
 50/60 Hz

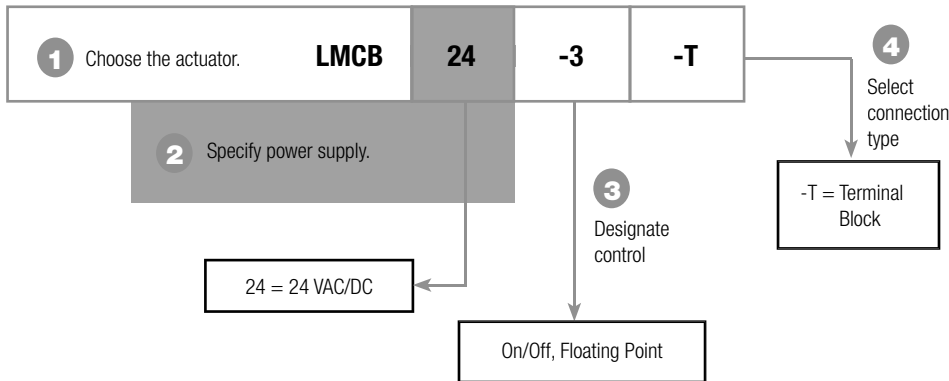
**Control\***

-1 = On/Off  
 -3 = On/Off, Floating Point  
 -3-P5 = On/Off, Floating Point  
 w/5 kΩ Feedback  
 -3-P10 = On/Off, Floating Point  
 w/10 kΩ Feedback  
 -SR = 2-10 VDC  
 -PC = 0 to 20 Volt (Phasecut)  
 -MFT = Multi-Function Technology  
 -MFT95 = 0 to 135Ω

**Options**

-T = Terminal Block\*  
 Blank = Cable Version  
 -S = Switch\*

**Ordering Example**



**5** Complete Ordering Example: LMCB24-3-T

\*Note: All functions and packaging are not available with all versions

\*\*Note: Q versions have a slightly lower torque rating.



\*Running time is per 4 inches [100 mm] of travel.

\*\*Running time is 150 seconds per 90°.

†Dual mounting on a single shaft (-3 and -SR wired in parallel), (-MFT wired Master-Slave). Please call Belimo customer service for details.

Ⓐ Shipped default. **150 seconds running time, 2-10 VDC control input and feedback.** Other setups are possible with MFT tools field programming.

Ⓑ Drop-in replacement of LM24-M VAV actuator.

		<b>Running Time(s)</b>		<b>Power Supply</b>		<b>Power Consumption</b>		<b>Control Input</b>		<b>Control Input MFT</b>				<b>Position Feedback</b>		<b>Add-On</b>		<b>NEMA 4X</b>					
		Motor Drive		24 VAC $\pm$ 20%, VDC $\pm$ 10%, 50/60 Hz		100 VAC to 240 VAC		VA Rating Wattage Running (Holding)		On/Off Floating Point		2-10 VDC or 4-20 mA (w/500Ω Resistor) On/Off Floating Point		Start and Span adj., Start 0.5 to 30 VDC, Span 2.5 to 32 VDC PWM adj., 0.02 to 50.0 Seconds		2-10 VDC (Default) Adjustable with MFT 5 kΩ Resistive Feedback 10 kΩ Resistive Feedback 1 SPDT, 3A (0.5A Inductive) @250V		S1A or S2A Potentiometer		Enclosure (Part No. +N4 or +N4H) with Terminal Strip			
<b>GMB Series</b> 360 in-lb [40 Nm] Approx. 90 sq. ft.	GMB24-3†	150	•	6	4.0 (2.0)	•	•																
	GMB24-SR†	150	•	6.5	4.5 (2.0)																		
	GMB24-MFT Ⓐ	150	•	7	4.0 (1.5)																		
<b>AMB Series</b> 180 in-lb [20 Nm] Approx. 45 sq. ft.	AMB24-3	95	•	5.5	2.5 (0.5)	•	•														•		
	AMB24-3-S	95	•	5.5	2.5 (0.5)	•	•																
	AMB24-SR	95	•	5	2.5 (0.4)																		
	AMB24-MFT Ⓐ	150	•	6	3.5 (1.3)																		
<b>AMQB Series</b> 140 in-lb [16 Nm]	AMQB24-1	7	•	26	15 (1.5)	•																	
<b>NMB Series</b> 90 in-lb [10 Nm] Approx. 22 sq. ft.	NMB24-3	95	•	4	2.0 (0.2)	•	•															•	
	NMCB24-3	45	•	4	2.5 (0.2)	•	•																
	NMB24-SR	95	•	5	2.5 (0.4)																	•	
	NMCB24-SR	45	•	5	2.5 (0.4)																		
	NMB24-MFT Ⓐ	150	•	6	3.5 (1.3)																		
<b>NMQB Series</b> 70 in-lb [8 Nm]	NMQB24-1	4	•	23	13 (1.5)	•																	
<b>LMB Series</b> 45 in-lb [5 Nm] Approx. 11 sq. ft.	LMB24-3	95	•	2	1.5 (0.2)	•	•																
	LMCB24-3	35	•	2.5	1.5 (0.2)	•	•																
	LMB24-3.1	95	•	2	1.5 (0.2)	•	•																
	LMB24-3-S	95	•	2	1.5 (0.2)	•	•																
	LMB24-3-T	95	•	2	1.5 (0.2)	•	•																
	LMCB24-3-T	35	•	2.5	1.5 (0.2)	•	•																
	LMB24-3-T.1	95	•	2	1.5 (0.2)	•	•																
	LMB24-3-P5-T	95	•	2	1.5 (0.2)	•	•																
	LMB24-3-P5-T.1	95	•	2	1.5 (0.2)	•	•																
	LMB24-3-P10-T	95	•	2	1.5 (0.2)	•	•																
	LMB24-SR	95	•	3	1.5 (0.4)																		
	LMCB24-SR	35	•	3	1.5 (0.4)																		
	LMB24-SR.1	95	•	3	1.5 (0.4)																		
	LMB24-SR-T	95	•	3	1.5 (0.4)																		
LMCB24-SR-T	35	•	3	1.5 (0.4)																			
LMB24-SR-T.1	95	•	3	1.5 (0.4)																			
LMB24-MFT Ⓐ	150	•	5	2.5 (1.2)																			
LMB24-HM Ⓑ	95	•	2	1.5 (0.2)																			
LMB24-10P-HM	95	•	2	1.5 (0.2)																			
<b>LMQB Series</b> 35 in-lb [4 Nm]	LMQB24-1	2.5	•	23	13 (1.5)	•																	
<b>CMB Series</b> 18 in-lb [2 Nm] Approx. 4.5 sq. ft.	CMB24-3	35	•	1.5	1.0 (0.2)	•	•																
	CMB24-3.1	35	•	1.5	1.0 (0.2)	•	•																
	CMB120-3	35	•	3.5	1.5 (1.0)	•	•																
	CMB24-3-T	35	•	1.5	1.0 (0.2)	•	•																
	CMB24-3-T.1	35	•	1.5	1.0 (0.2)	•	•																
	CMB24-SR-R	35	•	2.5	1.5 (0.5)																		
	CMB24-SR-L	35	•	2.5	1.5 (0.5)																		
<b>AHB Series</b> 101 lbf [450 N Force] 4" or 8" stroke	AHB24-3-100	150*	•	4.5	2.0 (0.5)	•	•																
	AHB24-3-200	150*	•	4.5	2.0 (0.5)	•	•																
	AHB24-SR-100	150*	•	4.5	2.5 (0.5)																		
	AHB24-SR-200	150*	•	4.5	2.5 (0.5)																		
<b>AHQB Series</b> 44 lbf [200 N Force]	AHQB24-1-100	7*	•	23	13 (1.5)	•																	
<b>LHB Series</b> 34 lbf [150 N Force] 4" or 8" stroke	LHB24-3-100	150*	•	3	1.5 (0.5)	•	•																
	LHB24-3-T-100	150*	•	3	1.5 (0.5)	•	•																
	LHB24-3-200	150*	•	3	1.5 (0.5)	•	•																
	LHB24-SR-100	150*	•	3	1.5 (0.5)																		
	LHB24-SR-200	150*	•	3	1.5 (0.5)																		
<b>LHQB Series</b> 22 lbf [100 N Force]	LHQB24-1-100	3.5*	•	23	13 (1.5)	•																	
<b>LUB Series</b> 27 in-lb [3 Nm]	LUB24-3	150**	•	2.5	1.0 (0.5)	•	•																
	LUB24-SR	150**	•	3	3.0 (0.5)																		

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# Product Range

## Custom Non-Spring Return Actuator



\* The LH and AH linear series actuators come in three different stroke lengths [4, 8 or 12 in]. The part number is followed by -100, -200, -300 respectively. The default running time is 150 seconds per 4 inches [100 mm]. Running time is adjustable depending on model:  
 LH Series: 70-270, 140-540, 200-810, on the -100, -200, -300 models respectively.  
 AH Series: 150-600, 300-1200, 450-1800, on the -100, -200, -300 models respectively.  
 LHQ and AHQ available in 4 inch version only.

† Dual mounting on a single shaft is possible for higher torque (-3 and -SR wired in parallel), (-MFT wired Master-Slave). Please call Belimo customer service for details.

	Custom Options	Running Time(s)	Power Supply		Power Consumption		Control Input				Control Input MFT		Position Feedback	Add-on	NEMA 4X		
			24 VAC +/- 20%, VDC +/- 10%	100 to 240 VAC	VA Rating	Wattage Running (Holding)	On/Off	Floating Point	4-20 mA (w/500Ω Resistor)	0-20 V Phasecut	Honeywell Series 90, 0-135 Ω	On/Off				Floating Point	Start and Span adj., Start 0.5 to 30 VDC, Span 2.5 to 32 VDC
<b>GMX Series</b> 360 in-lb [40 Nm] Approx. 90 sq. ft.	GMX24-3†	●	150	●	6	4.0 (2.0)	●	●									
	GMX24-SR†	●	150	●	6.5	4.5 (2.0)		●					●		●	●	
	GMX24-PC†	●	150	●	7	4.0 (1.5)			●						●	●	
	GMX120-3†	●	150	●	7	4.0 (2.0)									●	●	
	GMX24-MFT†	●	75-300 (150)	●	7	4.0 (1.5)		●							●	●	
	GMX24-MFT95†	●	75-300 (150)	●	7	4.0 (1.5)			●						●	●	
<b>AMX Series</b> 180 in-lb [20 Nm] Approx. 45 sq. ft.	AMX24-3	●	95	●	5.5	2.5 (0.5)	●	●									
	AMX24-3-T	●	95	●	5.5	2.5 (0.5)	●	●									
	AMX24-SR	●	95	●	5	2.5 (0.4)			●								
	AMX24-SR-T	●	95	●	5	2.5 (0.4)			●								
	AMX24-PC	●	90	●	5.5	3.5 (1.3)			●								
	AMX120-3	●	95	●	7	3.0 (0.6)	●	●									
	AMX120-SR	●	95	●	7.5	4.0 (1.0)			●								
	AMX24-MFT	●	90-300 (150)	●	6	3.5 (1.3)			●		●	●	●				
	AMCX24-MFT	●	35-120 (35)	●	6	3.5 (1.3)			●		●	●	●			●	
AMX24-MFT95	●	75-150 (150)	●	6	3.5 (1.3)			●		●	●	●					
<b>AMQ Series 140 in-lb [16 Nm]</b>	AMQX24-MFT	●	7-15 (7)	●	26	15 (1.5)			●		●	●	●	●	●		
<b>NMX Series</b> 90 in-lb [10 Nm] Approx. 22 sq. ft.	NMX24-3	●	95	●	4	2.0 (0.2)	●	●									
	NMX24-3-T	●	95	●	4	2.0 (0.2)	●	●									
	NMX24-SR	●	95	●	5	2.5 (0.4)			●								
	NMX24-SR-T	●	95	●	5	2.5 (0.4)			●								
	NMX24-PC	●	150	●	6	3.5 (1.3)			●								
	NMX120-3	●	150	●	5.5	2.5 (0.6)	●	●									
	NMX120-SR	●	150	●	6.5	3.5 (1.0)			●								
	NMX24-MFT	●	45-150	●	6	3.5 (1.3)			●		●	●	●				
	NMX24-MFT95	●	45-150 (150)	●	6	3.5 (1.3)			●		●	●	●			●	
NMCX24-MFT	●	20-75 (20)	●	5	3.0 (0.6)			●									
<b>NMQ Series 70 in-lb [8 Nm]</b>	NMQX24-MFT	●	4-20 (4)	●	23	13 (1.5)			●		●	●	●	●	●		
<b>LMX Series</b> 45 in-lb [5 Nm] Approx. 11 sq. ft.	LMX24-3	●	95	●	2	1.5 (0.2)	●	●									
	LMX24-3-T	●	95	●	2	1.5 (0.2)	●	●									
	LMX24-SR	●	95	●	3	1.5 (0.4)			●								
	LMX24-SR-T	●	95	●	3	1.5 (0.4)			●								
	LMX24-PC	●	95	●	5	2.5 (1.2)			●								
	LMX120-3	●	150	●	4	2.0 (0.5)	●	●									
LMX120-SR	●	150	●	4.5	2.5 (1.0)			●									
LMX24-MFT	●	35-200 (150)	●	5	2.5 (1.2)			●		●	●	●					
LMX24-MFT95	●	35-150 (150)	●	5	2.5 (1.2)			●		●	●	●					
<b>LMQ Series 35 in-lb [4 Nm]</b>	LMQX24-MFT	●	2.5-10 (2.5)	●	23	13 (1.5)			●		●	●	●	●	●		
<b>AHX Series</b> 101 lbf [450 N Force] 4" or 8" stroke	AHX24-3*	●	150*	●	4.5	2.0 (0.5)	●	●									
	AHX24-SR*	●	150*	●	4.5	2.5 (0.5)			●								
	AHX24-MFT*	●	150*	●	6	3.5 (1.3)			●		●	●	●				
<b>AHQ Series 44 lbf [200 N Force]</b>	AHQX24-MFT-100	●	7-20 (7)*	●	23	13 (1.5)			●		●	●	●	●	●		
<b>LHX Series</b> 34 lbf [150 N Force] 4" or 8" stroke	LHX24-3*	●	150*	●	3	1.5 (0.5)	●	●									
	LHX24-SR*	●	150*	●	3	1.5 (0.5)			●								
	LHX24-MFT*	●	75-150 (150)*	●	5	2.5 (1.2)			●		●	●	●				
<b>LHQ Series 22 lbf [100 N Force]</b>	LHQX24-MFT-100	●	3.5-15 (3.5)*	●	23	13 (1.5)			●		●	●	●	●	●		
<b>LUX Series</b> 27 in-lb [3 Nm]	LUX24-3	●	150	●	2.5	1.0 (0.5)	●	●									
	LUX24-SR	●	150	●	3	1.5 (0.5)			●								
	LUX24-MFT	●	75-150 (150)	●	5	2.5 (1.2)			●		●	●	●				

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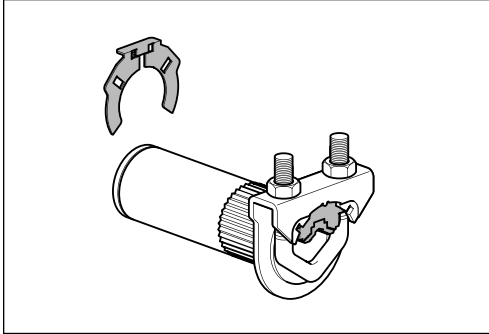
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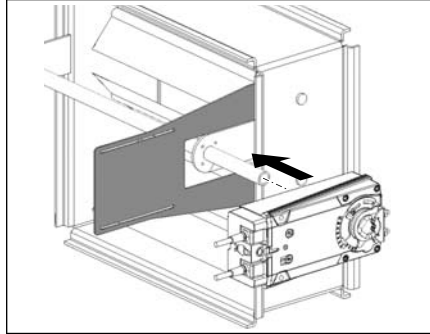
## Minimum 270 in-lb Torque

- For damper areas up to 66 sq-ft\* (For lower torque, see AFB, AF, NFB, LF, or TF series)

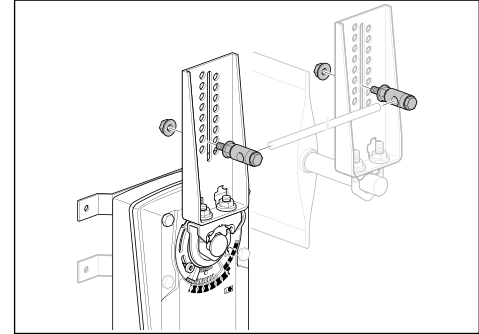
## Applications



New standard clamp fits standard 1/2" shafts to 1.05" jackshafts.



Mount directly to 1.05" jackshafts. (new ZG-120 bracket shown)



Linkage solutions are available when direct coupling is not possible.



All Actuators have BDCM

## EFB, EFX Series - At A Glance

	EFB24, EFX24 (p. 21)	EFB24 N4, EFX24 N4 (p. 23)	EFB24-S, EFX24-S (p. 21)	EFB24-S N4, EFX24-S N4(H) (p. 23)	EFB120, EFX120 (p. 25)	EFB120-S, EFX120-S (p. 25)	EFB120-S N4, EFX120-S N4(H) (p. 27)	EFB24-SR, EFX24-SR (p. 29)	EFB24-SR N4 (p. 31)	EFB24-SR-S, EFX24-SR-S (p. 29)	EFB24-SR-S N4, EFX24-SR-S N4(H) (p. 31)	EFB24-MFT, EFX24-MFT (p. 33)	EFB24-MFT-S, EFX24-MFT-S (p. 33)	EFB24-MFT-S N4, EFX24-MFT-S N4(H) (p. 35)	
Torque:	270 in-lb	●	●	●	●	●	●	●	●	●	●	●	●	●	
Power supply:	24 VAC/DC	●	●	●	●	●	●	●	●	●	●	●	●	●	
	120 VAC				●	●	●								
	230 VAC				●	●	●								
Control signal:	On/Off	●	●	●	●	●	●								
	2 to 10 VDC							●	●	●	●				
	Multi-function**											●	●	●	
Feedback signal:	2 to 10 VDC							●	●	●	●				
	VDC variable**											●	●	●	
Running time motor:	75 seconds	●	●	●	●	●	●								
	95 seconds							●	●	●	●				
	Adj. 60 to 150 seconds***											●	●	●	
	spring: <20 seconds	●	●	●	●	●	●	●	●	●	●	●	●	●	
Brushless DC Motor		●	●	●	●	●	●	●	●	●	●	●	●	●	
External direction of rotation switch								●	●	●	●	●	●	●	
Manual override		●	●	●	●	●	●	●	●	●	●	●	●	●	
Appliance rated cable, 18 GA <sup>†</sup> (default)		●		●		●	●	●	●	●	●	●	●		
Plenum rated cable, 18 GA (optional)		●						●				●			
Built-in auxiliary switch, Two SPDT				●	●		●			●	●		●	●	
NEMA 4 rated housing		●		●			●		●		●			●	
Installation instructions.....(p. 37-43)	General wiring.....(p. 45)				Start-up and checkout.....(p. 46)				Electrical operations.....(p. 44)						

\*Based on 4 in-lb/ft<sup>2</sup> damper torque loading. Parallel blade. No edge seals. \*\*Default 2 to 10 VDC. \*\*\*Default 150 seconds.

# A CLOSER LOOK...

- Cut labor costs with simple direct coupling.
- True mechanical spring return – the most reliable fail-safe.
- Reverse mount for clockwise or counterclockwise fail-safe.
- Check damper position easily with clear position indicator.
- Overload-proof throughout rotation
- Temporary restrictions in damper movement will not change actuator operation. Actuator returns to normal operation when restriction is removed (modulating actuators).
- Built-in mechanical stop to adjust angle of rotation.
- By eliminating internal condensation incorporated breather membrane optimizes performance in harsh airstream environments.
- Built-in auxiliary switches is easy to use, offers feedback or signal for additional device (-S models).
- Manual override crank speeds installation
- Need to change control direction? Do it easily with a simple switch (modulating actuators).
- Microprocessor-controlled brushless DC motor increases actuator life span and reliability, provides constant running time (modulating actuators).
- Rugged metal on plastic housing withstands rough handling in the mechanical room.
- Standard 3 ft. appliance cable and conduit connector eases installation.
- Double insulated – no need for separate safety ground. A Belimo exclusive (-S models).
- Automatically compensates for damper seal wear, ensuring tight close-off.
- Added Flexibility to Select Clamp, Electrical Connection, and Running Time to fit your Specific Application with Belimo's Flexible Line of Actuators (EFX).



## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

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# EFB24, EFB24-S, EFX24, EFX24-S

On/Off, Spring Return, 24 V



Technical Data		EFB24, EFB24-S, EFX24, EFX24-S
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	9.5 W
	holding	4.5 W
Transformer sizing		16 VA (class 2 power source)
Electrical connection		EFB24... 3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
		EFX24... 3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector <b>-S models:</b> two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		270 in-lb [30 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	75 seconds
	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		aluminum diecast and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤56.5dB(A) motor @ 75 seconds ≤71.4dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.82 lbs [4.45 kg], 10.14 lbs [4.6 kg] with switches
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
<b>EFB24-S, EFX24-S</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 85°

**Torque min. 270 in-lb, for control of air dampers**

## Application

For on/off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

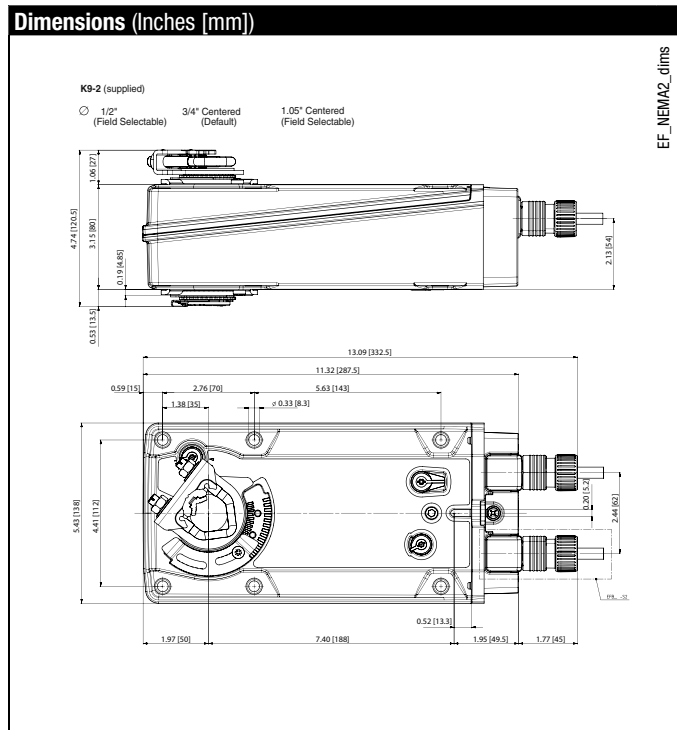
## Operation

The EFB and EFX series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The EFB and EFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The EFB24-S and EFX24-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +85°. The EFB24, EFB24-S, EFX24-S and EFX24-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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#### Accessories

IND-EFB	Damper position indicator
KH-EFB	Crank arm
K9-2	Universal clamp for up to 1.05" diameter jackshafts
TF-CC US	Conduit fitting
Tool-07	13 mm wrench
ZG-EFB	Crank arm adaptor kit

Note: When using EFB24, EFB24-S, EFX24, EFX24-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

#### Typical Specification

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

##### ✂️ INSTALLATION NOTES

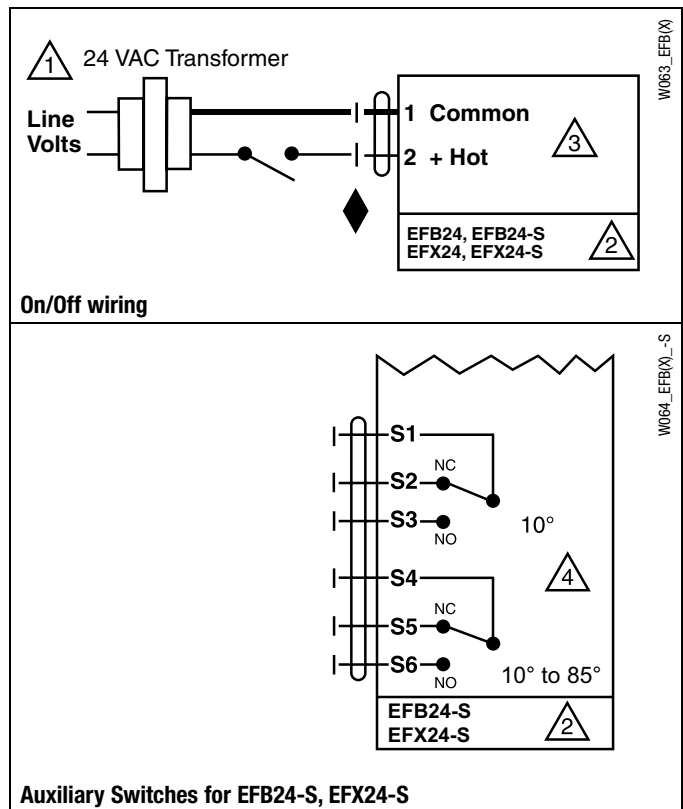
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., EFB24-S and EFX24-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 85°.

##### 📄 APPLICATION NOTES

- ◆ Meets cULus requirements without the need of an electrical ground connection.

##### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# EFB24 N4, EFB24-S N4, EFX24-S N4(H)

NEMA 4, On/Off, Spring Return, 24 V



Technical Data		EFB24 N4, EFB24-S N4, EFX24-S N4(H)
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	9.5 W / heater 21 W
	holding	4.5 W
Transformer sizing		16 VA (class 2 power source) / heater 21 VA
Electrical connection		terminal block(s) inside junction box with knockouts
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		270 in-lb [30 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	75 seconds
	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
	spring (w/heater)	< 20 seconds @ -22°F to 122°F [-30°C to 50°C]; < 60 seconds @ -40°F [-40°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
	with heater	-40°F to 122°F [-40°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA 4, IP66, Enclosure Type4
Housing material		aluminum diecast and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤56.5dB(A) motor @ 75 seconds ≤71.4dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		10 lbs [4.54 kg], 10.1 lbs [4.59 kg] with heater
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.		
<b>EFB24-S N4, EFX24-S N4(H)</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at 10° and one set at 85°

**Torque min. 270 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

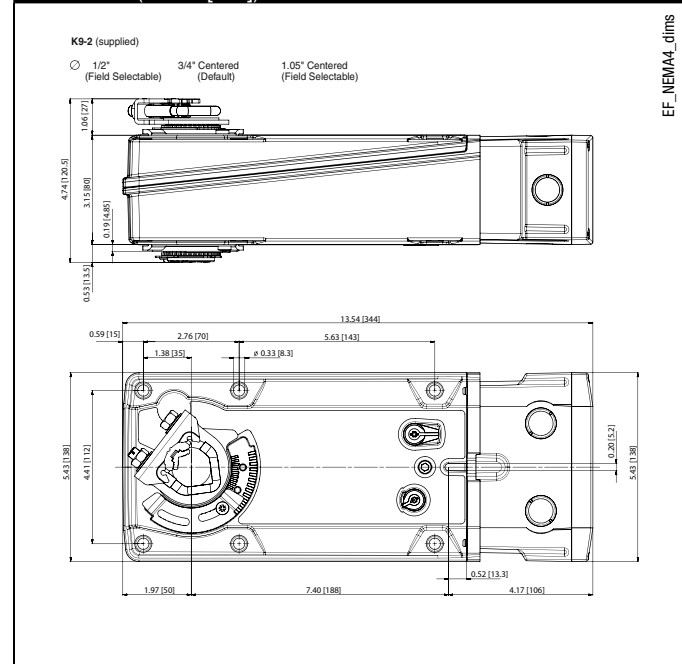
The EFB N4 and EFX N4 series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The EFB N4 and EFX N4 series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The EFB24-S N4 and EFX24-S N4 versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is fixed at 85°. The EFB24 N4, EFB24-S N4 and EFX24-S N4(H) actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

## Dimensions (Inches [mm])



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**Accessories**

IND-EFB	Damper position indicator
KH-EFB	Crank arm
K9-2	Universal clamp for up to 1.05" diameter jackshafts
Tool-07	13 mm wrench
ZG-EFB	Crank arm adaptor kit

Note: When using EFB24 N4, EFB24-S N4, EFX24-S N4(H) actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

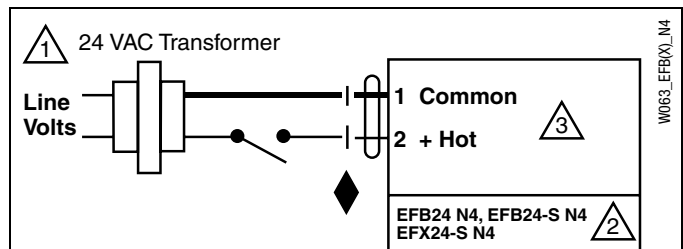
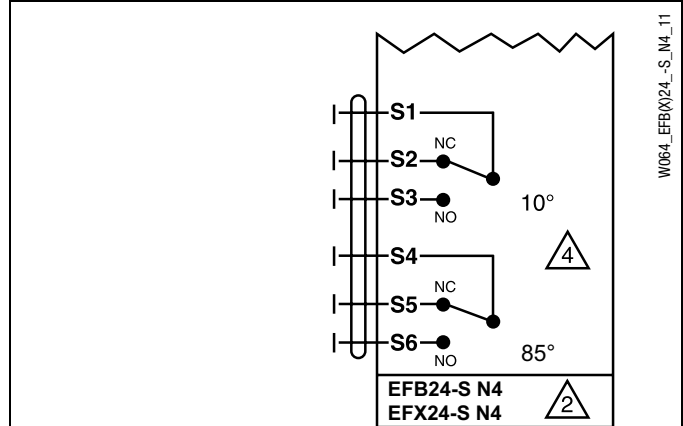
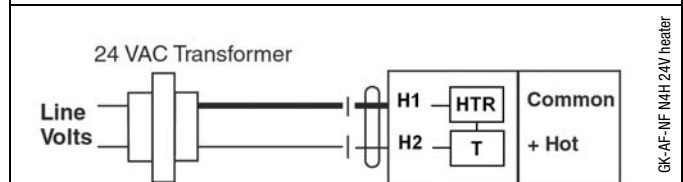
- 4 For end position indication, interlock control, fan startup, etc., EFB24-S N4 and EFX24-S N4(H) incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at 10°, the other is fixed at 85°.

**APPLICATION NOTES**

- ◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.


**On/Off wiring**

**Auxiliary Switches**

**NEMA 4 Heater**

# EFB120, EFB120-S, EFX120, EFX120-S

On/Off, Spring Return, 100 to 240 VAC



Technical Data		EFB120, EFB120-S, EFX120, EFX120-S
Power supply		100...240 VAC +10% / -20%, 50/60 Hz 100...125 VDC ±10%
Power consumption	running	9.5 W
	holding	4.5 W
VA rating		21 VA @ 100 VAC 29 VA @ 240 VAC
	Electrical connection	
	EFB120...	3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> Two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	EFX120...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance cable, with or without 1/2" conduit connector <b>-S models:</b> Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		270 in-lb [30 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	75 sec
	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		aluminum diecast and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤56.5dB(A) motor @ 75 seconds ≤71.4dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.82 lbs [4.45 kg], 10.14 lbs [4.6 kg] with switches
† Rated Impulse Voltage 2.5kV, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
<b>EFB120-S, EFX120-S</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL Approved one set at +10°, one adjustable 10° to 85°

**Torque min. 270 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

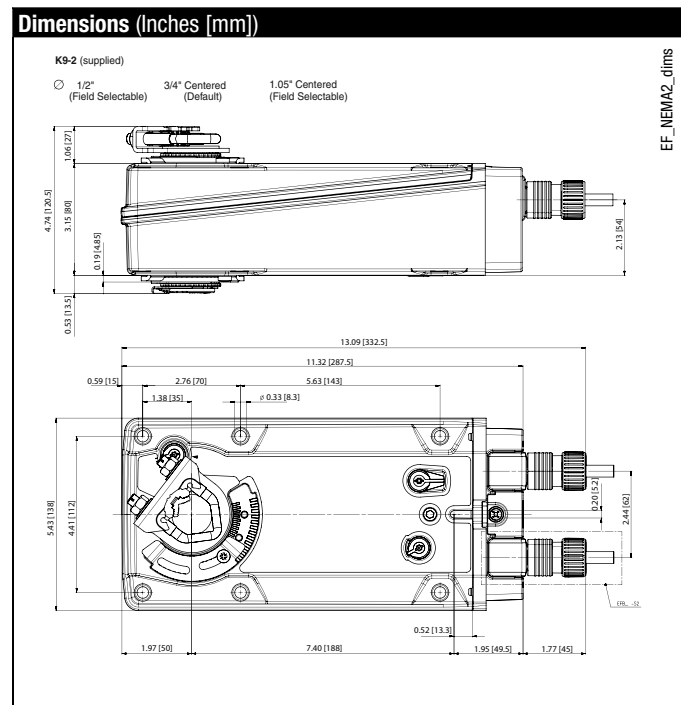
## Operation

The EFB and EFX series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The EFB and EFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The EFB120-S and EFX120-S versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +85°. The EFB120, EFB120-S, EFX120 and EFX120-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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**Accessories**

IND-EFB	Damper position indicator
KH-EFB	Crank arm
K9-2	Universal clamp for up to 1.05" diameter jackshafts
TF-CC US	Conduit fitting
Tool-07	13 mm wrench
ZG-EFB	Crank arm adaptor kit

**Note:** When using EFB120, EFB120-S, EFX120, EFX120-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. 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 approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 No ground connection is required.
- 4 For end position indication, interlock control, fan startup, etc., EFB120-S and EFX120-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 85°.

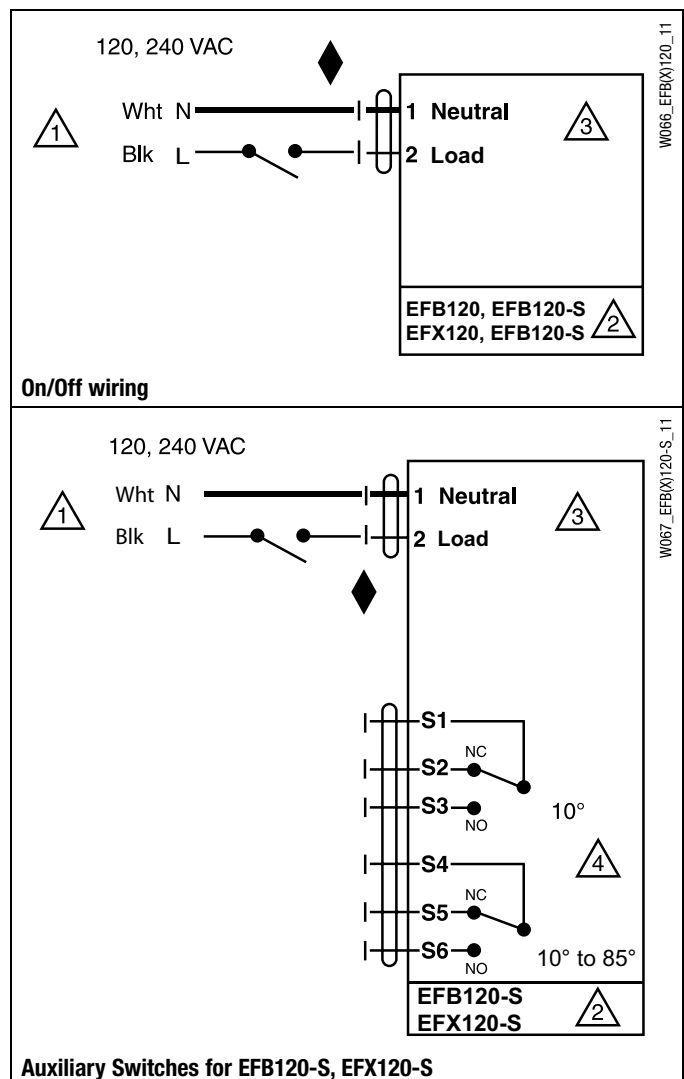
**APPLICATION NOTES**

- ◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

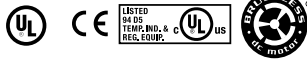
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

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# EFB120-S N4, EFX120-S N4(H)

NEMA 4, On/Off, Spring Return, 100 to 240 VAC



Technical Data		EFB120-S N4, EFX120-S N4(H)
Power supply		100...240 VAC +10% / -20%, 50/60 Hz 100...125 VDC ±10%
Power consumption	running	9.5 W / heater 22 W
	holding	4.5 W
VA rating		21 VA @ 120 VAC / heater 22 VA 29 VA @ 240 VAC
Electrical connection		terminal block(s) inside junction box with knockouts
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		270 in-lb [30 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	75 sec
	spring	< 20 sec @ -4°F to 122°F [-20°C to 50°C]; < 60 sec @ -22°F [-30°C]
	spring (w/heater)	< 20 sec @ -22°F to 122°F [-30°C to 50°C]; < 60 sec @ -40°F [-40°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
	with heater	-40°F to 122°F [-40°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA 4, IP66, Enclosure Type4
Housing material		aluminum diecast and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤56.5dB(A) motor @ 75 seconds ≤71.4dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		10 lbs [4.54 kg], 10.1 lbs [4.59 kg] with heater
† Rated Impulse Voltage 2.5kV, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4. EFX120-S N4H is only UL listed.		
<b>EFB120-S N4, EFX120-S N4(H)</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL Approved one set at 10° and one set at 85°

Torque min. 270 in-lb, for control of air dampers

## Application

For on/off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

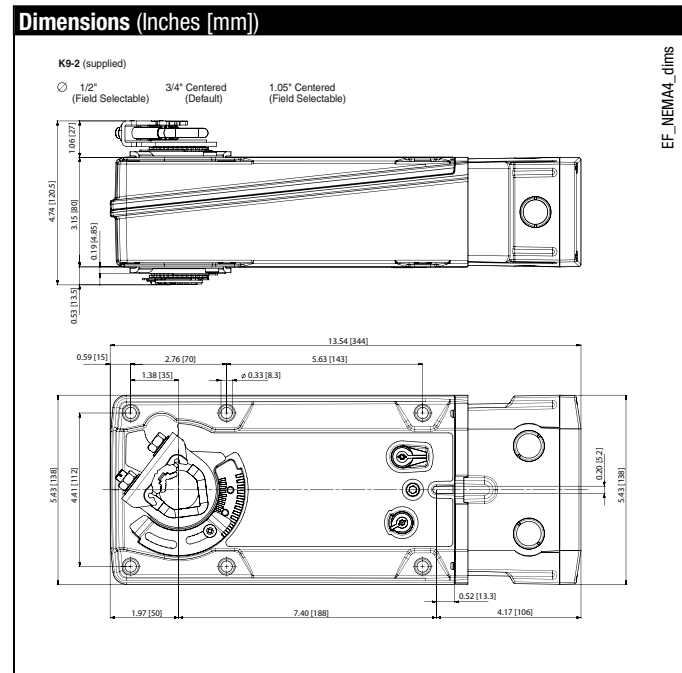
## Operation

The EFB N4 and EFX N4 series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The EFB N4 and EFX N4 series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The EFB120-S N4 and EFX120-S N4(H) versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is fixed at 85°. The EFB120-S N4 and EFX120-S N4(H) actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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**Accessories**

IND-EFB	Damper position indicator
KH-EFB	Crank arm
K9-2	Universal clamp for up to 1.05" diameter jackshafts
Tool-07	13 mm wrench
ZG-EFB	Crank arm adaptor kit

**Note:** When using EFB120-S N4, EFX120-S N4(H) actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided. 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 approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**

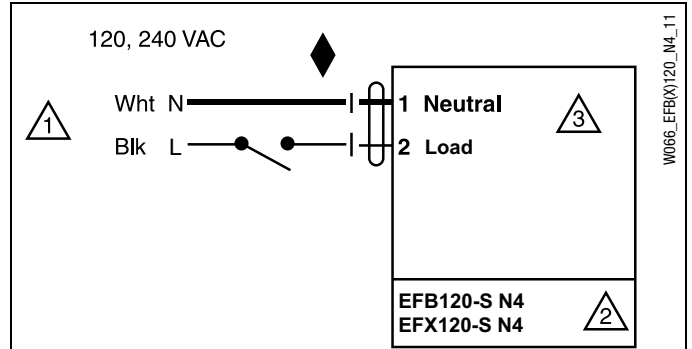
**INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 No ground connection is required.
- 4 For end position indication, interlock control, fan startup, etc., EFB120-S N4 and EFX120-S N4(H) incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at 10°, the other is fixed at 85°.

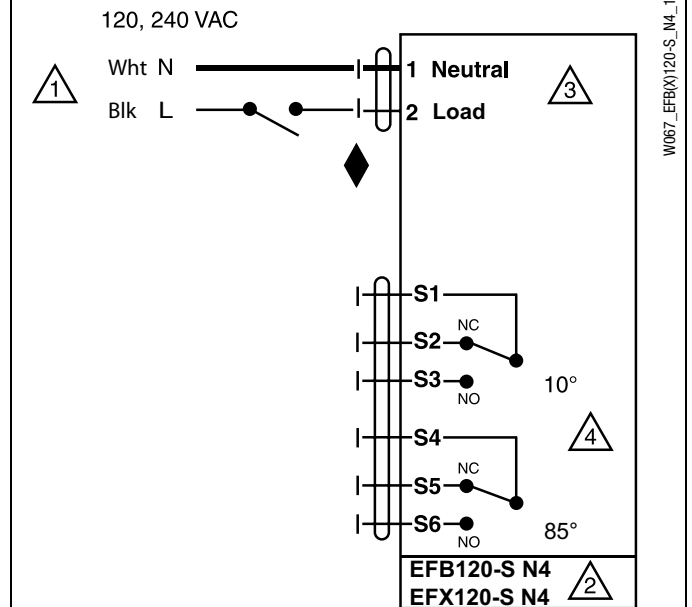
**APPLICATION NOTES**

Meets cULus requirements without the need of an electrical ground connection.

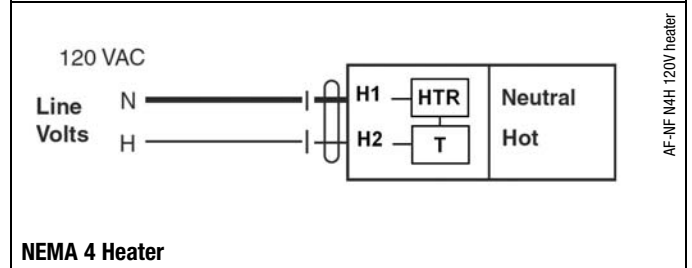
**WARNING Live Electrical Components!**  
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**On/Off wiring**



**Auxiliary Switches**



**NEMA 4 Heater**

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W066\_EFB(X)120\_N4\_11

W067\_EFB(X)120-S\_N4\_11

AF-NF-N4H 120V heater

# EFB24-SR, EFB24-SR-S, EFX24-SR, EFX24-SR-S

Proportional, Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data		EFB24-SR, EFB24-SR-S, EFX24-SR, EFX24-SR-S
Power supply		24 VAC ±20%, 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	8 W
	holding	4.5 W
Transformer sizing		14 VA (class 2 power source)
Electrical connection	EFB...	3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	EFX...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector <b>-S models:</b> Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20mA
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA
Feedback output U		2 to 10 VDC (max. 0.5 mA)
Torque		270 in-lb [30 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
	motor	reversible with built-in switch
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
	motor	95 seconds
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		aluminum diecast and plastic casing
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤56.5dB(A) motor @ 95 seconds
		≤71.4dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.82 lbs [4.45 kg], 10.14 lbs [4.6 kg] with switches

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

EFB24-SR-S, EFX24-SR-S	
Auxiliary switches	2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 85°

**Torque min. 270 in-lb, for control of air dampers**

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates 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. A 2 to 10 VDC feedback signal is provided for position indication. Not to be used for a master-slave application.

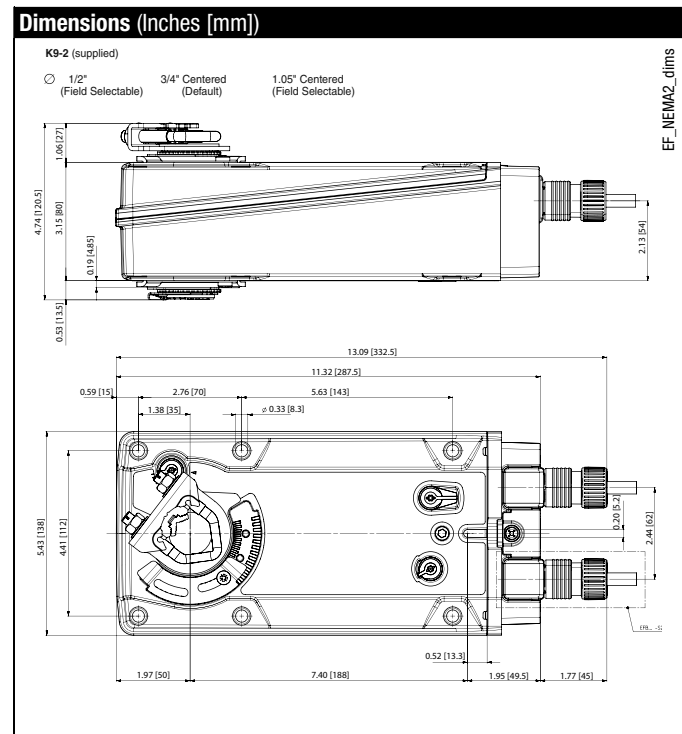
## Operation

The EFB and EFX series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The EFB and EFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The EFB24-SR and EFX24-SR 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 fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The EFB24-SR-S and EFX24-SR-S versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +85°. The EFB24-SR, EFB24-SR-S, EFX24-SR and EFX24-SR-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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### Accessories

IND-EFB	Damper position indicator
KH-EFB	Crank arm
K9-2	Universal clamp for up to 1.05" diameter jackshafts
TF-CC US	Conduit fitting
Tool-07	13 mm wrench
ZG-EFB	Crank arm adaptor kit

**NOTE:** When using EFB24-SR, EFB24-SR-S, EFX24-SR and EFX24-SR-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional 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 counterclockwise 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. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

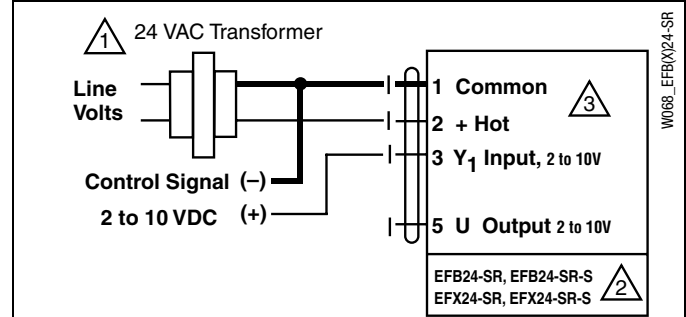
#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.  
Up to 4 actuators may be connected in parallel if not mechanically mounted to the same shaft. With 4 actuators wired to one 500 Ω resistor. Power consumption must be observed.
- 3 Actuator may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., EFB24-SR-S and EFX24-SR-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 85°.
- 5 Only connect common to neg. (-) leg of control circuits

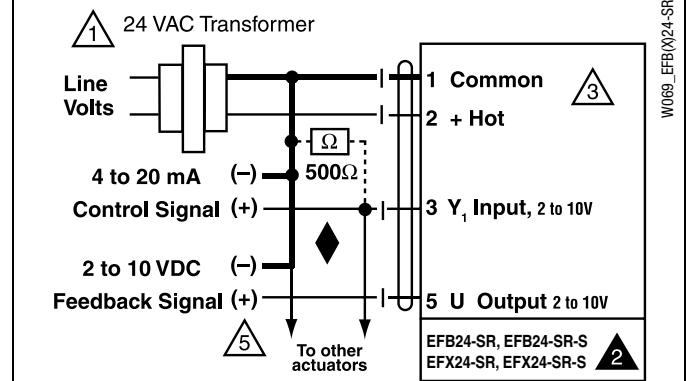
#### APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

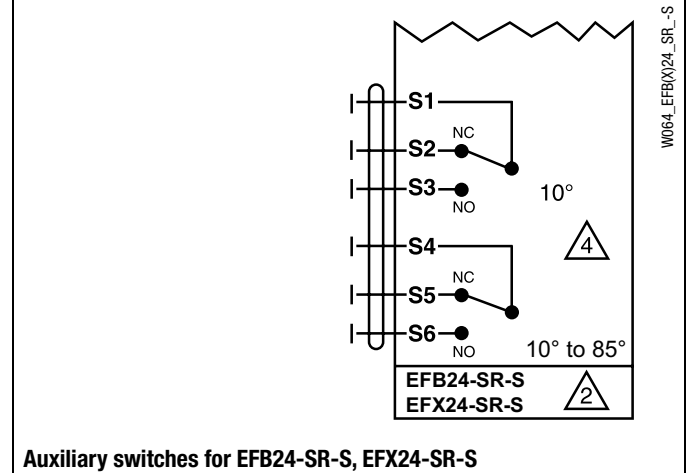
**WARNING Live Electrical Components!**  
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2 to 10 VDC control



4 to 20 mA control with 2 to 10 VDC feedback output



Auxiliary switches for EFB24-SR-S, EFX24-SR-S

# EFB24-SR N4, EFB24-SR-S N4, EFX24-SR-S N4(H)

NEMA 4, Proportional, Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data		EFB24-SR N4, EFB24-SR-S N4, EFX24-SR-S N4(H)
Power supply		24 VAC ±20%, 50/60 Hz 24 VDC +20% / -10%
Power consumption	running holding	8 W / heater 21 W 4.5 W
Transformer sizing		14 VA (class 2 power source) / heater 21 VA
Electrical connection		terminal block(s) inside junction box with knockouts
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20mA
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA
Feedback output U		2 to 10 VDC (max. 0.5 mA)
Torque		270 in-lb [30 Nm] minimum
Direction of rotation	spring motor	reversible with CW/CCW mounting reversible with built-in switch
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring  motor spring (w/heater)	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C] 95 seconds < 20 sec @ -22°F to 122°F [-30°C to 50°C]; < 60 sec @ -40°F [-40°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
	with heater	-40°F to 122°F [-40°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA 4, IP66, Enclosure Type4
Housing material		aluminum diecast and plastic casing
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤56.5dB(A) motor @ 95 seconds ≤71.4dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		10 lbs [4.54 kg], 10.1 lbs [4.59 kg] with heater
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.		
<b>EFB24-SR-S N4, EFX24-SR-S N4(H)</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at 10°, and one set at 85°

Torque min. 270 in-lb, for control of air dampers

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates 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. A 2 to 10 VDC feedback signal is provided for position indication. Not to be used for a master-slave application.

## Operation

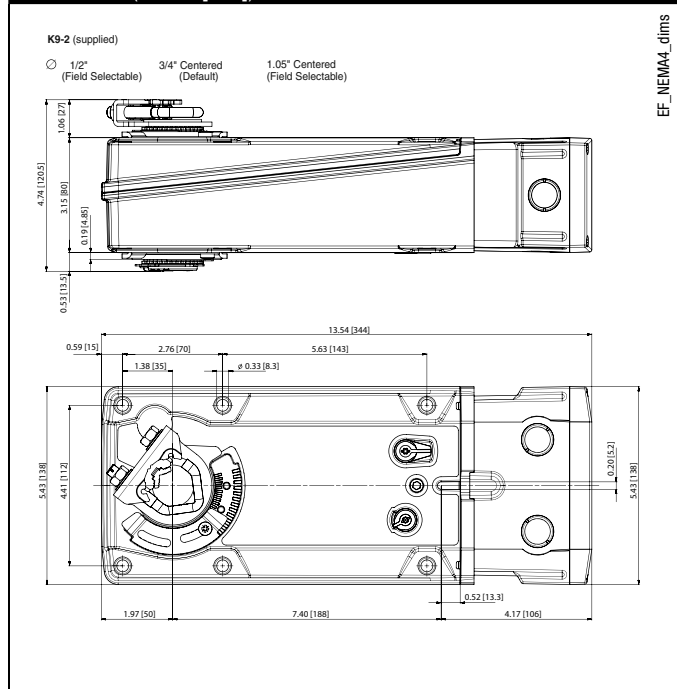
The EFB N4 and EFX N4 series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The EFB N4 and EFX N4 series provide 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The EFB N4 and EFX N4 series use 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 fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The EFB24-SR-S N4 and EFX24-SR-S N4(H) versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is fixed at 85°. The EFB24-SR N4, EFB24-SR-S N4, and EFX24-SR-S N4(H) actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

## Dimensions (Inches [mm])



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### Accessories

IND-EFB	Damper position indicator
KH-EFB	Crank arm
K9-2	Universal clamp for up to 1.05" diameter jackshafts
Tool-07	13 mm wrench
ZG-EFB	Crank arm adaptor kit

**NOTE:** When using EFB24-SR N4, EFB24-SR-S N4, and EFX24-SR-S N4(H) actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional 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 counterclockwise 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. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

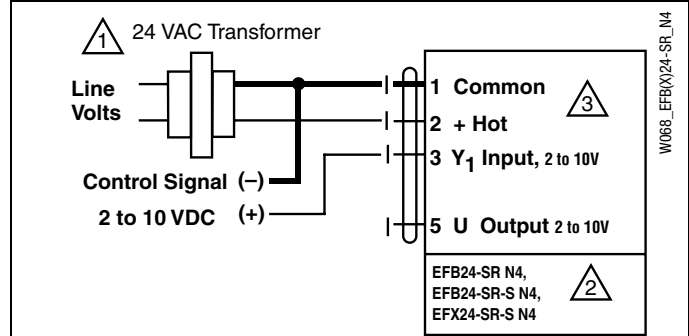
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.  
Up to 4 actuators may be connected in parallel if not mechanically mounted to the same shaft. With 4 actuators wired to one 500 Ω resistor.  
Power consumption must be observed.
- 3 Actuator may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., EFB24-SR-S N4 and EFX24-SR-S N4 incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, the other is fixed at 85°.
- 5 Only connect common to neg. (-) leg of control circuits

#### APPLICATION NOTES

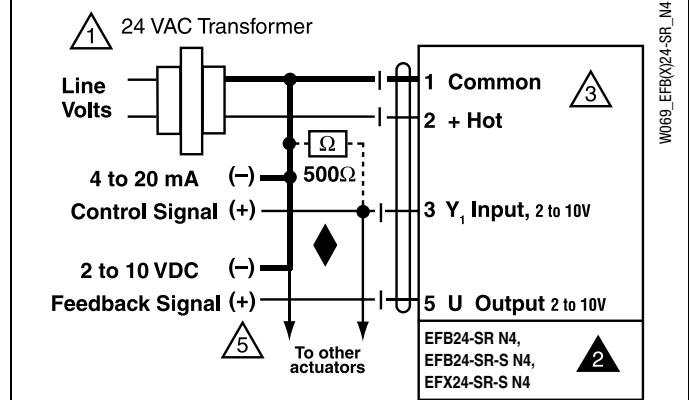
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

#### WARNING Live Electrical Components!

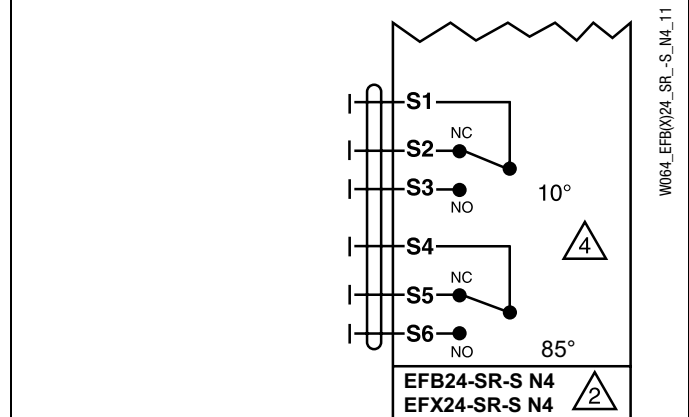
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



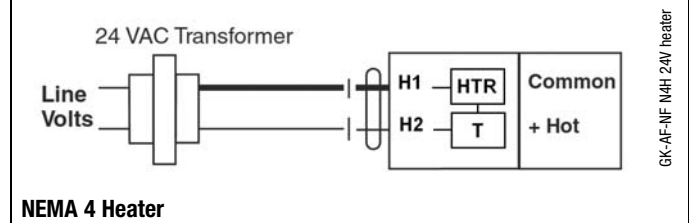
2 to 10 VDC control



4 to 20 mA control with 2 to 10 VDC feedback output



Auxiliary switches



NEMA 4 Heater

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W068\_EFB(X)24-SR\_N4

W069\_EFB(X)24-SR\_N4

W064\_EFB(X)24-SR-S\_N4\_11

GK-AF-NF N4H 24V heater

# EFB24-MFT, EFB24-MFT-S, EFX24-MFT, EFX24-MFT-S

Proportional, Spring Return, Direct Coupled, 24V, Multi-Function Technology®



MFT



- Torque min. 270 in-lb for control of air dampers
- Control 2 to 10 VDC (Default)
- Feedback 2 to 10 VDC (Default)

## Application

For proportional modulation of dampers in HVAC systems. The EFB24-MFT, EFX24-MFT provides mechanical spring return operation for reliable fail-safe application.

## Default/Configuration

Default parameters for 2 to 10 VDC applications of the EFB24-MFT, EFX24-MFT actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. The parameters noted in the Technical Data table are variable.

These parameters can be changed by three means:

- Pre-set or custom configurations from Belimo
- Configurations set by the customer using the MFT PC tool (version 3.4 or higher) software application.
- Handheld ZTH-GEN

## Operation

The EFB24-MFT, EFX24-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 EFB24-MFT, EFX24-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 EFB24-MFT, EFX24-MFT actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

**NOTE: Please see documentation on Multi-Function Technology.**

Technical Data		EFB24-MFT, EFB24-MFT-S, EFX24-MFT, EFX24-MFT-S
Power supply		24 VAC, +/- 20%, 50/60 Hz 24 VDC, +20% / -10%
Power consumption♦	running	9.5 W
	holding	4.5 W
Transformer sizing ♦		16 VA
Electrical connection		3 ft, 18 GA appliance cable, 1/2" conduit connector
EFB24-MFT		-S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
EFX24-MFT		3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector
EFX24-MFT-S		-S models: two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y*		2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1500 Ω for PWM, floating point and on/off control
Feedback output U*		2 to 10 VDC, 0.5 mA max (default)
Torque		270 in-lb [30 Nm] minimum
Direction of rotation*	spring motor	reversible with cw/ccw mounting reversible with built-in switch
Mechanical angle of rotation*		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring	<20 sec @ -4°F to 122°F [-20° C to 50° C]; <60 sec @ -22°F [-30° C]
	motor*	150 seconds (default), variable (60 to 150 seconds)
Angle of Rotation adaptation		off (default)
Override control*		min position = 0% mid. position = 50% max. position = 100%
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max 95% RH, non-condensing
Ambient temperature		-22 to 122° F (-30 to 50° C)
Storage temperature		-40 to 176° F (-40 to 80° C)
Housing		NEMA 2, IP54, Enclosure Type2
Housing material		aluminum diecast and plastic casing
Noise level		≤45.3dB(A) motor @ 150 seconds, run time dependent ≤71.4dB(A) spring return
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Quality standard		ISO 9001
Servicing		maintenance free
Weight		9.82 lbs [4.45 kg], 10.14 lbs [4.6 kg] with switches

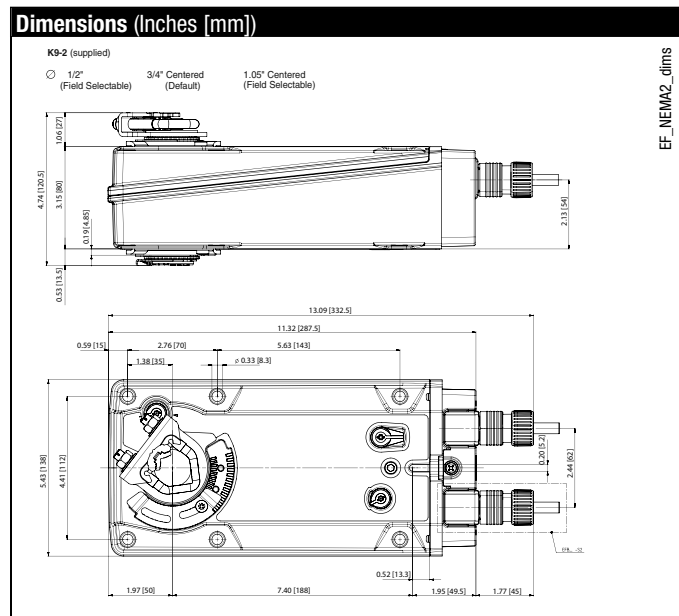
\* Variable when configured with MFT options

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

♦ Programmed for 60 sec motor run time. At 150 sec motor run time, transformer sizing is 12 VA and power consumption is 7 W running / 4.5 W holding.

## EFB24-MFT-S, EFX24-MFT-S

Auxiliary switches	2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 85°
--------------------	--



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**Accessories**

IND-EFB	Damper position indicator
KH-EFB	Crank arm
K9-2	Universal clamp for up to 1.05" diameter jackshafts
TF-CC US	Conduit fitting
Tool-07	13 mm wrench
ZG-EFB	Crank arm adaptor kit

**NOTE:** When using EFB24-MFT, EFB24-MFT-S, EFX24-MFT and EFX24-MFT-S actuators, only use accessories listed on this page.  
 For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**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 proportional 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 counterclockwise 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. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**

**INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

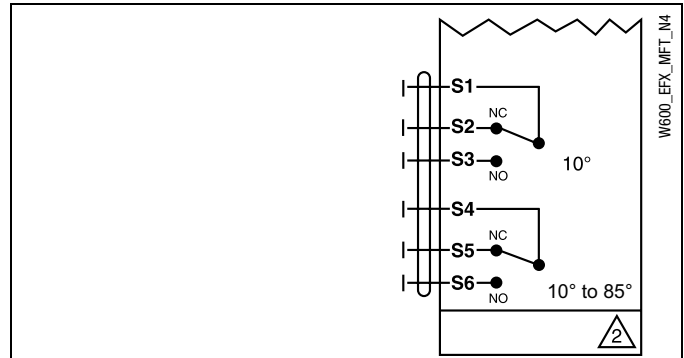
**APPLICATION NOTES**

- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor may be used.

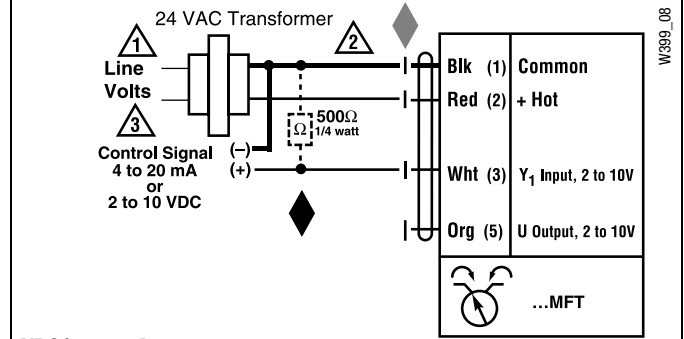
**WARNING Live Electrical Components!**

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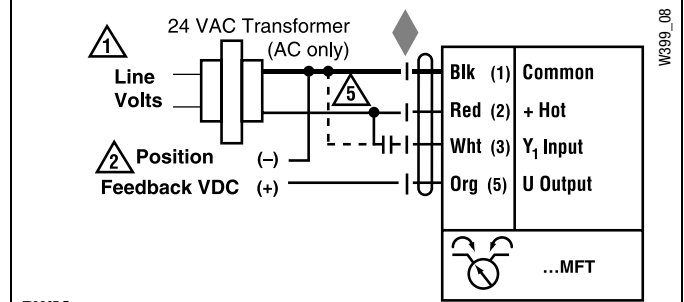
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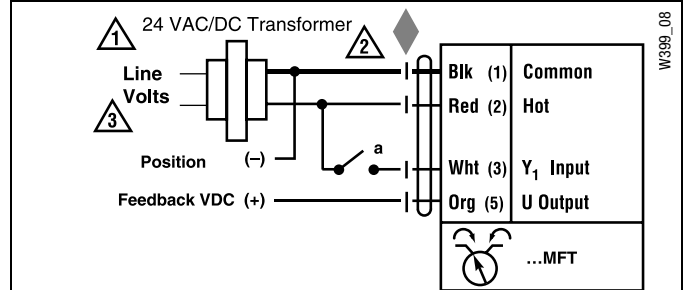
**Auxiliary Switches for EFB24-MFT-S, EFX24-MFT-S**



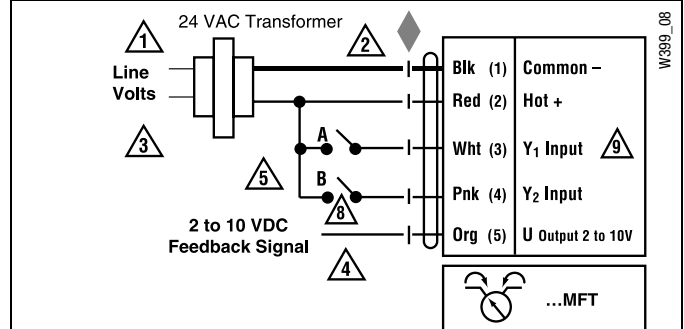
**VDC/4-20 mA**



**PWM**



**On/Off control**



**Floating Point control**

# EFB24-MFT-S N4, EFX24-MFT-S N4(H)

NEMA 4, Proportional, Spring Return, Direct Coupled, 24V, Multi-Function Technology®



MFT



Technical Data		EFB24-MFT-S N4, EFX24-MFT-S N4(H)
Power supply		24 VAC, +/- 20%, 50/60 Hz 24 VDC, +20% / -10%
Power consumption	running holding	9.5 W / heater 21 W 4.5 W
Transformer sizing		16 VA / heater 21 VA
Electrical connection		terminal block(s) inside junction box with knockouts
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y*		2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1500 Ω for PWM, floating point and on/off control
Feedback output U*		2 to 10 VDC, 0.5 mA max (default)
Torque		270 in-lb [30 Nm] minimum
Direction of rotation*	spring motor	reversible with cw/ccw mounting reversible with built-in switch
Mechanical angle of rotation*		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring motor* spring (w/heater)	<20 sec @ -4°F to 122°F [-20° C to 50° C]; <60 sec @ -22°F [-30° C] 150 seconds (default), variable (60 to 150 seconds) < 20 sec @ -22°F to 122°F [-30°C to 50°C]; < 60 sec @ -40°F [-40°C]
Angle of rotation adaptation		off (default)
Override control*		min position = 0% mid. position = 50% max. position = 100%
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max 95% RH, non-condensing
Ambient temperature		-22 to 122° F (-30 to 50° C)
with heater		-40°F to 122°F [-40°C to 50°C]
Storage temperature		-40 to 176° F (-40 to 80° C)
Housing		NEMA 4, IP66, Enclosure Type4
Housing material		aluminum diecast and plastic casing
Noise level		≤45.3dB(A) motor @ 150 seconds, run time dependent ≤71.4dB(A) spring return
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Quality standard		ISO 9001
Servicing		maintenance free
Weight		10 lbs [4.54 kg], 10.1 lbs [4.59 kg] with heater

\* Variable when configured with MFT options

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.

♦ Programmed for 60 sec motor run time. At 150 sec motor run time, transformer sizing is 12 VA and power consumption is 7 W running / 4.5 W holding.

## EFB24-MFT-S N4, EFX24-MFT-S N4(H)

Auxiliary switches	2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at 10°, and one set at 85°
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- Torque min. 270 in-lb for control of air dampers
- Control 2 to 10 VDC (Default)
- Feedback 2 to 10 VDC (Default)

## Application

For proportional modulation of dampers in HVAC systems. The EFB24-MFT-S N4, EFX24-MFT-S N4(H) provides mechanical spring return operation for reliable fail-safe application.

## Default/Configuration

Default parameters for 2 to 10 VDC applications of the EFB24-MFT-S N4, EFX24-MFT-S N4(H) actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. The parameters noted in the Technical Data table are variable.

These parameters can be changed by three means:

- Pre-set or custom configurations from Belimo
- Configurations set by the customer using the MFT PC tool (version 3.4 or higher) software application.
- Handheld ZTH-GEN

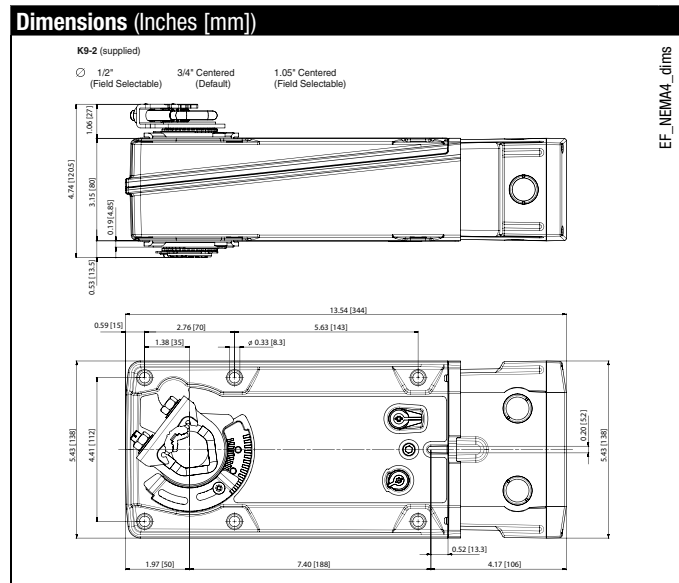
## Operation

The EFB24-MFT-S N4, EFX24-MFT-S N4(H) 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 EFB24-MFT-S N4, EFX24-MFT-S N4(H) 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 EFB24-MFT-S N4, EFX24-MFT-S N4(H) actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

**NOTE: Please see documentation on Multi-Function Technology.**



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### Accessories

IND-EFB	Damper position indicator
KH-EFB	Crank arm
K9-2	Universal clamp for up to 1.05" diameter jackshafts
Tool-07	13 mm wrench
ZG-EFB	Crank arm adaptor kit

**NOTE:** When using EFB24-MFT-S N4, and EFX24-MFT-S N4(H) actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional 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 counterclockwise 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. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

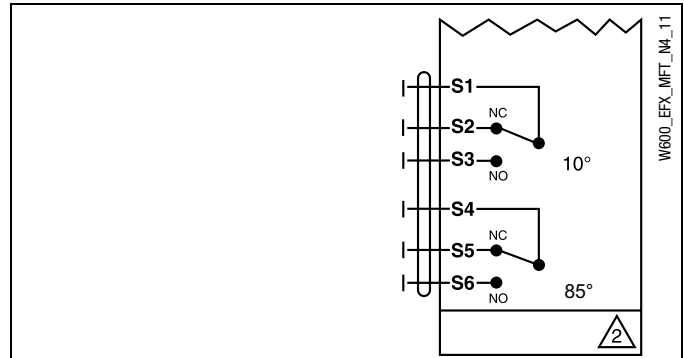
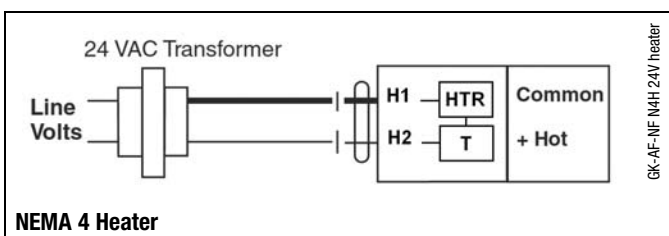
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

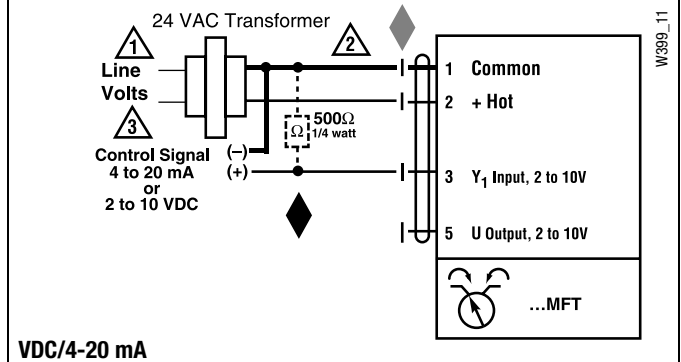
- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

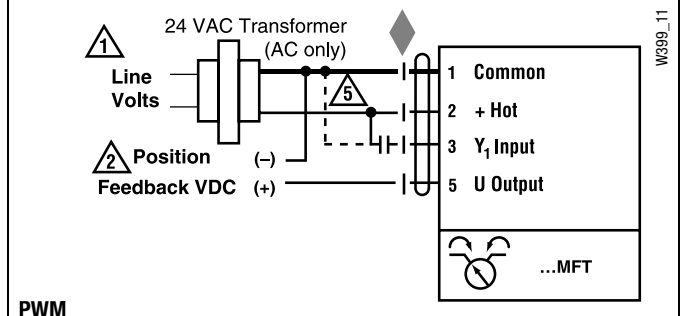
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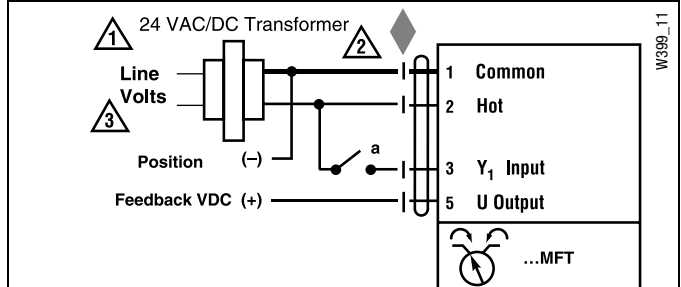
#### Auxiliary Switches for EFB24-MFT-S N4, EFX24-MFT-S N4



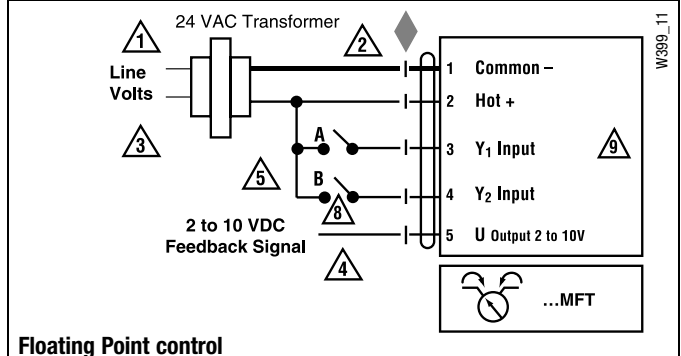
#### VDC/4-20 mA



#### PWM



#### On/Off control

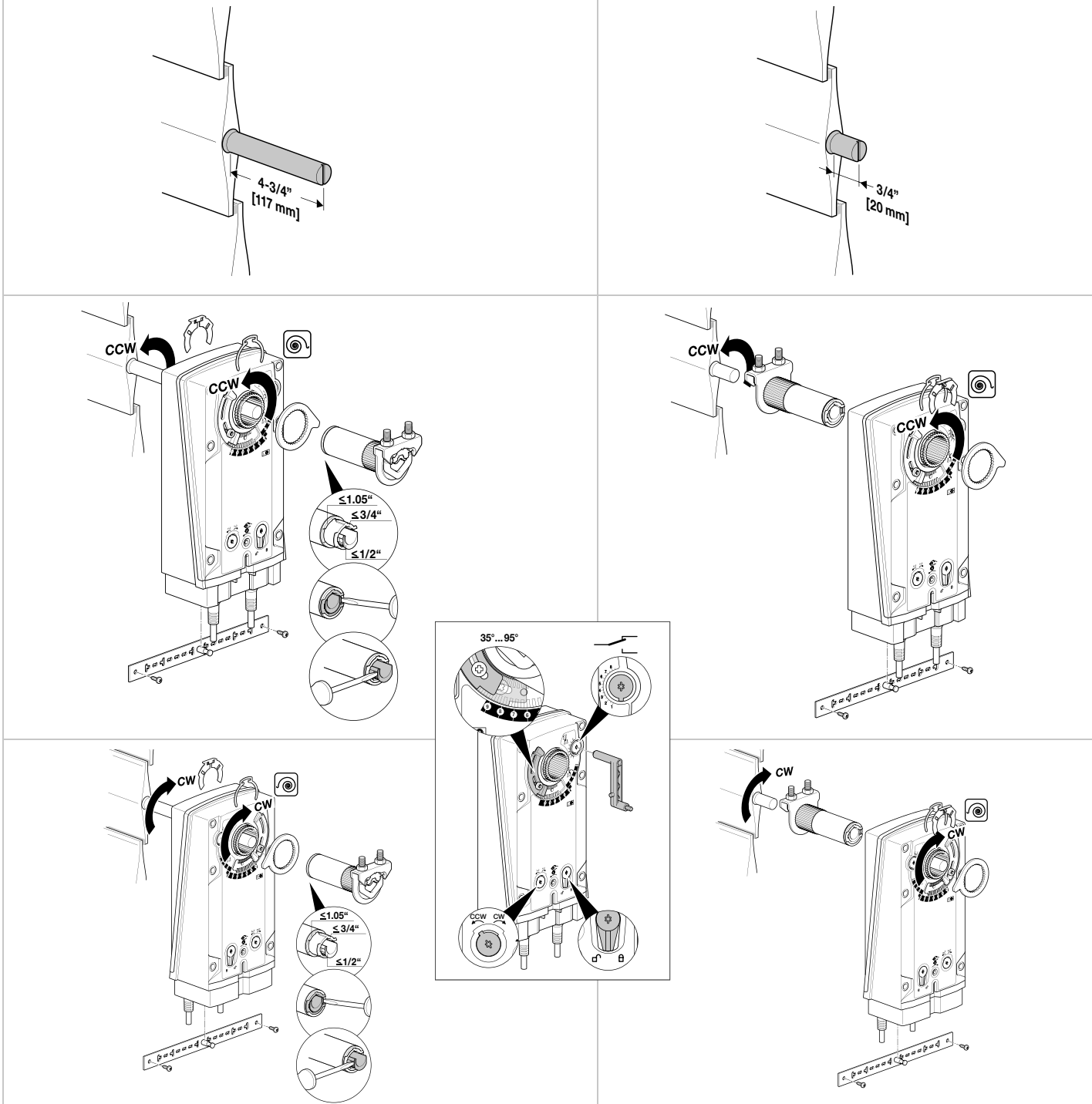


#### Floating Point control

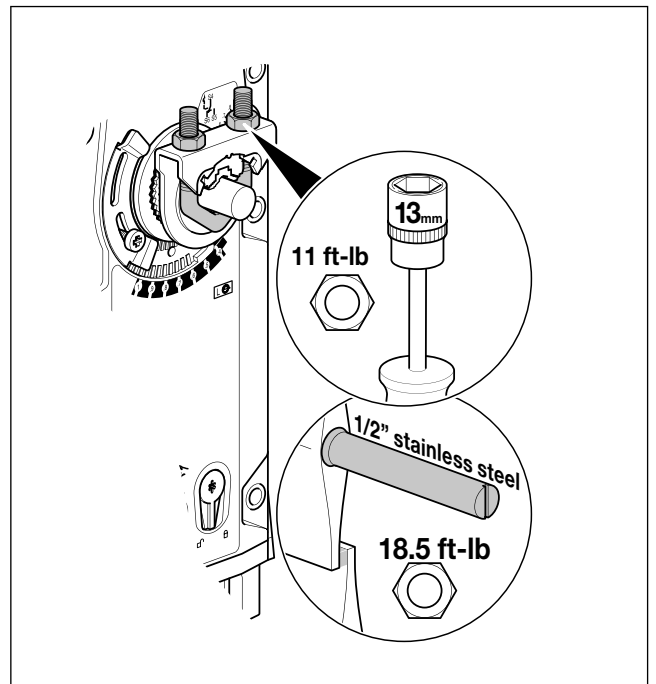
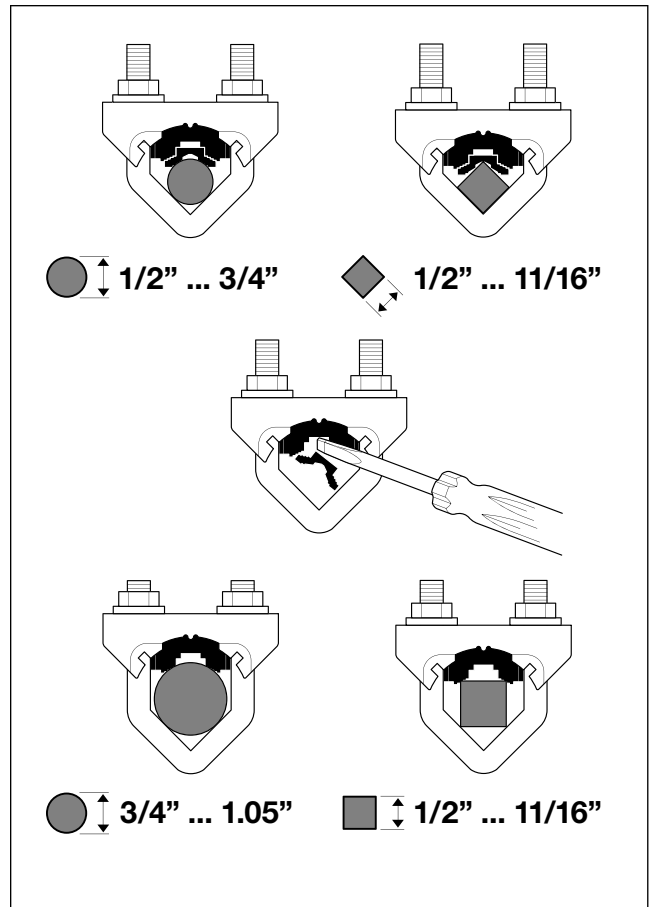
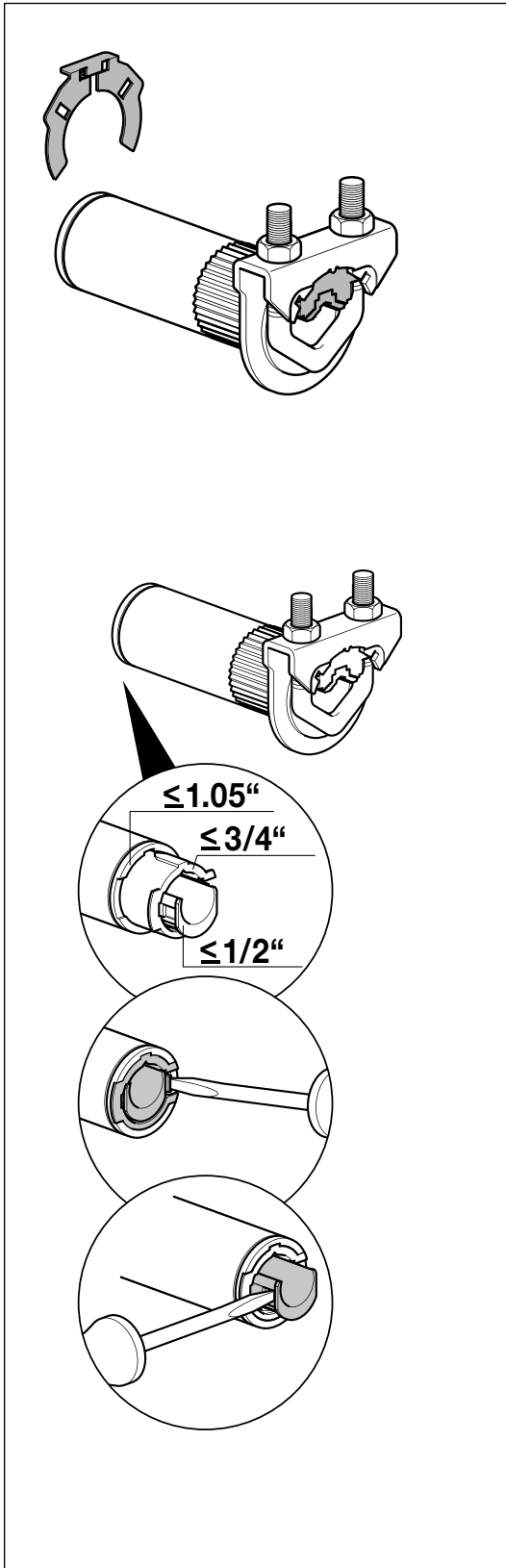
### Quick-Mount Visual Instructions

1. Rotate the damper to its fail-safe position.  
If the shaft rotates counterclockwise, mount the "CCW" side of the actuator out.  
If it rotates clockwise, mount the actuator with the "CW" side out.
  2. If the universal clamp is not on the correct side of the actuator, mount it onto the correct side.
  3. Slide the actuator onto the shaft and tighten the nuts on the V-bolt with a 13mm wrench to 11 ft-lb of torque.
  4. Slide the anti-rotation strap under the actuator so that it engages the slot at the base of the actuator. Secure the strap to the duct work with #8 self-tapping screws.
- NOTE: Read the "Standard Mounting" instructions, on the next page, for more detailed information.

### Dimensions (Inches [mm])



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# Installation Instructions

## Mechanical Installation



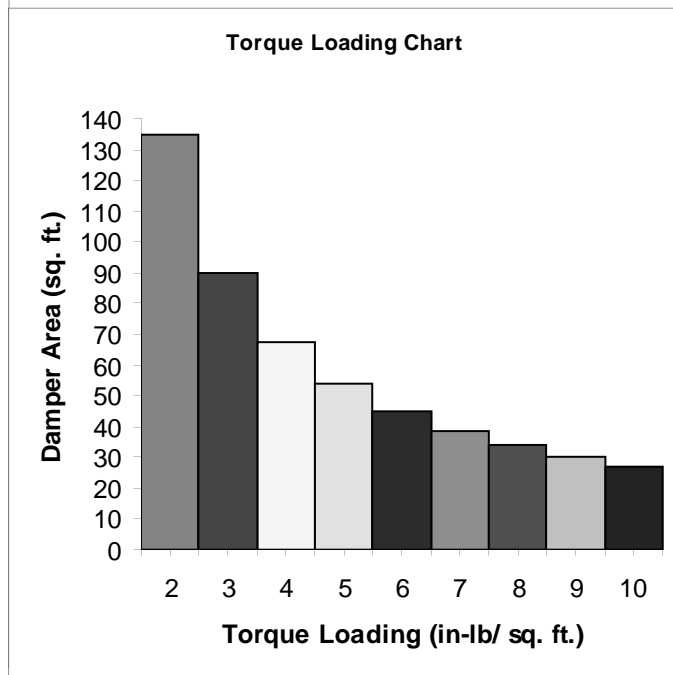
### Determining Torque Loading and Actuator Sizing

Damper torque loadings, used in selecting the correct size actuator, should be provided by the damper manufacturer. If this information is not available, the following general selection guidelines can be used.

Damper Type	Torque Loading
Opposed blade, without edge seals, for non-tight close-off applications	3 in-lb/sq. ft.
Parallel blade, without edge seals, for non-tight close-off applications	4 in-lb/sq. ft.
Opposed blade, with edge seals, for tight close-off applications	5 in-lb/sq. ft.
Parallel blade, with edge seals, for tight close-off applications	7 in-lb/sq. ft.

The above torque loadings will work for most applications with 1000 FPM face velocity. For applications between this criteria and 2500 FPM, the torque loading should be increased by a multiplier of 1.5. If the application calls for higher criteria up to 3000 FPM, use a multiplier of 2.0.

### Torque Loading Chart



### General Information

Belimo actuators should be mounted indoors in a dry, relatively clean environment free from corrosive fumes. If the actuator is to be mounted outdoors, a protective enclosure must be used to shield the actuator.

For new construction work, **order dampers with extended shafts**. Instruct the installing contractor to allow space for mounting and service of the Belimo actuator on the shaft. The damper shaft must extend at least 4-3/4" from the duct. If the shaft extends less than 4-3/4" or if an obstruction blocks access, the shaft can be extended with the AV 8-25 shaft extension accessory or the actuator may be mounted in its short shaft configuration.

### Mechanical Operation

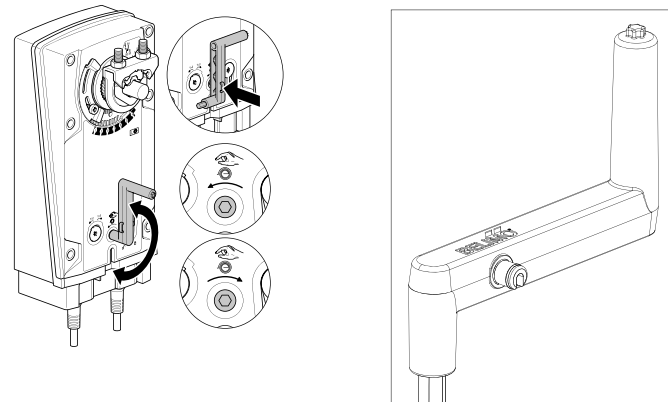
The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft. The EFB, EFX series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator. The EFB...-S, EFX...-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +85° (for NEMA 4 versions, the second switch is fixed at +85°.)

### Automatic Airtight Dampers/Manual Override

The EFB, EFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The EFB, EFX has a unique built in manual positioning mechanism which allows the setting of any damper position within its 95° of rotation. A pre-tensioned spring automatically tightens the damper when power is applied to the actuator, compensating for damper seal deterioration..

The actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off. When power is applied, the manual mechanism is released and the actuator drives toward the full fail-safe position.



### Standard Mounting

**NOTE:** The EFB, EFX...series actuator is shipped with the manual override adjusted for a +5° position at the universal clamp (not at full fail-safe, 0°). This allows for automatic compression of damper blade seals when the actuator is in use, providing tight shut-off. This assumes that the damper is to have tight shut-off at the fail-safe position. If tight close-off is desired at the opposite direction from fail-safe, the manual override should be released so the actuator can go to the full fail-safe position. See the manual override instructions.

1. Manually move the damper to the fail-safe position (usually closed). If the shaft rotated counterclockwise (↺), this is a CCW installation. If the shaft rotated clockwise (↻), this is a CW installation. In a CCW installation, the actuator side marked "CCW" faces out, while in a CW installation, the side marked "CW" faces out. All other steps are identical.
2. The actuator is usually shipped with the universal clamp mounted to the "CCW" side of the actuator. To test for adequate shaft length, slide the actuator over the shaft with the side marked "CCW" (or the "CW" side if this is the side with the clamp). If the shaft extends at least 1/8" through the clamp, mount the actuator as follows. If not, go to the *Short Shaft Installation* section.
3. If the clamp is not on the correct side as determined in step #1, re-mount the clamp as follows. If it is on the correct side, proceed to step #5. Look at the universal clamp. If you are mounting the actuator with the "CCW" side out,

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position the clamp so that the pointer section of the tab is pointing to 0° (see Figure C) and the spline pattern of the clamp mates with spline of the actuator. Slip the clamp over the spline. (Use the same procedure if the “CW” side is out.) If your application requires a mechanical minimum position, read the *Rotation Limiting, Mechanical Minimum Damper Position* section.

4. Lock the clamp to the actuator using the retaining clip.
5. Verify that the damper is still in its full fail-safe position.
6. Slide the actuator over the shaft.
7. Position the actuator in the desired location.
8. Tighten the two nuts on the clamp using a 13mm wrench or socket using 11 ft-lb of torque.
9. Slip the stud of the anti rotation strap into the slot at the base of the actuator. The stud should be positioned approximately 1/16 of an inch from the closed end of the slot. Bend the strap as needed to reach the duct. Attach the strap to the duct with #8 self tapping screws.

### Short Shaft Installation

If the shaft extends at least 3/4” from the duct, follow these steps:

1. Determine the best orientation for the universal clamp on the back of the actuator. The best location would be where you have the easiest access to the V bolt nuts on the clamp.
2. Engage the clamp to the actuator as close as possible to the determined location.
3. Lock the clamp in place using the remaining retainer clip.
4. Verify that the damper is still in its full fail-safe position.
5. Slide the actuator over the shaft.
6. Position the actuator in the desired location.
7. Tighten the two nuts on the clamp using a 13mm wrench or socket using 11 ft-lb of torque.
8. Slip the stud of the anti-rotation strap into the slot at the base of the actuator. The stud should be positioned approximately 1/16 of an inch from the closed end of the slot. Bend the strap as needed to reach the duct. Attach the strap to the duct with #8 self tapping screws.
9. If damper position indication is required, use the optional IND-EFB pointer. See **Figure A**.

### Jackshaft Installation

The EFB, EFX... series actuator is designed for use with jackshafts up to 1.05” in diameter. In most applications, the EFB, EFX actuator may be mounted in the same manner as a standard damper shaft application. If more torque is required than one EFB, EFX actuator can provide, a second EFB, EFX actuator may be mounted to the jackshaft using the ZG-102 multiple actuator mounting bracket. **See wiring guide for wiring details.**

#### EF ACTUATORS WHICH MAY BE USED ON ONE SHAFT

Model	Maximum Quantity Per Shaft	Minimum Shaft Diameter
EFB24(-S)(N4)	2*	3/4”
EFX24(-S)(N4)		
EFB120(-S)(N4)		
EFX120(-S)(N4)	3**	3/4” for 2x 1” for 3x
EFB24-MFT(-S)(N4)		
EFX24-MFT(-S)(N4)		

\* Wired in parallel

\*\* Wired master-slave

**MOUNTING:** If the actuators are mounted on the opposed ends of the shaft, the actuator direction must be selected carefully. Usually, the direction of rotation is reversed.

### Multiple Actuator Mounting

If more torque is required than one EFB, EFX actuator can provide, a second EFB, EFX actuator may be mounted to the shaft using the ZG-102 multiple mounting bracket.

**NOTE:** The manual positioning mechanism cannot be used in multiple actuator applications.

**Special Wiring and Additional Information:** See wiring guide

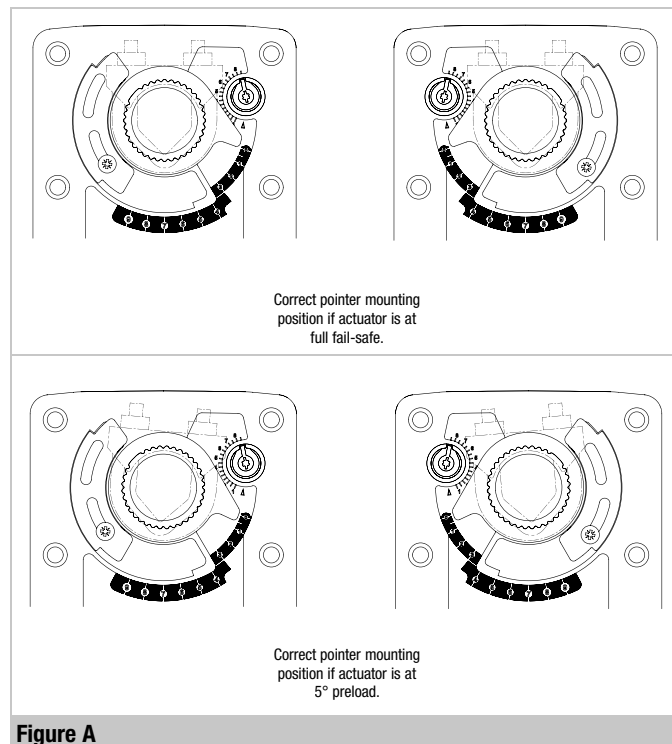


Figure A

### Rotation Limitation

The angle of rotation limiter, which is built into the actuator, is used in conjunction with the tab on the universal clamp or IND-EFB position indicator. In order to function properly, the clamp or indicator must be mounted correctly.

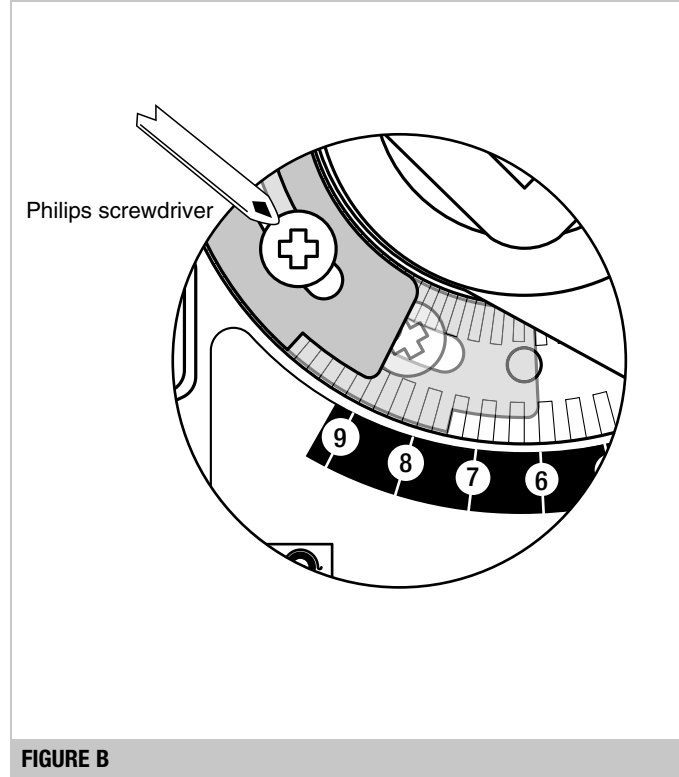
See **Figure A**.

The rotation limiter may not work in certain mounting orientations using the ZG-EFB mounting kit. Limiting the damper rotation must be accomplished by adjusting the crank arm linkage.

The built-in rotation limiter may be used in 2 ways to control the rotational output of the EFB, EFX series actuator. One use is in the application where a damper has a designed rotation less than 90°. An example would be a 45° or 60° rotating damper. The other application would be to set a minimum damper position which can be easily set or changed without having to remove the actuator from the damper.

### Damper Rotation Limiting

1. Determine the amount of damper rotation required.
2. Locate the Angle of Rotation Limiter on the actuator **Figure B**.
3. Position the limiter to the desired position, making sure the locating “teeth” on the limiter are engaged into the locating holes on the actuator.
4. Fasten the limiter by screwing the attached screw.
5. Test the damper rotation either manually with the manual crank or apply power and if required, a control signal. Re-adjust if necessary.

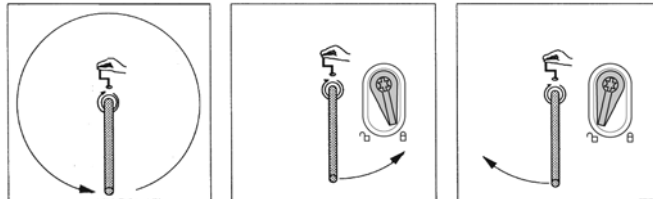


### Manual Override

The EFB, EFX series actuators can be manually positioned to ease installation or for emergency positioning.

1. The manual override will only work if no power is available to the actuator.
2. Insert the manual crank (shipped with the actuator) into the hexagon hole located on either side of the actuator. An illustration, located on the label, shows the location.
3. Turn the crank in the direction shown on the label (clockwise on the "CW" side, counterclockwise on the "CCW" side). It will take approximately 34 revolutions to rotate the full 95° of rotation.
4. To lock the actuator in the required position, flip the switch to the locked position that is located to the right of the crank on the CCW side of the actuator (left of the crank on the CW side).
5. The manual override may be disengaged in 2 ways.
  - Flip the switch to the unlocked position and the actuator will go to its fail-safe position.
  - Apply power to wire 1 and 2. The actuator will automatically disengage the override function and will go to the "on" position in the case of the On/Off versions. Or, in the case of the proportional versions, go to the 0 signal position and then go to the position corresponding to the control signal. The actuator will now work normally.

#### CCW Side Example:



#### Winding the damper actuator

- insert crank handle
- turn handle in direction of arrow

#### Locking the damper actuator

- Flip the lock switch to the position pointing to the "locked" symbol

#### Unlocking the damper actuator (2 options)

- Flip the lock switch to the position pointing to the "unlocked" symbol.
- Remote control by supplying power to the unit for > than 3 sec.

### Testing the installation Without Power

The actuator/damper installation may be tested without power at the actuator. Refer to the manual positioning section of the instructions. Move the damper to its full non-fail-safe position using the manual crank. Disengage the manual position mechanism and have the damper go to full fail-safe position. Correct any mechanical problems and retest.

### Auxiliary Switches

The EFB, EFX series actuators may be ordered with two built-in SPDT auxiliary switches used for safety interfacing or signaling, for example, for fan start-up. The switch position near the fail-safe position is fixed at 10°. The other is adjustable between 10° and 85° of rotation (for NEMA 4 versions, the second switch is fixed at +85°.) The crank that is supplied with the actuator is used to change the switch position.

#### SWITCH RATING

Voltage	Resistive Load	Inductive Load
120 VAC	3A	1.03A
250 VAC	3A	0.5A

Two methods may be used to adjust the switching point of the adjustable switch.

#### Method 1 - See Figure F

1. The actuator must be in its fail-safe position.
2. Insert the crank handle into the torx shaped hole located in the center of the adjustable switch pointer.
3. Gently rotate the crank until the switch pointer is at the desired switch point in degrees as shown.

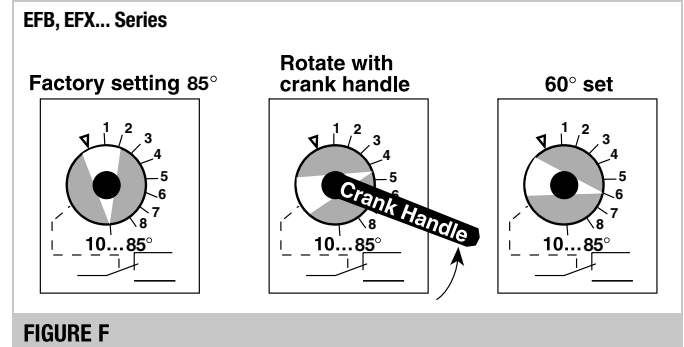


FIGURE F

#### Method 2 - See Figure G

1. Position the damper to the point at which you want the switch to activate. This may be done by using the manual override or by providing the appropriate proportional signal to EFB24, EFX24... modulating type actuator. The position of the switch pointer is not important during this step.
2. Insert the crank into the hexagon shaped hole located in the center of the adjustable switch pointer.
3. Gently rotate the switch pointer to just past the switch point indicating arrow as shown.

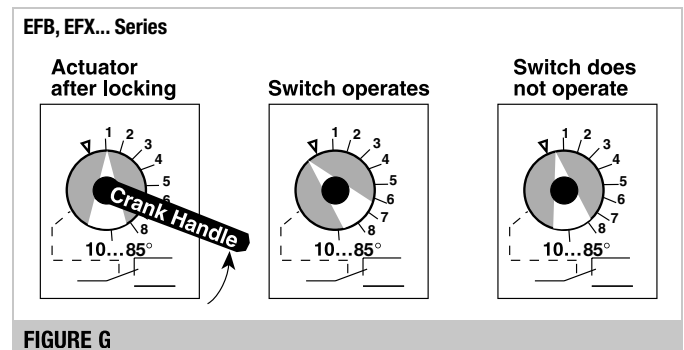


FIGURE G

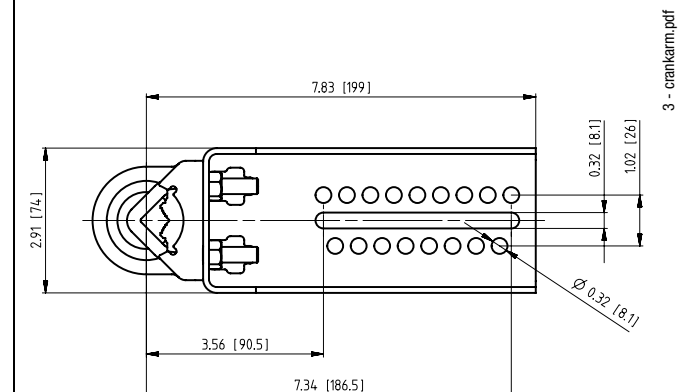
# KH-EFB Crank Arm

## Including Retaining Ring

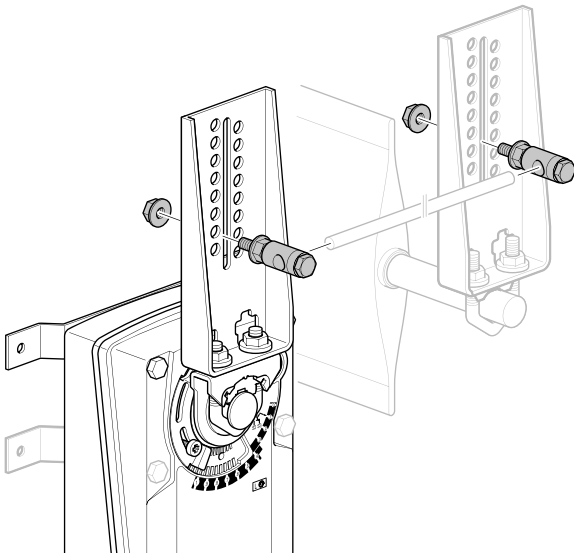
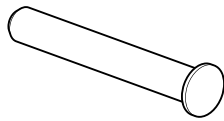
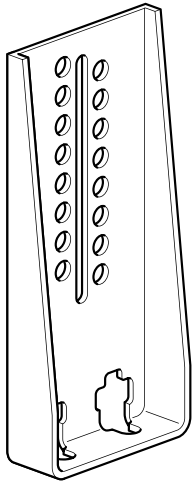
The KH-EFB crank arm is used in non-direct coupled mounting applications. The KH-EFB may also be used to simultaneously direct couple to a damper shaft and provide an additional crank arm connection to a second damper.

**KH-EFB** For round shafts up to 1.05" or square shafts up to 11/16"

### Dimensions (Inches [mm])



**NOTE:** The KH-EFB crank arm is designed to attach itself with the K9-2 clamp. The supplied rod must be used when the actuator is not direct coupled onto a shaft.



Non-direct mounting with ZG-EFB crank arm adaptor kit

### General

The EFB, EFX series actuators utilize both DC Motors and brushless DC motor technology. The EFB, EFX uses this motor in conjunction with an Application Specific Integrated Circuit (ASIC). In the On/Off versions of the EFB and EFX, the ASIC monitors and controls the actuator's rotation and a digital rotation sensing function to prevent damage to the actuator. The EFB24, EFX24... modulates type actuators incorporate a built in microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and knows the actuator's exact zero position.

### Brushless DC Motor Operation

Belimo's brushless DC motor spins by reversing the poles of stationary electromagnets housed inside of a rotating permanent magnet. The electromagnetic poles are switched by a special ASIC circuit developed by Belimo. Unlike the conventional DC motor, there are no brushes to wear or commutators to foul.

### Overload Protection

The EFB, EFX series actuators are protected from overload at all angles of rotation. The ASIC circuit constantly monitors the rotation of the DC motor inside the actuator and stops the pulses to the motor when it senses a stall condition. The DC motor remains energized and produces full rated torque to the load. This helps ensure that dampers are fully closed and that edge and blade seals are always properly compressed.

### Motor Position Detection

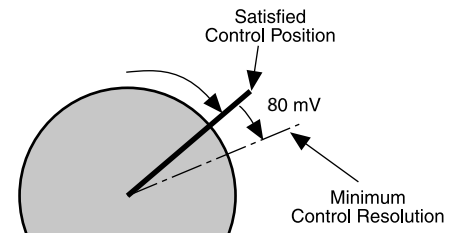
Belimo brushless DC motors eliminate the need for potentiometers for positioning in modulating type actuators. Inside the motor are three "Hall Effect" sensors. These sensors detect the spinning rotor and send pulses to the microprocessor which counts the pulses and calculates the position to within 1/3 of a revolution of the motor.

### Control Accuracy and Stability

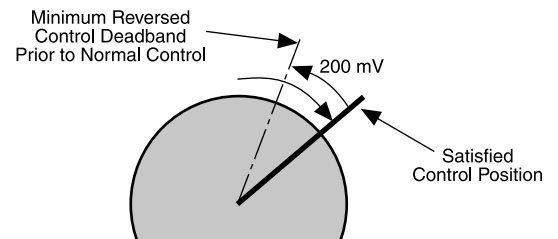
-SR and MFT EF actuators have built-in brushless DC motors which provide better accuracy and longer service life.

The -SR and MFT EF actuators are designed with a unique non-symmetrical deadband. The actuator follows an increasing or decreasing control signal with a 80 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 200 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**EF Actuator responds to an 80 mV signal when not changing direction from stop**



**EF Actuator responds to a 200 mV signal when reversing direction from stop position.**



**Note:** Resolution is a percentage of operating range. 1% in one direction, 2.5% when changing direction. 2-10 VDC control example shown above.

**WARNING** The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

**Always read the controller manufacturer's installation literature carefully before making any connections.** Follow all instructions in this literature. If you have any questions, contact the controller manufacturer and/or Belimo.

### Transformers

The EFB24, EFX24...actuators require a 24 VAC class 2 transformer and draws a maximum of 16 VA per actuator. The actuator enclosure cannot be opened in the field, there are no parts or components to be replaced or repaired.

- EMC directive: 2004/108/EC
- Software class A: Mode of operation type 1
- Low voltage directive: 2006/95/EC

**CAUTION:** It is good practice to power electronic or digital controllers from a separate power transformer than that used for actuators or other end devices. The power supply design in our actuators and other end devices use half wave rectification. Some controllers use full wave rectification. When these two different types of power supplies are connected to the same power transformer and the DC commons are connected together, a short circuit is created across one of the diodes in the full wave power supply, damaging the controller. Only use a single power transformer to power the controller and actuator if you know the controller power supply uses half wave rectification.

### Multiple Actuators, One Transformer

Multiple actuators may be powered from one transformer provided the following rules are followed:

1. The TOTAL current draw of the actuators (VA rating) is less than or equal to the rating of the transformer.
2. Polarity on the secondary of the transformer is strictly followed. *This means that all No. 1 wires from all actuators are connected to the common leg on the transformer and all No. 2 wires from all actuators are connected to the hotleg.* Mixing wire No. 1 & 2 on one leg of the transformer will result in erratic operation or failure of the actuator and/or controls.

### Multiple Actuators, Multiple Transformers

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

1. The transformers are properly sized.
2. All No. 1 wires from all actuators are tied together and tied to the negative leg of the control signal. See wiring diagram.

### Wire Length for EFB..., EFX... Actuators

Keep power wire runs below the lengths listed in the **Figure H**. If more than one actuator is powered from the same wire run, divide the allowable wire length by the number of actuators to determine the maximum run to any single actuator.

Example: 3 actuators, 16 Ga wire  
 $225 \text{ Ft} \div 3 \text{ Actuators} = 75 \text{ Ft. Maximum wire run}$

MAXIMUM WIRE LENGTH FOR 16VA			
Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	550 Ft.	18 Ga	145 Ft.
14 Ga	360 Ft.	20 Ga	75 Ft.
16 Ga	225 Ft.	22 Ga	37 Ft.

**FIGURE H**

### Wire Type and Wire Installation Tips

For most installations, 18 or 16 Ga. cable works well with the EFB24, EFX24...actuators. Use code-approved wire nuts, terminal strips or solderless connectors where wires are joined. It is good practice to run control wires unspliced from the actuator to the controller. If splices are unavoidable, make sure the splice can be reached for possible maintenance. Tape and/or wire-tie the splice to reduce the possibility of the splice being inadvertently pulled apart.

The EFB24, EFX24... proportional actuators have a digital circuit that is designed to ignore most unwanted input signals (pickup). In some situations the pickup may be severe enough to cause erratic running of the actuator. For example, a large inductive load (high voltage AC wires, motors, etc.) running near the power or control wiring may cause excessive pickup. To solve this problem, make one or more of the following changes:

1. Run the wire in metallic conduit.
2. Re-route the wiring away from the source of pickup.
3. Use shielded wire (Belden 8760 or equal). Ground the shield to an earth ground. **Do not** connect it to the actuator common.

### Initialization of the -SR and MFT

When power is initially applied, the actuator will first release its manual preload position (This assumes a manual position has been set). The actuator will then rotate to the full fail-safe position. At this point the microprocessor recognizes that the actuator is at full fail-safe and uses this position as the base for all of its position calculations. The microprocessor will retain the initialized zero during short power failures of up to 20 seconds. The -SR and MFT will also return to its position prior to the 20-second-or-less power loss. For power failures greater than 20 seconds, the actuator would naturally return to its full fail-safe position prior to the microprocessor losing its memory. The actuator will also re-initialize if the manual position mechanism is used.

EFB24-SR, EFX24-SR Electrical Check-Out Procedure				
STEP	Procedure	Expected Response	Gives Expected Response Go To Step...	Does Not Give Expected Response Go To Step...
1.	Control signal is applied to actuator.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	No response at all <b>Step 2.</b> Operation is reversed <b>Step 3.</b> Does not drive toward "Control Signal Position" <b>Step 4.</b>
2.	Check power wiring. Correct any problems. <b>See Note 1.</b>	Power supply rating should be the total power requirement of the actuator(s). Minimum voltage of 19.2 VAC or 21.6 VDC.	Power wiring corrected, actuator begins to drive <b>Step 1.</b>	Power wiring corrected, actuator still does not drive <b>Step 4.</b>
3.	Turn reversing switch to the correct position. Make sure the switch is turned all the way left or right.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	Does not drive toward "Control Signal Position" <b>Step 4.</b>
4.	Make sure the control signal positive (+) is connected to Wire No. 3 and control signal negative (-) is connected to wire No. 1. Most control problems are caused by reversing these two wires. Verify that the reversing switch is all the way CCW or CW.	Drives to "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	<b>Step 5.</b>
5.	Check input signal with a digital volt meter (DVM). Make sure the input is within the range of the actuator. <b>NOTE:</b> The input signal must be above the 2 VDC or 4 mA to have the actuator move.	Input voltage or current should be $\pm 1\%$ of what controller's adjustment or programming indicates.	Controller output (actuator input) is correct. Input Polarity Correct <b>Step 6.</b>	Reprogram, adjust repair or replace controller as needed <b>Step 1.</b>
6.	Check damper torque requirement.	Torque requirement is actuator's minimum torque.	Defective Actuator. Replace Actuator - <b>See Note 2.</b>	Recalculate actuator requirement and correct installation.
7.	Actuator works properly. Test controller by following controller manufacturer's instructions.			

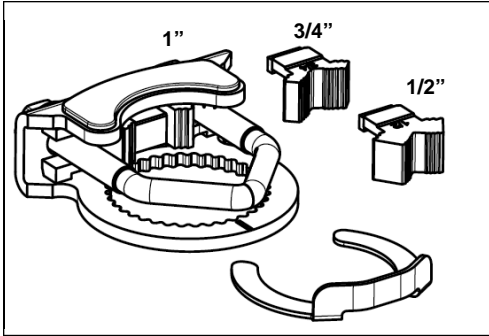
- NOTE 1** Check that the transformer(s) are sized properly.
- If a common transformer is used, make sure that polarity is observed on the secondary. This means connect all No. 1 wires to one leg of the transformer and all No. 2 wires to the other leg of the transformer.
  - If multiple transformers are used with one control signal, make sure all No. 1 wires are tied together and tied to control signal negative (-).
  - Controllers and actuators must have separate 24 VAC/VDC power sources.
- NOTE 2** If failure occurs within 5 years from original purchase date, notify Belimo and give details of the application.

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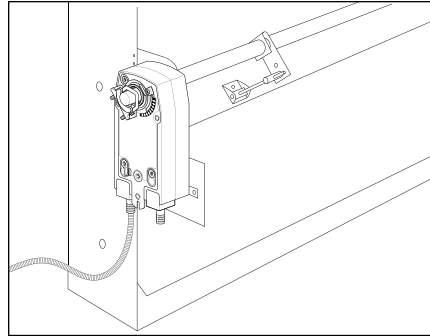
## Minimum 180 in-lb Torque

- For damper areas up to 45 sq-ft\* (For lower torque, see AF, NFB, LF, or TF series)

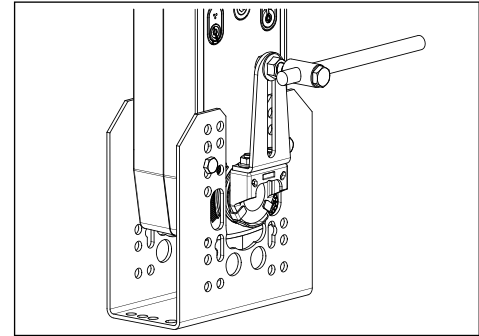
## Applications



New standard clamp fits standard 1/2" shafts to 1.05" jackshafts.



Mount directly to 1.05" jackshafts.



Linkage solutions are available when direct coupling is not possible.



All Actuators have BDCM

## AFB, AFX Series - At A Glance

	AFB24, AFX24 (p. 49)	AFB24 N4(H), AFX24 N4 (p. 51)	AFB24-S, AFX24-S (p. 49)	AFB24-S N4(H), AFX24-S N4 (p. 51)	AFBUP, AFXUP (p. 53)	AFBUP N4(H), AFXUP N4 (p. 55)	AFBUP-S, AFXUP-S (p. 53)	AFBUP-S N4(H), AFXUP-S N4 (p. 55)	AFB24-SR, AFX24-SR (p. 57)	AFB24-SR N4(H), AFX24-SR N4 (p. 59)	AFB24-SR-S, AFX24-SR-S (p. 57)	AFB24-SR-S N4(H), AFX24-SR-S N4 (p. 59)	AFB24-MFT, AFX24-MFT (p. 61)	AFB24-MFT N4(H), AFX24-MFT N4 (p. 63)	AFB24-MFT-S, AFX24-MFT-S (p. 61)	AFB24-MFT-S N4(H), AFX24-MFT-S N4 (p. 63)	AFB24-MFT95, AFX24-MFT95 (p. 65)	AFB24-MFT95 N4(H), AFX24-MFT95 N4 (p. 67)
Torque:	180 in-lb	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Power supply:	24 VAC/DC	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	120 VAC				●	●	●	●										
	230 VAC																	
Control signal:	On/Off	●	●	●	●	●	●	●										
	2 to 10 VDC								●	●	●	●						
	Multi-function**												●	●	●	●		
	0 to 135 Ω																●	●
Feedback signal:	VDC variable**												●	●	●	●	●	●
Running time	<75 seconds	●	●	●	●	●	●	●										
motor:	95 seconds								●	●	●	●						
	Adj. 70 to 220 seconds***												●	●	●	●	●	●
	spring: <20 seconds	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Brushless DC Motor		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
External direction of rotation switch									●	●	●	●	●	●	●	●	●	●
Manual override		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Appliance rated cable, 18 GA (default)		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Plenum rated cable, 18 GA (optional)		●							●								●	●
Built-in auxiliary switch, Two SPDT				●	●		●	●			●	●			●	●		●
NEMA 4 rated housing		●		●		●		●				●		●		●		●
Installation instructions.....(p. 69-75)																		
General wiring.....(p. 77)																		
Start-up and checkout.....(p. 78)																		
Electrical operations.....(p. 76)																		

\*Based on 4 in-lb/ft<sup>2</sup> damper torque loading. Parallel blade. No edge seals. \*\*Default 2 to 10 VDC. \*\*\*Default 150 seconds.



## A CLOSER LOOK...

- Cut labor costs with simple direct coupling.
- True mechanical spring return – the most reliable fail-safe.
- Reverse mount for clockwise or counterclockwise fail-safe.
- Check damper position easily with clear position indicator.
- Overload-proof throughout rotation
- Temporary restrictions in damper movement will not change actuator operation. Actuator returns to normal operation when restriction is removed (modulating actuators).
- Built-in mechanical stop to adjust angle of rotation.
- By eliminating internal condensation incorporated breather membrane optimizes performance in harsh airstream environments.
- Built-in auxiliary switches is easy to use, offers feedback or signal for additional device (-S models).
- Manual override crank speeds installation
- Need to change control direction? Do it easily with a simple switch (modulating actuators).
- Microprocessor-controlled brushless DC motor increases actuator life span and reliability, provides constant running time (modulating actuators).
- Rugged metal on plastic housing withstands rough handling in the mechanical room.
- Standard 3 ft. appliance cable and conduit connector eases installation.
- Double insulated – no need for separate safety ground. A Belimo exclusive (-S models).
- Automatically compensates for damper seal wear, ensuring tight close-off.
- Added Flexibility to Select Clamp, Electrical Connection, and Running Time to fit your Specific Application with Belimo's Flexible Line of Actuators (AFX).



### The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

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# AFB24, AFB24-S, AFX24, AFX24-S

On/Off, Spring Return, 24 V



Technical Data		AFB24, AFB24-S, AFX24, AFX24-S
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	5 W
	holding	2.5 W
Transformer sizing		7.5 VA (class 2 power source)
Electrical connection		3 ft, 18 GA appliance cable, 1/2" conduit connector
	AFB24...	-S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	AFX24...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector
		-S models: two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		180 in-lb [20 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	< 75 seconds
	spring	20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		zinc coated metal and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds <62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.6 lbs (2.1 kg); 4.9 lbs (2.25 kg) with switches
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
<b>AFB24-S, AFX24-S</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

**Torque min. 180 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

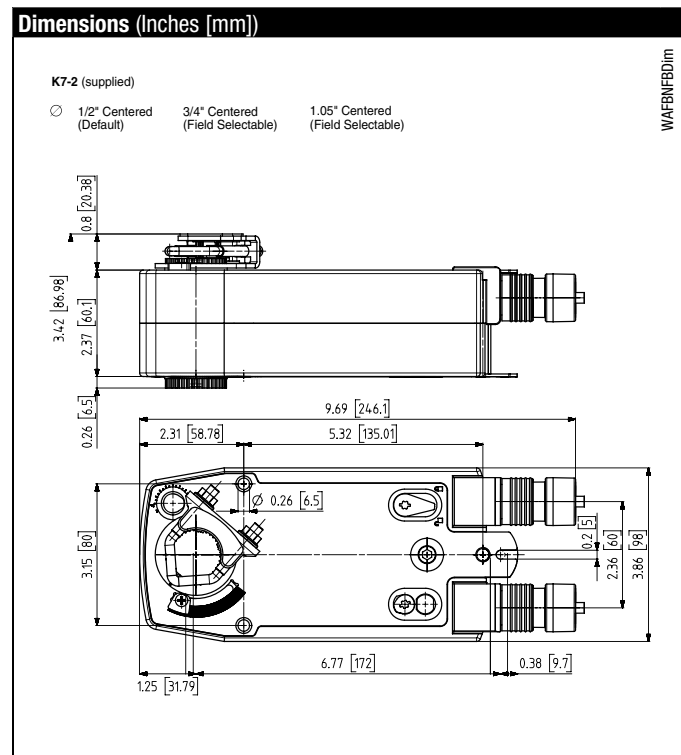
## Operation

The AFB and AFX series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The AFB and AFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The AFB24-S and AFX24-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°. The AFB24, AFB24-S, AFX24 and AFX24-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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**Accessories**

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
KH-AFB	Crank arm
K7-2	Universal clamp for up to 1.05" dia jackshafts
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4.., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

Note: When using AFB24, AFB24-S, AFX24, AFX24-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

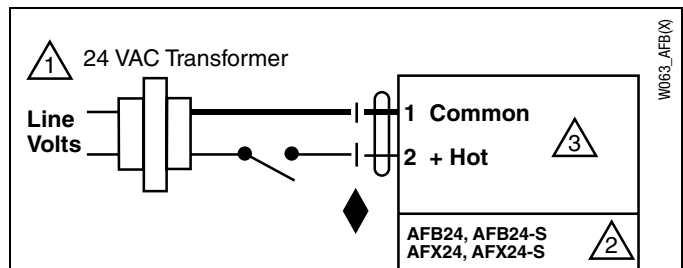
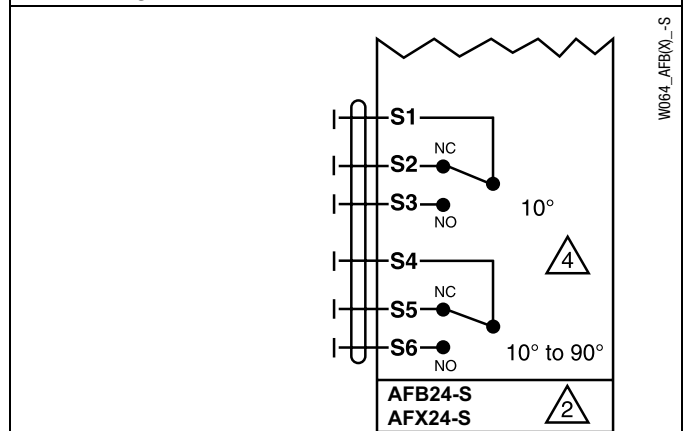
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., AFB24-S and AFX24-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

**APPLICATION NOTES**

- ◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.


**On/Off wiring for AFB24, AFX24**

**Auxiliary Switches for AFB24-S, AFX24-S**

# AFB24 N4(H), AFB24-S N4(H), AFX24 N4, AFX24-S N4

NEMA 4, On/Off, Spring Return, 24 V



Technical Data		AFB24 N4(H), AFB24-S N4(H), AFX24 N4, AFX24-S N4
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC +20% / -10%
Power consumption	running holding	5 W / heater 25 W 2.5 W
Transformer sizing		7.5 VA (class 2 power source) / heater 25 VA
Electrical connection		3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> Two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	heater (N4H)	terminal block, 26-16 GA
	AFX... N4	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance cable, with or without 1/2" conduit connector <b>-S models:</b> Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		180 in-lb [20 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting in housing
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor spring	< 75 seconds 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
	spring (with heater)	20 seconds @ -4°F to 122°F [-20°C to 50°C], < 60 seconds @ -49°F [-45°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
	with heater	-49°F to 122°F [-45°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		UL Type 4, NEMA 4, IP66
Housing material		polycarbonate
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.7 lbs (4.4 kg); 10 lbs (4.5 kg) with switches; 10.5 lbs (4.8 kg) with heater
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.		
<b>AFB24-S N4(H), AFX24-S N4</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

Torque min. 180 in-lb, for control of air dampers

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be directly coupled to the damper shaft.

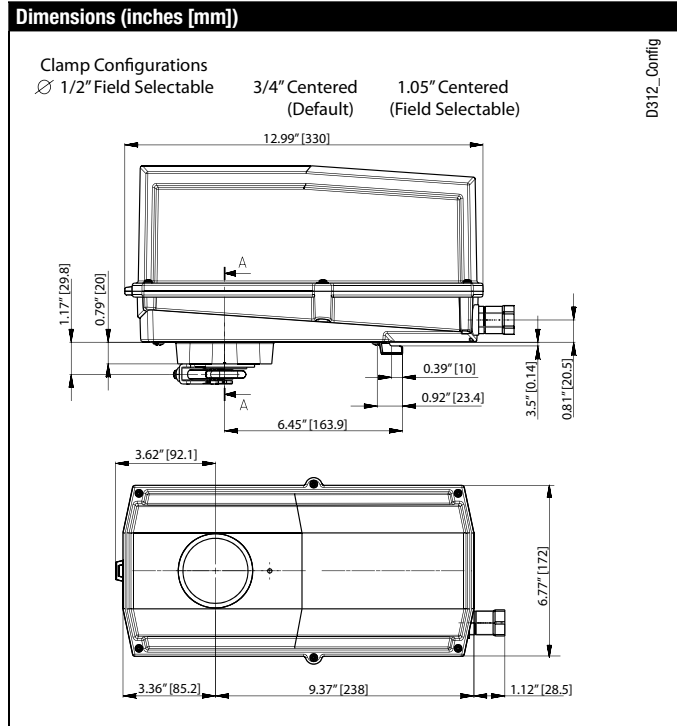
## Operation

The AFB N4(H) and AFX N4 series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The AFB N4(H) and AFX N4 series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The AFB24-S N4(H), AFX24-S N4 version are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°.



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**Accessories**

Tool-06	8mm and 10 mm wrench
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland (needed for additional wires)

**NOTE:** When using AFB24 N4(H), AFB24-S N4(H), AFX24 N4, AFX24-S N4 actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

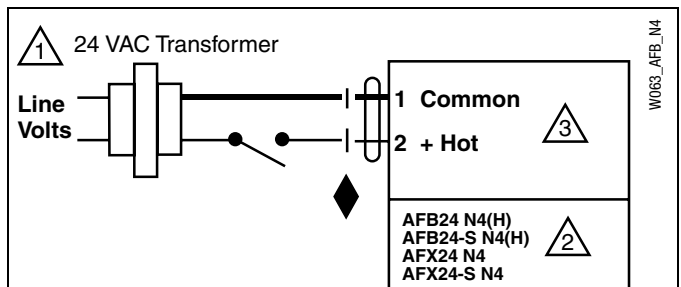
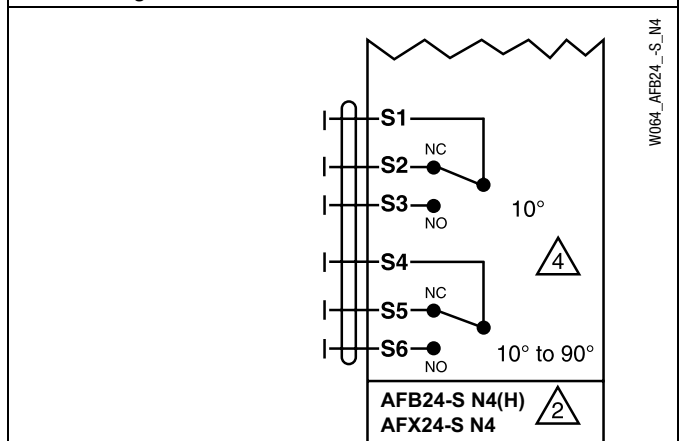
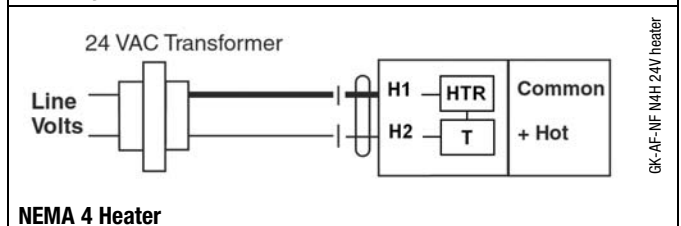
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., AFB24-S N4(H), AFX24-S N4 incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

**APPLICATION NOTES**

- ◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.


**On/Off wiring**

**Auxiliary Switches**

**NEMA 4 Heater**

# AFBUP, AFBUP-S, AFXUP, AFXUP-S

On/Off, Spring Return, 24 to 240 VAC



Technical Data		AFBUP, AFBUP-S, AFXUP, AFXUP-S
Power supply		24...240 VAC -20% / +10%, 50/60 Hz 24...125 VDC ±10%
Power consumption	running	7 W
	holding	3.5 W
Transformer sizing		7 VA @ 24 VAC (class 2 power source) 8.5 VA @ 120 VAC 18 VA @ 240 VAC
Electrical connection	AFBUP...	3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> Two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	AFXUP...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance cable, with or without 1/2" conduit connector <b>-S models:</b> Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		Electronic throughout 0 to 95° rotation
Control		On/Off
Torque		180 in-lb [20 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	< 75 sec
	spring	20 sec @ -4°F to 122°F [-20°C to 50°C]; < 60 sec @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		Zinc coated metal and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.6 lbs (2.1 kg), 4.9 lbs (2.25 kg) with switches
† Rated Impulse Voltage 4kV, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
<b>AFBUP-S, AFXUP-S</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL Approved one set at +10°, one adjustable 10° to 90°

**Torque min. 180 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

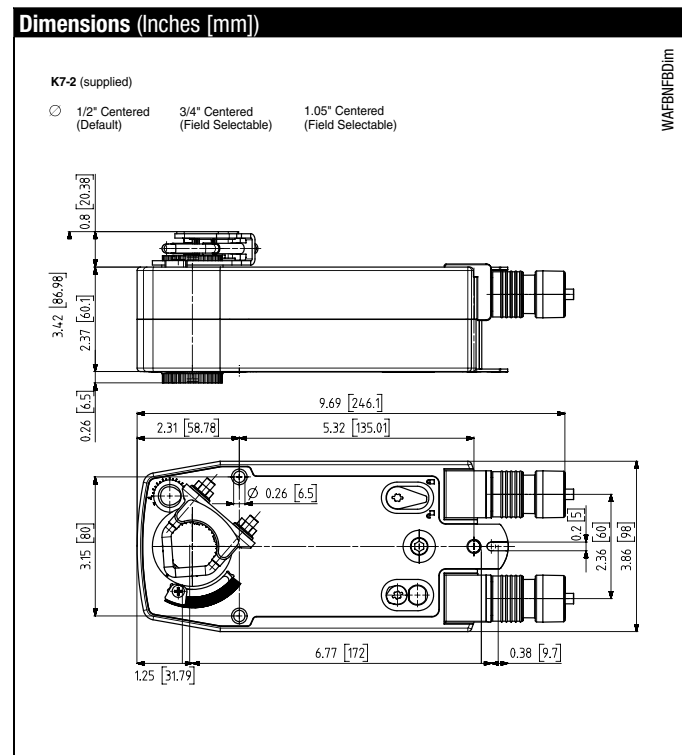
## Operation

The AFB and AFX series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The AFB and AFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The AFBUP-S and AFXUP-S versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°. The AFBUP, AFBUP-S, AFXUP and AFXUP-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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**Accessories**

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
K7-2	Universal clamp for up to 1.05" dia jackshafts
KH-AFB	Crank arm
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4.., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

**Note:** When using AFBUP, AFBUP-S, AFXUP, AFXUP-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. 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 approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

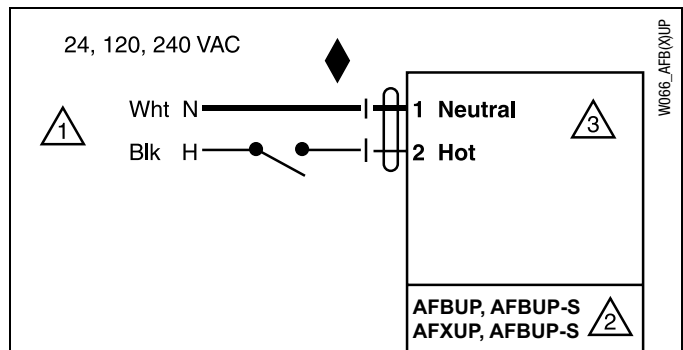
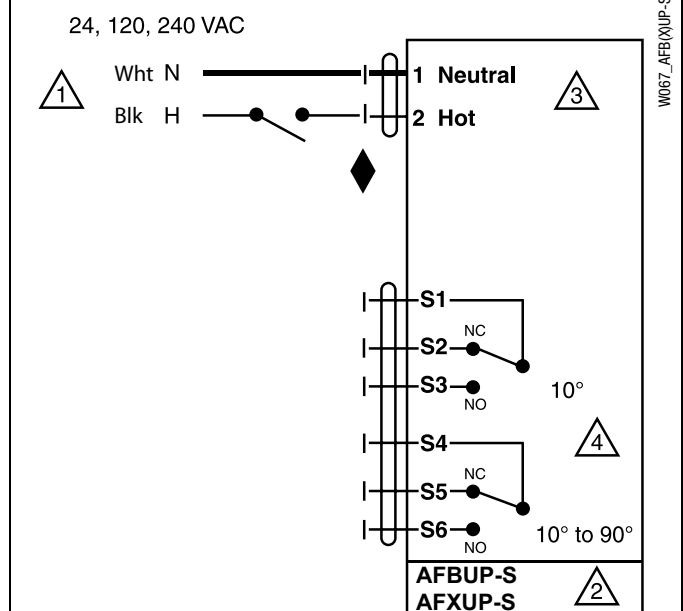
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 No ground connection is required.
- 4 For end position indication, interlock control, fan startup, etc., AFBUP-S and AFXUP-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

**APPLICATION NOTES**

- ◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.


**On/Off wiring for AFBUP, AFXUP**

**Auxiliary Switches for AFBUP-S, AFXUP-S**

# AFBUP N4(H), AFBUP-S N4(H), AFXUP N4, AFXUP-S N4

NEMA 4, On/Off, Spring Return, 24 to 240 VAC



Technical Data		AFBUP N4(H), AFBUP-S N4(H), AFXUP N4, AFXUP-S N4
Power supply		24...240 VAC -20% / +10%, 50/60 Hz 24...125 VDC ±10%
Power consumption	running holding	7 W / heater 25 W 3.5 W
Transformer sizing		7 VA @ 24 VAC (class 2 power source) 8.5 VA @ 120 VAC / heater 25 VA @120 VAC 18 VA @ 240 VAC
Electrical connection		3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> Two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	heater (N4H)	terminal block, 18-16 GA
	AFXUP... N4	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance cable, with or without 1/2" conduit connector <b>-S models:</b> Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		180 in-lb [20 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting inside housing
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor spring	< 75 sec 20 sec @ -4°F to 122°F [-20°C to 50°C]; < 60 sec @ -22°F [-30°C]
	spring (with heater)	20 sec @ -4°F to 122°F [-20°C to 50°C]; < 60 sec @ -49°F [-45°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
	with heater	-49°F to 122°F [-45°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		UL Type 4, NEMA 4, IP66
Housing material		polycarbonate
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds <62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.7 lbs (4.4 kg), 10 lbs (4.5 kg) with switches 10.5 lbs (4.8 kg) with heater
† Rated Impulse Voltage 4kV, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.		
<b>AFBUP-S N4(H), AFXUP-S N4</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL Approved one set at +10°, one adjustable 10° to 90°

**Torque min. 180 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

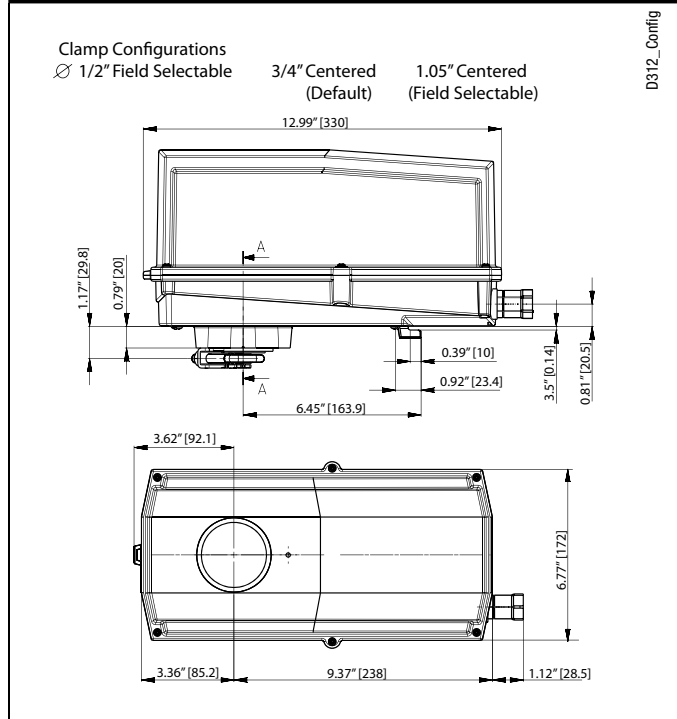
The AFB N4(H) and AFX N4 series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The AFB N4(H) and AFX N4 series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The AFBUP-S N4(H), AFXUP-S N4 versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°.

## Dimensions (inches [mm])



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**Accessories**

Tool-06	8mm and 10 mm wrench
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland (needed for additional wires)

**NOTE:** When using AFBUP N4(H), AFBUP-S N4(H), AFXUP N4, AFXUP-S N4 actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

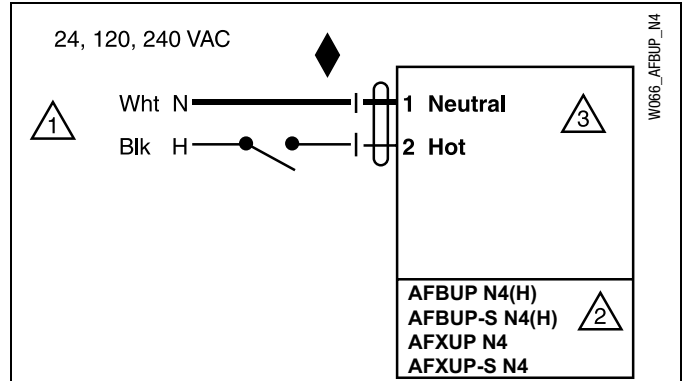
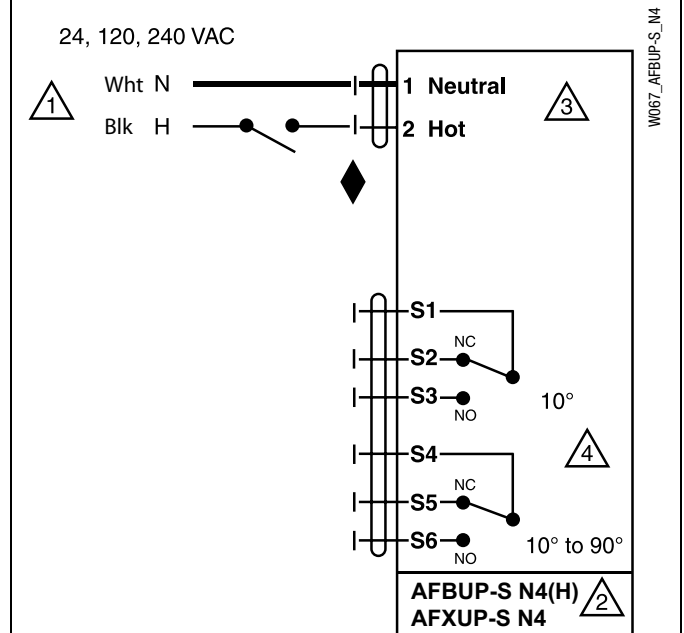
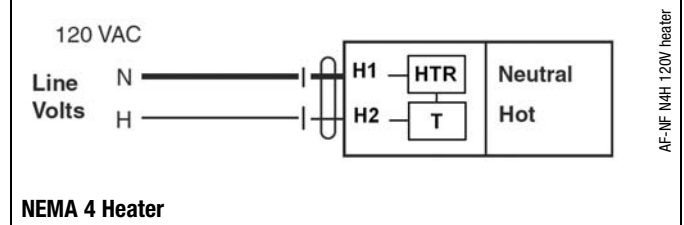
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 No ground connection is required.
- 4 For end position indication, interlock control, fan startup, etc.,  
AFBUP-S N4(H), AFXUP-S N4 incorporates two built-in auxiliary switches:  
2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

**APPLICATION NOTES**

- ◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

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**On/Off Wiring**

**Auxiliary Switches**

**NEMA 4 Heater**

# AFB24-SR, AFB24-SR-S, AFX24-SR, AFX24-SR-S

Proportional, Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data		AFB24-SR, AFB24-SR-S, AFX24-SR, AFX24-SR-S
Power supply		24 VAC ±20%, 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	5.5 W
	holding	3 W
Transformer sizing		8.5 VA (class 2 power source)
Electrical connection	AFB...	3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	AFX...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector <b>-S models:</b> Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20mA
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA
Feedback output U		2 to 10 VDC (max. 0.5 mA)
Torque		180 in-lb [20 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
	motor	reversible with built-in switch
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
	motor	95 seconds
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		zinc coated metal and plastic casing
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤40dB(A) motor @ 95 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.6 lbs (2.1 kg); 4.9 lbs (2.25 kg) with switches
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
<b>AFB24-SR-S, AFX24-SR-S</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

Torque min. 180 in-lb, for control of air dampers

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates 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. A 2 to 10 VDC feedback signal is provided for position indication. Not to be used for a master-slave application.

## Operation

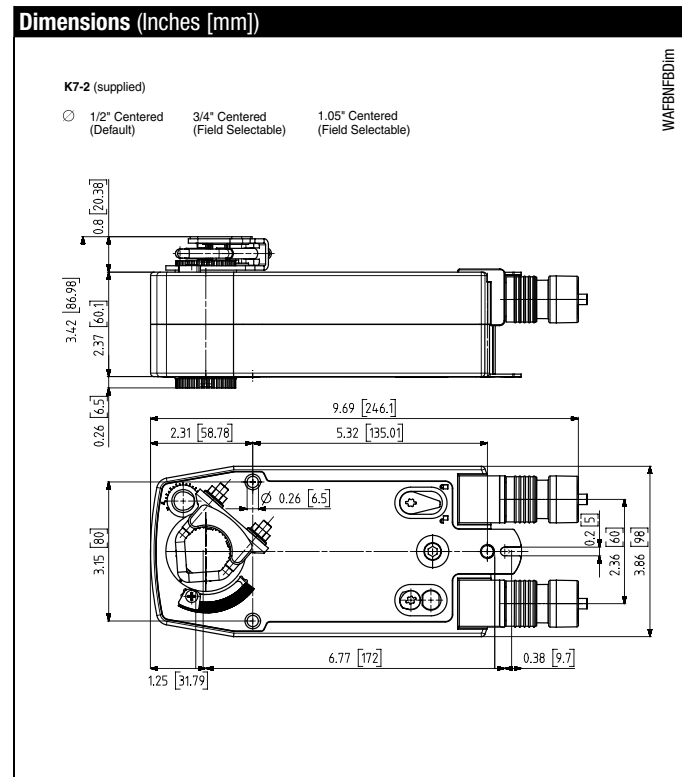
The AFB and AFX series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The AFB and AFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The AFB24-SR and AFX24-SR 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 fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The AFB24-SR-S and AFX24-SR-S versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°. The AFB24-SR, AFB24-SR-S, AFX24-SR and AFX24-SR-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

**ATTENTION:** AFB24-SR(-S) and AFX24-SR(-S) **cannot** be tandem mounted on the same damper or valve shaft. Only On/Off and MFT AF models can be used for tandem mount applications.



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### Accessories

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
KH-AFB	Crank arm
K7-2	Universal clamp for up to 1.05" dia jackshafts
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4..., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

**NOTE:** When using AFB24-SR, AFB24-SR-S, AFX24-SR and AFX24-SR-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional 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 counterclockwise 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. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.  
Up to 4 actuators may be connected in parallel if not mechanically mounted to the same shaft. With 4 actuators wired to one 500 Ω resistor.  
Power consumption must be observed.
- 3 Actuator may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., AFB24-SR-S and AFX24-SR-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.
- 5 Only connect common to neg. (-) leg of control circuits

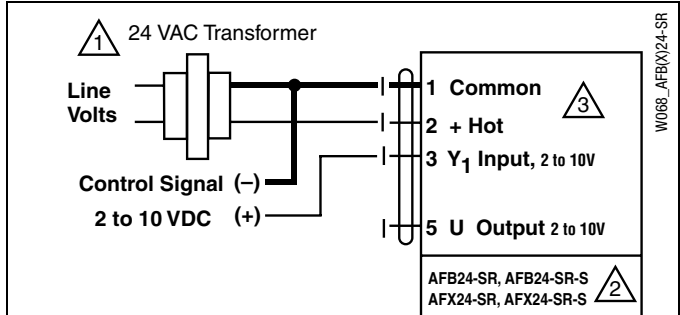
#### APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

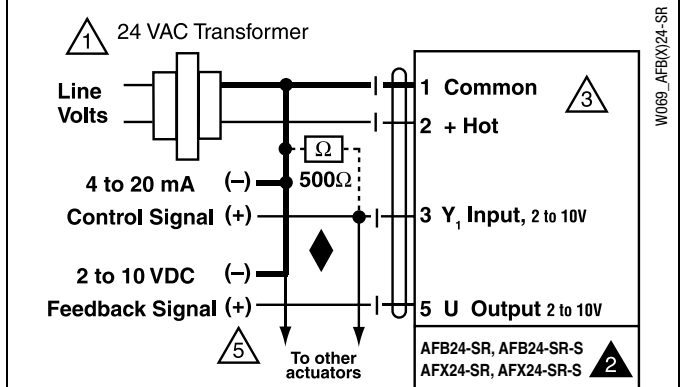
**ATTENTION:** AFB24-SR(-S) and AFX24-SR(-S) **cannot** be tandem mounted on the same damper or valve shaft. Only On/Off and MFT AF models can be used for tandem mount applications.

#### WARNING Live Electrical Components!

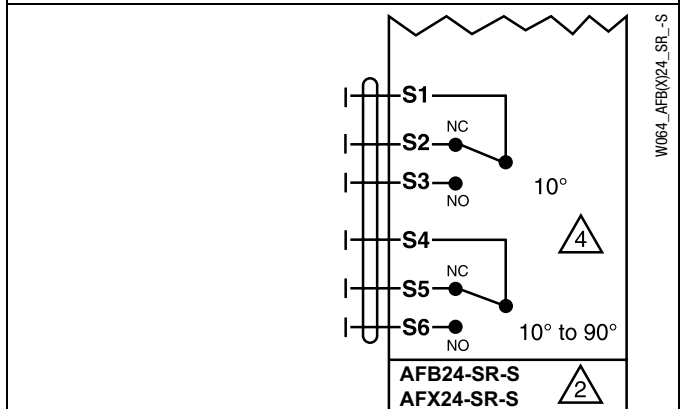
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



2 to 10 VDC control of AFB24-SR and AFX24-SR



4 to 20 mA control of AFB24-SR and AFX24-SR with 2 to 10 VDC feedback output



Auxiliary switches for AFB24-SR-S, AFX24-SR-S

# AFB24-SR N4(H), AFB24-SR-S N4(H), AFX24-SR N4, AFX24-SR-S N4

NEMA 4, Proportional, Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data		AFB24-SR N4(H) AFB24-SR-S N4(H), AFX24-SR N4 AFX24-SR-S N4
Power supply		24 VAC ±20%, 50/60 Hz 24 VDC +20% / -10%
Power consumption	running holding	5.5 W / heater 25 W 3 W
Transformer sizing		6 VA (class 2 power source) / heater 25 VA
Electrical connection	AFB... N4	3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	heater (N4H)	terminal block, 26-16 GA
	AFX... N4	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with 1/2" conduit connector <b>-S models:</b> Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20mA
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA
Feedback output U		2 to 10 VDC (max. 0.5 mA)
Torque		180 in-lb [10 Nm] minimum
Direction of rotation	spring motor	reversible with CW/CCW mounting inside housing reversible with built-in switch
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor spring spring (with heater)	95 seconds < 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C] < 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -49°F [-45°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature	with heater	-22°F to 122°F [-30°C to 50°C] -49°F to 122°F [-45°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		UL Type 4, NEMA 4, IP66
Housing material		polycarbonate
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤40dB(A) motor @ 95 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.7 lbs (4 kg); 10 lbs (4.5 kg) with switches 10.5 lbs (4.8 kg)
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.		
<b>AFB24-SR-S N4(H), AFB24-SR-S N4</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

Torque min. 180 in-lb, for control of air dampers

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates 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. A 2 to 10 VDC feedback signal is provided for position indication. Not to be used for a master-slave application.

## Operation

The AFB N4(H), AFX N4 series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

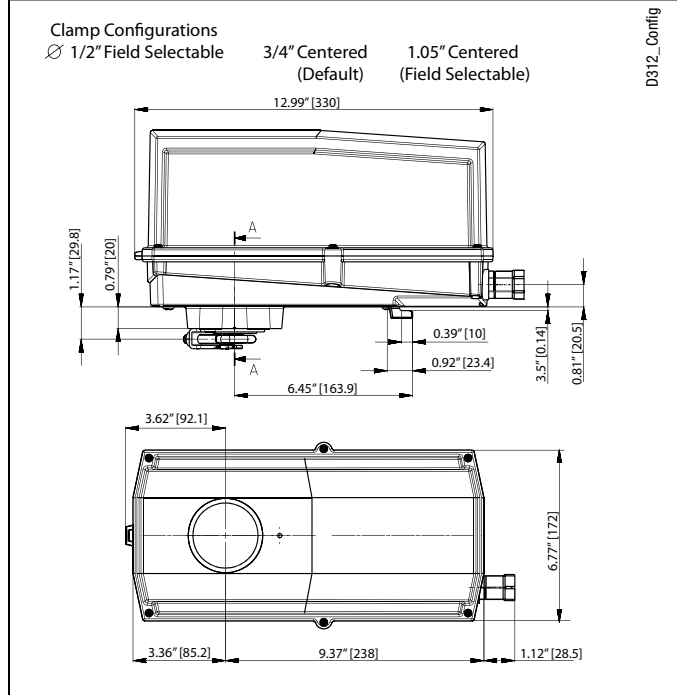
The AFB N4(H), AFX N4 series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The AFB24-SR N4(H), AFX24-SR N4 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 fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The AFB24-SR-S N4(H), AFX24-SR-S N4 version are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°.

**ATTENTION:** AFB24-SR(-S) N4(H) and AFX24-SR(-S) N4 **cannot** be tandem mounted on the same damper or valve shaft. Only On/Off and MFT AF models can be used for tandem mount applications.

## Dimensions (inches [mm])



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### Accessories

Tool-06	8mm and 10 mm wrench
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland (needed for additional wires)

**NOTE:** When using AFB24-SR N4(H), AFB24-SR-S N4(H), AFX24-SR N4, AFX24-SR-S N4 actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional 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 counterclockwise 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. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 2 Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor. Power consumption must be observed.
- 3 Actuator may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., AFB24-SR-S N4(H), AFX24-SR-S N4 incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.
- 5 Only connect common to neg. (-) leg of control circuits

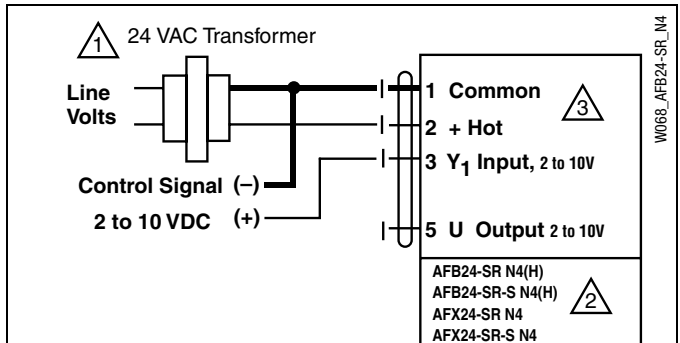
#### APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

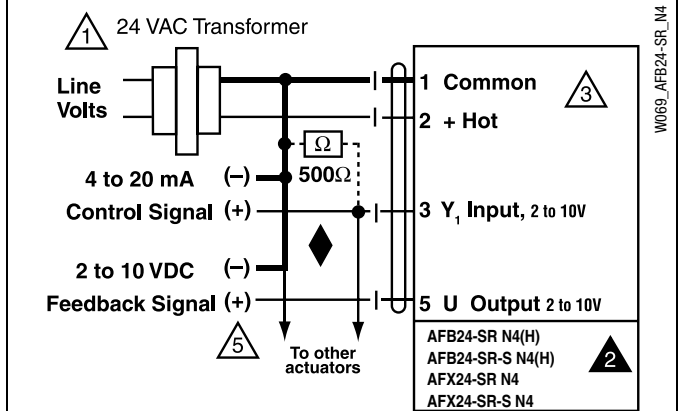
**ATTENTION:** AFB24-SR(-S) N4(H) and AFX24-SR(-S) N4 **cannot** be tandem mounted on the same damper or valve shaft. Only On/Off and MFT AF models can be used for tandem mount applications.

#### WARNING Live Electrical Components!

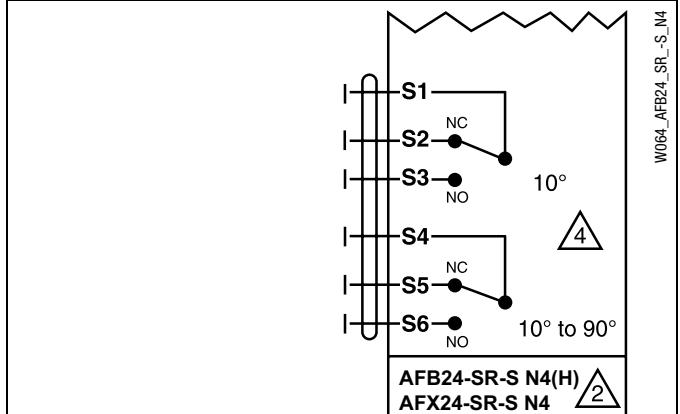
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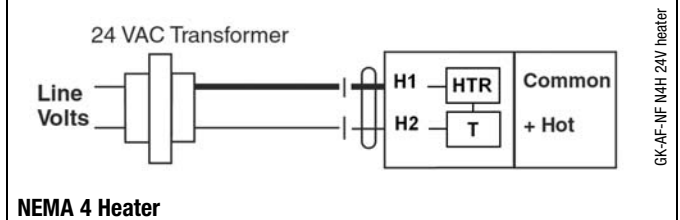
2 to 10 VDC control



4 to 20 mA control with 2 to 10 VDC feedback output



Auxiliary switches



NEMA 4 Heater

# AFB24-MFT, AFB24-MFT-S, AFX24-MFT, AFX24-MFT-S

Proportional, Spring Return, 24 V, Multi-Function Technology®



MFT



Technical Data		AFB24-MFT, AFB24-MFT-S, AFX24-MFT, AFX24-MFT-S
Power supply		24 VAC, +/- 20%, 50/60 Hz 24 VDC, +20% / -10%
Power consumption♦	running	7.5 W
	holding	3 W
Transformer sizing ♦		10 VA (Class 2 power source)
Electrical connection		
AFB...		3 ft, 18 GA appliance cable, 1/2" conduit connector -S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
AFX...		3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector -S models: two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y*		2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1500 Ω for PWM, floating point and on/off control
Feedback output U*		2 to 10 VDC, 0.5 mA max
Torque		minimum 180 in-lb (20 Nm)
Direction of rotation*	spring	reversible with cw/ccw mounting
	motor	reversible with built-in switch
Mechanical angle of rotation*		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring	<20 sec @ -4°F to 122°F [-20° C to 50° C]; <60 sec @ -22°F [-30° C]
	motor*	150 seconds (default), variable (70 to 220 seconds)
Angle of Rotation adaptation		off (default)
Override control*		min. position = 0% mid. position = 50% max. position = 100%
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH, non-condensing
Ambient temperature		-22 to 122° F (-30 to 50° C)
Storage temperature		-40 to 176° F (-40 to 80° C)
Housing		NEMA 2, IP54, Enclosure Type 2
Housing material		zinc coated metal and plastic casing
Noise level		≤40dB(A) motor @ 150 seconds, run time dependent ≤62dB(A) spring return
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Quality standard		ISO 9001
Servicing		maintenance free
Weight		4.6 lbs. (1.9 kg), 4.9 lbs. (2 kg) with switch

\* Variable when configured with MFT options

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

♦ Programmed for 70 sec motor run time. At 150 sec motor run time, transformer sizing is 8.5 VA and power consumption is 6 W running / 3 W holding.

## AFB24-MFT-S, AFX24-MFT-S

Auxiliary switches	2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°
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- Torque min. 180 in-lb
- Control 2 to 10 VDC (DEFAULT)
- Feedback 2 to 10 VDC (DEFAULT)

## Application

For proportional modulation of dampers and control valves in HVAC systems. The AFB24-MFT, AFX24-MFT provides mechanical spring return operation for reliable fail-safe application.

## Default/Configuration

Default parameters for 2 to 10 VDC applications of the AFB24-MFT, AFX24-MFT actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. The parameters noted in the Technical Data table are variable.

These parameters can be changed by three means:

- Pre-set configurations from Belimo
- Custom configurations from Belimo
- Configurations set by the customer using the MFT PC tool (version 3.4 or higher) software application.
- Handheld ZTH-GEN

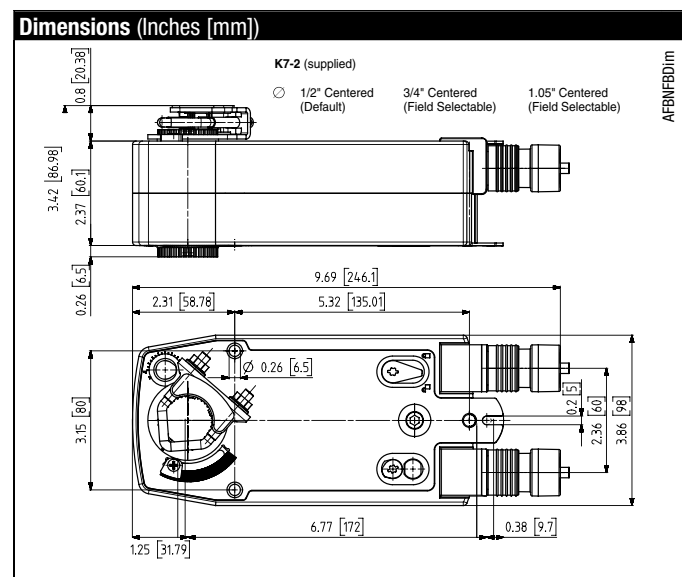
## Operation

The AFB24-MFT, AFX24-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 or valve 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 AFB24-MFT, AFX24-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 AFB24-MFT, AFX24-MFT actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

**NOTE: Please see documentation on Multi-Function Technology.**



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### Accessories

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
KH-AFB	Crank arm
K7-2	Universal clamp for up to 1.05" dia jackshafts
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-102	Multiple actuator mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4..., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

**NOTE:** When using AFB24-MFT, AFB24-MFT-S, AFX24-MFT and AFX24-MFT-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional 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 counterclockwise 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. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

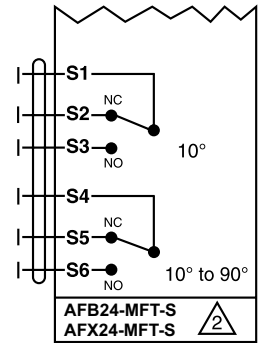
#### 📄 APPLICATION NOTES

- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor may be used.

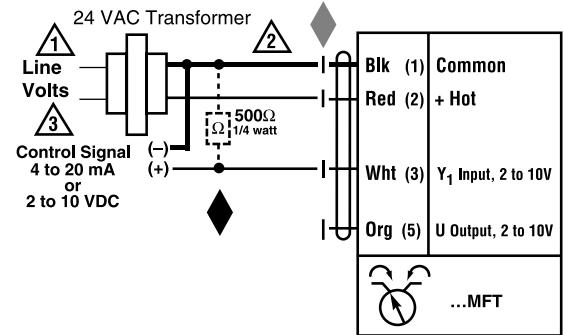
#### ⚠️ WARNING Live Electrical Components!

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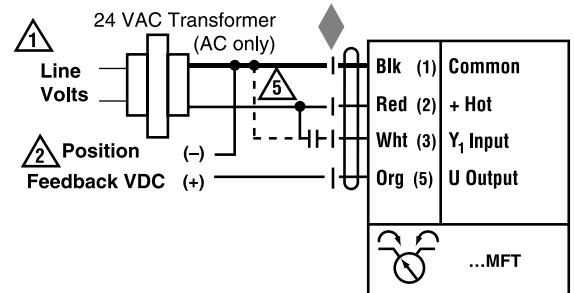
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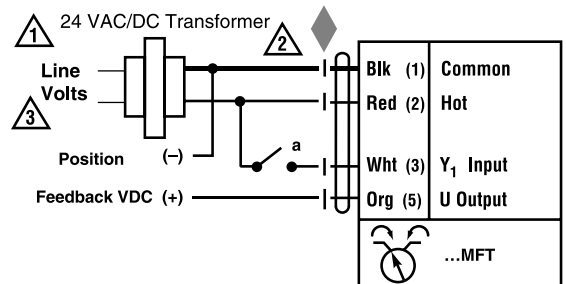
### Auxiliary Switches for AFB24-MFT-S, AFX24-MFT-S



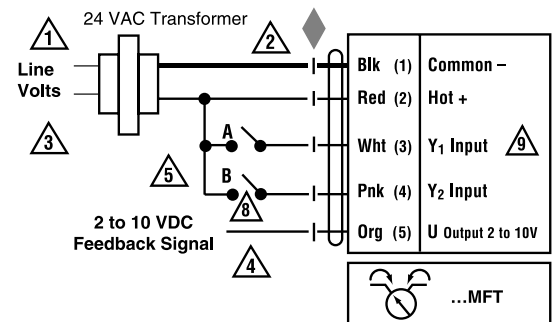
### VDC/4-20 mA



### PWM



### On/Off control



### Floating Point control

# AFB24-MFT N4(H), AFB24-MFT-S N4(H), AFX24-MFT N4, AFX24-MFT-S N4

NEMA 4, Proportional, Spring Return, Direct Coupled, 24V, Multi-Function Technology®



Technical Data		AFB24-MFT N4(H), AFB24-MFT-S N4(H), AFX24-MFT N4, AFX24-MFT-S N4
Power supply		24 VAC, +/- 20%, 50/60 Hz 24 VDC, +20% / -10%
Power consumption♦	running holding	7.5 W / heater 25 W 3 W
Transformer sizing		10 VA (Class 2 power source) / heater 25 VA
Electrical connection	AFB... N4 ♦	3 ft, 18 GA appliance cable, 1/2" conduit connector -S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	heater (N4H)	terminal block, 26-16 GA
	AFX... N4	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance cables, with 1/2" conduit connector -S models: two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y*		2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1500 Ω for PWM, floating point and on/off control
Feedback output U*		2 to 10 VDC, 0.5 mA max
Torque		minimum 180 in-lb (20 Nm)
Direction of rotation*	spring motor	reversible with cw/ccw mounting inside housing reversible with built-in switch
Mechanical angle of rotation*		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor* spring spring (with heater)	150 seconds (default), variable (70 to 220 seconds) <20 sec @ -4°F to 122°F [-20°C to 50°C]; <60 sec @ -22°F [-30°C] <20 sec @ -4°F to 122°F [-20°C to 50°C]; <60 sec @ -49°F [-45°C]
Angle of Rotation adaptation		off (default)
Override control*		min position = 0% mid. position = 50% max. position = 100%
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F (-30°C to 50°C)
with heater		-49°F to 122°F (-45°C to 50°C)
Storage temperature		-40°F to 176°F (-40°C to 80°C)
Housing		UL Type 4, NEMA 4, IP66
Housing material		polycarbonate
Noise level		≤40dB(A) motor @ 150 seconds, run time dependent ≤62dB(A) spring return
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Quality standard		ISO 9001
Servicing		maintenance free
Weight		9.7 lbs. (4.4 kg), 10 lbs. (4.5 kg) with switches 10.5 lbs (4.8 kg) with heater

\* Variable when configured with MFT options

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.

♦ Programmed for 70 sec motor run time. At 150 sec motor run time, transformer sizing is 8.5 VA and power consumption is 6 W running / 3 W holding.

## AFB24-MFT-S N4(H), AFX24-MFT-S N4

Auxiliary switches	2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°
--------------------	---

Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

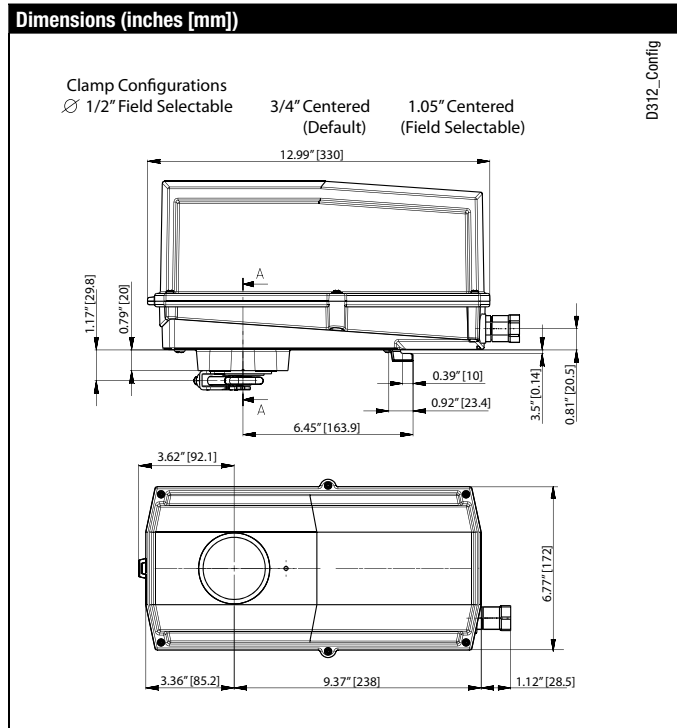
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AFB24-MFT N4(H), AFB24-MFT-S N4(H), AFX24-MFT N4, AFX24-MFT-S N4 provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The actuator can be manually operated with the manual crank that is supplied after the cover is removed.

The AFB24-MFT N4(H), AFB24-MFT-S N4(H), AFX24-MFT N4, AFX24-MFT-S N4 actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

Tool-06	8mm and 10 mm wrench
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland (needed for additional wires)

**NOTE:** When using AFB24-MFT N4(H), AFB24-MFT-S N4(H), AFX24-MFT N4 and AFX24-MFT-S N4 actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional 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 counterclockwise 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. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

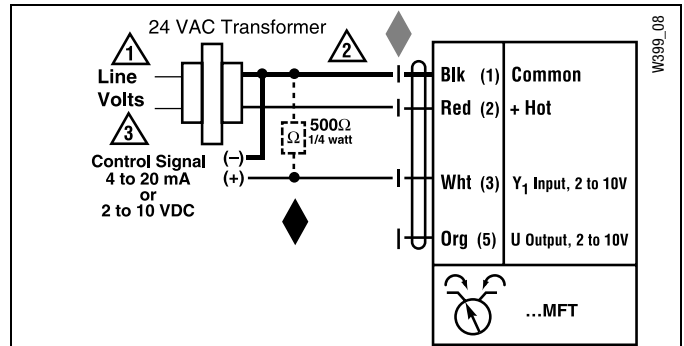
#### APPLICATION NOTES

◆ Meets UL requirements without the need of an electrical ground connection.

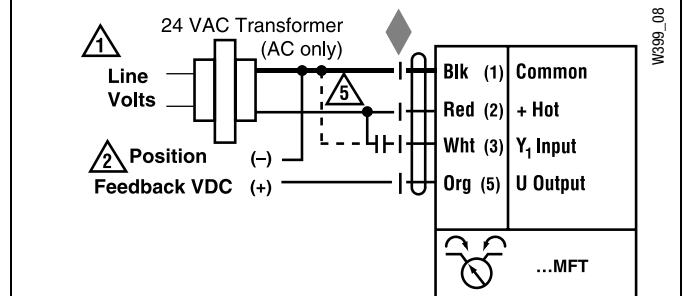
◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

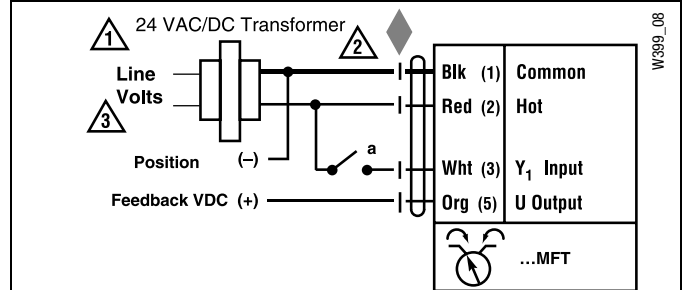
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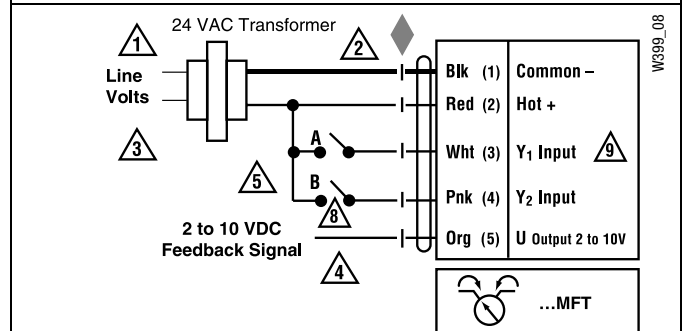
VDC/4-20 mA



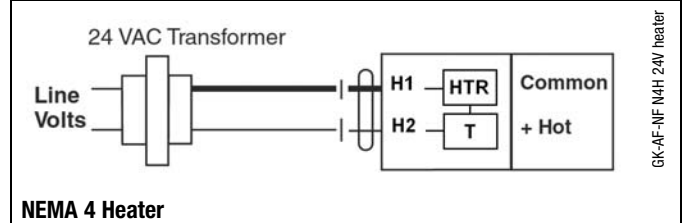
PWM



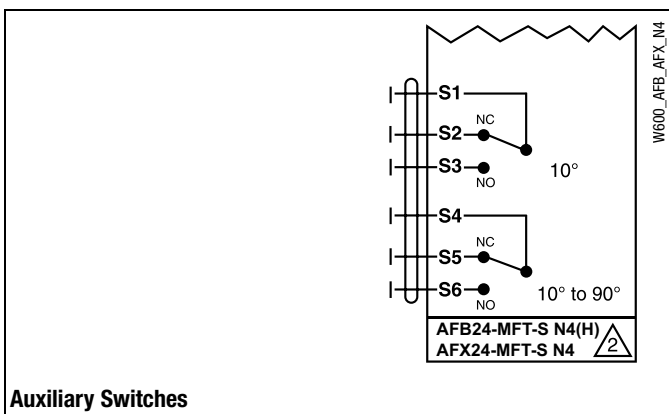
On/Off Control



Floating Point Control



NEMA 4 Heater



Auxiliary Switches

# AFB24-MFT95, AFX24-MFT95

Proportional, Spring Return, 24 V, for Use with Honeywell® Electronic Series 90 or a 0 to 135 Ω Input



MFT



Technical Data		AFB24-MFT95, AFX24-MFT95
Power supply		24 VAC, +/- 20%, 50/60 Hz 24 VDC, +20% / -10%
Power consumption♦	running holding	7.5 W 3 W
Transformer sizing♠		10 VA (Class 2 power source)
Electrical connection		
	AFB24-MFT95	3 ft, 18 GA plenum cable, with 1/2" conduit connector
	AFX24-MFT95	3 ft [1m], 18 GA plenum cable, with or without 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		0 to 135 Ω Honeywell Electronic Series 90, 0 to 135 Ω input
Feedback output U*		2 to 10 VDC, 0.5 mA max
Torque		minimum 180 in-lb (20 Nm)
Direction of rotation*	spring motor	reversible with cw/ccw mounting reversible with built-in switch
Mechanical angle of rotation*		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring motor*	<20 seconds @ -4°F to 122°F [-20° C to 50° C]; <60 seconds @ -22°F [-30° C] 150 seconds (default), variable (70 to 220 seconds)
Angle of Rotation adaptation		off (default)
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH, non-condensing
Ambient temperature		-22 to 122° F (-30 to 50° C)
Storage temperature		-40 to 176° F (-40 to 80° C)
Housing		NEMA 2, IP54, Enclosure Type 2
Housing material		zinc coated metal and plastic casing
Noise level		≤40dB(A) motor @ 150 seconds, run time dependent ≤62dB(A) spring return
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Quality standard		ISO 9001
Servicing		maintenance free
Weight		4.6 lbs. (1.9 kg)

\* Variable when configured with MFT options

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

♠ Programmed for 70 seconds motor run time. At 150 sec motor run time, transformer sizing is 8.5 VA and power consumption is 6 W running / 3 W holding.

- Torque min. 180 in-lb
- Control fixed, 0 to 135 Ω input, or Honeywell series 90 (fixed)
- Feedback 2 to 10 VDC (DEFAULT)

## Application

For proportional modulation of dampers and control valves in HVAC systems. The AFB24-MFT95, AFX24-MFT95 provides mechanical spring return operation for reliable fail-safe application.

## Default/Configuration

Default parameters for 0 to 135 Ω Input applications of the AFB24-MFT95 and AFX24-MFT95 actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. However the control input cannot be modified via MFT PC tool software. The parameters noted in the Technical Data table are variable.

These parameters can be changed by three means:

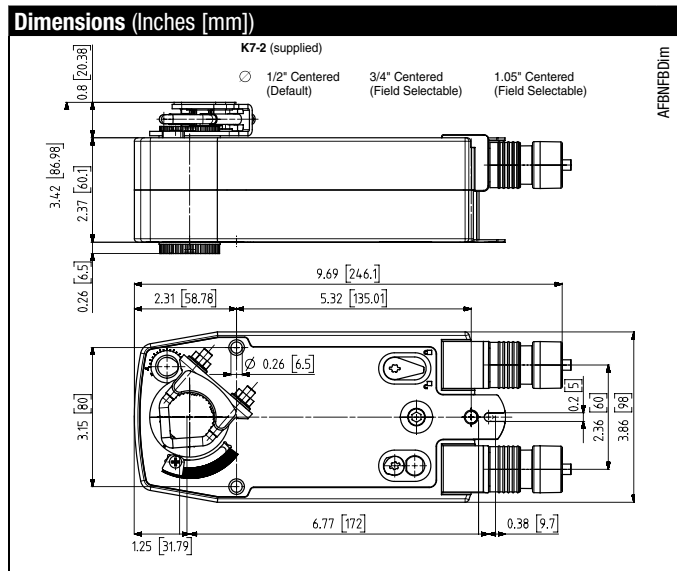
- Pre-set configurations from Belimo
- Custom configurations from Belimo
- Configurations set by the customer using the MFT PC tool (version 3.4 or higher) software application.

## Operation

The AFB24-MFT95, AFX24-MFT95 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 or valve 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 AFB24-MFT95, AFX24-MFT95 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 AFB24-MFT95, AFX24-MFT95 actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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#### Proportional Potentiometric Control - Wiring Diagrams

##### INSTALLATION NOTES

- 5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
- 21 Provide overload protection and disconnect as required.
- 22 Actuators and controller must have separate transformers.
- 23 Consult controller instruction data for more detailed information.
- 24 Resistor value depends on the type of controller and the number of actuators.
- 24 No resistor is used for one actuator. Honeywell® resistor kits may also be used.
- 25 To reverse control rotation, use the reversing switch.

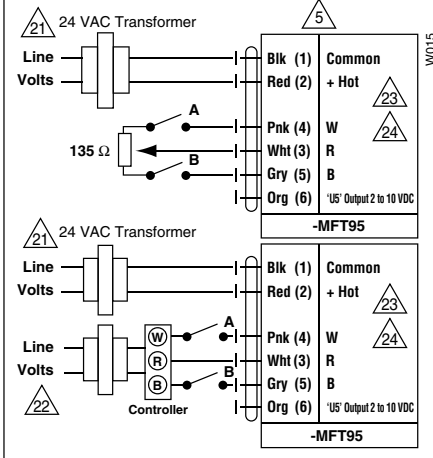
##### Wire Colors

1 = Black	3 = White	5 = Gray
2 = Red	4 = Pink	6 = Orange

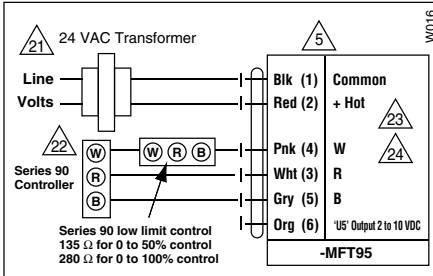
##### Override

Switch A	Switch B	Damper Position
		Damper Open
		Damper Closed

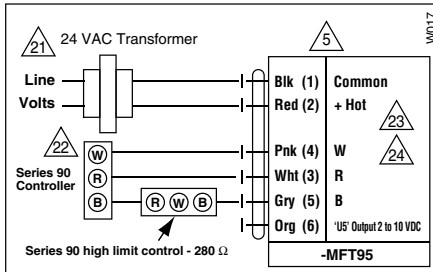
The direction of rotation switch is set so that the fail safe position and the position of the damper is closed with no signal at wire R.



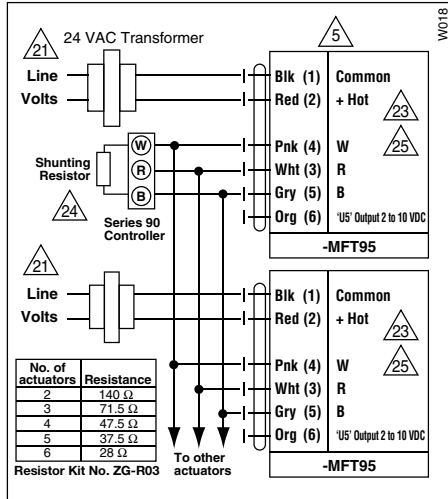
##### Low Limit Control



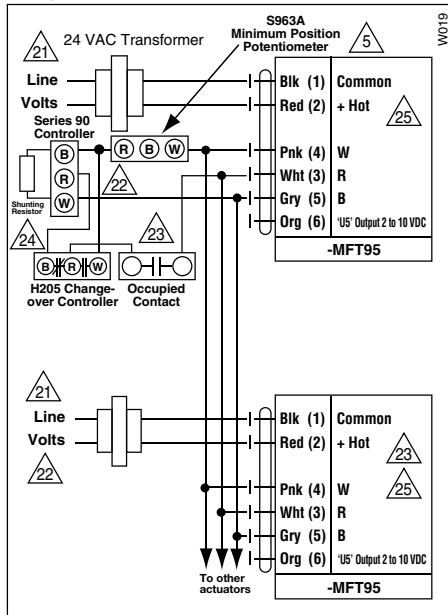
##### High Limit Control



##### Wiring Multiple Actuators to a Series 90 Controller



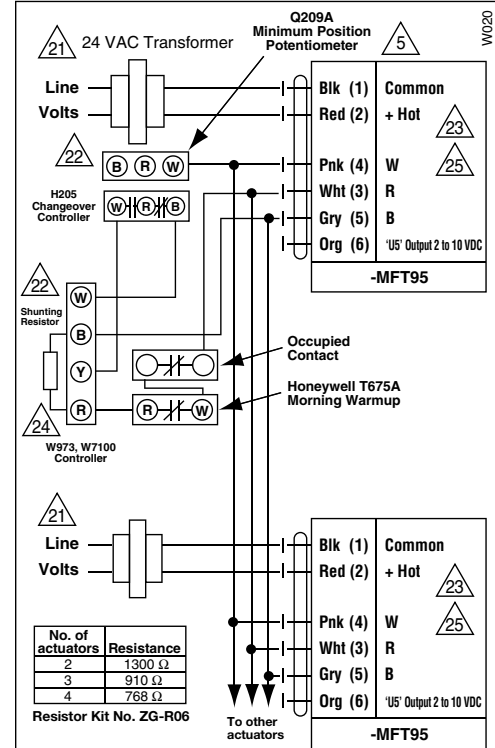
##### Wiring Multiple Actuators to a Series 90 Controller using a Minimum Position Potentiometer



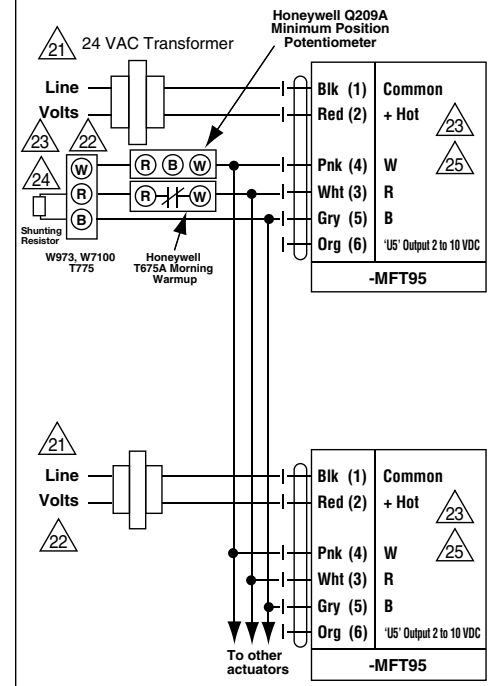
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##### Typical wiring diagrams for multiple actuators used with the W973, W7100 and T775 controllers

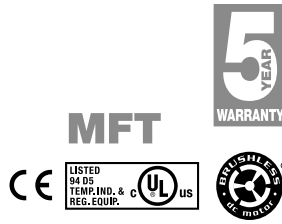


##### Used with the W973 and W7100 controllers



# AFB24-MFT95 N4(H), AFX24-MFT95 N4

NEMA 4, Proportional, Spring Return, 24 V, for Use with Honeywell® Electronic Series 90 or a 0 to 135 Ω Input



Technical Data		AFB24-MFT95 N4(H), AFX24-MFT95 N4
Power supply		24 VAC, +/- 20%, 50/60 Hz 24 VDC, +20% / -10%
Power consumption♦	running	7.5 W / heater 25 W
	holding	3 W
Transformer sizing♦		10 VA (Class 2 power source) / heater 25 VA
Electrical connection	AFB24-MFT95 N4	3 ft, 18 GA plenum cable, with 1/2" conduit connector
	heater (N4H)	terminal block, 26-16 GA
	AFX24-MFT95 N4	3 ft [1m], 18 GA plenum cable, with 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		0 to 135 Ω Honeywell Electronic Series 90, 0 to 135 Ω input
Feedback output U*		2 to 10 VDC, 0.5 mA max
Torque		minimum 180 in-lb (20 Nm)
Direction of rotation*	spring	reversible with cw/ccw mounting inside housing
	motor	reversible with built-in switch
Mechanical angle of rotation*		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor*	150 seconds (default), variable (70 to 220 seconds)
	spring	<20 seconds @ -4°F to 122°F [-20°C to 50°C]; <60 seconds @ -22°F [-30°C]
	spring (with heater)	<20 seconds @ -4°F to 122°F [-20°C to 50°C]; <60 seconds @ -49°F [-45°C]
Angle of rotation adaptation		off (default)
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122° F [-30°C to 50°C]
	with heater	-49°F to 122°F [-45°C to 50°C]
Storage temperature		-40°F to 176° F [-40°C to 80°C]
Housing		UL Type 4, NEMA 4, IP66
Housing material		polycarbonate
Noise level		≤40dB(A) motor @ 150 seconds, run time dependent ≤62dB(A) spring return
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Quality standard		ISO 9001
Servicing		maintenance free
Weight		9.7 lbs. (4.4 kg); 10.5 lbs (4.8 kg) with heater

\* Variable when configured with MFT options

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.

♦ Programmed for 70 seconds motor run time. At 150 sec motor run time, transformer sizing is 8.5 VA and power consumption is 6 W running / 3 W holding.

- Torque min. 180 in-lb
- Control fixed, 0 to 135 Ω input, or Honeywell series 90 (fixed)
- Feedback 2 to 10 VDC (DEFAULT)

## Application

For proportional modulation of dampers and control valves in HVAC systems. The AFB24-MFT95 N4(H), AFX24-MFT95 N4 provides mechanical spring return operation for reliable fail-safe application.

## Default/Configuration

Default parameters for 0 to 135 Ω Input applications of the AFB24-MFT95 N4(H) and AFX24-MFT95 N4 actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. However the control input cannot be modified via MFT PC tool software. The parameters noted in the Technical Data table are variable.

These parameters can be changed by three means:

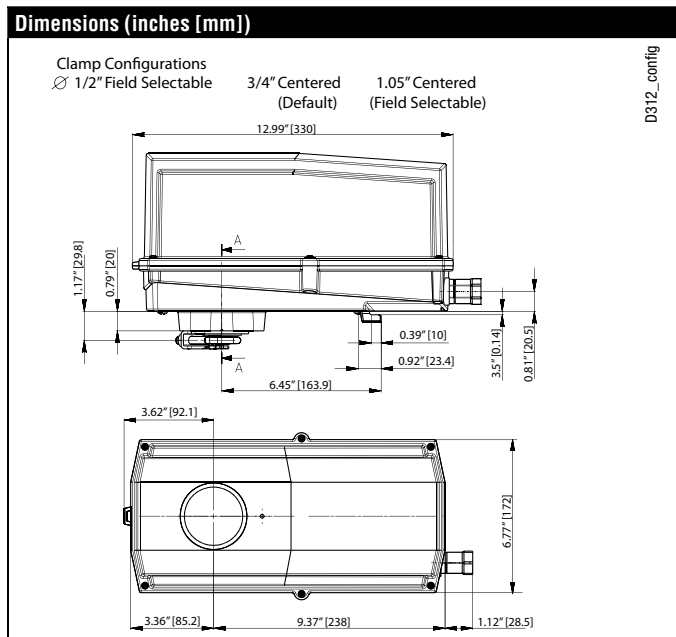
- Pre-set configurations from Belimo
- Custom configurations from Belimo
- Configurations set by the customer using the MFT PC tool (version 3.4 or higher) software application.

## Operation

The AFB24-MFT95 N4(H), AFX24-MFT95 N4 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 or valve 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 AFB24-MFT95 N4(H), AFX24-MFT95 N4 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.



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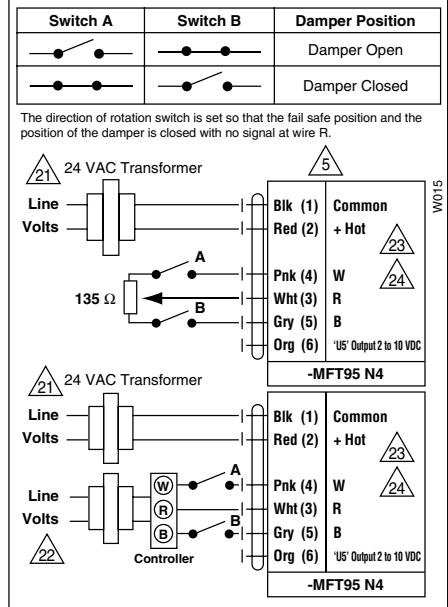
### Proportional Potentiometric Control - Wiring Diagrams

#### INSTALLATION NOTES

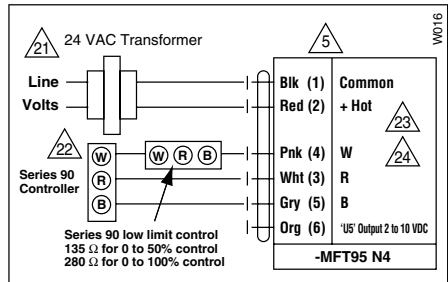
- 5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
- 21 Provide overload protection and disconnect as required.
- 22 Actuators and controller must have separate transformers.
- 23 Consult controller instruction data for more detailed information.
- 24 Resistor value depends on the type of controller and the number of actuators.
- 24 No resistor is used for one actuator. Honeywell® resistor kits may also be used.
- 25 To reverse control rotation, use the reversing switch.

Wire Colors		
1 = Black	3 = White	5 = Gray
2 = Red	4 = Pink	6 = Orange

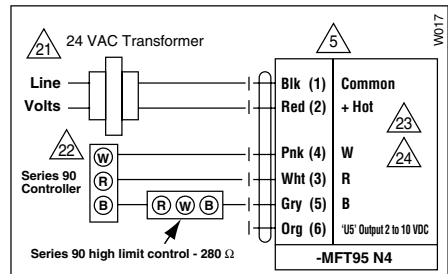
#### Override



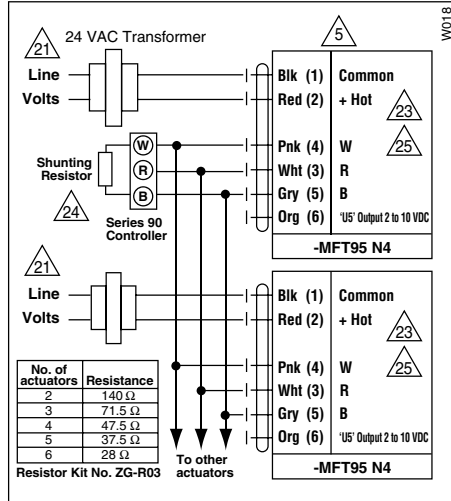
#### Low Limit Control



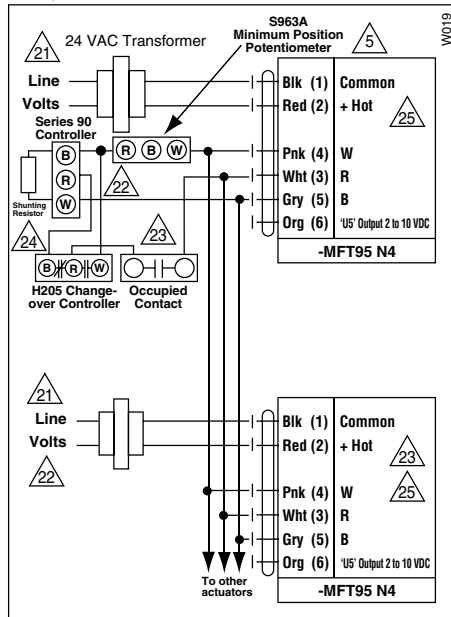
#### High Limit Control



#### Wiring Multiple Actuators to a Series 90 Controller



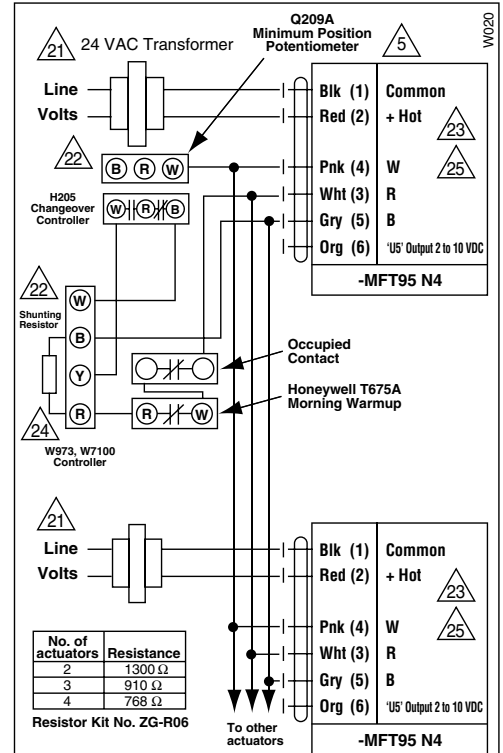
#### Wiring Multiple Actuators to a Series 90 Controller using a Minimum Position Potentiometer



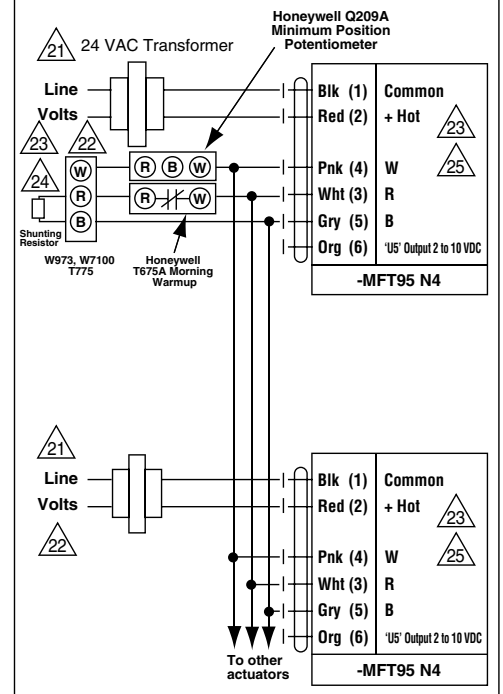
#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

#### Typical wiring diagrams for multiple actuators used with the W973, W7100 and T775 controllers



#### Used with the W973 and W7100 controllers



# Installation Instructions

## Quick-Mount Visual Instructions for Mechanical Installation

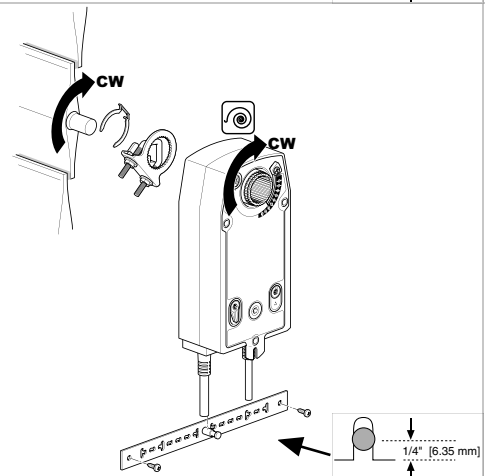
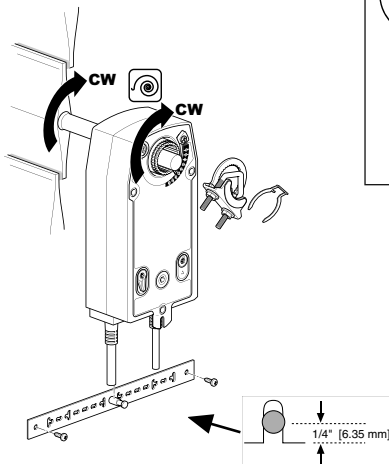
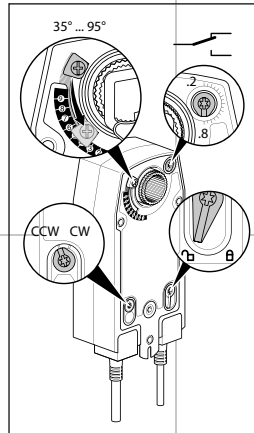
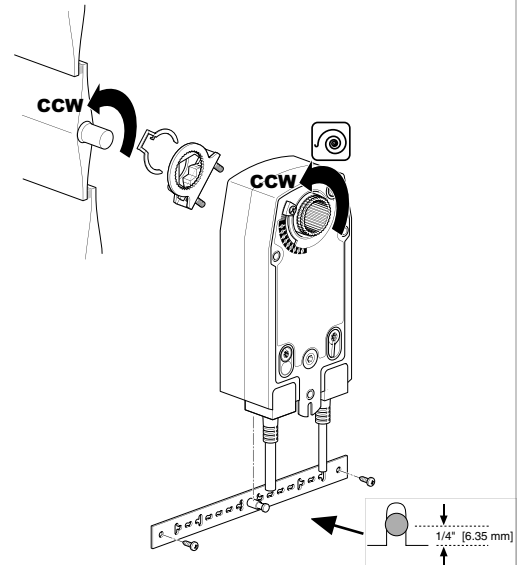
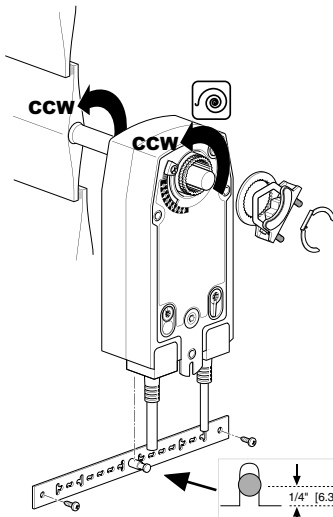
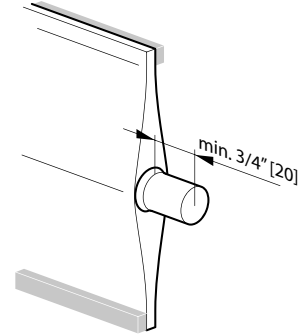
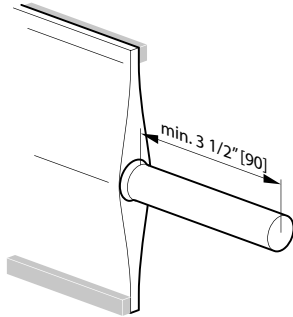


### Quick-Mount Visual Instructions

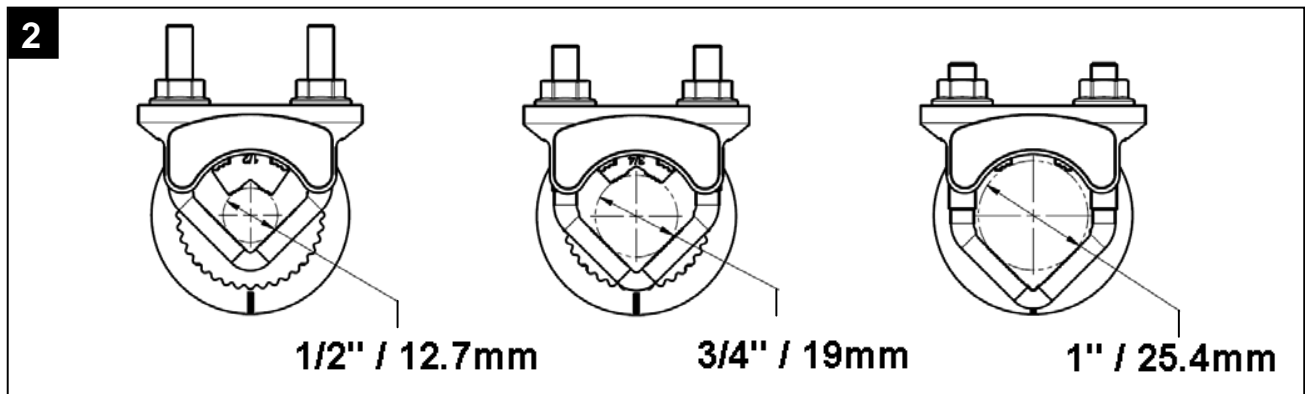
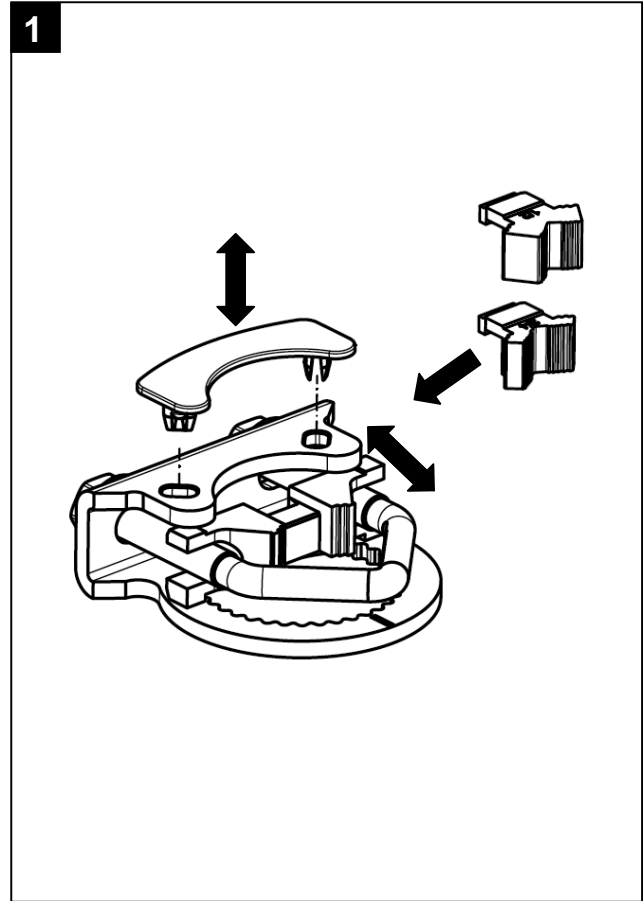
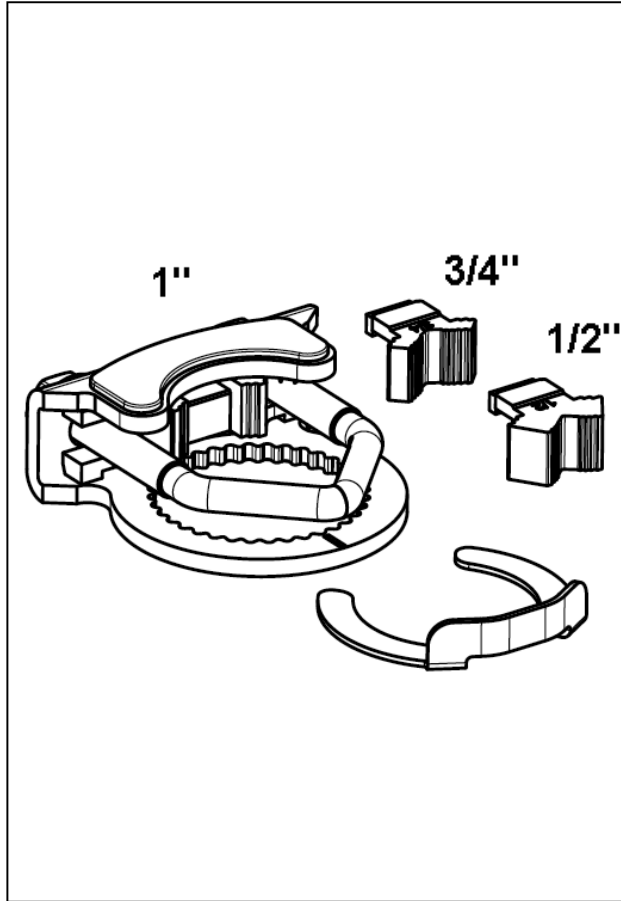
1. Rotate the damper to its fail-safe position.  
If the shaft rotates counterclockwise, mount the "CCW" side of the actuator out.  
If it rotates clockwise, mount the actuator with the "CW" side out.
2. If the universal clamp is not on the correct side of the actuator, mount it onto the correct side.
3. Slide the actuator onto the shaft and tighten the nuts on the V-bolt with a 10mm wrench to 6-8 ft-lb of torque.
4. Slide the anti-rotation strap under the actuator so that it engages the slot at the base of the actuator. Secure the strap to the duct work with #8 self-tapping screws.






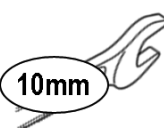
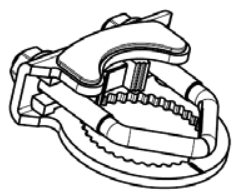
NOTE: Read the "Standard Mounting" instructions, on the next page, for more detailed information.

### Dimensions (Inches [mm])



M40103 - 09/11 - Subject to change. © Belimo Aircontrols (USA), Inc.



						 10mm	
1/2"	mm	12.7	10 ... 19	---	14 ... 20		
	inch	1/2	2/5 ... 3/4	---	9/16 ... 3/4		
3/4"	mm	19	10 ... 22	10	14 ... 25.4		
	inch	3/4	2/5 ... 3/4	3/8	9/16 ... 1		
1"	mm	25.4	19 ... 26.7	12 ... 18	---		
	inch	1	3/4 ... 1.05	1/2 ... 11/16	---		

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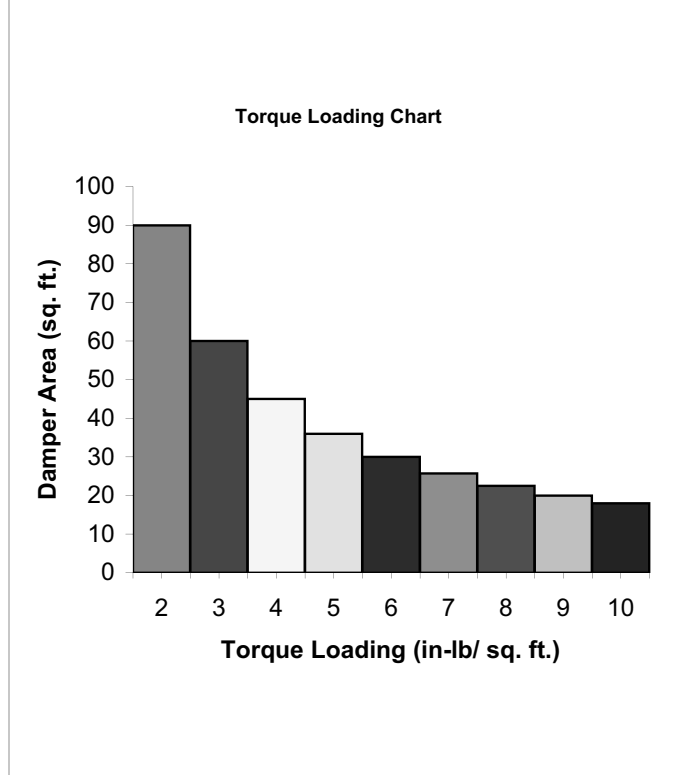
### Determining Torque Loading and Actuator Sizing

Damper torque loadings, used in selecting the correct size actuator, should be provided by the damper manufacturer. If this information is not available, the following general selection guidelines can be used.

Damper Type	Torque Loading
Opposed blade, without edge seals, for non-tight close-off applications	3 in-lb/sq. ft.
Parallel blade, without edge seals, for non-tight close-off applications	4 in-lb/sq. ft.
Opposed blade, with edge seals, for tight close-off applications	5 in-lb/sq. ft.
Parallel blade, with edge seals, for tight close-off applications	7 in-lb/sq. ft.

The above torque loadings will work for most applications with 1000 FPM face velocity. For applications between this criteria and 2500 FPM, the torque loading should be increased by a multiplier of 1.5. If the application calls for higher criteria up to 3000 FPM, use a multiplier of 2.0.

### Torque Loading Chart



### General Information

Belimo actuators should be mounted indoors in a dry, relatively clean environment free from corrosive fumes. If the actuator is to be mounted outdoors, a protective enclosure must be used to shield the actuator.

For new construction work, **order dampers with extended shafts**. Instruct the installing contractor to allow space for mounting and service of the Belimo actuator on the shaft. The damper shaft must extend at least 3 1/2" from the duct. If the shaft extends less than 3-1/2" or if an obstruction blocks access, the shaft can be extended with the AV 8-25 shaft extension accessory or the actuator may be mounted in its short shaft configuration.

### Mechanical Operation

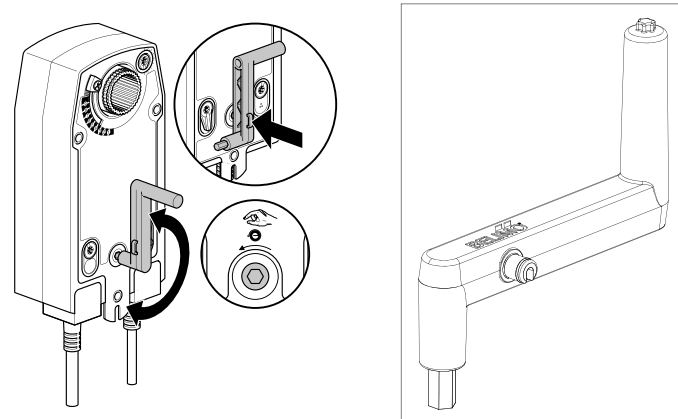
The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft. The AFB, AFX series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator. The AFB...-S, AFX...-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°.

### Automatic Airtight Dampers/Manual Override

The AFB, AFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The AFB, AFX has a unique built in manual positioning mechanism which allows the setting of any damper position within its 95° of rotation. A pre-tensioned spring automatically tightens the damper when power is applied to the actuator, compensating for damper seal deterioration..

The actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off. When power is applied, the manual mechanism is released and the actuator drives toward the full fail-safe position.



### Standard Mounting

**NOTE:** The AFB, AFX...series actuator is shipped with the manual override adjusted for a +5° position at the universal clamp (not at full fail-safe, 0°). This allows for automatic compression of damper blade seals when the actuator is in use, providing tight shut-off. This assumes that the damper is to have tight shut-off at the fail-safe position. If tight close-off is desired at the opposite direction from fail-safe, the manual override should be released so the actuator can go to the full fail-safe position. See the manual override instructions.

1. Manually move the damper to the fail-safe position (usually closed). If the shaft rotated counterclockwise (↺), this is a CCW installation. If the shaft rotated clockwise (↻), this is a CW installation. In a CCW installation, the actuator side marked "CCW" faces out, while in a CW installation, the side marked "CW" faces out. All other steps are identical.
2. The actuator is usually shipped with the universal clamp mounted to the "CCW" side of the actuator. To test for adequate shaft length, slide the actuator over the shaft with the side marked "CCW" (or the "CW" side if this is the side with the clamp). If the shaft extends at least 1/8" through the clamp, mount the actuator as follows. If not, go to the *Short Shaft Installation* section.
3. If the clamp is not on the correct side as determined in step #1, re-mount the clamp as follows. If it is on the correct side, proceed to step #5. Look at the universal clamp. If you are mounting the actuator with the "CCW" side out,



position the clamp so that the pointer section of the tab is pointing to 0° (see Figure C) and the spline pattern of the clamp mates with spline of the actuator. Slip the clamp over the spline. (Use the same procedure if the "CW" side is out.) If your application requires a mechanical minimum position, read the *Rotation Limiting, Mechanical Minimum Damper Position* section.

4. Lock the clamp to the actuator using the retaining clip.
5. Verify that the damper is still in its full fail-safe position.
6. Slide the actuator over the shaft.
7. Position the actuator in the desired location.
8. Tighten the two nuts on the clamp using a 10mm wrench or socket using 6-8 ft-lb of torque.
9. Slip the stud of the anti rotation strap into the slot at the base of the actuator. The stud should be positioned approximately 1/16 of an inch from the closed end of the slot. Bend the strap as needed to reach the duct. Attach the strap to the duct with #8 self tapping screws.

### Short Shaft Installation

If the shaft extends at least 3/4" from the duct, follow these steps:

1. Determine the best orientation for the universal clamp on the back of the actuator. The best location would be where you have the easiest access to the V bolt nuts on the clamp.
2. Engage the clamp to the actuator as close as possible to the determined location.
3. Lock the clamp in place using the remaining retainer clip.
4. Verify that the damper is still in its full fail-safe position.
5. Slide the actuator over the shaft.
6. Position the actuator in the desired location.
7. Tighten the two nuts on the clamp using a 10mm wrench or socket using 6-8 ft-lb of torque.
8. Slip the stud of the anti-rotation strap into the slot at the base of the actuator. The stud should be positioned approximately 1/16 of an inch from the closed end of the slot. Bend the strap as needed to reach the duct. Attach the strap to the duct with #8 self tapping screws.
9. If damper position indication is required, use the optional IND-AFB pointer. See **Figure A**.

### Jackshaft Installation

The AFB, AFX... series actuator is designed for use with jackshafts up to 1.05" in diameter. In most applications, the AFB, AFX actuator may be mounted in the same manner as a standard damper shaft application. If more torque is required than one AFB, AFX actuator can provide, a second AFB, AFX actuator may be mounted to the jackshaft using the ZG-102 multiple actuator mounting bracket. **See wiring guide for wiring details.**

#### AF ACTUATORS WHICH MAY BE USED ON ONE SHAFT

Model	Maximum Quantity Per Shaft
AFB24-MFT(-S), AFX24-MFT (-S)	3**
AFB24(-S), AFX24(-S)	2*
AFBUP(-S), AFXUP(-S)	2*

\* Wired in parallel    \*\*Wired master-slave

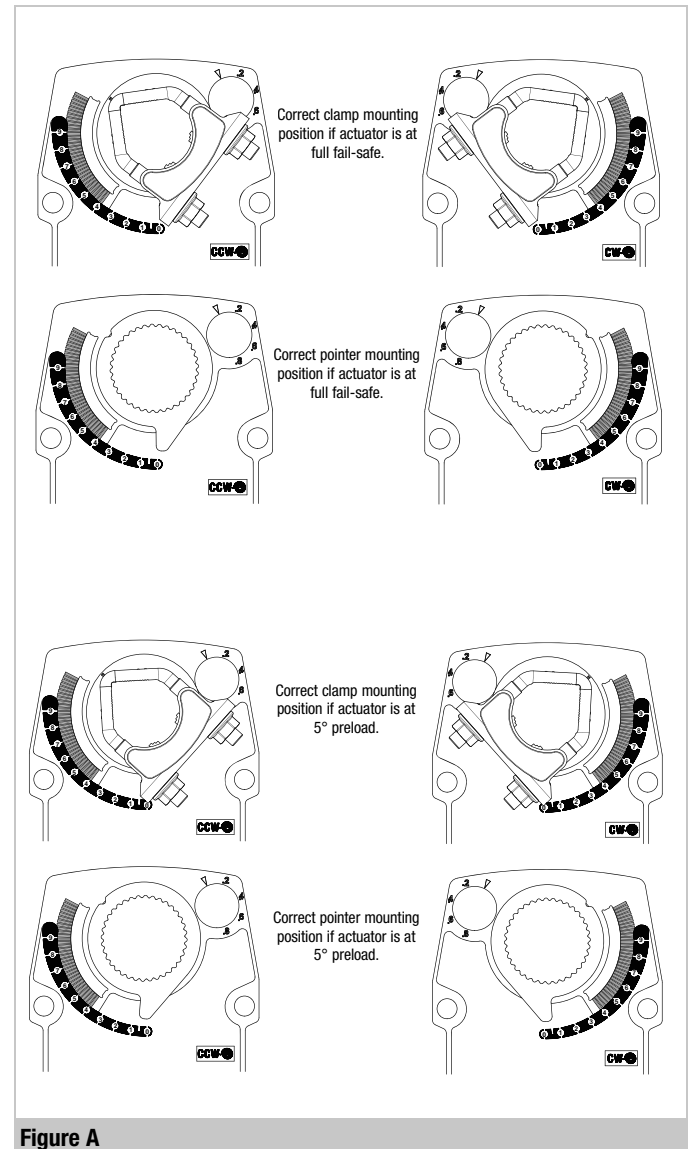
**MOUNTING:** If the actuators are mounted on the opposed ends of the shaft, the actuator direction must be selected carefully. Usually, the direction of rotation is reversed.

### Multiple Actuator Mounting

If more torque is required than one AFB, AFX actuator can provide, a second AFB, AFX actuator may be mounted to the shaft using the ZG-102 multiple mounting bracket.

**NOTE:** The manual positioning mechanism cannot be used in multiple actuator applications.

**Special Wiring and Additional Information:** See wiring guide



**Figure A**

### Rotation Limitation

The angle of rotation limiter, which is built into the actuator, is used in conjunction with the tab on the universal clamp or IND-AFB position indicator. In order to function properly, the clamp or indicator must be mounted correctly.

See **Figure A**.

The rotation limiter may not work in certain mounting orientations using the ZG-118 mounting bracket. Limiting the damper rotation must be accomplished by adjusting the crank arm linkage.

The built-in rotation limiter may be used in 2 ways to control the rotational output of the AFB, AFX series actuator. One use is in the application where a damper has a designed rotation less than 90°. An example would be a 45° or 60° rotating damper. The other application would be to set a minimum damper position which can be easily set or changed without having to remove the actuator from the damper.

### Damper Rotation Limiting

1. Determine the amount of damper rotation required.
2. Locate the Angle of Rotation Limiter on the actuator **Figure B**.
3. Position the limiter to the desired position, making sure the locating “teeth” on the limiter are engaged into the locating holes on the actuator.
4. Fasten the limiter by screwing the attached screw.
5. Test the damper rotation either manually with the manual crank or apply power and if required, a control signal. Re-adjust if necessary.

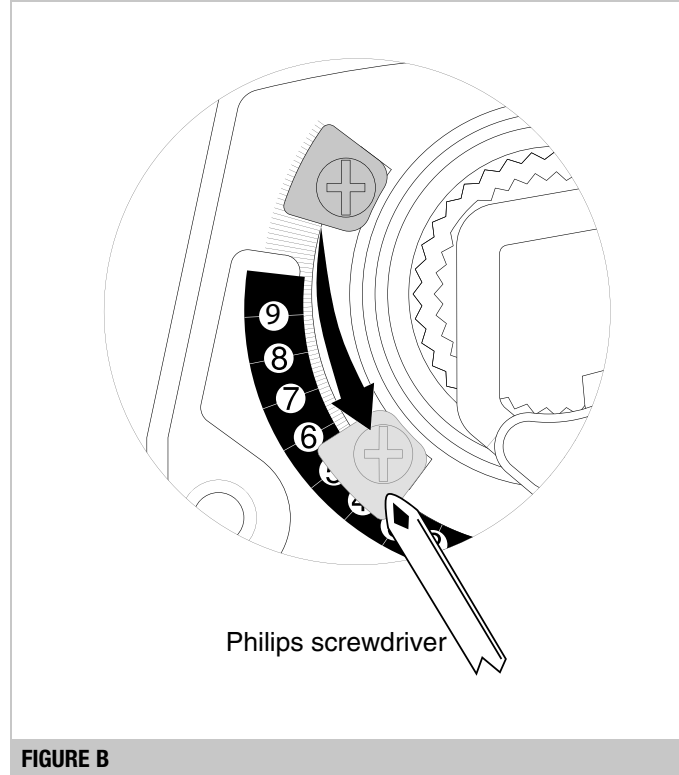
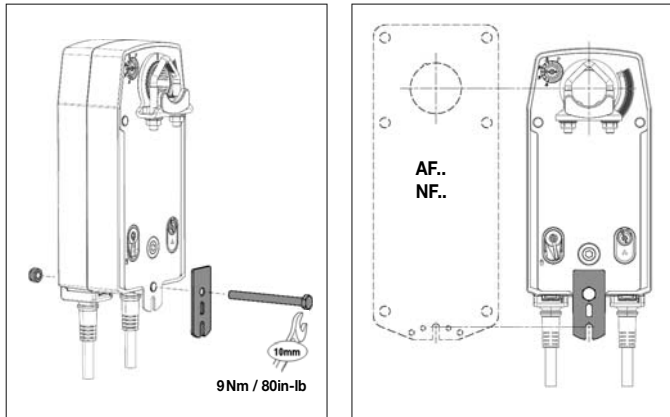


FIGURE B

### Z-AF For Replacing AF and NF Actuators

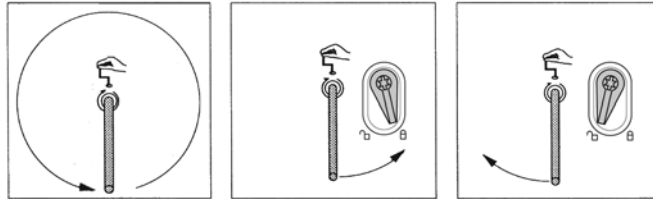


### Manual Override

The AFB, AFX series actuators can be manually positioned to ease installation or for emergency positioning.

1. The manual override will only work if no power is available to the actuator.
2. Insert the manual crank (shipped with the actuator) into the hexagon hole located on either side of the actuator. An illustration, located on the label, shows the location.
3. Turn the crank in the direction shown on the label (clockwise on the "CW" side, counterclockwise on the "CCW" side). It will take approximately 23 revolutions to rotate the full 95° of rotation.
4. To lock the actuator in the required position, flip the switch to the locked position that is located to the right of the crank on the CCW side of the actuator (left of the crank on the CW side).
5. The manual override may be disengaged in 2 ways.
  - Flip the switch to the unlocked position and the actuator will go to its fail-safe position.
  - Apply power to wire 1 and 2. The actuator will automatically disengage the override function and will go to the "on" position in the case of the On/Off versions. Or, in the case of the proportional versions, go to the 0 signal position and then go to the position corresponding to the control signal. The actuator will now work normally.

#### CCW Side Example:



#### Winding the damper actuator

- insert crank handle
- turn handle in direction of arrow

#### Locking the damper actuator

- Flip the lock switch to the position pointing to the "locked" symbol

#### Unlocking the damper actuator (2 options)

- Flip the lock switch to the position pointing to the "unlocked" symbol.
- Remote control by supplying power to the unit for > than 3 sec.

### Testing the installation Without Power

The actuator/damper installation may be tested without power at the actuator. Refer to the manual positioning section of the instructions. Move the damper to its full non-fail-safe position using the manual crank. Disengage the manual position mechanism and have the damper go to full fail-safe position. Correct any mechanical problems and retest.

### Auxiliary Switches

The AFB, AFX series actuators may be ordered with two built-in SPDT auxiliary switches used for safety interfacing or signaling, for example, for fan start-up. The switch position near the fail-safe position is fixed at 10°. The other is adjustable between 10° and 90° of rotation. The crank that is supplied with the actuator is used to change the switch position.

#### SWITCH RATING

Voltage	Resistive Load	Inductive Load
120 VAC	3A	1.03A
250 VAC	3A	0.5A

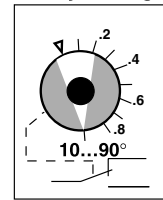
Two methods may be used to adjust the switching point of the adjustable switch.

#### Method 1 - See Figure F

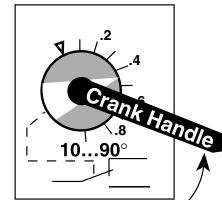
1. The actuator must be in its fail-safe position.
2. Insert the crank handle into the torx shaped hole located in the center of the adjustable switch pointer.
3. Gently rotate the crank until the switch pointer is at the desired switch point in degrees as shown.

#### AFB, AFX... Series

##### Factory setting 90°



##### Rotate with crank handle



##### 60° set

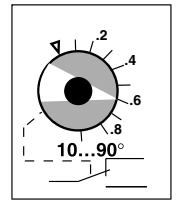


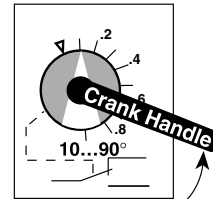
FIGURE F

#### Method 2 - See Figure G

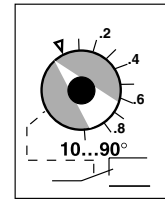
1. Position the damper to the point at which you want the switch to activate. This may be done by using the manual override or by providing the appropriate proportional signal to AFB24, AFX24... modulating type actuator. The position of the switch pointer is not important during this step.
2. Insert the crank into the torx shaped hole located in the center of the adjustable switch pointer.
3. Gently rotate the switch pointer to just past the switch point indicating arrow as shown.

#### AFB, AFX... Series

##### Actuator after locking



##### Switch operates



##### Switch does not operate

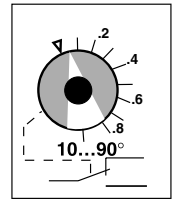


FIGURE G

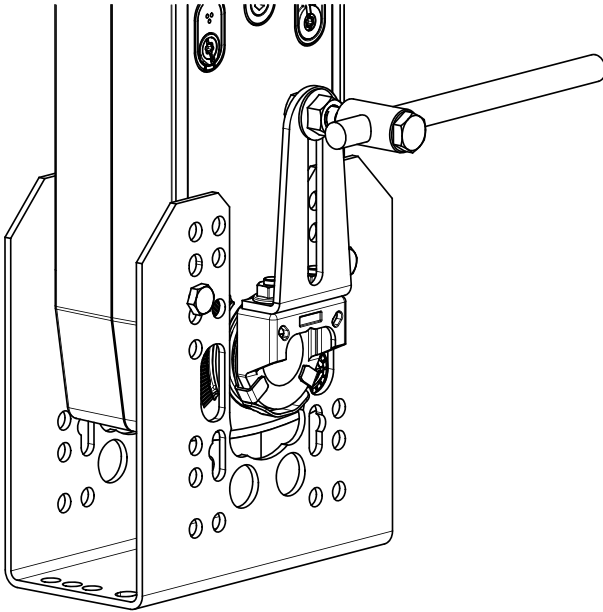
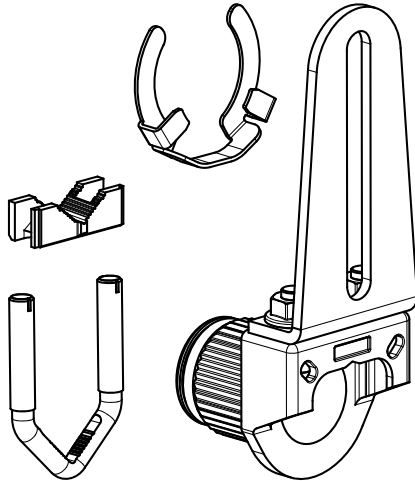
# KH-AFB Crank arm

## Including Retaining Ring

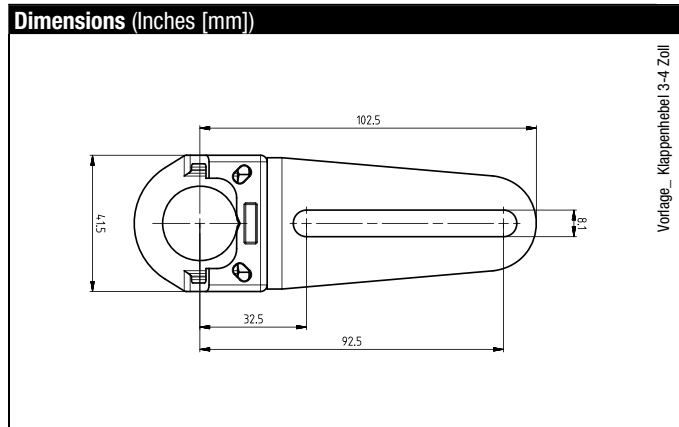
**CAUTION:** The retaining clip supplied with the clamp is **not** used to mount the KH-AFB crank arm.

The KH-AFB crank arm is used in non-direct coupled mounting applications. The KH-AFB may also be used to simultaneously direct couple to a damper shaft and provide an additional crank arm connection to a second damper.

**KH-AFB** For round shafts up to 3/4" or square shafts up to 5/8"



**KH-AFB non-direct mounting with ZG-118 mounting bracket**



### General

The AFB, AFX series actuators utilize both DC Motors and brushless DC motor technology. The AFB, AFX uses this motor in conjunction with an Application Specific Integrated Circuit (ASIC). In the On/Off versions of the AFB and AFX, the ASIC monitors and controls the actuator's rotation and a digital rotation sensing function to prevent damage to the actuator. The AFB24, AFX24... modulates type actuators incorporate a built in microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and knows the actuator's exact zero position.

### Brushless DC Motor Operation

Belimo's brushless DC motor spins by reversing the poles of stationary electromagnets housed inside of a rotating permanent magnet. The electromagnetic poles are switched by a special ASIC circuit developed by Belimo. Unlike the conventional DC motor, there are no brushes to wear or commutators to foul.

### Overload Protection

The AFB, AFX series actuators are protected from overload at all angles of rotation. The ASIC circuit constantly monitors the rotation of the DC motor inside the actuator and stops the pulses to the motor when it senses a stall condition. The DC motor remains energized and produces full rated torque to the load. This helps ensure that dampers are fully closed and that edge and blade seals are always properly compressed.

### Motor Position Detection

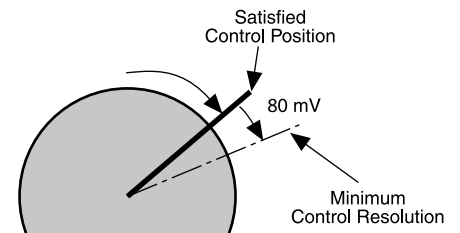
Belimo brushless DC motors eliminate the need for potentiometers for positioning in modulating type actuators. Inside the motor are three "Hall Effect" sensors. These sensors detect the spinning rotor and send pulses to the microprocessor which counts the pulses and calculates the position to within 1/3 of a revolution of the motor.

### Control Accuracy and Stability

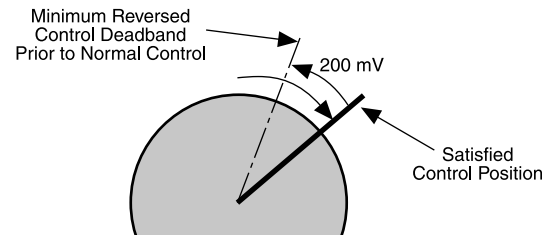
-SR and MFT AF actuators have built-in brushless DC motors which provide better accuracy and longer service life.

The -SR and MFT AF actuators are designed with a unique non-symmetrical deadband. The actuator follows an increasing or decreasing control signal with a 80 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 200 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**AF Actuator responds to an 80 mV signal when not changing direction from stop**



**AF Actuator responds to a 200 mV signal when reversing direction from stop position.**



**Note:** Resolution is a percentage of operating range. 1% in one direction, 2.5% when changing direction. 2-10 VDC control example shown above.

**WARNING** The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

**Always read the controller manufacturer's installation literature carefully before making any connections.** Follow all instructions in this literature. If you have any questions, contact the controller manufacturer and/or Belimo.

### Transformers

The AFB24, AFX24...actuators require a 24 VAC class 2 transformer and draws a maximum of 10 VA per actuator. The actuator enclosure cannot be opened in the field, there are no parts or components to be replaced or repaired.

- EMC directive: 2004/108/EC
- Software class A: Mode of operation type 1
- Low voltage directive: 2006/95/EC

**CAUTION:** It is good practice to power electronic or digital controllers from a separate power transformer than that used for actuators or other end devices. The power supply design in our actuators and other end devices use half wave rectification. Some controllers use full wave rectification. When these two different types of power supplies are connected to the same power transformer and the DC commons are connected together, a short circuit is created across one of the diodes in the full wave power supply, damaging the controller. Only use a single power transformer to power the controller and actuator if you know the controller power supply uses half wave rectification.

### Multiple Actuators, One Transformer

Multiple actuators may be powered from one transformer provided the following rules are followed:

1. The TOTAL current draw of the actuators (VA rating) is less than or equal to the rating of the transformer.
2. Polarity on the secondary of the transformer is strictly followed. *This means that all No. 1 wires from all actuators are connected to the common leg on the transformer and all No. 2 wires from all actuators are connected to the hotleg.* Mixing wire No. 1 & 2 on one leg of the transformer will result in erratic operation or failure of the actuator and/or controls.

### Multiple Actuators, Multiple Transformers

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

1. The transformers are properly sized.
2. All No. 1 wires from all actuators are tied together and tied to the negative leg of the control signal. See wiring diagram.

### Wire Length for AFB..., AFX... Actuators

Keep power wire runs below the lengths listed in the **Figure H**. If more than one actuator is powered from the same wire run, divide the allowable wire length by the number of actuators to determine the maximum run to any single actuator.

Example: 3 actuators, 16 Ga wire  
 $350 \text{ Ft} \div 3 \text{ Actuators} = 117 \text{ Ft. Maximum wire run}$

MAXIMUM WIRE LENGTH FOR 10VA			
Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	900 Ft.	18 Ga	220 Ft.
14 Ga	550 Ft.	20 Ga	120 Ft.
16 Ga	350 Ft.	22 Ga	60 Ft.

**FIGURE H**

### Wire Type and Wire Installation Tips

For most installations, 18 or 16 Ga. cable works well with the AFB24, AFX24... actuators. Use code-approved wire nuts, terminal strips or solderless connectors where wires are joined. It is good practice to run control wires unspliced from the actuator to the controller. If splices are unavoidable, make sure the splice can be reached for possible maintenance. Tape and/or wire-tie the splice to reduce the possibility of the splice being inadvertently pulled apart.

The AFB24, AFX24... proportional actuators have a digital circuit that is designed to ignore most unwanted input signals (pickup). In some situations the pickup may be severe enough to cause erratic running of the actuator. For example, a large inductive load (high voltage AC wires, motors, etc.) running near the power or control wiring may cause excessive pickup. To solve this problem, make one or more of the following changes:

1. Run the wire in metallic conduit.
2. Re-route the wiring away from the source of pickup.
3. Use shielded wire (Belden 8760 or equal). Ground the shield to an earth ground. **Do not** connect it to the actuator common.

### Initialization of the -SR and -MFT

When power is initially applied, the actuator will first release its manual preload position (This assumes a manual position has been set). The actuator will then rotate to the full fail-safe position. At this point the microprocessor recognizes that the actuator is at full fail-safe and uses this position as the base for all of its position calculations. The microprocessor will retain the initialized zero during short power failures of up to 20 seconds. The -SR and -MFT will also return to its position prior to the 20-second-or-less power loss. For power failures greater than 20 seconds, the actuator would naturally return to its full fail-safe position prior to the microprocessor losing its memory. The actuator will also re-initialize if the manual position mechanism is used.

AFB24-MFT, AFX24-MFT + P-100... Electrical Check-Out Procedure				
STEP	Procedure	Expected Response	Gives Expected Response Go To Step...	Does Not Give Expected Response Go To Step...
1.	Control signal is applied to actuator.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	No response at all <b>Step 2.</b> Operation is reversed <b>Step 3.</b> Does not drive toward "Control Signal Position" <b>Step 4.</b>
2.	Check power wiring. Correct any problems. <b>See Note 1.</b>	Power supply rating should be the total power requirement of the actuator(s). Minimum voltage of 19.2 VAC or 21.6 VDC.	Power wiring corrected, actuator begins to drive <b>Step 1.</b>	Power wiring corrected, actuator still does not drive <b>Step 4.</b>
3.	Turn reversing switch to the correct position. Make sure the switch is turned all the way left or right.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	Does not drive toward "Control Signal Position" <b>Step 4.</b>
4.	Make sure the control signal positive (+) is connected to Wire No. 3 and control signal negative (-) is connected to wire No. 1. Most control problems are caused by reversing these two wires. Verify that the reversing switch is all the way CCW or CW.	Drives to "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	<b>Step 5.</b>
5.	Check input signal with a digital volt meter (DVM). Make sure the input is within the range of the actuator. <b>NOTE:</b> The input signal must be above the 2 VDC or 4 mA to have the actuator move.	Input voltage or current should be $\pm 1\%$ of what controller's adjustment or programming indicates.	Controller output (actuator input) is correct. Input Polarity Correct <b>Step 6.</b>	Reprogram, adjust repair or replace controller as needed <b>Step 1.</b>
6.	Check damper torque requirement.	Torque requirement is actuator's minimum torque.	Defective Actuator. Replace Actuator - <b>See Note 2.</b>	Recalculate actuator requirement and correct installation.
7.	Actuator works properly. Test controller by following controller manufacturer's instructions.			

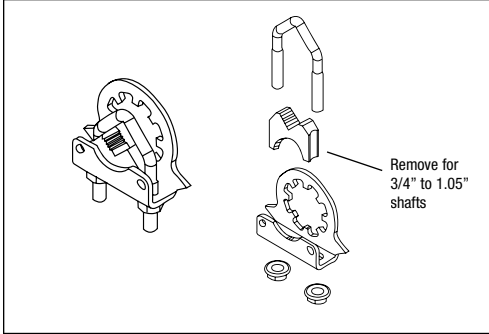
- NOTE 1** Check that the transformer(s) are sized properly.
- If a common transformer is used, make sure that polarity is observed on the secondary. This means connect all No. 1 wires to one leg of the transformer and all No. 2 wires to the other leg of the transformer.
  - If multiple transformers are used with one control signal, make sure all No. 1 wires are tied together and tied to control signal negative (-).
  - Controllers and actuators must have separate 24 VAC/VDC power sources.
- NOTE 2** If failure occurs within 5 years from original purchase date, notify Belimo and give details of the application.

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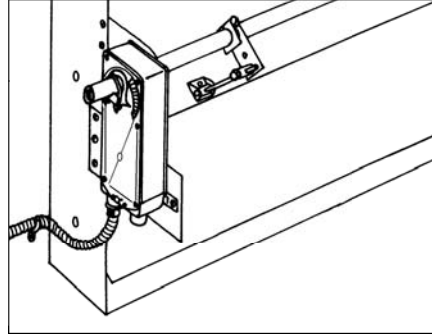
## Minimum 133 in-lb Torque

- For damper areas up to 35 sq-ft\* (For lower torque, see NFB, NFX, LF, or TF series)

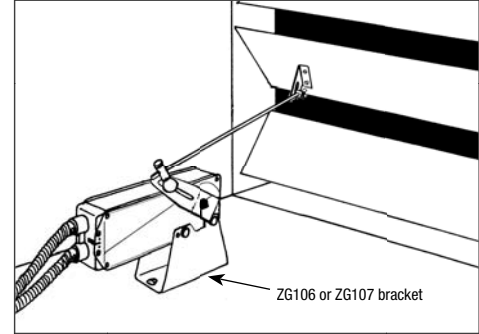
## Applications



Standard clamp fits standard 1/2" shafts to 1.05" jackshafts.



Mount directly to 1.05" jackshafts.



Linkage solutions are available when direct coupling is not possible. (See Mounting Methods Guide and Mechanical Accessories Documentation)



All Actuators have BDCM

## AF Series - At A Glance

		AF24 US (p. 81)	AF24-S US (p. 81)	AF120 US (p. 83)	AF120-S US (p. 83)	AF230 US (p. 83)	AF230-S US (p. 83)	AF24-SR US (p. 85)	AF24-SR US (p. 87)	AF24-ECON R03 US (p. 89)	AF24-PC US (p. 91)
Torque:	133 in-lb	●	●	●	●	●	●	●	●	●	●
Power supply:	24 VAC/DC	●	●					●	●	●	●
	120 VAC			●	●						
	230 VAC					●	●				
Control signal:	On/Off	●	●	●	●	●	●				
	2 to 10 VDC							●	●		
	3 kΩ NTC Type 10 thermistor									●	
	0 to 20 V phasecut										●
Feedback signal:	2 to 10 VDC							●		●	●
	Running time motor:										
	150 sec constant	●	●	●	●	●	●	●	●	●	●
	95 sec constant									●	
	spring: <20 seconds	●	●	●	●	●	●	●	●	●	●
Brushless DC Motor		●	●	●	●	●	●	●	●	●	●
External direction of rotation switch								●	●		●
Manual override		●	●	●	●	●	●	●	●	●	●
Plenum rated cable, 18 GA										●	
Appliance rated cable, 18 GA		●	●	●	●	●	●	●	●		●
Built-in auxiliary switch, two SPDT			●		●		●				
Installation instructions.....(p. 93-98)		General wiring.....(p. 100)			Start-up and checkout.....(p. 101)			Electrical operations.....(p. 99)			

\*Based on 4 in-lb/ft² damper torque loading. Parallel blade. No edge seals.



# A CLOSER LOOK...

- Cut labor costs with simple direct coupling.
- True mechanical spring return – the most reliable fail-safe.
- Reverse mount for clockwise or counterclockwise fail-safe.
- Check damper position easily with clear position indicator.
- Overload-proof throughout rotation
- Temporary restrictions in damper movement will not change actuator operation. Actuator returns to normal operation when restriction is removed (modulating actuators).
- Easy mechanical stop to adjust angle of rotation (add ZDB-AF2 US US accessory).
- By eliminating internal condensation Golden Point breather membrane optimizes performance in harsh airstream environments.
- Built-in auxiliary switch is easy to use, offers feedback or signal for additional device (-S models).
- Manual override crank speeds installation
- Need to change control direction? Do it easily with a simple switch (modulating actuators).
- Microprocessor-controlled brushless DC motor increases actuator life span and reliability, provides constant running time (modulating actuators).
- Rugged metal housing withstands rough handling in the mechanical room.
- 3 ft. appliance cable and conduit connector eases installation.
- Double insulated – no need for separate safety ground. A Belimo exclusive (-S, 120V, 230V models).
- Automatically compensates for damper seal wear, ensuring tight close-off.



## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

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# AF24(-S) US

On/Off, Spring Return, 24V



Technical Data		AF24... US
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	5 W
	holding	1.5 W
Transformer sizing		10 VA (class 2 power source)
Electrical connection		3 ft, 18 GA appliance cable
(-S models have 2 cables)		1/2" conduit connector
Electrical protection		auxiliary switches are double insulated
Overload protection		electronic throughout 0° to 95° rotation
Angle of rotation		95°, adjustable 35 to 95° w/ZDB-AF2 US
Torque		133 in-lb [15 Nm] constant
Direction of rotation		reversible with CW/CCW mounting
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		3mm hex crank (shipped w/actuator)
Auxiliary switches		2 x SPDT 7A (2.5A) @ 250 VAC, UL approved one set at +5°, one adjustable 25° to 85°
Running time		150 seconds constant, independent of load, spring return < 20 seconds
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP54
Housing material		zinc coated steel
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level		max. 45 dB (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		6.0 lbs (2.7 kg)

**Torque min. 133 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

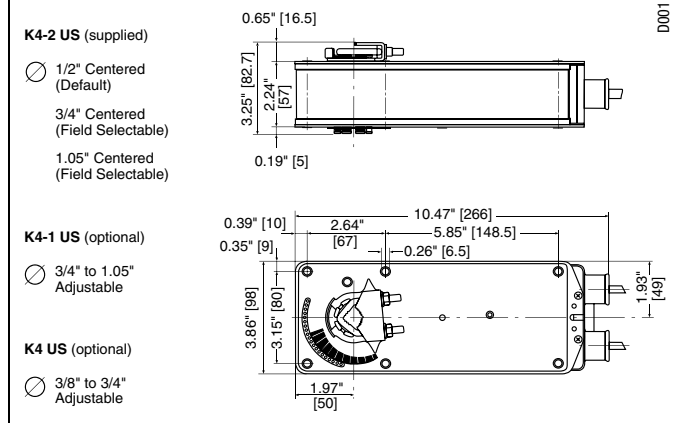
The AF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The AF series provide 95° of rotation and are provided with a graduated position indicator showing 0° to 95°. The AF has a unique manual positioning mechanism which allows the setting of any damper position within its 95° of rotation. The AF series actuators are shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off. When power is applied to the AF series, the manual mechanism is released. The actuators will now try to close against the 0° position during its normal control operations. The manual override can also be released physically by the use of a crank supplied with the actuator.

The AF uses a brushless DC motor which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The AF24-S US version is provided with two built in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +5°, the other switch function is adjustable between +25° to +85°.

## Dimensions (Inches [mm])



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Accessories	
AV 10-18	Shaft extension
IND-AF2	Damper position indicator
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Universal clamp for up to 1.05" dia jackshafts
K4-H	Universal clamp for hexshafts 3/8" to 5/8"
KH-AF	Crank arm for up to 3/4" round shaft (Series 2)
KH-AF-1	Crank arm for up to 1.05" jackshaft (Series 2)
KH-AFV	V-bolt kit for KH-AF and KH-AF-1
Tool-06	8mm and 10 mm wrench
ZG-HTR	Thermostat/Heater Kit
ZDB-AF2 US	Angle of rotation limiter
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-102	Multiple actuator mounting bracket
ZG-106	Mounting bracket for Honeywell® Mod IV
ZG-107	Mounting bracket for Honeywell® Mod III or Johnson® Series 100 replacement or new crank arm type installations
ZG-108	Mounting bracket for Barber Colman® MA 3../4..., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AF US	Crank arm adaptor kit for AF/NF
ZG-AF108	Crank arm adaptor kit for AF/NF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

**NOTE:** When using AF24 US and AF24-S US actuators, only use accessories listed on this page. For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### Typical Specification

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall have a manual positioning mechanism accessible on its cover. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation. Run time shall be constant and independent of torque. If required, two SPDT auxiliary switches shall be provided with one switch having the capability of being adjustable. Actuators with switches must be constructed to meet the requirement for Double Insulation so an electrical ground connection is not required to meet agency listings. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

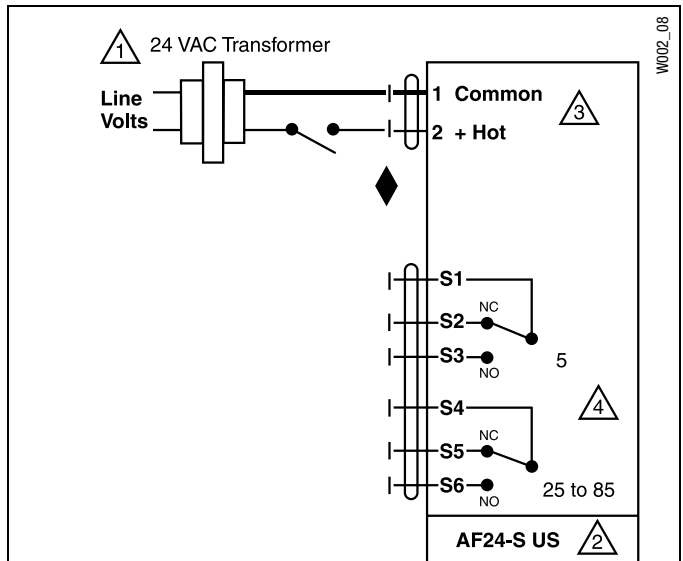
#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., AF24-S US incorporates two built-in auxiliary switches: 2 x SPDT, 7A (2.5A) @250 VAC, UL Approved, one switch is fixed at +5°, one is adjustable 25° to 85°.

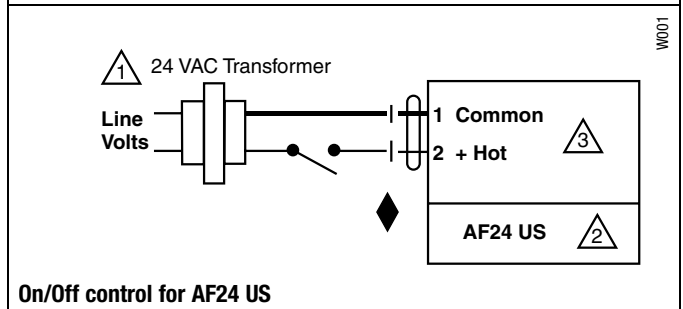
#### 📄 APPLICATION NOTES

◆ Meets cULus requirements without the need of an electrical ground connection.

⚠️ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



On/Off control for AF24-S US



On/Off control for AF24 US

# AF120(-S) US, AF230(-S) US

On/Off, Spring Return, 120 or 230 VAC



Technical Data		AF120... US, AF230... US
Power supply		
AF120(-S) US		120 VAC $\pm$ 10% 50/60 Hz
AF230(-S) US		230 VAC $\pm$ 15% 50/60 Hz
Power consumption		
AF120(-S) US	running	8 W
	holding	3 W
AF230(-S) US	running	8.5 W
	holding	3 W
Transformer sizing		
AF120(-S) US		11 VA
AF230(-S) US		11 VA
Electrical connection		
(-S models have 2 cables)		3 ft, 18 GA appliance cable 1/2" conduit connector
Electrical protection		actuators are double insulated
Overload protection		electronic throughout 0° to 95° rotation
Angle of rotation		95°, adjustable 35 to 95° w/ZDB-AF2 US
Torque		133 in-lb [15 Nm] constant
Direction of rotation		reversible with CW/CCW mounting
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		3mm hex crank (shipped w/actuator)
Auxiliary switches		2 x SPDT 7A (2.5A) @ 250 VAC, UL approved one set at +5°, one adjustable 25° to 85°
Running time		150 seconds constant, independent of load, spring return < 20 seconds
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP54
Housing material		zinc coated steel
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level		max. 45 dB (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		6.9 lbs (3.1 kg)

**Torque min. 133 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

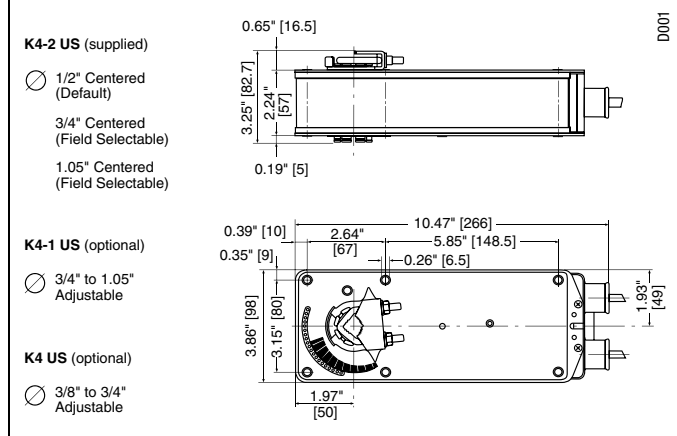
The AF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The AF series provide 95° of rotation and are provided with a graduated position indicator showing 0° to 95°. The AF has a unique manual positioning mechanism which allows the setting of any damper position within its 95° of rotation. The AF series actuators are shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off. When power is applied to the AF series, the manual mechanism is released. The actuators will now try to close against the 0° position during its normal control operations. The manual override can also be released physically by the use of a crank supplied with the actuator.

The AF uses a brushless DC motor which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. The actuators are Double Insulated so a ground connection is not required.

The AF120/230-S US version is provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +5°, the other switch function is adjustable between +25° to +85°.

## Dimensions (Inches [mm])



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Accessories	
AV 10-18	Shaft extension
IND-AF2	Damper position indicator
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Universal clamp for up to 1.05" dia jackshafts
KH-AF	Crank arm for up to 3/4" round shaft (Series 2)
KH-AF-1	Crank arm for up to 1.05" jackshaft (Series 2)
KH-AFV	V-bolt kit for KH-AF and KH-AF-1
Tool-06	8mm and 10 mm wrench
ZG-HTR	Thermostat/Heater Kit
ZDB-AF2 US	Angle of rotation limiter
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-102	Multiple actuator mounting bracket
ZG-106	Mounting bracket for Honeywell® Mod IV replacement or new crank arm type installations
ZG-107	Mounting bracket for Honeywell® Mod III or Johnson® Series 100 replacement or new crank arm type installations
ZG-108	Mounting bracket for Barber Colman® MA 3..4.., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AF US	Crank arm adaptor kit for AF/NF
ZG-AF108	Crank arm adaptor kit for AF/NF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

**NOTE:** When using AF120/230 US and AF120/230-S US actuators, only use accessories listed on this page. For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall have a manual positioning mechanism accessible on its cover. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation. Run time shall be constant and independent of torque. If required, two SPDT auxiliary switches shall be provided with one switch having the capability of being adjustable. Actuators must be constructed to meet the requirement for Double Insulation so an electrical ground connection is not required to meet agency listings. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

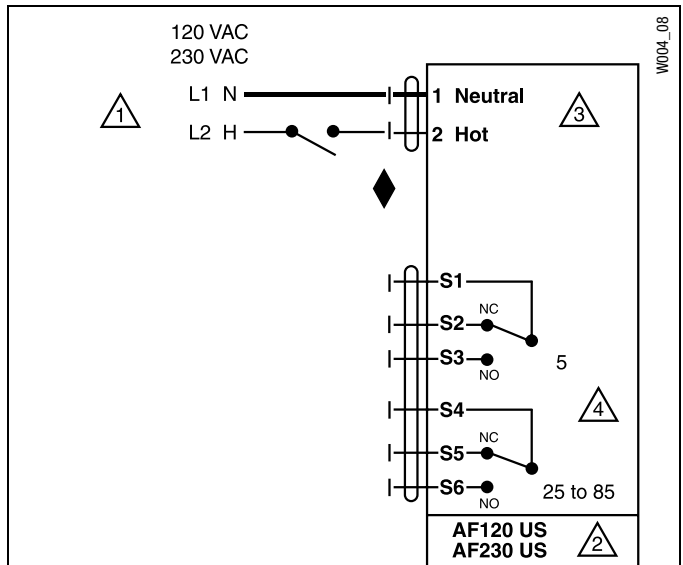
**Wiring Diagrams**

**INSTALLATION NOTES**

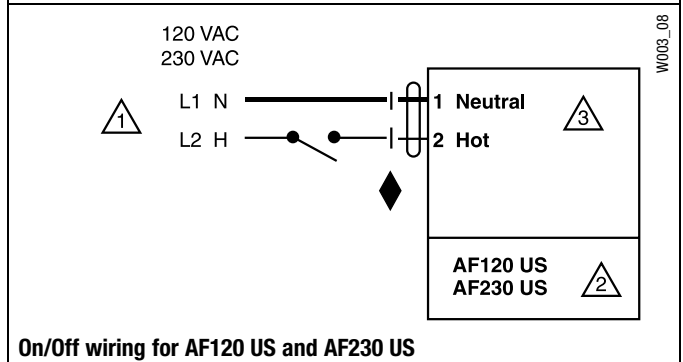
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 No ground connection is required.
- 4 For end position indication, interlock control, fan startup, etc., AF120/240-S US incorporates two built-in auxiliary switches: 2 x SPDT, 7A (2.5A) @250 VAC, UL Approved, one switch is fixed at +5°, one is adjustable 25° to 85°.

**APPLICATION NOTES**

- ◆ Meets cULus requirements without the need of an electrical ground connection.
- ⚠ **WARNING Live Electrical Components!** During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



**On/Off wiring for AF120-S US and AF230-S US**



**On/Off wiring for AF120 US and AF230 US**

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# AF24-SR US

Proportional, Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data		AF24... US
Power supply		24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	running	6 W
	holding	2 W
Transformer sizing		10 VA (class 2 power source)
Electrical connection		3 ft, 18 GA appliance cable 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20 mA
Input impedance		100 k $\Omega$ (0.1 mA), 500 $\Omega$
Feedback output U		2 to 10 VDC (max. 0.5 mA) for 95°
Angle of rotation		mechanically limited to 95°
Torque		133 in-lb [15 Nm] constant
Direction of rotation	spring	reversible with cw/ccw mounting
	motor	reversible with built-in switch
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		3mm hex crank (shipped w/actuator)
Running time		150 seconds constant, independent of load, spring return < 20 seconds
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP54
Housing material		zinc coated metal
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level		max. 45 dB (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		6.0 lbs (2.7 kg)

Torque min. 133 in-lb, for control of air dampers

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, with the addition of a 500 $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

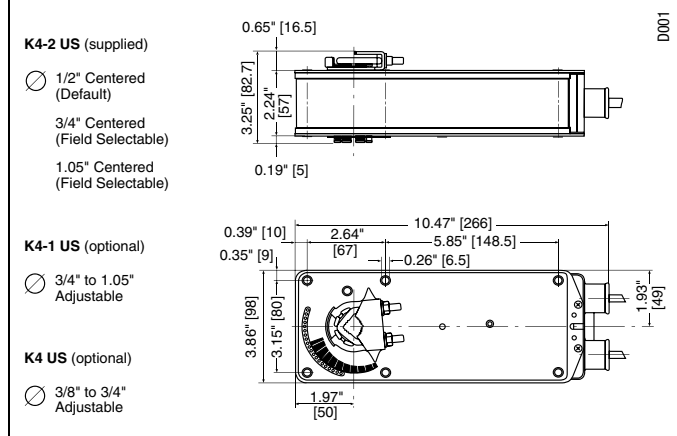
## Operation

The AF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The AF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°. The AF has a unique manual positioning mechanism which allows the setting of any damper position within its 95° of rotation. The actuator is shipped at +5° position (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off. When power is applied, the manual mechanism is released and the actuator drives toward the full fail-safe position. The actuator will memorize the angle where it stops rotating and use this point for its zero position for its normal control operations. The manual override can also be released physically by the use of a crank supplied with the actuator.

The AF 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 zero position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

## Dimensions (Inches [mm])



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### Accessories

AV 10-18	Shaft extension
IND-AF2	Damper position indicator
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Universal clamp for up to 1.05" dia jackshafts
K4-H	Universal clamp for hexshafts 3/8" to 5/8"
KH-AF	Crank arm for up to 3/4" round shaft (Series 2)
KH-AF-1	Crank arm for up to 1.05" jackshaft (Series 2)
KH-AFV	V-bolt kit for KH-AF and KH-AF-1
Tool-06	8mm and 10 mm wrench
SGA24	Min. and/or man. positioner in NEMA 4 housing
SGF24	Min. and/or man. positioner for flush panel mounting
ZG-R01	500 Ω resistor for 4 to 20 mA control signal
ZG-HTR	Thermostat/Heater Kit
ZDB-AF2 US	Angle of rotation limiter
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-102	Multiple actuator mounting bracket
ZG-103	Universal mounting bracket
ZG-104	Universal mounting bracket
ZG-106	Mounting bracket for Honeywell® Mod IV replacement or new crank arm type installations
ZG-107	Mounting bracket for Honeywell® Mod III or Johnson® Series 100 replacement or new crank arm type installations
ZG-108	Mounting bracket for Barber Colman® MA 3../4..., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AF US	Crank arm adaptor kit for AF/NF
ZG-AF108	Crank arm adaptor kit for AF/NF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

**NOTE:** When using AF24-SR US actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω 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 counterclockwise fail-safe operation. Actuators shall have control direction of rotation switch accessible on its cover. 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 master-slave applications. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

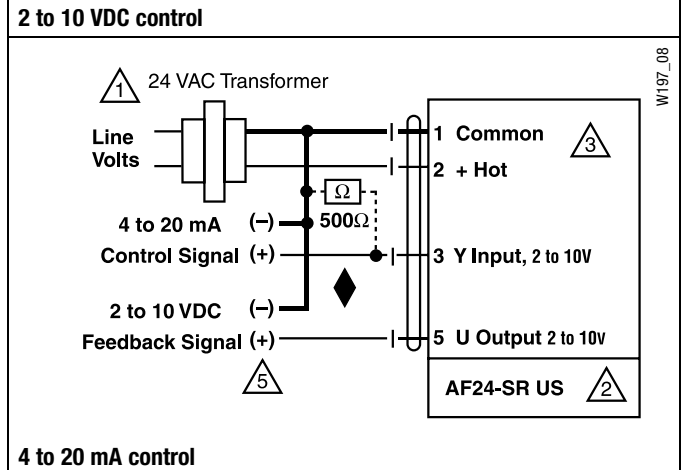
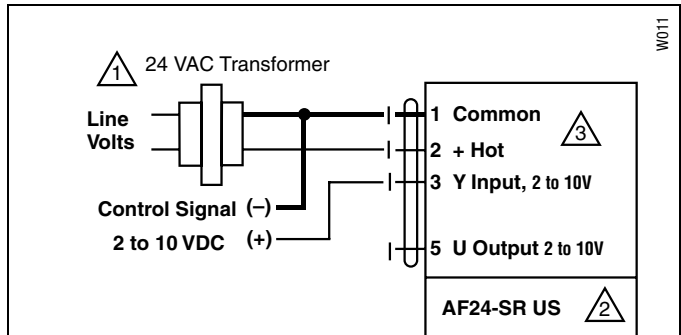
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

#### 📄 APPLICATION NOTES

◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

#### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.





Technical Data	AFA24... US
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running 6 W holding 2 W
Transformer sizing	10 VA (class 2 power source)
Electrical connection	3 ft, 18 GA appliance cable 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 kΩ (0.1 mA), 500 Ω
Angle of rotation	mechanically limited to 95°
Torque	133 in-lb [15 Nm] constant
Direction of rotation	spring motor reversible with cw/ccw mounting reversible with built-in switch
Position indication	visual indicator, 0° to 95° (0° is spring return position)
Manual override	3mm hex crank (shipped w/actuator)
Running time	150 seconds constant, independent of load, spring return < 20 seconds
Humidity	5 to 95% RH non-condensing
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA type 2 / IP54
Housing material	zinc coated metal
Agency listings	cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level	max. 45 dB (A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	6.0 lbs (2.7 kg.)

Torque min. 133 in-lb, for control of air dampers

### Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner.

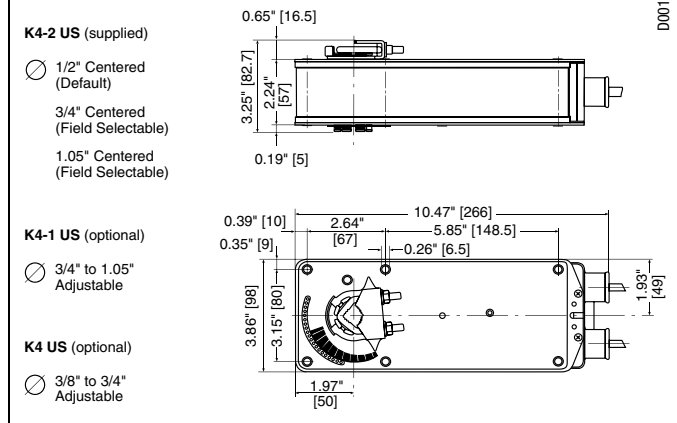
### Operation

The AFA series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The AFA series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°. The AFA has a unique manual positioning mechanism which allows the setting of any damper position within its 95° of rotation. The actuator is shipped at +5° position (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off. When power is applied, the manual mechanism is released and the actuator drives toward the full fail-safe position. The actuator will memorize the angle where it stops rotating and use this point for its zero position for its normal control operations. The manual override can also be released physically by the use of a crank supplied with the actuator.

The AFA 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 zero position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

### Dimensions (Inches [mm])



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### Accessories

AV 10-18	Shaft extension
IND-AF2	Damper position indicator
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Universal clamp for up to 1.05" dia jackshafts
K4-H	Universal clamp for hexshafts 3/8" to 5/8"
KH-AF	Crank arm for up to 3/4" round shaft (Series 2)
KH-AF-1	Crank arm for up to 1.05" jackshaft (Series 2)
KH-AFV	V-bolt kit for KH-AF and KH-AF-1
Tool-06	8mm and 10 mm wrench
SGA24	Min. and/or man. positioner in NEMA 4 housing
SGF24	Min. and/or man. positioner for flush panel mounting
ZG-R01	500 Ω resistor for 4 to 20 mA control signal
ZG-HTR	Thermostat/Heater Kit
ZDB-AF2 US	Angle of rotation limiter
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-102	Multiple actuator mounting bracket
ZG-106	Mounting bracket for Honeywell® Mod IV replacement or new crank arm type installations
ZG-107	Mounting bracket for Honeywell® Mod III or Johnson® Series 100 replacement or new crank arm type installations
ZG-108	Mounting bracket for Barber Colman® MA 3../4.., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AF US	Crank arm adaptor kit for AF/NF
ZG-AF108	Crank arm adaptor kit for AF/NF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

**NOTE:** When using AFA24-SR US actuators, only use accessories listed on this page. Actuator may not be tandem mounted on same shaft or otherwise mechanically linked.

### 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 proportional 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 counterclockwise fail-safe operation. Actuators shall have control direction of rotation switch accessible on its cover. 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. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

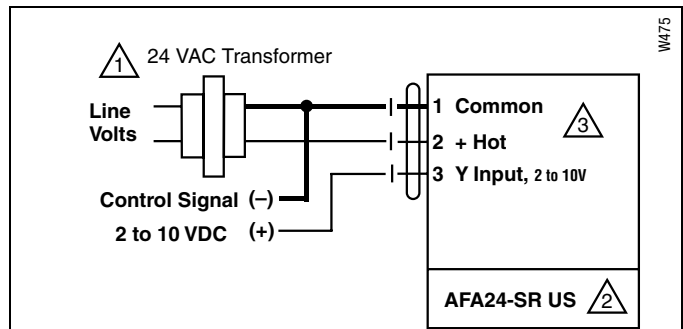
#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

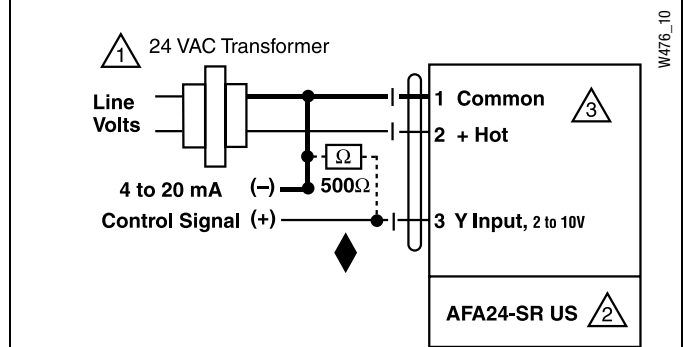
#### APPLICATION NOTES

◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

**WARNING Live Electrical Components!**  
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2 to 10 VDC control



4 to 20 mA control

# AF24-ECON-R03 US

Proportional, Spring Return, 24V, for Stand-Alone Economizer Damper Control Using 3 kΩ Mixed Air Sensor, Built-in Minimum Position Adjustment



Technical Data		AF24... US
Power supply		24 VAC ± 20% 50/60 Hz, 24 VDC ± 10%
Power consumption	running	6 W
	holding	2.5 W
Transformer sizing		10 VA (class 2 power source)
Electrical connection		3 ft, plenum rated cable 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Control Signal	Y1	3 kΩ NTC Type 10 thermistor, 3 kΩ @ 77°F (25°C) MA setpoint = 55°F
Input impedance	Y1	100 kΩ
	Y2	100 kΩ
Feedback output, U		2 to 10 VDC (max. 0.7 mA) for 95°
Angle of rotation		max. 95°, adjustable with mechanical stop
Torque		133 in-lb [15 Nm]
Override function		See override control table on opposite page
Direction of rotation	spring	reversible with cw/ccw mounting
Position indication		visual indicator, 0° to 95° scaled as 0 to 1 (0° is spring return position)
Running time	motor	95 seconds constant, independent of load
	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C] < 60 seconds @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP54
Housing material		zinc coated steel
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level (max)	running	<45 dB (A)
	spring return	62 dB (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		6.0 lbs (2.7 kg)

- Torque min. 133 in-lb, for control of air dampers
- Built-in adjustable min-position
- Integrated mixed air PI-control

## Application

For proportional control of mixed air setpoint on economizer dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to 3 kΩ thermistor.

## Operation

The AF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

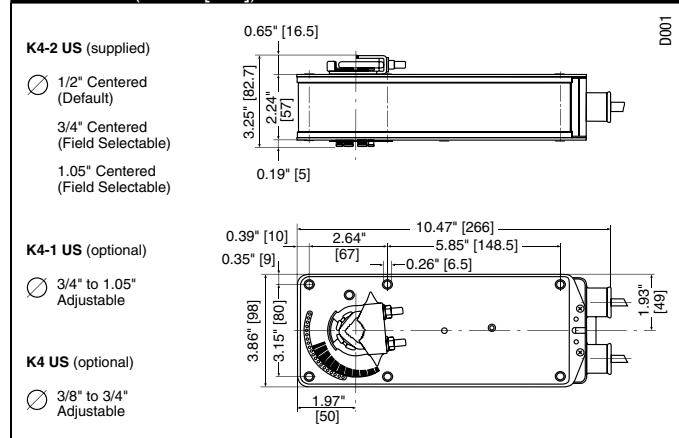
The AF24-ECON-R03 US provide 95° of rotation and are provided with a graduated position indicator showing 0° to 95°. The actuators are shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off. When power is first applied, the AF24-ECON-R03 US will move to 0° (full fail-safe). The actuator will now try to close against the 0° position during its normal control operations.

The AF24-ECON-R03 US 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 function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

## Installation

Refer to AF Section of the Standard Actuation and Accessories, Technical Documentation.

## Dimensions (Inches [mm])



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### Occupied - Economizer Mode

The AF24-ECON-R03 US enters Economizer Mode when either an external relay or controller completes the circuit between the actuator wire 3(Y1) and MA sensor. In this mode, the actuator moves proportionally to maintain a MA set-point of 55°F (fixed). A proportional band of 6°F modulates the actuator between 53 and 58°F. Also, a +/-1°F dead band eliminates hunting of the actuator, while maintaining suitable temperatures in the RTU mixed air chamber.

### MA Dry Bulb Temperature

### AF24-ECON... Position

< 53°F	Min. position
53°F < MAT < 58°F	Modulates between Min. Position and 100% open
> 58°F	100% open

Accessories, see page 308.

### 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 shaft up to a 1.05" diameter. Actuator shall deliver a minimum output torque of 133 in-lbs. The actuator must provide proportional damper control in response to a 3 kΩ NTC thermistor, 55°F setpoint. Actuator must have a built-in minimum position potentiometer. Actuator must have minimum position override via 0 to 10 VDC on wire 4. 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 independent of torque load. A 2 to 10 VDC feedback signal shall be provided for position feedback or master-slave applications. The actuator must be designed so that they may be used for either clock-wise or counterclockwise fail safe operation. Actuators shall be cUL Approved, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

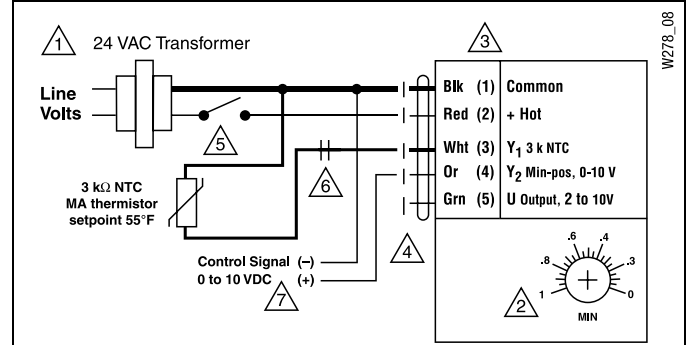
### Wiring Diagrams

#### INSTALLATION NOTES

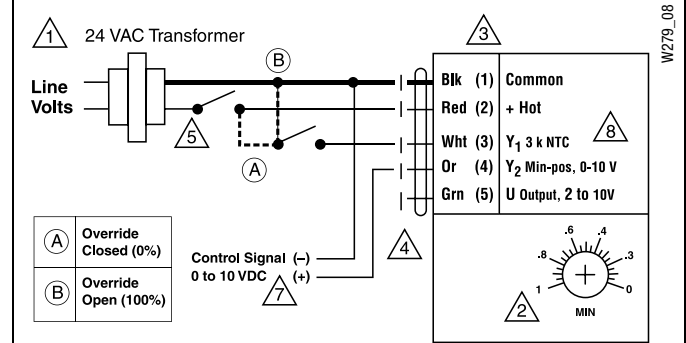
- 1 Provide overload protection and disconnect as required.
- 2 Min-position is adjustable from 0 to 100% with a potentiometer on the actuator cover.
- 3 Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
- 4 CW (default) indicates that motor drive starts at zero position.
- 5 A relay or switch can spring return the actuator when the RTU fan de-energizes, or if low ambient temperature is sensed.  
A standard relay can be used to close the sensor circuit to engage economizer mode, e.g. outside air changeover device like a dry bulb or enthalpy limit switch.
- 6 A remote CO2 sensor or DDC controller with a 0 to 10 VDC output can change the standard relay can be used to open and close the sensor circuit. This device can be a relay or a dry bulb/enthalpy limit switch.
- 7 Override control for Y2 only accepts 0 to 10 VDC override control.

#### WARNING Live Electrical Components!

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Standard Economizer Mode Wiring AF24-ECON-R03 US



Override for AF24-ECON-R03 US

### Override control

Wire	Input Signal	Position	Application
Y1	24 VAC	Drive closed (0%)	Morning warm-up cycle
Y1	Common	Drive open (100%)	Smoke Purge
Y1	Open wire	Drive to min position	Mechanical cooling in use, RTU thermostat calls for heat
Y2	0 VDC to 10 VDC	Min position of 0% to 100%	Override potentiometer via a remote CO2 sensor/controller or DDC controller

# AF24-PC US

Proportional, Spring Return, 24 V, 0 to 20 V Phasecut Control Signal



Technical Data		AF24... US
Power supply		24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	running	6 W
	holding	2.5 W
Transformer sizing		10 VA (class 2 power source)
Electrical connection		3 ft, 18 GA appliance cable 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		0 to 20 V phasecut control is only for the positive part of the sine wave (max of 10 volts)
Input impedance		8 k $\Omega$ (0.1 mA), 50 m $\Omega$
Feedback output U		2 to 10 VDC (max. 0.5 mA) for 95°
Angle of rotation		mechanically limited to 95°
Torque		133 in-lb [15 Nm] constant
Direction of rotation	spring motor	reversible with cw/ccw mounting reversible with built-in switch
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		3mm hex crank (shipped w/actuator)
Running time		150 seconds constant, independent of load, spring return < 20 seconds
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP54
Housing material		zinc coated metal
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level		max. 45 dB (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		6.0 lbs (2.7 kg)

Torque min. 133 in-lb, for control of air dampers

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 0-20 V phasecut control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

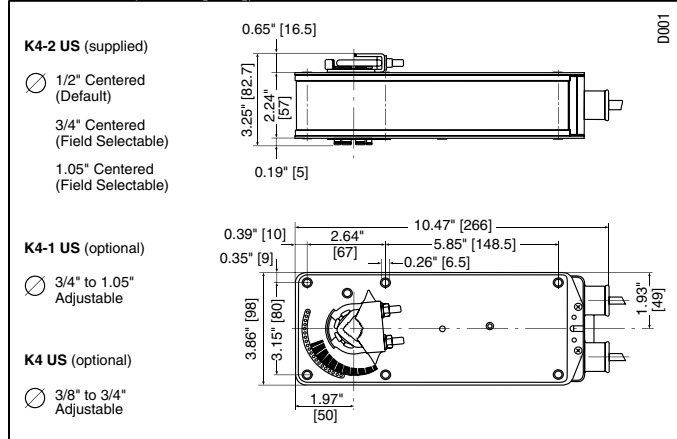
## Operation

The AF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The AF series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°. The AF has a unique manual positioning mechanism which allows the setting of any damper position within its 95° of rotation. When power is applied to the AF series its "one time use" mechanism is released. The actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off. When power is applied, the manual mechanism is released and the actuator drives toward the full fail-safe position. The actuator will memorize the angle where it stops rotating and use this point for its zero position for its normal control operations. The manual override can also be released physically by the use of a crank supplied with the actuator.

The AF 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 zero position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

## Dimensions (Inches [mm])



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Accessories	
AV 10-18	Shaft extension
IND-AF2	Damper position indicator
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Universal clamp for up to 1.05" dia jackshafts
K4-H	Universal clamp for hexshafts 3/8" to 5/8"
KH-AF	Crank arm for up to 3/4" round shaft (Series 2)
KH-AF-1	Crank arm for up to 1.05" jackshaft (Series 2)
KH-AFV	V-bolt kit for KH-AF and KH-AF-1
Tool-06	8mm and 10 mm wrench
SGA24	Min. and/or man. positioner in NEMA 4 housing
SGF24	Min. and/or man. positioner for flush panel mounting
ZG-R01	500 Ω resistor for 4 to 20 mA control signal
ZG-HTR	Thermostat/Heater Kit
ZDB-AF2 US	Angle of rotation limiter
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-102	Multiple actuator mounting bracket
ZG-106	Mounting bracket for Honeywell® Mod IV replacement or new crank arm type installations
ZG-107	Mounting bracket for Honeywell® Mod III or Johnson® Series 100 replacement or new crank arm type installations
ZG-108	Mounting bracket for Barber Colman® MA 3..4.., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AF US	Crank arm adaptor kit for AF/NF
ZG-AF108	Crank arm adaptor kit for AF/NF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

**NOTE:** When using AF24-PC US actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### Typical Specification

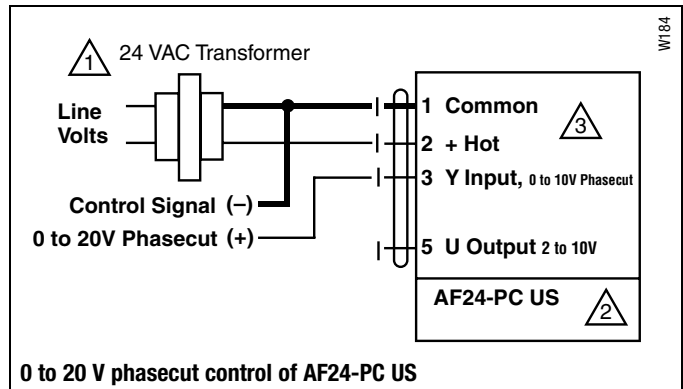
Spring return control damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter. The actuator must provide proportional damper control in response to a 0 to 20 V phasecut control output from an electronic controller or positioner. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall have control direction of rotation switch accessible on its cover. 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 master-slave applications. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

**⚠️ WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



**Note:** 0 to 20 V input range with a 0 to 10 V operating range. Controller output must be rescaled accordingly.

# Installation Instructions

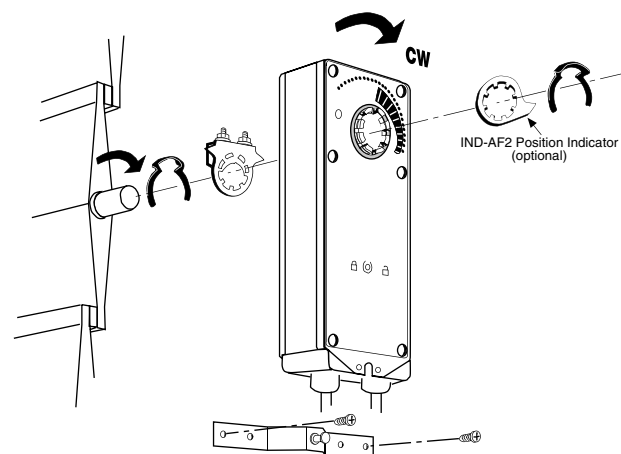
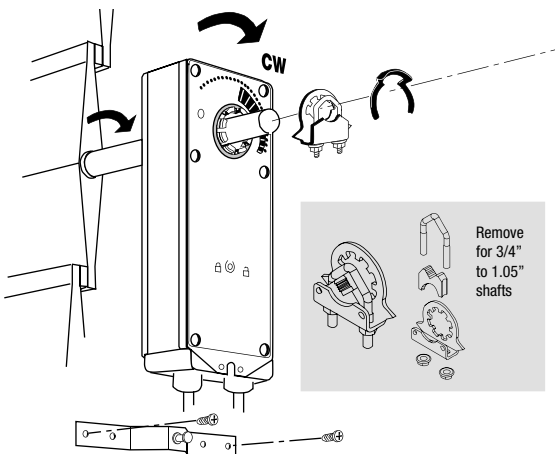
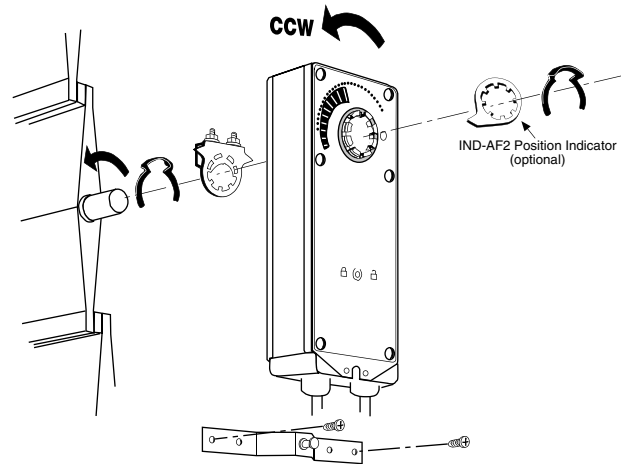
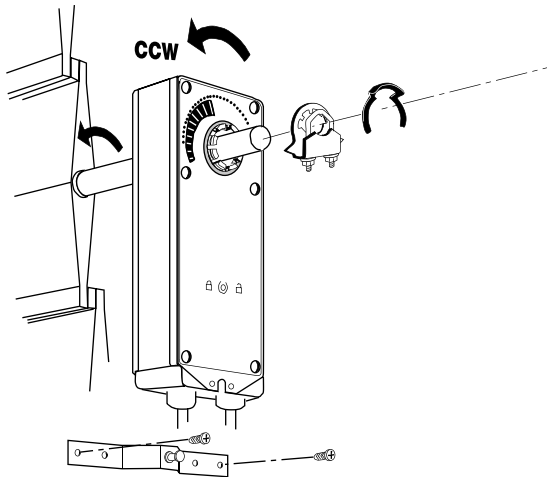
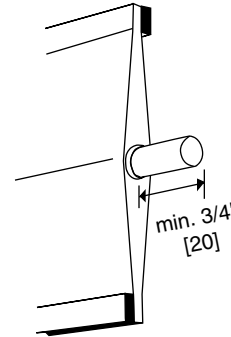
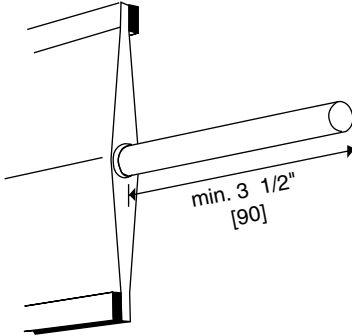
## Quick-Mount Visual Instructions for Mechanical Installation



### Quick-Mount Visual Instructions

1. Rotate the damper to its fail-safe position.  
If the shaft rotates counterclockwise, mount the "CCW" side of the actuator out.  
If it rotates clockwise, mount the actuator with the "CW" side out.
  2. If the universal clamp is not on the correct side of the actuator, move it to the correct side.
  3. Slide the actuator onto the shaft and tighten the nuts on the V-bolt with a 10mm wrench to 6-8 ft-lb of torque.
  4. Slide the anti-rotation strap under the actuator so that it engages the slot at the base of the actuator. Secure the strap to the duct work with #8 self-tapping screws.
- NOTE: Read the "Standard Mounting" instructions, on the next page, for more detailed information.

### Dimensions (Inches [mm])



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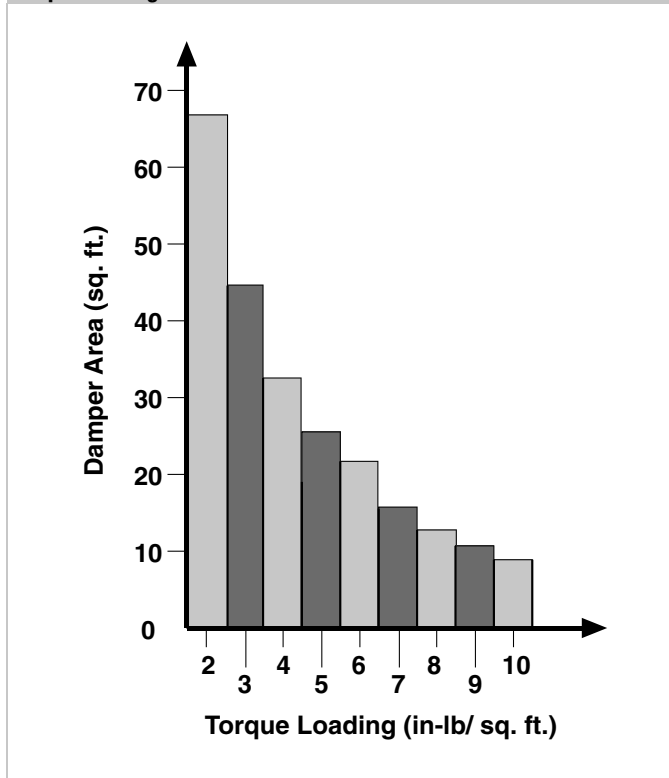
### Determining Torque Loading and Actuator Sizing

Damper torque loadings, used in selecting the correct size actuator, should be provided by the damper manufacturer. If this information is not available, the following general selection guidelines can be used.

Damper Type	Torque Loading
Opposed blade, without edge seals, for non-tight close-off applications	3 in-lb/sq. ft.
Parallel blade, without edge seals, for non-tight close-off applications	4 in-lb/sq. ft.
Opposed blade, with edge seals, for tight close-off applications	5 in-lb/sq. ft.
Parallel blade, with edge seals, for tight close-off applications	7 in-lb/sq. ft.

The above torque loadings will work for most applications under 2 in. w.g. static pressure or 1000 FPM face velocity. For applications between this criteria and 3 in. w.g. or 2500 FPM, the torque loading should be increased by a multiplier of 1.5. If the application calls for higher criteria up to 4 in. w.g. or 3000 FPM, use a multiplier of 2.0.

**Torque Loading Chart**



### General Information

Belimo actuators should be mounted indoors in a dry, relatively clean environment free from corrosive fumes. If the actuator is to be mounted outdoors, a protective enclosure must be used to shield the actuator.

For new construction work, **order dampers with extended shafts**. Instruct the installing contractor to allow space for mounting and service of the Belimo actuator on the shaft. The damper shaft must extend at least 3 1/2" from the duct. If the shaft extends less than 3-1/2" or if an obstruction blocks access, the shaft can be extended with the AV 10-18 shaft extension accessory or the actuator may be mounted in its short shaft configuration.

### Mechanical Operation

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft. The AF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator. The AF...-S versions are provided with 2 built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +5°, the other switch function is adjustable between +25 to +85°.

### Automatic Airtight Dampers/Manual Override

The AF series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The AF has a unique manual positioning mechanism which allows the setting of any damper position within its 95° of rotation. A pre-tensioned spring automatically tightens damper when power is applied to the actuator, compensating for damper seal deterioration.

The actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off. When power is applied, the manual mechanism is released and the actuator drives toward the full fail-safe position.

### Standard Mounting

**NOTE: The AF...series actuator is shipped with the manual override adjusted for a +5° position at the universal clamp (not at full fail-safe, 0°). This allows for automatic compression of damper blade seals when the actuator is in use, providing tight shut-off. This assumes that the damper is to have tight shut-off at the fail-safe position. If tight close-off is desired at the opposite direction from fail-safe, the manual override should be released so the actuator can go to the full fail-safe position. See the manual override instructions.**

1. Manually move the damper to the fail-safe position (usually closed). If the shaft rotated counterclockwise (↺), this is a CCW installation. If the shaft rotated clockwise (↻), this is a CW installation. In a CCW installation, the actuator side marked "CCW" faces out, while in a CW installation, the side marked "CW" faces out. All other steps are identical.
2. The actuator is usually shipped with the universal clamp mounted to the "CCW" side of the actuator. To test for adequate shaft length, slide the actuator over the shaft with the side marked "CCW" (or the "CW" side if this is the side with the clamp). If the shaft extends at least 1/8" through the clamp, mount the actuator as follows. If not, go to the *Short Shaft Installation* section.
3. If the clamp is not on the correct side as determined in step #1, re-mount the clamp as follows. If it is on the correct side, proceed to step #5. Look at the universal clamp. If you are mounting the actuator with the "CCW" side out, position the clamp so that the pointer section of the tab is pointing to 0° (see **Figure C**) and the spline pattern of the clamp mates with spline of the actuator. Slip the clamp over the spline. (Use the same procedure if the "CW" side is out.) If your application requires a mechanical minimum position, read the *Rotation Limiting, Mechanical Minimum Damper Position* section.
4. Lock the clamp to the actuator using the retaining clip.
5. Verify that the damper is still in its full fail-safe position.
6. Slide the actuator over the shaft.
7. Position the actuator in the desired location.
8. Tighten the two nuts on the clamp using a 10mm wrench or socket using 6-8 ft-lb of torque.
9. Slip the stud of the anti rotation strap into the slot at the base of the actuator. The stud should be positioned approximately 1/16 of an inch from the closed end of the slot. Bend the strap as needed to reach the duct. Attach the strap to the duct with #8 self tapping screws.

# Installation Instructions

## Mechanical Installation



### Short Shaft Installation

If the shaft extends at least 3/4" from the duct, follow these steps:

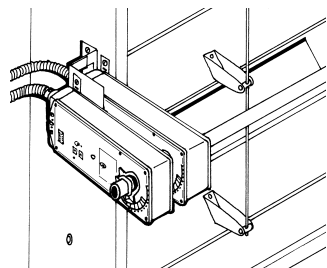
1. Determine the best orientation for the universal clamp on the back of the actuator.  
The best location would be where you have the easiest access to the V bolt nuts on the clamp.
2. Engage the clamp to the actuator as close as possible to the determined location.
3. Lock the clamp in place using the remaining retainer clip.
4. Verify that the damper is still in its full fail-safe position.
5. Slide the actuator over the shaft.
6. Position the actuator in the desired location.
7. Tighten the two nuts on the clamp using a 10mm wrench or socket using 6-8 ft-lb of torque.
8. Slip the stud of the anti-rotation strap into the slot at the base of the actuator.  
The stud should be positioned approximately 1/16 of an inch from the closed end of the slot. Bend the strap as needed to reach the duct. Attach the strap to the duct with #8 self tapping screws.
9. If damper position indication is required, use the optional IND-AF2 pointer. See **Figure A**.

### Jackshaft Installation

The AF... series actuator is designed for use with jackshafts up to 1.05" in diameter. In most applications, the AF actuator may be mounted in the same manner as a standard damper shaft application. If more torque is required than one AF actuator can provide, a second AF actuator may be mounted to the jackshaft using the ZG-102 multiple actuator mounting bracket. *See wiring guide for wiring details.*

#### AF ACTUATORS WHICH MAY BE USED ON ONE SHAFT

Model	Maximum Quantity Per Shaft
AF24(-S) US	4
AF120(-S) US	
AF230(-S) US	
AF24-SR US	4



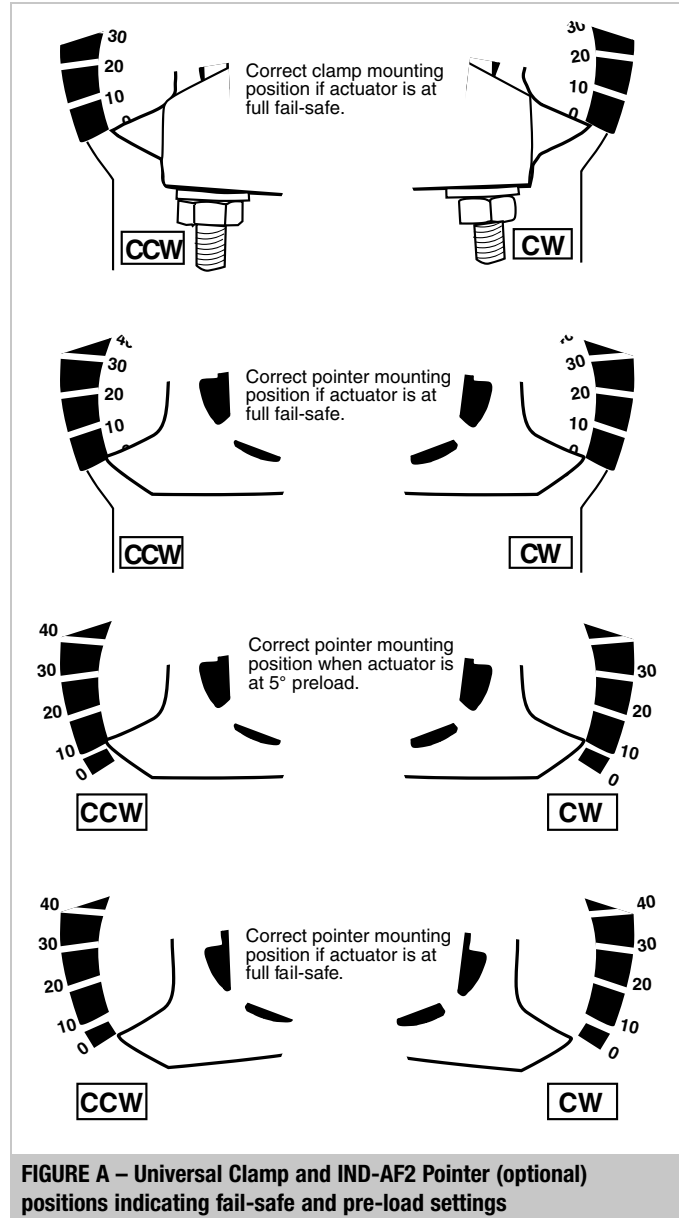
**MOUNTING:** If the actuators are mounted on the opposed ends of the shaft, the actuator direction must be selected carefully. Usually, the direction of rotation is reversed.

### Multiple Actuator Mounting

If more torque is required than one AF actuator can provide, a second AF actuator may be mounted to the shaft using the ZG-102 multiple mounting bracket.

**NOTE:** The manual positioning mechanism cannot be used in multiple actuator applications.

**Special Wiring and Additional Information:** *See wiring guide*



**FIGURE A – Universal Clamp and IND-AF2 Pointer (optional) positions indicating fail-safe and pre-load settings**



### Rotation Limitation

The angle of rotation limiter, ZDB-AF2 US, is used in conjunction with the tab on the universal clamp or IND-AF2 position indicator which comes with the ZDB-AF2 US. In order to function properly, the clamp or indicator must be mounted correctly.

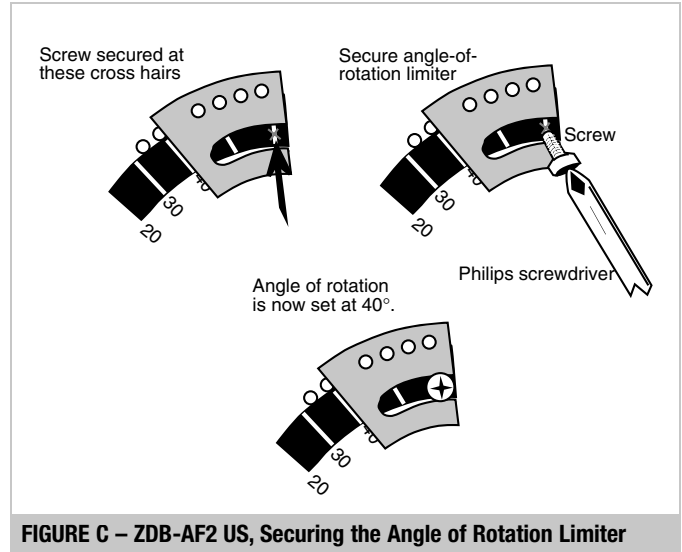
See **Figure A**.

The ZDB-AF2 US may not work in certain mounting orientations using the ZG-106 or ZG-107 mounting brackets. It will not work with the ZG-108 mounting bracket. Limiting the damper rotation must be accomplished by adjusting the crank arm linkage.

The ZDB-AF2 US may be used in 2 ways to control the rotational output of the AF series actuator. One use is in the application where a damper has a designed rotation less than 90°. An example would be a 45° or 60° rotating damper. The other application would be to set a minimum damper position which can be easily set or changed without having to remove the actuator from the damper.

### Damper Rotation Limiting

1. Determine the amount of damper rotation required.
2. Locate the Angle of Rotation Limiter (ZDB-AF2 US) on the actuator so that its edge lines up with the degree graduation on the actuator face which corresponds with the required rotation. See **Figure C**.
3. Find the appropriate cross-hair location through the slot of the limiter. This is the screw mounting location.
4. Pierce through the label material to allow easy fastening of the retaining screw.
5. Position the limiter back to the desired position, making sure the locating “teeth” on the limiter are engaged into the locating holes on the actuator.
6. Fasten the limiter to the actuator using the self tapping screw provided.
7. Test the damper rotation either manually with the manual crank or apply power and if required, a control signal. Re-adjust if necessary.

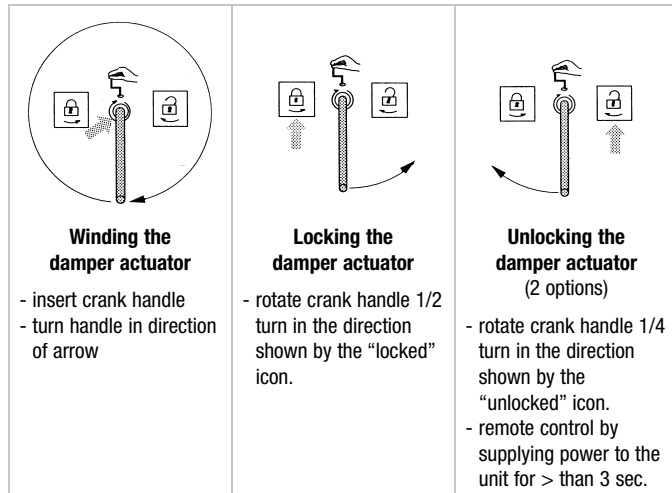


**FIGURE C – ZDB-AF2 US, Securing the Angle of Rotation Limiter**

### Manual Override

The AF series actuators can be manually positioned to ease installation or for emergency positioning.

1. The manual override will only work if no power is available to the actuator.
2. Insert the manual crank (shipped with the actuator) into the hexagon hole located on either side of the actuator. An illustration, located on the label, shows the location.
3. Turn the crank in the direction shown on the label (clockwise on the "CW" side, counterclockwise on the "CCW" side). It will take approximately 19 revolutions to rotate the full 95° of rotation.
4. To lock the actuator in the required position, rotate the crank quickly in the opposite direction, 1/2 of a revolution. The "lock closed" icon on the label shows the correct direction.
5. The manual override may be disengaged in 2 ways.
  - Rotate the crank about a 1/4 revolution in the same direction as the initial winding. The "lock open" icon shows the correct direction.
  - Apply power to wire 1 and 2. The actuator will automatically disengage the override function and will go to the "on" position in the case of the On/Off versions. Or, in the case of the proportional versions, go to the 0 signal position and then go to the position corresponding to the control signal. The actuator will now work normally.



### Testing the Installation Without Power

The actuator/damper installation may be tested without power at the actuator. Refer to the manual positioning section of the instructions. Move the damper to its full non-fail-safe position using the manual crank. Disengage the manual position mechanism and have the damper go to full fail-safe position. Correct any mechanical problems and retest.

### Auxiliary Switches

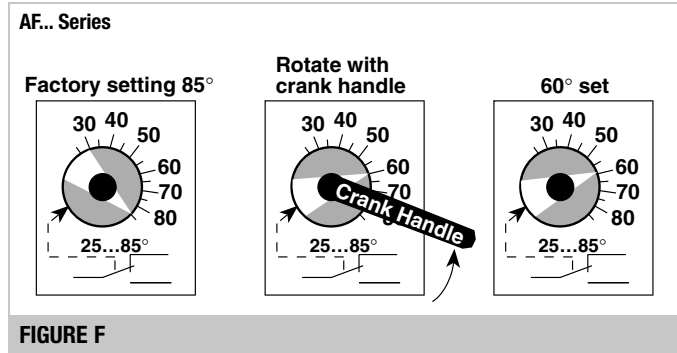
The AF series actuators may be ordered with 2 built-in SPDT auxiliary switches used for safety interfacing or signalling, for example, for fan start-up. The switch position near the fail-safe position is fixed at 5°. The other is adjustable between 25 and 85° of rotation. The crank, supplied with the actuator, or a 3mm allen wrench is used to adjust the switching position.

SWITCH RATING		
Voltage	Resistive Load	Inductive Load
120 VAC	7A	5A
250 VAC	7A	2.5A

Two methods may be used to adjust the switching point of the adjustable switch.

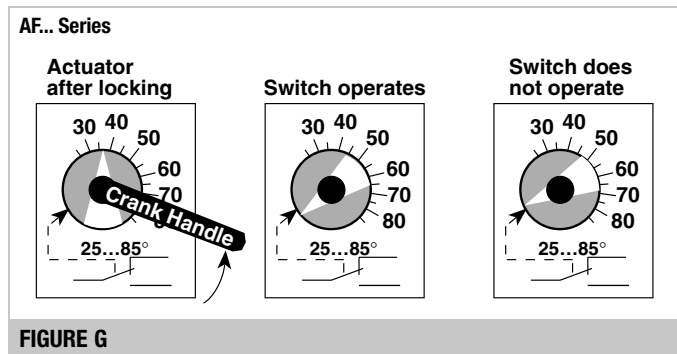
#### Method 1 - See Figure F

1. The actuator must be in its fail-safe position.
2. Insert the crank into the hexagon shaped hole located in the center of the adjustable switch pointer.
3. Rotate the crank until the switch pointer is at the desired switch point in degrees as shown.



#### Method 2 - See Figure G

1. Position the damper to the point at which you want the switch to activate. This may be done by using the manual override or by providing the appropriate proportional signal to AF24... modulating type actuator. The position of the switch pointer is not important during this step.
2. Insert the crank into the hexagon shaped hole located in the center of the adjustable switch pointer.
3. Rotate the switch pointer to just past the switch point indicating arrow as shown.



# KH-AF Crank arm

## Including Retaining Ring



**CAUTION:** The retaining clip supplied with the clamp is **not** used to mount the KH-AF crank arm.

The KH-AF (-1) crank arm is used in non-direct coupled mounting applications. The KH-AF (-1) may also be used to simultaneously direct couple to a damper shaft and provide an additional crank arm connection to a second damper. The KH-AFV V-bolt kit must be used for this non-direct application (see illustration this page).

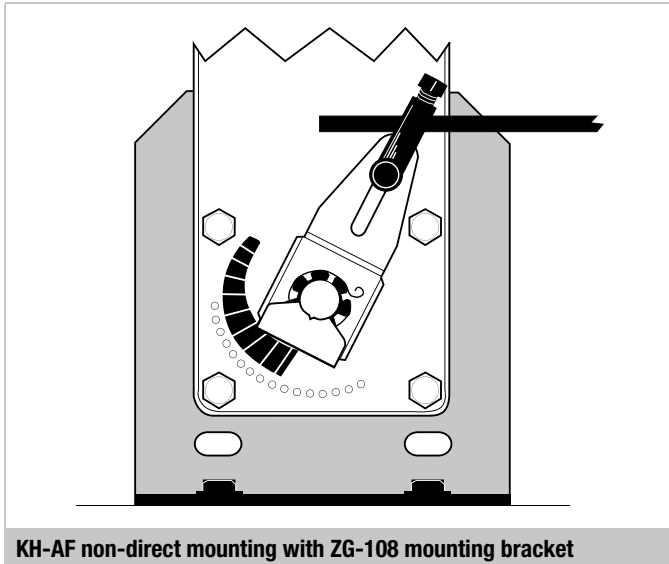
**TWO SIZES ARE AVAILABLE:**

**KH-AF** For round shafts up to 3/4" or square shafts up to 5/8"

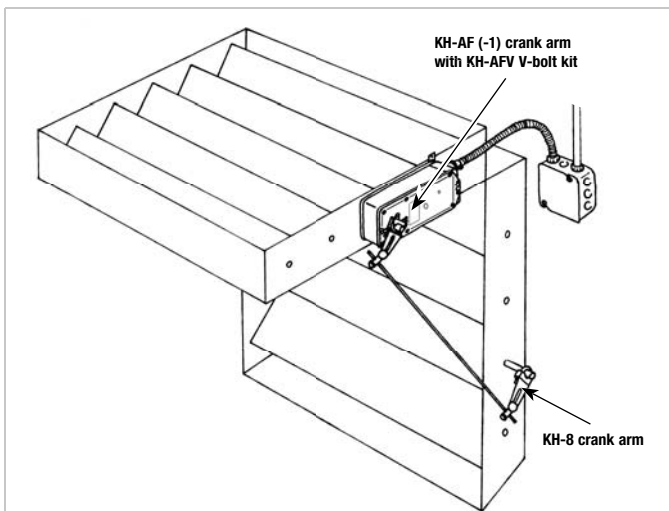
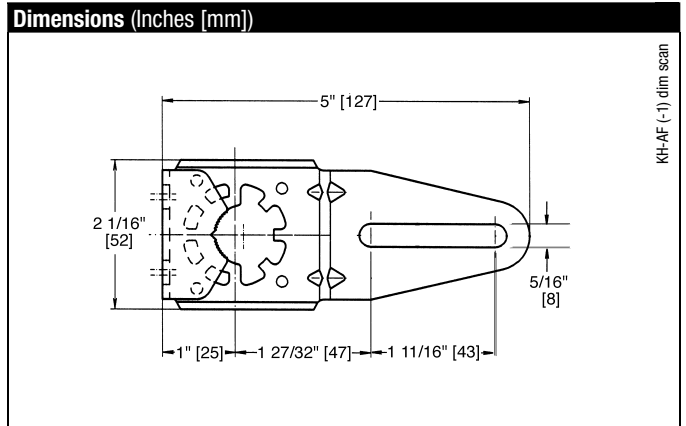
**KH-AF-1** For jackshafts up to 1.05"

**KH-AFV** V-bolt kit for KH-AF(-1) crank arm

Note: KH-AF (-1) crank arms cannot be used on AF Series 1 actuators.



**KH-AF non-direct mounting with ZG-108 mounting bracket**



**Multiple dampers direct coupled to one actuator with linkage to operate the other damper.**

M40103 - 09/11 - Subject to change. © Belimo Aircontrols (USA), Inc.

### General

The AF series actuators utilize brushless DC motor technology. The AF uses this motor in conjunction with an Application Specific Integrated Circuit (ASIC). In the On/Off versions of the AF, the ASIC monitors and controls the actuator's rotation and a digital rotation sensing function to prevent damage to the actuator. The AF24... modulating type actuators incorporate a built in microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and knows the actuator's exact zero position.

### Brushless DC Motor Operation

Belimo's brushless DC motor spins by reversing the poles of stationary electromagnets housed inside of a rotating permanent magnet. The electromagnetic poles are switched by a special ASIC circuit developed by Belimo. Unlike the conventional DC motor, there are no brushes to wear or commutators to foul.

### Overload Protection

The AF series actuators are protected from overload at all angles of rotation. The ASIC circuit constantly monitors the rotation of the DC motor inside the actuator and stops the pulses to the motor when it senses a stall condition. The DC motor remains energized and produces full rated torque to the load. This helps ensure that dampers are fully closed and that edge and blade seals are always properly compressed.

### Motor Position Detection

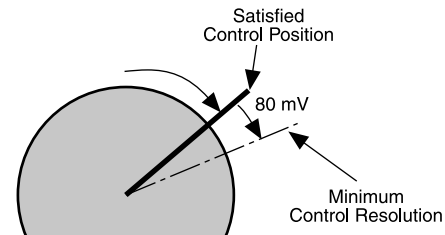
Belimo brushless DC motors eliminate the need for potentiometers for positioning in modulating type actuators. Inside the motor are three "Hall Effect" sensors. These sensors detect the spinning rotor and send pulses to the microprocessor which counts the pulses and calculates the position to within 1/3 of a revolution of the motor.

### Control Accuracy and Stability

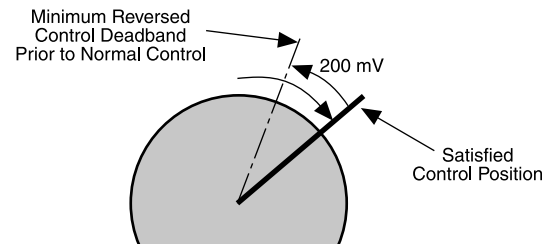
AF24-SR US actuators have built-in brushless DC motors which provide better accuracy and longer service life.

The AF24-SR US actuators are designed with a unique non-symmetrical dead-band. The actuator follows an increasing or decreasing control signal with a 80 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 200 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**AF Actuator responds to a 80 mV signal when not changing direction from stop.**  
(160 mV for AFA24-SR US)



**AF Actuator responds to a 200 mV signal when reversing direction from stop position.**



**WARNING** The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

**Always read the controller manufacturer's installation literature carefully before making any connections.** Follow all instructions in this literature. If you have any questions, contact the controller manufacturer and/or Belimo.

### Transformers

The AF24 . . actuators require a 24 VAC class 2 transformer and draws a maximum of 10 VA per actuator. The actuator enclosure cannot be opened in the field, there are no parts or components to be replaced or repaired.

- EMC directive: 2004/108/EC
- Software class A: Mode of operation type 1
- Low voltage directive: 2006/95/EC

**CAUTION:** It is good practice to power electronic or digital controllers from a separate power transformer than that used for actuators or other end devices. The power supply design in our actuators and other end devices use half wave rectification. Some controllers use full wave rectification. When these two different types of power supplies are connected to the same power transformer and the DC commons are connected together, a short circuit is created across one of the diodes in the full wave power supply, damaging the controller. Only use a single power transformer to power the controller and actuator if you know the controller power supply uses half wave rectification.

### Multiple Actuators, One Transformer

Multiple actuators may be powered from one transformer provided the following rules are followed:

1. The TOTAL current draw of the actuators (VA rating) is less than or equal to the rating of the transformer.
2. Polarity on the secondary of the transformer is strictly followed. *This means that all No. 1 wires from all actuators are connected to the common leg on the transformer and all No. 2 wires from all actuators are connected to the hotleg.* Mixing wire No. 1 & 2 on one leg of the transformer will result in erratic operation or failure of the actuator and/or controls.

### Multiple Actuators, Multiple Transformers

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

1. The transformers are properly sized.
2. All No. 1 wires from all actuators are tied together and tied to the negative leg of the control signal. See wiring diagram.

### Wire Length for AF... Actuators

Keep power wire runs below the lengths listed in the **Figure H**. If more than one actuator is powered from the same wire run, divide the allowable wire length by the number of actuators to determine the maximum run to any single actuator.

Example: 3 actuators, 16 Ga wire  
 $350 \text{ Ft} \div 3 \text{ Actuators} = 117 \text{ Ft. Maximum wire run}$

#### MAXIMUM WIRE LENGTH FOR 10VA

Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	900 Ft.	18 Ga	220 Ft.
14 Ga	550 Ft.	20 Ga	120 Ft.
16 Ga	350 Ft.	22 Ga	60 Ft.

**FIGURE H**

### Wire Type and Wire Installation Tips

For most installations, 18 or 16 Ga. cable works well with the AF24... actuators. Use code-approved wire nuts, terminal strips or solderless connectors where wires are joined. It is good practice to run control wires unspliced from the actuator to the controller. If splices are unavoidable, make sure the splice can be reached for possible maintenance. Tape and/or wire-tie the splice to reduce the possibility of the splice being inadvertently pulled apart.

The AF24... proportional actuators have a digital circuit that is designed to ignore most unwanted input signals (pickup). In some situations the pickup may be severe enough to cause erratic running of the actuator. For example, a large inductive load (high voltage AC wires, motors, etc.) running near the power or control wiring may cause excessive pickup. To solve this problem, make one or more of the following changes:

1. Run the wire in metallic conduit.
2. Re-route the wiring away from the source of pickup.
3. Use shielded wire (Belden 8760 or equal). Ground the shield to an earth ground.  
**Do not** connect it to the actuator common.

### Initialization of the AF24-SR US

When power is initially applied, the actuator will first release its manual preload position (This assumes a manual position has been set). The actuator will then rotate to the full fail-safe position. At this point the microprocessor recognizes that the actuator is at full fail-safe and uses this position as the base for all of its position calculations. The microprocessor will retain the initialized zero during short power failures of up to 20 seconds. For power failures greater than 20 seconds, the actuator would naturally return to its full fail-safe position prior to the microprocessor losing its memory. The actuator will also re-initialize if the manual position mechanism is used.

### AF24-SR US Electrical Check-out Procedure

STEP	Procedure	Expected Response	Gives Expected Response Go To Step...	Does Not Give Expected Response Go To Step...
1.	Control signal is applied to actuator.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	No response at all <b>Step 2.</b> Operation is reversed <b>Step 3.</b> Does not drive toward "Control Signal Position" <b>Step 4.</b>
2.	Check power wiring. Correct any problems. <b>See Note 1.</b>	Power supply rating should be the total power requirement of the actuator(s). Minimum voltage of 19.2 VAC or 21.6 VDC.	Power wiring corrected, actuator begins to drive <b>Step 1.</b>	Power wiring corrected, actuator still does not drive <b>Step 4.</b>
3.	Turn reversing switch to the correct position. Make sure the switch is turned all the way left or right.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	Does not drive toward "Control Signal Position" <b>Step 4.</b>
4.	Make sure the control signal positive (+) is connected to Wire No. 3 and control signal negative (-) is connected to wire No. 1. Most control problems are caused by reversing these two wires. Verify that the reversing switch is all the way CCW or CW.	Drives to "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	<b>Step 5.</b>
5.	Check input signal with a digital volt meter (DVM). Make sure the input is within the range of the actuator. For AF24-SR US this is 2 to 10 VDC or 4 to 20 mA. <b>NOTE:</b> The input signal must be above the 2 VDC or 4 mA to have the actuator move.	Input voltage or current should be $\pm 1\%$ of what controller's adjustment or programming indicate.	Controller output (actuator input) is correct. Input Polarity Correct <b>Step 6.</b>	Reprogram, adjust repair or replace controller as needed <b>Step 1.</b>
7.	Check damper torque requirement.	Torque requirement is actuator's minimum torque.	Defective Actuator. Replace Actuator - <b>See Note 2.</b>	Recalculate actuator requirement and correct installation.
8.	Actuator works properly. Test controller by following controller manufacturer's instructions.			

- NOTE 1** Check that the transformer(s) are sized properly.
- If a common transformer is used, make sure that polarity is observed on the secondary. This means connect all No. 1 wires to one leg of the transformer and all No. 2 wires to the other leg of the transformer.
  - If multiple transformers are used with one control signal, make sure all No. 1 wires are tied together and tied to control signal negative (-).
  - Controllers and actuators must have separate 24 VAC/VDC power sources.

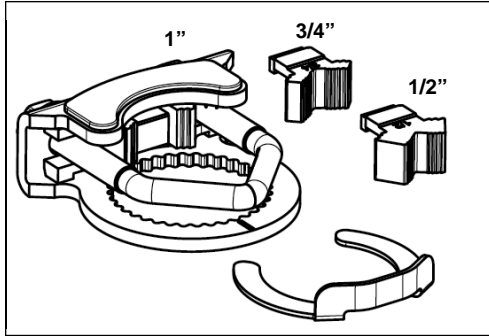
**NOTE 2** If failure occurs within 5 years from original installation date, notify Belimo and give details of the application.



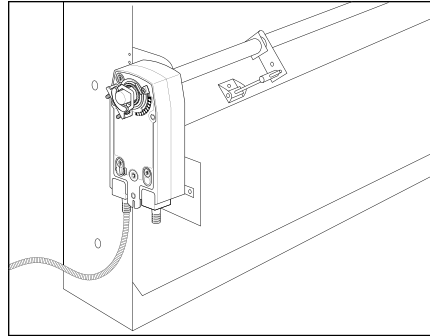
## Minimum 90 in-lb Torque

- For damper areas up to 22 sq-ft\*

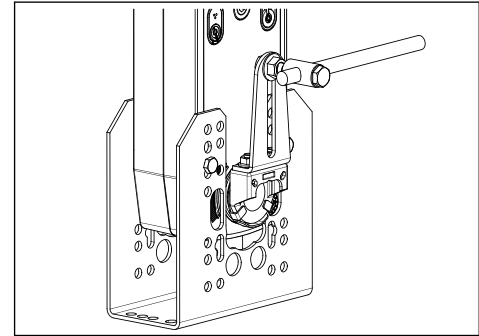
## Applications



New standard clamp fits standard 1/2" shafts to 1.05" jackshafts.



Mount directly to 1.05" jackshafts.



Linkage solutions are available when direct coupling is not possible.



Actuators in bold have BDCM

## NFB, NFX Series - At A Glance

	NFB24, NFX24 (p. 105)	NFB24 N4(H), NFX24 N4 (p. 107)	NFB24-S, NFX24-S (p. 105)	NFB24-S N4(H), NFX24-S N4 (p. 107)	NFBUP, NFXUP (p. 109)	NFBUP N4(H), NFXUP N4 (p. 111)	NFBUP-S, NFXUP-S (p. 109)	NFBUP-S N4(H), NFXUP-S N4 (p. 111)	NFB24-SR, NFX24-SR (p. 113)	NFB24-SR N4(H), NFX24-SR N4 (p. 115)	NFB24-SR-S, NFX24-SR-S (p. 113)	NFB24-SR-S N4(H), NFX24-SR-S N4 (p. 115)	NFB24-MFT, NFX24-MFT (p. 117)	NFB24-MFT N4(H), NFX24-MFT N4 (p. 119)	NFB24-MFT-S, NFX24-MFT-S (p. 117)	NFB24-MFT-S N4(H), NFX24-MFT-S N4 (p. 119)
Torque:	90 in-lb	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Power supply:	24 VAC/DC	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	120 VAC				●	●	●	●								
	230 VAC															
Control signal:	On/Off	●	●	●	●	●	●	●								
	Proportional 2 to 10 VDC								●	●	●	●				
	Multi-function**												●	●	●	●
Feedback signal:	2 to 10 VDC								●	●	●	●				
	VDC variable**												●	●	●	●
Running time motor:	<75 seconds	●	●	●	●	●	●	●								
	95 seconds constant								●	●	●	●				
	Adj. 40 to 220 seconds***												●	●	●	●
	spring: <20 seconds	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Brushless DC Motor									●	●	●	●	●	●	●	●
External direction of rotation switch									●	●	●	●	●	●	●	●
Manual override	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Appliance rated cable, 18 GA (default)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Plenum rated cable, 18 GA (optional)	●								●				●			
Built-in auxiliary switch, Two SPDT			●	●			●	●			●	●			●	●
NEMA 4 rated housing		●				●				●				●		●
Installation instructions.....(p. 121-127)																
General wiring.....(p. 129)																
Start-up and checkout.....(p. 130)																
Electrical operations.....(p. 128)																

\*Based on 4 in-lb/ft² damper torque loading. Parallel blade. No edge seals. \*\*Default 2 to 10 VDC. \*\*\*Default 150 seconds.



# A CLOSER LOOK...

- Cut labor costs with simple direct coupling.
- True mechanical spring return – the most reliable fail-safe.
- Mount for clockwise or counterclockwise fail-safe.
- Check damper position easily with clear position indicator.
- Don't worry about actuator burn-out. Belimo is overload-proof throughout rotation.
- Built-in mechanical stop to adjust angle of rotation.
- Manual override crank speeds installation
- Need to change control direction? Do it easily with a simple switch (modulating actuators).
- Incorporated breather membrane optimizes performance in harsh airstream environments.
- Built-in auxiliary switches are easy to use, offers feedback or signal for additional device (-S models).
- Microprocessor-controlled brushless DC motor increases actuator life span and reliability, provides constant running time (modulating actuators).
- Rugged metal on plastic housing withstands rough handling in the mechanical room.
- Standard 3 ft. appliance rated cable and conduit connector eases installation.
- Added flexibility to select clamp, electrical connection, and running time to fit your specific application with Belimo's customized line of actuators (NFX).



## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.



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Technical Data		NFB24, NFB24-S, NFX24, NFX24-S
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	6 W
	holding	2.5 W
Transformer sizing		8.5 VA (class 2 power source)
Electrical connection NFB24...		3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	NFX24...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector <b>-S models:</b> two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		90 in-lb [10 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	< 75 seconds
	spring	20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		zinc coated metal and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds <62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.15 lbs (1.9 kg); 4.4 lbs (2.0 kg) with switches
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
<b>NFB24-S, NFX24-S</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

- Torque min. 90 in-lb, for control of air dampers

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

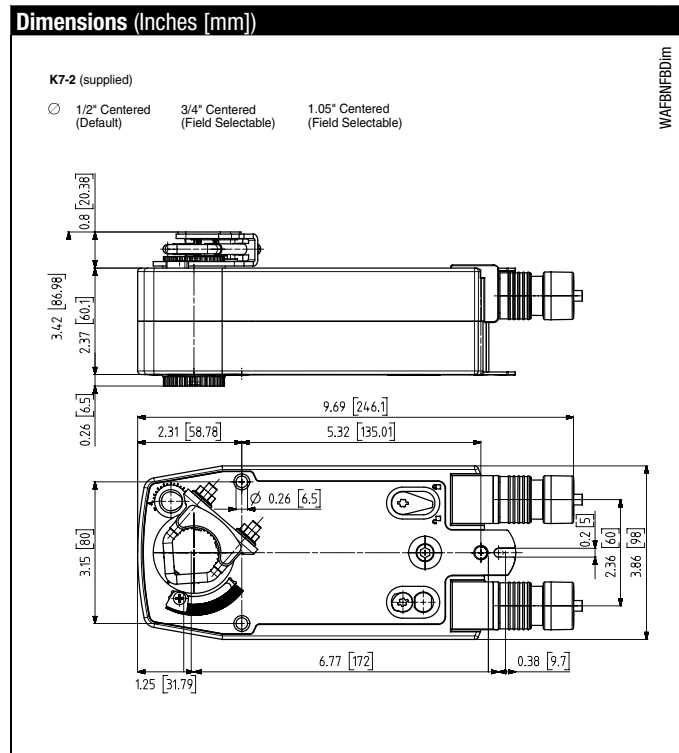
## Operation

The NFB and NFX series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The NFB and NFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The NFB24-S and NFX24-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°. The NFB24, NFB24-S, NFX24 and NFX24-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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**Accessories**

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
KH-AFB	Crank arm
K7-2	Universal clamp for up to 1.05" dia jackshafts
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4.., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

Note: When using NFB24, NFB24-S, NFX24, NFX24-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

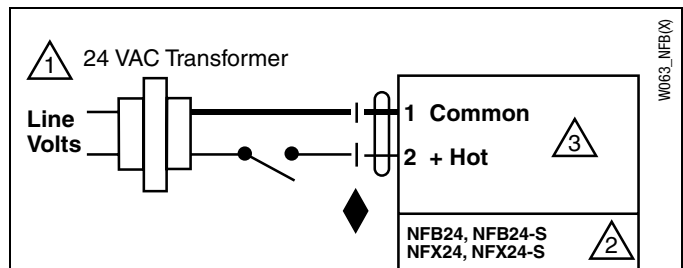
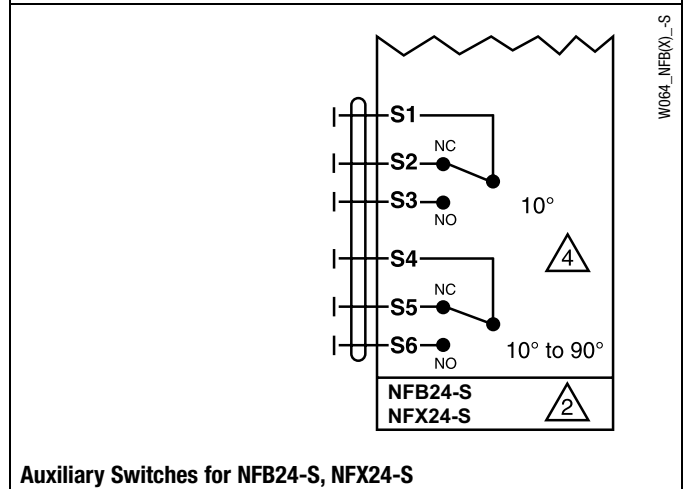
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., NFB24-S and NFX24-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

**APPLICATION NOTES**

- ◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.


**On/Off wiring for NFB24, NFX24**

**Auxiliary Switches for NFB24-S, NFX24-S**

# NFB24 N4(H), NFB24-S N4(H), NFX24 N4, NFX24-S N4

NEMA 4, On/Off, Spring Return, 24 V



Technical Data		NFB24 N4(H), NFB24-S N4(H), NFX24 N4, NFX24-S N4
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	6 W / heater 25 W
	holding	2.5 W
Transformer sizing		8.5 VA (class 2 power source) / heater 25 VA
Electrical connection		3 ft, 18 GA appliance cable, 1/2" conduit connector
	NFB... N4	-S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	heater (N4H)	terminal block, 26-16 GA
	NFX... N4	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with 1/2" conduit connector
		-S models: Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		90 in-lb [10 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting inside housing
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	< 75 seconds
	spring	20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
	spring (with heater)	20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -49°F [-45°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
	with heater	-49°F to 122°F [-45°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		UL Type 4, NEMA 4, IP66
Housing material		polycarbonate
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.25 lbs (4.2 kg); 9.5 lbs (4.3 kg) with switches 10 lbs (4.5 kg) with heater
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.		
<b>NFB24-S N4(H), NFX24-S N4</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

- Torque min. 90 in-lb, for control of air dampers

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

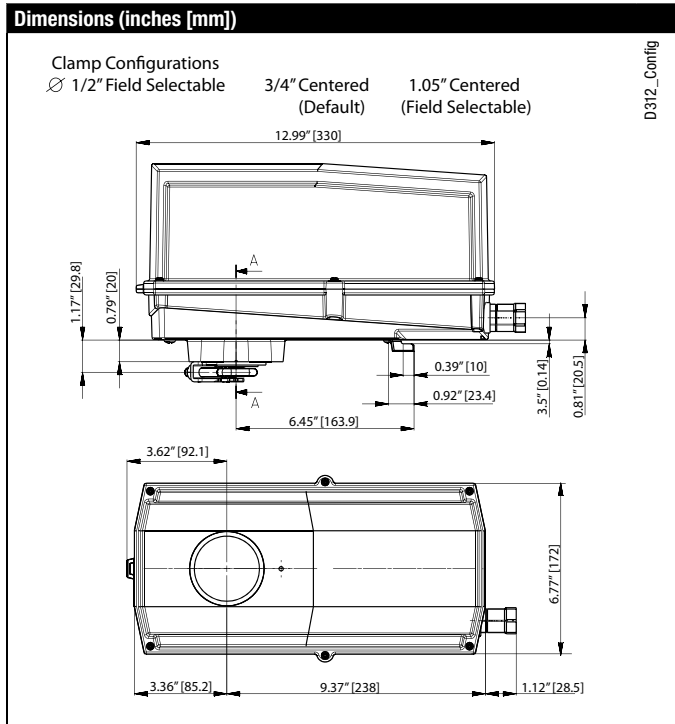
## Operation

The NFB N4(H), NFX N4 series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The NFB N4(H), NFX N4 series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The NFB24-S N4(H), NFX24-S N4 version are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°.



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**Accessories**

Tool-06	8mm and 10 mm wrench
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland (needed for additional wires)

**NOTE:** When using NFB24 N4(H), NFB24-S N4(H), NFX24 N4, NFX24-S N4 actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

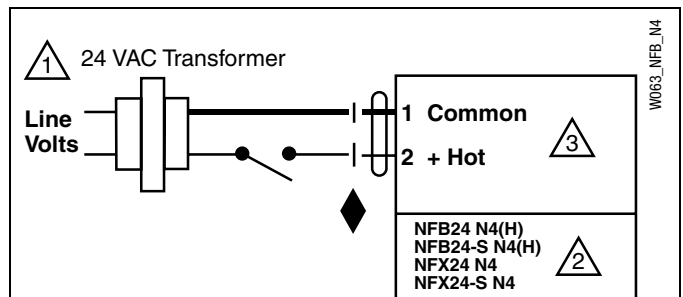
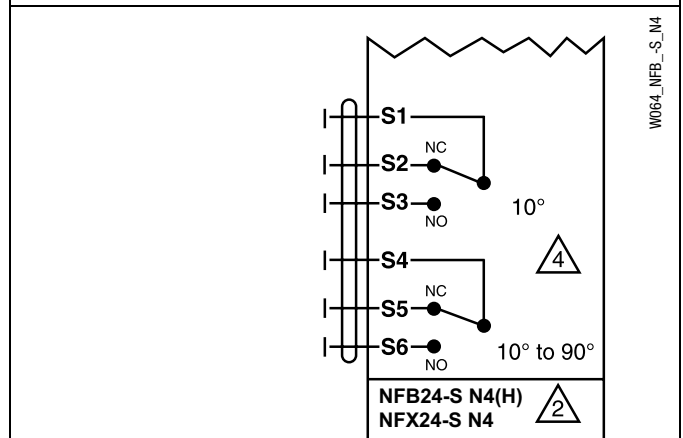
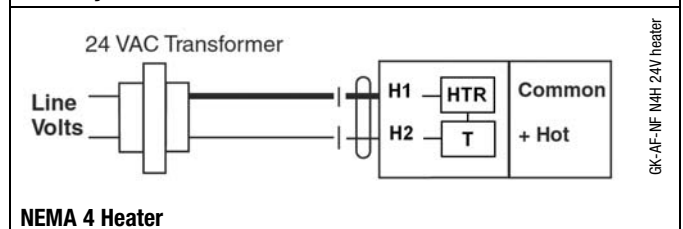
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., NFB24-S N4(H), NFX24-S N4 incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

**APPLICATION NOTES**

- ◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.


**On/Off Wiring**

**Auxiliary Switches**

**NEMA 4 Heater**

# NFBUP, NFBUP-S, NFXUP, NFXUP-S

On/Off, Spring Return, 24 to 240 VAC



Technical Data		NFBUP, NFBUP-S, NFXUP, NFXUP-S
Power supply		24...240 VAC -20% / +10%, 50/60 Hz 24...125 VDC ±10%
Power consumption	running	6 W
	holding	2.5 W
Transformer sizing		6 VA @ 24 VAC (class 2 power source) 6.5 VA @ 120 VAC 9.5 VA @ 240 VAC
Electrical connection		
	NFBUP...	3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> Two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	NFXUP...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance cable, with or without 1/2" conduit connector <b>-S models:</b> two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		90 in-lb [10 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	< 75 seconds
	spring	20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		zinc coated metal and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.15 lbs (1.9 kg), 4.4 lbs (2.0 kg) with switches
† Rated Impulse Voltage 4kV, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
<b>NFBUP-S, NFXUP-S</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

**Torque min. 90 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

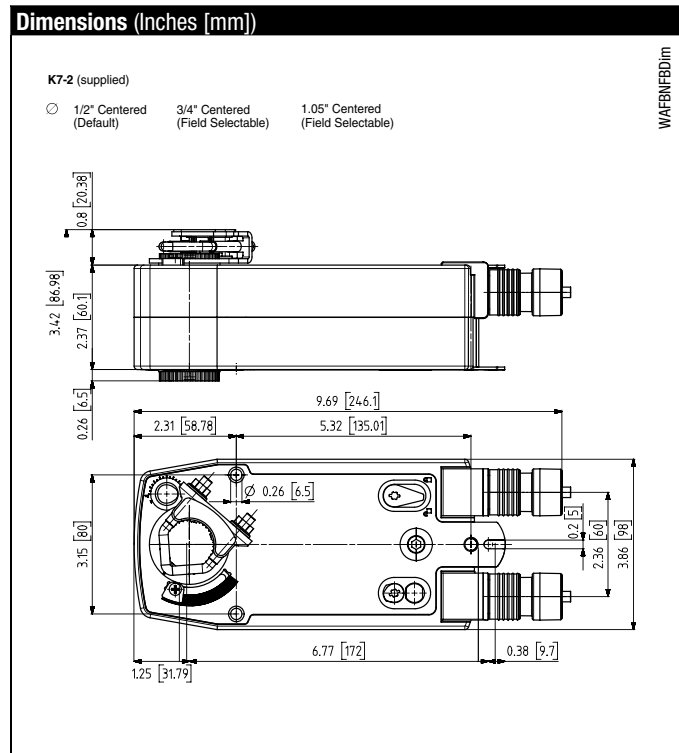
## Operation

The NFB and NFX series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The NFB and NFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The NFBUP-S and NFXUP-S versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°. The NFBUP, NFBUP-S, NFXUP and NFXUP-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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#### Accessories

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
K7-2	Universal clamp for up to 1.05" dia jackshafts
KH-AFB	Crank arm
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4.., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

Note: When using NFBUP, NFBUP-S, NFXUP, NFXUP-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

#### Typical Specification

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

##### ✂️ INSTALLATION NOTES

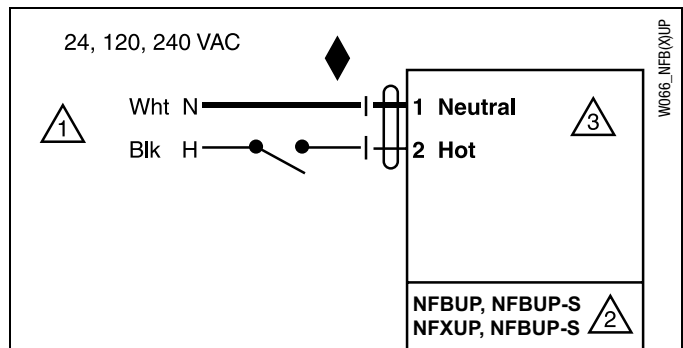
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 No ground connection is required.
- 4 For end position indication, interlock control, fan startup, etc., NFBUP-S and NFXUP-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

##### 📄 APPLICATION NOTES

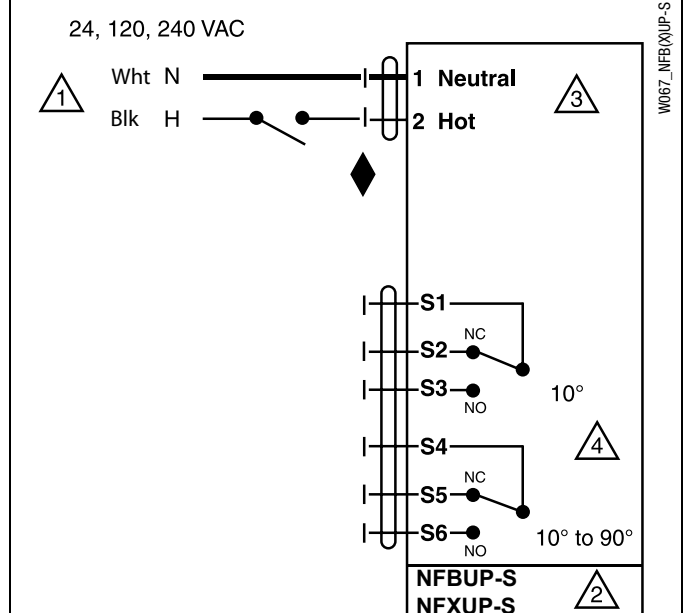
- ◆ Meets cULus requirements without the need of an electrical ground connection.

##### ⚠️ WARNING Live Electrical Components!

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On/Off wiring for NFBUP, NFXUP



Auxiliary Switches for NFBUP-S, NFXUP-S

# NFBUP N4(H), NFBUP-S N4(H), NFXUP N4, NFXUP-S N4

NEMA 4, On/Off, Spring Return, 24 to 240 VAC



Technical Data		NFBUP N4(H), NFBUP-S N4(H), NFXUP N4, NFXUP-S N4
Power supply		24...240 VAC -20% / +10%, 50/60 Hz 24...125 VDC ±10%
Power consumption	running holding	6 W / heater 25 W 2.5 W
Transformer sizing		6 VA @ 24 VAC (class 2 power source) 6.5 VA @ 120 VAC / heater 25 VA @ 120 VAC 9.5 VA @ 240 VAC
Electrical connection	NFBUP... N4	3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> Two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	heater (N4H)	terminal block, 18-16 GA
	NFXUP... N4	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance cable, with or without 1/2" conduit connector <b>-S models:</b> two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		90 in-lb [10 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting inside housing
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor spring	< 75 seconds 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
	spring (with heater)	20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -49°F [-45°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
	with heater	-49°F to 122°F [-45°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		UL Type 4, NEMA 4, IP66
Housing material		polycarbonate
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds <62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.25 lbs (4.2 kg), 9.5 lbs (4.3 kg) with switches 10 lbs (4.5 kg) with heater
† Rated Impulse Voltage 4kV, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.		
<b>NFBUP-S N4(H), NFXUP-S N4</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

**Torque min. 90 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

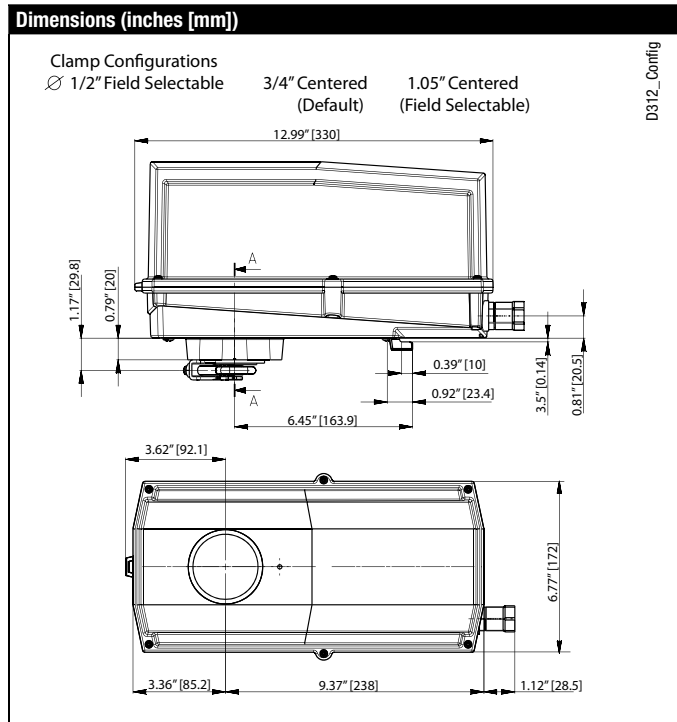
## Operation

The NFB N4(H), NFX N4 series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The NFB N4(H), NFX N4 series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The NFBUP-S N4(H), NFXUP-S N4 version are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°.



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**Accessories**

Tool-06	8mm and 10 mm wrench
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland (needed for additional wires)

**NOTE:** When using NFBUP N4(H), NFBUP-S N4(H), NFXUP N4, NFXUP-S N4 actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return 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 actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. 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 Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

**1** Provide overload protection and disconnect as required.

**2 CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.

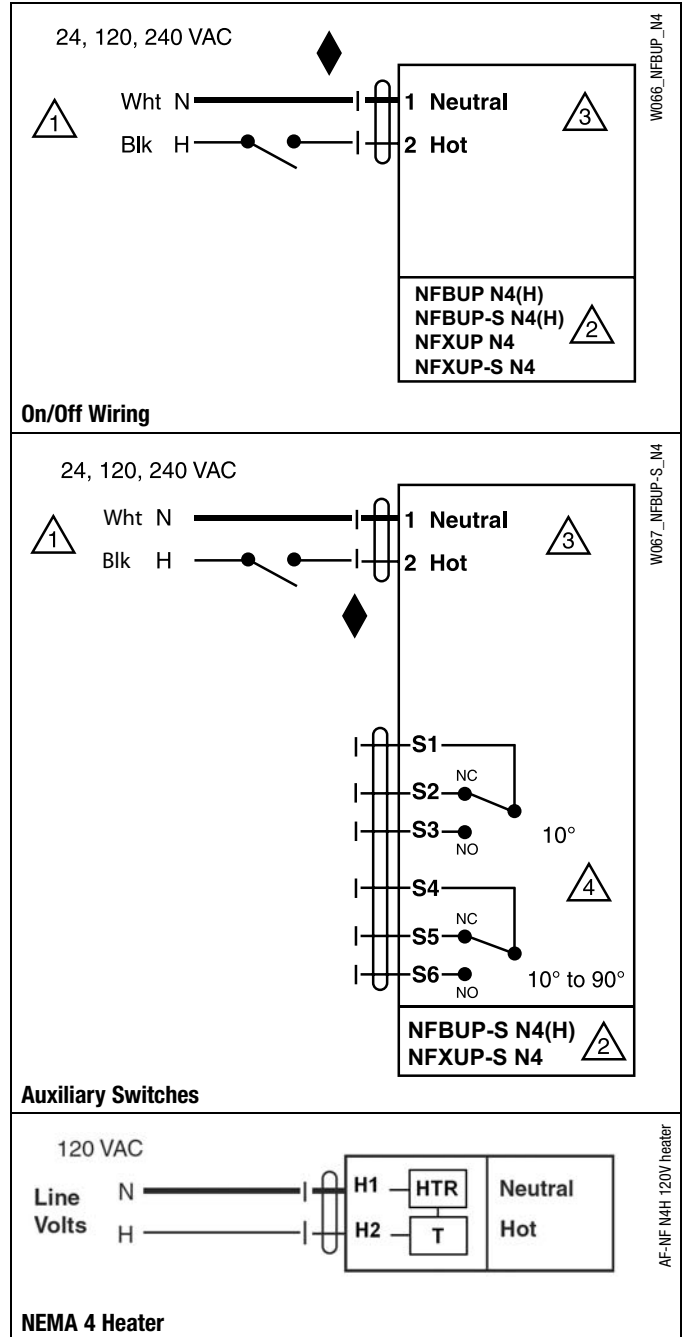
**3** No ground connection is required.

**4** For end position indication, interlock control, fan startup, etc., NFBUP-S N4(H), NFXUP-S N4 incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

**APPLICATION NOTES**

**◆** Meets cULus requirements without the need of an electrical ground connection.

**! WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



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W066\_NFBUP\_N4

W067\_NFBUP-S\_N4

AF-NF N4H 120V heater

# NFB24-SR, NFB24-SR-S, NFX24-SR, NFX24-SR-S

Proportional, Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data		NFB24-SR, NFB24-SR-S, NFX24-SR, NFX24-SR-S
Power supply		24 VAC ±20%, 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	3.5 W
	holding	2.5 W
Transformer sizing		6 VA (class 2 power source)
Electrical connection	NFB...	3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	NFX...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector <b>-S models:</b> Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20mA
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA)
		500 Ω for 4 to 20 mA
Feedback output U		2 to 10 VDC (max. 0.5 mA)
Torque		90 in-lb [10 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
	motor	reversible with built-in switch
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
	motor	95 seconds
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		zinc coated metal and plastic casing
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤40dB(A) motor @ 95 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.15 lbs (1.9 kg); 4.4 lbs (2.0 kg) with switches
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
<b>NFB24-SR-S, NFX24-SR-S</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

Torque min. 90 in-lb, for control of air dampers

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates 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. A 2 to 10 VDC feedback signal is provided for position indication. Not to be used for a master-slave application.

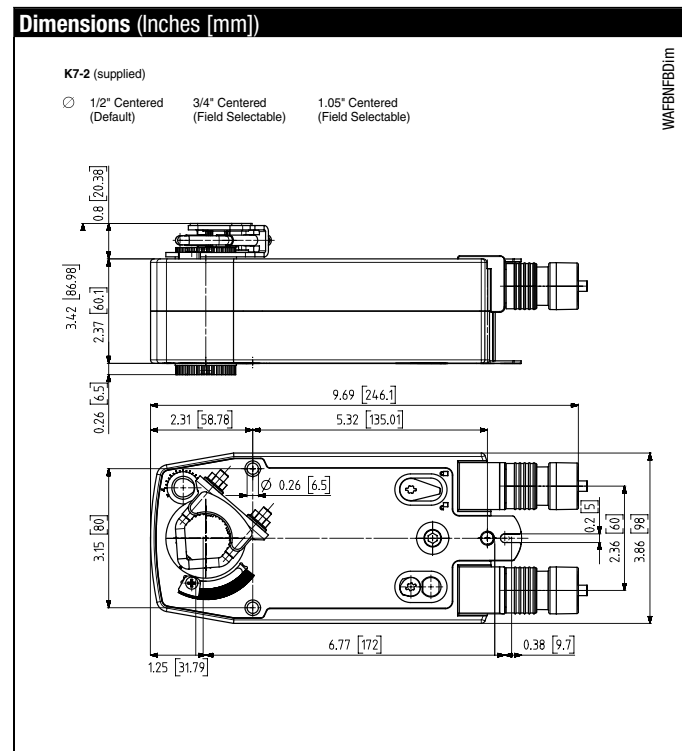
## Operation

The NFB and NFX series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The NFB and NFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The NFB24-SR and NFX24-SR 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 fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The NFB24-SR-S and NFX24-SR-S versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°. The NFB24-SR, NFB24-SR-S, NFX24-SR and NFX24-SR-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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### Accessories

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
KH-AFB	Crank arm
K7-2	Universal clamp for up to 1.05" dia jackshafts
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4..., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

**NOTE:** When using NFB24-SR, NFB24-SR-S, NFX24-SR and NFX24-SR-S actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional 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 counterclockwise 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. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

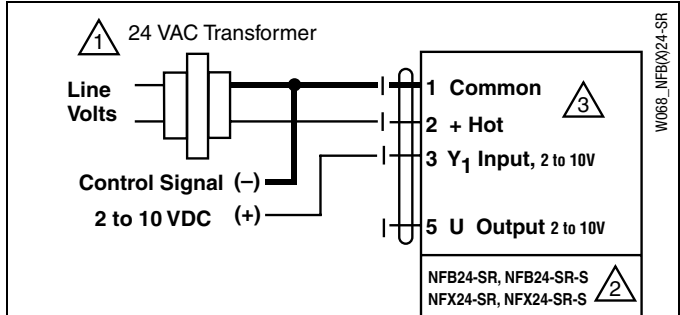
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor. Power consumption must be observed.
- 4 Actuator may also be powered by 24 VDC.
- 5 For end position indication, interlock control, fan startup, etc., NFB24-SR-S and NFX24-SR-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.
- 6 Only connect common to neg. (-) leg of control circuits

#### APPLICATION NOTES

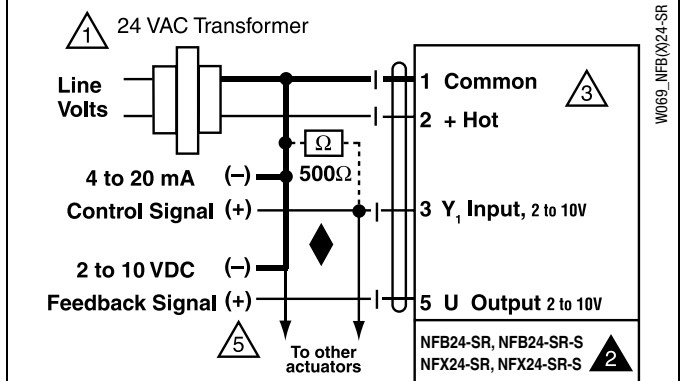
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

#### WARNING Live Electrical Components!

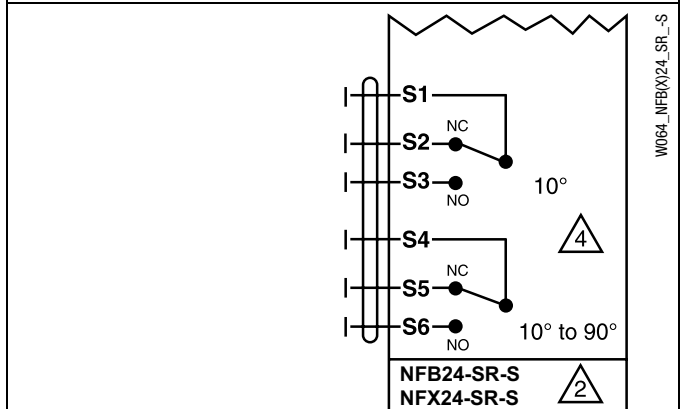
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2 to 10 VDC control of NFB24-SR and NFX24-SR



4 to 20 mA control of NFB24-SR and NFX24-SR with 2 to 10 VDC feedback output



Auxiliary switches for NFB24-SR-S, NFX24-SR-S

# NFB24-SR N4(H), NFB24-SR-S N4(H), NFX24-SR N4, NFX24-SR-S N4

NEMA 4, Proportional, Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA Control Signal



## Technical Data

Technical Data		NFB24-SR N4(H), NFB24-SR-S N4(H), NFX24-SR N4, NFX24-SR-S N4
Power supply		24 VAC ±20%, 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	3.5 W / heater 25 W
	holding	2.5 W
Transformer sizing		6 VA (class 2 power source) / heater 25 VA
Electrical connection		3 ft, 18 GA appliance cable, 1/2" conduit connector
	NFB... N4	-S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	heater (N4H)	terminal block, 26-16 GA
	NFX... N4	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with 1/2" conduit connector
		-S models: two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20mA
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA
Feedback output U		2 to 10 VDC (max. 0.5 mA)
Torque		90 in-lb [10 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting inside housing
	motor	reversible with built-in switch
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	95 seconds
	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
	spring (with heater)	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -49°F [-45°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
	with heater	-49°F to 122°F [-45°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		UL Type 4, NEMA 4, IP66
Housing material		polycarbonate
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤40dB(A) motor @ 95 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.25 lbs (4.2 kg); 9.5 lbs (4.3 kg) with switches 10 lbs (4.5 kg) with heater

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.

## NFB24-SR-S N4(H), NFB24-SR-S N4

Auxiliary switches	2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°
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Torque min. 90 in-lb, for control of air dampers

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates 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. A 2 to 10 VDC feedback signal is provided for position indication. Not to be used for a master-slave application.

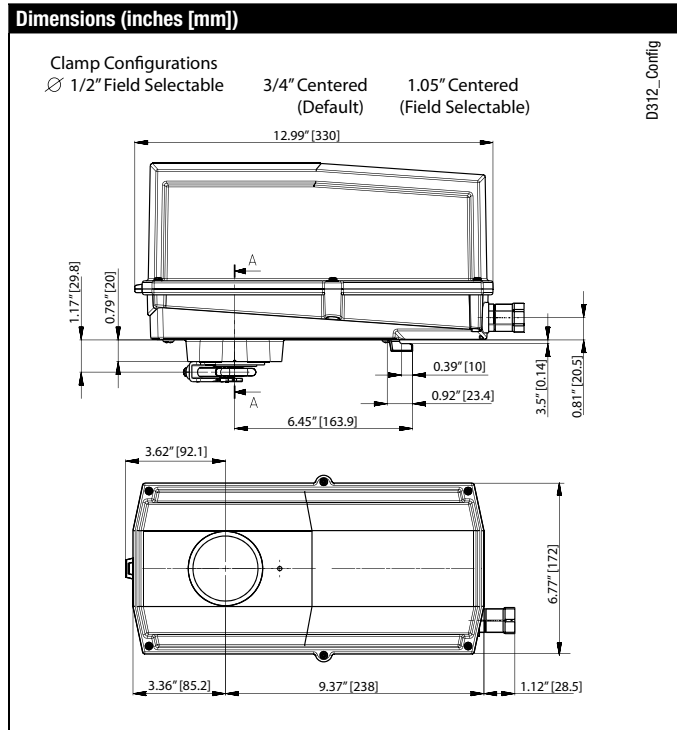
## Operation

The NFB N4(H), NFX N4 series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The NFB N4(H), NFX N4 series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The NFB24-SR N4(H), NFX24-SR N4 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 fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The NFB24-SR-S N4(H), NFX24-SR-S N4 version are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°.



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### Accessories

Tool-06	8mm and 10 mm wrench
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland (needed for additional wires)

**NOTE:** When using NFB24-SR N4(H), NFB24-SR-S N4(H), NFX24-SR N4, NFX24-SR-S N4 actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω 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 counterclockwise 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. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

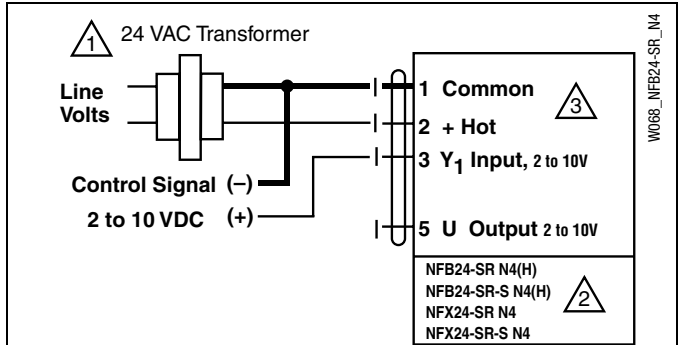
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 2 Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor. Power consumption must be observed.
- 3 Actuator may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., NFB24-SR-S N4(H), NFX24-SR-S N4 incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.
- 5 Only connect common to neg. (-) leg of control circuits

#### APPLICATION NOTES

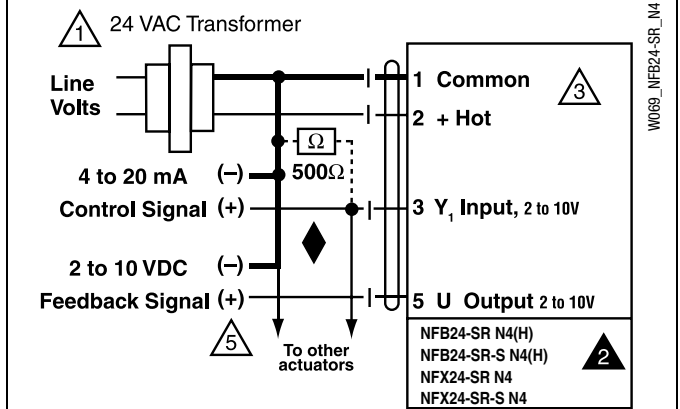
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

#### WARNING Live Electrical Components!

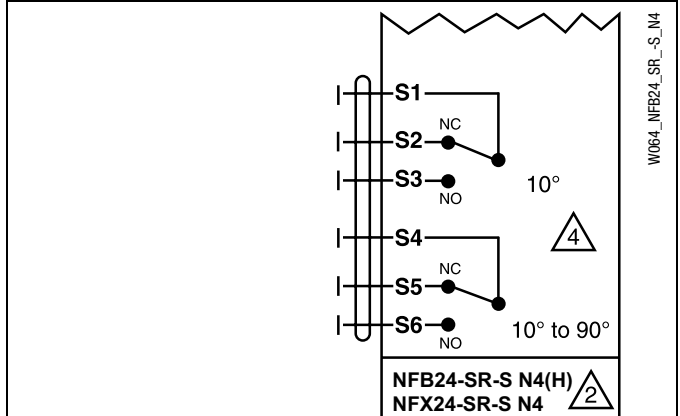
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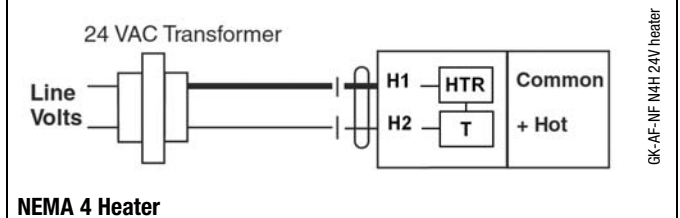
2 to 10 VDC control



4 to 20 mA control with 2 to 10 VDC feedback output



Auxiliary switches



NEMA 4 Heater

# NFB24-MFT, NFB24-MFT-S, NFX24-MFT, NFX24-MFT-S

Proportional, Spring Return, Multi-Function Technology®



MFT



Technical Data		NFB24-MFT, NFB24-MFT-S, NFX24-MFT, NFX24-MFT-S
Power supply		24 VAC ±20%, 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	6.5 W
	holding	3 W
Transformer sizing		9 VA (class 2 power source)
Electrical connection		
	NFB...	3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	NFX...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector <b>-S models:</b> Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y*		2 to 10 VDC, 4 to 20mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1500 Ω for PWM, floating point, on/off
Feedback output U*		2 to 10 VDC (max. 0.5 mA)
Torque		90 in-lb [10 Nm] minimum
Direction of rotation*	spring motor	reversible with CW/CCW mounting reversible with built-in switch
Mechanical angle of rotation*		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring	< 20 sec @ -4°F to 122°F [-20°C to 50°C]; < 60 sec @ -22°F [-30°C]
	motor*	150 seconds (default), variable (40 to 220 secs)
Angle of Rotation Adaptation*		off (Default)
Override control*		min position = 0% mid. position = 50% max. position = 100%
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		zinc coated metal and plastic casing
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤40dB(A) motor @ 150 seconds, run time dependent ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.2 lbs (1.9 kg), 4.4 lbs (2.0 kg) with switches
*Variable when configured with MFT options.		
† Rated Impulse Voltage 800V, Type of action 1.AA.B for -S version), Control Pollution Degree 3.		
♦ Programmed for 40 sec motor run time. At 150 sec motor run time, transformer sizing is 6.5 VA and power consumption is 4.5 W running / 3 W holding.		
<b>NFB24-MFT-S, NFX24-MFT-S</b>		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

- Torque min. 90 in-lb
- Control 2 to 10 VDC (DEFAULT)
- Feedback 2 to 10 VDC (DEFAULT)

## Application

For proportional modulation of dampers and control valves in HVAC systems. The NFB24-MFT and NFX24-MFT provides mechanical spring return operation for reliable fail-safe application.

## Default/Configuration

Default parameters for 2 to 10 VDC applications of the NFB24-MFT and NFX24-MFT actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. The parameters noted in the Technical Data table are variable.

These parameters can be changed by three means:

- Pre-set configurations from Belimo
- Custom configurations from Belimo
- Configurations set by the customer using the MFT PC tool (version 3.4 or higher) software application.
- Handheld ZTH-GEN

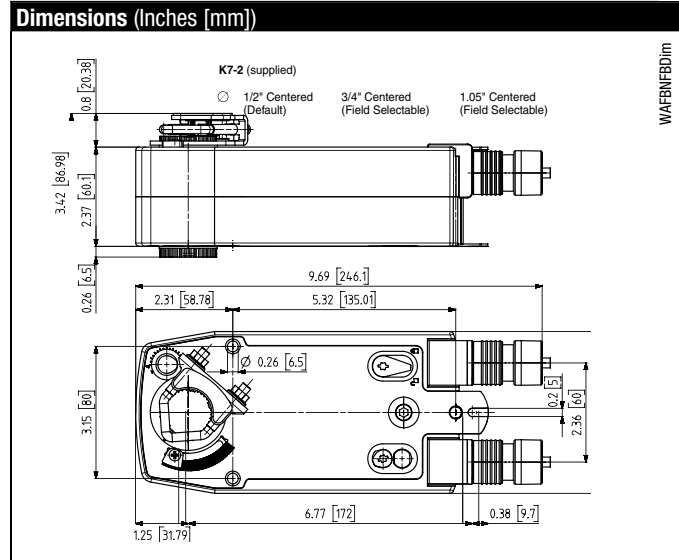
## Operation

The NFB24-MFT, NFX24-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 damper or valves mechanical stop and use this point for its zero position during normal control operations.

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 with out 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 NFB24-MFT, NFB24-MFT-S, NFX24-MFT and NFX24-MFT-S 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 NFB24-MFT, NFB24-MFT-S, NFX24-MFT and NFX24-MFT-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

**NOTE:** Refer to Multi-Function Technology documentation.



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### Accessories

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
KH-AFB	Crank arm
K7-2	Universal clamp for up to 1.05" dia jackshafts
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3./4., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

**NOTE:** When using NFB24-MFT, NFB24-MFT-S, NFX24-MFT and NFX24-MFT-S actuators, only use accessories listed on this page. For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional 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 counterclockwise 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. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

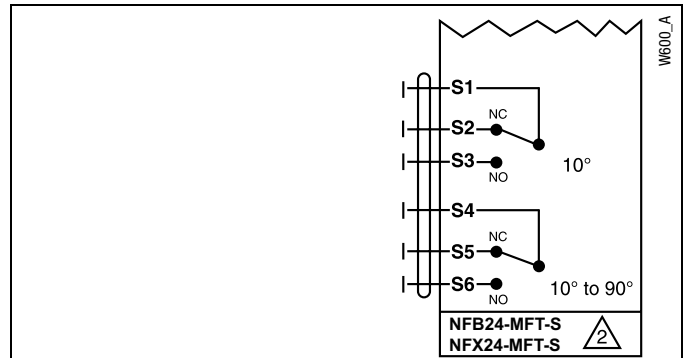
#### APPLICATION NOTES

Meets UL requirements without the need of an electrical ground connection.

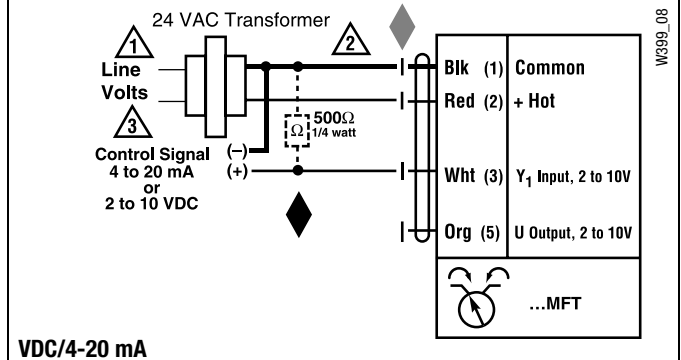
The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

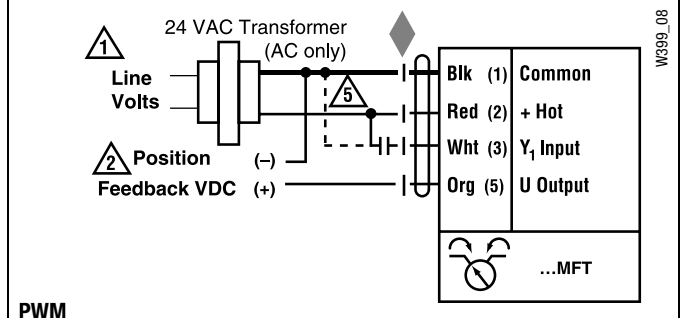
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



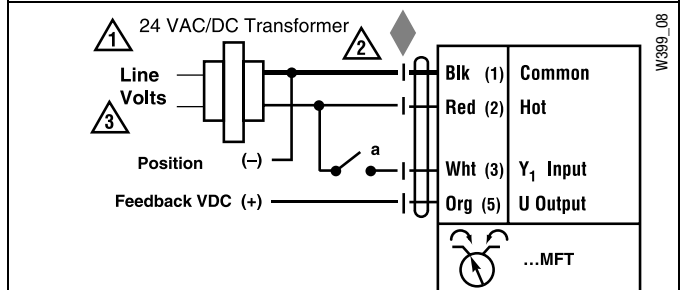
Auxiliary Switches for NFB24-MFT-S, NFX24-MFT-S



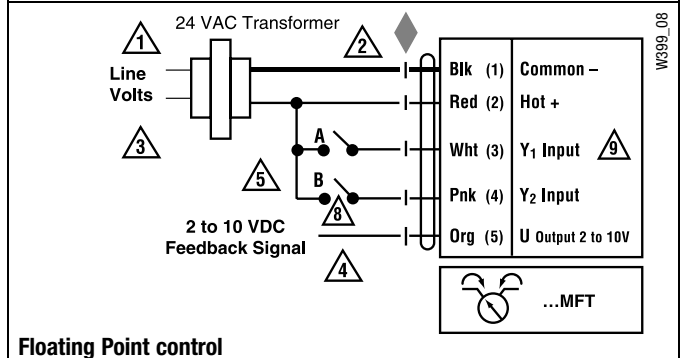
VDC/4-20 mA



PWM



On/Off control



Floating Point control

# NFB24-MFT N4(H), NFB24-MFT-S N4(H), NFX24-MFT N4, NFX24-MFT-S N4



NEMA 4, Proportional, Spring Return, Multi-Function Technology®



MFT



Technical Data		NFB24-MFT N4(H), NFB24-MFT-S N4(H), NFX24-MFT N4, NFX24-MFT-S N4
Power supply		24 VAC ±20%, 50/60 Hz 24 VDC +20% / -10%
Power consumption	running holding	6.5 W / heater 25 W 3 W
Transformer sizing		9 VA (class 2 power source) / heater 25 VA
Electrical connection		
	NFB... N4	3 ft, 18 GA appliance cable, 1/2" conduit connector <b>-S models:</b> two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	heater (N4H)	terminal block, 26-16 GA
	NFX... N4	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with 1/2" conduit connector <b>-S models:</b> two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y*		2 to 10 VDC, 4 to 20mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1500 Ω for PWM, floating point, on/off
Feedback output U*		2 to 10 VDC (max. 0.5 mA)
Torque		90 in-lb [10 Nm] minimum
Direction of rotation*	spring motor	reversible with CW/CCW mounting inside housing reversible with built-in switch
Mechanical angle of rotation*		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor* spring	150 seconds (default), variable (40 to 220 secs) < 20 sec @ -4°F to 122°F [-20°C to 50°C]; < 60 sec @ -22°F [-30°C]
	spring (with heater)	< 20 sec @ -4°F to 122°F [-20°C to 50°C]; < 60 sec @ -49°F [-45°C]
Angle of rotation adaptation*		off (Default)
Override control*		min position = 0% mid. position = 50% max. position = 100%
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
	with heater	-49°F to 122°F [-45°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		UL Type 4, NEMA 4, IP66
Housing material		polycarbonate
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤40dB(A) motor @ 150 seconds, run time dependent ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.3 lbs (4.2 kg), 9.5 lbs (4.3 kg) with switches 10 lbs (4.5 kg) with heater

\*Variable when configured with MFT options.

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 4.

♦ Programmed for 40 sec motor run time. At 150 sec motor run time, transformer sizing is 6.5 VA and power consumption is 4.5 W running / 3 W holding.

## NFB24-MFT-S N4(H), NFX24-MFT-S N4

Auxiliary switches 2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

- Torque min. 90 in-lb
- Control 2 to 10 VDC (DEFAULT)
- Feedback 2 to 10 VDC (DEFAULT)

## Application

For proportional modulation of dampers and control valves in HVAC systems. The NFB24-MFT N4(H) and NFX24-MFT N4 provides mechanical spring return operation for reliable fail-safe application.

## Default/Configuration

Default parameters for 2 to 10 VDC applications of the NFB24-MFT N4(H) and NFX24-MFT N4 actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. The parameters noted in the Technical Data table are variable.

These parameters can be changed by three means:

- Pre-set configurations from Belimo
- Custom configurations from Belimo
- Configurations set by the customer using the MFT PC tool (version 3.4 or higher) software application.
- Handheld ZTH-GEN

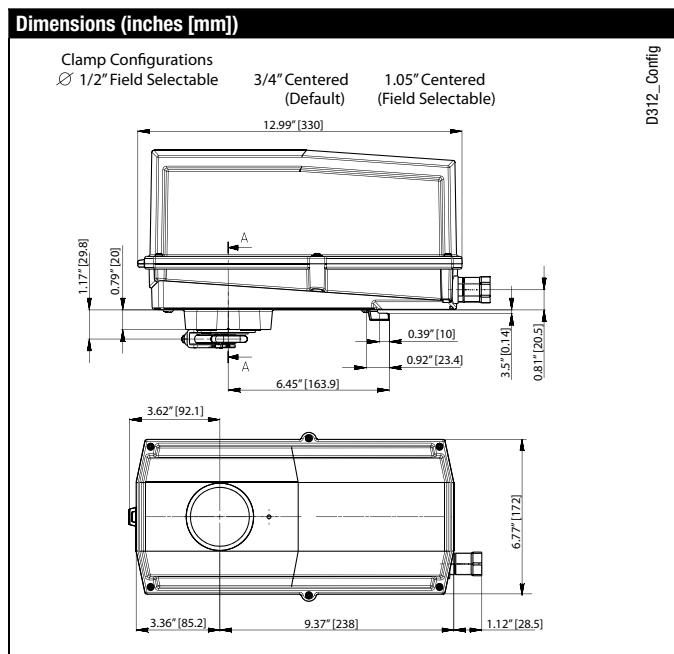
## Operation

The NFB24-MFT N4(H), NFX24-MFT N4 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 damper or valves mechanical stop and use this point for its zero position during normal control operations.

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 with out 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 NFB24-MFT N4(H), NFB24-MFT-S N4(H), NFX24-MFT N4 and NFX24-MFT-S N4 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.

**NOTE:** Refer to Multi-Function Technology documentation.



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### Accessories

Tool-06	8mm and 10 mm wrench
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland (needed for additional wires)

**NOTE:** When using NFB24-MFT N4(H), NFB24-MFT-S N4(H), NFX24-MFT N4, NFX24-MFT-S N4 actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### 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 proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω 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 counterclockwise 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. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

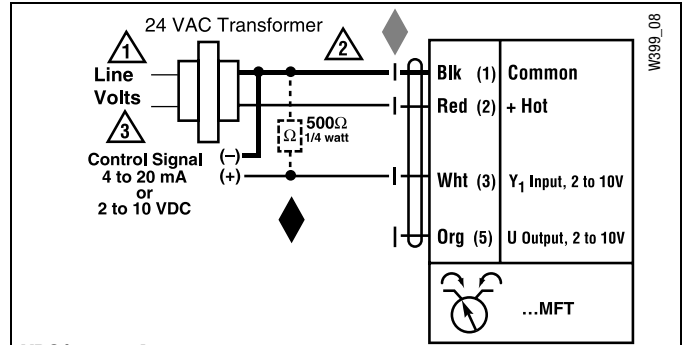
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible. Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 5 Contact closures A & B also can be triacs.
- 8 A & B should both be closed for triac source and open for triac sink.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

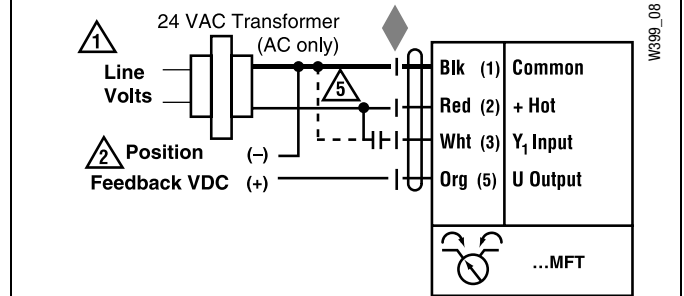
- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

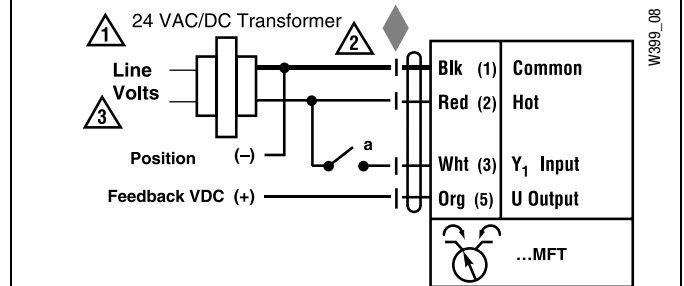
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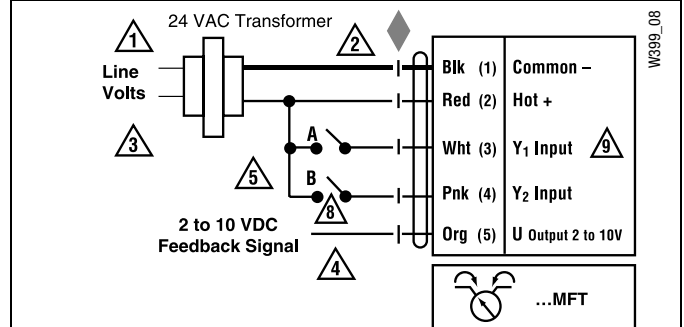
VDC/4-20 mA



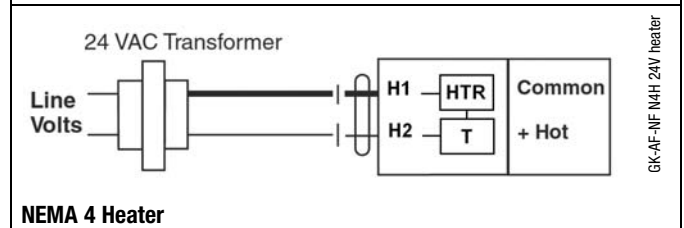
PWM



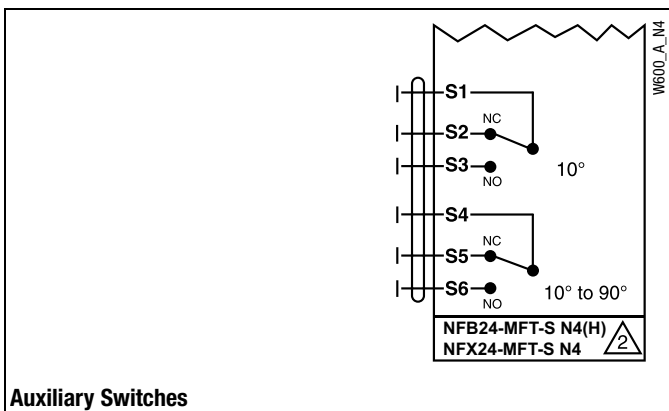
On/Off Control



Floating Point Control



NEMA 4 Heater



Auxiliary Switches

# Installation Instructions

## Quick-Mount Visual Instructions for Mechanical Installation

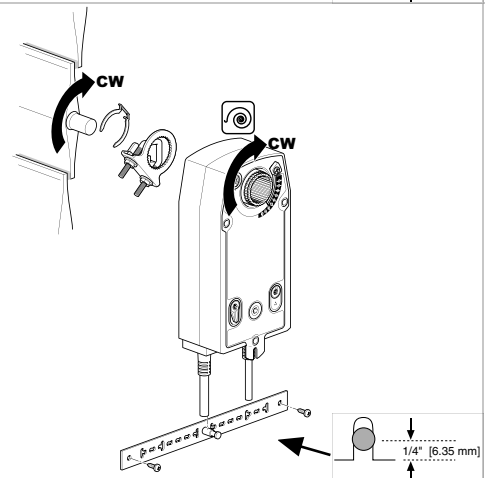
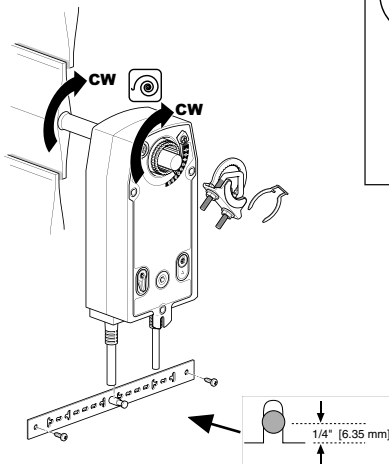
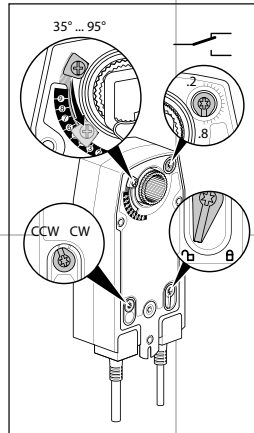
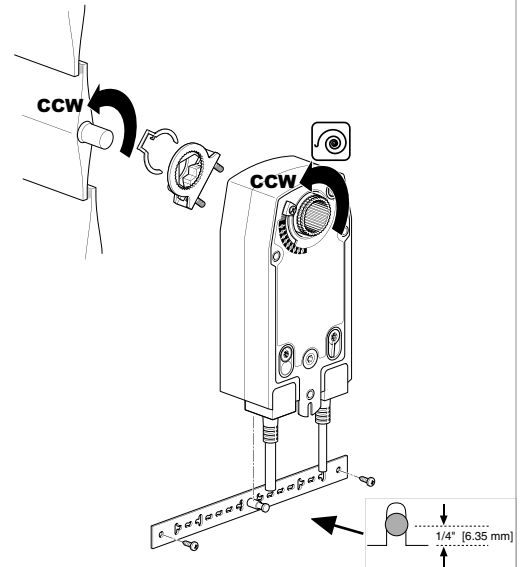
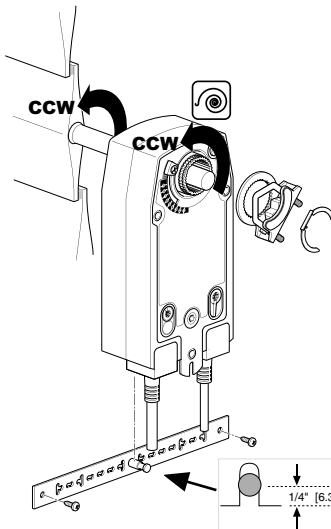
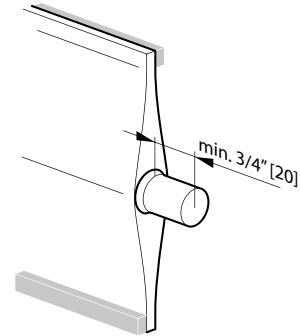
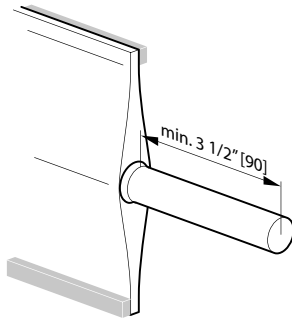


### Quick-Mount Visual Instructions

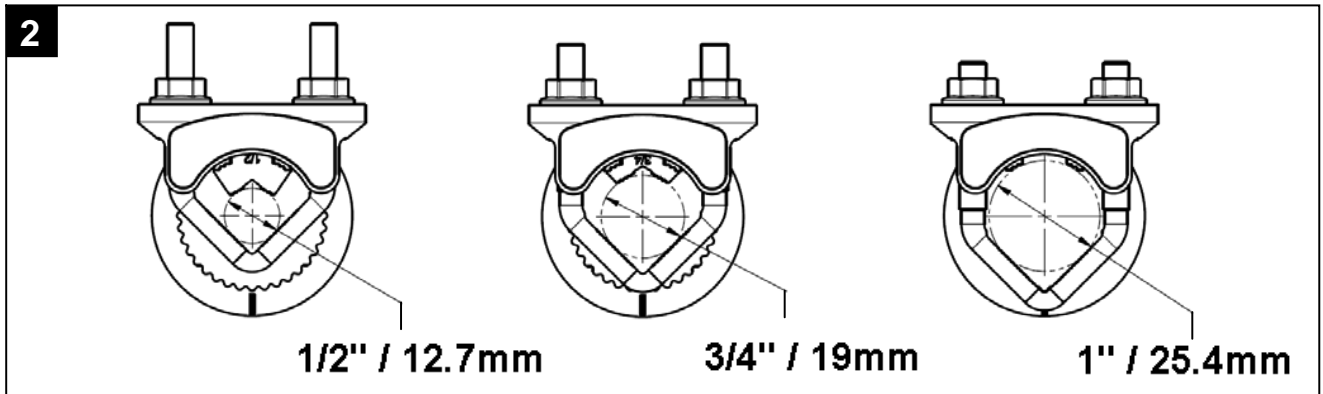
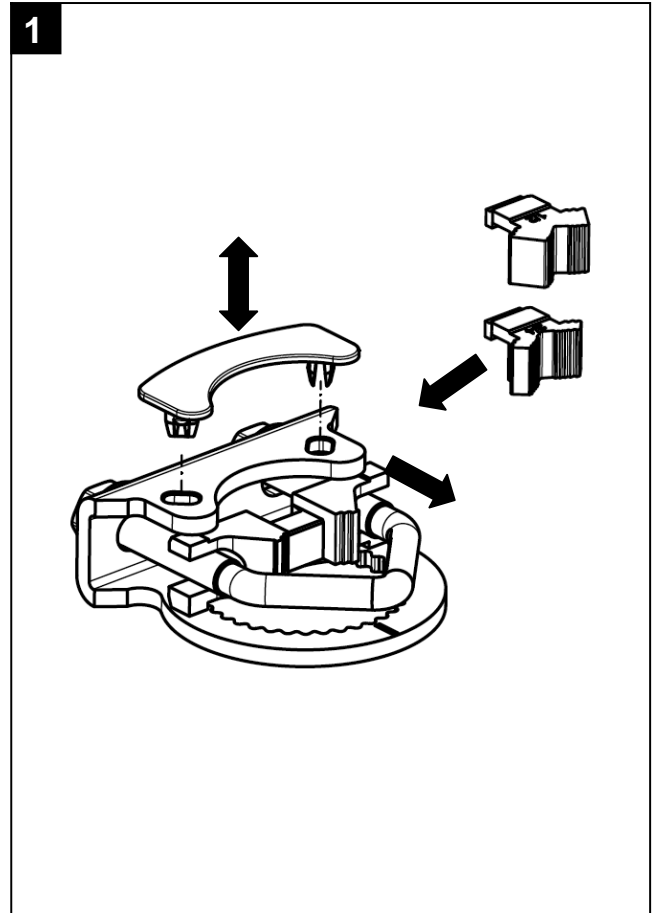
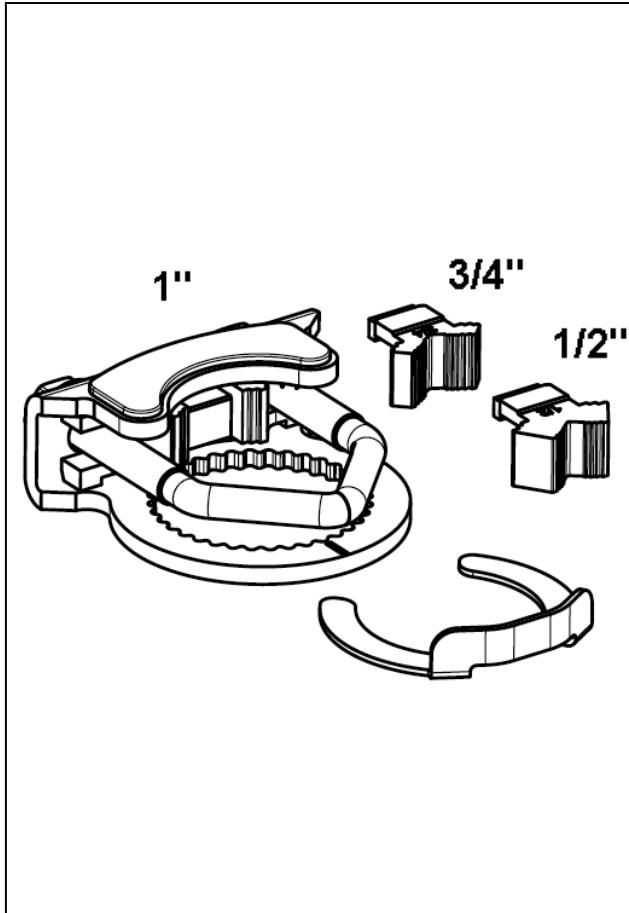
1. Rotate the damper to its failsafe position.  
If the shaft rotates counterclockwise, mount the "CCW" side of the actuator out.  
If it rotates clockwise, mount the actuator with the "CW" side out.
2. If the universal clamp is not on the correct side of the actuator, move it to the correct side for ease of installation.
3. Slide the actuator onto the shaft and tighten the nuts on the V-bolt with a 10mm wrench to 6-8 ft-lb of torque.
4. Slide the anti-rotation strap under the actuator so that it engages the slot at the base of the actuator. Secure the strap to the duct work with #8 self-tapping screws.






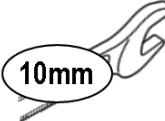
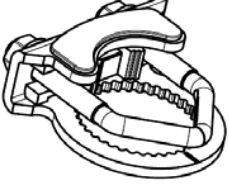
**NOTE:** Read the "Standard Mounting" instructions, on the next page, for more detailed information.

### Dimensions (Inches [mm])



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						 <b>10mm</b>	
<b>1/2"</b>	<b>mm</b>	<b>12.7</b>	<b>10 ... 19</b>	---	<b>14 ... 20</b>		
	<b>inch</b>	<b>1/2</b>	<b>2/5 ... 3/4</b>	---	<b>9/16 ... 3/4</b>		
<b>3/4"</b>	<b>mm</b>	<b>19</b>	<b>10 ... 22</b>	<b>10</b>	<b>14 ... 25.4</b>		
	<b>inch</b>	<b>3/4</b>	<b>2/5 ... 3/4</b>	<b>3/8</b>	<b>9/16 ... 1</b>		
<b>1"</b>	<b>mm</b>	<b>25.4</b>	<b>19 ... 26.7</b>	<b>12 ... 18</b>	---		
	<b>inch</b>	<b>1</b>	<b>3/4 ... 1.05</b>	<b>1/2 ... 11/16</b>	---		

**9 Nm / 80 in-lb**

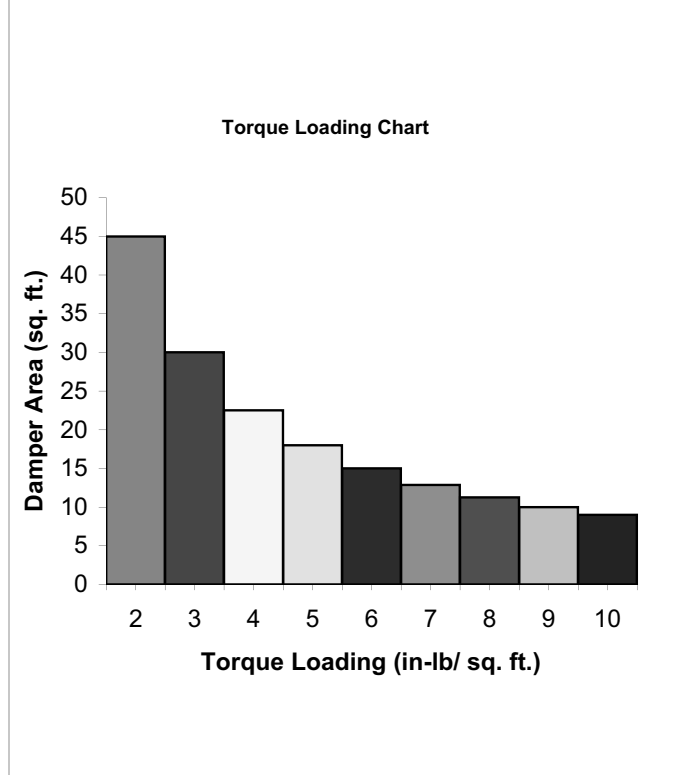
### Determining Torque Loading and Actuator Sizing

Damper torque loadings, used in selecting the correct size actuator, should be provided by the damper manufacturer. If this information is not available, the following general selection guidelines can be used.

Damper Type	Torque Loading
Opposed blade, without edge seals, for non-tight close-off applications	3 in-lb/sq. ft.
Parallel blade, without edge seals, for non-tight close-off applications	4 in-lb/sq. ft.
Opposed blade, with edge seals, for tight close-off applications	5 in-lb/sq. ft.
Parallel blade, with edge seals, for tight close-off applications	7 in-lb/sq. ft.

The above torque loadings will work for most applications with 1000 FPM face velocity. For applications between this criteria and 2500 FPM, the torque loading should be increased by a multiplier of 1.5. If the application calls for higher criteria up to 3000 FPM, use a multiplier of 2.0.

### Torque Loading Chart



### General Information

Belimo actuators should be mounted indoors in a dry, relatively clean environment free from corrosive fumes. If the actuator is to be mounted outdoors, a protective enclosure must be used to shield the actuator.

For new construction work, **order dampers with extended shafts**. Instruct the installing contractor to allow space for mounting and service of the Belimo actuator on the shaft. The damper shaft must extend at least 3 1/2" from the duct. If the shaft extends less than 3-1/2" or if an obstruction blocks access, the shaft can be extended with the AV 8-25 shaft extension accessory or the actuator may be mounted in its short shaft configuration.

### Mechanical Operation

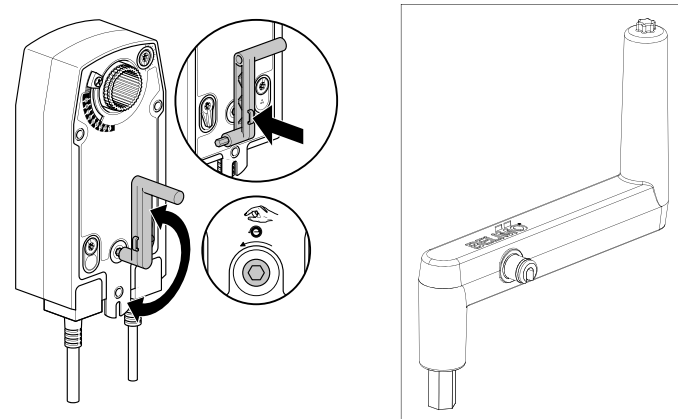
The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft. The NFB, NFX series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator. The NFB...-S, NFX...-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°.

### Automatic Airtight Dampers/Manual Override

The NFB, NFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The NFB, NFX has a unique built in manual positioning mechanism which allows the setting of any damper position within its 95° of rotation. A pre-tensioned spring automatically tightens the damper when power is applied to the actuator, compensating for damper seal deterioration.

The actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off. When power is applied, the manual mechanism is released and the actuator drives toward the full fail-safe position.



### Standard Mounting

**NOTE:** The NFB, NFX...series actuator is shipped with the manual override adjusted for a +5° position at the universal clamp (not at full fail-safe, 0°). This allows for automatic compression of damper blade seals when the actuator is in use, providing tight shut-off. This assumes that the damper is to have tight shut-off at the fail-safe position. If tight close-off is desired at the opposite direction from fail-safe, the manual override should be released so the actuator can go to the full fail-safe position. See the manual override instructions.

1. Manually move the damper to the fail-safe position (usually closed). If the shaft rotated counterclockwise (↺), this is a CCW installation. If the shaft rotated clockwise (↻), this is a CW installation. In a CCW installation, the actuator side marked "CCW" faces out, while in a CW installation, the side marked "CW" faces out. All other steps are identical.
2. The actuator is usually shipped with the universal clamp mounted to the "CCW" side of the actuator. To test for adequate shaft length, slide the actuator over the shaft with the side marked "CCW" (or the "CW" side if this is the side with the clamp). If the shaft extends at least 1/8" through the clamp, mount the actuator as follows. If not, go to the *Short Shaft Installation* section.
3. If the clamp is not on the correct side as determined in step #1, re-mount the clamp as follows. If it is on the correct side, proceed to step #5. Look at the

universal clamp. If you are mounting the actuator with the "CCW" side out, position the clamp so that the pointer section of the tab is pointing to 0° (see Figure C) and the spline pattern of the clamp mates with spline of the actuator. Slip the clamp over the spline. (Use the same procedure if the "CW" side is out.) If your application requires a mechanical minimum position, read the *Rotation Limiting, Mechanical Minimum Damper Position* section.

4. Lock the clamp to the actuator using the retaining clip.
5. Verify that the damper is still in its full fail-safe position.
6. Slide the actuator over the shaft.
7. Position the actuator in the desired location.
8. Tighten the two nuts on the clamp using a 10mm wrench or socket using 6-8 ft-lb of torque.
9. Slip the stud of the anti rotation strap into the slot at the base of the actuator. The stud should be positioned approximately 1/16 of an inch from the closed end of the slot. Bend the strap as needed to reach the duct. Attach the strap to the duct with #8 self tapping screws.

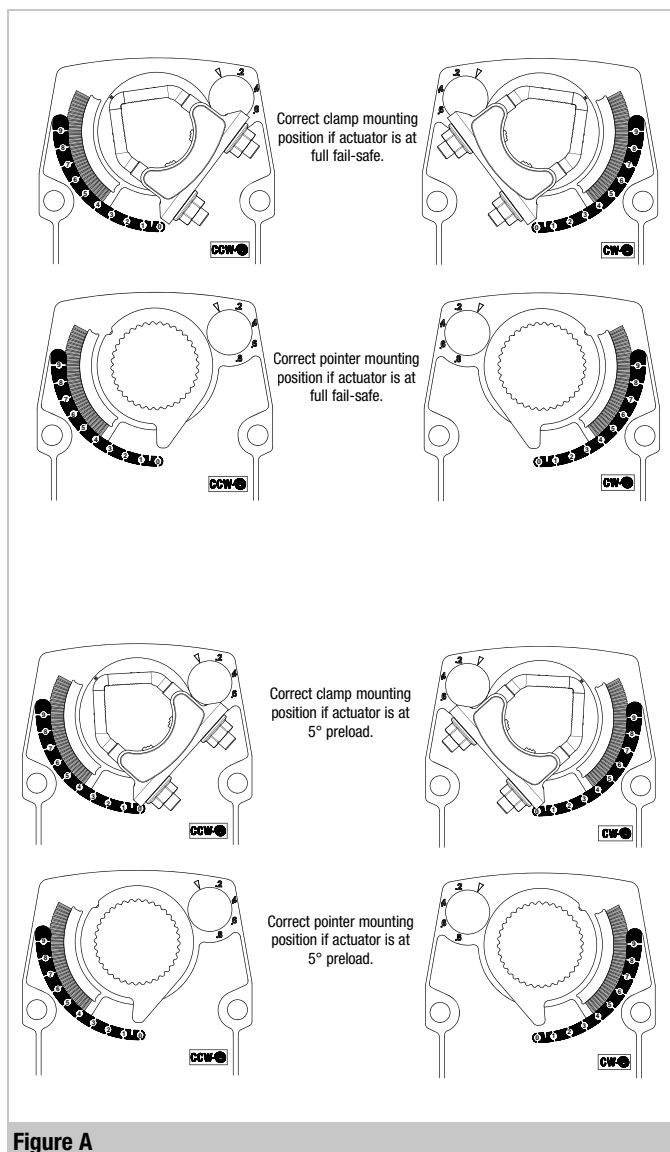
#### Short Shaft Installation

If the shaft extends at least 3/4" from the duct, follow these steps:

1. Determine the best orientation for the universal clamp on the back of the actuator. The best location would be where you have the easiest access to the V bolt nuts on the clamp.
2. Engage the clamp to the actuator as close as possible to the determined location.
3. Lock the clamp in place using the remaining retainer clip.
4. Verify that the damper is still in its full fail-safe position.
5. Slide the actuator over the shaft.
6. Position the actuator in the desired location.
7. Tighten the two nuts on the clamp using a 10mm wrench or socket using 6-8 ft-lb of torque.
8. Slip the stud of the anti-rotation strap into the slot at the base of the actuator. The stud should be positioned approximately 1/16 of an inch from the closed end of the slot. Bend the strap as needed to reach the duct. Attach the strap to the duct with #8 self tapping screws.
9. If damper position indication is required, use the optional IND-AFB pointer. See **Figure A**.

#### Jackshaft Installation

The NFB, NFX... series actuator is designed for use with jackshafts up to 1.05" in diameter. In most applications, the NFB, NFX actuator may be mounted in the same manner as a standard damper shaft application. If more torque is required than one NFB, NFX actuator can provide, refer to AFB, AFX or AF series actuators.



**Figure A**

### Rotation Limitation

The angle of rotation limiter, which is built into the actuator, is used in conjunction with the tab on the universal clamp or IND-AFB position indicator. In order to function properly, the clamp or indicator must be mounted correctly.

See **Figure A**.

The rotation limiter may not work in certain mounting orientations using the ZG-118 mounting bracket. Limiting the damper rotation must be accomplished by adjusting the crank arm linkage.

The built-in rotation limiter may be used in 2 ways to control the rotational output of the NFB, NFX series actuator. One use is in the application where a damper has a designed rotation less than 90°. An example would be a 45° or 60° rotating damper. The other application would be to set a minimum damper position which can be easily set or changed without having to remove the actuator from the damper.

### Damper Rotation Limiting

1. Determine the amount of damper rotation required.
2. Locate the Angle of Rotation Limiter on the actuator **Figure B**.
3. Position the limiter to the desired position, making sure the locating "teeth" on the limiter are engaged into the locating holes on the actuator.
4. Fasten the limiter by screwing the attached screw.
5. Test the damper rotation either manually with the manual crank or apply power and if required, a control signal. Re-adjust if necessary.

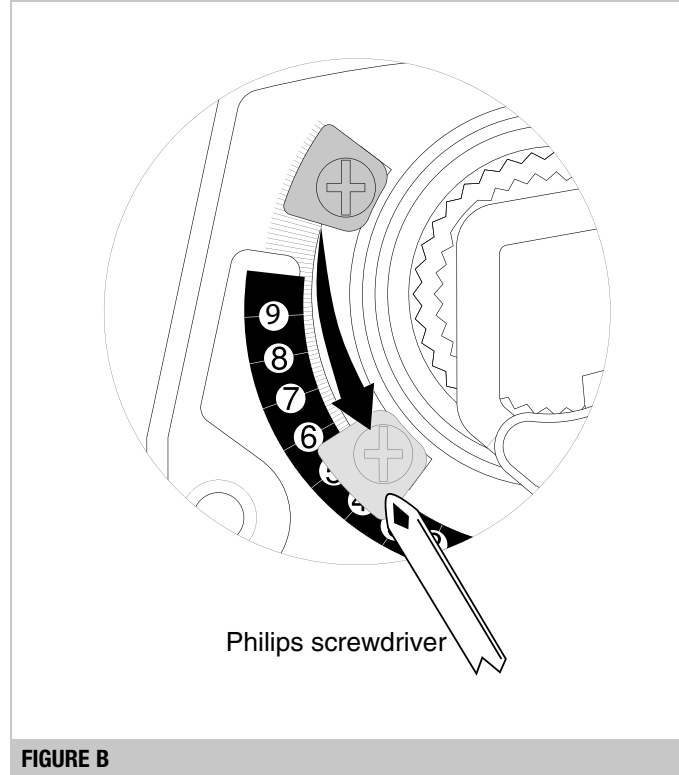
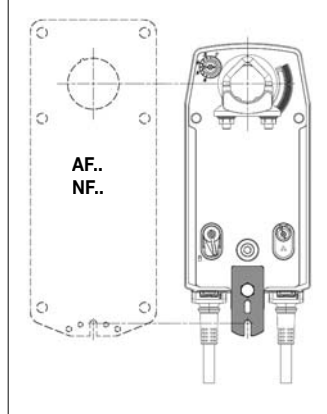
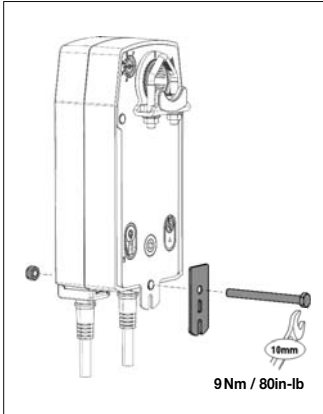


FIGURE B

### Z-AF For Replacing AF and NF Actuators

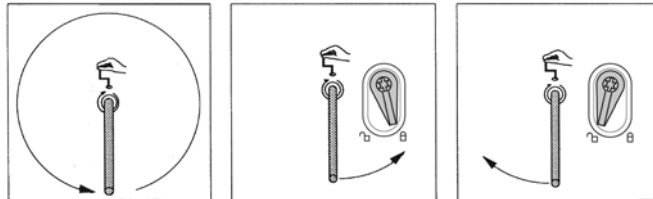


### Manual Override

The NFB, NFX series actuators can be manually positioned to ease installation or for emergency positioning.

1. The manual override will only work if no power is available to the actuator.
2. Insert the manual crank (shipped with the actuator) into the hexagon hole located on either side of the actuator. An illustration, located on the label, shows the location.
3. Turn the crank in the direction shown on the label (clockwise on the "CW" side, counterclockwise on the "CCW" side). It will take approximately 23 revolutions to rotate the full 95° of rotation.
4. To lock the actuator in the required position, flip the switch to the locked position that is located to the right of the crank on the CCW side of the actuator (left of the crank on the CW side).
5. The manual override may be disengaged in 2 ways.
  - Flip the switch to the unlocked position and the actuator will go to its fail-safe position.
  - Apply power to wire 1 and 2. The actuator will automatically disengage the override function and will go to the "on" position in the case of the On/Off versions. Or, in the case of the proportional versions, go to the 0 signal position and then go to the position corresponding to the control signal. The actuator will now work normally.

#### CCW Side Example:



#### Winding the damper actuator

- insert crank handle
- turn handle in direction of arrow

#### Locking the damper actuator

- Flip the lock switch to the position pointing to the "locked" symbol

#### Unlocking the damper actuator (2 options)

- Flip the lock switch to the position pointing to the "unlocked" symbol.
- Remote control by supplying power to the unit for > than 3 sec.

### Testing the installation Without Power

The actuator/damper installation may be tested without power at the actuator. Refer to the manual positioning section of the instructions. Move the damper to its full non-fail-safe position using the manual crank. Disengage the manual position mechanism and have the damper go to full fail-safe position. Correct any mechanical problems and retest.

### Auxiliary Switches

The NFB, NFX series actuators may be ordered with 2 built-in SPDT auxiliary switches used for safety interfacing or signaling, for example, for fan start-up. The switch position near the fail-safe position is fixed at 10°. The other is adjustable between 10° and 90° of rotation. The crank that is supplied with the actuator is used to change the switch position.

#### SWITCH RATING

Voltage	Resistive Load	Inductive Load
120 VAC	3A	1.03A
250 VAC	3A	0.5A

Two methods may be used to adjust the switching point of the adjustable switch.

#### Method 1 - See Figure F

1. The actuator must be in its fail-safe position.
2. Insert the crank handle into the torx shaped hole located in the center of the adjustable switch pointer.
3. Gently rotate the crank until the switch pointer is at the desired switch point in degrees as shown.

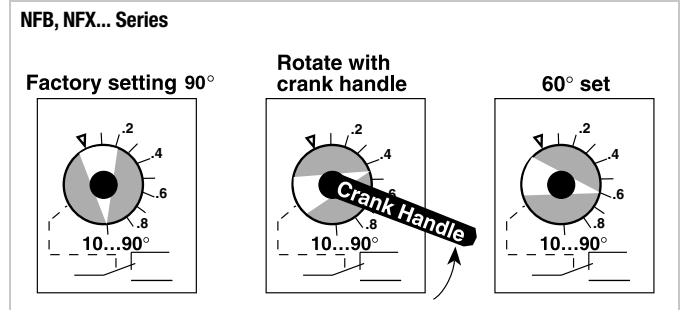


FIGURE F

#### Method 2 - See Figure G

1. Position the damper to the point at which you want the switch to activate. This may be done by using the manual override or by providing the appropriate proportional signal to NFB24, NFX24... modulating type actuator. The position of the switch pointer is not important during this step
2. Insert the crank into the torx shaped hole located in the center of the adjustable switch pointer.
3. Gently rotate the switch pointer to just past the switch point indicating arrow as shown.

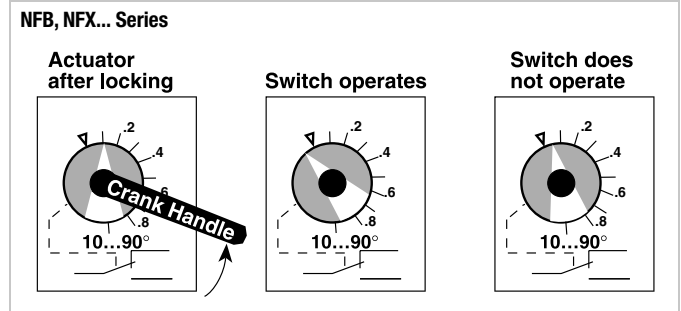


FIGURE G

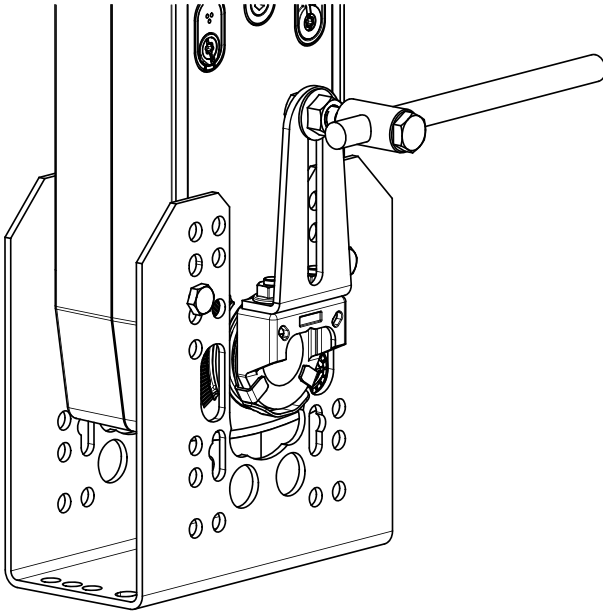
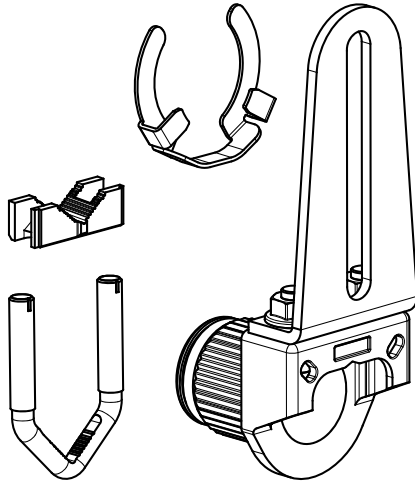
# KH-AFB Crank arm

## Including Retaining Ring

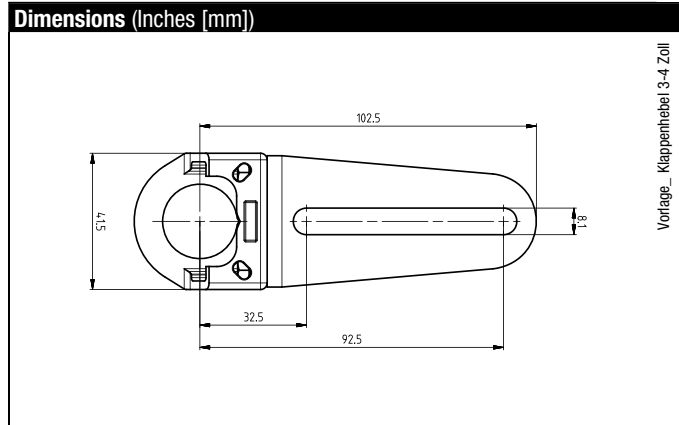
**CAUTION:** The retaining clip supplied with the clamp is **not** used to mount the KH-AFB crank arm.

The KH-AFB crank arm is used in non-direct coupled mounting applications. The KH-AFB may also be used to simultaneously direct couple to a damper shaft and provide an additional crank arm connection to a second damper.

**KH-AFB** For round shafts up to 3/4" or square shafts up to 5/8"



**KH-AFB non-direct mounting with ZG-118 mounting bracket**





### General

The NFB, NFX series actuators utilize both DC Motors and brushless DC motor technology. The NFB, NFX uses this motor in conjunction with an Application Specific Integrated Circuit (ASIC). In the On/Off versions of the NFB and NFX, the ASIC monitors and controls the actuator's rotation and a digital rotation sensing function to prevent damage to the actuator. The NFB24, NFX24... modulates type actuators incorporate a built in microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and knows the actuator's exact zero position.

### Brushless DC Motor Operation

Belimo's brushless DC motor spins by reversing the poles of stationary electromagnets housed inside of a rotating permanent magnet. The electromagnetic poles are switched by a special ASIC circuit developed by Belimo. Unlike the conventional DC motor, there are no brushes to wear or commutators to foul.

### Overload Protection

The NFB, NFX series actuators are protected from overload at all angles of rotation. The ASIC circuit constantly monitors the rotation of the DC motor inside the actuator and stops the pulses to the motor when it senses a stall condition. The DC motor remains energized and produces full rated torque to the load. This helps ensure that dampers are fully closed and that edge and blade seals are always properly compressed.

### Motor Position Detection

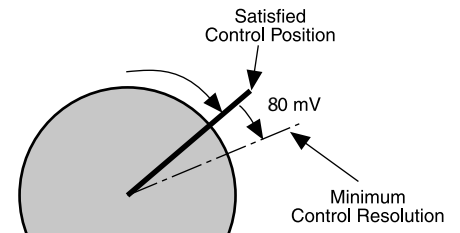
Belimo brushless DC motors eliminate the need for potentiometers for positioning in modulating type actuators. Inside the motor are three "Hall Effect" sensors. These sensors detect the spinning rotor and send pulses to the microprocessor which counts the pulses and calculates the position to within 1/3 of a revolution of the motor.

### Control Accuracy and Stability

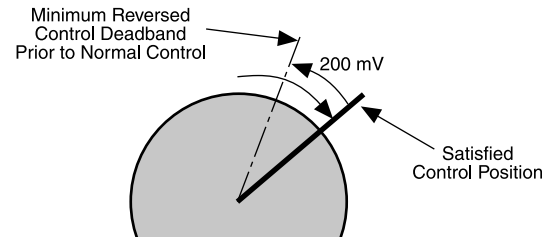
-SR and MFT NF actuators have built-in brushless DC motors which provide better accuracy and longer service life.

The NFB24-MFT, NFX24-MFT actuators are designed with a unique non-symmetrical deadband. The actuator follows an increasing or decreasing control signal with a 80 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 200 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**NF Actuator responds to an 80 mV signal when not changing direction from stop**



**NF Actuator responds to a 200 mV signal when reversing direction from stop position.**



**Note:** Resolution is a percentage of operating range. 1% in one direction, 2.5% when changing direction. 2-10 VDC control example shown above.

# Installation Instructions

## General Wiring Instructions



**WARNING** The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

**Always read the controller manufacturer's installation literature carefully before making any connections.** Follow all instructions in this literature. If you have any questions, contact the controller manufacturer and/or Belimo.

### Transformers

The NFB24, NFX24...actuators require a 24 VAC class 2 transformer and draws a maximum of 10 VA per actuator. The actuator enclosure cannot be opened in the field, there are no parts or components to be replaced or repaired.

- EMC directive: 2004/108/EC
- Software class A: Mode of operation type 1
- Low voltage directive: 2006/95/EC

**CAUTION:** It is good practice to power electronic or digital controllers from a separate power transformer than that used for actuators or other end devices. The power supply design in our actuators and other end devices use half wave rectification. Some controllers use full wave rectification. When these two different types of power supplies are connected to the same power transformer and the DC commons are connected together, a short circuit is created across one of the diodes in the full wave power supply, damaging the controller. Only use a single power transformer to power the controller and actuator if you know the controller power supply uses half wave rectification.

### Multiple Actuators, One Transformer

Multiple actuators may be powered from one transformer provided the following rules are followed:

1. The TOTAL current draw of the actuators (VA rating) is less than or equal to the rating of the transformer.
2. Polarity on the secondary of the transformer is strictly followed. *This means that all No. 1 wires from all actuators are connected to the common leg on the transformer and all No. 2 wires from all actuators are connected to the hotleg.* Mixing wire No. 1 & 2 on one leg of the transformer will result in erratic operation or failure of the actuator and/or controls.

### Multiple Actuators, Multiple Transformers

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

1. The transformers are properly sized.
2. All No. 1 wires from all actuators are tied together and tied to the negative leg of the control signal. See wiring diagram.

### Wire Length for NFB..., NFX... Actuators

Keep power wire runs below the lengths listed in the **Figure H**. If more than one actuator is powered from the same wire run, divide the allowable wire length by the number of actuators to determine the maximum run to any single actuator.

Example: 3 actuators, 16 Ga wire  
 $350 \text{ Ft} \div 3 \text{ Actuators} = 117 \text{ Ft. Maximum wire run}$

MAXIMUM WIRE LENGTH FOR 10VA			
Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	900 Ft.	18 Ga	220 Ft.
14 Ga	550 Ft.	20 Ga	120 Ft.
16 Ga	350 Ft.	22 Ga	60 Ft.

**FIGURE H**

### Wire Type and Wire Installation Tips

For most installations, 18 or 16 Ga. cable works well with the NFB24, NFX24...actuators. Use code-approved wire nuts, terminal strips or solderless connectors where wires are joined. It is good practice to run control wires unspliced from the actuator to the controller. If splices are unavoidable, make sure the splice can be reached for possible maintenance. Tape and/or wire-tie the splice to reduce the possibility of the splice being inadvertently pulled apart.

The NFB24, NFX24... proportional actuators have a digital circuit that is designed to ignore most unwanted input signals (pickup). In some situations the pickup may be severe enough to cause erratic running of the actuator. For example, a large inductive load (high voltage AC wires, motors, etc.) running near the power or control wiring may cause excessive pickup. To solve this problem, make one or more of the following changes:

1. Run the wire in metallic conduit.
2. Re-route the wiring away from the source of pickup.
3. Use shielded wire (Belden 8760 or equal). Ground the shield to an earth ground. **Do not** connect it to the actuator common.

### Initialization of the NFB24-MFT, NFX24-MFT

When power is initially applied, the actuator will first release its manual preload position (This assumes a manual position has been set). The actuator will then rotate to the full fail-safe position. At this point the microprocessor recognizes that the actuator is at full fail-safe and uses this position as the base for all of its position calculations. The microprocessor will retain the initialized zero during short power failures of up to 20 seconds. The NFB24-MFT and NFX24-MFT will also return to its position prior to the 20-second-or-less power loss. For power failures greater than 20 seconds, the actuator would naturally return to its full fail-safe position prior to the microprocessor losing its memory. The actuator will also re-initialize if the manual position mechanism is used.

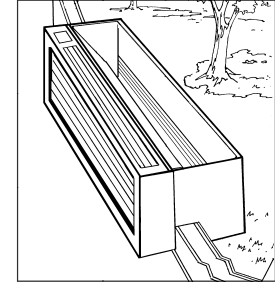
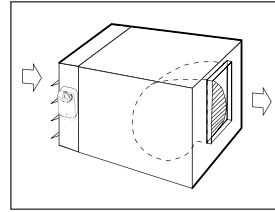
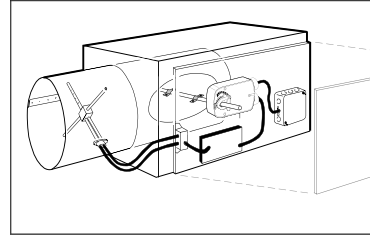
NFB24-MFT, NFX24-MFT + P-100... Electrical Check-Out Procedure				
STEP	Procedure	Expected Response	Gives Expected Response Go To Step...	Does Not Give Expected Response Go To Step...
1.	Control signal is applied to actuator.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	No response at all <b>Step 2.</b> Operation is reversed <b>Step 3.</b> Does not drive toward "Control Signal Position" <b>Step 4.</b>
2.	Check power wiring. Correct any problems. <b>See Note 1.</b>	Power supply rating should be the total power requirement of the actuator(s). Minimum voltage of 19.2 VAC or 21.6 VDC.	Power wiring corrected, actuator begins to drive <b>Step 1.</b>	Power wiring corrected, actuator still does not drive <b>Step 4.</b>
3.	Turn reversing switch to the correct position. Make sure the switch is turned all the way left or right.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	Does not drive toward "Control Signal Position" <b>Step 4.</b>
4.	Make sure the control signal positive (+) is connected to Wire No. 3 and control signal negative (-) is connected to wire No. 1. Most control problems are caused by reversing these two wires. Verify that the reversing switch is all the way CCW or CW.	Drives to "Control Signal" position.	Actuator operates properly <b>Step 7.</b>	<b>Step 5.</b>
5.	Check input signal with a digital volt meter (DVM). Make sure the input is within the range of the actuator. <b>NOTE:</b> The input signal must be above the 2 VDC or 4 mA to have the actuator move.	Input voltage or current should be $\pm 1\%$ of what controller's adjustment or programming indicates.	Controller output (actuator input) is correct. Input Polarity Correct <b>Step 6.</b>	Reprogram, adjust repair or replace controller as needed <b>Step 1.</b>
6.	Check damper torque requirement.	Torque requirement is actuator's minimum torque.	Defective Actuator. Replace Actuator - <b>See Note 2.</b>	Recalculate actuator requirement and correct installation.
7.	Actuator works properly. Test controller by following controller manufacturer's instructions.			

- NOTE 1** Check that the transformer(s) are sized properly.
- If a common transformer is used, make sure that polarity is observed on the secondary. This means connect all No. 1 wires to one leg of the transformer and all No. 2 wires to the other leg of the transformer.
  - If multiple transformers are used with one control signal, make sure all No. 1 wires are tied together and tied to control signal negative (-).
  - Controllers and actuators must have separate 24 VAC/VDC power sources.
- NOTE 2** If failure occurs within 5 years from original purchase date, notify Belimo and give details of the application.

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## Minimum 35 in-lb Torque

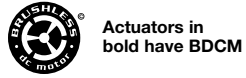
- For damper areas up to 8.5 sq-ft\*



## Applications

Cost effective quality and performance for a range of applications including:

- Classroom Unit Ventilators
- Fan/Coil Units
- Airhandlers
- VAV Terminal Units
- Economizer Units
- Control Dampers



## LF Series - At A Glance

	<i>LF24 US (p. 133)</i>	<i>LF24-S US (p. 133)</i>	<i>LF120 US (p. 135)</i>	<i>LF120-S US (p. 135)</i>	<i>LF230 US (p. 135)</i>	<i>LF230-S US (p. 135)</i>	<i>LF24-3- US (p. 137)</i>	<i>LF24-3-S US (p. 137)</i>	<i>LF24-3-R US (p. 139)</i>	<i>LF24-3-S US (p. 139)</i>	<i>LF24-SR US (p. 141)</i>	<i>LF24-SR-S US (p. 141)</i>	<i>LF24-SR-E US (p. 143)</i>	<i>LF24-ECON-R03 US (p. 147)</i>	<i>LF24-ECON-R10 US (p. 147)</i>	<i>LF24-MFT US (p. 151)</i>	<i>LF24-MFT-S US (p. 151)</i>	<i>LF24-MFT-20 US (p. 153)</i>	<i>LF24-MFT-20-S US (p. 153)</i>	
Torque:	35 in-lb	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Power supply:	24 VAC/DC	•	•				•	•	•	•	•	•	•	•	•	•	•	•	•	•
	120 VAC			•	•															
	230 VAC					•	•													
Control signal:	On/Off	•	•	•	•	•														
	floating point						•	•	•	•										
	proportional 2 to 10 VDC										•	•	•							
	6 to 9 VDC																	•	•	
	multi-function**															•	•			
	3kΩ NTC type 10 thermistor													•						
	10kΩ NTC type 7 thermistor														•					
Feedback:	2 to 10 VDC										•	•	•	•	•					
	VDC variable**															•	•	•	•	
Auxiliary output, 20 VDC (to power controller)																		•	•	
Running time motor:	<40 to 75 seconds	•	•	•	•	•														
	150 seconds constant						•	•			•	•	•							
	90 seconds constant								•	•										
	95 seconds constant													•	•					
	adj. 75 to 300 seconds***															•	•	•	•	
	spring: <25 seconds	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
External direction of rotation switch							•	•	•	•	•	•	•	•	•	•	•	•	•	•
Plenum rated cable, 18 GA									•	•	•	•	•	•	•					
Conduit fitting	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Appliance cable, 18 GA	•	•	•	•	•	•			•	•	•	•	•	•	•					
Built-in auxiliary switch		•	•	•	•	•	•	•	•	•	•	•	•	•	•					

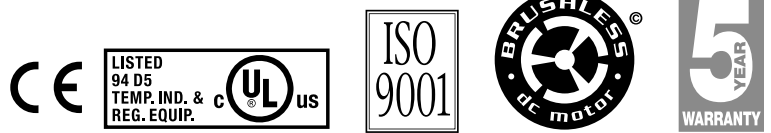
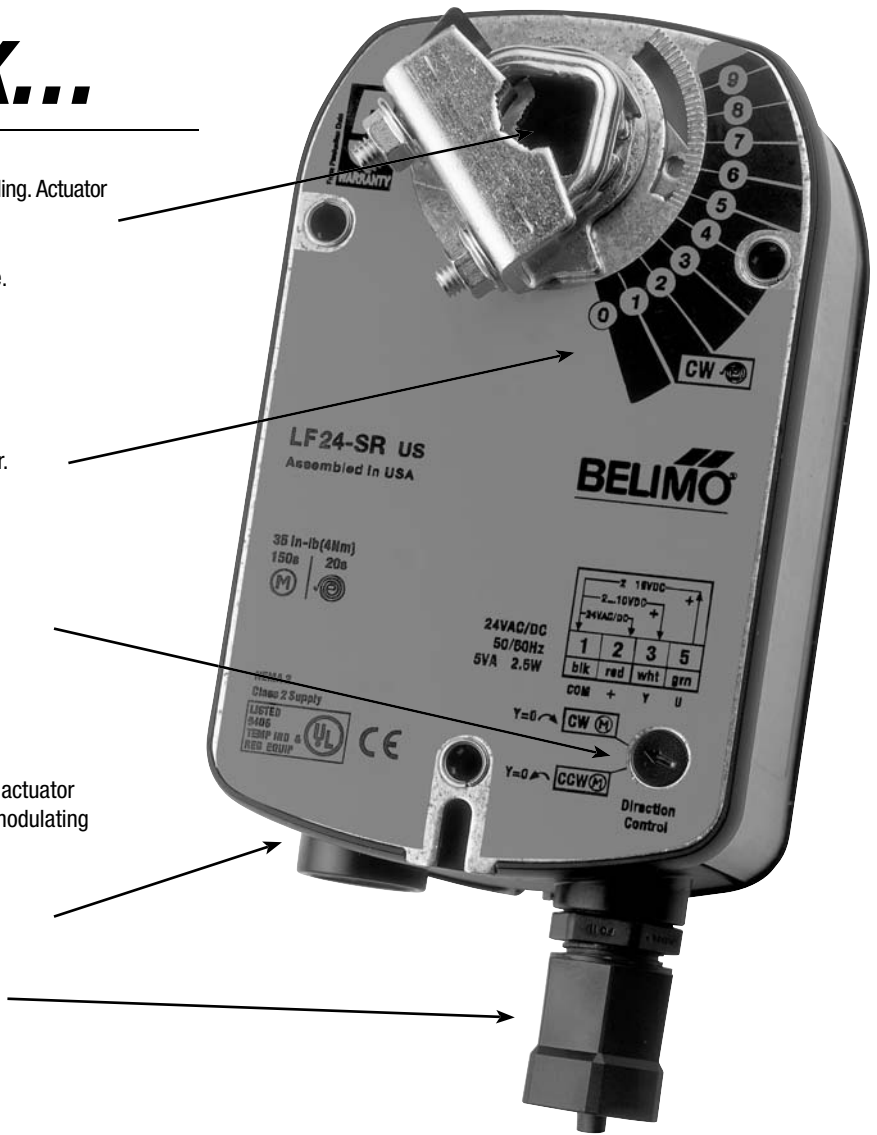
LF24-SR-E US operation.....(p. 145)      Installation instructions.....(p. 155-159)  
 General wiring .....(p. 160)              Start-up and checkout.....(p. 161)

\*Based on 4 in-lb/ft² damper torque loading. Parallel blade. No edge seals. \*\*Default 2 to 10 VDC. \*\*\*Default 150 seconds.

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# A CLOSER LOOK...

- Cut labor costs with (10 min. installation) simple direct coupling. Actuator Centers on 1/2" shaft (K6-1, 3/4" clamp optional).
- True mechanical spring return – the most reliable failsafe.
- Mount for clockwise or counterclockwise fail-safe.
- Easy-to-adjust mechanical stop to limit damper rotation.
- Check damper position easily with clear position indicator.
- Don't worry about actuator burn-out. Belimo is overload-proof throughout rotation.
- Need to change control direction? Do it easily with a simple switch (modulating actuators).
- Built-in auxiliary switch is easy to use, offers feedback or signal for additional device.
- Microprocessor-controlled brushless DC motor increases actuator life span and reliability, provides constant running time (modulating actuators).
- Rugged metal housing withstands rough handling in the mechanical room.
- 3 ft. cable and conduit connector eases installation.



## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

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# LF24(-S) US

On/Off, Spring Return, 24V



Technical Data		LF24(-S) US
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	5 W
	holding	2.5 W
Transformer sizing		7 VA (class 2 power source)
Electrical connection		3 ft, 18 GA appliance cable (LF24-S US has 2 cables)
Overload protection		electronic throughout 0 to 95° rotation
Angle of rotation		max. 95°, adjust. with mechanical stop
Torque		35 in-lb [4 Nm]
Direction of rotation		reversible with cw/ccw mounting
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Running time	motor	< 40 to 75 sec
(nominal)	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP54
Housing material		zinc coated steel
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level (max)	running	< 50 db (A)
	spring return	62 db (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight	LF24	3.1 lbs (1.40 kg)
	LF24-S	3.2 lbs (1.45 kg)
<b>LF24-S US</b>		
Auxiliary switch		1 x SPDT 3A (0.5A) @ 250 VAC, UL Approved adjustable 0° to 95° (double insulated)

**Torque min. 35 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, digital output, or a manual switch.

The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

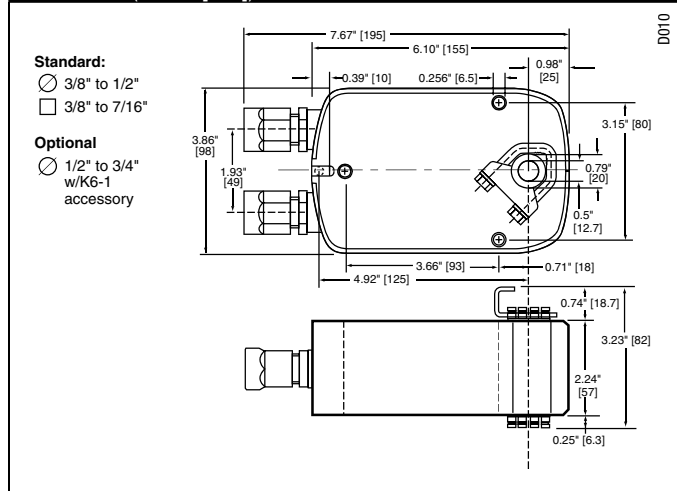
The LF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

The LF24-S US version is provided with one built in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°. The auxiliary switch in the LF24-S is double insulated so an electrical ground connection is not necessary.

## Dimensions (Inches [mm])



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Accessories	
AV 10-18	Shaft extension (K6-1 is required)
IND-LF	Damper position indicator
K6-1	Universal clamp for up to 3/4" diameter shafts
KH-LF	Crank arm for up to 1/2" round shaft
Tool-06	8mm and 10 mm wrench
ZG-LF2	Crank arm adaptor kit for LF
ZG-112	Mounting bracket for Honeywell Mod IV, M6415 type actuators, and new installations
ZG-LF112	Crank arm adaptor kit for Honeywell Mod IV, M6415 type actuators, and new installations
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing

**NOTE:** When using LF24 US and LF24-S US actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### Typical Specification

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 3/4" diameter and center a 1/2" shaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators with auxiliary switch 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, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

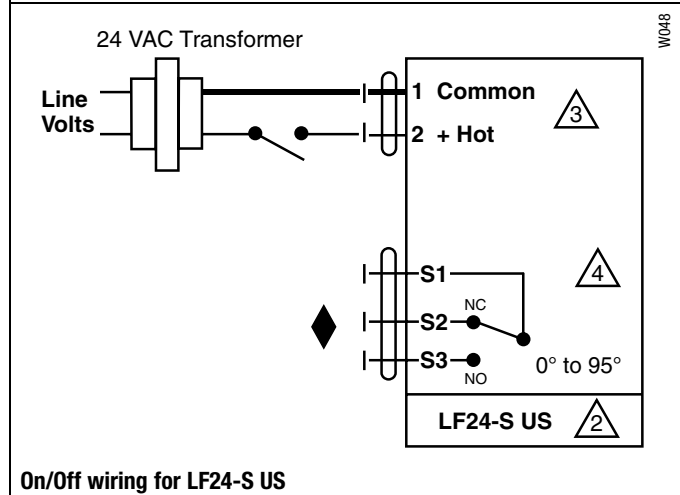
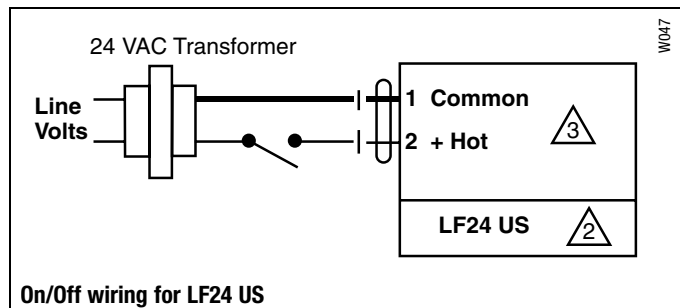
### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., LF24-S US incorporates a built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.

#### 📄 APPLICATION NOTES

- ◆ Meets cULus requirements without the need of an electrical ground connection.
- ⚠️ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LF120(-S) US / LF230(-S) US

On/Off, Spring Return, 120/230 VAC



Technical Data		LF120(-S) US / LF230(-S) US
Power supply	LF120(-S) US LF230(-S) US	120 VAC ± 10% 50/60 Hz 230 VAC ± 10% 50/60 Hz
Power consumption		
	LF120(-S) US	running 5.5 W holding 3.5 W
	LF230(-S) US	running 5 W holding 3 W
Transformer sizing		
	LF120(-S) US LF230(-S) US	7.5 VA 7 VA
Electrical connection		3 ft, 18 GA appliance cable (-S models have 2 cables) 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Electrical protection		actuators are double insulated
Angle of rotation		max 95°, adjust. with mechanical stop
Torque		35 in-lb [4 Nm] constant torque
Direction of rotation		reversible with cw/ccw mounting
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Electrical protection		actuators are double insulated
Running time (nominal)	motor spring	< 40 to 75 sec < 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP54
Housing material		zinc coated steel
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level (max)	running spring return	< 50 db (A) 62 db (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight	LF120/230 LF120/230-S	3.4 lbs (1.54 kg) 3.5 lbs (1.60 kg)
<b>LF120-S US / LF230-S US</b>		
Auxiliary switch		1 x SPDT 3A (0.5A) @ 250 VAC, UL Approved adjustable 0° to 95°

**Torque min. 35 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

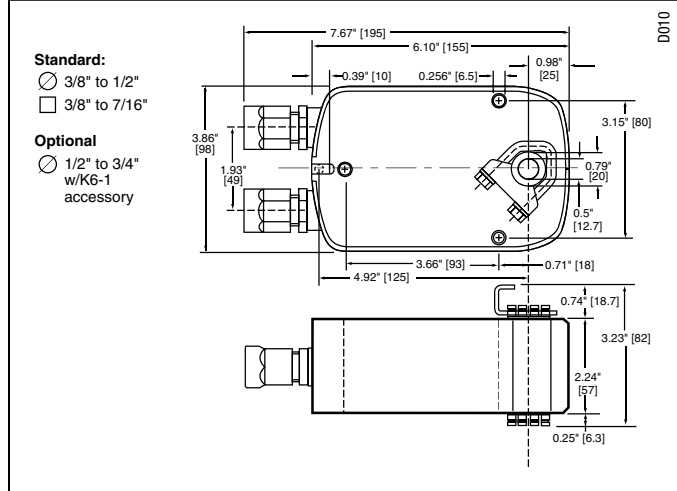
The LF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode. The actuator is double insulated so an electrical ground connection is not necessary.

The LF120-S US and LF230-S US versions are provided with one built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°.

## Dimensions (Inches [mm])



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**Accessories**

AV 10-18	Shaft extension (K6-1 is required)
IND-LF	Damper position indicator
K6-1	Universal clamp for up to 3/4" diameter shafts
KH-LF	Crank arm for up to 1/2" round shaft
Tool-06	8mm and 10 mm wrench
ZG-LF2	Crank arm adaptor kit for LF
ZG-112	Mounting bracket for Honeywell Mod IV, M6415 type actuators, and new installations
ZG-LF112	Crank arm adaptor kit for Honeywell Mod IV, M6415 type actuators, and new installations
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing

**NOTE:** When using LF120/230 US & LF120-S/230-S US actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 3/4" diameter and center a 1/2" shaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators 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, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

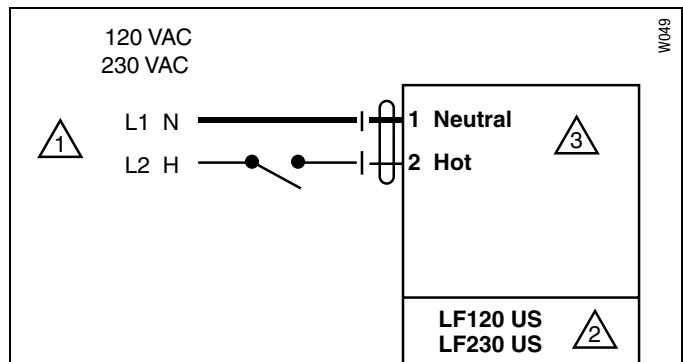
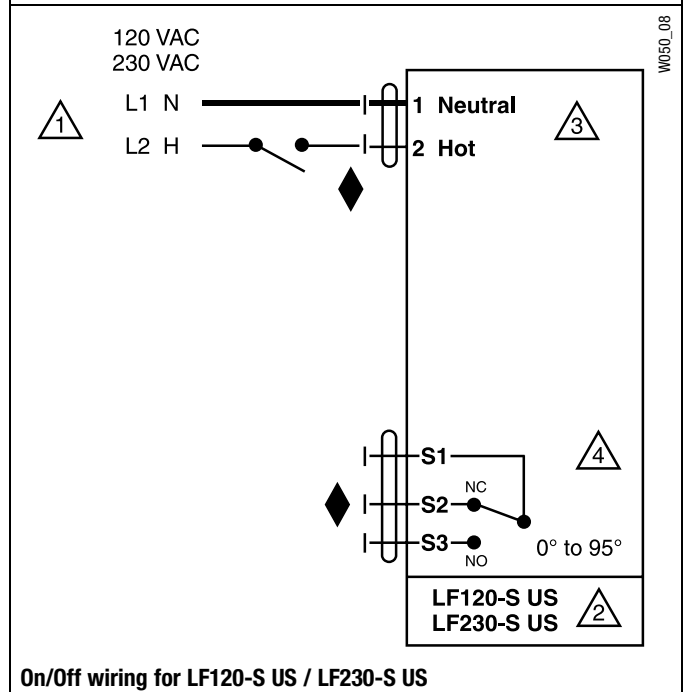
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 No ground connection is required.
- 4 For end position indication, interlock control, fan startup, etc., LF120-S US and LF230-S US incorporate one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.

**APPLICATION NOTES**

◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.


**On/Off wiring for LF120 US / LF230 US**

**On/Off wiring for LF120-S US / LF230-S US**

# LF24-3(-S) US

On/Off, Floating Point, Spring Return, 24V



Technical Data		LF24-3(-S) US
Power supply		24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	running	2.5 W
	holding	1 W
Transformer sizing		5 VA (class 2 power source)
Electrical connection		
	LF24-3 US	3 ft, plenum rated cable 1/2" conduit connector
	LF24-3-S US	3 ft, 18 GA appliance cables (2) 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Input impedance		1000 $\Omega$ (0.6w) control inputs
Angle of rotation		max. 95°, adjust. with mechanical stop
Torque		35 in-lb [4 Nm]
Direction of rotation		
	spring	reversible with cw/ccw mounting
	motor	reversible with built-in switch
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Running time	motor	150 sec constant, independent of load
	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 /IP54
Housing material		zinc coated metal
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level (max)	running	< 30 db (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight	LF24-3	3.1 lbs (1.40 kg)
	LF24-3-S	3.6 lbs (1.45 kg)

LF24-3-S US	
Auxiliary switch	1 x SPDT 3A (0.5A) @ 250 VAC, UL Approved adjustable 0° to 95° (double insulated)

**Torque min. 35 in-lb, for control of air dampers**

## Application

For modulation or On/Off control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

Control is floating point from a triac or relay, or On/Off from an auxiliary contact from a fan motor contactor, controller, or manual switch.

## Operation

The LF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

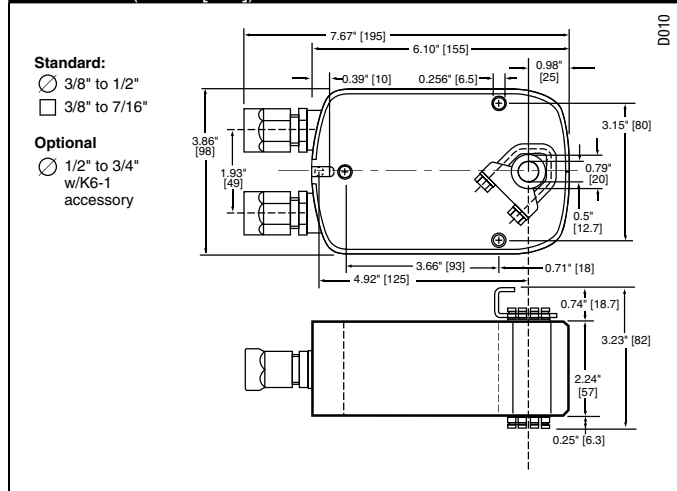
The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°.

The LF24-3 (-S) US 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. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

Power consumption is reduced in holding mode.

The LF24-3-S US version is provided with one built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°. The auxiliary switch in the LF24-3-S US is double insulated so an electrical ground is not necessary.

## Dimensions (Inches [mm])



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### Accessories

AV 10-18	Shaft extension (K6-1 is required)
IND-LF	Damper position indicator
K6-1	Universal clamp for up to 3/4" diameter shafts
KH-LF	Crank arm for up to 1/2" round shaft
Tool-06	8mm and 10 mm wrench
ZG-LF2	Crank arm adaptor kit for LF
ZG-112	Mounting bracket for Honeywell Mod IV, M6415 type actuators, and new installations
ZG-LF112	Crank arm adaptor kit for Honeywell Mod IV, M6415 type actuators, and new installations
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing

**NOTE:** When using LF24-3 (-S) US actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

### Typical Specification

Floating point, On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 3/4" diameter and center a 1/2" shaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall have an external direction of rotation switch to reverse control logic. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators with auxiliary switch must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

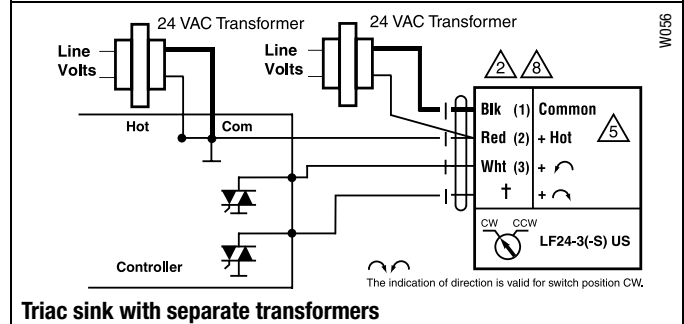
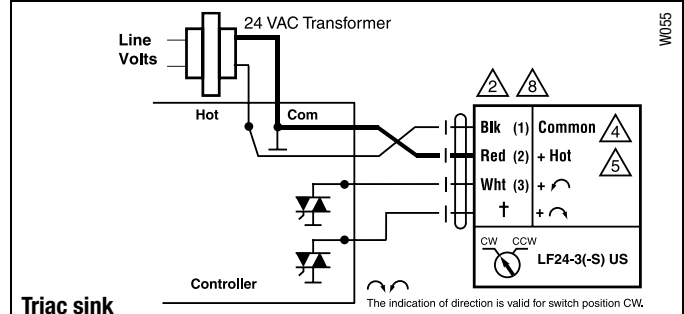
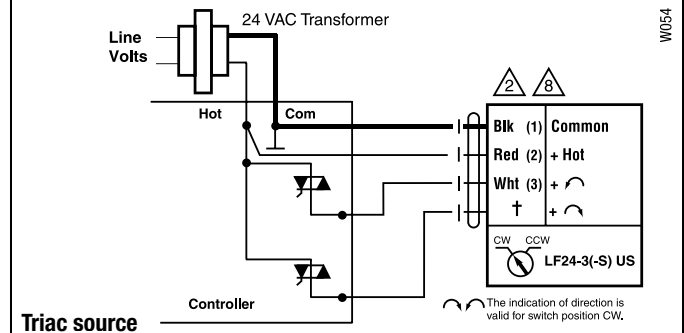
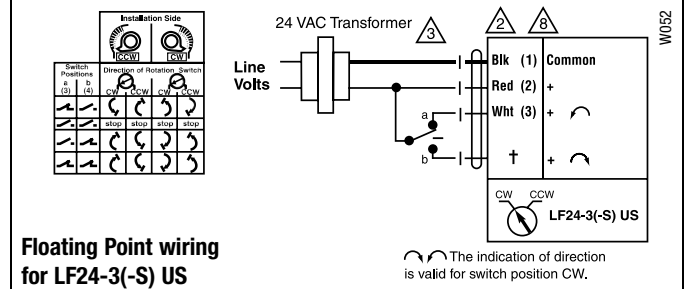
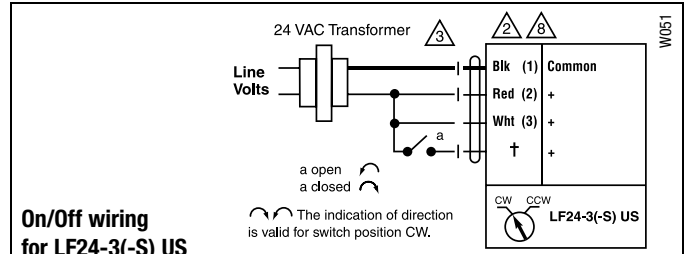
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 The Common connection from the actuator must be connected to the Hot connection of the controller.
- 5 The actuator Hot must be connected to the control board Common.
- 6 For end position indication, interlock control, fan startup, etc., LF24-3-S US LF120-S US and LF230-S US incorporate one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.
- 8 Actuators with plenum rated cable do not have numbers on wires; use color coded instead. Actuators with appliance rated cable use numbers.  
† LF24-3 US, Green wire #4, LF24-3-S US, White wire #5

#### APPLICATION NOTES

- ◆ Meets cULus requirements without the need of an electrical ground connection.

#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LFC24-3-R(-S) US

On/Off, Floating Point, Spring Return, 24V, Trane Voyager Retrofit



Technical Data		LFC24-3-R(-S) US
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	2.5 W
	holding	1 W
Transformer sizing		5 VA (class 2 power source)
Electrical connection	LFC24-3-R US	3 ft, plenum rated cable 4 male spade connectors
	LFC24-3-S US	3 ft, 18 GA appliance cables (2) 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Input impedance		1000 Ω (0.6w) control inputs
Angle of rotation		max. 95°, adjust. with mechanical stop
Torque		35 in-lb [4 Nm]
Direction of rotation	spring	reversible with cw/ccw mounting
	motor	reversible with built-in switch
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Running time	motor	90 sec constant, independent of load
	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 /IP54
Housing material		zinc coated metal
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level (max)	running	< 30 db (A)
	spring return	62 db (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight	LFC24-3-R US	3.1 lbs (1.40 kg)
	LFC24-3-S US	3.6 lbs (1.45 kg)

LFC24-3-S US	
Auxiliary switch	1 x SPDT 3A (0.5A) @ 250 VAC, UL Approved adjustable 0° to 95° (double insulated)

**Torque min. 35 in-lb, for control of air dampers**

## Application

For modulation or On/Off control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. The ZG-LFC114 universal mounting kit can be used with the LFC24-3-R US actuator for retrofit of the economizer section of the Trane Voyager unit.

Control is floating point from a triac or relay, or On/Off from an auxiliary contact from a fan motor contactor, controller, or manual switch.

## Operation

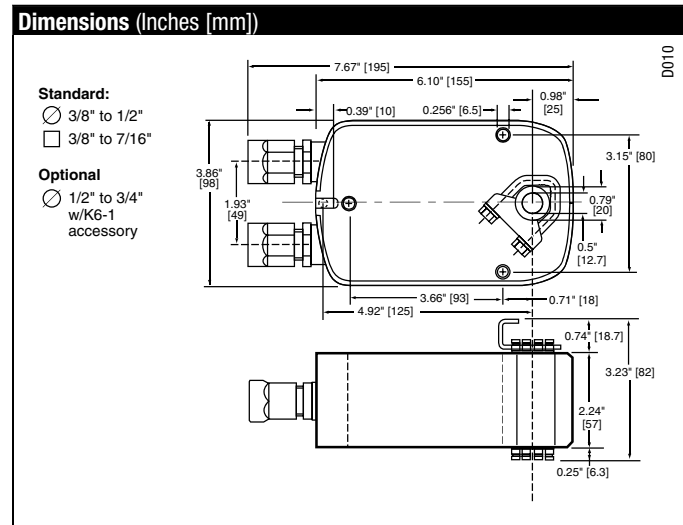
The LF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°.

The LFC24-3-R (-S) US 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. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

Power consumption is reduced in holding mode.

The LFC24-3-S US version is provided with one built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°. The auxiliary switch in the LFC24-3-S US is double insulated so an electrical ground is not necessary.



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### Accessories

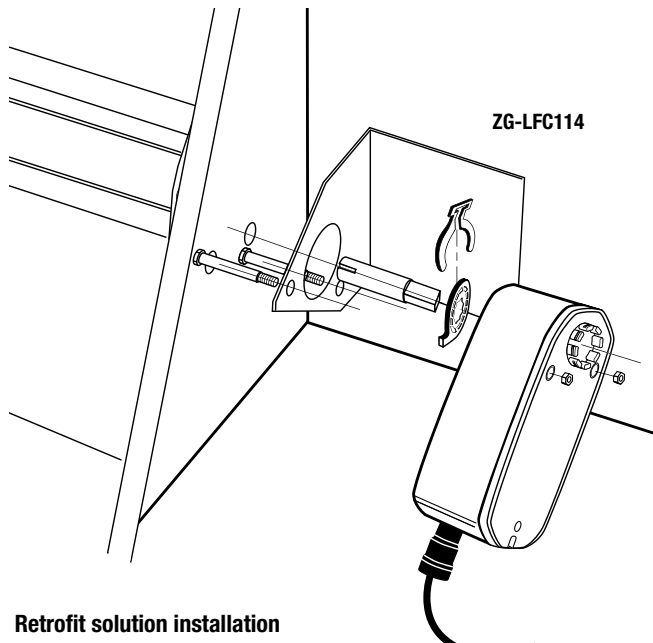
AV 10-18	Shaft extension (K6-1 is required)
IND-LF	Damper position indicator
K6-1	Universal clamp for up to 3/4" diameter shafts
KH-LF	Crank arm for up to 1/2" round shaft
Tool-06	8mm and 10 mm wrench
ZG-LF2	Crank arm adaptor kit for LF
ZG-112	Mounting bracket for Honeywell Mod IV, M6415 type actuators, and new installations
ZG-LF112	Crank arm adaptor kit for Honeywell Mod IV, M6415 type actuators, and new installations
<b>ZG-LFC114</b>	<b>Used with LFC24-3-R US, mounting bracket kit for Trane Voyager economizer actuator retrofit. Kit includes mounting bracket and installation hardware.</b>
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing

**NOTE:** When using LFC24-3-R (-S) US actuators, only use accessories listed on this page.

**NOTE:** For On/Off control wiring please see LF24-3 US wiring diagram. "On/Off control of LF24-3(-S) US" page 71.

**NOTE:** For Floating point control wiring, Triac source, sink or wiring with separate power supplies please see page 71 for correct wiring.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.



**Retrofit solution installation**

### Typical Specification

Floating point, On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 3/4" diameter and center a 1/2" shaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall have an external direction of rotation switch to reverse control logic. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators with auxiliary switch must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

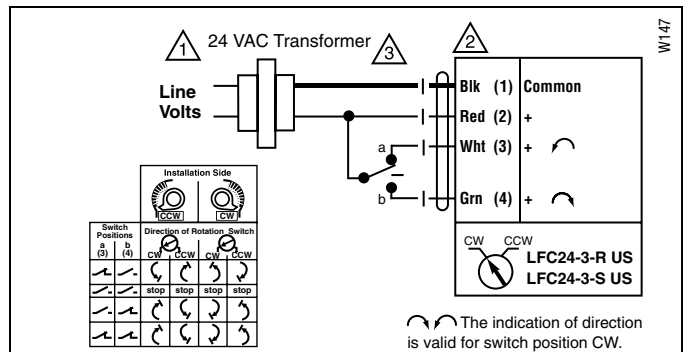
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 No ground connection is required.
- 6 For end position indication, interlock control, fan startup, etc., LFC24-3-S US incorporates one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°. LFC24-3-S US has a white wire #5 instead of a green wire #4.
- 8 Actuators with plenum rated cable do not have numbers on wires; use color coded instead. Actuators with appliance rated cable use numbers.

#### APPLICATION NOTES

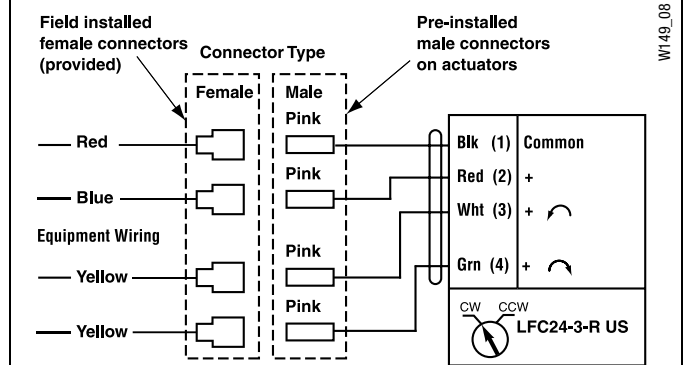
Meets cULus requirements without the need of an electrical ground connection.

#### WARNING Live Electrical Components!

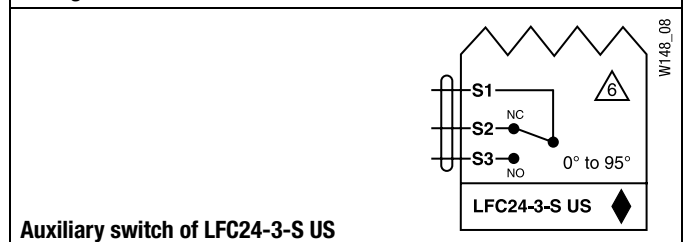
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



#### Floating point control of LFC24-3... US



#### Wiring LFC24-3-R US



# LF24-SR(-S) US

Proportional, Spring Return, 24 V for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data		LF24-SR(-S) US
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	2.5 W
	holding	1 W
Transformer sizing		5 VA (class 2 power source)
Electrical connection		
	LF24-SR US	3 ft, plenum rated cable 1/2" conduit connector
	LF24-SR-S US	3 ft, 18 GA appliance cables (2) 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Input impedance		100 kΩ (0.1 mA), 500 Ω
Angle of rotation		max. 95°, adjust. with mechanical stop
Torque		35 in-lb [4 Nm]
Direction of rotation		
	spring	reversible with cw/ccw mounting
	motor	reversible with built-in switch
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Running time (nominal)	motor	150 sec constant, independent of load
	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 /IP54
Housing material		zinc coated metal
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level (max)	running	< 30 db (A)
	spring return	62 db (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight	LF24-SR US	3.1 lbs (1.40 kg)
	LF24-SR-S US	3.2 lbs (1.45 kg)
<b>LF24-SR-S US</b>		
Auxiliary switch		1 x SPDT 3A (0.5A) @ 250 VAC, UL Approved adjustable 0° to 95° (double insulated)

**Torque min. 35 in-lb, for control of air dampers**

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500W resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

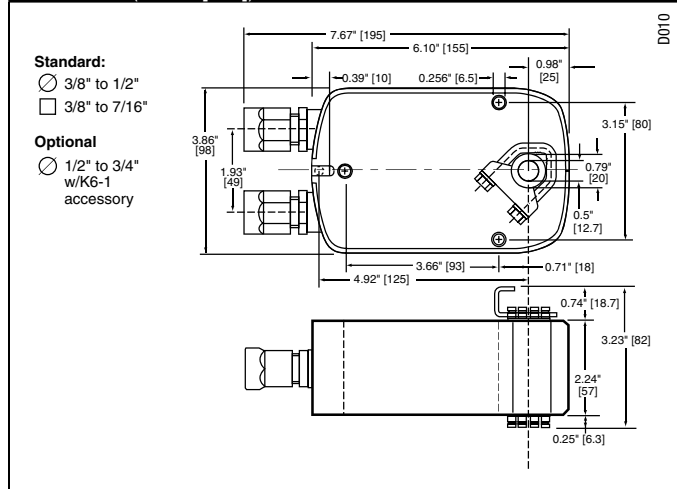
The LF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°.

The LF24-SR (-S) US 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 fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

The LF24-SR-S US version is provided with one built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°. The auxiliary switch in the LF24-SR-S US is double insulated so an electrical ground is not necessary.

## Dimensions (Inches [mm])



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#### Accessories

AV 10-18	Shaft extension (K6-1 is required)
IND-LF	Damper position indicator
K6-1	Universal clamp for up to 3/4" diameter shafts
KH-LF	Crank arm for up to 1/2" round shaft
SGA24	Min. and/or man. positioner in NEMA 4 housing
SGF24	Min. and/or man. positioner for flush panel mounting
Tool-06	8mm and 10 mm wrench
ZG-LF2	Crank arm adaptor kit for LF
ZG-112	Mounting bracket for Honeywell Mod IV, M6415 type actuators, and new installations
ZG-LF112	Crank arm adaptor kit for Honeywell Mod IV, M6415 type actuators, and new installations
ZG-R01	500 Ω resistor for 4 to 20 mA control signal
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing

NOTE: When using LF24-SR(-S) US actuators, only use accessories listed on this page. For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

#### 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 shaft up to a 3/4" diameter and center a 1/2" shaft. The actuator must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω 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 counterclockwise 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 master-slave applications. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators with auxiliary switch 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, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

##### INSTALLATION NOTES

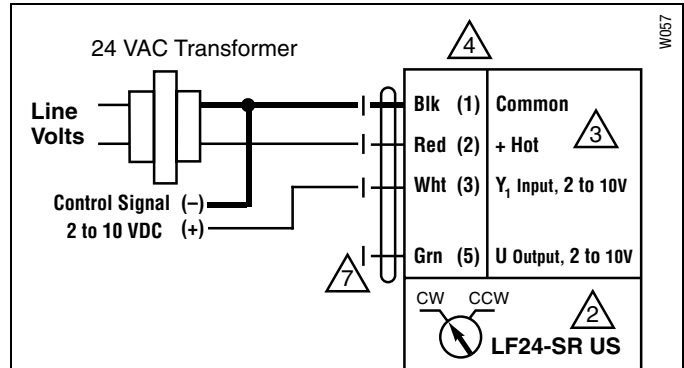
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel. Power consumption and input impedance must be observed. Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor. Power consumption must be observed.
- 3 Actuator may also be powered by 24 VDC.
- 4 Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
- 5 Only connect common to neg. (-) leg of control circuits
- 6 For end position indication, interlock control, fan startup, etc., LF24-SR-S US incorporates one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.
- 7 The LF24-SR-S US wire 5 is white.

##### APPLICATION NOTES

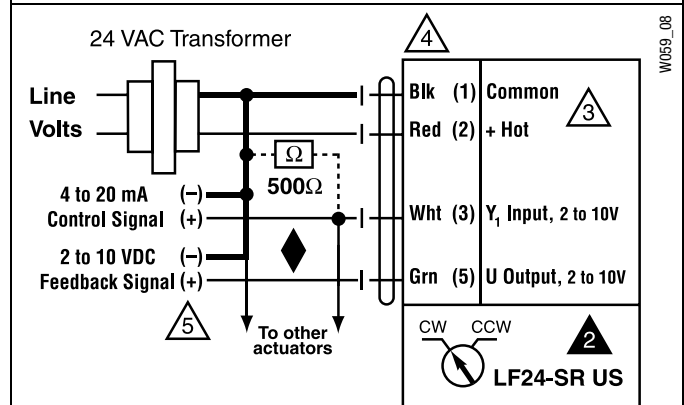
- ◆ Meets cULus requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

#### WARNING Live Electrical Components!

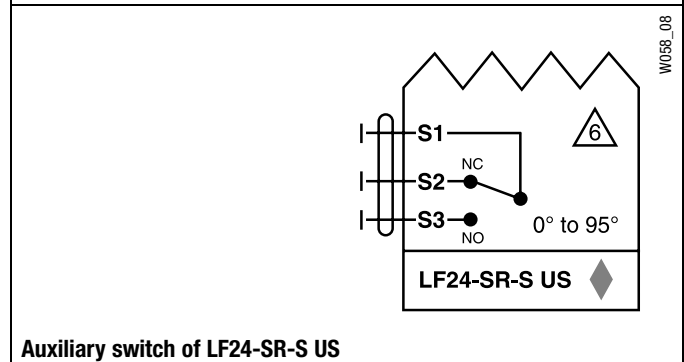
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



2 to 10 VDC control of LF24-SR(-S) US



4 to 20 mA control of LF24-SR(-S) US with 2 to 10 VDC feedback output



Auxiliary switch of LF24-SR-S US

# LF24-SR-E US

Proportional, Spring Return, 24 V, for 2 to 10 VDC, 4 to 20 mA Control Signal or 3-position On/Off Control with Minimum Position Potentiometer



- Torque min. 35 in-lb, for control of air dampers
- Built-in adjustable min-position for 3-position and proportional control

## Application

For proportional control with minimum position setpoint, or three position control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to 24 VAC on wire 2 or 3, which allows the LF24-SR-E US to retrofit or replace Honeywell® M8405A actuators.

## Operation

The LF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°.

The LF24-SR-E US 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 function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

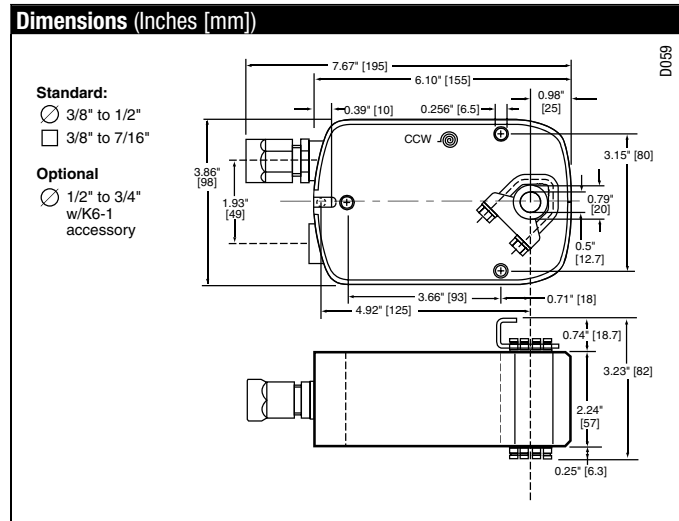
See wiring diagrams for LF24-SR-E US for more details on 3-position control.

## Installation

Refer to LF Section of the Standard Actuation and Accessories, Technical Documentation.

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Technical Data		LF24-SR-E US
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	2.5 W
	holding	1 W
Transformer sizing		5 VA (class 2 power source)
Electrical connection		3 ft, plenum rated cable 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Control signal		Y 0 to 10 VDC, 0 to 20 mA, or 24 VAC for 3-position on/off control
Input impedance		100 kΩ
Operating range Y		2 to 10 VDC, 4 to 20mA between 0% and 100%
Feedback output U		2 to 10 VDC (max. 0.7 mA) for 95°
Angle of rotation		max. 95°, adjust. with mechanical stop
Torque		35 in-lb [4 Nm]
Override function		Minimum, Open, Closed via spring Min-position adjusts on actuator cover between 0 and 100% (scaled 0 to 1)
Direction of rotation	spring	reversible with cw/ccw mounting
	motor	reversible with built-in switch
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Running time (nominal)	motor	150 sec constant, independent of load
	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 /IP54
Housing material		zinc coated metal
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level (max)	running	< 30 db (A)
	spring return	62 db (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		3.2 lbs (1.45 kg)



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### Accessories

AV 10-18	Shaft extension (K6-1 is required)
IND-LF	Damper position indicator
K6-1	Universal clamp for up to 3/4" diameter shafts
KH-LF	Crank arm for up to 1/2" round shaft
Tool-06	8mm and 10 mm wrench
ZG-LF2	Crank arm adaptor kit for LF
ZG-112	Mounting bracket for replacing Honeywell Mod IV, M6415 and M8405 type actuators, and new installations
ZG-LF112	Crank arm adaptor kit for replacing Honeywell Mod IV, M6415 and M8405 type actuators, and new installations
ZG-113	Mounting bracket kit for Honeywell W7459 logic module
ZG-ECON1	Mounting bracket kit for Honeywell M8405 economizer actuator retrofit and new installations
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)

NOTE: When using LF24-SR-E US actuators, only use accessories listed on this page.

### 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 shaft up to a 3/4" diameter and center a 1/2" shaft. Actuator shall deliver a minimum output torque of 35 in.-lbs. The actuator must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500W resistor, a 4 to 20mA control input from an electronic controller. Actuator must have a built-in minimum position potentiometer. During 3-position control, the actuator shall drive to minimum position with 24 VAC on wire 2 and drive full open with 24 VAC on wire 3. 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 feedback signal shall be provided for position feedback or master-slave applications. The actuator must be designed so that they may be used for either clockwise or counterclockwise failsafe operation. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Three-Position Control Signals

Switch A	Wire 2-Red (x)	Wire 3-White (D)	Position
Open**	Any	Any	Closed (via spring)
Closed	24 VAC	Open	Mid-position*
Closed	Open	24 Vac	Full Open*
Closed	24 VAC	24 VAC	Full Open*

\*Desired position achieved by driving actuator with motor.

\*\*An example would be to interlock the actuator power supply with the fan motor starter.

### Wiring Diagrams

#### INSTALLATION NOTES

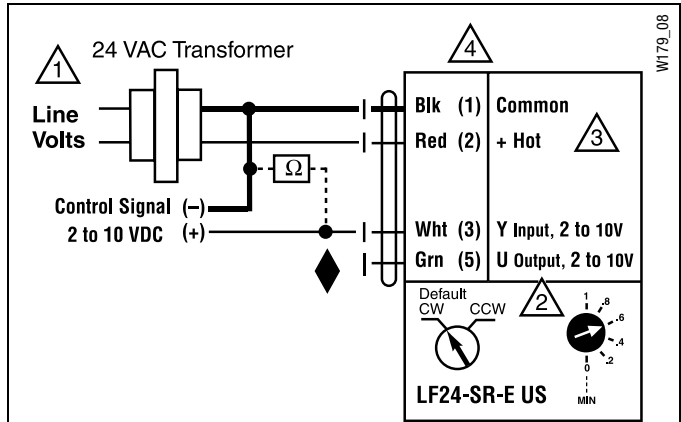
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 2 Min-position is adjustable from 0 to 100% with a potentiometer on the actuator cover.
- 3 Actuator may also be powered by 24 VDC.
- 4 Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
- 5 Switch A, actuator spring returns when open (e.g., fan interlock).

#### APPLICATION NOTES

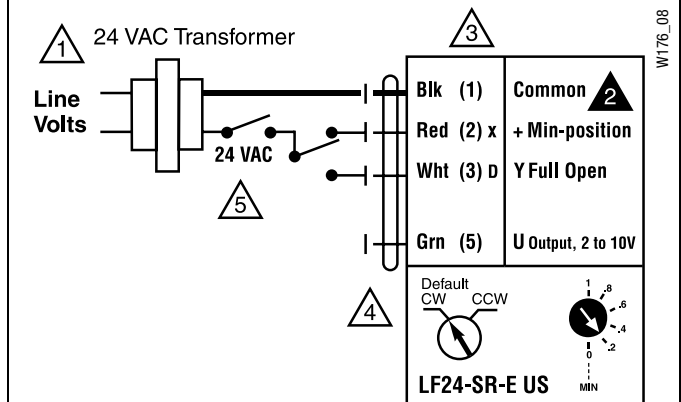
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

#### WARNING Live Electrical Components!

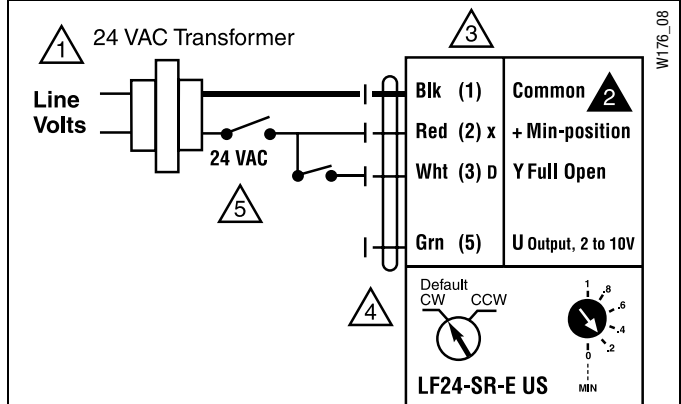
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2 to 10 VDC control of LF24-SR-E US



3-position control with a SPDT switch or two contact closures (e.g. fan, cooling Y)



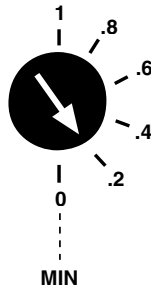
Min-position with Full Open override (with a single contact closure)

## Application of the LF24-SR-E US with Minimum Position Potentiometer

The LF24-SR-E US is the newest addition to the LF-series product range featuring dual functionality. A minimum position potentiometer has been built into the actuator for cost effective proportional and three position applications, e.g. economizer dampers in rooftop units.

### Proportional Control with Minimum Position

Minimum position is adjustable using the built-in potentiometer on the cover of the LF24-SR-E US. The minimum position can be adjusted anywhere over the full 0 to 95° range of the actuator. A 2 to 10 VDC input proportionally controls the actuator to the set-point position. The actuator electronics see both the 2 to 10 VDC input and the input signal from the potentiometer (minimum position setting). The actuator's electronics select between the higher of these two signals. Therefore, the actuator moves to the position of the higher signal, which is the same operating characteristic the Belimo -SR actuators exhibit with the Belimo SGA24 and SGF24 positioners.



### LF24-SR-E US Operates as Follows:

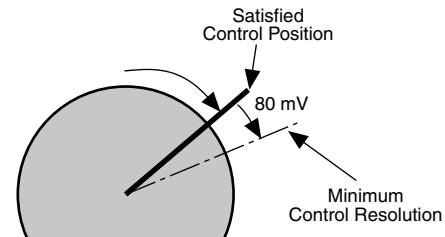
1. Set desired minimum position (Example 20%), while leaving the direction of rotation switch in the CW (default) position.
2. With power applied to wire 2 (red), the actuator will maintain the desired minimum position.
3. Applying a signal higher than that set by the minimum position potentiometer. In this example the input DC voltage must be greater than 3.6 VDC to move the actuator toward full open.
4. Changing the position of the direction of rotation switch to CCW will reverse the actuator's control logic. If only the position of the direction of rotation switch is changed, then the actuator will move from 20% to 80%. The scale is now reverse from the default (e.g. 10VDC moves the actuator to 0).
5. Typically, power to the actuator is interlocked with the fan relay, which causes the actuator to spring return closed if the fan de-energizes.

## Control Accuracy and Stability

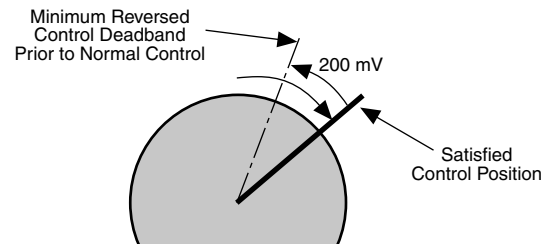
LF24-SR-E US actuators have built-in brushless DC motors which provide better accuracy and longer service life.

The LF24-SR-E US actuators are designed with a unique non-symmetrical deadband. The actuator follows an increasing or decreasing control signal with a 80 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 250 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**LF Actuator responds to a 80 mV signal when not changing direction from stop position.**



**LF Actuator responds to a 200 mV signal when reversing direction from stop position.**



## Three-Position Control Using the LF24-SR-E US

By applying the LF24-SR override functionality and the new minimum position potentiometer, it is possible to achieve simple three-position control with the LF24-SR-E US.

1. Set desired minimum position (Example 20%), while leaving the direction of rotation switch in the CW (default) position. The direction of rotation switch does not need to be changed for three-position control, because direction of rotation can be changed by flipping the actuator.
2. With 24 VAC power applied across wire 1 (black) and 2 (red), the actuator will maintain minimum position.
3. Applying 24 VAC power across wire 1 (black) and 3 (white) overrides the minimum position and moves the actuator to Full Open.
4. With no power applied to actuator, it will spring return (fail-safe) closed.
5. Typically, power to the actuator is interlocked with the fan relay, which causes the actuator to spring return closed if the fan de-energizes.

## Features of the Belimo Three-Position Solution

### The LF24-SR-E US will:

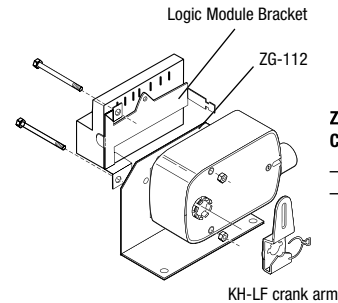
- Direct couple to the damper shaft between 3/8" and 3/4" diameter for reduced installation cost.
- Spring return in either CW or CCW direction depending on mounting orientation of the actuator. This feature eliminates the need to select a specific model with correct spring return direction.
- Spring returns in <25 seconds @ -4° to 122°F.
- Increase minimum torque output to 35 in-lbs for 40% more torque than other 3-position actuator solutions.
- Drive to the adjustable minimum position from either the fully Open or Closed position using its brushless DC motor for improved reliability. Spring returns only during power loss.
- Drive full stroke in 150 seconds.
- Output a 2 to 10 VDC signal for position feedback
- Control a damper proportionally between minimum position and full open (2 to 10 VDC input) for additional applications.
- Have dual (3-position and proportional control) wiring diagrams on actuator label for clear and easy wiring in the field.
- Consumes only 2.5 W driving to setpoint and 1 W to hold position, lower than actuators using AC motor technology.

## Replacing an M8405 Actuator

The three-position control functionality of the LF24-SR-E US allows direct replacement of a Honeywell M8405A foot mounted economizer actuator.

## Mounting

For non-direct coupled applications use the ZG-ECON1 accessory kit, which includes the KH-LF crank arm, ZG-112 bracket and logic module bracket (20477-00001). The ZG-112 aligns the plane of the crank arm with that of the Honeywell M8405A and has at least two mounting holes that match the M8405A foot pattern. The logic module bracket allows for attachment to the end of the LF24-SR-E US actuator. It provides for installation flexibility to place the module where space is available.



### ZG-LF112 Crank arm adaptor kit

- Includes bracket and KH-LF crank arm.
- Bracket and crank arm for replacement of Honeywell M8405 actuators.

## Wiring

For proper control logic wiring always refer to the controller manufactures documentation. See the Product Documentation Standard Actuation and Accessories for proper three position wiring diagram Belimo wiring diagram booklet.

# LF24-ECON-R03(-R10) US

Proportional, Spring Return, 24 V, for Stand-Alone Economizer Damper Control Using 3 kΩ or 10 kΩ Mixed Air Sensor, Built-in Minimum Position Adjustment



Technical Data		LF24-ECON-R03(-R10) US
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	2.5 W
	holding	1 W
Transformer sizing		5 VA (class 2 power source)
Electrical connection		3 ft, plenum rated cable 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Control signal, Y1 (LF24-ECON-R03 US)		3 kΩ NTC Type 10 thermistor, 3 kΩ @ 77°F (25°C) MA setpoint = 55°F
Input impedance		100 kΩ
Feedback output U		2 to 10 VDC (max. 0.7 mA) for 95°
Angle of rotation		max. 95°, adjust. with mechanical stop
Torque		35 in-lb [4 Nm]
Override function		See override control table on opposite page
Direction of rotation	spring	reversible with cw/ccw mounting
	motor	reversible with built-in switch
Position indication		Visual indicator, 0° to 95° scaled as 0 to 1 (0° is spring return position)
Running time	motor	95 sec constant, independent of load
	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 /IP54
Housing material		zinc coated metal
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level (max)	running	< 30 db (A)
	spring return	62 db (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		3.2 lbs (1.45 kg)

LF24-ECON-R10 US	
Control Signal, Y1	10 kΩ NTC Type 7 thermistor, 10 kΩ @ 77°F (25°C) MA setpoint = 55°F

- Torque min. 35 in-lb, for control of air dampers
- Built-in adjustable min-position
- Integrated mixed air PI-control

## Application

For proportional control of mixed air setpoint on economizer dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to 3 kΩ or 10 kΩ thermistor, which allows the LF24-ECON... to retrofit or replace Honeywell® M7415 actuators.

## Operation

The LF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 90°.

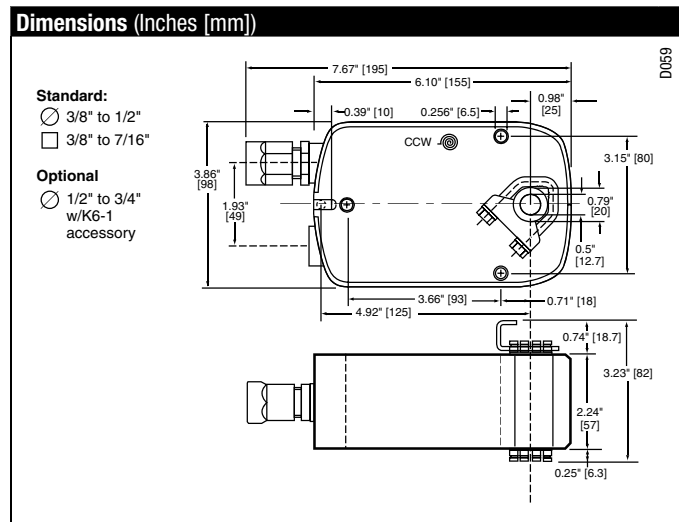
The LF24-ECON-R03 (-R10) US uses a brushless DC motor which is controlled by an Application Specific Integrated Circuit (ASIC) and a microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and to know the actuator's exact position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

See wiring diagrams for LF24-ECON-R03 US for more details on 3-position control.

## Installation

Refer to LF Section of the Standard Actuation and Accessories, Product Documentation.

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**Accessories**

AV 10-18	Shaft extension (K6-1 is required)
IND-LF	Damper position indicator
K6-1	Universal clamp for up to 3/4" diameter shafts
KH-LF	Crank arm for up to 1/2" round shaft
Tool-06	8mm and 10 mm wrench
ZG-LF2	Crank arm adaptor kit for LF
ZG-112	Mounting bracket for replacing Honeywell Mod IV, M7415 type actuators, and new installations
ZG-LF112	Crank arm adaptor kit for replacing Honeywell Mod IV, M7415 type actuators, and new installations
20477-00001	Mounting bracket for Honeywell W7459 logic module
ZG-ECON1	Mounting bracket kit for Honeywell M7415 economizer actuator retrofit and new installations
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)

**NOTE:** When using LF24-ECON-R03 (R10) US actuators, use accessories listed on this page.

**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 shaft up to a 3/4" diameter and center a 1/2" shaft. Actuator shall deliver a minimum output torque of 35 in.-lbs. The actuator must provide proportional damper control in response to a 3 kΩ or 10 kΩ NTC thermistor, 55°F setpoint. Actuator must have a built-in minimum position potentiometer. Actuator must have minimum position override via 0 to 10VDC on wire 4. 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 independent of torque load. A 2 to 10VDC feedback signal shall be provided for position feedback or master-slave applications. The actuator must be designed so that they may be used for either clock-wise or counterclockwise fail safe operation. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo

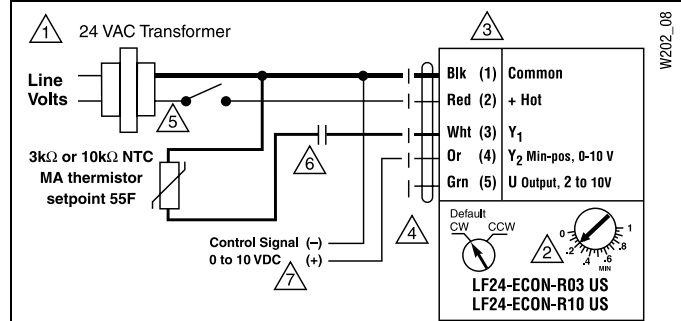
**Wiring Diagrams**

**INSTALLATION NOTES**

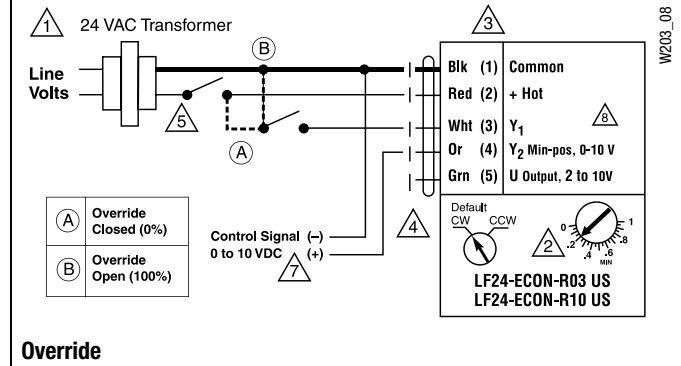
- 1 Provide overload protection and disconnect as required.
- 2 Min-position is adjustable from 0 to 100% with a potentiometer on the actuator cover.
- 3 Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
- 4 CW (default) indicates that motor drive starts at zero position.
- 5 A relay or switch can spring return the actuator when the RTU fan de-energizes, or if low ambient temperature is sensed.
- 6 A standard relay can be used to close the sensor circuit to engage economizer mode, e.g. outside air changeover device like a dry bulb or enthalpy limit switch. Honeywell® logic module W7459A and enthalpy sensor C7400 also provide terminals for this switching.
- 7 A remote CO2 sensor or DDC controller with a 0 to 10 VDC output can change the standard relay or can be used to open and close the sensor circuit. This device can be a relay or a dry bulb/enthalpy limit switch.
- 8 Override control for Y2 only accepts 0 to 10 VDC override control.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



**Standard Economizer Mode Wiring**



**Override**

**Override Control**

Wire	Input Signal	LF24-ECON... Position	Application
Y1	24 VAC	Drive closed (0%)	Morning warm-up cycle
Y1	Common	Drive open (100%)	Smoke Purge
Y1	Open wire	Drive to min position	Mechanical cooling in use, RTU thermostat calls for heat
Y2	0 VDC to 10 VDC	Min position of 0% to 100%	Override potentiometer via a remote CO2 sensor/controller or DDC controller

# LF24-ECON-R03(-R10) US

## Operation, Installation and Wiring



### Operation LF24-ECON-R03(-R10) US

The LF24-ECON-R03(-R10) US provides a direct coupling solution for Rooftop Unit(RTU) economizer dampers.

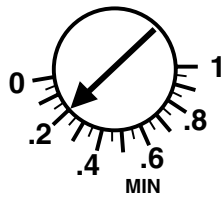
### Control of Mixed Air in Typical Economizer Dampers

#### Occupied - Economizer Mode

The LF24-ECON-R03 (-R10) US enters Economizer Mode when either an external relay or controller (e.g. Honeywell® W7459A) completes the circuit between the actuator wire 3(Y1) and MA sensor. In this mode, the actuator moves proportionally to maintain a MA set-point of 55°F(fixed). A proportional band of 6°F modulates the actuator between 53 and 58°F. Also, a +/-1°F dead band eliminates hunting of the actuator, while maintaining suitable temperatures in the RTU mixed air chamber.

#### Occupied – Mechanical CH (Cooling or Heating) Mode

The LF24-ECON-R03(-R10) US enters Mechanical CH Mode when either an external relay or controller (e.g. Honeywell® W7459A) breaks the circuit between the actuator wire 3(Y1) and MA sensor. In this mode, the actuator drives to minimum position. Minimum position can be set on built-in potentiometer, or set remotely by sending a 0 to 10 VDC signal to wire 4(Y2) via a SGA24 or DDC controller.

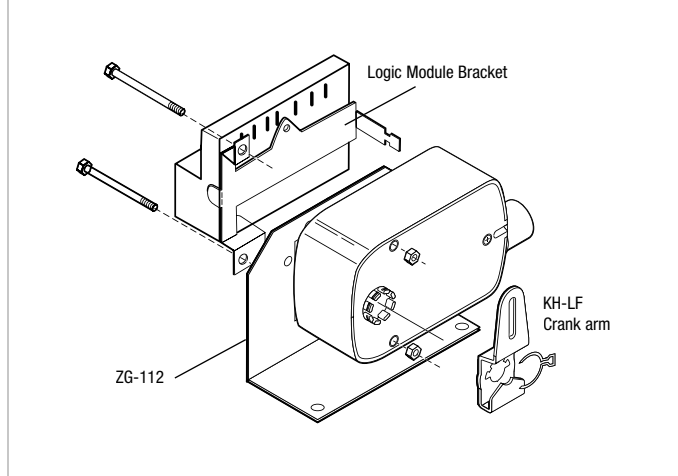


#### Unoccupied

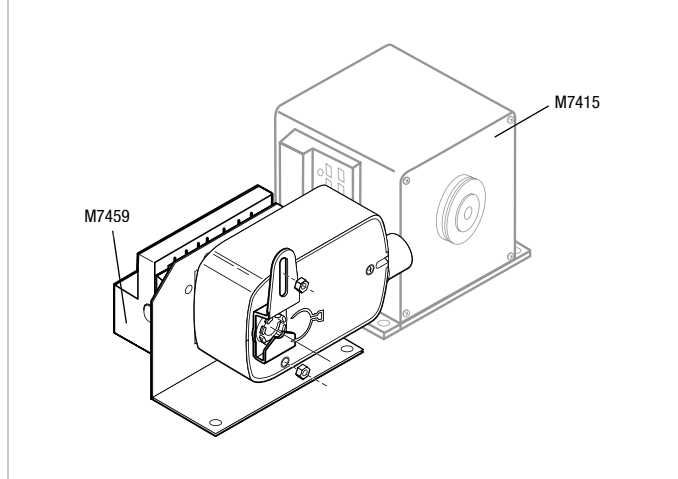
RTU Economizer damper actuators typically interlock actuator supply power with RTU fan motor starter/relay. This set-up ensures that the actuator spring returns the economizer damper closed during periods when the ventilation air is not required.

MA Dry Bulb Temperature	LF24-ECON... Position
< 53°F	Min. position
53°F < MAT < 58°F	Modulates between Min. Position and 100% open
> 58°F	100% open

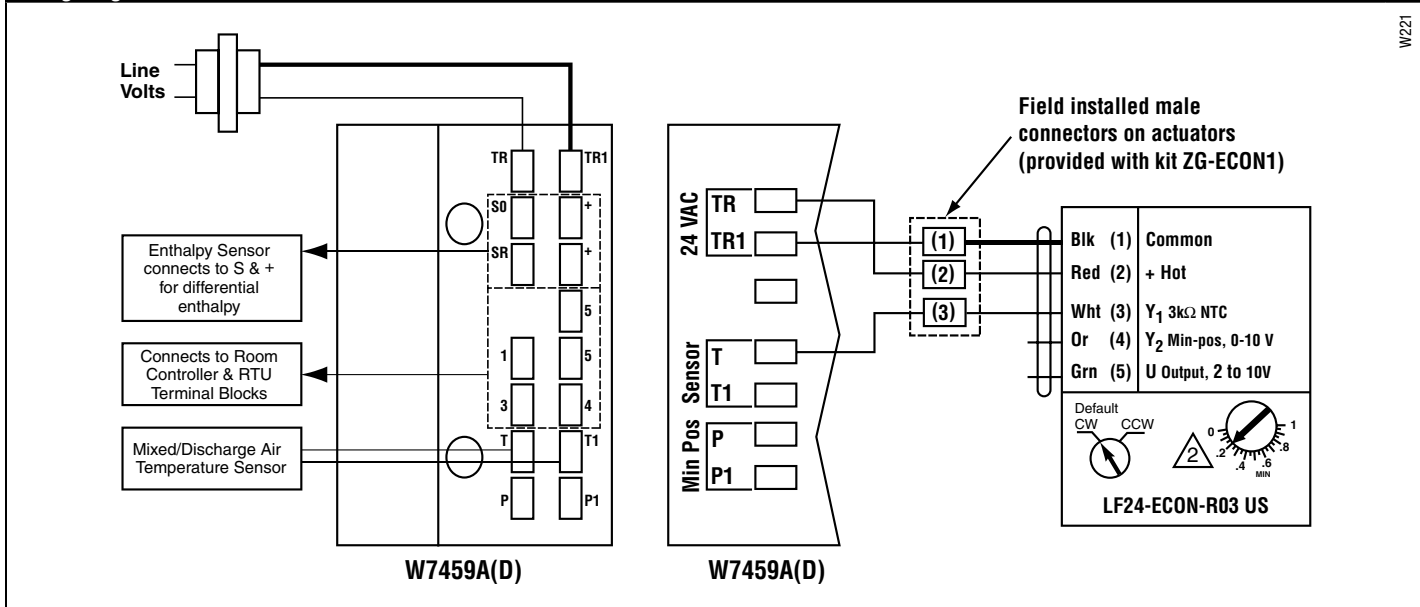
### Mounting



### Replacing an Honeywell® M7415 actuator

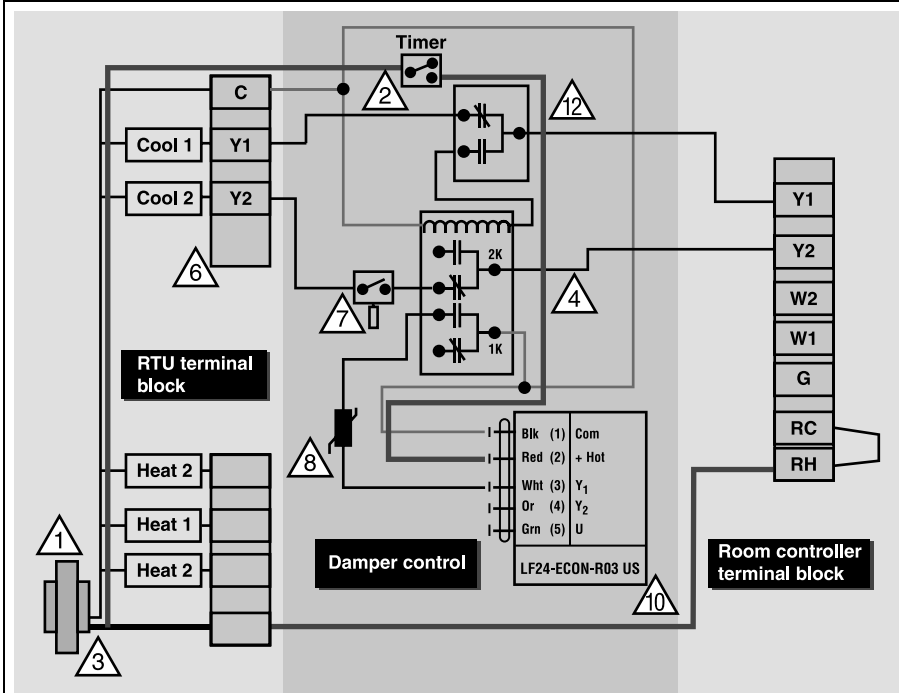


### Wiring Diagram for Installation of the LF24-ECON-R03 US

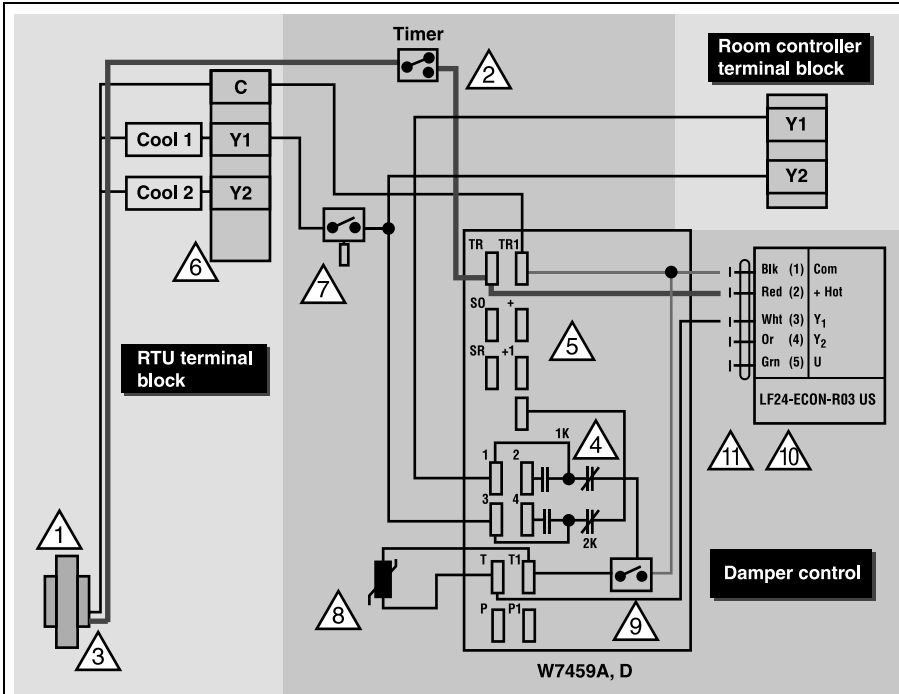


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**LF24-ECON-R03 US used with W7459A(D) / C7400 in two-stage cooling system with single enthalpy changeover**



**LF24-ECON-R03 US used with W7459A(D) / C7400 in one-stage cooling system with differential enthalpy changeover**

**Wiring Diagrams**

**INSTALLATION NOTES**

- 1 Power supply is 24VAC transformer. Provide overload protection and disconnect as required.
- 2 A fan delay relay should be interlocked with both fan and actuator power to ensure the actuator spring returns when the RTU fan de-energizes. A time clock for occupied or unoccupied mode is shown. The actuator spring returns in unoccupied mode.
- 3 Be sure the transformer is sized to accommodate the actuator, control module and other devices for economizer control.
- 4 Relays 1K and 2K actuate when the enthalpy sensed by the C7400 is higher than the enthalpy setpoint A-D..
- 5 Factory installed 620 OHM, 1 Watt 5% Resistor should be removed only if a C7400 enthalpy sensor is added to SR and + for differential enthalpy.
- 6 The heating, fan and power terminals of the RTU and room thermostat are not shown to simplify the wiring diagram. Typically there is a direct wiring connection between terminals W1, W2, G and R on both terminal strips. In addition the R terminal from the RTU connects to the RC or RH terminal on the thermostat. RH and RC are jumpered on the thermostat to ensure power gets to both the cooling and heating relays.
- 7 The ambient lockout controller sets a low limit of 50 degrees F. This set-up ensures the compressors for mechanical cooling remain off at lower temperatures.
- 8 Mixed/Discharge air temperature sensor is used to regulate discharge air temperature by changing damper position of the LF24-ECON-R03(-R10) US.
- 9 This switch contacts when 24V power is applied from the relays in note 4.
- 10 The LF24-ECON-R03(-R10) US provides a 2 to 10 VDC output indicating position.
- 11 A remote CO2 sensor or DDC controller with a 0 to 10 VDC output can change the standard relay or can be used to open and close the sensor circuit. This device can be a relay or a dry bulb/enthalpy limit switch.
- 12 When conditions are met the dry bulb or enthalpy limit switch changes over the economizer from mechanical cooling to 100% outside air free cooling. This switch completes the circuit between the thermistor and the Y1 input on the actuator.

**WARNING Live Electrical Components!** During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

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# LF24-MFT(-S) US

Proportional, Spring Return, Multi-Function Technology®



Technical Data	LF24-MFT(-S) US
Power supply	24 VAC, ± 20%, 50/60 Hz 24 VDC, ±10%
Power consumption	running 2.5 W holding 1.0 W
Transformer sizing	5 VA (Class 2 power source)
Electrical connection (-S models have 2 cables)	3 ft, 18 GA, appliance cables 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y*	2 to 10 VDC 4 to 20 mA (w/500 Ω, 1/4 Ω resistor) ZG-R01
Input impedance	100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1500 Ω for PWM, floating point and on/off control
Feedback output U*	2 to 10 VDC, 0.5 mA max
Torque	min 35 in-lb (4 Nm)
Direction of rotation*	spring reversible with cw/ccw mounting motor reversible with built-in switch
Mech. angle of rotation*	max 95°, adjust with mechanical stop
Running time	motor* 150 sec constant spring <25 sec @-4°F to 122°F [-20°C to 50°C] <60 sec @-22°F [-30°C]
Angle of rotation adaptation*	off (default)
Override control*	Min. (Min Position) = 0% - ZS (Mid. Position) = 50% - Max. (Max. Position) = 100%
Position indication	visual indicator, 0° to 95°
Humidity	5 to 95% RH, non-condensing
Ambient temperature	-22 to 122° F (-30 to 50° C)
Storage temperature	-40 to 176° F (-40 to 80° C)
Housing	NEMA 2, IP54
Housing material	zinc coated metal
Noise level	less than 45 dB (A)
Agency listings	cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Quality standard	ISO 9001
Servicing	maintenance free
Weight	3.1 lbs [1.4 kg], 3.2 lbs [1.45 kg] with switch

\* Variable when configured with MFT options

LF24-MFT-S US	
Auxiliary switches	1 x SPDT 3A (0.5A) @ 250 VAC, UL approved adjustable 0° to 95° (double insulated)

- Torque min. 35 in-lb
- Control 2 to 10 VDC (DEFAULT)
- Feedback 2 to 10 VDC (DEFAULT)

## Application

For proportional modulation of dampers and control valves in HVAC systems. The LF24-MFT US provides mechanical spring return operation for reliable fail-safe application.

## Default/Configuration

Default parameters for 2 to 10 VDC applications of the LF24-MFT US actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. The parameters noted in the Technical Data table are variable.

These parameters can be changed by three means:

- Pre-set configurations from Belimo
- Custom configurations from Belimo
- Configurations set by the customer using the MFT PC tool software application.

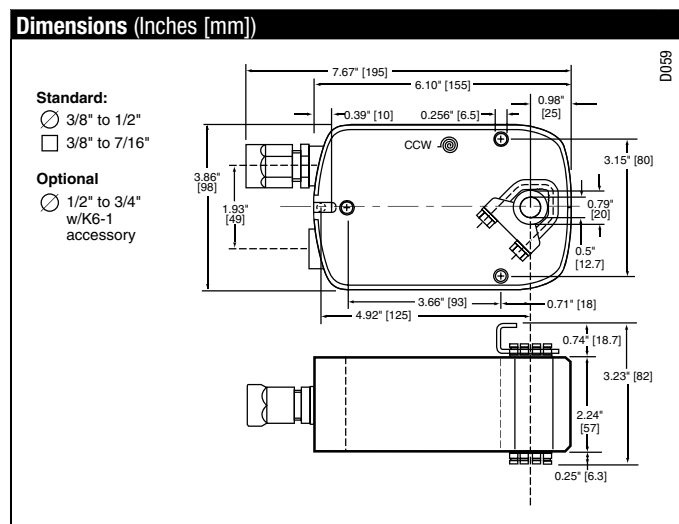
## Operation

The LF24-MFT US 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 damper or valves mechanical stop and use this point for its zero position during normal control operations.

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 LF24-MFT US is mounted directly to control shafts up to 3/4" 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 LF24-MFT US actuator is shipped in the zero position, compression against seats or gaskets for tight shut-off is accomplished manually.

**NOTE:** Please see documentation on Multi-Function Technology.



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## Wiring Diagrams

### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 The Common connection from the actuator must be connected to the Hot connection of the controller.
- 5 For end position indication, interlock control, fan startup, etc., LF24-MFT-S US incorporates one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.

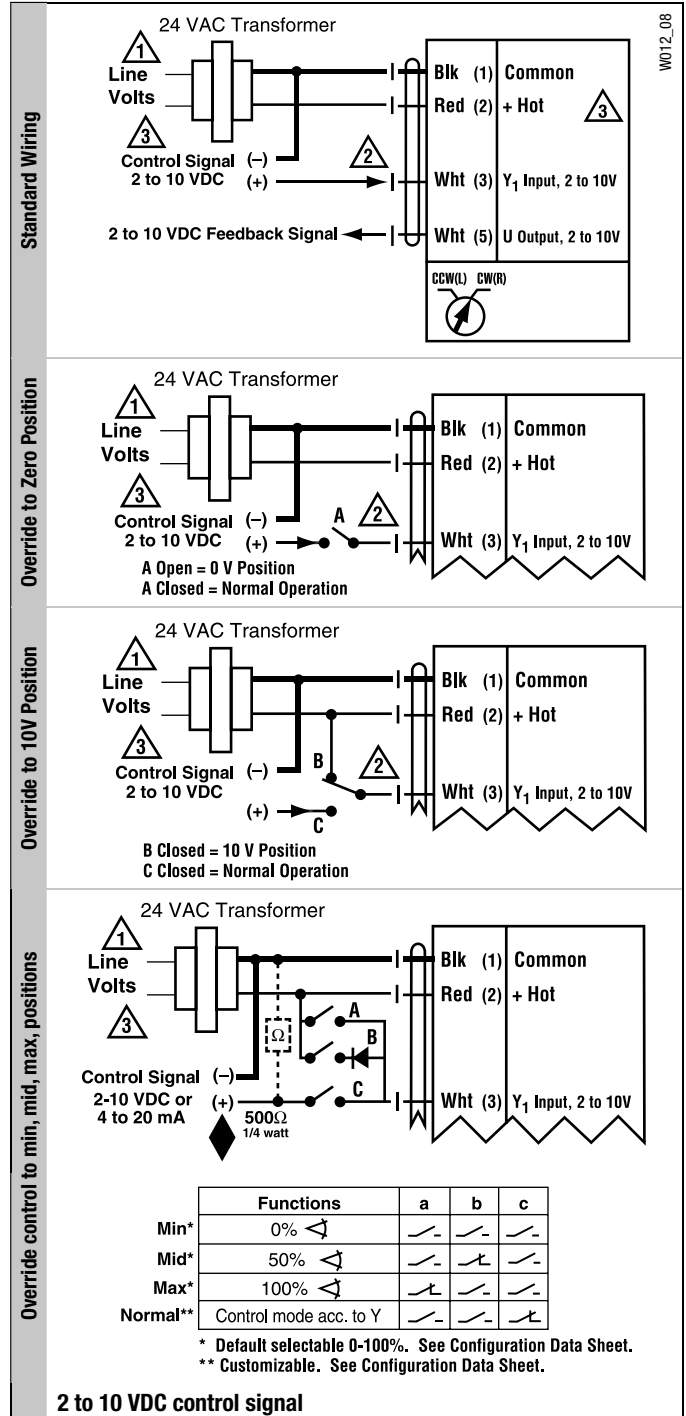
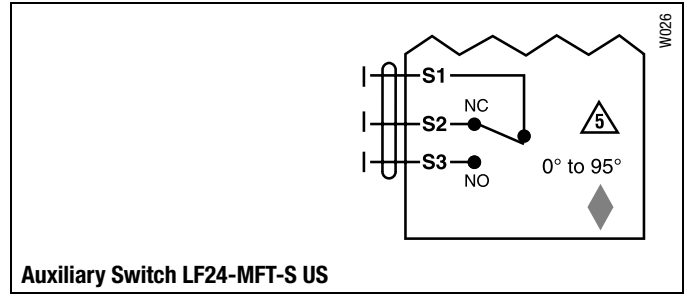
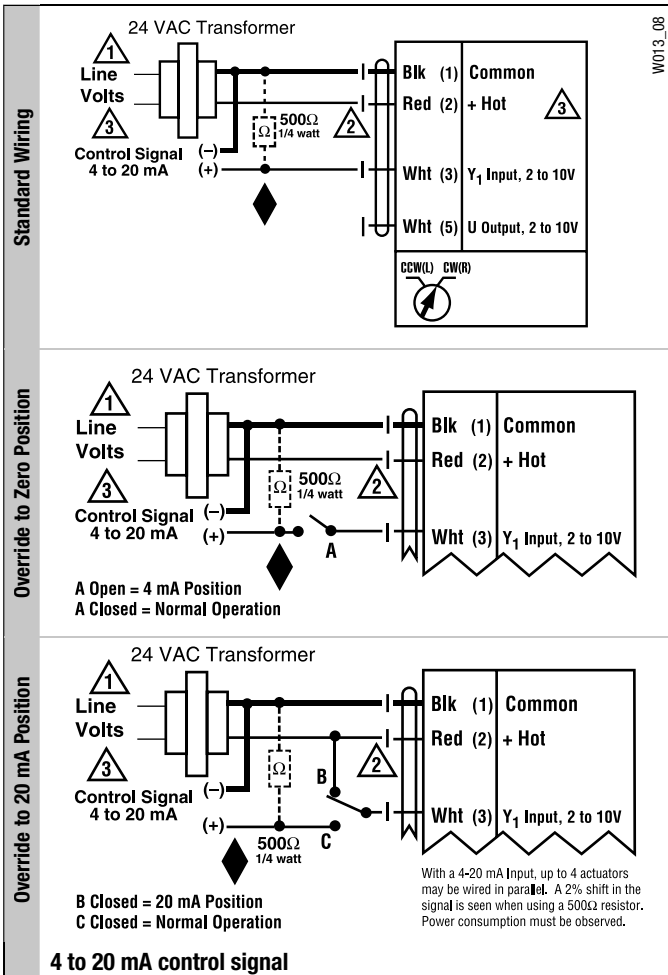
### APPLICATION NOTES

- ◆ Meets cULus requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor may be used.

### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

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# LF24-MFT(-S)-20 US

Proportional, Spring Return, 24 V, for 6 to 9 VDC

Output Power Supply 20 VDC Provides Power to Controllers



MFT



Technical Data		LF24-MFT(-S) -20 US
Power supply		24 VAC, ± 20%, 50/60 Hz 24 VDC, ±10%
Power consumption	running	3 W
	holding	1.5 W
Transformer sizing		6 VA (Class 2 power source)
Electrical connection		3 ft, 18 GA, appliance cable
(-S models have 2 cables)		1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y*		6 to 9 VDC (Default), P-10005
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA)
		500 Ω for 4 to 20 mA
		1500 Ω for PWM, floating point and on/off control
Feedback output U*		2 to 10 VDC, 0.5 mA max
Torque		35 in-lb (4 Nm)
Direction of rotation*	spring	reversible with cw/ccw mounting
	motor	reversible with built-in switch
Angle of rotation*		max 95°, adjustable with mechanical stop
Mechanical angle of rotation*		limited to 95°
Running time	motor*	150 sec constant
	spring	<25 sec @ -4°F to 122°F [-20°C to 50°C] <60 sec @ -22°F [-30°C]
Angle of rotation adaptation*		off (default)
Override control*		Min. (Min Position) = 0%
		- ZS (Mid. Position) = 50%
		- Max. (Max. Position) = 100%
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Humidity		5 to 95% RH, non-condensing
Ambient temperature		-22 to 122° F (-30 to 50° C)
Storage temperature		-40 to 176° F (-40 to 80° C)
Housing		NEMA 2, IP54
Housing material		zinc coated metal
Noise level	running	< 30 db (A)
	spring return	62 dB (A)
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Quality standard		ISO 9001
Servicing		maintenance free
Weight	LF24-MFT-20 US	3.1 lbs (1.40 kg)
	LF24-MFT-S-20 US	3.2 lbs (1.45 kg)

\* Variable when configured with MFT options

LF24-MFT-S-20 US	
Auxiliary switches	1 x SPDT 3A (0.5A) @ 250 VAC, UL approved adjustable 0° to 95° (double insulated)

- Torque min. 35 in-lb
- Control 6 to 9 VDC (DEFAULT)
- Feedback 2 to 10 VDC (DEFAULT)
- 20 VDC power output

## Application

For proportional modulation of dampers and control valves in HVAC systems. The LF24-MFT(-S)-20 US provides mechanical spring return operation for reliable fail-safe application.

## Default/Configuration

Default parameters for 6 to 9 VDC applications of the LF24-MFT(-S)-20 US actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. The parameters noted in the Technical Data table are variable.

These parameters can be changed by three means:

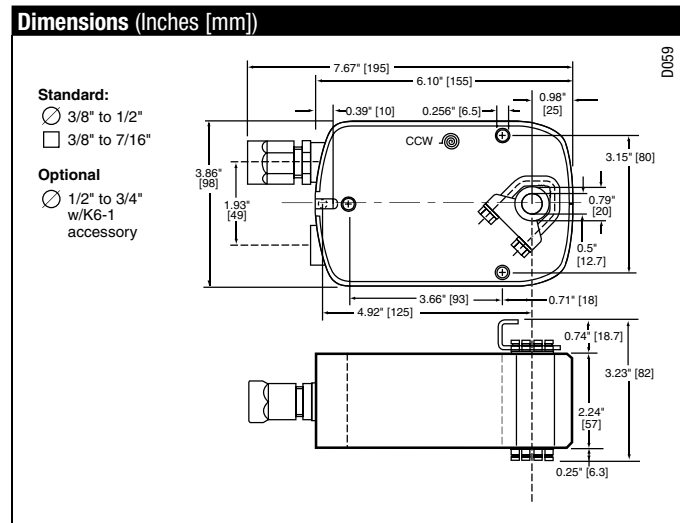
- Pre-set configurations from Belimo
- Custom configurations from Belimo
- Configurations set by the customer using the MFT PC tool software application.

## Operation

The LF24-MFT(-S)-20 US 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 damper or valves mechanical stop and use this point for its zero position during normal control operations.

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 with out 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 LF24-MFT(-S)-20 US is mounted directly to control shafts up to 3/4" 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 LF24-MFT(-S)-20 US actuator is shipped in the zero position, compression against seats or gaskets for tight shut-off is accomplished manually.



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### Wiring Diagrams

#### INSTALLATION NOTES

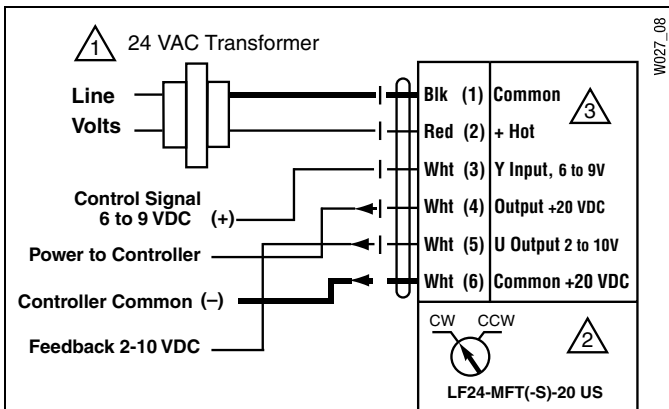
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 2 Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuator may also be powered by 24 VDC.
- 6 For end position indication, interlock control, fan startup, etc., LF24-MFT(-S)-20 US incorporates one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.
- A 24 VAC: Black/Blue  
120 VAC: White  
240 VAC: White/Black  
Belimo modulating actuators are 24 VAC/DC, if 120 or 240 is available an external transformer is required.
- B Maximum of 2
- C MP-52XX-500 models include internal SPDT auxiliary switch.

#### APPLICATION NOTES

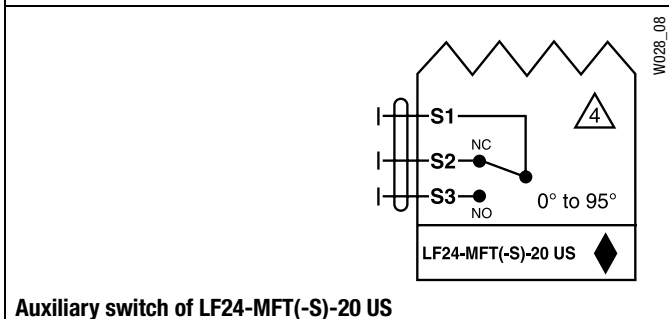
- ◆ Meets cULus requirements without the need of an electrical ground connection.

#### WARNING Live Electrical Components!

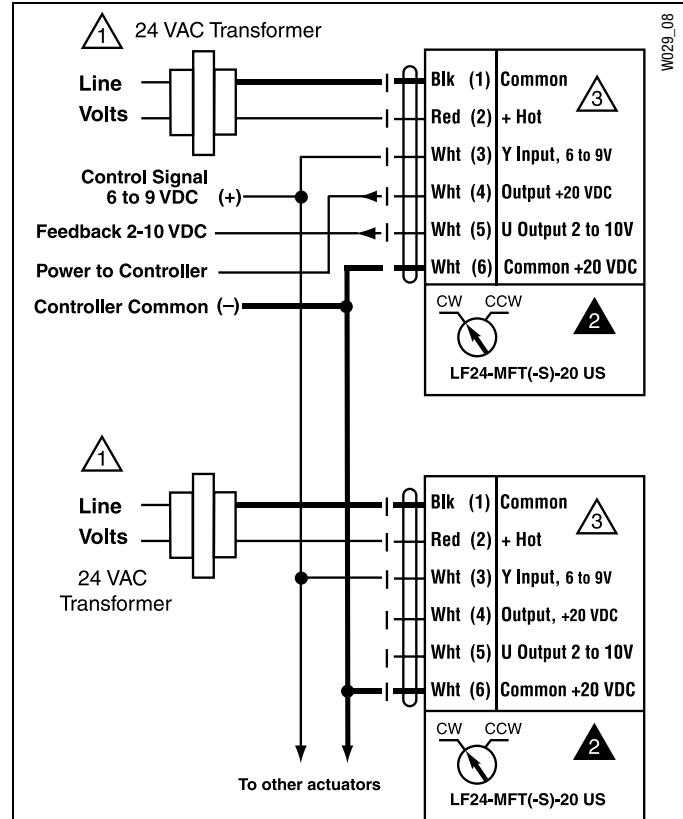
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



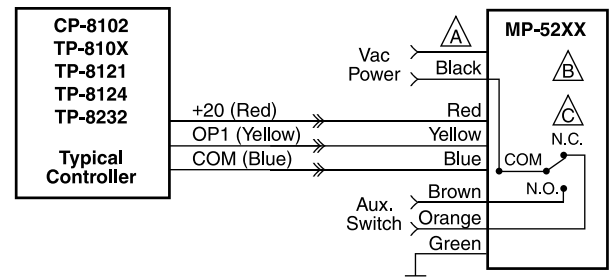
6 to 9 VDC control of LF24-MFT(-S)-20 US



Auxiliary switch of LF24-MFT(-S)-20 US



Multiple LF24-MFT(-S)-20 US actuators from one controller



#### Wire cross reference

MP-52XX	Belimo (SR or MFT)	
Black/Blue, Power	2, Hot	
Black, Power	1, Com	
Red, +20	4, +20 VDC	
Yellow, OP1	3, Signal	
Blue, COM	6, Com VDC	
Brown, N. O.	S3, N.O.	"-S" type
Orange, N.C.	S2, N.C.	"-S" type
Green, ground	Not used	

Typical Control Wiring for MP-52XX Series Actuators to Controllers Requiring External 20 VDC Power Supply.

# Installation Instructions

## Quick-Mount Visual Instructions for Mechanical Installation



### Quick-Mount Visual Instructions

1. Rotate the damper to its failsafe position. If the shaft rotates counterclockwise, mount the "CCW" side of the actuator out. If it rotates clockwise, mount the actuator with the "CW" side out.
2. If the universal clamp is not on the correct side of the actuator, move it to the correct side.
3. Slide the actuator onto the shaft and tighten the nuts on the V-bolt with a 10mm wrench to 6-8 ft-lb of torque.
4. Slide the anti-rotation strap under the actuator so that it engages the slot at the base of the actuator. Secure the strap to the duct work with #8 self-tapping screws.

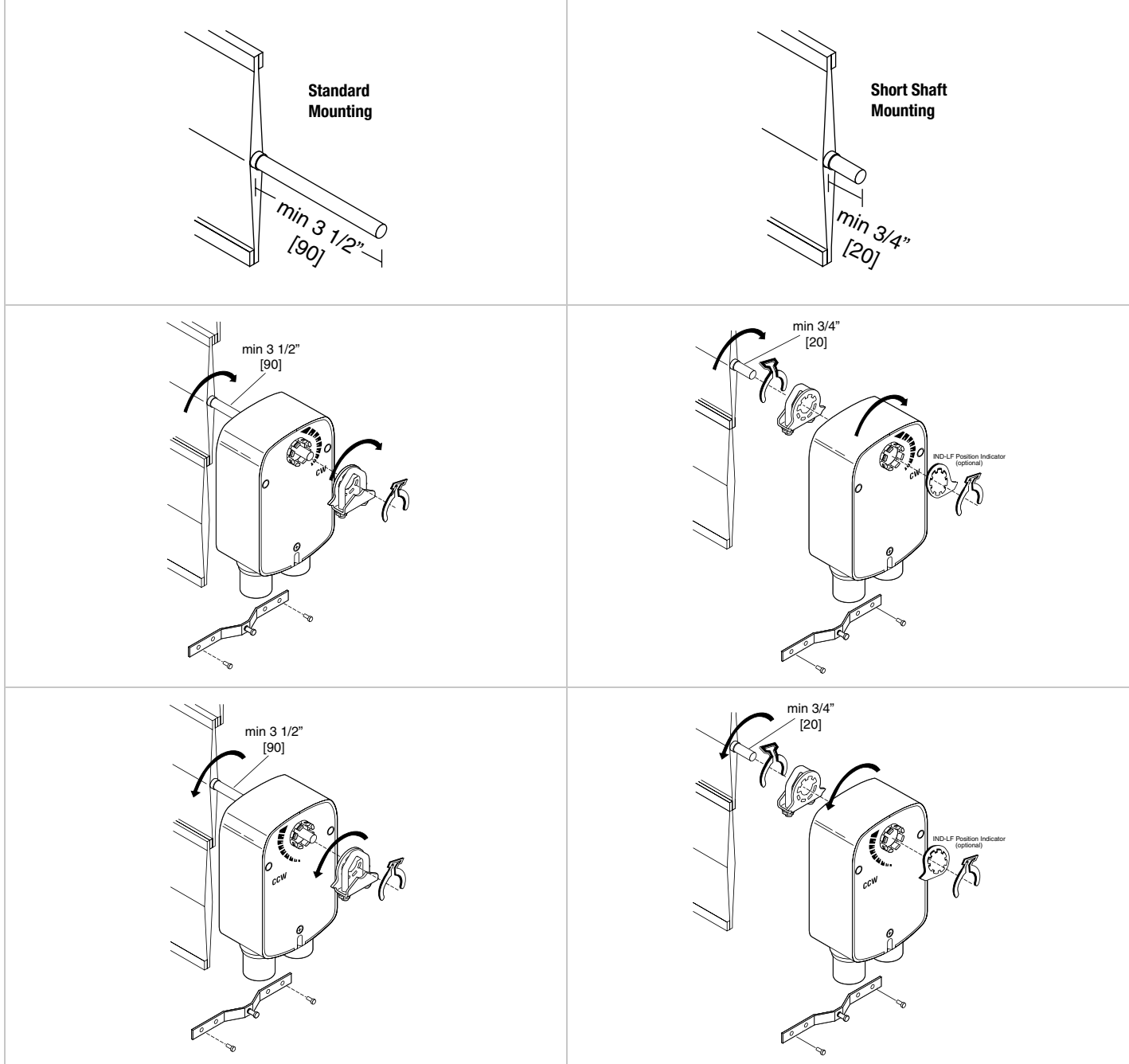
**NOTE:** Read the "Standard Mounting" instructions, on the next page, for more detailed information.

### Preliminary Steps

1. Belimo actuators should be mounted indoors in dry, relatively clean environment free from corrosive fumes. If the actuator is to be mounted outdoors, a protective enclosure must be used to shield the actuator (See *Belimo Mechanical Accessories*).
2. For new construction work, **order dampers with extended shafts**. Instruct the installing contractor to allow space for mounting and service of the Belimo actuator on the shaft.
3. For standard mounting, the damper shaft must extend at least 3 1/2" from the duct. If the shaft extends less than 3 1/2", the actuator may be mounted in its short shaft configuration. If an obstruction blocks access, the shaft can be extended with the AV 10-18 shaft extension. (K6-1 is required)



### Dimensions (Inches [mm])



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### Mechanical Operation

The actuator is mounted directly to a damper shaft up to 1/2" in diameter by means of its universal clamp, or up to a 3/4" shaft with the optional K6-1 clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

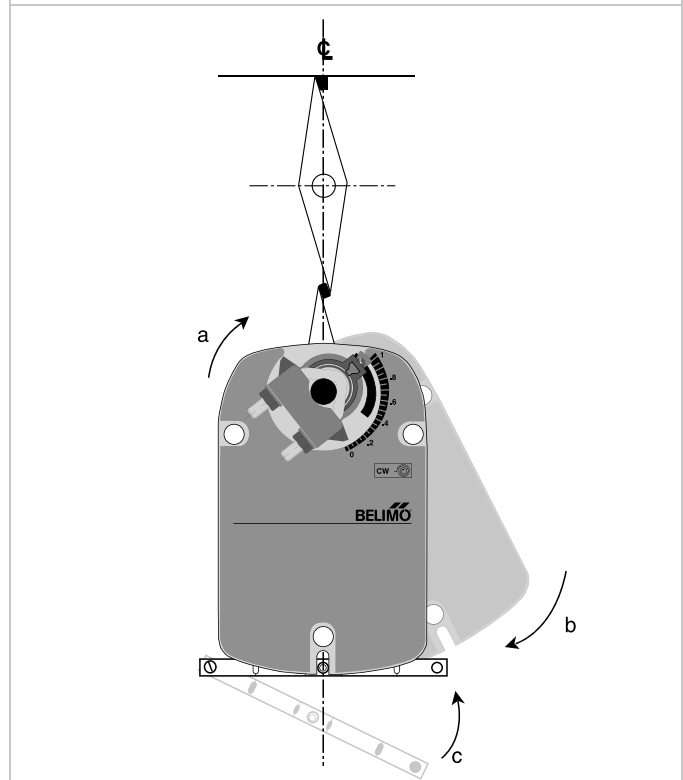
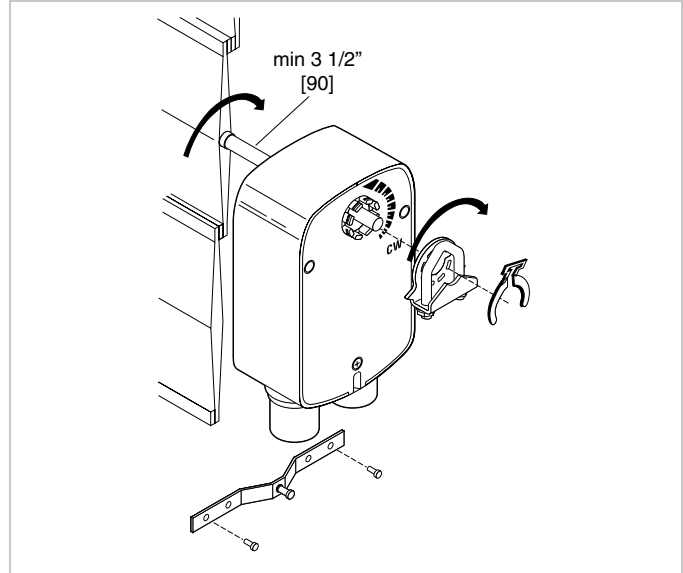
The LF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°.

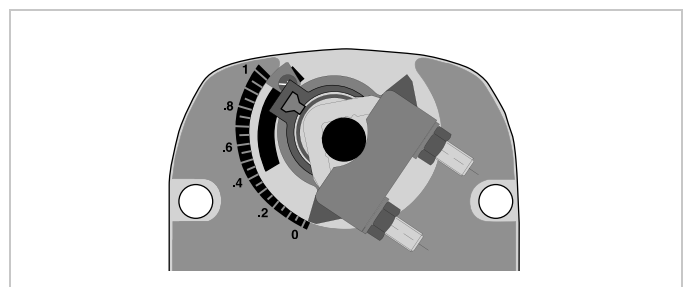
The LF...-S versions are provided with 1 built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°.

### Standard Mounting / Airtight Damper Procedure

1. See **Figure B**. Manually move the damper to the fail-safe position (a) (usually closed). If the shaft rotated counterclockwise (↺), this is a CCW installation. If the shaft rotated clockwise (↻), this is a CW installation. In a Left Hand installation, the actuator side marked "CW" faces out, while in a CW installation, the side marked "CCW" faces out. All other steps are identical.
2. The actuator is usually shipped with the universal clamp mounted to the "CW" side of the actuator. To test for adequate shaft length, slide the actuator over the shaft with the side marked "CW" (or the "CCW" side if this is the side with the clamp). If the shaft extends at least 1/8" through the clamp, mount the actuator as follows. If not, go to the *Short Shaft Installation* section.
3. If the clamp is not on the correct side as determined in step #1, re-mount the clamp as follows. If it is on the correct side, proceed to step #5. Look at the universal clamp. If you are mounting the actuator with the "CCW" side out, position the clamp so that the pointer section of the tab is pointing to 0° (see **Figure C**) and the spline pattern of the clamp mates with spline of the actuator. Slip the clamp over the spline. (Use the same procedure if the "CW" side is out.)
4. Lock the clamp to the actuator using the retaining clip.
5. Verify that the damper is still in its full fail-safe position (a).
6. Mount the spring return actuator to the shaft. Tighten the universal clamp, finger tight only.
7. Mount the anti-rotation strap at the base of the actuator. Do not tighten the screws.
8. Remove the screw from one end of the mounting bracket and pivot it away from the actuator.
9. Loosen the universal clamp and, making sure not to move the damper shaft, rotate the actuator approximately 5° in the direction which would open the damper.
10. Tighten the universal clamp to the shaft.
11. Rotate the actuator to apply pressure to the damper seals (b) and re-engage the anti-rotation strap (c).
12. Tighten all fasteners.



**FIGURE B – Standard Mounting** (Dimensions in Inches [mm])



**FIGURE C – Universal Clamp**

### Short Shaft Mounting with IND-LF Position Indicator / Airtight Damper Procedure

If the shaft extends at least 3/4" from the duct, follow these steps:

1. (See **Figure D**) Move damper blades to the fail-safe position (a).
2. Determine the best orientation for the universal clamp on the back of the actuator. The best location would be where you have the easiest access to the V bolt nuts on the clamp.
3. Engage the clamp to the actuator as close as possible to the determined location.
4. Lock the clamp to the actuator using the retainer clip.
5. Mount the spring return actuator to the shaft. Tighten the universal clamp, finger tight only.
6. Mount the anti-rotation strap at the base of the actuator. Do not tighten the screws.
7. Remove the screw from one end of the mounting bracket and pivot it away from the actuator.
8. Loosen the universal clamp and, making sure not to move the damper shaft, rotate the actuator approximately 5° in the direction which would open the damper.
9. Verify that the damper is still in its full fail-safe position.
10. Tighten the universal clamp to the shaft.
11. Rotate the actuator to apply pressure to the damper seals (b) and re-engage the anti-rotation strap (c).
12. Tighten all fasteners.
13. Use IND-LF accessory if position indication is needed.

### Operational Information for LF24-SR US and LF24-MFT... US Actuators

#### Initialization of the LF24-SR US and LF24-MFT... US

When power is applied, the internal microprocessor recognizes that the actuator is at its full fail-safe position and uses this position as the base for all of its position calculations. This procedure takes approximately 15 seconds. During this time you will see no response at the actuator. The microprocessor will retain the initialized zero during short power failures of up to 25 seconds. When power is applied during this period, the actuator will return to normal operation and proceed to the position corresponding to the input signal provided. For power failures over 25 seconds, the actuator will be at its fail-safe position and will go through the start up initialization again.

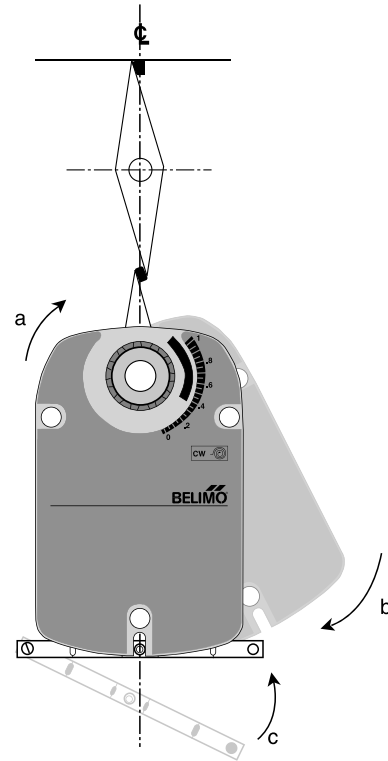
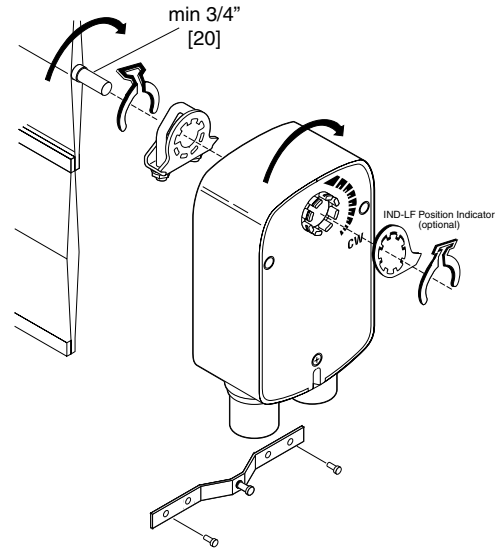
#### Motor position detection

Belimo brushless DC motors eliminate the need for potentiometers for positioning. Inside the motor are three "Hall Effect" sensors. These sensors detect the spinning rotor and send pulses to the microprocessor which counts the pulses and calculates the position to within 1/3 of a revolution of the motor.

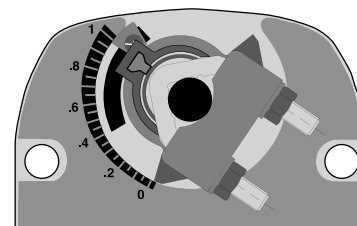
#### Overload protection

The LF, On/Off actuators are electronically protected against overload. The LF, On/Off actuators have an internal current limiter which maintains the current at a safe level which will not damage the actuator while providing adequate holding torque.

The LF24, modulating actuators (LF24-SR US, LF24-3 US, LF24-MFT US) are protected against overload by digital technology located in the ASIC. The ASIC circuitry constantly monitors the rotation of the brushless DC motor inside the actuator and stops the pulsing to the motor when it senses a stall condition. The motor remains energized and produces full rated torque during stall conditions. The actuator will try to move in the direction of the stall every 2 minutes, for a period of 32 minutes. After this, the actuator will try again every 2 hours.



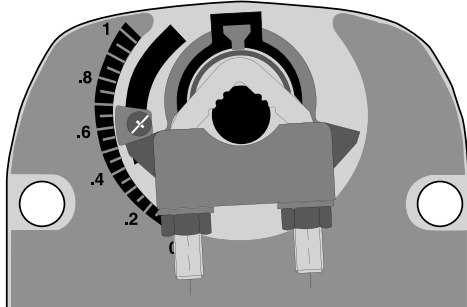
**FIGURE D – Standard Mounting** (Dimensions in Inches [mm])



**FIGURE C – Universal Clamp**

### Mechanical Angle of Rotation Limiting

The LF actuators are provided with an adjustable stop to limit the rotation of the actuator. This function works in conjunction with the universal clamp or the optional position indicator. The adjustable stop is needed when rotation of less than 95° is required. The LF actuator can be indefinitely stalled, in any position, without harming the actuator.



### Using the Universal Clamp

1. Loosen the end stop fastening screw using a #2 Phillips screwdriver.
2. Move the stop block so the bottom edge of the block lines up with the number corresponding to the desired degrees of rotation. (example: 45 degrees of rotation = .5)
3. Lock the block in place with the fastening screw.
4. Check the actuator for proper rotation.

### Using the IND-LF Position Indicator with Adjustable Stop

**NOTE:** preferred method if short shaft mounting is used.

1. With the actuator in its fail-safe position, place the IND-LF Position Indicator so that it points to the 0 degree position.
2. Loosen the end stop fastening screw using a #2 Phillips screwdriver.
3. Move the stop block so the bottom edge of the block lines up with the number corresponding to the desired degrees of rotation (example: 45 degrees of rotation = .5).
4. Lock the block in place with the fastening screw.
5. Check the actuator for proper rotation.

### Direction of Rotation Switch

LF24-3(-S) US and LF24-SR(-S) US actuators have a direction of rotation switch on the cover labeled "CW-CCW". Switch position indicates start point. For the LF24-SR, with the switch in position "CW", the actuator rotates clockwise with a decrease in voltage or current. With the switch in position "CCW", the actuator rotates counter-clockwise with a decrease in voltage or current.

The LF24-3(-S) US and LF24-SR(-S) US actuators rotate clockwise when the switch is in the "CW" position and power is applied to wire #3. When power is applied to wire #4 the actuator rotates counter clockwise.

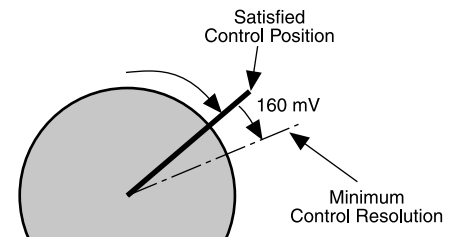
Rotating the direction of rotation switch to "CCW" reverses the control logic. During checkout, the switch position can be temporarily reversed and the actuator will reverse its direction. This allows the technician a fast and easy way to check the actuator operation without having to switch wires or change settings on the controller. When the check-out is complete, make sure the switch is placed back to its original position.

### Control Accuracy and Stability

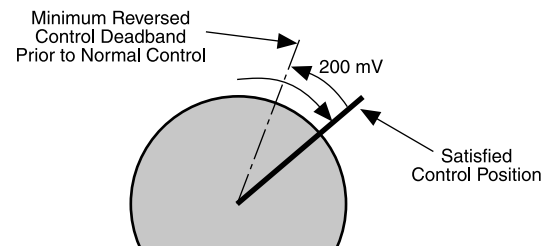
LF24-SR US actuators have built-in brushless DC motors which provide better accuracy and longer service life.

The LF24-SR US actuators are designed with a unique non-symmetrical deadband. The actuator follows an increasing or decreasing control signal with a 160 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 200 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**LF Actuator responds to a 160 mV signal when not changing direction from stop position.**



**LF Actuator responds to a 200 mV signal when reversing direction from stop position.**



The LF24-MFT(-S) US control accuracy and stability can be found in the MFT technical documentation.

# Installation Instructions

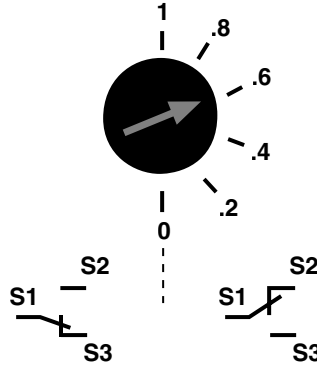
## Auxiliary Switches and Non-Direct Mounting Methods



### Auxiliary Switches

The ...-S model actuators are equipped with an adjustable auxiliary switch used to indicate damper position or to interface additional controls or equipment. Switching positions can be set over the full 0 to 95° rotation simply by setting a switch on the actuator.

1. Set desired switch position.  
(Example 60%)
2. As the actuator rotates, the switch indicator moves from .6 (60%) toward 0 (0%). When the indicator passes 0 the switch contact between S1 and S2 is broken and the contact between S1 and S3 is made.



### Switch Rating

Voltage	Resistive load	Inductive load
120 VAC	3 A	1.03 A
250 VAC	3 A	0.5 A

### Non-Direct Mounting Methods

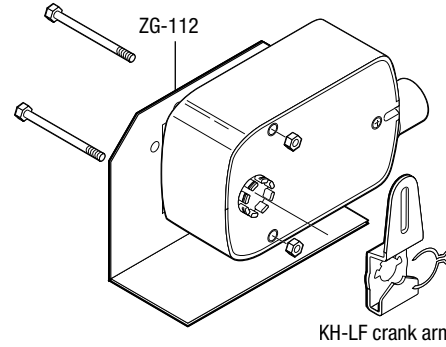
#### KH-LF Crank arm

Including Retaining Ring



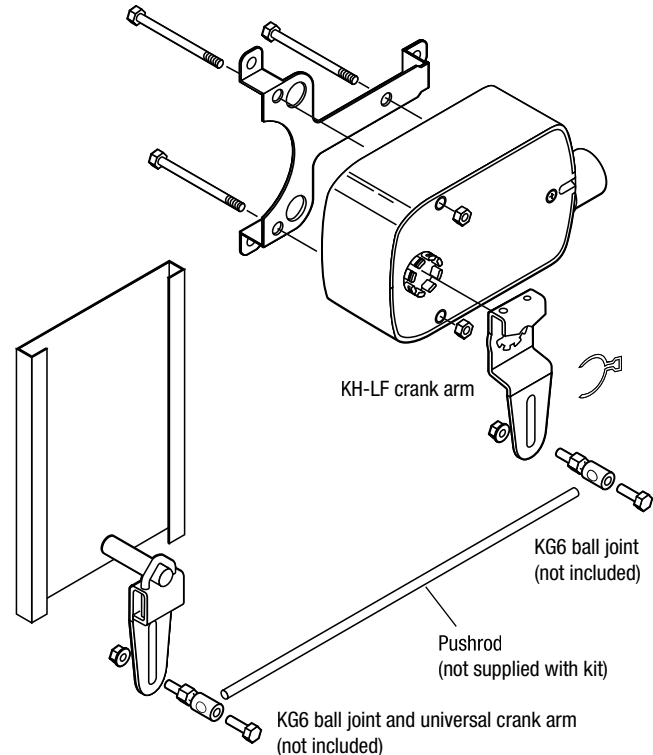
**KH-LF**  
For round shafts up to 1/2"

#### ZG-LF112 Crank arm Adaptor Kit



KH-LF crank arm

#### ZG-LF2 Crank arm Adaptor Kit



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**WARNING** The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

Always read the controller manufacturer's installation literature carefully before making any connections. Follow all instructions in this literature. If you have any questions, contact the controller manufacturer and/or Belimo.

### Transformers

The LF24 . . . actuator requires a 24 VAC class 2 transformer and draws a maximum of 7 VA per actuator. The actuator enclosure cannot be opened in the field, there are no parts or components to be replaced or repaired.

- EMC directive: 2004/108/EC
- Software class A: Mode of operation type 1
- Low voltage directive: 2006/95/EC

**CAUTION** It is good practice to power electronic or digital controllers from a separate power transformer than that used for actuators or other end devices. The power supply design in our actuators and other end devices use half wave rectification. Some controllers use full wave rectification. When these two different types of power supplies are connected to the same power transformer and the DC commons are connected together, a short circuit is created across one of the diodes in the full wave power supply, damaging the controller. Only use a single power transformer to power the controller and actuator if you know the controller power supply uses half wave rectification.

### Multiple Actuators, One Transformer

Multiple actuators may be powered from one transformer provided the following rules are followed:

1. The TOTAL current draw of the actuators (VA rating) is less than or equal to the rating of the transformer.
2. Polarity on the secondary of the transformer is strictly followed. This means that all No. 1 wires from all actuators are connected to the common leg on the transformer and all No 2 wires from all actuators are connected to the hotleg. Mixing wire No. 1 & 2 on one leg of the transformer will result in erratic operation or failure of the actuator and/or controls.

### Multiple Actuators, Multiple Transformers

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

1. The transformers are properly sized.
2. All No. 1 wires from all actuators are tied together and tied to the negative leg of the control signal. See wiring diagram.

### Wire Length for LF... Actuators

Keep power wire runs below the lengths listed in the table in **Figure A**. If more than one actuator is powered from the same wire run, divide the allowable wire length by the number of actuators to determine the maximum run to any single actuator.

Example for LF24-SR US: 3 actuators, 16 Ga wire  
 $550 \text{ Ft} \div 3 \text{ Actuators} = 183 \text{ Ft. Maximum wire run}$

#### LF24(-S) US Maximum Wire Length

Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	1100 Ft.	18 Ga	260 Ft.
14 Ga	700 Ft.	20 Ga	140 Ft.
16 Ga	440 Ft.	22 Ga	75 Ft.

#### LF120(-S) US / LF230(-S) Maximum Wire Length

Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	1250 Ft.	18 Ga	320 Ft.
14 Ga	800 Ft.	20 Ga	160 Ft.
16 Ga	500 Ft.	22 Ga	85 Ft.

#### LF24-SR(-S) US / LF24-3(-S) US LFC24-3-R(-S) US / LF24-MFT... US Maximum Wire Length

Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	1500 Ft.	18 Ga	375 Ft.
14 Ga	925 Ft.	20 Ga	200 Ft.
16 Ga	550 Ft.	22 Ga	100 Ft.

**FIGURE A**

### Wire Type and Wire Installation Tips

For most installations, 18 or 16 Ga. cable works well with the LF24... actuators. Use code-approved wire nuts, terminal strips or solderless connectors where wires are joined. It is good practice to run control wires unspliced from the actuator to the controller. If splices are unavoidable, make sure the splice can be reached for possible maintenance. Tape and/or wire-tie the splice to reduce the possibility of the splice being inadvertently pulled apart.

The LF24... proportional actuators have a digital circuit that is designed to ignore most unwanted input signals (pickup). In some situations the pickup may be severe enough to cause erratic running of the actuator. For example, a large inductive load (high voltage AC wires, motors, etc.) running near the power or control wiring may cause excessive pickup. To solve this problem, make one or more of the following changes:

1. Run the wire in metallic conduit.
2. Re-route the wiring away from the source of pickup.
3. Use shielded wire (Belden 8760 or equal). Ground the shield to an earth ground. Do not connect it to the actuator common.

### Brushless DC Motor Operation

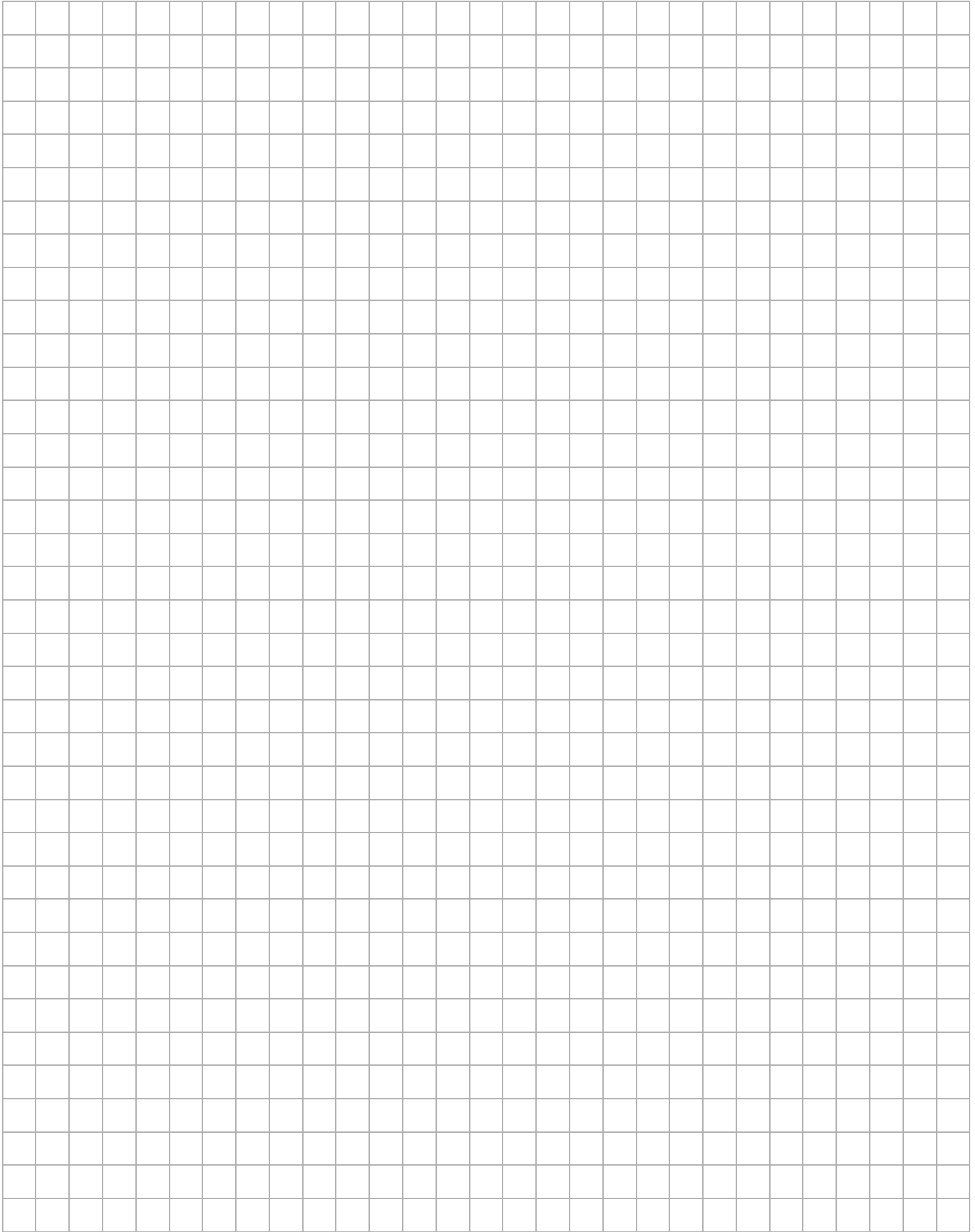
Belimo's brushless DC motor spins by reversing the poles of stationary electromagnets housed inside rotating permanent magnets. The electromagnetic poles are switched by a microprocessor and a special ASIC (Application Specific Integrated Circuit) developed by Belimo. Unlike the conventional DC motor, there are no brushes to wear or commutators to foul.

LF24-SR (-S) US and LF24-MFT...US + P100 Electrical Check-Out Procedure				
STEP	Procedure	Expected Response	Gives Expected Response Go To Step...	Does Not Give Expected Response Go To Step...
1.	Remove power to reset actuator. Re-apply power. Apply control signal to actuator.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 8.</b>	No response at all <b>Step 2.</b> Operation is reversed <b>Step 3.</b> Does not drive toward "Control Signal Position" <b>Step 4.</b>
2.	Check power wiring. Correct any problems. See Note 1.	Power supply rating should be the total power requirement of the actuator(s). Minimum voltage of 19.2 VAC or 21.6 VDC.	Power wiring corrected, actuator begins to drive <b>Step 1.</b>	Power wiring corrected, actuator still does not drive <b>Step 4.</b>
3.	Turn reversing switch to the correct position. Make sure the switch is turned all the way left or right.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 8.</b>	Does not drive toward "Control Signal Position" <b>Step 4.</b>
4.	Make sure the control signal positive (+) is connected to Wire No 3 and control signal negative (-) is connected to wire No. 1. Most control problems are caused by reversing these two wires. Verify that the reversing switch is all the way CCW or CW.	Drives to "Control Signal" position	Actuator operates properly <b>Step 8.</b>	<b>Step 5.</b>
5.	Check input signal with a digital volt meter (DVM). Make sure the input is within the range of the actuator. For LF24-SR US this is 2 to 10 VDC or 4 to 20 mA. Note: The input signal must be above the 2 VDC or 4 mA to have the actuator move.	Input voltage or current should be $\pm 1\%$ of what controller's adjustment or programming indicate.	Controller output (actuator input) is correct. Input Polarity Correct <b>Step 6.</b>	Reprogram, adjust repair or replace controller as needed <b>Step 1.</b>
6.	Loosen the nuts on the V-bolt and move the damper by hand from fully closed to fully open.	Damper will go from fully closed to fully open.	Damper moves properly <b>Step 7.</b>	Find cause of damper jam and repair. Move damper back to the fully closed position and tighten the nuts <b>Step 1.</b>
7.	Check damper torque requirement.	Torque requirement is actuator's minimum torque.	Defective Actuator. Replace Actuator. - <b>See Note 2.</b>	Recalculate actuator requirement and correct installation.
8.	Actuator works properly. Test controller by following controller manufacturer's instructions.			

- NOTE 1** Check that the transformer(s) are sized properly.
- If a common transformer is used, make sure that polarity is observed on the secondary. This means connect all No. 1 wires to one leg of the transformer and all No. 2 wires to the other leg of the transformer.
  - If multiple transformers are used with one control signal, make sure all No. 1 wires are tied together and tied to control signal negative (-).
  - Controllers and actuators must have separate 24 VAC/VDC power sources.

**NOTE 2** If failure occurs within 5 years from original installation date, notify Belimo and give details of the application.

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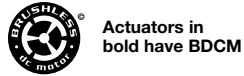
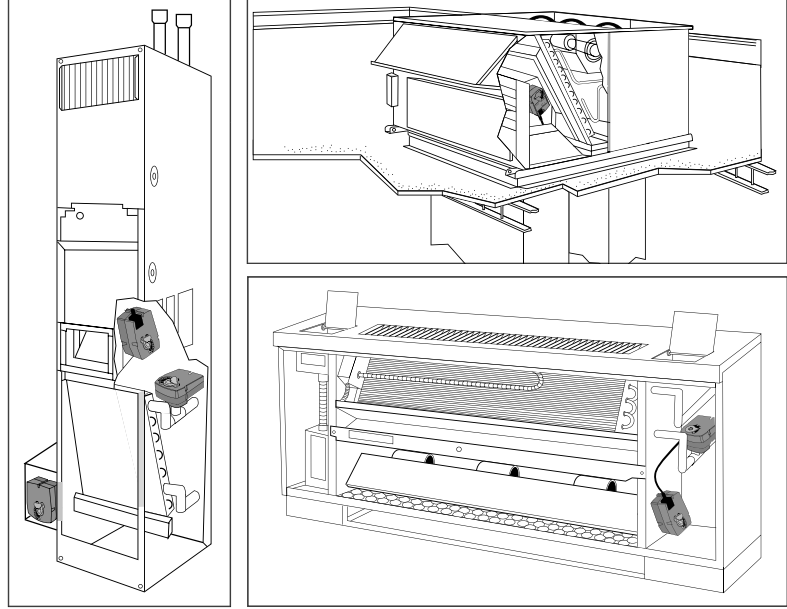
## Minimum 18 in-lb Torque

- For damper areas up to 4.5 sq-ft\*

## Applications

Cost effective quality and performance for a range of applications including:

- Classroom Unit Ventilators
- Fan/Coil Units
- Economizer Units
- Airhandlers
- Control Dampers
- VAV Terminal Units



## TF Series - At A Glance

	<i>TF24 US (p. 165)</i>	<i>TF24-S US (p. 165)</i>	<i>TF120 US (p. 167)</i>	<i>TF120-S US (p. 167)</i>	<i>TFC120-S US (p. 169)</i>	<i>TF24-3 US (p. 171)</i>	<i>TF24-3-S US (p. 171)</i>	<i>TF24-SR US (p. 173)</i>	<i>TF24-SR-S US (p. 173)</i>	<i>TF24-MFT US (p. 175)</i>
Torque:	18 in-lb	●	●	●	●	●	●	●	●	●
Power supply:	24 VAC/DC**	●	●			●	●	●	●	●
	120 VAC			●	●					
	230 VAC			●	●					
Control signal:	on/off	●	●	●	●					
	floating point					●	●			
	proportional 2 to 10 VDC							●	●	
	multi-function									●
Running time motor:	<75 seconds	●	●	●	●					
	< 30 seconds					●				
	95 seconds constant					●	●	●	●	
	Adj. 75 to 300 seconds***									●
spring:	<25 seconds	●	●	●	●	●	●	●	●	●
External direction of rotation switch						●	●	●	●	●
Plenum rated cable, 18 GA						●	●	●	●	●
Appliance cable, 18 GA	●	●	●	●	●	●	●	●	●	●
Conduit fitting	●	●	●	●	●	●	●	●	●	●
Built-in auxiliary switch		●		●	●			●	●	

General wiring ..... (p. 182)

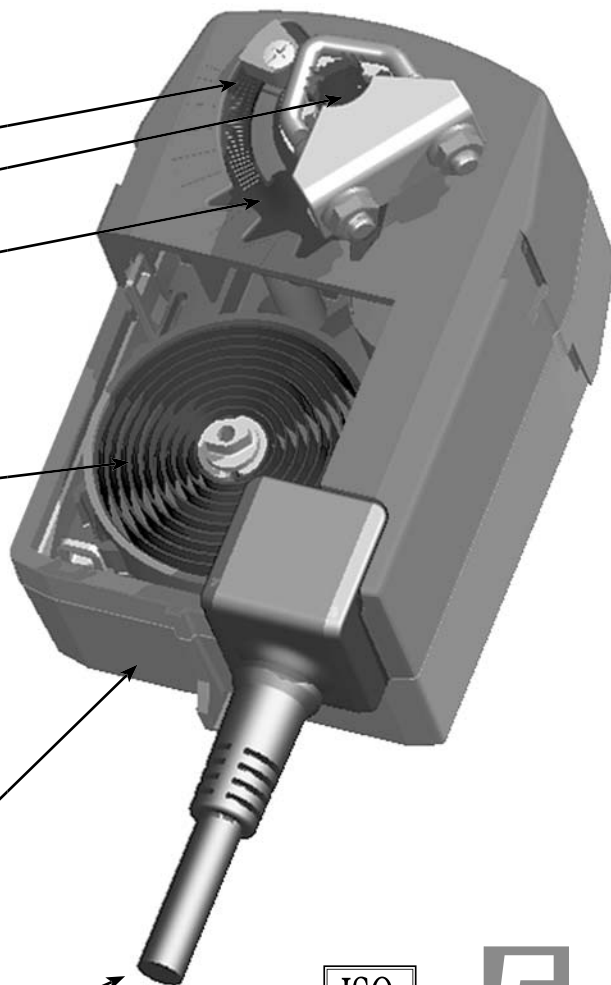
Installation instructions ..... (p. 177-181)

Start-up and checkout ..... (p. 183)

\*Based on 4 in-lb/ft<sup>2</sup> damper torque loading. Parallel blade. No edge seals. \*\*Note: TF24-3 (-S) US is only 24 VAC. \*\*\*Default 150 seconds

# A CLOSER LOOK...

- Easy-to-adjust mechanical stop to limit damper rotation.
- Cut labor costs with simple direct coupling. Actuator Centers on 1/2" shaft.
- Clockwise or counterclockwise fail-safe mounting for fail-safe.
- Compact size with the shortest shaft-center to edge distance in the industry - 0.77".
- True mechanical spring return – the most reliable fail-safe.
- Single line voltage model for on/off application has 100 to 240V (-15/+10%), 50/60 Hz supply power.
- Check damper position easily with clear position indicator.
- Don't worry about actuator burn-out. Belimo is overload-proof throughout rotation.
- Need to change control direction? Do it easily with a simple switch (modulating actuators).
- Built-in auxiliary switch is easy to use, offers feedback or signal for additional device.
- Microprocessor-controlled brushless DC motor increases actuator life span and reliability, provides constant running time (modulating actuators).
- Rugged housing withstands rough handling in the mechanical room.
- 3 ft. standard cable and conduit connector (not shown) eases installation.



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## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30 years direct coupled actuator design.

# TF24(-S) US

On/Off, Spring Return, 24 V



Technical Data		TF24(-S) US
Power supply		24VAC ± 20%, 50/60Hz 24VDC ± 10%
Power consumption	running	2 W
	holding	1.3 W
Transformer sizing		5 VA (class 2 power source)
Electrical connection (-S models have 2 cables)		3 ft, 18 GA appliance cable 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Angle of rotation		max 95°, adjust. with mechanical stop
Torque		min. 18 in-lb [2 Nm]
Direction of rotation		reversible with cw/ccw mounting
Position indication		visual indicator, 0° to 95° (0° spring return position)
Running time (nominal)	motor	< 75 sec (0 to 18 in-lb)
	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP42, UL enclosure type 2
Housing material		UL94-5VA
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC (and 2006/95/EC for -S versions)
Noise level (max)	running	< 50 db (A)
	spring return	62 dB (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight	TF24	1.4 lbs (0.6 kg)
	TF24-S	1.5 lbs (0.7 kg)

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

TF24-S US	
Auxiliary switch	1 x SPDT 3A (0.5A) @ 250 VAC, UL approved adjustable 0° to 95°

**Torque min. 18 in-lb, for control of air dampers**

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft from 1/4" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

The TF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The TF series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 90°.

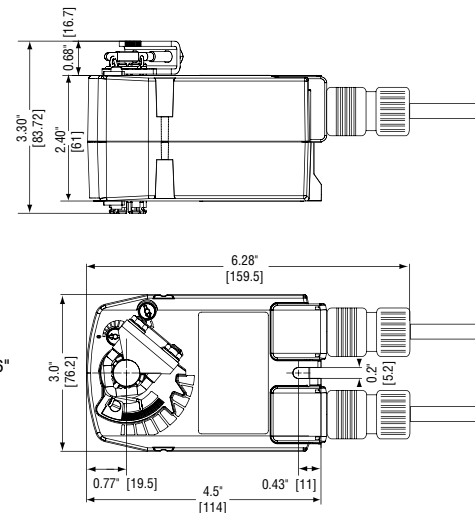
The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

The TF24-S US versions are provided with one built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°.

## SAFETY NOTE

Screw a conduit fitting into the actuator's bushing. Jacket the actuator's input and output wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

## Dimensions (Inches [mm])



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**Accessories**

Tool-06	8mm and 10 mm wrench
KH-TF	Crank arm for up to 1/2" round shaft
ZG-TF2	Crank arm adaptor kit for TF
ZG-TF112	Mounting bracket, kit for TF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)

**NOTE:** When using TF24 US and TF24-S US actuators, only use accessories listed on this page. For actuator wiring information and diagrams, Please See Belimo Wiring Guide (pg 349).

**Typical Specification**

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 1/2" diameter and center a 1/2" shaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators with auxiliary switch 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 certified, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**

**INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel. Power consumption must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., TF24-S US incorporates a built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0 to 95.

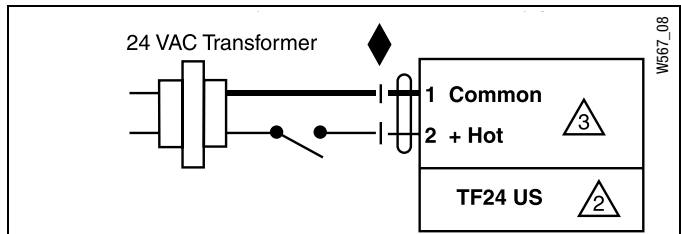
**APPLICATION NOTES**

Meets cULus requirements without the need of an electrical ground connection.

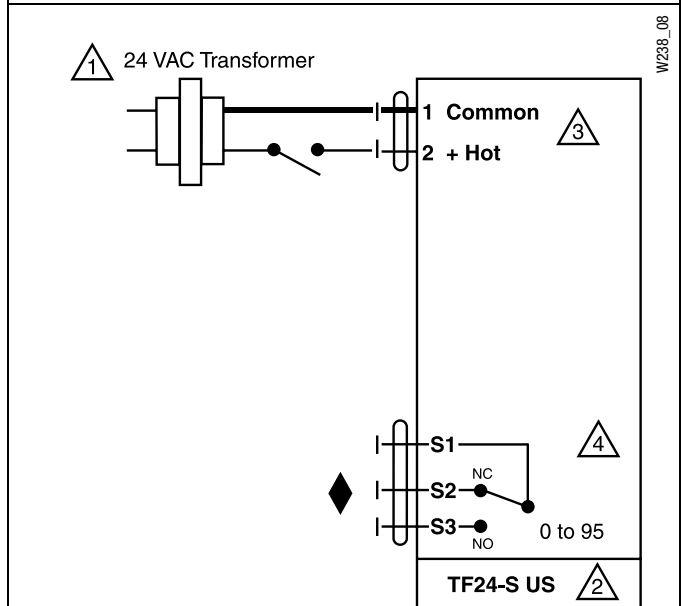
**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

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On/Off wiring for TF24 US



On/Off wiring for TF24-S US

# TF120(-S) US

On/Off, Spring Return, 100 to 240 VAC



Technical Data		TF120(-S) US
Power supply	nominal	100 to 240 VAC, 50/60 Hz
	tolerance	85 to 265 VAC, 50/60 Hz
Power consumption	running	2.5 W
	holding	1.3 W
Transformer sizing		5 VA (class 2 power source)
Electrical connection		3 ft, 18 GA appliance cable
(-S models have 2 cables)		1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Electrical protection		actuators are double insulated
Angle of rotation		max 95°, adjust. with mechanical stop
Torque		min. 18 in-lb [2 Nm]
Direction of rotation		reversible with cw/ccw mounting
Position indication		visual indicator, 0° to 95° (0° spring return position)
Running time	motor	< 75 sec (0 to 18 in-lb)
	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C]
		< 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP42, UL enclosure type 2
Housing material		UL94-5VA
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC (and 2006/95/EC for -S versions)
Noise level (max)	running	< 50 db (A)
	spring return	62 dB (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight	TF120	1.4 lbs (0.6 kg)
	TF120-S	1.5 lbs (0.7 kg)

† Rated Impulse Voltage 4kV, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

TF120-S US	
Auxiliary switch	1 x SPDT 3A (0.5A) @ 250 VAC, UL approved adjustable 0° to 95°

Torque min. 18 in-lb, for control of air dampers

## Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft from 1/4" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

The TF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The TF series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 90°.

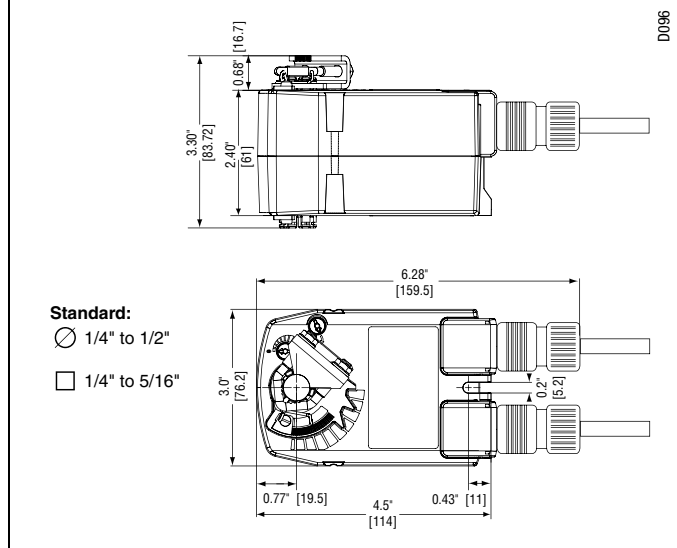
The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode. The actuator is double insulated so an electrical ground connection is not necessary.

The TF120-S US versions are provided with one built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°.

## SAFETY NOTE

Screw a conduit fitting into the actuator's bushing. Jacket the actuator's input and output wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

## Dimensions (Inches [mm])



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**Accessories**

Tool-06	8mm and 10 mm wrench
KH-TF	Crank arm for up to 1/2" round shaft
ZG-TF2	Crank arm adaptor kit for TF
ZG-TF112	Mounting bracket, kit for TF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)

**NOTE:** When using TF120 US and TF120-S US actuators, only use accessories listed on this page. For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 1/2" diameter and center a 1/2" shaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators 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.

**Wiring Diagrams**
**INSTALLATION NOTES**

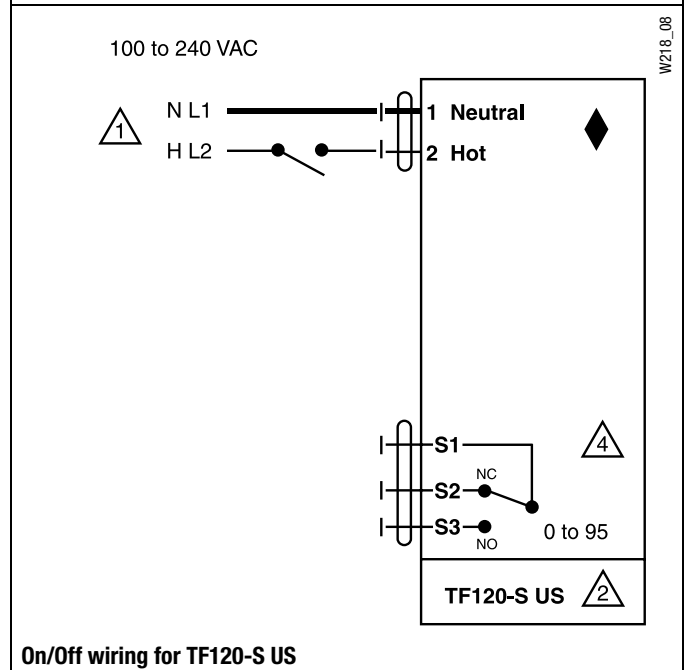
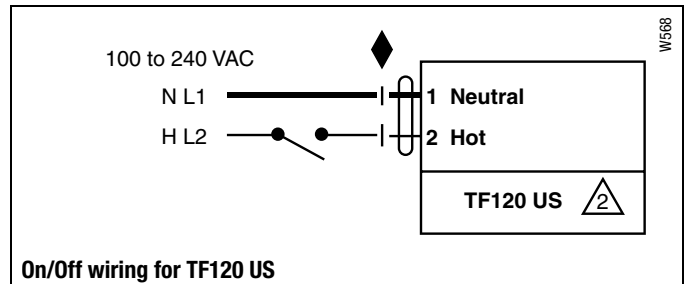
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel. Power consumption must be observed.
- 4 For end position indication, interlock control, fan startup, etc., TF120-S US incorporate one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.

**APPLICATION NOTES**

◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!** During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

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# TFC120-S US

On/Off, Spring Return, 100-240 VAC



Technical Data		TFC120-S US
Power supply	nominal	100 to 240 VAC, 50/60 Hz
	tolerance	85 to 265 VAC, 50/60 Hz
Power consumption	running	3 W
	holding	1.5 W
Transformer sizing		6 VA (class 2 power source)
Electrical connection		two 3 ft, 18 GA appliance cable 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Electrical protection		actuators are double insulated
Angle of rotation		max 95°, adjust. with mechanical stop
Torque		min. 18 in-lb [2 Nm]
Direction of rotation		reversible with cw/ccw mounting
Position indication		visual indicator, 0° to 95° (0° spring return position)
Auxiliary switch		1 x SPDT 3A (0.5A) @ 250 VAC, UL approved adjustable 0° to 95°
Running time	motor	< 30 sec (0 to 18 in-lb)
	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP42, UL enclosure type 2
Housing material		UL94-5VA
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC, and 2006/95/EC
Noise level (max)	running	< 56 db (A)
	spring return	63 db (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		1.5 lbs (0.7 kg)

† Rated Impulse Voltage 4kV, Type of action 1.AA.B, Control Pollution Degree 3.

**Torque min. 18 in-lb, for control of air dampers**

## Application

For On/Off fast running, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft from 1/4" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

The TF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The TF series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 90°.

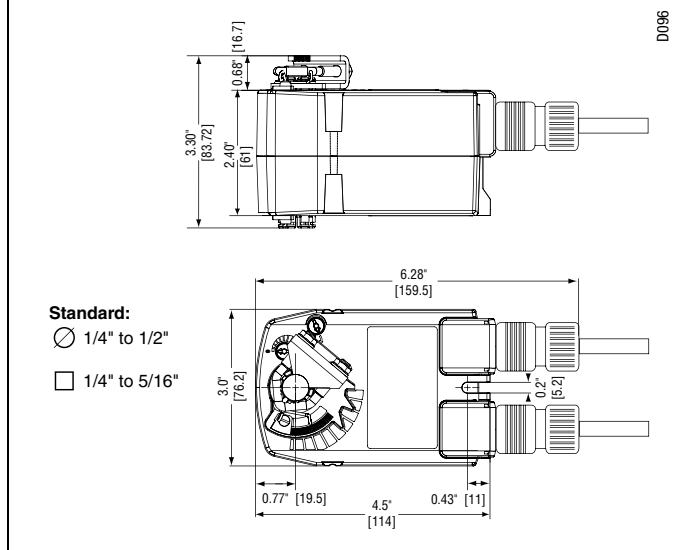
The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode. The actuator is double insulated so an electrical ground connection is not necessary.

The TFC120-S US versions are provided with one built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°.

## SAFETY NOTE

Screw a conduit fitting into the actuator's bushing. Jacket the actuator's input and output wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

## Dimensions (Inches [mm])



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**Accessories**

Tool-06	8mm and 10 mm wrench
KH-TF	Crank arm for up to 1/2" round shaft
ZG-TF2	Crank arm adaptor kit for TF
ZG-TF112	Mounting bracket, kit for TF
ZG-TF113	Mounting bracket, kit for TF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)

**NOTE:** When using TFC120-S US actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**Typical Specification**

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 1/2" diameter and center a 1/2" shaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators 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.

**Wiring Diagram**
**INSTALLATION NOTES**

1 Provide overload protection and disconnect as required.

2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption must be observed.

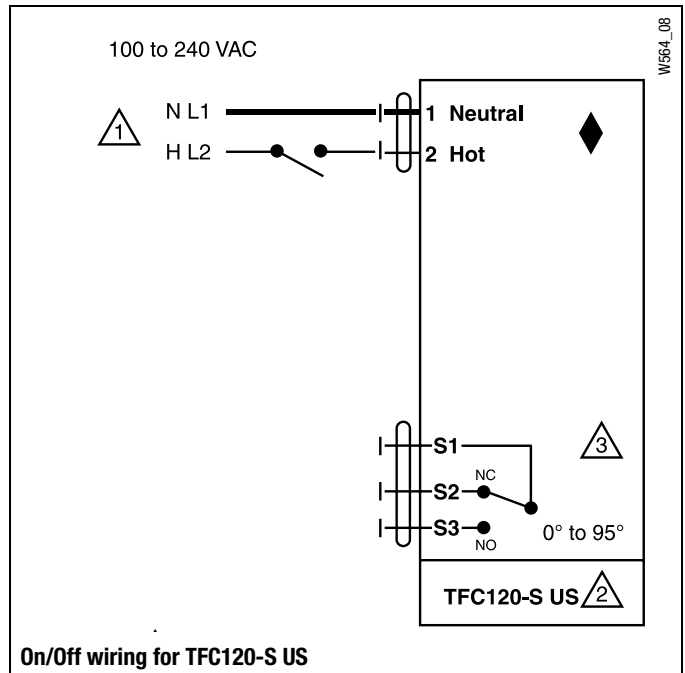
4 For end position indication, interlock control, fan startup, etc., TFC120-S US incorporate one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.

**APPLICATION NOTES**

◆ Meets cULus requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# TF24-3(-S) US

On/Off, Floating Point, Spring Return, 24V



Technical Data		TF24-3(-S) US
Power supply		24 VAC ± 20%, 50/60 Hz
Power consumption	running	2.5 W
	holding	1 W
Transformer sizing		4 VA (class 2 power source)
Electrical connection		
	TF24-3 US	3 ft, plenum rated cable 1/2" conduit connector
	TF24-3-S US	3 ft, 18 GA appliance cables (2) 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Input impedance		1000 Ω (0.6W) control inputs
Electrical protection		actuators are double insulated
Angle of rotation		max 95°, adjust. with mechanical stop
Torque		18 in-lb [2 Nm]
Direction of rotation	spring motor	reversible with cw/ccw mounting reversible with built-in switch
Position indication		visual indicator, 0° to 95° (0° spring return position)
Running time	motor	95 sec constant, independent of load
	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP42, UL enclosure type 2
Housing material		UL94-5VA
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC, (and 2006/95/EC for -S versions)
Noise level (max)	running	< 35 db (A)
	spring return	62 dB (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight	TF24-3	1.4 lbs (0.6 kg)
	TF24-3-S	1.5 lbs (0.7 kg)

†Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

TF24-3-S US	
Auxiliary switch	1 x SPDT 3A (0.5A) @ 250 VAC, UL approved adjustable 0° to 95° (double insulated)

Torque min. 18 in-lb, for control of air dampers

## Application

For modulation or On/Off control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

Control is floating point from a triac or relay, or On/Off from an auxiliary contact on a fan motor contactor, controller, or manual switch.

## Operation

The TF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

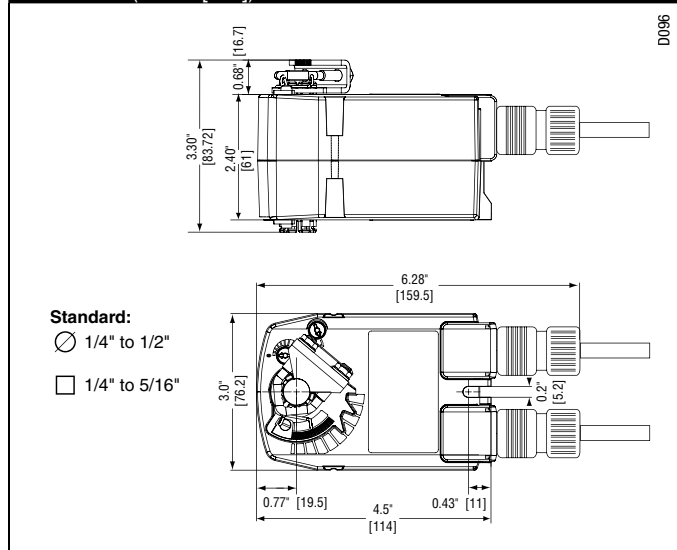
The TF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°.

The TF24-3(-S) US 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. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

Power consumption is reduced in holding mode.

The TF24-3-S US version is provided with one built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°. The auxiliary switch in the TF24-3-S US is double insulated so an electrical ground is not necessary.

## Dimensions (Inches [mm])



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## Accessories

Tool-06	8mm and 10 mm wrench
KH-TF	Crank arm for up to 1/2" round shaft
ZG-TF2	Crank arm adaptor kit for TF
ZG-TF112	Mounting bracket, kit for TF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)

**NOTE:** When using TF24-3(-S) US actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

## Typical Specification

Floating point, On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 1/2" diameter and center a 1/2" shaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall have an external direction of rotation switch to reverse control logic. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators with auxiliary switch must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Run time shall be constant and independent of torque. Actuators shall be cULus listed certified, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

## Wiring Diagrams

### INSTALLATION NOTES

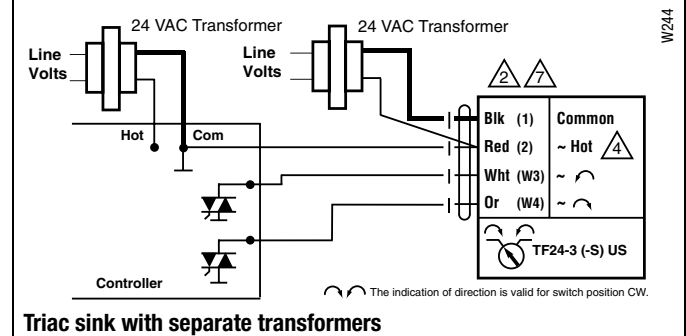
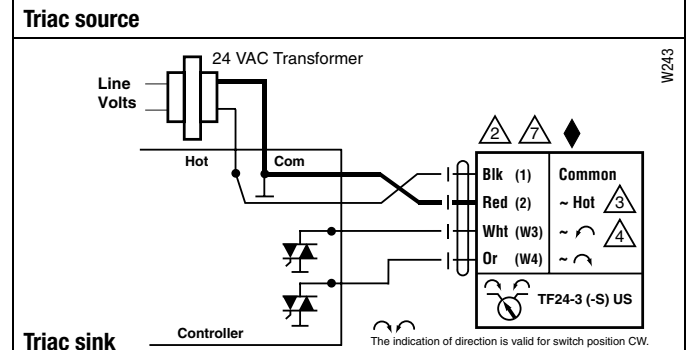
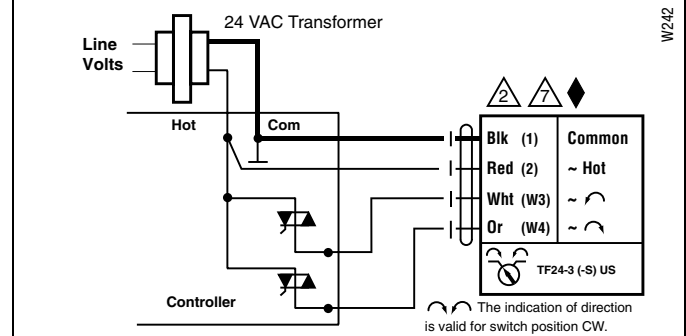
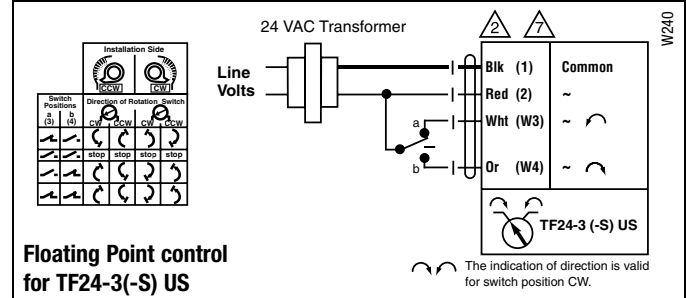
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption must be observed.
- 3 The Common connection from the actuator must be connected to the Hot connection of the controller.
- 4 The actuator Hot must be connected to the control board Common.
- 5 For end position indication, interlock control, fan startup, etc., TF24-3-S US incorporates one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.
- 7 Actuators with plenum rated cable do not have numbers on wires; use color coded instead. Actuators with appliance rated cable use numbers. TF24-3-S US has an Orange wire #5 instead of #4.

### APPLICATION NOTES

- Meets cULus requirements without the need of an electrical ground connection.

### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# TF24-SR(-S) US

Proportional, Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data		TF24-SR(-S) US
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	2 W
	holding	1 W
Transformer sizing		4 VA (class 2 power source)
Electrical connection		
	TF24-SR US	3 ft, plenum rated cable 1/2" conduit connector
	TF24-SR-S US	3 ft, 18 GA appliance cables (2) 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20mA
Input impedance		100 kΩ (0.1 mA), 500 Ω
Angle of rotation		max 95°, adjust. with mechanical stop
Torque		18 in-lb [2 Nm]
Direction of rotation	spring motor	reversible with cw/ccw mounting reversible with built-in switch
Position indication		visual indicator, 0° to 95° (0° spring return position)
Running time	motor	95 sec constant, independent of load
	spring	< 25 sec @ -4°F to 122°F [-20°C to 50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP42, UL enclosure type 2
Housing material		UL94-5VA
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC (and 2006/95/EC for -S versions)
Noise level (max)	running	< 35 db (A)
	spring return	62 db (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight	TF24-SR	1.4 lbs (0.6 kg)
	TF24-SR-S	1.5 lbs (0.7 kg)

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

TF24-SR-S US	
Auxiliary switch	1 x SPDT 3A (0.5A) @ 250 VAC, UL approved adjustable 0° to 95° (double insulated)

**Torque min. 18 in-lb, for control of air dampers**

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner.

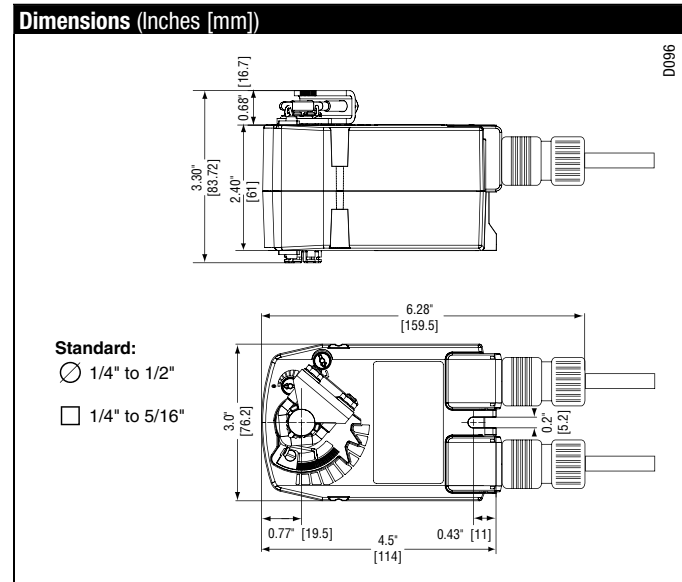
## Operation

The TF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The TF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°.

The TF24-SR (-S) US 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 fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

The TF24-SR-S US version is provided with one built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°. The auxiliary switch in the TF24-SR-S US is double insulated so an electrical ground is not necessary.



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**Accessories**

Tool-06	8mm and 10 mm wrench
KH-TF	Crank arm for up to 1/2" round shaft
ZG-TF2	Crank arm adaptor kit for TF
ZG-TF112	Mounting bracket, kit for TF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)

**NOTE:** When using TF24-SR (-S) US actuators, only use accessories listed on this page.  
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

**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 shaft up to a 1/2" diameter and center a 1/2" shaft. The actuator must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω 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 counterclockwise 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. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators with auxiliary switch 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 certified, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

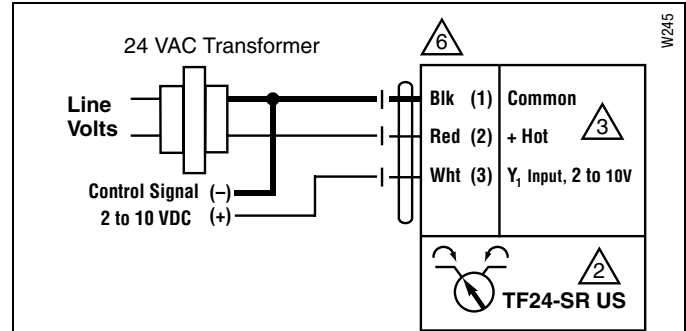
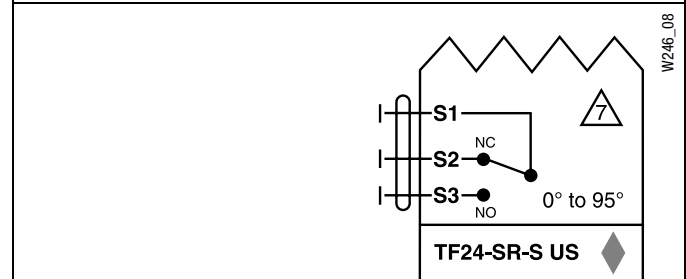
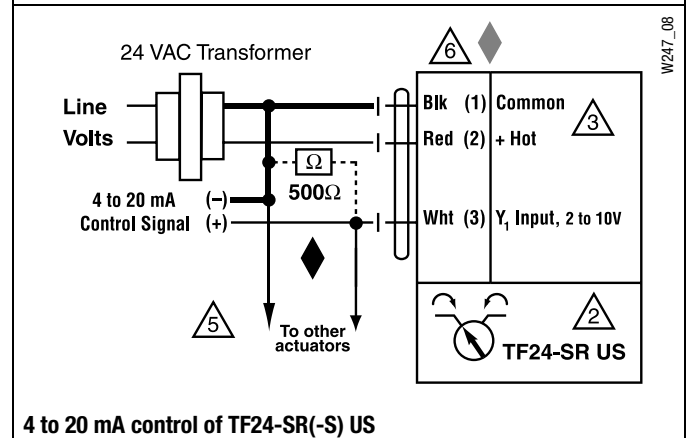
**Wiring Diagrams**
**INSTALLATION NOTES**

- CAUTION Equipment Damage!**  
Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor, a +2% shift of control signal may be required. Power consumption must be observed.
- Actuator may also be powered by 24 VDC.
- Only connect common to neg. (-) leg of control circuits.
- Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
- For end position indication, interlock control, fan startup, etc., TF24-SR-S US incorporates one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.

**APPLICATION NOTES**

- Meets cULus requirements without the need of an electrical ground connection.
- The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

**WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.


**2 to 10 VDC control of TF24-SR(-S) US**

**Auxiliary switch of TF24-SR-S US**

**4 to 20 mA control of TF24-SR(-S) US**

# TF24-MFT US

Proportional, Spring Return, Multi-Function Technology®



MFT



Technical Data	TF24-MFT US
Power supply	24 VAC, ± 20%, 50/60 Hz 24 VDC, ±10%
Power consumption	running 2.5 W holding 1 W
Transformer sizing	4 VA (Class 2 power source)
Electrical connection	3 ft, 18 GA, plenum rated cable 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y*	2 to 10 VDC 4 to 20 mA (w/500 Ω, 1/4 Ω resistor) ZG-R01
Input impedance	100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1500 Ω for PWM, floating point and on/off control
Feedback output U*	2 to 10 VDC, 0.5 mA max
Torque	min 18 in-lb (2 Nm)
Direction of rotation*	spring reversible with cw/ccw mounting motor reversible with built-in switch
Mech. angle of rotation*	max 95°, adjust with mechanical stop
Running time	motor* 150 sec constant independent of load spring <25 sec @ -4°F to 122°F [-20°C to 50°C] <60 sec @ -22°F [-30°C]
Angle of rotation adaptation*	off (default)
Override control*	Min. (Min Position) = 0% - ZS (Mid. Position) = 50% - Max. (Max. Position) = 100%
Position indication	visual indicator, 0° to 95°
Humidity	5 to 95% RH, non-condensing
Ambient temperature	-22 to 122° F (-30 to 50° C)
Storage temperature	-40 to 176° F (-40 to 80° C)
Housing	NEMA 2, IP42, UL enclosure type 2
Housing material	UL 94-5VA
Noise level (max)	<35 dB (A) spring return <65 dB (A)
Agency listings	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC
Quality standard	ISO 9001
Servicing	maintenance free
Weight	1.4 lbs. (0.6 kg)

\* Variable when configured with MFT options

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

- Torque min. 18 in-lb.
- Control 2 to 10 VDC (Default)
- Feedback 2 to 10 VDC (Default)

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

## Default/Configuration

Default parameters for 2 to 10 VDC applications of the TF24-MFT US actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. The parameters noted in the Technical Data table are variable.

These parameters can be changed by three means:

- Pre-set configurations from Belimo
- Custom configurations from Belimo
- Configurations set by the customer using the MFT PC tool software application.

## Operation

The TF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

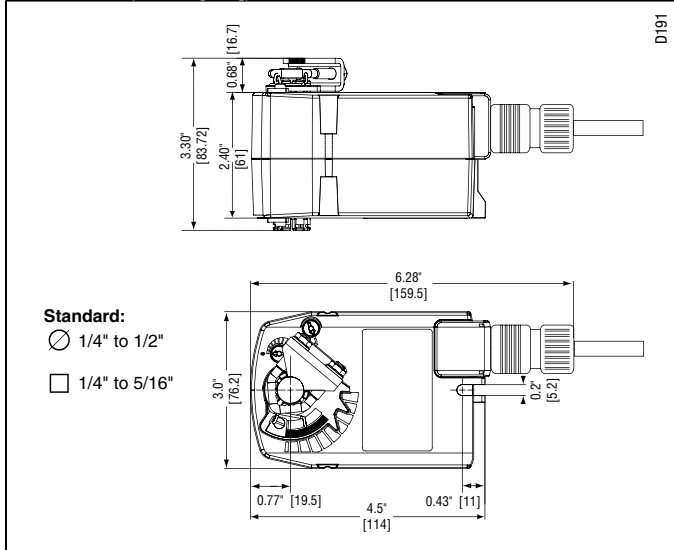
The TF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°.

The TF24-MFT US 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 fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

## SAFETY NOTE

Screw a conduit fitting into the actuator's bushing. Jacket the actuator's input and output wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

## Dimensions (Inches [mm])



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## Wiring Diagrams

### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

### APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor may be used.

### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

W025\_08

**Standard Wiring**

W025\_08

**Override to Zero Position**

A Open = 4 mA Position  
A Closed = Normal Operation

W025\_08

**Override to 20 mA Position**

B Closed = 20 mA Position  
C Closed = Normal Operation

4 to 20 mA control signal

With a 4-20 mA Input, up to 4 actuators may be wired in parallel. A 2% shift in the signal is seen when using a 500Ω resistor. Power consumption must be observed.

W024\_08

**Standard Wiring**

W024\_08

**Override to Zero Position**

A Open = 0 V Position  
A Closed = Normal Operation

W024\_08

**Override to 10V Position**

B Closed = 10 V Position  
C Closed = Normal Operation

W024\_08

**Override control to min, mid, max, positions**

Functions	a	b	c
Min*	0% ↖	↖	↖
Mid*	50% ↖	↖	↖
Max*	100% ↖	↖	↖
Normal**	Control mode acc. to Y	↖	↖

\* Default selectable 0-100%. See Configuration Data Sheet.  
\*\* Customizable. See Configuration Data Sheet.

2 to 10 VDC control signal

# Installation Instructions

## Quick-Mount Visual Instructions for Mechanical Installation



### Quick-Mount Visual Instructions

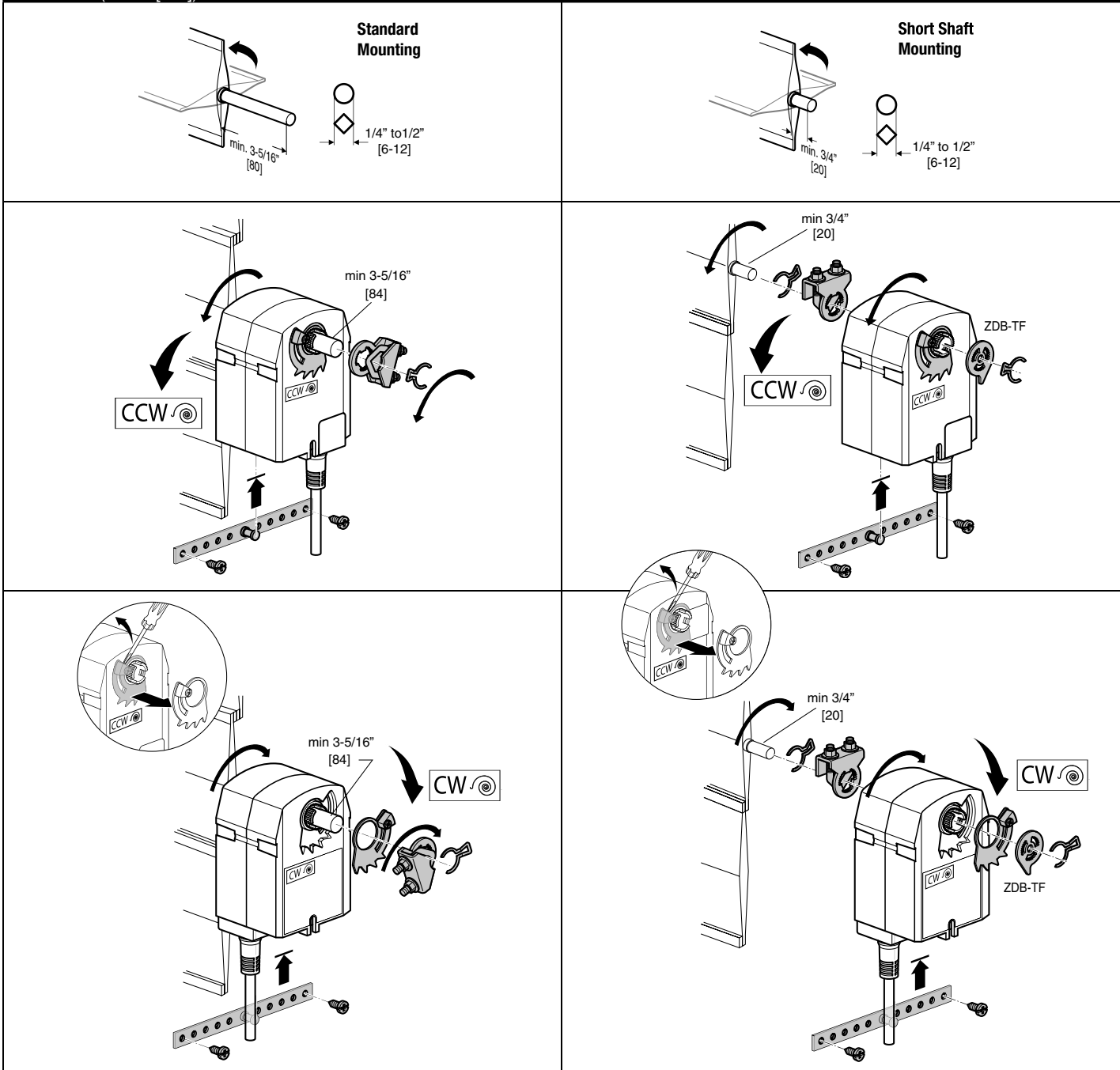
1. Rotate the damper to its failsafe position. If the shaft rotates counterclockwise, mount the "CCW" side of the actuator out. If it rotates clockwise, mount the actuator with the "CW" side out.
2. If the universal clamp is not on the correct side of the actuator, move it to the correct side.
3. Slide the actuator onto the shaft and tighten the nuts on the V-bolt with an 8mm wrench to 6-8 ft-lb of torque.
4. Slide the anti-rotation strap under the actuator so that it engages the slot at the base of the actuator. Secure the strap to the duct work with #8 self-tapping screws.

**NOTE:** Read the "Standard Mounting" instructions, for more detailed information.

### Preliminary Steps

1. Belimo actuators should be mounted indoors in dry, relatively clean environment free from corrosive fumes. If the actuator is to be mounted outdoors, a protective enclosure must be used to shield the actuator. (See Mechanical Accessories Section)
2. For new construction work, order dampers with extended shafts. Instruct the installing contractor to allow space for mounting and service of the Belimo actuator on the shaft.
3. For standard mounting, the damper shaft must extend at least 3 1/2" from the duct. If the shaft extends less than 3 1/2", the actuator may be mounted in its short shaft configuration.

### Dimensions (Inches [mm])



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### Mechanical Operation

The actuator is mounted directly to a damper shaft up to 1/2" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

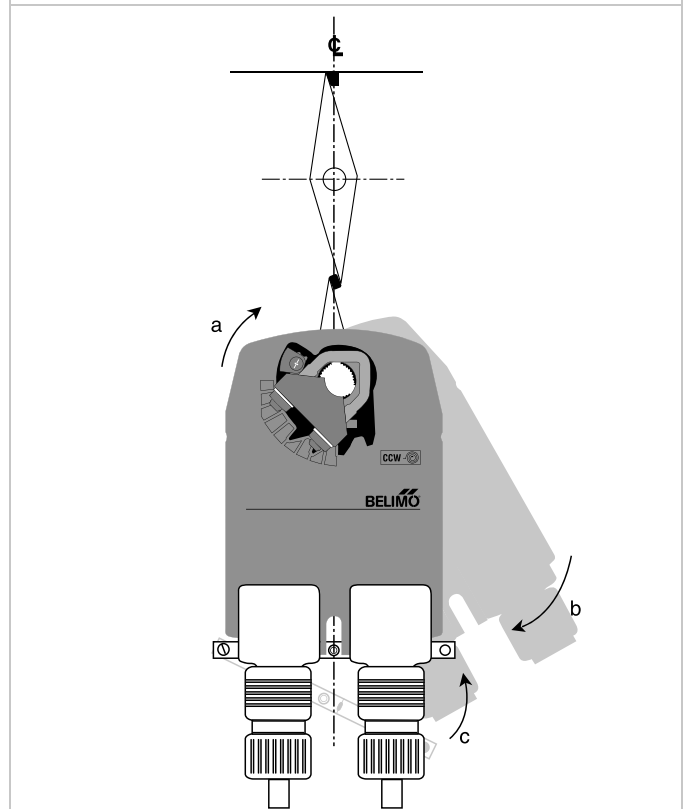
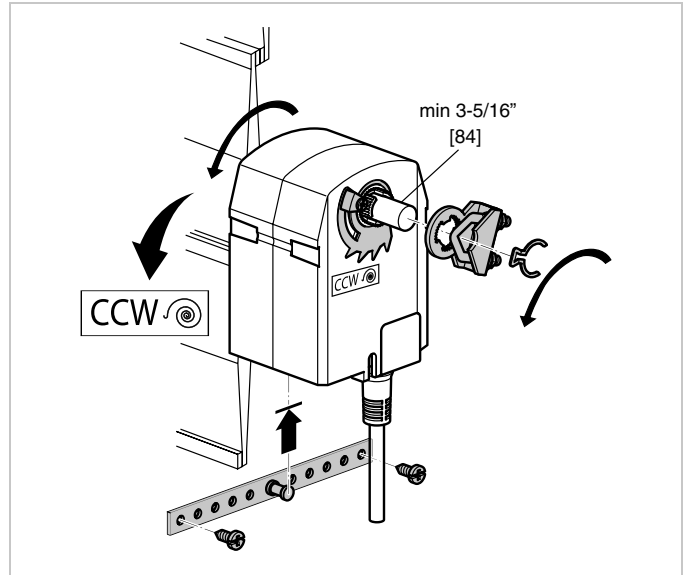
The TF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The TF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°.

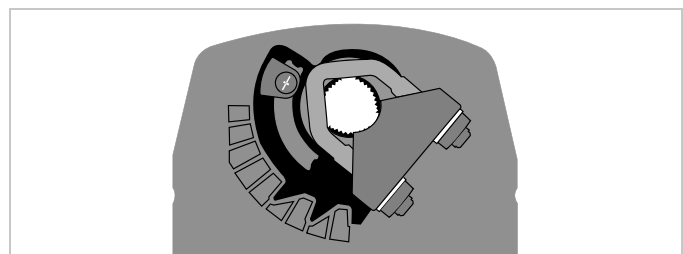
The TF...-S versions are provided with 1 built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°.

### Standard Mounting / Airtight Damper Procedure

1. See **Figure B**. Manually move the damper to the fail-safe position (a) (usually closed). If the shaft rotated counterclockwise (↺), this is a CCW installation. If the shaft rotated clockwise (↻), this is a CW installation. In a Left Hand installation, the actuator side marked "CW" faces out, while in a CW installation, the side marked "CCW" faces out. All other steps are identical.
2. The actuator is usually shipped with the universal clamp mounted to the "CW" side of the actuator. To test for adequate shaft length, slide the actuator over the shaft with the side marked "CW" (or the "CCW" side if this is the side with the clamp). If the shaft extends at least 1/8" through the clamp, mount the actuator as follows. If not, go to the Short Shaft Installation section.
3. If the clamp is not on the correct side as determined in step #1, re-mount the clamp as follows. If it is on the correct side, proceed to step #5. Look at the universal clamp. If you are mounting the actuator with the "CCW" side out, position the clamp so that the pointer section of the tab is pointing to 0° (see Fig. C) and the spline pattern of the clamp mates with spline of the actuator. Remount the stroke limiter to this side then slip the clamp over the spline. (Use the same procedure if the "CW" side is out.)
4. See Remounting the Stroke Limiter after the section Short Shaft Mounting with IND-TF Position Indicator.
5. Lock the clamp to the actuator using the retaining clip.
6. Verify that the damper is still in its full fail-safe position. (a)
7. Mount the spring return actuator to the shaft. Tighten the universal clamp, finger tight only.
8. Mount the anti-rotation strap at the base of the actuator. Do not tighten the screws.
9. Remove the screw from one end of the mounting bracket and pivot it away from the actuator.
10. Loosen the universal clamp and, making sure not to move the damper shaft, rotate the actuator approximately 5° in the direction which would open the damper.
11. Tighten the universal clamp to the shaft.
12. Rotate the actuator to apply pressure to the damper seals (b) and re-engage the anti-rotation strap (c).
13. Tighten all fasteners.



**FIGURE B – Standard Mounting** (Dimensions in Inches [mm])



**FIGURE C – Universal Clamp**

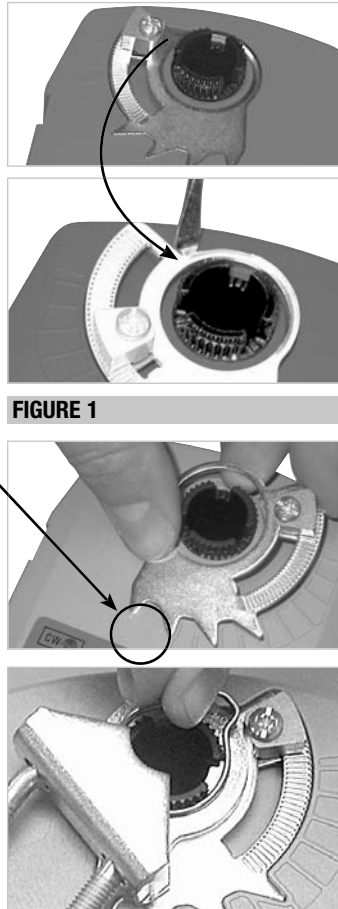
### Short Shaft Mounting with IND-TF Position Indicator / Airtight Damper Procedure

If the shaft extends at least 3/4" from the duct, follow these steps:

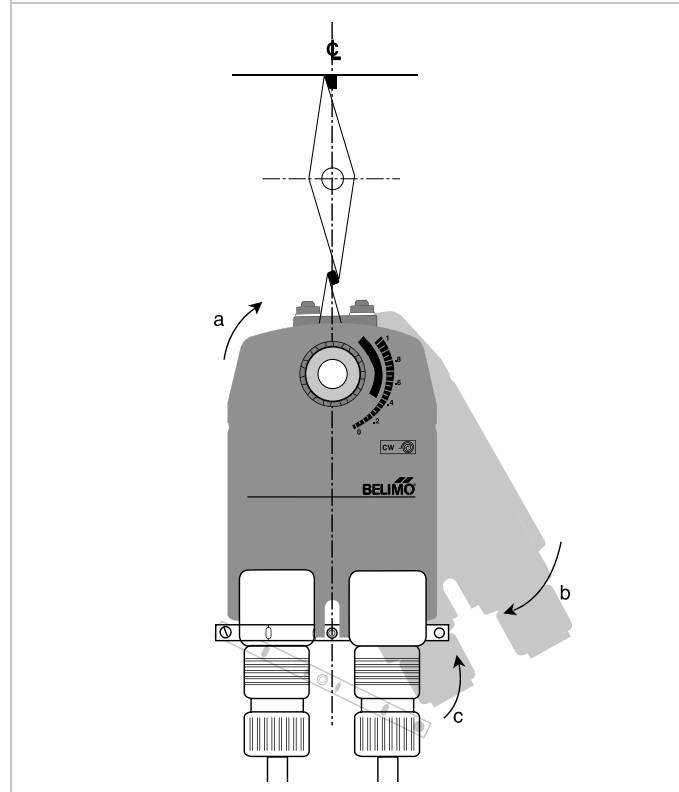
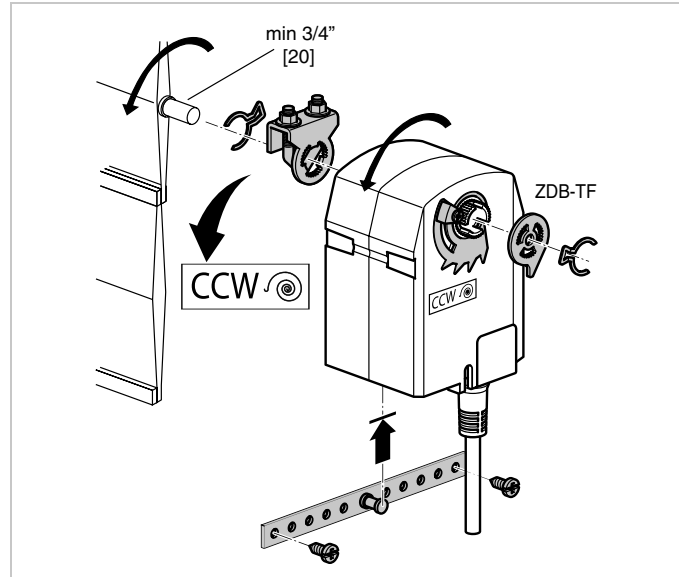
1. (See **Figure D**) Move damper blades to the fail-safe position (a).
2. Determine the best orientation for the universal clamp on the back of the actuator. The best location would be where you have the easiest access to the V bolt nuts on the clamp.
3. Engage the clamp to the actuator as close as possible to the determined location.
4. Lock the clamp to the actuator using the retainer clip.
5. Mount the spring return actuator to the shaft. Tighten the universal clamp, finger tight only.
6. Mount the anti-rotation strap at the base of the actuator. Do not tighten the screws.
7. Remove the screw from one end of the mounting bracket and pivot it away from the actuator.
8. Loosen the universal clamp and, making sure not to move the damper shaft, rotate the actuator approximately 5° in the direction which would open the damper.
9. Verify that the damper is still in its full fail-safe position.
10. Tighten the universal clamp to the shaft.
11. Rotate the actuator to apply pressure to the damper seals (b) and re-engage the anti-rotation strap (c).
12. Tighten all fasteners.
13. Use IND-TF accessory if position indication is needed.

### Remounting the Stroke Limiter

1. Remove the stroke limiter by inserting a small screwdriver, like the one shown, and gently prying upward. This procedure takes very little force. See **Figure 1**.
2. While holding the back eye-let, unscrew the end-stop so that eye-let separates from the end-stop.
3. Flip the limiter over, so the teeth point the other direction. Replace the eye-let and end-stop.
4. Flip the actuator over to the opposite side (this reverses the spring return direction of the actuator). Replace the stroke limiter assembly by inserting the first two teeth as shown in the orange circle. Then press the stroke limiter into place by pushing downward on the adjustable stop.
5. Replace clamp and retaining clip.



**FIGURE 1**



**FIGURE D – Standard Mounting** (Dimensions in Inches [mm])

### Operational Information for TF Actuators

#### Initialization of the TF24-SR (-S) US

When power is applied, the internal microprocessor recognizes that the actuator is at its full fail-safe position and uses this position as the base for all of its position calculations. This procedure takes approximately 15 seconds. During this time you will see no response at the actuator. The microprocessor will retain the initialized zero during short power failures of up to 25 seconds. When power is applied during this period, the actuator will return to normal operation and proceed to the position corresponding to the input signal provided. For power failures over 25 seconds, the actuator will be at its fail-safe position and will go through the start up initialization again.

#### Motor position detection TF24-SR (-S) US

Belimo brushless DC motors eliminate the need for potentiometers for positioning. Inside the motor are three "Hall Effect" sensors. These sensors detect the spinning rotor and send pulses to the microprocessor which counts the pulses and calculates the position to within 1/3 of a revolution of the motor.

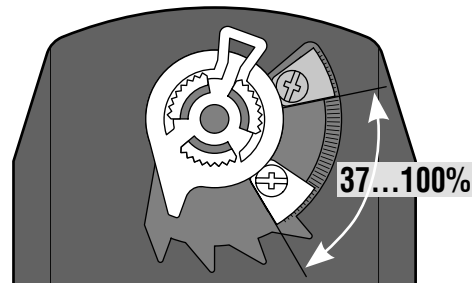
#### Overload protection

The TF, On/Off actuators are electronically protected against overload. The TF, On/Off actuators have an internal current limiter which maintains the current at a safe level which will not damage the actuator while providing adequate holding torque.

The TF24, modulating, actuators (TF24-SR (-S) US, TF24-3 US) are protected against overload by digital technology located in the ASIC. The ASIC circuitry constantly monitors the rotation of the brushless DC motor inside the actuator and stops the pulsing to the motor when it senses a stall condition. The motor remains energized and produces full rated torque during stall conditions. The actuator will try to move in the direction of the stall every 2 minutes, for a period of 32 minutes. After this, the actuator will try again every 2 hours.

### Mechanical Angle of Rotation Limiting

The TF actuators are provided with an adjustable stop to limit the rotation of the actuator. This function works in conjunction with the universal clamp or the optional position indicator. The adjustable stop is needed when rotation of less than 95° is required. The TF actuator can be indefinitely stalled, in any position, without harming the actuator.



#### Using the Universal Clamp

1. Loosen the end stop fastening screw using a #2 Phillips screwdriver.
2. Move the stop block so the bottom edge of the block lines up with the number corresponding to the desired degrees of rotation. (example: 45 degrees of rotation = .5)
3. Lock the block in place with the fastening screw.
4. Check the actuator for proper rotation.

#### Using the IND-TF Position Indicator with Adjustable Stop

**NOTE:** preferred method if short shaft mounting is used.

1. With the actuator in its fail-safe position, place the IND-TF Position Indicator so that it points to the 0 degree position.
2. Loosen the end stop fastening screw using a #2 Phillips screwdriver.
3. Move the stop block so the bottom edge of the block lines up with the number corresponding to the desired degrees of rotation (example: 45 degrees of rotation = .5).
4. Lock the block in place with the fastening screw.
5. Check the actuator for proper rotation.

### Direction of Rotation Switch

TF24-3 (-S) US and TF24-SR (-S) US actuators have a direction of rotation switch on the cover labeled "CW-CCW". Switch position indicates start point. For the TF24-SR, with the switch in position "CW", the actuator rotates clockwise with a decrease in voltage or current. With the switch in position "CCW", the actuator rotates counter-clockwise with a decrease in voltage or current.

The TF24-3 (-S) US and TF24-SR (-S) US actuators rotate clockwise when the switch is in the "CW" position and power is applied to wire #3. When power is applied to wire #4 the actuator rotates counter clockwise.

Rotating the direction of rotation switch to "CCW" reverses the control logic.

During checkout, the switch position can be temporarily reversed and the actuator will reverse its direction. This allows the technician a fast and easy way to check the actuator operation without having to switch wires or change settings on the controller. **When the check-out is complete, make sure the switch is placed back to its original position.**

# Installation Instructions

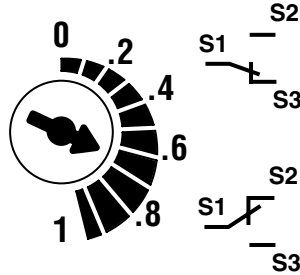
## Mechanical Installation



### Auxiliary Switches

The ...-S model actuators are equipped with an adjustable auxiliary switch used to indicate damper position or to interface additional controls or equipment. Switching positions can be set over the full 0 to 95° rotation simply by setting a switch on the actuator.

1. Set desired switch position.  
(Example 60%)
2. As the actuator rotates, the switch indicator moves from .6 (60%) toward 0 (0%).



### Switch Rating

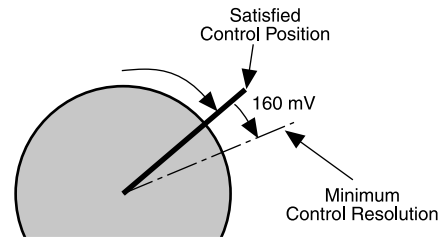
Voltage	Resistive load	Inductive load
250 VAC	3 A	0.5 A

### Control Accuracy and Stability

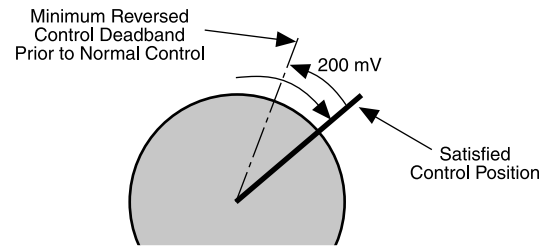
TF24-SR US actuators have built-in brushless DC motors which provide better accuracy and longer service life.

The TF24-SR US actuators are designed with a unique non-symmetrical dead-band. The actuator follows an increasing or decreasing control signal with a 160 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 200 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**TF Actuator responds to a 160 mV signal when not changing direction from stop position.**

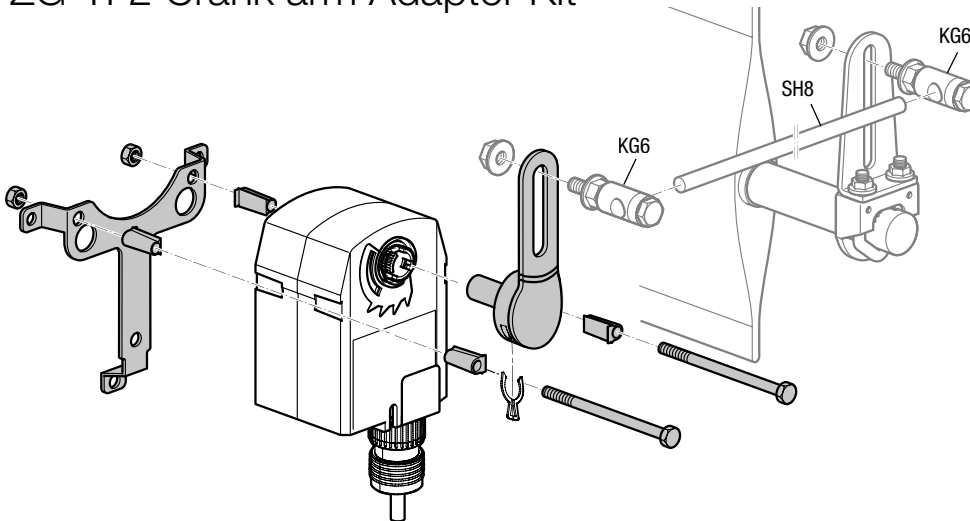


**TF Actuator responds to a 200 mV signal when reversing direction from stop position.**

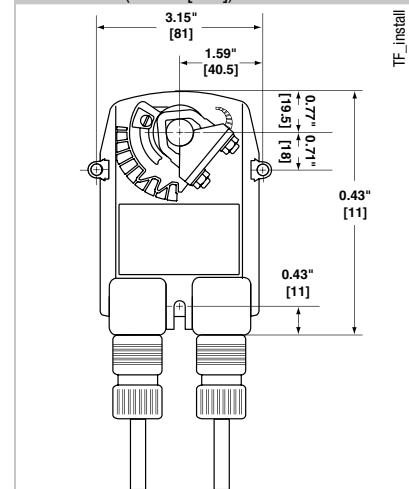


### Non-Direct Mounting Methods

## ZG-TF2 Crank arm Adaptor Kit



### Dimensions (Inches [mm])



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**WARNING** The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

**Always read the controller manufacturer's installation literature carefully before making any connections.** Follow all instructions in this literature. If you have any questions, contact the controller manufacturer and/or Belimo.

### Transformers

The TF24 . . actuator requires a 24 VAC class 2 transformer and draws a maximum of 5 VA per actuator. The actuator enclosure cannot be opened in the field, there are no parts or components to be replaced or repaired.

- EMC directive: 2004/108/EC
- Software class A: Mode of operation type 1
- Low voltage directive: 2006/95/EC

**CAUTION** It is good practice to power electronic or digital controllers from a separate power transformer than that used for actuators or other end devices. The power supply design in our actuators and other end devices use half wave rectification. Some controllers use full wave rectification. When these two different types of power supplies are connected to the same power transformer and the DC commons are connected together, a short circuit is created across one of the diodes in the full wave power supply, damaging the controller. Only use a single power transformer to power the controller and actuator if you know the controller power supply uses half wave rectification.

### Multiple Actuators, One Transformer

Multiple actuators may be powered from one transformer provided the following rules are followed:

1. The TOTAL current draw of the actuators (VA rating) is less than or equal to the rating of the transformer.
2. Polarity on the secondary of the transformer is strictly followed. *This means that all No. 1 wires from all actuators are connected to the common leg on the transformer and all No 2 wires from all actuators are connected to the hotleg.* Mixing wire No. 1 & 2 on one leg of the transformer will result in erratic operation or failure of the actuator and/or controls.

### Multiple Actuators, Multiple Transformers

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

1. The transformers are properly sized.
2. All No. 1 wires from all actuators are tied together and tied to the negative leg of the control signal. See wiring diagram.

### Wire Length for TF... Actuators

Keep power wire runs below the lengths listed in the table in **Figure A**. If more than one actuator is powered from the same wire run, divide the allowable wire length by the number of actuators to determine the maximum run to any single actuator.

Example for TF24-SR US: 3 actuators, 16 Ga wire  
 $550 \text{ Ft} \div 3 \text{ Actuators} = 183 \text{ Ft. Maximum wire run}$

TF24(-S) US / TF120(-S) US Maximum Wire Length			
Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	1300 Ft.	18 Ga	575 Ft.
14 Ga	1175 Ft.	20 Ga	300 Ft.
16 Ga	900 Ft.	22 Ga	150 Ft.

TF24-3(-S) US Maximum Wire Length			
Wire Size	Max. Feet.	Wire Size	Max. Feet
16 Ga	1125 Ft.	20 Ga	400 Ft.
18 Ga	725 Ft.	22 Ga	200 Ft.

TF24-SR(-S) US Maximum Wire Length			
Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	1800 Ft.	18 Ga	450 Ft.
14 Ga	1100 Ft.	20 Ga	275 Ft.
16 Ga	700 Ft.	22 Ga	125 Ft.

**FIGURE A**

### Wire Type and Wire Installation Tips

For most installations, 18 or 16 Ga. cable works well with the TF24... actuators. Use code-approved wire nuts, terminal strips or solderless connectors where wires are joined. It is good practice to run control wires unspliced from the actuator to the controller. If splices are unavoidable, make sure the splice can be reached for possible maintenance. Tape and/or wire-tie the splice to reduce the possibility of the splice being inadvertently pulled apart.

The TF24... proportional actuators have a digital circuit that is designed to ignore most unwanted input signals (pickup). In some situations the pickup may be severe enough to cause erratic running of the actuator. For example, a large inductive load (high voltage AC wires, motors, etc.) running near the power or control wiring may cause excessive pickup. To solve this problem, make one or more of the following changes:

1. Run the wire in metallic conduit.
2. Re-route the wiring away from the source of pickup.
3. Use shielded wire (Belden 8760 or equal). Ground the shield to an earth ground. Do not connect it to the actuator common.

### Brushless DC Motor Operation

Belimo's brushless DC motor spins by reversing the poles of stationary electromagnets housed inside rotating permanent magnets. The electromagnetic poles are switched by a microprocessor and a special ASIC (Application Specific Integrated Circuit) developed by Belimo. Unlike the conventional DC motor, there are no brushes to wear or commutators to foul.

### TF24-SR(-S) US Electrical Check-Out Procedure

STEP	Procedure	Expected Response	Gives Expected Response Go To Step...	Does Not Give Expected Response Go To Step...
1.	Remove power to reset actuator. Re-apply power. Apply control signal to actuator.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 8.</b>	No response at all Step 2. Operation is reversed Step 3. Does not drive toward "Control Signal Position" <b>Step 4.</b>
2.	Check power wiring. Correct any problems. See <b>Note 1.</b>	Power supply rating should be the total power requirement of the actuator(s). Minimum voltage of 19.2 VAC or 21.6 VDC.	Power wiring corrected, actuator begins to drive <b>Step 1.</b>	Power wiring corrected, actuator still does not drive <b>Step 4.</b>
3.	Turn reversing switch to the correct position. Make sure the switch is turned all the way left or right.	Actuator will move to its "Control Signal" position.	Actuator operates properly <b>Step 8.</b>	Does not drive toward "Control Signal Position" <b>Step 4.</b>
4.	Make sure the control signal positive (+) is connected to Wire No 3 and control signal negative (-) is connected to wire No. 1. Most control problems are caused by reversing these two wires. Verify that the reversing switch is all the way CCW or CW.	Drives to "Control Signal" position.	Actuator operates properly <b>Step 8.</b>	<b>Step 5.</b>
5.	Check input signal with a digital volt meter (DVM). Make sure the input is within the range of the actuator. For TF24-SR US this is 2 to 10 VDC or 4 to 20 mA. Note: The input signal must be above the 2 VDC or 4 mA to have the actuator move.	Input voltage or current should be $\pm 1\%$ of what controller's adjustment or programming indicate.	Controller output (actuator input) is correct. Input Polarity Correct <b>Step 6.</b>	Reprogram, adjust repair or replace controller as needed <b>Step 1.</b>
6.	Loosen the nuts on the V-bolt and move the damper by hand from fully closed to fully open.	Damper will go from fully closed to fully open.	Damper moves properly <b>Step 7.</b>	Find cause of damper jam and repair. Move damper back to the fully closed position and tighten the nuts <b>Step 1.</b>
7.	Check damper torque requirement.	Torque requirement is actuator's minimum torque.	Defective Actuator. Replace Actuator - See <b>Note 2.</b>	Recalculate actuator requirement and correct installation.
8.	Actuator works properly. Test controller by following controller manufacturer's instructions.			

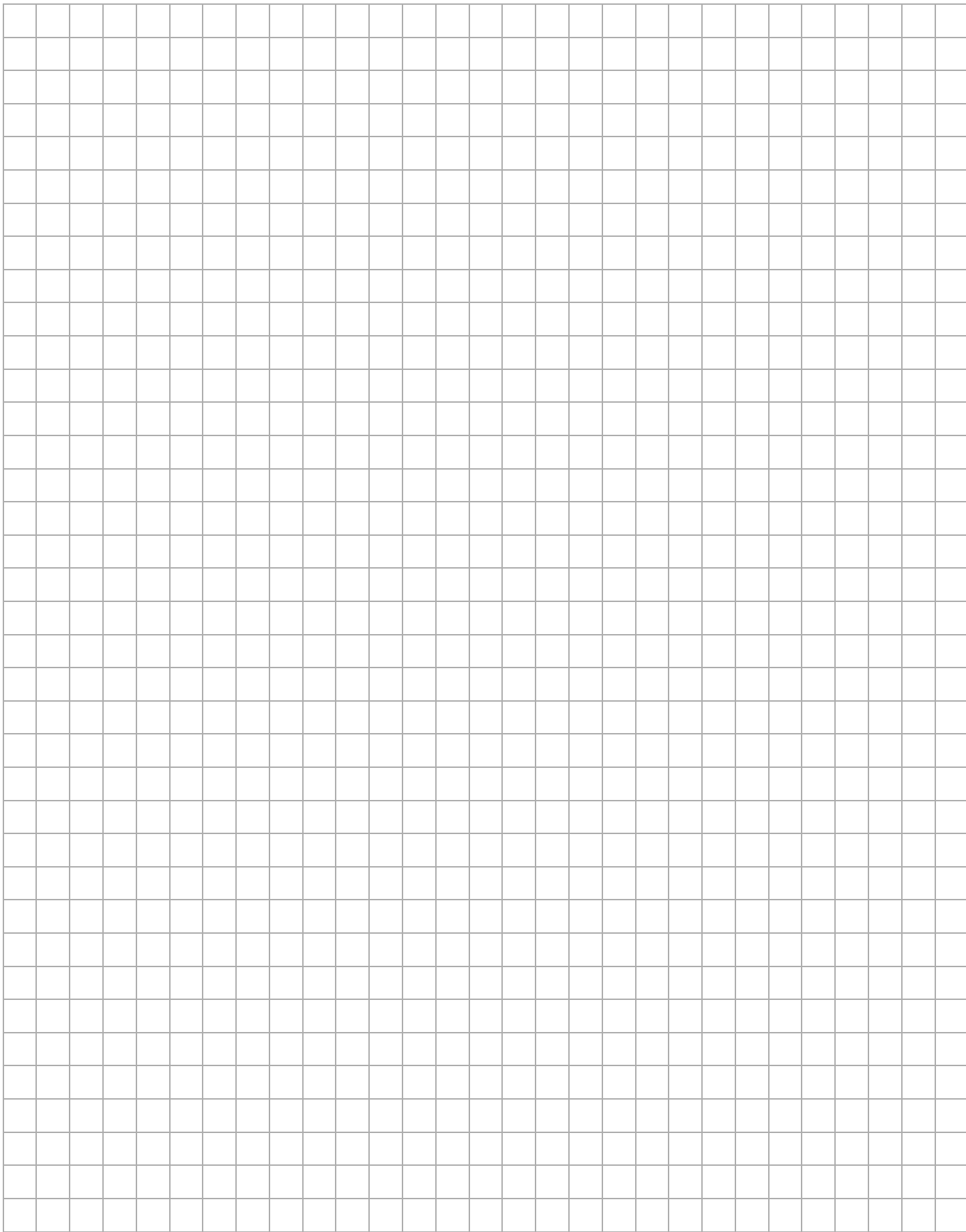
**NOTE 1** Check that the transformer(s) are sized properly.

- If a common transformer is used, make sure that polarity is observed on the secondary. This means connect all No. 1 wires to one leg of the transformer and all No. 2 wires to the other leg of the transformer.
- If multiple transformers are used with one control signal, make sure all No. 1 wires are tied together and tied to control signal negative (-).
- Controllers and actuators must have separate 24 VAC/VDC power sources.

**NOTE 2** If failure occurs within 5 years from original installation date, notify Belimo and give details of the application.



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**Minimum 360 in-lb torque - GK**

- For damper areas up to 90 sq. ft\*

**Minimum 54 in-lb torque - NKQ**

- For damper areas up to 12 sq. ft\*

**Minimum 101 lbf - AHK**



All Actuators have BDCM

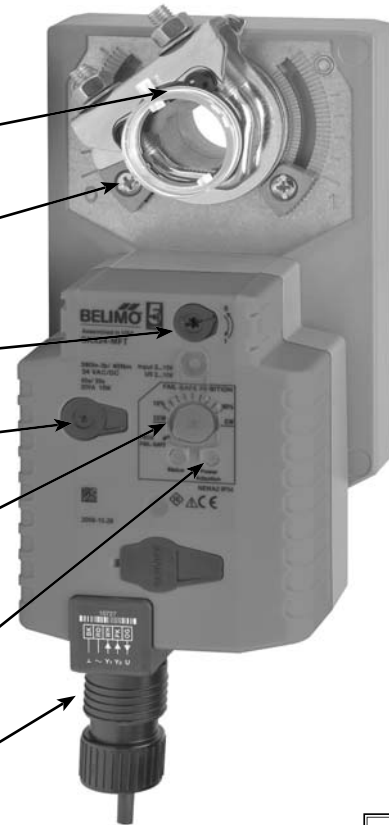
**Electronic Fail-Safe Series At A Glance**

		<i>GKB24-3, GKX24-3 (p. 187)</i>	<i>GKB24-3-T N4(H) (p. 189)</i>	<i>GKB24-SR, GKX24-SR (p. 191)</i>	<i>GKB24-SR-T N4(H) (p. 193)</i>	<i>GKX24-MFT (p. 195)</i>	<i>GKB24-MFT-T N4(H), GKX24-MFT-T N4 (p. 197)</i>	<i>NQB24-1, NKQX24-1 (p. 199)</i>	<i>NQB24-SR, NKQX24-SR (p. 201)</i>	<i>NKQX24-MFT (p. 203)</i>	<i>AHKX24-MFT-100 (p. 205)</i>
Basic Product		•	•	•	•			•	•		
Flexible Product		•		•		•	•	•	•	•	•
Torque		360 in-lb	360 in-lb	360 in-lb	360 in-lb	360 in-lb	360 in-lb	54 in-lb	54 in-lb	54 in-lb	101 lbf
Angle of Rotation	95 degrees	•	•	•	•	•	•	•	•	•	
Power Supply	24 VAC/DC	•	•	•	•	•	•	•	•	•	•
Control Input	On/Off							•			
	On/Off, Floating Point	•	•								
	2 to 10 VDC (4 to 20mA)			•	•				•		
	Multi-Function Technology					•	•			•	•
Feedback	None	•	•					•			
	2 to 10 VDC			•	•				•		
	Variable (2 to 10 VDC)					•	•			•	•
Running Time	Seconds	150	150	150	150	150 default	150 default	4	4	4 default	150
	Adj.					(90-150)	(90-150)			(4-16)	
Wiring	Plenum Rated Cable	•		•		•		•	•	•	•
	Conduit Fitting	•	•	•	•	•	•	•	•	•	•
Auxiliary Switch	Add-On	•	•	•	•	•	•	•	•	•	
NEMA 4 rated housing			•		•		•				

\*Based on 4 in-lb/ft<sup>2</sup> damper torque loading. Parallel blade. No edge seals.

# A CLOSER LOOK...

- Brushless DC Motor for Added Accuracy and Controllability
- Cut Labor Costs with Simple Direct Coupling
- Self-Centers on 1.05" or 3/4" with the Standard Clamp
- Check Damper Position with Clear Position Indicator
- Don't Worry about Actuator Burn-Out; Belimo is Overload Proof throughout Rotation
- Enjoy Added Flexibility with Easy Mechanical Stops to Adjust Angle of Rotation
- Need to Change Control Direction? Do it easily with a Simple Switch
- Easily Accessible Manual Override Button helps you Pre-Tension Damper Blades
- Auxiliary Switch and Feedback Potentiometer Add-Ons Mount Directly on Clamp, Includes Conduit Connector
- Added Flexibility to Select Clamp, Electrical Connection, and Running Time to fit your Specific Application with Belimo's New Flexible Line of Actuators
- Preset the Fail Position in 10% increments
- Patented loading of the caps for longer life
- Programmable delay for brown outs and quick power dips
- Front Panel LED to notify if there are issues with the caps
- Standard 3ft Plenum Rated Cable and Conduit Connector Provided on Basic Models



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## The Belimo Difference

- *Customer Commitment*  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- *Low Installation and Life-Cycle Cost*  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- *Long Service Life*  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

# GKB24-3, GKX24-3

On/Off, Floating Point, Fail-Safe, Operation, Direct Coupled, 24V



Technical Data	GKB24-3, GKX24-3
Power supply	24VAC ±20% 50/60Hz
Power consumption	12W (3W)
Transformer sizing	21VA (class 2 power source)
Electrical connection	18 GA plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95 rotation
Operation range Y	on/off, floating point
Input impedance	100kΩ (0.1 mA), 500Ω 1500Ω (floating point, on/off)
Feedback output U	2 to 10VDC, 0.5mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Fail-safe position	adjustable with dial or tool 0 to 100% in 10% increments
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	
normal operation	150 seconds (default), variable 90 to 150 seconds
fail-safe	35 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EC and 2006/95/EC
Noise level	< 45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.85 lbs [1.75 kg]
Initial charge	approximately 20 seconds
Bridge time	2 second delay before fail-safe activates

**Torque min. 360 in-lb for control damper surfaces up to 90 sq ft.**

## Application

For proportional modulation of dampers in HVAC systems.

The GKB24-3 and GKX24-3 provide electrical power off operation for reliable fail-safe application.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by a universal clamp. A crank arm and several mounting brackets are available for applications where actuator cannot be direct coupled to the damper shaft.

## Operation

The actuator is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

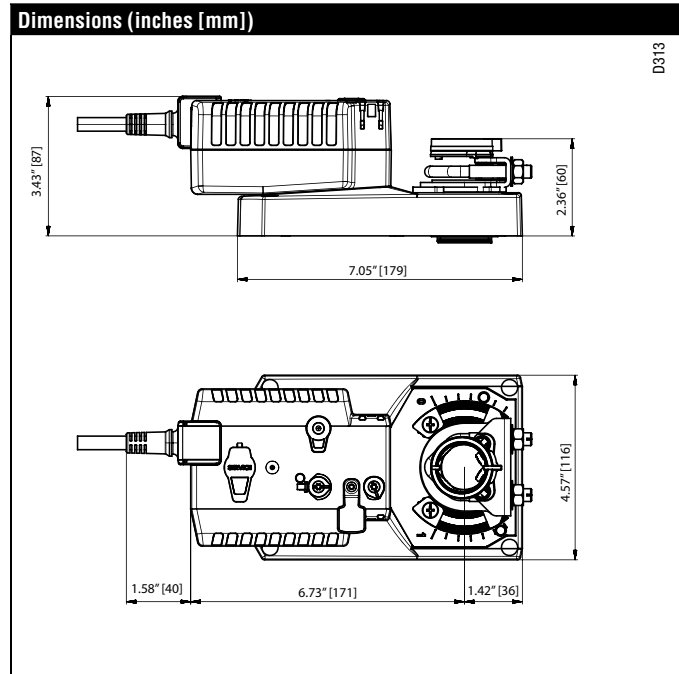
The GKB24-3 and GKX24-3 actuators provide 95° of rotation and a visual indicator shows the position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gear can be manually disengaged by pressing the button located on the actuator cover.

The GKB24-3 and GKX24-3 actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuators rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Fail-Safe Indication

The status LED on the actuator will turn solid yellow. On MFT versions, there is a repeating high-low-high signal on the feedback line. The high-low-high signal will display for 3 seconds and repeats every 30 seconds.



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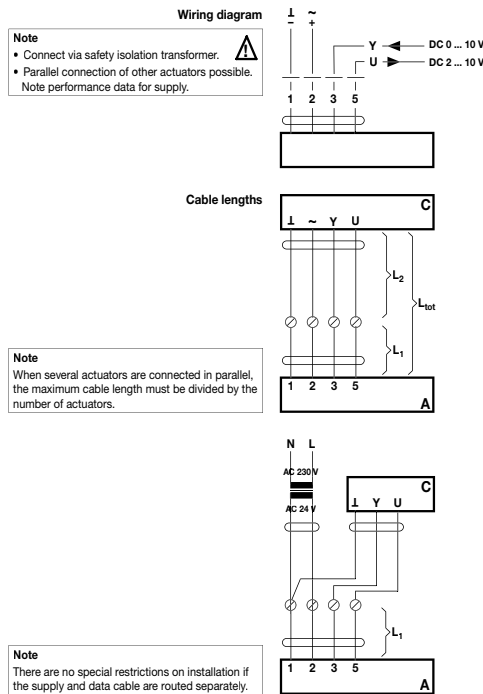
Accessories	
K-GM20	3/4" [20mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
ZG-GMA	Crank arm Adaptor Kit
ZG-JSA (-1,2,3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-07	13 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**Note:** When using GKB24-3, GKX24-3 actuators, only use accessories listed on this page.

### Typical Specification

On/off, floating point control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Electrical Installation



**Cable colors:**

- 1 = black
- 2 = red
- 3 = white
- 4 = pink

- A = Actuator
- C = Control unit
- L1 = Belimo connecting cable, 1 m (4 x 0.75 mm<sup>2</sup>)
- L2 = Customer cable
- Ltot = Maximum cable length

Cross section L2 I / ~	Max. cable length		Example for DC
	AC	DC	
0.75 mm <sup>2</sup>	≤30 m	≤5 m	1 m (L1) + 4 m (L2)
1.00 mm <sup>2</sup>	≤40 m	≤8 m	1 m (L1) + 7 m (L2)
1.50 mm <sup>2</sup>	≤70 m	≤12 m	1 m (L1) + 11 m (L2)
2.50 mm <sup>2</sup>	≤100 m	≤20 m	1 m (L1) + 19 m (L2)

- A = Actuator
- C = Control unit
- L1 = Belimo connecting cable, 1 m (4 x 0.75 mm<sup>2</sup>)

### Wiring Diagrams

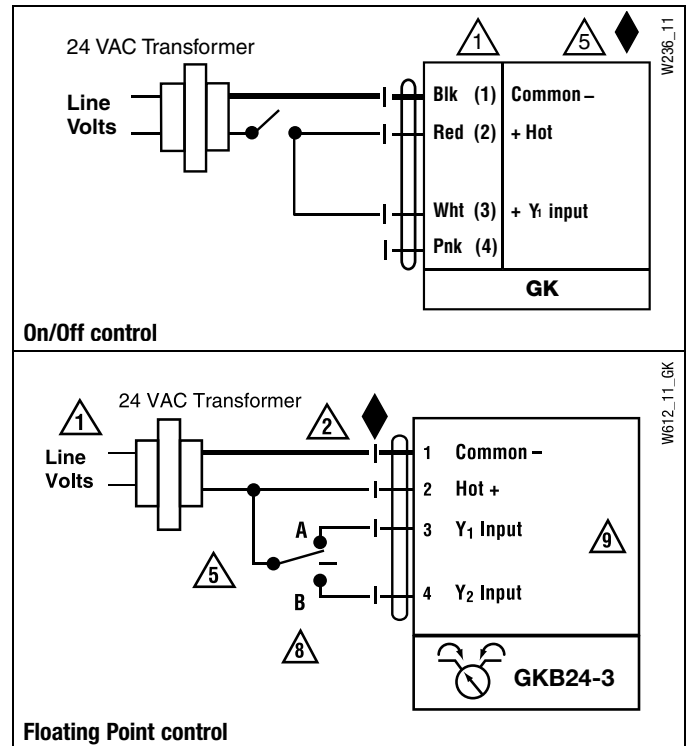
#### INSTALLATION NOTES

- Provide overload protection and disconnect as required.
- CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- Contact closures A & B also can be triacs.
- For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

Meets UL requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# GKB24-3-T N4(H)

NEMA 4, On/Off, Floating Point Control, Electronic Fail-Safe, Direct Coupled, 24V



Technical Data	GKB24-3-T N4(H)
Power supply	24VAC ±20% 50/60Hz
Power consumption	12W (3W) / heater 21 W
Transformer sizing	21VA (class 2 power source) / heater 21 VA
Electrical connection	screw terminal (for 26 to 14 GA wire) ½" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	100 kΩ
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	360 in-lb [40 Nm] minimum
Direction of rotation	reversible with  switch
Position indication	dial
Running time	150 seconds
motor (fail-safe)	35 seconds
Humidity	max. 95% RH non-condensing
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
with heater	-40°F to 122°F [-40°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL Type 4, NEMA 4, IP66
Housing material	polycarbonate
Agency listings†	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 2004/108/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	8.95 lbs [4.05 kg]; 9.45 lbs [4.3 kg] with heater

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

**Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.**

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by a universal clamp, self-centered default.

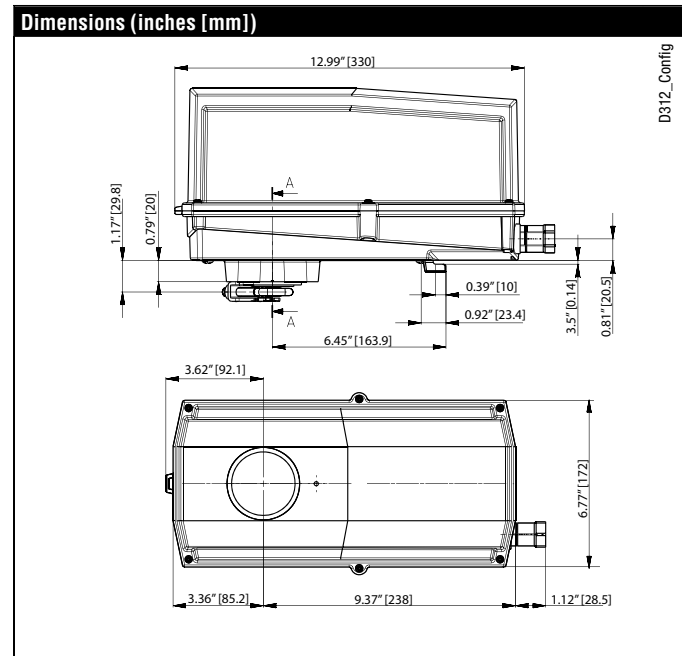
## Operation

The actuator is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GKB24-3-T N4 provides 95° of rotation and a visual indicator shows the position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged by pressing the button located on the actuator cover.

The GKB24-3-T N4 actuator uses a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch(es)
P...A	Feedback Potentiometers
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland






**Note:** When using GKB24-3-T N4(H) actuators, only use accessories listed on this page.

### Typical Specification


On/off, floating point control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuators needing auxiliary switches, can be provided as an add-on accessory. 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. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### **INSTALLATION NOTES**

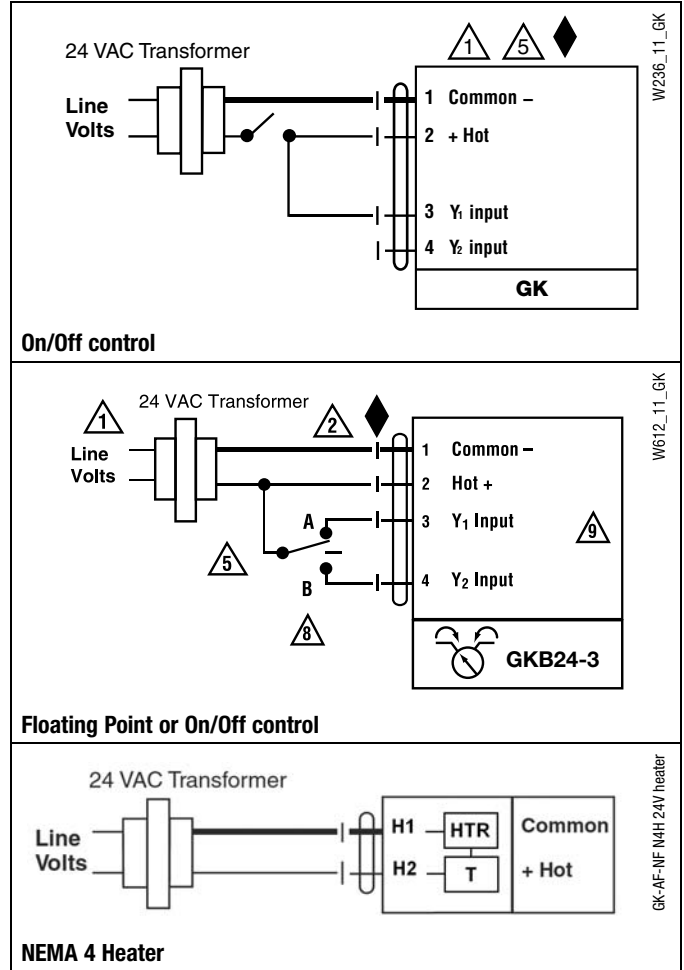
-  Provide overload protection and disconnect as required.
-  Equipment damage!  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
-  Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
-  Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
-  For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### **APPLICATION NOTES**

-  Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

#### **WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# GKB24-SR, GKX24-SR

Proportional Control, Fail-Safe, Operation, Direct Coupled, 24V, for 2 to 10 VDC and 4 to 20mA



Technical Data	GKB24-SR, GKX24-SR
Power supply	24VAC ±20% 50/60Hz 24VDC ±10%
Power consumption	12W (3W)
Transformer sizing	21VA (class 2 power source)
Electrical connection	18 GA plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95 rotation
Operation range Y	2 to 10 VDC, 4 to 20mA (default)
Input impedance	100kΩ (0.1 mA), 500Ω
Feedback output U	2 to 10VDC, 0.5mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Fail-safe position	adjustable with dial or tool 0 to 100% in 10% increments
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	
normal operation	150 seconds (default), variable 90 to 150 seconds
fail-safe	35 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EC and 2006/95/EC
Noise level	< 45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.85 lbs [1.75 kg]
Initial charge	approximately 20 seconds
Bridge time	2 second delay before fail-safe activates

**Torque min. 360 in-lb for control damper surfaces up to 90 sq ft.**

## Application

For proportional modulation of dampers in HVAC systems.

The GKB24-SR and GKX24-SR provide electrical power off operation for reliable fail-safe application.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by a universal clamp. A crank arm and several mounting brackets are available for applications where actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

The actuator is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

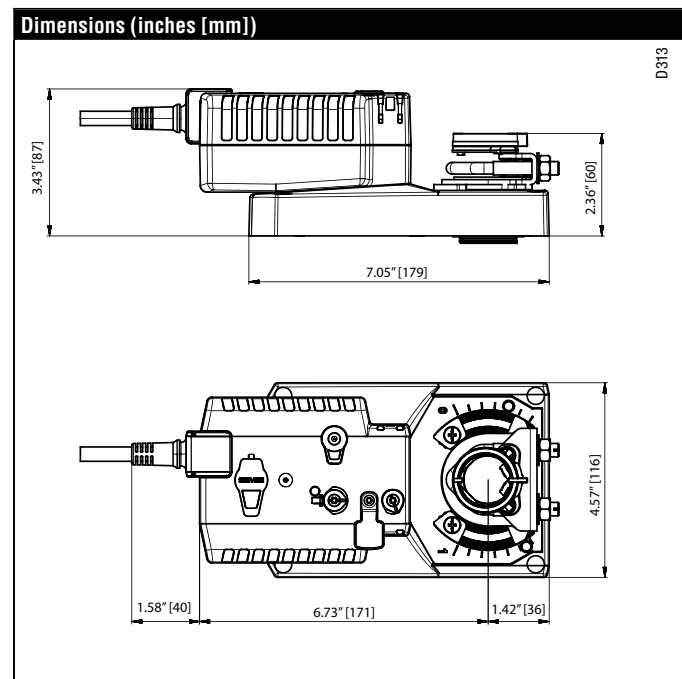
The GKB24-SR and GKX24-SR provide 95° of rotation and a visual indicator shows the position of the actuator. When reaching the damper or actuator end position the actuator automatically stops. The gear can be manually disengaged by pressing the button located on the actuator cover.

The GKB24-SR and GKX24-SR actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuators rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Fail-Safe Indication

The status LED on the actuator will turn solid yellow. On MFT versions, there is a repeating high-low-high signal on the feedback line. The high-low-high signal will display for 3 seconds and repeats every 30 seconds.



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### Accessories

K-GM20	3/4" [20mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
ZG-GMA	Crank arm Adaptor Kit
ZG-JSA (-1,2,3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-07	13 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**Note:** When using GKB24-SR and GKX24-SR actuators, only use accessories listed on this page.

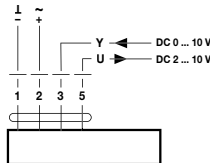
### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to shaft up to 1.05" diameter. Actuators must provide proportional damper control 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. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

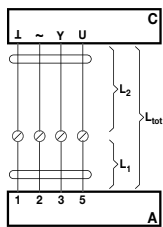
### Electrical Installation

#### Wiring diagram

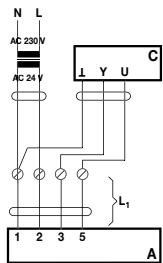
- Note**
- Connect via safety isolation transformer.
  - Parallel connection of other actuators possible.
- Note performance data for supply.



#### Cable lengths



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



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

#### Cable colors:

- 1 = black
- 2 = red
- 3 = white
- 5 = orange

- A = Actuator
- C = Control unit
- L1 = Belimo connecting cable, 1 m (4 x 0.75 mm<sup>2</sup>)
- L2 = Customer cable
- L<sub>tot</sub> = Maximum cable length

Cross section L <sub>2</sub>	Max. cable length L <sub>tot</sub> = L <sub>1</sub> + L <sub>2</sub>		Example for DC
	1/~	AC DC	
0.75 mm <sup>2</sup>	≤30 m	≤5 m	1 m (L <sub>1</sub> ) + 4 m (L <sub>2</sub> )
1.00 mm <sup>2</sup>	≤40 m	≤8 m	1 m (L <sub>1</sub> ) + 7 m (L <sub>2</sub> )
1.50 mm <sup>2</sup>	≤70 m	≤12 m	1 m (L <sub>1</sub> ) + 11 m (L <sub>2</sub> )
2.50 mm <sup>2</sup>	≤100 m	≤20 m	1 m (L <sub>1</sub> ) + 19 m (L <sub>2</sub> )

- A = Actuator
- C = Control unit
- L1 = Belimo connecting cable, 1 m (4 x 0.75 mm<sup>2</sup>)

### Wiring Diagrams

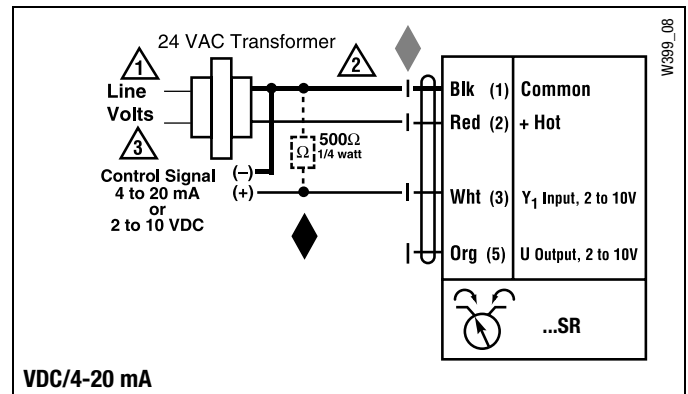
#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

#### APPLICATION NOTES

- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor may be used.

- WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# GKB24-SR-T N4(H)

NEMA 4, Proportional Control, Electric Fail-Safe, Direct Coupled, 24V, for 2 to 10 VDC and 4 to 20 mA



Technical Data	GKB24-SR-T N4(H)
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	12 W (3 W) / heater 21 W
Transformer sizing	21 VA (Class 2 power source) / heater 21 VA
Electrical connection	screw terminal (for 26 to 14 GA wire) $\frac{1}{2}$ " conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 k $\Omega$
Feedback output U	2 to 10 VDC (max 0.5 mA)
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	dial
Running time	150 seconds
motor (fail-safe)	35 seconds
Humidity	max. 95% RH non-condensing
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
with heater	-40°F to 122°F [-40°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL Type 4, NEMA 4, IP66
Housing material	polycarbonate
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 2004/108/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	8.95 lbs [4.05 kg]; 9.45 lbs [4.3 kg] with heater

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

**Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.**

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by a universal clamp.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500  $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

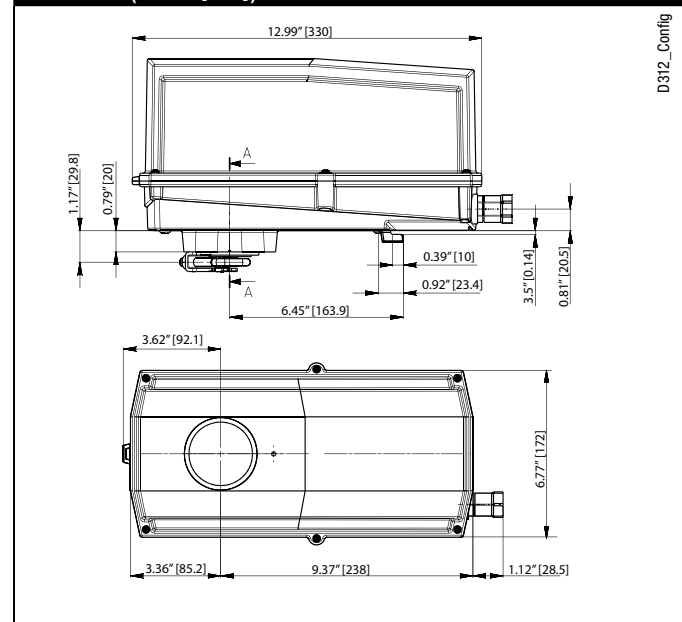
The actuator is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GKB24-SR-T N4 provides 95° of rotation and a visual indicator shows the position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged by pressing the button located on the actuator cover.

The GKB24-SR-T N4 actuator uses a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (inches [mm])



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Accessories	
S1A, S2A	Auxiliary Switch(es)
P...A	Feedback Potentiometers
SGA24	Min positioners for surface mounting
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
ZG-X40	Transformer
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland

**Note:** When using GKB24-SR-T N4(H) actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

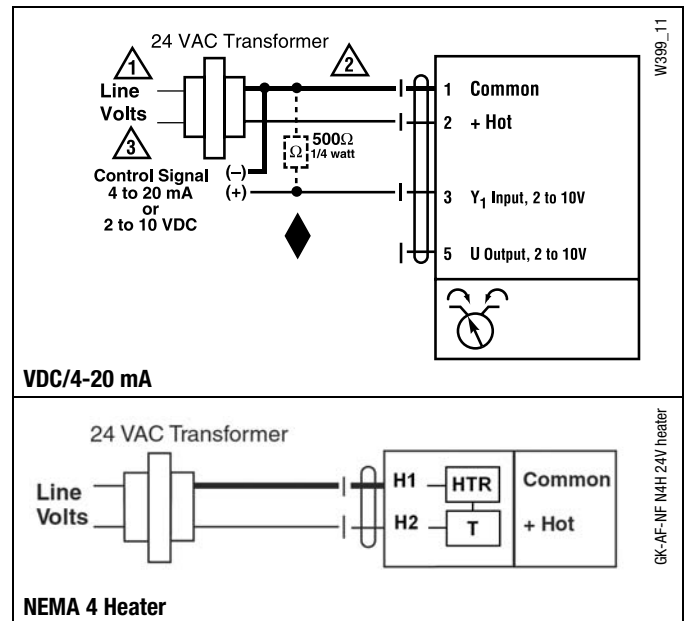
#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits

#### 📄 APPLICATION NOTES

◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

⚠️ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# GKX24-MFT

Proportional Control, Fail-Safe, Operation, Direct Coupled, 24V, Multi-Function Technology®



Technical Data	GKX24-MFT
Power supply	24VAC ±20% 50/60Hz 24VDC ±10%
Power consumption	12W (3W)
Transformer sizing	21VA (class 2 power source)
Electrical connection	18 GA plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95 rotation
Operation range Y	2 to 10 VDC, 4 to 20mA (default) variable (VDC,PWM, floating point, on/off)
Input impedance	100kΩ (0.1 mA), 500Ω 1500Ω (PWM, floating point, on/off)
Feedback output U	2 to 10VDC, 0.5mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Fail-safe position	adjustable with dial or tool 0 to 100% in 10% increments
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	
normal operation	95 seconds (default), variable 90 to 150 seconds
fail-safe	35 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EC and 2006/95/EC
Noise level	< 45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.85 lbs [1.75 kg]
Initial charge	approximately 20 seconds
Bridge time	programmable time delay before fail-safe activates 0-10 seconds [2]

**Torque min. 360 in-lb for control damper surfaces up to 90 sq ft.**

## Application

For proportional modulation of dampers in HVAC systems.

The GKX24-MFT provides electrical power off operation for reliable fail-safe application.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by a universal clamp. A crank arm and several mounting brackets are available for applications where actuator cannot be direct coupled to the damper shaft.

The default parameters for 2 to 10 VDC applications of the GKX24-MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuator can be ordered. The parameters can be changed by: pre set or custom configuration provided by Belimo or on-site using the PC-Tool software.

## Operation

The actuator is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GKX24-MFT provides 95° of rotation and a visual indicator shows the position of the actuator. When reaching the damper or actuator end position the actuator automatically stops. The gear can be manually disengaged by pressing the button located on the actuator cover.

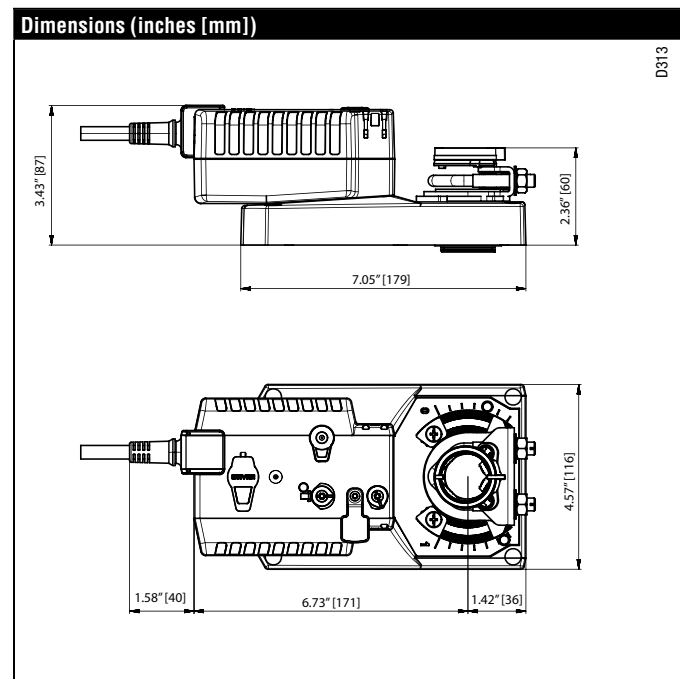
The GKX24-MFT actuator uses a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuators rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Fail-Safe Indication

The status LED on the actuator will turn solid yellow. On MFT versions, there is a repeating high-low-high signal on the feedback line. The high-low-high signal will display for 3 seconds and repeats every 30 seconds.

**When combining signal and power cable together, see important electrical installation diagram on page 188.**



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Accessories	
K-GM20	3/4" [20mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
ZG-GMA	Crank arm Adaptor Kit
ZG-JSA (-1,2,3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-07	13 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 Housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

Note: When using GKX24-MFT actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to shaft up to 1.05" diameter. Actuators must provide proportional damper control 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. Actuators shall have Brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

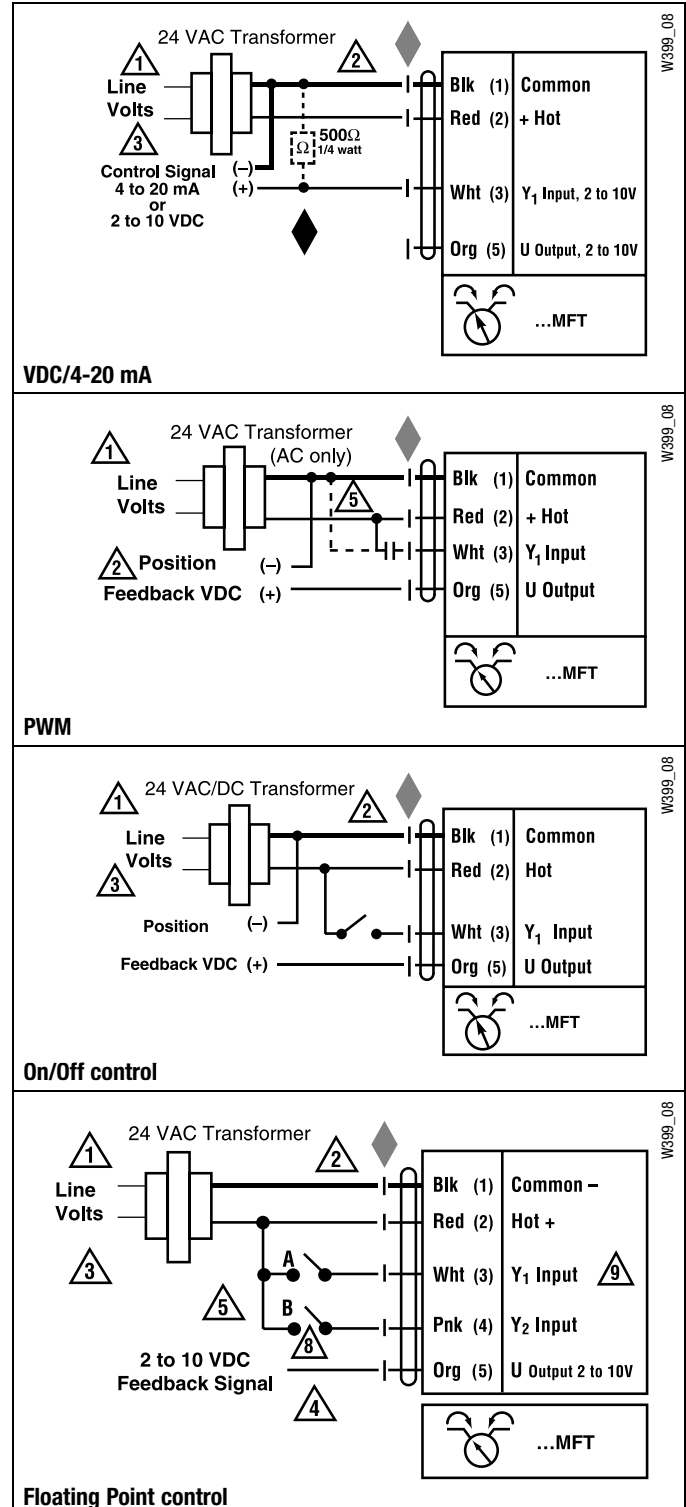
#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor may be used.

**WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# GKB24-MFT-T N4(H), GKX24-MFT-T N4

NEMA 4, Proportional Control, Electronic Fail-Safe, Direct Coupled, 24V, Multi-Function Technology®



Technical Data	GKB24-MFT-T N4(H), GKX24-MFT-T N4
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	12 W (3 W) / heater 21 W
Transformer sizing	21 VA (class 2 power source) / heater 21 VA
Electrical connection	screw terminal (for 26 to 14 GA wire) ½" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, floating point, on/off)
Input impedance	100 kΩ
Feedback output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	dial
Running time	150 seconds (default) variable (90 to 350 seconds)
motor (fail-safe)	35 seconds
Humidity	max. 95% RH non-condensing
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
with heater	-40°F to 122°F [-40°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL Type 4, NEMA 4, IP66
Housing material	polycarbonate
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 2004/108/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	8.95 lbs [4.05 kg]; 9.42 lbs [4.3 kg] with heater

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

Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by a universal clamp.

The default parameters for 2 to 10 VDC applications of the GKX24-MFT-T N4 actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by: pre-set or custom configurations provided by Belimo or on-site using the PC-Tool software.

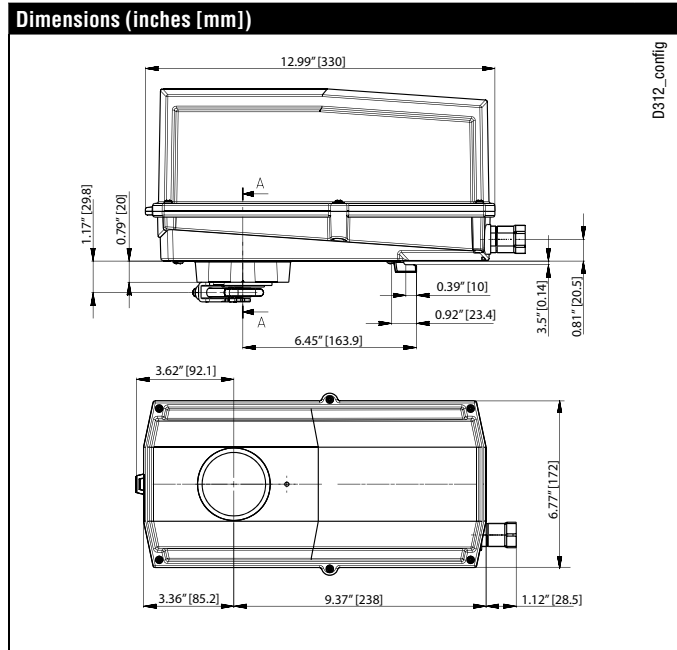
## Operation

The actuator is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GKX24-MFT-T N4 provides 95° of rotation and a visual indicator shows the position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged by pressing the button located on the actuator cover.

The GKX24-MFT-T N4 actuator uses a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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**Accessories**

ZS-100	Weather Shield - Steel
S1A, S2A	Auxiliary Switch(es)
P...A	Feedback Potentiometers
SGA24	Min positioners for surface mounting
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
ZG-X40	Transformer
43442-00001	Gland (needed for additional wires)
11097-00001	Gasket for Gland

**Note:** When using GKB24-MFT-T N4(H), GKX24-MFT-T N4 actuators, only use accessories listed on this page.

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**

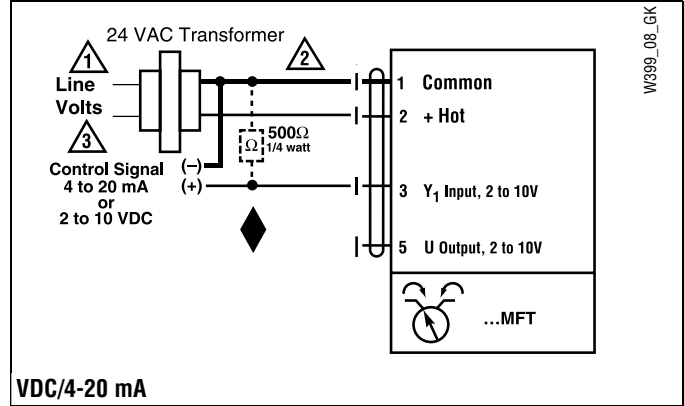
**INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

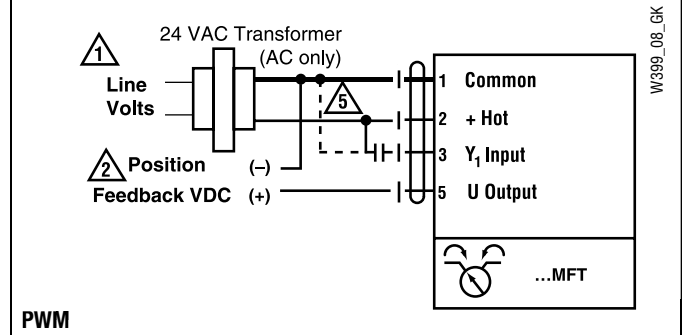
**APPLICATION NOTES**

◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

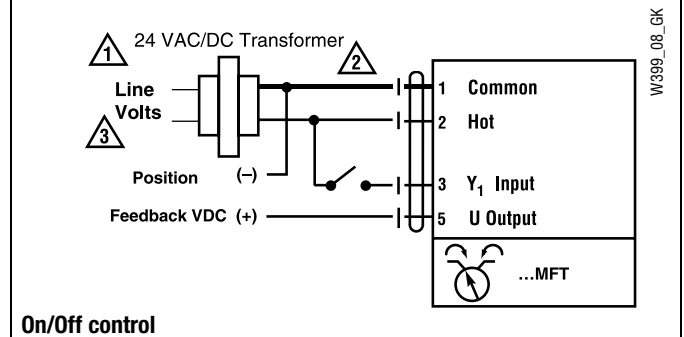
⚠ **WARNING Live Electrical Components!**  
 During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



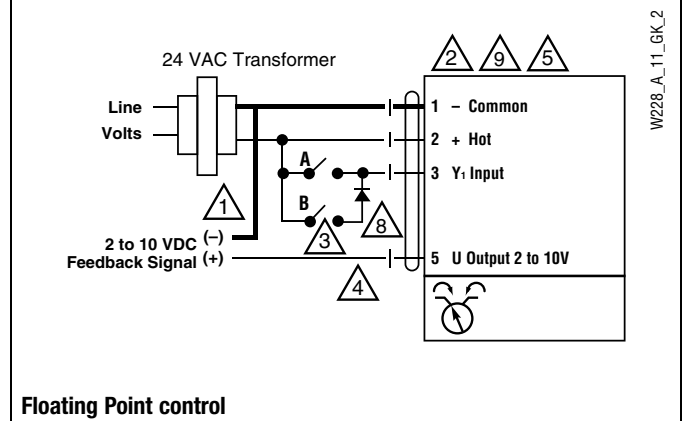
**VDC/4-20 mA**



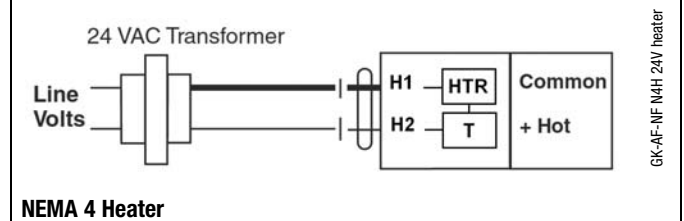
**PWM**



**On/Off control**



**Floating Point control**



**NEMA 4 Heater**

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W999\_08\_GK

W399\_08\_GK

W999\_08\_GK

W228\_A\_11\_GK.2

GK-AF-NF N4H 24V heater

# NKQB24-1, NKQX24-1

On/Off, Fail-Safe, Operation, Direct Coupled, 24V



Technical Data	NKQB24-1, NKQX24-1
Power supply	24VAC $\pm$ 20% 50/60Hz 24VDC $\pm$ 10%
Power consumption	11W (3W)
Transformer sizing	22VA (class 2 power source)
Electrical connection	18 GA plenum rated cable $\frac{1}{2}$ " conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95 rotation
Operation range Y	on/off
Input impedance	100k $\Omega$ (0.1 mA), 500 $\Omega$ 1500 $\Omega$ (PWM, on/off)
Feedback output U	2 to 10VDC, 0.5mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	54 in-lb [6 Nm]
Direction of rotation	reversible with  switch
Fail-safe position	adjustable with dial or tool 0 to 100% in 10% increments
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	normal operation 4 seconds (default), variable 4 to 16 seconds fail-safe 4 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EC and 2006/95/EC
Noise level	< 60dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.4 lbs [1.10 kg]
Initial charge	approximately 20 seconds
Bridge time	2 second delay before fail-safe activates

Torque min. 54 in-lb for control damper surfaces up to 12 sq ft.

## Application

For proportional modulation of dampers in HVAC systems.

The NKQB24-1 and NKQX24-1 provide electrical power off operation for reliable fail-safe application.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter. A crank arm and several mounting brackets are available for applications where actuator cannot be direct coupled to the damper shaft.

## Operation

The actuator is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

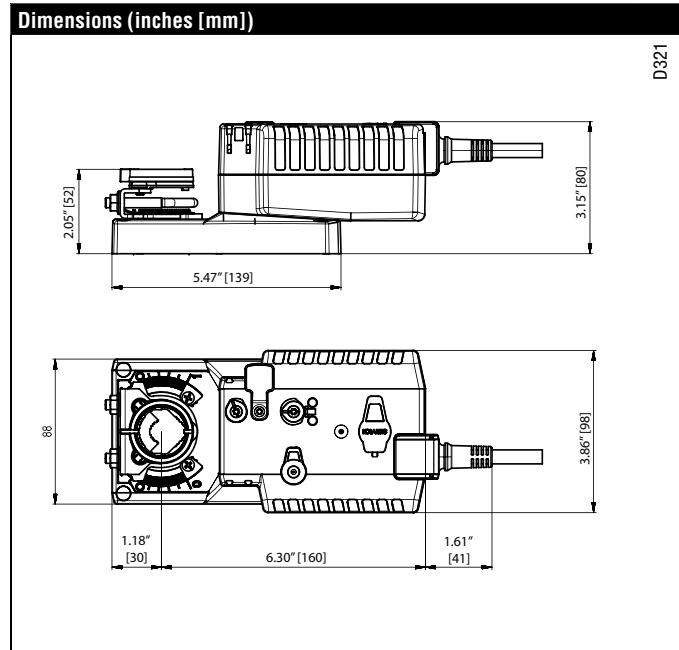
The NKQB24-1 and the NKQX24-1 provide 95° of rotation and a visual indicator shows the position of the actuator. When reaching the damper or actuator end position the actuator automatically stops. The gear can be manually disengaged by pressing the button located on the actuator cover.

The NKQB24-1 and NKQX24-1 actuators use a brushless DC motor controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuators rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Fail-Safe Indication

The status LED on the actuator will turn solid yellow. On MFT versions, there is a repeating high-low-high signal on the feedback line. The high-low-high signal will display for 3 seconds and repeats every 30 seconds.



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Accessories	
K-AM25	3/4" [20mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
ZG-JSA (-1,2,3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 and 10 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
ZG-X40	Transformer

**Note:** When using NKQB24-3 and NKQX24-3 actuators, only use accessories listed on this page.

### Typical Specification

On/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to shaft up to 1.05" diameter. Actuators shall have Brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

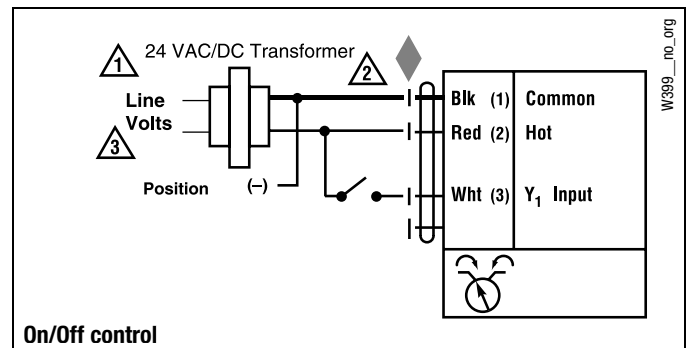
### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### 📄 APPLICATION NOTES

- ◆ Meets UL requirements without the need of an electrical ground connection.
- ⚠️ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# NKQB24-SR, NKQX24-SR

Proportional Control, Fail-Safe, Operation, Direct Coupled, 24V, for 2 to 10 VDC and 4 to 20mA



Technical Data	NKQB24-SR, NKQX24-SR
Power supply	24VAC $\pm$ 20% 50/60Hz 24VDC $\pm$ 10%
Power consumption	11W (3W)
Transformer sizing	22VA (class 2 power source)
Electrical connection	18 GA plenum rated cable $\frac{1}{2}$ " conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95 rotation
Operation range Y	2 to 10 VDC, 4 to 20mA (default)
Input impedance	100k $\Omega$ (0.1 mA), 500 $\Omega$
Feedback output U	2 to 10VDC, 0.5mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	54 in-lb [6 Nm]
Direction of rotation	reversible with  switch
Fail-safe position	adjustable with dial or tool 0 to 100% in 10% increments
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	
normal operation	4 seconds (default), variable 4 to 16 seconds
fail-safe	4 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EC and 2006/95/EC
Noise level	60dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.40 lbs [1.1 kg]
Initial charge	approximately 20 seconds
Bridge time	2 second delay before fail-safe activates

Torque min. 54 in-lb for control damper surfaces up to 12 sq ft.

## Application

For proportional modulation of dampers in HVAC systems.

The NKQB24-SR and NKQX24-SR provide electrical power off operation for reliable fail-safe application.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by a universal clamp. A crank arm and several mounting brackets are available for applications where actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500  $\Omega$  resistor, a 4 to 20mA control input from an electronic controller or potentiometer. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

The actuator is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

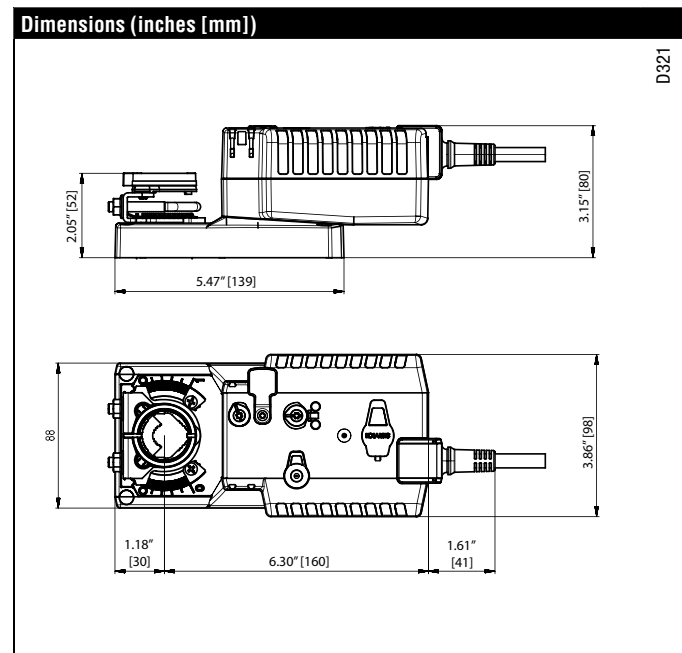
The NKQB24-SR and NKQX24-SR provide 95° of rotation and a visual indicator shows the position of the actuator. When reaching the damper or actuator end position the actuator automatically stops. The gear can be manually disengaged by pressing the black button located on the actuator cover.

The NKQB24-SR and NKQX24-SR actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuators rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Fail-Safe Indication

The status LED on the actuator will turn solid yellow. On MFT versions, there is a repeating high-low-high signal on the feedback line. The high-low-high signal will display for 3 seconds and repeats every 30 seconds.



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### Accessories

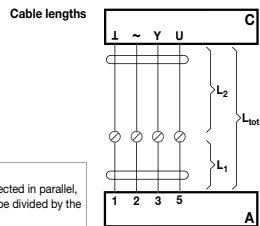
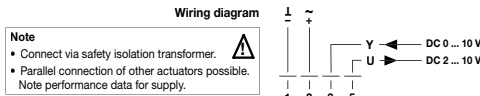
K-AM25	3/4" [20mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
ZG-JSA (-1,2,3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 and 10 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch

**Note:** When using NKQB24-SR and NKQX24-SR actuators, only use accessories listed on this page.

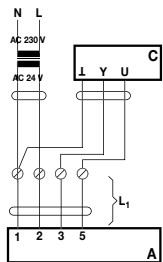
### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to shaft up to 1.05" diameter. Actuators must provide proportional damper control 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. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Electrical Installation



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



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

**A** = Actuator  
**C** = Control unit  
**L<sub>1</sub>** = Belimo connecting cable, 1 m (4 x 0.75 mm<sup>2</sup>)  
**L<sub>2</sub>** = Customer cable  
**L<sub>tot</sub>** = Maximum cable length

Cross section L <sub>2</sub> l / ~	Max. cable length L <sub>tot</sub> = L <sub>1</sub> + L <sub>2</sub>		Example for DC
	AC	DC	
0.75 mm <sup>2</sup>	≤30 m	≤5 m	1 m (L <sub>1</sub> ) + 4 m (L <sub>2</sub> )
1.00 mm <sup>2</sup>	≤40 m	≤8 m	1 m (L <sub>1</sub> ) + 7 m (L <sub>2</sub> )
1.50 mm <sup>2</sup>	≤70 m	≤12 m	1 m (L <sub>1</sub> ) + 11 m (L <sub>2</sub> )
2.50 mm <sup>2</sup>	≤100 m	≤20 m	1 m (L <sub>1</sub> ) + 19 m (L <sub>2</sub> )

**A** = Actuator  
**C** = Control unit  
**L<sub>1</sub>** = Belimo connecting cable, 1 m (4 x 0.75 mm<sup>2</sup>)

### Wiring Diagrams

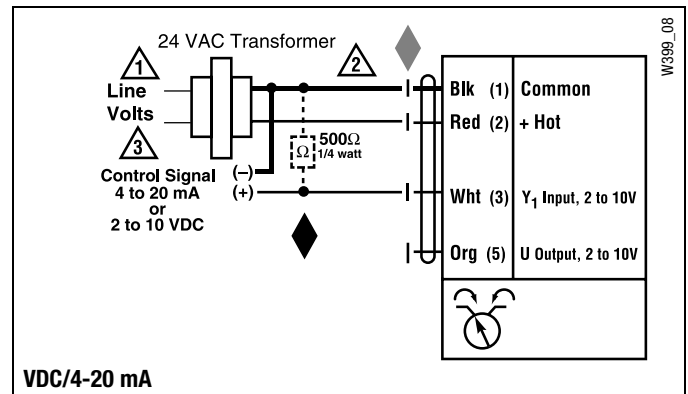
#### INSTALLATION NOTES

- Provide overload protection and disconnect as required.
- CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- Actuators may also be powered by 24 VDC.

#### APPLICATION NOTES

- Meets UL requirements without the need of an electrical ground connection.
- The ZG-R01 500 Ω resistor may be used.

**WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.





Technical Data	NKQX24-MFT
Power supply	24VAC ±20% 50/60Hz 24VDC ±10%
Power consumption	11W (3W)
Transformer sizing	22VA (class 2 power source)
Electrical connection	18 GA plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95 rotation
Operation range Y	2 to 10 VDC, 4 to 20mA (default), variable (VDC, on/off)
Input impedance	100kΩ (0.1 mA), 500Ω
Feedback output U	2 to 10VDC, 0.5mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	54 in-lb [6 Nm]
Direction of rotation	reversible with  switch
Fail-safe position	adjustable with dial or tool 0 to 100% in 10% increments
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running Time	
normal operation	4 seconds (default), variable 4 to 16 seconds
fail-safe	4 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EC and 2006/95/EC
Noise level	60dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.40 lbs [1.1 kg]
Initial charge	approximately 20 seconds
Bridge time	programmable time delay before fail-safe activates 0-10 seconds [2]

Torque min. 54 in-lb for control damper surfaces up to 12 sq ft.

### Application

For proportional modulation of dampers in HVAC systems.

The NKQX24-MFT provides electrical power off operation for reliable fail-safe application.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by a universal clamp. A crank arm and several mounting brackets are available for applications where actuator cannot be direct coupled to the damper shaft.

The default parameters for 2 to 10 VDC applications of the NKQX24-MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuator can be ordered. The parameters can be changed by: pre set or custom configurations provided by Belimo or on-site using the PC-Tool software.

### Operation

The actuator is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NKQX24-MFT provides 95° of rotation and a visual indicator shows the position of the actuator. When reaching the damper or actuator end position the actuator automatically stops. The gear can be manually disengaged by pressing the button located on the actuator cover.

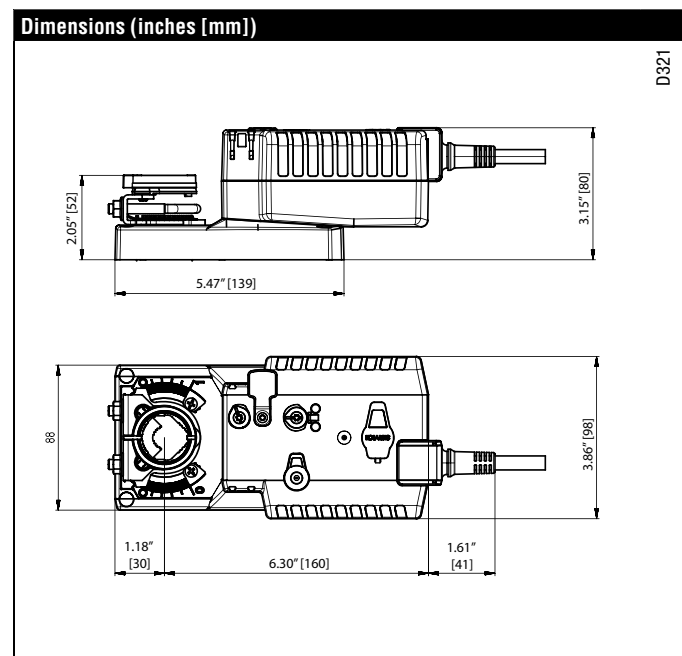
The NKQX24-MFT actuator uses a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuators rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

### Fail-Safe Indication

The status LED on the actuator will turn solid yellow. On MFT versions, there is a repeating high-low-high signal on the feedback line. The high-low-high signal will display for 3 seconds and repeats every 30 seconds.

**When combining signal and power cable together, see important electrical installation diagram on page 202.**



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#### Accessories

K-AM25	¾" [20mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
ZG-JSA (-1,2,3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 and 10 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 Housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

Note: When using NKQX24-MFT actuators, only use accessories listed on this page.

#### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to shaft up to 1.05" diameter. Actuators must provide proportional damper control 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. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

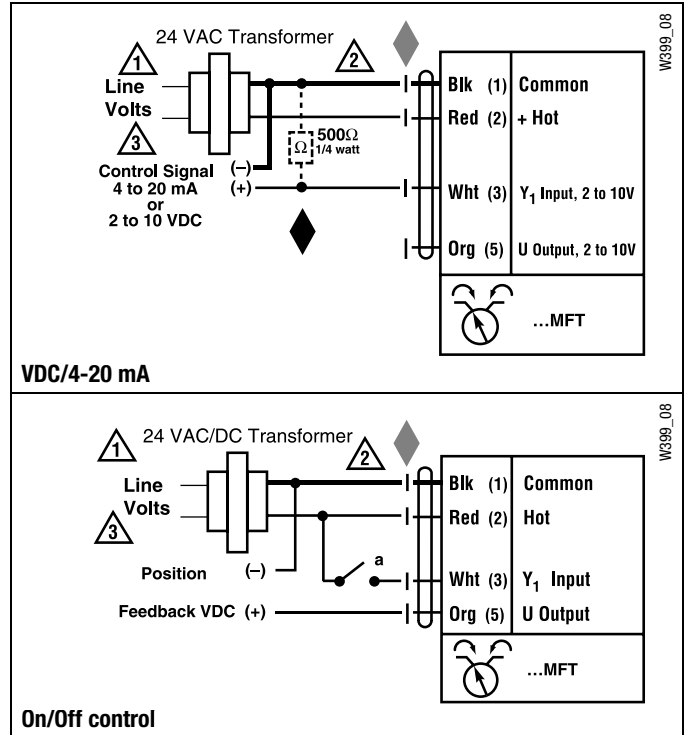
#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

#### APPLICATION NOTES

- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor may be used.

**WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# AHKX24-MFT-100

Proportional Control, Fail-Safe Operation, Linear Stroke, 24V, Multi-Function Technology®



Technical Data	AHKX24-MFT-100
Power supply	24 VAC ±20% 50/60Hz 24 VDC ±10%
Power consumption	11W (3W)
Transformer sizing	22VA (class 2 power source)
Electrical Connection	18 GA plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout the full stroke
Operation range Y	2 to 10 VDC, 4 to 20mA (default) variable VDC
Input impedance	100kΩ (0.1 mA), 500Ω
Feedback output U	2 to 10 VDC, 0.5mA max, VDC variable
Linear stroke	4" [100mm]
Linear force	101 lbf [450 N]
Direction of rotation	reversible with  switch
Fail-Safe position	adjustable with dial or tool 0 to 100% in 10% increments
Manual override	external push button
Running time	normal operation 150 seconds per 4" [100mm] fail-safe 35 seconds per 4" [100mm]
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EC and 2006/95/EC
Noise level	< 45dB (A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.40 lbs [1.50 kg]
Initial charge	approximately 20 seconds
Bridge time	programmable time delay before fail-safe activates 0-10 seconds [2]

Linear force min. 101 lbf.

## Application

For proportional modulation of dampers in HVAC systems. The AHKX24-MFT-100 provides electrical power off operation for reliable fail-safe application.

The default parameters for 2 to 10 VDC applications of the AHKX24-MFT-100 actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by: pre set or custom configurations provided by Belimo or on-site using the PC-Tool software.

## Operation

The actuator is electronically protected against overload.

The AHKX24-MFT-100 provides a 4 inch linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20mm] with the mechanical end stops.

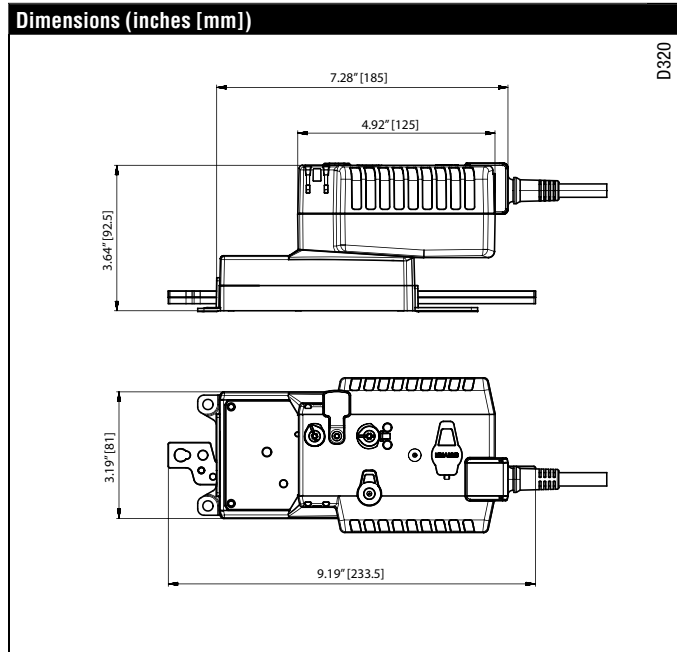
When reaching the damper or actuator end position the actuator automatically stops. The gear can be manually disengaged by pressing the button located on the actuator cover.

The AHKX24-MFT-100 actuator uses a brushless DC motor controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

## Fail-Safe Indication

The status LED on the actuator will turn solid yellow. On MFT versions, there is a repeating high-low-high signal on the feedback line. The high-low-high signal will display for 3 seconds and repeats every 30 seconds.

**When combining signal and power cable together, see important electrical installation diagram on page 202.**



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### Accessories

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSA	Linear Coupling
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**Note:** When using AHKX24-MFT-100 actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

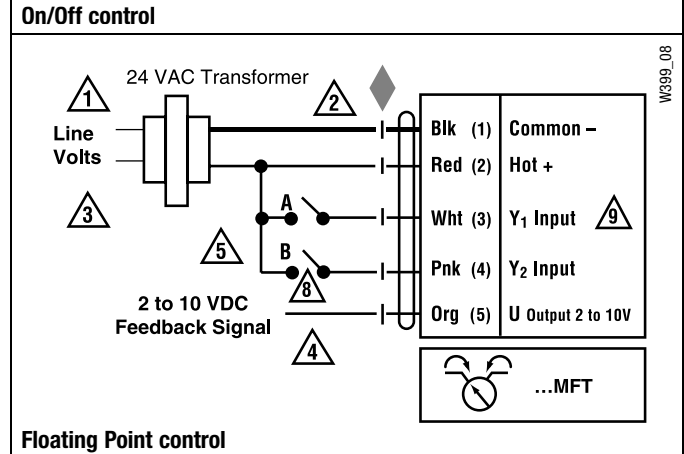
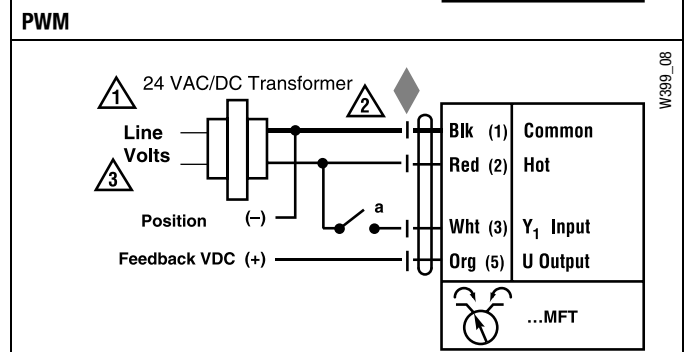
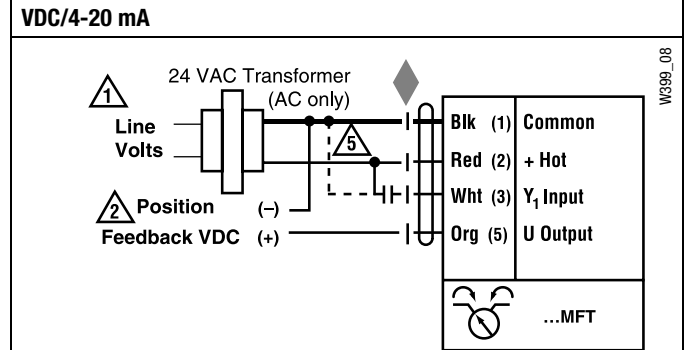
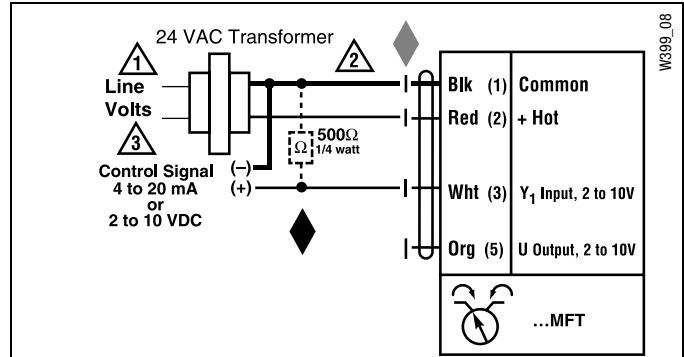
#### ✂ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### 📄 APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor may be used.

**⚠ WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



## Belimo is the Worldwide Leader in Fire and Smoke Actuation

Belimo first produced actuators for the European fire and smoke damper market in 1978. Belimo has consistently offered new technology since entering the market. Since 1978 Belimo's market share has grown as actuator variations were released to meet various worldwide requirements. The FSAF24-SR(-S) proportional and the FSAF24-BAL(-S) balancing actuator are the latest models to be introduced for the United States and regions of the world requiring UL 555 and UL 555S listing.



**Pier 1 Imports Corporate Headquarters, Fort Worth, TX**

### FS Series At A Glance

		FSAF24 US* (p. 209)	FSAF24-S US (p. 209)	FSAF120 US (p. 209)	FSAF120-S US (p. 209)	FSAF230 US (p. 211)	FSAF230-S US (p. 211)	FSAF24-SR US (p. 213)	FSAF24-SR-S US (p. 213)	FSAF24-BAL (p. 215)	FSAF24-BAL-S (p. 215)	FSNF24 US (p. 217)	FSNF24-S US (p. 217)	FSNF120 US (p. 217)	FSNF120-S US (p. 217)	FSNF230 US (p. 219)	FSNF230-S US (p. 219)	FSLF24 US (p. 221)	FSLF24-S US (p. 221)	FSLF120 US (p. 221)	FSLF120-S US (p. 221)	FSLF230 US (p. 223)	FSLF230-S US (p. 223)
Torque:	133 in-lb	●	●	●	●	●	●	●	●	●	●												
	70 in-lb											●	●	●	●	●	●						
	30 in-lb																	●	●	●	●	●	●
Power supply:	24 VAC**	●	●					●	●	●	●	●	●					●	●				
	120 VAC			●	●									●	●						●	●	
	230 VAC					●	●									●	●					●	●
Control signal:	On/Off	●	●	●	●	●	●					●	●	●	●	●	●	●	●	●	●	●	●
	2 to 10 VDC							●	●														
	3-position balancing									●	●												
	Running time motor:	<15 seconds													●	●	●	●	●	●	●	●	●
	<75 seconds	●	●	●	●	●	●	●	●	●	●												
spring:	<15 seconds											●	●	●	●	●	●	●	●	●	●	●	
	<20 seconds	●	●	●	●	●	●	●	●	●	●												
Built-in auxiliary switch			●		●		●		●		●		●		●		●		●		●		
Manual override		●	●	●	●	●	●	●	●	●	●												

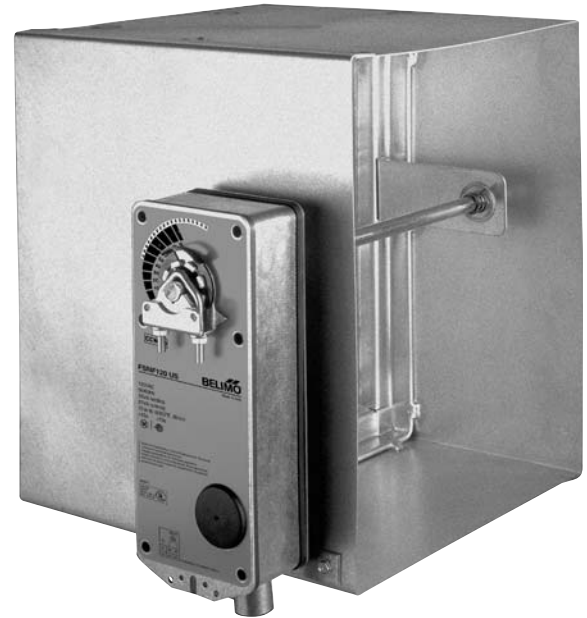
\* FSNF230 VAC data sheets are available at [www.belimo.com](http://www.belimo.com)

\*\* FSAF24-SR, FSAF24-BAL, and FSAF24 are 24VDC also



# A CLOSER LOOK...

- True mechanical spring return – the most reliable failsafe.
- Reverse mount for clockwise or counterclockwise fail-safe.
- Check damper position easily with clear position indicator.
- Overload-proof throughout rotation.
- Easy mechanical stop to adjust angle of rotation (add ZDB-AF2 US accessory/FSAF and FSNF only).
- Built-in auxiliary switch is easy to use, offers feedback or signal for additional device (-S models).
- Manual override crank speeds installation (only on FSAF models).
- The same 100% steel toothed cold-weld clamp that Belimo uses on all actuators is used on the FS Series. No slipping on damper shafts will occur.
- UL555S listed with damper manufacturers.
- Reliable DC motor—low current draw. FSAF24 is DC voltage.
- Permanently lubricated gears.
- California State Fire Marshall listed.
- New York City MEA listed.
- Belimo actuator is silent when holding at end position.



## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

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# FSAF24(-S) US, FSAF120(-S) US

On/Off, Spring Return, Meets 250°F [121°C] for Half Hour, 75 Seconds



Technical Data		FSAF24(-S) US, FSAF120(-S) US
Power supply		
	FSAF24(-S) US	24 VAC ± 20%, 24 VDC -10% +20%
	FSAF120(-S) US	120 VAC ± 10%, 50/60 Hz
Power consumption		
	FSAF24(-S) US	running 7.5 W, 10 VA, .4 A
		holding 2 W, 4 VA, .15 A
	FSAF120(-S) US	running 50/60Hz: 9.5 W, 11 VA, .1 A
		holding 3.5 W, 6 VA, .05 A
Transformer sizing		10 VA (Class 2 power source 24V only)
Electrical connection	motor	3 ft, 18 ga, 2 color coded leads 1/2" conduit connectors
	-S models	3 ft, 18 ga, 4 leads appliance cable 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Angle of rotation		mechanically limited to 95°
Torque		133 in-lb [15 Nm] constant
Direction of rotation	spring	reversible with cw/ccw mounting
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		3mm hex crank (shipped w/actuator)
Running time		<75 sec. constant, independent of load
	spring	<20 seconds nominal
Humidity		5 to 95% RH non-condensing
Ambient temperature		
	normal duty	-22°F to 122°F [-30°C to 50°C]
	safety duty	3 on/off cycles after 30 minutes at ambient temperature of 250°F [121°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 1 / IP40
Housing material		zinc coated metal
Gears		permanently lubricated
Agency listings		cULus listed to UL873 and CAN/CSA C22.2 No.24
Noise level (max)		45 dB (A)
	spring return	62 dB
Servicing		Maintenance free
Quality standard		ISO 9001, 5 year Belimo warranty
Weight		(standard / -S model)
	FSAF24(-S) US	5.7 / 6.2 lbs (2.6 / 2.8 kg)
	FSAF120(-S) US	6.1 / 6.6 lbs (2.8 / 3 kg)

## FSAF24-S US, FSAF120-S US

Auxiliary Switch	2xSPST 7A resistive, 2.5A inductive at 120V or 250V, UL Approved, double-insulated, one switch at 10°, one adjustable from 30° to 90°
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Torque min. 133 in-lb, for control of air dampers

## Application

For two position control of UL555S rated dampers in HVAC. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft or jackshaft 3/8" to 1.05" in diameter by means of its universal clamp. A crank arm and mounting brackets are available if the actuator cannot be direct coupled to the jackshaft or damper shaft.

Square footage of damper operated will depend on make and model of damper. Typically 12 sq.ft. minimum up to 24 sq.ft maximum will be operated for UL555S applications.

## Operation

The FSAF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on UL555S dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The FSAF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°. The FSAF has a manual positioning mechanism which allows the setting of any damper position within its 95° of rotation.

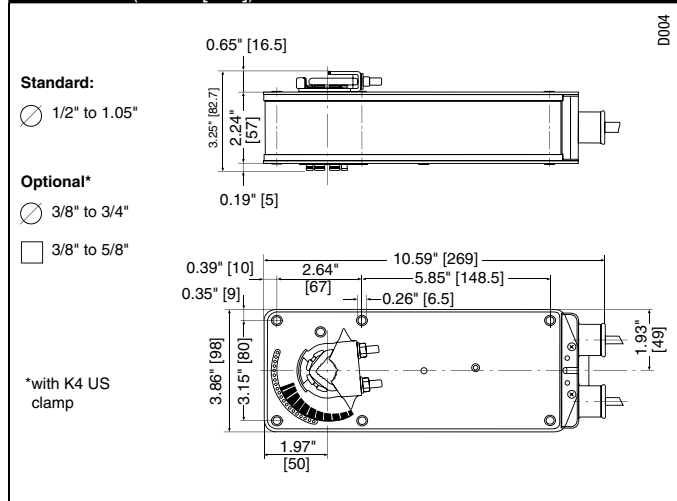
The actuator is shipped in the zero fail-safe position to provide automatic compression against damper gaskets for tight shut-off. When power is applied, the manual mechanism is released and the actuator drives toward the open position where it stops rotating.

The manual override can also be released physically by the use of a crank supplied with the actuator.

## SAFETY NOTE

Screw a conduit fitting into the actuator's bushing. Jacket the actuator's input and output wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

## Dimensions (Inches [mm])



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**Accessories (AF series accessories may be employed)**

IND-AF2	Damper position indicator
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Universal clamp for up to 1.05" dia. jackshafts
K4-H	Universal clamp for hexshafts 3/8" to 5/8"
KH-AF	Crank arm for up to 3/4" round shaft (Series 2)
KH-AF-1	Crank arm for up to 1.05" jackshaft (Series 2)
KH-AFV	V-bolt kit for KH-AF and KH-AF-1
Tool-01	10 mm wrench
ZDB-AF2 US	Angle of rotation limiter
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-102	Multiple actuator mounting bracket
ZG-103	Universal mounting bracket
ZG-104	Universal mounting bracket
ZG-106	Mounting bracket for Honeywell® Mod IV replacement or new crank arm type installations
ZG-107	Mounting bracket for Honeywell® Mod III or Johnson® Series 100 replacement or new crank arm type installations
ZG-108	Mounting bracket for Barber Colman® MA 3./4., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AF	Crank arm adaptor kit for AF/NF
ZG-AF108	Crank arm adaptor kit for AF/NF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-300	NEMA 4X housing
22965-00001	12mm form fit square shaft adaptor

For an overview of how to apply the accessories, see Belimo Mechanical Accessories and refer to the Belimo Mounting Methods Guide.

**NOTE:** When using FSAFxx (-S) US actuators, only use accessories listed on this page.

**Typical Specification**

Large combination fire and smoke dampers are to be operated by Belimo FSAF series actuators. Manufacturer shall provide 5 year warranty.

Actuators shall draw no more than 11VA at 120V or 24V.

Where auxiliary switches are required for signaling, starting fans, or position indication, -S model actuators, damper blade, or proximity switches shall be provided.

Smaller dampers shall employ Belimo FSLF or FSNF actuators per damper manufacturer recommendations.

**Wiring Diagrams**
**INSTALLATION NOTES**

1 Provide overload protection and disconnect as required.

2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.

3 Actuator may also be powered by 24 VDC.

4 No ground connection required. Double insulated.

5 For end position indication, interlock control, fan startup, etc., the FSAF24-S US and FSAF120-S US incorporates two built-in auxiliary switches: 2 x SPST, 7A resistive, 2.5 inductive @120/250 VAC, UL Approved, one switch is fixed at 10, one is adjustable from 30 to 90.

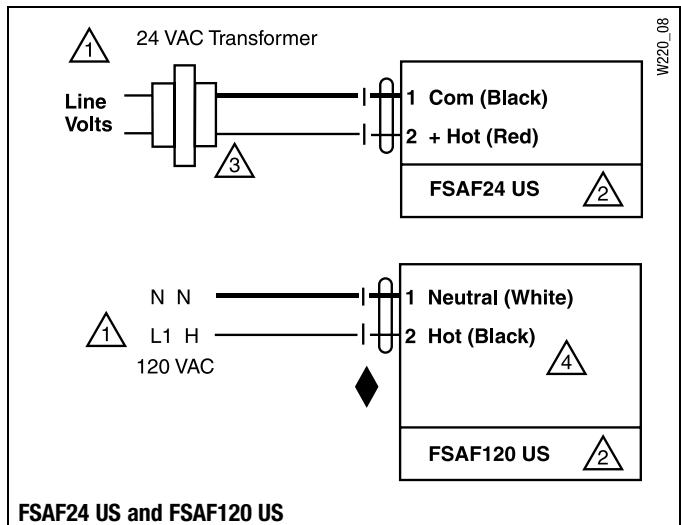
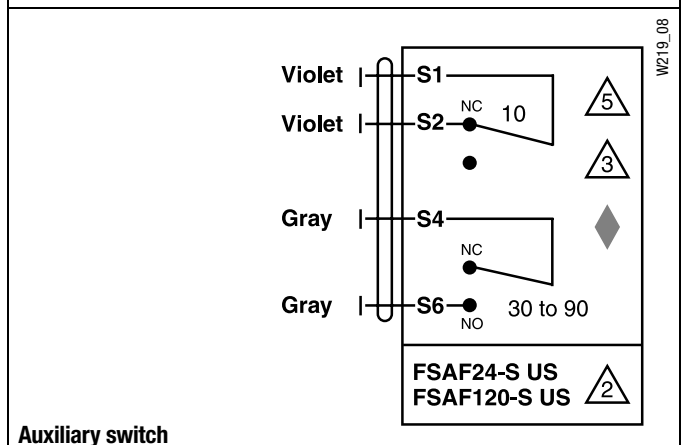
**APPLICATION NOTES**

◆ Meets UL requirements without the need of an electrical ground connection.

◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.


**FSAF24 US and FSAF120 US**

**Auxiliary switch**

# FSAF230(-S) US

On/Off, Spring Return, 250°F [121°C] for Half Hour, 75 Seconds



Technical Data		FSAF230(-S) US
Power supply		230 VAC ± 14%, 50/60 Hz
Power consumption	running	50/60Hz: 11 W, 12 VA, .07 A
	holding	3.5 W, 6 VA, .03 A
Transformer sizing		10 VA (Class 2 power source 24V only)
Electrical connection	motor	3 ft, 18 ga, 2 color coded leads 1/2" conduit connectors
	-S models	3 ft, 18 ga, 4 leads appliance cable 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Angle of rotation		mechanically limited to 95°
Torque		133 in-lb [15 Nm] constant
Direction of rotation	spring	reversible with cw/ccw mounting
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Manual override		3mm hex crank (shipped w/actuator)
Running time	spring	<75 sec. constant, independent of load <20 seconds nominal
Humidity		5 to 95% RH non-condensing
Ambient temperature	normal duty	-22°F to 122°F [-30°C to 50°C]
	safety duty	3 on/off cycles after 30 minutes at ambient temperature of 250°F [121°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 1 / IP40 with flexible conduit
Housing material		zinc coated metal
Gears		permanently lubricated
Agency listings		cULus listed to UL873 and CAN/CSA C22.2 No.24
Noise level (max)	spring return	45 dB (A) 62 dB
Servicing		Maintenance free
Quality standard		ISO 9001, 5 year Belimo warranty
Weight		6.9 lbs (3.1 kg)

FSAF230-S US	
Auxiliary Switch	2xSPST 7A resistive, 2.5A inductive at 120V or 250V, UL Approved, double-insulated, one switch at <10°, one adjustable from >30° to 90°

**Torque min. 133 in-lb, for control of air dampers**

## Application

For two position control of UL555S rated dampers in HVAC. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft or jackshaft 3/8" to 1.05" in diameter by means of its universal clamp. A crank arm and mounting brackets are available if the actuator cannot be direct coupled to the jackshaft or damper shaft.

Square footage of damper operated will depend on make and model of damper. Typically 12 sq.ft. minimum up to 24 sq.ft maximum will be operated for UL555S applications.

## Operation

The FSAF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on UL555S dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The FSAF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°. The FSAF has a manual positioning mechanism which allows the setting of any damper position within its 95° of rotation.

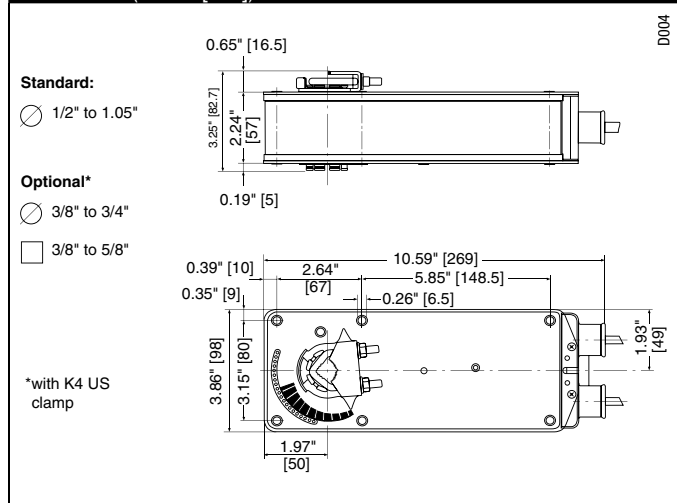
The actuator is shipped in the zero fail-safe position to provide automatic compression against damper gaskets for tight shut-off. When power is applied, the manual mechanism is released and the actuator drives toward the open position where it stops rotating.

The manual override can also be released physically by the use of a crank supplied with the actuator.

### SAFETY NOTE

Screw a conduit fitting into the actuator's bushing. Jacket the actuator's input and output wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

### Dimensions (Inches [mm])



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### Accessories (AF series accessories may be employed)

IND-AF2	Damper position indicator
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Universal clamp for up to 1.05" dia. jackshafts
K4-H	Universal clamp for hexshafts 3/8" to 5/8"
KH-AF	Crank arm for up to 3/4" round shaft (Series 2)
KH-AF-1	Crank arm for up to 1.05" jackshaft (Series 2)
KH-AFV	V-bolt kit for KH-AF and KH-AF-1
Tool-01	10 mm wrench
ZDB-AF2 US	Angle of rotation limiter
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-102	Multiple actuator mounting bracket
ZG-103	Universal mounting bracket
ZG-104	Universal mounting bracket
ZG-106	Mounting bracket for Honeywell® Mod IV replacement or new crank arm type installations
ZG-107	Mounting bracket for Honeywell® Mod III or Johnson® Series 100 replacement or new crank arm type installations
ZG-108	Mounting bracket for Barber Colman® MA 3./4., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AF	Crank arm adaptor kit for AF/NF
ZG-AF108	Crank arm adaptor kit for AF/NF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-300	NEMA 4X housing
22965-00001	12mm form fit square shaft adaptor

For an overview of how to apply the accessories, see Belimo Mechanical Accessories and refer to the Belimo Mounting Methods Guide.

**NOTE:** When using FSAFxx (-S) US actuators, only use accessories listed on this page.

### Typical Specification

Large combination fire and smoke dampers are to be operated by Belimo FSAF series actuators. Manufacturer shall provide 5 year warranty.

Actuators shall draw no more than 12VA at 230V or 10 VA at 24V.

Where auxiliary switches are required for signaling, starting fans, or position indication, -S model actuators, damper blade, or proximity switches shall be provided.

Smaller dampers shall employ Belimo FSLF or FSNF actuators per damper manufacturer recommendations.

### Wiring Diagrams

#### INSTALLATION NOTES

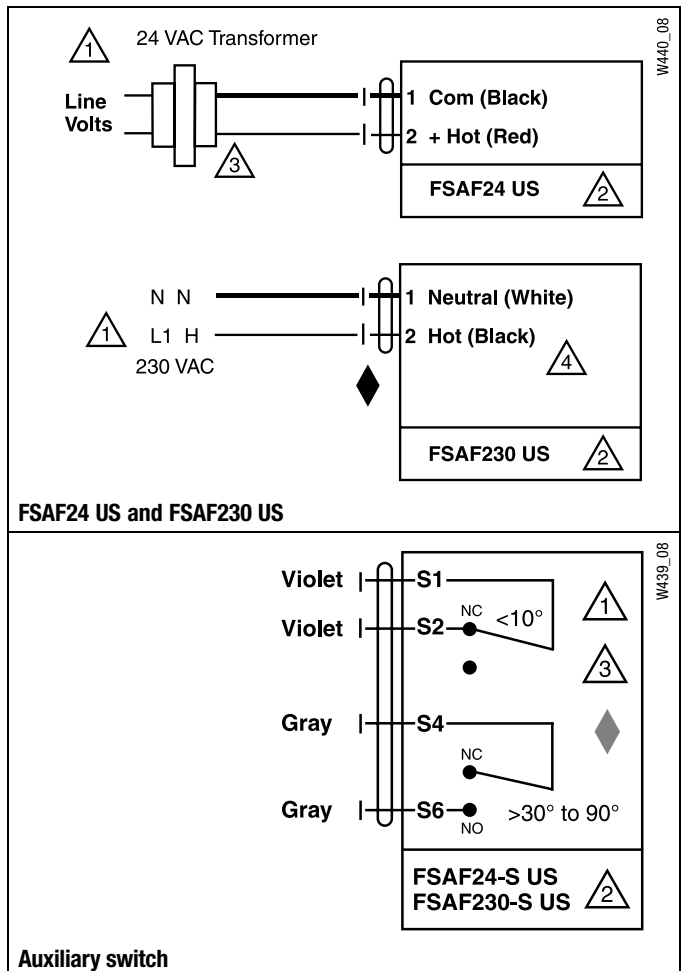
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuator may also be powered by 24 VDC.
- 4 No ground connection required. Double insulated.
- 5 For end position indication, interlock control, fan startup, etc., the FSAF230-S US incorporates two built-in auxiliary switches: 2 x SPST, 7A resistive, 2.5 inductive @120/250 VAC, UL Approved, one switch is fixed at 10°, one is adjustable from 30° to 90°.

#### APPLICATION NOTES

- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# FSAF24-SR(-S) US

Proportional, Spring Return, 24 V, 2 to 10 VDC or 4 to 20 mA control signal  
Operation at 250°F for limited time per UL555S testing



Technical Data		FSAF24-SR(-S) US
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	7 W, 11 VA
	holding	3 W, 5 VA
Transformer sizing		15 VA (class 2 power source)
Electrical connection	FSAF24-SR	3 ft, 18 GA, 4 color coded leads (24V) 1/2" conduit connector
	FSAF24-SR-S	3 ft, 18 GA appliance cable 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Operating range		2 to 10 VDC, 4 to 20mA
Input impedance		100 kΩ (0.1 mA), 500 Ω
Feedback output U		2 to 10 VDC (max. 0.5 mA) for 95°
Angle of rotation		mechanically limited to 95°
Torque		133 in-lb [15 Nm] constant
Direction of rotation	spring	reversible with cw/ccw mounting The control direction switch is not present. Direct acting only. 2 VDC=Fail-safe position.
Position indication		visual indicator, 0° to 95° (0° spring return position)
Manual override		3mm hex crank (shipped w/actuator)
Running time	motor	<75 sec. constant, independent of load
	spring	< 20 seconds
Humidity		5 to 95% RH non-condensing
Ambient temperature	normal duty	-22°F to 122°F [-30°C to 50°C]
	safety duty	3 on/off cycles after 30 minutes at ambient temperature of 250°F [121°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP40
Housing material		zinc coated metal
Agency listings†		cULus to UL873 and CSA C22.2 No. 24-93
Noise level (max)	running	45 db (A)
Servicing		maintenance free
Quality standard		ISO 9001, 5 year Belimo warranty
Weight		6.0 lbs (2.7 kg.)
<b>FSAF24-SR-S US</b>		
Auxiliary switch		2 x SPDT 7A resistive, 2.5A inductive at 120/250VAC. UL Approved, double-insulated, one set at =+10°, one adjustable 30° to 90°

## Torque min. 133 in-lb, for control of air dampers

### Application

For proportional modulation of UL555S rated dampers in HVAC. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft or jackshaft up to 1.05" in diameter by means of its universal clamp. A crank arm and mounting brackets are available if the actuator cannot be direct coupled to the jackshaft or damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications. See Application Bulletin for details.

### Operation

The FSAF series actuators provide spring return operation. There is no reversing switch on the FSAF24-SR. It is direct acting only. A reverse acting signal is required if it must spring open while 2V signal drives it closed. The torque is asymmetrical giving 180 in-lb drive and 133 in-lb spring.

The FSAF resets after being driven or springing closed to the 0 position. There is a possible hysteresis of 1° every 1000 changes in signal. This can cause a position shift. It is recommended that power or signal be reset once a week.

A manual override winder and locking mechanism is provided. If the manual winder is used when the actuator is powered, the actuator will release and drive closed to reset the 0 degree position.

The actuator may not be mechanically paralleled or "piggybacked." Each damper section should be controlled by a separate actuator.

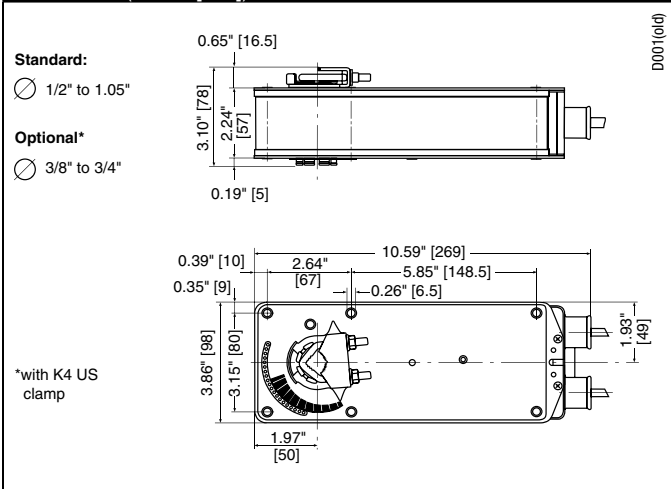
The wire 5 feedback can be used to parallel up to five additional actuators. If less than 2.1 V or greater than 9.9V is given wire 3, actuator drives all the way to the respective end stop.

The FSAF uses a DC motor which is controlled by a microchip. The actuator may be stalled anywhere during its rotation without damage. If power is removed, the damper will spring closed. Interlocks must be provided as necessary for life safety functions and to shut down fan if required.

### SAFETY NOTE

Screw a conduit fitting into the actuator's bushing. Jacket the actuator's input and output wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

### Dimensions (Inches [mm])



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### Accessories (AF series accessories may be employed)

IND-AF2	Damper position indicator
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Universal clamp for up to 1.05" dia. jackshafts
K4-H	Universal clamp for hexshafts 3/8" to 5/8"
KH-AF	Crank arm for up to 3/4" round shaft (Series 2)
KH-AF-1	Crank arm for up to 1.05" jackshaft (Series 2)
KH-AFV	V-bolt kit for KH-AF and KH-AF-1
Tool-01	10 mm wrench
SGA24	Min. and/or max. positioner in NEMA 4 housing
SGF24	Min. and/or max. positioner for flush panel mounting
ZG-R01	500 Ω resistor for 0 to 20 mA control signal
ZDB-AF2 US	Angle of rotation limiter
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-102	Multiple actuator mounting bracket
ZG-103	Universal mounting bracket
ZG-104	Universal mounting bracket
ZG-106	Mounting bracket for Honeywell® Mod IV replacement or new crank arm type installations
ZG-107	Mounting bracket for Honeywell® Mod III or Johnson® Series 100 replacement or new crank arm type installations
ZG-108	Mounting bracket for Barber Colman® MA 3./4., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AF	Crank arm adaptor kit for AF/NF
ZG-AF108	Crank arm adaptor kit for AF/NF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

For an overview of how to apply the accessories, see Belimo Mechanical Accessories and refer to the Belimo Mounting Methods Guide.

**NOTE:** When using FSAF24-SR(-S) US actuators, only use accessories listed on this page.

### Typical Specification

Proportional smoke, and combination fire and smoke dampers, shall be controlled by Belimo FSAF24-SR actuators. The control signal shall provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω 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. Actuator shall open damper in <75 seconds per UL555S and shall spring closed in under 20 seconds. Actuators shall be UL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo. Actuators with auxiliary switches must be constructed to meet the requirement for double insulation so an electrical ground connection is not required to meet agency listings.

### Replacement Application

The number one "equal or better" requirement for use as a replacement for obsolete defective motors is the UL555S listing of the Belimo actuator with the damper for the application. The local authority having jurisdiction sets the requirements since UL has stated that they do not regulate replacements.

### Wiring Diagrams

#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuator may also be powered by 24 VDC.

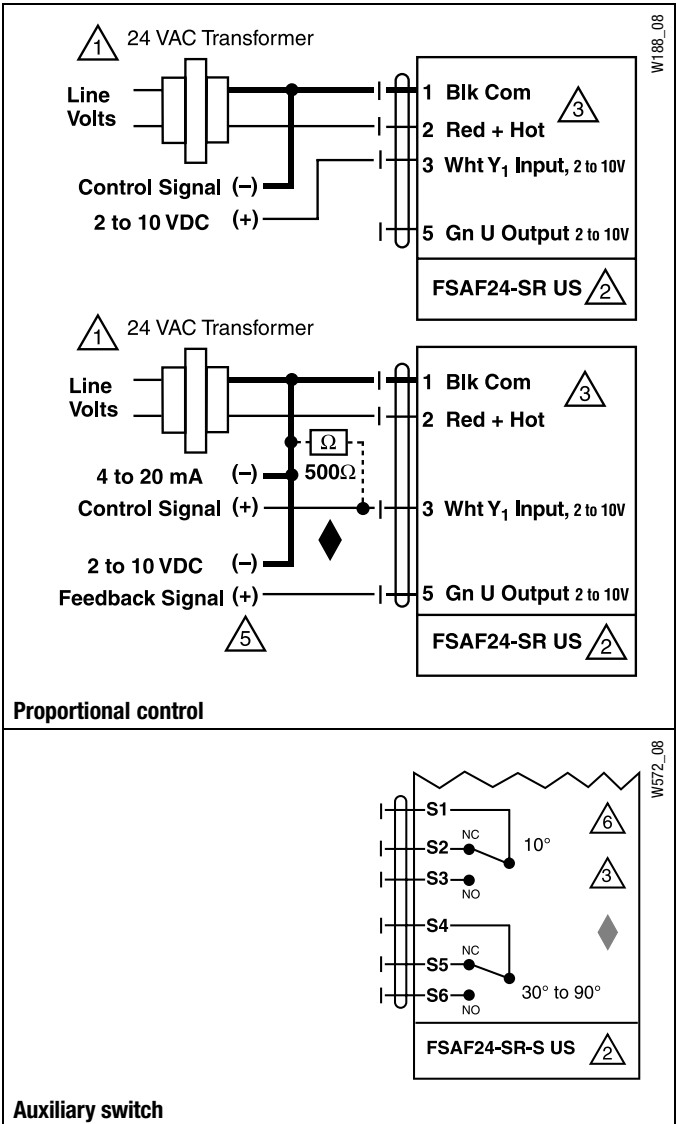
- 4 No ground connection required. Double insulated.
- 5 Only connect common to neg. (-) leg of control circuits.
- 6 For end position indication, interlock control, fan startup, etc., FSAF24-SR-S US incorporates two built-in auxiliary switches:  
2 x SPDT, 7A resistive, 2.5A inductive 120/250 VAC, UL Approved, one switch is fixed at 10°, one is adjustable 30° to 90°.

#### APPLICATION NOTES

- Meets UL requirements without the need of an electrical ground connection.
- The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# FSAF24-BAL(-S) US

Spring Return, 24 V, 3-Position, 100% Open Override  
Operation at 250°F for limited time per UL555S testing



Technical Data		FSAF24-BAL(-S) US
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	AC 9.5 VA 6.5W DC 6W
	holding	AC 5 VA 3W DC 3W
Transformer sizing		10 VA (class 2 power source 24V only)
Electrical connection		3 ft, 18 GA, 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Control signal		24 VAC/DC 3-position
Angle of rotation		20° to 95°, pot adjustable
Torque		133 in-lb [15 Nm]
Direction of rotation	spring	reversible with cw/ccw mounting
Position indication		visual indicator, 0° to 95° (0° spring return position)
Manual override		3mm hex crank (shipped w/actuator)
Running time	motor	<75 seconds @ 250°F [121°C]
	spring	< 20 seconds
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 1/IP40 (with flex conduit)
Housing material		zinc coated metal
Agency listings†		cULus to UL873 and CSA C22.2 No. 24-93
Noise level (max)	running	<45 dB(A)
	spring	<62dB(A)
Servicing		maintenance free
Quality standard		ISO 9001, 5 year Belimo warranty
Weight		5.3 lbs (2.4 kg)
		5.7 lbs (2.6 kg) for -S model

FSAF24-BAL-S US	
Auxiliary switch	2 x SPDT 7A resistive, 2.5A inductive at 120/250VAC. UL listed, double-insulated, one switch is set at 10°, one is adjustable 30° to 90°

## Application

For 3-position control of UL555S rated dampers in HVAC. Actuator sizing should be done in accordance with the damper manufacturer's tests. In the absence of other information, use 10 in-lb of torque per square foot of area for opposed blade and 14 in-lb for parallel blade fire and smoke dampers at 1000 fpm air velocity.

The FSAF24-BAL is specifically designed to balance the air flow in ducts and simultaneously provide control of fire and smoke dampers. 0V = spring closed. 24V on wire 2, not 3 = drive to the potentiometer position (balanced flow). 24V on wire 3, regardless of the status of wire 2 = drive full open (smoke control extraction or pressurization). See Application Bulletin for details.

## Operation

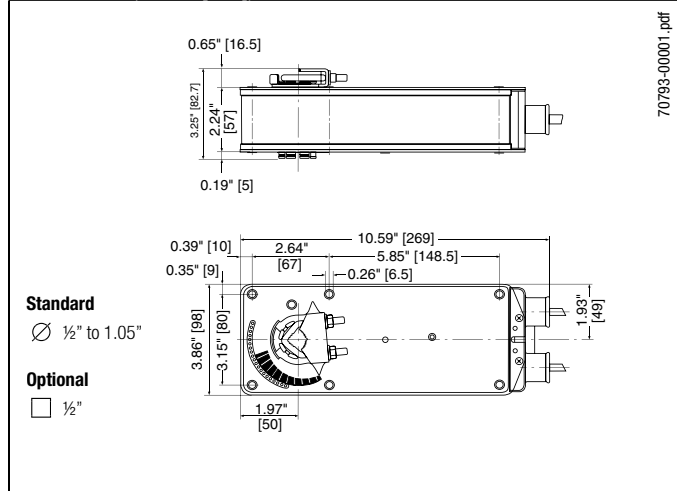
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## SAFETY NOTE

The actuator contains no components which the user can replace or repair.

## Dimensions (Inches [mm])



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**Accessories (AF series accessories may be employed)**

IND-AF2	Damper position indicator
K4-1 US	Universal clamp for up to 1.05" dia. jackshafts
KH-AF	Crank arm for up to 3/4" round shaft (Series 2)
KH-AF-1	Crank arm for up to 1.05" jackshaft (Series 2)
KH-AFV	V-bolt kit for KH-AF and KH-AF-1
Tool-01	10 mm wrench
ZDB-AF2	Angle of rotation limiter
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-103	Universal mounting bracket
ZG-104	Universal mounting bracket
ZG-106	Mounting bracket for Honeywell® Mod IV replacement or new crank arm type installations
ZG-107	Mounting bracket for Honeywell® Mod III or Johnson® Series 100 replacement or new crank arm type installations
ZG-108	Mounting bracket for Barber Colman® MA 3../4..., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AF	Crank arm adaptor kit for AF/NF
ZG-AF108	Crank arm adaptor kit for AF/NF
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-300	NEMA 4X housing
22965-00001	12 mm form fit square shaft adaptor

For an overview of how to apply the accessories, see Belimo Mechanical Accessories and refer to the Belimo Mounting Methods Guide.

**NOTE:** When using FSAF24-BAL(-S) US actuators, only use accessories listed on this page.

**Typical Specification**

Where indicated on drawings, combination fire and smoke and balancing dampers shall be controlled by Belimo FSAF24-BAL or equal actuators. The actuators must be designed so that they may be used for either clockwise or counter clockwise failsafe operation. Actuator shall open damper in <75 seconds per UL555S and shall spring closed in under 20 seconds. Actuators shall have a 5-year warranty and be manufactured under ISO9001 International Quality Control Standards.

Actuator shall have an adjustable Maximum Opening Potentiometer which shall be used by the TAB contractor to adjust flow to that portion of the system fed by the damper.

The actuator shall spring closed if either the smoke detector or alarm system removes power from it. Actuator shall spring closed if the primary temperature thermdisc opens due to high ambient of >165°F or as otherwise indicated on drawings.

The actuator shall drive full open if either the smoke control system 100% open override or Fire Fighters Smoke Control Station override is activated. Damper shall spring closed again if the thermdisc of a combination fire and smoke damper opens due to high temperature (typically 250°F).

**Wiring Diagrams**

**INSTALLATION NOTES**

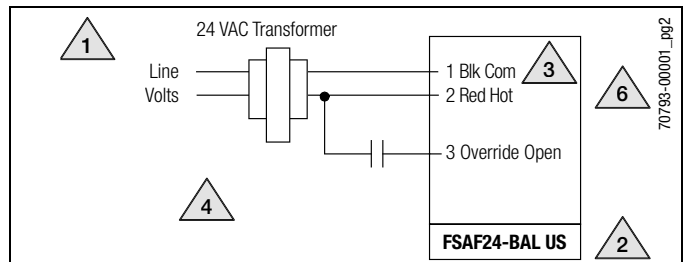
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuator may also be powered by 24 VDC.
- 4 Only connect Hot, Wire 2 to Wire 3 override control
- 5 For end position, interlock control, fan start-up, etc., FSAF24-BAL-S incorporates two built-in auxiliary switches: 2 x SPDT, 7A resistive, 2.5A inductive 120/250 VAC, UL listed, one switch is fixed at 10°, one adjustable 30° to 90°
- 6 For end position indication, interlock control, fan startup, etc., FSAF24-SR-S US incorporates two built-in auxiliary switches: 2 x SPDT, 7A resistive, 2.5A inductive 120/250 VAC, UL Approved, one switch is fixed at 10°, one is adjustable 30° to 90°.

**APPLICATION NOTES**

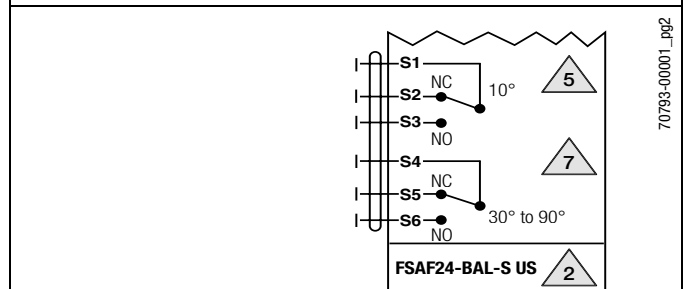
- 6 Meets UL requirements without the need of an electrical ground connection.
- 7 Double insulated

**WARNING Live Electrical Components!**

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**Override control**



**Auxiliary switch**

# FSNF24(-S) US, FSNF120(-S) US

On/Off, Spring Return, 350°F for Half Hour, 15 Seconds Cycle Time



Technical Data		FSNF24(-S) US, FSNF120(-S) US
Power supply		
	FSNF24(-S) US	24 VAC ± 20%, 50/60 Hz
	FSNF120(-S) US	120 VAC ± 10%, 50/60 Hz
Power consumption		
	running	27 VA, .23 A
	120 VAC holding	10 VA, .09 A
Transformer sizing		
	24 VAC	27 VA Class 2 power supply
Electrical connection		
	FSNF24(-S) US	3 ft, 18 ga, 2 color coded leads
	FSNF120(-S) US	3 ft, 18 ga, 3 color coded leads
	FSNF...-S US	3 ft, 18 ga, appliance cable
Overload protection		Electronic throughout 0 to 95° rotation grounded enclosure, 120V
Control		microprocessor
Angle of rotation		95°
Torque		70 in-lb [7.9 Nm] minimum from 32°F to 350°F [0°C to 177°C]
Direction of rotation		spring can be selected by CCW/CW mounting
Position indication		visual indicator, 0° to 95°
Running time		between 32°F and 350°F [0°C to 177°C]
	motor	<75 seconds constant, independent of load
	spring	<20 seconds nominal
Humidity		5 to 95% RH non-condensing
Ambient temperature		32°F to 122°F [0°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 1
Housing material		zinc coated steel
Gears		steel, permanently lubricated
Agency listings		cULus listed to UL873 and CAN/CSA C22.2 No. 24
Servicing		Maintenance free
Quality standard		ISO 9001
Weight		
	FSNF24(-S) US	6.0 lbs (2.75 kg)
	FSNF120(-S) US	6.7 lbs (3.0 kg)
	FSNF...-S US	+0.5 lbs (+0.23 kg)

FSNF24-S US, FSNF120-S US	
Auxiliary Switch	2xSPST 7A resistive, 2.5A inductive at 120V or 250V, UL Approved, double-insulated, one switch at <10°, one adjustable from >30° to 90°

## Application

The type FSNF spring-return actuator is intended for the operation of smoke and combination fire and smoke dampers in ventilation and air-conditioning systems. The actuator will meet requirements of UL555 and UL555S when tested as an assembly with the damper and will meet requirements of UBC for 15 second opening and closing at 350°F. Square footage of damper operated will depend on make and model and the temperature required.

## Operation

Mounting of the actuator to the damper axle shaft or jackshaft (3/8" to 1.05") is via a cold-weld clamp. Teeth in the clamp and V-bolt dig into the metal of both solid and hollow shafts maintaining a perfect connection. The specially designed clamp will not crush hollow shafts. The bottom end of the actuator is held by an anti-rotation strap or by a stud provided by the damper manufacturer.

The actuator is mounted in its fail safe position with the damper blade(s) closed. Upon applying power, the actuator drives the damper to the open position. The internal spring is tensioned at the same time. If the power supply is interrupted, the spring moves the damper back to its fail-safe position.

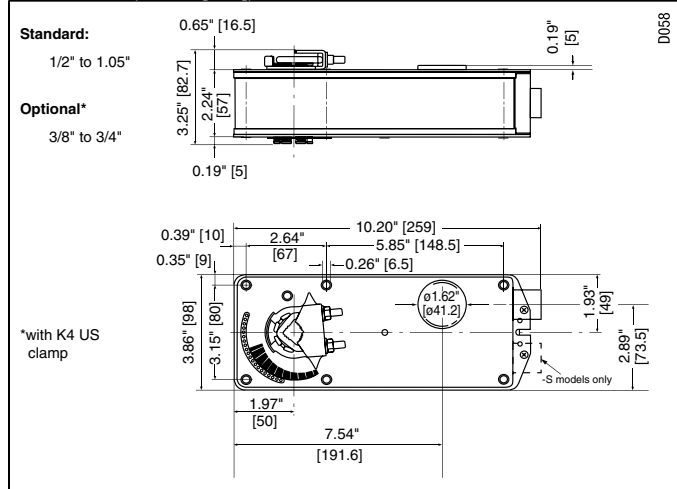
## SAFETY NOTES

The actuator contains no components which the user can replace or repair.

**1/2" Threaded Connector** – Screw a conduit fitting into the actuator's metal bushing. Jacket the actuator's input wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

**3/8" Flexible Connector Models (-FC Screw Connector)** – Mount the flexible conduit into the actuator's metal bushing by means of the provided screw with a torque of 1.2 Nm. Jacket the actuator's input wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

## Dimensions (Inches [mm])



## Accessories

All AF/NF linkages and parts may be employed.

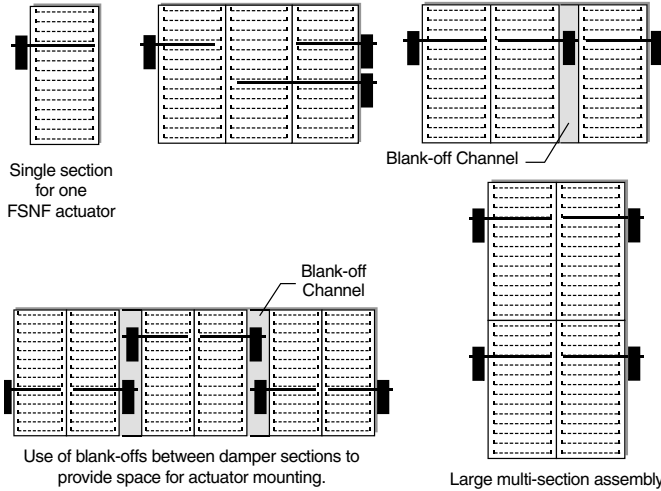
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### Typical Applications

#### Multi-section Damper Assemblies

The typical fire and smoke damper requires from 5-15 in-lb of torque per square foot at 250°F – 350°F under dynamic load (2400 fpm velocity). The FSNF will operate multi-section dampers using multiple actuators for multiple sections. Some of the methods used are shown below.

This is a direct coupled actuator. If linkages are needed use the FSNF series. Square shaft adaptors are available: 22153-00002, 22153-00003, 22513-00004 for the 8mm, 10mm, and 12mm, form fit respectively.



### Typical Specification

#### Smoke Control and Combination Fire and Smoke Control Damper Actuators

All smoke and combination fire and smoke dampers shall be provided with Belimo FSLF, FSNF, or FSAF actuators. No substitutions allowed.

Damper and actuator shall have UL555S Listing for 250°F (350°F) and shall comply with UBC if required by local codes.

Where proof of closure switches are required, blade switches, actuator auxiliary switches, or proximity switches are allowed.

### Replacement Applications

The number one "equal or better" requirement for use as a replacement for obsolete defective motors is the UL555S listing of the Belimo actuator with the damper for the application. The local authority having jurisdiction sets the requirements. In some cases a permit and inspection may be required.

Contact Belimo for a list of damper manufacturers with UL555S listing with Belimo FSAF, FSLF, & FSNF actuators.

#### CAUTION

Caution must be used when replacing failed motors with new Belimo actuators. Many old motors did not have internal springs and depended on external springs on the side of the damper or wrapped around the damper shaft to close the damper.

In some cases, the damper must be replaced because the damper would have to undergo major modifications to replace an actuator.

In many cases, replacing the actuator voids the UL555S listing of the damper.

### Wiring Diagrams

#### INSTALLATION NOTES

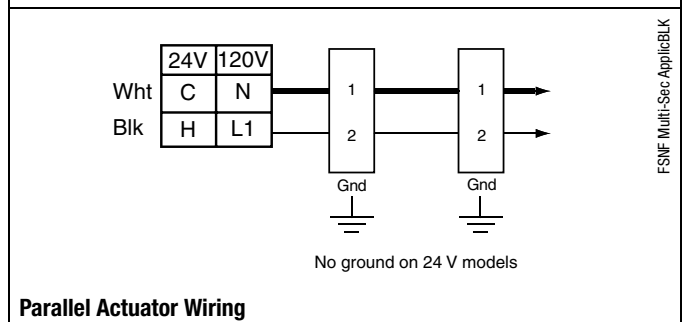
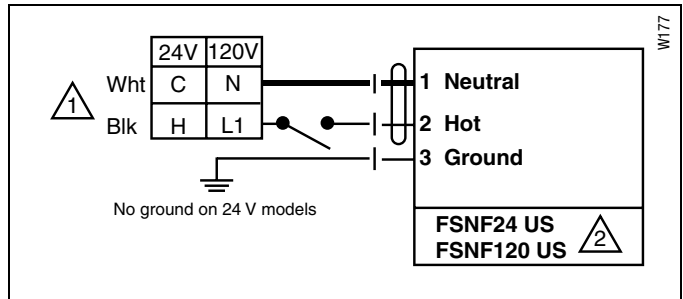
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 4 For end position indication, interlock control, fan startup, etc., FSNF24-S US and FSNF120-S US incorporate two built-in auxiliary switches: 2 x SPDT, 7A (2.5A inductive)@125/250 VAC, UL Approved, 5 and 85. Switch rating is for 250F 1/2 hour only.

#### APPLICATION NOTES

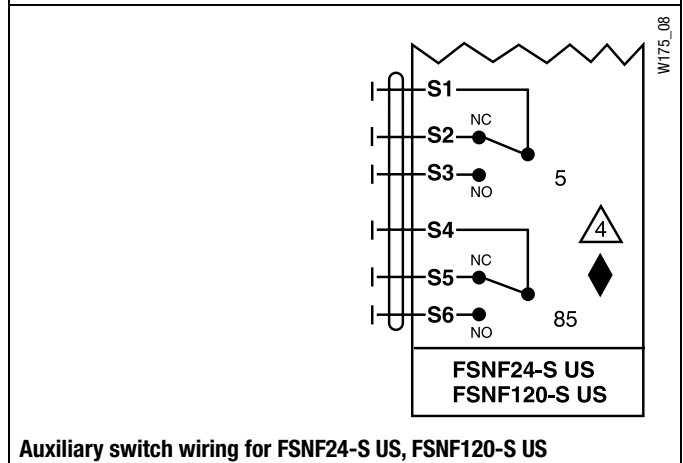
- Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



#### Parallel Actuator Wiring



#### Auxiliary switch wiring for FSNF24-S US, FSNF120-S US

# FSNF230(-S) US

On/Off, Spring Return, 350°F [177°C] for Limited Time, Nominal 15 Seconds Operation



Technical Data		FSNF230(-S) US
Power supply	FSNF230(-S) US	230 VAC ± 10%, 50/60 Hz
Power consumption	running	18 W, 27 VA, .13 A
	230 VAC holding	6 W, 10 VA, .04 A
Transformer sizing	24 VAC	27 VA Class 2 power supply
Electrical connection	FSNF230(-S) US	3 ft [1m], 18 ga, 3 color coded leads
	FSNF...-S US	3 ft [1m], 18 ga, appliance cable
Overload protection		Electronic throughout 0 to 95° rotation auto-restart after temporary overload
Electrical protection		grounded enclosure, 230V
Control		microprocessor
Angle of rotation		95°
Torque		70 in-lb [7.9 Nm] minimum from 32°F to 350°F [0°C to 177°C]
Direction of rotation	spring	can be selected by CCW/CW mounting
Position indication		visual indicator, 0° to 95°
Running time	motor	between 32°F and 350°F [0°C to 177°C] approx. 15 sec at rated voltage and torque
	spring	approx. 15 sec
Humidity		5 to 95% RH non-condensing
Ambient temperature		32°F to 122°F [0°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 1
Housing material		zinc coated steel
Gears		steel, permanently lubricated
Agency listings		cULus listed to UL873 and CAN/CSA C22.2 No. 24
Servicing		Maintenance free
Quality standard		ISO 9001
Weight	FSNF230(-S) US	6.7 lbs (3.0 kg)
	FSNF...-S US	+0.5 lbs (+.23 kg)
<b>FSNF230-S US</b>		
Auxiliary Switch		2 x SPDT 7A (2.5A inductive)@ 125/250VAC, UL Approved, 5° and 85°, double insulated

## Application

The type FSNF spring-return actuator is intended for the operation of smoke and combination fire and smoke dampers in ventilation and air-conditioning systems. The actuator will meet requirements of UL555 and UL555S when tested as an assembly with the damper and will meet requirements of UBC for 15 second opening and closing. Square footage of damper operated will depend on make and model and the temperature required.

## Operation

Mounting of the actuator to the damper shaft or jackshaft (3/8" to 1.05") is via a cold-weld clamp. Teeth in the clamp and V-bolt dig into the metal of both solid and hollow shafts maintaining a perfect connection. The specially designed clamp will not crush hollow shafts. The bottom end of the actuator is held by an anti-rotation strap or by a stud provided by the damper manufacturer.

The actuator is mounted in its fail safe position with the damper blade(s) closed. Upon applying power, the actuator drives the damper to the open position. The internal spring is tensioned at the same time. If the power supply is interrupted, the spring moves the damper back to its fail-safe position.

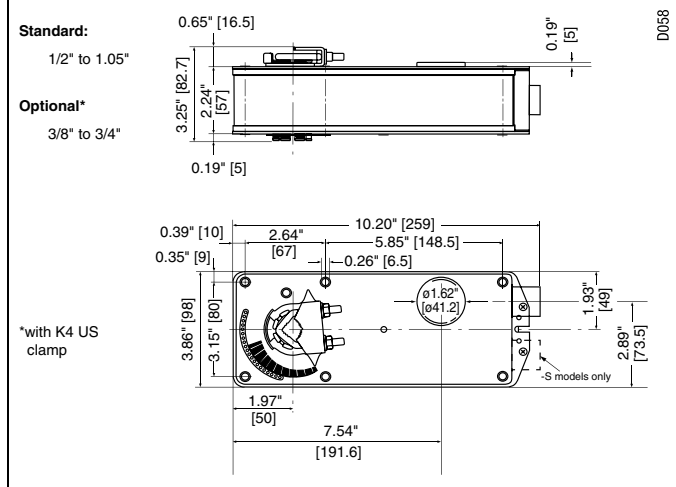
## SAFETY NOTES

The actuator contains no components which the user can replace or repair.

**1/2" Threaded Connector** – Screw a conduit fitting into the actuator's metal bushing. Jacket the actuator's input wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

**3/8" Flexible Connector Models (-FC Screw Connector)** – Mount the flexible conduit into the actuator's metal bushing by means of the provided screw with a torque of 1.2 Nm. Jacket the actuator's input wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

## Dimensions (Inches [mm])



## Accessories

All AF/NF linkages and parts may be employed.

Order part 22965-00001 for square shafts.

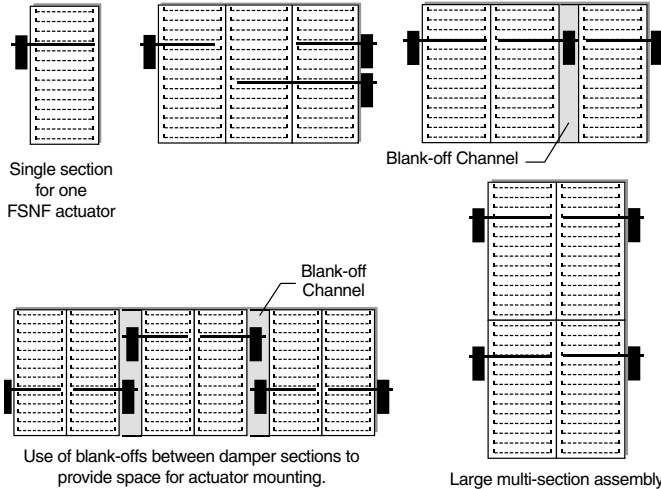
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### Typical Applications

#### Multi-section Damper Assemblies

The typical US fire-smoke damper requires from 5-15 in-lb torque per square ft. [6-17 Nm per square meter] at 350°F [171°C] under dynamic load (2400 fpm [12m/s] velocity).

Some of the methods used for multi-section dampers with the FSNF actuators are shown below.



### Typical Specification

#### Smoke Control and Combination Fire and Smoke Control Damper Actuators

All smoke and combination fire and smoke dampers shall be provided with Belimo FSLF, FSNF, or FSAF actuators. No substitutions allowed.

Damper and actuator shall have UL555S Listing for 250°F (350°F) and shall comply with UBC if required by local codes.

Where proof of closure switches are required, blade switches, actuator auxiliary switches, or proximity switches are allowed.

### Replacement Applications

The number one "equal or better" requirement for use as a replacement for obsolete defective motors is the UL555S listing of the Belimo actuator with the damper for the application. The local authority having jurisdiction sets the requirements. In some cases a permit and inspection may be required.

Contact Belimo for a list of damper manufacturers with UL555S listing with Belimo FSAF, FSLF, & FSNF actuators.

#### CAUTION

Caution must be used when replacing failed motors with new Belimo actuators. Many old motors did not have internal springs and depended on external springs on the side of the damper or wrapped around the damper shaft to close the damper.

In some cases, the damper must be replaced because the damper would have to undergo major modifications to replace an actuator.

In many cases, replacing the actuator voids the UL555S listing of the damper.

### Wiring Diagrams

#### INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

#### 2 CAUTION Equipment Damage!

Actuators may be connected in parallel.

Power consumption and input impedance must be observed.

4 For end position indication, interlock control, fan startup, etc., FSNF230-S incorporates two built-in auxiliary switches: 2 x SPDT, 7A (2.5A inductive)@125/250 VAC, UL Approved, 5 and 85. Switch rating 250°F [121°C] 1/2 hour only.



#### APPLICATION NOTES

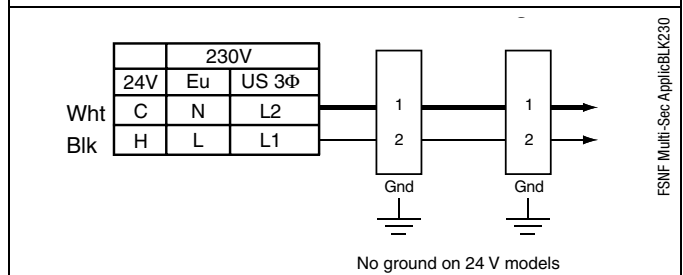
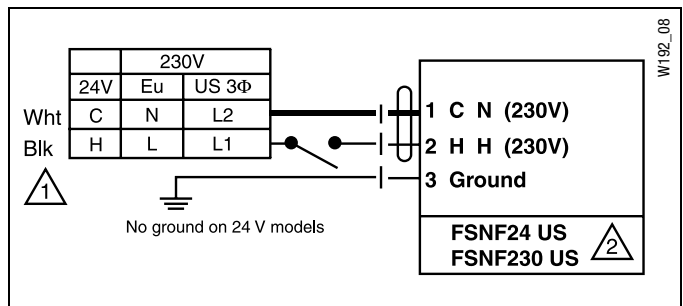


Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

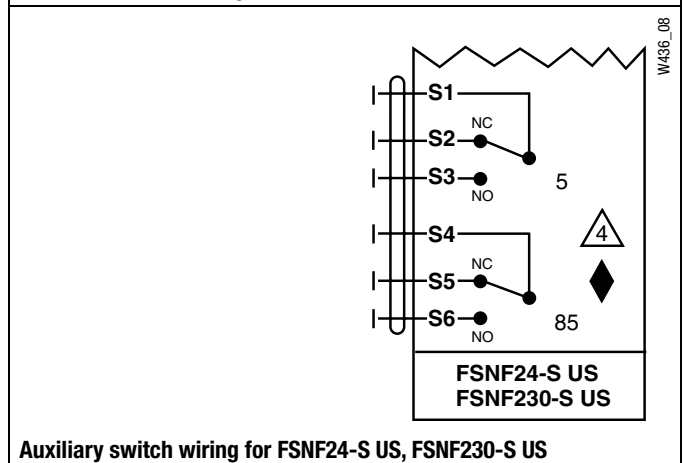


#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



#### Parallel Actuator Wiring



# FSLF24(-S) US, FSLF120(-S) US

On/Off, Spring Return, 350°F [177°C] for Half Hour, 15 Seconds Operation



Technical Data		FSLF24(-S) US, FSLF120(-S) US
Power supply		
	FSLF24(-S) US	24 VAC, 50/60 Hz nominal voltage range 21.6-26.4 VAC
	FSLF120(-S) US	120 VAC, 50/60 Hz nominal voltage range 108-132 VAC
Power consumption		
24 VAC	running	50/60 Hz, 5.0 VA
	holding	50/60 Hz, 3.5 VA
120 VAC	running	50 Hz, 20 VA / 60 Hz, 18 VA
	holding	50 Hz, 12 VA / 60 Hz, 6.5 VA
Transformer sizing		Safety Note, connect via safety isolating transformer, class 2 supply
24 VAC		
Electrical connection		
	FSLF24(-S) US	3 ft [1m], 18 ga, 2 color coded leads
	FSLF120(-S) US	3 ft [1m], 18 ga, 3 color coded leads
	FSLF...-S US	3 ft [1m], 18 ga, appliance cable
Overload protection		electronic throughout 0 to 95° rotation auto-restart after temporary overload
Electrical protection		grounded enclosure, 120V
Control		microprocessor
Angle of rotation		95°
Torque		30 in-lb [3.5 Nm] minimum from 32°F to 350°F [0°C to 177°C]
Direction of rotation		spring can be selected by CCW/CW mounting
Position indication		visual indicator, 0° to 95°
Running time		motor < 15 seconds at rated voltage and torque 32°F and 122°F [0°C to 50°C]
	spring	< 15 seconds at ambient temperature
Humidity		5 to 95% RH non-condensing
Ambient temperature		
	normal duty	32°F to 122°F [0°C to 50°C]
	safety duty	3 on/off cycles after 30 minutes at ambient temperature of 350°F [177°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 1, zinc coated steel
Type of action		Type 1.B Software class A
Shaft		3/8"-1/2" rnd (7/16" sq) 1/2"-3/4" rnd w/K6-1
Gears		permanently lubricated
Agency listings		cULus listed to UL 60730-1 and CAN/CSA 22.2 No 4
Servicing		maintenance free
Quality standard		ISO 9001
Weight		
	FSLF24(-S) US	3.4 lbs (1.7 kg)
	FSLF120(-S) US	4.0 lbs (1.8 kg)
	FSLF...-S US	+0.3 lbs (+.14 kg)

FSLF24-S US, FSLF120-S US	
Auxiliary Switch	2 x SPST 0.5 A inductive @ 120/250 V, 1 mA @ 5 VDC, 3 A resistive @ 120/250 V, UL Approved, 10° and 85°, double insulated

## Application:

The type FSLF spring-return actuator is intended for the operation of smoke and combination fire and smoke dampers in ventilation and air-conditioning systems. The actuator will meet requirements of UL555 and UL555S when tested as an assembly with the damper and will meet requirements of UBC for 15 second opening and closing.

Square footage of damper operated will depend on make and model and the temperature required.

## Operation

Mounting of the actuator to the damper axle shaft or jackshaft is via a cold-weld clamp. Teeth in the clamp and V-bolt dig into the metal of both solid and hollow shafts maintaining a perfect connection. The specially designed clamp will not crush hollow shafts. The bottom end of the actuator is held by an anti-rotation strap or by a stud provided by the damper manufacturer.

The actuator is mounted in its fail safe position with the damper blade(s) closed. Upon applying power, the actuator drives the damper to the open position. The internal spring is tensioned at the same time. If the power supply is interrupted, the spring moves the damper back to its fail-safe position.

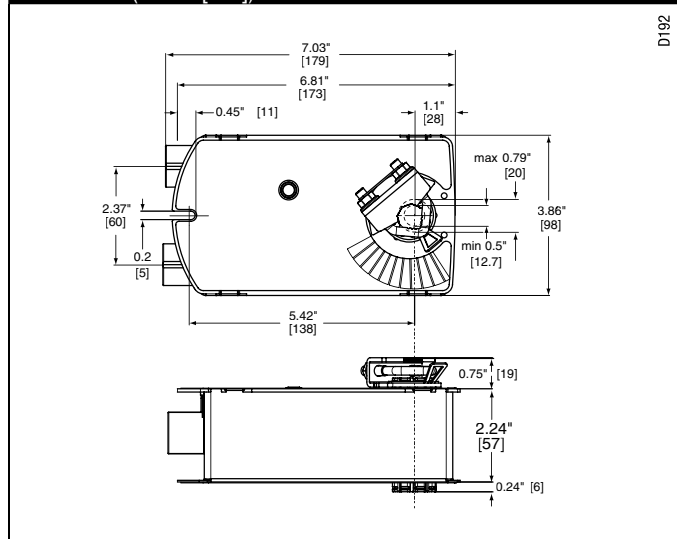
## SAFETY NOTES

The actuator contains no components which the user can replace or repair.

**1/2" Threaded Connector** – Screw a conduit fitting into the actuator's metal bushing. Jacket the actuator's input wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

**3/8" Flexible Connector Models (-FC Screw Connector)** – Mount the flexible conduit into the actuator's metal bushing by means of the provided screw with a torque of 1.2 Nm. Jacket the actuator's input wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

## Dimensions (Inches [mm])



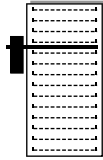
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## Typical Applications

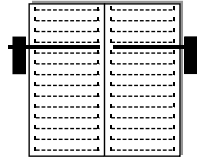
### Multi-section Damper Assemblies

The typical fire and smoke damper requires from 5-15 in-lb of torque per square foot at 250°F - 350°F under dynamic load (2000 fpm velocity). The FSLF is a single section damper actuator. For the multi section dampers, use the FSNF series. This is a direct coupled actuator. If linkages are needed use the FSNF series.

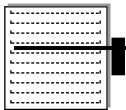
Square shaft adaptors are available: 22153-00002, 22153-00003, 22513-00004 for the 8mm, 10mm, and 12mm, form fit respectively.



Single section for one FSLF actuator



Two section for two FSLF actuators



Maximum area one actuator



Maximum area for two actuators

## Typical Specification

### Smoke Control and Combination Fire and Smoke Control Damper Actuators

All smoke and combination fire and smoke dampers shall be provided with Belimo FSLF, FSNF, or FSAF actuators. No substitutions allowed.

Damper and actuator shall have UL555S Listing for 250°F (350°F) and shall comply with UBC if required by local codes.

Where proof of closure switches are required, blade switches, actuator auxiliary switches, or proximity switches are allowed.

## Replacement Applications

The number one "equal or better" requirement for use as a replacement for obsolete defective motors is the UL555S listing of the Belimo actuator with the damper for the application. The local authority having jurisdiction sets the requirements.

Contact Belimo for a list of damper manufacturers with UL555S listing with Belimo FSAF, FSNF, & FSLF actuators.

### CAUTION

Caution must be used when replacing failed motors with new Belimo actuators. Many old motors did not have internal springs and depended on external springs on the side of the damper or wrapped around the damper shaft to close the damper.

In some cases, the damper must be replaced because the damper would have to undergo major modifications to replace an actuator.

Most codes require that "equal or better" actuators be used to replace defectives.

## Wiring Diagrams

### INSTALLATION NOTES

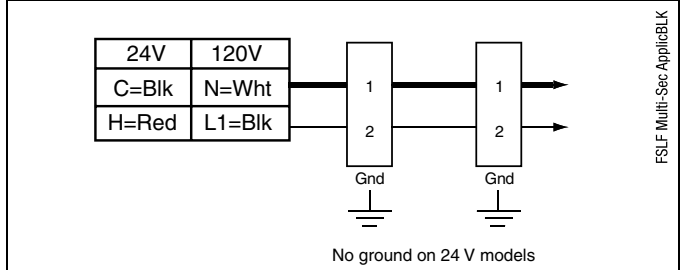
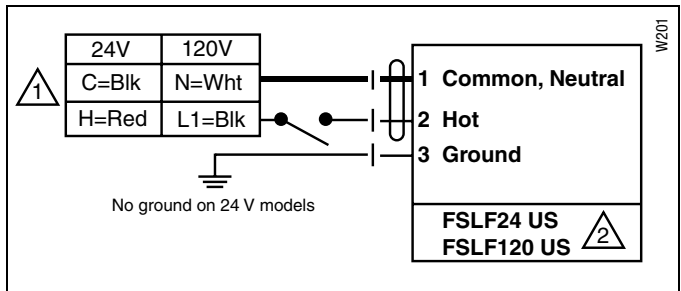
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 No ground connection required. Double insulated.
- 4 For end position indication, interlock control, fan startup, etc., FSNF24-S and FSNF230-S incorporate two built-in auxiliary switches: 2 x SPDT, 7A (2.5A inductive)@125/250 VAC, UL Approved, 5 and 85. Switch rating 250°F [121°C] 1/2 hour only.

### APPLICATION NOTES

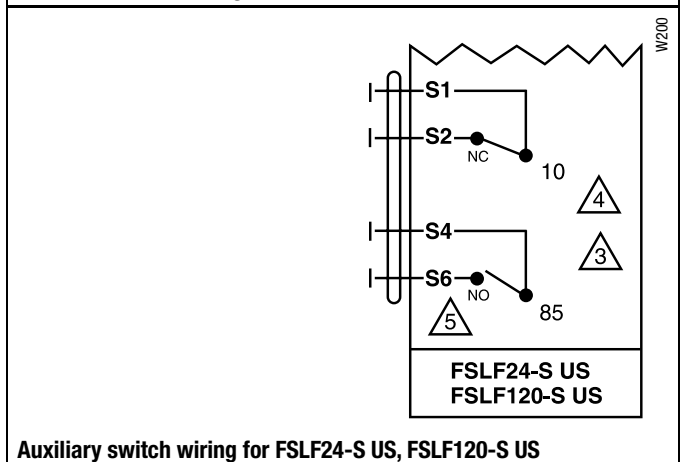
- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



### Parallel Actuator Wiring



# FSLF230(-S) US

On/Off, Spring Return, 350°F [177°C] for Half Hour, 15 Seconds Operation



Technical Data		FSLF230(-S) US
Power supply		230 VAC, 50/60 Hz nominal voltage range 207-253 VAC
Power consumption	running	50 Hz, 17 VA / 60 Hz, 17 VA
	holding	50 Hz, 8 VA / 60 Hz, 6 VA
Transformer sizing	24 VAC	Safety Note, connect via safety isolating transformer, class 2 supply
Electrical connection	FSLF230(-S) US	3 ft [1m], 18 ga, 3 color coded leads
	FSLF...-S US	3 ft [1m], 18 ga, appliance cable
Overload protection		electronic throughout 0 to 95° rotation auto-restart after temporary overload
Electrical protection		grounded enclosure, 230V
Control		microprocessor
Angle of rotation		95°
Torque		30 in-lb [3.5 Nm] minimum from 32°F to 350°F [0°C to 177°C]
Direction of rotation	spring	can be selected by CCW/CW mounting
Position indication		visual indicator, 0° to 95°
Running time	motor	< 15 sec at rated voltage and torque 32°F and 122°F [0°C to 50°C]
	spring	< 15 sec
Humidity		5 to 95% RH non-condensing
Ambient temperature	normal duty	32°F to 122°F [0°C to 50°C]
	safety duty	3 on/off cycles after 30 minutes at ambient temperature of 350°F [177°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 1 / IP10, zinc coated steel
Type of action		Type 1.B Software class A
Shaft		3/8"-1/2" rnd (7/16" sq) 1/2"-3/4" rnd w/K6-1
Gears		permanently lubricated
Agency listings		cULus listed to UL 60730-1 and CAN/CSA 22.2 No 4
Servicing		maintenance free
Quality standard		ISO 9001
Weight	F5NF230(-S) US	4.0 lbs (1.8 kg)
	F5NF...-S US	+0.3 lbs (+.14 kg)

FSLF230-S US	
Auxiliary Switch	2 x SPST 0.5 A inductive @ 120/250 V, 1 mA @ 5 VDC, 3 A resistive @ 120/250 V, UL Approved, 10° and 85°, double insulated

## Application

The type FSLF spring-return actuator is intended for the operation of smoke and combination fire and smoke dampers in ventilation and air-conditioning systems. The actuator will meet requirements of UL555 and UL555S when tested as an assembly with the damper and will meet requirements of UBC for 15 second opening and closing.

Square footage of damper operated will depend on make and model and the temperature required.

## Operation

Mounting of the actuator to the damper axle shaft or jackshaft is via a cold-weld clamp. Teeth in the clamp and V-bolt dig into the metal of both solid and hollow shafts maintaining a perfect connection. The specially designed clamp will not crush hollow shafts. The bottom end of the actuator is held by an anti-rotation strap or by a stud provided by the damper manufacturer.

The actuator is mounted in its fail safe position with the damper blade(s) closed. Upon applying power, the actuator drives the damper to the open position. The internal spring is tensioned at the same time. If the power supply is interrupted, the spring moves the damper back to its fail-safe position.

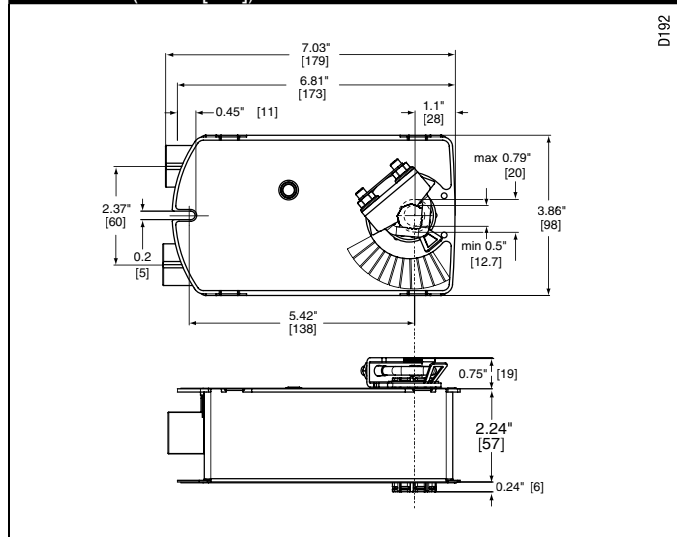
## SAFETY NOTES

The actuator contains no components which the user can replace or repair.

**1/2" Threaded Connector** – Screw a conduit fitting into the actuator's metal bushing. Jacket the actuator's input wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

**3/8" Flexible Connector Models (-FC Screw Connector)** – Mount the flexible conduit into the actuator's metal bushing by means of the provided screw with a torque of 1.2 Nm. Jacket the actuator's input wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

## Dimensions (Inches [mm])



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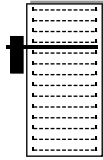


## Typical Applications

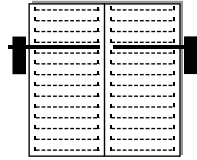
### Multi-section Damper Assemblies

The typical fire and smoke damper requires from 5-15 in.-lb of torque per square foot at 250°F - 350°F under dynamic load (2000 fpm velocity). The FSLF is a single section damper actuator. For the multi section dampers, use the FSNF series.

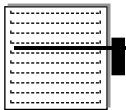
This is a direct coupled actuator. If linkages are needed use the FSNF series. Square shaft adaptors are available: 22153-00002, 22153-00003, 22513-00004 for the 8mm, 10mm, and 12mm, form fit respectively.



Single section for one FSLF actuator



Two section for two FSLF actuators



Maximum area one actuator



Maximum area for two actuators

## Typical Specification

### Smoke Control and Combination Fire and Smoke Control Damper Actuators

All smoke and combination fire and smoke dampers shall be provided with Belimo FSLF, FSNF, or FSAF actuators. No substitutions allowed.

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### CAUTION

Caution must be used when replacing failed motors with new Belimo actuators. Many old motors did not have internal springs and depended on external springs on the side of the damper or wrapped around the damper shaft to close the damper.

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Most codes require that "equal or better" actuators be used to replace defectives.

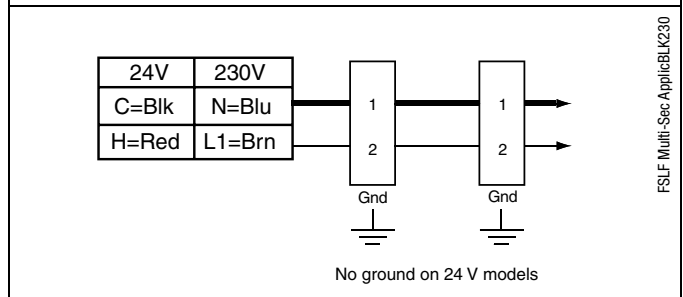
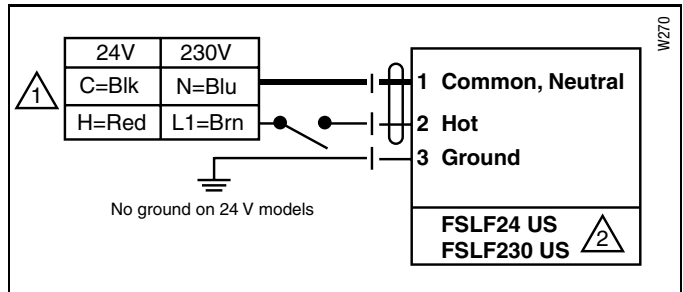
## Wiring Diagrams

### INSTALLATION NOTES

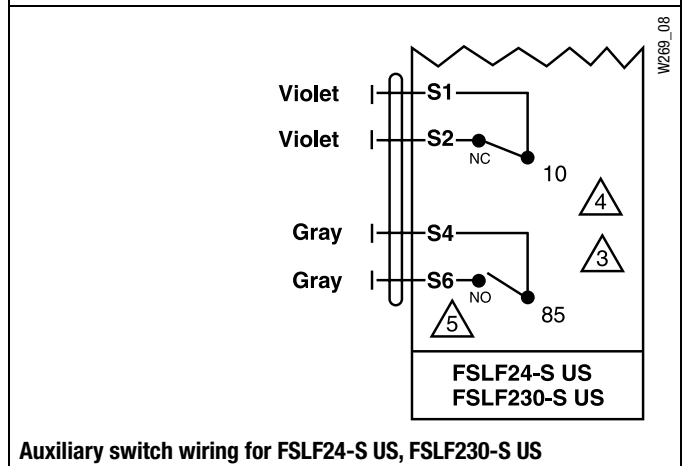
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 No ground connection required. Double insulated.
- 4 For end position indication, interlock control, fan startup, etc., FSLF230-S US incorporate two built-in auxiliary switches.
- 5 S4 makes to S6 when the actuator is powered open.

### WARNING Live Electrical Components!

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### Parallel Actuator Wiring



### Auxiliary switch wiring for FSLF24-S US, FSLF230-S US

## Minimum 360 in-lb Torque

- For damper areas up to 90 sq-ft\*



Actuators in bold have BDCM

### GM Series - At A Glance

		<b>GMB(X)24-3</b> (p. 227)	<b>GMB24-3-T N4</b> (p. 229)	<b>GMX120-3</b> (p. 231)	<b>GMB(X)24-SR</b> (p. 233)	<b>GMB24-SR-T N4</b> (p. 235)	<b>GMB(X)24-MFT</b> (p. 237)	<b>GMX24-MFT-T N4</b> (p. 239)	<b>GMX24-MFT95</b> (p. 241)	<b>GMX24-PC</b> (p. 243)	<b>GMX24-LON</b> (p. 245)
Basic Product		●	●		●	●	●	●	●	●	●
Flexible Product		●		●	●	●	●	●	●	●	●
Torque	360 in-lb [40 Nm]	●	●	●	●	●	●	●	●	●	●
Angle of Rotation	95 degrees	●	●	●	●	●	●	●	●	●	●
Power Supply	24 VAC/DC	●	●		●	●	●	●	●	●	●
	100 to 240 VAC			●							
Control Input	On/Off, Floating Point	●	●	●							
	2 to 10 VDC (4 to 20mA)				●	●					
	Multi-Function Technology						●	●			
	0 to 135 Ohm								●		
	0 to 20V Phasecut									●	
	LonWORKS®										●
Feedback	None	●	●	●							
	2 to 10 VDC				●	●				●	
	Variable (0 to 10 VDC)						●	●	●		
Running Time	150 seconds	●	●	●	●	●				●	●
	Adj. 75 to 280 seconds						●	●	●		
Wiring	Plenum Rated Cable	●			●		●	●	●	●	●
	Appliance Rated Cable			●							
	Conduit Fitting	●		●	●		●	●	●	●	●
Auxiliary Switch	Add-On	●	●	●	●	●	●	●	●	●	●

Installation and Operations... (page 400).

\*Based on 4 in-lb/ft² damper torque loading. Parallel blade. No edge seals.

# A CLOSER LOOK...

- Brushless DC Motor for Added Accuracy and Controllability.
- Cut Labor Costs with Simple Direct Coupling.
- Self-Centers on 1.05" or 3/4" with the Standard Clamp.
- Check Damper Position with Clear Position Indicator.
- Don't Worry about Actuator Burn-Out; Belimo is Overload Proof throughout Rotation.
- Enjoy Added Flexibility with Easy Mechanical Stops to Adjust Angle of Rotation.
- Need to Change Control Direction? Do it easily with a Simple Switch.
- Easily Accessible Manual Override Button helps you Pre-Tension Damper Blades.
- Auxiliary Switch and Feedback Potentiometer Add-Ons Mount Directly on Clamp, Includes Conduit Connector.
- Standard 3ft Plenum Rated Cable and Conduit Connector Provided on Basic Models.
- Added Flexibility to Select Clamp, Electrical Connection, and Running Time to fit your Specific Application with Belimo's New Flexible Line of Actuators.

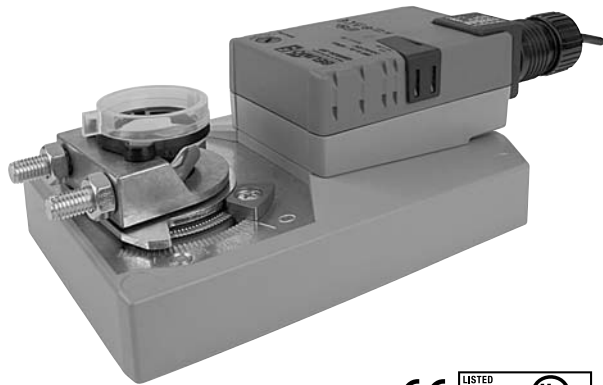


## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

# GMB(X)24-3

On/Off, Floating Point, Non-Spring Return, 24 V



Technical Data	GMB(X)24-3
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	4 W (2 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 $\Omega$
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.4 lbs [1.55 kg]

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

Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

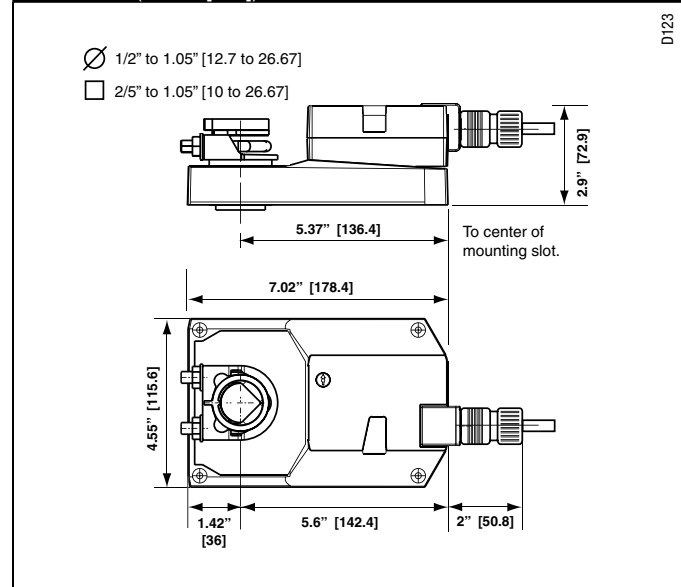
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GMB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The GMB(X)24-3... actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



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### Accessories

K-GM20	1/2"-1.05 [12.7 to 26.67 mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
Z-GMA	GM to GM Retrofit Mounting Bracket
ZG-GMA	Crank arm Adaptor Kit
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-07	13 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using GMB(X)24-3... actuators, only use accessories listed on this page.

### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

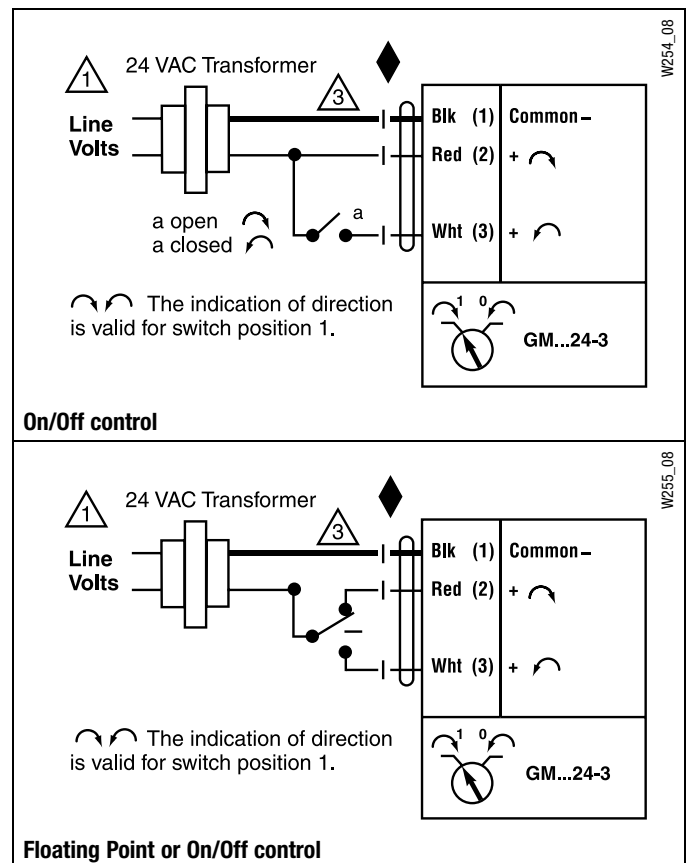
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

#### 📄 APPLICATION NOTES

- ◆ Meets cULus requirements without the need of an electrical ground connection.

#### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# GMB24-3-T N4

NEMA 4 , On/Off, Floating Point Control, Non-Spring Return, Direct Coupled, 24 VAC



Technical Data	GMB24-3-T N4
Power supply	24 VAC $\pm$ 20%, 50/60 Hz 24 VDC $\pm$ 10%, 50/60 Hz
Power consumption	4.0 W (2.0 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	screw terminal (for 26 to 14 GA wire) 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 $\Omega$
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	dial
Running time	150 seconds constant independent of load
Humidity	5 to 100% RH (UL Type 4)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL Type 4, NEMA 4, IP66
Housing material	polycarbonate
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	4.8 lbs [4.45 kg]

†Rated Impulse Voltage 4kV, Type of action 1, Control Pollution Degree 3.

Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp.

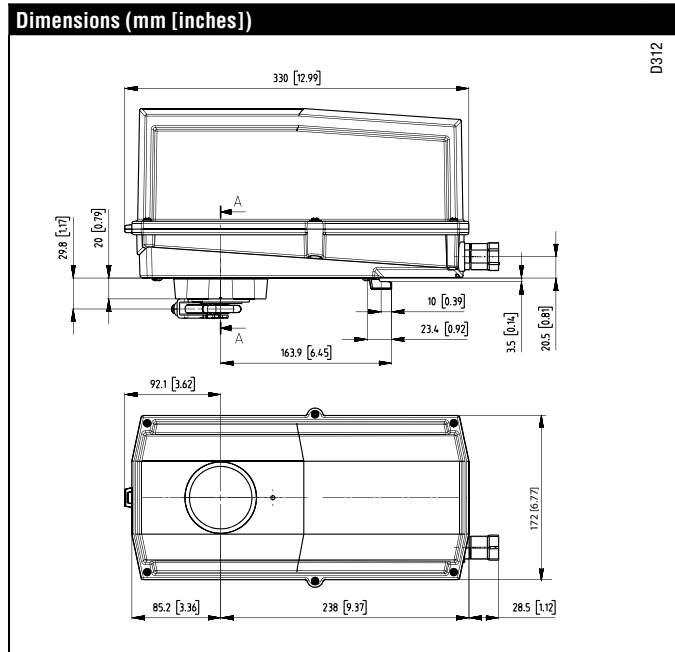
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GMB24-3-T N4 provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator after the cover is removed.

The GMB24-3-T N4 actuator uses a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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#### Accessories

S1A, S2A	Auxiliary Switch (es)
P...A	Feedback Potentiometers
43442-00001	Gland*
11097-00001	Gasket for Gland*

**NOTE:** When using GMB24-3-T N4 actuators, only use accessories listed on this page.  
\* Both parts are needed when using an auxiliary switch or potentiometer with GMB24-3-T N4

#### Typical Specification

On/Off, Floating Point control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover of the actuator. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

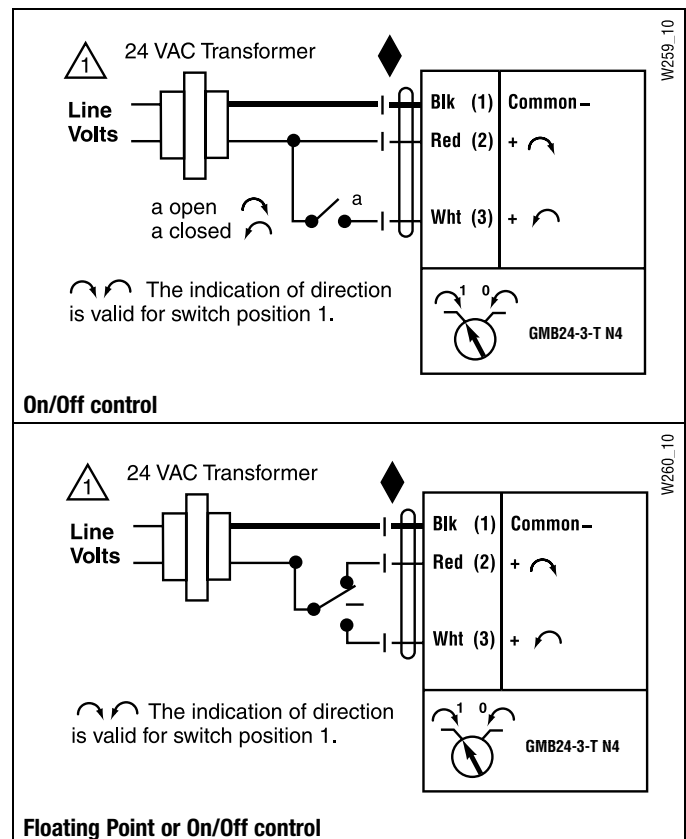
##### ✂️ **INSTALLATION NOTES**

⚠️ Provide overload protection and disconnect as required.

##### 📄 **APPLICATION NOTES**

◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

⚠️ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# GMX120-3

On/Off, Floating Point, Non-Spring Return, 100 to 240 VAC



Technical Data	GMX120-3
Power supply	100 to 240 VAC, 50/60 Hz (nominal) 85 to 265 VAC, 50/60 Hz (tolerance)
Power consumption	4 W (2 W)
Transformer sizing	7 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 Ω
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.4 lbs [1.55 kg]

†Rated Impulse Voltage 2.5kV, Type of action 1, Control Pollution Degree 3.

Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

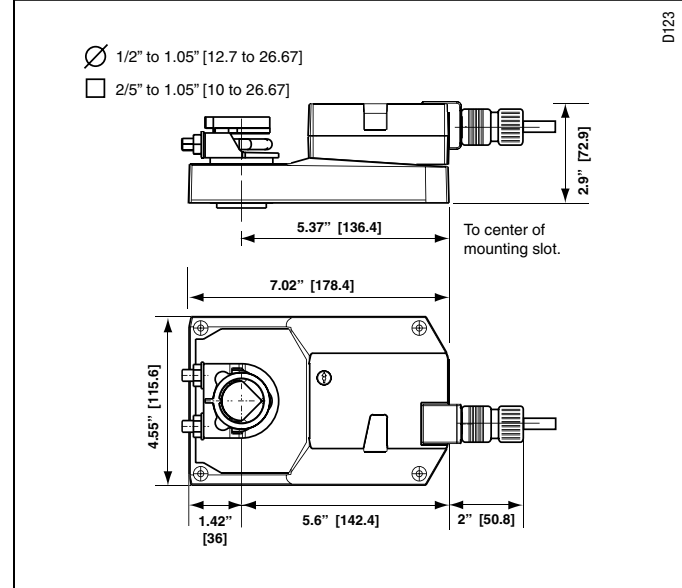
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The GMX120-3 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



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Accessories	
K-GM20	1/2"-1.05 [12.7 to 26.67 mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
Z-GMA	GM to GM Retrofit Mounting Bracket
ZG-GMA	Crank arm Adaptor Kit
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-07	13 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using GMX120-3 actuators, only use accessories listed on this page.

### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

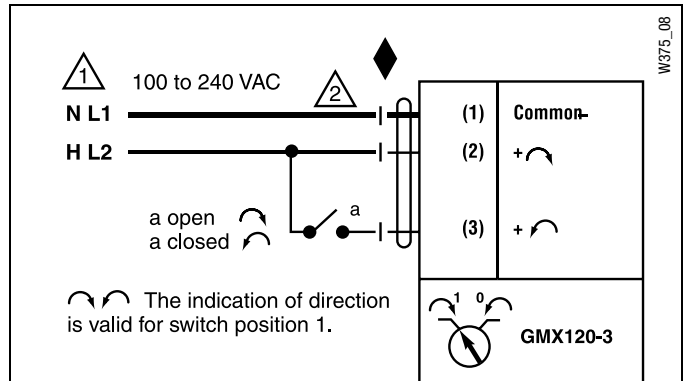
1 Provide overload protection and disconnect as required.

2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.

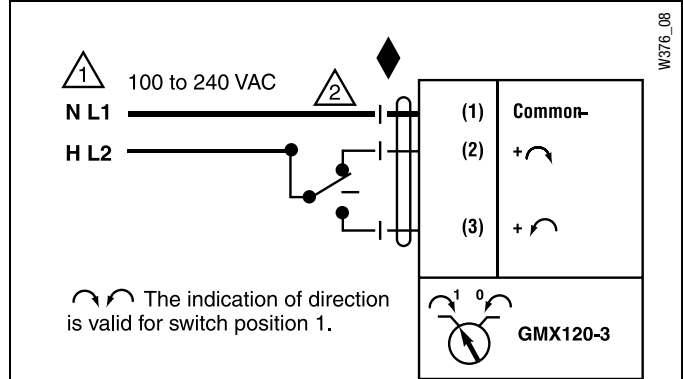
#### 📄 APPLICATION NOTES

◆ Meets cULus requirements without the need of an electrical ground connection.

⚠️ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



#### On/Off control



#### Floating Point or On/Off control

# GMB(X)24-SR

Proportional, Non-Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	GMB(X)24-SR
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	4.5 W (2W)
Transformer sizing	6.5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 k $\Omega$ (0.1 mA), 500 $\Omega$
Feedback Output U	2 to 10 VDC (max 0.5 mA)
Angle of Rotation	max. 95°, adjustable with mechanical stop
Torque	360 in-lb [40 Nm]
Direction of Rotation	reversible with  switch actuator will move: =CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.4 lbs [1.55 kg]

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

Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500  $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

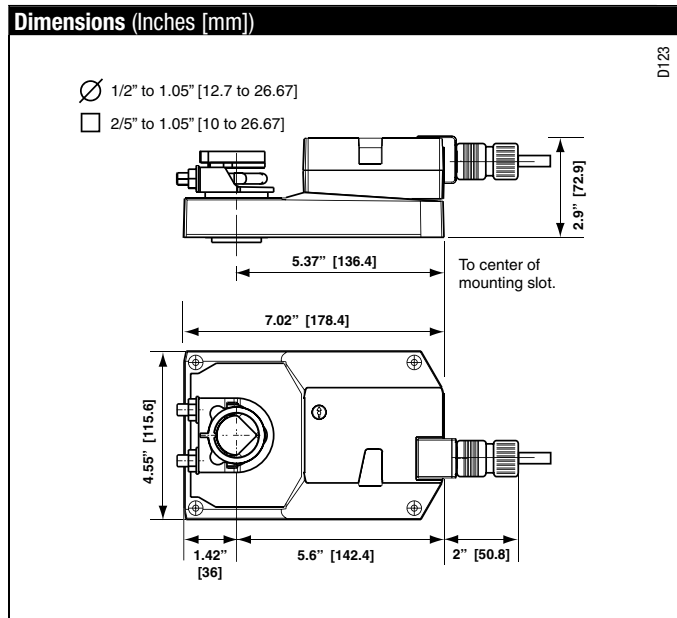
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GMB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The GMB(X)24-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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#### Accessories

K-GM20	1/2"-1.05 [12.7 to 26.67 mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
Z-GMA	GM to GM Retrofit Mounting Bracket
ZG-GMA	Crank arm Adaptor Kit
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-07	13 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using GMB(X)24-SR... actuators, only use accessories listed on this page.

#### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have Brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

##### INSTALLATION NOTES

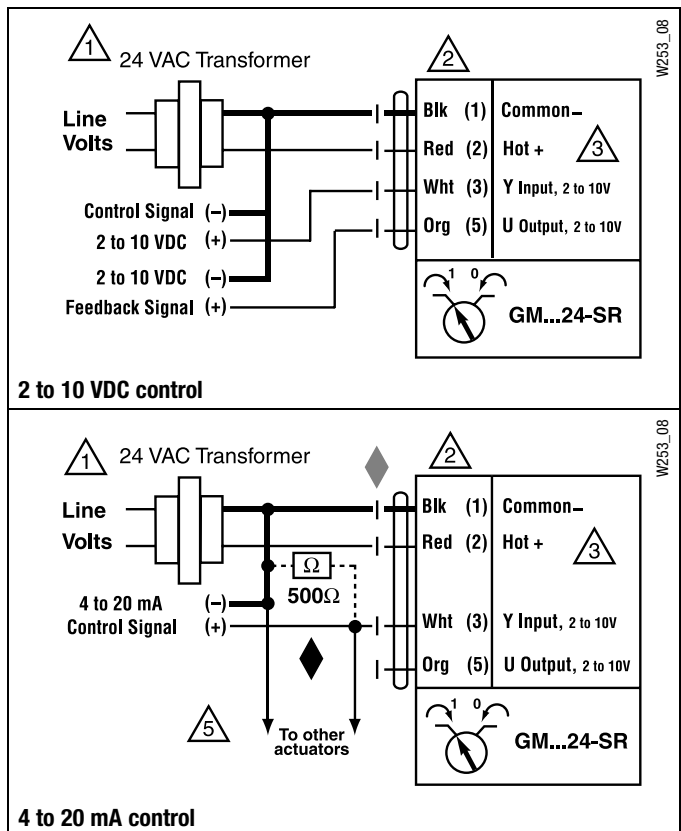
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

##### APPLICATION NOTES

- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

##### WARNING Live Electrical Components!


During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# GMB24-SR-T N4

NEMA 4, Proportional Control, Non-Spring Return, Direct Coupled, 24V, for 2 to 10 VDC and 4 to 20 mA



Technical Data	GMB24-SR-T N4
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	4.5 W (2.0 W)
Transformer Sizing	6.5 VA (Class 2 power source)
Electrical connection	screw terminal (for 26 to 14 GA wire) $\frac{1}{2}$ " conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 k $\Omega$ (0.1 mA), 500 $\Omega$
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	dial
Running time	150 seconds constant independent of load
Humidity	5 to 100% RH (UL Type 4)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL Type 4X, NEMA 4X, IP66
Housing material	polycarbonate
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	9.8 lbs [4.45 kg]

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

**Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.**

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500  $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

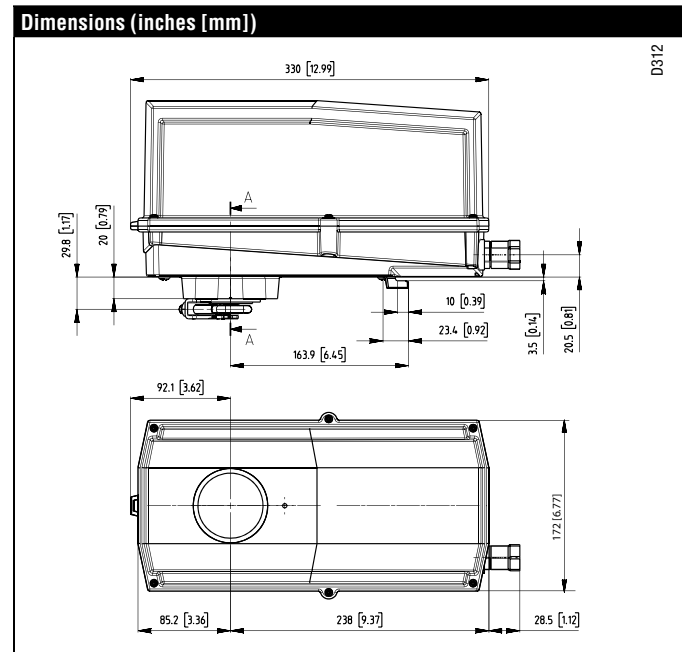
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GMB24-SR-T N4 provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator after the cover is removed.

The GMB24-SR-T N4 actuator uses a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
S1A, S2A	Auxiliary Switch (es)
P...A	Feedback Potentiometers
SGA24	Min positioners for surface mounting
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer
43442-00001	Gland*
11097-00001	Gasket for Gland*

**NOTE:** When using GMB24-SR-T N4 actuators, only use accessories listed on this page.  
 \* Both parts are needed when using an auxiliary switch or potentiometer with GMB24-SR-T N4

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover of the actuator. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, NEMA 4X, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**

**INSTALLATION NOTES**

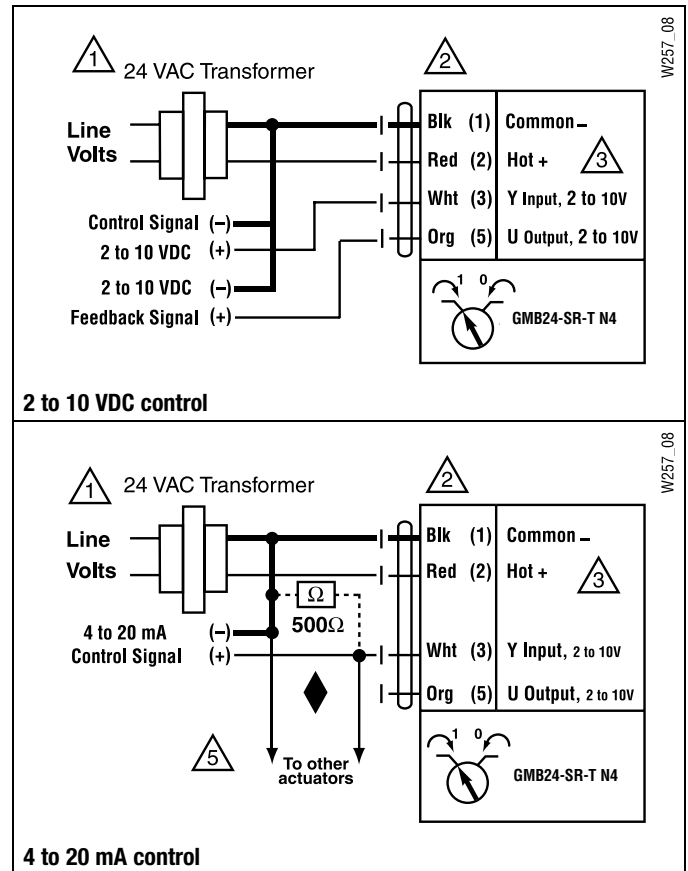
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits

**APPLICATION NOTES**

The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

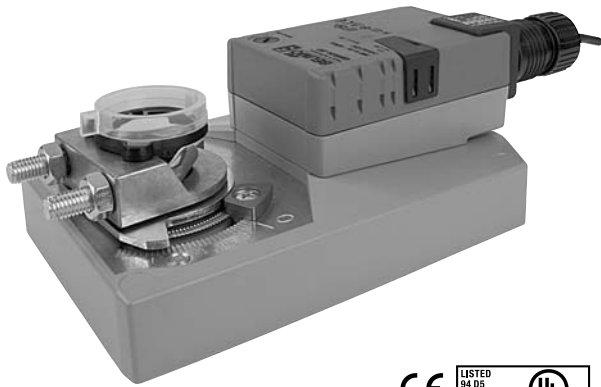
**WARNING Live Electrical Components!**  
 During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

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# GMB(X)24-MFT

Proportional, Non-Spring Return, 24 V, Multi-Function Technology®



Technical Data	GMB(X)24-MFT
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	4.5 W (1.5 W)
Transformer sizing	7 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default) variable (75 to 300 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.4 lbs [1.55 kg]

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

Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

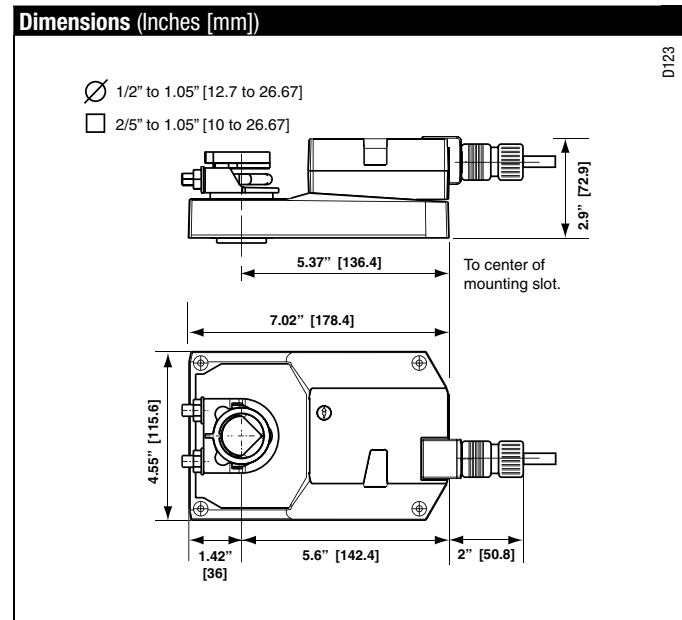
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GMB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The GMB(X)24-MFT actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

K-GM20	3/4" [20 mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
ZG-GMA	Crank arm Adaptor Kit
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-07	13 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using GMB(X)24-MFT actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

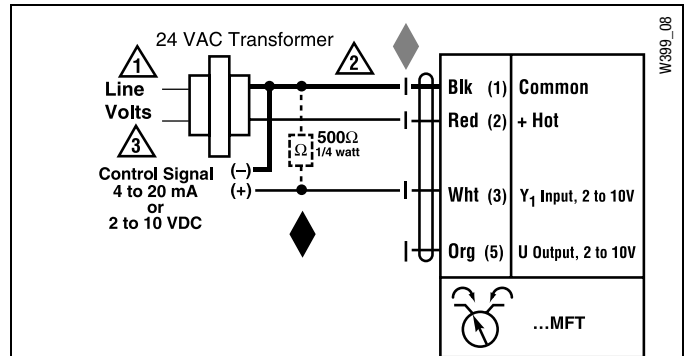
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

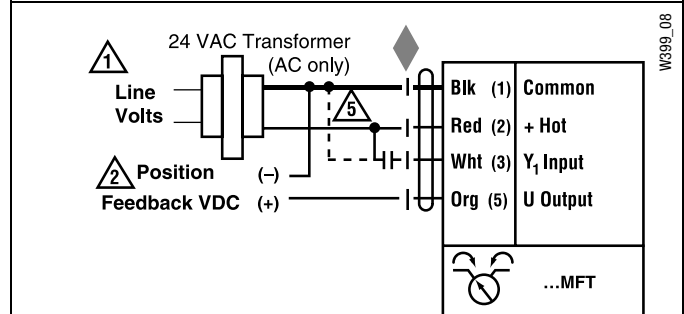
- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

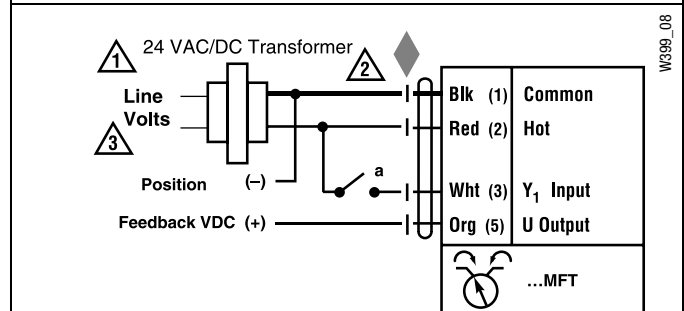
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



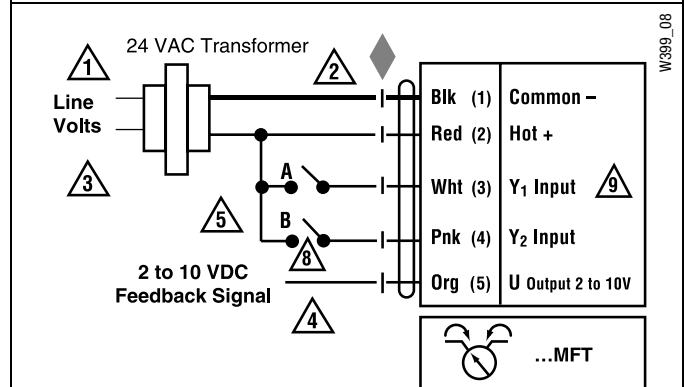
VDC/4-20 mA



PWM



On/Off control



Floating Point control

# GMX24-MFT-T N4

NEMA 4, Proportional Control, Non-Spring Return, Direct Coupled, 24V, Multi-Function Technology®



Technical Data	GMX24-MFT-T N4
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	4.0 W (2.0 W)
Transformer sizing	7 VA (Class 2 power source)
Electrical connection	screw terminal (for 26 to 14 GA wire) ½" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	dial
Running time	150 seconds (default) variable (45 to 170 seconds)
Humidity	5 to 100% RH (UL Type 4)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL Type 4X, NEMA 4X, IP66
Housing material	polycarbonate
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	10 lbs [4.56 kg]

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

Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

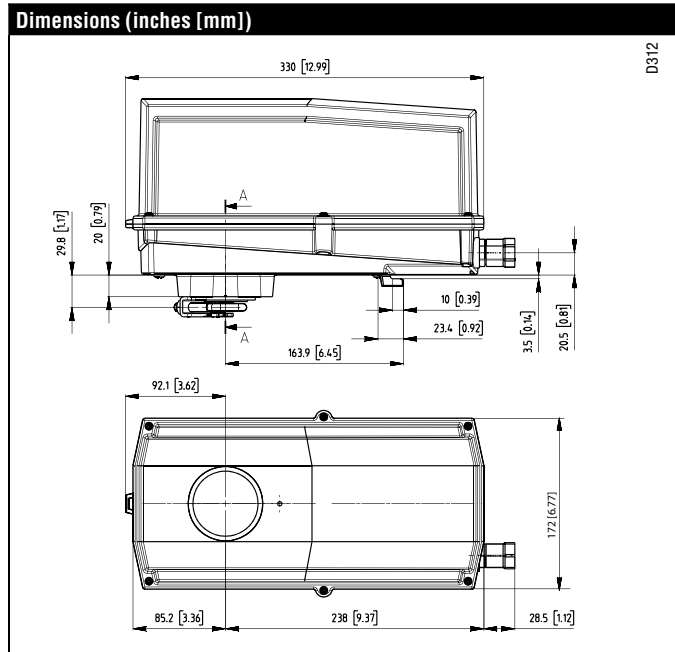
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GMX24-MFT-T N4 provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator after the cover is removed.

The GMX24-MFT-T N actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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#### Accessories

S1A, S2A	Auxiliary Switch (es)
P...A	Feedback Potentiometers
SGA24	Min positioners for surface mounting
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer
43442-00001	Gland*
11097-00001	Gasket for Gland*

**NOTE:** When using GMX24-MFT-T N4 actuators, only use accessories listed on this page.  
 \* Both parts are needed when using an auxiliary switch or potentiometer with GMX24-MFT-T N4

#### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover of the actuator. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

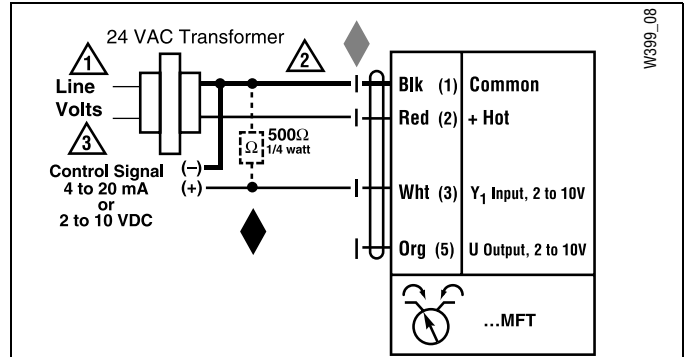
##### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

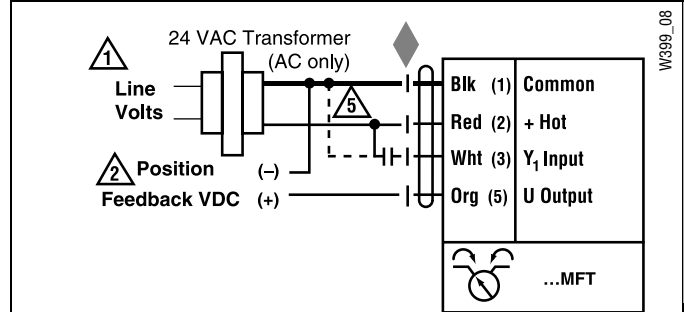
##### 📄 APPLICATION NOTES

◆ The ZG-R01 500 Ω resistor may be used.

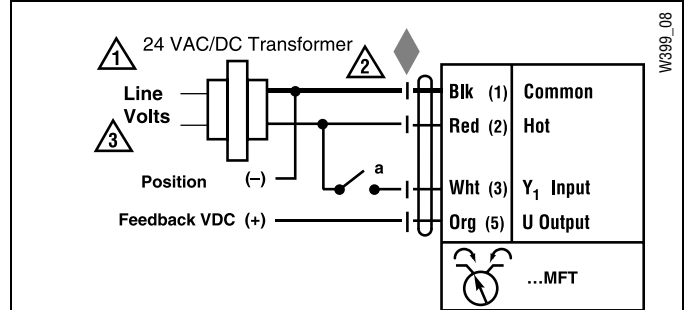
⚠️ **WARNING Live Electrical Components!** During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



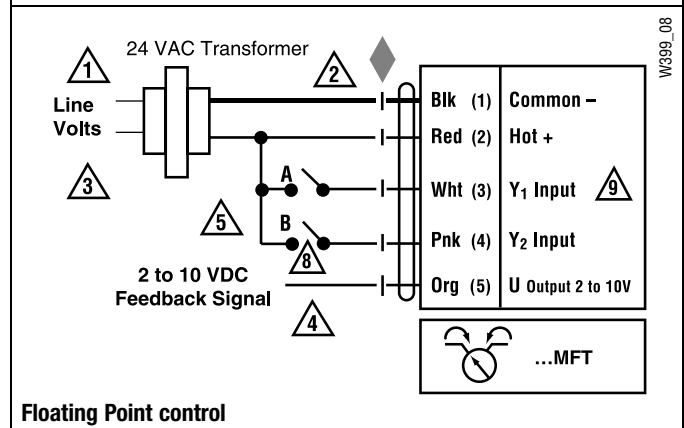
VDC/4-20 mA



PWM



On/Off control



Floating Point control

# GMX24-MFT95

Proportional, Non-Spring Return, 24 V, 0 to 135 Ω Input



MFT



Technical Data	GMX24-MFT95
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	4.5 W (1.5 W)
Transformer sizing	7 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range WRB	135 Ω Honeywell Electronic Series 90, 0 to 135 Ω input
Feedback output U	2 to 10 VDC, 0.5 mA max VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default) variable (100 to 280 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.4 lbs [1.55 kg]

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

Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The default parameters for 0 to 135Ω input applications of the ...MFT95 actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

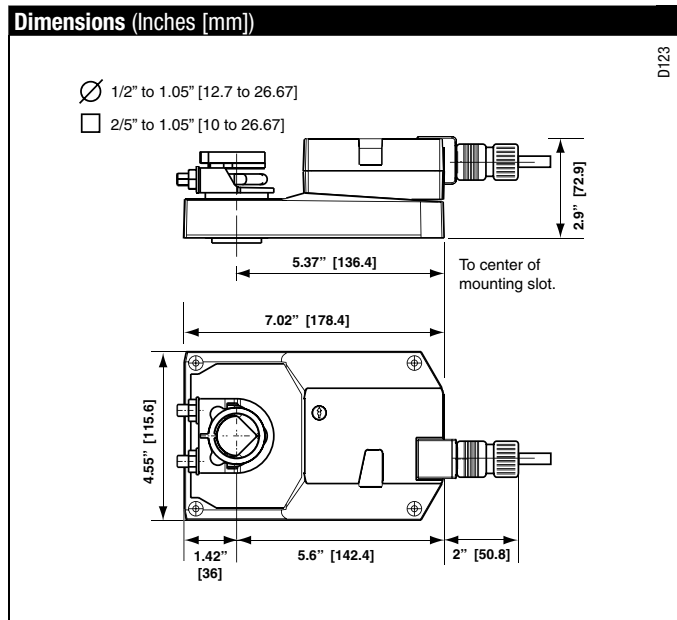
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The GMX24-MFT95 actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

K-GM20	1/2"-1.05 [12.7 to 26.67 mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
ZG-GMA	Crank arm Adaptor Kit
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-07	13 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

NOTE: When using GMX24-MFT95 actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to 0 to 135 Ω input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cUL listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

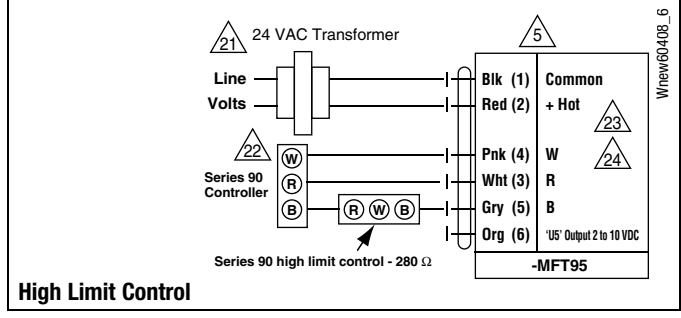
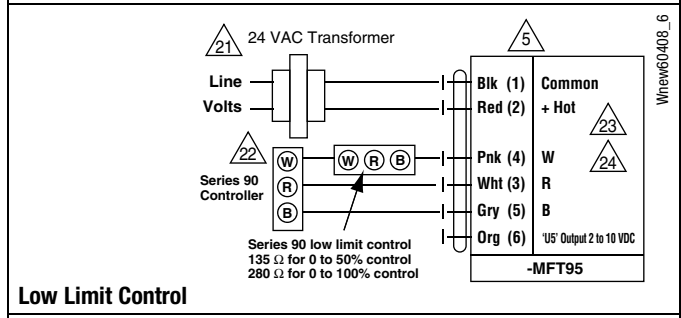
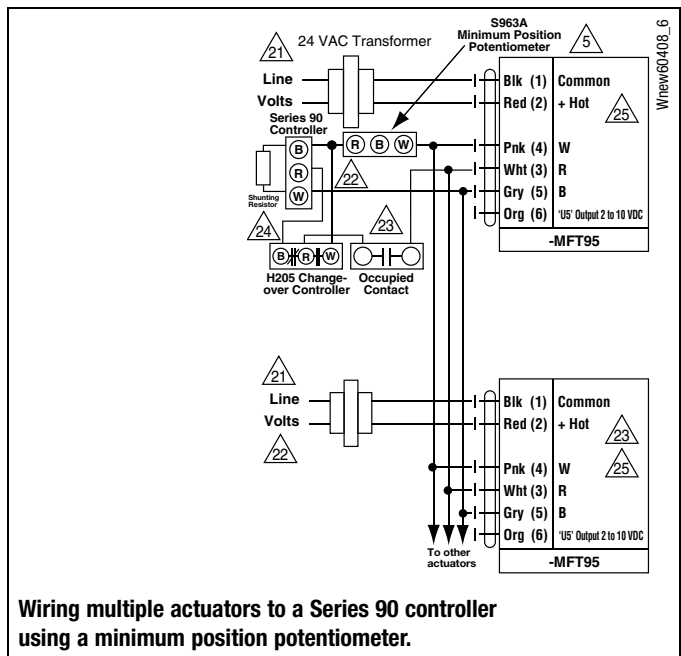
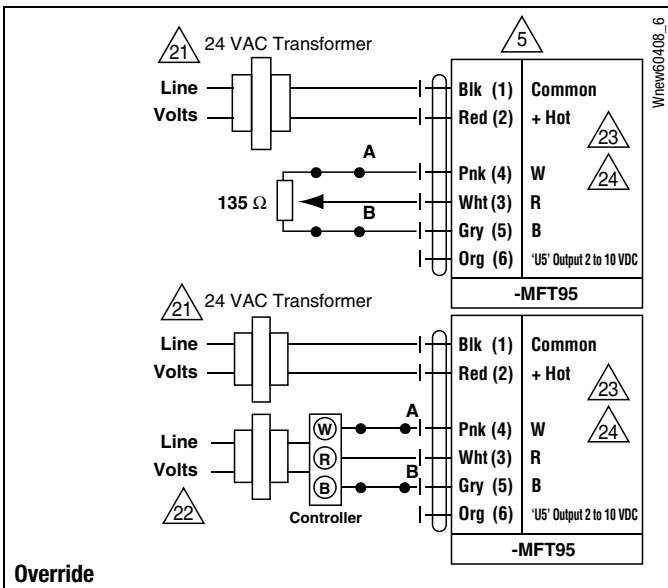
### Wire Colors

1 = Black	3 = White	5 = Gray
2 = Red	4 = Pink	6 = Orange

### Wiring Diagrams

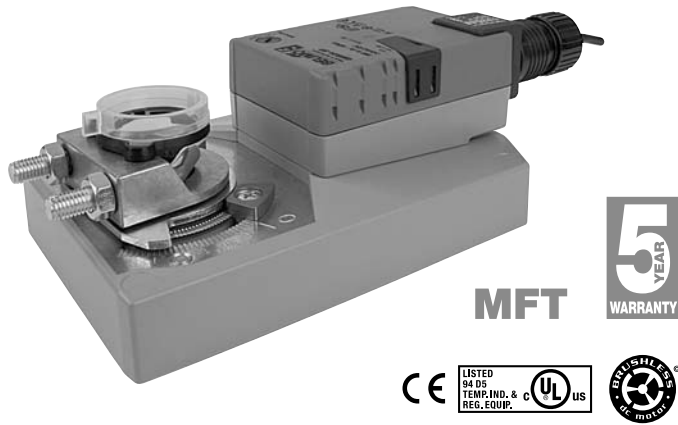
#### INSTALLATION NOTES

- △5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
- △21 Provide overload protection and disconnect as required.
- △22 Actuators and controller must have separate transformers.
- △23 Consult controller instruction data for more detailed information.
- Resistor value depends on the type of controller and the number of actuators. No resistor is used for one actuator. Honeywell® resistor kits may also be used.
- △24 To reverse control rotation, use the reversing switch.
- △25



# GMX24-PC

Proportional, Non-Spring Return, 24 V, 0 to 20 V Phasecut



Technical Data	GMX24-PC
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	4.5 W (1.5 W)
Transformer sizing	7 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	0 to 20 V phasecut control is only for the positive part of the sine wave (max of 10 volts)
Input impedance	8 k $\Omega$ (50 mW)
Feedback output U	2 to 10 VDC, 0.5 mA max
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.4 lbs [1.55 kg]

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

Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled (only the positive part of the sine wave) to the damper shaft.

The actuator operates in response to 0 to 20V phasecut control input only on the positive part of the sine wave from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication.

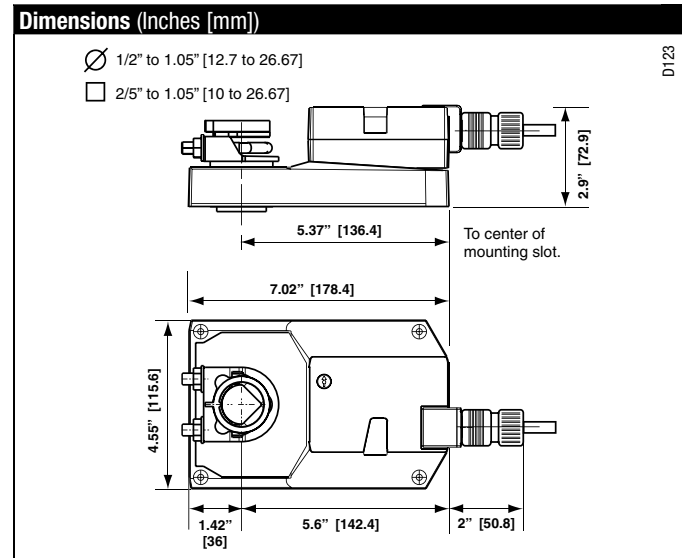
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The GMX24-PC actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
K-GM20	1/2"-1.05 [12.7 to 26.67 mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
ZG-GMA	Crank arm Adaptor Kit
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-07	13 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using GMX24-PC actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to 0 to 20 V phasecut control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

### ✂ INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.

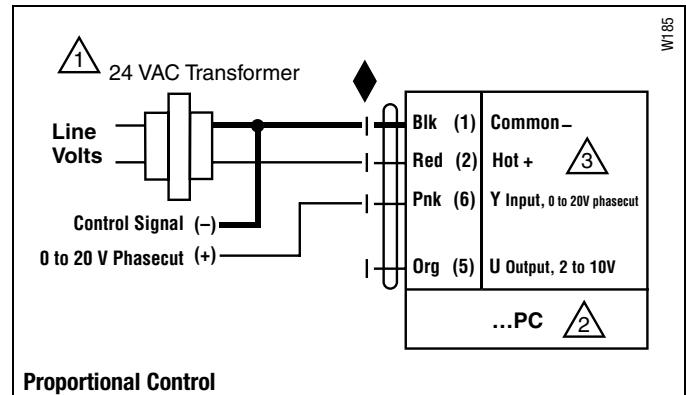
3 Actuators may also be powered by 24 VDC.

### 📄 APPLICATION NOTES

◆ Meets UL requirements without the need of an electrical ground connection.

### ⚠ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# GMX24-LON

LonWorks®, Non-Spring Return, 24 V



Technical Data	GMX24-LON
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	4.5 W (1.5 W)
Transformer sizing	7 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m]
Overload protection	electronic throughout 0 to 95° rotation
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.4 lbs [1.55 kg]

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

LonWorks®	
Certified	according to LonMARK® 3.3
Processor	Neuron 3120
Transceiver	FTT-10A, compatible with LPT-10
Functional profile	according to LonMARK® Damper actuator object #8110 open loop sensor object #1
LNS plug-in for actuator/sensor	can be run with any LNS based integration tool (min. for LNS 3.x)
Service button and status LED	according to LonMARK® guidelines
Conductors, cables	conductor lengths, cable specifications and topology of the LonWorks® network according to the Echelon® directives

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Torque min. 360 in-lb for control of damper surfaces up to 90 sq ft.

## Application

Direct coupled actuators for direct link to LonWorks network. Actuators are easily installed by direct shaft mounting on air dampers in ventilation and air conditioning systems. Actuator can be controlled by any compatible LON system.

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

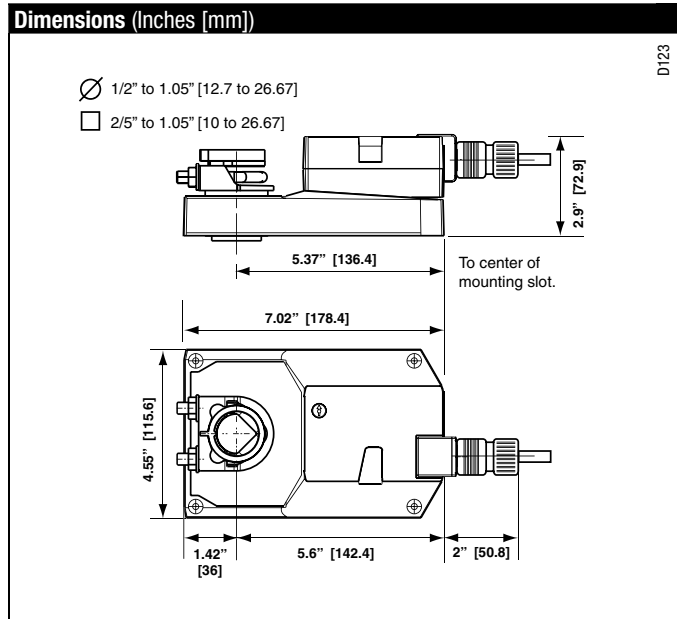
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The GMX24-LON series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The GMX24-LON actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

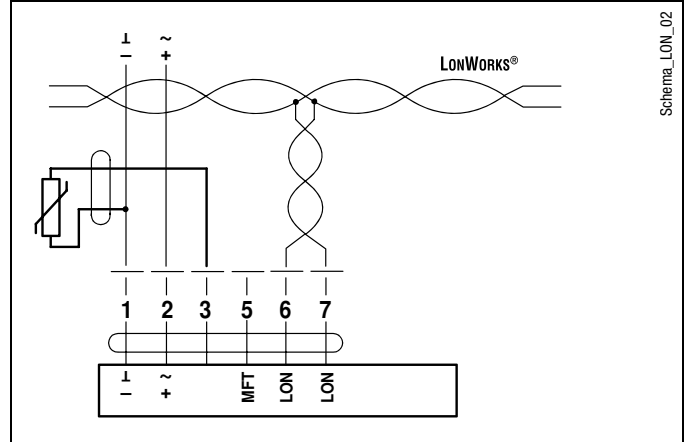
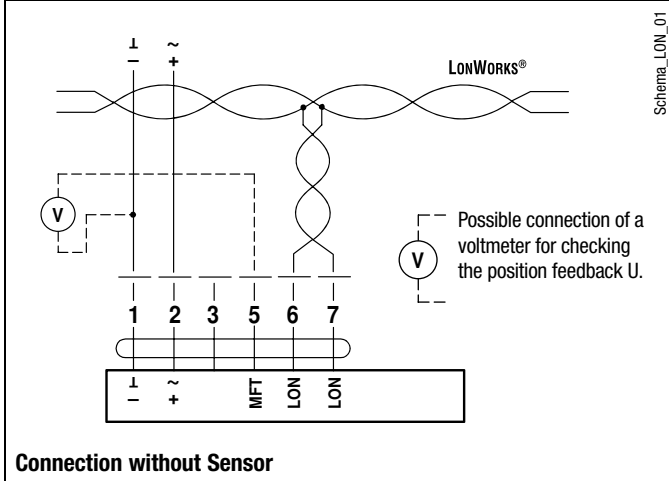
K-GM20	3/4" [20 mm] Shaft Clamp
ZG-102	Multiple Actuator Mounting Bracket
ZG-GMA	Crank arm Adaptor Kit
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-07	13 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

NOTE: When using GMX24-LON actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

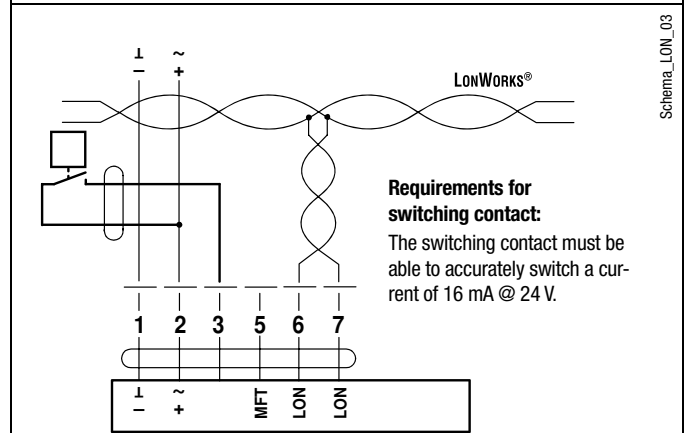


#### Sensor scaling:

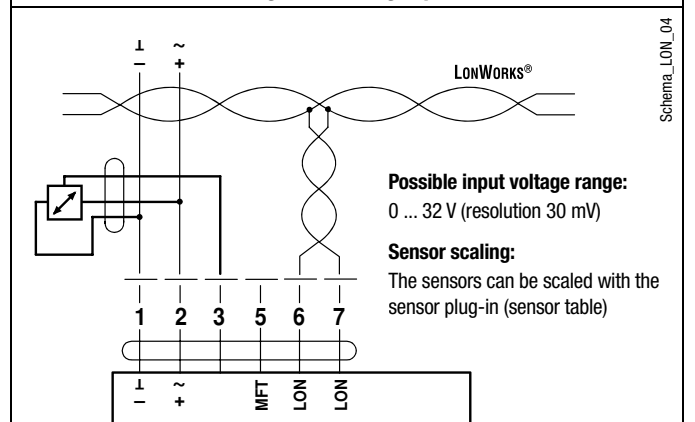
The sensors can be scaled with the sensor plug-in (sensor table).

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 ... 60 kΩ	1 Ω

### Connection with Passive Sensor, e.g. Pt1000, Ni1000, NTC



### Connection with Switching Contact, e.g. Δp-monitor



### Connection with Active Sensor, e.g. 0...10 V @ 0...50° C







<b>1 Direction of rotation switch</b>	
Switching over	Direction of rotation changes
<b>2 Pushbutton and green LED display</b>	
Off	No voltage supply or malfunction
Green, on	Operation
Press button	Switches on angle of rotation adaption followed by standard operation
<b>3 Service button for commissioning LONWORKS® and yellow LED display for the LON status</b>	
Off	The SR24ALON-5 rotary actuator is connected and ready for operation in the LONWORKS®network.
Yellow, on	No application software is loaded in the SR24ALON-5.
Yellow, flashing (flashing interval 2 seconds)	The SR24ALON-5 is ready for operation but not integrated in the LONWORKS® network (unconfigured).
Other flashing codes	A fault is present in the SR24ALON-5.
Press button	Service Pin Message is sent to the LONWORKS®network.
<b>4 Gear disengagement switch</b>	
Press button	Gear disengaged, motor stops, manual operation possible
Release button	Gear engaged, synchronisation starts, followed by standard operation
<b>5 Service plug</b>	
For connecting MFT parameterizing and service tools	

## Versatile and Powerful

- Minimum 180 in-lb torque in a compact package.
- For damper areas up to 45 sq. ft\*, Q Series- 35 sq. ft\*



All Actuators have BDCM

### AM Series - At A Glance

		<i>AMB(X)24-3 (p. 251)</i>	<i>AMB24-3-S (p. 251)</i>	<i>AMX24-3-T (p. 251)</i>	<i>AMB24-3-T N4(H) (p. 253)</i>	<i>AMX120-3 (p. 255)</i>	<i>AMB(X)24-SR (p. 257)</i>	<i>AMX24-SR-T (p. 257)</i>	<i>AMB24-SR-T N4(H) (p. 259)</i>	<i>AMX120-SR (p. 261)</i>	<i>AMB(X)24-MFT (p. 263)</i>	<i>AMX24-MFT-T N4(H) (p. 265)</i>	<i>AMC24-MFT (p. 267)</i>	<i>AMX24-MFT95 (p. 269)</i>	<i>AMX24-PC (p. 271)</i>	<i>AMQB(X)24-1 (p. 273)</i>	<i>AMQB(X)24-MFT (p. 275)</i>	<i>AMX24-LON (p. 277)</i>
Basic Product (B)		•	•				•				•					•	•	
Flexible Product		•		•		•	•	•		•	•	•	•	•	•	•	•	•
Torque	180 in-lb [20 Nm]	•	•	•		•	•	•		•	•	•	•	•	•			•
	160 in-lb [16 Nm]				•				•			•						
	140 in-lb [16 Nm]																•	•
Angle of Rotation	95 degrees	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Power Supply	24 VAC/DC	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	100 to 240 VAC					•			•									
Control Input	On/Off																•	
	On/Off, Floating Point	•	•	•	•	•												
	2 to 10 VDC (4 to 20mA)					•	•	•	•									
	Multi-Function Technology										•	•	•					•
	0 to 135 Ohm													•				
	0 to 20V Phasecut														•			
Feedback	LonWORKS®																	•
	None	•	•	•	•	•											•	
	2 to 10 VDC						•	•	•	•					•			
	Variable (0 to 10 VDC)									•	•	•	•				•	
Running Time	95 seconds	•	•	•		•		•										
	Adj. 7 to 20 seconds																•	•
	Adj. 95 to 300 seconds (150)	•		•		•		•		•	•		•	•				
	150 seconds										•	•						•
Wiring	Plenum Rated Cable	•				•				•		•	•	•	•	•	•	•
	Appliance Rated Cable		•			•			•									
	Terminal Strip			•	•			•	•			•						
	Conduit Fitting	•	•			•	•		•	•		•	•	•	•	•	•	•
Auxiliary Switch	Built-In		•															
	Add-On	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Installation and Operation... (page 400).

\*Based on 4 in-lb/ft² damper torque loading. Parallel blade. No edge seals.

# A CLOSER LOOK...

- Brushless DC Motor for Added Accuracy and Controllability.
- Cut Labor Costs with Simple Direct Coupling.
- Self-Centers on 1/2", 3/4", and 1.05" Jackshafts with Standard Clamp.
- Check Damper Position with Clear Position Indicator.
- Don't Worry about Actuator Burn-Out; Belimo is Overload Proof throughout Rotation.
- Enjoy Added Flexibility with Easy Mechanical Stops to Adjust Angle of Rotation.
- Need to Change Control Direction? Do it easily with a Simple Switch.
- Easily Accessible Manual Override Button helps you Pre-Tension Damper Blades.
- Fully Adjustable Built-In Auxiliary Switch (AMB24-3-S).
- Auxiliary Switch and Feedback Potentiometer Add-Ons Mount Directly on Clamp, Includes Conduit Connector.
- Standard 3ft Plenum Rated Cable and Conduit Connector Provided on Basic Models.
- Added Flexibility to Select Clamp, Electrical Connection, and Running Time to fit your Specific Application with Belimo's New Flexible Line of Actuators.



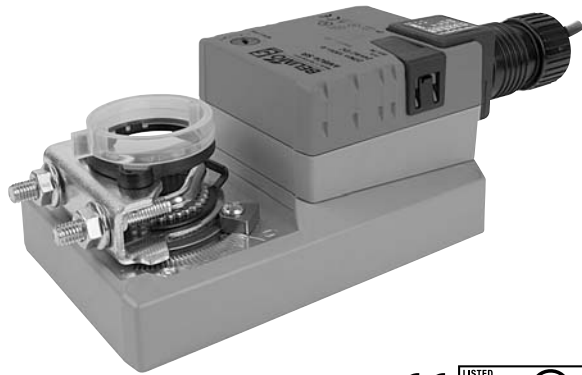
## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

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# AMB(X)24-3(-S)(-T)

On/Off, Floating Point, Non-Spring Return, 24 V



Technical Data	AMB(X)24-3(-S)(-T)
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	2.5 W (0.5 W)
Transformer sizing	5.5 VA (Class 2 power source)
Electrical connection	3 ft, 18 GA plenum rated cable 3 ft, 18 GA appliance rated cable (-S) 1/2" conduit connector protected NEMA 2 (IP54)
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 $\Omega$
Angle of rotation	max. 95°, adjust. with mechanical stop
Torque	180 in-lb [20 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Auxiliary switch (-S models)	1 x SPDT, 3A (0.5A) @ 250 VAC adj. 0 to 100%, UL approved
Running time	95 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.2 lbs [1000 Kg] AMB24-3 2.4 lbs [1050 Kg] AMB24-3-S

AMB(X)24-3-T	
Electrical connection	screw terminal (for 26 to 14 GA wire) unprotected (NEMA 1/IP20)

†Rated Impulse Voltage 800V, Type of action 1, (1.B for -S version), Control Pollution Degree 3.

Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

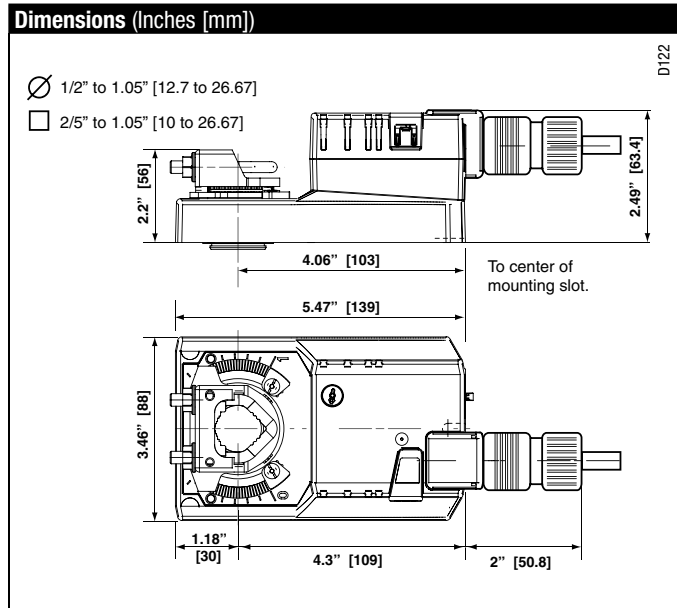
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AM... series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AM...24-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

The AM...24-3-S version is provided with 1 built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable 0 to 95°. The auxiliary switch is double insulated so an electrical ground connection is not necessary.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

K-SA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
Z-SMA	AM/SM to AM Retrofit Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2,3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-T	Terminal Cover for NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using AM...24-3... actuators, only use accessories listed on this page.

### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuators shall be provided with one adjustable SPDT auxiliary switch. 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. If required, actuators will be provided with a screw terminal strip for electrical connections (AMX24-3-T). Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by 24 VDC.

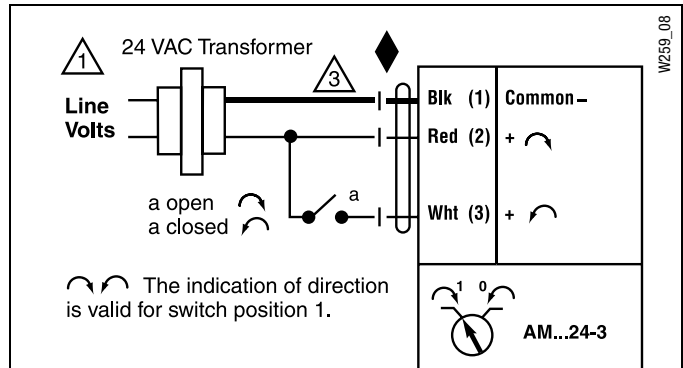
For end position indication, interlock control, fan startup, etc., AMB24-3-S incorporates one built-in auxiliary switches: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0 to 95.

#### 📄 APPLICATION NOTES

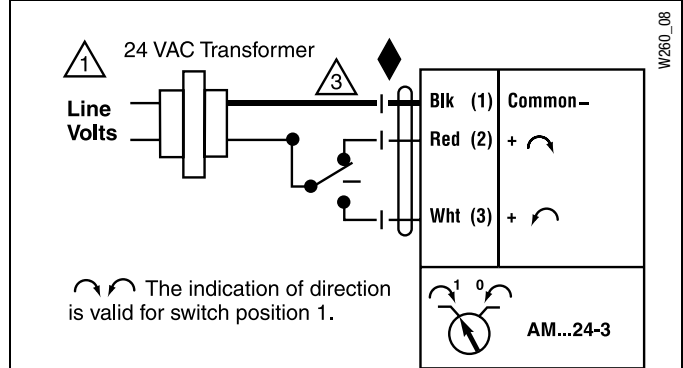
◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### ⚠️ WARNING Live Electrical Components!

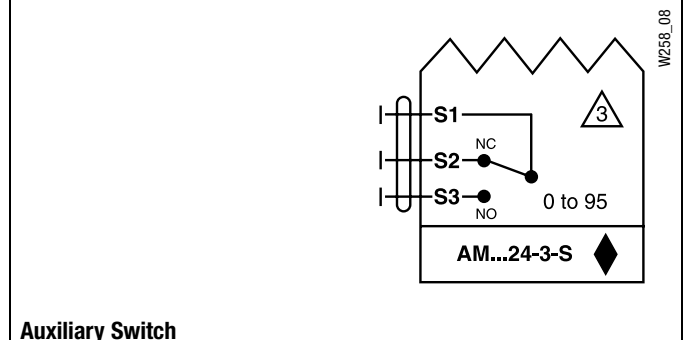
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



#### On/Off control



#### Floating Point or On/Off control



#### Auxiliary Switch

# AMB24-3-T N4, AMB24-3-T N4H

NEMA 4X, On/Off, Floating Point Control, Non-Spring Return, Direct Coupled, 24V



Technical Data	AMB24-3-T N4, AMB24-3-T N4H
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	2.5 W (0.5 W) / heater 23 W
Transformer sizing	5.5 VA (Class 2 power source) / heater 20.5 VA
Electrical connection	screw terminal (for 26 to 14 GA wire [heater 15 GA wire]) 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 $\Omega$
Angle of rotation	max. 95°, adjust. with mechanical stop
Torque	160 in-lb [16 Nm]
Direction of rotation	reversible with  switch
Position indication	pointer
Manual override	external push button
Running time	95 seconds constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL Type 4X, NEMA 4X, IP66/67
Housing material	UL94-5VA
Agency listings†	ccULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.3 lbs [1.5 Kg] 3.7 lbs [1.6 Kg] with heater

Torque min. 160 in-lb for control of damper surfaces up to 40 sq ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 3/4" in diameter by means of its universal clamp, self-centered default.

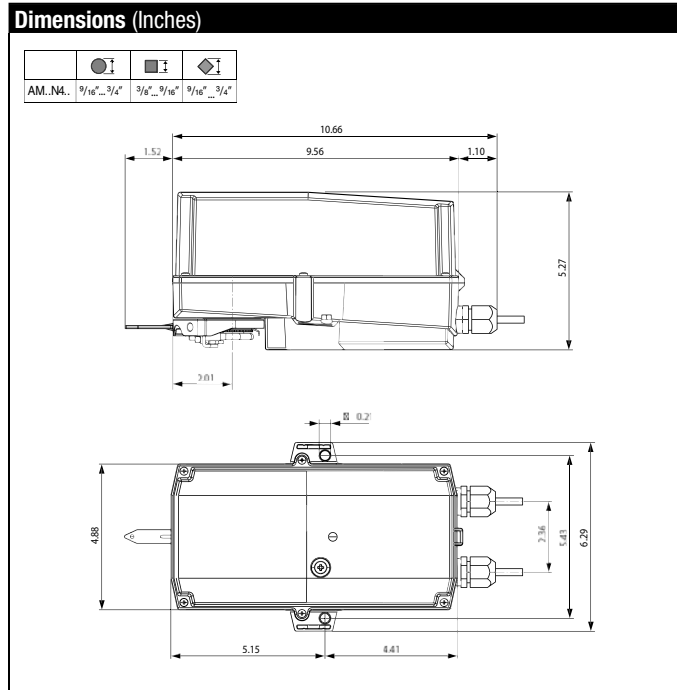
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMB24-3-T N4 provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMB24-3-T N4 actuator uses a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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#### Accessories

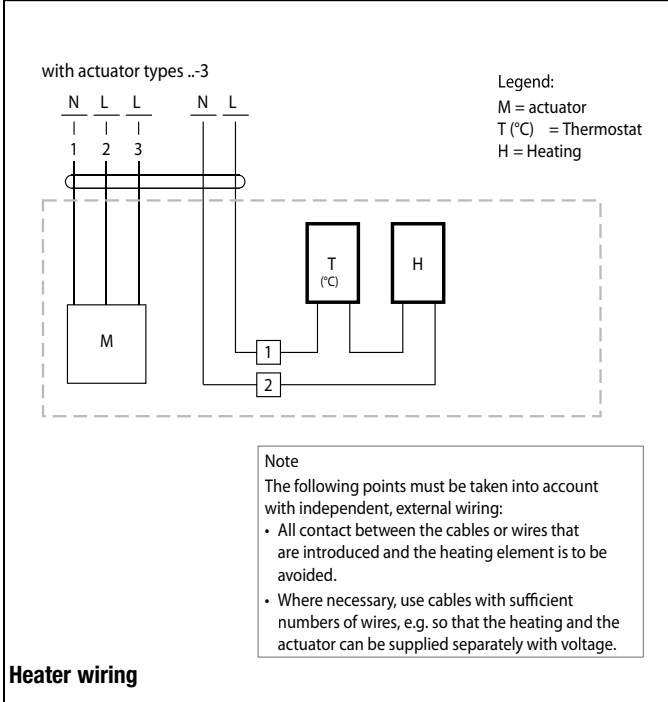
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch (es)
P...A	Feedback Potentiometers

NOTE: When using AMB24-3... actuators, only use accessories listed on this page.

#### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 3/4" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuators needing auxiliary switches, can be provided as an add-on accessory. 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. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams



#### Wiring Diagrams

#### INSTALLATION NOTES

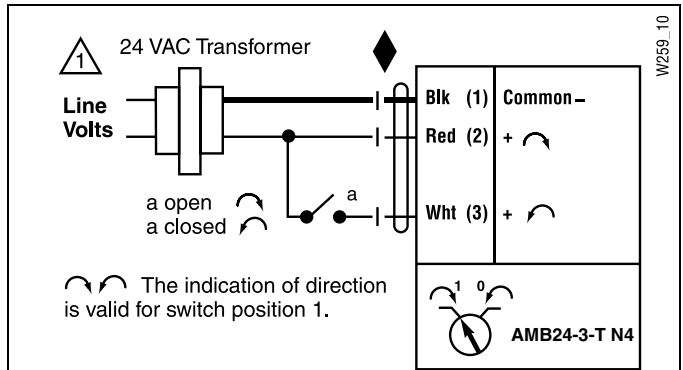
1 Provide overload protection and disconnect as required.

#### APPLICATION NOTES

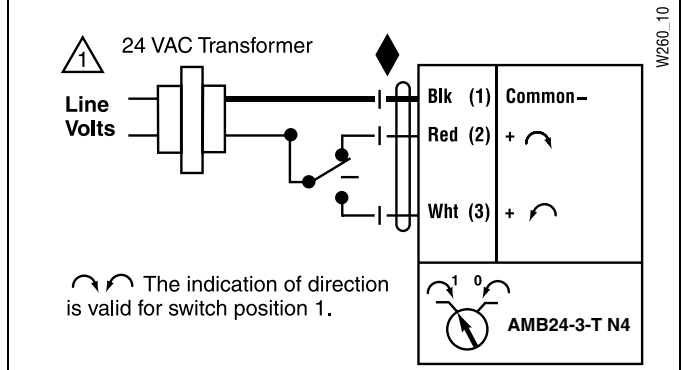
Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

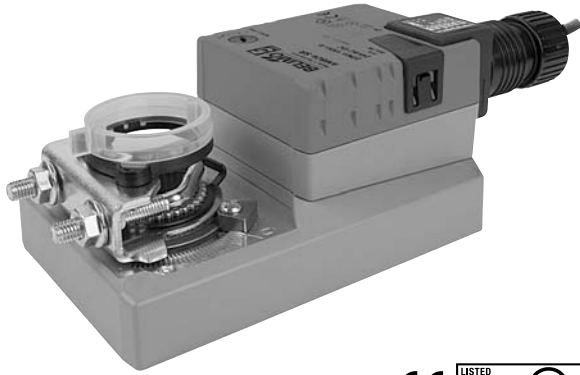


#### On/Off control



# AMX120-3

On/Off, Floating Point, Non-Spring Return, 100 to 240 VAC



Technical Data	AMX120-3
Power supply	100 to 240 VAC, 50/60 Hz (nominal) 85 to 265 VAC, 50/60 Hz (tolerance)
Power consumption	3 W (0.6 W)
Transformer sizing	7 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 Ω
Angle of rotation	max. 95°, adjust. with mechanical stop
Torque	180 in-lb [20 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	300 seconds 150 seconds 95 seconds constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2/IP54
Housing material	NEMA 2, IP54, UL enclosure type 2
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.2 lbs [1.0 Kg]

†Rated Impulse Voltage 4kV, Type of action 1, Control Pollution Degree 3

Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

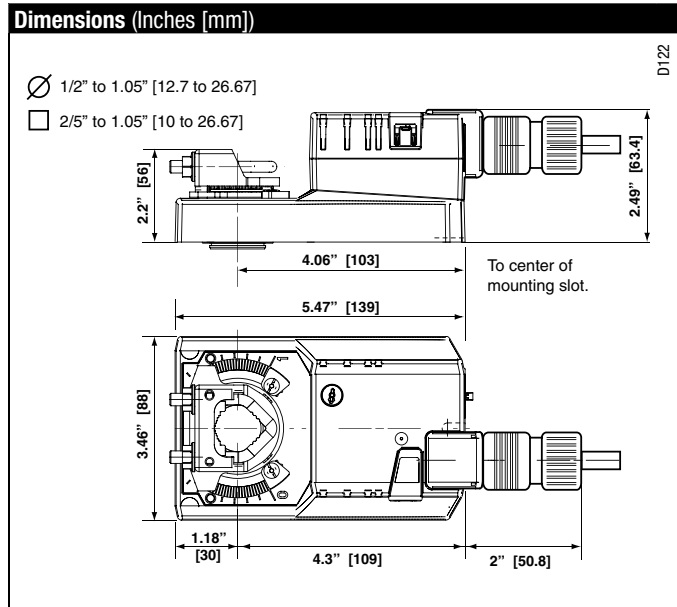
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMX120-3 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
K-SA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
Z-SMA	AM/SM to AM Retrofit Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2,3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using AMX120-3 actuators, only use accessories listed on this page.

### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂ **INSTALLATION NOTES**

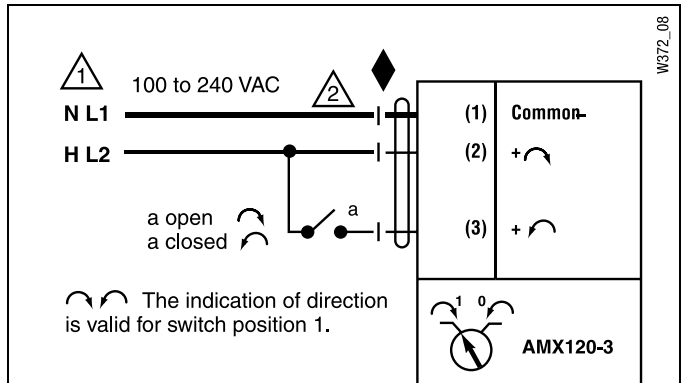
1 Provide overload protection and disconnect as required.

2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.

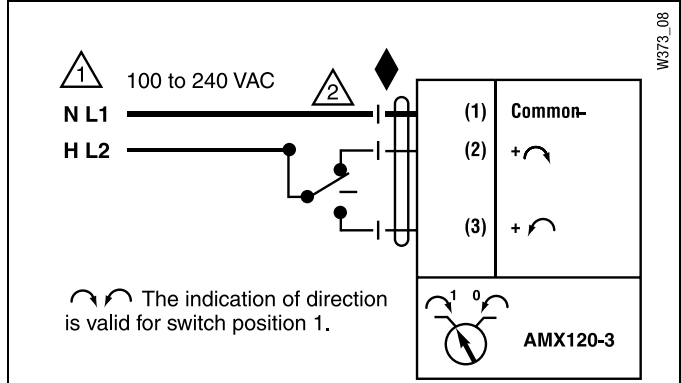
#### 📄 **APPLICATION NOTES**

◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

⚠ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



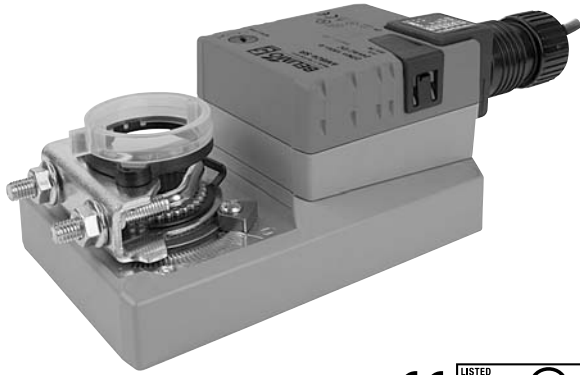
#### On/Off control



#### Floating Point or On/Off control

# AMB(X)24-SR(-T)

Proportional, Non-Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	AMB(X)24-SR(-T)
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	2.5 W (0.4 W)
Transformer sizing	5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 k $\Omega$ (0.1 mA), 500 $\Omega$
Feedback output U	2 to 10 VDC (max 0.5 mA)
Angle of rotation	max. 95°, adjust. with mechanical stop
Torque	180 in-lb [20 Nm]
Direction of rotation	reversible with  switch actuator will move: =CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	300 seconds 150 seconds 95 seconds constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.2 lbs [1000 Kg]

AMB(X)24-SR-T	
Electrical connection	screw terminal (for 26 to 14 GA wire) unprotected (NEMA 1/IP20)

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

Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500  $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

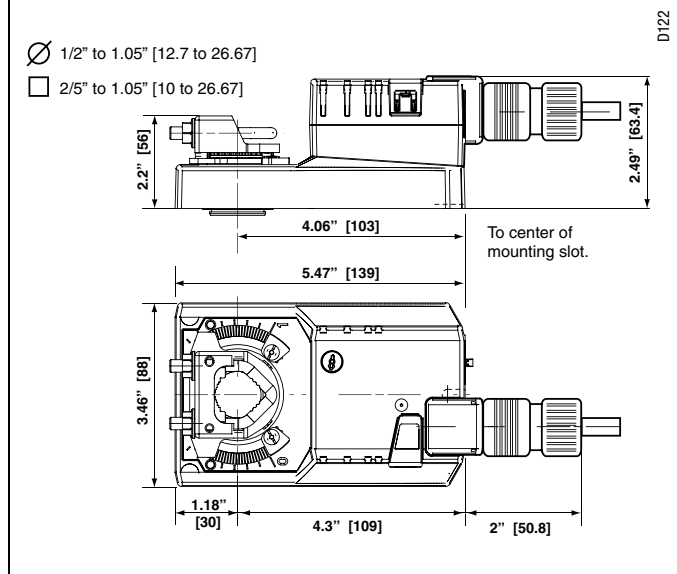
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMB(X)24-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



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Accessories	
K-SA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
Z-SMA	AM/SM to AM Retrofit Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-T	Terminal Cover NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using AMB(X)24-SR... actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuator will be provided with screw terminal strip for electrical connections (AMX24-SR-T). Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂ INSTALLATION NOTES

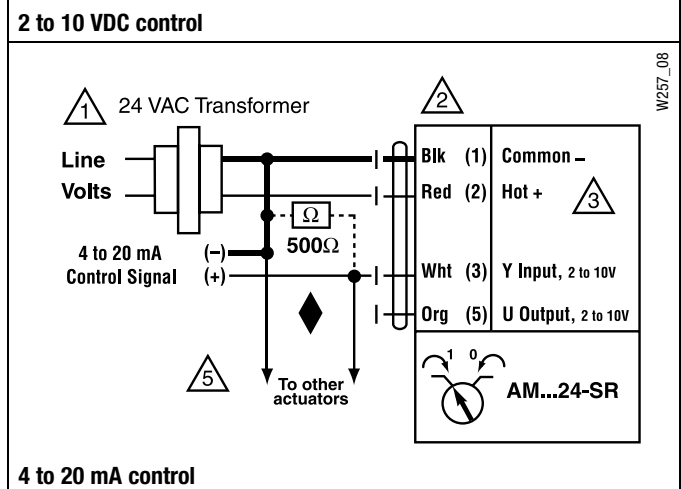
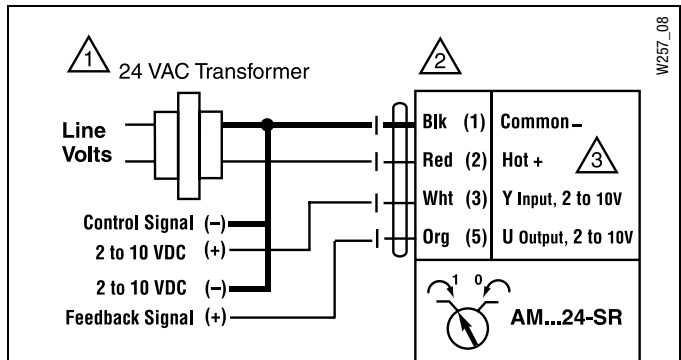
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

#### 📄 APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

#### ⚠ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# AMB24-SR-T N4, AMB24-SR-T N4H

NEMA 4X, Proportional Control, Non-Spring Return, Direct Coupled, 24V, for 2 to 10 VDC and 4 to 20 mA



Technical Data	AMB24-SR-T N4, AMB24-SR-T N4H
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	2.5 W (0.4 W) / heater 23 W
Transformer sizing	5 VA (Class 2 power source) / heater 20 VA
Electrical connection	screw terminal (for 26 to 14 GA wire [heater 15 GA wire]) 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 k $\Omega$ (0.1 mA), 500 $\Omega$
Feedback output U	2 to 10 VDC (max 0.5 mA)
Angle of rotation	max. 95°, adjust. with mechanical stop
Torque	160 in-lb [16 Nm]
Direction of rotation	reversible with  switch
Position indication	pointer
Manual override	external push button
Running time	95 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL type 4X, NEMA 4X, IP66/67
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.3 lbs [1.5 Kg] 3.7 lbs [1.6 Kg] with heater

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

Torque min. 160 in-lb for control of damper surfaces up to 40 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 3/4" in diameter by means of its universal clamp.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500  $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

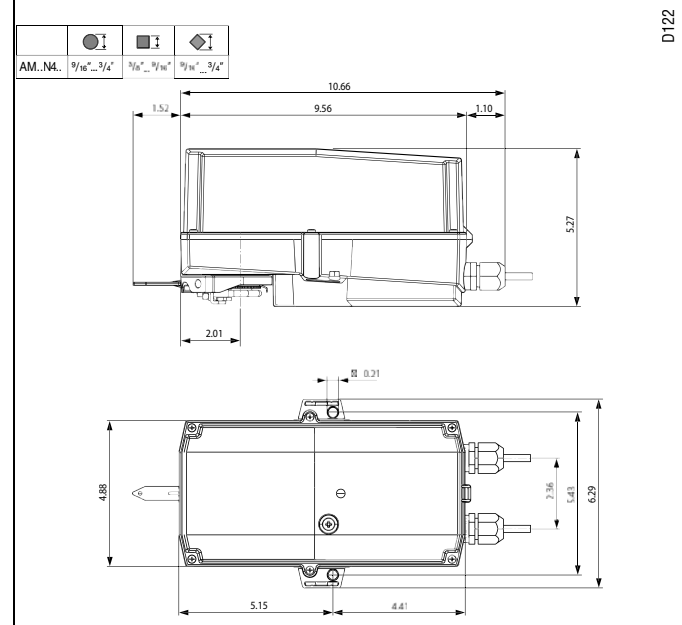
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMB24-SR-T N4 provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMB24-SR-T N4 actuator uses a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



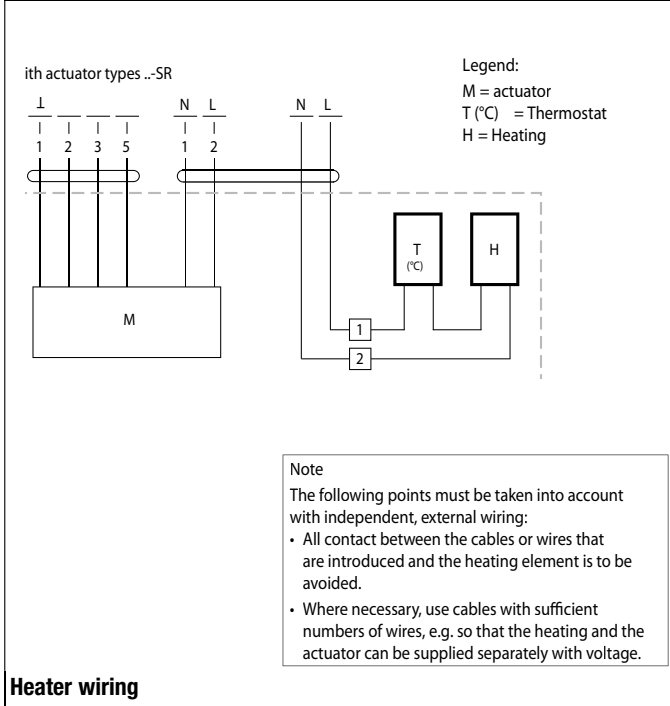
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Accessories	
S1A, S2A	Auxiliary Switch (es)
P...A	Feedback Potentiometers
SGA24	Min positioners for surface mounting
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 3/4" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagram**



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**Wiring Diagram**

**INSTALLATION NOTES**

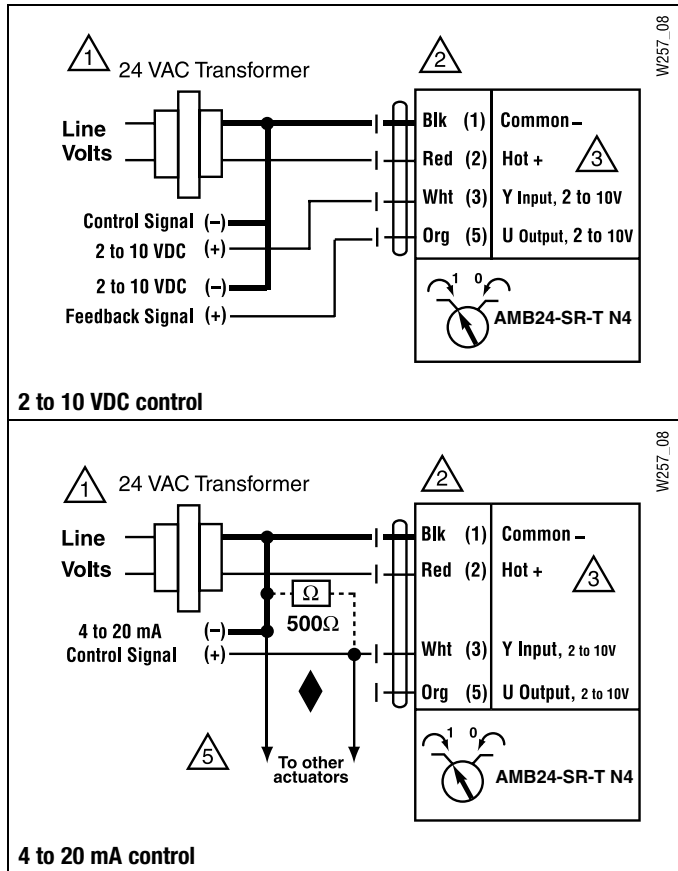
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

**APPLICATION NOTES**

The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# AMX120-SR

Proportional, Non-Spring Return, 100 to 240 VAC, for 2 to 10 VDC or 4 to 20 mA



Technical Data	AMX120-SR
Power supply	100 to 240 VAC, 50/60 Hz (nominal) 85 to 265 VAC, 50/60 Hz (tolerance)
Power consumption	4 W (1 W)
Transformer sizing	7.5 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 kΩ (0.1 mA), 500 Ω
Feedback output U	2 to 10 VDC (max 0.5 mA)
Angle of rotation	max. 95°, adjust. with mechanical stop
Torque	180 in-lb [20 Nm]
Direction of rotation	reversible with  switch actuator will move: =CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	300 seconds 150 seconds 95 seconds constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.2 lbs [1.0 Kg]

†Rated Impulse Voltage 4kV, Type of action 1, Control Pollution Degree 3.

Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

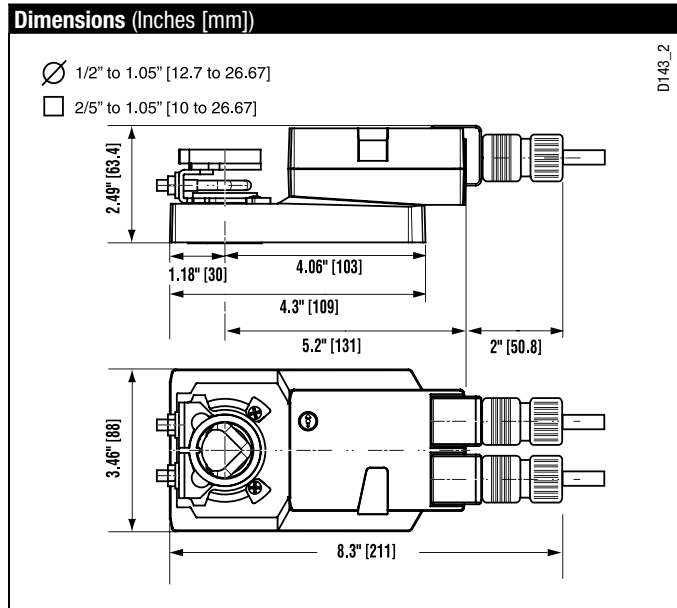
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMX120-SR actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
K-SA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
Z-SMA	AM/SM to AM Retrofit Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

NOTE: When using AMX120-SR actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### ✂ INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.

5 Only connect common to neg. (-) leg of control circuits.

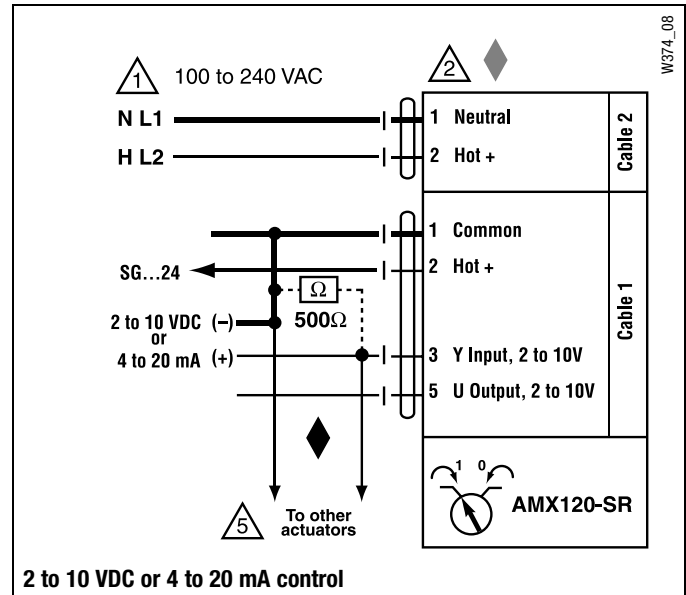
#### 📄 APPLICATION NOTES

◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

#### ⚠ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# AMB(X)24-MFT

Proportional, Non-Spring Return, 24 V, Multi-Function Technology®



MFT



Technical Data	AMB(X)24-MFT
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	3.5 W (1.3 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 W (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	180 in-lb [20 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default) variable (90 to 350 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.6 lbs [1.2 kg]

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

Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

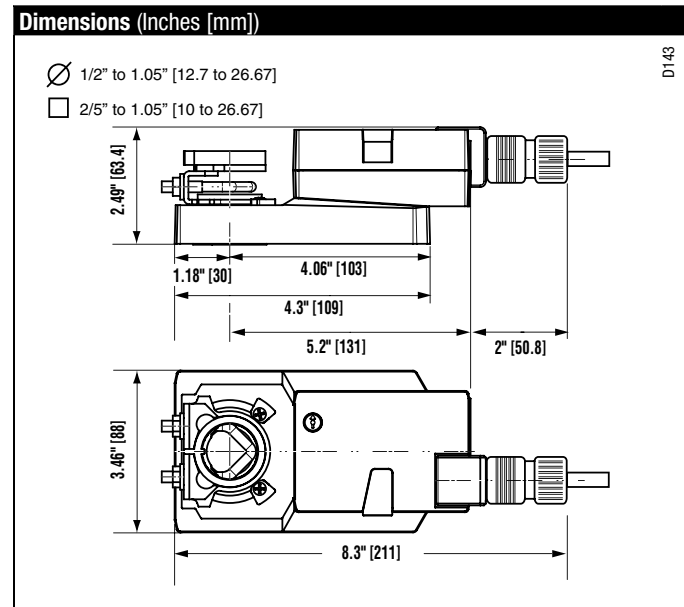
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMB(X)24-MFT actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

K-SA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
Z-SMA	AM/SM to AM Retrofit Mounting Bracket
ZG-AMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using AMB(X)24-MFT... actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

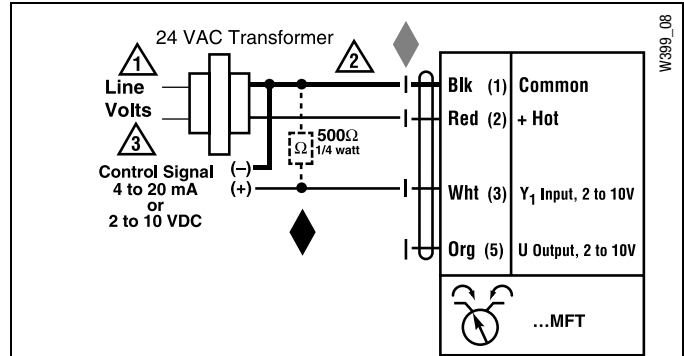
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.  
A & B should both be closed for triac source and open for triac sink.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

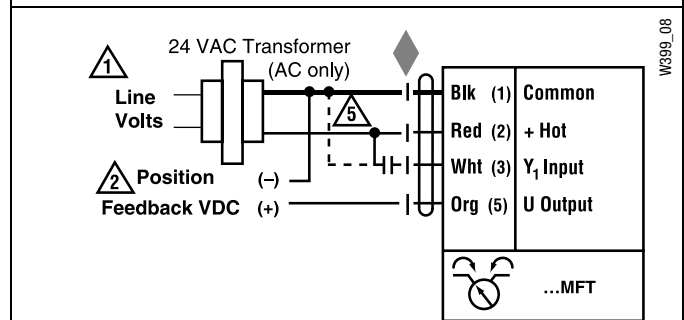
- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

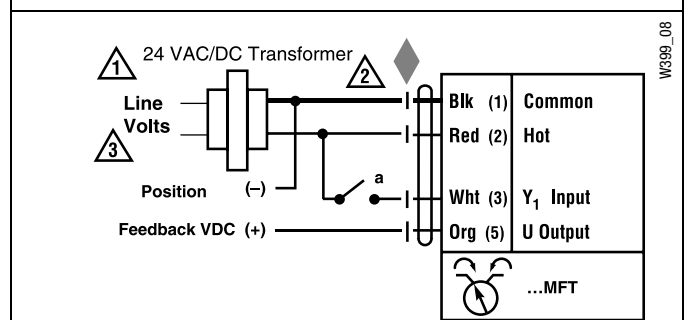
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



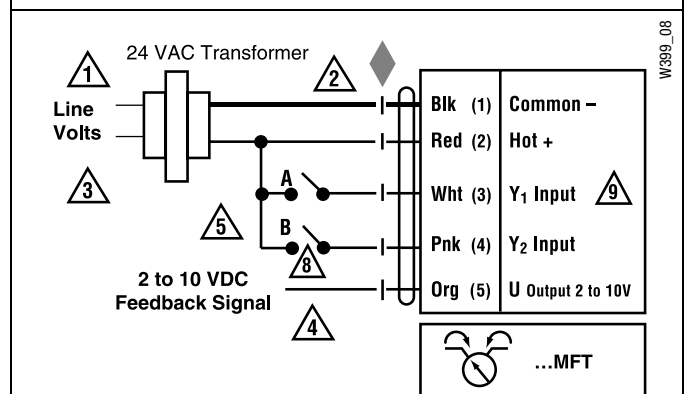
VDC/4-20 mA



PWM



On/Off control



Floating Point control

# AMX24-MFT-T N4, AMX24-MFT-T N4H

NEMA 4X, Proportional Control, Non-Spring Return, Direct Coupled, 24V, Multi-Function Technology®



MFT



Technical Data	AMX24-MFT-T N4, AMX24-MFT-T N4H
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	3.5 W (1.25 W) / heater 24 W
Transformer sizing	6 VA (Class 2 power source) / heater 21 VA
Electrical connection	screw terminal (for 26 to 14 GA wire [heater 15 GA wire]) 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	160 in-lb [16 Nm]
Direction of rotation	reversible with  switch
Position indication	pointer
Manual override	external push button
Running time	150 seconds (default) variable (90 to 300 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL type 4X, NEMA 4X, IP66/67
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.7 lbs [1.6 kg] 4.1 lbs [1.8 kg] with heater

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

Torque min. 160 in-lb for control of damper surfaces up to 40 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 3/4" in diameter by means of its universal clamp.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

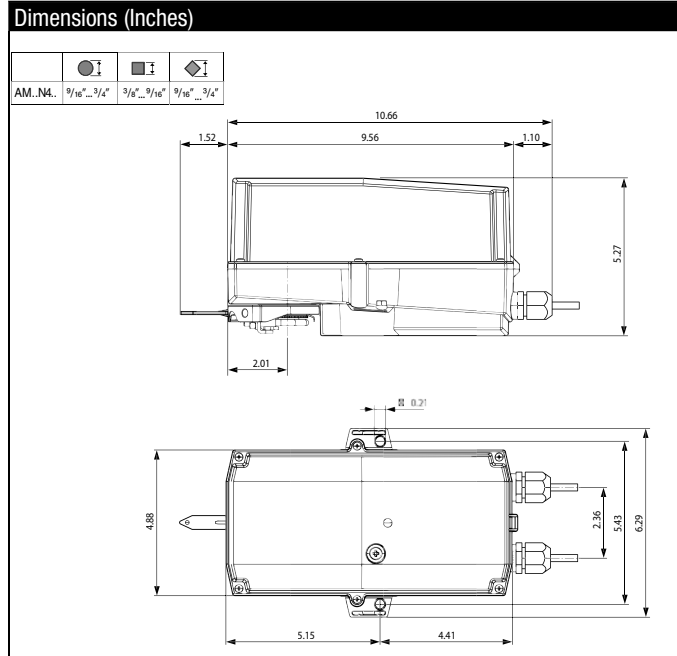
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMX24-MFT-T N4 provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMX24-MFT-T N4 actuator uses a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

ZS-100	Weather Shield - Steel
S1A, S2A	Auxiliary Switch (es)
P...A	Feedback Potentiometers
SGA24	Min positioners for surface mounting
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 3/4" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

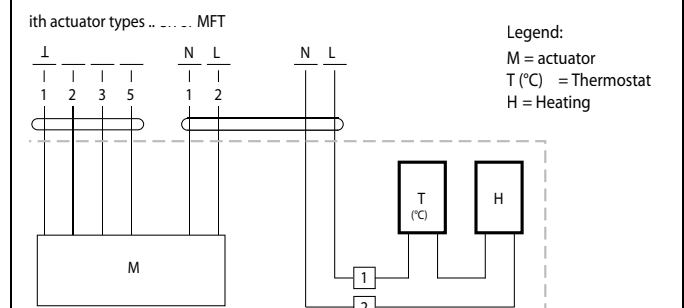
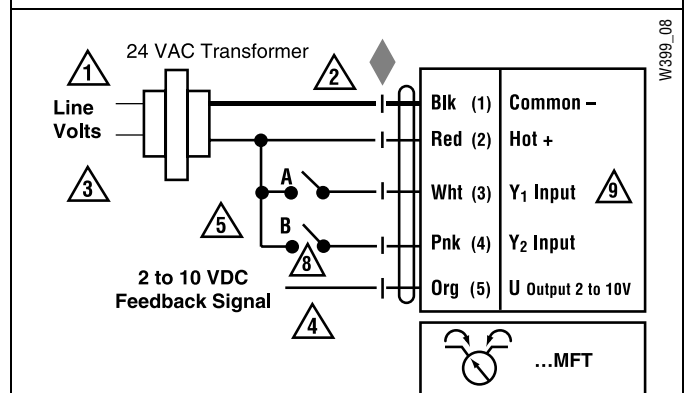
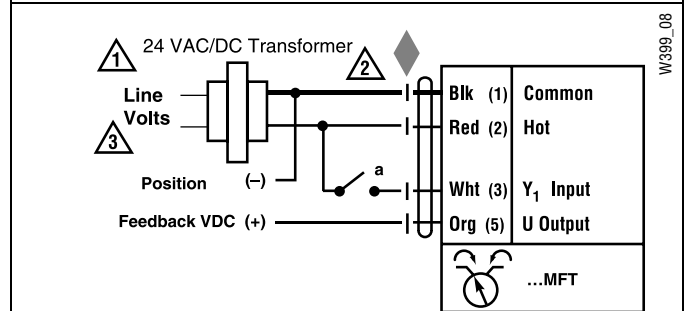
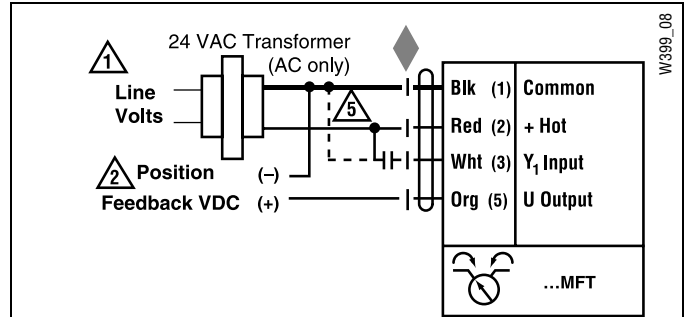
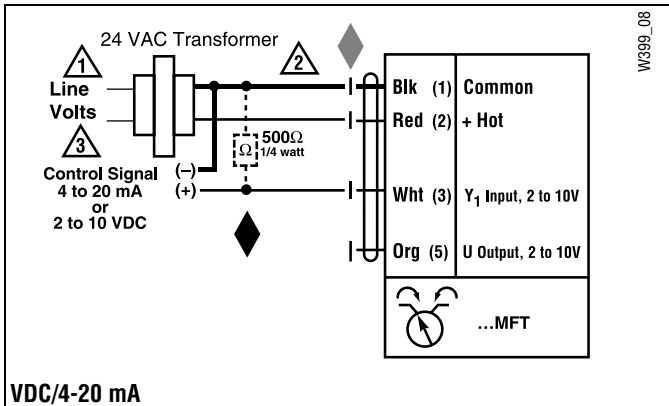
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



**Note**  
The following points must be taken into account with independent, external wiring:

- All contact between the cables or wires that are introduced and the heating element is to be avoided.
- Where necessary, use cables with sufficient numbers of wires, e.g. so that the heating and the actuator can be supplied separately with voltage.

# AMCX24-MFT

Proportional, Non-Spring Return, 24 V, Multi-Function Technology®



MFT



Technical Data	AMCX24-MFT
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	4 W (1.25 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 W (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	180 in-lb [20 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	35 seconds (default) variable (35 to 120 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.6 lbs [1.2 kg]

Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

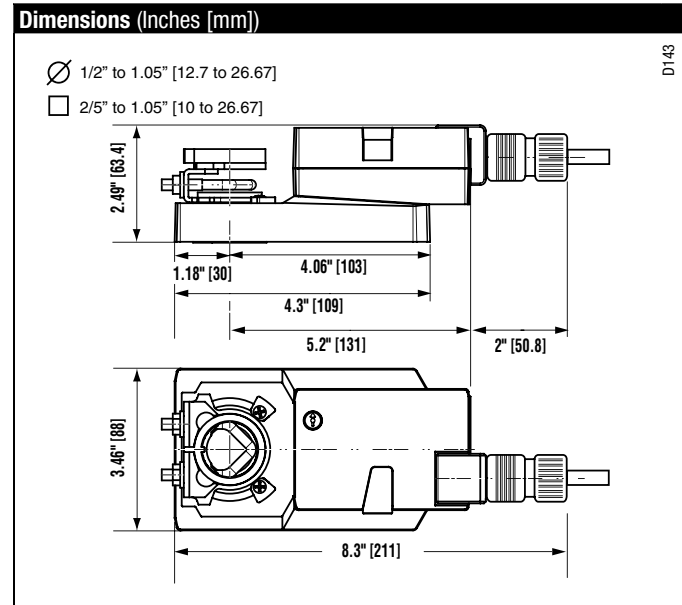
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMCX24-MFT actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions



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### Accessories

K-SA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
Z-SMA	AM/SM to AM Retrofit Mounting Bracket
ZG-AMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24	US Battery Back-Up Module
ZG-X40	Transformer

Note: When using AMCX24-MFT... actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

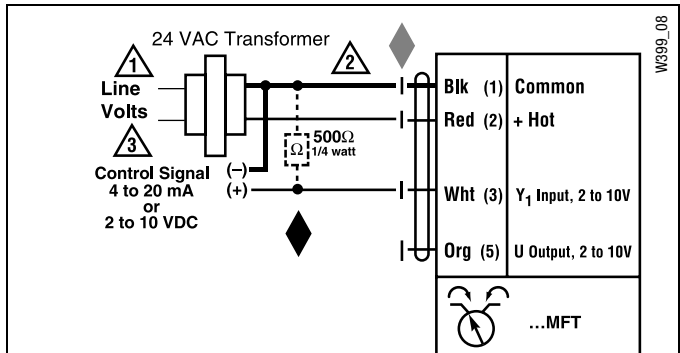
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### 📄 APPLICATION NOTES

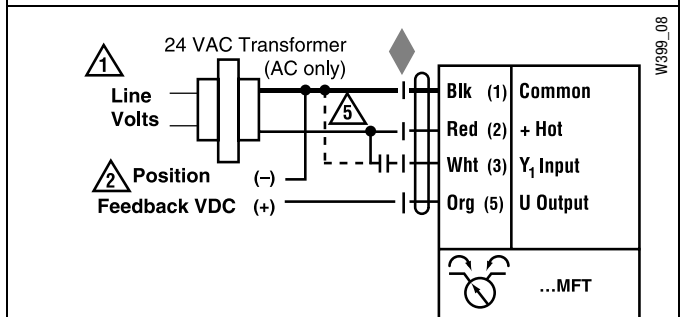
- ◆ The ZG-R01 500 Ω resistor may be used.

#### ⚠️ WARNING Live Electrical Components!

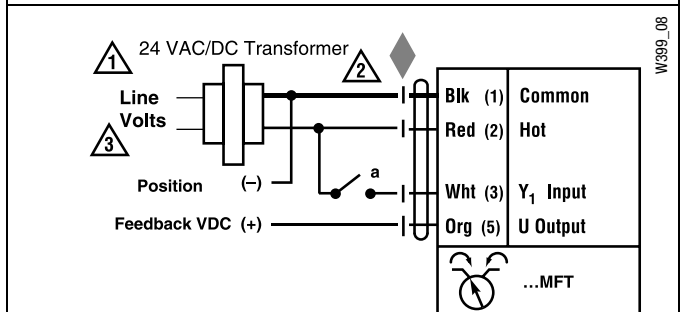
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



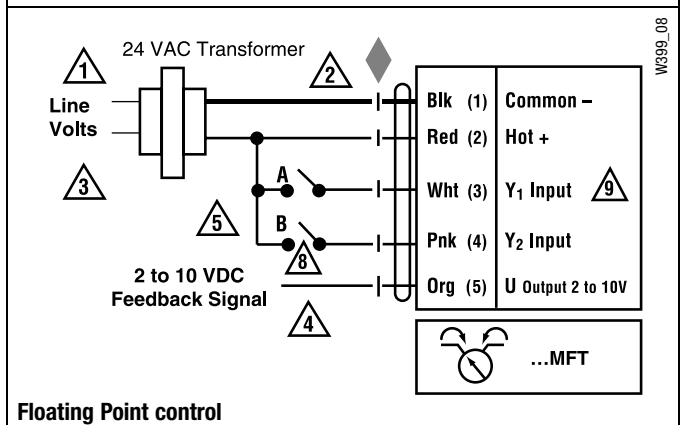
VDC/4-20 mA



PWM



On/Off control



Floating Point control

# AMX24-MFT95

Proportional, Non-Spring Return, 24 V, 0 to 135 Ω Input



MFT



Technical Data	AMX24-MFT95
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	3.5 W (1.3 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range WRB	135 Ω Honeywell Electronic Series 90, 0 to 135 Ω input
Feedback output U	2 to 10 VDC, 0.5 mA max
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	180 in-lb [20 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default) variable (90 to 350 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.6 lbs [1.2 kg]

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

Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The default parameters for 0 to 135 Ω input applications of the ...MFT95 actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

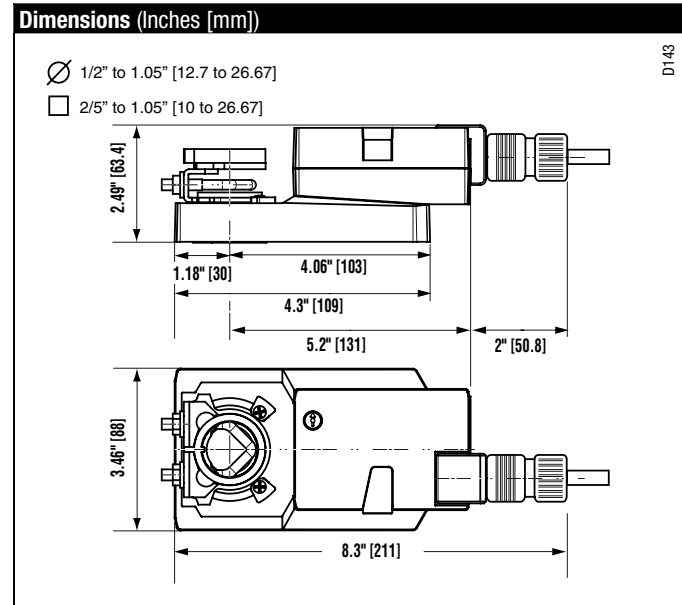
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMX24-MFT95 actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

K-SA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
Z-SMA	AM/SM to AM Retrofit Mounting Bracket
ZG-AMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using AMX24-MFT95... actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to 0 to 135 Ω control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

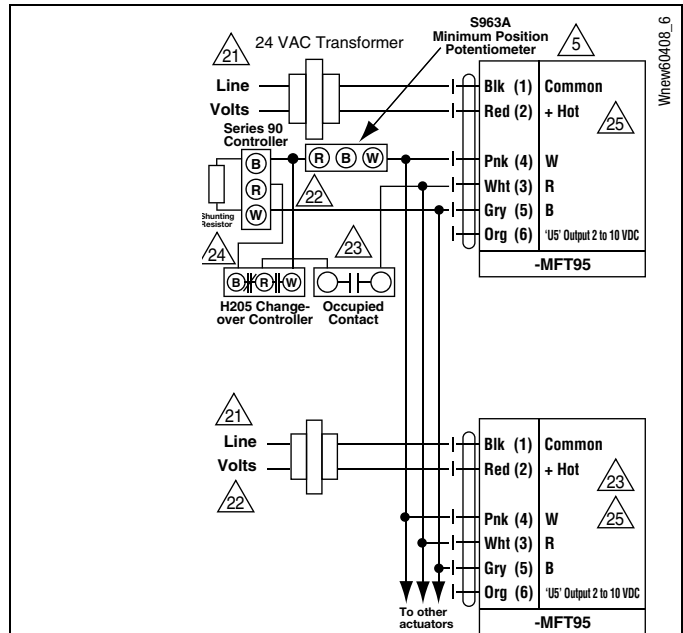
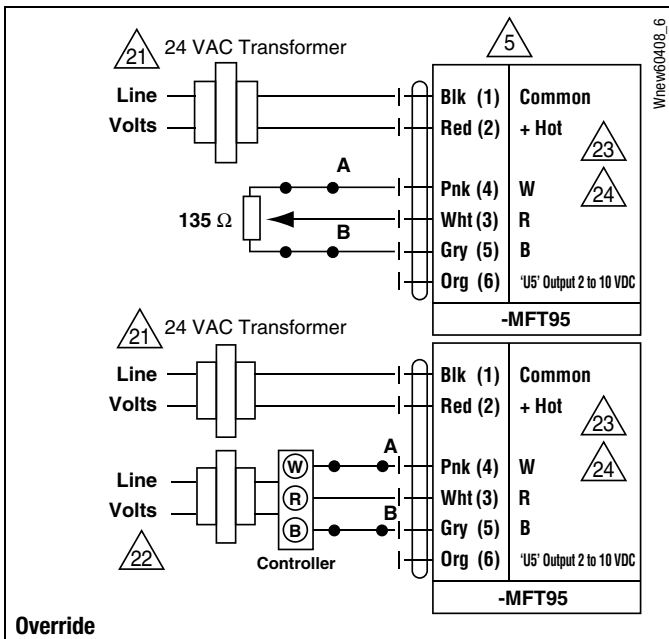
### Wire Colors

1 = Black	3 = White	5 = Gray
2 = Red	4 = Pink	6 = Orange

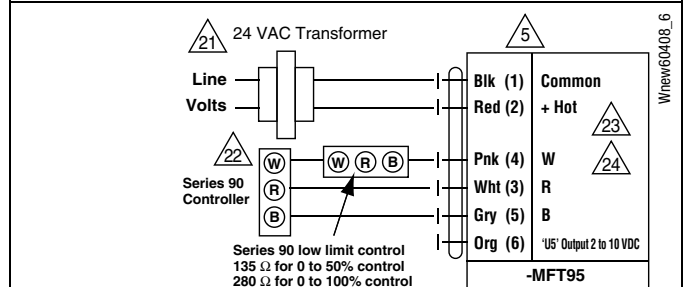
### Wiring Diagrams

#### INSTALLATION NOTES

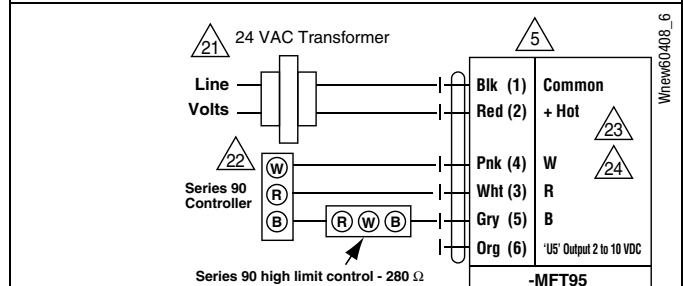
- △5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
- △21 Provide overload protection and disconnect as required.
- △22 Actuators and controller must have separate transformers.
- △23 Consult controller instruction data for more detailed information.
- △24 Resistor value depends on the type of controller and the number of actuators. No resistor is used for one actuator. Honeywell® resistor kits may also be used.
- △25 To reverse control rotation, use the reversing switch.



#### Wiring multiple actuators to a Series 90 controller using a minimum position potentiometer.



#### Low Limit Control



# AMX24-PC

Proportional, Non-Spring Return, 24 V, 0 to 20V Phasecut



Technical Data	AMX24-PC
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	3.5 W (1.3 W)
Transformer sizing	5.5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	0 to 20 V phasecut Control is only for the positive part of the sine wave (max of 10 volts)
Input impedance	8 k $\Omega$ (50 mW)
Feedback output U	2 to 10 VDC, 0.5 mA max VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	180 in-lb [20 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.6 lbs [1.2 kg]

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

**Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.**

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled (only the positive part of the sine wave) to the damper shaft.

The actuator operates in response to 0 to 20V phasecut control input only on the positive part of the sine wave from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication.

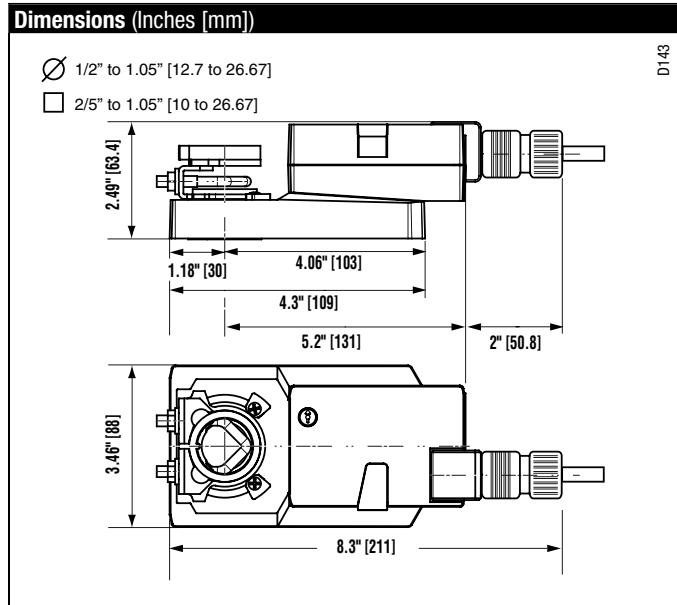
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMX24-PC actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

K-SA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
Z-SMA	AM/SM to AM Retrofit Mounting Bracket
ZG-AMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using AMX24-PC... actuators, only use accessories listed on this page.

### Typical Specification

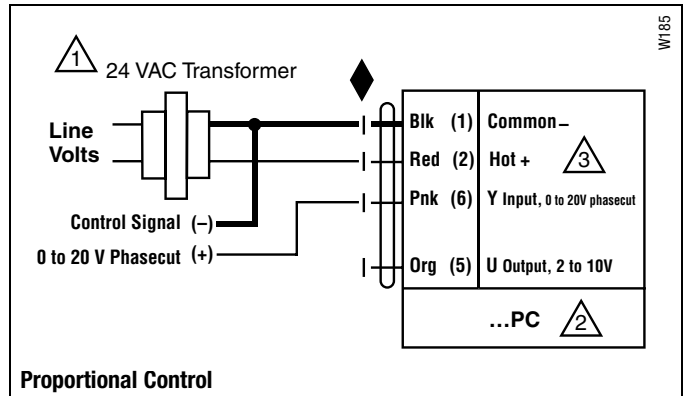
Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to 0 to 20V phasecut control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

**⚠️ WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# AMQB(X)24-1

On/Off, Non-Spring Return, 24 V



Technical Data	AMQB(X)24-1
Power supply	24 VAC $\pm 20\%$ 50/60 Hz 24 VDC $\pm 10\%$
Power consumption	15 W (1.5 W)
Transformer sizing	26 VA (Class 2 power source)
Electrical connection	3 ft [1m] 10 ft [3m] 16 ft [5m] 18 GA plenum rated cable protected NEMA 2 (IP54)
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off
Input impedance	1000 $\Omega$
Angle of rotation	min. 30°, max. 95°, adjust. with mechanical stop
Torque	140 in-lb [16 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	7, 10, 15 or 20 seconds constant independent of load
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<52 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.75 lbs [1.7 kg]

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

Torque min. 140 in-lb for control of damper surfaces up to 35 sq ft.

## Application

For On/Off control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

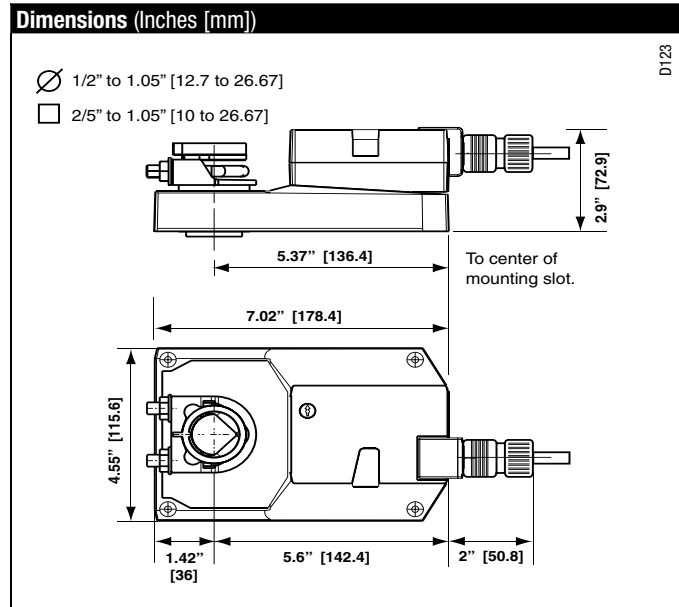
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMQB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMQB(X)24-1 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
K-GM20	½" -1.05" Shaft Clamp
ZG-100	Universal Mounting Bracket
ZG-102	Universal Mounting Bracket
Z-GMA	Retrofit Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
PS-100	Actuator Power Supply Simulator
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using AMQB(X)24-1 actuators, only use accessories listed on this page.

### Typical Specification

On/Off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### ✂️ INSTALLATION NOTES

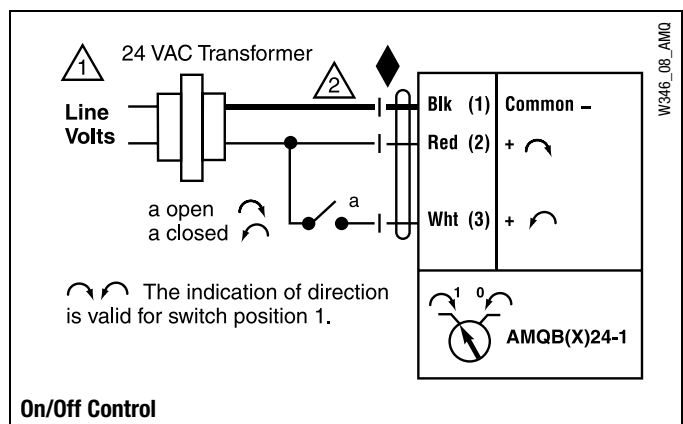
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

#### 📄 APPLICATION NOTES

- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# AMQB(X)24-MFT

Proportional, Non-Spring Return, 24 V, Multi-Function Technology®



MFT



Technical Data	AMQB(X)24-MFT
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	15 W (1.5 W)
Transformer sizing	26 VA (Class 2 power source)
Electrical connection	3 ft [1m] 10 ft [3m] 16 ft [5m] 18 GA plenum rated cable protected NEMA 2 (IP54)
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω, 1000 Ω (on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of rotation	min. 30°, max. 95°, adjust. with mechanical stop electronically variable
Torque	140 in-lb [16 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	7, 10, 15 or 20 seconds constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<52dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.75 lbs [1.7 kg]

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

Torque min. 140 in-lb for control of damper surfaces up to 35 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, ½" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

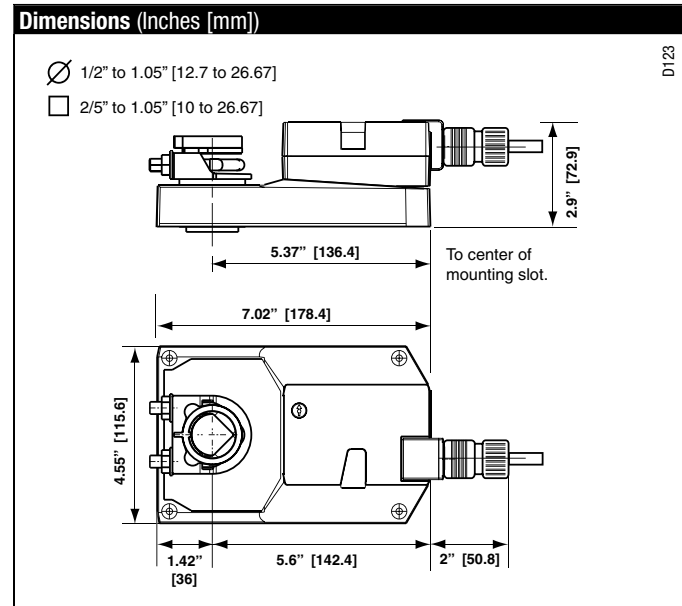
The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMQB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMQB(X)24-MFT actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.



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Accessories	
K-GM20	½"-1.05 Shaft Clamp
ZG-100	Universal Mounting Bracket
ZG-102	Universal Mounting Bracket
Z-GMA	Retrofit Mounting Bracket
ZG-AMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

NOTE: When using AMQB(X)24-MFT actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

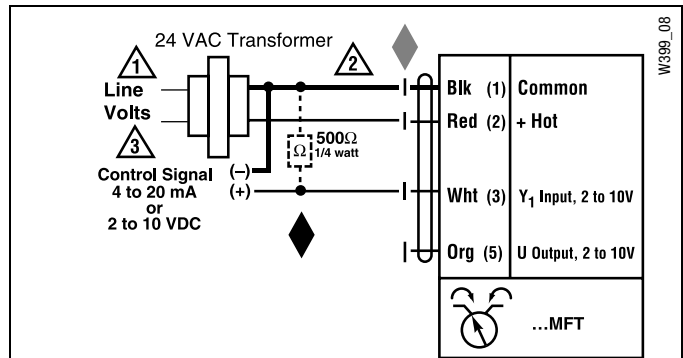
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

#### APPLICATION NOTES

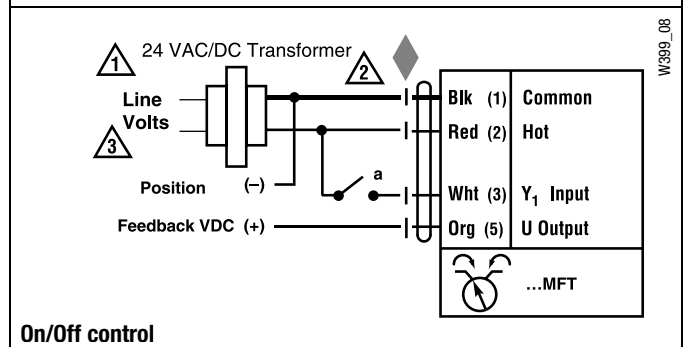
- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



VDC/4-20 mA



On/Off control

# AMX24-LON

LonWorks®, Non-Spring Return, 24 V



Technical Data	AMX24-LON
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	3.5 W (1.3 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m]
Overload protection	electronic throughout 0 to 95° rotation
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	180 in-lb [20 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.6 lbs [1.2 kg]

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

LonWorks®	
Certified	according to LonMARK® 3.3
Processor	Neuron 3120
Transceiver	FTT-10A, compatible with LPT-10
Functional profile	according to LonMARK® damper actuator object #8110 open loop sensor object #1
LNS plug-in for actuator/sensor	can be run with any LNS based integration tool (min. for LNS 3.x)
Service button and status LED	according to LonMARK® guidelines
Conductors, cables	conductor lengths, cable specifications and topology of the LonWorks® network according to the Echelon® directives

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Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.

## Application

Direct coupled actuators for direct link to LonWorks network. Actuators are easily installed by direct shaft mounting on air dampers in ventilation and air conditioning systems. Actuator can be controlled by any compatible LON system.

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

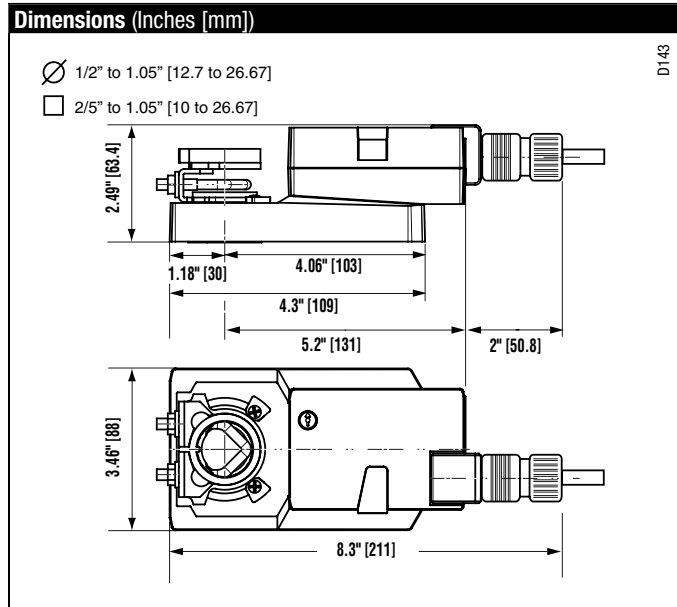
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMX24-LON series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AMX24-LON actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

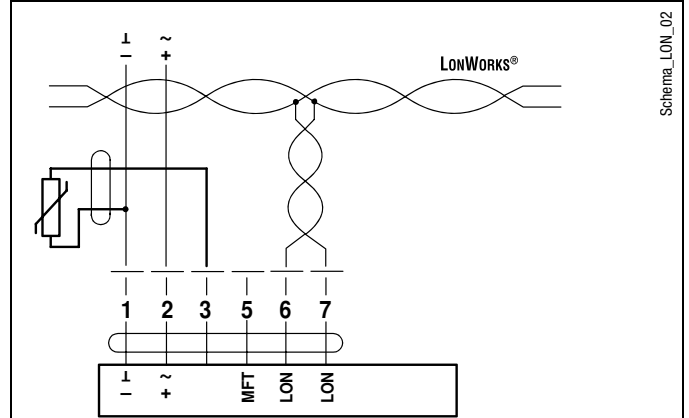
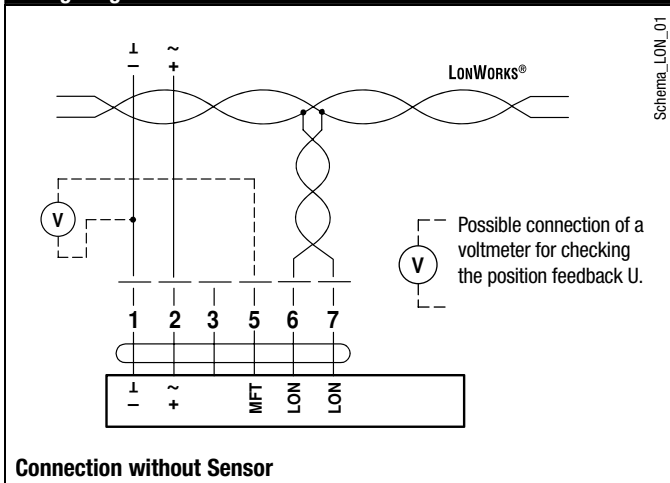
K-SA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
Z-SMA	AM/SM to AM Retrofit Mounting Bracket
ZG-AMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using AMX24-LON... actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

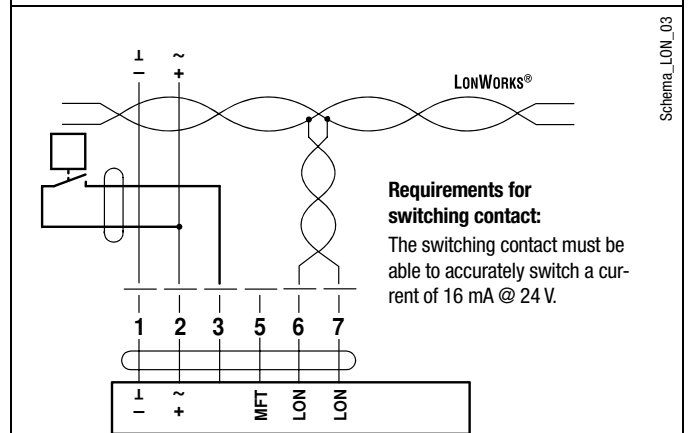


#### Sensor scaling:

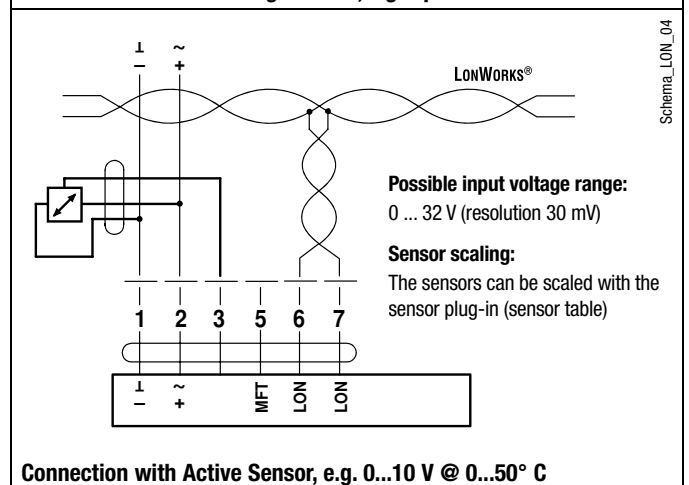
The sensors can be scaled with the sensor plug-in (sensor table).

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 ... 60 kΩ	1 Ω

### Connection with Passive Sensor, e.g. Pt1000, Ni1000, NTC

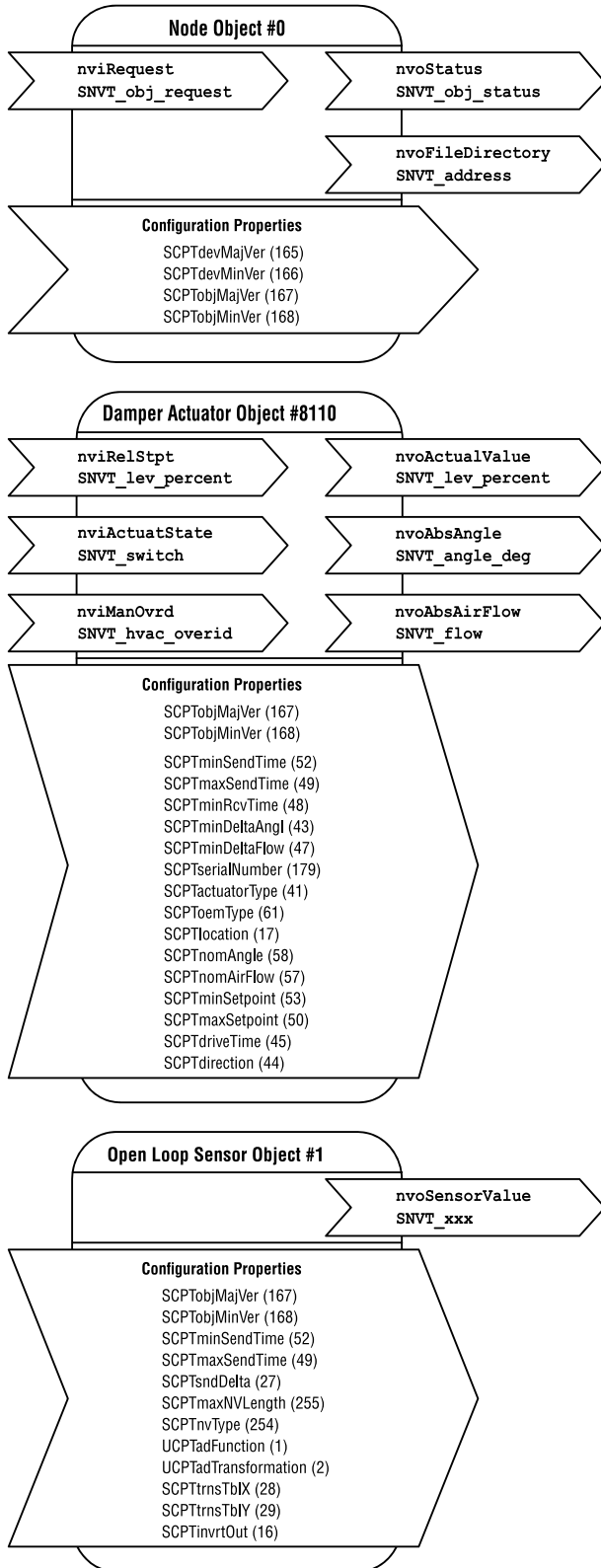


### Connection with Switching Contact, e.g. Δp-monitor



**Functional Profile according to LonMARK®**

The LON-capable damper actuator is certified by LonMARK®. The actuator functions are supplied with the LonWorks® network as standardized network variables according to LonMARK®. The Node Object #0, the Damper Actuator Object #8110 and the Open Loop SensorObject #1 are implemented in the actuator.



**Node object #0**

The node object contains the object status and object request functions.

**nviRequest**      **SNVT\_obj\_request**  
Input variable for requesting the status of a particular object in the node.

**nvoStatus**      **SNVT\_obj\_status**  
Output variable that outputs the current status of a particular object in the node.

**nvoFileDirectory**      **SNVT\_address**  
Output variable that shows information in the address range of the Neuron chip.

**Damper actuator object #8110**

The actuator object is used to map the functions of the MP actuators to the LONWORKS® network.

**nviRelStpt**      **SNVT\_lev\_percent**  
The nominal position is assigned to the actuator via this input variable. This variable is normally linked to the output variable of an HVAC controller.

**nviActuateState**      **SNVT\_switch**  
A preset position is assigned to the actuator via this input variable. Note on priority: The last variable that was active, either nviActuatorState or nviRelStpt, has priority.

**nviManOvrld**      **SNVT\_hvac\_overid**  
These input variables can be used to manually override the actuator into a particular position.

**nvoActualValue**      **SNVT\_lev\_percent**  
This output variable shows the current actual position of the actuator and can be used for control circuit feedback or for displaying positions.

**nvoAbsAngle**      **SNVT\_angle\_deg**  
This output variable shows the current angle of rotation of the actuator or the valve and can be used to display the position or for service purposes.

**nvoAbsAirFlow**      **SNVT\_flow**  
This output variable is inactive with the SR24ALON-5 rotary actuator and shows a constant value of 65535 (this variable is only active in conjunction with LON-capable VAV controllers).

**Open loop sensor object #1**

A sensor can be connected to the rotary actuator. A passive resistance sensor (e.g. Ni1000), an active sensor (output 0 ... 32 V) or a switch (on/off) can be connected. The open loop sensor object transfers the measured sensor values to the LONWORKS® network.

**nvoSensorValue**      **SNVT\_xxx**  
This output variable shows the current sensor value. Depending on the connected sensor, the output variable can be configured via the sensor plug-in and specifically adapted to the system.

**The SNVT\_... can be configured as:**

SNVT_temp_p	SNVT_lev_percent	SNVT_lux
SNVT_temp	SNVT_abs_humid	SNVT_press_p
SNVT_switch	SNVT_enthalpy	SNVT_smo_obscur
SNVT_flow	SNVT_ppm	SNVT_power
SNVT_flow_p	SNVT_rpm	SNVT_elec_kwh

**Notes**

Detailed information on the functional profiles can be found on the website of LonMARK® ([www.lonmark.org](http://www.lonmark.org)).





<b>1 Direction of rotation switch</b>	
Switching over	Direction of rotation changes
<b>2 Pushbutton and green LED display</b>	
Off	No voltage supply or malfunction
Green, on	Operation
Press button	Switches on angle of rotation adaption followed by standard operation
<b>3 Service button for commissioning LONWORKS® and yellow LED display for the LON status</b>	
Off	The SR24ALON-5 rotary actuator is connected and ready for operation in the LONWORKS®network.
Yellow, on	No application software is loaded in the SR24ALON-5.
Yellow, flashing (flashing interval 2 seconds)	The SR24ALON-5 is ready for operation but not integrated in the LONWORKS® network (unconfigured).
Other flashing codes	A fault is present in the SR24ALON-5.
Press button	Service Pin Message is sent to the LONWORKS®network.
<b>4 Gear disengagement switch</b>	
Press button	Gear disengaged, motor stops, manual operation possible
Release button	Gear engaged, synchronisation starts, followed by standard operation
<b>5 Service plug</b>	
For connecting MFT parameterizing and service tools	

## Minimum 90 in-lb Torque

- For damper areas up to 22 sq-ft\*



Actuators in bold have BDCM

### NM Series - At A Glance

		<i>NMB(X)24-3(-T)</i> (p. 283)	<i>NMB24-3-T N4(H)</i> (p. 285)	<i>NMCB24-3</i> (p. 287)	<i>NMX120-3</i> (p. 289)	<i>NMB(X)24-SR(-T)</i> (p. 291)	<i>NMB24-SR-T N4(H)</i> (p. 293)	<i>NMCB24-SR</i> (p. 295)	<i>NMX120-SR</i> (p. 297)	<i>NMB(X)24-MFT</i> (p. 299)	<i>NMX24-MFT-T N4(H)</i> (p. 301)	<i>NMCX24-MFT</i> (p. 303)	<i>NMX24-PC</i> (p. 307)	<i>NMX24-MFT95</i> (p. 305)	<i>NMQB(X)24-1</i> (p. 309)	<i>NMQB(X)24-MFT</i> (p. 311)	<i>NMX24-LON</i> (p. 313)
Basic Product		●	●	●		●	●	●		●				●	●	●	
Flexible Product		●			●	●			●	●	●	●	●	●	●	●	●
Torque	90 in-lb [10 Nm]	●		●	●	●		●	●	●	●	●	●	●			●
	70 in-lb [8 Nm]		●				●				●				●	●	
Angle of Rotation	95 degrees	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	24 VAC/DC	●	●	●		●	●	●		●	●	●	●	●	●	●	●
Power Supply	100 to 240 VAC				●				●								
	Control Input																
Control Input	On/Off														●		
	On/Off, Floating Point	●	●	●	●												
	2 to 10 VDC (4 to 20mA)					●	●	●	●	●							
	Multi-Function Technology										●	●				●	
	135 Ω													●			
	0 to 20V Phasecut												●				
Feedback	LonWORKS®																●
	None	●	●	●	●	●									●		
	2 to 10 VDC					●	●	●	●								
	Variable (0 to 10 VDC)									●	●	●	●	●		●	
Running Time	95 seconds	●	●		●	●	●		●		●						
	45 seconds			●				●									
	Adj. 45 to 150 seconds	●			●	●			●	●	●			●			
	Adj. 20 to 75 seconds											●					
	Adj. 4 to 15 seconds														●	●	
	150 seconds												●				●
Wiring	Plenum Rated Cable	●		●		●		●		●		●	●	●	●	●	●
	Appliance Rated Cable				●				●								
	Terminal Strip	●	●			●	●				●						
	Conduit Fitting	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●
Auxiliary Switch	Add-On	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●

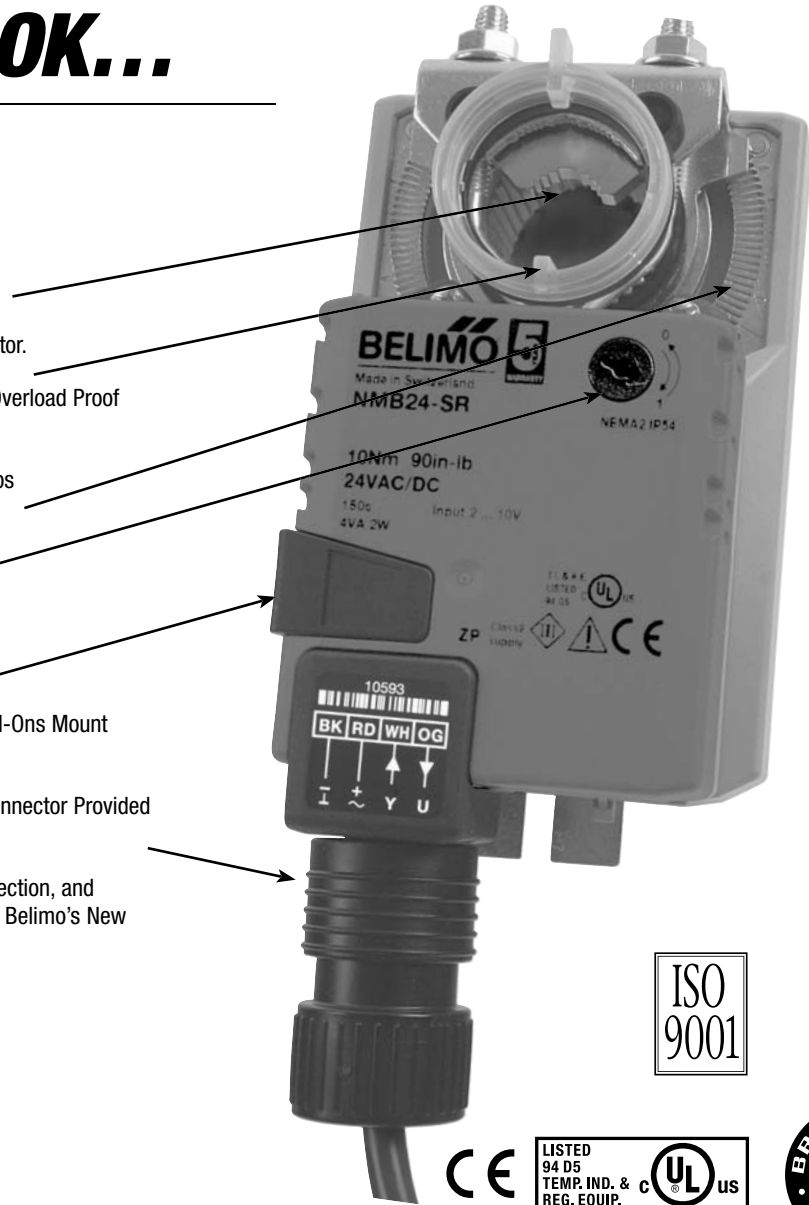
Installation and Operation... (page 400).

\*Based on 4 in-lb/ft² damper torque loading. Parallel blade. No edge seals.

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# A CLOSER LOOK...

- Brushless DC Motor for Added Accuracy and Controllability.
- Cut Labor Costs with Simple Direct Coupling.
- Self-Centers on 1/2", 3/4", and 1.05".
- Check Damper Position with Clear Position Indicator.
- Don't Worry about Actuator Burn-Out; Belimo is Overload Proof throughout Rotation.
- Enjoy Added Flexibility with Easy Mechanical Stops to Adjust Angle of Rotation.
- Need to Change Control Direction? Do it easily with a Simple Switch.
- Easily Accessible Manual Override Button helps you Pre-Tension Damper Blades.
- Auxiliary Switch and Feedback Potentiometer Add-Ons Mount Directly on Clamp, Includes Conduit Connector.
- Standard 3ft Plenum Rated Cable and Conduit Connector Provided on Basic Models.
- Added Flexibility to Select Clamp, Electrical Connection, and Running Time to fit your Specific Application with Belimo's New Flexible Line of Actuators.



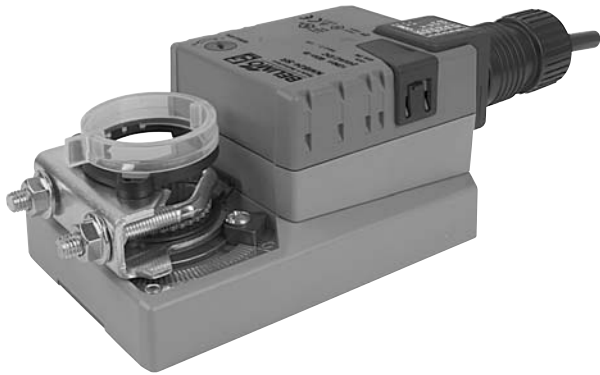
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## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

# NMB(X)24-3(-T)

On/Off, Floating Point, Non-Spring Return, 24 V



Technical Data	NMB(X)24-3(-T)
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	2 W (0.2 W)
Transformer sizing	4 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 $\Omega$
Angle of rotation	max. 95°, adjust. with mechanical stop
Torque	90 in-lb [10 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	95 seconds (default) constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.7 lbs [0.75 Kg]

NMB(X)24-3-T	
Electrical connection	screw terminal (for 26 to 14 GA wire) unprotected (NEMA 1/IP20)

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

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

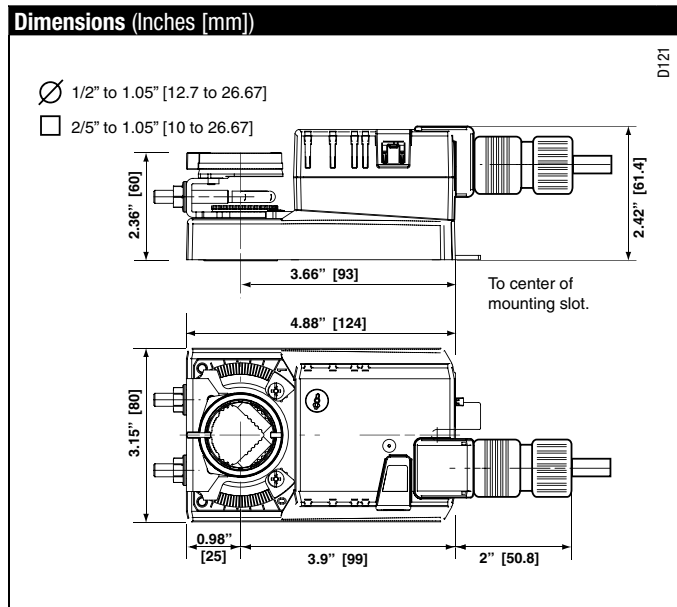
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMB(X)24-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-T	Terminal Cover for NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using NMX24-3... actuators, only use accessories listed on this page.

### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuators will be provided with a screw terminal strip for electrical connections (NMX24-3-T). Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

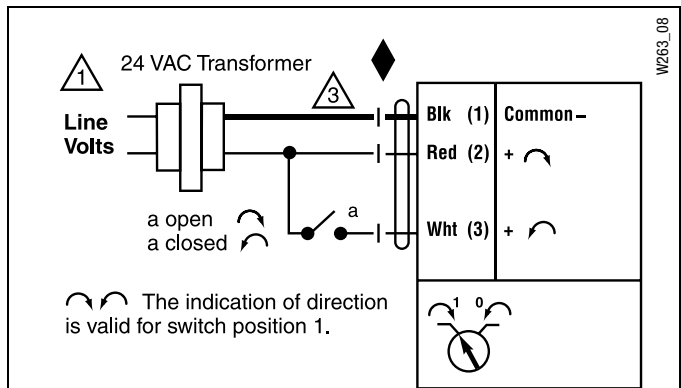
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

#### 📄 APPLICATION NOTES

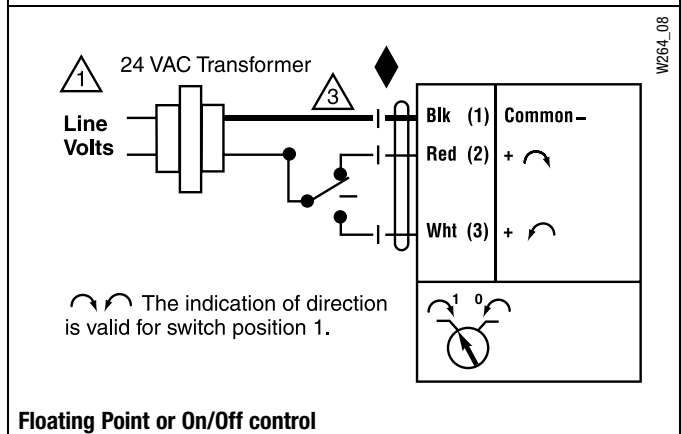
- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



#### On/Off control



#### Floating Point or On/Off control

# NMB24-3-T N4, NMB24-3-T N4H

NEMA 4X, On/Off-Floating Point Control, Non-Spring Return, Direct Coupled, 24 VAC



Technical Data	NMB24-3-T N4, NMB24-3-T N4H
Power supply	24 VAC $\pm 20\%$ , 50/60 Hz 24 VDC $\pm 10\%$ , 50/60 Hz
Power consumption	2.0 W (0.2 W) / heater 24 W
Transformer sizing	4.0 VA (Class 2 power source) / heater 19 VA
Electrical connection	screw terminal (for 26 to 14 GA wire [heater 15 GA wire]) 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 $\Omega$
Angle of rotation	max. 95°, adjust. with mechanical stop
Torque	70 in-lb [8 Nm]
Direction of rotation	reversible with  switch
Position indication	pointer
Manual override	external push button
Running time	95 seconds constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL type 4X, NEMA 4X, IP66/67
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.8 lbs [1.27 kg] 3.2 lbs [1.4 kg] with heater

†Rated Impulse Voltage 4kV, Type of action 1, Control Pollution Degree 3.

Torque min. 70 in-lb for control of damper surfaces up to 16 sq ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 3/4" in diameter by means of its universal clamp.

## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

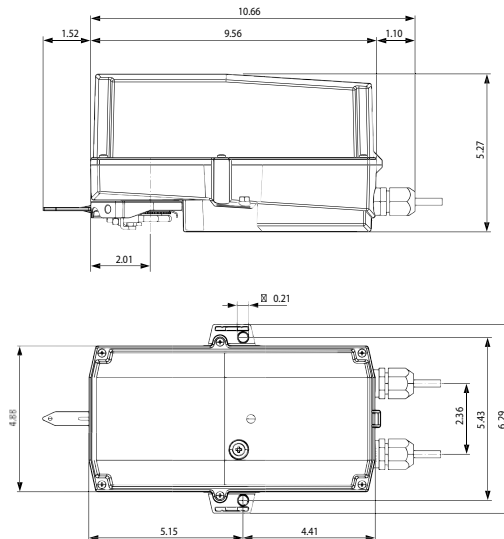
The NMB24-3-T N4 provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMB24-3-T N4 actuator uses a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])

NM..N4.	3/8"	3/4"	3/8"-9/16"	3/8"-9/16"
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#### Accessories

S1A, S2A	Auxiliary Switch (es)
P...A	Feedback Potentiometers

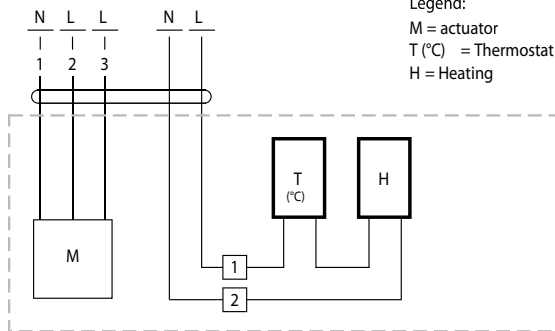
**NOTE:** When using NMB24-3-T N4(H) actuators, only use accessories listed on this page.

#### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 3/4" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagram

with actuator types ...3



#### Note

- The following points must be taken into account with independent, external wiring:
- All contact between the cables or wires that are introduced and the heating element is to be avoided.
  - Where necessary, use cables with sufficient numbers of wires, e.g. so that the heating and the actuator can be supplied separately with voltage.

#### Heater wiring

#### Wiring Diagram

#### INSTALLATION NOTES

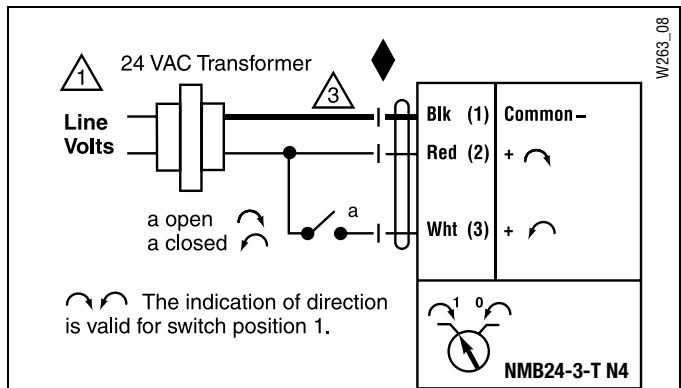
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

#### APPLICATION NOTES

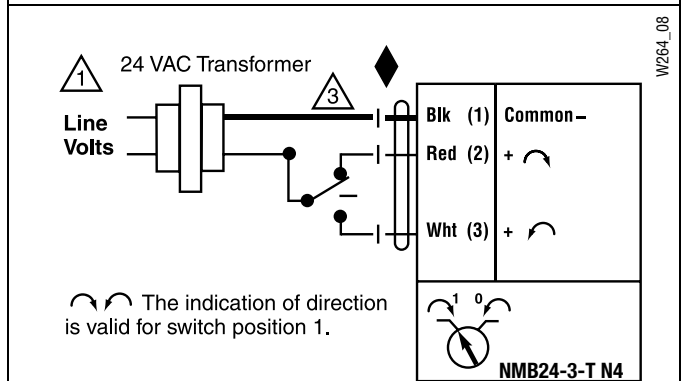
- Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



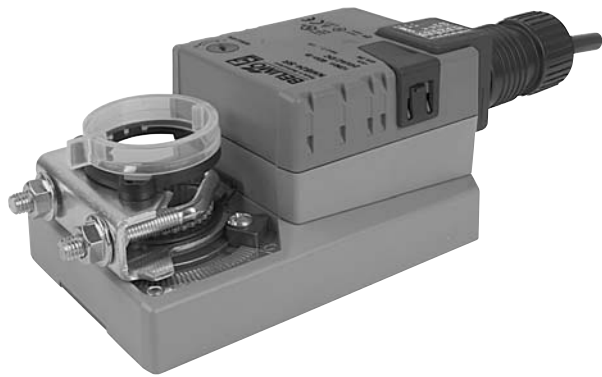
#### On/off control



#### Floating point or on/off control

# NMCB24-3

On/Off, Floating Point, Non-Spring Return, 24 V



Technical Data	NMCB24-3
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	2 W (0.2 W)
Transformer sizing	4 VA (Class 2 power source)
Electrical connection	3 ft, 18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54)
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 Ω
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	90 in-lb [10 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual Indicator (snap-on)
Manual override	external push button
Running time	45 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.7 lbs [0.75 kg]

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

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

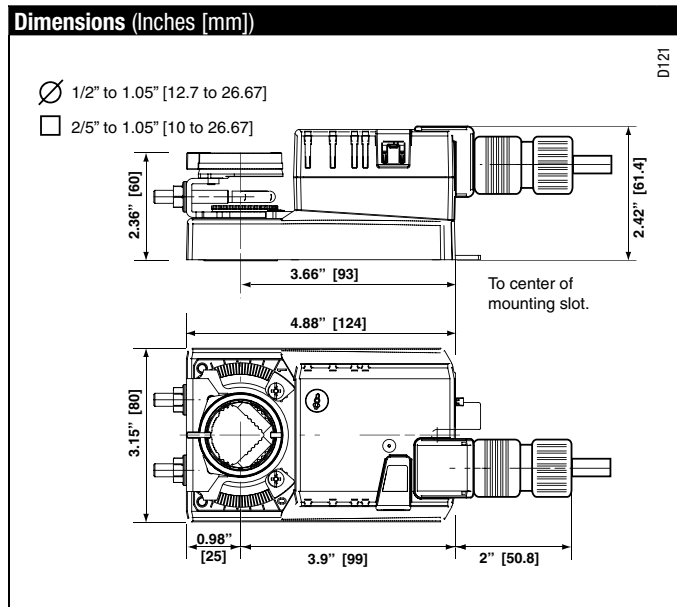
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMB series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMCB24-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-T	Terminal Cover for NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using NMCB24-3... actuators, only use accessories listed on this page.

### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

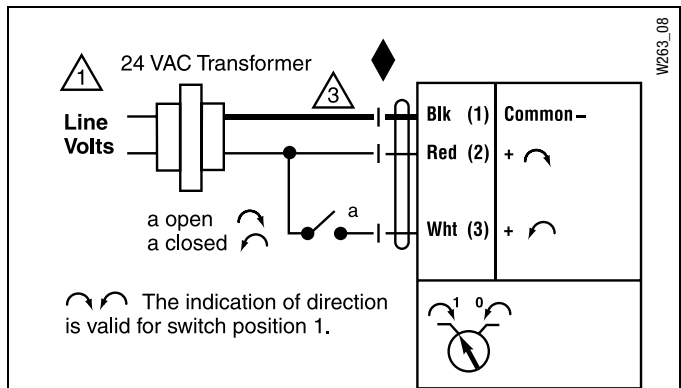
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

#### 📄 APPLICATION NOTES

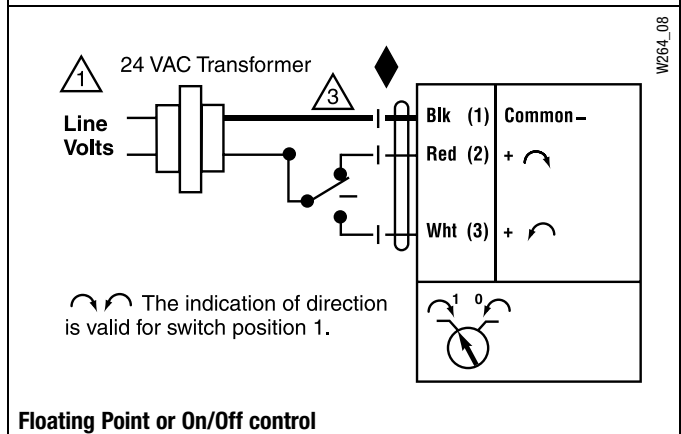
- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### ⚠️ WARNING Live Electrical Components!

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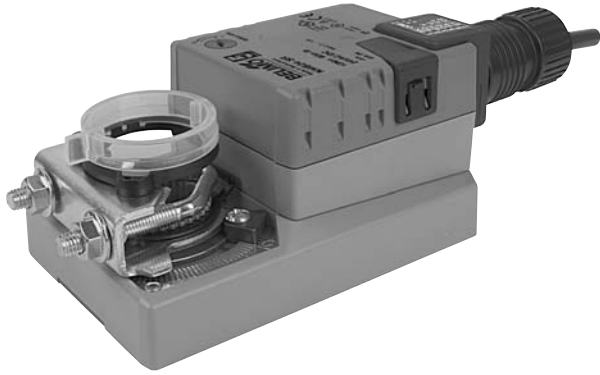
#### On/Off control



#### Floating Point or On/Off control

# NMX120-3

On/Off, Floating Point, Non-Spring Return, 100 to 240 VAC



Technical Data		NMX120-3
Power supply	nominal	100 to 240 VAC, 50/60 Hz
	tolerance	85 to 265 VAC, 50/60 Hz
Power consumption		3.5 W (0.6 W)
Transformer sizing		5.5 VA (Class 2 power source)
Electrical connection		18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off, floating point
Input impedance		600 Ω
Angle of rotation		max. 95°, adjustable with mechanical stop
Torque		90 in-lb [10 Nm]
Direction of rotation		reversible with  switch
Position indication		reflective visual indicator (snap-on)
Manual override		external push button
Running time		150 seconds 95 seconds 60 seconds 45 seconds constant independent of load
Humidity		5 to 95% RH non condensing (EN 60730-1)
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA 2, IP54, UL enclosure type 2
Housing material		UL94-5VA
Agency listings†		cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level		<45dB(A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		1.7 lbs [0.75 kg]

†Rated Impulse Voltage 4kV, Type of action 1, Control Pollution Degree 3.

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

## Operation

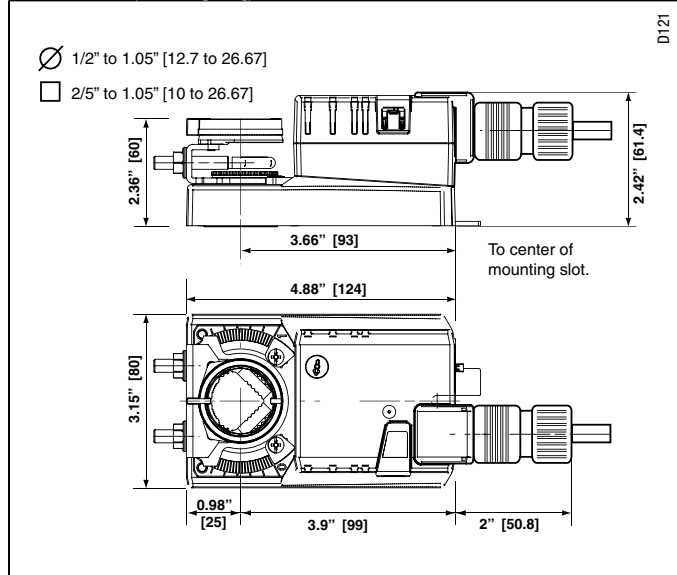
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMX120-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



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Accessories	
K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using NMX120-3 actuators, only use accessories listed on this page.

### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂ **INSTALLATION NOTES**

1 Provide overload protection and disconnect as required.

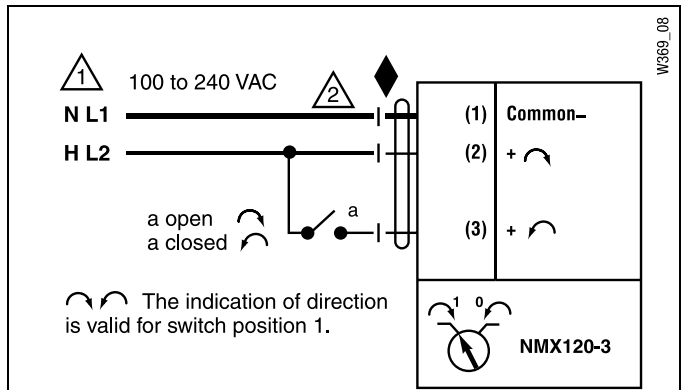
2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.

#### 📄 **APPLICATION NOTES**

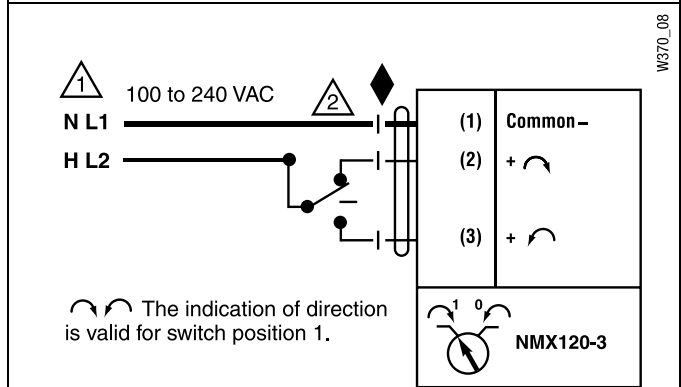
◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### ⚠ **WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



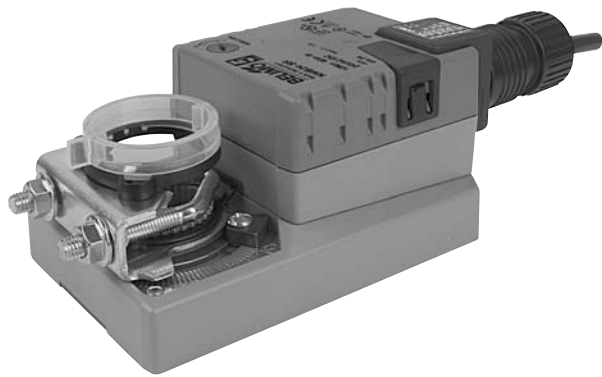
**On/Off control**



**Floating Point or On/Off control**

# NMB(X)24-SR(-T)

Proportional, Non-Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	NMB(X)24-SR(-T)
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	2.5 W (0.4 W)
Transformer sizing	5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 kΩ (0.1 mA), 500 Ω
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	90 in-lb [10 Nm]
Direction of rotation	reversible with  switch actuator will move: =CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds 95 seconds 60 seconds 45 seconds constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.7 lbs [0.75 kg]

NMB(X)24-SR-T	
Electrical connection	screw terminal (for 26 to 14 GA wire) unprotected (NEMA 1/IP20)

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

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

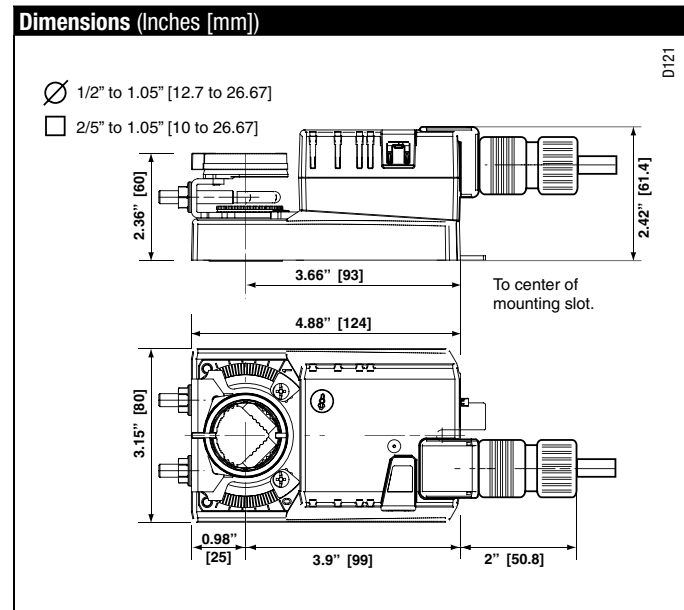
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMB(X)24-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-T	Terminal Cover for NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using NMB(X)24-SR... actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuator will be provided with screw terminal strip for electrical connections (NMX24-SR-T). Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂ INSTALLATION NOTES

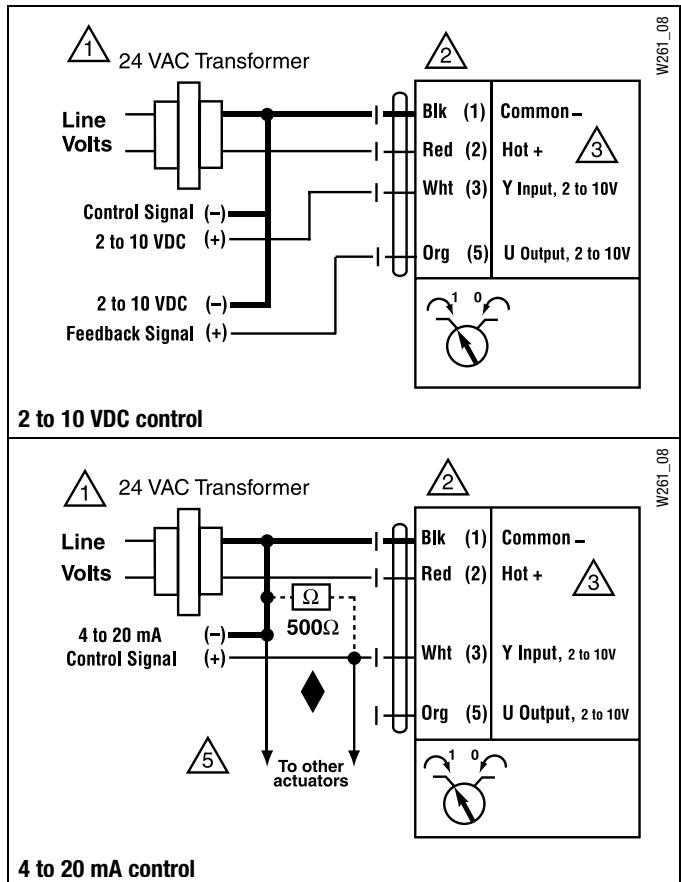
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

#### 📄 APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

#### ⚠ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# NMB24-SR-T N4, NMB24-SR-T N4H

NEMA 4X, Proportional Control, Non-Spring Return, Direct Coupled, 24V, for 2 to 10 VDC and 4 to 20 mA



Technical Data	NMB24-SR-T N4, NMB24-SR-T N4H
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	3.5 W (0.6 W) / heater 24 W
Transformer sizing	5 VA (Class 2 power source) / heater 20 VA
Electrical connection	screw terminal (for 26 to 14 GA wire [heater 15 GA wire]) 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 k $\Omega$ (0.1 mA), 500 $\Omega$
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	70 in-lb [8 Nm]
Direction of rotation	reversible with  switch
Position indication	pointer
Manual override	external push button
Running time	55 seconds constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL type 4X, NEMA 4X, IP66/67
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.8 lbs [1.2 kg] 3.2 lbs [1.4 kg]

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

Torque min. 70 in-lb for control of damper surfaces up to 16 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 3/4" in diameter by means of its universal clamp.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500  $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

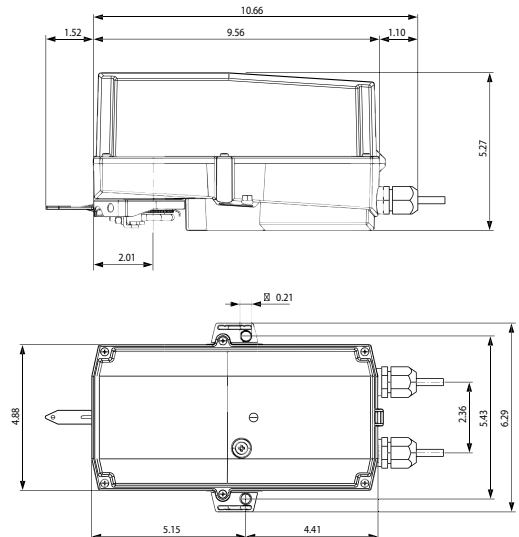
The NMB24-SR-T N4 provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMB24-SR-T N4 actuator uses a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])

NM..N4.	3/8"	3/4"	3/8"



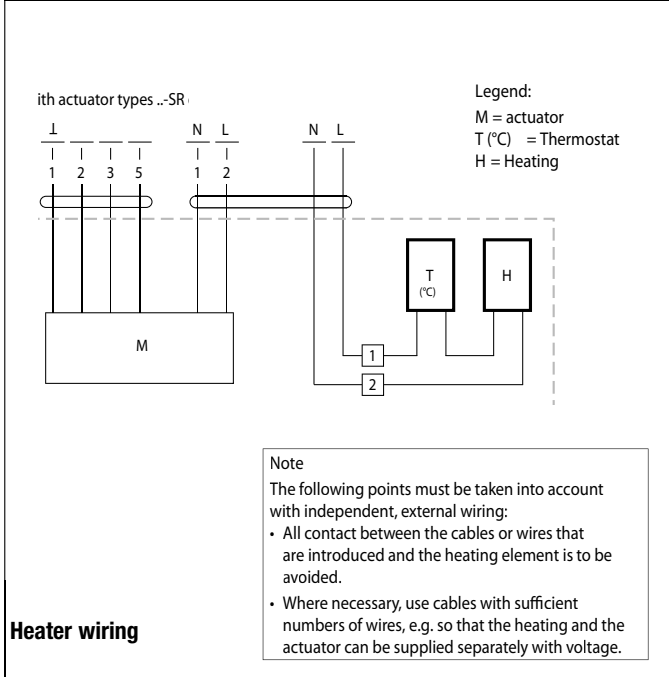
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Accessories	
S1A, S2A	Auxiliary Switch (es)
P...A	Feedback Potentiometers
SGA24	Min positioners for surface mounting
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 3/4" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, NEMA 4X, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagram**



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**Wiring Diagram**

**INSTALLATION NOTES**

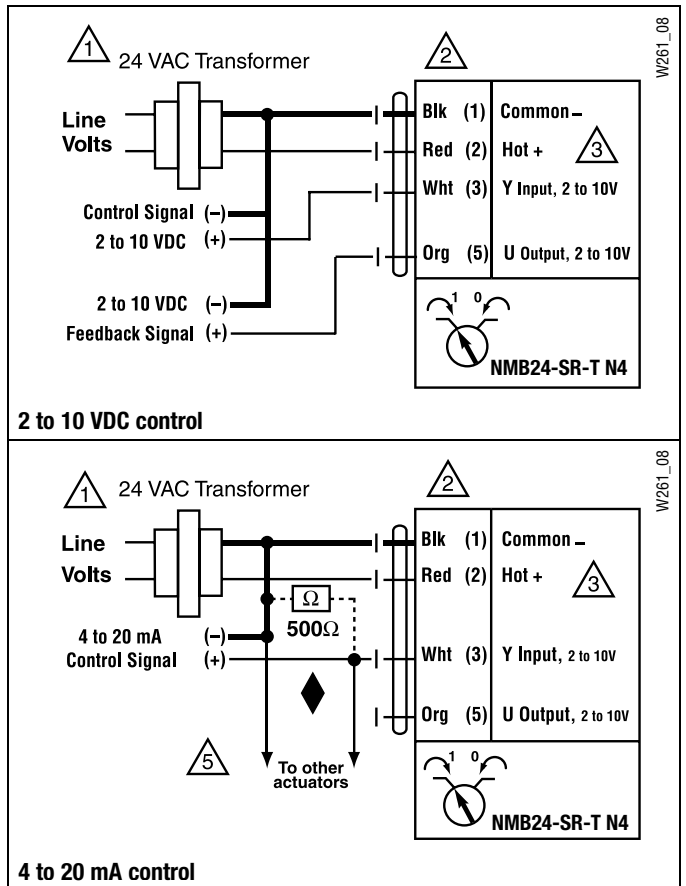
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

**APPLICATION NOTES**

The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

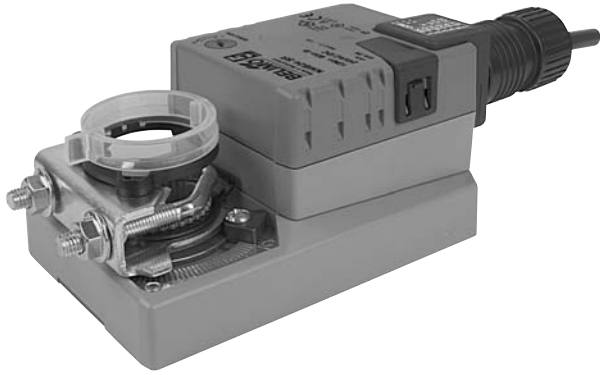
**WARNING Live Electrical Components!**

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# NMCB24-SR

Proportional, Non-Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	NMCB24-SR
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	2.5 W (.4 W)
Transformer sizing	5 VA (Class 2 power source)
Electrical connection	3ft, 18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54)
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 k $\Omega$ (0.1 mA), 500 $\Omega$
Feedback output U	2 to 10 VDC (max 0.5 mA)
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	90 in-lb [10 Nm]
Direction of rotation	reversible with  switch actuator will move: =CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	45 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.7 lbs [0.75 kg]

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

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500  $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

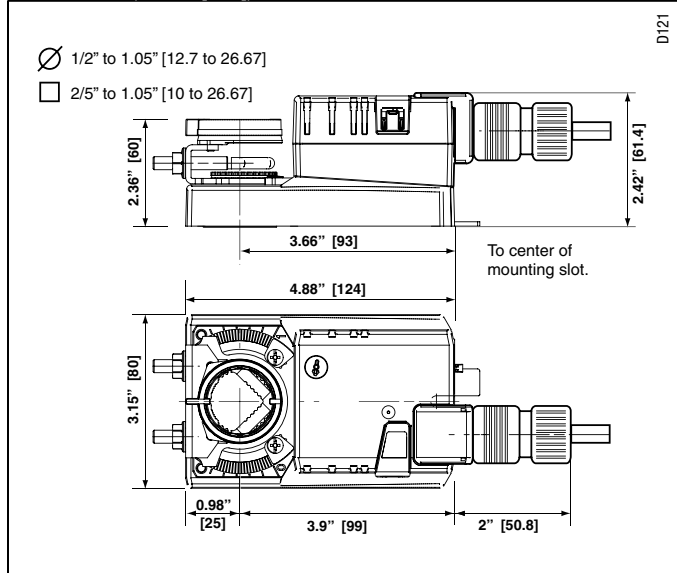
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NM series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMCB24-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



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**Accessories**

K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-T	Terminal Cover for NEMA 2/IP54
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using NMCB24-SR... actuators, only use accessories listed on this page.

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

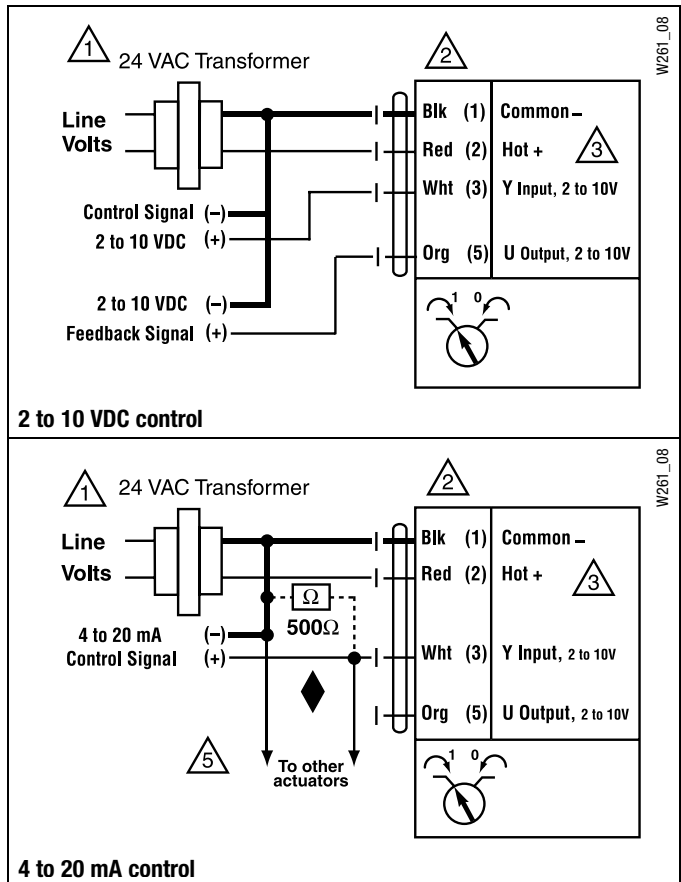
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

**APPLICATION NOTES**

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# NMX120-SR

Proportional, Non-Spring Return, 100 to 240 VAC, for 2 to 10 VDC or 4 to 20 mA



Technical Data		NMX120-SR
Power supply	nominal	100 to 240 VAC, 50/60 Hz
	tolerance	85 to 265 VAC, 50/60 Hz
Power consumption		3.5 W (1 W)
Transformer sizing		6.5 VA (Class 2 power source)
Electrical connection		18 GA appliance rated cable
		1/2" conduit connector
		protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20 mA
Input impedance		100 kΩ (0.1 mA), 500 Ω
Feedback output U		2 to 10 VDC (max 0.5 mA)
Angle of rotation		max. 95°, adjust. with mechanical stop
Torque		90 in-lb [10 Nm]
Direction of rotation		reversible with  switch
		actuator will move: =CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Position indication		reflective visual indicator (snap-on)
Manual override		external push button
Running time		150 seconds 95 seconds 60 seconds 45 seconds
		constant independent of load
Humidity		5 to 95% RH non condensing (EN 60730-1)
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA 2, IP54, UL enclosure type 2
Housing material		UL94-5VA
Agency listings†		cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level		<45dB(A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		1.7 lbs [0.75 kg]

†Rated Impulse Voltage 4kV, Type of action 1, Control Pollution Degree 3.

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

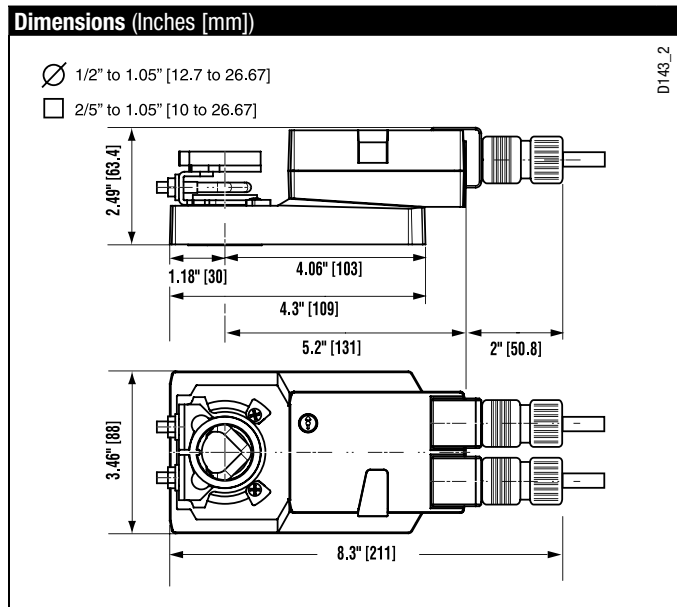
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMX120-SR actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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**Accessories**

K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module

**NOTE:** When using NMX120-SR actuators, only use accessories listed on this page.

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagram**
**INSTALLATION NOTES**

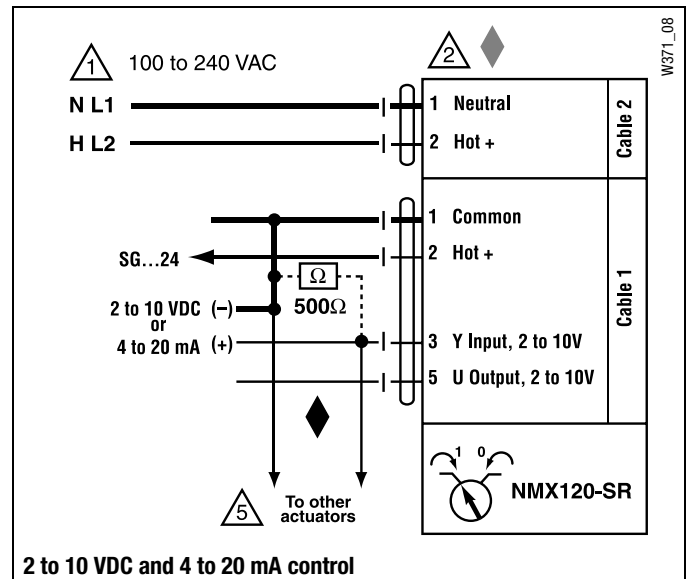
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 5 Only connect common to neg. (-) leg of control circuits.

**APPLICATION NOTES**

- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# NMB(X)24-MFT

Proportional, Non-Spring Return, 24 V, Multi-Function Technology®



Technical Data	NMB(X)24-MFT
Power Supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	3.5 W (1.3 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	90 in-lb [10 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default) variable (45 to 170 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.1 lbs [0.95 Kg]

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

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

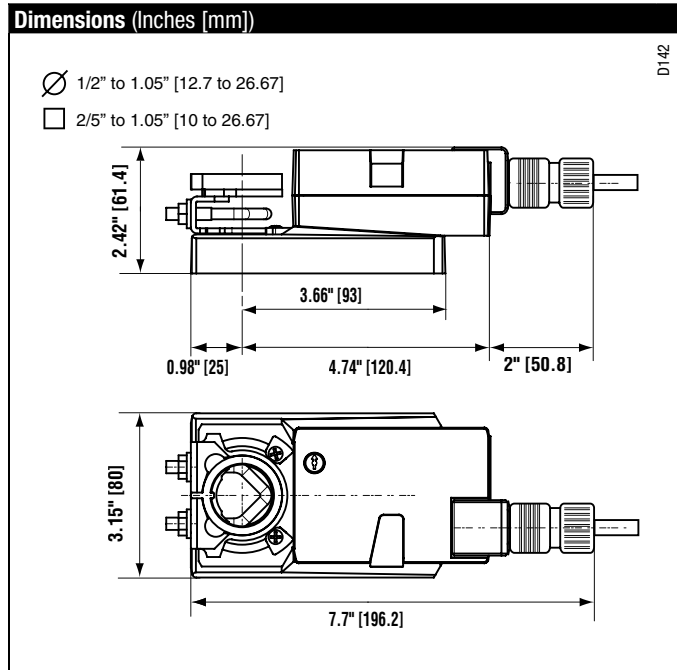
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMB(X)24-MFT actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

NOTE: When using NMB(X)24-MFT actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

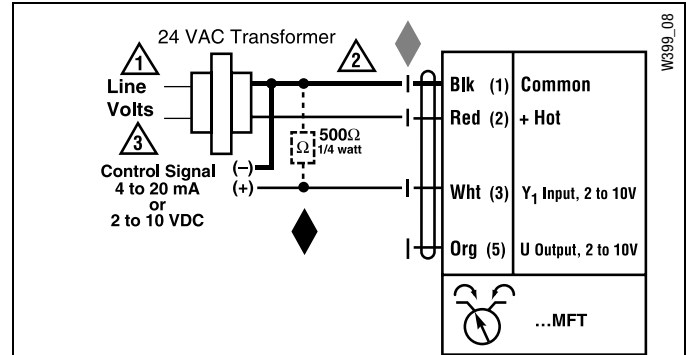
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

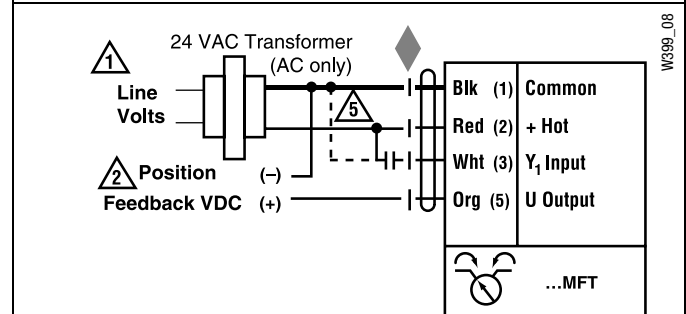
- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

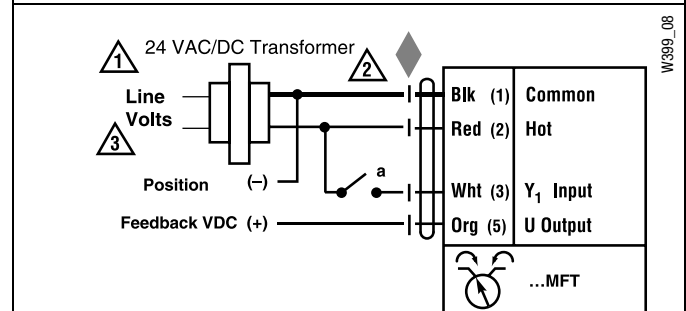
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



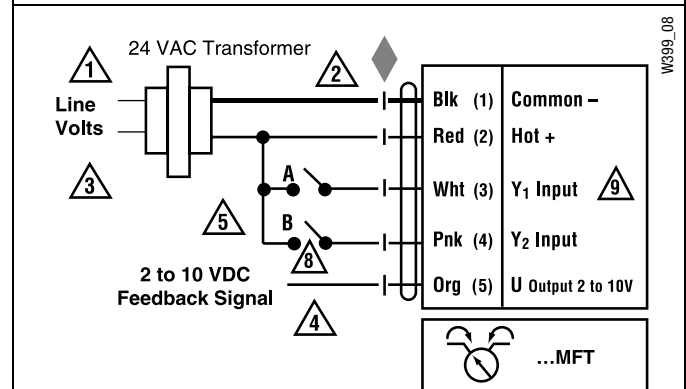
VDC/4-20 mA



PWM



On/Off control



Floating Point control

# NMX24-MFT-T N4, NMX24-MFT-T N4H

NEMA 4X, Proportional Control, Non-Spring Return, Direct Coupled, 24V, Multi-Function Technology®



Technical Data	NMX24-MFT-T N4, NMX24-MFT-T N4H
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	3.5 W (1.3 W) / heater 24 W
Transformer sizing	6 VA (Class 2 power source) / heater 21 VA
Electrical connection	screw terminal (for 26 to 14 GA wire [heater 15 GA wire]) 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	70 in-lb [8 Nm]
Direction of rotation	reversible with  switch
Position indication	pointer
Manual override	external push button
Running time	150 seconds (default) variable (45 to 170 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	UL type 4X, NEMA 4X, IP 66/67
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.2 lbs [1.45 kg] 3.6 lbs [1.6 kg] with heater

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

Torque min. 70 in-lb for control of damper surfaces up to 16 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

## Operation

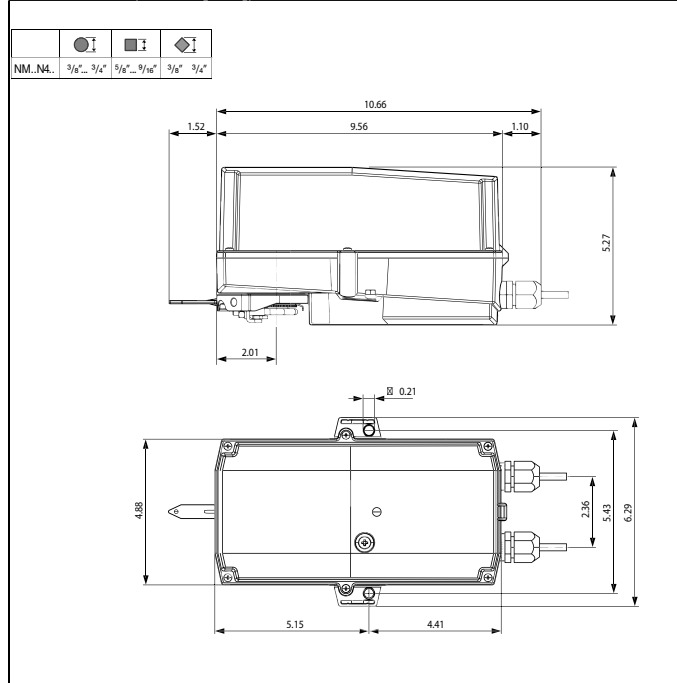
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMB(X)24-MFT-T N4 provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMB(X)24-MFT-T N actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



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**Accessories**

S1A, S2A	Auxiliary Switch (es)
P...A	Feedback Potentiometers
SGA24	Min positioners for surface mounting
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 3/4" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**

**INSTALLATION NOTES**

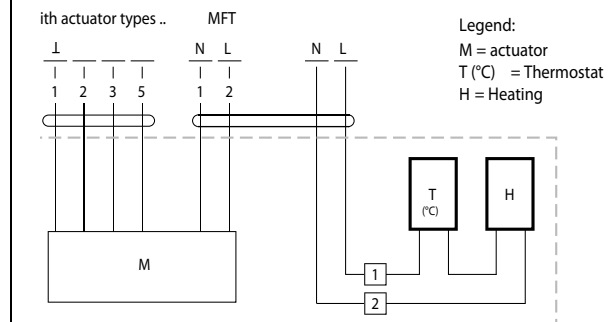
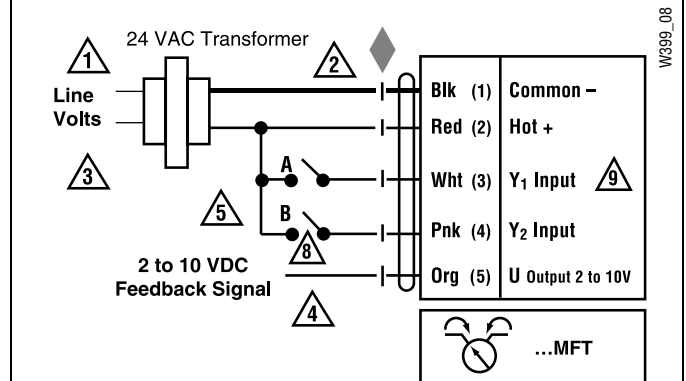
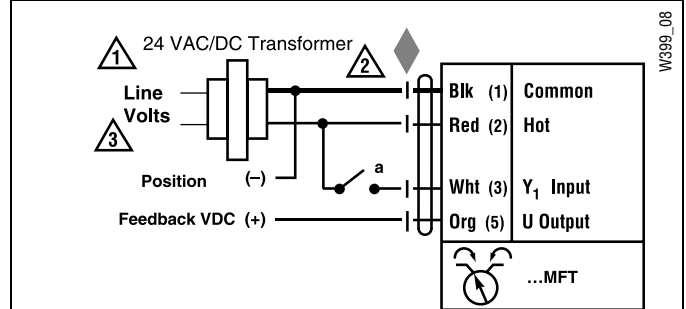
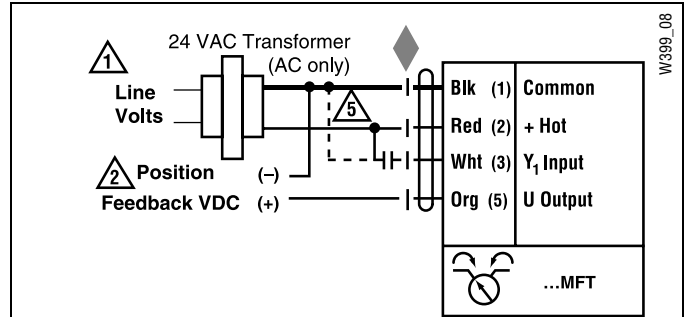
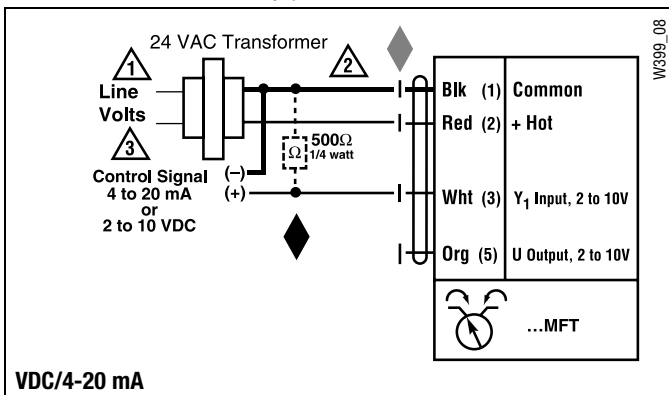
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

**APPLICATION NOTES**

The ZG-R01 500 Ω resistor may be used.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

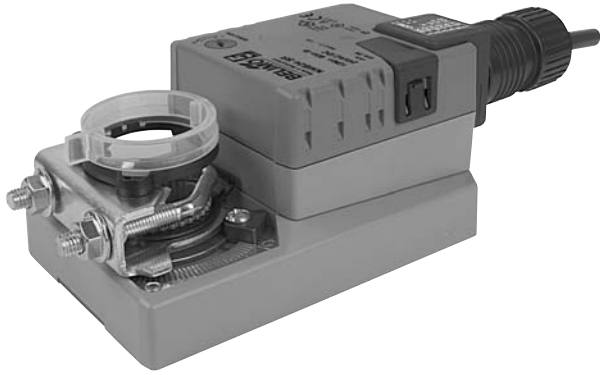


**Note**  
 The following points must be taken into account with independent, external wiring:

- All contact between the cables or wires that are introduced and the heating element is to be avoided.
- Where necessary, use cables with sufficient numbers of wires, e.g. so that the heating and the actuator can be supplied separately with voltage.

# NMCX24-MFT

Proportional, Non-Spring Return, 24 V, Multi-Function Technology®



Technical Data	NMCX24-MFT
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	3.5 W (1.25 W)
Transformer sizing	5.5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of rotation	max. 95°, adjust. with mechanical stop electronically variable
Torque	90 in-lb [10 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	45 seconds (default) variable (20 to 60 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.1 lbs [0.95 kg]

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

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The default parameters for 2 to 10 VDC applications of the . . .MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

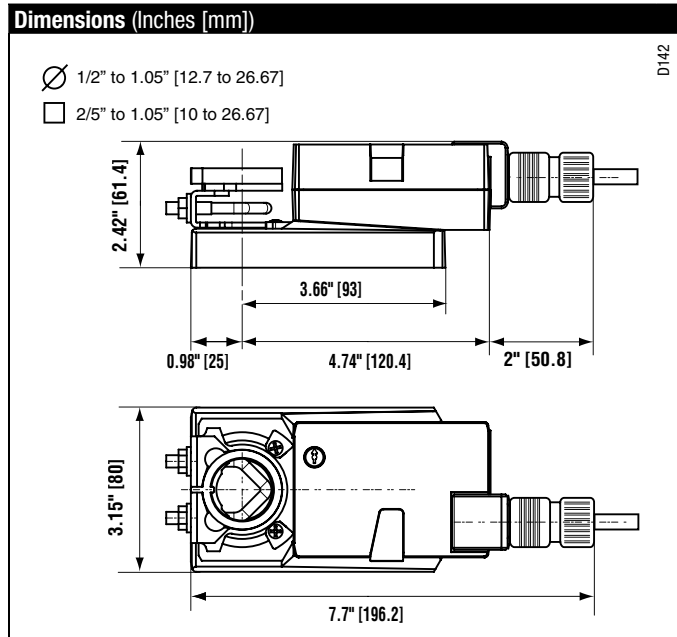
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMCX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMCX24-MFT actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function

to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode. Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

NOTE: When using NMCX24-MFT actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

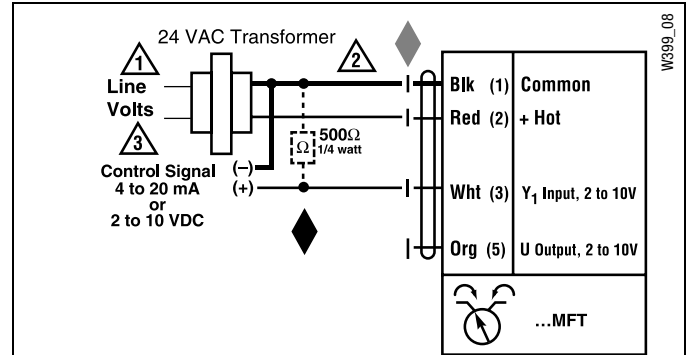
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

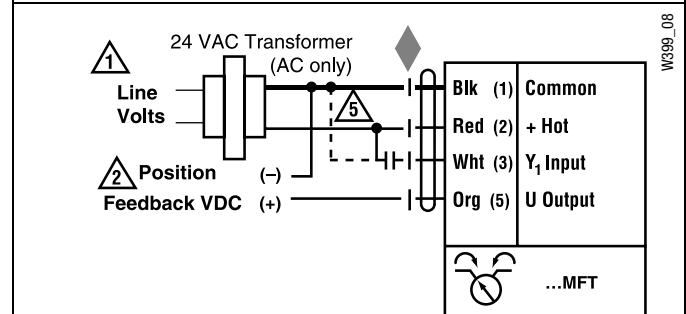
- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

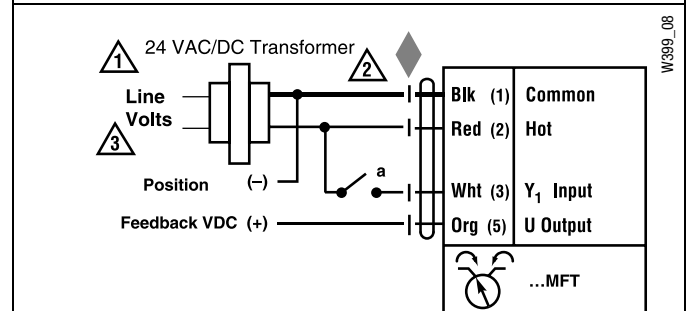
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



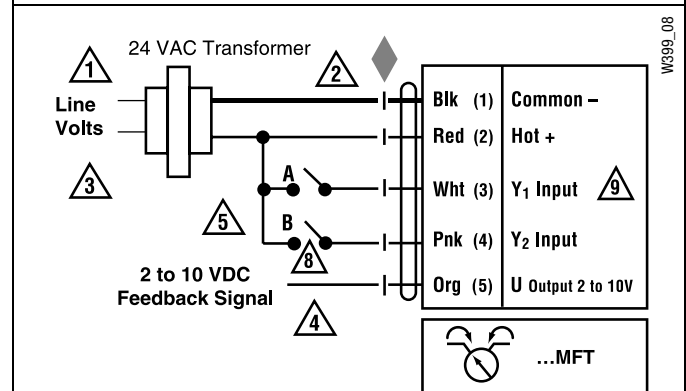
VDC/4-20 mA



PWM



On/Off control



Floating Point control

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# NMX24-MFT95

Proportional, Non-Spring Return, 24 V, 0 to 135 Ω Input



MFT



Technical Data	NMX24-MFT95
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	3.5 W (1.3 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range WRB	0 to 135 Ω Honeywell Electronic Series 90, 0 to 135 Ω input
Feedback output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	90 in-lb [10 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default) variable (45 to 170 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	ULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.1 lbs [0.95 Kg]

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

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The default parameters for 0 to 135 Ω input applications of the ...MFT95 actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

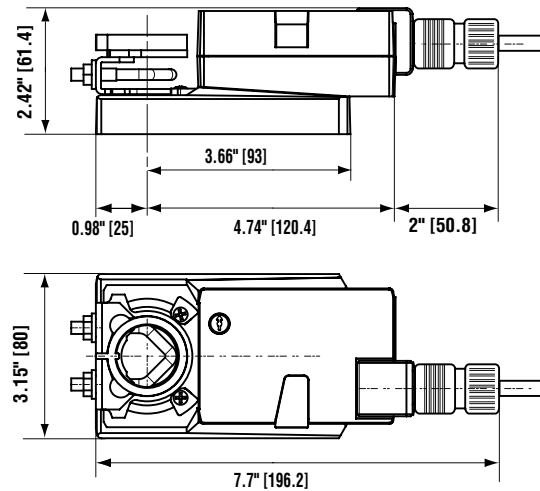
The NMX24-MFT95 actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])

∅ 1/2" to 1.05" [12.7 to 26.67]

□ 2/5" to 1.05" [10 to 26.67]



D142

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### Accessories

K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using NMX24-MFT95 actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 0 to 135 Ω input control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

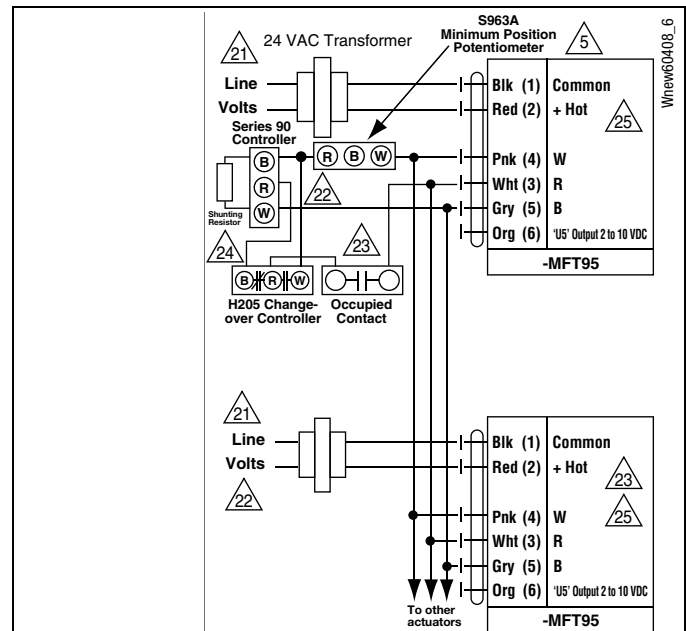
### Wire Colors

1 = Black	3 = White	5 = Gray
2 = Red	4 = Pink	6 = Orange

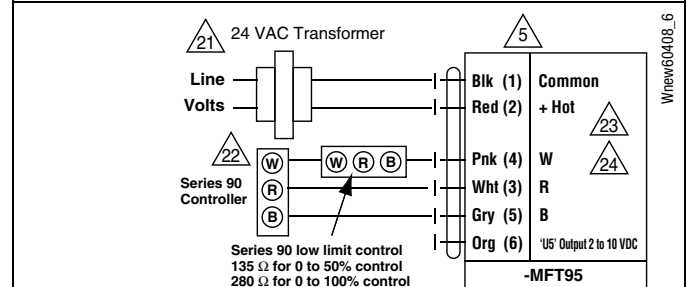
### Wiring Diagrams

#### INSTALLATION NOTES

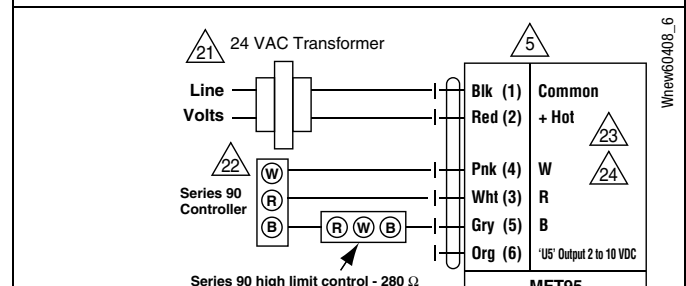
- 1 Provide overload protection and disconnect as required.
- 2 Actuators and controller must have separate transformers.
- 3 Consult controller instruction data for more detailed installation information.
- 4 Resistor value depends on the type of controller and the number of actuators. No resistor is used for one actuator. Honeywell resistor kits may also be used.
- 5 To reverse control rotation, use the reversing switch.



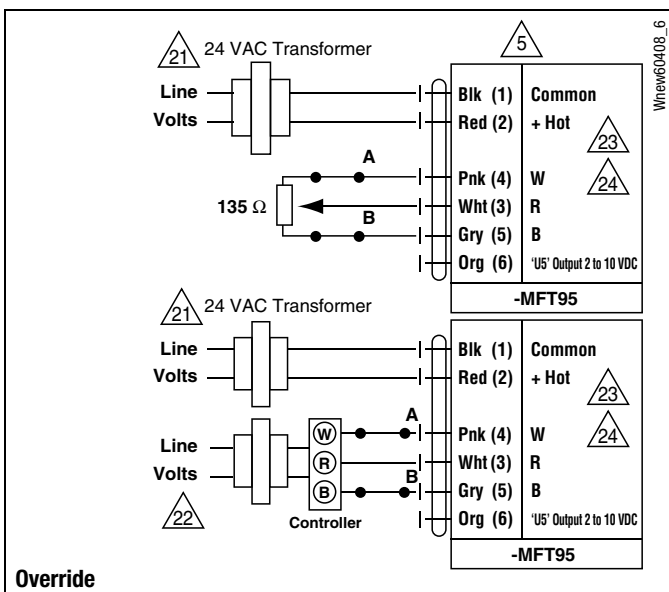
#### Wiring multiple actuators to a Series 90 controller using a minimum position potentiometer.



#### Low Limit Control



#### High Limit Control



#### Override

# NMX24-PC

Proportional, Non-Spring Return, 24 V, 0 to 20V Phasecut



Technical Data	NMX24-PC
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	3.5 W (1.3 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	0 to 20V phasecut
Input impedance	8 k $\Omega$ (50 mW)
Feedback output U	2 to 10 VDC, 0.5 mA max
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	90 in-lb [10 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.1 lbs [0.95 kg]

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

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled (only the positive part of the sine wave) to the damper shaft.

The actuator operates in response to 0 to 20V phasecut control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication.

## Operation

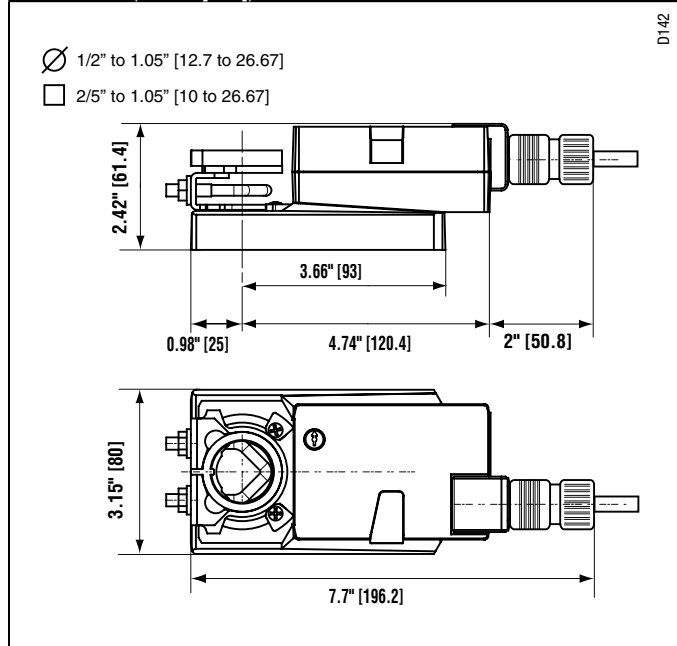
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMX24-PC actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



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Accessories	
K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using NMX24-PC actuators, only use accessories listed on this page.

### Typical Specification

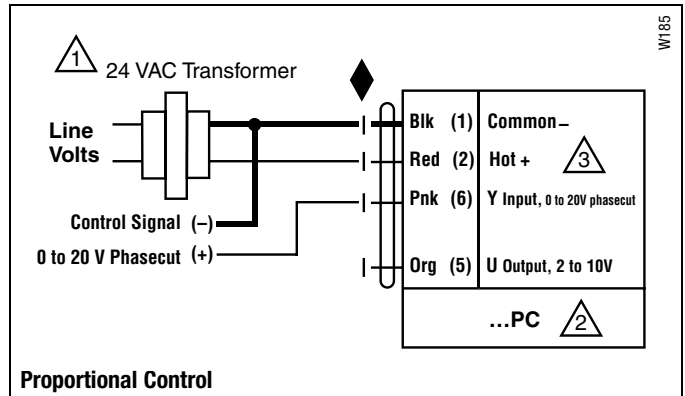
Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to 0 to 20V phasecut control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### ✂ **INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

**⚠ WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# NMQB(X)24-1

On/Off, Non-Spring Return, 24 V



Technical Data	NMQB(X)24-1
Power supply	24 VAC $\pm 20\%$ 50/60 Hz 24 VDC $\pm 10\%$
Power consumption	13 W (1.5 W)
Transformer sizing	23 VA (Class 2 power source) (I max 20A@5ms)
Electrical connection	3 ft [1m] 10 ft [3m] 16 ft [5m] 18 GA plenum rated cable protected NEMA 2 (IP54)
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off
Input impedance	100 $\Omega$
Angle of rotation	min. 30°, max. 95°, adjust. with mechanical stop
Torque	70 in-lb [10 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	4, 10 or 15 seconds constant independent of load
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<52 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.8 lbs [0.85 kg]

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

Torque min. 70 in-lb for control of damper surfaces up to 17 sq ft.

## Application

For On/Off control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

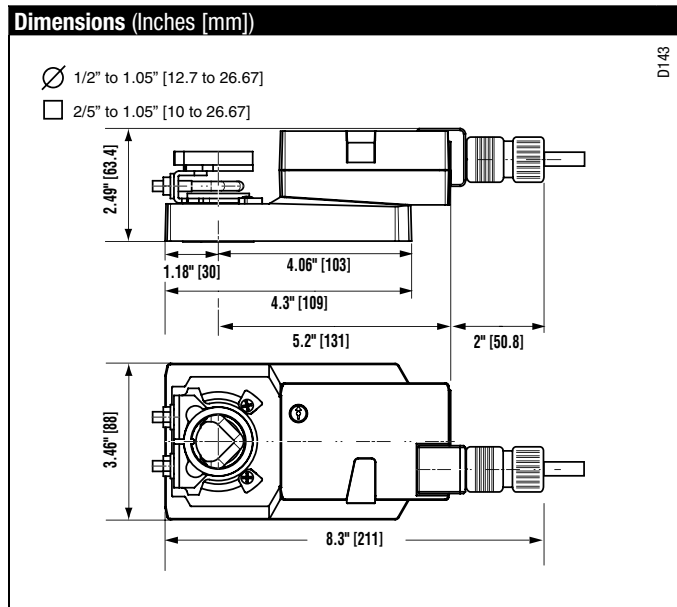
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMQB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMQB(X)24-1 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-T	Terminal Cover for NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using NMQB(X)24-1 actuators, only use accessories listed on this page.

### Typical Specification

On/Off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### ✂️ INSTALLATION NOTES

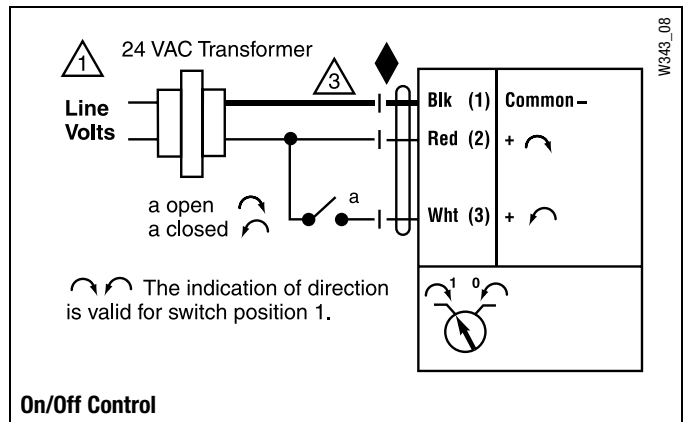
- ⚠️ 1 Provide overload protection and disconnect as required.
- ⚠️ 3 Actuators may also be powered by 24 VDC.

#### 📄 APPLICATION NOTES

- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# NMQB(X)24-MFT

Proportional, Non-Spring Return, 24 V, Multi-Function Technology®



MFT



Technical Data	NMQB(X)24-MFT
Power supply	24 VAC ±20% 50/60 Hz 24 VDC ±10%
Power consumption	13 W (1.5 W)
Transformer sizing	23 VA (Class 2 power source) (I max 20A@5ms)
Electrical connection	3 ft [1m] 10 ft [3m] 16 ft [5m] 18 GA plenum rated cable protected NEMA 2 (IP54)
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default)
Variable (VDC, on/off)	on/off
Input impedance	100 kΩ (0.1 mA), 500 Ω, 1000 Ω (on/off)
Feedback output U	2 to 10 VDC, 0.5mA max, VDC variable
Angle of rotation	min. 30°, max. 95°, adjust. with mechanical stop electronically variable
Torque	70 in-lb [8 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	4, 10 or 15 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<52 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.8 lbs [0.85 kg]

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

Torque min. 70 in-lb for control of damper surfaces up to 17 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software (version 3.3 or later).

## Operation

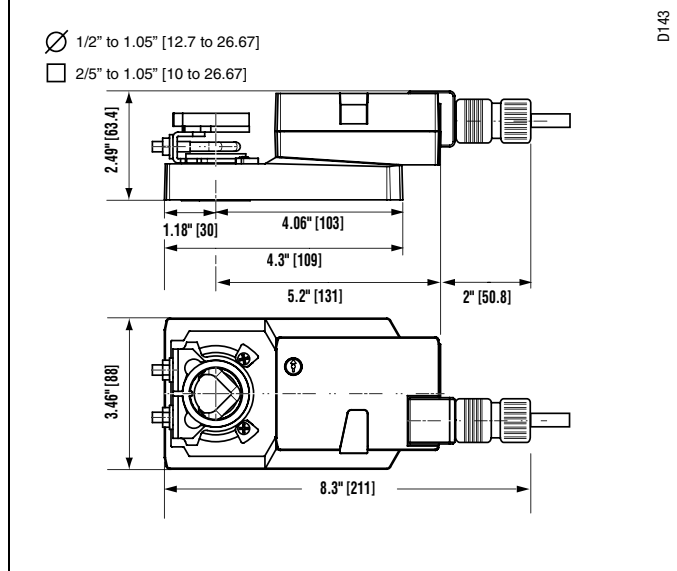
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMQB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMQB(X)24-MFT actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



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### Accessories

K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using NMQB(X)24-MFT actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover.

Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

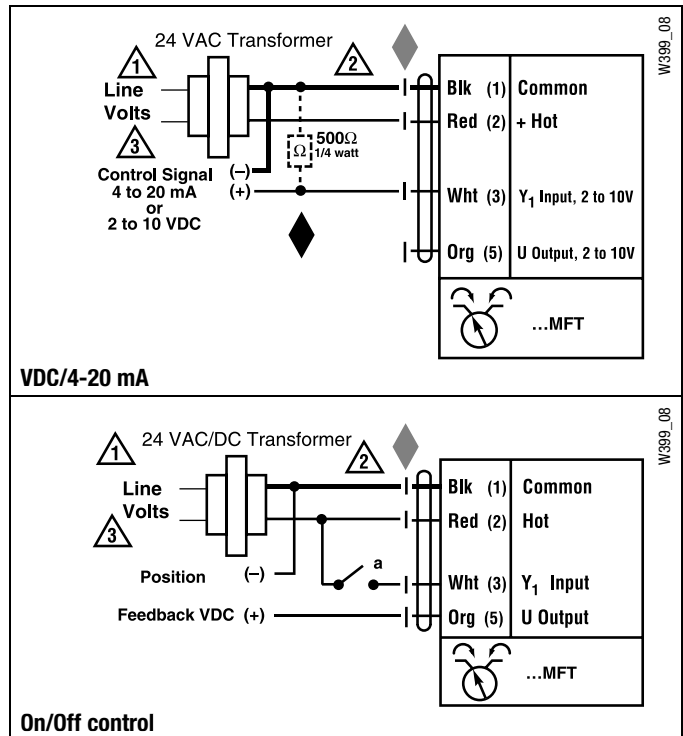
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.

#### 📄 APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor may be used.

#### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# NMX24-LON

LonWorks®, Non-Spring Return, 24 V



Technical Data	NMX24-LON
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	3.5 W (1.3 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m]
Overload protection	electronic throughout 0 to 95° rotation
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	90 in-lb [10 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.1 lbs [0.95 kg]

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

LonWorks®	
Certified	according to LonMARK® 3.3
Processor	Neuron 3120
Transceiver	FTT-10A, compatible with LPT-10
Functional profile	according to LonMARK® Damper actuator object #8110 open loop sensor object #1
LNS plug-in for actuator/sensor	can be run with any LNS based integration tool (min. for LNS 3.x)
Service button and status LED	according to LonMARK® guidelines
Conductors, cables	conductor lengths, cable specifications and topology of the LonWorks® network according to the Echelon® directives

LonWorks and LonMARK © 2007-2009 LonMark International

**Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.**

## Application

Direct coupled actuators for direct link to LonWorks network. Actuators are easily installed by direct shaft mounting on air dampers in ventilation and air conditioning systems. Actuator can be controlled by any compatible LON controller or automation system.

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

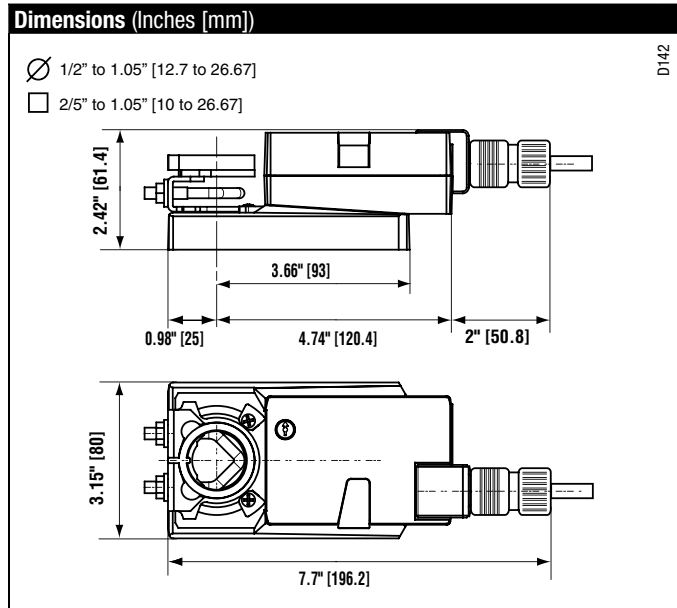
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMX24-LON series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMX24-LON actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

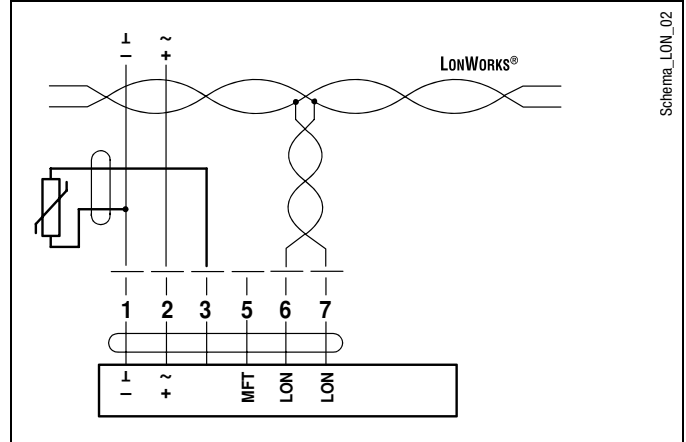
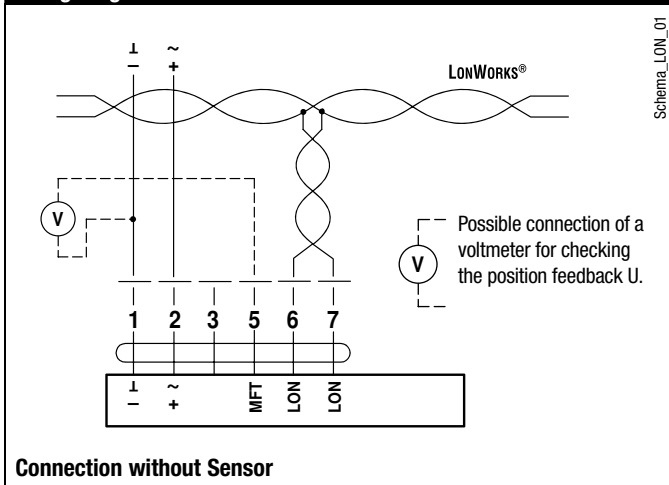
K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using NMX24-LON actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

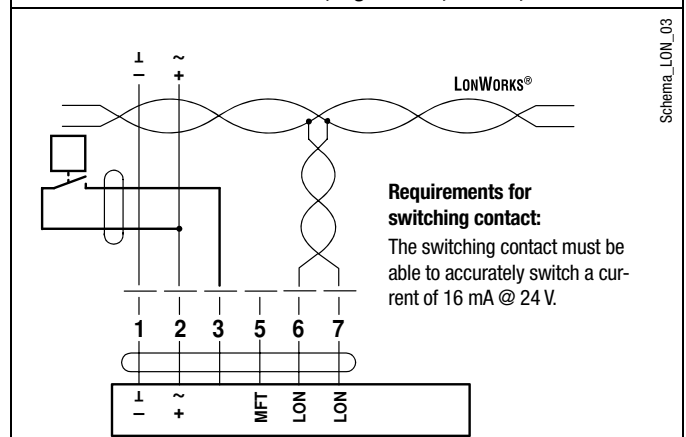


#### Sensor scaling:

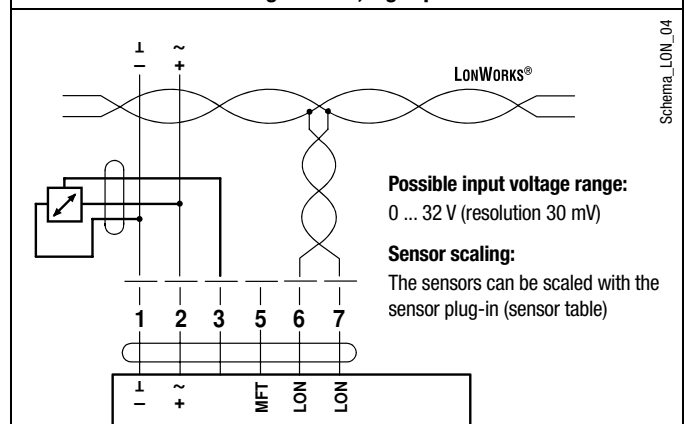
The sensors can be scaled with the sensor plug-in (sensor table).

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 ... 60 kΩ	1 Ω

### Connection with Passive Sensor, e.g. Pt1000, Ni1000, NTC



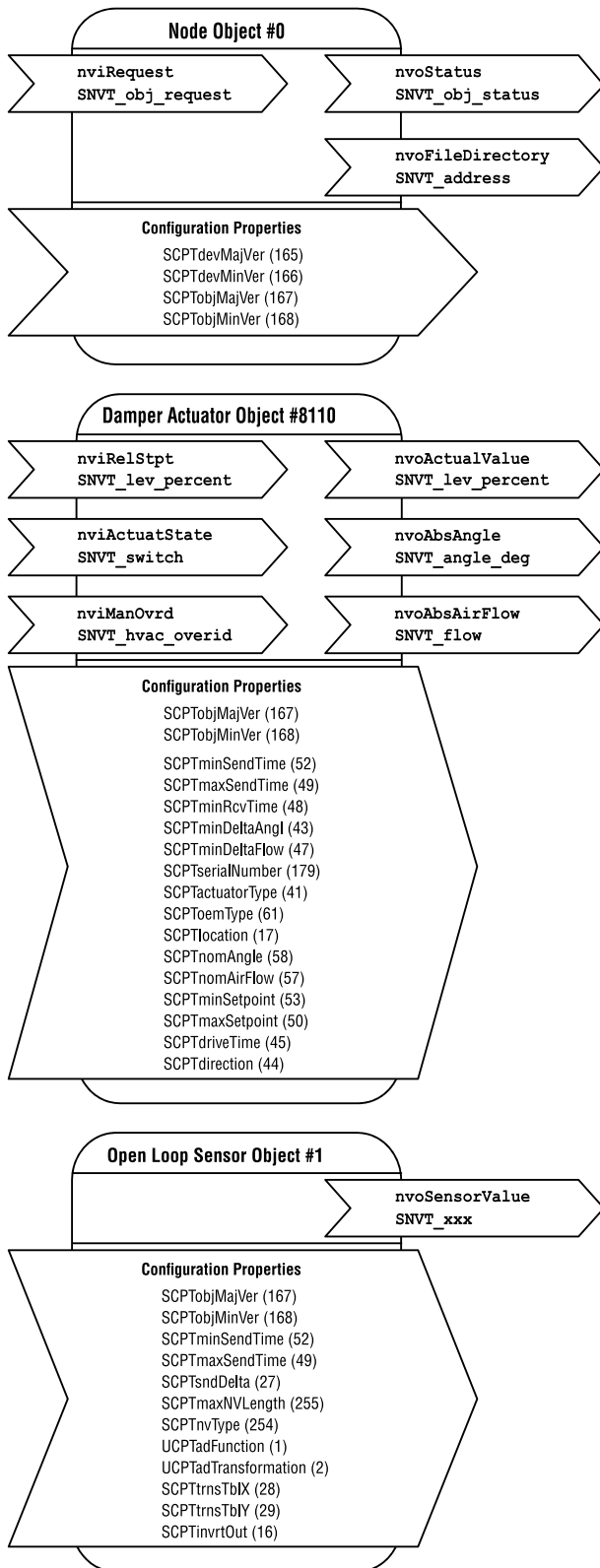
### Connection with Switching Contact, e.g. Δp-monitor



### Connection with Active Sensor, e.g. 0...10 V @ 0...50° C

**Functional Profile according to LonMARK®**

The LON-capable damper actuator is certified by LonMARK®. The actuator functions are supplied with the LonWorks® network as standardized network variables according to LonMARK®. The Node Object #0, the Damper Actuator Object #8110 and the Open Loop SensorObject #1 are implemented in the actuator.



**Node object #0**

The node object contains the object status and object request functions.

**nviRequest**                      **SNVT\_obj\_request**  
Input variable for requesting the status of a particular object in the node.

**nvoStatus**                      **SNVT\_obj\_status**  
Output variable that outputs the current status of a particular object in the node.

**nvoFileDirectory**              **SNVT\_address**  
Output variable that shows information in the address range of the Neuron chip.

**Damper actuator object #8110**

The actuator object is used to map the functions of the MP actuators to the LONWORKS® network.

**nviRelStpt**                      **SNVT\_lev\_percent**  
The nominal position is assigned to the actuator via this input variable. This variable is normally linked to the output variable of an HVAC controller.

**nviActuateState**              **SNVT\_switch**  
A preset position is assigned to the actuator via this input variable. Note on priority: The last variable that was active, either nviActuatorState or nviRelStpt, has priority.

**nviManOvrld**                    **SNVT\_hvac\_overid**  
These input variables can be used to manually override the actuator into a particular position.

**nvoActualValue**              **SNVT\_lev\_percent**  
This output variable shows the current actual position of the actuator and can be used for control circuit feedback or for displaying positions.

**nvoAbsAngle**                    **SNVT\_angle\_deg**  
This output variable shows the current angle of rotation of the actuator or the valve and can be used to display the position or for service purposes.

**nvoAbsAirFlow**                **SNVT\_flow**  
This output variable is inactive with the SR24ALON-5 rotary actuator and shows a constant value of 65535 (this variable is only active in conjunction with LON-capable VAV controllers).

**Open loop sensor object #1**

A sensor can be connected to the rotary actuator. A passive resistance sensor (e.g. Ni1000), an active sensor (output 0 ... 32 V) or a switch (on/off) can be connected. The open loop sensor object transfers the measured sensor values to the LONWORKS® network.

**nvoSensorValue**              **SNVT\_xxx**  
This output variable shows the current sensor value. Depending on the connected sensor, the output variable can be configured via the sensor plug-in and specifically adapted to the system.

**The SNVT\_... can be configured as:**

SNVT_temp_p	SNVT_lev_percent	SNVT_lux
SNVT_temp	SNVT_abs_humid	SNVT_press_p
SNVT_switch	SNVT_enthalpy	SNVT_smo_obscur
SNVT_flow	SNVT_ppm	SNVT_power
SNVT_flow_p	SNVT_rpm	SNVT_elec_kwh

**Notes**

Detailed information on the functional profiles can be found on the website of LonMARK® ([www.lonmark.org](http://www.lonmark.org)).



<b>1 Direction of rotation switch</b>	
Switching over	Direction of rotation changes
<b>2 Pushbutton and green LED display</b>	
Off	No voltage supply or malfunction
Green, on	Operation
Press button	Switches on angle of rotation adaption followed by standard operation
<b>3 Service button for commissioning LONWORKS® and yellow LED display for the LON status</b>	
Off	The SR24ALON-5 rotary actuator is connected and ready for operation in the LONWORKS®network.
Yellow, on	No application software is loaded in the SR24ALON-5.
Yellow, flashing (flashing interval 2 seconds)	The SR24ALON-5 is ready for operation but not integrated in the LONWORKS® network (unconfigured).
Other flashing codes	A fault is present in the SR24ALON-5.
Press button	Service Pin Message is sent to the LONWORKS®network.
<b>4 Gear disengagement switch</b>	
Press button	Gear disengaged, motor stops, manual operation possible
Release button	Gear engaged, synchronisation starts, followed by standard operation
<b>5 Service plug</b>	
For connecting MFT parameterizing and service tools	

Versatile and Powerful

- Minimum 45 in-lb torque in a compact package.

For damper areas up to 11 sq-ft\*



Actuators in bold have BDCM

LM Series - At A Glance

		<i>LMB(X)24-3(-S)(-T) (p. 319)</i>	<i>LMB24-3-P5-T (p. 319)</i>	<i>LMB24-3-P10-T (p. 319)</i>	<i>LMCB24-3-T (p. 321)</i>	<i>LMX120-3 (p. 232)</i>	<i>LMB(X)24-SR-T (p. 325)</i>	<i>LMCB24-SR-T (p. 327)</i>	<i>LMX120-SR (p. 329)</i>	<i>LMB(X)24-MFT (p. 331)</i>	<i>LMX24-MFT95 (p. 333)</i>	<i>LMX24-PC (p. 335)</i>	<i>LMQB(X)24-1 (p. 337)</i>	<i>LMQB(X)24-MFT (p. 339)</i>	<i>LMX24-LON (p. 341)</i>	<i>LMB24-HM (10P-HM) (p. 345)</i>
Basic Product		•	•	•	•		•	•		•			•	•		
Flexible Product		•				•	•		•	•	•	•	•	•	•	
Torque	45 in-lb [5 Nm]	•	•	•	•	•	•	•	•	•	•	•			•	•
	35 in-lb [4 Nm]												•	•		
Angle of Rotation	95 degrees	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Power Supply	24 VAC/DC	•	•	•	•		•	•		•	•	•	•	•	•	•
	100 to 240 VAC					•			•							
Control Input	On/Off												•			•
	On/Off, Floating Point	•	•	•	•	•										
	2 to 10 VDC (4 to 20mA)						•	•	•							
	Multi-Function Technology									•				•		
	135 Ω										•					
	0 to 20V Phasecut											•				
LonWORKS®														•		
Feedback	None	•			•	•	•						•			
	5 kΩ Potentiometer		•													
	10 kΩ Potentiometer			•												•
	2 to 10 VDC						•	•	•			•				
	Variable (0 to 10 VDC)									•	•			•		
Running Time	95 seconds	•	•	•	•	•	•	•	•			•				•
	35 seconds							•								
	Adjustable 2.5 to 10 seconds												•	•		
	Adjustable 35 to 150 seconds	•				•	•	•	•	•	•					•
	150 seconds														•	
Wiring	Plenum Rated Cable	•			•	•	•	•	•	•	•	•	•	•	•	•
	Appliance Rated Cable					•		•								
	Terminal Strip	•	•	•	•	•	•	•		•	•	•	•	•	•	•
	Conduit Fitting	•			•	•	•	•	•	•	•	•	•	•	•	
Auxiliary Switch	Built-In	•														
	Add-On	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Installation and Operation... (page 400).

\*Based on 4 in-lb/ft² damper torque loading. Parallel blade. No edge seals.

# A CLOSER LOOK...

- Brushless DC Motor for Added Accuracy and Controllability.
- Cut Labor Costs with Simple Direct Coupling.
- Self-Centers on 5/8" Jackshafts with Standard Clamp or 3/4" with Flexible Line Selection or Accessory Clamp.
- Check Damper Position with Clear Position Indicator.
- Don't Worry about Actuator Burn-Out; Belimo is Overload Proof throughout Rotation.
- Enjoy Added Flexibility with Easy Mechanical Stops to Adjust Angle of Rotation.
- Need to Change Control Direction? Do it easily with a Simple Switch.
- Easily Accessible Manual Override Button helps you Pre-Tension Damper Blades.
- Fully Adjustable Built-In Auxiliary Switch (LMB24-3-S).
- Auxiliary Switch and Feedback Potentiometer Add-Ons Mount Directly on Clamp, Includes Conduit Connector.
- Standard 3ft Plenum Rated Cable and Conduit Connector Provided on Basic Models.
- Added Flexibility to Select Clamp, Electrical Connection, and Running Time to fit your Specific Application with Belimo's New Flexible Line of Actuators.



**Bulk Packaging Offers Big Value for Large jobs, Stocking Orders.**



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## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

# LMB(X)24-3(-S)(-P5)(-P10)(-T)

On/Off, Floating Point, Non-Spring Return, 24 V



Technical Data	LMB(X)24-3(-S)(-P5)(-P10)(-T)
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	1.5 W (0.2 W)
Transformer sizing	2.5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector, protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 $\Omega$
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	45 in-lb [5 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150, 95, 60, 45, or 35 seconds constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.1 lbs [0.5 kg]

LMB24-3-S	
Electrical connection	3 ft, 18 GA appliance rated cable 1/2" conduit connector
Auxiliary switch	adj. 0° to 100°, SPDT 3 A (0.5A) @ 250 VAC
Weight	1.4 lbs [0.6 kg]

LMB24-3-P10-T	
Electrical connection	screw terminal (for 26 to 14 GA wire)
Feedback	10 k $\Omega$ , 1W potentiometer

LMB24-3-P5-T (bulk pack only)	
Feedback	5 k $\Omega$ , 1W potentiometer
Housing	NEMA 1/IP20

LMB24-3-T	
Electrical connection	screw terminal (for 26 to 14 GA wire)
Housing	NEMA 1/IP20

†Rated Impulse Voltage 800V, Type of action 1, (1.B for -S version), Control Pollution Degree 3.

Torque min. 45 in-lb for control of damper surfaces up to 11 sq ft.

## Models

LMB(X)24-3	LMB24-3.1 (bulk)	LMB24-3-P10-T
LMB(X)24-3-T	LMB24-3-T.1 (bulk)	LMB24-3-S
LMB24-3-P5-T	LMB24-3-P5-T.1 (bulk)	

## Application

For On/Off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 5/8" in diameter by means of its standard universal clamp. Shafts up to 3/4" diameter can be accommodated by an accessory clamp.

## Operation

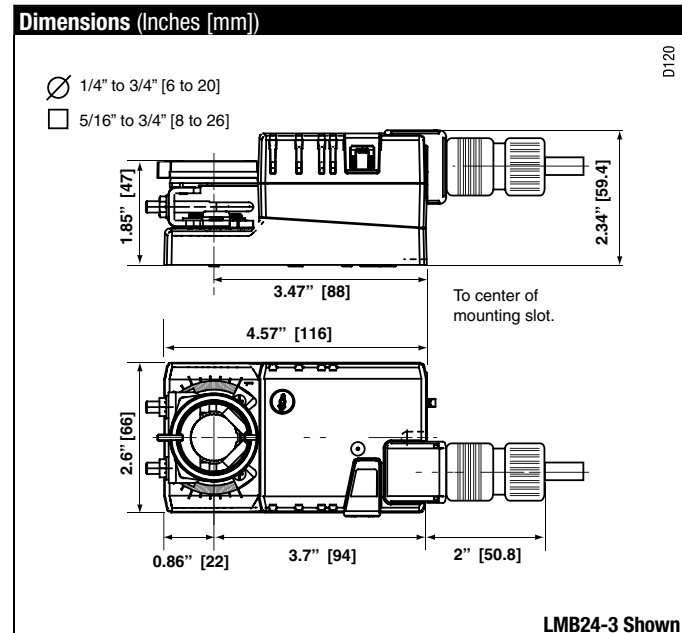
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMB series provides 95° of rotation and a visual indicator which indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be disengaged with manual release on the actuator cover.

The LMB24-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

The LMB24-3-S version is provided with one built-in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable 0 to 95°. The auxiliary switch is double insulated so an electrical ground connection is not necessary.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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**Accessories**

K-LM20	3/4" [20 mm] Shaft Clamp
AV6-20	Shaft Extension
ZG-LMSA	Shaft Adaptor for 1/2" Diameter Shafts
ZG-LMSA-1	Shaft Adaptor for 3/8" Diameter Shafts
ZS-T	Terminal Cover for NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using LMB(X)24-3... actuators, only use accessories listed on this page.

**Typical Specification**

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Shafts up to 3/4" diameter can be accommodate with an accessory clamp. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuator will be provided with screw terminal strip for electrical connections [LMB(X)24-3-T]. If required, actuators shall be provided with one adjustable SPDT auxiliary switch. 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. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**

**INSTALLATION NOTES**

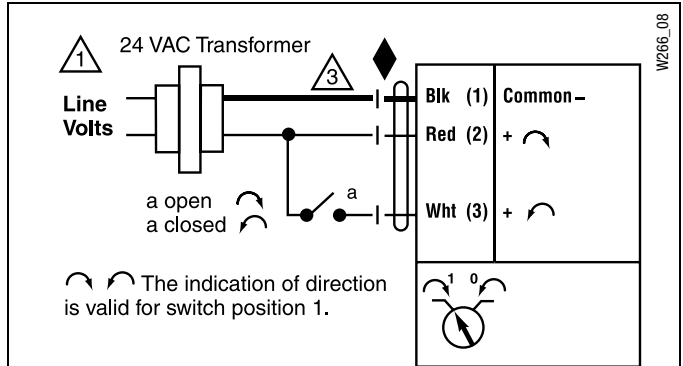
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., xMB24-3-S incorporates one built-in auxiliary switches: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0 to 95.

**APPLICATION NOTES**

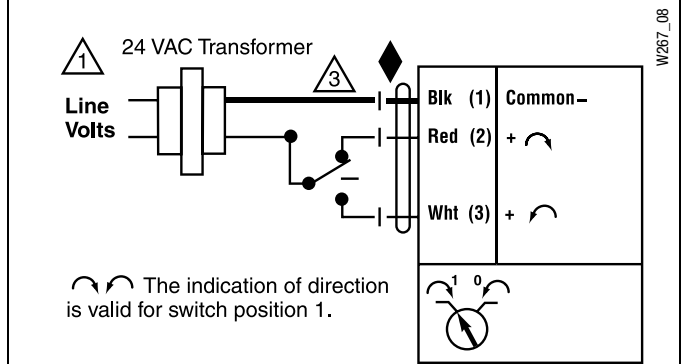
- Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

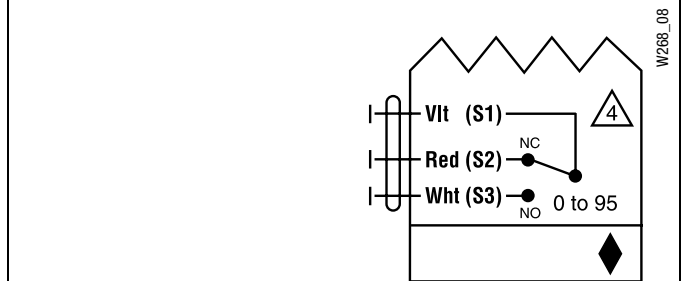
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



**On/Off control**



**Floating Point or On/Off control**



**Auxiliary Switch**

# LMCB24-3(-T)

On/Off, Floating Point, Non-Spring Return, 24 V



Technical Data	LMCB24-3(-T)
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	1.5 W (0.2 W)
Transformer sizing	3 VA (Class 2 power source)
Electrical connection	3 ft, 18 GA plenum rated cable (-S versions) 1/2" conduit connector protected NEMA 2 (IP54)
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 $\Omega$
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	45 in-lb [5 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	35 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.1 lbs [0.5 kg]

LMCB24-3-T	
Electrical connection	screw terminal (for 26 to 14 GA wire)
Housing	NEMA 1/IP20

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

Torque min. 45 in-lb for control of damper surfaces up to 11 sq ft.

## Models

LMCB24-3  
LMCB24-3-T

## Application

For On/Off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 5/8" in diameter by means of its standard universal clamp. Shafts up to 3/4" diameter can be accommodated by an accessory clamp.

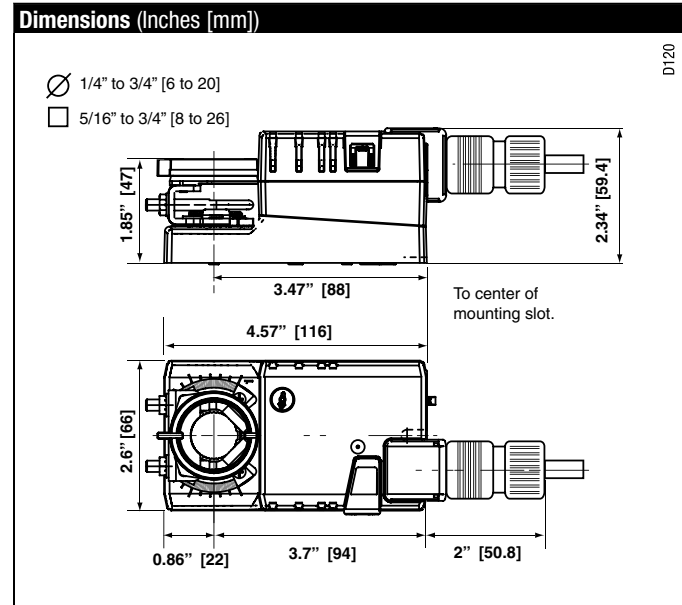
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMB series provides 95° of rotation and a visual indicator which indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be disengaged with manual release on the actuator cover.

The LMCB24-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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#### Accessories

K-LM20	3/4" [20 mm] Shaft Clamp
AV6-20	Shaft Extension
ZG-LMSA	Shaft Adaptor for 1/2" Diameter Shafts
ZG-LMSA-1	Shaft Adaptor for 3/8" Diameter Shafts
ZS-T	Terminal Cover for NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using LMCB24-3... actuators, only use accessories listed on this page.

#### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Shafts up to 3/4" diameter can be accommodate with an accessory clamp. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuator will be provided with screw terminal strip for electrical connections (LMCB24-3-T). If required, actuators shall be provided with one adjustable SPDT auxiliary switch. 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. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

##### ✂️ INSTALLATION NOTES

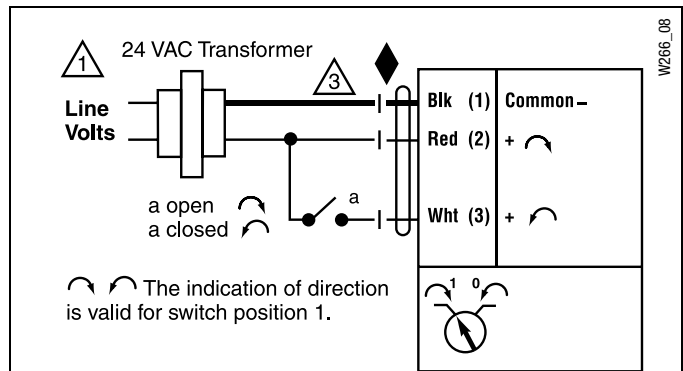
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc.

##### 📄 APPLICATION NOTES

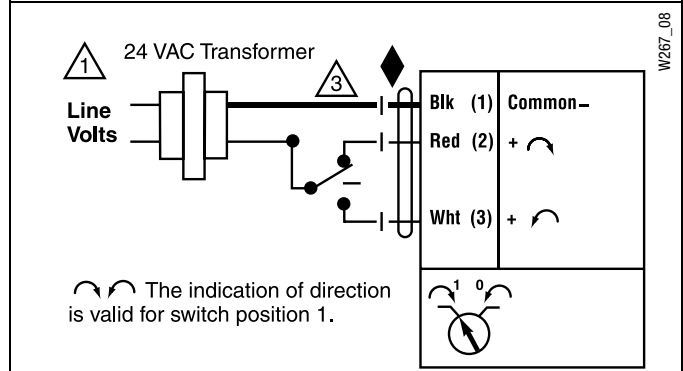
- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

##### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



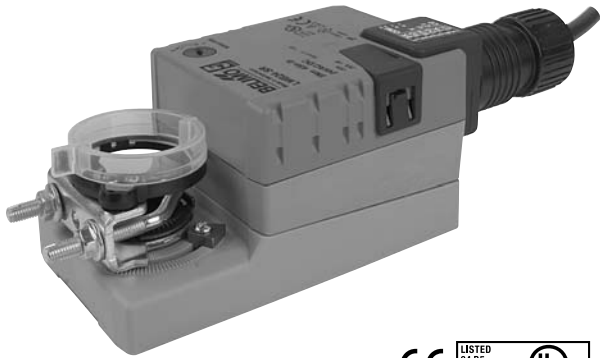
On/Off control



Floating Point or On/Off control

# LMX120-3

On/Off, Floating Point, Non-Spring Return, 100 to 240 VAC



Technical Data		LMX120-3
Power supply	nominal	100 to 240 VAC, 50/60 Hz
	tolerance	85 to 265 VAC, 50/60 Hz
Power consumption		2 W (0.5 W)
Transformer sizing		4 VA (Class 2 power source)
Electrical connection		18 GA appliance rated cable
		1/2" conduit connector
		protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off, floating point
Input impedance		600 Ω
Angle of rotation		max. 95°, adjustable with mechanical stop
Torque		45 in-lb [5 Nm]
Direction of rotation		reversible with  switch
Position indication		reflective visual indicator (snap-on)
Manual override		external push button
Running time		150, 95, 60, 45, or 35 seconds constant independent of load
Humidity		5 to 95% RH non condensing (EN 60730-1)
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA 2, IP54, UL enclosure type 2
Housing material		UL94-5VA
Agency listings†		cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level		<35dB(A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		1.1 lbs [0.5 kg]

†Rated Impulse Voltage 4kV, Type of action 1, Control Pollution Degree 3.

Torque min. 45 in-lb for control of damper surfaces up to 11 sq ft.

## Application

For On/Off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 5/8" in diameter by means of its standard universal clamp. Shafts up to 3/4" diameter can be accommodated by an accessory clamp.

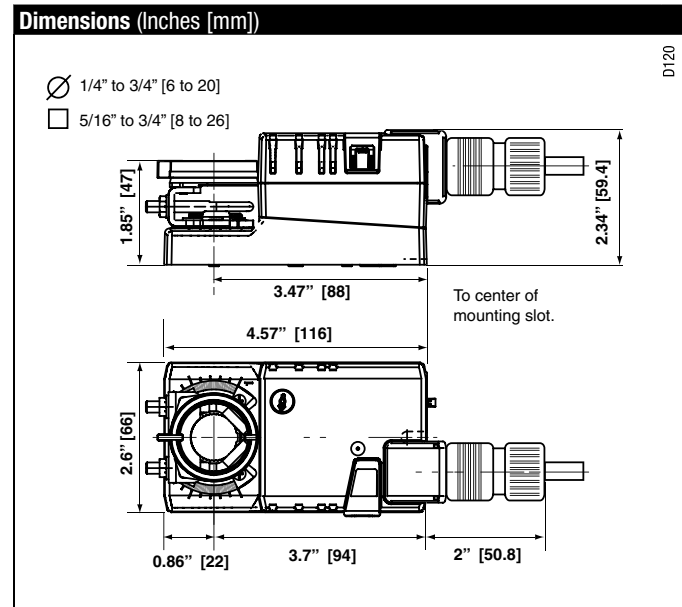
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMX series provides 95° of rotation and a visual indicator which indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be disengaged with manual release on the actuator cover.

The LMX120-3 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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### Accessories

K-LM20	3/4" [20 mm] Shaft Clamp
AV6-20	Shaft Extension
ZG-LMSA	Shaft Adaptor for 1/2" Diameter Shafts
ZG-LMSA-1	Shaft Adaptor for 3/8" Diameter Shafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using LMX120-3 actuators, only use accessories listed on this page.

### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

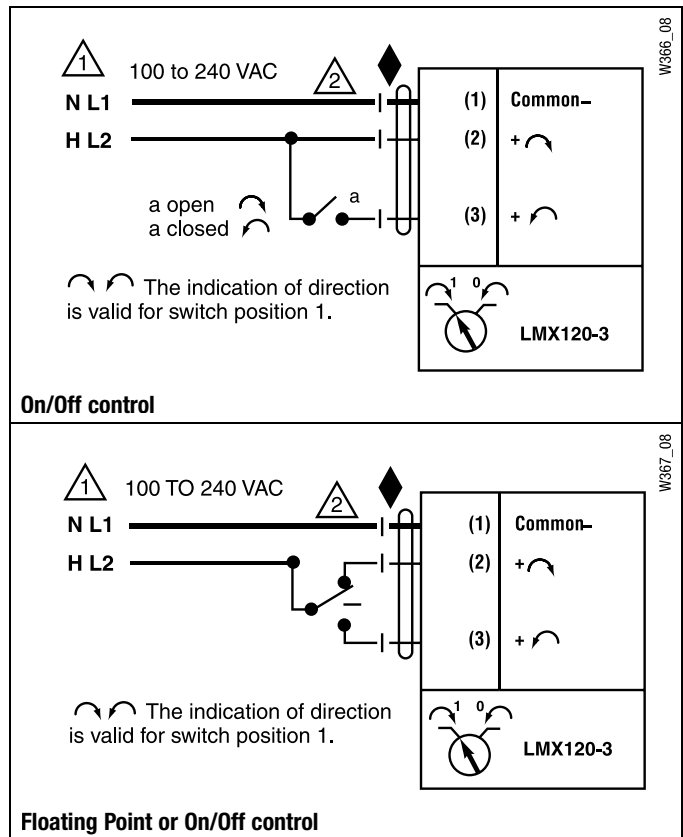
2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption must be observed.

#### 📄 APPLICATION NOTES

◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LMB(X)24-SR(-T)

Proportional, Non-Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	LMB(X)24-SR(-T)
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	1.5 W (0.4 W)
Transformer sizing	3 VA (Class 2 power source)
Electrical connection	3 ft, 18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 k $\Omega$ (0.1 mA), 500 $\Omega$
Feedback output U	2 to 10 VDC (max 0.5 mA)
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	45 in-lb [5 Nm]
Direction of rotation	reversible with  switch actuator will move: =CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	95 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.7 lbs [0.5 kg]

LMB(X)24-SR-T	
Electrical connection	screw terminal (for 26 to 14 GA wire)
Housing	unprotected (NEMA 1/IP20) protected (NEMA 2/IP20) use ZS-T

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

Torque min. 45 in-lb for control of damper surfaces up to 11 sq ft.

## Models

LMB24-SR/LMX24-SR      LMB24-SR.1 (bulk)  
LMB24-SR-T/LMX24-SR-T      LMB24-SR-T.1 (bulk)

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 5/8" in diameter by means of its universal clamp. Shafts up to 3/4" diameter can be accommodated by an accessory clamp.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500  $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

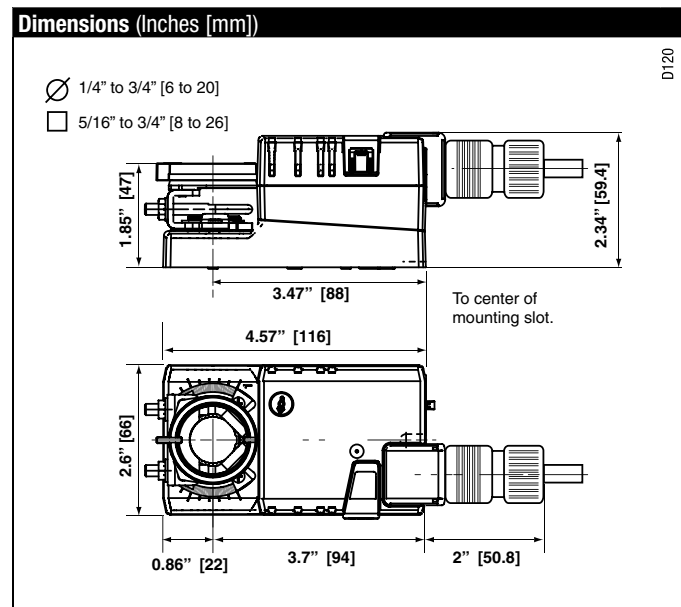
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMB series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LMB24-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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**Accessories**

K-LM20	3/4" [20 mm] Shaft Clamp
AV6-20	Shaft Extension
ZG-LMSA	Shaft Adaptor for 1/2" Diameter Shafts
ZG-LMSA-1	Shaft Adaptor for 3/8" Diameter Shafts
ZS-T	Terminal Cover for NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using LMB(X)24-SR... actuators, only use accessories listed on this page.

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Shafts up to 3/4" diameter can be accommodate with an accessory clamp. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuator will be provided with screw terminal strip for electrical connections (LMB24-SR-T). Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

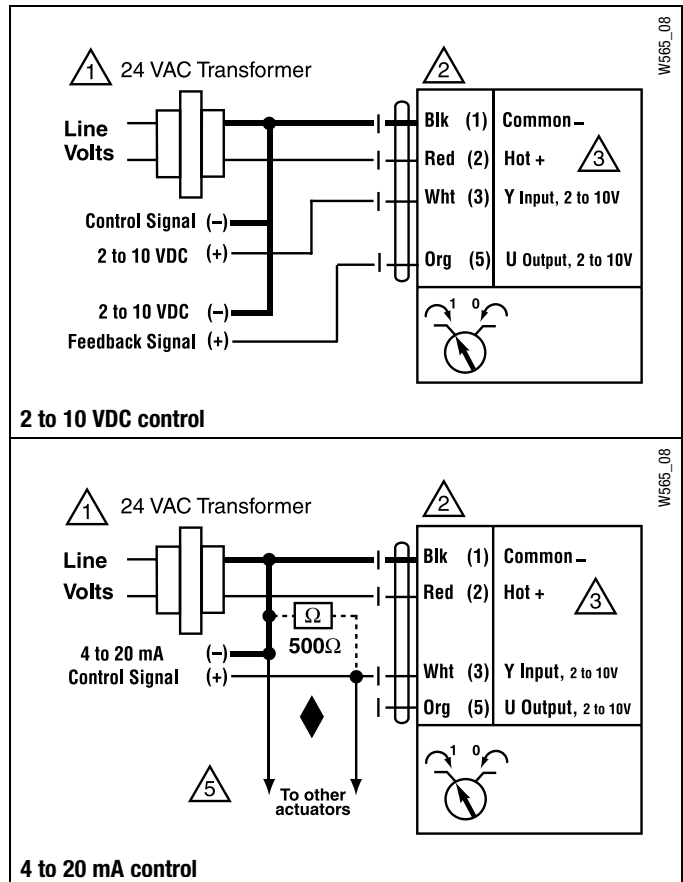
**Wiring Diagrams**
**INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

**APPLICATION NOTES**

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

**WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LMCB24-SR(-T)

Proportional, Non-Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	LMCB24-SR(-T)
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	1.5 W (0.4 W)
Transformer sizing	3 VA (Class 2 power source)
Electrical connection	3 ft, 18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54)
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 k $\Omega$ (0.1 mA), 500 $\Omega$
Feedback output U	2 to 10 VDC (max 0.5 mA)
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	45 in-lb [5 Nm]
Direction of rotation	reversible with  switch actuator will move: =CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	35 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.1 lbs [0.5 kg]

LMCB24-SR-T	
Electrical connection	screw terminal (for 26 to 14 GA wire)
Housing	NEMA 1/IP20

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

Torque min. 45 in-lb for control of damper surfaces up to 11 sq ft.

## Models

LMCB24-SR  
LMCB24-SR-T

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 5/8" in diameter by means of its universal clamp. Shafts up to 3/4" diameter can be accommodated by an accessory clamp.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500  $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

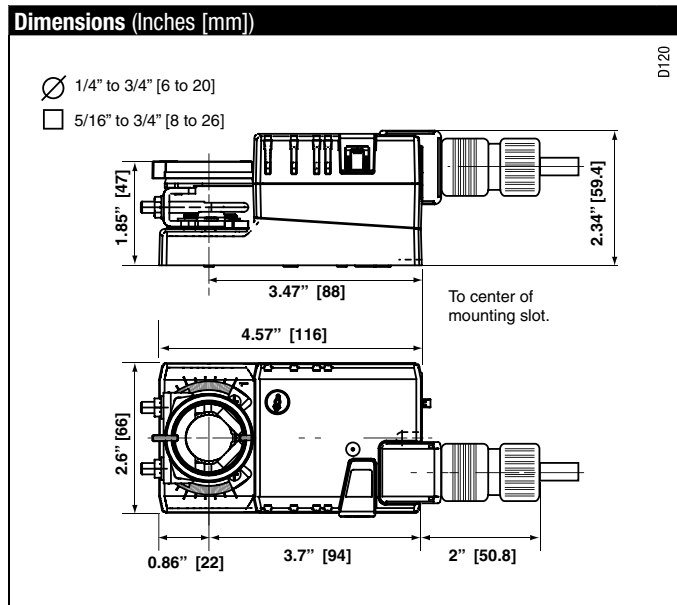
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMB series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LMCB24-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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**Accessories**

K-LM20	3/4" [20 mm] Shaft Clamp
AV6-20	Shaft Extension
ZG-LMSA	Shaft Adaptor for 1/2" Diameter Shafts
ZG-LMSA-1	Shaft Adaptor for 3/8" Diameter Shafts
ZS-T	Terminal Cover for NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using LMCB24-SR... actuators, only use accessories listed on this page.

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Shafts up to 3/4" diameter can be accommodate with an accessory clamp. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuator will be provided with screw terminal strip for electrical connections (LMCB24-SR-T). Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

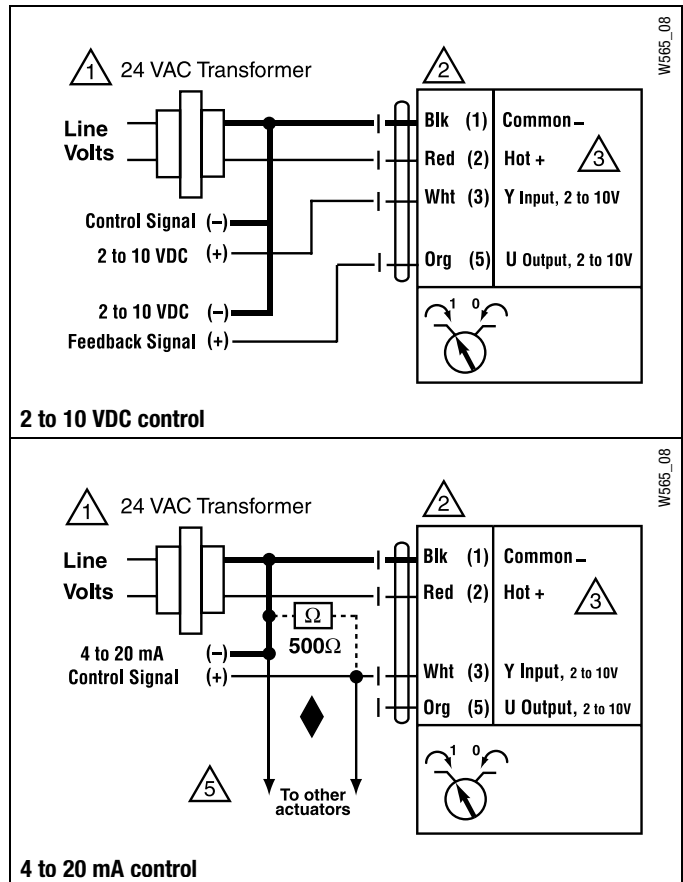
**Wiring Diagrams**
**INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

**APPLICATION NOTES**

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

**WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LMX120-SR

Proportional, Non-Spring Return, 100 to 240 VAC, for 2 to 10 VDC or 4 to 20 mA



Technical Data		LMX120-SR
Power supply	nominal	100 to 240 VAC, 50/60 Hz
	tolerance	85 to 265 VAC, 50/60 Hz
Power consumption		2.5 W (1 W)
Transformer sizing		4.5 VA (Class 2 power source)
Electrical connection		18 GA appliance rated cable
		1/2" conduit connector
		protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20 mA
Input impedance		100 kΩ (0.1 mA), 500 Ω
Feedback output U		2 to 10 VDC (max 0.5 mA)
Angle of rotation		max. 95°, adjustable with mechanical stop
Torque		45 in-lb [5 Nm]
Direction of rotation		reversible with  switch
		actuator will move:
		=CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Position indication		reflective visual indicator (snap-on)
Manual override		external push button
Running time		150, 95, 60, 45, or 35 seconds constant independent of load
Humidity		5 to 95% RH non condensing (EN 60730-1)
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA 2, IP54, UL enclosure type 2
Housing material		UL94-5VA
Agency listings†		cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level		<35dB(A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		1.1 lbs [0.5 kg]

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

Torque min. 45 in-lb for control of damper surfaces up to 11 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 5/8" in diameter by means of its universal clamp. Shafts up to 3/4" diameter can be accommodated by an accessory clamp.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

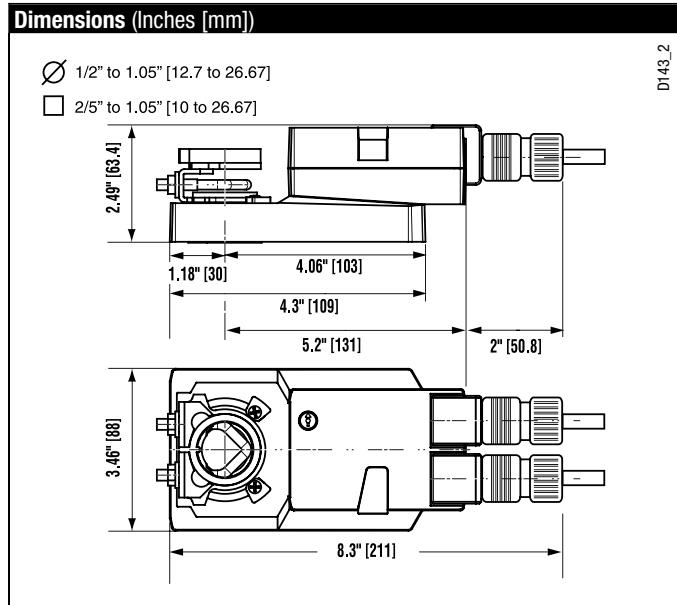
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LMX120-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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**Accessories**

K-LM20	3/4" [20 mm] Shaft Clamp
AV6-20	Shaft Extension
ZG-LMSA	Shaft Adaptor for 1/2" Diameter Shafts
ZG-LMSA-1	Shaft Adaptor for 3/8" Diameter Shafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
S1B, S2B	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module

**NOTE:** When using LMX120-SR actuators, only use accessories listed on this page.

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagram**
**INSTALLATION NOTES**

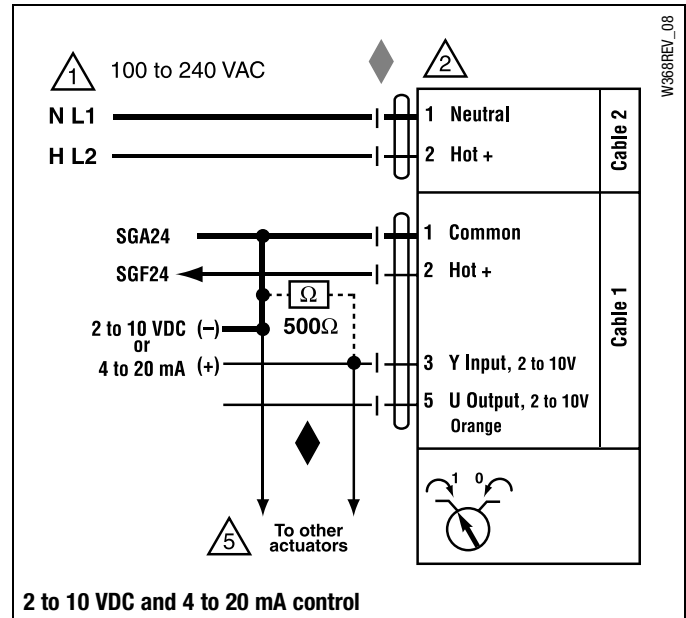
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 5 Only connect common to neg. (-) leg of control circuits.

**APPLICATION NOTES**

- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LMB(X)24-MFT

Proportional, Non-Spring Return, 24 V, Multi-Function Technology®



Technical Data	LMB(X)24-MFT
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	2.5 W (1.2 W)
Transformer sizing	5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector Protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC, 0.5mA max VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	45 in-lb [5 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default) variable (35 to 150 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.5 lbs [0.7 kg]

Torque min. 45 in-lb for control of damper surfaces up to 11 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 5/8" in diameter by means of its universal clamp. Shafts up to 3/4" diameter can be accommodated by an accessory clamp.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

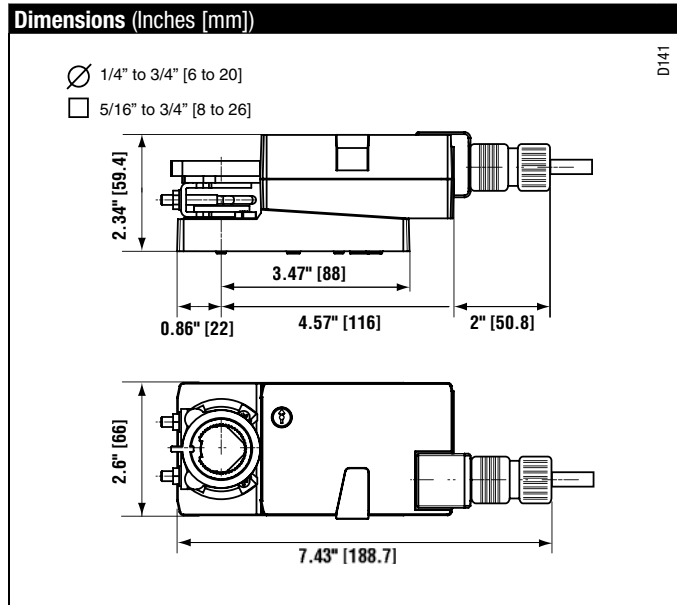
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LMB(X)24-MFT... actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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**Accessories**

K-LM20	3/4" [20 mm] Shaft Clamp
AV6-20	Shaft Extension
ZG-LMSA	Shaft Adaptor for 1/2" Diameter Shafts
ZG-LMSA-1	Shaft Adaptor for 3/8" Diameter Shafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using LMB(X)24-MFT actuators, only use accessories listed on this page.

**Typical Specification**

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

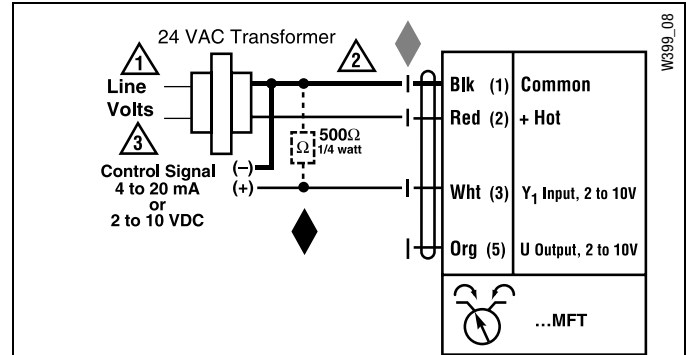
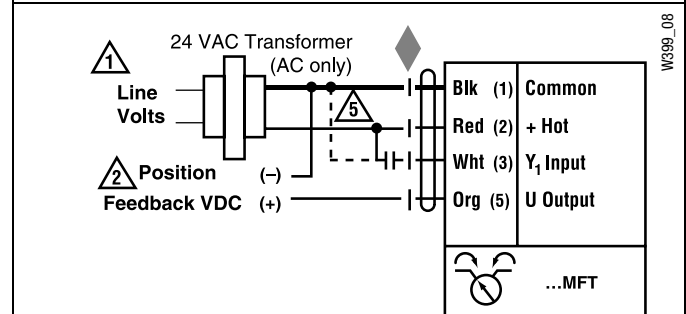
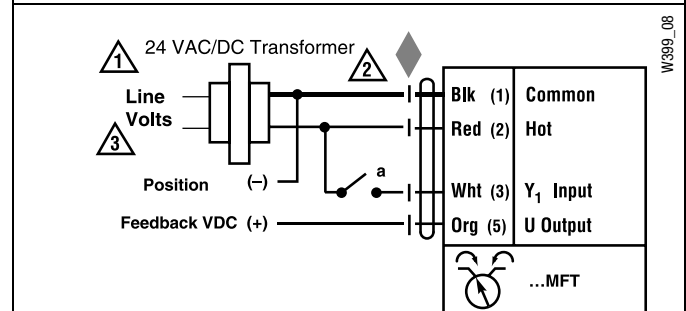
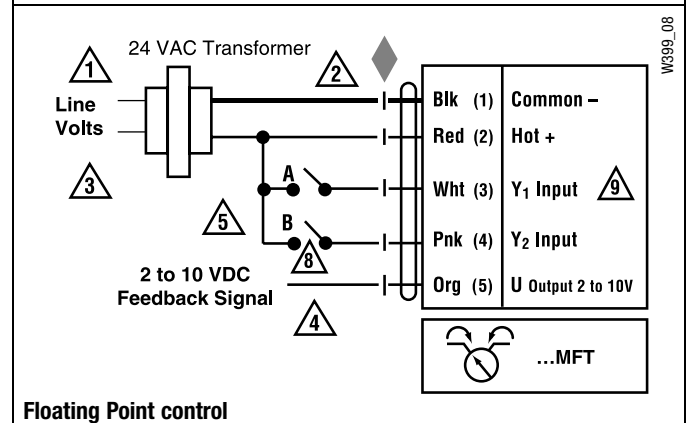
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

**APPLICATION NOTES**

- ◆ The ZG-R01 500 Ω resistor may be used.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.


**VDC/4-20 mA**

**PWM**

**On/Off control**

**Floating Point control**

# LMX24-MFT95

Proportional, Non-Spring Return, 24 V, 135 Ω Input



MFT



Technical Data	LMX24-MFT95
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	2.5 W (1.2 W)
Transformer sizing	5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range WRB	135 Ω Honeywell Electronic Series 90, 135 Ω input
Feedback output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	45 in-lb [5 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default) variable (35 to 150 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.5 lbs [0.7 kg]

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

Torque min. 45 in-lb for control of damper surfaces up to 11 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 5/8" in diameter by means of its universal clamp. Shafts up to 3/4" diameter can be accommodated by an accessory clamp.

The default parameters for 0 to 135 Ω input applications of the ...MFT95 actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

## Operation

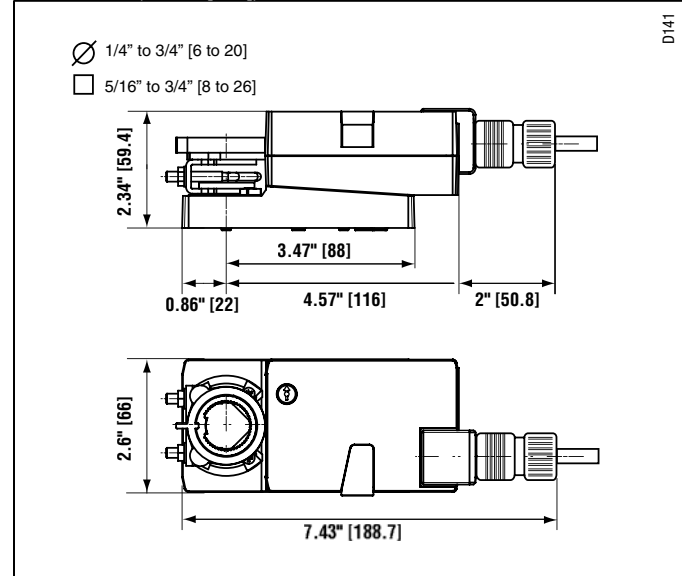
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LMX24-MFT95 actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



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Accessories	
K-LM20	3/4" [20 mm] Shaft Clamp
AV6-20	Shaft Extension
ZG-LMSA	Shaft Adaptor for 1/2" Diameter Shafts
ZG-LMSA-1	Shaft Adaptor for 3/8" Diameter Shafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

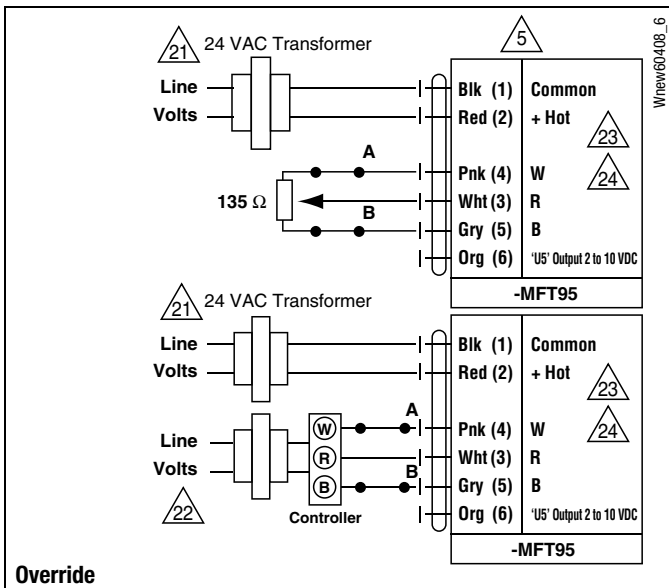
**NOTE:** When using LMX24-MFT95 actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wire Colors

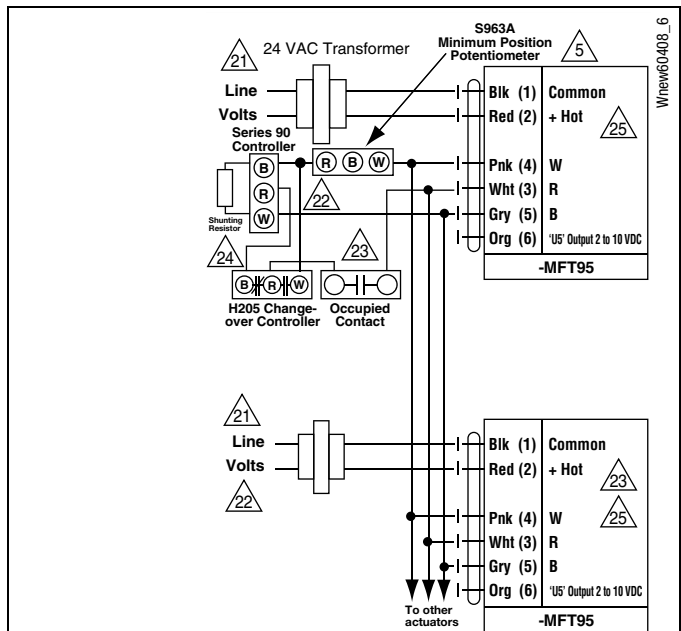
1 = Black	3 = White	5 = Gray
2 = Red	4 = Pink	6 = Orange



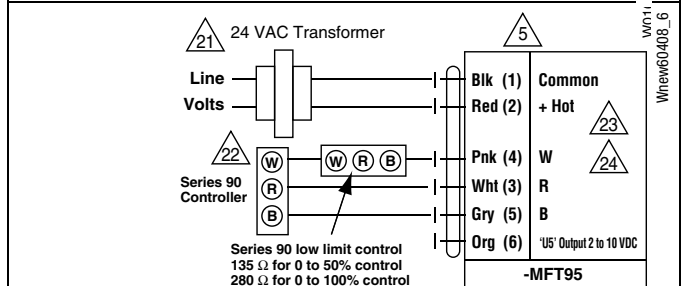
### Wiring Diagrams

#### INSTALLATION NOTES

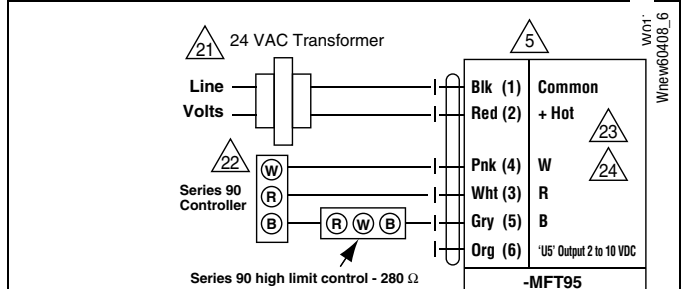
- △5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
- △21 Provide overload protection and disconnect as required.
- △22 Actuators and controller must have separate transformers.
- △23 Consult controller instruction data for more detailed information.
- △24 Resistor value depends on the type of controller and the number of actuators. No resistor is used for one actuator. Honeywell® resistor kits may also be used.
- △25 To reverse control rotation, use the reversing switch.



#### Wiring multiple actuators to a Series 90 controller using a minimum position potentiometer.



#### Low Limit Control



#### High Limit Control

# LMX24-PC

Proportional, Non-Spring Return, 24 V, 0 to 20V Phasecut



MFT



Technical Data	LMX24-PC
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	2.5 W (1.2 W)
Transformer sizing	5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	0 to 20 V phasecut control is only for the positive part of the sine wave (max of 10 volts)
Input impedance	8 k $\Omega$ (50 mW)
Feedback output U	2 to 10 VDC, 0.5 mA max
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	45 in-lb [5 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.5 lbs [0.7 kg]

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

Torque min. 45 in-lb for control of damper surfaces up to 11 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 5/8" in diameter by means of its universal clamp. Shafts up to 3/4" diameter can be accommodated by an accessory clamp.

The actuator operates in response to 0 to 20V phasecut control input only on the positive part of the sine wave from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication.

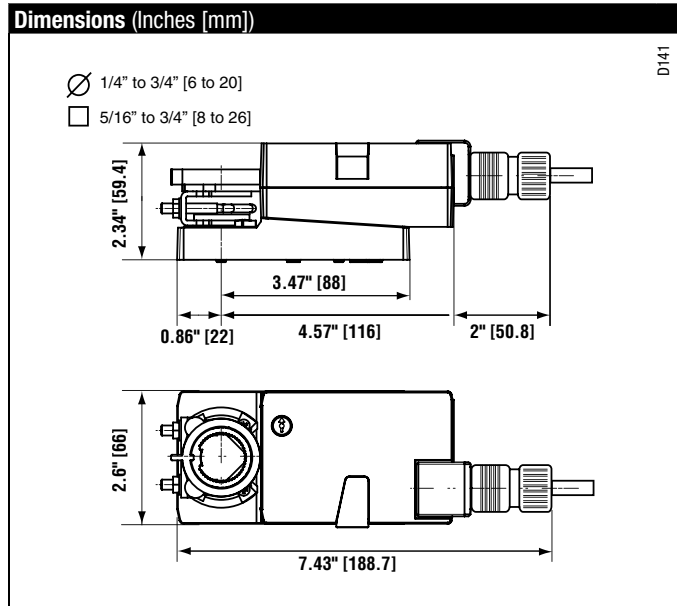
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMX series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LMX24-PC actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
K-LM20	3/4" [20 mm] Shaft Clamp
AV6-20	Shaft Extension
ZG-LMSA	Shaft Adaptor for 1/2" Diameter Shafts
ZG-LMSA-1	Shaft Adaptor for 3/8" Diameter Shafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using LMX24-PC actuators, only use accessories listed on this page.

### Typical Specification

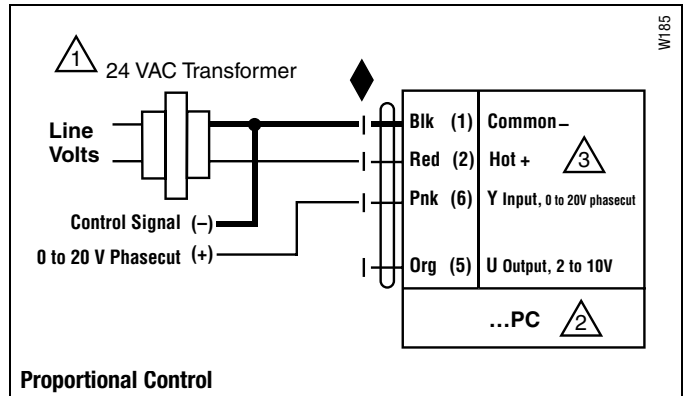
Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

**⚠️ WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LMQB(X)24-1

On/Off, Non-Spring Return, 24 V



Technical Data	LMQB(X)24-1
Power supply	24 VAC $\pm 20\%$ 50/60 Hz 24 VDC $\pm 10\%$
Power consumption	13 W (1.5 W)
Transformer sizing	23 VA (Class 2 power source) (I max 20A@5ms)
Electrical connection	18 GA plenum rated cable protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off
Input impedance	1000 $\Omega$
Angle of rotation	min. 30°, max. 95°, adjust. with mechanical stop
Torque	35 in-lb [4 Nm]
Direction of rotation	reversible with switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	2.5, 5 or 10 seconds constant independent of load
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<52 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.8 lbs [0.85 kg]

Rated Impulse Voltage 800V, Type of action 1, (1.B for -S version), Control Pollution Degree 3.

**Torque min. 35 in-lb for control of damper surfaces up to 11 sq ft.**

## Application

For On/Off control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. The actuator is mounted directly to a damper shaft from 1/2" up to 1.05" in diameter by means of its standard universal clamp.

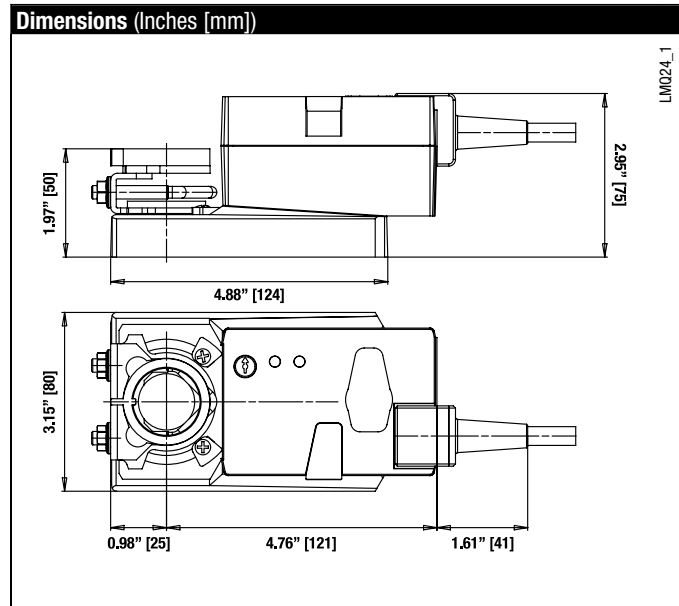
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMQB(X) series provides 95° of rotation and a visual indicator which indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be disengaged with manual release on the actuator cover.

The LMQB(X)24-1 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
K-NA	Reversible Clamp
ZG-101	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adapter Kit
AU8-25	Universal Shaft Extension
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

**NOTE:** When using LMQB(X)24-1 actuators, only use accessories listed on this page.

### Typical Specification

On/Off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/2" to 1.05". Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. 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. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### INSTALLATION NOTES

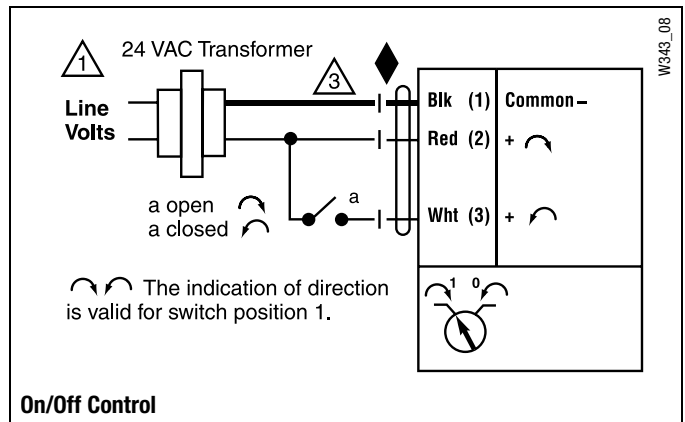
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

#### APPLICATION NOTES

- Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### WARNING Live Electrical Components!

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# LMQB(X)24-MFT

Proportional, Non-Spring Return, 24 V, Multi-Function Technology®



MFT



Technical Data	LMQB(X)24-MFT
Power supply	24 VAC ±20% 50/60 Hz 24 VDC ±10%
Power consumption	13 W (1.5 W)
Transformer sizing	23 VA (Class 2 power source) (I max 20A@5ms)
Electrical connection	18 GA plenum rated cable protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default)
Variable (VDC, on/off)	on/off
Input impedance	100 kΩ (0.1 mA), 500 Ω, 1000 Ω (on/off)
Feedback output U	2 to 10 VDC, 0.5mA max, VDC variable
Angle of rotation	min. 30°, max. 95°, adjust. with mechanical stop electronically variable
Torque	35 in-lb [4 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	2.5, 5 or 10 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<52 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.8 lbs [0.85 kg]

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

Torque min. 35 in-lb for control of damper surfaces up to 11 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from ½" up to 1.05" in diameter by means of its universal clamp.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software (version 3.3 or later).

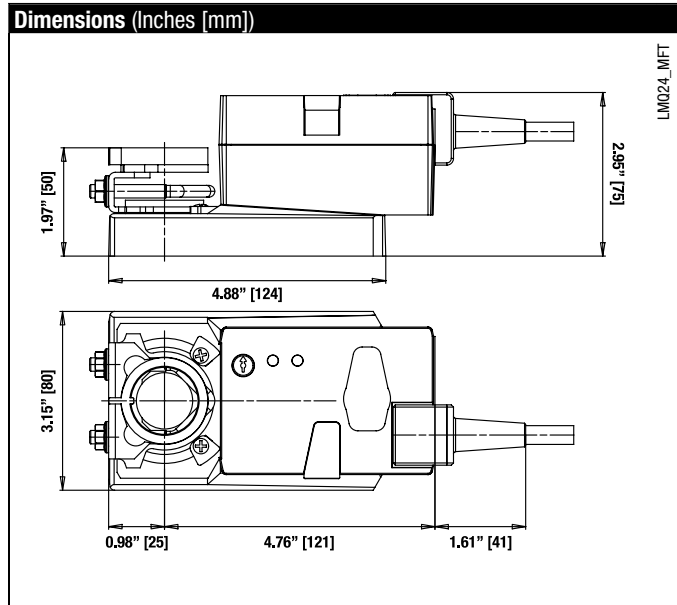
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMQB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LMQB(X)24-MFT actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories	
K-NA	Reversible Clamp
AV8-25	Universal Shaft Extension
ZG-NMA	Shaft Adaptor
ZG-LMSA-1	Shaft Adaptor for 3/4" Diameter Shafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24	US Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using LMQB(X)24-MFT actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 3/8". Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

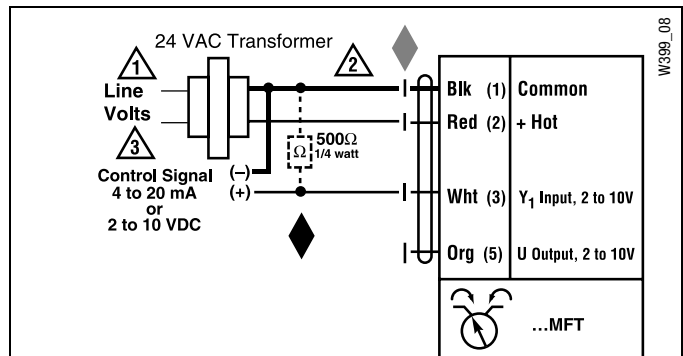
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

#### APPLICATION NOTES

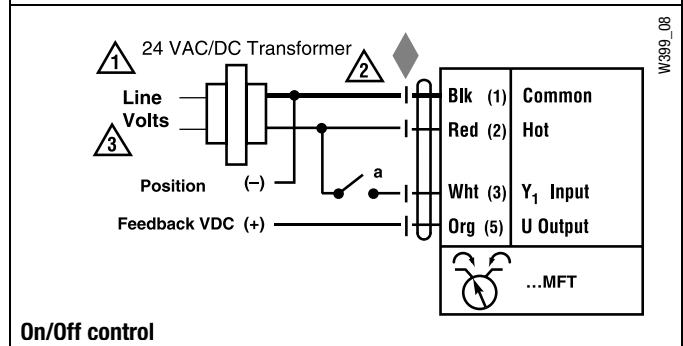
- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

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VDC/4-20 mA



On/Off control

# LMX24-LON

LonWorks®, Non-Spring Return, 24 V



Technical Data	LMX24-LON
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	2.5 W (1.2 W)
Transformer Sizing	5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m]
Overload protection	electronic throughout 0 to 95° rotation
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	45 in-lb [5 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.5 lbs [0.7 kg]

LonWorks®	
Certified	according to LonMARK® 3.3
Processor	Neuron 3120
Transceiver	FTT-10A, compatible with LPT-10
Functional profile	according to LonMARK® Damper actuator object #8110 open loop sensor object #1
LNS plug-in for actuator/sensor	can be run with any LNS based integration tool (min. for LNS 3.x)
Service button and status LED	according to LonMARK® guidelines
Conductors, cables	conductor lengths, cable specifications and topology of the LonWorks® network according to the Echelon® directives

LonWorks and LonMARK © 2007-2009 LonMark International

**Torque min. 45 in-lb for control of damper surfaces up to 11 sq ft.**

## Application

Direct coupled actuators for direct link to LonWorks network. Actuators are easily installed by direct shaft mounting on air dampers in ventilation and air conditioning systems. Actuator can be controlled by any compatible LON controller or automation system.

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft from 1/4" up to 5/8" in diameter by means of its universal clamp. Shafts up to 3/4" diameter can be accommodated by an accessory clamp.

## Operation

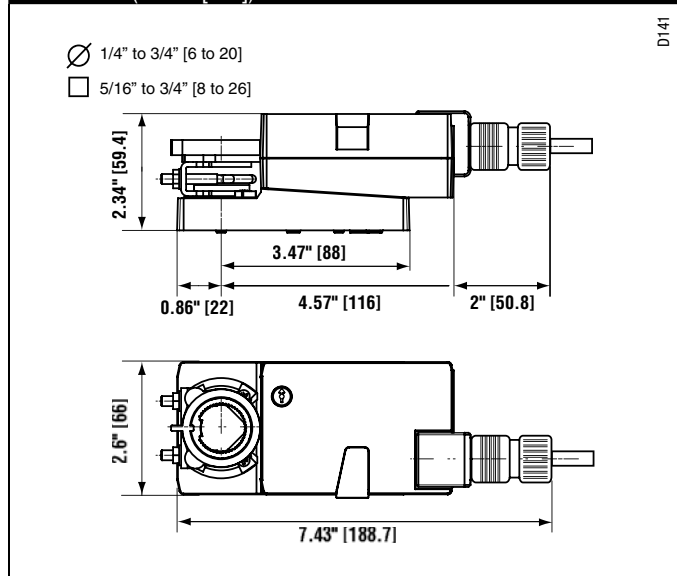
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LMX24-LON series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LMX24-LON actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Dimensions (Inches [mm])



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### Accessories

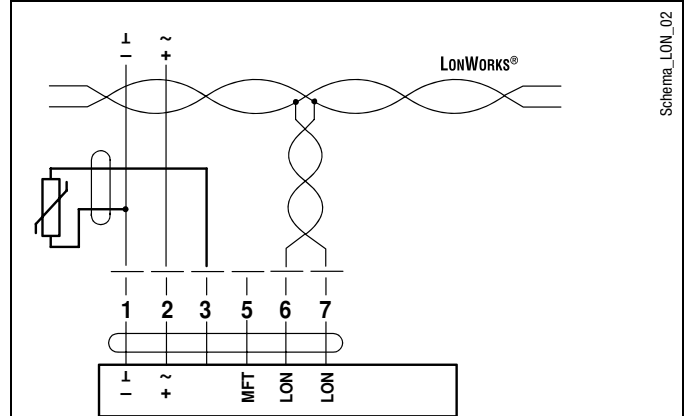
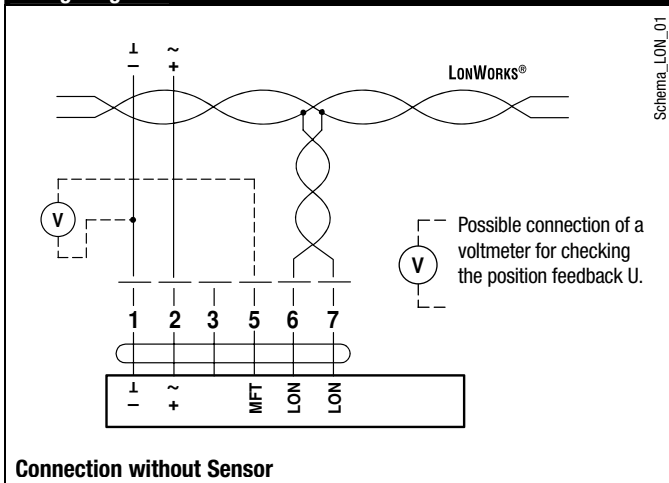
K-LM20	3/4" [20 mm] Shaft Clamp
AV6-20	Shaft Extension
ZG-LMSA	Shaft Adaptor for 1/2" Diameter Shafts
ZG-LMSA-1	Shaft Adaptor for 3/8" Diameter Shafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch(es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
ADS-100	Analog to Digital Switch
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using LMX24-LON actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

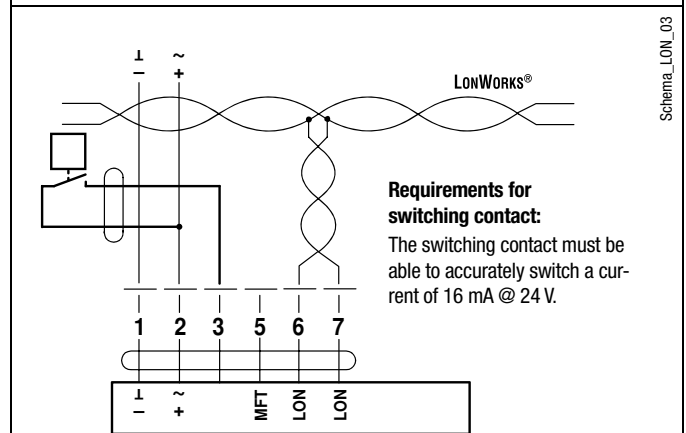


### Sensor scaling:

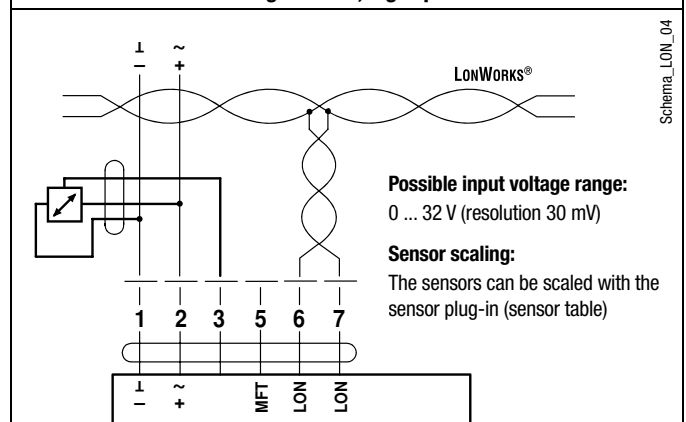
The sensors can be scaled with the sensor plug-in (sensor table).

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 ... 60 kΩ	1 Ω

### Connection with Passive Sensor, e.g. Pt1000, Ni1000, NTC

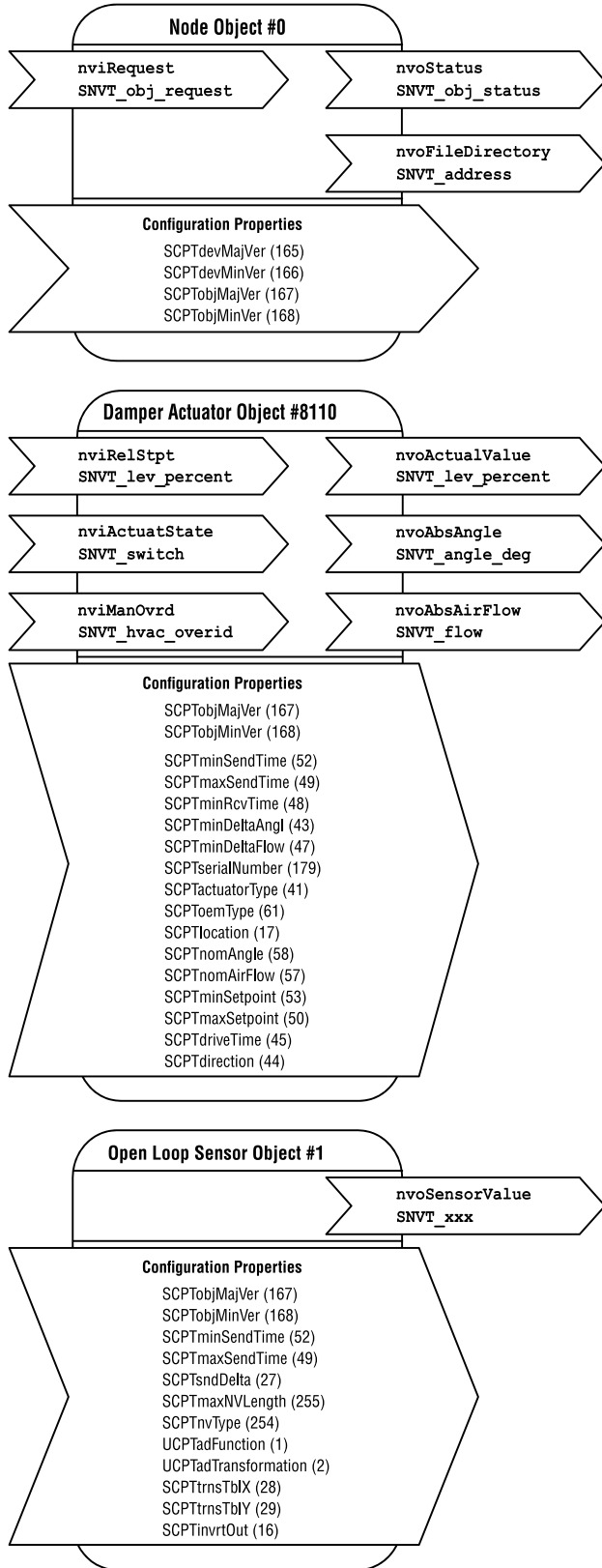


### Connection with Switching Contact, e.g. Δp-monitor



### Connection with Active Sensor, e.g. 0...10 V @ 0...50° C

The LON-capable damper actuator is certified by LonMARK®. The actuator functions are supplied with the LonWorks® network as standardized network variables according to LonMARK®. The Node Object #0, the Damper Actuator Object #8110 and the Open Loop SensorObject #1 are implemented in the actuator.



**Node object #0**

The node object contains the object status and object request functions.

**nviRequest**      **SNVT\_obj\_request**  
Input variable for requesting the status of a particular object in the node.

**nvoStatus**      **SNVT\_obj\_status**  
Output variable that outputs the current status of a particular object in the node.

**nvoFileDirectory**      **SNVT\_address**  
Output variable that shows information in the address range of the Neuron chip.

**Damper actuator object #8110**

The actuator object is used to map the functions of the MP actuators to the LONWORKS® network.

**nviRelStpt**      **SNVT\_lev\_percent**  
The nominal position is assigned to the actuator via this input variable. This variable is normally linked to the output variable of an HVAC controller.

**nviActuateState**      **SNVT\_switch**  
A preset position is assigned to the actuator via this input variable. Note on priority: The last variable that was active, either nviActuatorState or nviRelStpt, has priority.

**nviManOvrdr**      **SNVT\_hvac\_overid**  
These input variables can be used to manually override the actuator into a particular position.

**nvoActualValue**      **SNVT\_lev\_percent**  
This output variable shows the current actual position of the actuator and can be used for control circuit feedback or for displaying positions.

**nvoAbsAngle**      **SNVT\_angle\_deg**  
This output variable shows the current angle of rotation of the actuator or the valve and can be used to display the position or for service purposes.

**nvoAbsAirFlow**      **SNVT\_flow**  
This output variable is inactive with the SR24ALON-5 rotary actuator and shows a constant value of 65535 (this variable is only active in conjunction with LON-capable VAV controllers).

**Open loop sensor object #1**

A sensor can be connected to the rotary actuator. A passive resistance sensor (e.g. Ni1000), an active sensor (output 0 ... 32 V) or a switch (on/off) can be connected. The open loop sensor object transfers the measured sensor values to the LONWORKS® network.

**nvoSensorValue**      **SNVT\_xxx**  
This output variable shows the current sensor value. Depending on the connected sensor, the output variable can be configured via the sensor plug-in and specifically adapted to the system.

**The SNVT\_... can be configured as:**

SNVT_temp_p	SNVT_lev_percent	SNVT_lux
SNVT_temp	SNVT_abs_humid	SNVT_press_p
SNVT_switch	SNVT_enthalpy	SNVT_smo_obscur
SNVT_flow	SNVT_ppm	SNVT_power
SNVT_flow_p	SNVT_rpm	SNVT_elec_kwh

**Notes**

Detailed information on the functional profiles can be found on the website of LonMARK® ([www.lonmark.org](http://www.lonmark.org)).





<b>1 Direction of rotation switch</b>	
Switching over	Direction of rotation changes
<b>2 Pushbutton and green LED display</b>	
Off	No voltage supply or malfunction
Green, on	Operation
Press button	Switches on angle of rotation adaption followed by standard operation
<b>3 Service button for commissioning LONWORKS® and yellow LED display for the LON status</b>	
Off	The SR24ALON-5 rotary actuator is connected and ready for operation in the LONWORKS®network.
Yellow, on	No application software is loaded in the SR24ALON-5.
Yellow, flashing (flashing interval 2 seconds)	The SR24ALON-5 is ready for operation but not integrated in the LONWORKS® network (unconfigured).
Other flashing codes	A fault is present in the SR24ALON-5.
Press button	Service Pin Message is sent to the LONWORKS®network.
<b>4 Gear disengagement switch</b>	
Press button	Gear disengaged, motor stops, manual operation possible
Release button	Gear engaged, synchronisation starts, followed by standard operation
<b>5 Service plug</b>	
For connecting MFT parameterizing and service tools	



## Application

The -HM series of actuators are intended for retrofit of Belimo LM24-M and LM24-10P-M actuators used in OEM VAV controllers that have reached the end of their service life. These actuators are specifically designed as a drop-in replacement without any alteration to the existing VAV system.

## Operation

The actuator is mounted in the same location as the current actuator and mates directly to the damper shaft by means of the standard universal clamp. The existing 5 pin Molex connector plugs directly into the replacement actuator and 24 VAC/DC power is applied via a separate plenum rated power cable.

The -HM series utilize Belimo brushless Halomo motor technology. This motor drive technology monitors and controls the actuator position based on an input signal from the VAV controller. When reaching an end position, the actuator automatically stops and reports this condition to the VAV controller. Power consumption is reduced when in holding mode.

## Models

LMB24-HM

LMB24-10P-HM

Technical Data	LMB24-HM (10P-HM)
Power supply	24 VAC +/- 20% 50/60 Hz 24 VDC +/- 10%
Power consumption	1.5 W (0.2 W)
Transformer sizing	2 VA (Class 2 power source)
Electrical connection	5 pin male Molex connector (control signal) 18 GA, 2 conductor plenum rated cable for power
Overload protection	electronic throughout 0 to 95° rotation
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	45 in-lb
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	95 seconds, constant independent of load
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA 1/ IP20
Housing material	UL54-5VA
Agency listings	cULus
Noise level	<35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.1 lbs [0.5 kg]
Feedback	
LMB24-10P-HM	10 kΩ, 1W potentiometer

## Accessories

Tool-03	#10 Torx driver
Tool-06	8mm & 10mm wrench

**NOTE:** When using LMB24-HM (10P-HM) actuators, only use accessories listed on this page.

## Wiring Directions

1. Disconnect all wires including power to VAV controller.
2. Remove VAV controller from ductwork.
3. Disconnect 5 pin Molex connector from actuator.
4. Using Belimo Tool-03, remove three screws from back of VAV controller housing and remove old actuator.
5. Place VAV controller housing on flat surface.
6. Place rear (Cable end) of new actuator into the housing actuator tray (see picture below) and press down on clamp side of actuator until unit "clicks" into place.
7. Connect 5 pin Molex connector to new actuator.
8. Reinstall OEM VAV controller on ductwork.
9. Reconnect all wires to VAV controller.
10. Connect 24V to actuator cable.

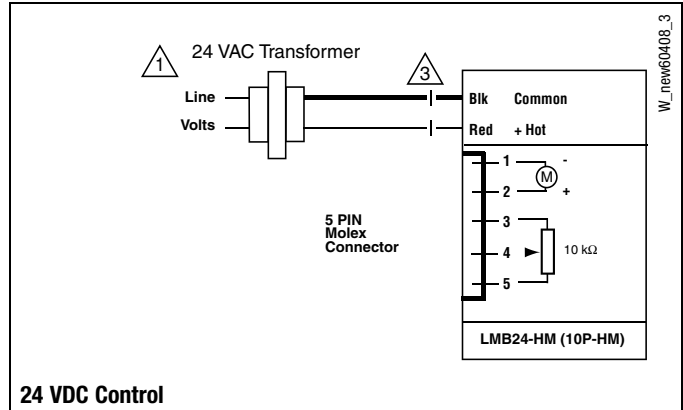


## Wiring Diagram

### ✂️ INSTALLATION NOTES

- ⚠️ 1 Provide overload protection and disconnect as required.
- ⚠️ 3 Actuators may also be powered by 24 VDC.

**⚠️ WARNING Live Electrical Components!** During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



**Minimum 18 in-lb Torque**

- For damper areas up to 6.8 sq-ft\*



Actuators in bold have BDCM

**CMB Series - At A Glance**

		<i><b>CMB24-3</b></i> (p. 349)	<i><b>CMB24-3-T</b></i> (p. 349)	<i><b>CMB120-3</b></i> (p. 351)	<i><b>CMB24-SR-R</b></i> (p. 353)	<i><b>CMB24-SR-L</b></i> (p. 353)
Basic Product		●	●	●	●	●
Flexible Product						
Torque	18 in-lb [2 Nm]	●	●	●	●	●
Angle of Rotation	Endless	●	●	●		
	90 degrees				●	●
	330 degrees with end stop	●	●	●		
Power Supply	24 VAC/DC	●	●		●	●
Control Input	On/Off, Floating Point	●	●	●		
	2 to 10 VDC (4 to 20mA)				●	●
Feedback	None	●	●	●		
	2 to 10 VDC				●	●
Running Time	35 seconds	●	●	●	●	●
Wiring	Plenum Rated Cable	●	●		●	●
	Appliance Rated Cable			●		
	Terminal Strip		●			

Installation and Operation... (page 400).

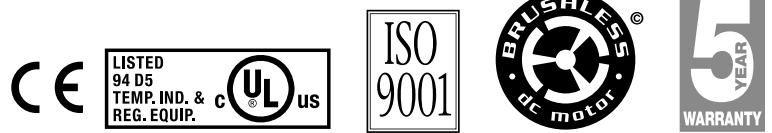
\*Based on 4 in-lb/ft<sup>2</sup> damper torque loading. Parallel blade. No edge seals.

# A CLOSER LOOK...

- Brushless DC Motor for Added Accuracy and Controllability.
- Cut Labor Costs with Simple Direct Coupling.
- Self-Centers on 1/2" shafts with Universal Clamp.
- Check Damper Position with Clear Position Indicator.
- Don't Worry about Actuator Burn-Out; Belimo is Overload Proof throughout Rotation.
- Enjoy Added Flexibility with Easy Mechanical Stops to Adjust Angle of Rotation.
- Easy override with use of magnet located on position indicator.
- Mounts Directly on Clamp, Includes Conduit Connector.
- Standard 3ft Plenum Rated Cable Provided on Basic Models.



**Bulk Packaging Offers Big Value for Large jobs, Stocking Orders.**



## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

N40103 - 09/11 - Subject to change. © Belimo Aircontrols (USA), Inc.

# CMB24-3(-T)

On/Off, Floating Point, Non-Spring Return, 24 V



**Torque min. 18 in-lb for control of damper surfaces up to 4.5 sq ft.**

## Application

Damper actuator for operating air control dampers in ventilation and air-conditioning systems for building services installations.

- For air control dampers up to approximately 4.5 sq ft
- Torque 2 Nm
- Nominal voltage AC/DC 24 V
- Control: Open-close or 3-point
- Running time 35 sec. @ 90°

## Operation

Simple direct mounting on the damper spindle with a universal spindle clamp or form fit, supplied with an anti-rotation bracket to prevent the actuator from rotating.

Manual operation is possible with a magnet (the gearing latch remains disengaged as long as the magnet is in place).

Adjustable angle of rotation with mechanical end stops, that requires no tools to move or remove.

The actuator is overload-proof, requires no limit switches and automatically stops when the end stops is reached.

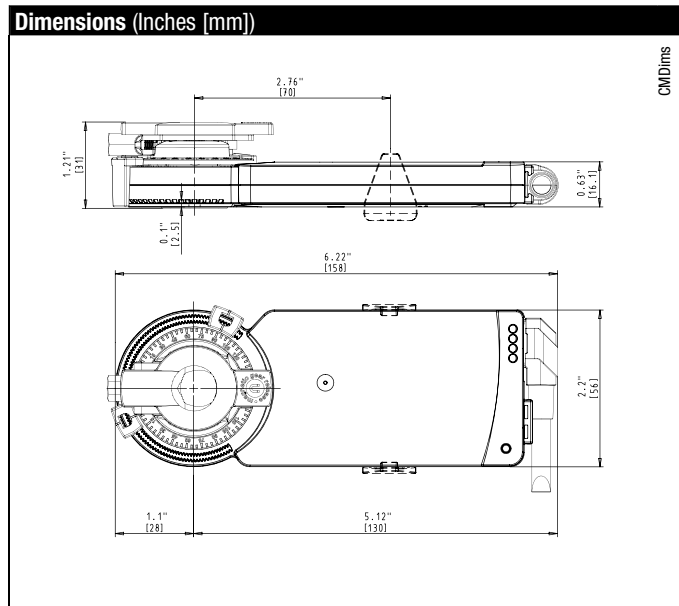
The CM24-3 actuator uses a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Belimo's Halomo sensorless brushless DC motor spins by reversing the poles of stationary electromagnets housed inside rotational permanent magnets. The electromagnetic poles are switched by the an ASIC developed by Belimo. Unlike the conventional DC motor, there are no brushes to wear or commutators to foul. This means the brushless DC motor adds accuracy and reduces power consumption in a holding mode.

Technical Data	CMB24-3
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	1.0 W (0.2 W resting)
Transformer sizing	1.5 VA (Class 2 power source)
Electrical connection	3 ft, 18 GA appliance rated cable protected NEMA 2 (IP54)
Overload protection	electronic throughout rotation
Control	on/off, floating point
Angle of rotation	without end stop; limitless with end stop; 315° fix 287.5° max. with two end stops
Torque	18 in-lb [2 Nm]
Direction of rotation	by electrical installation
Position indication	reflective visual indicator (snap-on), with magnet
Manual override	disengage with magnet
Running time	35 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	0.4 lbs [0.18 kg]

CMB24-3-T	
Electrical connection	screw terminal (for 18 to 16 GA wire)
Form fit	0.31" x 0.31" [8mm x 8mm]
Housing	NEMA 1/IP20
Weight	0.3 lbs [0.13 kg]

†Rated Impulse Voltage 800V, Type of action 1, Control Pollution Degree 3 for 24-3-T Degree 2.



M40103 - 09/11 - Subject to change. © Belimo Aircontrols (USA), Inc.

### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 1/2". Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have manual override on the cover. If required, actuators will be provided with screw terminal strip for electrical connections (CMB24-3-T). Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### SAFETY NOTES

The damper actuator is not allowed to be used outside the specified field application, especially in aircraft or any other form of air transport.

Assembly must be carried out by trained personnel. Any legal regulations or regulations issued by authorities must be observed during assembly.

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.

The cable must not be removed from the device.

When calculating the required torque, the specifications supplied by the damper manufactures (cross section, design, installation site), and the air flow conditions must be observed.

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.

### Wiring Diagrams

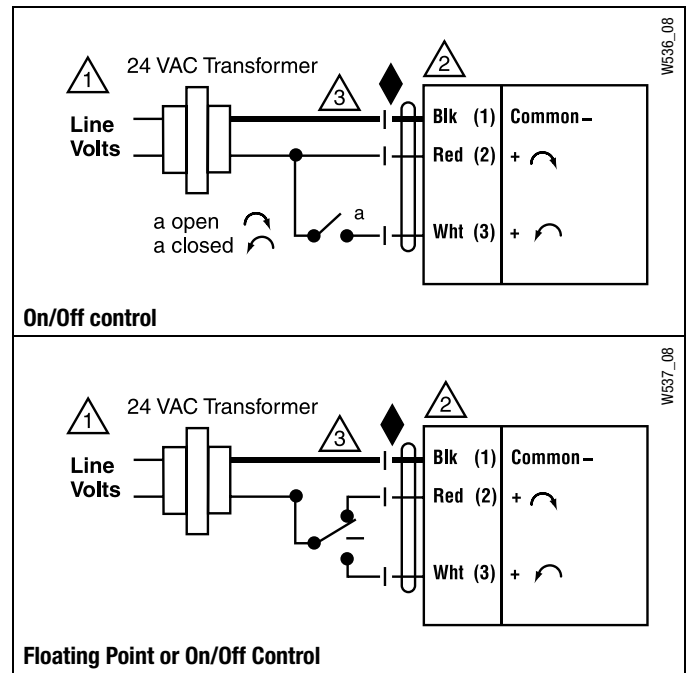
#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.

#### 📄 APPLICATION NOTES

- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

- ⚠️ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# CMB120-3

On/Off, Floating Point, Non-Spring Return, 100 to 240 VAC



Technical Data		CMB120-3
Power supply nominal tolerance		100 to 240 VAC, 50/60 Hz 85 to 265 VAC, 50/60 Hz
Power consumption		1.5 W (1.0 W)
Transformer sizing		3.5 VA (Class 2 power source)
Electrical connection		3 ft, 18 GA appliance rated cable protected NEMA 2 (IP54)
Overload protection		electronic throughout rotation
Control		on/off, floating point
Angle of rotation		without end stop; limitless with end stop; 315° fix 287.5° max. with two end stops
Torque		18 in-lb [2 Nm]
Direction of rotation		by electrical installation
Position indication		reflective visual indicator (snap-on)
Manual override		disengage with magnet
Running time		35 seconds, constant independent of load
Humidity		5 to 95% RH non condensing (EN 60730-1)
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA 2, IP54, UL enclosure type 2
Housing material		UL94-5VA
Agency listings†		cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level		<45dB(A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight		0.4 lbs [0.18 kg]

†Rated Impulse Voltage 2.5kV, Type of action 1.AA, Control Pollution Degree 3.

Torque min. 18 in-lb for control of damper surfaces up to 4.5 sq ft.

## Application

Damper actuator for operating air control dampers in ventilation and air-conditioning systems for building services installations.

- For air control dampers up to approximately 4.5 sq ft
- Torque 2 Nm
- Nominal voltage AC/DC 100-240 V
- Control: Open-close or 3-point
- Running time 35 sec. @ 90°

## Operation

Simple direct mounting on the damper spindle with a universal spindle clamp or form fit, supplied with an anti-rotation bracket to prevent the actuator from rotating.

Manual operation is possible with a magnet (the gearing latch remains disengaged as long as the magnet is in place).

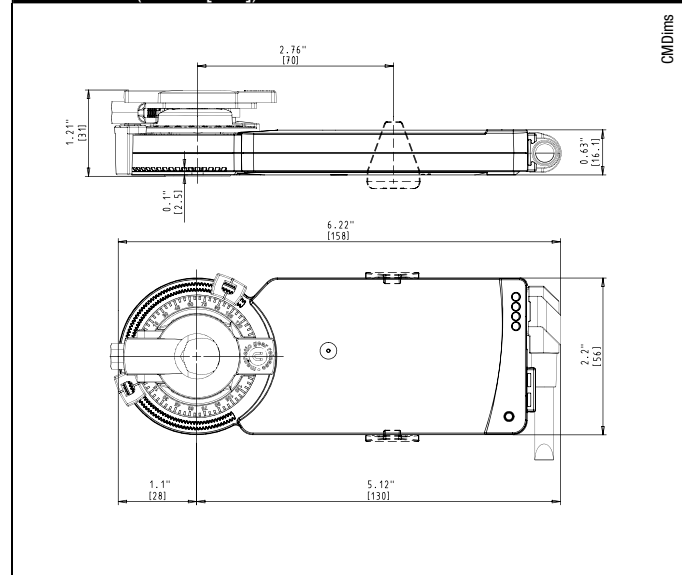
Adjustable angle of rotation with mechanical end stops, that requires no tools to move or remove.

The actuator is overload-proof, requires no limit switches and automatically stops when the end stops is reached.

The CM24-3 actuator uses a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Belimo's Halomo sensorless brushless DC motor spins by reversing the poles of stationary electromagnets housed inside rotational permanent magnets. The electromagnetic poles are switched by the an ASIC developed by Belimo. Unlike the conventional DC motor, there are no brushes to wear or commutators to foul. This means the brushless DC motor adds accuracy and reduces power consumption in a holding mode.

## Dimensions (Inches [mm])



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### Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 1/2". Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### SAFETY NOTES

The damper actuator is not allowed to be used outside the specified field application, especially in aircraft or any other form of air transport.

Assembly must be carried out by trained personnel. Any legal regulations or regulations issued by authorities must be observed during assembly.

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.

The cable must not be removed from the device.

When calculating the required torque, the specifications supplied by the damper manufactures (cross section, design, installation site), and the air flow conditions must be observed.

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.

### Wiring Diagrams

#### INSTALLATION NOTES

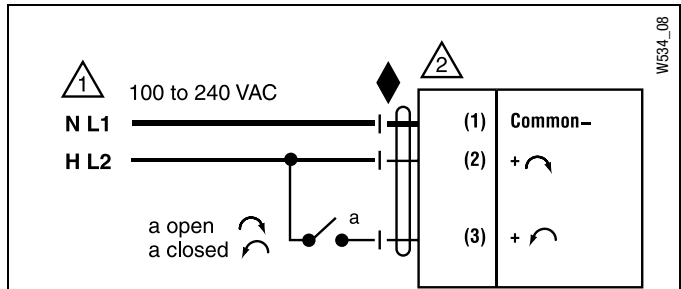
1 Provide overload protection and disconnect as required.

2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.

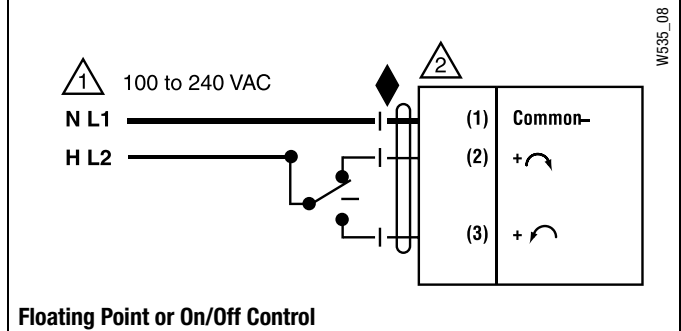
#### APPLICATION NOTES

◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

⚠ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



On/Off control



Floating Point or On/Off Control

# CMB24-SR-R(-L)

Proportional, Non-Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	CMB24-SR-R(-L)
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 20%
Power consumption	1.5 W (0.5 W resting)
Transformer sizing	1.5 VA (Class 2 power source)
Electrical connection	3 ft, 18 GA appliance rated cable protected NEMA 2 (IP54)
Overload protection	electronic throughout rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Angle of rotation	without end stop; limitless with end stop; 315° fix 287.5° max. with two end stops
Torque	18 in-lb [2 Nm]
Direction of rotation	by electrical installation
Position indication	reflective visual indicator (snap-on), with magnet
Manual override	disengage with magnet
Running time	35 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	0.4 lbs [0.18 kg] with form fit 0.3 lbs [0.13 kg]

†Rated Impulse Voltage 800V, Type of action 1, Control Pollution Degree 3 for 24-3-T Degree 2.

Torque min. 18 in-lb for control of damper surfaces up to 4.5 sq ft.

## Application

Damper actuator for operating air control dampers in ventilation and air-conditioning systems for building services installations.

- For air control dampers up to approximately 4.5 sq ft
- Torque 2 Nm
- Nominal voltage AC/DC 24 V
- Control: 2 to 10 VDC
- Running time 35 sec. @ 90°

## Operation

Simple direct mounting on the damper spindle with a universal spindle clamp or form fit, supplied with an anti-rotation bracket to prevent the actuator from rotating.

Manual operation is possible with a magnet (the gearing latch remains disengaged as long as the magnet is in place).

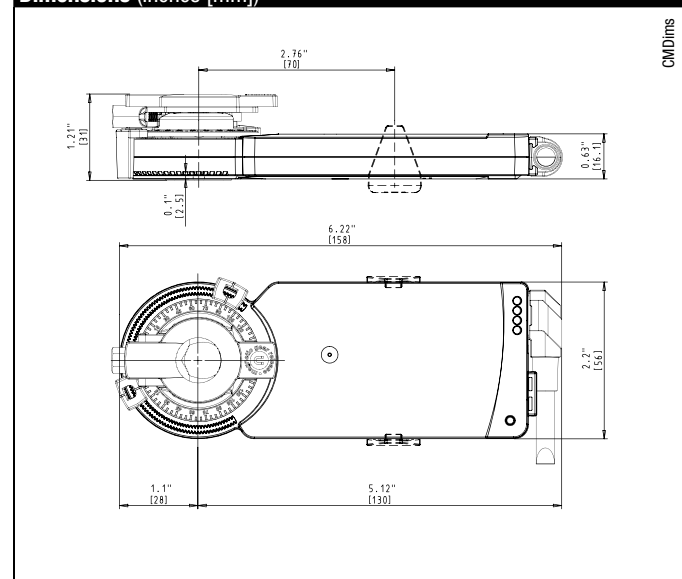
Adjustable angle of rotation with mechanical end stops, that requires no tools to move or remove.

The actuator is overload-proof, requires no limit switches and automatically stops when the end stops is reached.

The CMB24-SR (-R or -L) actuator uses a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Belimo's Halomo sensorless brushless DC motor spins by reversing the poles of stationary electromagnets housed inside rotational permanent magnets. The electromagnetic poles are switched by the an ASIC developed by Belimo. Unlike the conventional DC motor, there are no brushes to wear or commutators to foul. This means the brushless DC motor adds accuracy and reduces power consumption in a holding mode.

## Dimensions (Inches [mm])



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### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 1/2". Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology 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 indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### SAFETY NOTES

The damper actuator is not allowed to be used outside the specified field application, especially in aircraft or any other form of air transport.

Assembly must be carried out by trained personnel. Any legal regulations or regulations issued by authorities must be observed during assembly.

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.

The cable must not be removed from the device.

When calculating the required torque, the specifications supplied by the damper manufactures (cross section, design, installation site), and the air flow conditions must be observed.

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.

### Wiring Diagrams

#### ✂ INSTALLATION NOTES

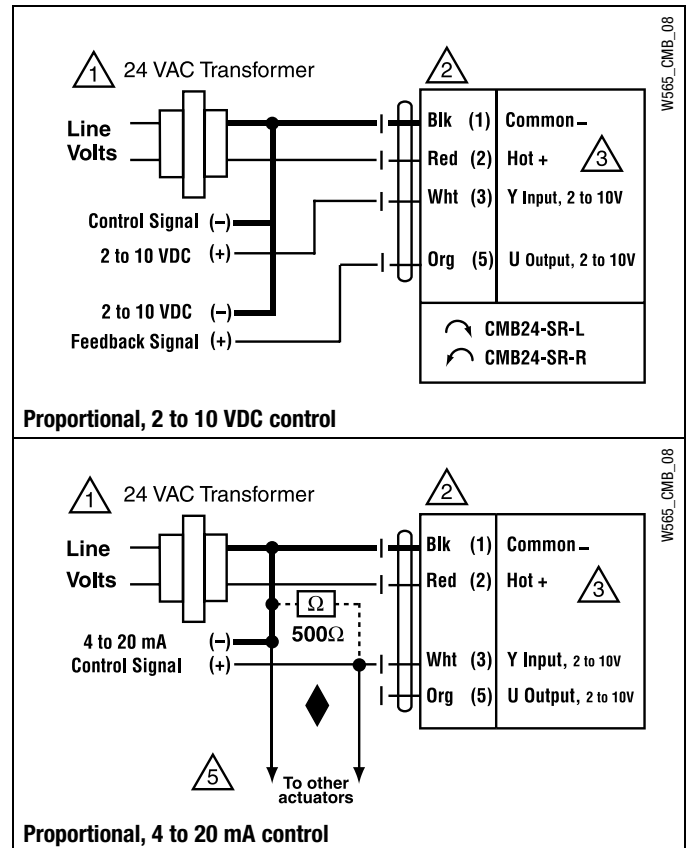
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

#### 📄 APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

#### ⚠ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



## Minimum 101 lbf Linear Force

- For damper surfaces up to 32 sq-ft\*



Actuators in bold have BDCM

### AH Series - At A Glance

		<i>AHB(X)24-3(-100)(-200)(-300) (p. 357)</i>	<i>AHX120-3(-100)(-200)(-300) (p. 359)</i>	<i>AHB(X)24-SR(-100)(-200) (p. 361)</i>	<i>AHX120-SR(-100)(-200) (p. 363)</i>	<i>AHX24-MFT-100(-200)(-300) (p. 365)</i>	<i>AHQB(X)24-1-100 (p. 367)</i>	<i>AHQB(X)24-MFT-100 (p. 369)</i>
Basic Product		●		●			●	●
Flexible Product		●	●	●	●	●	●	●
Linear Force	101 lbf [450 N]	●	●	●	●	●		
	44 lbf [200 N]						●	●
Linear Stroke	4" [100mm]	●	●	●	●	●	●	●
	8" [200mm]	●	●	●	●	●		
	12" [300mm]	●	●		●	●		
Power Supply	24 VAC/DC	●		●		●	●	●
	120 VAC		●		●			
Control Input	On/Off						●	
	On/Off, Floating Point	●	●					
	2 to 10 VDC (4 to 20mA)			●	●			
	Multi-Function Technology					●		●
Feedback	None	●	●				●	
	2 to 10 VDC			●	●			
	Variable (0 to 10 VDC)					●		●
Running Time	150 seconds	●	●	●	●	●		
	7 seconds						●	●
Wiring	Plenum Rated Cable	●		●		●	●	●
	Appliance Cable		●		●			
	Conduit Fitting	●	●	●	●	●	●	●

Installation and Operation... (page 400).

\*Based on 4 in-lb/ft<sup>2</sup> damper torque loading. Parallel blade. No edge seals.

# A CLOSER LOOK...

- Brushless DC Motor for Added Accuracy and Controllability.
- Don't Worry about Actuator Burn-Out; Belimo is Overload Proof throughout Rotation.
- Enjoy Added Flexibility with Easy Mechanical Stops to Adjust Linear Movement.
- Need to Change Control Direction? Do it easily with a Simple Switch.
- Easily Accessible Manual Override Button helps you Pre-Tension Damper Blades.
- Standard 3ft Plenum Rated Cable and Conduit Connector Provided on Basic Models.
- Added Flexibility to Select Clamp, Electrical Connection, and Running Time to fit your Specific Application with Belimo's New Flexible Line of Actuators.



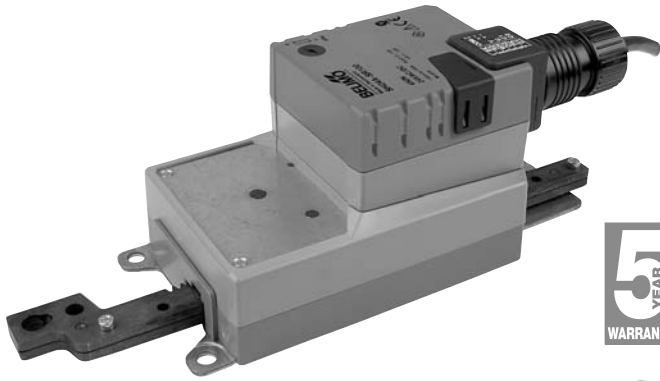
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## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

# AHB(X)24-3(-100)(-200)(-300)

On/Off, Floating Point, Non-Spring Return, Linear Stroke, 24 V



Technical Data	AHB(X)24-3(-100)(-200)(-300)
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	2 W (0.5 W)
Transformer sizing	4.5 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full stroke
Control	on/off, floating point
Input impedance	600 Ω
Linear Stroke	
AHB(X)24-3-100	4 in [100 mm]
AHB(X)24-3-200	8 in [200 mm]
AHB(X)24-3-300	12 in [300 mm]
Linear force	101 lbf [450 N]
Stroke direction	reversible with ↓/↑ switch
Manual override	external push button
Running time	150 seconds per 4" [100mm]
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	
AHB(X)24-3-100	2.6 lbs [1.18 kg]
AHB(X)24-3-200	2.7 lbs [1.23 kg]
AHB(X)24-3-300	2.9 lbs [1.32 kg]

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

Linear Force min. 101lbf for control of damper surfaces up to 32 sq. ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

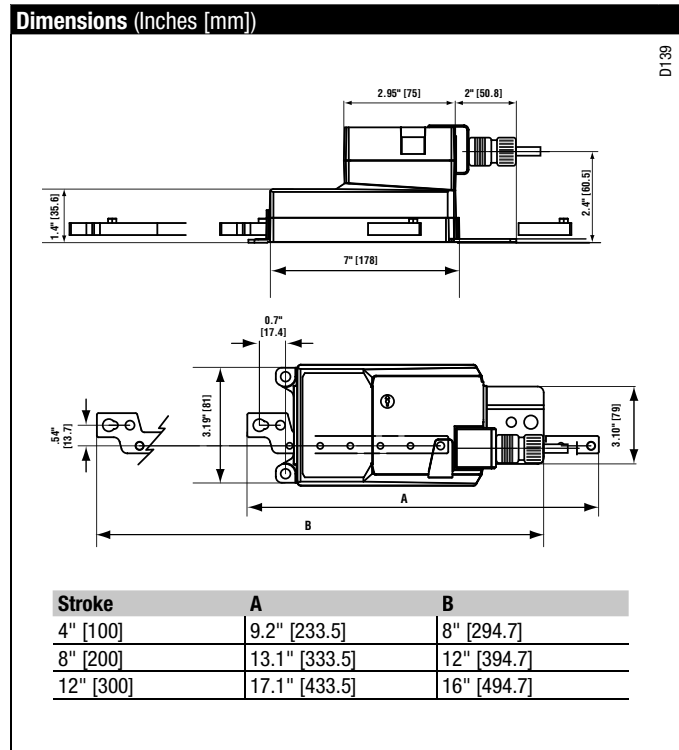
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AHB(X)... series provides 4, 8, or 12 inches of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AHB(X)24-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.



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#### Accessories

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSC	Linear Coupling
P370	Shaft Mount Auxiliary Switch

**NOTE:** When using AHB(X)24-3... actuators, only use accessories listed on this page.

#### Typical Specification

Floating point, on/off control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators shall have brushless DC motor technology and be protected from overload at all positions of linear stroke. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

##### ✂️ INSTALLATION NOTES

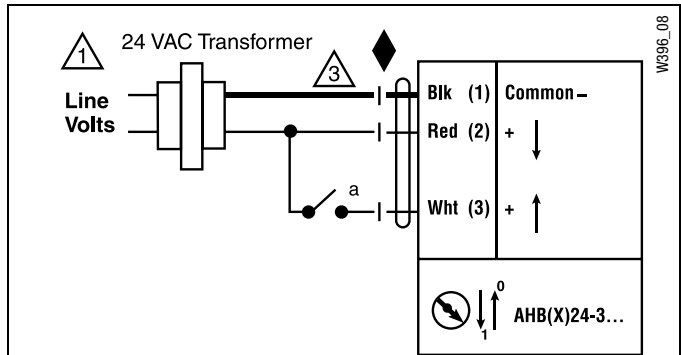
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

##### 📄 APPLICATION NOTES

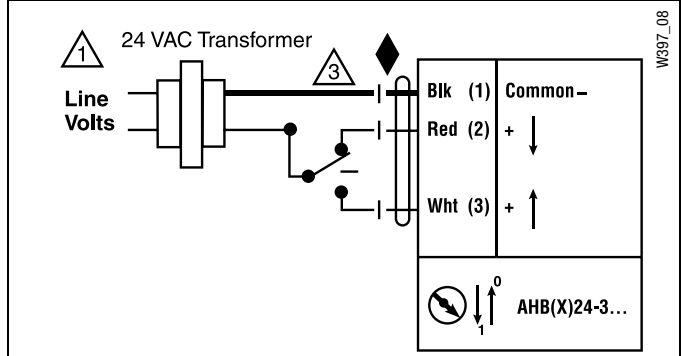
- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

##### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



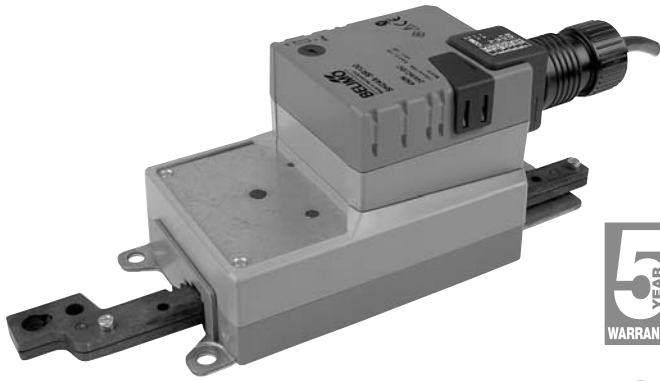
On/Off control



Floating Point or On/Off control

# AHX120-3(-100)(-200)(-300)

On/Off, Floating Point, Non-Spring Return, Linear Stroke, 100 to 240 VAC



Technical Data	AHX120-3(-100)(-200)(-300)
Power supply	100 to 240 VAC 50/60 Hz (nominal) 85 to 265 VAC 50/60 Hz (tolerance)
Power consumption	2.5 W
Transformer sizing	4.5 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full stroke
Control	on/off, floating point
Input impedance	600 Ω
Linear stroke	
AHX120-3-100	4 in [100 mm]
AHX120-3-200	8 in [200 mm]
AHX120-3-300	12 in [300 mm]
Linear force	101 lbf [450 N]
Stroke direction	reversible with ↓/↑ switch
Manual override	external push button
Running time	150 seconds per 4" [100mm]
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA C22.2 No. 24, CE according to #74123IEEC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	
AHX120-3-100	2.6 lbs [1.18 kg]
AHX120-3-200	2.7 lbs [1.23 kg]
AHX120-3-300	2.9 lbs [1.32 kg]

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

Linear Force min. 101lbf for control of damper surfaces up to 30 sq. ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

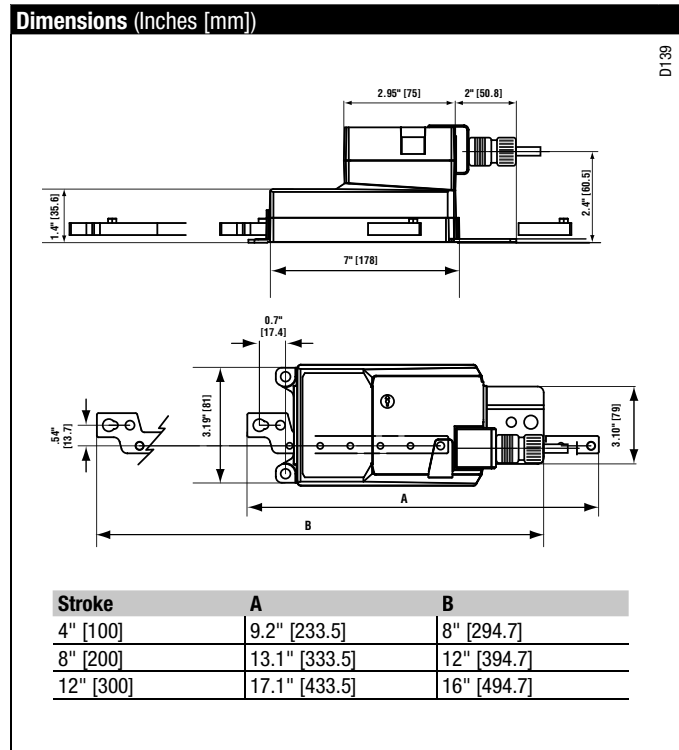
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AHX... series provides 4, 8, or 12 inches of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AHX120-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.



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#### Accessories

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSC	Linear Coupling
KG6	Ball Joint
KG8	Ball Joint (90° angle)
KG10A	Ball Joint
P370	Shaft Mount Auxiliary Switch

**NOTE:** When using AHX120-3... actuators, only use accessories listed on this page.

#### Typical Specification

Floating point, on/off control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators shall have brushless DC motor technology and be protected from overload at all positions of linear stroke. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

##### ✂️ INSTALLATION NOTES

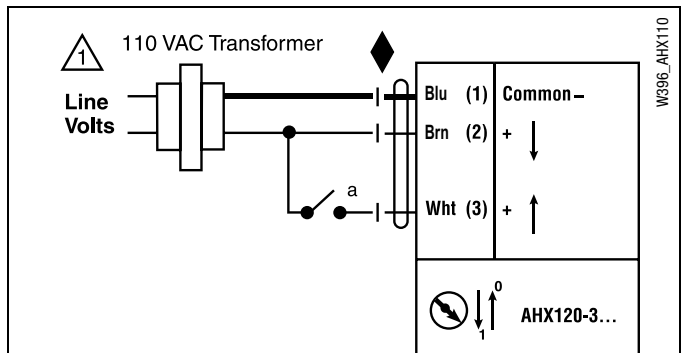
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

##### 📄 APPLICATION NOTES

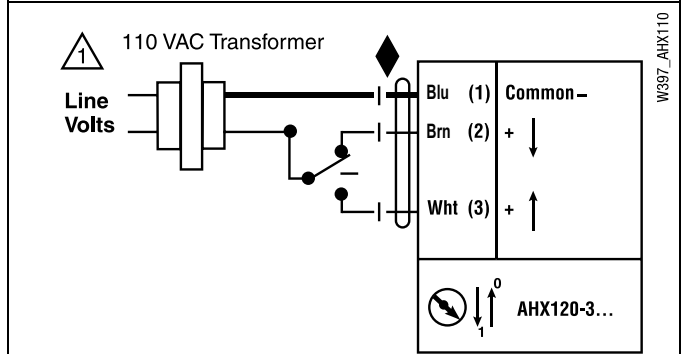
- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

##### ⚠️ WARNING Live Electrical Components!

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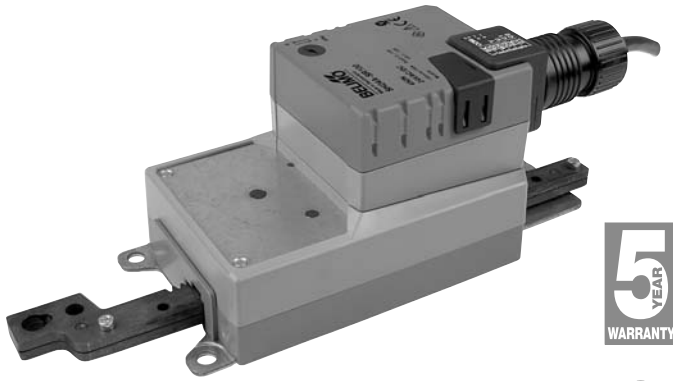
On/Off control



Floating Point or On/Off control

# AHB(X)24-SR(-100)(-200)

Proportional, Non-Spring Return, Linear Stroke, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	AHB(X)24-SR(-100)(-200)
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	2.5 W (0.5 W)
Transformer sizing	4.5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full stroke
Control	2 to 10 VDC, 4 to 20 mA
Input impedance	100 kΩ (0.1 mA), 500 Ω
Feedback output U	2 to 10 VDC (max 0.5 mA)
Linear stroke	
AHB(X)24-SR-100	4 in [100 mm]
AHB(X)24-SR-200	8 in [200 mm]
Linear force	101 lbf [450 N]
Stroke direction	reversible with ↓/↑ switch actuator will move in the selected direction with increasing control signal (2 to 10V)
Manual override	external push button
Running time	150 seconds per 4" [100mm] variable
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	
AHB(X)24-SR-100	2.6 lbs [1.78 kg]
AHB(X)24-SR-200	2.7 lbs [1.23 kg]

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

Force min. 101 lbf for control of damper surfaces up to 32 sq. ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

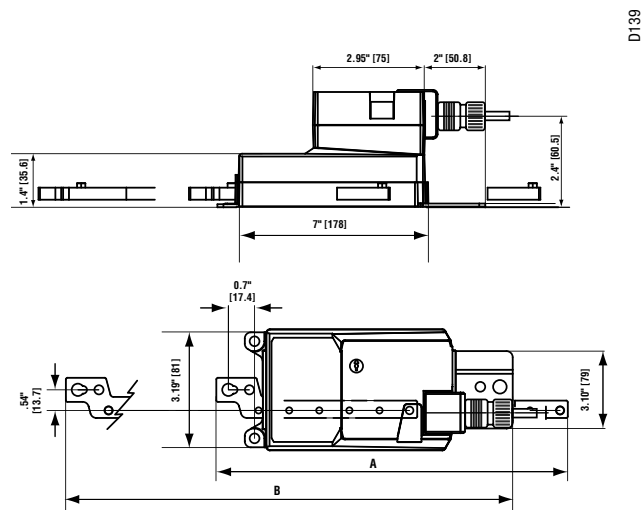
The AHB(X)24 series provides 4 or 8 inches of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AHB(X)24-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

## Dimensions (Inches [mm])



Stroke	A	B
4" [100]	9.2" [233.5]	8" [203.2]
8" [200]	13.1" [333.5]	12" [304.8]

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**Accessories**

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSC	Linear Coupling
P370	Shaft Mount Auxiliary Switch
SGA24	Min Positioners in NEMA 4 Housing
SGF24	Min Positioners for Flush Panel Mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using AHB(X)24-SR... actuators, only use accessories listed on this page.

**Typical Specification**

Proportional control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**
**INSTALLATION NOTES**

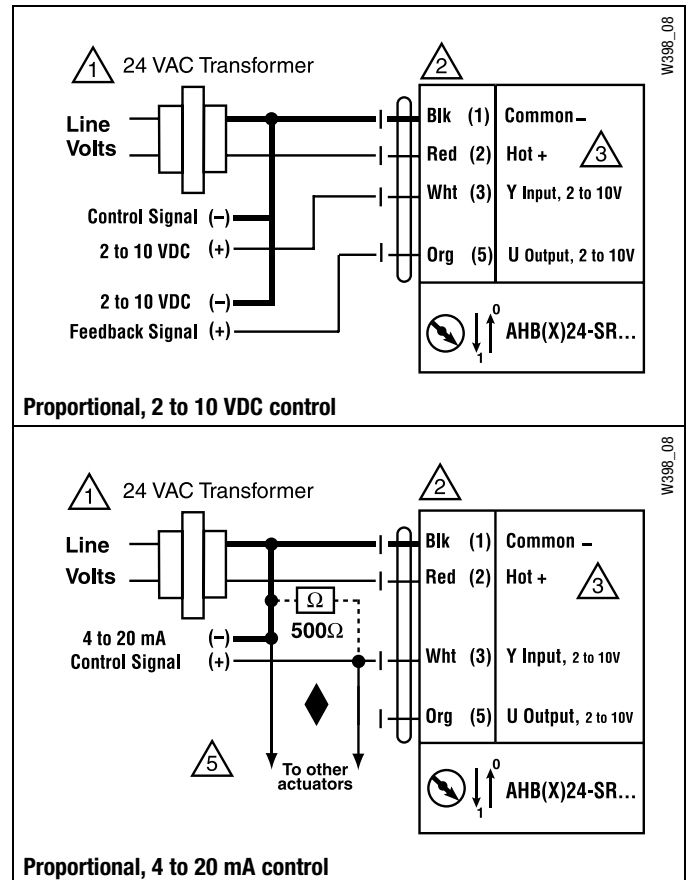
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

**APPLICATION NOTES**

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

**WARNING Live Electrical Components!**

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# AHX120-SR(-100)(-200)

Proportional, Non-Spring Return, Linear Stroke, 120 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	AHX120-SR(-100)(-200)
Power supply	100 to 240 VAC 50/60 Hz (nominal) 85 to 265 VAC 50/60 Hz (tolerance)
Power consumption	5 W (1.2 W)
Transformer sizing	7.5 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full stroke
Control	2 to 10 VDC, 4 to 20 mA
Input impedance	100 kΩ (0.1 mA), 500 Ω
Feedback output U	2 to 10 VDC (max 0.5 mA)
Linear stroke	
AHX120-SR-100	4 in [100 mm]
AHX120-SR-200	8 in [200 mm]
Linear force	101 lbf [450 N]
Stroke direction	reversible with ↓/↑ switch actuator will move in the selected direction with increasing control signal (2 to 10V)
Manual override	external push button
Running time	150 seconds per 4" [100mm] variable
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	
AHX120-SR-100	2.6 lbs [1.18 kg]
AHX120-SR-200	2.7 lbs [1.23 kg]

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

Force min. 101 lbf for control of damper surfaces up to 32 sq. ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

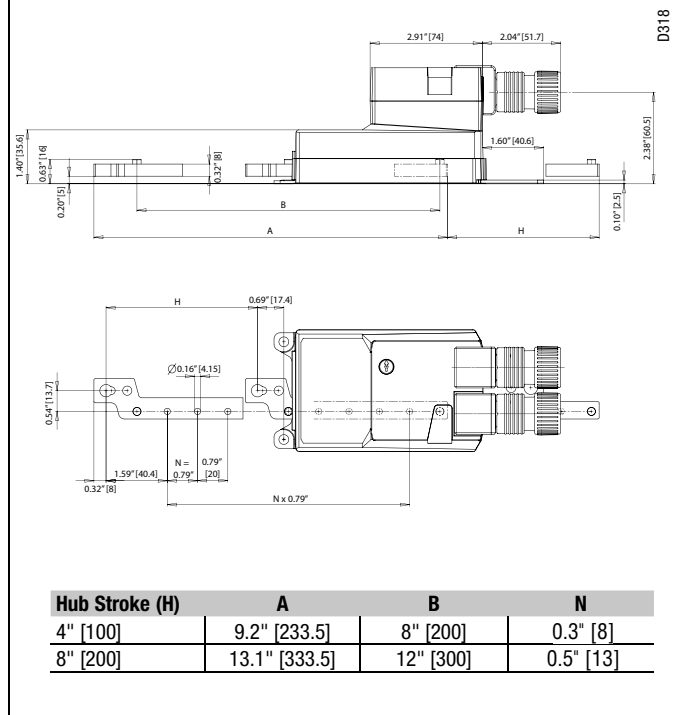
The AHX120 series provides 4 or 8 inches of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AHX120-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

## Dimensions (Inches [mm])



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**Accessories**

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSA	Linear Coupling
P370	Shaft Mount Auxiliary Switch
SGA24	Min Positioners in NEMA 4 Housing
SGF24	Min Positioners for Flush Panel Mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using AHX120-SR... actuators, only use accessories listed on this page.

**Typical Specification**

Proportional control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

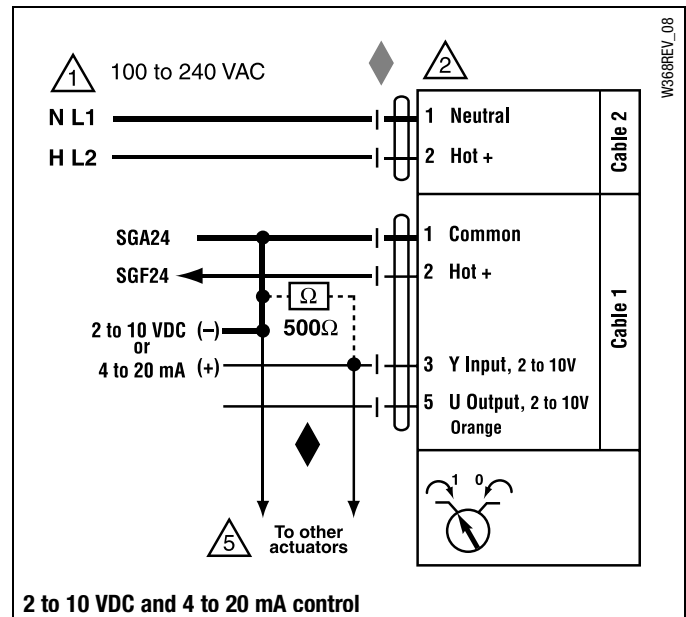
**Wiring Diagram**
**INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 5 Only connect common to neg. (-) leg of control circuits.

**APPLICATION NOTES**

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

**WARNING Live Electrical Components!**  
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# AHX24-MFT(-100)(-200)(-300)

Proportional, Non-Spring Return, Linear Stroke, 24 V, Multi-Function Technology®



MFT



Technical Data	AHX24-MFT(-100)(-200)(-300)
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	3.5 W (1.3 W)
Transformer sizing	6 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full stroke
Control	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC (max 0.5 mA) VDC variable
Linear stroke	
AHX24-MFT-100	4 in [100 mm]
AHX24-MFT-200	8 in [200 mm]
AHX24-MFT-200	12 in [300 mm]
Linear force	101 lbf [450 N]
Stroke direction	reversible with ↓/↑ switch
Manual override	external push button
Running time	150 seconds per 4" [100mm]
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	
AHX24-MFT-100	2.6 lbs [1.18 kg]
AHX24-MFT-200	2.7 lbs [1.23 kg]
AHX24-MFT-200	2.9 lbs [1.32 kg]

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

Linear Force min. 101 lbf for control of damper surfaces up to 32 sq. ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

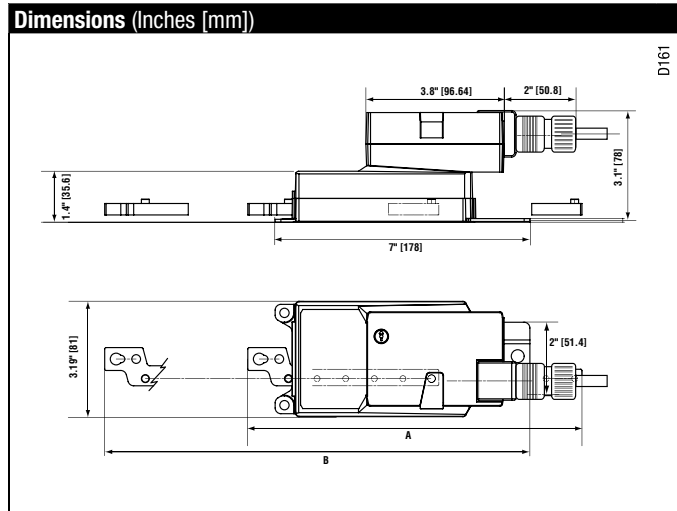
## Operation

The actuator is not provided with and does not require and limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AHX series provides 4, 8, or 12 inches of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AHX24-MFT... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.



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### Accessories

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSC	Linear Coupling
P370	Shaft Mount Auxiliary Switch
SGA24	Min Positioners in NEMA 4 Housing
SGF24	Min Positioners for Flush Panel Mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

NOTE: When using AHX24-MFT... actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

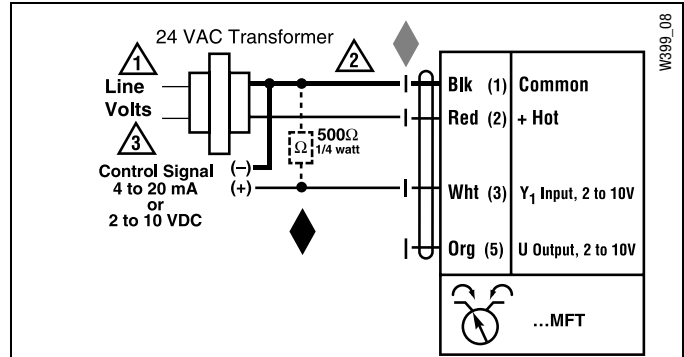
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

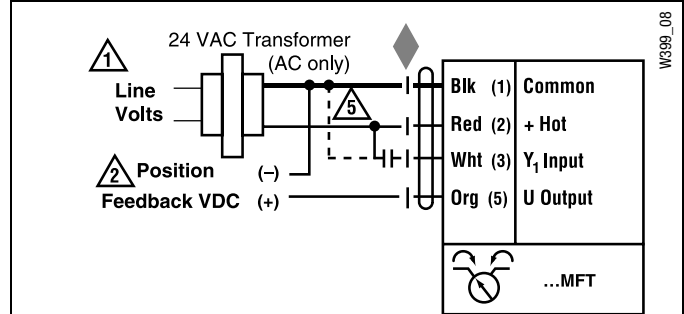
- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

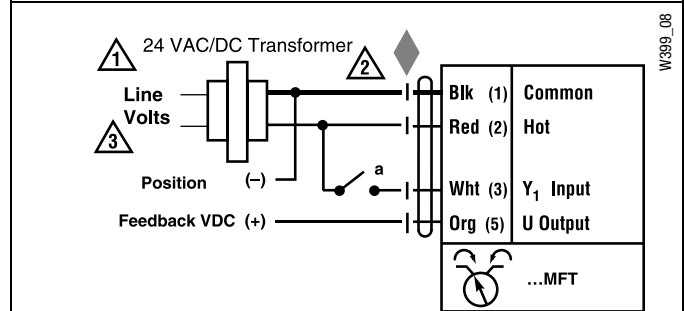
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



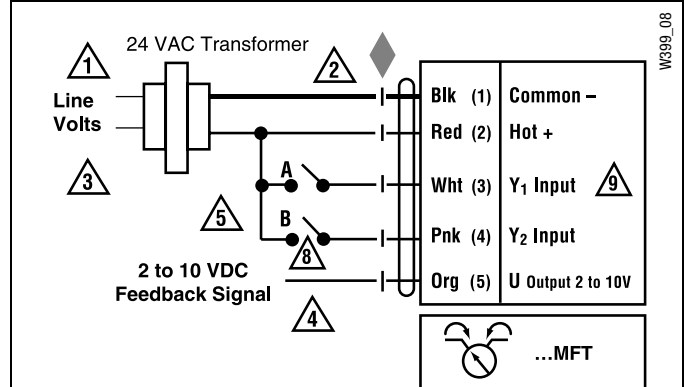
VDC/4-20 mA



PWM



On/Off control



Floating Point control

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# AHQB(X)24-1-100

On/Off, Non-Spring Return, Linear Stroke, 24 V



MFT



Technical Data	AHQB(X)24-1-100
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 20%
Power consumption	13 W (1.5 W)
Transformer sizing	23 VA (Class 2 power source)
Electrical connection	
AHQB24-1-100	3 ft [1m] 18 GA plenum rated cable protected NEMA 2 (IP54)
AHQX24-1-100	3 ft [1m] 10 ft [3m] 16 ft [5m] 18 GA plenum rated cable protected NEMA 2 (IP54)
Overload protection	electronic throughout full stroke
Control	on/off
Input impedance	1000 $\Omega$
Linear stroke	1.6" to 4.0" [40mm to 100 mm]
Linear force	44 lbf [200 Nm]
Stroke direction	reversible with $\downarrow/\uparrow$ switch
Manual override	external push button
Running time	7 seconds per 4" [100mm]
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	<52 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.7 lbs [1.23 kg]

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

Linear Force min. 44 lbf for control of damper surfaces up to 12 sq. ft.

## Application

For On/Off control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

## Operation

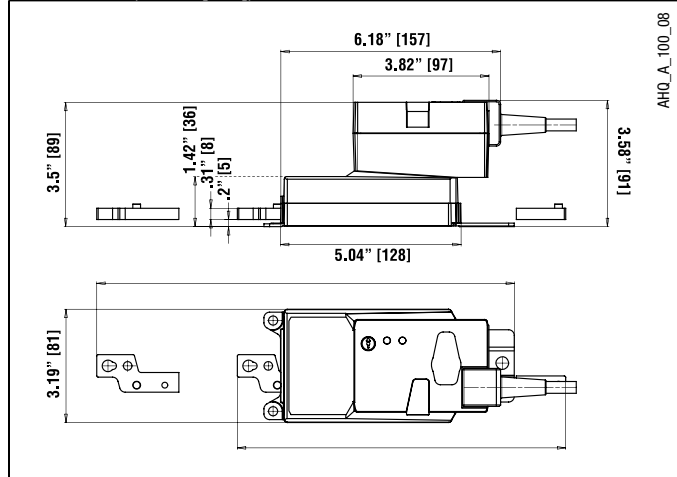
The actuator is not provided with and does not require and limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AHQB(X) series provides 4" [100 mm] of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8" [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AHQB(X)24-1-100 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

## Dimensions (Inches [mm])



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### Accessories

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSC	Linear Coupling
P370	Shaft Mount Auxiliary Switch

**NOTE:** When using AHQB(X)24-1-100 actuators, only use accessories listed on this page.

### Typical Specification

On/Off control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators shall have brushless DC motor technology and be protected from overload at all positions of linear stroke. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cUL listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### ✂ **INSTALLATION NOTES**

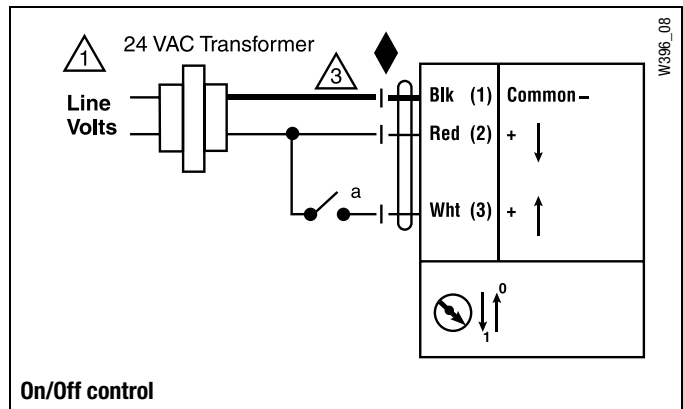
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

#### 📄 **APPLICATION NOTES**

- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### ⚠ **WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# AHQB(X)24-MFT-100

Proportional, Non-Spring Return, Linear Stroke, 24 V, Multi-Function Technology®



MFT



**Linear Force min. 44 lbf for control of damper surfaces up to 12 sq. ft.**

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

## Operation

The actuator is not provided with and does not require and limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

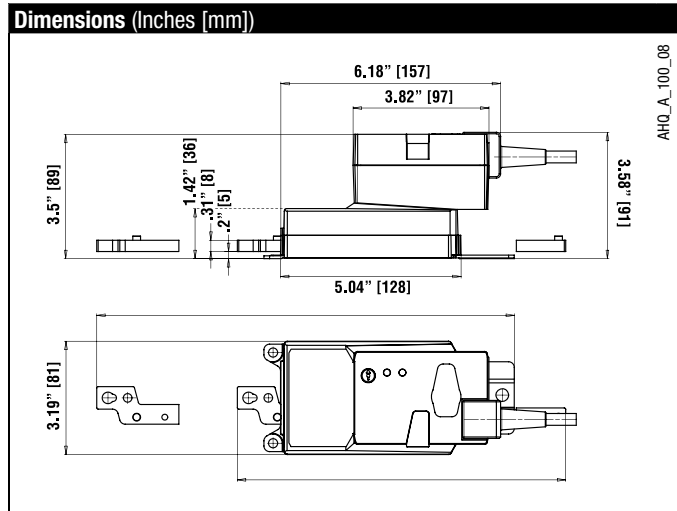
The AHQB(X) series provides 4" [100 mm] of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8" [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The AHQB(X)24-MFT-100 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Technical Data	AHQB(X)24-MFT-100
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	13 W (1.5 W)
Transformer sizing	23 VA (Class 2 power source)
Electrical connection	
AHQB24-MFT-100	3 ft [1m] 18 GA plenum rated cable protected NEMA 2 (IP54)
AHQX24-MFT-100	3 ft [1m] 10 ft [3m] 16 ft [5m] 18 GA plenum rated cable protected NEMA 2 (IP54)
Overload protection	electronic throughout full stroke
Control	2 to 10 VDC, 4 to 20 mA (default) Variable (VDC, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω, 1000 Ω (on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max, VDC variable
Linear stroke	1.6" to 4.0" [40mm to 100 mm]
Linear force	44 lbf [200 Nm]
Stroke direction	reversible with ↓/↑ switch
Manual override	external push button
Running time	7 seconds per 4" [100mm] variable (7, 10, 15 or 35 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	<52 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	2.7 lbs [1.23 kg]

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



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Accessories	
Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSC	Linear Coupling
P370	Shaft Mount Auxiliary Switch
SGA24	Min Positioners in NEMA 4 Housing
SGF24	Min Positioners for Flush Panel Mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using AHQB(X)24-MFT-100 actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

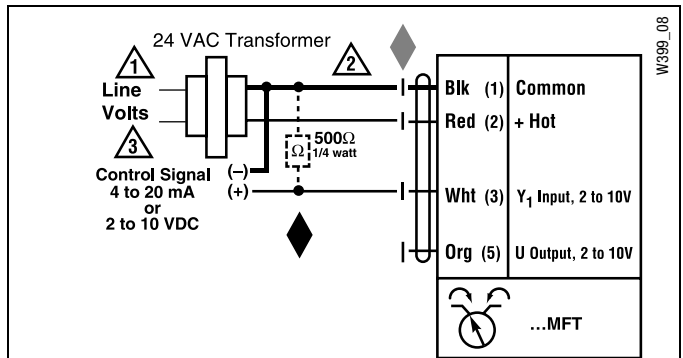
#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!** Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.

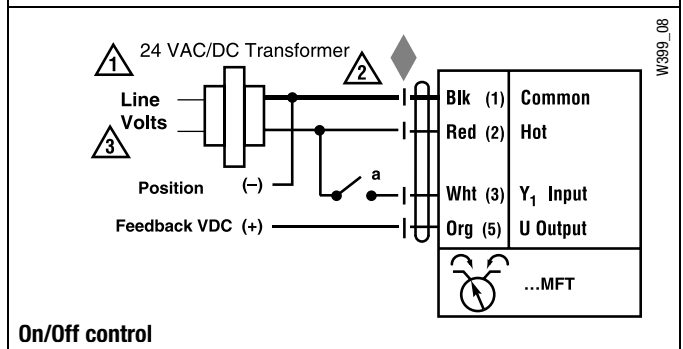
#### 📄 APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor may be used.

**⚠️ WARNING Live Electrical Components!** During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



VDC/4-20 mA



On/Off control

## Minimum 34 lbf Linear Force

- For damper surfaces up to 10 sq. ft\*
- Q Series- 22 lbf for damper surfaces up to 6 sq. ft.



Actuators in bold have BDCM

### LH Series - At A Glance

		<i>LHB(X)24-3(-100)(-200)(-300) (p. 373)</i>	<i>LHX120-3(-100)(-200)(-300) (p. 375)</i>	<i>LHB(X)24-SR(-100)(-200) (p. 377)</i>	<i>LHX120-SR(-100)(-200) (p. 379)</i>	<i>LHX24-MFT-100 (p. 381)</i>	<i>LHQB(X)24-1-100 (p. 383)</i>	<i>LHQB(X)24-MFT-100 (p. 385)</i>
Basic Product		•		•			•	•
Flexible Product		•	•	•		•	•	•
Linear Force	34 lbf [150 N]	•	•	•	•	•		
	22 lbf [150 N]						•	•
Linear Stroke	4" [100mm]	•	•	•	•	•	•	•
	8" [200mm]	•	•	•	•	•		
	12" [300mm]	•	•			•		
Power Supply	24 VAC/DC	•		•		•	•	•
	120 VAC		•		•			
Control Input	On/Off		•				•	
	On/Off, Floating Point	•	•					
	2 to 10 VDC (4 to 20mA)			•	•			
	Multi-Function Technology					•		•
Feedback	None	•	•				•	
	2 to 10 VDC			•	•			
	Variable (0 to 10 VDC)					•		•
Running Time	3.5 seconds per 4"						•	
	150 seconds per 4"	•	•	•	•			
	Adj. 75 to 150 seconds per 4"	•		•		•		
	Adj. 3.5 to 15 seconds per 4"							•
Wiring	Plenum Rated Cable	•		•		•	•	•
	Conduit Fitting	•	•	•	•	•	•	•

Installation and Operation... (page 400).

\*Based on 4 in-lb/ft<sup>2</sup> damper torque loading. Parallel blade. No edge seals.

# A CLOSER LOOK...

- Brushless DC Motor for Added Accuracy and Controllability.
- Don't Worry about Actuator Burn-Out; Belimo is Overload Proof throughout Rotation.
- Enjoy Added Flexibility with Easy Mechanical Stops to Adjust Linear Movement.
- Need to Change Control Direction? Do it easily with a Simple Switch.
- Easily Accessible Manual Override Button helps you Pre-Tension Damper Blades.
- Standard 3ft Plenum Rated Cable and Conduit Connector Provided on Basic Models.
- Added Flexibility to Select Clamp, Electrical Connection, and Running Time to fit your Specific Application with Belimo's New Flexible Line of Actuators.



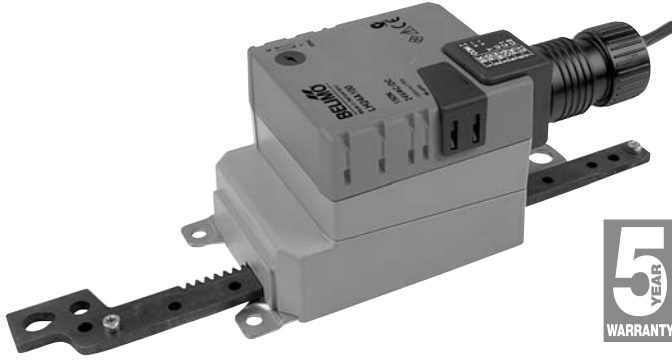
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## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

# LHB(X)24-3(-100)(-200)(-300)

On/Off, Floating Point, Non-Spring Return, Linear Stroke, 24 V



Technical Data	LHB(X)24-3(-100)(-200)(-300)
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	1.5 W (0.5 W)
Transformer sizing	3 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full stroke
Control	on/off, floating point
Input impedance	600 Ω
Linear stroke	
LHB(X)24-3-100	4 in [100 mm]
LHB(X)24-3-200	8 in [200 mm]
LHB(X)24-3-300	12 in [300 mm]
Linear force	34 lbf [150 N]
Stroke direction	reversible with ↓/↑ switch
Manual override	external push button
Running time	150, 95, or 75 seconds per 4" [100mm]
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	
LHB(X)24-3-100	0.81 lbs [0.37 kg]
LHB(X)24-3-200	0.86 lbs [0.39 kg]
LHB(X)24-3-300	0.93 lbs [0.42 kg]

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

Linear Force min. 34 lbf for control of damper surfaces up to 11 sq. ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

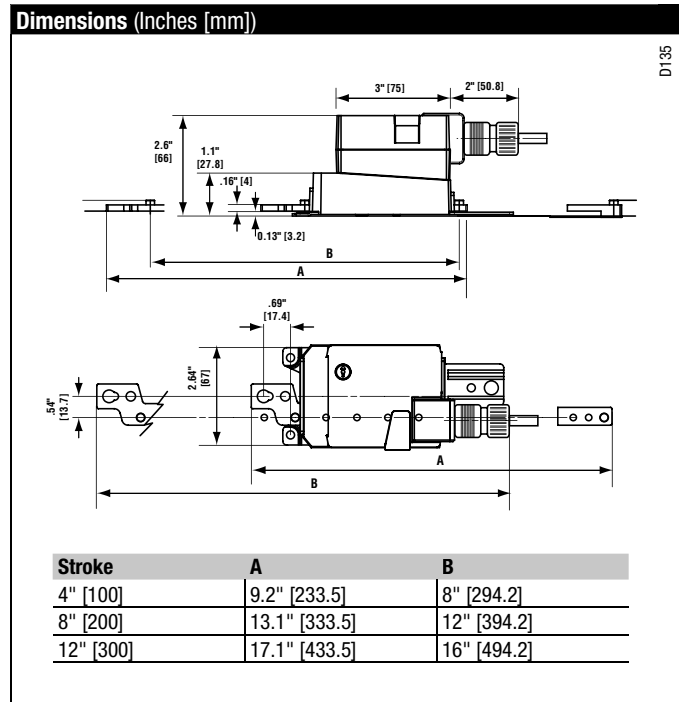
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LHB(X)24-3... series provides 4, 8, or 12 in of linear force. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LHB(X)24-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.



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#### Accessories

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSA	Linear Coupling
P370	Shaft Mount Auxiliary Switch

**NOTE:** When using LHB(X)24-3... actuators, only use accessories listed on this page.

#### Typical Specification

Floating point, on/off control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators shall have brushless DC motor technology and be protected from overload at all positions of linear stroke. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

##### ✂️ INSTALLATION NOTES

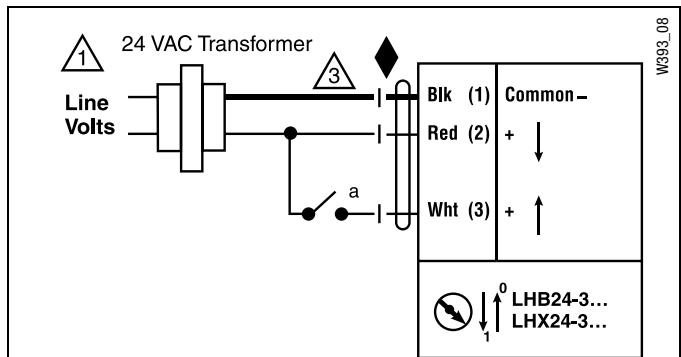
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

##### 📄 APPLICATION NOTES

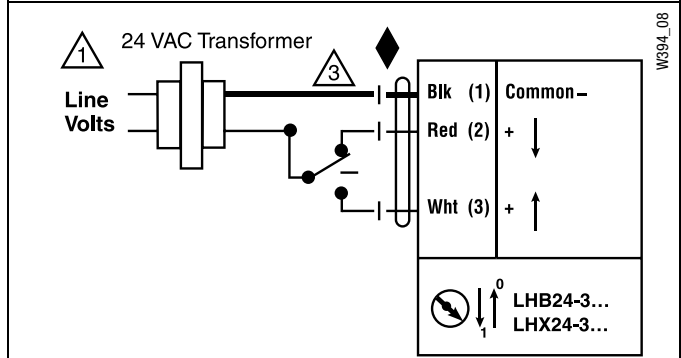
- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

##### ⚠️ Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



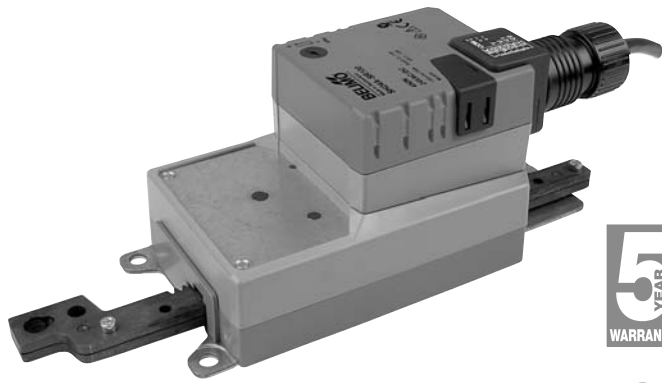
On/Off control



Floating Point or On/Off control

# LHX120-3(-100)(-200)(-300)

On/Off, Floating Point, Non-Spring Return, Linear Stroke, 100 to 240 VAC



Technical Data	LHX120-3(-100)(-200)(-300)
Power supply	100 to 240 VAC 50/60 Hz (nominal) 85 to 265 VAC 50/60 Hz (tolerance)
Power consumption	2.5 W
Transformer sizing	4 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full stroke
Control	on/off, floating point
Input impedance	600 Ω
Linear stroke	
LHX120-3-100	4 in [100 mm]
LHX120-3-200	8 in [200 mm]
LHX120-3-300	12 in [300 mm]
Linear force	101 lbf [450 N]
Stroke direction	reversible with ↓/↑ switch
Manual override	external push button
Running time	150 seconds per 4" [100mm]
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA C22.2 No. 24, CE according to #74123IEEC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	
LHX120-3-100	0.81 lbs [0.37 kg]
LHX120-3-200	0.86 lbs [0.39 kg]
LHX120-3-300	0.93 lbs [0.42 kg]

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

Linear Force min. 34lbf for control of damper surfaces up to 11 sq. ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

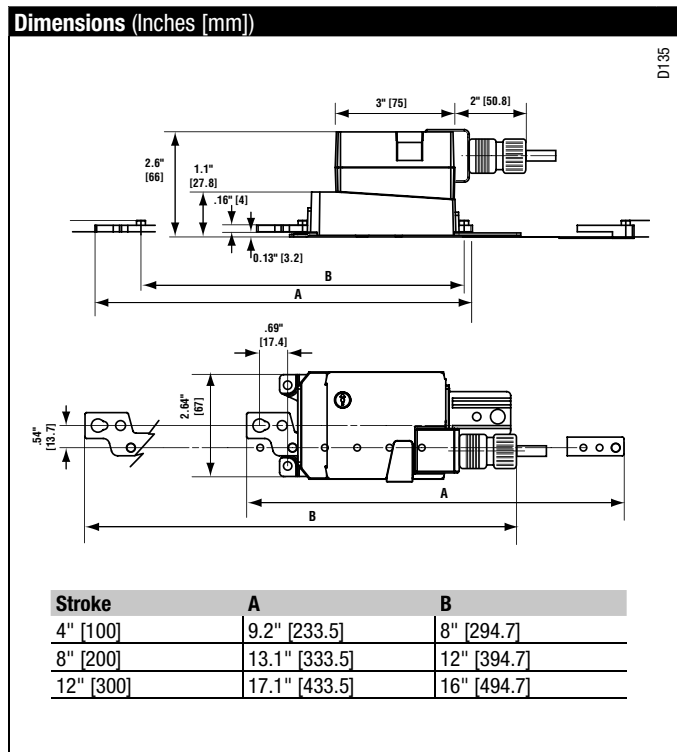
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LHX... series provides 4, 8, or 12 in of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LHX120-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.



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#### Accessories

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSA	Linear Coupling
P370	Shaft Mount Auxiliary Switch

NOTE: When using LHX120-3... actuators, only use accessories listed on this page.

#### Typical Specification

Floating point, on/off control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators shall have brushless DC motor technology and be protected from overload at all positions of linear stroke. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

##### ✂️ INSTALLATION NOTES

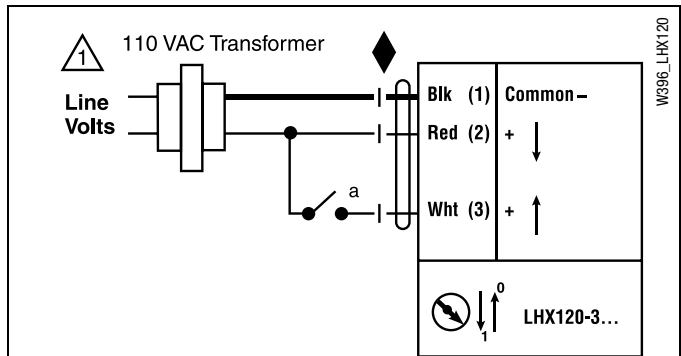
⚠️ Provide overload protection and disconnect as required.

##### 📄 APPLICATION NOTES

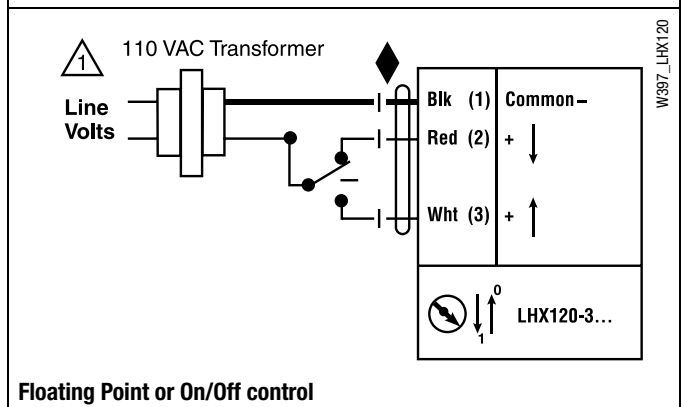
◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

##### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



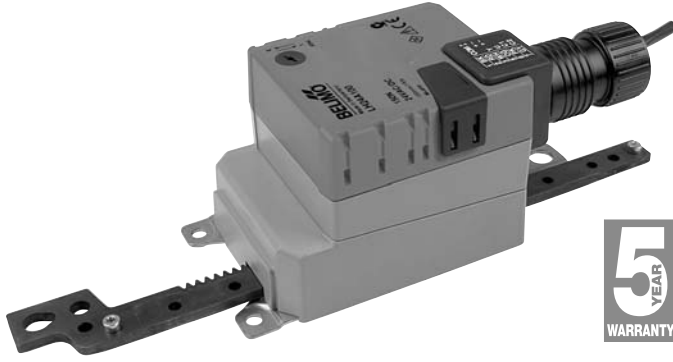
On/Off control



Floating Point or On/Off control

# LHB(X)24-SR(-100)(-200)

Proportional Control, Non-Spring Return, Linear Stroke, 24V, for 2 to 10 VDC and 4 to 20 mA



Technical Data	LHB(X)24-SR(-100)(-200)
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	1.5 W (0.5 W)
Transformer sizing	3 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full stroke
Control	2 to 10 VDC, 4 to 20 mA
Input impedance	100 kΩ (0.1 mA), 500 Ω
Feedback output U	2 to 10 VDC (max 0.5 mA)
Linear stroke	
LHB(X)24-SR-100	4 in [100 mm]
LHB(X)24-SR-200	8 in [200 mm]
Linear force	34 lbf [150 N]
Stroke direction	reversible with ↓/↑ switch actuator will move in the selected direction with increasing control signal (2 to 10V)
Manual override	external push button
Running time	150, 95, or 75 seconds per 4" [100mm]
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	
LHB(X)24-SR-100	0.81 lbs [0.37 kg]
LHB(X)24-SR-200	0.86 lbs [0.39 kg]

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

Force min. 34 lbf for control of damper surfaces up to 11 sq. ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

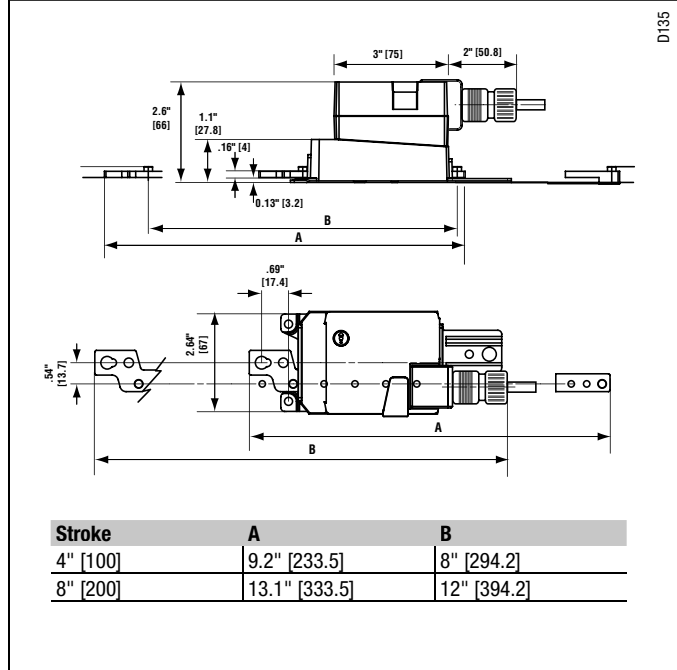
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LHB(X)24-SR... series provides 4 or 8 in of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LHB(X)24-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

## Dimensions (Inches [mm])



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Accessories	
Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSA	Linear Coupling
P370	Shaft Mount Auxiliary Switch
SGA24	Min Positioners in NEMA 4 Housing
SGF24	Min Positioners for Flush Panel Mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

NOTE: When using LHB(X)24-SR... actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

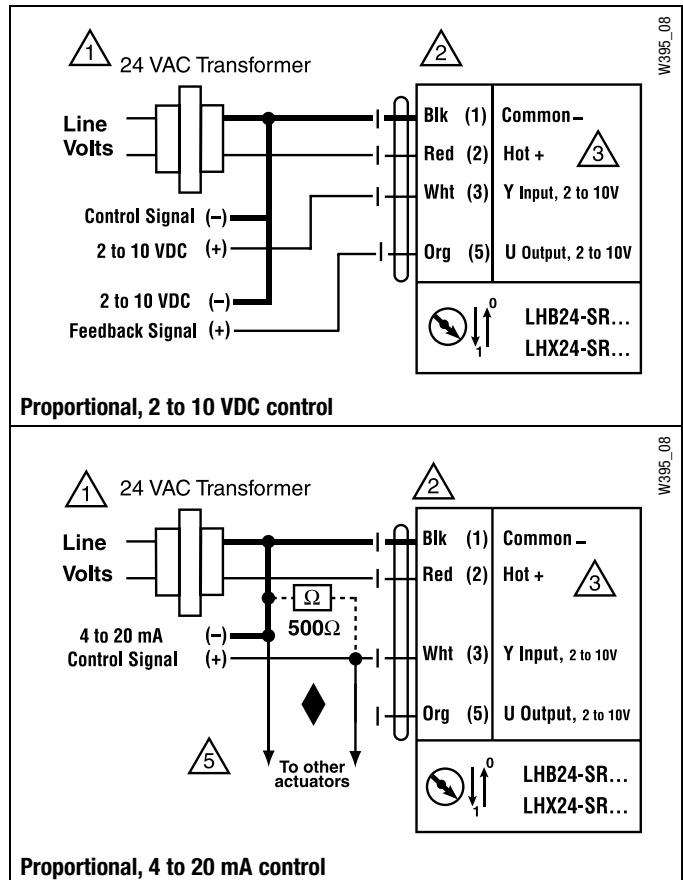
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

#### APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

#### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LHX120-SR(-100)(-200)

Proportional, Non-Spring Return, Linear Stroke, 120 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	LHX120-SR(-100)(-200)
Power supply	100 to 240 VAC 50/60 Hz (nominal) 85 to 265 VAC 50/60 Hz (tolerance)
Power consumption	3 W (1.0 W)
Transformer sizing	4 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full stroke
Control	on/off, floating point
Input impedance	600 Ω
Linear stroke	
LHX120-SR-100	4 in [100 mm]
LHX120-SR-200	8 in [200 mm]
Linear force	101 lbf [450 N]
Stroke direction	reversible with ↓/↑ switch
Manual override	external push button
Running time	150 seconds per 4" [100mm]
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA C22.2 No. 24, CE according to #74123IEEC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	
LHX120-SR-100	0.81 lbs [0.37 kg]
LHX120-SR-200	0.86 lbs [0.39 kg]

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

Linear Force min. 34lbf for control of damper surfaces up to 11 sq. ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

## Operation

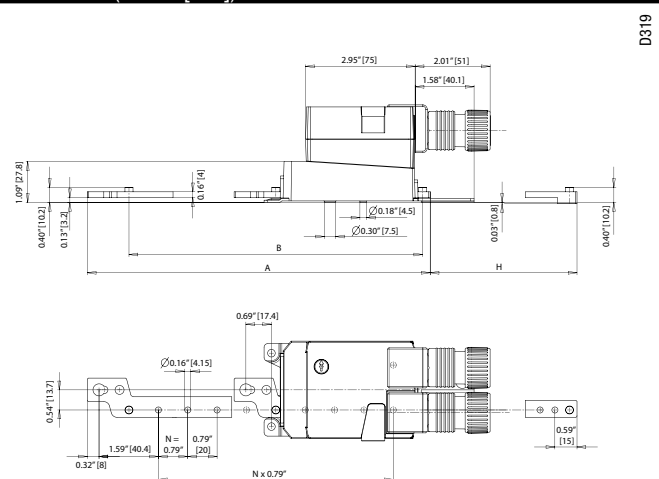
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LHX120-SR... series provides 4 or 8 in of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LHX120-SR... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

## Dimensions (Inches [mm])



Hub Stroke (H)	A	B	N
4" [100]	9.2" [233.5]	8" [200]	0.3" [8]
8" [200]	13.1" [333.5]	12" [300]	0.5" [13]

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**Accessories**

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSA	Linear Coupling
P370	Shaft Mount Auxiliary Switch

**NOTE:** When using LHB(X)120-SR... actuators, only use accessories listed on this page.

**Typical Specification**

Floating point, on/off control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators shall have brushless DC motor technology and be protected from overload at all positions of linear stroke. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagram**
**INSTALLATION NOTES**

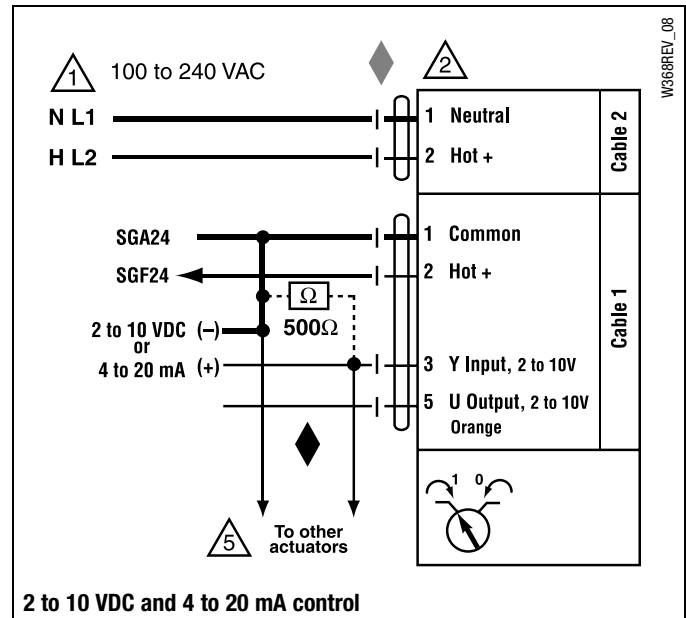
Provide overload protection and disconnect as required.

**APPLICATION NOTES**

Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

**WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LHX24-MFT(-100)(-200)(-300)

Proportional, Non-Spring Return, Linear Stroke, 24 V, Multi-Function Technology®



MFT



Technical Data	LHX24-MFT(-100)(-200)(-300)
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	2.5 W (1.2 W)
Transformer sizing	5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full stroke
Control	2 to 10 VDC, 4 to 20 mA (default) Variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC (max 0.5 mA) VDC variable
Linear stroke	LHX24-MFT-100 4 in [100 mm] LHX24-MFT-200 8 in [200 mm] LHX24-MFT-300 12 in [300 mm]
Linear force	34 lbf [450 N]
Stroke direction	reversible with ↓/↑ switch
Manual override	external push button
Running time	150 seconds per 4" [100mm] variable (75 to 150 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	LHX24-MFT-100 0.81 lbs [0.37 kg] LHX24-MFT-200 0.86 lbs [0.39 kg] LHX24-MFT-300 0.93 lbs [0.42 kg]

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

Linear Force min. 34 lbf for control of damper surfaces up to 11 sq. ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

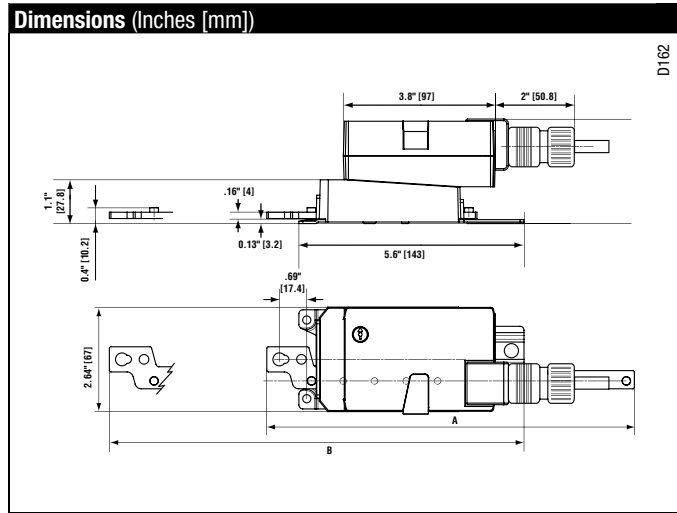
## Operation

The actuator is not provided with and does not require and limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LHX series provides 4, 8, or 12 in of linear force. The stroke of the gear rack can be adjusted on both sides in increments of 0.8 in [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LHX24-MFT... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.



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Accessories	
Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSA	Linear Coupling
P370	Shaft Mount Auxiliary Switch
SGA24	Min Positioners in NEMA 4 Housing
SGF24	Min Positioners for Flush Panel Mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using LHX24-MFT... actuators, only use accessories listed on this page.

**Typical Specification**

Proportional control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Wiring Diagrams**

**INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

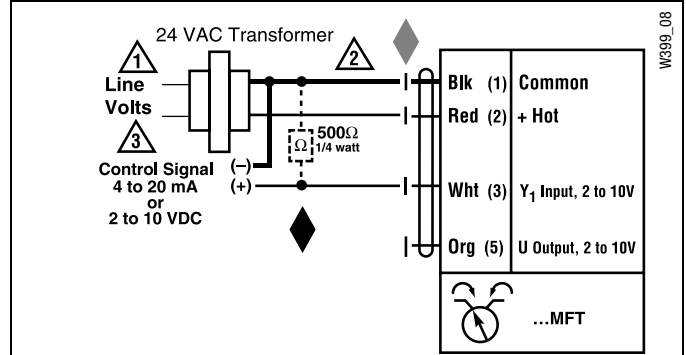
**APPLICATION NOTES**

The ZG-R01 500 Ω resistor may be used.

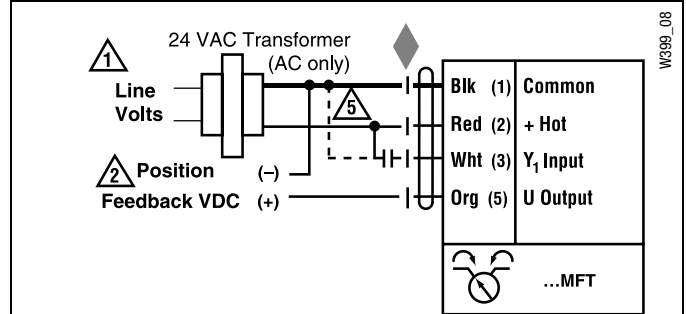
**WARNING Live Electrical Components!**

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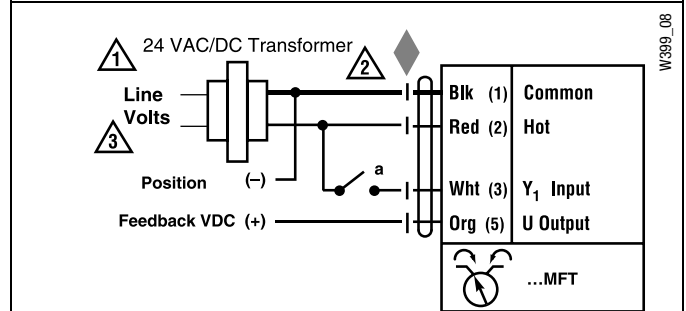
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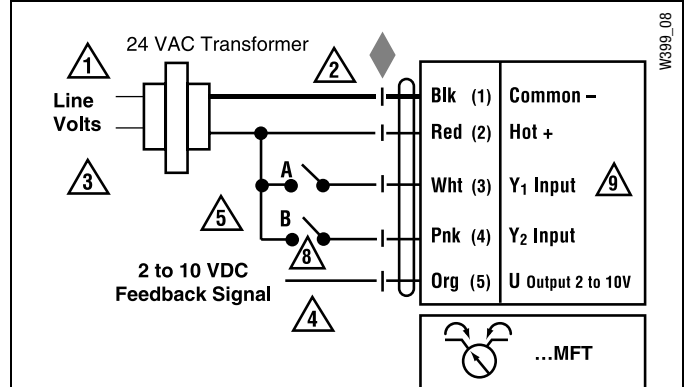
VDC/4-20 mA



PWM



On/Off control



Floating Point control

# LHQB(X)24-1-100

On/Off, Non-Spring Return, Linear Stroke, 24 V



Technical Data	LHQB(X)24-1-100
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 20%
Power consumption	12 W (1.5 W)
Transformer sizing	18 VA (Class 2 power source)
Electrical connection	
LHQB24-1-100	3 ft [1m] 18 GA plenum rated cable protected NEMA 2 (IP54)
LHQX24-1-100	3 ft [1m] 10 ft [3m] 16 ft [5m] 18 GA plenum rated cable protected NEMA 2 (IP54)
Overload protection	electronic throughout full stroke
Control	on/off
Input impedance	1000 $\Omega$
Feedback output U	2 to 10 VDC (max 0.5 mA) VDC variable
Linear stroke	1.6" to 4.0" [40mm to 100 mm]
Linear force	22 lbf [100 Nm]
Stroke direction	reversible with $\downarrow/\uparrow$ switch
Manual override	external push button
Running time	3.5 seconds per 4" [100mm]
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	<52 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.4 lbs [0.64 kg]

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

Linear Force min. 22 lbf for control of damper surfaces up to 6 sq. ft.

## Application

For On/Off control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

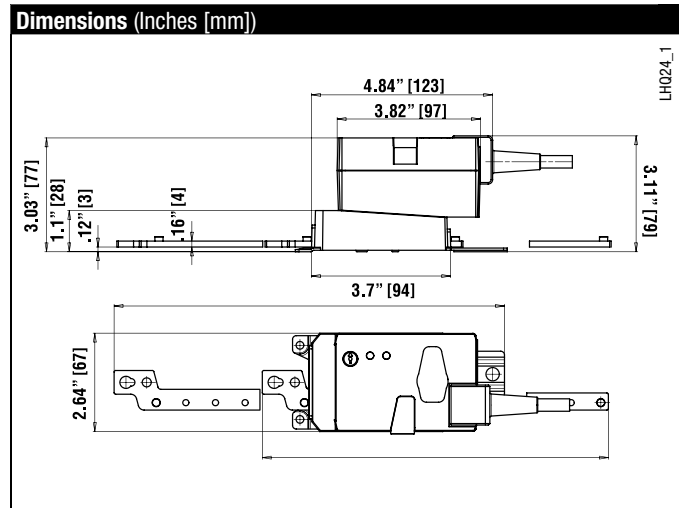
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LHQB(X) provides 4" [100 mm] of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8" [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LHQB(X)24-1-100 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.



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### Accessories

Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSA	Linear Coupling
P370	Shaft Mount Auxiliary Switch

**NOTE:** When using LHQB(X)24-1... actuators, only use accessories listed on this page.

### Typical Specification

On/Off control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators shall have brushless DC motor technology and be protected from overload at all positions of linear stroke. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cUL listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### ✂️ INSTALLATION NOTES

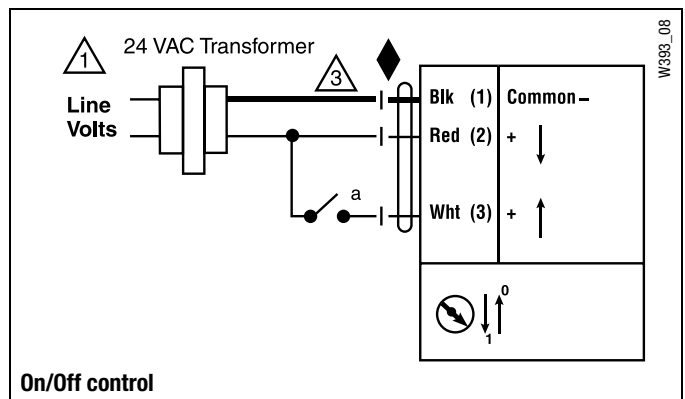
- ⚠️ 1 Provide overload protection and disconnect as required.
- ⚠️ 3 Actuators may also be powered by 24 VDC.

#### 📄 APPLICATION NOTES

- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

#### ⚠️ **WARNING Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LHQB(X)24-MFT-100

On/Off, Non-Spring Return, Linear Stroke, 24 V



**Linear Force min. 22 lbf for control of damper surfaces up to 6 sq. ft.**

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

## Operation

The actuator is not provided with and does not require and limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

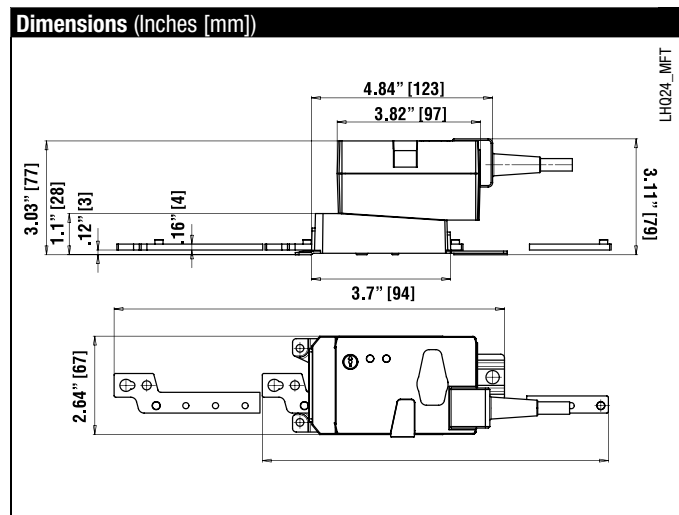
The LHQB(X) series provides 4" [100 mm] of linear stroke. The stroke of the gear rack can be adjusted on both sides in increments of 0.8" [20 mm] by means of the mechanical end stops.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LHQB(X)24-MFT-100 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Technical Data	LHQB(X)24-MFT-100
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	12 W (1.5 W)
Transformer sizing	18 VA (Class 2 power source)
Electrical connection	
LHQB24-MFT-100	3 ft [1m] 18 GA plenum rated cable protected NEMA 2 (IP54)
LHQB24-MFT-100	3 ft [1m] 10 ft [3m] 16 ft [5m] 18 GA plenum rated cable protected NEMA 2 (IP54)
Overload protection	electronic throughout full stroke
Control	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω, 1000 Ω (on/off)
Feedback output U	2 to 10 VDC (max 0.5 mA) VDC variable
Linear stroke	1.6" to 4.0" [40mm to 100 mm]
Linear force	22 lbf [100 Nm]
Stroke direction	reversible with ↓/↑ switch
Manual override	external push button
Running time	3.5 seconds per 4" [100mm] variable (3.5, 5, 10 or 15 seconds)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	<52 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.4 lbs [0.64 kg]

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



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Accessories	
Z-DS1	Rotary Support to Compensate Lateral Forces
Z-KSA	Linear Coupling
P370	Shaft Mount Auxiliary Switch
SGA24	Min Positioners in NEMA 4 Housing
SGF24	Min Positioners for Flush Panel Mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

**NOTE:** When using LHQB(X)24-MFT-100 actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic type, with integrated linear stroking arm. Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

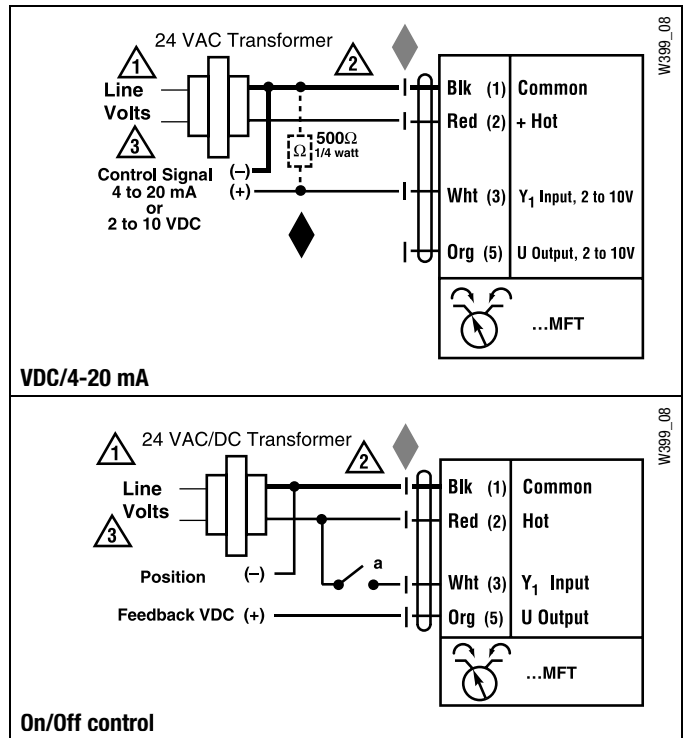
#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.

#### 📄 APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor may be used.

**⚠️ WARNING Live Electrical Components!**  
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**Minimum 27 in-lb Torque**

- For damper areas up to 6.8 sq-ft\*



Actuators in bold have BDCM

**LU Series - At A Glance**

		<i>LUB(X)24-3 (p. 389)</i>	<i>LUX120-3 (p. 391)</i>	<i>LUB(X)24-SR (p. 393)</i>	<i>LUX120-SR (p. 395)</i>	<i>LUX24-MFT (p. 397)</i>
Basic Product		●		●		
Flexible Product		●	●	●	●	●
Torque	27 in-lb [3 Nm]	●	●	●	●	●
Angle of Rotation	Endless	●	●			●
	330 degrees			●	●	
Power Supply	24 VAC/DC	●		●		●
	100-240 VAC		●		●	
Control Input	On/Off, Floating Point	●	●			
	2 to 10 VDC (4 to 20mA)			●	●	
	Multi-Function Technology					●
Feedback	None	●	●			
	2 to 10 VDC			●	●	
	Variable (0 to 10 VDC)					●
Running Time	150 seconds per 90°	●	●	●	●	●
	Adj. 35 to 150 seconds per 90°	●	●	●	●	●
Wiring	Plenum Rated Cable	●		●		●
	Appliance Rated Cable		●		●	
	Conduit Fitting	●	●	●	●	●

Installation and Operation... (page 400).

\*Based on 4 in-lb/ft² damper torque loading. Parallel blade. No edge seals.

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# A CLOSER LOOK...

- Brushless DC Motor for Added Accuracy and Controllability.
- Cut Labor Costs with Simple Direct Coupling.
- Don't Worry about Actuator Burn-Out; Belimo is Overload Proof throughout Rotation.
- Enjoy Added Flexibility with Mechanical Stops to Adjust Angle of Rotation (ZDB-LU).
- Need to Change Control Direction? Do it easily with a Simple Switch.
- Easily Accessible Manual Override Button helps you Pre-Tension Damper Blades.
- Standard 3ft Plenum Rated Cable and Conduit Connector Provided on Basic Models.
- Added Flexibility to Select Clamp, Electrical Connection, and Running Time to fit your Specific Application with Belimo's New Flexible Line of Actuators.



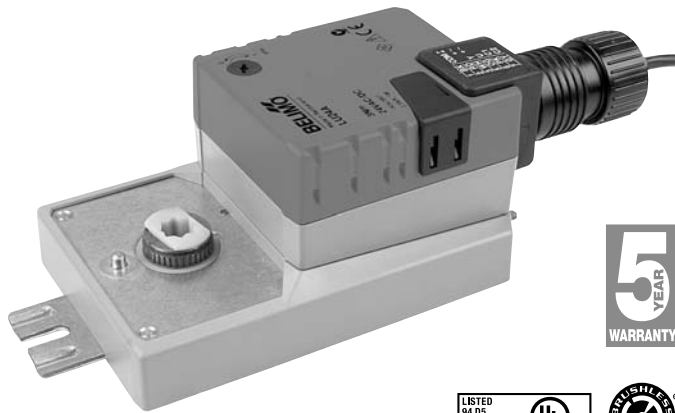
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## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
30+ years direct coupled actuator design.

# LUB(X)24-3

On/Off, Floating Point, Non-Spring Return, 360°, 24 V



Technical Data	LUB(X)24-3
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	1 W (0.5 W)
Transformer sizing	2.5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full rotation
Control	on/off, floating point
Input impedance	600 Ω
Angle of rotation	endless adjustable 0 to 330° with ZDB-LU
Torque	27 in-lb [3 Nm]
Direction of rotation	reversible with  switch
Manual override	external push button
Running time (per 90 degrees)	150 seconds (1.25 rpm) 95 seconds (1.6 rpm) 75 seconds (2.5 rpm)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.43 lbs [0.65 kg]

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

Torque min. 27 in-lb for control of damper surfaces up to 6.8 sq. ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

Control is floating point from a triac or relay, or on/off from an auxiliary contact from a fan motor contactor, controller, or manual switch.

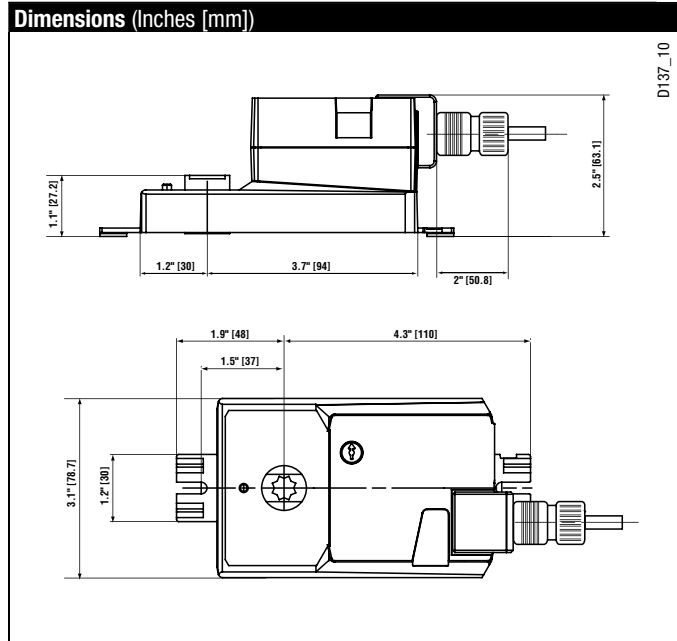
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LUB(X) series provides 330° of rotation with angle of rotation limiter, ZDB-LU. Without ZDB-LU the LUB(X) provides endless rotation.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LUB24-3 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.



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### Accessories

K-LU	1/3" to 1/2" [8 to 12 mm] Shaft Clamp
ZDB-LU	Angle of Rotation Limiter with Scaling
P370	Shaft Mount Auxiliary Switch

**NOTE:** When using LUB(X)24-3 actuators, only use accessories listed on this page.

### Typical Specification

Floating point, on/off control damper actuators shall be electronic type, which require no crank arm and linkage. Actuators shall have brushless DC motor technology and be protected from overload at all positions of linear stroke. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

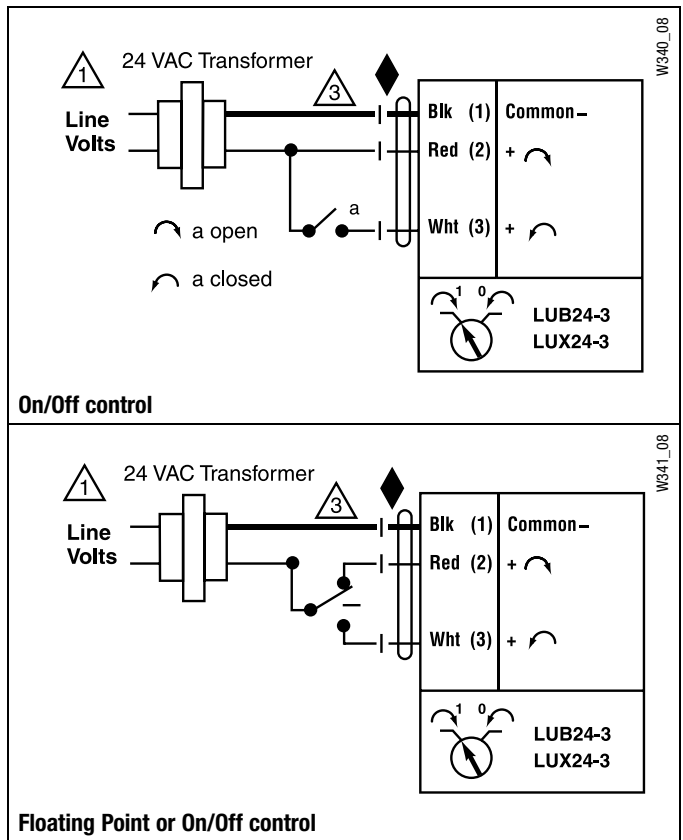
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

#### 📄 APPLICATION NOTES

- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

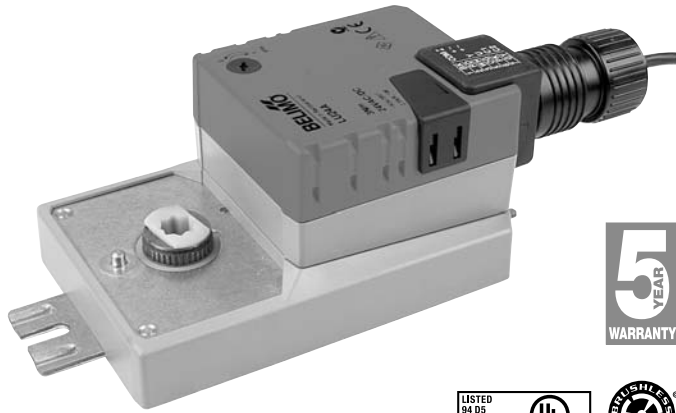
#### ⚠️ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



# LUX120-3

On/Off, Floating Point, Non-Spring Return, 360°, 100 to 240 VAC



Technical Data	LUX120-3
Power supply	100-240 VAC ± 20% 50/60 Hz
Power consumption	3 W (1.5 W)
Transformer sizing	2.5 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full rotation
Control	on/off, floating point
Input impedance	600 Ω
Angle of rotation	endless adjustable 0 to 330° with ZDB-LU
Torque	27 in-lb [3 Nm]
Direction of rotation	reversible with  switch
Manual override	external push button
Running time (per 90 degrees)	150 seconds (1.25 rpm) 95 seconds (1.6 rpm) 75 seconds (2.5 rpm)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.43 lbs [0.65 kg]

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

Torque min. 27 in-lb for control of damper surfaces up to 6.8 sq. ft.

## Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

Control is floating point from a triac or relay, or on/off from an auxiliary contact from a fan motor contactor, controller, or manual switch.

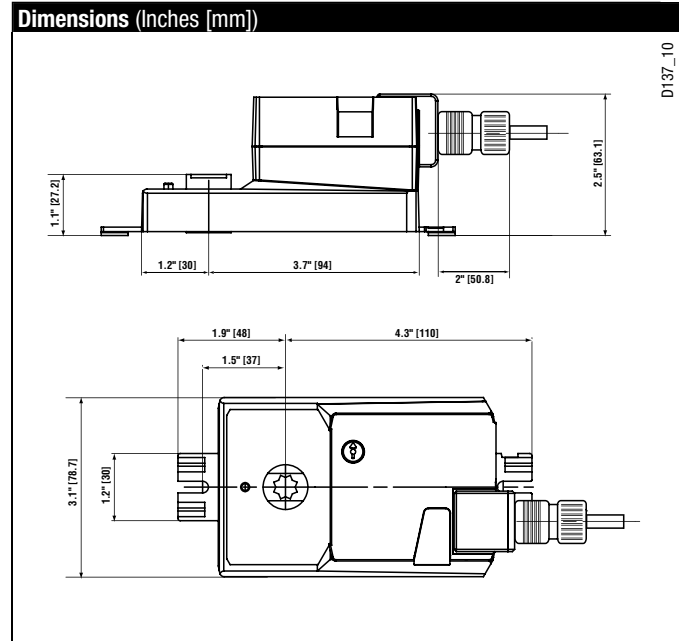
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LUB(X) series provides 330° of rotation with angle of rotation limiter, ZDB-LU. Without ZDB-LU the LUB(X) provides endless rotation.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LUX120-3 actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.



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#### Accessories

K-LU	1/3" to 1/2" [8 to 12 mm] Shaft Clamp
ZDB-LU	Angle of Rotation Limiter with Scaling
P370	Shaft Mount Auxiliary Switch

**NOTE:** When using LUX120-3 actuators, only use accessories listed on this page.

#### Typical Specification

Floating point, on/off control damper actuators shall be electronic type, which require no crank arm and linkage. Actuators shall have brushless DC motor technology and be protected from overload at all positions of linear stroke. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

#### Wiring Diagrams

##### ✂️ INSTALLATION NOTES

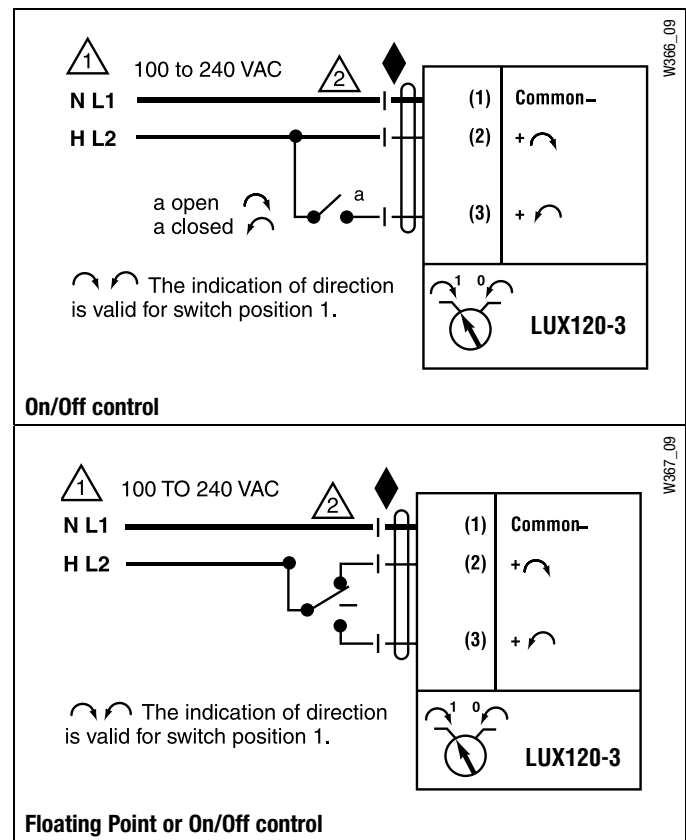
- 1 Provide overload protection and disconnect as required.
- 2 Actuators may be connected in parallel. Power consumption must be observed.

##### 📄 APPLICATION NOTES

- ◆ Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

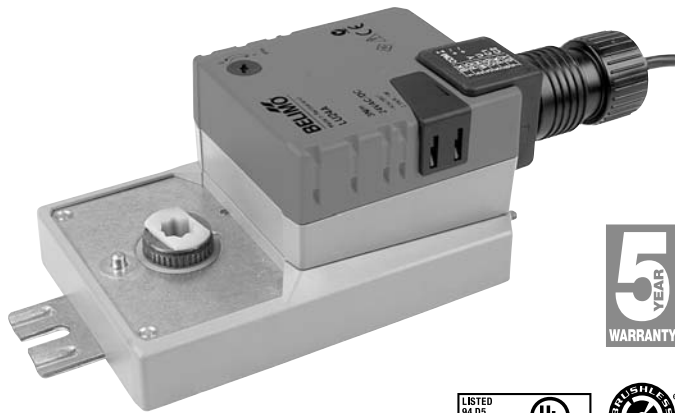
##### ⚠️ WARNING Live Electrical Components!

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# LUB(X)24-SR

Proportional, Non-Spring Return, 360°, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	LUB(X)24-SR
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 20%
Power consumption	1.5 W (0.5 W)
Transformer sizing	3 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 kΩ (0.1 mA), 500 Ω
Feedback output U	2 to 10 VDC (max 0.5 mA)
Angle of rotation	endless, adjustable 0° to 330° with ZDB-LU
Torque	27 in-lb [3 Nm]
Direction of rotation	reversible with  /  switch actuator will move: =CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Manual override	external push button
Running time (per 90 degrees)	150 seconds (1.25 rpm) 95 seconds (1.6 rpm) 75 seconds (2.5 rpm)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.43 lbs [0.65 kg]

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

Force min. 27 in-lb for control of damper surfaces up to 6.8 sq. ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

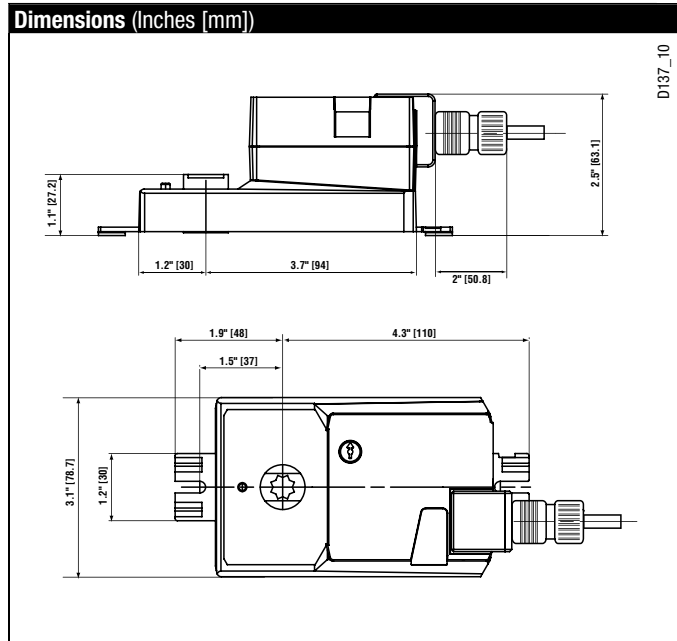
## Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LUB(X) series provides 330° of rotation with angle of rotation limiter, ZDB-LU.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LUB(X)24-SR actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.



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# LUX120-SR

Proportional, Non-Spring Return, 330°, 100 to 240 VAC, for 2 to 10 VDC or 4 to 20 mA



Technical Data	LUX120-SR
Power supply	100-240 VAC ± 20% 50/60 Hz
Power consumption	1.5 W (0.5 W)
Transformer sizing	3 VA (Class 2 power source)
Electrical connection	18 GA appliance rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 kΩ (0.1 mA), 500 Ω
Feedback output U	2 to 10 VDC (max 0.5 mA)
Angle of rotation	endless, adjustable with ZDB-LU
Torque	27 in-lb [3 Nm]
Direction of rotation	reversible with  switch actuator will move: =CCW with decreasing control signal (10 to 2V) =CW with decreasing control signal (10 to 2V)
Manual override	external push button
Running time (per 90 degrees)	150 seconds (2.5 rpm) 95 seconds (1.6 rpm) 75 seconds (1.25 rpm)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level (max)	35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.43 lbs [0.65 kg]

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

Force min. 27 in-lb for control of damper surfaces up to 6.8 sq. ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

## Operation

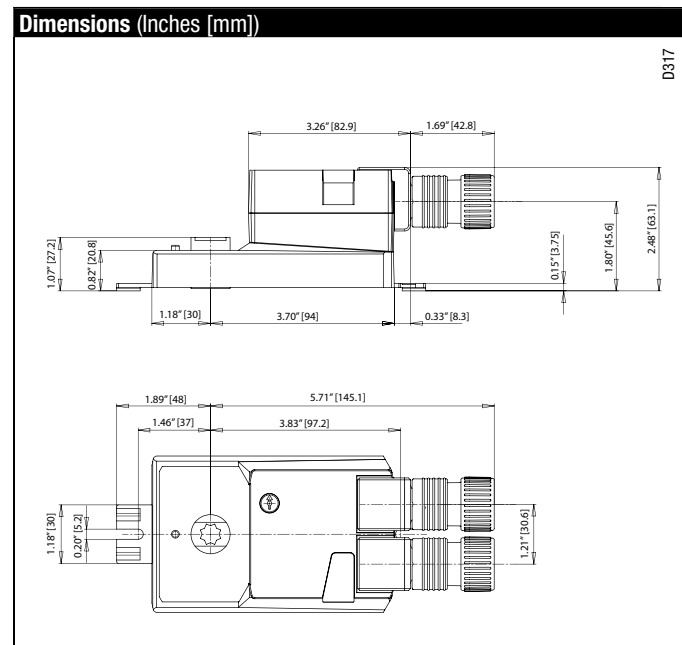
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LUX120-SR series provides 330° of rotation with angle of rotation limiter, ZDB-LU.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LUX120-SR actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

## Dimensions (Inches [mm])



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### Accessories

K-LU	1/3" to 1/2" [8 to 12 mm] Shaft Clamp
P370	Shaft Mount Auxiliary Switch
SGA24	Min Positioners in NEMA 4 Housing
SGF24	Min Positioners for Flush Panel Mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
ZDB-LU	Rotational Limiter

**NOTE:** When using LUX120-SR actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic type, which require no crank arm and linkage. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication.

Actuators shall be cUL Approved, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagram

#### ✂️ INSTALLATION NOTES

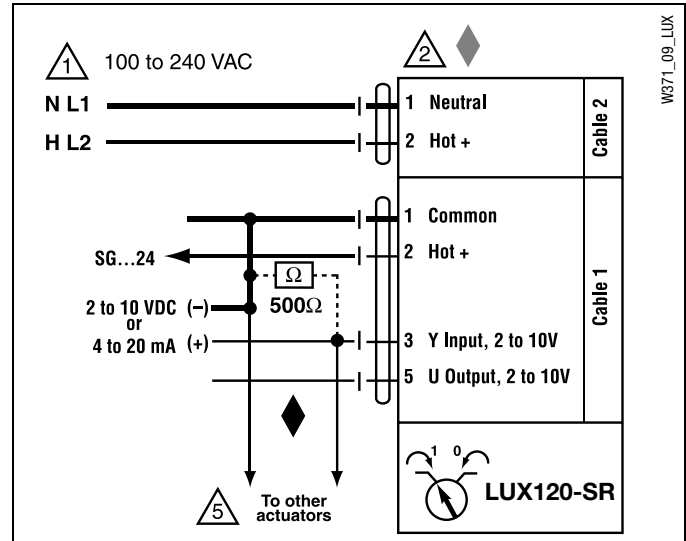
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 5 Only connect common to neg. (-) leg of control circuits.

#### 📄 APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.
- ◆ Meets cULus requirements without the need of an electrical ground connection.

#### ⚠️ WARNING Live Electrical Components!

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# LUX24-MFT

Proportional, Non-Spring Return, 360°, 24 V, Multi-Function Technology®



MFT



Technical Data	LUX24-MFT
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	2.5 W (1.2 W)
Transformer sizing	5 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout full rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC (max 0.5 mA) VDC variable
Angle of rotation	endless, adjustable with ZDB-LU electronically variable
Torque	27 in-lb [3 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time (per 90 degrees)	150 seconds (2.5 rpm, default) variable, 75 to 150 seconds (0.8 to 0.4 rpm)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<35dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.43 lbs [0.65 kg]

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

Torque min. 27 in-lb for control of damper surfaces up to 6.8 sq ft.

## Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The default parameters for 2 to 10 VDC applications of the ...MFT actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. The parameters can be changed by two means: pre-set and custom configurations from Belimo or on-site configurations using the Belimo PC-Tool software.

## Operation

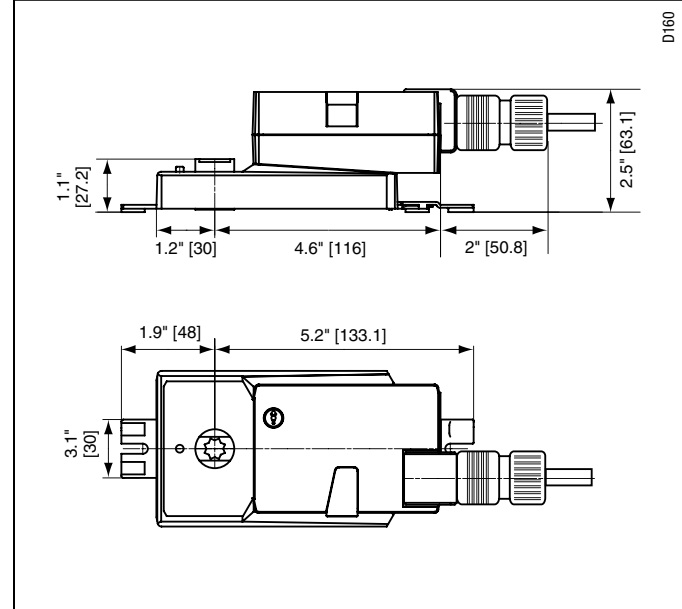
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The LUB series provides 330° of rotation with angle of rotation limiter, ZDB-LU. Without ZDB-LU the LUB24-3 provides endless rotation.

When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The LUX24-MFT... actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

## Dimensions (Inches [mm])



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### Accessories

K-LU	1/3" to 1/2" [8 to 12 mm] Shaft Clamp
ZDB-LU	Angle of Rotation Limiter with Scaling
P370	Shaft Mount Auxiliary Switch
SGA24	Min Positioners in NEMA 4 Housing
SGF24	Min Positioners for Flush Panel Mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

NOTE: When using LUX24-MFT actuators, only use accessories listed on this page.

### Typical Specification

Proportional control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft from 1/4" to 5/8". Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

### Wiring Diagrams

#### INSTALLATION NOTES

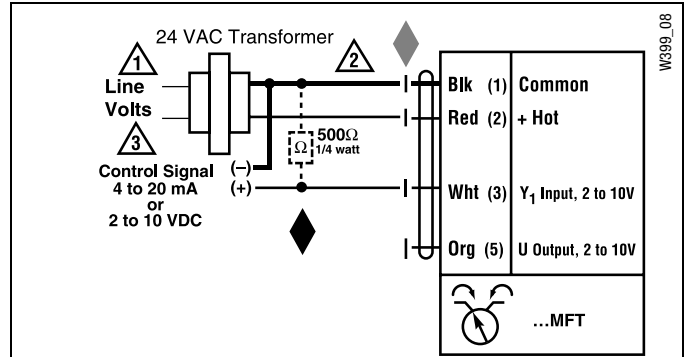
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs.
- 9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

#### APPLICATION NOTES

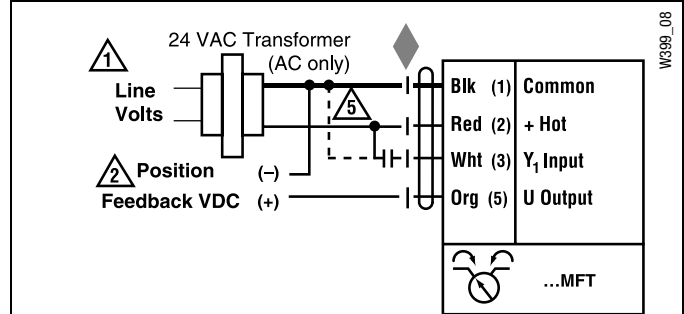
- ◆ The ZG-R01 500 Ω resistor may be used.

#### WARNING Live Electrical Components!

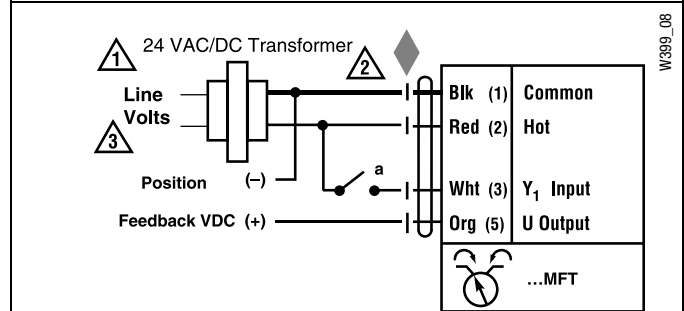
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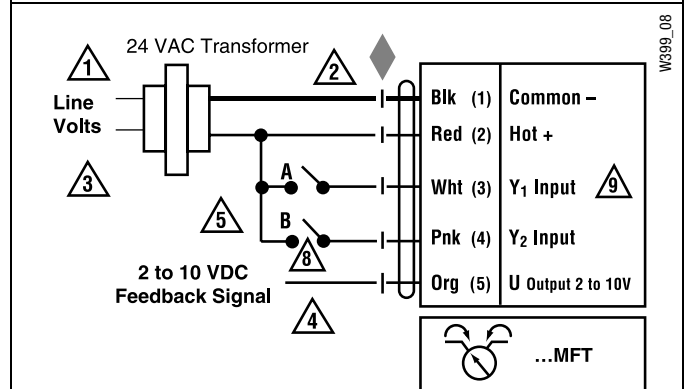
VDC/4-20 mA



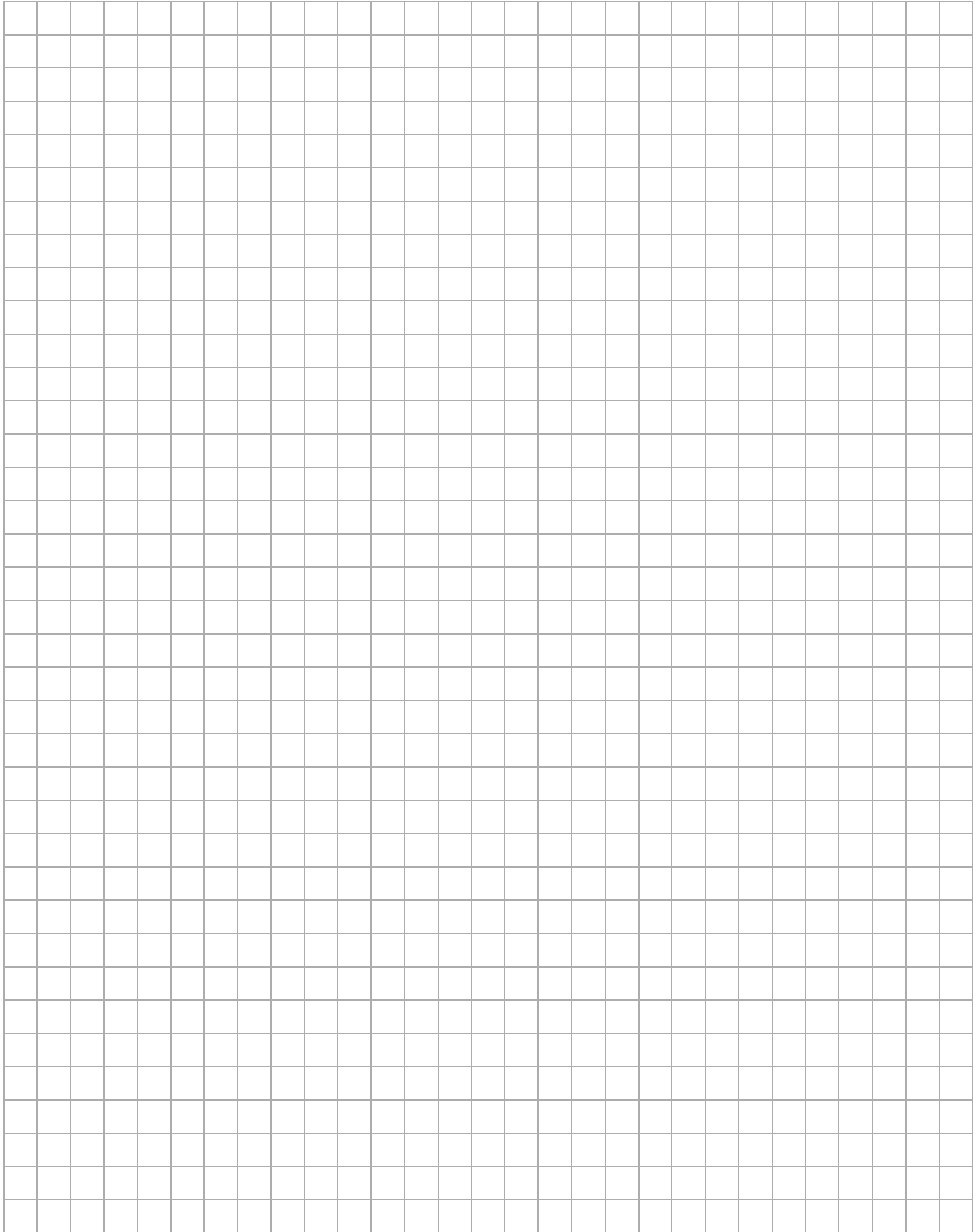
PWM



On/Off control



Floating Point control





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### General Information

#### Preliminary Steps

1. Belimo actuators with NEMA 1 or NEMA 2 ratings should be mounted indoors in a dry, relatively clean environment free from corrosive fumes. If the actuator is mounted outdoors, a protective enclosure must be used to shield the actuator.
2. For new construction work, order dampers with extended shafts. Instruct the installing contractor to allow space for mounting the Belimo actuator on the shaft.

#### For replacement of existing gear train actuators, there are two options:

- A. From a performance standpoint, it is best to mount the actuator directly onto the damper shaft.
- B. If the damper shaft is not accessible, mount the non-spring return actuator with a ZG-NMA or ZG-GMA crank arm kit, and a mounting bracket (ZG-100, ZG-101, ZG-103, ZG-104)

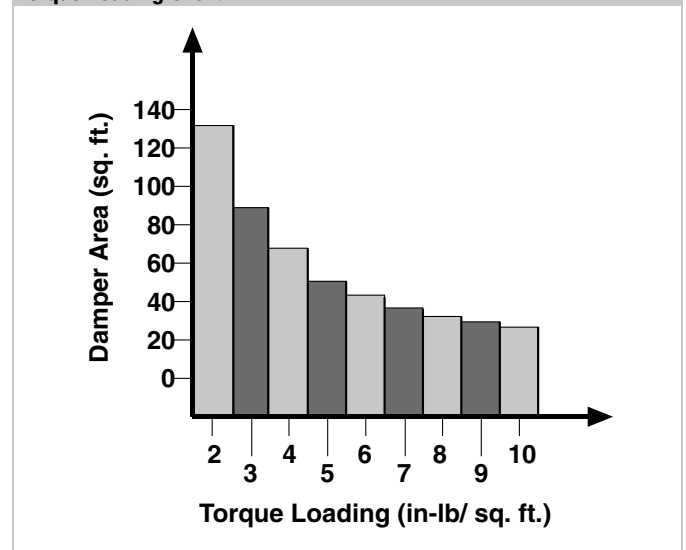
### Determining Torque Loading and Actuator Sizing

Damper torque loadings, used in selecting the correct size actuator, should be provided by the damper manufacturer. If this information is not available, the following general selection guidelines can be used.

Damper Type	Torque Loading
Opposed blade, without edge seals, for non-tight close-off applications	3 in-lb/sq. ft.
Parallel blade, without edge seals, for non-tight close-off applications	4 in-lb/sq. ft.
Opposed blade, with edge seals, for tight close-off applications	5 in-lb/sq. ft.
Parallel blade, with edge seals, for tight close-off applications	7 in-lb/sq. ft.

The above torque loadings will work for most applications under 2 in. w.g. static pressure or 1000 FPM face velocity. For applications between this criteria and 3 in. w.g. or 2500 FPM, the torque loading should be increased by a multiplier of 1.5. If the application calls for higher criteria up to 4 in. w.g. or 3000 FPM, use a multiplier of 2.0.

#### Torque Loading Chart

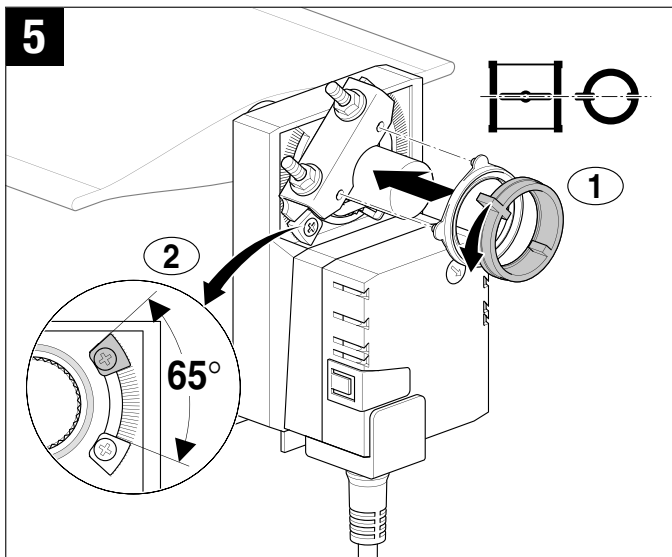
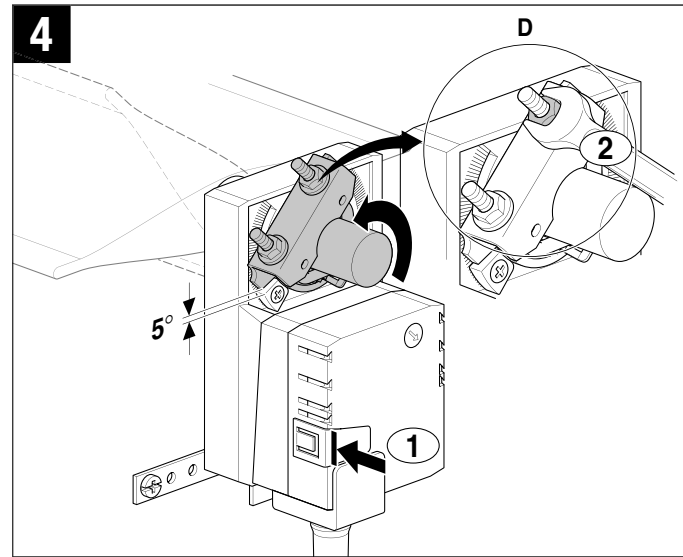
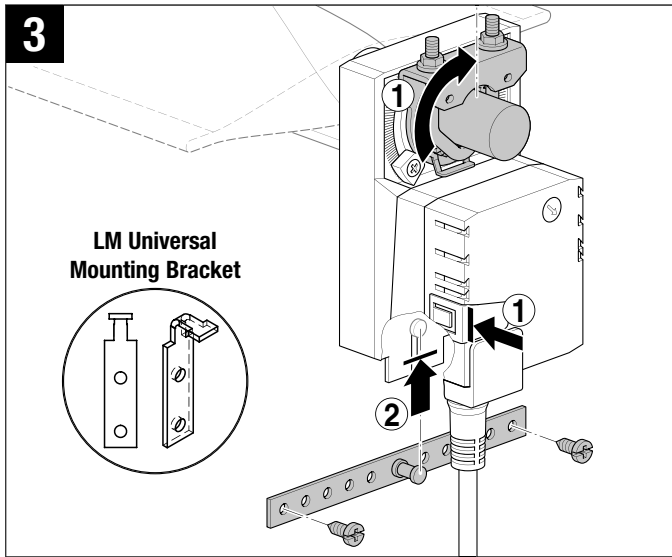
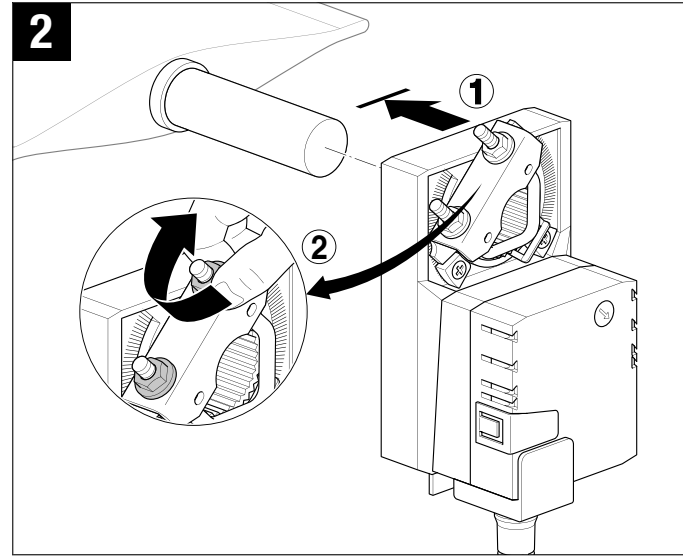
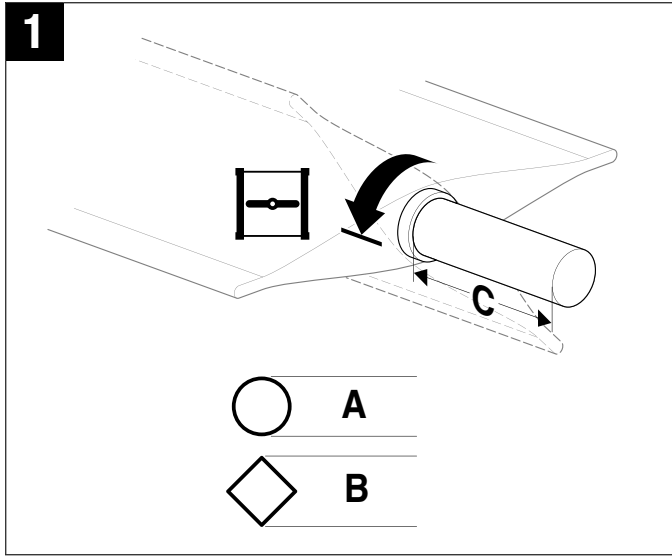


### Multiple Actuator Mounting

If more torque is required than one GM can provide, GM24B, GMB24-SR or GMX24-MFT may be installed on the same shaft.

# Installation Instructions

## Quick-Mount Visual Instructions for Mechanical Installation



SEE NEXT PAGE FOR STANDARD MOUNTING INSTRUCTIONS.

	A*	B	C**	D
LMB	1/4" to 5/8"	5/16" to 9/16"	1.5"	4 to 5 ft-lb
LMQB	1/2" to 1.05"	3/8" to 11/16"	1.5"	6 to 7 ft-lb
NMB	1/2" to 1.05"	3/8" to 11/16"	1.5"	6 to 7 ft-lb
NMQB	1/2" to 1.05"	3/8" to 11/16"	1.5"	6 to 7 ft-lb
AMB	1/2" to 1.05"	3/8" to 11/16"	1.5"	6 to 7 ft-lb
AMQB	1/2" to 1.05"	7/16" to 11/16"	1.5"	6 to 7 ft-lb
GMB	1/2" to 1.05"	7/16" to 11/16"	1.5"	6 to 7 ft-lb

\* LMB standard clamp has max 5/8" diameter. Accessory clamp K-LM20 can be mounted for sizes up to 3/4" diameter. NM and AM clamps have an insert that self-centers on the following diameter shafts: 1/2" (default), 3/4" and 1.05". GM clamps have an insert that self-centers on 3/4" diameter.

\*\* Shorter with reversible clamp for NMB, AMB, and GMB.

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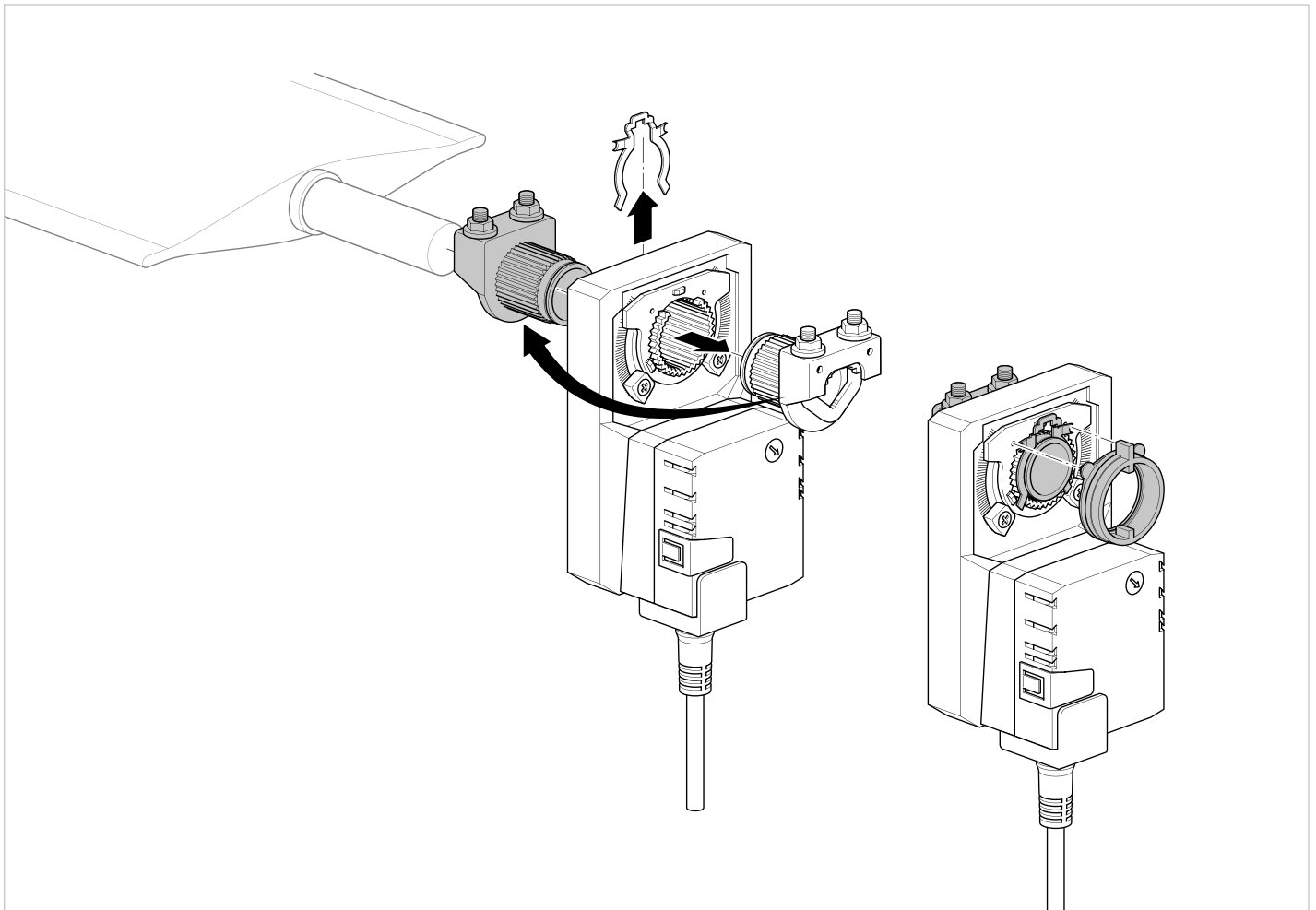
#### Standard Mounting

- 1** Turn the damper shaft until the blades are fully closed.
- 2**
  - ① Slip the actuator's universal clamp over the damper shaft. Make sure that the duct and the controls on the cover are accessible. Place the actuator in the desired mounting position.
  - ② Hand tighten the two nuts on the actuators universal clamp.
- 3**
  - ① Disengage the actuator gear train by pressing the manual override button and rotate the clamp until centered.
  - ② Slide the anti-rotation strap up under the actuator so it engages the actuator at the center cutout. Bend the bracket as needed to support the rear of the actuator. Secure to ductwork with self-tapping screws (No. 8 recommended).
- 4**
  - ① Loosen the nuts on the universal clamp. Press the manual override button and rotate the clamp to about 5° from the closed position (1/16 to 1/8" between stop and clamp).
  - ② Tighten the two nuts on the universal clamp with a 10 mm wrench (see table for required torque).
- 5**
  - ① Snap on the reflective position indicator.
  - ② Adjust end-stops, if required.
- 6** Mount actuators indoors. If mounted outdoors, use approved protective enclosure.

The damper is now fully closed but the actuator is 5° from fully closed. This is called "pre-loading" the actuator. When the actuator is powered and sent to the closed position: it will put its full torque on the shaft compressing the edge and blade seals. This ensures that the damper will meet its leakage rating. The actuator is electronically protected from overload and will not be damaged.

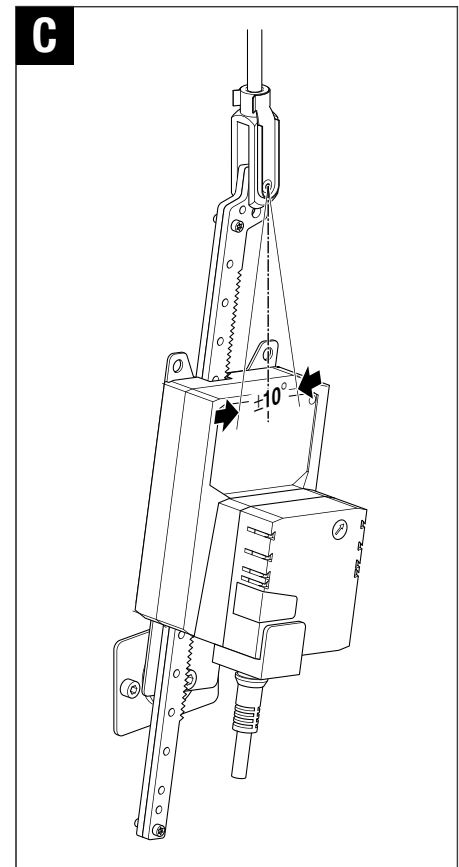
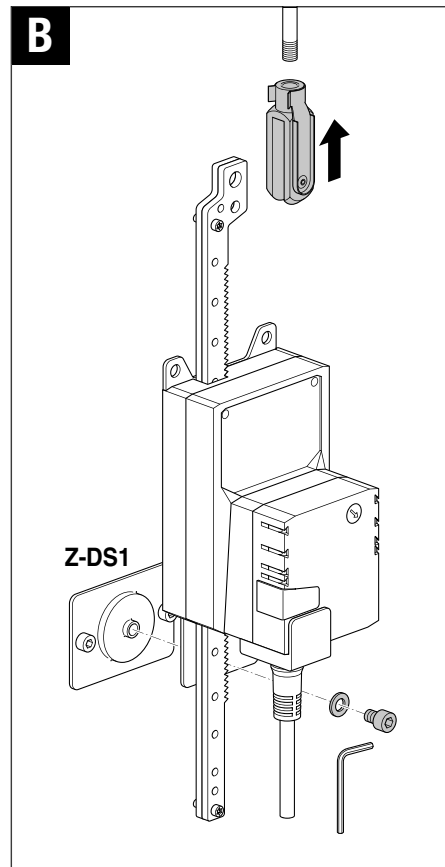
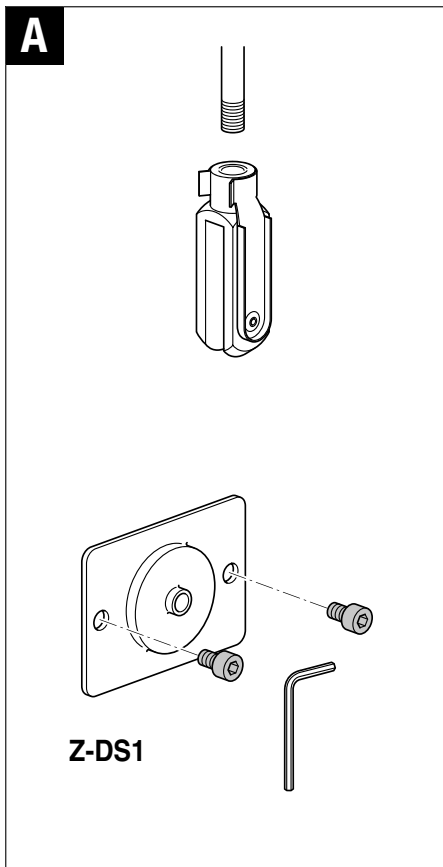
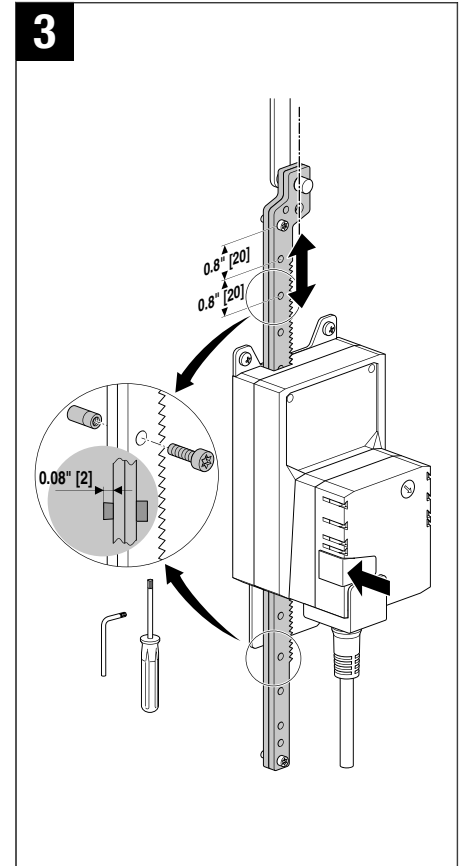
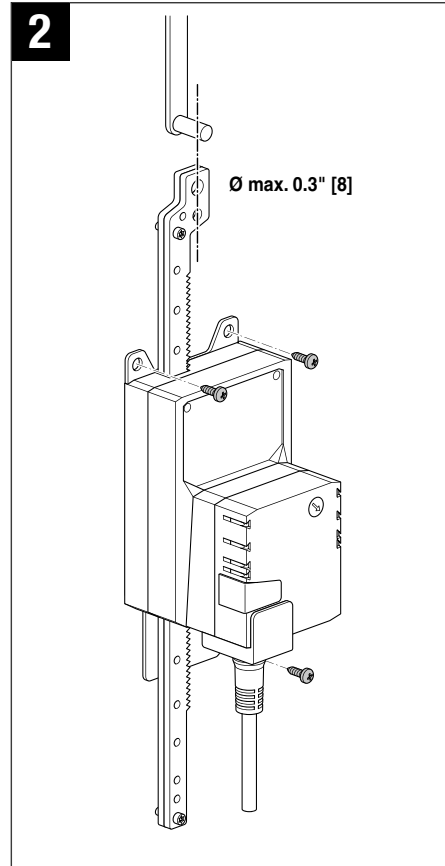
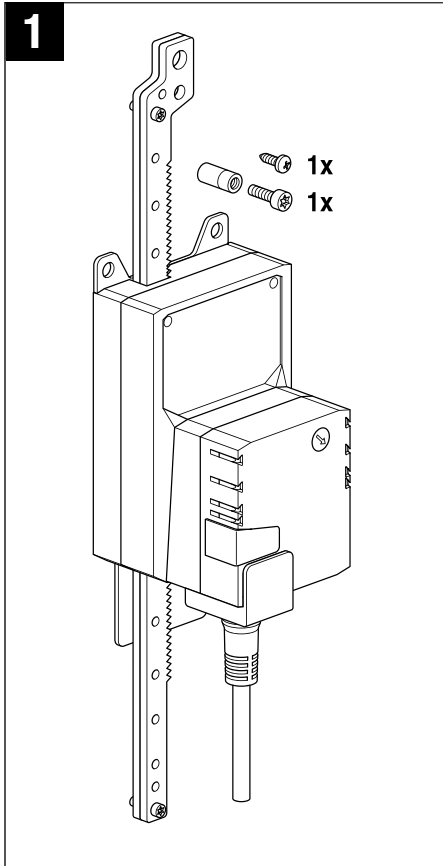
#### Testing the Installation Without Power

1. Disengage the gear train with the manual override button and move the shaft from closed to open to closed. Ensure that there is no binding and that the damper goes fully open and closes with 5° of actuator stroke left.
2. Correct any problems and retest.



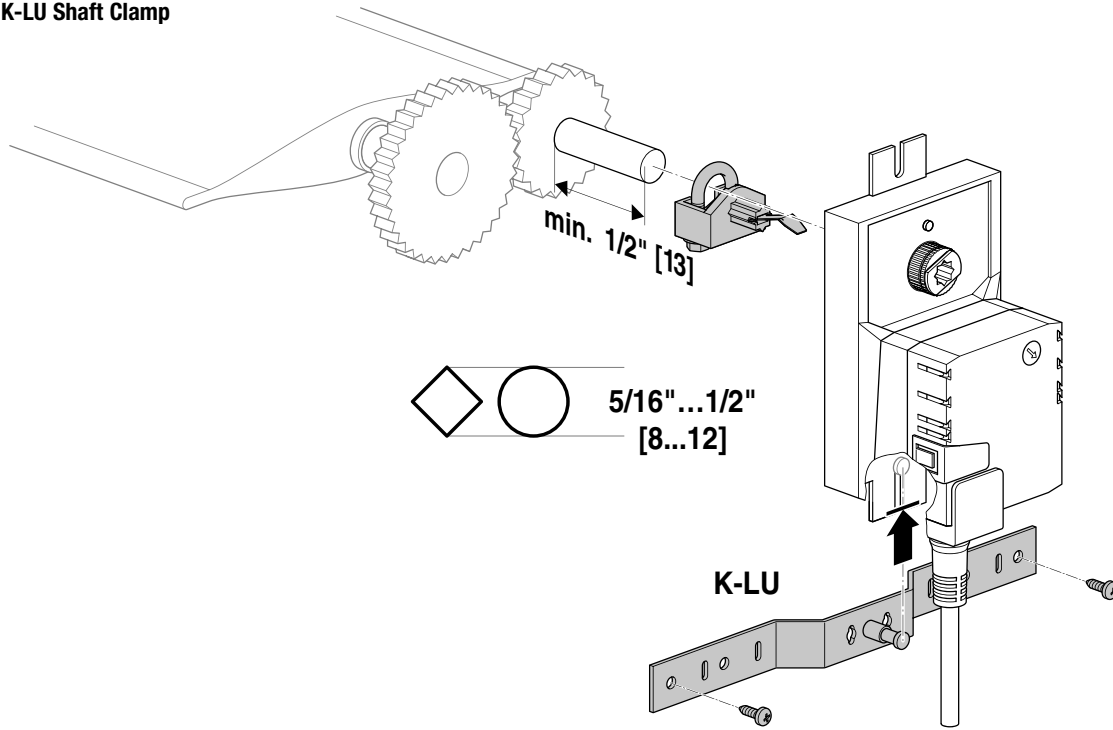
# Mounting Installation

Linear Quick Mount (LH, AH)

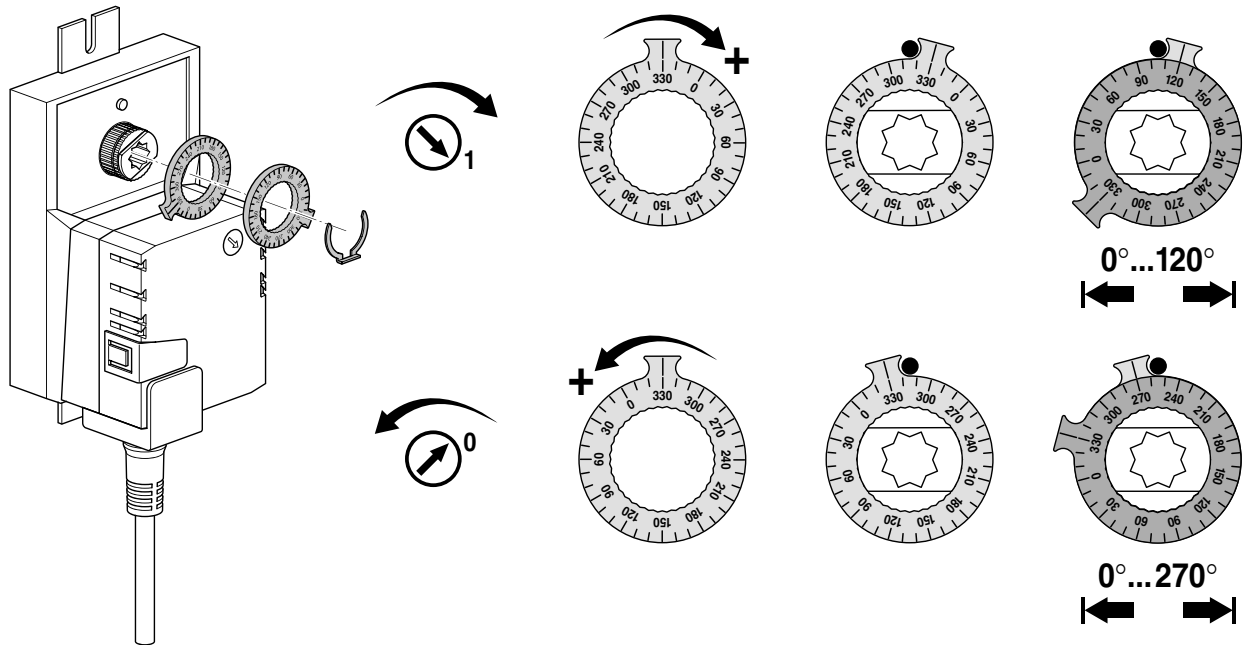


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**K-LU Shaft Clamp**



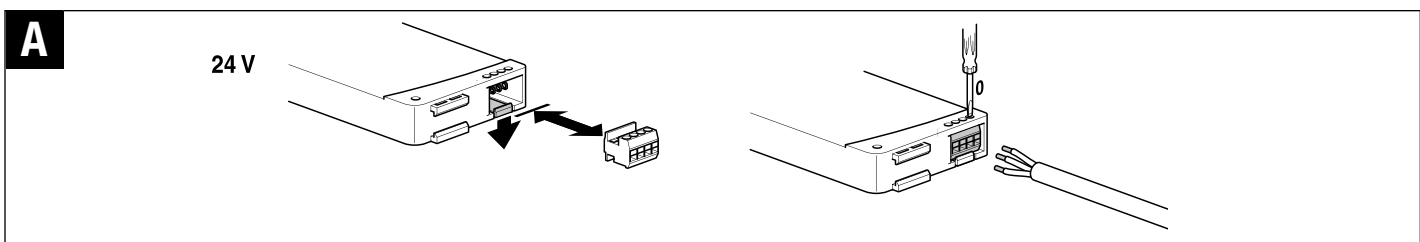
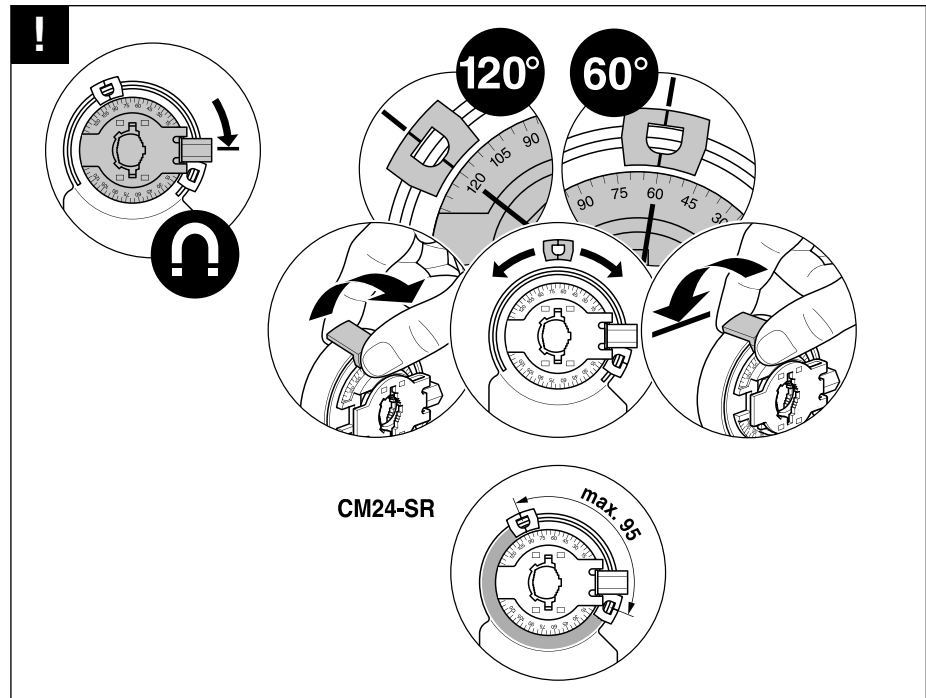
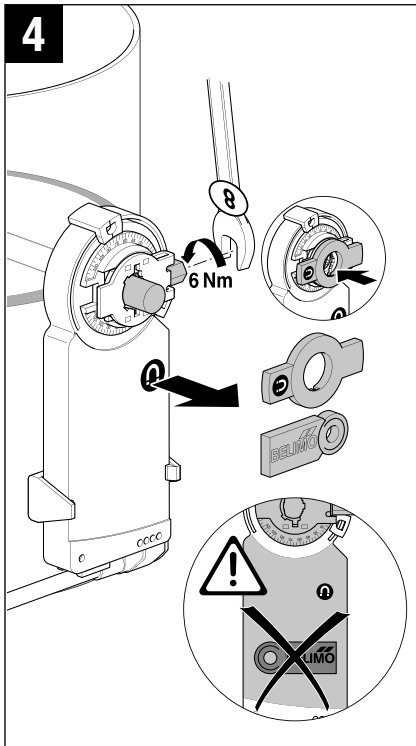
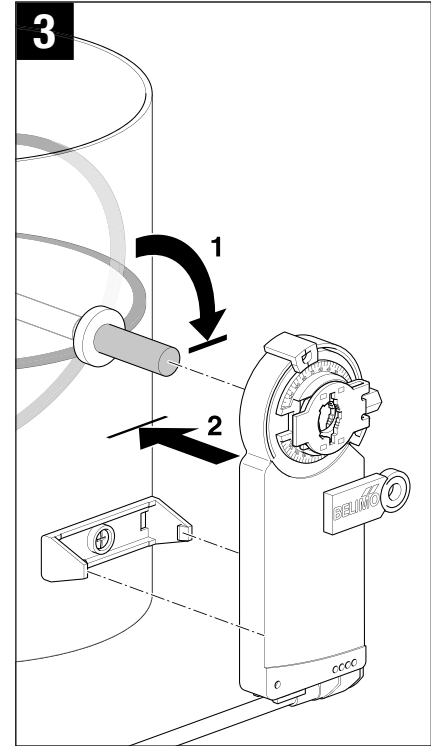
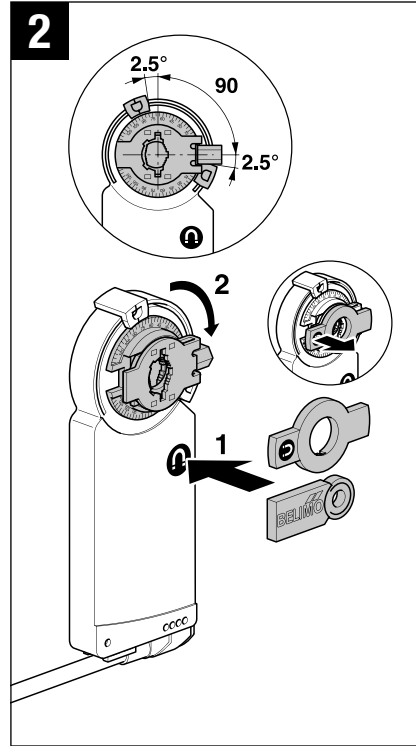
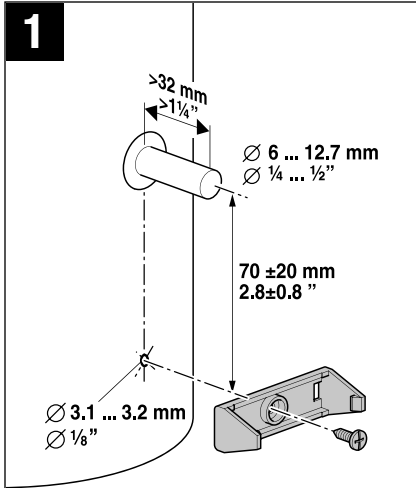
**ZDB-LU Angle of Rotation Limiter**



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# Mounting Installation

Quick Mount, Direct Coupled CMB24-3(-T) / CMB120-3



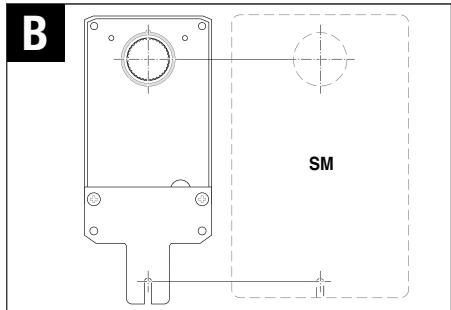
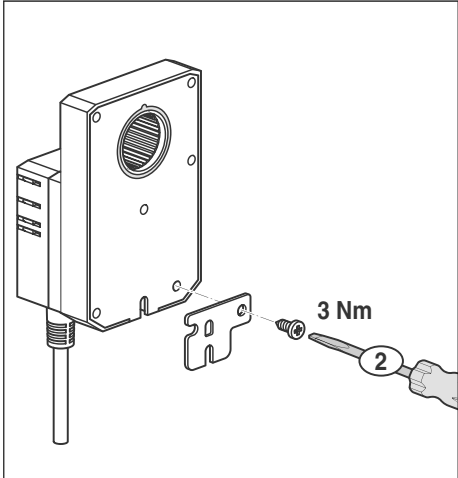
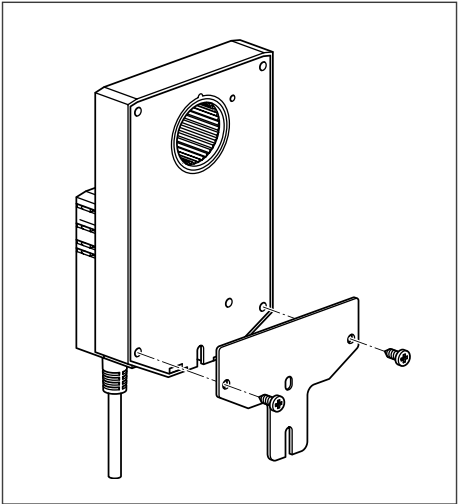
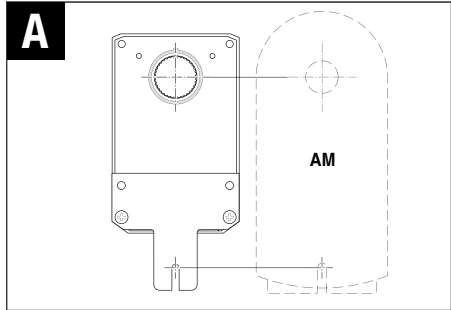
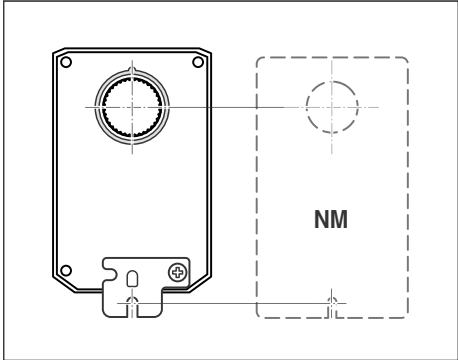
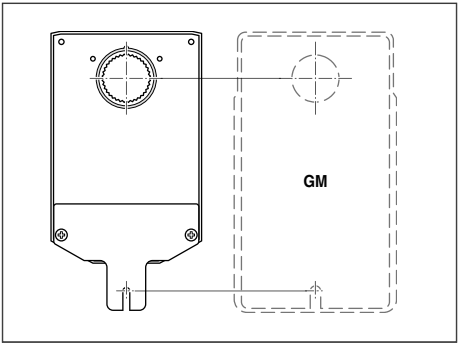
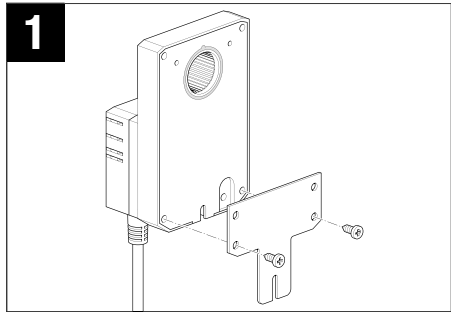
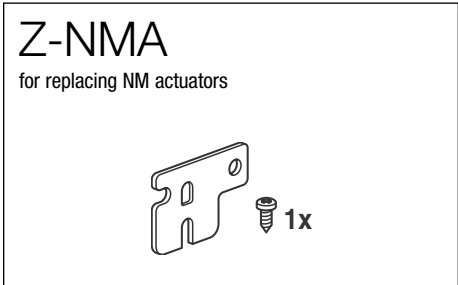
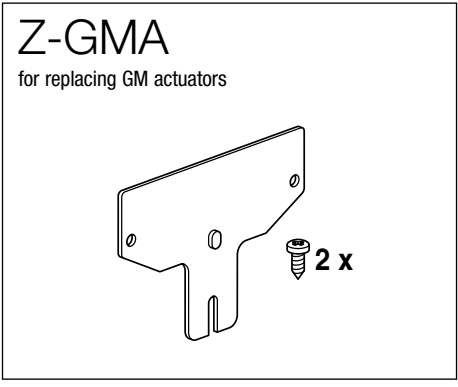
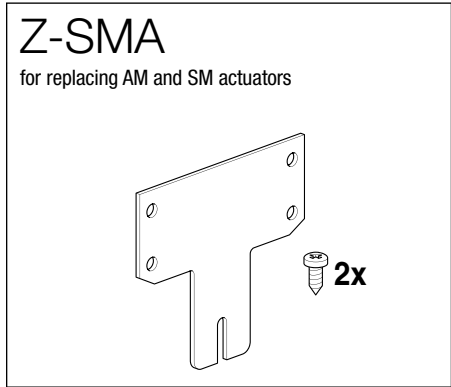
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#### Replacing Discontinued Belimo Actuators

When replacing an actuator, whether Belimo or other, be sure to consider the application parameters before selecting the replacement. The new product may not be the best fit for the application. Example would be a Belimo AM24 US mounted to a valve linkage. The direct replacement of the actuator is AMB24-3. However, the AM24 US and the AMB24-3 are different lengths, the linkage would need to be replaced as well.

Instead of replacing the linkage the retrofit bracket Z-SMA and Z-GMA can be used to extend the location of the anti-rotation bracket to match the location of the anti-rotation bracket of discontinued Belimo actuators.

**NOTE:** LM and LMB are the same size.



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### Electrical Operation

#### General

Belimo non-spring return actuators utilize Halomo sensorless Brushless DC motor technology developed by Belimo. The non-spring return actuators use this motor in conjunction with an Application Specific Integrated Circuit (ASIC). The Halomo ASIC provides the intelligence to provide a constant rotation rate to prevent damage to the actuator.

#### Initialization

When a power source is applied the motor carries out an initialization of the actuator. The purpose of this initialization is to determine the mechanical angle of rotation and to adapt the running time to the angle of rotation. When power is applied, the internal microprocessor recognizes that the actuator is at its full-safe position and uses this position as the base for all of its calculations.

#### Brushless DC Motor Operation

Belimo's Halomo sensorless brushless DC motor spins by reversing the poles of stationary electromagnets housed inside rotation permanent magnets. The electromagnetic poles are switched by a special ASIC developed by Belimo. Unlike the conventional DC motor, there are no brushes to wear or commutators to foul.

#### Motor Position Detection

Belimo's Halomo motor technology is a sensorless, brushless DC motor. The Halomo technology eliminates the need for potentiometers for positioning. The Halomo ASIC detects the spinning rotor by monitoring the back EMF of the motor poles. The ASIC counts these pulses and calculates position within 1/3 of a motor revolution.

#### Overload Protection

The Belimo non-spring return actuators are electronically protected from overload at all angles of rotation by digital technology in the ASIC. The ASIC circuitry constantly monitors the rotation of the brushless DC motor inside the actuator and stops the pulsing to the motor when it senses an overload. The motor remains energized and produces full rated torque when in overload.

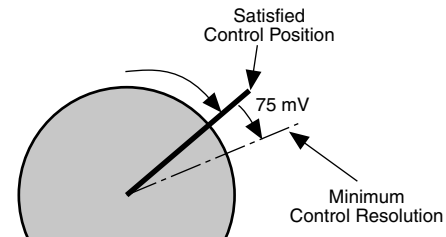
The overload filtration helps increase the actuators installed life expectancy by filtering out unnecessary control signal changes or end-stop pulsing while in overload. This helps ensure that dampers are fully closed and that edge and blade seals are always properly compressed.

### Control Accuracy and Stability

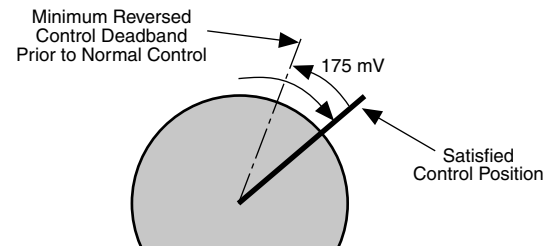
All Belimo actuators have built-in brushless DC motors which provide better accuracy and longer service life.

Belimo non-spring return actuators are designed with a unique non-symmetrical deadband. The actuator follows an increasing or decreasing control signal with a 75 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 175 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**Actuator responds to a 75 mV signal when not changing direction from stop position.**



**Actuator responds to a 175 mV signal when reversing direction from stop position.**

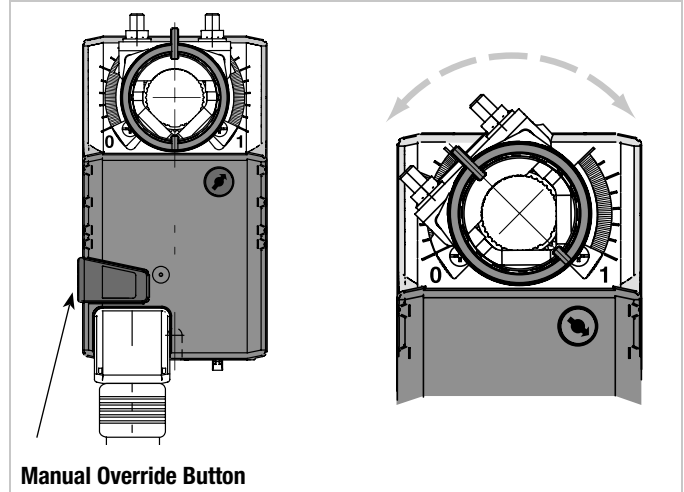




### Manual Override

The Belimo non-spring return actuators have a black, “manual override button” located on the top of the housing. Press this button and the gear train is disengaged so the damper shaft can be moved manually. Release the button and the gear train is re-engaged.

Use the manual override to test the installation without power. For tight shut-off the damper should close with 5° of actuator stroke left.

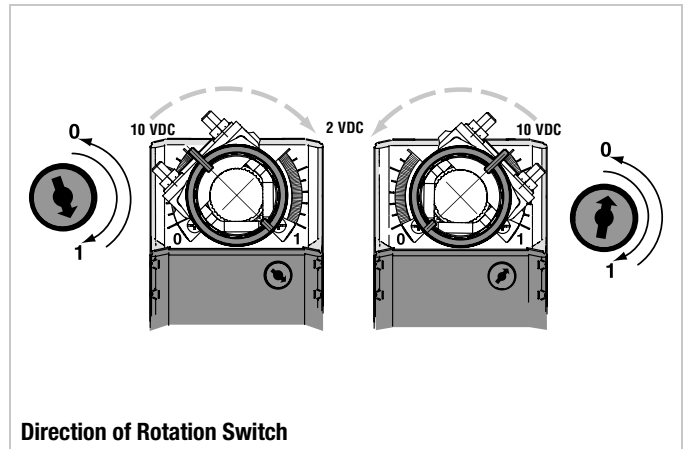


### Direction of Rotation Switch

Non-spring return actuators have a reversing switch on the cover. Switch position indicates start point. For the non-spring return, with the switch in position 1, the actuator rotates clockwise with an decrease in voltage or current. With the switch in position 0, the actuator rotates counterclockwise with an decrease in voltage or current.

The non-spring return rotates clockwise when the switch is in the 1 position and power is applied to wire #2. When power is applied to wire #3 the actuator rotates counterclockwise. Rotating the switch to 0 reverses the control logic.

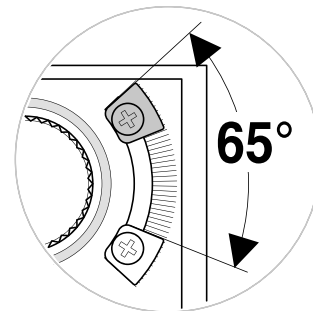
During checkout, the switch position can be temporarily reversed and the actuator will reverse its direction. This allows the technician a fast and easy way to check the actuator operation without having to switch wires or change settings on the thermostat. When the check-out is complete, make sure the switch is placed back to its original position.



### Mechanical Angle of Rotation Limiting

The adjustable stops are needed when there is no damper stop or if you want the damper to stop rotating before it reaches its stops. The non-spring return actuators can be indefinitely stalled in any position without harm.

1. Loosen the two end stops with a No. 2 Phillips head screwdriver being careful not to unscrew the captive nut under the slot.
2. Move the stops (in 2.5° steps) to the desired position and re-tighten the screws.



# Operation

## General Wiring Instructions



**WARNING** The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

**Always read the controller manufacturer's installation literature carefully before making any connections.** Follow all instructions in this literature. If you have any questions, contact the controller manufacturer and/or Belimo.

### Transformer(s)

The non-spring return actuators require a 24 VAC class 2 transformer and draws a maximum of 5 VA per actuator. The actuator enclosure cannot be opened in the field, there are no parts or components to be replaced or repaired.

- EMC directive: 89/336/EEC
- Software class A: Mode of operation type 1
- Low voltage directive: 73/23/EEC

**CAUTION:** It is good practice to power electronic or digital controllers from a separate power transformer than that used for actuators or other end devices. The power supply design in our actuators and other end devices use half wave rectification. Some controllers use full wave rectification. When these two different types of power supplies are connected to the same power transformer and the DC commons are connected together, a short circuit is created across one of the diodes in the full wave power supply, damaging the controller. Only use a single power transformer to power the controller and actuator if you know the controller power supply uses half wave rectification.

### Multiple Actuators, One Transformer

Multiple actuators may be powered from one transformer provided the following rules are followed:

1. The TOTAL current draw of the actuators (VA rating) is less than or equal to the rating of the transformer.
2. Polarity on the secondary of the transformer is strictly followed. *This means that all No. 1 wires from all actuators are connected to the common leg on the transformer and all No. 2 wires from all actuators are connected to the hotleg.* Mixing wire No. 1 & 2 on one leg of the transformer will result in erratic operation or failure of the actuator and/or controls.

### Multiple Actuators, Multiple Transformers

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

1. The transformers are properly sized.
2. All No. 1 wires from all actuators are tied together and tied to the negative leg of the control signal. See wiring diagram.

### Wire Lengths for Actuators

Keep power wire runs below the lengths listed in the **Figure H**. If more than one actuator is powered from the same wire run, divide the allowable wire length by the number of actuators to determine the maximum run to any single actuator.

Example: 3 actuators, 16 Ga wire  
 $350 \text{ Ft} \div 3 \text{ Actuators} = 117 \text{ Ft. Maximum wire run}$

LH-24.../LU-24...		LM-24.../CM24	
Wire Size	Max. Feet.	Wire Size	Max. Feet
16 Ga	1175 Ft.	16 Ga	1125 Ft.
18 Ga	1075 Ft.	18 Ga	750 Ft.
20 Ga	575 Ft.	20 Ga	400 Ft.
22 Ga	300 Ft.	22 Ga	200 Ft.

NM-24.../AH-24.../LMX120...		AM-24...	
Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	1250 Ft.	12 Ga	1150 Ft.
14 Ga	1130 Ft.	12 Ga	925 Ft.
16 Ga	900 Ft.	16 Ga	550 Ft.
18 Ga	575 Ft.	18 Ga	375 Ft.
20 Ga	300 Ft.	20 Ga	200 Ft.
22 Ga	150 Ft.	22 Ga	100 Ft.

GM.../NMX120.../AMX120...			
Wire Size	Max. Feet.	Wire Size	Max. Feet
12 Ga	1125 Ft.	18 Ga	325 Ft.
14 Ga	800 Ft.	20 Ga	175 Ft.
16 Ga	500 Ft.	22 Ga	90 Ft.

**FIGURE H – Maximum Wire Lengths**

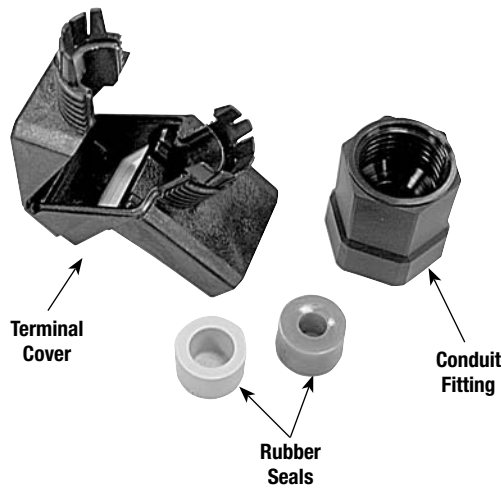
### Wire Type and Wire Installation Tips

For most installations, 18 or 16 Ga. cable works well with the non-spring return actuators. Use code-approved wire nuts, terminal strips or solderless connectors where wires are joined. It is good practice to run control wires unspliced from the actuator to the controller. If splices are unavoidable, make sure the splice can be reached for possible maintenance. Tape and/or wire-tie the splice to reduce the possibility of the splice being inadvertently pulled apart.

The non-spring return proportional actuators have a digital circuit that is designed to ignore most unwanted input signals (pickup). In some situations the pickup may be severe enough to cause erratic running of the actuator. For example, a large inductive load (high voltage AC wires, motors, etc.) running near the power or control wiring may cause excessive pickup. To solve this problem, make one or more of the following changes:

1. Run the wire in metallic conduit.
2. Re-route the wiring away from the source of pickup.
3. Use shielded wire (Belden 8760 or equal). Ground the shield to an earth ground.  
Do not connect it to the actuator common.

## ZS-T – Protective Terminal Cover



### Application

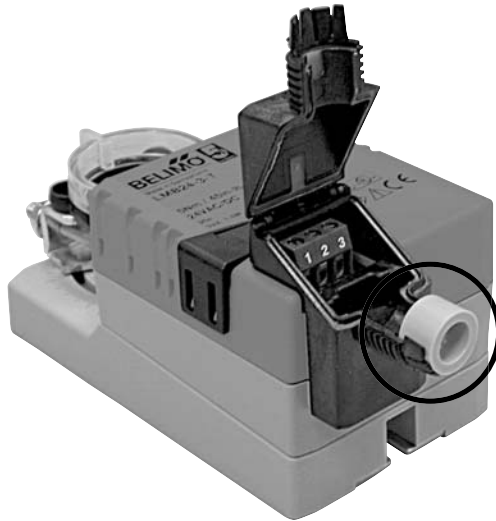
Belimo non-spring return actuators with terminal strips are can be converted from NEMA 1/IP20 to NEMA 2/IP54 using the protective terminal cover **ZS-T**.

#### The ZS-T terminal cover accessory consists of:

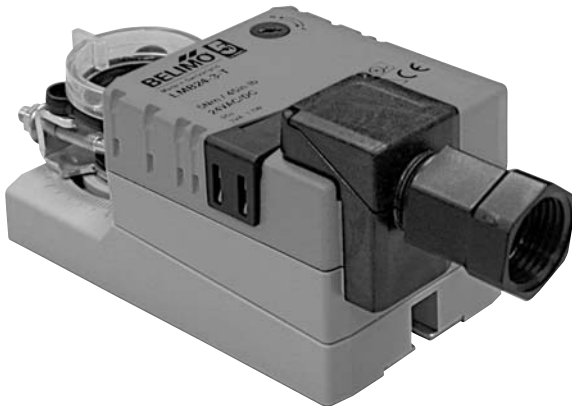
- Terminal Cover
- Conduit Fitting
- Rubber Seal for Wire Diameter 4-6
- Rubber Seal for Wire Diameter 6-8

#### Mounting the Terminal Cover

1. Attach terminal cover to actuator, if not done already.
2. Slide the conduit fitting and correct size rubber seal onto wire.
3. Wire up actuator using the terminal strips.
4. Fit rubber seal into slot of terminal cover.

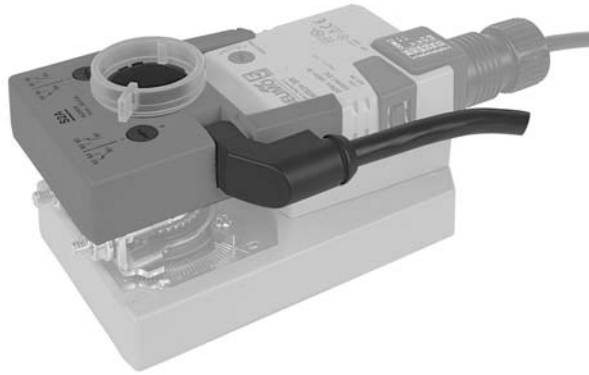


5. Shut terminal top and screw on conduit connector.



# Feedback Potentiometer P...A GR

For the Non-Spring Return Direct-Coupled Actuators



Types		
P140A GR	Feedback Potentiometer	140 Ω
P200A GR	Feedback Potentiometer	200 Ω
P500A GR	Feedback Potentiometer	500 Ω
P1000A GR	Feedback Potentiometer	1000 Ω
P2800A GR	Feedback Potentiometer	2800 Ω
P5000A GR	Feedback Potentiometer	5000 Ω
P10000A GR	Feedback Potentiometer	10000 Ω

Technical Data	P...A
Resistance values	as above
Output	1 W
Tolerance	± 5%
Linearity	± 2%
Resolution	min. 1%
Residual resistance	max. 5% on both sides
Electrical connection	3 ft, 18 GA appliance cable ½" conduit connector
Humidity	5 to 95% RH non-condensing
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2 / IP54
Housing rating	UL94-5VA
Servicing	maintenance free
Agency listings	cULus acc. to UL60730-1 CE according to 73/23/EEC
Quality standard	ISO 9001
Weight	4.6 oz [130 g]

## Application

The P...A GR feedback potentiometers are used with LM, NM, AM, and GM actuators to provide a resistive signal which varies with damper position.

The P...A GR units are applied with commercial proportional temperature controllers to provide feedback of the damper position, or with electric or electronic meters to provide position indication. The signal can also be used as a positioner for parallel operation of multiple actuators.

## Operation

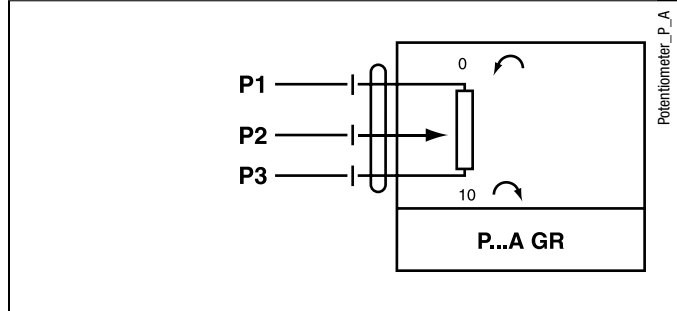
The P...A GR feedback potentiometers are mounted onto the direct coupled actuator. The switches are modular units that mount directly onto LM, NM, AM, and GM type actuators and are locked into place by guiding grooves on the sides of the actuator.

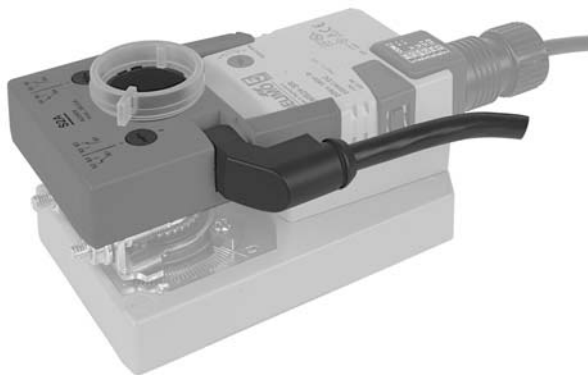
A driver disk is attached to the actuator handle and offers direct transmission of the actuator position to the micro switch cams.

## Mounting Instructions

1. Remove position indicator from actuator.
2. Press down the manual override button and rotate the actuator fully counter clockwise.
3. Place the switch/potentiometer adaptor onto the hex shaft of the handle which is in the center of the valve/actuator coupling.
4. Slide switch onto the actuator using the actuator guiding grooves on the sides of the actuator.
5. Check for correct mating of the adaptor to the switch.
6. Adjust switch dials as necessary.

## Wiring Diagram





Types		
<b>S1A</b>	one SPDT	3 ft, 18 GA appliance cable
<b>S2A</b>	two SPDT	3 ft, 18 GA appliance cable

Technical Data	S1A	S2A
Number of switches	one SPDT	two SPDT
Weight	4.6 oz [130 g]	6.0 oz [170 g]
Switching capacity	3A (0.5A), 250 VAC	
Switching point	adjustable over full rotation (0° to 95°)	
Pre-setting	with scale possible	
Humidity	5 to 95% RH non-condensing	
Ambient temperature	-22°F to 122°F [-30°C to +50°C]	
Storage temperature	-40°F to 176°F [-40°C to 80°C]	
Housing	NEMA 2 / IP54	
Housing rating	UL94-5VA	
Servicing	maintenance free	
Agency listings	cULus acc. to UL60730-1 CE according to 73/23/EEC	
Quality standard	ISO 9001	

### Application

The S1A and S2A auxiliary switches are used to indicate when a desired position of a damper is reached or to interface additional controls for a specific control sequence.

### Operation

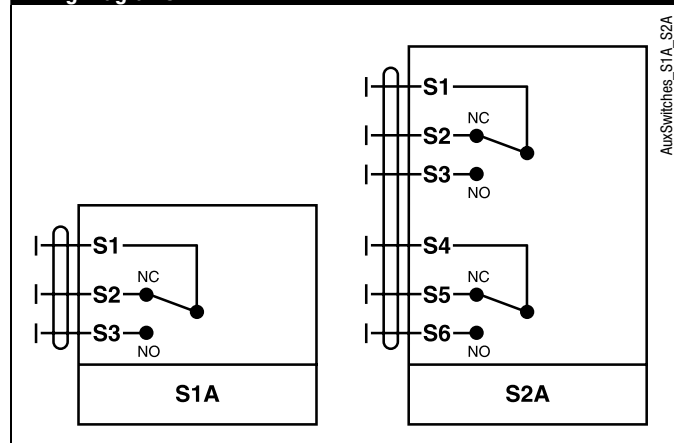
The S1A and S2A auxiliary switches are mounted onto the direct coupled actuator. The switches are modular units that mount directly onto LM, NM, AM, and GM type actuators and are locked into place by guiding grooves on the sides of the actuator.

A driver disk is attached to the actuator clamp and offers direct transmission of the actuator position to the micro switch cams. The switching points can be set over the full scale of 0 to 1 simply by adjusting the slotted discs.

### Mounting Instructions

1. Remove position indicator from actuator.
2. Press down the manual override button and rotate the actuator fully counter clockwise.
3. Turn the driver disk on the switch fully counterclockwise.
4. Slide switch onto the actuator using the actuator guiding grooves on the sides of the actuator.
5. Check for correct mating of the driver disk to the universal clamp.
6. Adjust switch dials as necessary.

### Wiring Diagrams



# Startup and Checkout

Electrical Check-out Procedure for (-SR) and VDC Programmed (-MFT) Actuators				
STEP	Procedure	Expected Response	Actuator Responds Go To Step...	No Response Go To Step...
1.	Connect signal Input to wires 1 & 3. Connect signal output (if used) to wires 1 & 4. Connect 24 VAC/VDC power to Wires 1 & 2 .	Actuator drives to the "No Signal" position (usually closed), then to the "Maximum Signal" position (usually open) then to the "Control Signal" position.	Actuator operates properly <b>Step 9.</b>	No response at all <b>Step 2.</b> Operation is reversed <b>Step 3.</b> Does not drive toward "Control Signal Position" <b>Step 4.</b>
2.	Check power wiring. Correct any problems. <b>Note 1</b>	Power supply rating should be the total power requirement of the actuator(s). Minimum voltage of 19.2 VAC or 21.6 VDC.	Power wiring corrected, actuator begins to drive <b>Step 1.</b>	Power wiring corrected, actuator still does not drive <b>Step 8.</b>
3.	Turn reversing switch to the correct position. Make sure the switch is turned all the way left or right. Press "Override Button" all the way down and release	Actuator drives to the "No Signal" position (usually closed), then to the "Maximum Signal" position (usually open) then to the "Control Signal" position.	Actuator operates properly <b>Step 9.</b>	Does not drive toward "Control Signal Position" <b>Step 4.</b>
4.	Make sure the control signal positive (+) is connected to Wire No 3 and control signal negative (-) is connected to wire No. 1. Most control problems are caused by reversing these two wires. Verify that the reversing switch is all the way CCW or CW.	Drives to "Control Signal" position.	Actuator operates properly <b>Step 9.</b>	<b>Step 5.</b>
5.	Disconnect signal input from Wires No. 1 & 3	Actuator drives to the "No Signal" position.	<b>Step 6.</b>	<b>Step 8.</b>
6.	Check input signal with a digital volt meter (DVM). Make sure the input is within the range of the actuator. For (-SR) actuators this is 2 to 10 VDC or 4 to 20 mA (with 500 $\Omega$ resistor).	Input voltage or current should be $\pm 1\%$ of what controller's adjustment or programming indicate.	Controller output (actuator input) is correct. Input Polarity Correct <b>Step 7.</b>	Reprogram, adjust repair or replace controller as needed <b>Step 7.</b>
7.	Disconnect power from Wire No. 2. Reconnect signal input to Wires No. 1 & 3. Reconnect power to Wire No. 2.	Actuator drives to the "No Signal" position (usually closed), then to the "Maximum Signal" position (usually open) then to the "Control Signal" position.	Actuator operates properly <b>Step 9.</b>	<b>Step 8.</b>
8.	Actuator does not drive	Defective actuator.		Replace actuator.
9.	Actuator works properly. Test controller by following controller manufacturer's instructions.			

**NOTE 1** Check that the transformer(s) are sized properly.

- If a common transformer is used, make sure that polarity is observed on the secondary. This means connect all No. 1 wires to one leg of the transformer and all No. 2 wires to the other leg of the transformer.
- If multiple transformers are used with one control signal, make sure all No. 1 wires are tied together and tied to control signal negative (-).
- Controllers and actuators must have separate 24 VAC/VDC power sources.

## Table of Contents Customizable Section

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## Multi-Functional Technology

Belimo damper actuators and control valves with Multi-Function Technology® (MFT) include standard 2 to 10 VDC proportional control functions, plus they can be re-programmed. Parameters can be changed on-site to optimize/enable application. Parameters can be set for voltage control (VDC), time proportional control (PWM), floating point, On/Off or feedback signal. You can also set, modify or read position, running time, mechanical working range, address, status, and diagnostics. MFT allows you to adapt the actuator to your system for service replacement and to improve system functionality.



## Other Customizable Options with New Generation Spring Return and Non-Spring Return Actuators

### Clamping Options

Select with clamp, no clamp or crank arm (not mounted on actuator) on new AFX and NFX. Select alternate clamps to accommodate larger damper shafts or to allow for short-shaft mounting on select models (non-spring only).

### Electrical Connection

Select longer cables for simplified installation: 3ft [1m], 10ft [3m] or 16ft [5m] are available. A new NEMA 2 protective cover is available for actuators with terminal strip electrical connection (non-spring only).

### Running Time

The customizable non-spring product range enables the actuator running time to be increased for faster operation or slowed for more traditional HVAC temperature control. For spring return, only MFT versions can have different running times.



### Ordering Example – New Generation AFX, NFX and Non-Spring Return Actuator

The ordering process for the new generation AFX, NFX and non-spring return actuators is simple. First select a base actuator that meets the needs of the application and then add the desired options.

<b>1. Base Actuator</b>	<b>LMX24-MFT (LM100)</b>
Select a base actuator	
<ul style="list-style-type: none"> <li>• Torque or linear force, control input, position feedback, power supply...</li> <li>• See pages 14 &amp; 15 for complete list of non-spring base actuators.</li> </ul>	
<b>2. Clamp Option</b>	<b>3/4" dia. universal clamp (6)</b>
Select clamp that accommodates the damper shaft	
<ul style="list-style-type: none"> <li>• LM defaults to a 5/8" dia. clamp, but the 3/4" option can be selected as seen in this example.</li> <li>• NM and AM default to a 1/2" dia. clamp that also accommodates 3/4" and 1.05" dia. shafts.</li> <li>• GM accommodates a 1.05" dia. shafts. A 3/4" dia. clamp is available for retrofits of past GM and SM types.</li> </ul>	
<b>3. Electrical Connection Option</b>	<b>16 ft. [5m] 18 GA, plenum rated cable (C5)</b>
<ul style="list-style-type: none"> <li>• Default connection is a 3 ft. [1m] long cable. 10 ft [3m] or 16ft [5m] cables are also available.</li> <li>• Non-spring actuators with a "-T" in the model number have a screw terminal strip, which default to a NEMA 1 enclosure rating. A NEMA 2 cover for the terminal strip can be selected.</li> </ul>	
<b>4. Programming</b>	<b>P-20003 (W03)</b>
<ul style="list-style-type: none"> <li>• For non-spring return –3 and –SR type actuators only the running time can be changed. This is a one-time factory setting.</li> <li>• For –MFT type actuators refer to MFT technical documentation for available configurations.</li> </ul>	
<b>5. Total</b>	<b>LMX24-MFT (LM100 6 C5 W03)</b>

### Ordering Example – Original Spring Return Actuator

<b>1. Base Actuator</b>	<b>LF24-MFT-S US</b>
Select a base actuator	
<b>2. Programming</b>	<b>P-10003 (A03) 2 – 10 VDC input / 0 – 5 VDC feedback</b>
Select pre-set programming code	
<ul style="list-style-type: none"> <li>● P-100xx (Axx) Control voltage applications</li> <li>● P-200xx (Wxx) Pulse width modulation applications</li> <li>● P-300xx (Fxx) Floating point applications</li> <li>● P-400xx (Jxx) On/Off applications</li> <li>● Or create custom MFT configuration codes</li> <li>● Or create custom MFT configurations in the field with MFT-Actuate PC software.</li> </ul>	
<b>3. Total</b>	<b>LF24-MFT-S US + P10003</b>

Order confirmation and invoice example for spring return actuators:

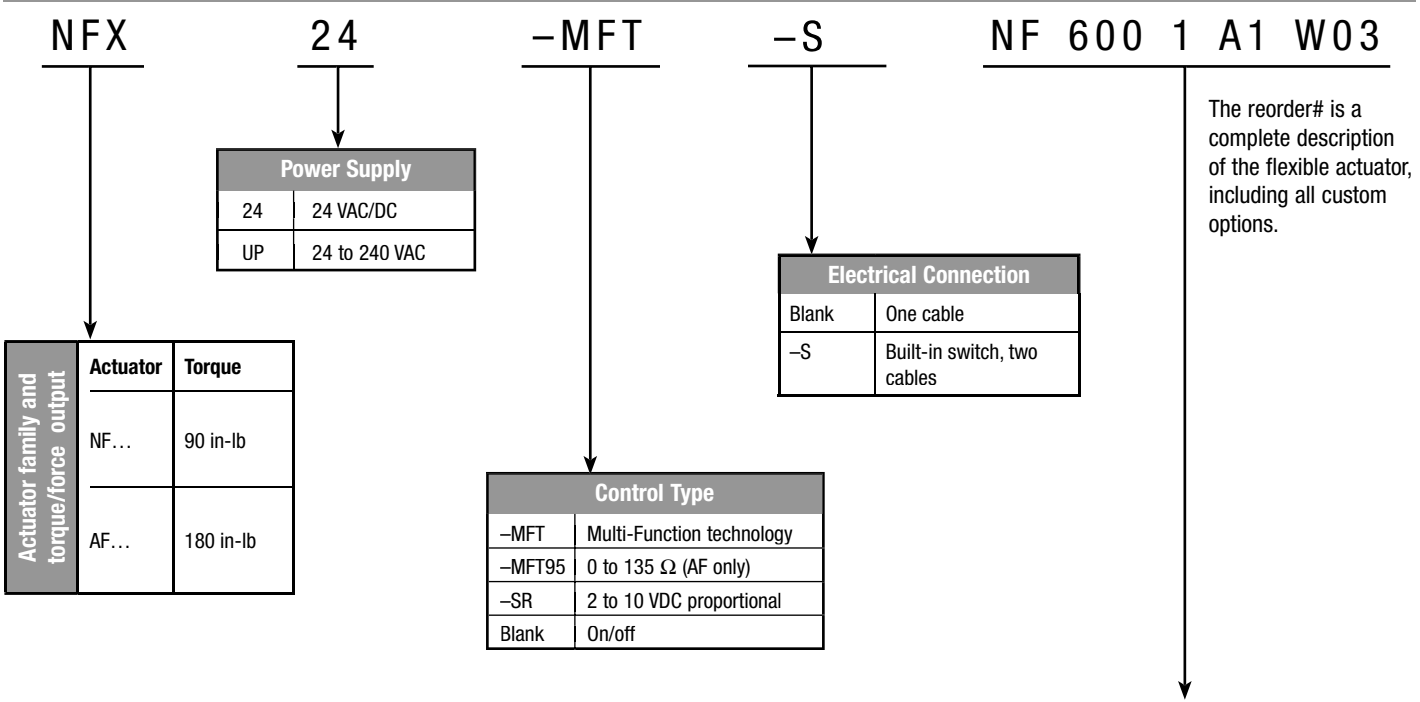
Line Item	Model	Quantity
10	LF24-MFT US P-10003	10
20	LF24-MFT US P-20002	10
30	TF24-MFT US P-10006	5
40	99981-00100	25

The part number 99981-00100 is a requirement for Belimo as a designation for all the configurations in an order. This product's description will read "MFT CONFIGURATION CHARGE, (P-.../V-...)". It is used to confirm the correct quantities and to invoice the proper fee for the MFT configurations. The total quantity of configurations is represented in this one line item. The product line item will list the specific configuration below the actuator ordered. If you have more than one model with multiple configurations, each change in configuration will be shown on separate line items. As an example lines 10 and 20 are the same model actuator with different configurations.

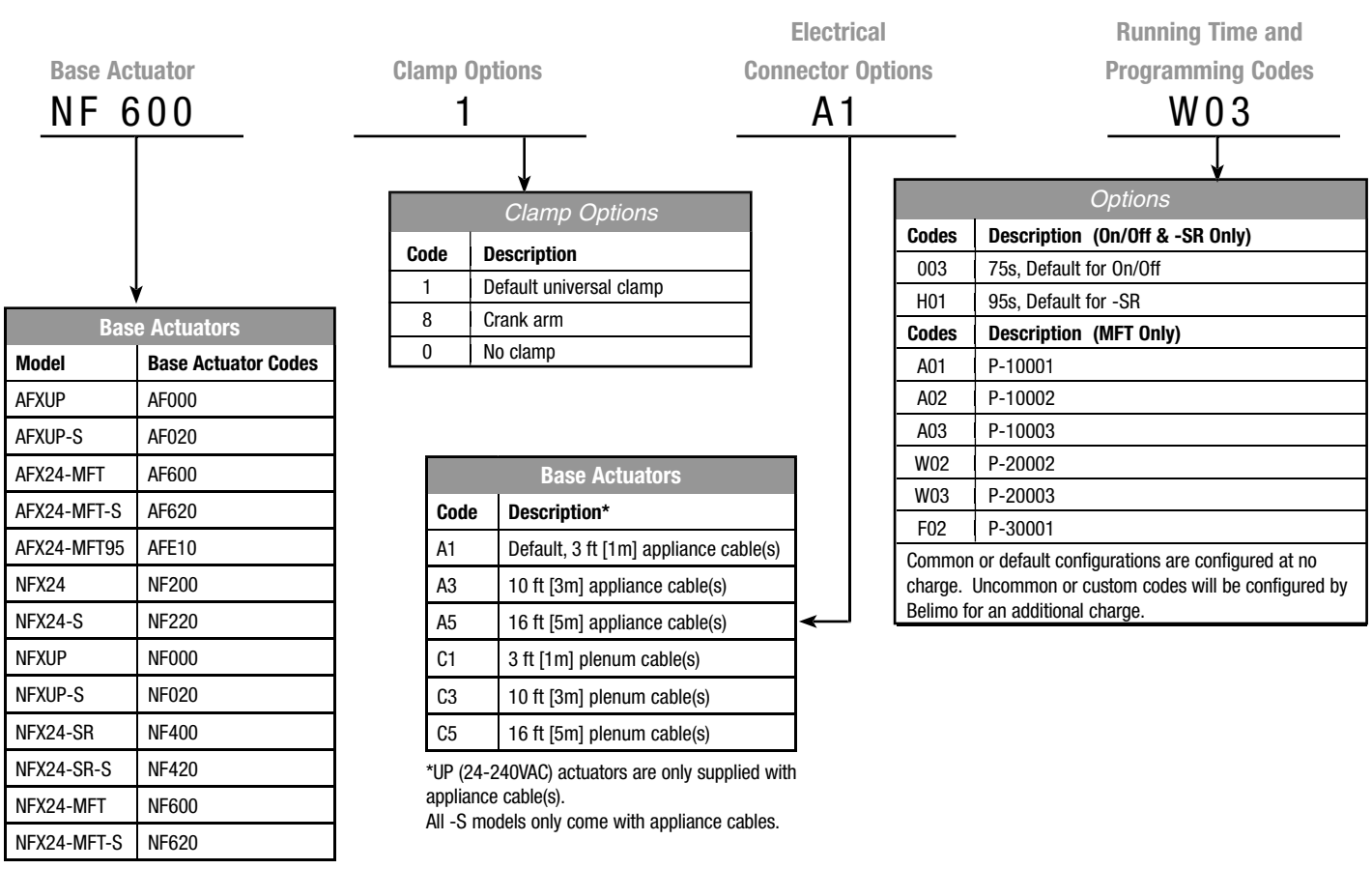


## New Generation Spring Return Actuators

### Model Description

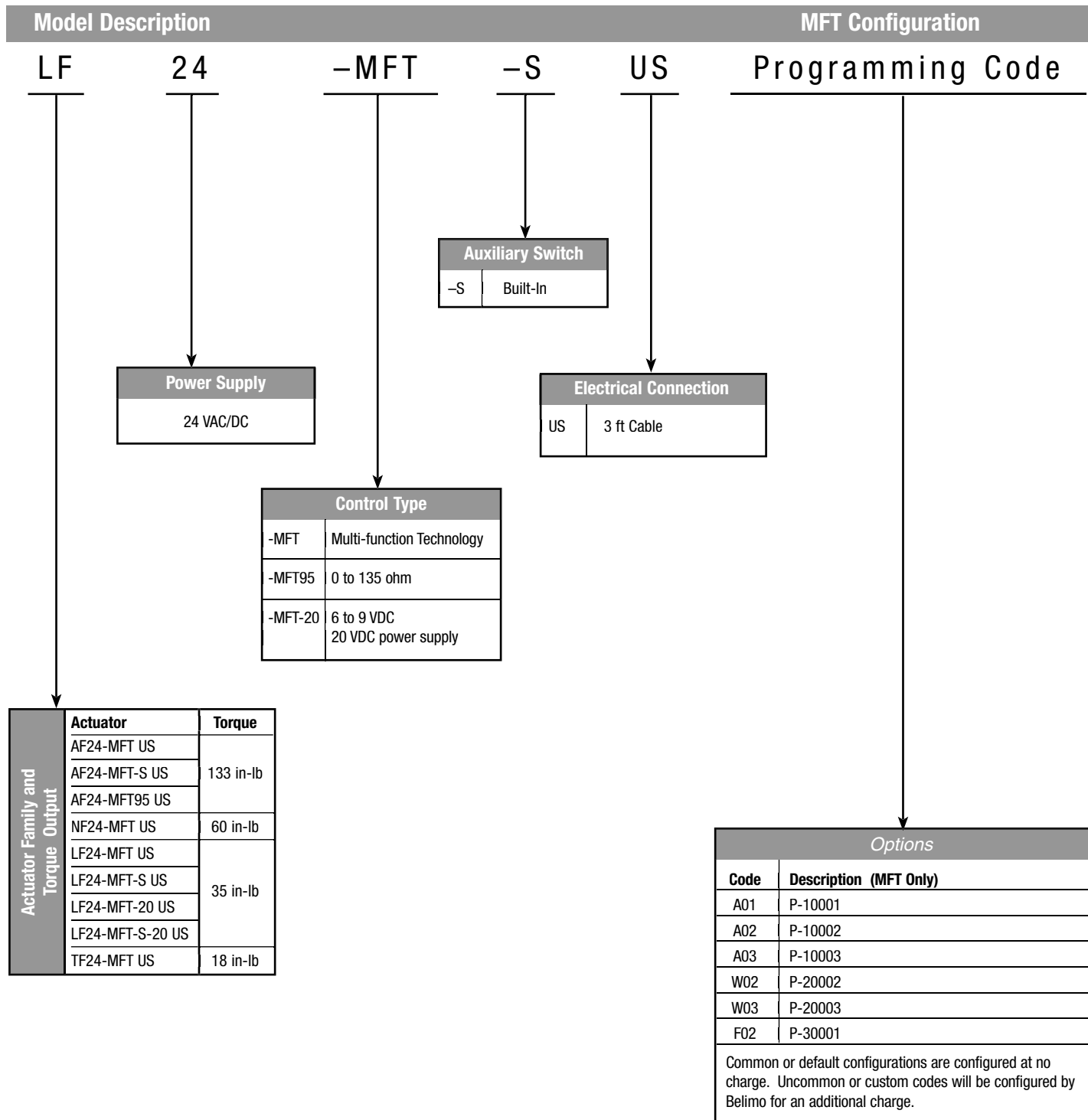


### Reorder Number Break-Down



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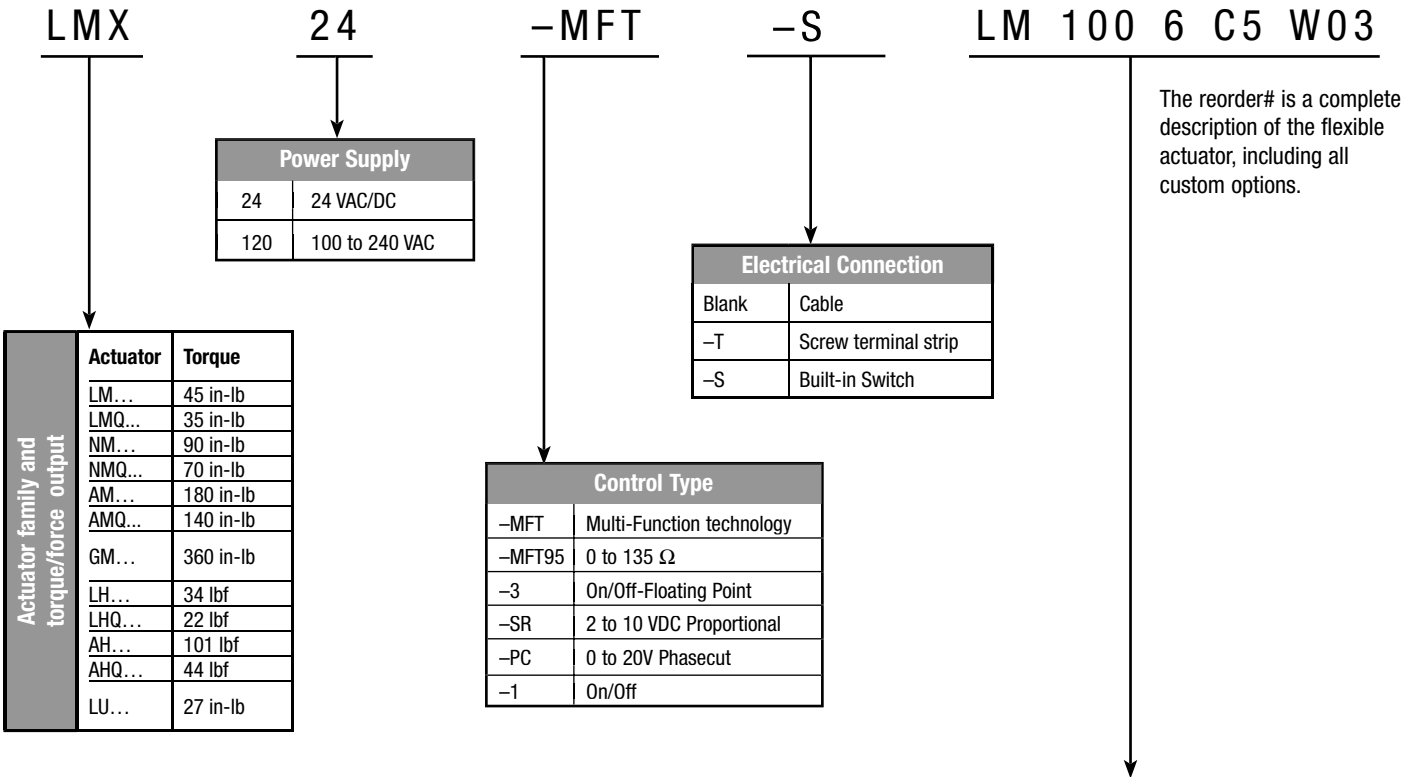
## Original Spring Return MFT Actuators



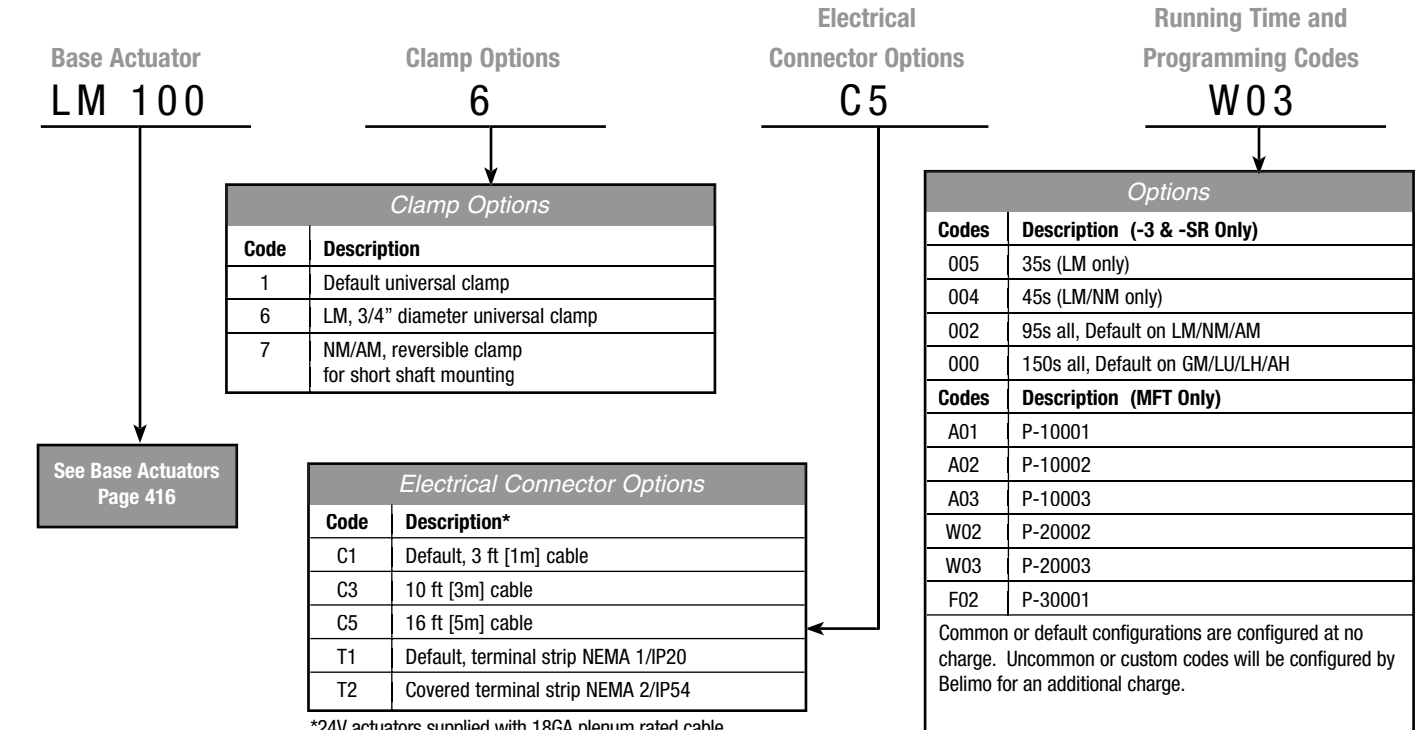
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## Non-Spring Return Actuators

### Model Description Reorder # for actuator



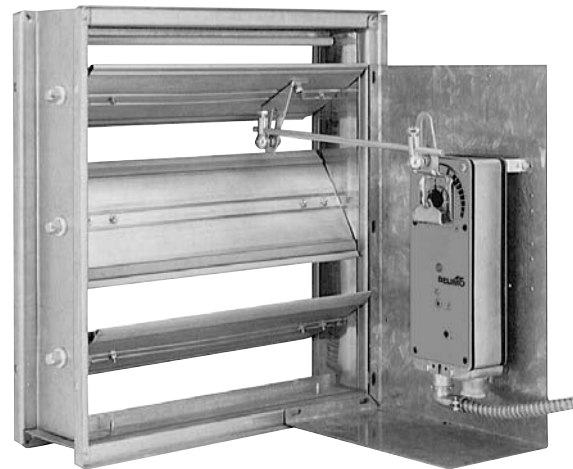
### Reorder Number Break-Down



\*24V actuators supplied with 18GA plenum rated cable.  
120 to 240V actuators supplied with 18GA appliance cable.

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We'll help solve any application problem with a wide range of accessories and unparalleled customer service.



## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Competitive project pricing. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
20+ years direct coupled actuator design.

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	Part Number	Description	AFB	AF	NFB	LF	TF	GM	AM	NM	LM	AH	LH	LU
<b>Clamp / Positioner Indicators</b>	IND-AFB	Damper Position Indicator	●		●									
	IND-AF2	Damper Position Indicator		●										
	IND-LF	Damper Position Indicator				●								
	IND-TF	Damper Position Indicator					●							
	K7-2	Standard AFB/NFB Clamp (1/2" to 1.05")	●		●									
	K4-2 US	Standard AF/NF Clamp (1/2" to 1.05")		●										
	K4-1 US	Jackshaft Clamp (Up to 1.05')		●										
	K4-H US	Hex Shaft Clamp (3/8" to 5/8")		●										
	K6 US	Standard LF Clamp (3/8" to 1/2")				●								
	K6-1	Jackshaft Clamp (1/2" to 3/4")				●								
	K8 US	Standard TF Clamp					●							
	K-GM20	Reversible Clamp (1/2" to 1.05")						●						
	K-AM25	Standard Clamp (1/2" to 1")							●					
	K-SA	Reversible AM Clamp (2/5" to 3/4")							●					
	K-NA	Reversible NM Clamp (5/16" to 3/4")								●				
	K-LM20	Clamp (3/4")										●		
	K-LM16	Standard Clamp (5/8")										●		
	K-LM13	Clamp (1/2")										●		
	K-LM10	Clamp (3/8")										●		
	K-LU	Spindle Clamp (5/16" to 1/2")												●
<b>Linkage Accessories</b>	KH-AFB	Crank Arm	●		●									
	KH-AF	Crank Arm		●										
	KH-AF-1 US	Crank Arm for Jackshaft Applications		●										
	KH-AFV	V-Bolt Kit for KH-AF (-1) Crank Arms		●										
	KH-LF	Crank Arm				●								
	KH-LFV	V-Bolt Kit for KH-LF Crank Arms				●								
	KH-TF US	Crank Arm					●							
	AH-GMA	GMB(X) Crank Arm						●						
	AH-25	AMB(X) and NMB(X) Crank Arm							●	●				
	KH6	Universal Crank Arm (For KG6 Ball Joint)		●	●	●	●	●	●	●		●	●	
	KH8	Universal Crank Arm (For KG8 Ball Joint)		●	●	●	●	●	●	●		●	●	
	KH10	Universal Crank Arm (For KG10A Ball Joint)	●	●	●	●	●	●	●	●				
	KH12	Universal Crank Arm (For KG10A Ball Joint)	●	●	●	●	●	●	●	●				
	KG6	Ball Joint (5/16")		●	●	●	●	●	●	●		●	●	
	KG8	Ball Joint (5/16", 90)		●	●	●	●	●	●	●	●	●	●	
	KG10	Ball Joint for KH6 (3/8")		●	●	●	●	●	●	●		●	●	
	SH8	Push Rod for KG6 & KG8 Ball Joints (36", 5/16" Dia.)		●	●	●	●	●	●	●		●	●	
	SH10	Push Rod for KG10 Ball Joints (36", 3/8" Dia.)		●	●	●	●	●	●	●		●	●	
	ZG-DC1	Damper Clip for Damper Blade		●	●	●	●	●	●	●		●	●	
	ZG-DC2	Damper Clip for Damper Blade		●	●	●	●	●	●	●		●	●	

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	Part Number	Description	AFB	AF	NFB	LF	TF	GM	AM	NM	LM	AH	LH	LU
<b>Brackets</b>	ZG-100	Universal Mounting Bracket	●	●	●			●	●					
	ZG-101	Universal Mounting Bracket	●	●	●			●	●					
	ZG-102	Multiple Actuator Mounting Bracket	●	●				●	●					
	ZG-103	Universal Mounting Bracket						●	●	●				
	ZG-104	Universal Mounting Bracket						●	●	●				
	ZG-106	Universal Mounting Bracket		●										
	ZG-107	Universal Mounting Bracket		●										
	ZG-108	Universal Mounting Bracket		●										
	ZG-109	Mounting Bracket for ZS-260 Housings	●	●	●	●		●	●					
	ZG-110	Mounting Bracket for ZS-260 Housings	●	●	●	●		●	●					
	ZG-112	Universal Mounting Bracket for LF				●								
	ZG-113	Universal Mounting Bracket for TF					●							
	ZG-118	Universal Mounting Bracket for AFB, NFB	●		●									
	Z-GMA	GM to GMB(X) Retrofit Mounting Bracket							●					
	Z-SMA	AM, SM to AMB(X) Retrofit Mounting Bracket								●				
	Z-NMA	NM to NMB(X) Retrofit Mounting Bracket									●			
<b>Crank arm Adaptor Kits</b>	ZG-AFB	Crank Arm Adaptor Kit	●		●									
	ZG-AFB118	Crank Arm Adaptor Kit	●		●									
	ZG-AF US	Crank Arm Adaptor Kit (includes mounting hardware)		●										
	ZG-AF108	Crank Arm Adaptor Kit (includes ZG-108 & KH-AF US)		●										
	ZG-LF112	Crank Arm Adaptor Kit (includes ZG-112 & KH-LF)				●								
	ZG-LF2	Crank Arm Adaptor Kit (includes mounting hardware)				●								
	ZG-LFC114	Trane Voyager Retrofit Kit (includes retrofit bracket)				●								
	ZG-ECON1	Honeywell Economizer Retrofit Kit (includes retrofit bracket)				●								
	ZG-ECON2	Honeywell Economizer Retrofit Kit				●								
	ZG-TF112	Crank Arm Adaptor Kit (includes ZG-113 & KH-TF US)					●							
	ZG-TF2	Crank Arm Adaptor Kit (includes mounting hardware)					●							
	ZG-GMA	Crank Arm Adaptor Kit (includes mounting hardware)							●					
ZG-NMA	Crank Arm Adaptor Kit (includes mounting hardware)								●	●				
<b>Shaft Adaptors</b>	AV6-20	Shaft Extension fits 1/4' to 3/4" Diameter Shafts				●	●				●			
	AV8-25	Shaft Extension fits 5/16" to 1" Diameter Shafts	●	●	●	●		●	●	●				
	ZG-JSA (-1,2,3)	Jackshaft Adaptors for Hollow Jackshafts	●	●	●			●	●	●				
	ZG-LMSA(-1)	Shaft Adaptor									●			
	ZG-NMSA-1	Shaft Adaptor								●				
<b>Rotation Limiters</b>	ZDB-AF2 US	Angle of Rotation Limiter for AF/NF		●										
	ZDB-LF	Angle of Rotation Limiter for LF				●								
	ZDB-TF	Angle of Rotation Limiter for TF					●							
	ZDB-LU	Angle of Rotation Limiter for LU												●
<b>Housings</b>	ZS-100	Weather Shield - Galvaneal	●	●	●	●		●	●					
	ZS-101	Base for ZS-100	●	●	●	●		●	●					
	ZS-150	Weather Shield - Polycarbonate	●	●	●	●		●	●					
	ZS-260	Explosion Proof Housing	●	●	●	●		●	●					
	ZS-300 (-1) (-5)	NEMA 4X Housing	●	●	●	●		●	●					
	ZS-T	Protective Terminal Strip Cover (-T Models Only)							●	●	●	●		

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	Part Number	Description	AFB	AF	NFB	LF	TF	GM	AM	NM	LM	AH	LH	LU
<b>Miscellaneous</b>	AF-CC US	Conduit Connector		●										
	TF-CC US	Conduit Connector	●		●		●	●	●	●	●	●	●	●
	AF-P	Anti-Rotation Bracket (11414)	●	●	●									
	LF-P	Anti-Rotation Bracket (11695)				●								
	TF-P	Anti-Rotation Bracket (11533)					●				●			
	Z-DS1	Rotary Support for Lateral Force Compensation											●	●
	Tool-06	8 mm and 10 mm Wrench	●	●	●	●	●		●	●	●	●	●	●
	<b>Tool-07</b>	13 mm Wrench						●						

**Clamps / Position Indicators / Rotation Limiters**

**K7-2** Standard Clamp. Fits shafts 1/2" to 1.05".



**IND-AFB** Damper Position Indicator.  
For damper position indication in short shaft installations



**Shaft Adaptors / Extensions**

**AV8-25** Shaft Extension. For damper operating shafts.  
Approx. 6-5/8" [170 mm] extension for shafts  
1/4" to 3/4" [6 to 20 mm].



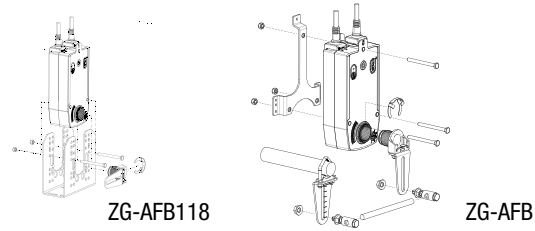
The shaft adaptors listed below may be used with AFB, AFX, NFB, NFX actuators.  
For more information see page 448.

**ZG-JSA-1 ZG-JSA-2 ZG-JSA-3**

**Non-Direct Mounting**

**ZG-AFB** Crank Arm Adaptor Kit  
For more information see page 439.

**ZG-AFB118** Crank Arm Adaptor Kit  
For more information see page 434.



**KH-AFB** Crank Arm  
Fits round shafts up to 3/4".



**Mounting Brackets**

The mounting brackets listed below may be used with AFB, AFX, NFB, NFX actuators.  
For more information see pages 433, 434 and 443.

**ZG-100 ZG-101 ZG-102 ZG-118**

**Housings**

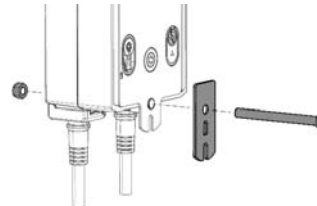
The housings listed below may be used with AF/NF actuators.  
For more information see pages 449 to 453.

**ZS-100 ZS-150 ZS-260 ZS-300**

**Miscellaneous**

**AF-P** Anti-Rotation T-Bracket for AF/NF.

**Z-AF** AF, NF to AFB, AFX, NFB, NFX Retrofit Mounting Bracket



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### Clamps / Position Indicators / Rotation Limiters

**K4 US** Clamp. Fits shafts 3/8" to 3/4".

**K4-1 US** Jackshaft Clamp. Fits jackshafts up to 1.05".

**K4-2 US** Standard Clamp. Fits shafts 1/2" to 1.05".

**K4-H** Hex Shaft clamp. Fits hex shafts 3/8" to 5/8".

**IND-AF2** Damper Position Indicator.  
For damper position indication in short shaft installations.

**ZDB-AF2 US** Angle of Rotation Limiter for AF/NF actuators. Includes IND-AF2.

**KH-AFV** V-Bolt Kit allows for direct coupling with KH-LF.  
Contains V-Bolt and 2 nuts.



### Shaft Adaptors / Extensions

**AV8-25** Shaft Extension. For damper operating shafts.  
Approx. 6-5/8" [170 mm] extension for shafts  
1/4" to 3/4" [6 to 20 mm].



The shaft adaptors listed below may be used with AF/NF actuators.  
For more information see page 448.

**ZG-JSA-1 ZG-JSA-2 ZG-JSA-3**

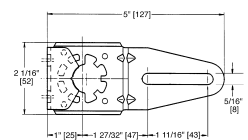
### Non-Direct Mounting

**ZG-AF US** Crank Arm Adaptor Kit  
For more information see page 440.

**ZG-AF108** Crank Arm Adaptor Kit  
For more information see page 436.

**KH-AF** Crank Arm  
Fits round shafts up to 3/4".

**KH-AF-1 US** Crank Arm for Jackshaft Applications  
Fits round shafts up to 1.05".



### Mounting Brackets

The mounting brackets listed below may be used with AF/NF actuators.  
For more information see pages 433, 436, 438 and 443.

**ZG-100 ZG-101 ZG-102 ZG-106 ZG-107 ZG-108**

### Housings

The housings listed below may be used with AF/NF actuators.  
For more information see pages 449 to 453.

**ZS-100 ZS-150 ZS-260 ZS-300**

### Miscellaneous

**AF-P** Anti-Rotation T-Bracket for AF/NF.

## Clamps / Position Indicators / Rotation Limiters

**K6 US** Clamp. Fits shafts 3/8" to 1/2".

**K6-1** Clamp. Fits shafts 1/2" to 3/4".

**IND-LF** Damper Position Indicator



**ZDB-LF** Angle of Rotation Limiter for LF actuators

**KH-LFV** V-Bolt Kit allows direct coupling with KH-LF. Contains V-Bolt and 2 nuts.



## Shaft Adaptors / Extensions

**ZG-LMSA-1** Shaft Adaptor (See LM Accessories)

**AV6-20** Shaft Extension. For damper operating shafts. Approx. 6 5/8" [170 mm] extension for shafts 1/4" to 3/4" [6 to 20 mm] (must use K6-1 clamp).



**AV8-25** Shaft Extension. For damper operating shafts. Approx. 9.8" [170 mm] extension for shafts 5/16" to 1" [8 to 10 mm].

## Non-Direct Mounting

**ZG-LF112** Crank Arm Adaptor Kit  
For more information see page 444.

**ZG-LF2** Crank Arm Adaptor Kit  
For more information see page 445.

**ZG-LFC114** Crank Arm Adaptor Kit  
Specifically for Trane Voyager unit retrofit  
For more information see page 446.

**ZG-ECON1** Crank Arm Adaptor Kit  
Specifically for Honeywell economizer retrofit  
For more information see page 447.

**ZG-ECON2** Crank Arm Adaptor Kit  
Specifically for Honeywell economizer retrofit  
For more information see page 447.

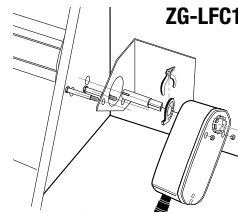
**KH-LF** Crank Arm

**ZG-LF112**

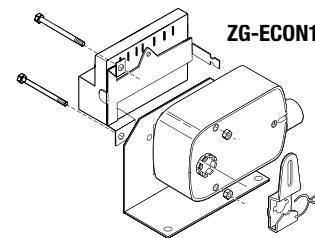


**ZG-LF2**

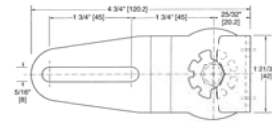
**ZG-LFC114**



**ZG-ECON1**



**KH-LF**



## Mounting Brackets

The mounting brackets listed below may be used with LF actuators. For more information see page 444.

**ZG-112**

## Housings

The housings listed below may be used with LF actuators. For more information see pages 449 to 451.

**ZS-100 ZS-150 ZS-260**

## Miscellaneous

**LF-P** Anti-Rotation T-Bracket for LF.

### Clamps / Position Indicators / Rotation Limiters

- IND-TF**                      Damper Position Indicator

---

- ZDB-TF**                      Angle of Rotation Limiter for TF actuators.

### Shaft Adaptors / Extensions

- AV6-20**                      Shaft Extension. For damper operating shafts.  
Approx. 6-5/8" [170 mm] extension for shafts  
1/4" to 3/4" [6 to 20 mm].



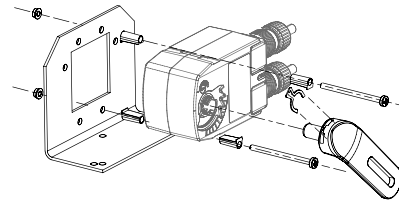
### Non-Direct Mounting

- ZG-TF112**                      Crank Arm Adaptor Kit.  
For more information see page 444.

---

- ZG-TF2**                      Crank Arm Adaptor Kit.  
For more information see page 445.

---

- KH-TF US**                      Crank Arm.  
With 5/16" slot (can be used with KG8 or KG10A Ball Joint).

---

- KH-TF-1 US**                      Crank Arm.  
With 1/4" slot (can be used with KG6 Ball Joint).

---

### Mounting Brackets

The mounting brackets listed below may be used with TF actuators.  
For more information see page 444.

- ZG-113**

### Housings

The housings listed below may be used with TF actuators.  
For more information see page 449.

- ZS-100      ZS-150**

### Miscellaneous

- TF-CC US**                      Conduit Connector for AFB(X) / NFB (X) / TF / GM / AM / NM / LM

---

- TF-P**                      Anti-Rotation T-Bracket for TF / LM.

---

**Clamps / Position Indicators / Rotation Limiters**

**K-GM20** Reversible Clamp. Fits shafts up to 1.05".



**Shaft Adaptors**

**AV8-25** Shaft Extension. For damper operating shafts. Approx. 9.8" [170 mm] extension for shafts 5/16" to 1" [8 to 10 mm].



The shaft adaptors listed below may be used with GM actuators. For more information see page 448.

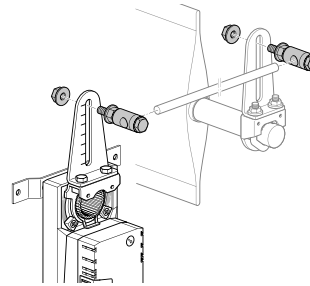
**ZG-JSA-1 ZG-JSA-2 ZG-JSA-3**

**Non-Direct Mounting**

**ZG-GMA** Crank Arm Adaptor Kit  
For more information see page 441.

**AH-GMA** Crank Arm

**23681-00001** GK Adaptor. For short shafting to connect to auxiliary switch or potentiometer.



**Mounting Brackets**

The mounting brackets listed below may be used with GM actuators. For more information see pages 433 and 443.

**ZG-100 ZG-101 ZG-102 ZG-103 ZG-104**

**Housings**

The housings listed below may be used with GM actuators. For more information see pages 449 to 453 and page 410.

**ZS-100 ZS-150 ZS-260 ZS-300 ZS-T**

**Miscellaneous**

**TF-CC US** Conduit Connector for AFB, AFX / NFB, NFX / TF / GM / AM / NM / LM

**Z-GMA** GM to GMB, GMX Retrofit Mounting Bracket.

### Clamps / Position Indicators / Rotation Limiters

**K-AM25** Standard Reversible Clamp. Fits shafts up to 1.05".

**K-SA** Reversible Clamp. Fits shafts up to 3/4".



### Non-Direct Mounting

**ZG-NMA** Crank Arm Adaptor Kit  
For more information see page 442.

**AH-25** Crank Arm



### Shaft Adaptors / Extensions

**AV8-25** Shaft Extension. For damper operating shafts.  
Approx. 9.8" [170 mm] extension for shafts  
5/16" to 1" [8 to 10 mm].



The shaft adaptors listed below may be used with AM actuators.  
For more information see page 448.

**ZG-JSA-1 ZG-JSA-2 ZG-JSA-3**

### Mounting Brackets

The mounting brackets listed below may be used with AM actuators.  
For more information see page 443.

**ZG-100 ZG-101 ZG-103 ZG-104**

### Housings

The housings listed below may be used with AM actuators.  
For more information see pages 449 to 453 and page 410.

**ZS-100 ZS-150 ZS-260 ZS-300 ZS-T**

### Miscellaneous

**TF-CC US** Conduit Connector for AFB, AFX / NFB, NFX / TF / GM / AM / NM / LM

**Z-SMA** AM, SM to AMB, AMX Retrofit Mounting Bracket

**Clamps / Position Indicators / Rotation Limiters**

**K-AM25** Standard Reversible Clamp. Fits shafts up to 1.05".

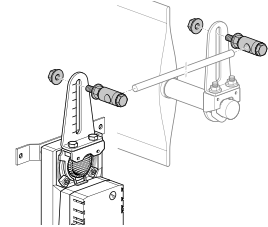
**K-NA** Reversible Clamp. Fits shafts up to 3/4".



**Non-Direct Mounting**

**ZG-NMA** Crank Arm Adaptor Kit  
For more information see page 442.

**AH-25** Crank Arm



**Shaft Adaptors / Extensions**

**ZG-NMSA-1** Short Shaft Extension



**AV8-25** Shaft Extension. For damper operating shafts.  
Approx. 9.8" [170 mm] extension for shafts  
5/16" to 1" [8 to 10 mm].



The shaft adaptors listed below may be used with NM actuators.  
For more information see page 448.

**ZG-JSA-1 ZG-JSA-2 ZG-JSA-3**

**Mounting Brackets**

The mounting brackets listed below may be used with NM actuators.  
For more information see page 443.

**ZG-103 ZG-104**

**Housings**

The housings listed below may be used with NM actuators.  
For more information see pages 449 and page 410.

**ZS-100 ZS-150 ZS-T**

**Miscellaneous**

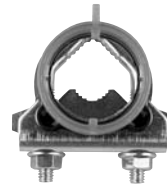
**TF-CC US** Conduit Connector for AFB, AFX / NFB, NFX / TF / GM / AM / NM / LM

**Z-NMA** NM to NMB, NMX Retrofit Mounting Bracket

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**Clamps / Position Indicators / Rotation Limiters**

<b>K-LM20</b>	Clamp. Fits shafts up to 3/4".
<b>K-LM16</b>	Standard Clamp. Fits shafts up to 5/8".
<b>K-LM12</b>	Clamp. Fits shafts up to 1/2".
<b>K-LM10</b>	Clamp. Fits shafts up to 3/8".


**Shaft Adaptors / Extensions**

<b>ZG-LMSA</b>	Shaft Extension
<b>ZG-LMSA-1</b>	Shaft Extension
<b>AV6-20</b>	Shaft Extension. For damper operating shafts. Approx. 6 5/8" [170 mm] extension for shafts 1/4" to 3/4" [6 to 20 mm] (must use K6-1 clamp).


**Housings**

The housings listed below may be used with LM actuators.  
For more information see pages 449 and 410.

**ZS-100    ZS-150    ZS-T**

**Miscellaneous**

<b>TF-CC US</b>	Conduit Connector for TF / GM / AM / NM / LM
<b>TF-P</b>	Anti-Rotation T-Bracket for TF / LM.

## AH/LH Accessories

### Crank arms / Ball Joints / Push Rods

**KH6** Universal Crank Arm  
(For more information see Universal Accessories).



**KH8** Universal Crank Arm  
(For more information see Universal Accessories).

**KG6** Ball Joint (Zinc Plated)  
(For more information see Universal Accessories).



**KG8** Ball Joint (Galvanized)  
(For more information see Universal Accessories).

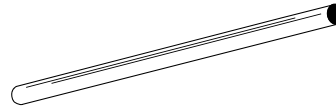


**KG10** Ball Joint (Zinc Plated)  
(For more information see Universal Accessories).



**SH8** Push Rod  
(For more information see Universal Accessories).

**SH10** Push Rod  
(For more information see Universal Accessories).



## Miscellaneous

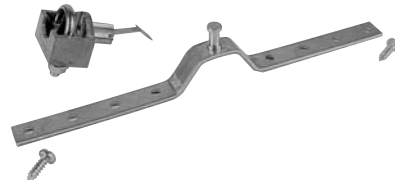
**TF-CC US** Conduit Connector for TF / GM / AM / NM / LM

**Z-DS1** Rotary Support for Lateral Force Compensation

## LU Accessories

### Clamps / Position Indicators / Rotation Limiters

**K-LU** Spindle Clamp. Fits shafts 5/16" to 1/2".



**ZDB-LU** Angle of Rotation Limiter for LU.

**Z-DS1** Rotary Support for Lateral Force Compensation

**Z-KSA** 5/16" Shaft Clevis

**Z-KSC** 3/8" Shaft Clevis

## Housings

The housings listed below may be used with LU actuators.  
For more information see pages 449 and 410.

**ZS-100**    **ZS-150**    **ZS-T**

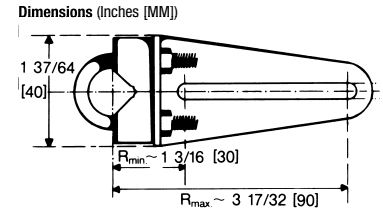
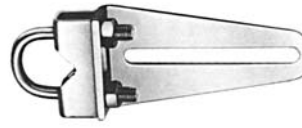
## Miscellaneous

**TF-CC US** Conduit Connector for TF / GM / AM / NM / LM



## Universal Crank arms

- KH6** Zinc plated steel. Slot width 1/4" (6.2mm).  
For damper shafts:  
3/8" to 11/16" dia. (10 to 18mm) or  
3/8" to 9/16" sq. (10 to 14mm).  
Uses KG6 Ball Joint.
- KH8** Zinc plated steel. Slot width 21/64" (8.2mm).  
For damper shafts:  
3/8" to 11/16" dia. (10 to 18mm) or  
3/8" to 9/16" sq. (10 to 14mm).  
Uses KG8 or KG10A Ball Joint.
- KH10** Zinc plated steel. Slot width 21/64" (8.2mm).  
For damper shafts:  
9/16" to 1.05" dia. (14 to 25mm).  
Uses KG10A Ball Joint.
- KH12** Zinc plated steel. Slot width 21/64" (8.2mm).  
For damper shafts:  
3/4" to 1" dia. (20 to 25mm).  
Uses KG10A Ball Joint.



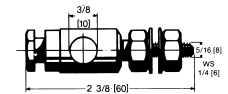
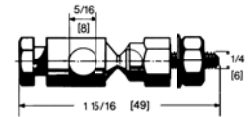
**KH10**



**KH12**

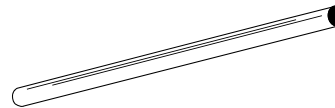
## Ball Joints

- KG6** For KH6 Universal Crank Arm. Zinc plated steel.  
For 5/16" dia. rod (8mm).  
The KG6 ball joint is only recommended  
up to 70 in-lbs. (8Nm)
- KG8** For KH8 Universal Crank Arm  
Galvanized steel. 90° angle.  
For 5/16" dia. rod (8mm).
- KG10A** Zinc Plated Steel  
Used with following crank arms:  
KH8 = 5/16" (8mm)



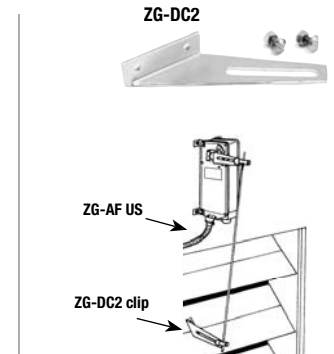
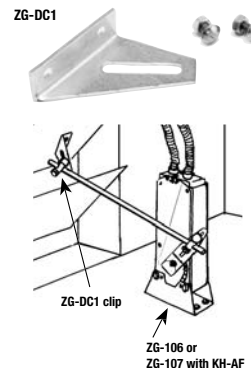
## Push Rods

- SH8** For KG6 and KG8 Ball Joints. 36" length, 5/16" dia.
- SH10** For KG10 Ball Joints. 36" length, 3/8" dia.



## Damper Clips

- ZG-DC1** Mounts to Damper Blades – 3.5"
- ZG-DC2** Mounts to Damper Blades – 6"
- The ZG-DC1 and ZG-DC2 damper clips are designed to mount to damper blades and work as crank arms in damper linkage applications. The ZG-DC1 is designed to be used in applications where the actuator is located in front of the damper. The ZG-DC2 is designed to be used when the actuator is located above or below the damper.



# ZG-102 Multiple Actuator Mounting Bracket

For AFB, AFX, AF and GM Series Actuators



## Application

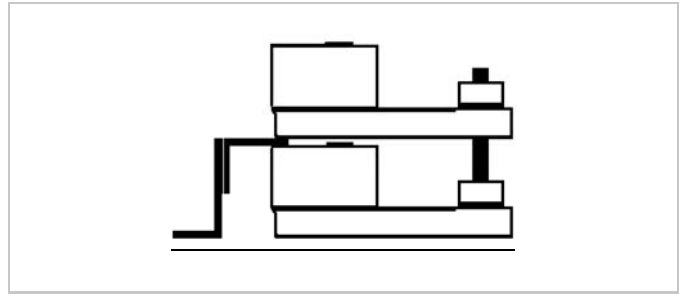
The ZG-102 multiple actuator mounting bracket is designed for cases where it is necessary to mount two actuators to one shaft to provide extra torque.

The dual mounting bracket is typically used with the AFB, AFX, AF and GM series actuators. This is due to the fact that each of these series are the highest torque range available.

Figures A and B demonstrates two different mounting configurations using the ZG-102 mounting bracket.

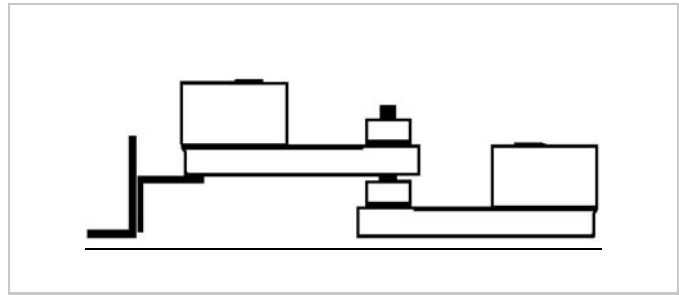
## Accessory

AV10 - 25 Universal shaft extension



**FIGURE A**

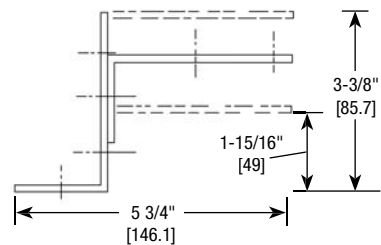
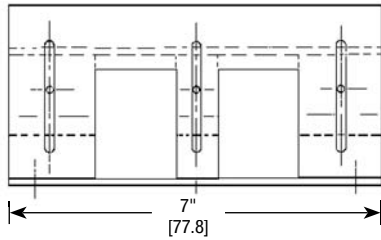
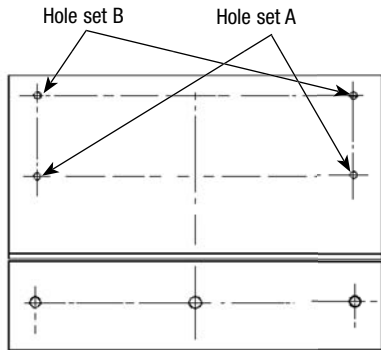
The major advantage with this method is it requires less mounting area. The manual override, if available, cannot be used in this configuration.



**FIGURE B**

The major advantages are that a shorter shaft is required and a lower profile is achieved.

## Dimensions (Inches [mm])



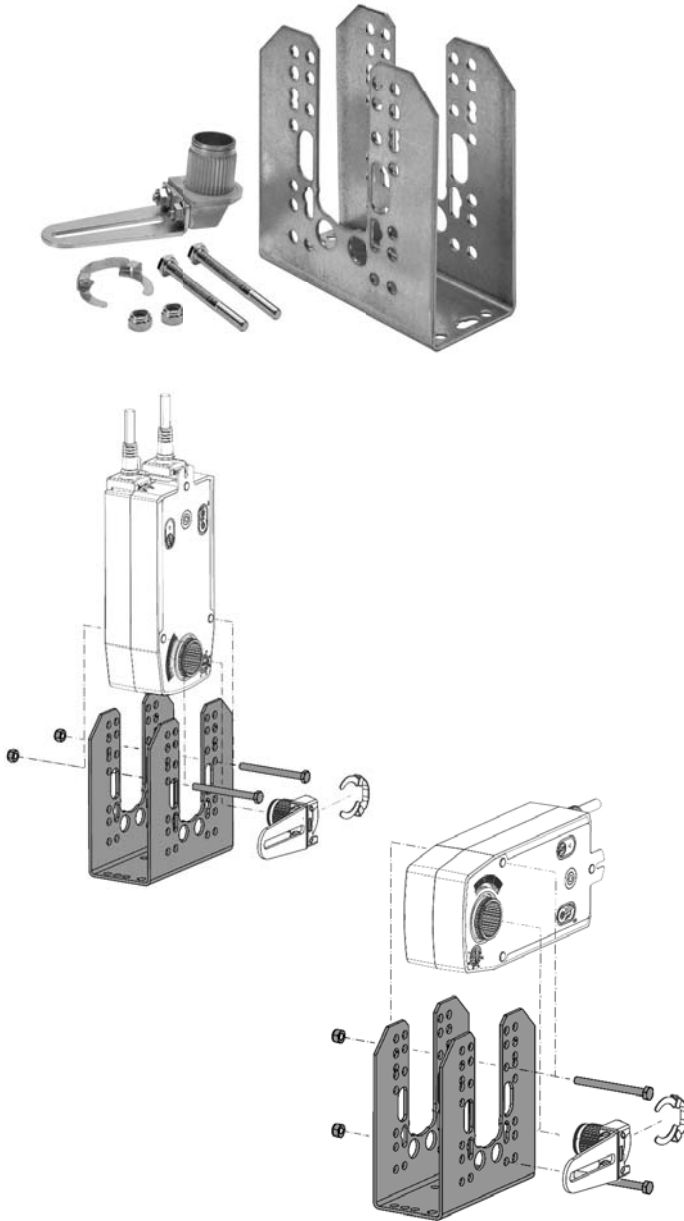
Material	12 GA Galvanized
Weight	1.8 lbs.

## OTHER CRANK ARM ADAPTOR KITS AND UNIVERSAL MOUNTING BRACKETS

KIT	MOUNTING BRACKET*	ACTUATOR USED WITH
ZG-AFB	NA	AFB, AFX, NFB, NFX
ZG-AFB118	ZG-118	AFB, AFX, NFB, NFX
ZG-AF108	ZG-108 (Included)	AF
ZG-AF US	ZG-100, ZG-101	AF
ZG-LF112	ZG-112 (Included)	LF
ZG-LF2	NA	LF
ZG-LFC114	NA	LF
ZG-ECON1	ZG-112 (Included)	LF
ZG-ECON2	ZG-112 (Included)	LF
ZG-TF112	ZG-113 (Included)	TF
ZG-TF2	NA	TF
ZG-GMA	ZG-101, ZG-101, ZG-103, ZG-104	GM
ZG-NMA	ZG-101, ZG-101, ZG-103, ZG-104	NM, AM
NA	ZG-106	AF
NA	ZG-107	AF

\*Unless otherwise noted, mounting brackets are not included in crank arm adaptor kits.

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## Application

The ZG-AFB118 Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft. It may be used for outside or inside the duct mounting.

### The ZG-AFB118 Crank Arm Adaptor Kit includes:

- 1 ZG-118 Mounting Bracket
- 1 KH-AFB Crank Arm with Retaining Clip
- 2 Bolts with Nuts

**NOTE:** May require crank arm and ball joints

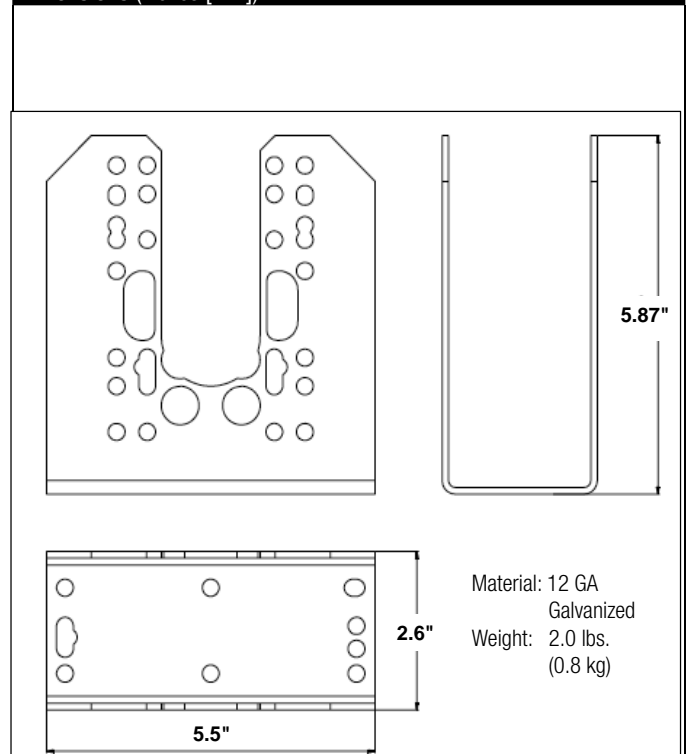
The ZG-118 is provided with hole patterns to mount the AFB, AFX, NFB and NFX actuators in either a horizontal or vertical position to meet space requirements. The KH-AFB crank arm is required to fully convert the AFB, AFX, NFB or NFX for crank arm operation.

The ZG-118 is designed to mount the AFB, AFX, NFB and NFX actuators in the same mounting locations as common foot mounted, crank arm style actuators. Hole patterns in the base match common Honeywell™, Siebe™ (Barber Coleman™) and Johnson Controls™ actuators for easy retrofit.

### USE WHEN REPLACING THESE ACTUATORS

<b>Honeywell</b>	M91... M945...	M955... M965...	M975... M8...
<b>Johnson</b>	M110... M120...	M130... M140...	M150...
<b>Barber Coleman</b>	MA3...	MA4...	MA5...

### Dimensions (Inches [mm])



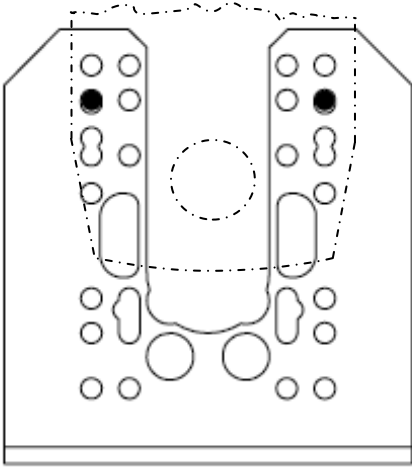
### OTHER CRANK ARM ADAPTOR KITS AND UNIVERSAL MOUNTING BRACKETS

KIT	MOUNTING BRACKET*	ACTUATOR USED WITH
ZG-AFB	NA	AFB, AFX, NFB, NFX
ZG-AFB118	ZG-118	AFB, AFX, NFB, NFX
ZG-AF108	ZG-108 (Included)	AF
ZG-AF US	ZG-100, ZG-101	AF
ZG-LF112	ZG-112 (Included)	LF
ZG-LF2	NA	LF
ZG-LFC114	NA	LF
ZG-ECON1	ZG-112 (Included)	LF
ZG-ECON2	ZG-112 (Included)	LF
ZG-TF112	ZG-113 (Included)	TF
ZG-TF2	NA	TF
ZG-GMA	ZG-101, ZG-101, ZG-103, ZG-104	GM
ZG-NMA	ZG-101, ZG-101, ZG-103, ZG-104	NM, AM
NA	ZG-106	AF
NA	ZG-107	AF

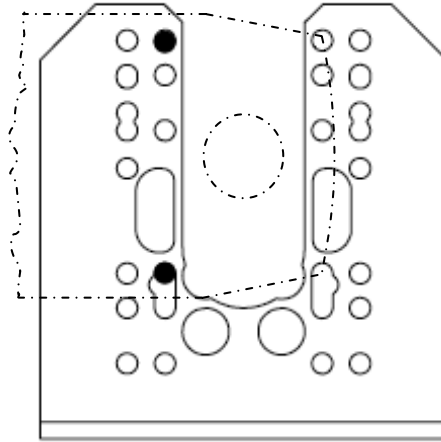
\*Unless otherwise noted, mounting brackets are not included in crank arm adaptor kits.

# ZG-AFB118 Crank Arm Adaptor Kit

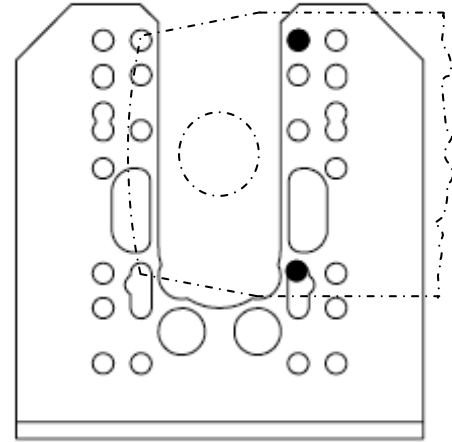
## Mounting Positions for Typical Replacements



Barber Colman™ MA Type - Vertical

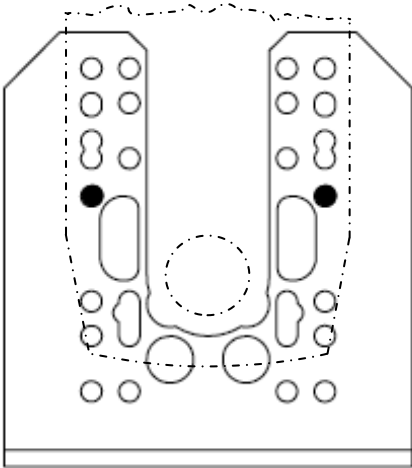


Barber Colman™ MA Type - Horizontal (left)

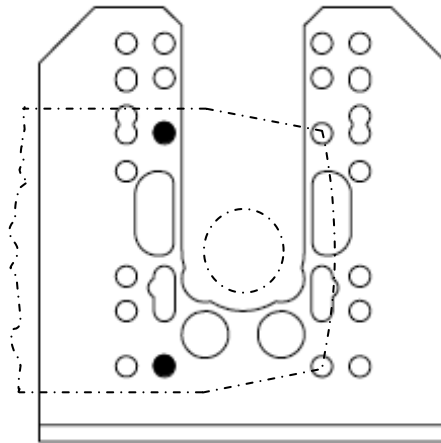


Barber Colman™ MA Type - Horizontal (right)

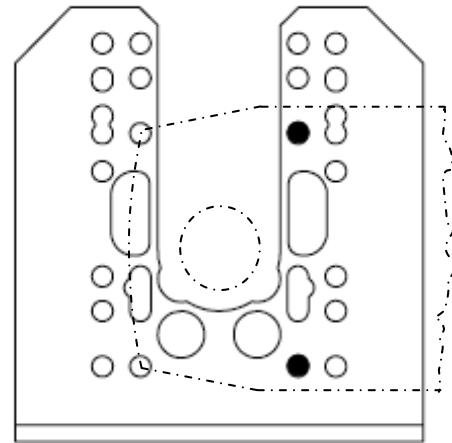
*Black holes represent correct bolt locations*



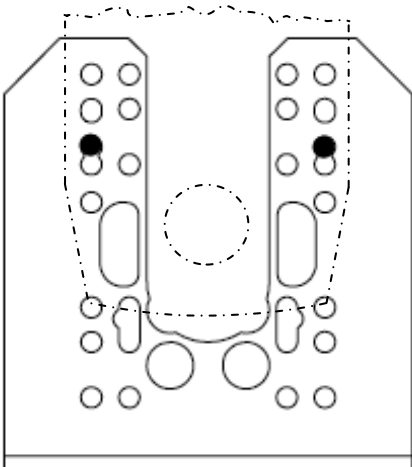
Honeywell™ Mod. IV Type - Vertical



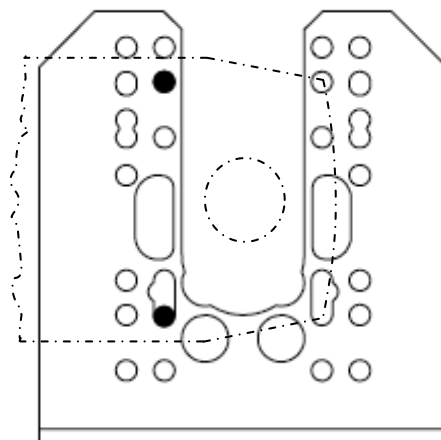
Honeywell™ Mod. IV Type - Horizontal (left)



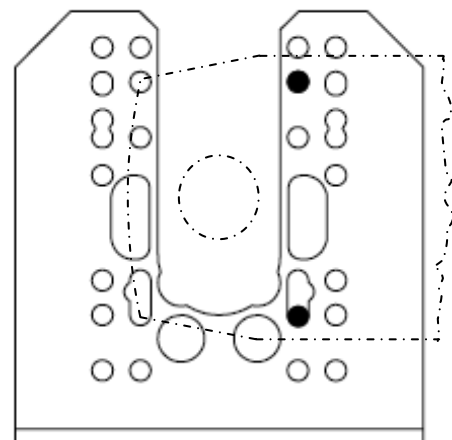
Honeywell™ Mod. IV Type - Horizontal (right)



Johnson Controls™ 100 Series Type and  
Honeywell™ Mod. III Type - Vertical

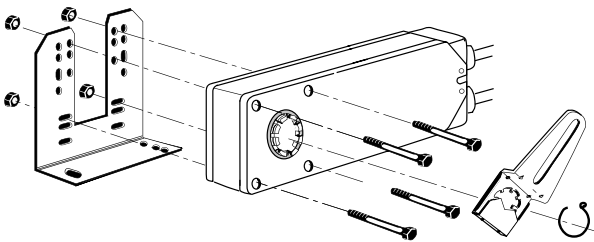
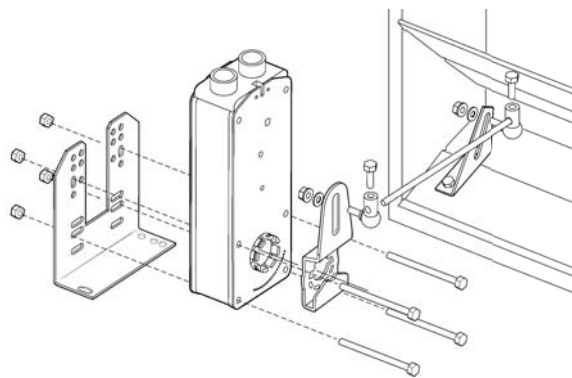
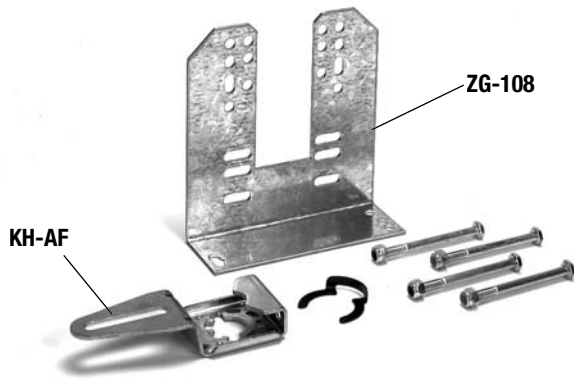


Johnson Controls™ 100 Series Type and  
Honeywell™ Mod. III Type - Horizontal (left)



Johnson Controls™ 100 Series Type and  
Honeywell™ Mod. III Type - Horizontal (right)

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## Application

The ZG-AF108 Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft. It may be used for outside or inside the duct mounting.

### The ZG-AF108 Crank Arm Adaptor Kit includes:

- 1 ZG-108 Mounting Bracket
- 1 KH-AF Crank Arm with Retaining Ring
- 4 Bolts with Nuts

**NOTE:** May require crank arm and ball joints

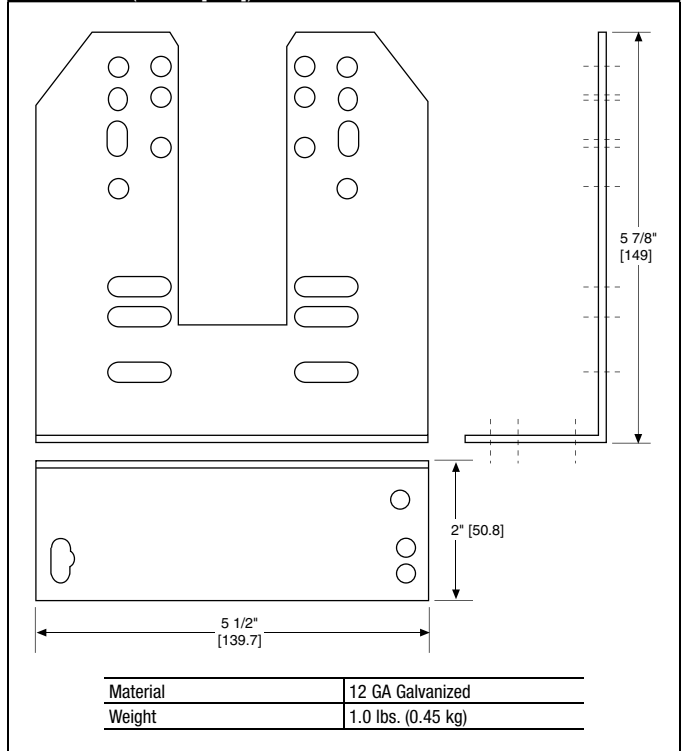
The ZG-108 is provided with hole patterns to mount the AF series actuators in either a horizontal or vertical position to meet space requirements.

The ZG-108 Mounting Bracket is designed to mount the AF series actuator in the same mounting locations as common foot mounted, crank arm style actuators. Hole patterns in the base match common Honeywell™, Siebe™ (Barber Coleman™), and Johnson Controls™ actuators for easy retrofit.

### USE WHEN REPLACING THESE ACTUATORS

Honeywell	M91...	M955...	M975...
	M945...	M965...	M8...
Johnson	M110...	M130...	M150...
	M120...	M140...	
Barber Coleman	MA3...	MA4...	MA5...

### Dimensions (Inches [mm])



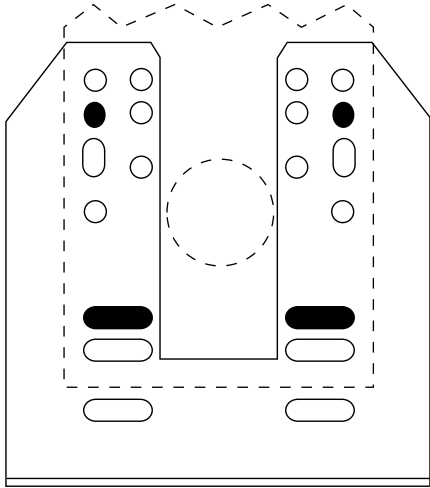
### OTHER CRANK ARM ADAPTOR KITS AND UNIVERSAL MOUNTING BRACKETS

KIT	MOUNTING BRACKET*	ACTUATOR USED WITH
ZG-AFB	NA	AFB, AFX, NFB, NFX
ZG-AFB118	ZG-118	AFB, AFX, NFB, NFX
ZG-AF108	ZG-108 (Included)	AF
ZG-AF US	ZG-100, ZG-101	AF
ZG-LF112	ZG-112 (Included)	LF
ZG-LF2	NA	LF
ZG-LFC114	NA	LF
ZG-ECON1	ZG-112 (Included)	LF
ZG-ECON2	ZG-112 (Included)	LF
ZG-TF112	ZG-113 (Included)	TF
ZG-TF2	NA	TF
ZG-GMA	ZG-101, ZG-101, ZG-103, ZG-104	GM
ZG-NMA	ZG-101, ZG-101, ZG-103, ZG-104	NM, AM
NA	ZG-106	AF
NA	ZG-107	AF

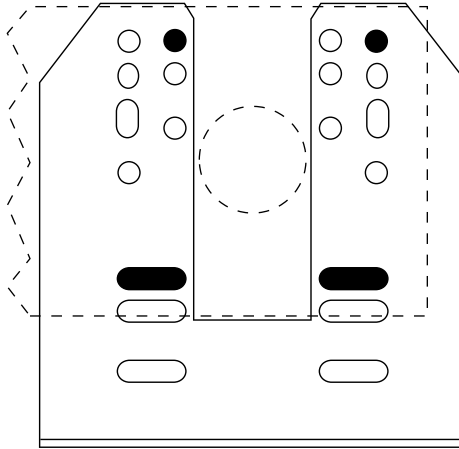
\*Unless otherwise noted, mounting brackets are not included in crank arm adaptor kits.

# ZG-AF108 Crank Arm Adaptor Kit

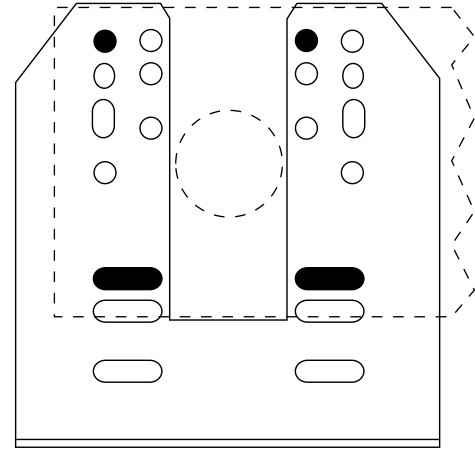
Mounting Positions for Typical Replacements



Barber Colman™ MA Type - Vertical

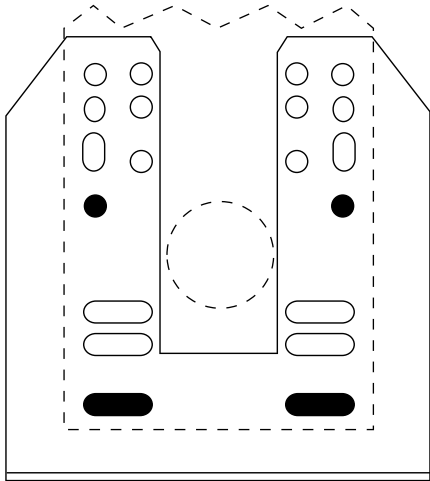


Barber Colman™ MA Type - Horizontal (left)

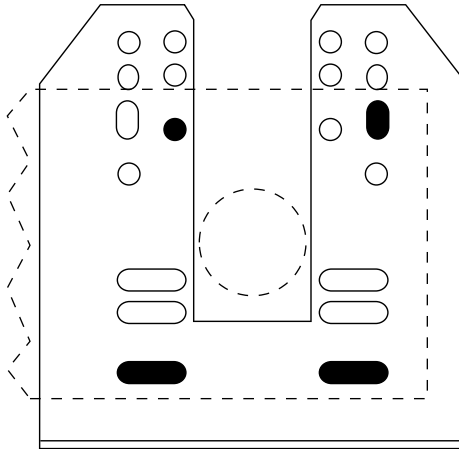


Barber Colman™ MA Type - Horizontal (right)

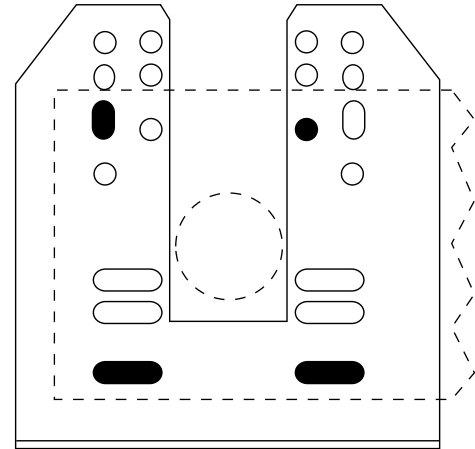
*Black holes represent correct bolt locations.*



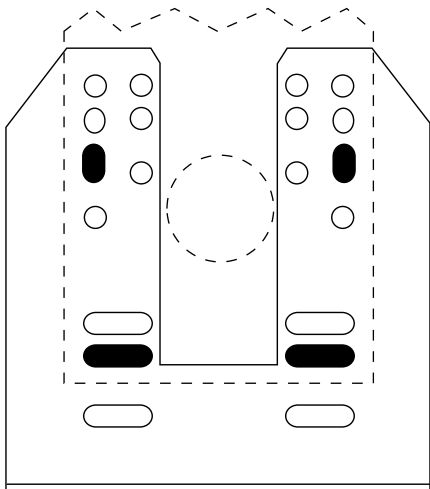
Honeywell™ Mod. IV Type - Vertical



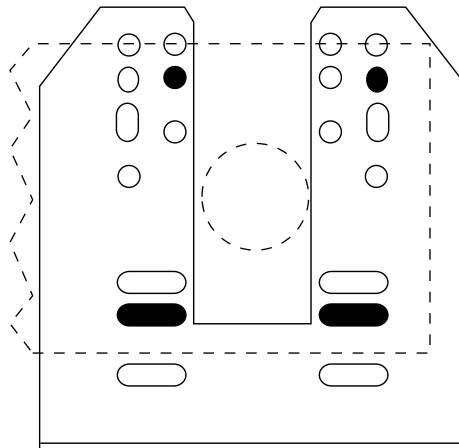
Honeywell™ Mod. IV Type - Horizontal (left)



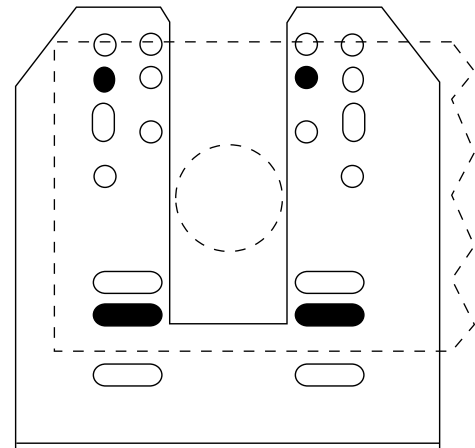
Honeywell™ Mod. IV Type - Horizontal (right)



Johnson Control™ 100 Series Type  
and Honeywell™ Mod. III Type  
Vertical

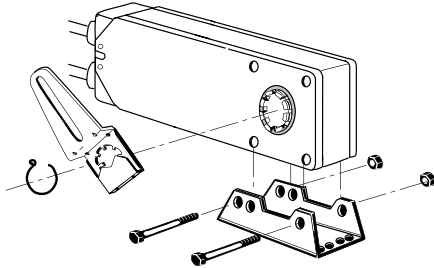
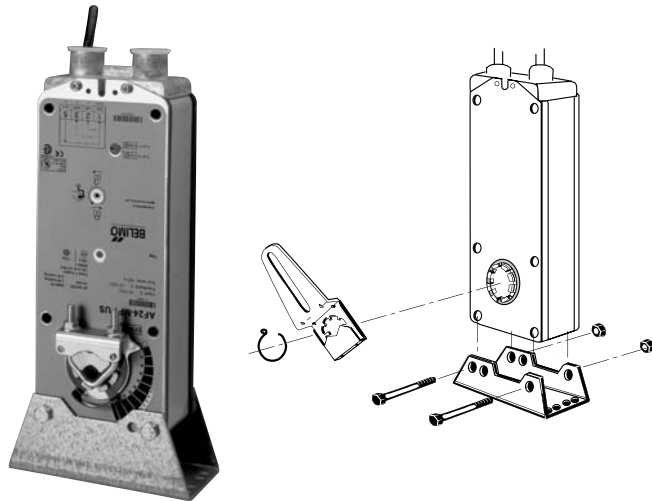


Johnson Control™ 100 Series Type  
and Honeywell™ Mod. III Type  
Horizontal (left)



Johnson Control™ 100 Series Type  
and Honeywell™ Mod. III Type  
Horizontal (right)

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## Application

The ZG-106 and ZG-107 Universal Mounting Brackets are designed for applications where the actuator cannot be mounted directly to the damper shaft. They may be used for outside or inside the duct mounting.

The ZG-106 and ZG-107 is provided with hole patterns to mount the AF series actuators in either a horizontal or vertical position to meet space requirements.

The KH-AF crank arm is required to fully convert the AF for crank arm operation.

The ZG-106 and ZG-107 are designed to mount the AF series actuators in the same mounting locations as common foot mounted, crank arm style actuators. Hole patterns in the base match common Honeywell™, Siebe™ (Barber Coleman™), and Johnson Controls™ actuators for easy retrofit.

The ZG-106 is designed to place the KH-AF crank arm in the same relative position as the Honeywell™ Mod IV actuators. The ZG-107 is designed to place the crank arm in the same relative position as the Honeywell™ Mod III actuators.

### USE THE ZG-106 WHEN REPLACING THESE ACTUATORS

Honeywell	Mod IV	M91...	M945...
	M955...	M965...	M975... M8...

### USE THE ZG-107 WHEN REPLACING THESE ACTUATORS

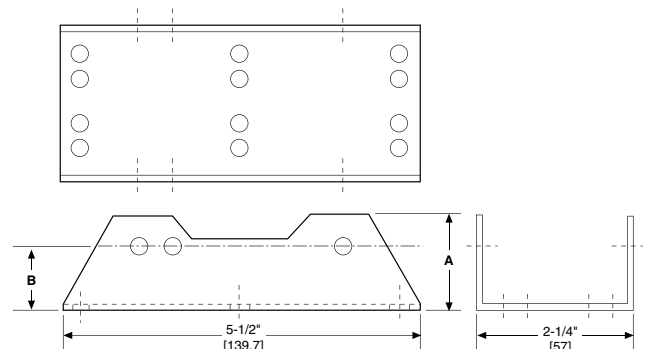
Honeywell	Mod III
-----------	---------

### OTHER CRANK ARM ADAPTOR KITS AND UNIVERSAL MOUNTING BRACKETS

KIT	MOUNTING BRACKET*	ACTUATOR USED WITH
ZG-AFB	NA	AFB, AFX, NFB, NFX
ZG-AFB118	ZG-118	AFB, AFX, NFB, NFX
ZG-AF108	ZG-108 (Included)	AF
ZG-AF US	ZG-100, ZG-101	AF
ZG-LF112	ZG-112 (Included)	LF
ZG-LF2	NA	LF
ZG-LFC114	NA	LF
ZG-ECON1	ZG-112 (Included)	LF
ZG-ECON2	ZG-112 (Included)	LF
ZG-TF112	ZG-113 (Included)	TF
ZG-TF2	NA	TF
ZG-GMA	ZG-101, ZG-101, ZG-103, ZG-104	GM
ZG-NMA	ZG-101, ZG-101, ZG-103, ZG-104	NM, AM
NA	ZG-106	AF
NA	ZG-107	AF

\*Unless otherwise noted, mounting brackets are not included in crank arm adaptor kits.

### Dimensions (Inches [mm])



	A	B
ZG-106	1.50"	1.02"
ZG-107	2.25"	1.77"

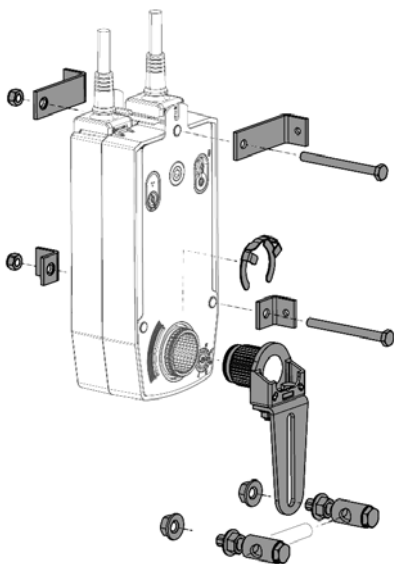
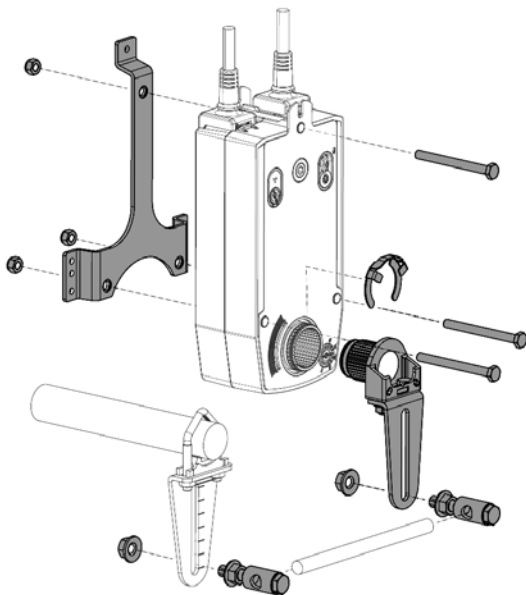
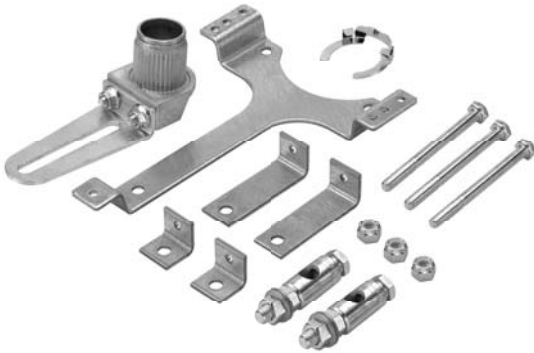
Material	12 GA Galvanized	
Weight	ZG-106	0.7 lbs.
	ZG-107	0.9 lbs.

# ZG-AFB Crank Arm Adaptor Kit

For AFB, AFX, NFB and NFX Series Actuators



## ZG-AFB



## Application

The ZG-AFB Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft.

### The ZG-AFB Crank Arm Adaptor Kit includes:

- 1 KH-AFB Crank Arm with Retaining Clip
- 1 "T" Bracket
- 4 Mounting Feet
- 3 Bolts with Nuts
- 2 KG10A Ball Joints

The following Universal Mounting Brackets are needed to fully convert to crank arm operation:

- ZG-100**
- ZG-101**

The ZG-100 and ZG-101 Universal Mounting Brackets are designed for applications where the actuator cannot be mounted directly to the shaft, and no proper mounting surface is available. It may be used for outside or inside the duct mounting, fastened to the ductwork or directly to the damper assembly. It may also be used to mount to other surfaces rather than the duct.

The ZG-100 and ZG-101 are provided with pre-punched hole patterns for the AM, SM, GM, AF, AFB(X) and NFB(X) series actuators. The ZG-100 hole pattern layout allows mounting these actuators in three different, mounting orientations. The ZG-101 hole pattern layout allows mounting these actuators in two different, mounting orientations. The ZG-100 and ZG-101 may also be field drilled for special or more exact mounting of linkage components.

For technical data and dimensions on ZG-100 and ZG-101 Universal Mounting Brackets, see page 443.

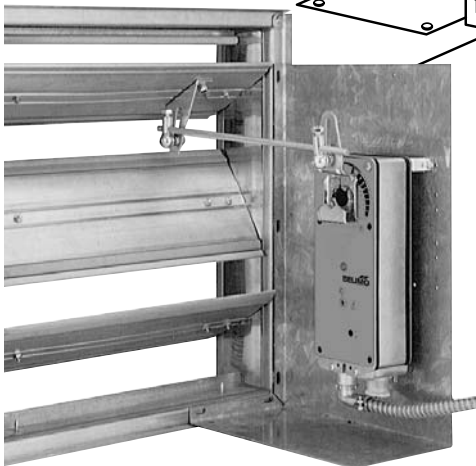
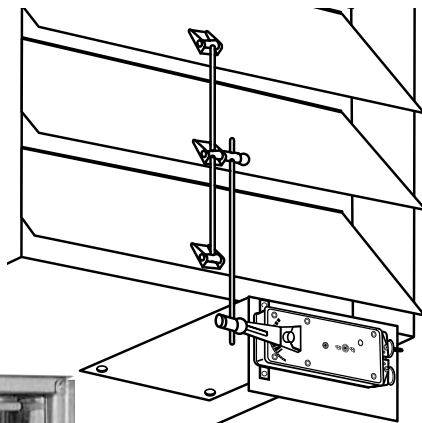
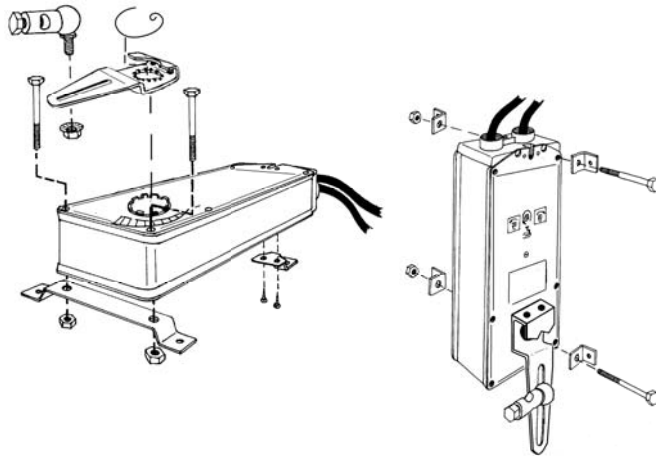
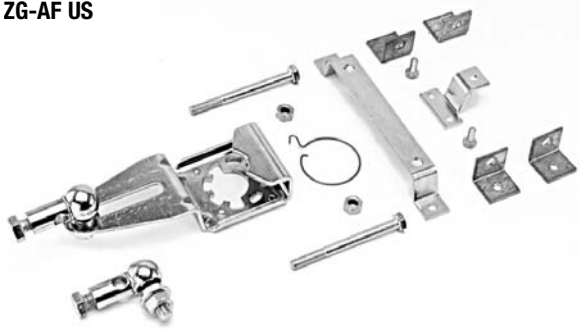
### OTHER CRANK ARM ADAPTOR KITS AND UNIVERSAL MOUNTING BRACKETS

KIT	MOUNTING BRACKET*	ACTUATOR USED WITH
ZG-AFB	NA	AFB, AFX, NFB, NFX
ZG-AFB118	ZG-118	AFB, AFX, NFB, NFX
ZG-AF108	ZG-108 (Included)	AF
ZG-AF US	ZG-100, ZG-101	AF
ZG-LF112	ZG-112 (Included)	LF
ZG-LF2	NA	LF
ZG-LFC114	NA	LF
ZG-ECON1	ZG-112 (Included)	LF
ZG-ECON2	ZG-112 (Included)	LF
ZG-TF112	ZG-113 (Included)	TF
ZG-TF2	NA	TF
ZG-GMA	ZG-101, ZG-101, ZG-103, ZG-104	GM
ZG-NMA	ZG-101, ZG-101, ZG-103, ZG-104	NM, AM
NA	ZG-106	AF
NA	ZG-107	AF

\*Unless otherwise noted, mounting brackets are not included in crank arm adaptor kits.



### ZG-AF US



### Application

The ZG-AF US Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft.

#### The ZG-AF US Crank Arm Adaptor Kit includes:

- 1 KH-AF Crank Arm with Retaining Ring
- 2 Standoff Brackets
- 4 Mounting Feet
- 2 Bolts with Nuts
- 2 Self-Tapping Screws
- 2 KG8 Ball Joints

The following Universal Mounting Brackets are needed to fully convert to crank arm operation:

- ZG-100**
- ZG-101**

The ZG-100 and ZG-101 Universal Mounting Brackets are designed for applications where the actuator cannot be mounted directly to the shaft, and no proper mounting surface is available. It may be used for outside or inside the duct mounting, fastened to the ductwork or directly to the damper assembly. It may also be used to mount to other surfaces rather than the duct.

The ZG-100 and ZG-101 are provided with pre-punched hole patterns for the AM, SM, GM, AF, AFB(X) and NFB(X) series actuators. The ZG-100 hole pattern layout allows mounting these actuators in three different, mounting orientations. The ZG-101 hole pattern layout allows mounting these actuators in two different, mounting orientations. The ZG-100 and ZG-101 may also be field drilled for special or more exact mounting of linkage components.

For technical data and dimensions on ZG-100 and ZG-101 Universal Mounting Brackets, see page 443.

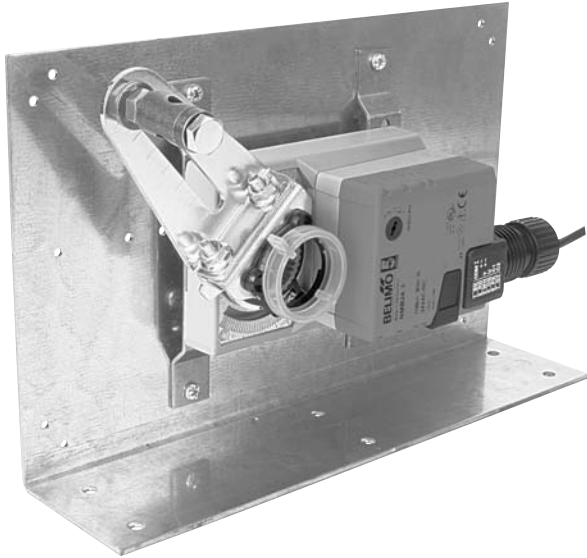
#### OTHER CRANK ARM ADAPTOR KITS AND UNIVERSAL MOUNTING BRACKETS

KIT	MOUNTING BRACKET*	ACTUATOR USED WITH
ZG-AFB	NA	AFB, AFX, NFB, NFX
ZG-AFB118	ZG-118	AFB, AFX, NFB, NFX
ZG-AF108	ZG-108 (Included)	AF
ZG-AF US	ZG-100, ZG-101	AF
ZG-LF112	ZG-112 (Included)	LF
ZG-LF2	NA	LF
ZG-LFC114	NA	LF
ZG-ECON1	ZG-112 (Included)	LF
ZG-ECON2	ZG-112 (Included)	LF
ZG-TF112	ZG-113 (Included)	TF
ZG-TF2	NA	TF
ZG-GMA	ZG-101, ZG-101, ZG-103, ZG-104	GM
ZG-NMA	ZG-101, ZG-101, ZG-103, ZG-104	NM, AM
NA	ZG-106	AF
NA	ZG-107	AF

\*Unless otherwise noted, mounting brackets are not included in crank arm adaptor kits.

# ZG-GMA Crank Arm Adaptor Kit

For GM Series Actuators



## Application

The ZG-GMA Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft.

### The ZG-GMA Crank Arm Adaptor Kit includes:

- 1 AH-25 Crank Arm
- 2 KG10 Ball Joints
- 2 Mounting Brackets
- 1 Spacer
- Mounting Hardware

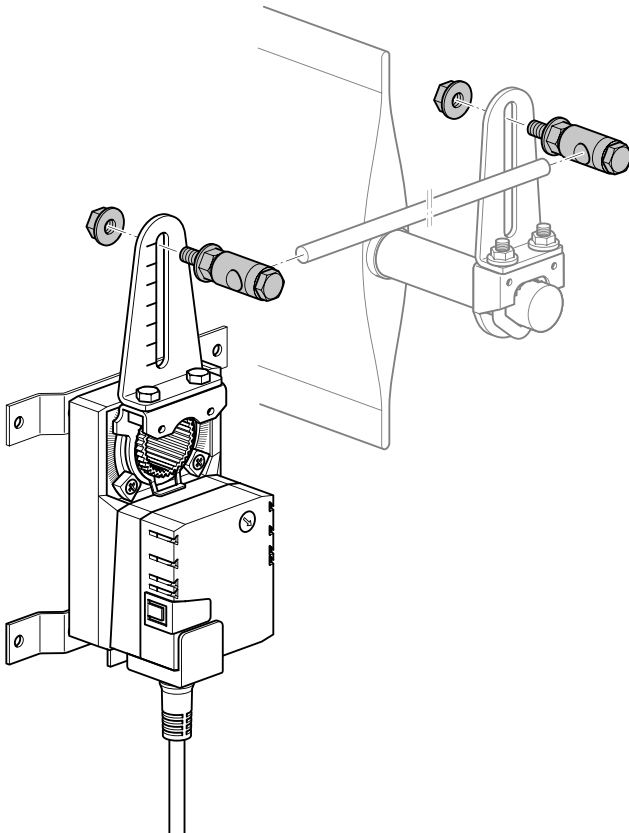
The following Universal Mounting Brackets are needed to fully convert to crank arm operation:

- ZG-100**
- ZG-101**
- ZG-103**
- ZG-104**

The ZG-100, ZG-101, ZG-103, and ZG-104 Universal Mounting Brackets are designed for applications where the actuator cannot be mounted directly to the shaft, and no proper mounting surface is available. It may be used for outside or inside the duct mounting, fastened to the ductwork or directly to the damper assembly. It may also be used to mount to other surfaces rather than the duct.

The ZG-100, ZG-101, ZG-103, ZG-104 are provided with pre-punched hole patterns for the NM, AM, SM, GM, AFB(X), NFB(X), and AF series actuators. The ZG-100 hole pattern layout allows mounting these actuators in three different, mounting orientations. The ZG-101, ZG-103, and ZG-104 hole pattern layout allows mounting these actuators in two different, mounting orientations. The ZG-100 and ZG-101 may also be field drilled for special or more exact mounting of linkage components.

For technical data and dimensions on ZG-100 , ZG-101, ZG-103, and ZG-104 Universal Mounting Brackets, see page 443.

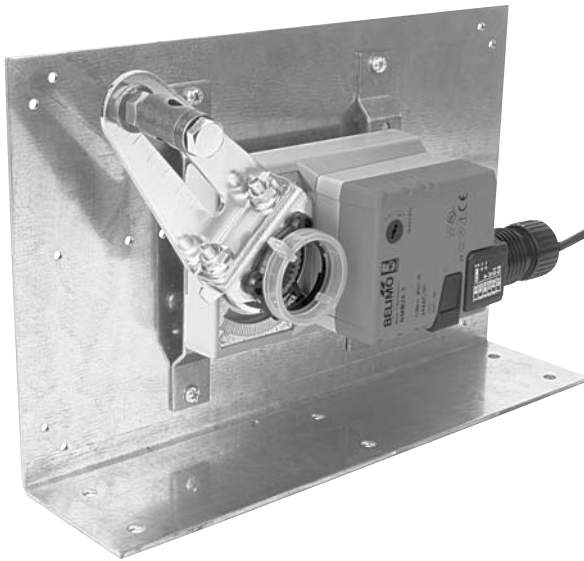


### OTHER CRANK ARM ADAPTOR KITS AND UNIVERSAL MOUNTING BRACKETS

KIT	MOUNTING BRACKET*	ACTUATOR USED WITH
ZG-AFB	NA	AFB, AFX, NFB, NFX
ZG-AFB118	ZG-118	AFB, AFX, NFB, NFX
ZG-AF108	ZG-108 (Included)	AF
ZG-AF US	ZG-100, ZG-101	AF
ZG-LF112	ZG-112 (Included)	LF
ZG-LF2	NA	LF
ZG-LFC114	NA	LF
ZG-ECON1	ZG-112 (Included)	LF
ZG-ECON2	ZG-112 (Included)	LF
ZG-TF112	ZG-113 (Included)	TF
ZG-TF2	NA	TF
ZG-GMA	ZG-101, ZG-101, ZG-103, ZG-104	GM
ZG-NMA	ZG-101, ZG-101, ZG-103, ZG-104	NM, AM
NA	ZG-106	AF
NA	ZG-107	AF
NA	ZG-107	AF

\*Unless otherwise noted, mounting brackets are not included in crank arm adaptor kits.

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## Application

The ZG-NMA Crank arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft.

### The ZG-NMA Crank Arm Adaptor Kit includes:

- 1 Crank Arm
- 2 KG10 Ball Joints
- 2 Mounting Brackets
- 1 Spacer
- Mounting Hardware

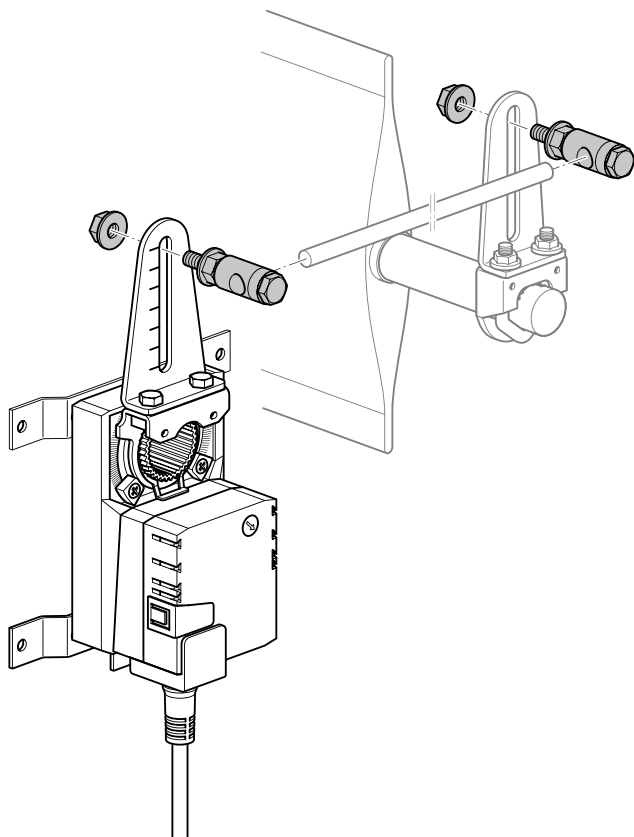
The following Universal Mounting Brackets are needed to fully convert to crank arm operation:

- ZG-100**
- ZG-101**
- ZG-103**
- ZG-104**

The ZG-100, ZG-101, ZG-103, and ZG-104 Universal Mounting Brackets are designed for applications where the actuator cannot be mounted directly to the shaft, and no proper mounting surface is available. It may be used for outside or inside the duct mounting, fastened to the ductwork or directly to the damper assembly. It may also be used to mount to other surfaces rather than the duct.

The ZG-100, ZG-101, ZG-103, ZG-104 are provided with pre-punched hole patterns for the NM, AM, SM, GM, AFB(X), NFB(X), and AF series actuators. The ZG-100 hole pattern layout allows mounting these actuators in three different, mounting orientations. The ZG-101, ZG-103, and ZG-104 hole pattern layout allows mounting these actuators in two different, mounting orientations. The ZG-100 and ZG-101 may also be field drilled for special or more exact mounting of linkage components.

For technical data and dimensions on ZG-100, ZG-101, ZG-103, and ZG-104 Universal Mounting Brackets, see page 443.



## OTHER CRANK ARM ADAPTOR KITS AND UNIVERSAL MOUNTING BRACKETS

KIT	MOUNTING BRACKET*	ACTUATOR USED WITH
ZG-AFB	NA	AFB, AFX, NFB, NFX
ZG-AFB118	ZG-118	AFB, AFX, NFB, NFX
ZG-AF108	ZG-108 (Included)	AF
ZG-AF US	ZG-100, ZG-101	AF
ZG-LF112	ZG-112 (Included)	LF
ZG-LF2	NA	LF
ZG-LFC114	NA	LF
ZG-ECON1	ZG-112 (Included)	LF
ZG-ECON2	ZG-112 (Included)	LF
ZG-TF112	ZG-113 (Included)	TF
ZG-TF2	NA	TF
ZG-GMA	ZG-101, ZG-101, ZG-103, ZG-104	GM
ZG-NMA	ZG-101, ZG-101, ZG-103, ZG-104	NM, AM
NA	ZG-106	AF
NA	ZG-107	AF
NA	ZG-107	AF

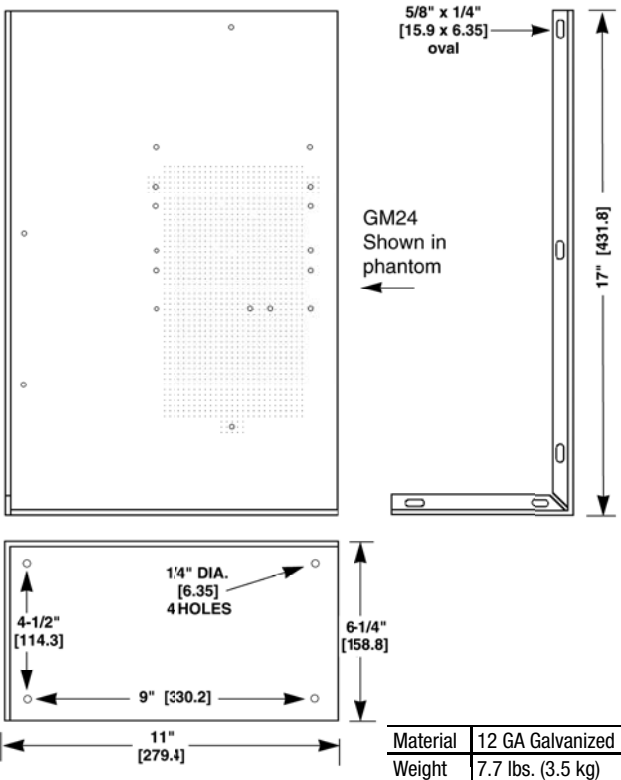
\*Unless otherwise noted, mounting brackets are not included in crank arm adaptor kits.

# ZG-100, ZG-101, ZG-103, ZG-104 Universal Mounting Brackets

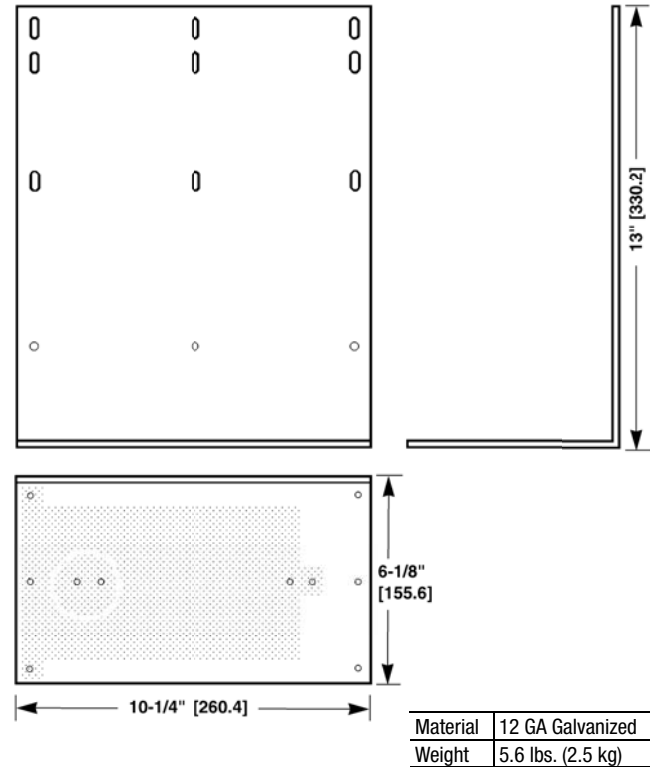
For AM, SM, GM, NFB(X), and AFB(X) Series Actuators



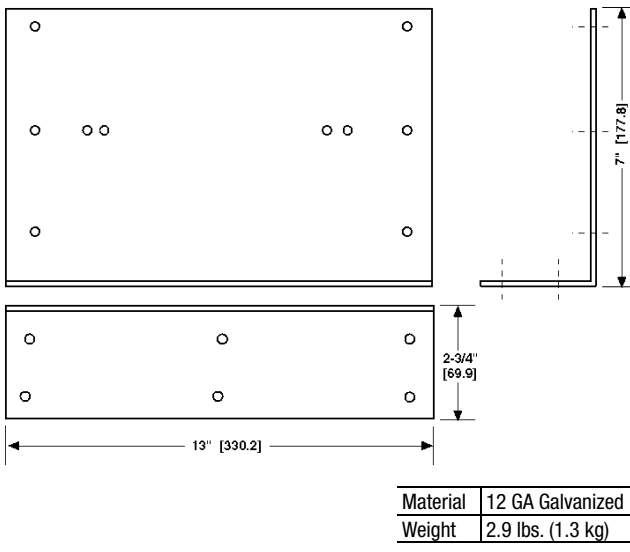
**ZG-100 Universal Mounting Bracket\* (Inches [mm])**



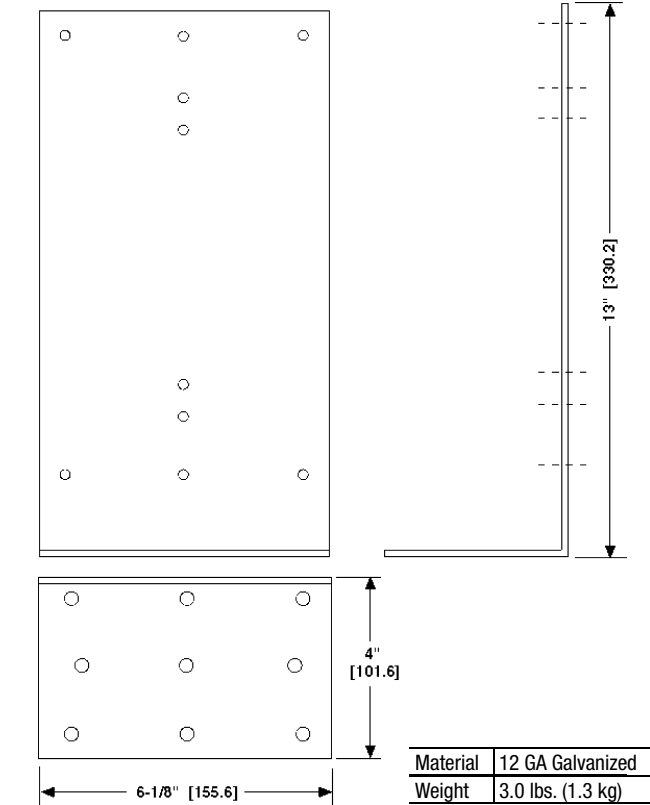
**ZG-101 Universal Mounting Bracket\* (Inches [mm])**



**ZG-103 Universal Mounting Bracket (Inches [mm])**



**ZG-104 Universal Mounting Bracket (Inches [mm])**

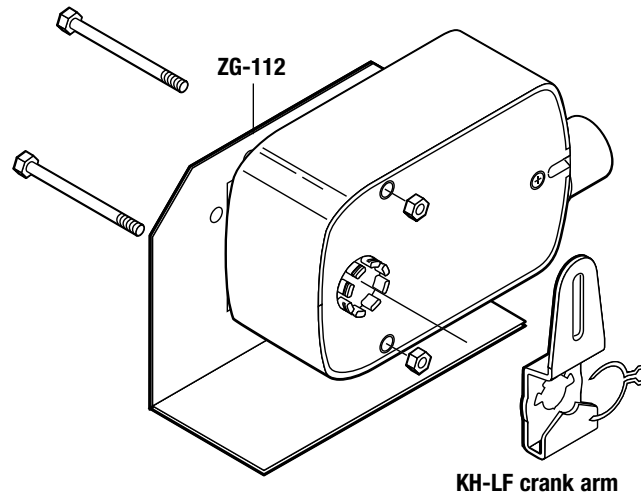


\* NOTE: ZG-AFB, ZG-AF US, ZG-GMA, or ZG-NMA Required

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## ZG-LF112 Crank Arm Adaptor Kit

For LF Series Actuators



### Application

The ZG-LF112 Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft. It may be used for outside or inside the duct mounting.

#### The ZG-LF112 Crank Arm Adaptor Kit includes:

- 1 ZG-112 Mounting Bracket
- 1 KH-LF Crank Arm with Retaining Clip
- 2 Bolts with Nuts

**NOTE:** May require crank arm and ball joints

The ZG-112 is provided with hole patterns to mount the LF series actuators in either a horizontal or vertical position to meet space requirements.

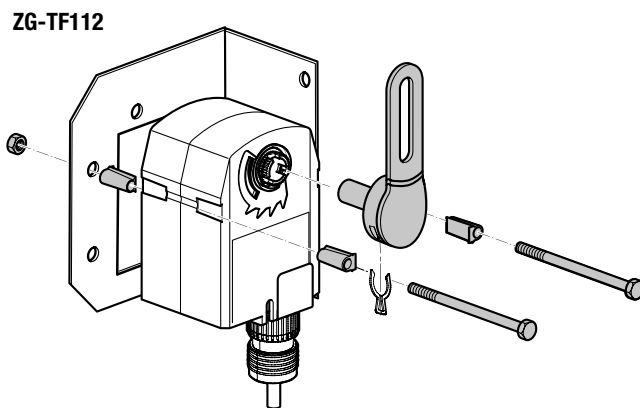
The ZG-112 Mounting Bracket is designed to mount the NF and AF series actuator in the same mounting locations as common foot mounted, crank arm style actuators. Hole patterns in the base match common Honeywell™, Siebe™ (Barber Coleman™), and Johnson Controls™ actuators for easy retrofit.

#### USE WHEN REPLACING THESE ACTUATORS

Honeywell	M84...	M7
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## ZG-TF112 Crank Arm Adaptor Kit

For TF Series Actuators



### Application

The ZG-TF112 Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft. It may be used for outside or inside the duct mounting.

#### The ZG-TF112 Crank Arm Adaptor Kit includes:

- 1 ZG-113 Mounting Bracket
- 1 KH-TF-1 Crank arm with Retaining Clip
- 2 Bolts with Nuts

**NOTE:** May require crank arm and ball joints

The ZG-113 is provided with hole patterns to mount the TF series actuators in either a horizontal or vertical position to meet space requirements.

The ZG-113 Mounting Bracket is designed to mount the TF series actuator in the same mounting locations as common foot mounted, crank arm style actuators. Hole patterns in the base match common Honeywell™, Siebe™ (Barber Coleman™), and Johnson Controls™ actuators for easy retrofit.

#### USE WHEN REPLACING THESE ACTUATORS

Honeywell	M84...	M7...
-----------	--------	-------

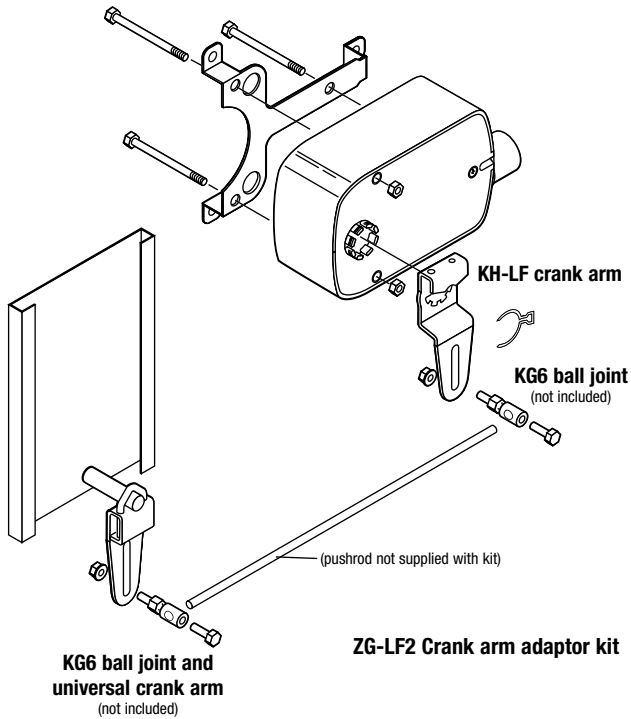
# ZG-LF2 and ZG-TF2 Crank Arm Adaptor Kits

For LF and TF Series Actuators



## ZG-LF2 Crank Arm Adaptor Kit

For LF Series Actuators



### Application

The ZG-LF2 Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft. It may be used for outside or inside the duct mounting.

### The ZG-LF2 Crank Arm Adaptor Kit includes:

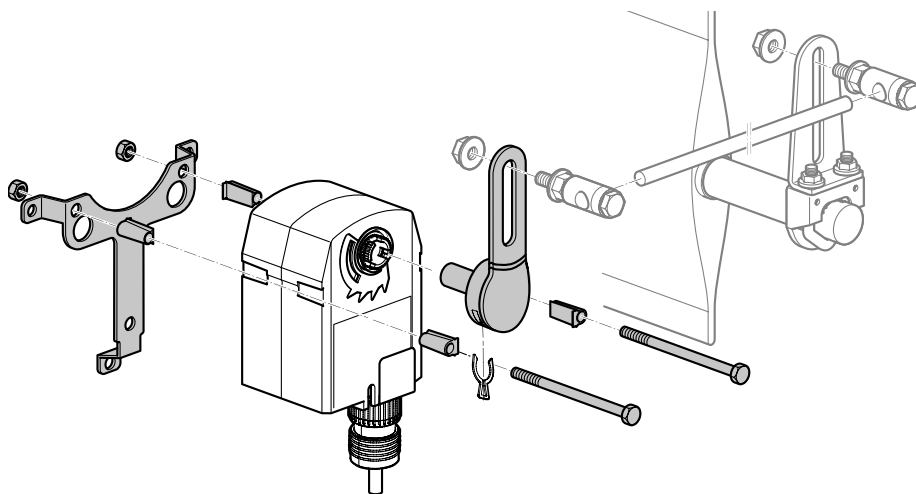
- 1 Mounting Bracket
- 1 KH-LF Crank Arm with Retaining Ring
- 3 Bolts with Nuts

**NOTE:** May require crank arm and ball joints

The ZG-LF2 Crank Arm Adaptor Kit can be used to replace foot mounted, crank arm style actuators. The ZG-LF2 allows for easy retrofit of Honeywell™, Siebe™ (Barber Coleman™), and Johnson Controls™ actuators.

## ZG-TF2 Crank Arm Adaptor Kit

For TF Series Actuators



### Application

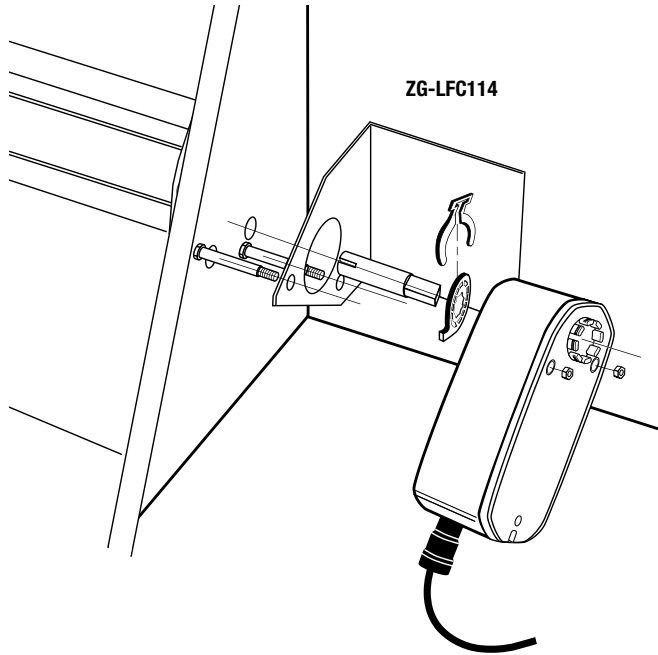
The ZG-TF2 Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft. It may be used for outside or inside the duct mounting.

### The ZG-TF2 Crank Arm Adaptor Kit includes:

- 1 Mounting Bracket
- 1 KH-TF-1 Crank Arm with Retaining Clip
- 3 Bolts with Nuts

**NOTE:** May require crank arm and ball joints

The ZG-TF2 Crank Arm Adaptor Kit can be used to replace foot mounted, crank arm style actuators. The ZG-TF2 allows for easy retrofit of Honeywell™, Siebe™ (Barber Coleman™), and Johnson Controls™ actuators.



### Application

The ZG-LFC114 Crank Arm Adaptor Kit is designed for Trane voyager economizer actuator retrofit.

#### The ZG-LFC114 Crank Arm Adaptor Kit includes:

- 1 Mounting Bracket
- 1 Shaft Adaptor
- 2 Bolts with Nuts
- 4 Female Spade Connectors

Note: May require crank arm and ball joints

#### USE WHEN REPLACING THESE ACTUATORS

Honeywell	M84...	M7...
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#### OTHER CRANK ARM ADAPTOR KITS AND UNIVERSAL MOUNTING BRACKETS

KIT	MOUNTING BRACKET*	ACTUATOR USED WITH
ZG-AFB	NA	AFB, AFX, NFB, NFX
ZG-AFB118	ZG-118	AFB, AFX, NFB, NFX
ZG-AF108	ZG-108 (Included)	AF
ZG-AF US	ZG-100, ZG-101	AF
ZG-LF112	ZG-112 (Included)	LF
ZG-LF2	NA	LF
ZG-LFC114	NA	LF
ZG-ECON1	ZG-112 (Included)	LF
ZG-ECON2	ZG-112 (Included)	LF
ZG-TF112	ZG-113 (Included)	TF
ZG-TF2	NA	TF
ZG-GMA	ZG-101, ZG-101, ZG-103, ZG-104	GM
ZG-NMA	ZG-101, ZG-101, ZG-103, ZG-104	NM, AM
NA	ZG-106	AF
NA	ZG-107	AF
NA	ZG-107	AF

\*Unless otherwise noted, mounting brackets are not included in crank arm adaptor kits.

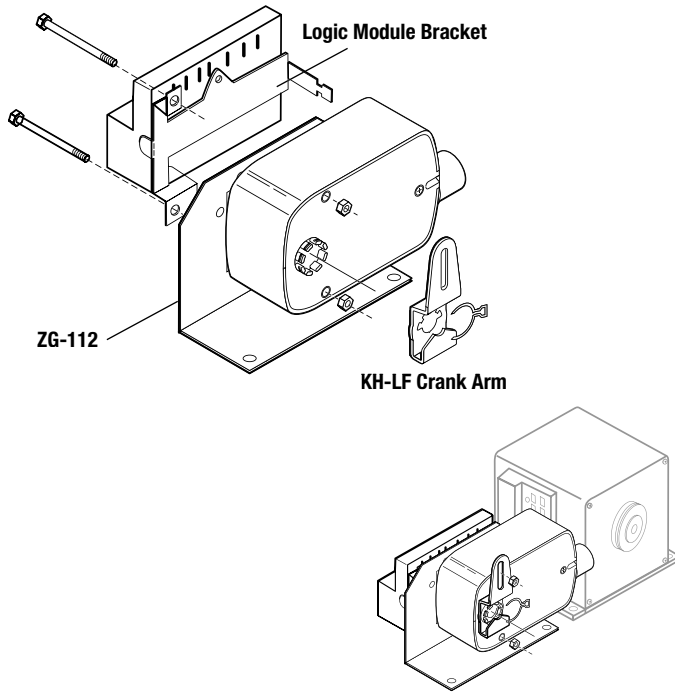
# ZG-ECON1 and ECON2 Crank Arm Adaptor Kits

For LF and Series Actuators



## ZG-ECON1 Crank Arm Adaptor Kit

For LF Series Actuators



### Application

The ZG-ECON1 Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft. It may be used for outside or inside the duct mounting.

#### The ZG-ECON1 Crank Arm Adaptor Kit includes:

- 1 ZG-112 Mounting Bracket
- 1 Logic Module Mounting Bracket (20477-00001)
- 1 KH-LF Crank Arm with Retaining Ring
- 1 KG6 Ball Joint
- 4 Male Spades
- 2 Bolts with Nuts

**NOTE:** May require crank arm and ball joints

The ZG-112 is provided with hole patterns to mount the LF series actuators in either a horizontal or vertical position to meet space requirements.

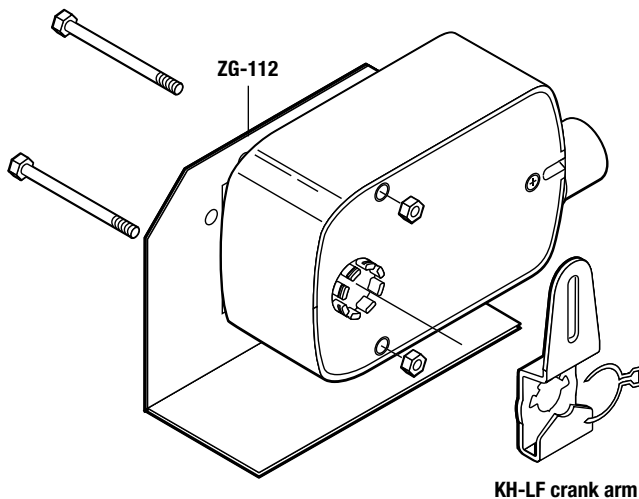
The ZG-112 Mounting Bracket is designed to mount the TF and LF series actuator in the same mounting locations as common foot mounted, crank arm style actuators. Hole patterns in the base match common Honeywell™, Siebe™ (Barber Coleman™), and Johnson Controls™ actuators for easy retrofit.

#### USE WHEN REPLACING THESE ACTUATORS

Honeywell	M84...	M7...
-----------	--------	-------

## ZG-ECON2 Crank Arm Adaptor Kit

For LF Series Actuators



### Application

The ZG-ECON2 Crank Arm Adaptor Kit is designed for applications where the actuator cannot be mounted directly to the damper shaft. It may be used for outside or inside the duct mounting.

#### The ZG-ECON2 Crank Arm Adaptor Kit includes:

- 1 ZG-112 Mounting Bracket
- 1 KH-LF Crank Arm with Retaining Ring
- 1 KG6 Ball Joint
- 4 Female Spades
- 2 Bolts with Nuts

**NOTE:** May require crank arm and ball joints

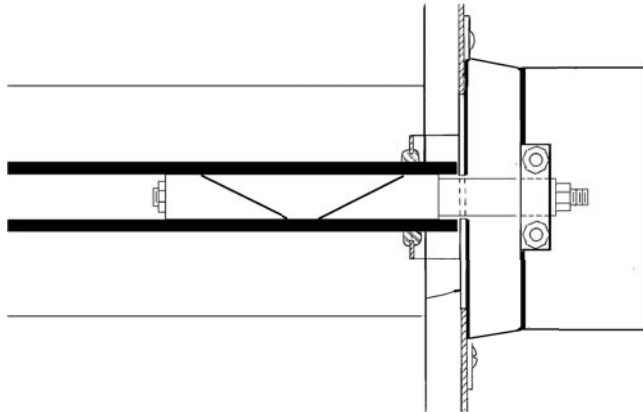
The ZG-112 is provided with hole patterns to mount the LF series actuators in either a horizontal or vertical position to meet space requirements.

The ZG-112 Mounting Bracket is designed to mount the TF and LF series actuator in the same mounting locations as common foot mounted, crank arm style actuators. Hole patterns in the base match common Honeywell™, Siebe™ (Barber Coleman™), and Johnson Controls™ actuators for easy retrofit.

#### USE WHEN REPLACING THESE ACTUATORS

Honeywell	M84...	M7...
-----------	--------	-------





### Application

The ZG-JSA jack shaft adaptors are designed to be inserted into hollow jack shafts which have an outside diameter greater than 3/4 inch and provide a 3/4 inch shaft for mounting Belimo actuators.

Technical Data		ZG-JSA-1
Jack Shaft Size	Outside diameter	1.00"
	Inside diameter	3/4"
Weight		1.3 lbs.
Material		Cold rolled steel, nickel plated

Technical Data		ZG-JSA-2
Jack Shaft Size	Outside diameter	1-5/16"
	Inside diameter	1-3/32"
Weight		2.3 lbs.
Material		Cold rolled steel, nickel plated

Technical Data		ZG-JSA-3
Jack Shaft Size	Outside diameter	1.05"
	Inside diameter	27/32"
Weight		1.6 lbs.
Material		Cold rolled steel, nickel plated

**Dimensions (Inches [mm])**

	A (Diameter)	B (Diameter)	C	D
ZG-JSA-1	3/4"	3/4"	-	10-3/4"
ZG-JSA-2	1-1/16"	3/4"	6"	12-1/2"
ZG-JSA-3	13/16"	3/4"	6"	12-1/4"

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## ZS-100 Weather Shield



### Application

The ZS-100 weather shield provides moderate protection to actuators which are mounted outdoors. This product is not designed as a water tight enclosure. The weather shield will work with all damper actuators.

### Installation

The ZS-100 weather shield is supplied disassembled. Supplying it in this manner makes it applicable to a wider range of field applications.

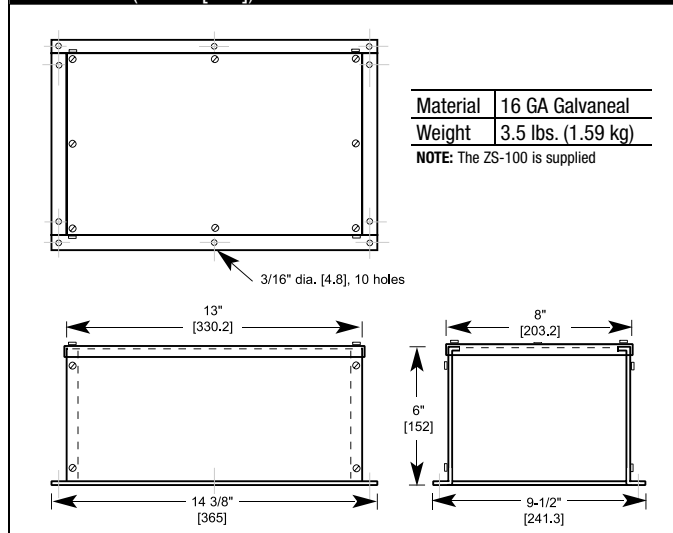
It may be assembled with 2 sides, 2 ends and the cover to completely conceal the actuator. A hole punch can be used to provide a hole to mount a wire conduit. A foam gasket is also provided to achieve a better seal between the cover and sides or from the base to the mounting surface.

If desired, a side or end can be deleted from the assembly to provide easy access from the bottom of the enclosure.

### Accessories

**ZS-101** Base mounting plate

### Dimensions (Inches [mm])



## ZS-150 Weather Shield



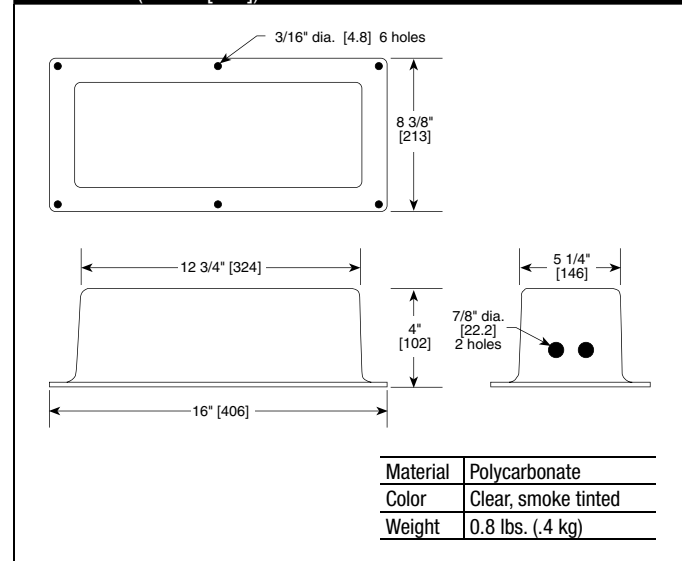
### Application

The ZS-150 weather shield provides moderate protection to actuators which are mounted outdoors. This product is not designed as a water tight enclosure. The one piece, smoke tinted, polycarbonate housing allows easy mounting over all damper actuators. The tinted, clear housing allows easy viewing of the actuator in operation.

### Installation

The ZS-150 weather shield is supplied as a one piece enclosure. Two 7/8 inch wiring holes are pre-drilled to allow easy connections of conduit to the housing. If connections must be made to a different spot on the enclosure or only one hole is required, two plastic plugs are provided to seal the holes. A foam gasket is also provided to achieve a better seal between the base of the enclosure to the mounting surface.

### Dimensions (Inches [mm])



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## Application

The ZS-260 explosion-proof housing may be used with the GM..., AM..., NFB..., NFX..., AFB..., AFX..., AF..., LF... series actuators. This housing is not designed for direct coupling. UL and CSA; Class I, Division 1&2, Groups B, C, D, (NEMA 7), Class II, Division 1&2, Groups E, F and G, (NEMA 9), Class III, Hazardous (classified) Locations, outdoor application NEMA 4X.

## Operation

The ZS-260 enclosure is designed so that the required actuator may be easily field mounted into the enclosure. The actuator is fastened on to the internal portion of the operating shaft and secured at the end with an anti-rotation strap. A crank-arm, such as the KH8, is mounted to the external portion of the operating shaft for connection to connection to the damper linkage. ZG-109 right angle, and ZG-110 standoff mounting brackets may be used (see back).

The ZS-260 is designed so that the operating shaft can be mounted on either the front or rear side of the housing.

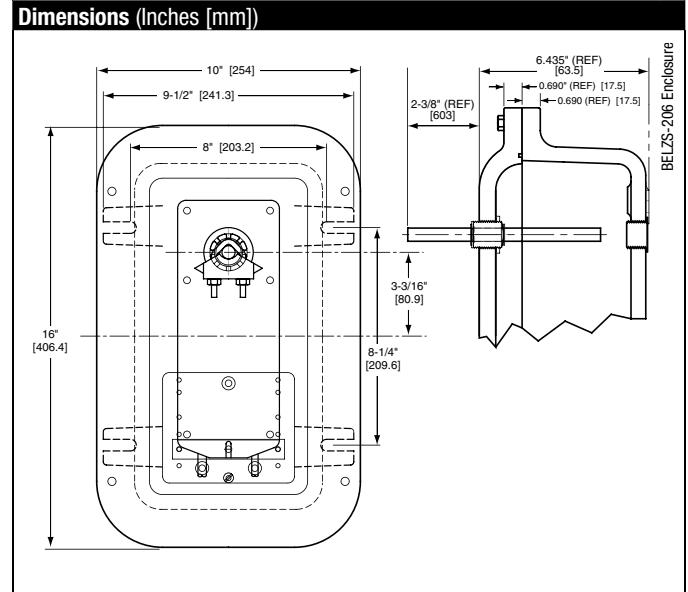
## Accessories

<b>KH8</b>	Universal crank arm
<b>KG8</b>	Universal ball joint
<b>KG10</b>	Universal ball joint
<b>ZG-109</b>	Right angle mounting bracket
<b>ZG-110</b>	Stand-off mounting bracket

Technical Data		ZS-260
Material	Housing	cast, copper-free, aluminum,
	Cover Bolts	stainless steel
	Operating Shaft	stainless steel
Conduit holes		3/4"-14 NPT (2 supplied), <b>see NOTE 1</b>
Operating shaft diameter		1/2 inch [12.7]
Operating shaft location		front or rear side of housing (Field selected)
Approved applications		UL and CSA; Class I, Division 1&2, Groups B, C, D, (NEMA 7), Class II, Division 1&2, Groups E, F and G, (NEMA 9), Class III, Hazardous (classified) Locations, outdoor application NEMA 4X.
Weight		31.0 lb. (14.0 kg) without actuator

**NOTE 1:** Fittings that meet the requirements of the hazardous location must be used. All applications must comply with applicable local and/or national electric code.

**NOTE:** Since conditions of use of this product are outside the control of Belimo, the purchaser should determine suitability of the product for their intended use, and assumes all risk and liability in connection therewith.

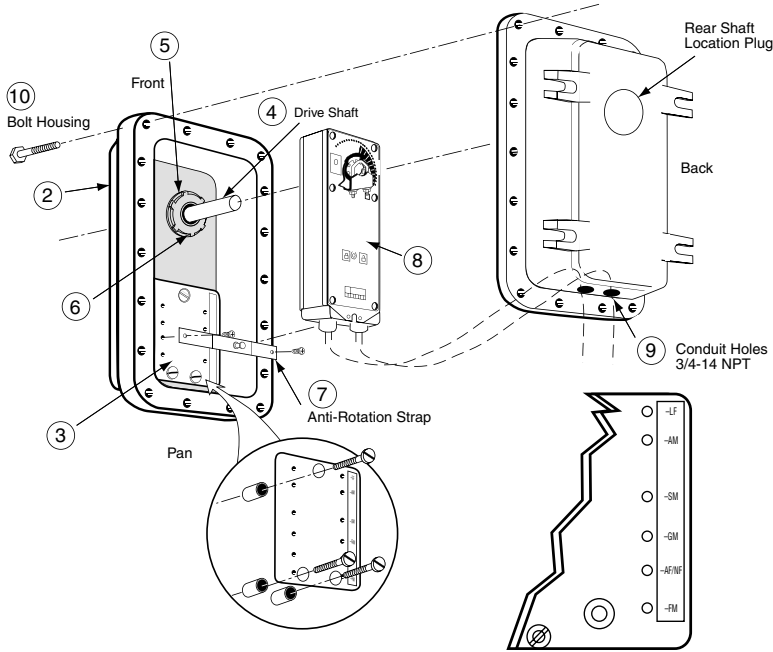


# ZS-260 Explosion-proof Housing

For GM..., AM..., AFB..., AFX..., NFB..., NFX..., LF... Actuators



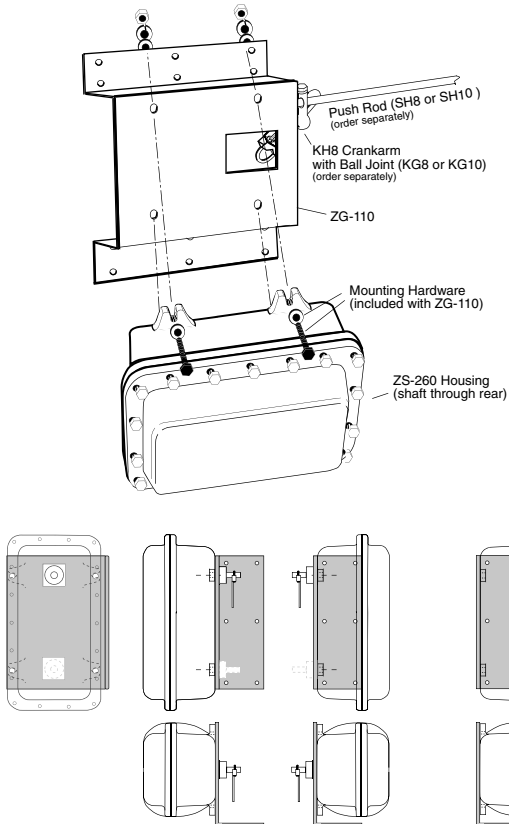
## ZS-260 Shaft Thru Front



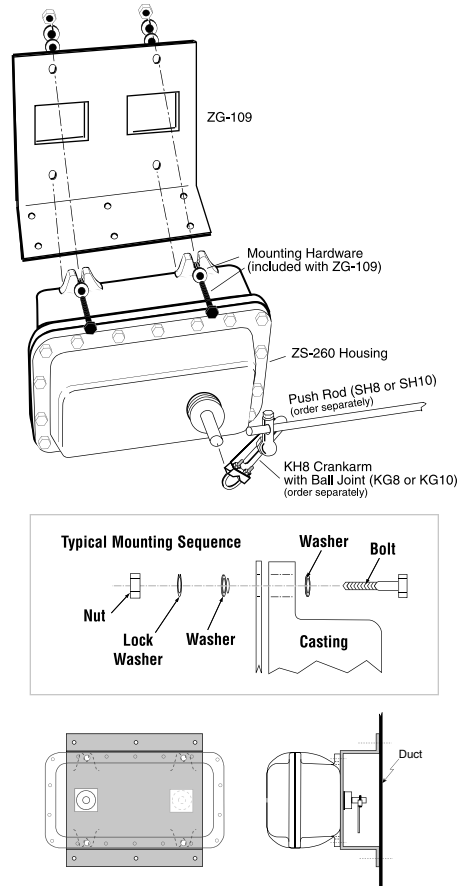
### ZS-260 Mounting Instructions

1. Determine proper operating shaft location.
2. Remove threaded plug from the hole in which the operating shaft will be mounted.
3. Install the anti-rotation strap, mounting plate, to the side of the housing where the operating shaft will be mounted.
4. From the inside surface of the housing, insert the operating shaft, short length first, into the mounting hole.
5. Hand tighten the shaft bushing into the housing until the star nut/seal is in contact with the face of the housing.
6. Using a screw driver blade, drive the star nut/seal clockwise until the bushing is locked into place.
7. Install the anti-rotation strap into the mounting plate at the designated holes for the actuator to be used.
8. Install actuator.
9. Wire actuator (per electrical code).
10. Bolt housing together.

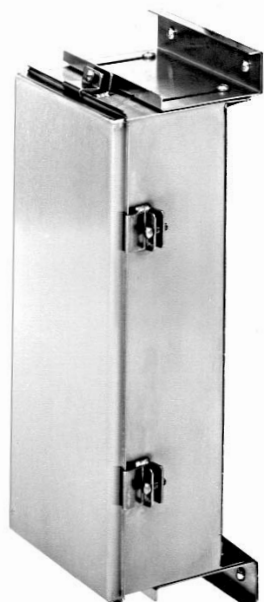
## Typical ZG-109 Mounting



## Typical ZG-110 Mounting



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ZS-300

## ZS-300 NEMA 4X Housing

For AMB, GMB, LF, NFB, NFX, AFB, AFX, AF Series Actuators

### Application

The ZS-300 (-1) NEMA 4X enclosures may be used with AMB, GMB, LF, NF, and AF Belimo actuators. They are intended for use primarily to provide protection against corrosion, windblown dust and rain, splashing water, hose-directed water; undamaged by the formation of ice on the enclosure. Type 304 stainless steel enclosures resist moisture, dust, salt, and corrosive chemicals, and are easy to keep clean for sanitary applications.

### Operation

The ZS-300 enclosures are designed so that the required actuator may be easily mounted in the enclosure. The operating shaft and coupling are inserted from the backside through the rotating shaft seal. The actuator is fastened on the end of the operating shaft and secured at the end with an anti-rotation strap. Adjustable mounting brackets, if supplied, are assembled to the fixed mounting holes at the top and bottom of the enclosure with stainless steel nuts, bolts and lock washers. The direct drive coupling is designed for a 1/2" round or hexagonal shaft and secured with two square head set screws. Mounting brackets are adjusted and secured in place.

### Ordering Information

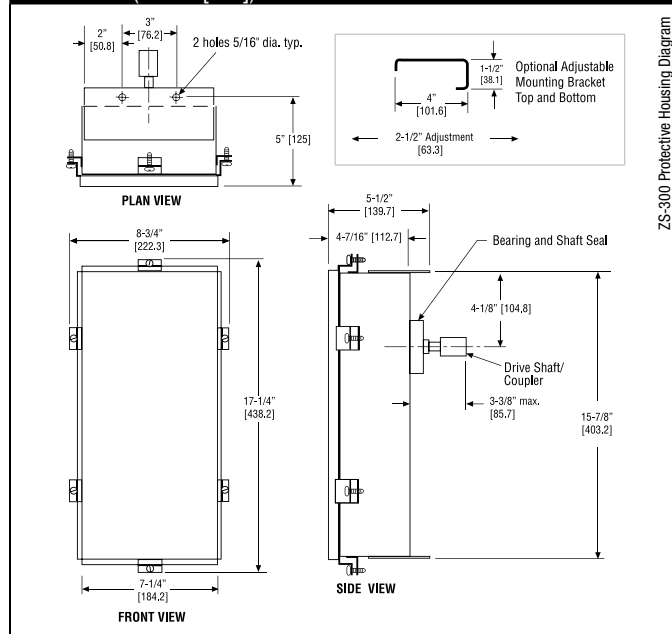
ZS-300	304 stainless steel housing with mounting brackets
ZS-300-1	304 stainless steel housing without mounting brackets
ZS-300-5	316L stainless steel housing with mounting brackets

### Accessories

ZS-300-BK	Mounting bracket set
ZS-300-C1	1/2" shaft adaptor (standard with housing)
ZS-300-C2	3/4" shaft adaptor
ZS-300-C3	1" shaft adaptor

Technical Data	ZS-300 (-1) (-5)
Material	All stainless steel housing, door, (with microcellular urethane gasket), shaft, coupling, universal mounting plate, and hardware.
Conduit holes	Field drilled as required. UL listed electrical fittings for NEMA 4X conditions must be used.
Drive shaft/coupler	1/2" by 5 15/16" long stainless steel with integral coupling for direct mounting to 1/2" round or hexagonal drive shafts. Square head set screws are stainless steel.
Rotating shaft seal	6061 aluminium hub with black anodize plating, bronze oilite bearings, 10 PSI, Nitrile, bi-rotational, hydrodynamic, radial lip Wave seal.
Industry standards	The Belimo ZS-300 NEMA 4X enclosure and Belimo model AMB, GMB, LF, NFB(X), AF, and AFB(X) are UL listed. These enclosures conform to the NEMA standard for Type 4X (water-tight, dust-tight and corrosion resistant).
Weight	11 lbs. [5 kg] without actuator or mounting brackets.

### Dimensions (Inches [mm])



ZS-300 Protective Housing Diagram

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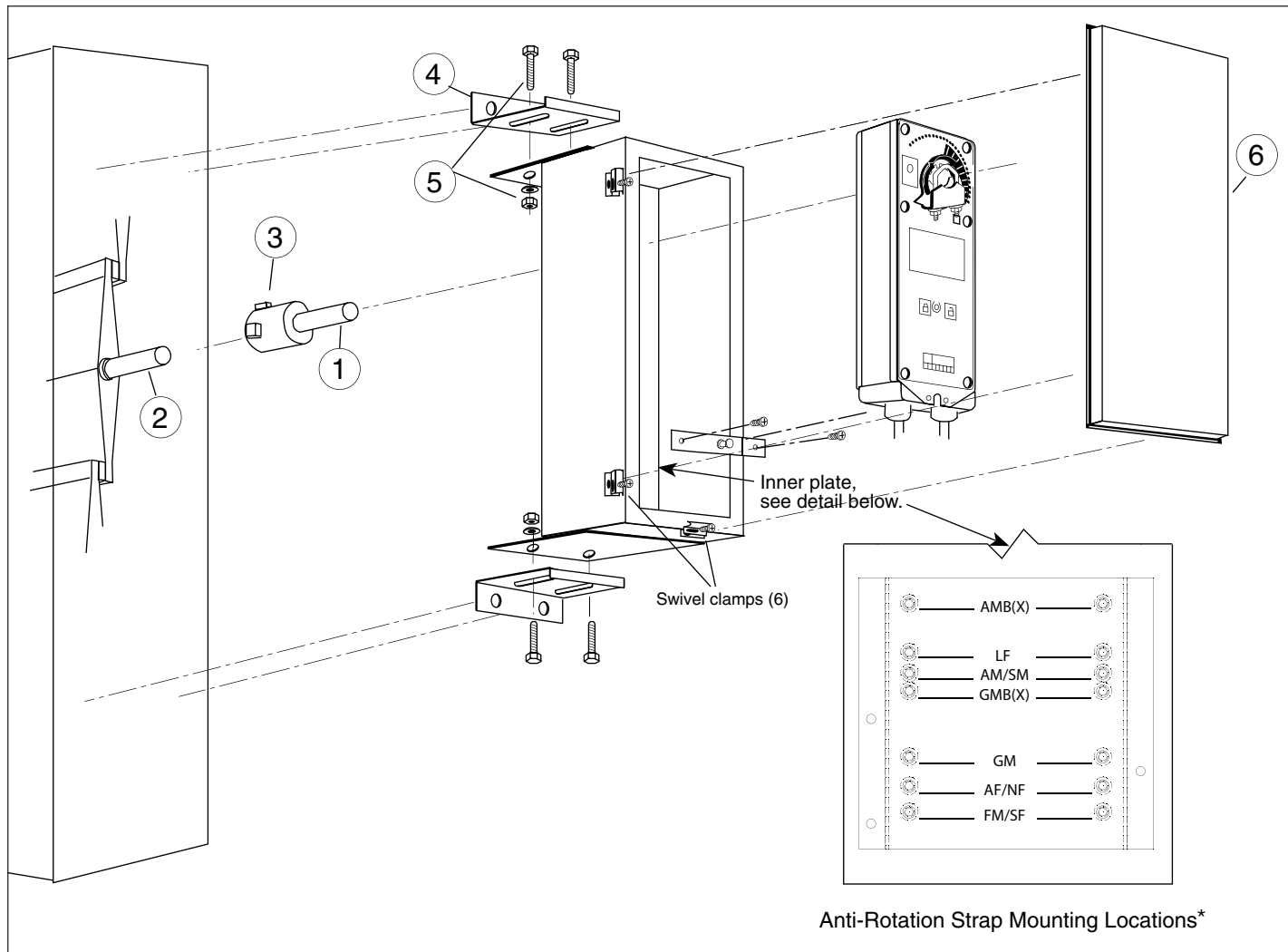
# ZS-300 (-1, -5)

NEMA 4X, stainless steel, corrosion resistant enclosures for AM, GM, NFB, NFX, AFB, AFX and AF actuators



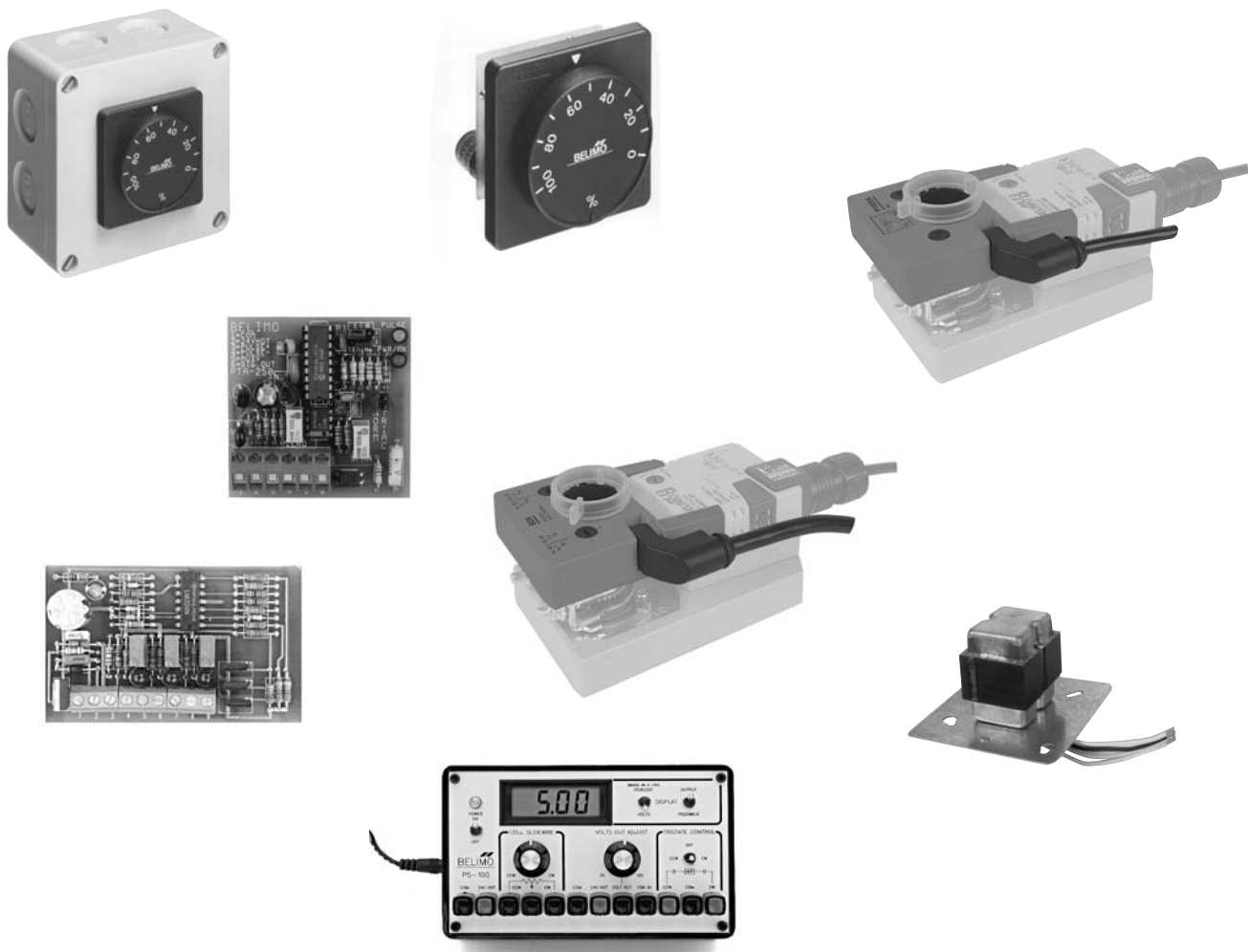
## ZS-300 Mounting Instructions

1. The damper operating shaft should extend approximately 1-1/2 inches from the damper assembly or duct side. Mount the drive shaft/coupler (1) to the damper operating shaft (2). Fasten the coupler to the damper operating shaft by tightening the two 3/8 inch square head set screws (3).
2. Determine the housing mounting orientation for the application.
3. Locate the housing hole position(s) for the control wiring of the actuator.
4. Make the necessary holes in the housing for the electrical fittings. All fittings must be rated for use in NEMA 4X applications.
5. Install (if ordered with) the 2 mounting brackets (4) to the housing using the four 1/4-20 screws, washers, and nuts (5). Do not tighten.
6. Carefully slide the housing over the drive shaft.
7. Place the housing in the desired mounting position. Transfer the mounting hole locations from the mounting bracket to the mounting surface.
8. Drill the 4 holes and fasten the brackets to the surface.
9. Install the anti-rotation strap to the housing in the correct location for the actuator which is being used.
10. Mount the actuator to the drive shaft using the instructions for the actuator being used. Finger tighten the nuts of the universal clamp. Make sure the back of the actuator is parallel to the back of the housing.
11. The operating shaft must pass through the mounting clamp at least 3/8 of an inch. It must not extend beyond the front of the housing. Slide the actuator/housing assembly in the mounting brackets to obtain the proper position.
12. Tighten the mounting brackets to the housing. Verify that the back of the actuator is still parallel to the back of the housing. Tighten the nuts on the universal clamp.
13. Make all of the required electrical connections.
14. Test the actuator/damper operation.
15. Fasten the housing cover (6) using the 6 swivel clamps.



\*AFB, AFX, NFB and NFX can be installed using GM mounting location without the need of the Z-AF retrofit bracket.

We'll help solve any application problem with a wide range of accessories and unparalleled customer service.



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## The Belimo Difference

- **Customer Commitment.**  
Extensive product range. Competitive project pricing. Application assistance.  
Same-day shipments. Free technical support. Five year warranty.
- **Low Installation and Life-Cycle Cost.**  
Easy installation. Accuracy and repeatability.  
Low power consumption. No maintenance.
- **Long Service Life.**  
Components tested before assembly. Every product tested before shipment.  
20+ years direct coupled actuator design.

# Electronic Accessory Usage Chart



SEE PAGE NUMBER	▶	463	412	—	411	456	457	458	459	461	461	461	460	463	464	Refer to MFT Technical Documentation						
BELIMO ACTUATOR	PART NUMBER	PS-100	S1A, SZA	P370	P.. A GR	SGA24, SGF24	PTA-250	IRM-100	ADS-100	ZG-R01	ZG-R02	ZG-R03, ZG-R05, ZG-R06	NSV24	ZG-X40	ZG-HTR	MFT-P US	ZIP-RS232 US	ZIP-USB-MP US	ZK1-GEN	ZK2-GEN	ZK3-GEN	
	AF24 (-S) US	●		●											●	●						
AF120 (-S) US			●																			
AF230 (-S) US			●																			
AF24-SR US	●		●			●	●		●	●	●			●	●							
AFB24-MFT (-S), AFX24-MFT (-S)	●		●			●			●	●	●		●	●		●	●				●	
AFB24-MFT95, AFX24-MFT95	●		●									●		●		●	●				●	
AF24-PC US	●		●											●	●							
NFB24 (-S), NFX24 (-S)	●		●											●								
NFBUP (-S), NFXUP (-S)	●		●											●								
NFB24-SR (-S), NFX24-SR (-S)	●		●			●	●		●	●	●			●								
NFB24-MFT (-S), NFX24-MFT (-S)	●		●			●			●	●	●		●	●		●	●				●	
LF24 (-S) US	●		●											●								
LF120 (-S) US			●																			
LF230 (-S) US			●																			
LF(C)24-3... US	●		●											●								
LF24-SR... US	●		●			●	●	●	●	●	●			●								
LF24-ECON... US	●		●			●				●	●			●								
LF24-MFT... US	●		●			●			●	●	●			●		●	●					
TF24 (-S) US	●													●								
TF120 (-S) US																						
TF24-3 (-S) US	●													●								
TF24-SR (-S) US	●					●	●	●	●	●	●			●								
GM_24-3	●	●	●	●	●								●	●								
GMX120-3		●	●	●	●								●	●								
GM_24-SR	●	●	●	●	●	●	●	●	●	●	●		●	●								
GMX24-MFT	●	●	●	●	●	●				●	●		●	●		●	●	●	●	●	●	●
GMX24-MFT95	●	●	●	●	●							●	●	●		●	●	●	●	●	●	●
GMX24-PC	●	●	●	●	●								●	●								
AM_24-3(-S)(-T)	●	●	●	●	●								●	●								
AM120-3		●	●	●	●								●	●								
AM_24-SR(-T)	●	●	●	●	●	●	●	●	●	●	●		●	●								
AMX120-SR		●	●	●	●	●	●	●	●	●	●		●	●								
AMX24-MFT	●	●	●	●	●	●				●	●		●	●		●	●	●	●	●	●	●
AMX24-MFT95	●	●	●	●	●							●	●	●		●	●	●	●	●	●	●
AMX24-PC	●	●	●	●	●								●	●								
NM_24-3(-T)	●	●	●	●	●								●	●								
NM120-3		●	●	●	●								●	●								
NM_24-SR(-T)	●	●	●	●	●	●	●	●	●	●	●		●	●								
NM120-SR		●	●	●	●	●	●	●	●	●	●		●	●								
NMX24-MFT	●	●	●	●	●	●				●	●		●	●		●	●	●	●	●	●	●
NMX24-MFT95	●	●	●	●	●							●	●	●		●	●	●	●	●	●	●
NMX24-PC	●	●	●	●	●								●	●								
NMQ24-MFT US	●	●	●	●	●								●	●								
LM_24-3 (-P5) (-P10) (-S) (-T)	●	●	●	●	●	●							●	●								
LMX120-3		●	●	●	●								●	●								
LM_24-SR(-T)	●	●	●	●	●	●	●	●	●	●	●		●	●								
LMX120-SR		●	●	●	●	●	●	●	●	●	●		●	●								
LMX24-MFT	●	●	●	●	●	●				●	●		●	●		●	●	●	●	●	●	●
LMX24-MFT95	●	●	●	●	●							●	●	●		●	●	●	●	●	●	●
LMX24-PC	●	●	●	●	●								●	●								

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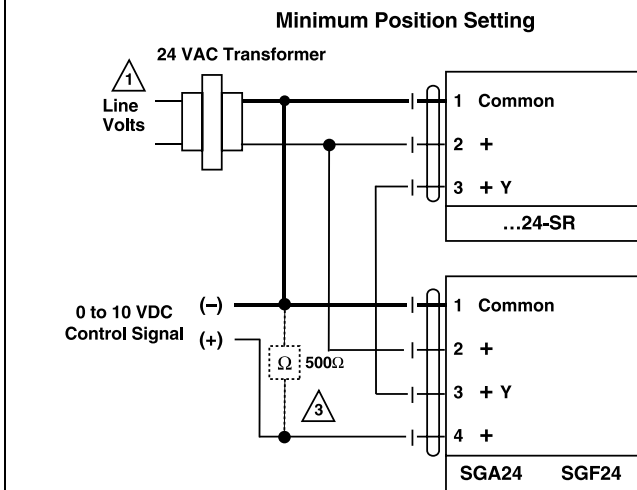
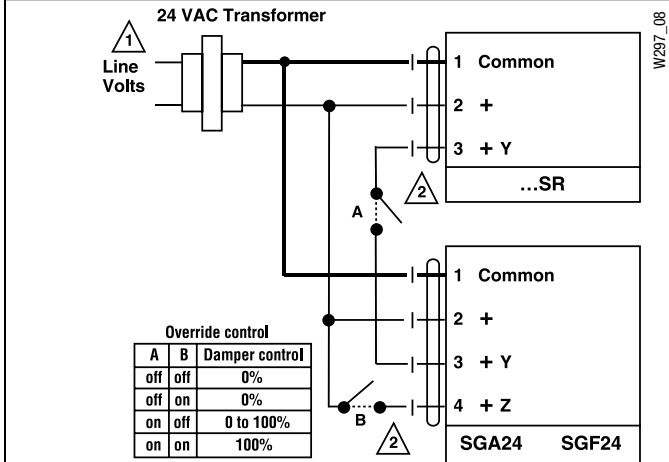
SGA24



SGF24

Technical Data	SGA24, SGF24
Power supply	24 VAC ± 20% 50/60 Hz, 24 VDC ± 10%
Transformer sizing	1 VA
Control signal Y	0.5 to 10 VDC; 2 to 10 VDC (switchable)
Power output	up to 10 actuators (1 mA max)
Degree of protection	(SGA24 only NEMA 2 [IP54])
Connection	Terminals (14 ga. wire max)
Humidity	5 to 95% RH non-condensing

### Wiring Diagrams



- 1 Provide overload protection and disconnect as required.
- 2 Override switches are optional.
- 3 A 500Ω resistor (ZG-R01) must be added for 4 to 20 mA control.

### Application

These positioners are intended for the remote control of modulating actuators or for use as a minimum positioner (providing a minimum limit for the output signal from a modulating controller). The control range is 0 to 100% of the angle of rotation of the actuator.

Positioner SGA24 is for surface mounting with a NEMA 2 housing included. Positioner SGF24 is for flush mounting.

### Operation

The positioner receives its supply voltage through terminals 1 and 2. A rotary knob is turned, producing a proportional control signal (Y) at the output (terminal 3) of either 0.5 to 10 VDC or 2 to 10 VDC and therefore a proportional change in the position of the actuator between 0 and 100%. When used for a minimum limit, the positioner works as a higher of 2 signal selector. This function allows only the signal from the controller or positioner, whichever is greater, to go to the actuator.

### Function

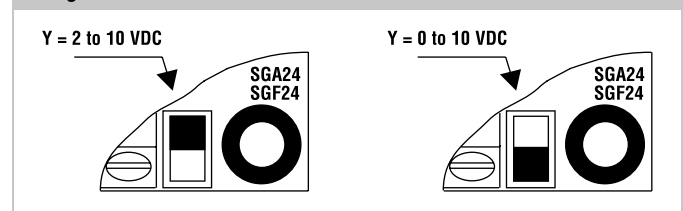
The changeover from 2 to 10 V to 0 to 10 V is selected by means of a slide switch on the printed circuit board.

The angle of rotation of the knob can be limited mechanically, by moving the adjustable stops under the knob.

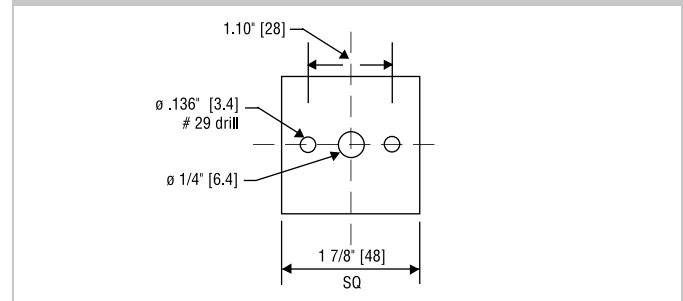
### Accessory

ZG-SGF Mounting plate for single gang wiring box

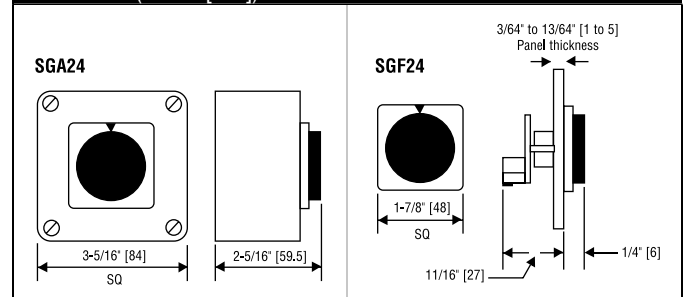
### Changeover Switch



### Drilling template for SGF24 (flush mount)



### Dimensions (Inches [mm])



# Pulse Width Modulation Interface PTA-250

To Convert a Pulse Width Modulated Signal to a 2 to 10 VDC Signal for Belimo Proportional Actuators  
(Series 3)



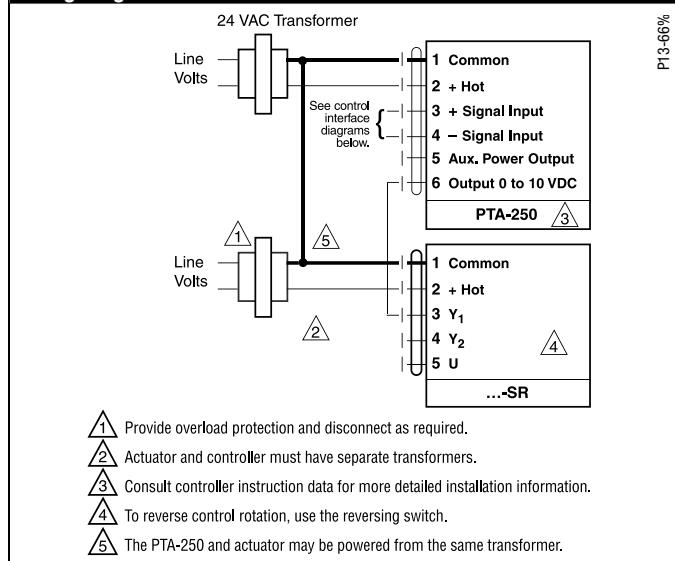
Technical Data	PTA-250
Power supply	24 VAC $\pm 15\%$ 24 VDC $\pm 15\%$
Power consumption	<1 W
Transformer sizing	2 VA

Input	
Isolation	optically isolated (when wired as such)
Type	normal or triac, jumper selectable
Trigger level	12 to 24 VAC/VDC or dry contact to com
Time between trigger pulses	12.5 milliseconds min
Impedance	VAC - 500 $\Omega$ , VDC - 10 k $\Omega$
Pulse duration/resolution	four selectable ranges, in seconds of dry contact or SSR closure $\pm 40\%$ of signal increment
Range 1	0.0235 to 6 seconds/in 0.0235 sec increments
Range 2	0.0196 to 5 seconds/in 0.0196 sec increments
Range 3	0.1 to 25.5 seconds/in 0.100 sec increments
Range 4	0.59 to 2.93 seconds/in in 0.0092 increments

Output	
Voltage	2 to 10 VDC
Current	15 mA max
Accuracy	$\pm 2\%$

Electrical connection	wire terminals, 14 gauge max
Ambient temperature	-20°F to 150° F [-30°C to 65° C]
Operating humidity	5% to 95% non-condensing
Mounting	Snap-Track (provided)
Dimensions	board 2 3/16" x 2 3/16" x 9/16"
	with Snap-Track 2 3/8" x 2 1/4" x 15/16"
Weight	1.5 oz

## Wiring Diagram



## Application

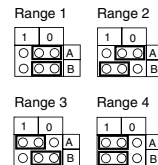
The PTA-250 converts a single pulse-width modulated input to an analog, 2 to 10 VDC, output to modulate a Belimo -SR actuator. The PTA-250 is available for replacement of existing installations. The ...MFT product can replace 100% of the PTA-250 applications, more effectively.

## Operation

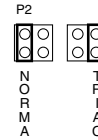
A timed contact or solid state closure from the controlling microprocessor controller is converted to a linear analog output with 256 steps of resolution. The last output is held until the PTA-250 receives the end of the next pulsed output. The PTA-250's output will not wrap around if an excessively long input pulse is received. Four input pulse clock rates are jumper selectable. Normal/Triac input positions are also jumper selectable. The input signal can be optically isolated from the PTA-250 circuit and can accept either positive or negative polarity. A red LED indicator is provided to indicate that power is applied to the PTA-250 and that the microprocessor is functioning. A green LED indicator is provided to indicate the presence of a pulse from the controller.

**NOTE:** The onboard zero and span adjustments are not for field use.

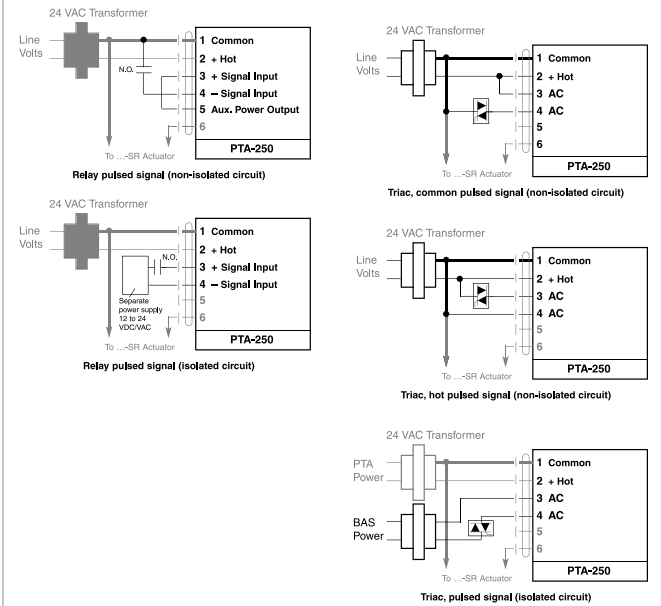
## Pulse Timing Selection



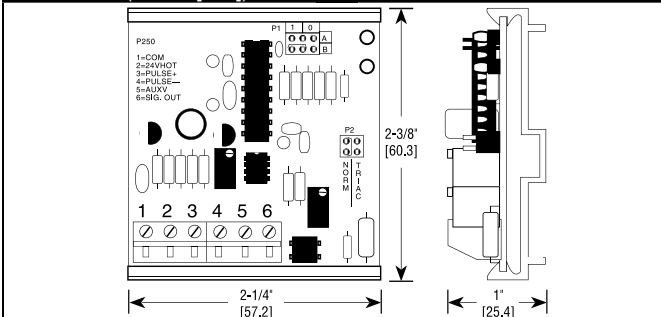
## Normal/Triac Input Selection



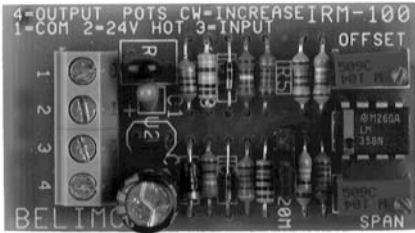
## Control Interface Drawings



## Dimensions (Inches [mm])



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### Technical Data IRM-100

Power supply	24 VAC ± 15% 24 VDC ± 15%
Power consumption	< 1 W
Transformer sizing	1 VA

### Input

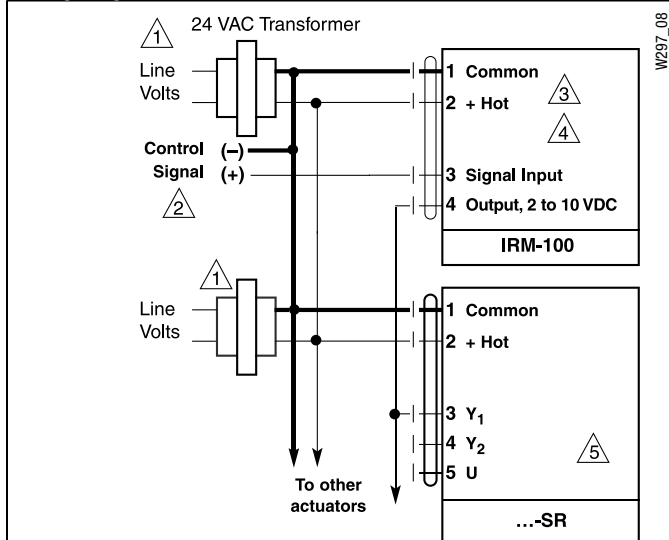
Voltage (max)	25 VDC
Zero (starting point)	0 to 18 VDC
Span adjustment	2.6 to 17 VDC
Impedance	400 kΩ
Current	0 to 20 mA
Impedance	500 Ω

### Output

Voltage	2 to 10 VDC
Current	15 mA max

Electrical connection	wire terminals, 14 gauge max
Ambient temperature	-20° F to 150° F [-30° C to 65° C]
Humidity	5 to 95% RH non-condensing
Mounting	Snap-Track (provided)
Dimensions	board 1-3/16" x 2-3/16" x 9/16" with Snap-Track 1-7/8" x 2-3/8" x 15/16"
Weight	0.9 oz.

### Wiring Diagram



- ① Provide overload protection and disconnect as required.
- ② The controller should be powered from a separate transformer.
- ③ The actuator and IRM-100 may be powered from the same transformer.
- ④ Consult controller instruction data for more detailed installation information.
- ⑤ To reverse control rotation, use the reversing switch.

### Application

The IRM-100 input rescaling module is designed to change non-standard voltage or current signal levels into a 2 to 10 VDC output to modulate Belimo ...SR type actuators. The IRM-100 is available for replacement of existing installations. The ...MFT product can replace 100% of the IRM-100 applications, more effectively.

### Operation

The IRM-100 is installed between a controller and a Belimo ...SR actuator. The module can be adjusted to work with a zero offset of 0 to 18 VDC and a span range of 2.6 to 17 VDC. The IRM-100 has a 2 pin jumper mounted to the circuit board. When the jumper is connected between these 2 pins, a 4 to 20 mA signal can be fed directly into the IRM. The result being the conversion of a wide range of analog control signals to a 2 to 10 VDC range.

**Jumper not connected to both pins for voltage applications (as shipped)**

**Jumper on both pins for 4 to 20 mA applications**

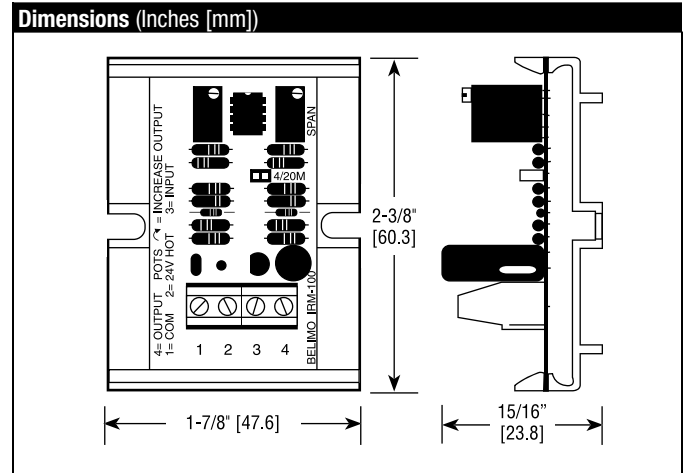
The IRM may also be used to sequence several actuators from one signal source. This is done by adjusting the IRM units to work at different in put ranges.

### IRM-100 Used as a Current Amplifier

In some applications, the capacity of a controller output may not have current available to control multiple end devices. An example would be a controller which has an output current of .5 mA maximum. If 10 AF24-SR US actuators have to be driven from the same output, the current requirement would be  $I = E/R = (10 \text{ volts})/(100000 \Omega) = .1 \text{ mA}$  for each actuator. For the 10 actuators, 1 mA of current would be necessary to properly control the actuators.

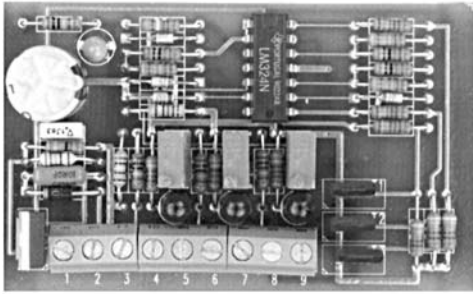
The IRM-100 may be used as an interface to provide a higher current capacity to the system. The IRM-100 has an output capacity of 15 mA. This higher level output can handle a greater number of actuators. By calibrating the IRM-100 for a 2 to 10 VDC input to achieve a 2 to 10 VDC output, IRM-100 provides this added capacity for the system.

The same circuit will also work if a 4 to 20 mA signal is used. A 500 Ω resistor is placed across terminal #1 and #3 which converts the 4 to 20 mA to 2 to 10 VDC.

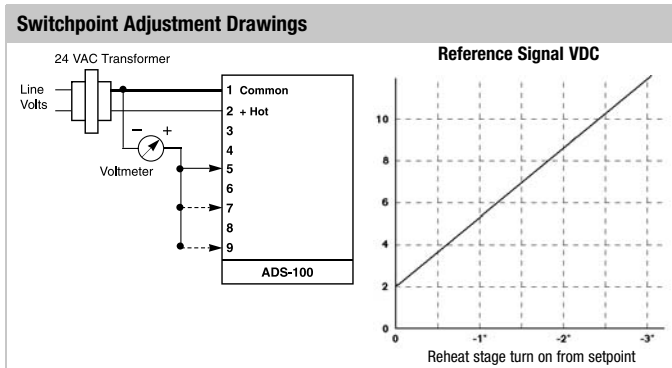
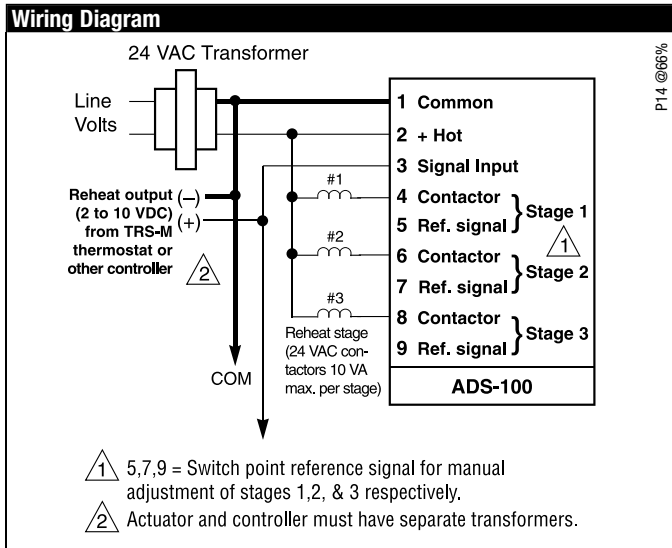


# Analog to Digital Switch ADS-100

For Belimo Proportional ( ... -SR) Actuators



Technical Data	ADS-100
Power supply	24 VAC ± 20% 50/60 HZ
Power consumption	1.5 W
Transformer sizing	3 VA (not including contactors)
Electrical connection	9 pole wire-terminal
Control input	2 to 10 VDC
Input impedance	100 kΩ
Adjusting range	2.5 to 9.5 VDC
Dead band	0.3°F fixed
Switching capacity	24 VAC 10 VA max., (voltage sinking triac)
Mounting	Snap-Track (provided)
Dimensions	3-1/4" x 2"
	with Snap-Track 3-7/16" x 2"



## Application

To control reheat coils and/or a fan stage in a fan-powered terminal unit. The ADS-100 is controlled by a 2 to 10 VDC reheat output of a temperature controller. (TRS-M)

## Operation

The ADS-100 is designed to switch up to three independent stages of reheat on and off, according to a 2 to 10 VDC signal. The three output stages are furnished with a triac output. Each stage can be adjusted independently from each other over the 0 to 2.4° F throttling range of the TRS-M temperature controller.

The ADS-100 is shipped pre-adjusted, as shown in the following table. (Based on differential from setpoint)

	1st. stage	2nd. stage	3rd. stage
Switch ON	-0.45°F	-1.35°F	-2.25°F
Switch OFF	-0.15°F	-1.05°F	-1.95°F
Switch ON	2.8V	5.8V	8.8V
Switch OFF	0.4V	0.2V	0.4V

If desired, each stage may be field readjusted for special requirements. Three red LED indicators are provided to verify when the stages are energized.

## Setpoint Readjustment

**Tools required:** small screwdriver, voltmeter.

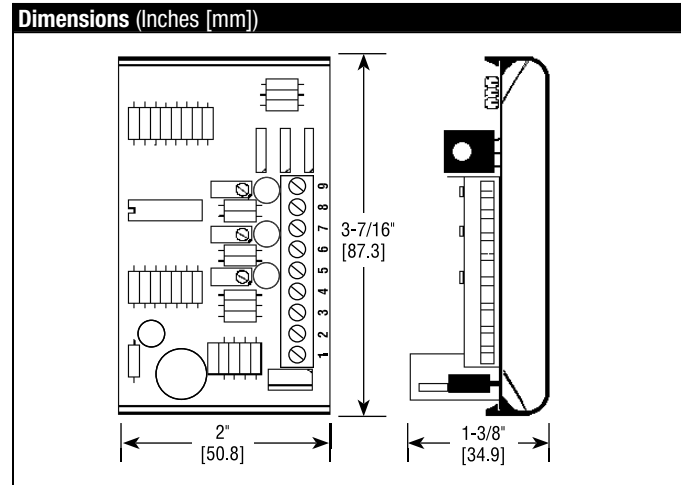
**To readjust the output stages, the following procedure is used:**

Connect the voltmeter to the desired switchpoint reference signal output and terminal 1 (COM). Readjust the switch point reference signal output with the corresponding potentiometer to your desired switch point. The adjustment range is 2.5 to 9.5 VDC. If you go below or above these values the ADS-100 may not switch off or on properly. If this occurs you have to increase or decrease your switching level until the ADS-100 works correctly.

## ADS-100 Used as an Auxiliary Switch

The ADS-100 was originally designed as an accessory to switch on stages of electric reheat from an electronic thermostat. However, it can also function as an electronic auxiliary switch from any device which can provide 0 to 10 VDC signal, such as any feedback wire 5 from any ...SR or ...MFT type actuator.

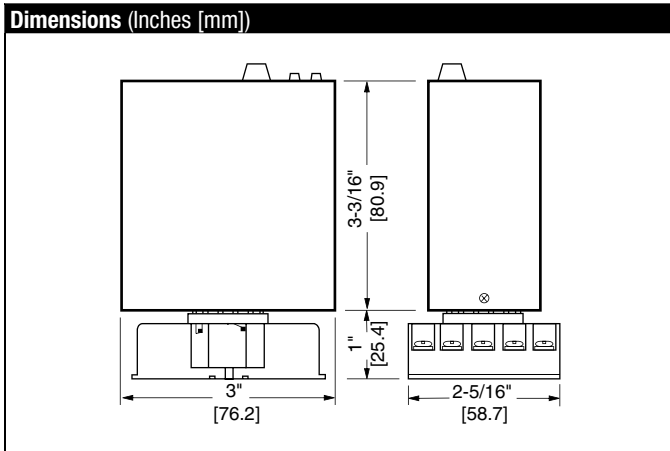
The ADS-100 has 3 triac outputs rated at 10 VA maximum each which will turn on, in sequence, with an increasing voltage.



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Technical Data	
Power supply	24 VAC $\pm$ 20% 50/60 Hz
Fusing	4A slow blow fuse
Power consumption	min. 5W (without actuator load)
Transformer	8 VA
Batteries	24 V Nominal 1.2 Ah (2-12 volt lead-acid batteries; batteries not supplied with module)
Maintenance	the batteries should be checked annually (approximate life is 6 years)
Charging circuit	charge current max. 150 mA charge voltage 24-27 V, temperature compensated
Battery back-up operation	24 V nominal 1.2 Ah, max. 60 W auto shut off after 250 seconds
Indication LED	green - main power source operation (battery will be charged) red - battery back-up operation
Mounting	mounted in the control panel with an 11 terminal plug-in base (not supplied with module)
Ambient temperature	14°F to 122°F [-10°C . . . 50°C]



## Application

Several Belimo damper actuators can be used either with 24 VAC or 24 VDC.

In case of a power failure, the NSV24 battery back-up unit switches the damper actuator from its main AC power supply over to the 24 VDC battery to drive the actuators to their safety position.

For easy maintenance, the battery back-up system is placed in the control panel, not in the actuator. Several actuators may be powered by one back-up module. The batteries are separate from the NSV24.

## Operation

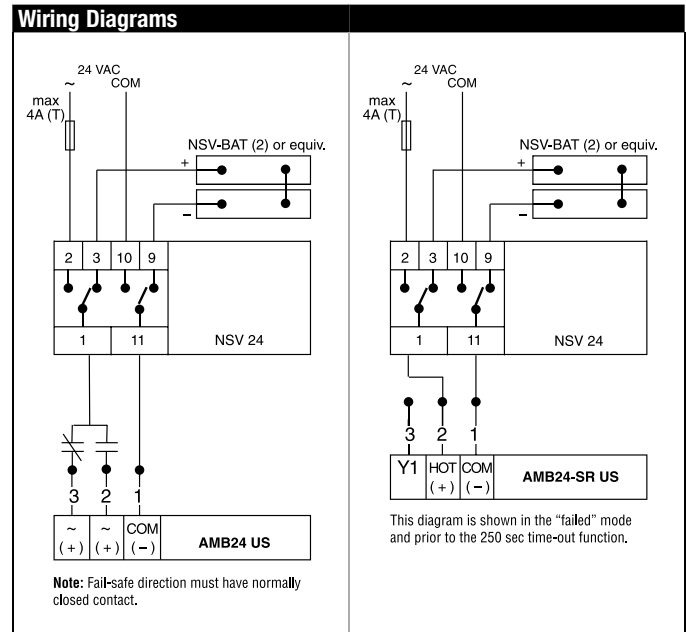
The NSV24 is connected to the same 24 VAC power source as the damper actuators. It also charges the 24 V (2-12 volt batteries) storage battery. Its charge current is limited to 150 mA maximum, and the maximum charge voltage is temperature compensated.

In case of a power failure, the NSV24 switches immediately over to the battery power source, and according to the control function, the actuators will move to their safety position. After 250 seconds, the batteries are disconnected from the actuators to prolong battery life. Because of this, a safe battery back-up can be provided for several short-term failures. The main power source operation is indicated by a green LED, and the battery power source by a red LED.

Connectable Actuator Models	Maximum per module
GMB24-3X1	20
GMX24-3	15
GMX24-MFTX1	15
GMB24-SR	15
AMB24-3	30
AMX24-MFT	30
AMB24-SR	30
NMB24-3	30
NMX24-MFT	30
NMB24-SR	30
LMB24-3	30
LMX24-MFT	30
LMB24-SR	30

## Accessories

**NSV-BAT** 12 VDC 1.2 Ah battery (2 required)



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# NSV-BAT, ZGR01, ZGR02 and Resistor Kits for Multiple Actuators



## NSV-BAT 12V Battery

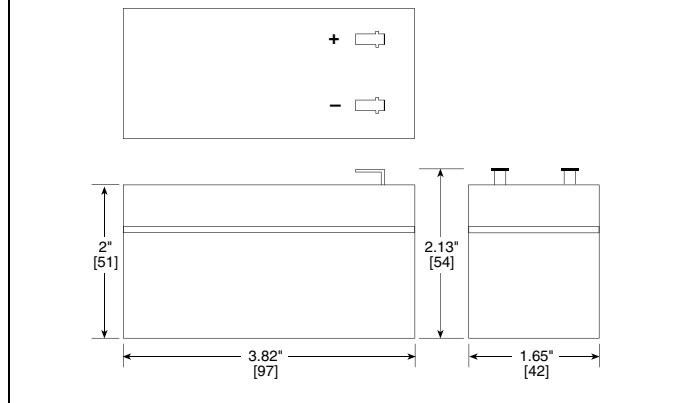


Technical Data	NSV-BAT
Battery type	lead-acid
Voltage	12 VDC
Nominal capacity	1.2 AH
Connections	.187 male spade
Weight	1.32 lb [.6 kg]

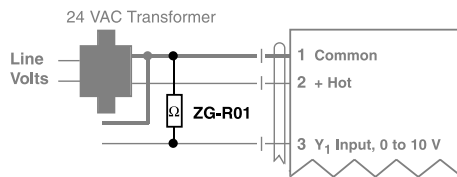
## Application

The NSV-BAT battery is for use with the NSV24 battery back-up module. It is a sealed, maintenance free, lead-acid battery. Two NSV-BAT batteries are required for one NSV24.

## Dimensions (Inches [mm])



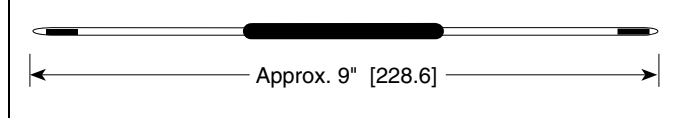
## ZG-R01 Resistor for 4 to 20 mA conversions



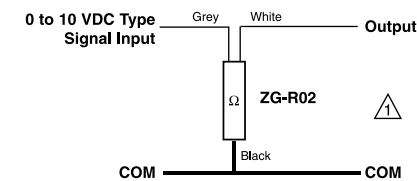
## Application

The ZG-R01 is a 499  $\Omega$  Resistor which has been encased in a section of heat shrink tubing with short sections of hook up wire. The ZG-R01 is used to convert a 4 to 20mA signal into a 2 to 10 VDC control signal.

## Dimensions (Inches [mm])



## ZG-R02 50% Voltage Divider

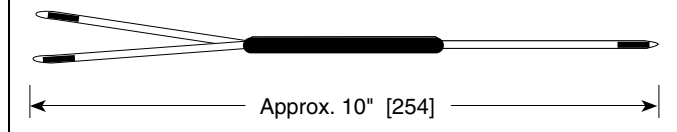


The impedance of the device attached must be 100k $\Omega$ .

## Application

The ZG-R02 is a voltage divider designed so that when connected to a 100 K $\Omega$  input impedance, the output signal is 50% if the input signal. The voltage divider circuit is encased in a short section of heat shrink tubing with three short sections of hook up wire.

## Dimensions (Inches [mm])



## Resistor kits for Multiple Actuator Applications

### Resistor Kit No. ZG-R03

135  $\Omega$  Operation

No. of Actuators	Resistance $\Omega$
2	140
3	71.5
4	47.5
5	37.5
6	28

### Resistor Kit No. ZG-R05

4 to 20 mA Operation

No. of Actuators	Resistance $\Omega$
1	237
2	150
3	124
4	113
5	105
6	97.6

### Resistor Kit No. ZG-R06

For Honeywell® Electronic Series 90 Circuits (W7100, W973, T775)

No. of Actuators	Resistance $\Omega$
2	1300
3	910
4	768

## Application

For use with the ...MFT95 actuators and Honeywell® controllers

**ZG-R03** See table to left

**ZG-R05** See table to left

**ZG-R06** See table to left

**ZG-CBNS Junction box**



## ZG-CBNS

### Application

The ZG-CBNS accessory is used when the application requires the wiring terminations to be made at the actuator.

### Operation

The ZG-CBNS serves as an electrical junction box. The products that can be used with this accessory are as follows:

AF24 US, AF120 US, AF230 US, AF24-SR US

\* Due to the internal volume of this junction box, according to UL requirements, The ZG-CBNS CANNOT be used with the following products:

NF24-S2 US, AF24-S US, AF120-S US, AF230-S US

**ZG-CBLS Junction box**



## ZG-CBLS

### Application

The ZG-CBLS accessory is used when the application requires the wiring terminations to be made at the actuator.

### Operation

The ZG-CBLS serves as an electrical junction box.

This product can be used with any standard LF product.

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Technical Data	ZG-CBNS / ZG-CBLS
Voltage rating	250 VAC
Electrical connection	maximum 5 line voltage connection
Housing rating	UL94 5VA
Material type	FR/ABS CYCOLAC FR15
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Agency listing	UL pending
Quality standards	ISO 9001
Weight	<0.5 lbs

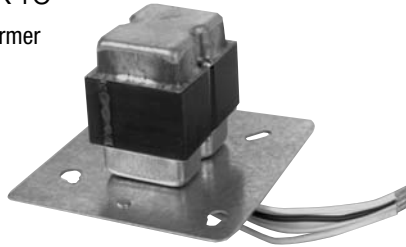
# Transformer ZG-X40

## Power Supply, Signal Simulator PS-100



### Transformer ZGX40

40 VA, 120 to 24 VAC Transformer



#### Application

The ZG-X40 is a 40 VA, 120 to 24 VAC transformer. It is designed so that both the primary and secondary leads exit through the same side of a 4-1/4" square outlet box cover. With this design, all wiring can be done inside a standard J-box with a minimum amount of labor.

Technical Data	ZG-X40
Primary voltage	120 VAC 50/60 Hz
Secondary voltage	24 VAC
Max VA rating	40 VA
Connections	6-1/2" leads with stripped ends
Type	Class 2
Mounting method	4-1/4" square outlet box cover
Agency approvals	UL 1585, CSA 22.2 #66

#### Wire Specification

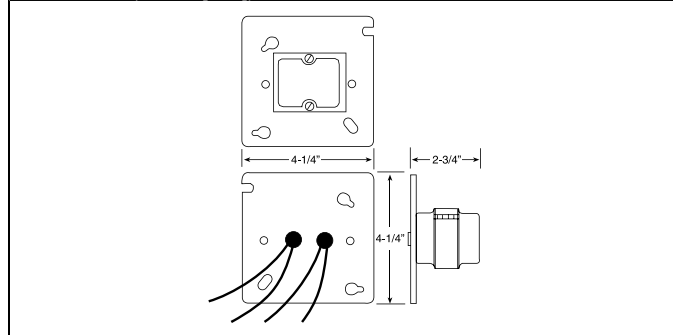
Wire	No. 18 AWG leads, 6-1/2" length
Termination	Color
Primary	White-Black
Secondary	Yellow-Yellow

#### Maximum Number of like Actuators per Transformer

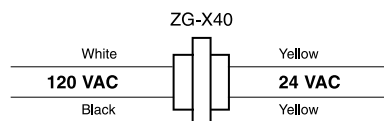
Model #	Quantity	Model #	Quantity
NMB24-3	11	NFB24(-S), NFX24(-S)	4
NMB24-SR	13	NFB24-SR(-S), NFX24-SR(-S)	6
AMB24-3	8	NFB24-MFT(-S), NFX24-MFT(-S)	4
AMX24 MFT	3	Original NF24(-S) US	5
AMB24-SR	8	Original NF24-SR(-S) US, ...MFT US	6
AMX24-MFT95	8	LF24(-S) US	5
GMB24-3	6	LF24-3(-S), ...SR(-S),...MFT(-S) US	8
GMB24-SR	5	TF24(-S) US	8
AFB24... AFX24..	4	TF24-3(-S), ...SR(-S),...MFT(-S) US	10
Original AF24..US	4		

Refer to appropriate actuator documentation for specific VA ratings.

#### Dimensions (Inches [mm])



#### Wiring Diagram



P14 @66%

### Power Supply, Signal Simulator PS-100



#### Application

The PS-100 power supply and signal simulator is designed to operate most proportional, floating, and On/Off style actuators without the presence of a controller.

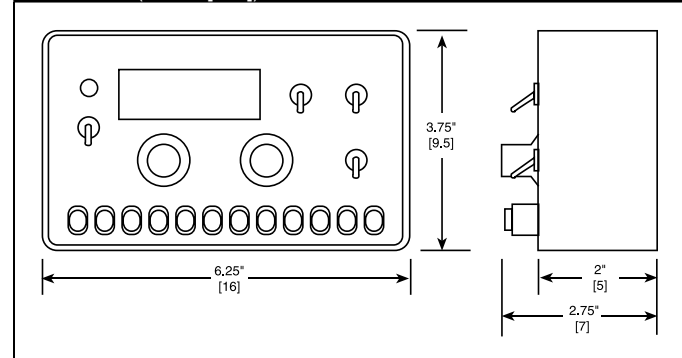
The PS-100 can produce 24 VAC On/Off and floating control signal along with a 0 to 10 VDC and 135Ω proportional signal. A multi-function digital display is provided which can read either the 0 to 10 VDC output or a 0 to 10 VDC feedback signal either as voltage or percentage of control.

The PS-100 comes with a 120 to 24 VAC, plug into the wall transformer for power. Both the PS-100 and transformer are supplied in a black fabric carrying case.

#### Replacement Power Supply: PS-XFMR

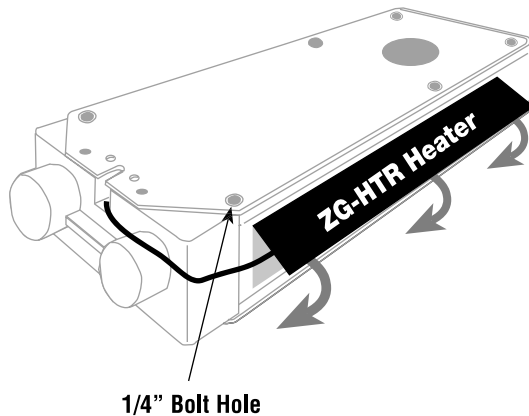
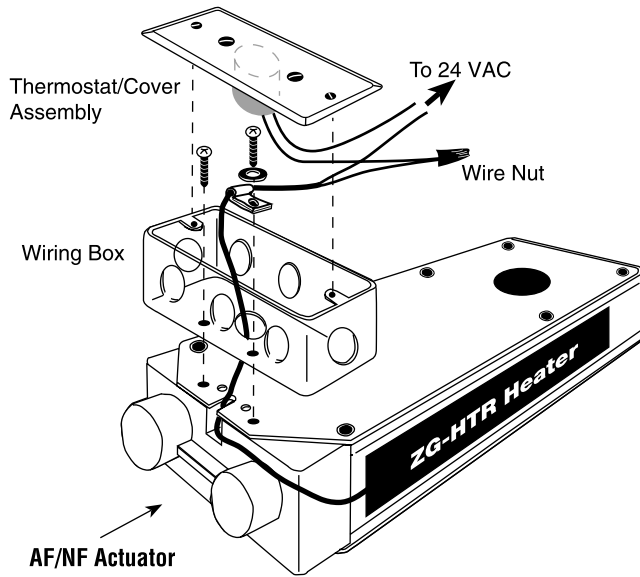
Technical Data	PS-100	
Power supply	120 VAC 50/60 Hz	
Power consumption	<4 W without actuator	
Transformer	Primary	120 VAC, 35 W
	Secondary	24 VAC, Class 2 trans.
	PN	PS-XFMR
Terminal outputs	push-button, wire terminals (12) on/off, floating point, 135 Ω, 0 to 10 VDC	
VDC output range	0 to 10 VDC	
Display	LCD	
Readouts	Output	0 to 10 VDC in volts or percentage based on a 2 to 10 VDC control span
	Input	0 to 10 VDC in volts or percentage based on a 2 to 10 VDC control span
Weight	3 lbs [1.4 kg] with case	

#### Dimensions (Inches [mm])



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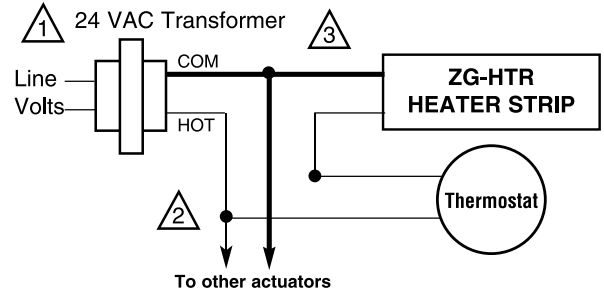


Technical Data	ZG-HTR
Power supply	24 VAC ± 20% 50/60 Hz
Transformer sizing	35 VA
Heater output	35 watts
Actuator low ambient rating	
with enclosure	-40° F [-40° C]
enclosure with 1" insulation	-58° F [-50° C]
Weight	11 oz [320 g]

### Application

The ZG-HTR Thermostat/Heater kit is designed to be field installed to the original AF and NF series actuators. The ZG-HTR provides a thermostatically controlled heater which allows the original AF and NF actuators to be used below their normal low ambient temperature rating. At approximately 10° F [-12° C] the heater energizes to maintain the actuators internal temperature to within working limits. The rubberized heating element has an adhesive back which attaches to the side of the actuator housing. The thermostat assembly mounts to the rear of the actuator and provides for the connection of the 24 VAC supply voltage. The actuator/heater assembly should be contained in a housing, similar to the ZS-100 Weather Shield, to achieve best results.

### Wiring Diagram



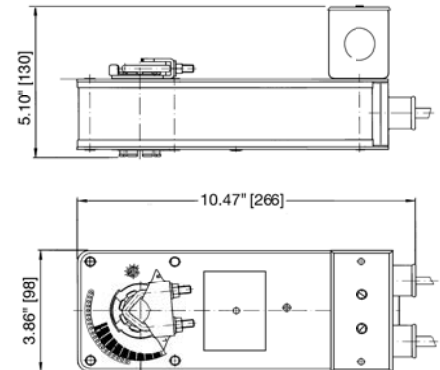
- 1 Provide overload protection and disconnect as required.
- 2 The ZG-HTR may be wired to the same transformer as the actuator. Total VA ratings must be observed.
- 3 Power to the ZG-HTR must be applied continuously during the heating season. Do not wire the ZG-HTR to the on-off control signal when on-off type actuators are being used.

ZG-Heater Wiring Diagram\_08

### Dimensions (Inches [mm])

- Standard:**
- ∅ 3/8" to 3/4"
  - 3/8" to 5/8"
- Optional\***
- ∅ 3/4" to 1.05"

\*with K4-1 US clamp



ZG-HTR Dimensions

## Special Control Range Applications

Control Signal	Belimo Actuator	Accessory	Notes	
1 to 5 VDC	AFX24-MFT NFX24-MFT LF24-MFT US TF24-MFT US	GMX24-MFT AMX24-MFT NMX24-MFT LMX24-MFT	None	Preset at factory or use PC tool software. Set start point for 1 VDC, span for 4 VDC.
4 to 20 mA	Any -MFT,-SR Actuator	ZG-R01, or 500Ω, 1/2 W resistor		Wire the ZG-R01 across the wires #1 and #3.
10.5 to 13.5 VDC	AFX24-MFT NFX24-MFT LF24-MFT US TF24-MFT US	GMX24-MFT AMX24-MFT NMX24-MFT LMX24-MFT	None	Preset at factory or use PC tool software. Set start point for 10.5 VDC, span for 3 VDC.
14 to 17 VDC	AFX24-MFT NFX24-MFT LF24-MFT US TF24-MFT US	GMX24-MFT AMX24-MFT NMX24-MFT LMX24-MFT	None	Preset at factory or use PC tool software. Set start point for 14 VDC, span for 3 VDC.
Pulse Width Modulation	AFX24-MFT NFX24-MFT LF24-MFT US TF24-MFT US	GMX24-MFT AMX24-MFT NMX24-MFT LMX24-MFT	None	Preset at factory or use PC tool software.

\*Preset at factory or use MFT PC tool software

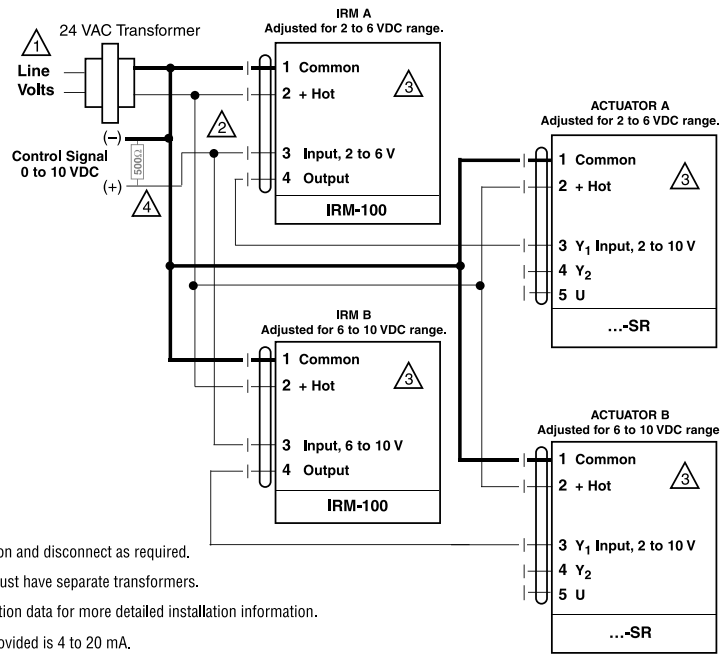
IRM-100 Calibrate the IRM-100 for an input range of 1 to 5 VDC. Calibrate IRM-100 2-10 in 2 to 10 out for signal amplification.

## Sequencing Two or More Actuators With One Control Signal using the IRM-100

IRM-100  
Voltage Settings  
Based on  
4 to 20 mA

mA	VDC
4	2
5	2.5
6	3
7	3.5
8	4
9	4.5
10	5
11	5.5
12	6
13	6.5
14	7
15	7.5
16	8
17	8.5
19	9.5
20	10

- 1 Provide overload protection and disconnect as required.
- 2 Actuator and controller must have separate transformers.
- 3 Consult controller instruction data for more detailed installation information.
- 4 500Ω resistor if signal provided is 4 to 20 mA.

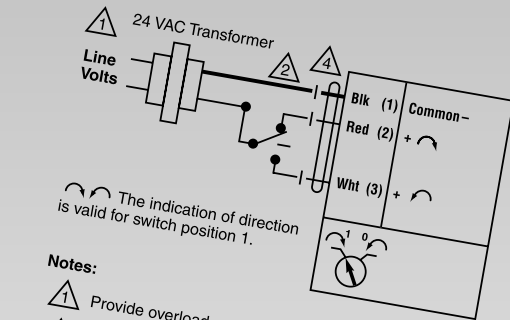


IRM-100 Diagram\_08

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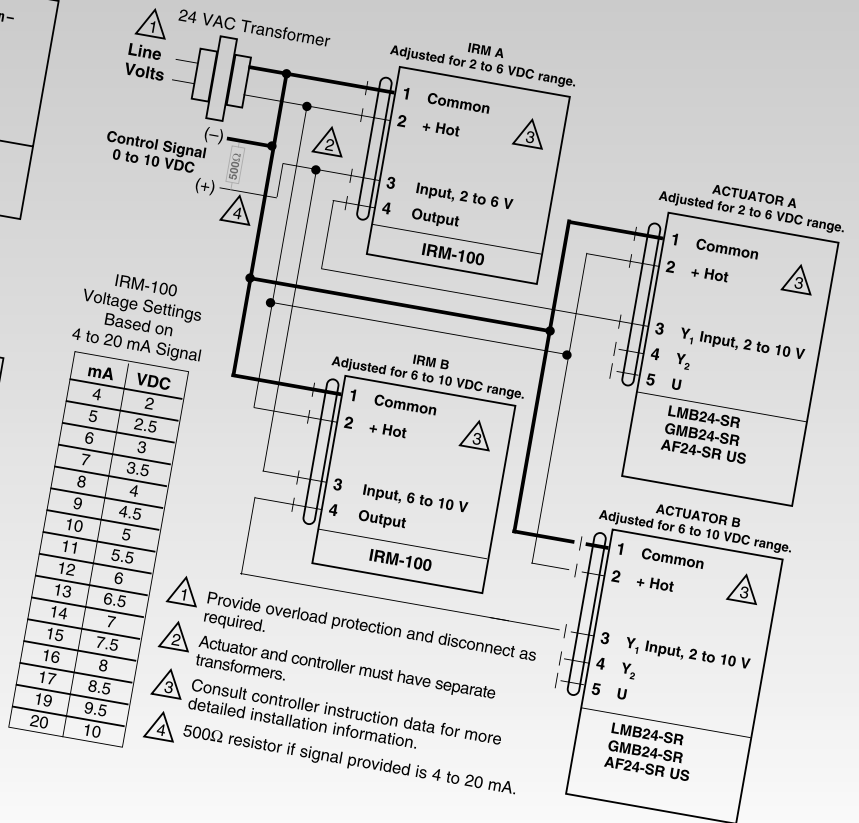
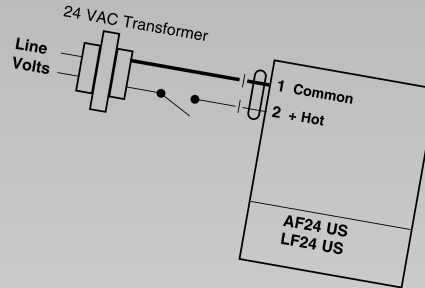
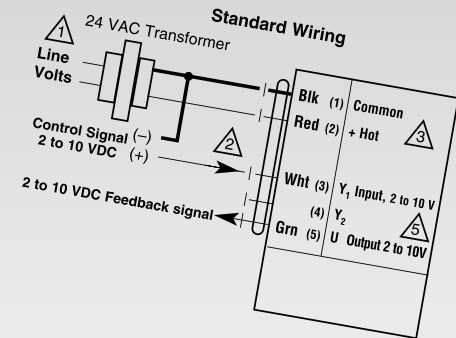
# A CLOSER LOOK...

Application Information and Wiring Diagrams for Belimo Products.



Notes:

- 1 Provide overload protection
- 2 Provide overload protection



- 1 Provide overload protection and disconnect as required.
- 2 Actuator and controller must have separate transformers.
- 3 Consult controller instruction data for more detailed installation information.
- 4 500Ω resistor if signal provided is 4 to 20 mA.

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## The Belimo Difference

- Basic Electricity
- Understanding Wiring Diagrams
- Analog Outputs
- Wiring Diagrams for Belimo Products
- Applications
- Specifications

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## I. BASIC ELECTRICITY

---

### I-A. Abbreviations

DC	=	Direct Current
AC	=	Alternating Current
VDC	=	Direct Current Voltage
VAC	=	Alternating Current Voltage

### I-B. Current

---

A	=	Ampere	
mA	=	Milliamperes = Thousandths of an ampere.	<b>Example:</b> 12mA = 12/1000 = .012A
I	=	The symbol for current in mathematical formulas.	

### I-C. Voltage

---

V	=	Volt*	
mV	=	Millivolt = Thousandths of a volt.	<b>Example:</b> 5mV = 5/1000 = .005V
E	=	The symbol for voltage in mathematical formulas.	

### I-D. Resistance

---

$\Omega$	=	Ohm = Resistance
k $\Omega$	=	Kilo ohm = Thousands of ohms. 1k $\Omega$ = 1,000 $\Omega$
M $\Omega$	=	Mega ohm = Millions of ohms. 1M $\Omega$ = 1,000k $\Omega$ = 1,000,000 $\Omega$
R	=	The symbol for resistance in mathematical formulas.

### I-E. OHM's Law

---

E = Voltage    I = Current    R = Resistance

E = I x R                    **Example:** I = 20mA, R = 500 $\Omega$     Therefore, E = .020 x 500 = 10V

R = E/I                      **Example:** E = 1.35V, I = 10mA    Therefore, R = 1.35/.010 = 135 $\Omega$

I = E/R                      **Example:** E = 120V, R = 50 $\Omega$     Therefore, 120/50 = 2.4A

### I-F. Power

---

W	=	Watt*	
mW	=	Milliwatt = Thousandths of a watt	<b>Example:</b> 7mW = 7/1000 = .007W
kW	=	Kilowatt = Thousands of watts	<b>Example:</b> 1kW = 1,000W

### I-G. Power Calculations

---

W = E x I                    **Example:**                    V = 24V, I = 260mA    Therefore, W = 24 x .260 = 6.24W

W = R x I<sup>2</sup>                    **Example 1:**                    R = 100 $\Omega$ , I = 3A  
W = 100 x 3<sup>2</sup> = 100 x 3 x 3 = 900W

**Example 2:**                    R = 500 $\Omega$ , I = 20mA = .020A  
W = 500 x .020<sup>2</sup> = 500 x .020 x .020 = 500 x .0004 = .2W or 200mW.

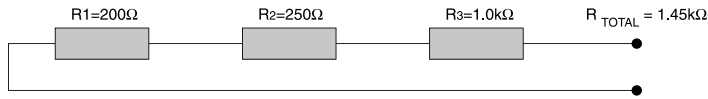
W = E<sup>2</sup>/R                    **Example:**                    V = 24V, R = 100,    Therefore, W = 24<sup>2</sup>/100 = 24 x 24/100 = 5.76W

\* I.S.O. standard indicates "U" be used for voltage and "P" for power.

## I-H. Series Connection of Resistors

Resistors that are connected in series have a total resistance value that is equal to the sum of all the resistance values of the resistors.

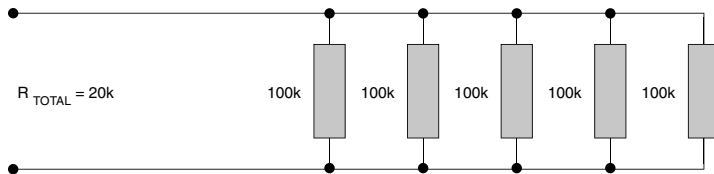
**Example:**  $R_1 = 200\Omega$   $R_2 = 250\Omega$   $R_3 = 1.0k\Omega$   $R_{TOTAL} = R_1 + R_2 + R_3 = 200\Omega + 250\Omega + 1.0k\Omega = 1.45k\Omega$



*The total resistance is always smaller than the smallest single resistor!*

## I-I. Parallel Connection of Resistors

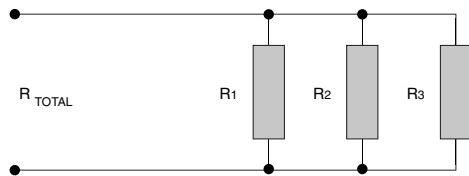
If all the resistors have the same resistance value, the total resistance will be equal to the resistance value of one resistor divided by the number of resistors.



**Example:** Five equal resistors  $R = 100k$  are connected in parallel.  
The total resistance  $R_{TOTAL} = R/5 = 100/5 = 20k$

If the resistors that are connected in parallel have different values, the following formula must be used:

**Example:**  $R_1 = 200$   $R_2 = 250$   $R_3 = 1.0k$



$$\frac{1}{R_{TOTAL}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_{TOTAL}} = \frac{1}{200} + \frac{1}{250} + \frac{1}{1000} = .005 + .004 + .001 = .01$$

$$R_{TOTAL} = \frac{1}{.01} = 100 \Omega \quad R_{TOTAL} = 100 \Omega$$

## I-J. Impedance

The expression “impedance” is used in the BELIMO literature in the following way:

- **Input impedance:** The input circuit of a control device, based on its circuitry, has a certain electrical resistance. The value of this resistance determines how much current the device will draw from the controller. This value must be taken into consideration when connecting any device to a controller output. **Example:** “Input impedance 100 kΩ.” This means that the DC resistance between the input (Y or Y1) and common (COM) is 100 kΩ (100,000 ohm). When the signal is 10 VDC, using Ohm’s Law ( $I=E/R$ ), the current draw on the output of the controller will be  $(10V/100,000 \Omega) = .0001A = .1$  mA for each actuator that is connected to the signal. **The combined input impedance must be higher than the controller output impedance.**
- **Output impedance:** The output of a controller has a limited amount of current capacity to supply to the devices it is controlling. The capacity can be given in one of 2 ways. One way is by stating it as “Maximum output current .2 mA.” The other is by giving its output impedance. The output impedance must always be lower than the combined input impedance of the devices being controlled.

**Example I:** “Output impedance 1000Ω minimum.” This means that the combined input impedance of the devices being controlled must be greater than 1000Ω.

**Example II:** “Maximum output current .2 mA.” Based on a 0 to 10 VDC control signal, the output impedance would be equal to  $R=E/I$  or  $(10V)/(.0002A) = 50k\Omega$

In general, the higher the input impedance, the lower the current draw, therefore less strain on the controller output. The lower the output impedance, the more current available; the more current available, the more devices can be controlled.

**I-K. Power Consumption (W) / Volt Amperes (VA)**

When a device is powered with direct current (DC), or alternating current (AC) into a pure resistive load (bulb, heater, etc.), the rated power consumption is watts (W) and is the product of the current (I) and voltage (E), ( $W = E \times I$ ).

When an actuator is powered with alternating current (AC), the actual power consumption in watts (W) inside the actuator will remain the same. However, due to the inductive and capacitive character of the load, a shift between current and voltage occurs (phase shift). This results in an “apparent” power consumption, which is higher than the actual power consumption. The “apparent” power consumption is expressed in volt-amperes (VA), which is the product of AC volts and the current ( $VA = V \times I \times \text{efficiency}$ ).

The size of a transformer is expressed in volt-amperes (VA) and not in watts (W). **The VA rating of a transformer must be at least as large as the combined VA rating of all the actuators connected to the transformer.**

**Example:** Actuator AMB24

Power consumption: 2.5 W. Transformer sizing: 5 VA

If five (5) AMB24 are connected to one transformer, the VA rating of the transformer must be  $5 \times 5 \text{ VA} = 25 \text{ VA}$ , or larger.

It is better to use a number of small transformers than one large one.

The Belimo products are designed to be powered from Class II transformers for UL applications. These transformers have internal power limitation. A Class II transformer must not provide more than 30 V and no more than 100 VA output. **Do not use a Class I transformer and fuse, because it does not constitute a Class II power source!**

**I-L. Wire Sizing**

Using the correct wire size is important when long wire runs are used. Using too small of a wire increases the resistive losses of the run. The result of this may be too low of a voltage at the actuator to operate correctly. **Chart 1** can be used to determine the correct wire size to use for an application.

**Example I:** Three AMB24-SR actuators are powered from the same wire. The wire run is 100 feet.

- Step #1 Calculate the total power required.  
The AMB24-SR requires 5 VA, 3 actuators are being used.  
 $3 \times 5 = 15 \text{ VA Total}$ .
- Step #2 Locate 15 VA on the vertical axis of the chart and 100 feet on the horizontal axis.
- Step #3 Find the intersection of 15 VA and 100 Ft (Point “A”)
- Step #4 Read the diagonal line to the **right** of point “A”. It is the 18 ga. wire gauge line. Use 18 ga. or larger wire.

**NOTE:** A low gauge number = a thicker wire; A high gauge number = a thinner wire.

**Example II:** The maximum wire length for a 10 VA power consumption using different wire gauges.

Point “B”	22 Ga	Max. 60 FT
Point “C”	20 Ga	Max. 120 FT
Point “D”	18 Ga	Max. 220 FT
Point “E”	16 Ga	Max. 350 FT
Point “F”	14 Ga	Max. 550 FT
Point “G”	12 Ga	Max. 900 FT

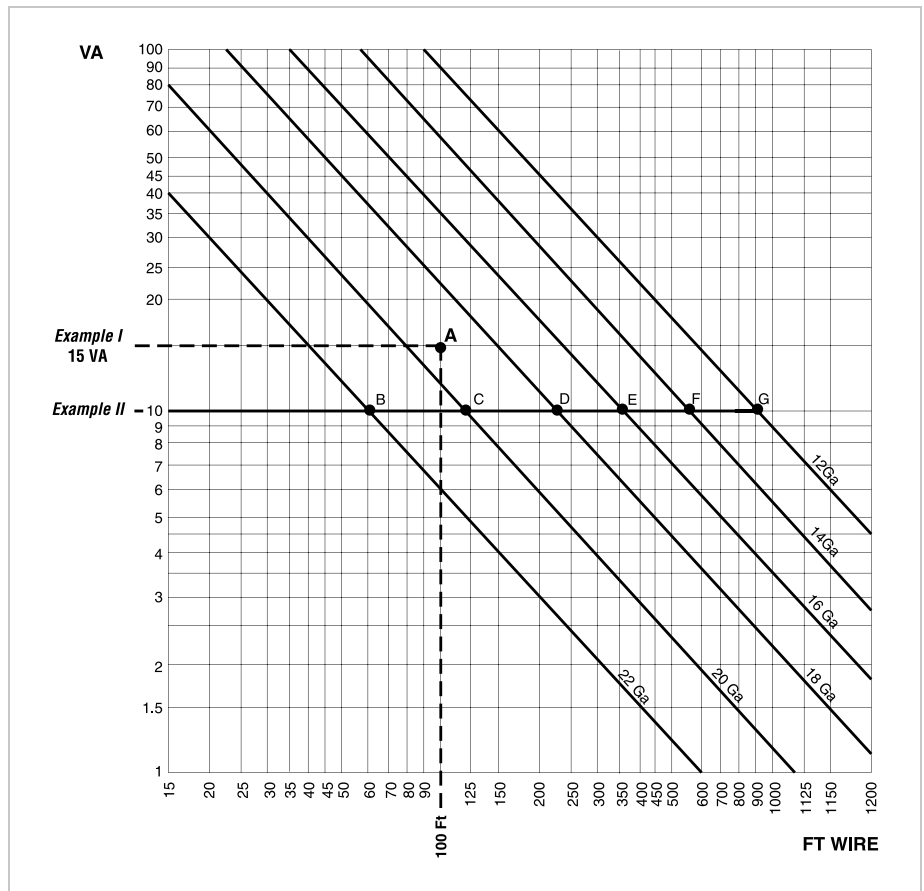


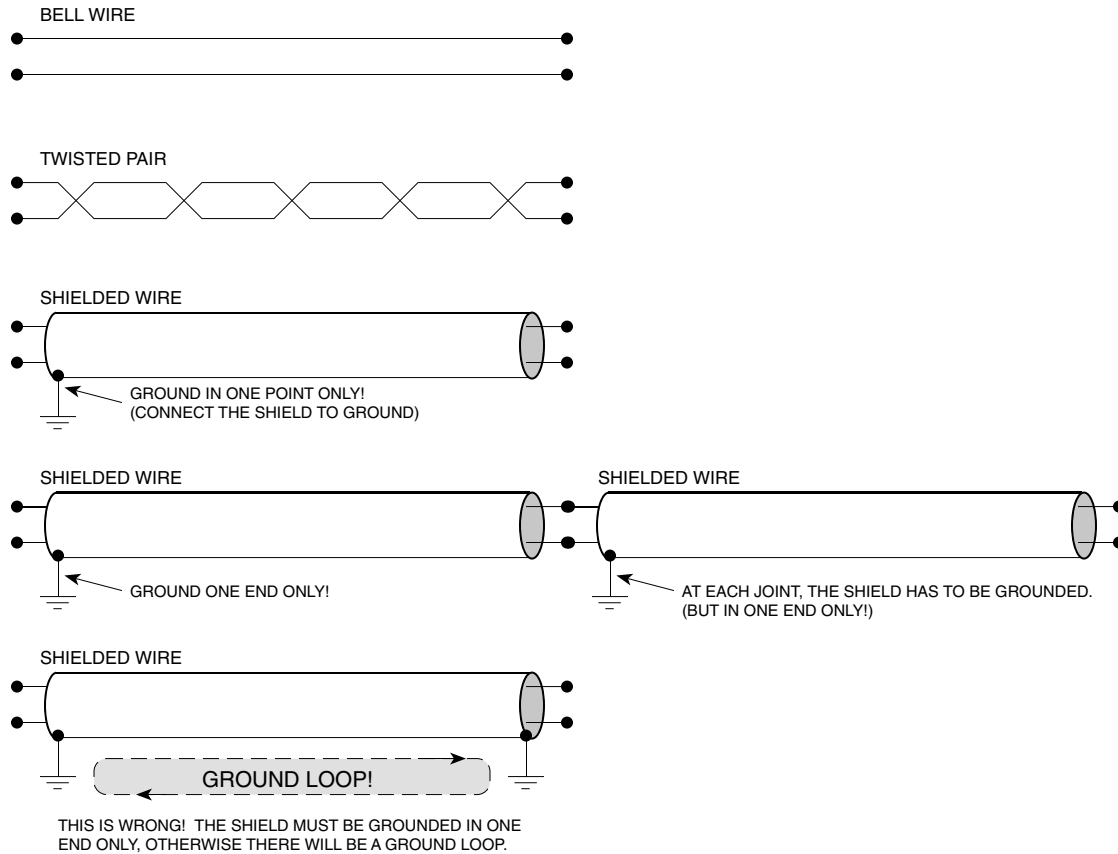
CHART 1

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## I-M. Multi-Conductor Wire Types

- “**BELL WIRE**” has parallel wires, which may act as an antenna and is therefore sensitive to electrical noise. This type of wire should not be used for control circuits.
- “**TWISTED PAIR**” cancels out most of the electrical noise because the wires alternate their positions. This is the type of wire that is used for most control circuits.
- “**SHIELDED WIRE**” is a twisted pair that is surrounded by a metal foil or wire mesh which acts as a shield and prevents electrical noise from reaching the wires inside.

Shielded wires are used for the BELIMO actuators only if the electrical noise is very severe. Normally twisted pairs are sufficient.  
*Remember! The shield must be grounded in one point only!*



## I-N. Ground Loops

If a shield is grounded at both ends of a shielded wire, a ground loop is created. Ground loops will defeat the purpose of shielding, and aggravate the electrical noise problem.

Ground loops can also be created by using more than one wire for signal common (COM  $\perp$ ). The (-) signal common terminals on the controller are usually interconnected. Therefore, a ground loop is formed when two or more signal common terminals of the controller are wired to the same transformer. **See Figure 11-5 and 11-6, page 475.**

Signal common (COM  $\perp$ ) is necessary, as a reference, but only one connection should be used.

Redundant signal common terminals should not be connected.

A ground loop acts as an antenna and will pick up electrical noise. This should be avoided, by using the correct wiring practice.



## II. UNDERSTANDING WIRING DIAGRAMS

### II-A. Electrical Symbols

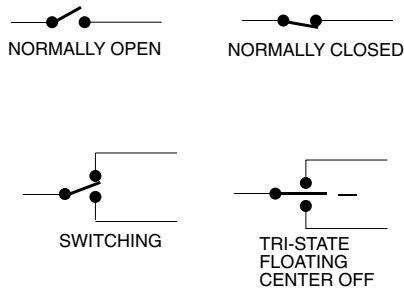
#### U.S. Electrical Symbols for Contacts



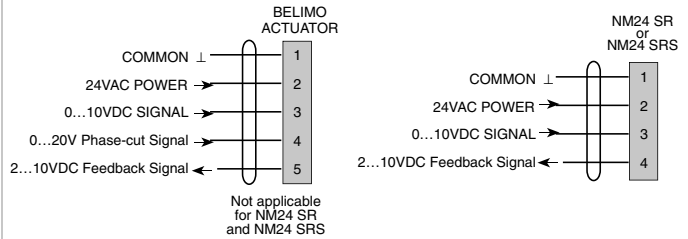
#### International Symbols for Contacts



#### Traditional Electronic Symbols for Contacts



#### Belimo Proportional Actuators- Wire Symbols and Numbers



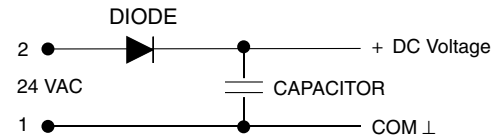
If a feedback is available at the actuator, we recommend that this signal be brought back to the control panel. Even if it is not required for the control sequence, it is a useful signal to have available for possible troubleshooting in the future.

### II-B. Compatibility of Different Power Supplies

#### Power Supply with Half-Wave Rectifier

Half-wave rectifiers offer the advantage of using the same connection for the AC common and DC common. Therefore, the common of different devices using half-wave rectifiers can be interconnected and use the same power source.

Some devices, typically DDC controllers, have full-wave rectifiers. In this case, always use a separate transformer for the controller.

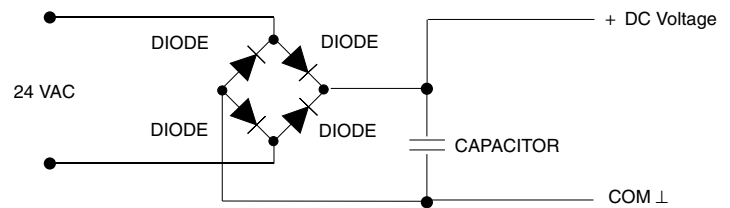


#### Power Supply with Full-Wave Rectifier

Full-wave rectifiers provide more current capacity. Their disadvantage is that the AC and DC sides cannot be interconnected.

Every device which has a full-wave rectifier must be powered from *its own separate transformer*, if the COM ⊥ wire is connected to the Common of other devices.

**Note:** If a device with a full-wave rectifier is powered from the same transformer as a device with a half-wave rectifier, **a short circuit will result** if the commons (COM ⊥) are interconnected.



The Belimo products use half-wave rectifiers. Therefore, they may be connected to the same transformer as long as all commons (COM ⊥) are connected to the same leg of the transformer. However, anytime actuators are connected to a controller a separate transformer should be used for the controller power supply unless you know that the controller also uses a half-wave rectifier.

## II-C. Connection of Actuators

### 0 to 10 V Control Signals

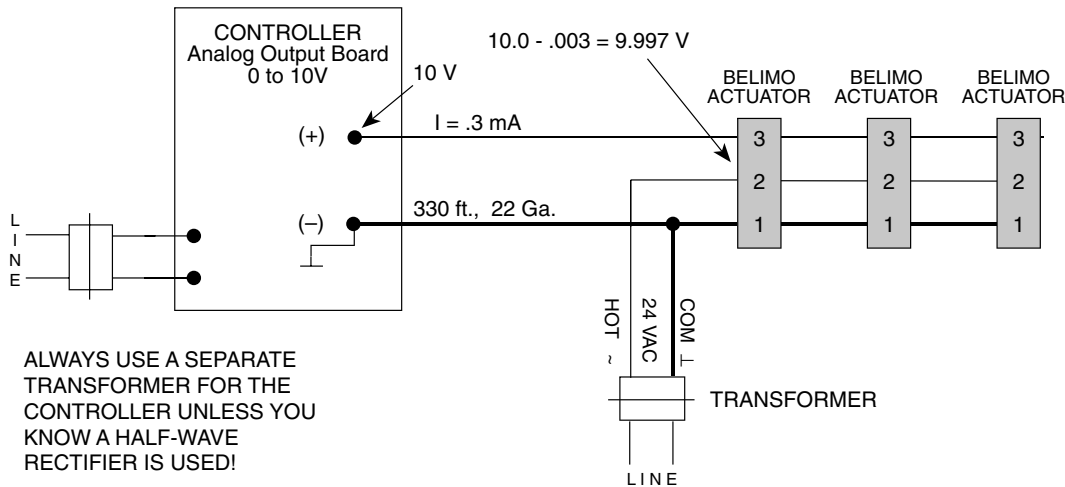
#### Signal Loss

Due to the high input impedance (100kΩ) of the actuators, the current through the signal wire is very low. Therefore, the loss of signal will be negligible, even if with long wire runs.

**Example:** Three actuators are connected via a 330 ft. (100 meters) long pair of 22 Ga. wires. Each wire has a resistance of 5 Ω.

The current draw from each actuator is  $(I = E/R) 10/100,000 = 0.1$  mA, when the signal is 10 VDC.

The current in the wire will be  $3 \times 0.1 = 0.3$  mA. Because 2 wires, the Common and the Source, go to the actuator, the resistance in the wires is  $2 \times 5 \Omega = 10 \Omega$ . The loss of signal will be  $(E = R \times I) 10 \times 0.3 = 3$  mV = .003V.

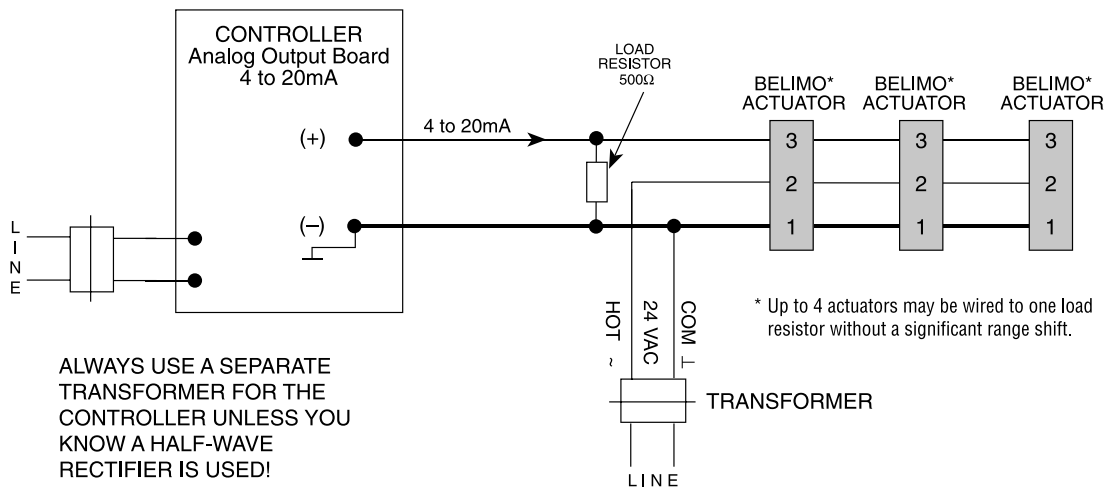


### 4 to 20 mA Control Signals

The controller will regulate the output current (signal) to the desired value, regardless of the resistance (up to a specified value) in the wires and the load resistor.

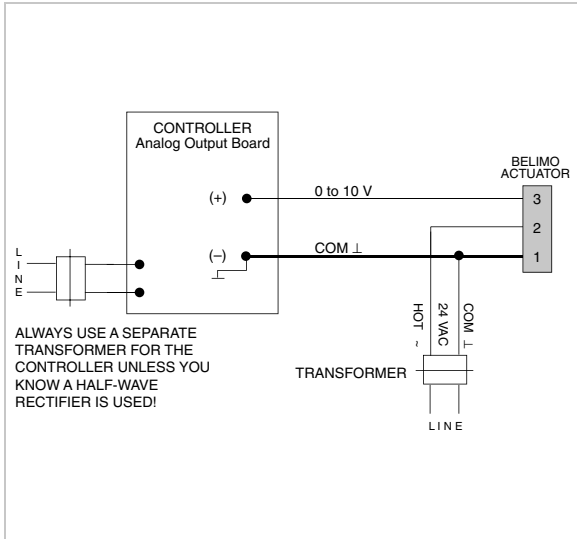
The resistance in the wires will only cause the output voltage of the controller to be slightly higher than the input of the actuators.

The advantage with a 4 to 20 mA output signal to the actuators is that wire resistance does not cause any error to the control signal, and that electrical interference is rejected.

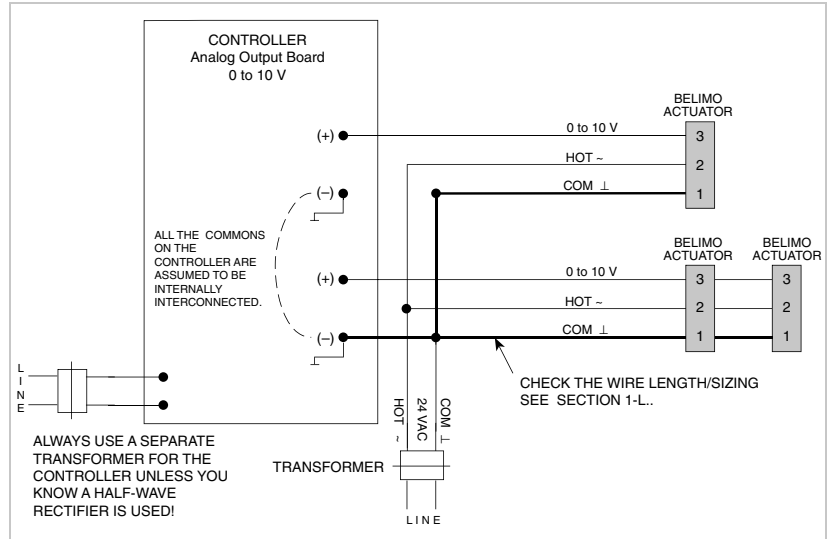


The input impedance of the actuators will reduce the resulting resistance of the load resistor. However, the error is so small that there is no need to compensate for this by using a slightly higher resistance value. A 500Ω load resistor will give an adequate accuracy. Use a 499 Ω, 1%, 1/2w resistor or two 1kΩ, 1%, 1/4 w resistors in parallel.

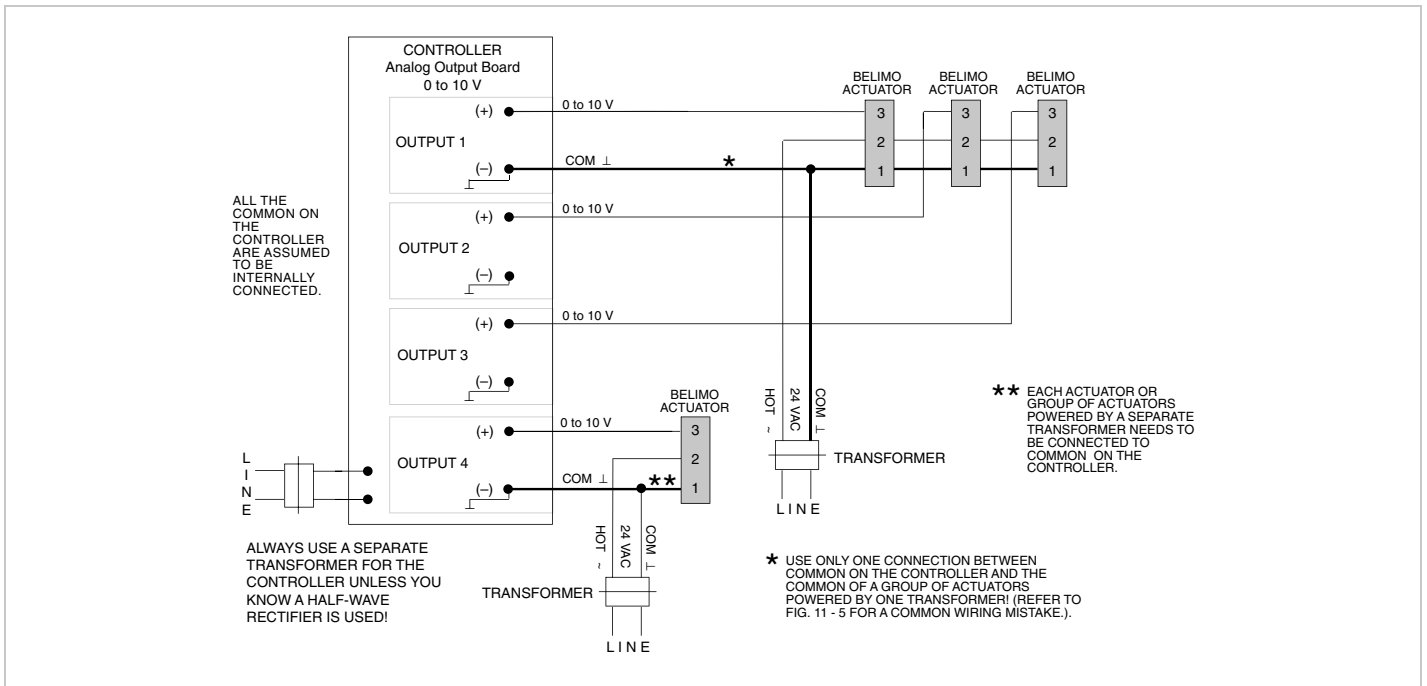
**Modulating Control Signal Wiring**



**FIGURE II-1**  
Single Output to Single Actuator



**FIGURE II-2**  
Multiple Outputs to Multiple Actuators Using 1 Transformer for Actuators



**FIGURE II-3**  
Multiple Outputs to Multiple Actuators Using 2 Transformers for Actuators

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## II-D. Long Distance Wiring

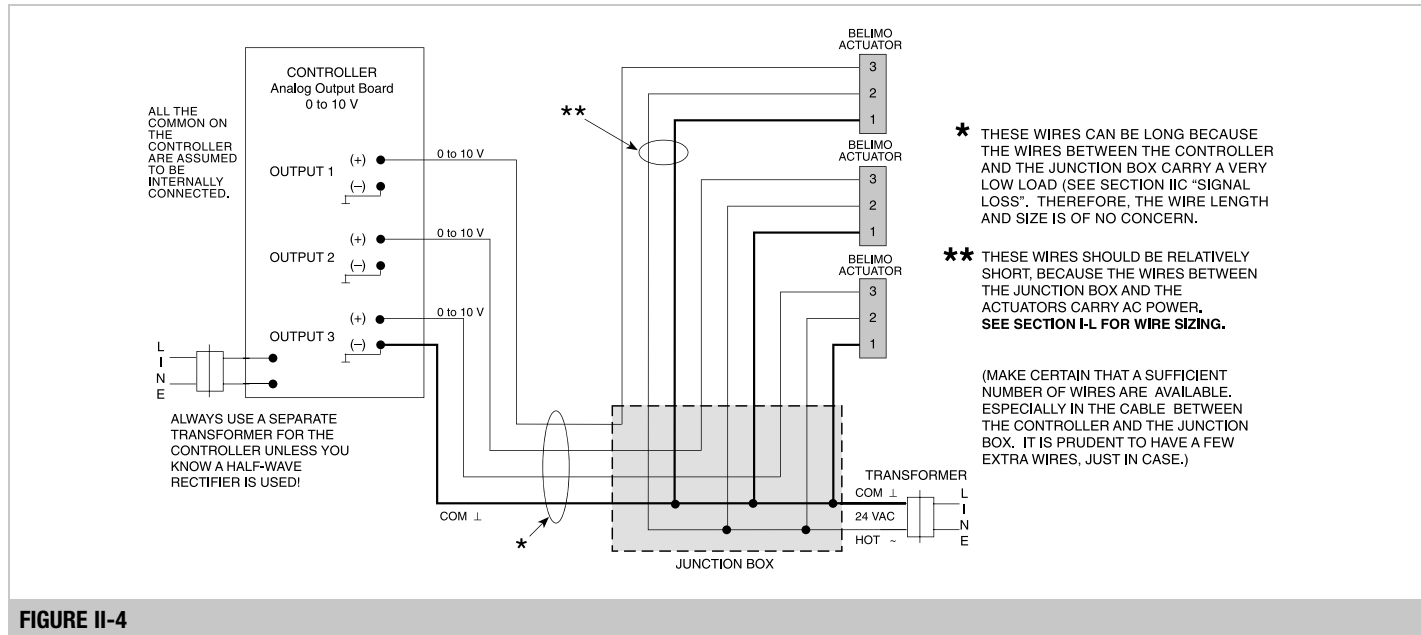


FIGURE II-4

## II-E. Wiring Mistakes

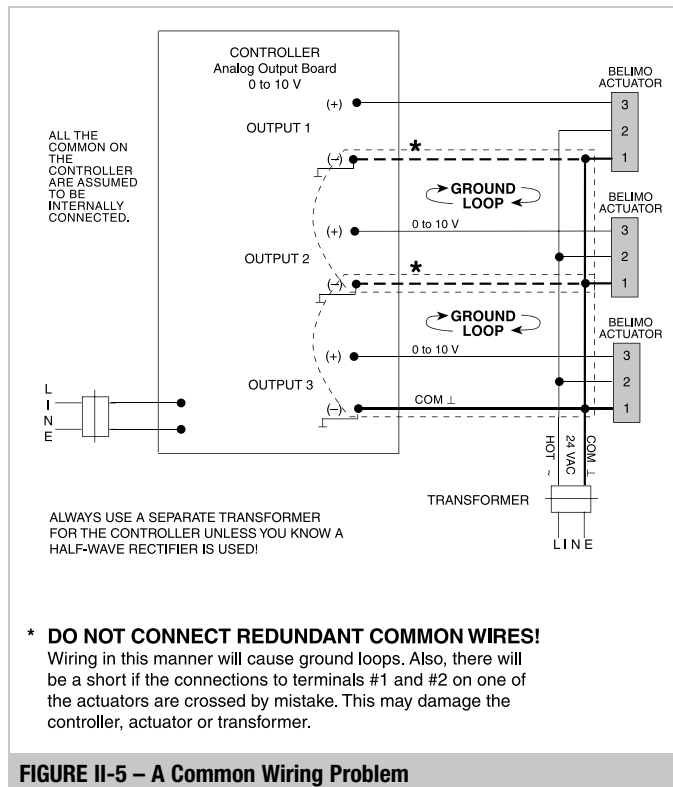


FIGURE II-5 – A Common Wiring Problem

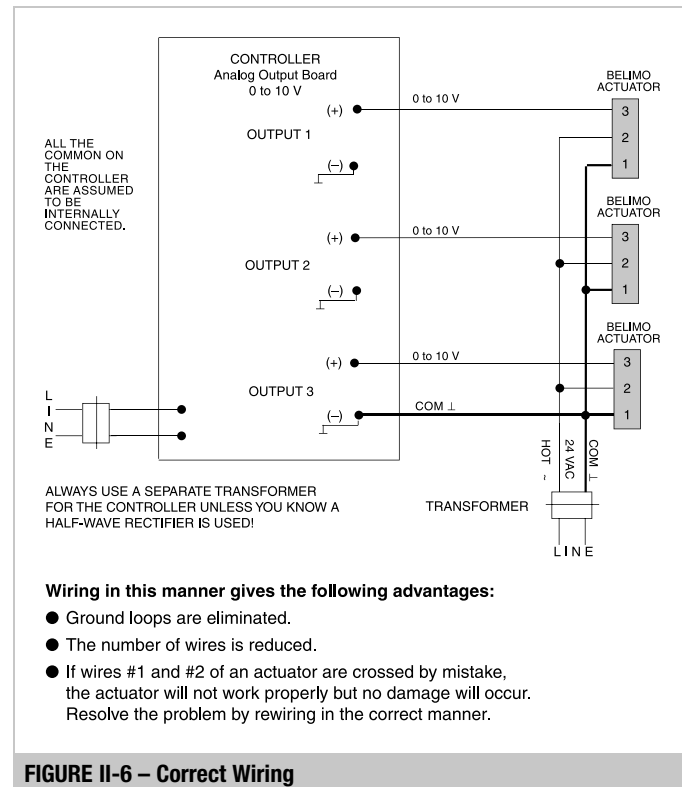


FIGURE II-6 – Correct Wiring

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### III. ANALOG OUTPUTS

#### III-A. 2 to 10 Volt Analog Output

The controller produces a variable voltage between signal common and the analog output.

The signal common (wire #1) of the actuator must be connected to the signal common of the controller, and the output of the controller is connected to actuator signal input (wire #3).

#### III-B. Sourcing 4 to 20 mA Analog Output

A sourcing 4 to 20mA analog output sends out a current to the actuator, and receives it at the signal common terminal.

It is similar to a 2 to 10 V output. The only difference is that one 500Ω resistor has to be installed between wires #3 and #1 at the actuator. The resistor converts the current (4 to 20 mA) to a 2 to 10 V signal. The resistor should be located at the actuator.

#### III-C. Sinking 4 to 20 mA Analog Output

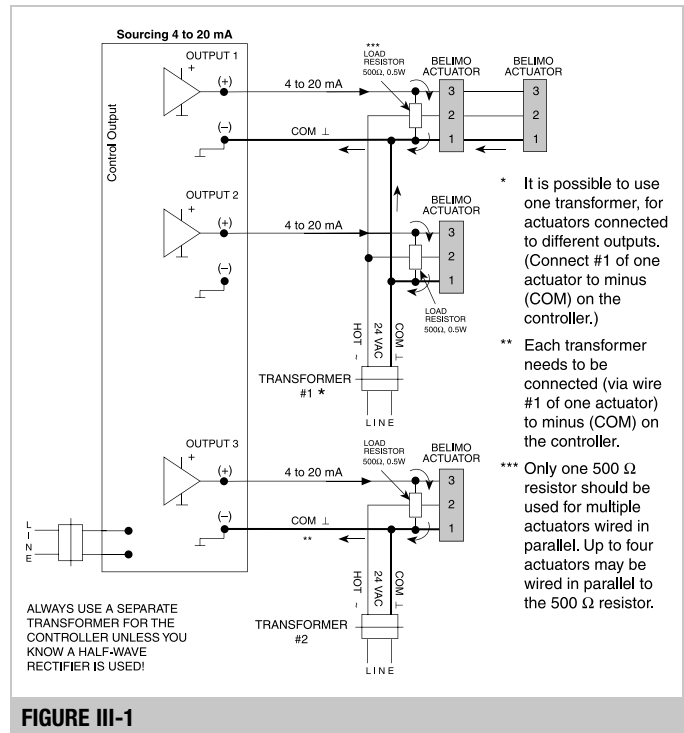
A sinking 4 to 20 mA output uses a different logic to create a control signal. In both a 2 to 10 VDC and sourcing 4 to 20 mA application, the signal is regulated at the positive (+) source of the signal. In a sinking application the signal is regulated between the device being controlled and common. For this reason, the term "Output" in a sinking application is sometimes confusing.

The controller has one terminal that supplies a constant DC voltage (often +24V). The input of the actuators (wire #3) are connected to the constant voltage. A 500 Ω resistor is connected between wires #1 and #3 on one actuator connected to each output. (One resistor for each output.) Terminal #1 on the actuator is connected to the output of the controller.

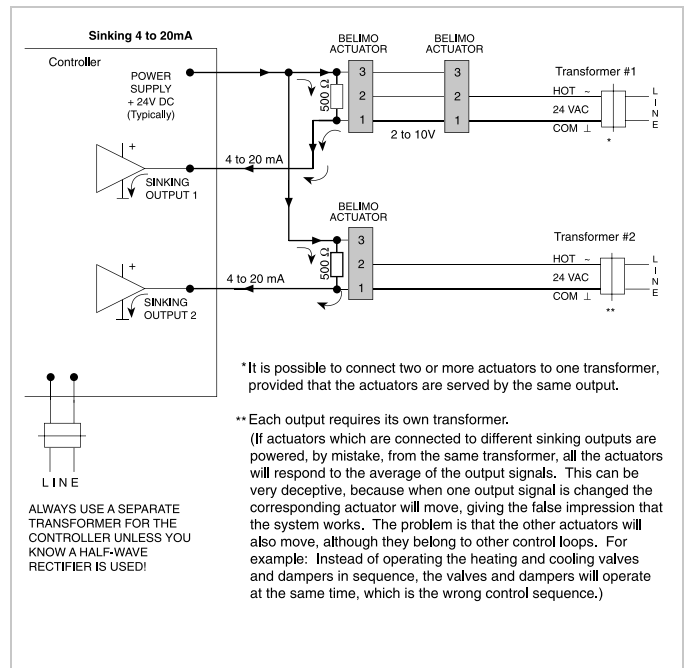
The current will run from the constant voltage on the controller, to wire #3 on the actuator, through the 500 Ω resistor, to wire #1, and back to the input of the controller.

From the controllers point of view, all the #3 terminals of the actuators are at a "common" constant +24VDC. The signal common, wire #1, of the actuators will vary with the control signal.

Because the signal common of the actuators is variable, each output requires a separate transformer. The signal common of actuators connected to different outputs must never be interconnected. **See note \*\* in the wiring diagram.**



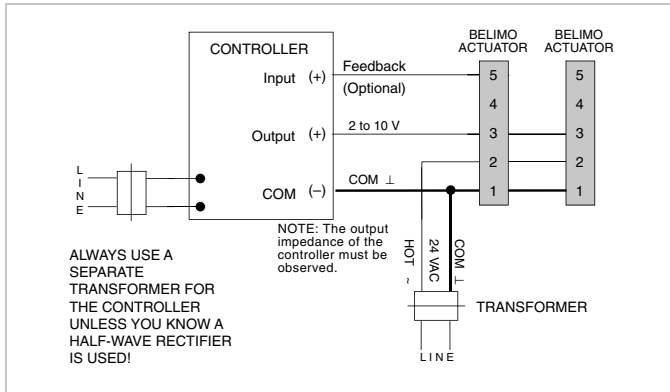
**FIGURE III-1**



**FIGURE III-2 – Sinking 4 to 20 mA**

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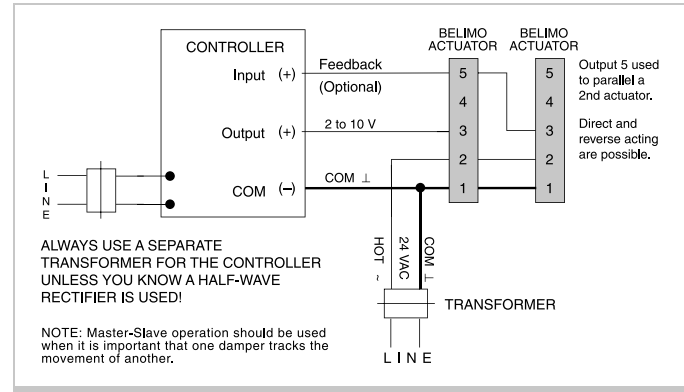
## III-D. Parallel Operation



**FIGURE III-3**

**NOTE:** If multiple actuators are on one shaft, see Section V-A.

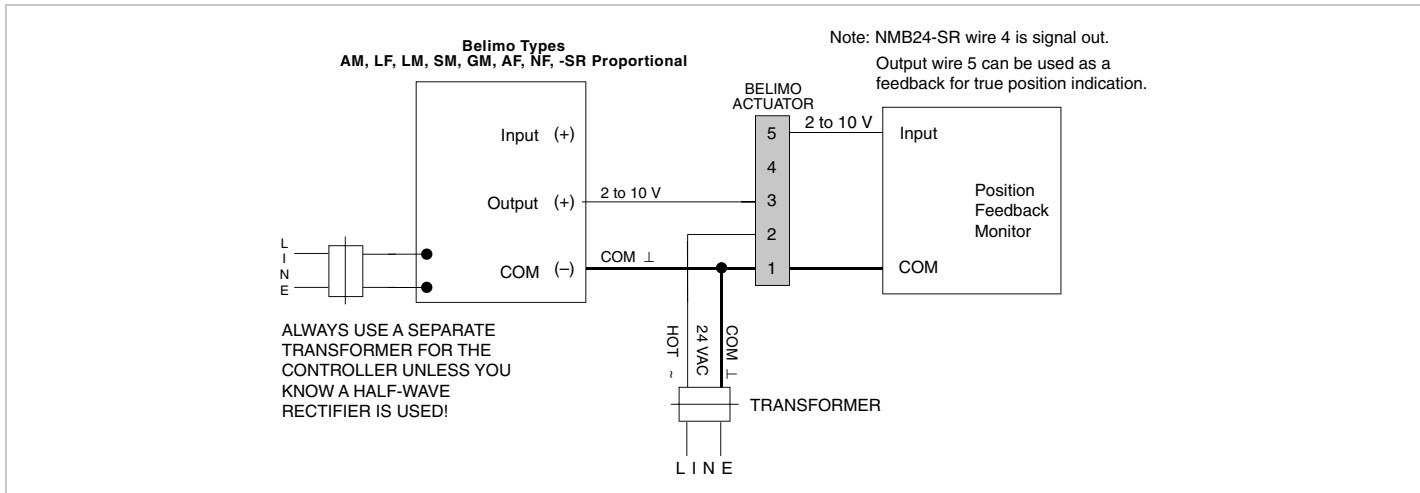
## III-E. Master-Slave Operation



**FIGURE III-4**

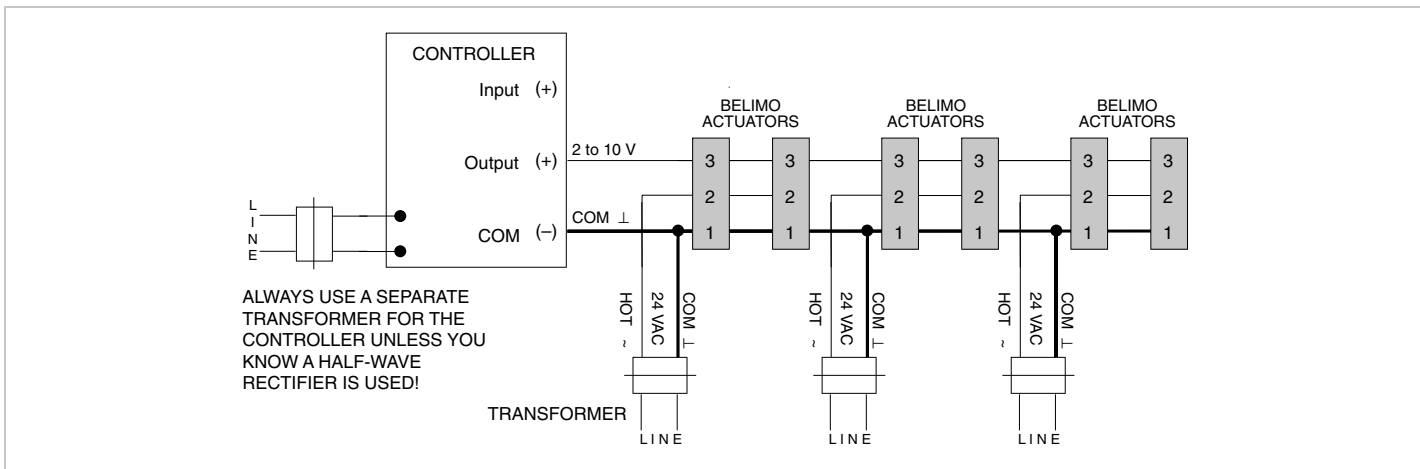
**NOTE:** If multiple actuators are on one shaft, see Section V-A.

## III-F. Monitoring Feedback with a Remote Indicator



**FIGURE III-5**

## III-G. One Output/Multiple Transformers



**FIGURE III-6** – **NOTE:** If multiple actuators are on one shaft, see Section V-A.

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**IV. WIRING DIAGRAMS FOR BELIMO PRODUCTS**

**IV-A. On/Off Control, 24V**

**Diagram 1:** 24 VAC Transformer. Line Volts. Terminals: 1 Common Blk, 2 + Hot Red, 3 Ground. Actuator models: AF24(-S) US, NFB24(-S), NFX24(-S), LF24(-S) US, TF24(-S) US, FS...24(-S) US.

**Diagram 2:** 24 VAC Transformer. Line Volts. Terminals: Blk (1) Common, Red (2) +, Wht (3) +, (4) +. Actuator models: CCW, CW, LF24-3 (-S) US, TF24-3 (-S) US.

**Diagram 3:** 24 VAC Transformer. Line Volts. Terminals: Blk (1) Common, Red (2) +, Wht (3) +. Actuator models: LM\_24-3..., NM\_24-3..., AM\_24-3..., GM\_24-3...

**Notes:**

- 1 Provide overload protection and disconnect as required.
- 2 Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Meets cULus requirements without the need of an electrical ground connection.
- 5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
- 6 Ground connection required only for Fire and Smoke actuators.

W419\_10

**IV-B. On/Off Control, 120/230V**

**Diagram 1:** 120 VAC 230 VAC. Line Volts. Terminals: 1 Neutral Wht, 2 Hot Blk, 3 Ground. Actuator models: AFBUP(-S), AFXUP(-S), AF120(-S) US, AF230(-S) US, NFBUP(-S), NFXUP(-S), LF120(-S) US, LF230(-S) US, TF120(-S) US, FS...120(-S) US, FSNF230(-S) US.

**Diagram 2:** 100 to 240 VAC. Line Volts. Terminals: (1) Common -, (2) +, (3) +. Actuator models: GMX120-3, AMX120-3, NMX120-3, LMX120-3.

**Notes:**

- 1 Provide overload protection and disconnect as required.
- 2 Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 AF..UP, NF..UP, TF, GM, AM, NM, and LM can be supplied with both 120 VAC and 230 VAC
- 4 Meets cULus requirements without the need of an electrical ground connection.
- 5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
- 6 Ground connection required only for Fire Smoke actuators.

W420\_10

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## IV-C. Floating Point Control, 24V

<p>⚠ 1 The indication of direction is valid for switch position CW.</p> <p>⚠ 2 ⚠ 3 ⚠ 4 ⚠ 5</p> <p>Blk (1) Common Red (2) + Wht (3) + Grn (4) +</p> <p>CW CCW LF24-3(-S) US LFC24-3-R US LFC24-3-S US TF24-3(-S) US</p>	<p>⚠ 1 The indication of direction is valid for switch position CW.</p> <p>⚠ 2 ⚠ 3 ⚠ 4 ⚠ 5</p> <p>Blk (1) Common Red (2) + Hot Wht (3) + Grn (4) +</p> <p>CW CCW LF24-3(-S) US TF24-3(-S) US</p>	<p>⚠ 1 The indication of direction is valid for switch position CW.</p> <p>⚠ 2 ⚠ 3 ⚠ 4 ⚠ 5</p> <p>Blk (1) Common Red (2) + Hot Wht (3) + Grn (4) +</p> <p>CW CCW LF24-3(-S) US TF24-3(-S) US</p>
<b>Triac Sink</b>	<b>Triac Sink</b>	<b>Triac Source</b>
<p>⚠ 1 The indication of direction is valid for switch position 1.</p> <p>⚠ 2 ⚠ 3 ⚠ 4 ⚠ 5</p> <p>Blk (1) Common Red (2) + Wht (3) +</p> <p>1 0 LM_24-3... NM_24-3... AM_24-3... GM_24-3...</p>	<p>⚠ 1 The indication of direction is valid for switch position CW.</p> <p>⚠ 2 ⚠ 3 ⚠ 4 ⚠ 5</p> <p>Blk (1) Common Red (2) + Hot Wht (3) + Grn (4) +</p> <p>CW CCW LF24-3(-S) US TF24-3(-S) US</p>	<ul style="list-style-type: none"> <li>⚠ 1 Provide overload protection and disconnect as required.</li> <li>⚠ 2 Actuators may be connected in parallel. Power consumption and input impedance must be observed.</li> <li>⚠ 3 Actuators may also be powered by 24 VDC.</li> <li>⚠ 4 Meets cULus requirements without the need of an electrical ground connection.</li> <li>⚠ 5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance rated cable use numbers.</li> </ul>
<b>Triac Sink with separate transformer</b>	<b>Triac Sink with separate transformer</b>	W421_08

## IV-D. Floating Point Control, 120/230V

<p>⚠ 1 The indication of direction is valid for switch position 1.</p> <p>⚠ 2 ⚠ 3</p> <p>(1) Common- (2) + (3) +</p> <p>GMX120-3 AMX120-3 NMX120-3 LMX120-3</p>	<ul style="list-style-type: none"> <li>⚠ 1 Provide overload protection and disconnect as required.</li> <li>⚠ 2 Actuators may be connected in parallel. Power consumption and input impedance must be observed.</li> <li>⚠ 3 LM, NM, AM, GM, LR, and AR can be supplied with both 120 VAC and 230 VAC.</li> <li>⚠ 4 Meets cULus requirements without the need of an electrical ground connection.</li> <li>⚠ 5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.</li> </ul>
W422_08	



**IV-E. Proportional Control, 24V**

**1** Provide overload protection and disconnect as required.

**2** Up to Four Actuators may be connected in parallel. Power consumption and input impedance must be observed.

**3** Actuator may also be powered by 24 VDC.

**4** Meets cULus requirements without the need of an electrical ground connection.

**5** Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.

**6** Only connect common to neg. (—) leg of control circuits.

**7** A 500Ω resistor converts the 4 to 20mA control signal to 2 to 10 VDC.)

W423\_10

**IV-F. Proportional Control, 120/230V**

**1** Provide overload protection and disconnect as required.

**2** Actuators may be connected in parallel. Power consumption and input impedance must be observed.

**3** LM, NM, and AM can be supplied with both 120 VAC and 230 VAC.

**4** Meets cULus requirements without the need of an electrical ground connection.

**5** Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.

**6** Only connect common to neg. (—) leg of control circuits.

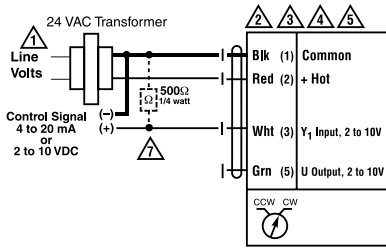
**7** A 500Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

**8** 24 VAC power supply output.

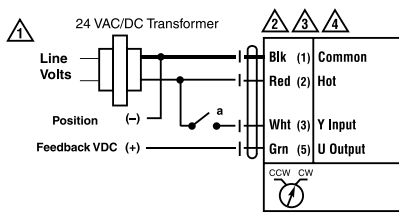
W424\_08

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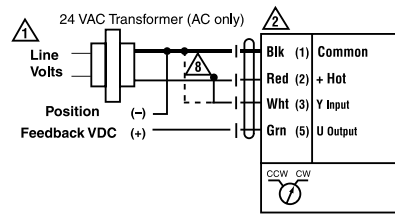
## Spring Return Actuator with MFT



VDC / 4 to 20mA

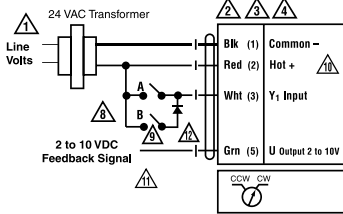


Two Position

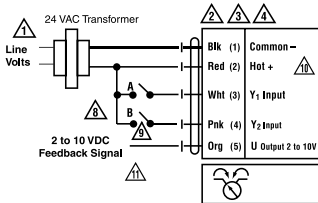


PWM

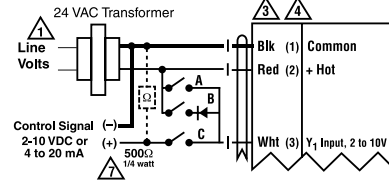
## Original AF, NF, LF, TF



## New Generation AF, NF



Floating Point



Override control to min, mid, max positions

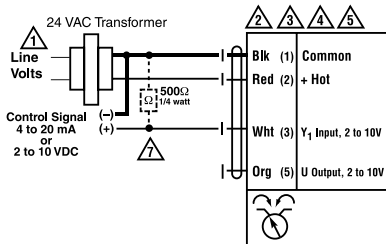
Functions	a	b	c
Min*	0% <	—	—
Mid*	50% <	—	—
Max*	100% <	—	—
Normal**	Control mode acc. to Y	—	—

\* Default selectable 0-100%. See Configuration Data Sheet  
 \*\* Customizable. See Configuration Data Sheet.

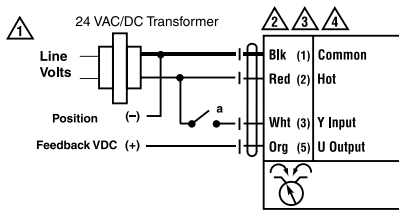
- 1 Provide overload protection and disconnect as required.
- 2 Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Meets cULus requirements without the need of an electrical ground connection.
- 5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
- 7 A 500Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.
- 8 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 VAC line.
- 9 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
- 10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller.
- 11 Position feedback cannot be used with a Triac sink controller. The actuator internal common reference is not compatible.
- 12 IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155)

W425\_08

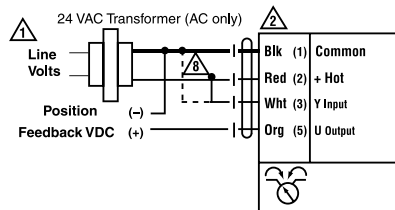
## Non-Spring Return Actuator with MFT



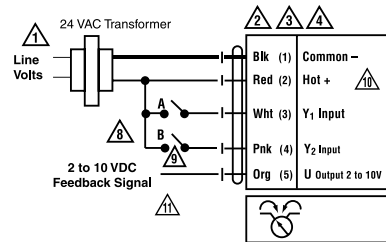
VDC / 4 to 20mA



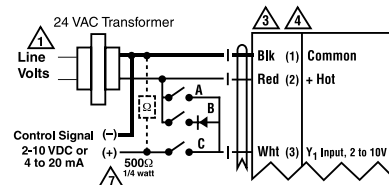
Two Position



PWM



Floating Point



Override control to min, mid, max positions

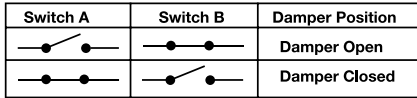
Functions	a	b	c
Min*	0% <	—	—
Mid*	50% <	—	—
Max*	100% <	—	—
Normal**	Control mode acc. to Y	—	—

\* Default selectable 0-100%. See Configuration Data Sheet  
 \*\* Customizable. See Configuration Data Sheet.

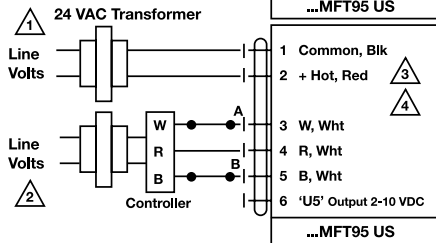
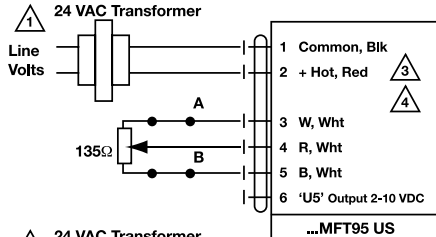
- 1 Provide overload protection and disconnect as required.
- 2 Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Meets cULus requirements without the need of an electrical ground connection.
- 5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
- 7 A 500Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.
- 8 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 VAC line.
- 9 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
- 10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller.
- 11 Position feedback cannot be used with a Triac sink controller. The actuator internal common reference is not compatible.

W426\_08

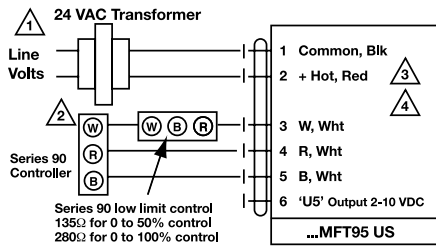
## 0 to 135 Ω Control (MFT95)



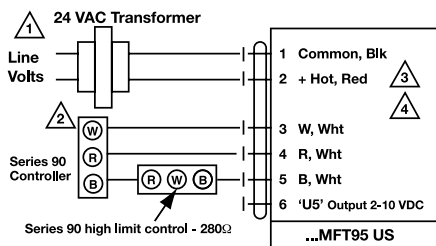
The direction of rotation switch is set so that the fail safe position and the position of the damper is closed with no signal at wire R.



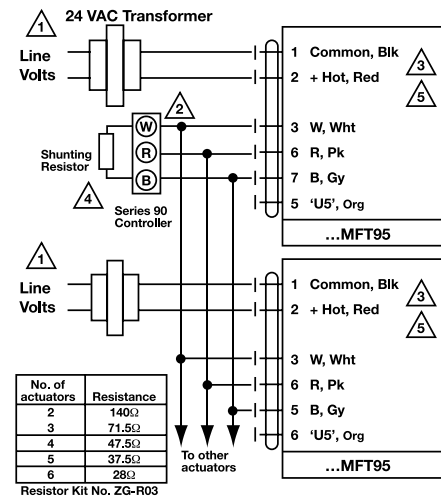
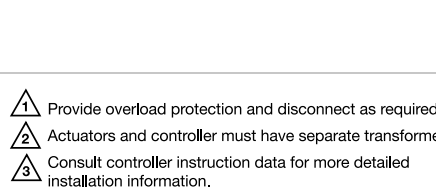
### Override



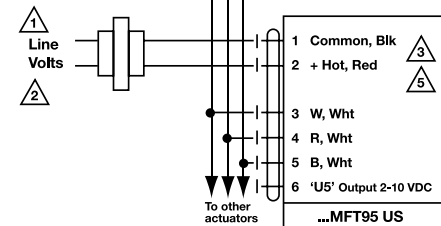
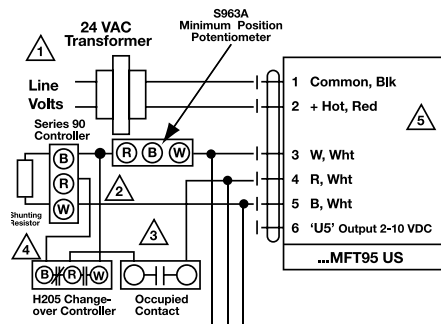
### Low Limit Control



### High Limit Control

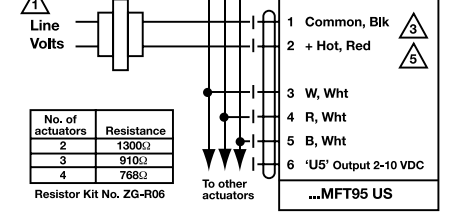
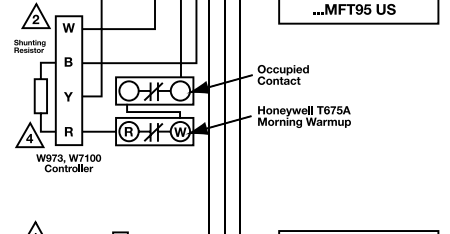
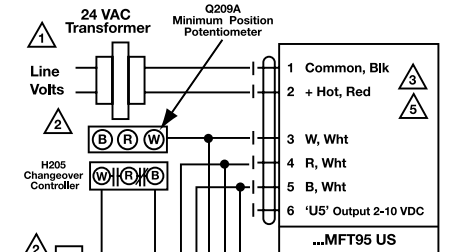


### Wiring multiple actuators to a Series 90 controller

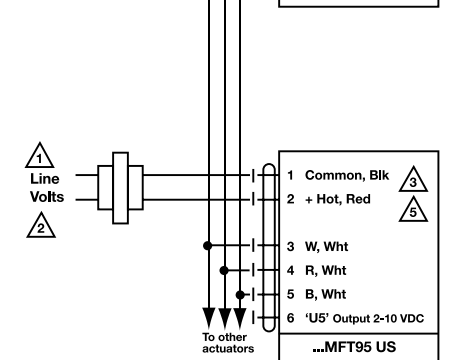
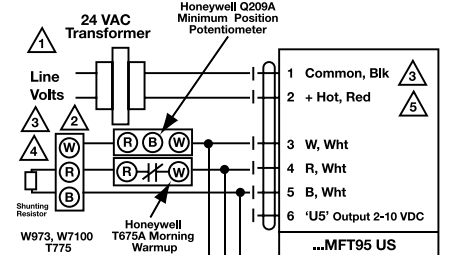


### Wiring multiple actuators to a Series 90 controller using a minimum position potentiometer

- ⚠️ Resistor value depends on the type of controller and the number of actuators. No resistor is used for one actuator. Honeywell resistor kits may also be used.
- ⚠️ To reverse control rotation, use the reversing switch.



### Used with the W973 and W7100 controllers.



### Typical wiring diagrams for multiple actuators used with the W973, W7100 and T775 controllers.

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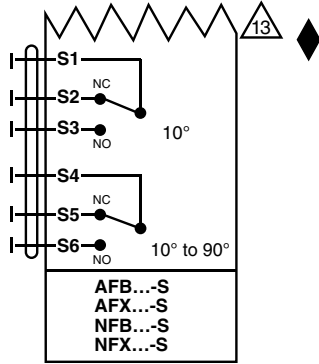
#### AF24-MFT95 US Wire Colors

1=Black	3=White	5=White
2=Red	4=White	6=White

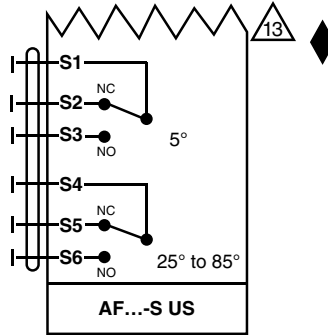
#### AFX24-MFT95 and Non-Spring Return Wire Colors

1=Black	3=White	5=Gray
2=Red	4=Pink	6=Orange

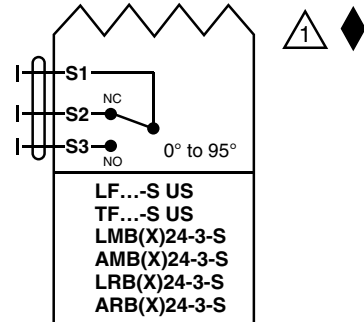
## IV-1. Auxiliary Switch Wiring



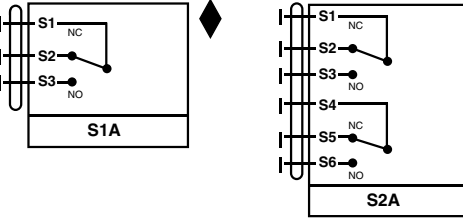
Auxiliary switch wiring for AFB...-S, AFX...-S, NFB...-S, NFX...-S



Auxiliary switch wiring for AF...-S US



Auxiliary switch wiring for LF...-S US, TF...-S, LMB(X)24-3-S, AMB(X)24-3-S, LRB(X)24-3-S, ARB(X)24-3-S



Add-on Auxiliary Switches  
S1A/S2A for GMB(X), AMB(X), NMB(X), LMB(X), GRB(X), ARB(X), NRB(X), LRB(X)

Auxiliary Switch Ratings

Product	Voltage	Resistive Load	Inductive Load
AFB...-S	250	3.0 A	0.5 A
AFX...-S			
AF...-S US	250	7.0 A	2.5 A
NFB...-S	250	3.0 A	0.5 A
NFX...-S			
LF...-S US	250	3.0 A	0.5 A
TF...-S US	250	3.0 A	0.5 A
AMB(X)...-S	250	3.0 A	0.5 A
LMB(X)...-S	250	3.0 A	0.5 A
ARB(X)...-S	250	3.0 A	0.5 A
LRB(X)...-S	250	3.0 A	0.5 A
S1A, S2A	250	3.0 A	0.5 A

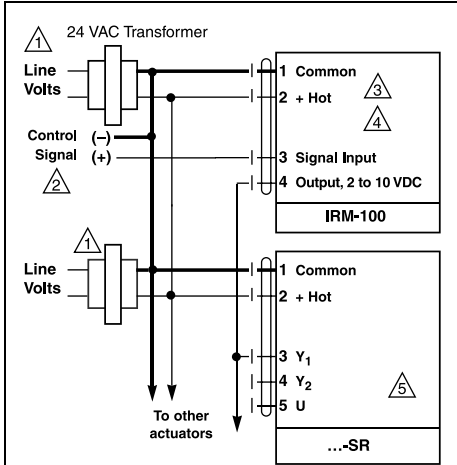
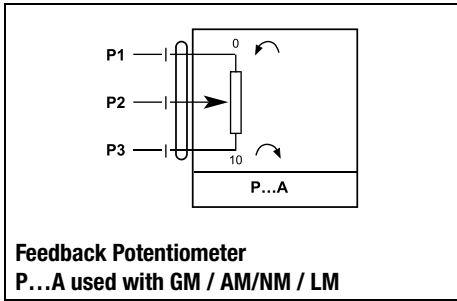
One built-in auxiliary switch (1xSPDT), for end position indication, interlock control, fan startup, etc.

Two built-in auxiliary switches (2xSPDT), for end position indication, interlock control, fan startup, etc.

Meets cULus requirements without the need of an electrical ground connection.

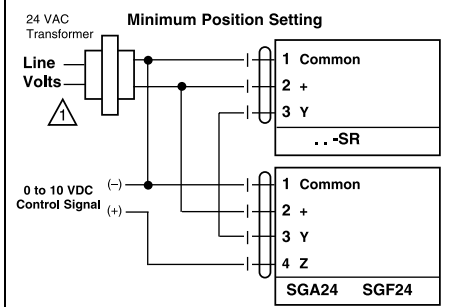
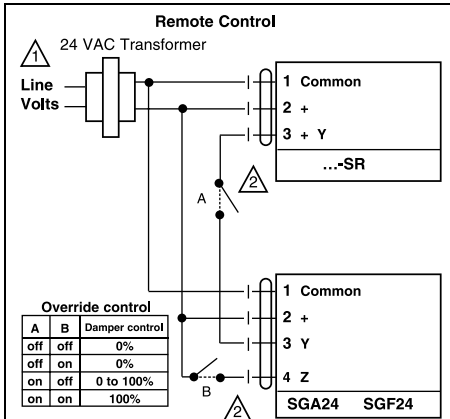
W224\_A

## IV-J. Accessories



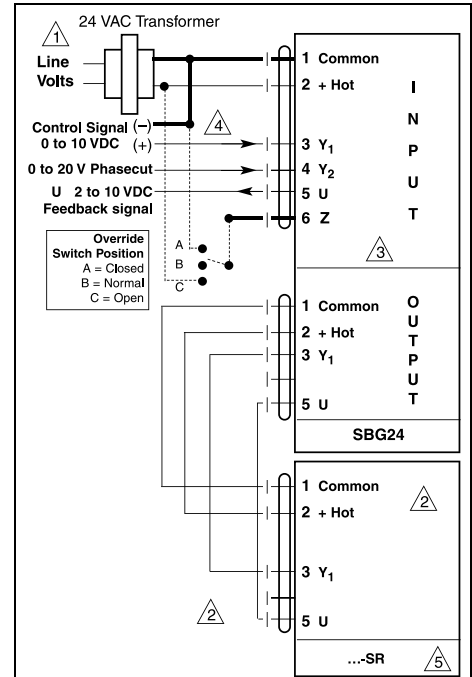
- 1 Provide overload protection and disconnect as required.
- 2 The controller should be powered from a separate transformer.
- 3 The actuator and IRM-100 may be powered from the same transformer.
- 4 Consult controller instruction data for more detailed installation information.
- 5 To reverse control rotation, use the reversing switch.

### IRM-100 Input Rescaling Module



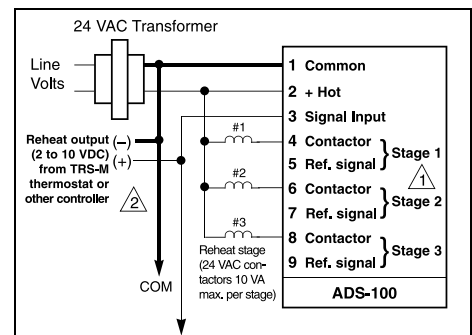
- 1 Provide overload protection and disconnect as required.
- 2 Override switches are optional.

### SGA, SGF Positioners



- 1 Provide overload protection and disconnect as required.
- 2 Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 The actuator and SBG-24 may be powered from the same transformer.
- 4 The controller should be powered from a separate transformer.
- 5 Wire No. 4 on the NM24-SR us is used for feedback.

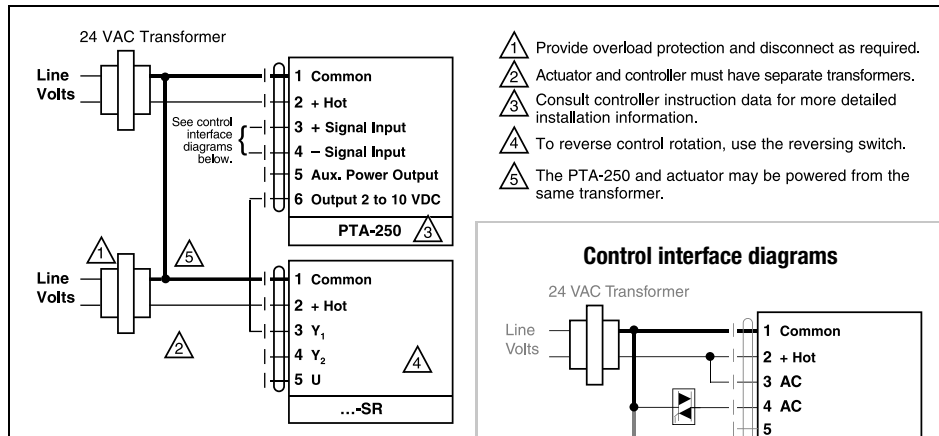
### SBG 24 Range Controller



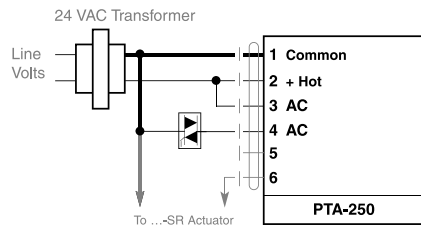
- 1 5,7,9 = Switch point reference signal for manual adjustment of stages 1,2, & 3 respectively.
- 2 Actuator and controller must have separate transformers.

### ADS-100 Analog to Digital Switch

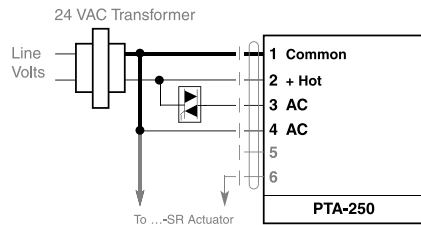
## IV-J. Accessories, continued



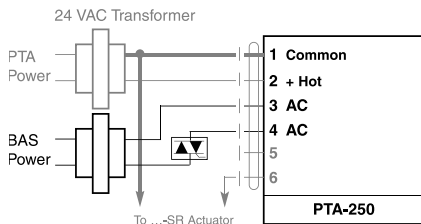
### Control interface diagrams



Triac, common pulsed signal (non-isolated circuit)

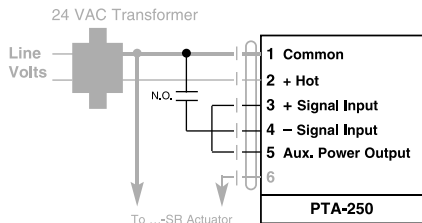


Triac, hot pulsed signal (non-isolated circuit)

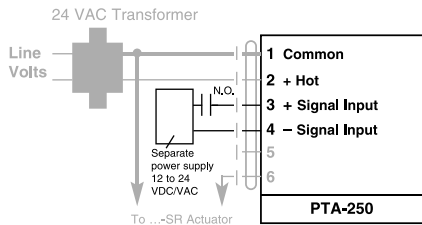


Triac, pulsed signal (isolated circuit)

### Control interface diagrams

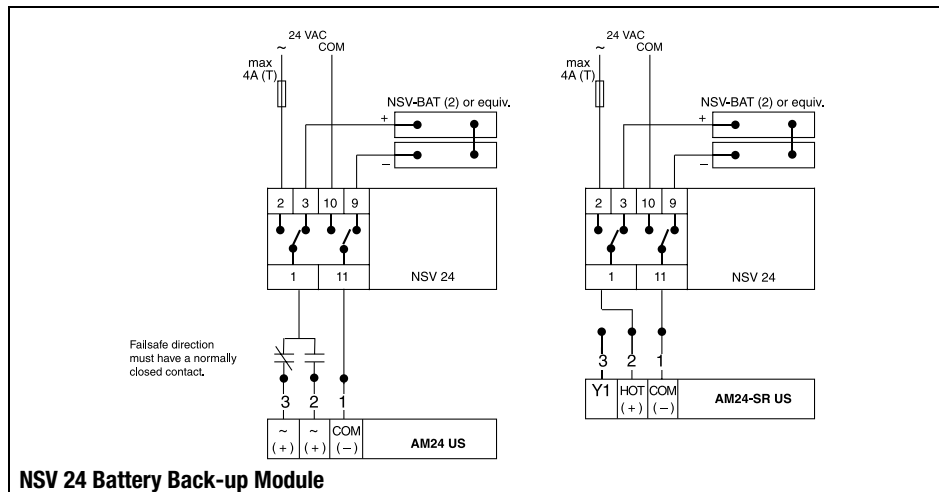


Relay pulsed signal (non-isolated circuit)

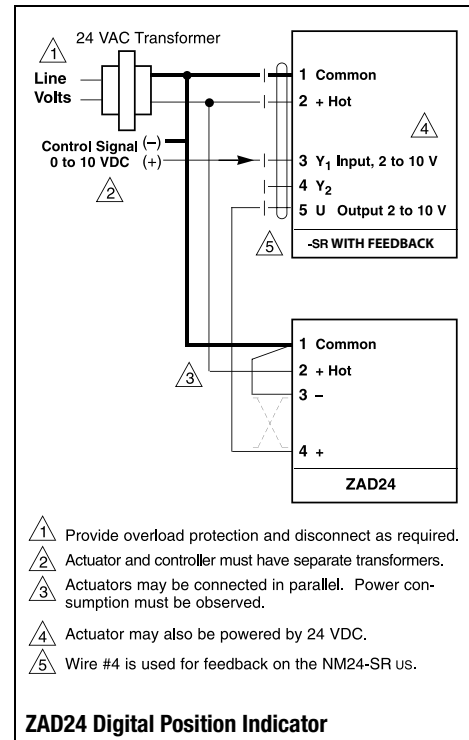


Relay pulsed signal (isolated circuit)

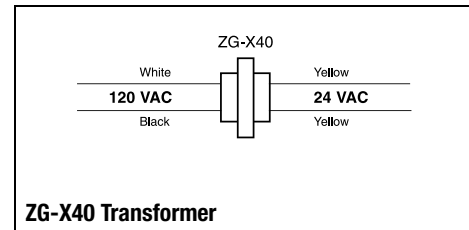
### PTA-250 Pulse Width Modulation Interface



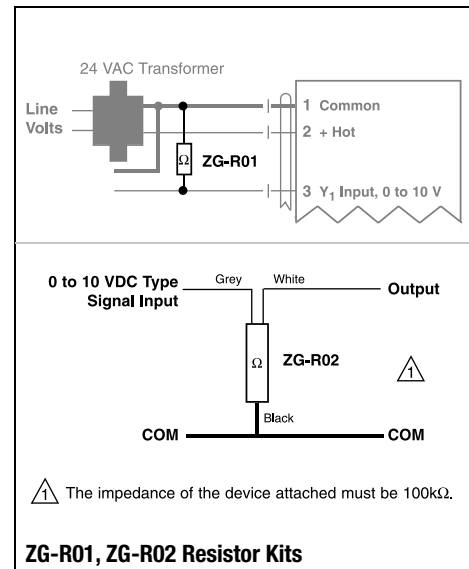
### NSV 24 Battery Back-up Module



### ZAD24 Digital Position Indicator



### ZG-X40 Transformer

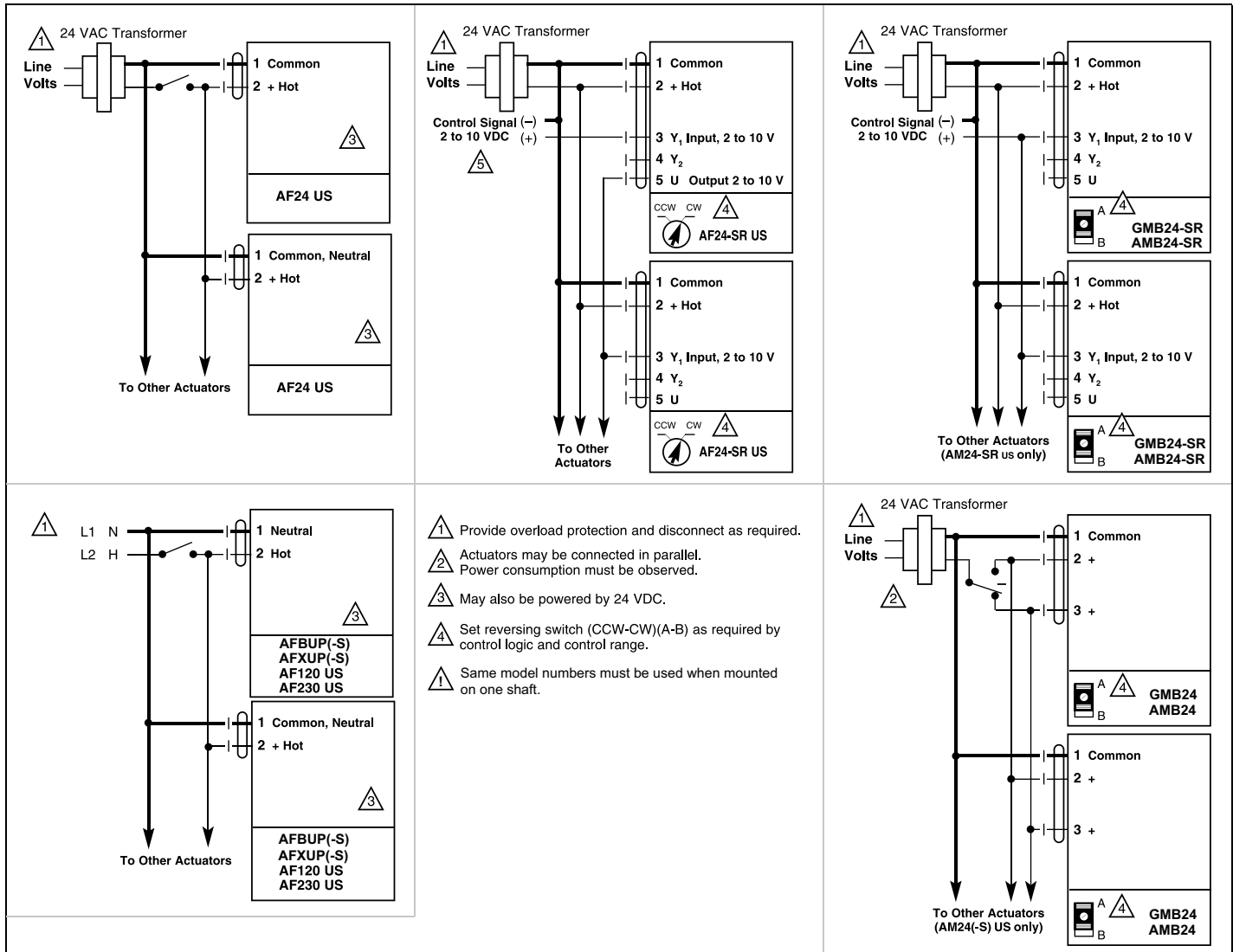


### ZG-R01, ZG-R02 Resistor Kits

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## V. APPLICATION INFORMATION

### V-A. Wiring for Multiple Actuators on One Shaft (AF/GM, for other actuators use next higher torque actuator)



#### Actuators which may be used on one shaft:

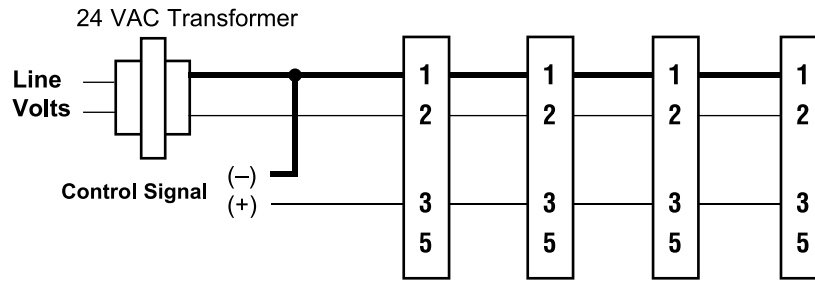
Model	Max Quantity Per Shaft
AFBUP(-S)	2*
AFXUP(-S)	2*
AFB24-MFT(-S)	3**
AFX24-MFT(-S)	3**
AF24(-S) US	4*
AF120(-S) US	4*
AF230 (-S) US	4*
AF24-SR US	4**
AF24-MFT(-S) US	4**
GMB24-MFT	2**
GMB24-3	2*
GMB24-SR	2*

\* Wired in parallel

\*\* Wired master-slave

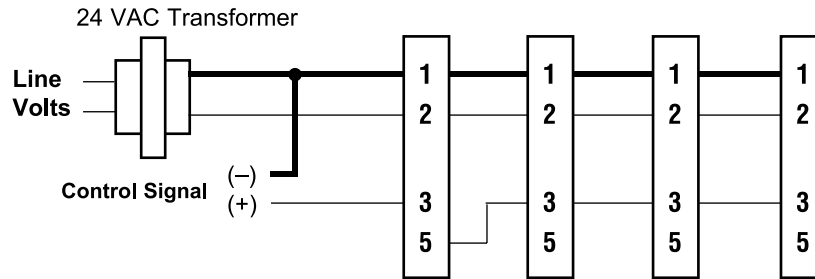
Multiple Actuators on Single Shaft Wiring Diagram

V-A. Wiring for Multiple Actuators on One Shaft (AF/GM, for other actuators use next higher torque actuator), continued



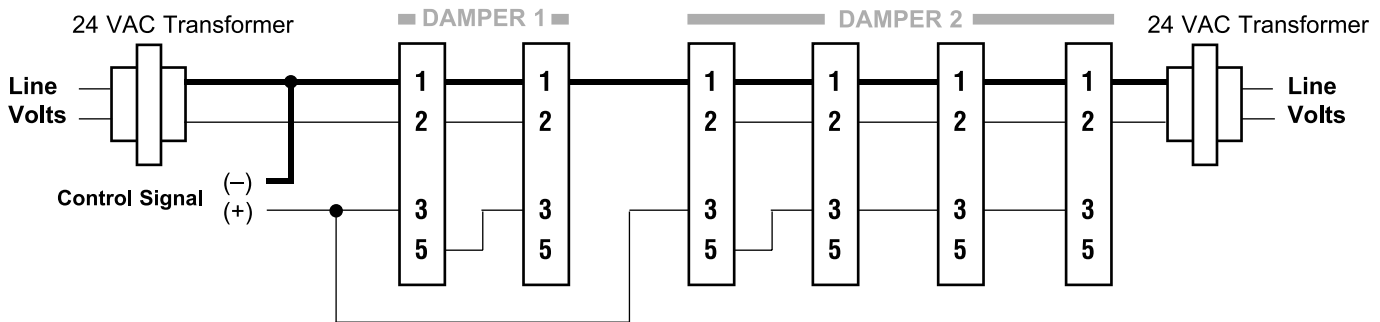
NOTE: See table on page 448 for maximum number of actuators allowed.

All actuators except AF24-SR US



NOTE: AF24-SR US must be wired in this manner when more than one actuator is mounted on a single shaft. A maximum of 4 actuators may be mounted to a single shaft.

AF24-SR US

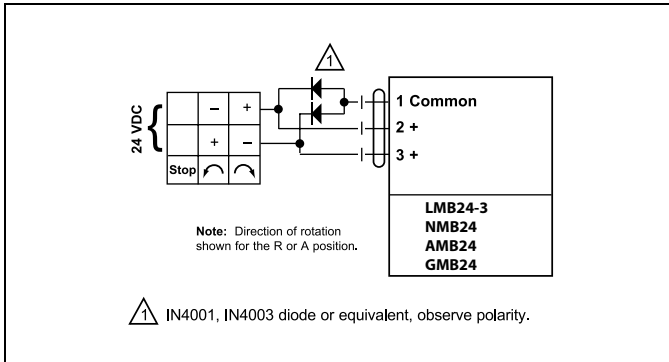


NOTE: Shown with typical 2 transformer wiring, if one transformer does not have enough capacity for 6 actuators.

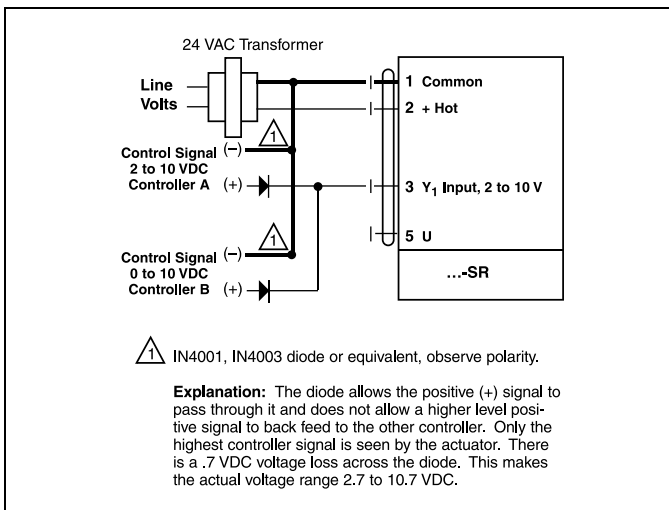
Typical wiring of multiple dampers with more than one AF24-SR US mounted on a single shaft.



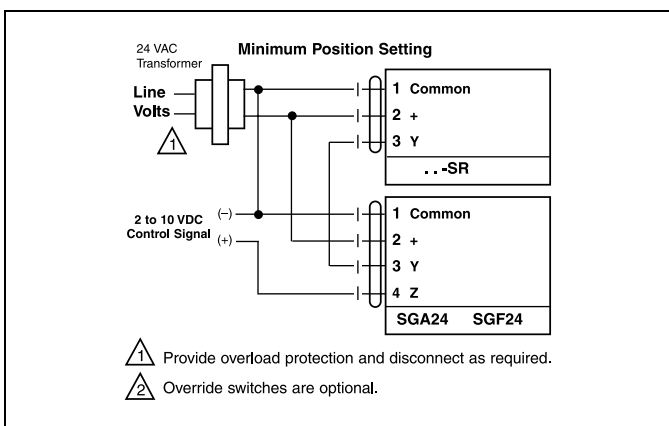
**V-E. Floating Control Using a 2-wire DC Control Signal**



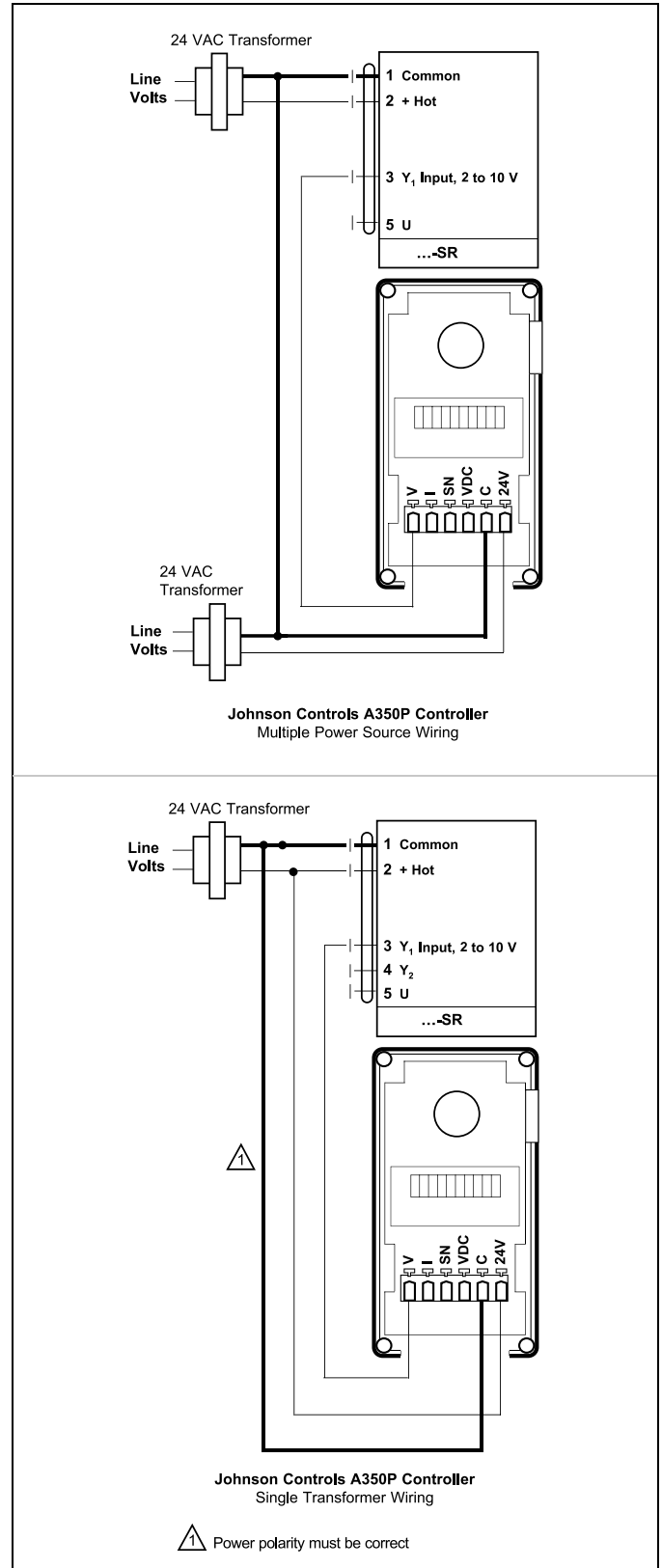
**V-F. Operating two 2 to 10 VDC Controllers with the Higher of Two Control Signals**



**V-G. Minimum Position with 2 to 10 VDC Actuators**



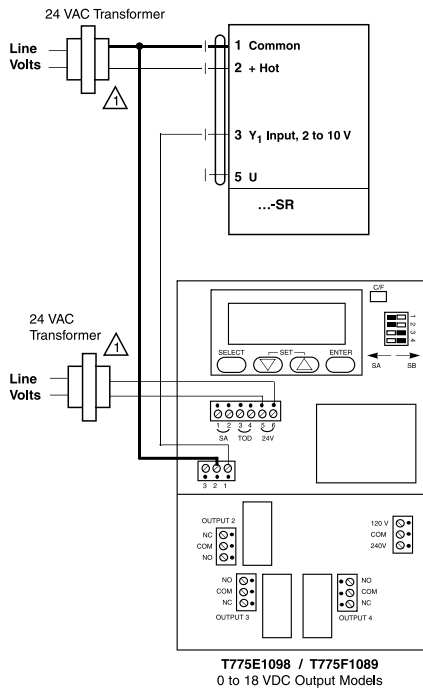
**V-H. Wiring to Johnson Controls A350P Controller**



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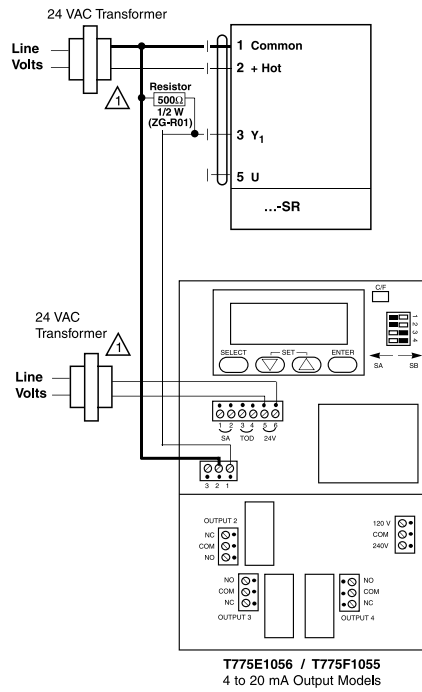
# Application Information

## V-I. Wiring to Honeywell T775 Controller

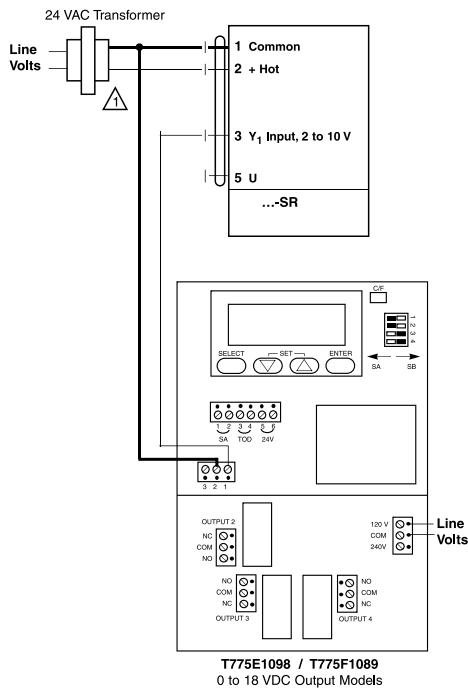


⚠ Use separate transformer for T775 if powering from 24 VAC.

**Note:** The T775 Controllers have an adjustable control range of 0 to 18 VDC. Use the T775 Calibration instructions to calibrate a 2 to 10 VDC range.

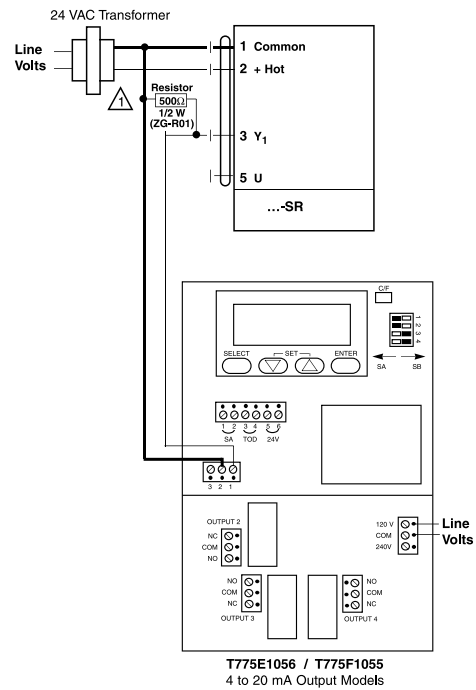


⚠ Use separate transformer for T775 if powering from 24 VAC.



⚠ Use separate transformer for T775 if powering from 24 VAC.

**Note:** The T775 Controllers have an adjustable control range of 0 to 18 VDC. Use the T775 Calibration instructions to calibrate a 2 to 10 VDC range.



⚠ Use separate transformer for T775 if powering from 24 VAC.

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## Replacement of discontinued Belimo products

When replacing an actuator, whether Belimo or other, be sure to consider the application parameters before selecting the replacement. The new product may not be the best fit for the application.

An example would be an existing SM24-SR US mounted to a valve linkage. The direct replacement of the actuator is the AMX24-MFT. However, the SM... and AM... are different lengths, the linkage would need to be replaced as well. When retrofitting or replacing actuators, it is always best to select the new product based on application parameters. This ensures the selected actuator is fit for the application. Never only use a part number cross-reference when replacing defective actuators.

### Spring Return

Discontinued	Correct Replacement	PAGE
LF24-SR-MP US	LF24-MFT-20 US	153
LF24-SR-S-MP US	LF24-MFT-S-20 US	153
NF230 US	NFBUP	109
NF230-S US	NFBUP-S	109
SF24 US	AF24 US	81
SF24-S US	AF24-S US	81
SF120 US	AF120 US	83
SF120-S US	AF120-S US	83
FM24 US	AF24 US	81
FM24-SR US	AF24-SR US	85
FM24-SR90 US	AFB24-MFT95	65
FM24-SR95 US	AFB24-MFT95	65
FS24	AF24 US	81
FS24-S	AF24-S US	81
AFR24 US	AF24 US	81
AFR24-S US	AF24-S US	81
AFR120 US	AF120 US	83
AFR120-S US	AF120-S US	83
AF24-3 US	AFX24-MFT + P-300...	61

Discontinued	Correct Replacement	PAGE
AFR24-3 US	AFX24-MFT + P-300...	61
AF24-3-S US	AFX24-MFT-S + P-300...	61
AFR24-3-S US	AFX24-MFT-S + P-300...	61
AFR24-SR US	AF24-SR US	85
AF24-SR-S US	AFX24-MFT-S + P-100...	61
AF24-SR95 US	AFB24-MFT95	65
AF24-PWM US	AFX24-MFT + P-200...	61
AF24-SR US*	AF24-PC US if phasecut is needed	91
AF24-MFT US	AFB24-MFT	61
AF24-MFT-S US	AFB24-MFT-S	61
AF24-MFT95 US	AFB24-MFT95	65
NF24 US	NFB24	105
NF24-S US	NFB24-S	105
NF24-S2 US	NFB24-S	105
NF120 US	NFBUP	109
NF120-S US	NFBUP-S	109
NF24-SR US	NFB24-SR	113
NF24-SR-S US	NFB24-SR-S	113
NF24-MFT US	NFB24-MFT	117

### Non-Spring Return

Discontinued	Correct Replacement	PAGE
LM24-SR US	LMB24-SR	325
LM24-SR.1 US	LMB24-SR.1	325
LM24-SR-2.0 US	LMB24-SR	325
LM24-SR-T US	LMB24-SR-T	327
LM24-SR-T.1 US	LMB24-SR-T.1	327
LM24-SR-T-2.0 US	LMB24-SR-T	327
LMC24-SR US	LMCB24-SR	327
LM24-MFT US	LMX24-MFT + # LM100 1C1 □ □ □	331
LM24-MFT.1 US	LMX24-MFT + # LM100 1C1 □ □ □	331
NM24 US	NMB24-3	283
NM24-1 US	NMB24-3	283
NM24 EU	NMB24-3	283
NM24-1/200 US	NMX24-3 + # NM00 1C3 000	283
NM24-1/300 US	NMX24-3 + # NM00 1C3 000	283
NM24-SR US	NMB24-SR	291
NM24-SRS US	NMX24-MFT + # NM100 1C1 A □ □	299
NM24-PWM US	NMX24-MFT + # NM100 1C1 W □ □	299
NM24-MFT US	NMX24-MFT + # NM100 1C1 □ □ □	299
NM24-MFT.1 US	NMX24-MFT + # NM100 1C1 □ □ □	299
NMQ24-MFT US	NMQ24-MFT	311
NMV24-D US	NMV-D2M US, contact Belimo for support	-
NMV24-V US	NMV-D2M US, contact Belimo for support	-

Discontinued	Correct Replacement	PAGE
AM24 US	AMB24-3	251
AM24-S US	AMB24-3-S	251
AM24-SR US	AMB24-SR	257
AM24-PWM-A US	AMX24-MFT + # AM100 1C1 W02	263
AM24-PWM-B US	AMX24-MFT + # AM100 1C1 W03	263
AM24-PWM-C US	AMX24-MFT + # AM100 1C1 W01	263
AM24-SRS-A US	AMX24-MFT + # AM100 1C1 A04	263
AM24-SRS-B US	AMX24-MFT + # AM100 1C1 A05	263
AM24-SRS-C US	AMX24-MFT + # AM100 1C1 A06	263
AM24-PC US	AMX24-PC + # AM0N0 1C1	271
AM24-MFT US	AMX24-MFT + # AM100 1C1...	263
AM24-MFT 95 US	AMX24-MFT95 + # AM0L0 1C1 R01	269
SM24 US	AMB24-3	251
SM24-S US	AMX24-MFT + # AM110 1C1 □ □ □ + S1A/S2A	263
SM24-SR US	AMB24-SR	257
SM24-SR US	AMX24-PC if phasecut is needed	271
SM24-SRS US	AMX24-MFT + # AM100 1C1 A □ □	263
SM24-SR94 US	AMX24-MFT95 + # AM0L0 1C1 R01	269
GM24 US	GMB24-3	227
GM24-SR US	GMB24-SR	233
GM24-SR US	GMX24-PC if phasecut is needed	243
GM24-MFT US	GMX24-MFT + # GM110 1C1 A □ □	237

\*For correct reorder # please call Belimo customer service at 800-543-9038.

\*Purchased before May 2003.

□ Placeholder for custom options