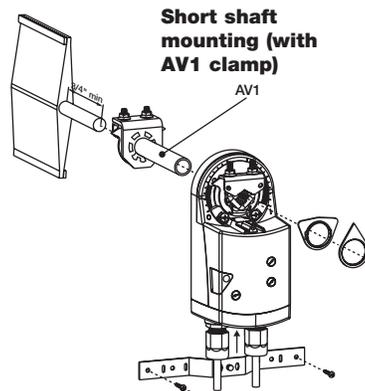
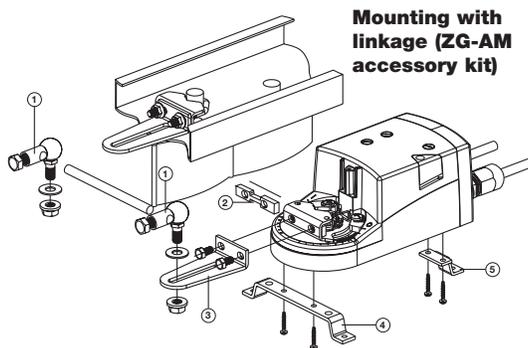
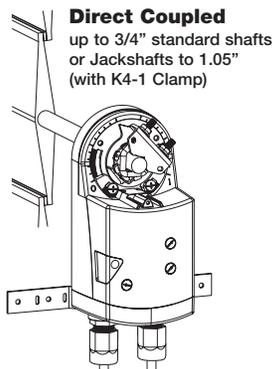


## Versatile and Powerful

- Minimum 160 in-lb torque in a compact package.  
For damper areas up to 40 sq-ft\*.

## Areas of Application



Fits Jackshafts also.



## AM Series - at a glance

	AM24 US (p. 118)	AM24-S US (p. 118)	AM24-SR US (p. 120)	AM24-PC US (p. 122)	AM24-MFT US (p. 124)	AM24-MFT95 US (p. 126)	SM24-S US (p. 128)
Torque:	●	●	●	●	●	●	133in-lb
Power supply:	●	●	●	●	●	●	●
Control signal:	●	●					On/Off
			●				
						●	
				●			
					●		
Feedback:		●		●			
					●	●	
Running time motor:			●	●			
	●	●					
					●	●	
							●
External direction of rotation switch	●	●	●	●	●	●	●
Conduit fitting	●	●	●	●	●	●	●
Appliance cable	●	●	●	●	●	●	●
Built-in auxiliary switches		●	●	●	●	●	●
UL listed, CSA certified, CE	●	●	●	●	●	●	●

Auxiliary switches and feedback potentiometer(p.129-130)

Installation instructions .....(p. 131-135)

General wiring .....(p. 133)

Start-up and checkout (p. 136)

\*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...



- 20% more torque than SM.
- Fits inside 4" damper frame.
- Full stroke overload protection.
- Electronic deadband for accuracy and stability (modulating actuators).
- Easy direct coupled mounting, including jackshafts to 1.05".
- Check damper position with clear position indicator.
- Set actuator to compensate for damper seal wear and compression (modulating actuators).
- Constant running time aids control loop tuning (modulating actuators).
- Added flexibility with built-in mechanical stops.
- Fully adjustable, built-in auxiliary switches (AM24-S US only).
- Auxiliary switch add-on mounts on clamp, includes conduit fitting (SA1 US, SA2 US).
- Push button manual override
- Easily reverse control direction with switch on housing
- 3' cable speeds installations
- Micro processor controlled Brushless DC Motor



## 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.

# AM24 (-S) US

On-off/ floating point control, non-spring return, direct coupled, 24 V



AM24 US

Torque min. 160 in-lb, for control of air dampers.

## AM24 US AM24-S US

### 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 crankarm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

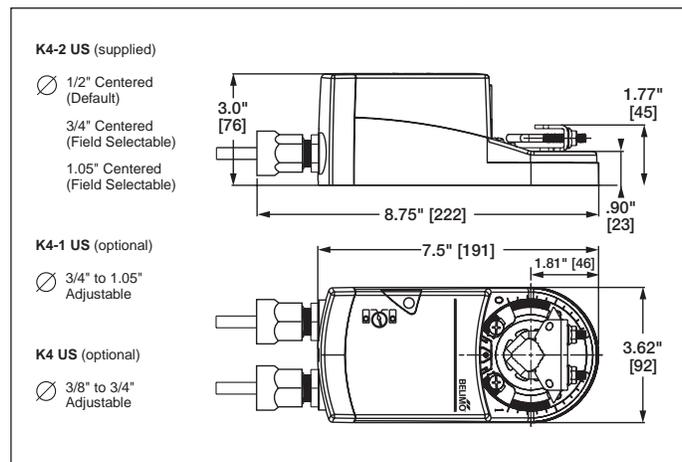
### Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The angle of rotation is mechanically limited to 95°. 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 position of the actuator is indicated by a visual pointer. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AM24-S US version is provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling. The switching function is adjustable between 0 and 95°.

Technical Data	AM24 US, AM24-S US
Power supply	24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	running: 2.5 W; holding: 1.2W
Transformer sizing	4.5 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
Angle of rotation	0 to 95°, adjust with mechanical stops
Torque	min 160 in-lb [18 Nm]
Direction of rotation	reversible with switch CW/CCW
Position indication	clip-on indicator
Running time	110 to 150 sec. for 0 to 160 in-lb
Manual override	external push button
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 type	NEMA 2 (IP54 with cable entry down)
Housing material rating	UL94-5V (flammability rating)
Noise level	less than 45 dB (A)
Servicing	maintenance free
Agency listings	UL 873 listed, CSA C22.2 No.24 certified, CE
Quality standard	ISO 9001
Weight	2.8 lbs [1.3 kg]
<b>AM24-S US</b>	
Auxiliary switches	adj. 0° to 95°, 2 x SPDT 3A (0.5A) @24 VAC

### Dimensions [All numbers in brackets are in millimeters.]



### Accessories

AV 1	Damper shaft extension for AM
AV10-18	Universal shaft extension
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Clamp for 3/4" to 1.05" jackshafts
K4-H	Hex shaft clamp, for 3/8"-5/8" shafts
KH-AM	Crankarm
SA1 US, SA2 US	Auxiliary switches
PA... US	140 Ω, 500 Ω, 1000 Ω, 2800 Ω feedback potentiometers
Tool-06	8mm and 10 mm wrench
ZA-AM US	SM to AM retrofit bracket
ZG-AM US	Crank arm adaptor kit
ZG-100	Mounting bracket
ZG-101	Mounting bracket
ZG-103	Mounting bracket
ZG-104	Mounting bracket
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

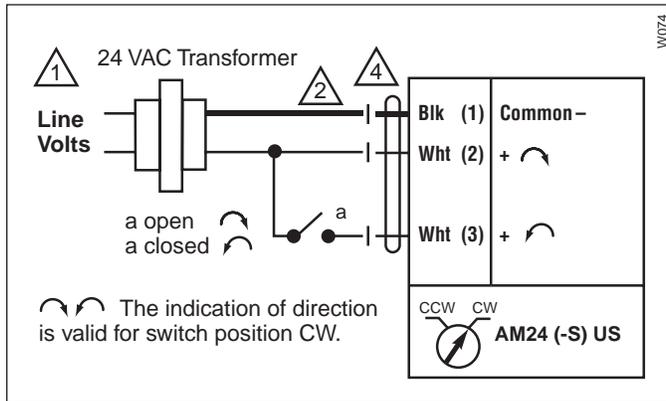
### AM24 (-S) US - Typical Specification:

Control damper actuators shall be electronic 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. Actuators shall be UL and CSA listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall have reversing switch and manual override on the cover, and be protected from overload at all angles of rotation. If required, two adjustable SPDT auxiliary switches shall be provided (AM24-S US). Actuators shall be as manufactured by Belimo.

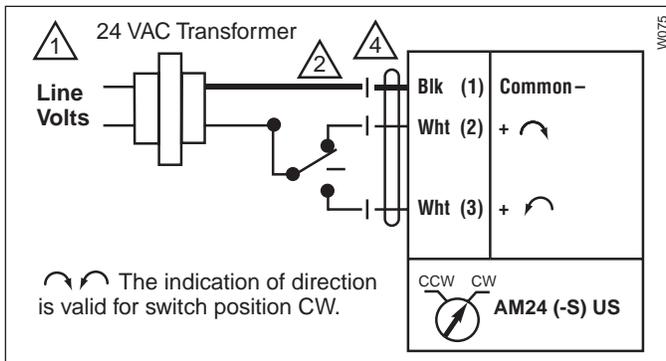
**NOTE:** When using AM24(-S) US actuators, use only the accessories listed on this page.

AM

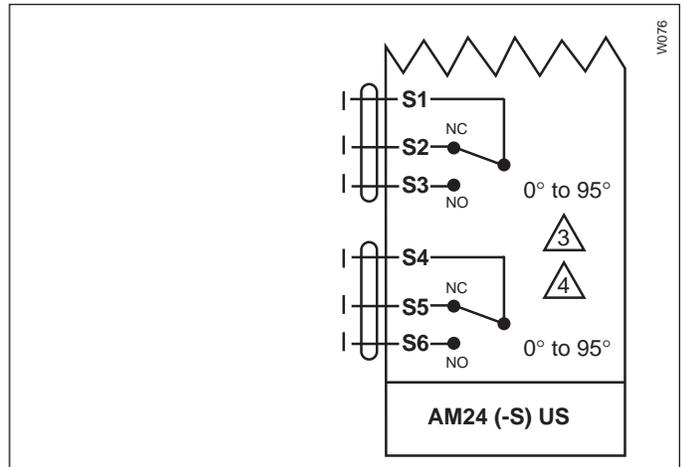
### Wiring diagrams



**On-off control**



**Floating point or on-off control**



**Auxiliary switch wiring for AM24-S US**

### Notes

- 1 Provide overload protection and disconnect as required.
- 2 Actuators may also be powered by 24 VDC.
- 3 For end position indication, interlock control, fan startup, etc., AM24-S us incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @24 VAC, UL listed, adjustable between 0° and 95°.
- 4 Meets UL and CSA requirements without the need of an electrical ground connection.

# AM24-SR US



Proportional damper actuator, non-spring return, direct coupled,  
24 V, for 2 to 10 VDC and 4 to 20 mA control signal



AM24-SR US

Technical Data	AM24-SR US
Power supply	24 VAC, $\pm 20\%$ , 50/60 Hz 24 VDC, $\pm 10\%$
Power consumption	running: 2.5 W; holding: 1.2 W
Transformer sizing	5 VA (Class 2 power source)
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100k $\Omega$ (0.1 mA), 500 $\Omega$ for 4 to 20mA
Feedback output 'U'	2 to 10 VDC, 0.5 mA max
Electrical connection	3 ft, 18 GA, appliance cable, 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Torque	min 160 in-lb (18 Nm)
Direction of rotation	reversible with switch CW/CCW CW with a decrease in voltage CCW with a decrease in voltage
Position indication	clip on indicator
Manual override	external push button
Angle of rotation	0 to 95°, adjust with mechanical stops
Running time	150 secs. constant, independent of load
Run time stability	$\pm 5\%$
Humidity	5 to 95% RH, non-condensing
Operating temperature	-22 to +122° F (-30 to +50° C)
Storage temperature	-40 to +176° F (-40 to +80° C)
Housing	NEMA 2 (IP54 with cable entry down)
Housing material	UL 94-5V (flammability rating)
Noise level	less than 45 dB (A)
Agency listings	UL 873 listed, CSA C22.2 No.24 certified, CE
Quality standard	ISO 9001
Servicing	maintenance free
Weight	2.8 lbs. (1.3kg.)

Torque min. 160 in-lb, for control of air dampers.

## Application

For proportional modulation of dampers in HVAC systems. Actual 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 crankarm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

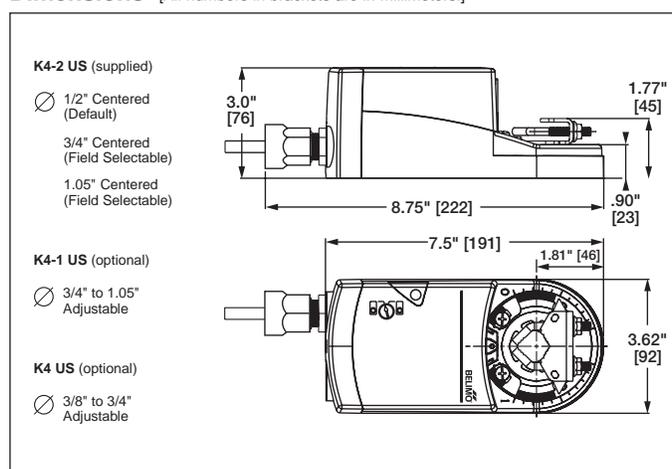
## Operation

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.

The actuator has a constant running time of 150 seconds. A functional test of the actuator-damper assembly may be done by pressing in the manual override button, this will activate the actuators test mode and cycle the actuator fully closed and back to control point. The microprocessor will correct for compression of tight close-off gaskets with age, providing the actuator is not on its mechanical stops.

A 2 to 10 VDC feedback (U) is provided with full 8 volt output range proportional to the operational rotation of the damper. A digital rotation sensing circuit protects the actuator in a stall anywhere in its 95° operating range without the need of limit switches. Add on auxiliary switches are easily fastened directly onto the actuator body for signalling and switching functions.

## Dimensions [All numbers in brackets are in millimeters.]



G20492-IG-Subject to change. © Belimo Aircontrols (USA), Inc.

Proportional damper actuator, non-spring return, direct coupled, 24 V, for 2 to 10 VDC and 4 to 20 mA control signal

### Accessories

AV 1	Damper shaft extension for AM
AV10-18	Universal shaft extension
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Clamp for 3/4" to 1.05" jackshafts
K4-H	Hex shaft clamp, for 3/8"-5/8" shafts
KH-AM	Crankarm
SA1 US, SA2 US	Auxiliary switches
PA... US	140 Ω, 500 Ω, 1000 Ω, 2800 Ω feedback potentiometers
PTA-250	Pulse width modulation interface
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	500Ω resistor for 4 to 20 mA control signal
ZA-AM US	SM to AM retrofit bracket
ZG-AM US	Crank arm adaptor kit
ZG-100	Mounting bracket
ZG-101	Mounting bracket
ZG-103	Mounting bracket
ZG-104	Mounting bracket
ZS-100	Weather shield
ZS-150	Weather shield
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

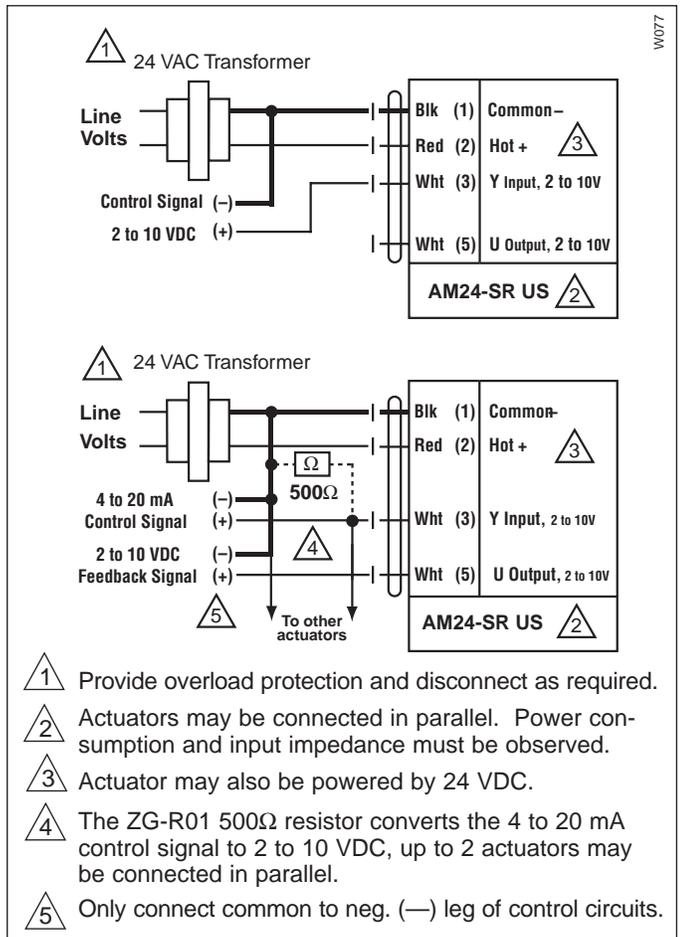
### AM24-SR US - Typical Specification:

Control damper actuators shall be electronic 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. Actuators shall be UL and CSA listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. 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. Actuators shall have reversing switch and gear disengagement button on the cover, and be electronically protected from overload at all angles of rotation. Actuators shall respond to 2 to 10VDC output relative to position regardless of the amount of damper rotation. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication or master-slave applications. Actuators shall be as manufactured by Belimo.

**NOTE:** When using AM24-SR US actuators, use only the accessories listed on this page.

AM

### Wiring diagrams



# AM24-PC US



Proportional damper actuator, non-spring return, direct coupled,  
24 V, for 0 to 20 V phasecut control signal



AM24-PC US

Technical Data	AM24-PC US
Power supply	24 VAC, ± 20%, 50/60 Hz 24 VDC, ±10%
Power consumption	running: 2.5 W; holding: 1.2 W
Transformer sizing	5 VA (Class 2 power source)
Operating range Y	0 to 10 V, phasecut
Input impedance	8kΩ (50 mW)
Feedback output 'U'	2 to 10 VDC, 0.5 mA max
Electrical connection	3 ft, 18 GA, appliance cable, 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Torque	min 160 in-lb (18 Nm)
Direction of rotation	reversible with switch CW/CCW CW with a decrease in voltage CCW with a decrease in voltage
Position indication	clip on indicator
Manual override	external push button
Angle of rotation	0 to 95°, adjust with mechanical stops
Running time	150 secs. constant, independent of load
Run time stability	± 5%
Humidity	5 to 95% RH, non-condensing
Operating temperature	-22 to +122° F (-30 to +50° C)
Storage temperature	-40 to +176° F (-40 to +80° C)
Housing	NEMA 2 (IP54 with cable entry down)
Housing material	UL 94-5V (flammability rating)
Noise level	less than 45 dB (A)
Agency listings	UL 873 listed, CSA C22.2 No.24 certified, CE
Quality standard	ISO 9001
Servicing	maintenance free
Weight	2.8 lbs. (1.3kg.)

Torque min. 160 in-lb, for control of air dampers.

## Application

For proportional modulation of dampers in HVAC systems. Actual 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 crankarm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

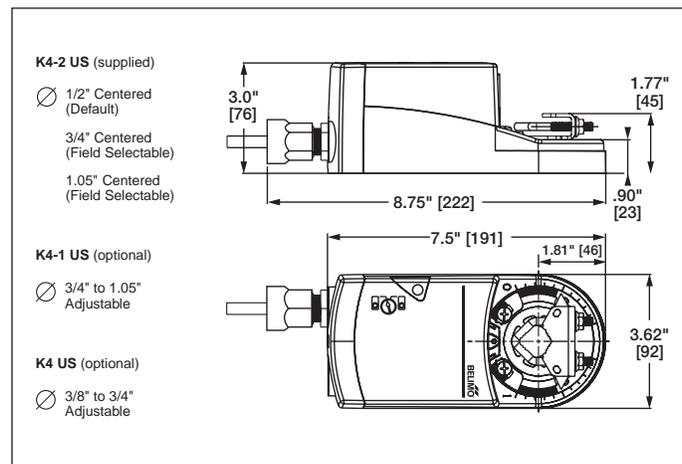
## Operation

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

The actuator has a constant running time of 150 seconds. A functional test of the actuator-damper assembly may be done by pressing in the manual override button, this will activate the actuators test mode and cycle the actuator fully closed and back to control point. The microprocessor will correct for compression of tight close-off gaskets with age, providing the actuator is not on its mechanical stops.

A 2 to 10 VDC feedback (U) is provided with full 8 volt output range proportional to the operational rotation of the damper. A digital rotation sensing circuit protects the actuator in a stall anywhere in its 95° operating range without the need of limit switches. Add on auxiliary switches are easily fastened directly onto the actuator body for signalling and switching functions.

## Dimensions [All numbers in brackets are in millimeters.]



Proportional damper actuator, non-spring return, direct coupled, 24 V, for 0 to 20 V phasecut control signal

### Accessories

AV 1	Damper shaft extension for AM
AV10-18	Universal shaft extension
K4 US	Universal clamp for 3/8" to 3/4" shafts
K4-1 US	Clamp for 3/4" to 1.05" jackshafts
K4-H	Hex shaft clamp, for 3/8"-5/8" shafts
KH-AM	Crankarm
SA1 US, SA2 US	Auxiliary switches
PA... US	140 Ω, 500 Ω, 1000 Ω, 2800 Ω feedback potentiometers
PTA-250	Pulse width modulation interface
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	500Ω resistor for 4 to 20 mA control signal
ZA-AM US	SM to AM retrofit bracket
ZG-AM US	Crank arm adaptor kit
ZG-100	Mounting bracket
ZG-101	Mounting bracket
ZG-103	Mounting bracket
ZG-104	Mounting bracket
ZS-100	Weather shield
ZS-150	Weather shield
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

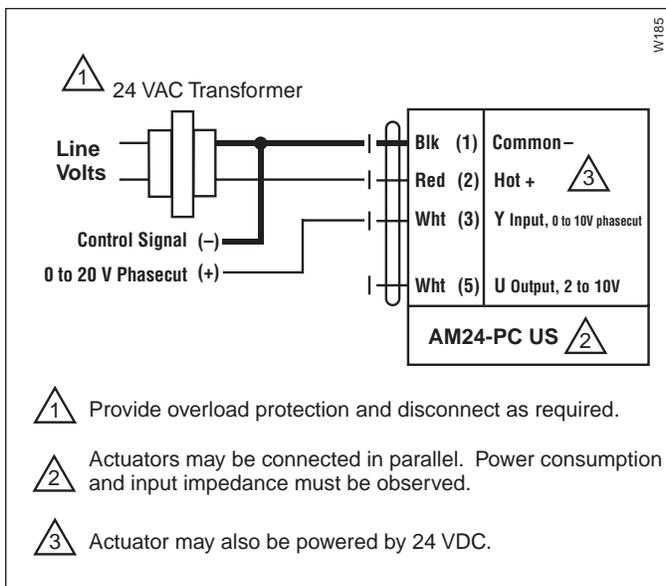
### AM24-PC US - Typical Specification:

Control damper actuators shall be electronic 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. Actuators shall be UL and CSA listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. The actuator must provide proportional damper control in response to a 0 to 10 V phasecut input from an electronic controller or positioner. Actuators shall have reversing switch and gear disengagement button on the cover, and be electronically protected from overload at all angles of rotation. Actuators shall respond to 2 to 10VDC output relative to position regardless of the amount of damper rotation. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication or master-slave applications. Actuators shall be as manufactured by Belimo.

**NOTE:** When using AM24-PC US actuators, use only the accessories listed on this page.

AM

### Wiring diagrams



# AM24-MFT US

Proportional damper actuator, non-spring return, Multi-Function Technology®



- Torque min. 160 in-lb
- Control 2 to 10 VDC (DEFAULT)
- Feedback 2 to 10 VDC (DEFAULT)

### Application

For proportional modulation of dampers in HVAC systems. The AM24-MFT US is a non-spring return type actuator. When supply power is removed the actuator will maintain its last position.

### Default/Configuration

The default parameters for 2 to 10 VDC applications of the AM24-MFT US actuator are assigned during manufacturing. If necessary, custom versions of the actuators 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-Handy® or the MFT-Actuate™ PC software application.

### Operation

The AM24-MFT US actuator provides 95° of rotation and is provided with a position indicator. The actuator will synchronize it's mechanical stop or the damper or valves mechanical stop and use this point for its zero position during normal control operations.

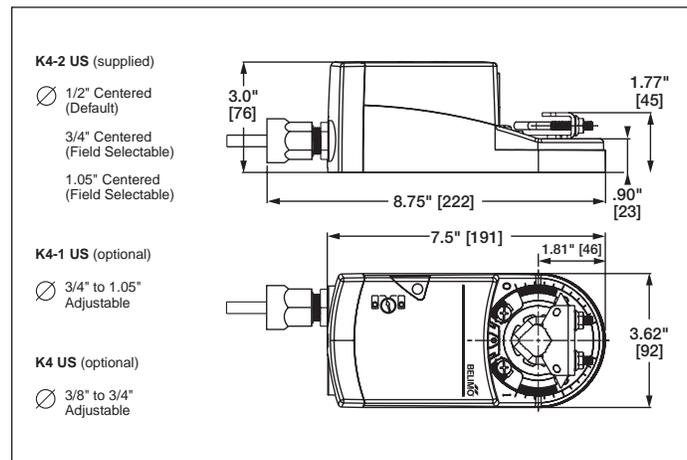
The actuator uses a brushless DC motor which is controlled by an Application Specific Integrated Circuit (ASIC) and a microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and to know the actuator's exact position. The ASIC monitors and controls 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 AM24-MFT US is mounted directly to control shafts up to 1.05" diameter by means of its universal clamp and anti-rotation bracket. A crankarm and several mounting brackets are available for damper applications where the actuator cannot be direct coupled to the damper shaft. The actuator provides constant torque to the application with and without power applied to the actuator. The AM24-MFT US actuator is shipped in a Mid position, compression against seats or gaskets for tight shut-off is accomplished manually.

Technical Data	AM24-MFT US
Power supply	24 VAC, ± 20%, 50/60 Hz 24 VDC, ±10%
Power consumption	running: 2.5 W; holding: 1.2 W
Transformer sizing	5 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 (w/500 Ω, 1/4 W resistor) ZG-R01
Input impedance	100kΩ for 2 to 10 VDC (0.1 mA) 500Ω for 4 to 20 mA 1500Ω for PWM, Floating point and On-Off control
Feedback output U*	2 to 10 VDC, 0.5 mA max
Torque*	min 160 in-lb (18 Nm)
Direction of rotation*	reversible with switch CW/CCW CW=CCW with decrease in signal CCW=CCW with a decrease in signal
Angle of rotation*	0 to 95°, adjust with mechanical stops
Running time*	150 seconds constant
Angle of Rotation Adaptation*	Off (Default)
Override control*	Min. (Min Position) = 0% ZS (Mid. Position) = 50% Max. (Max. Position) = 100%
Manual override	Manual push button
Position indication	clip on indicator
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 (with cable entry down)
Housing material	UL 94-5V (flammability rating)
Noise level	less than 45 dB (A)
Agency listings	UL 873 listed, CE, CSA C22.2 No. 24 certified
Quality standard	ISO 9001
Servicing	maintenance free
Weight	2.8 lbs. (1.3kg.)

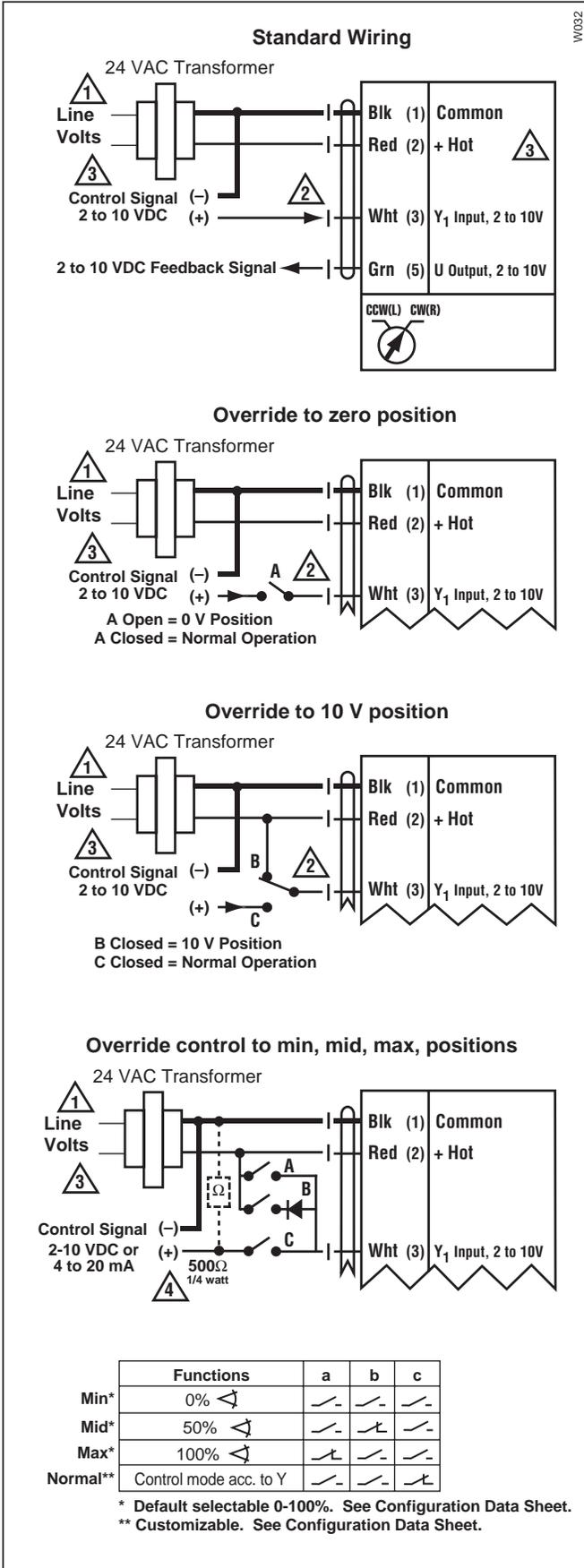
\* Variable when configured with MFT options

### Dimensions [All numbers in brackets are in millimeters.]

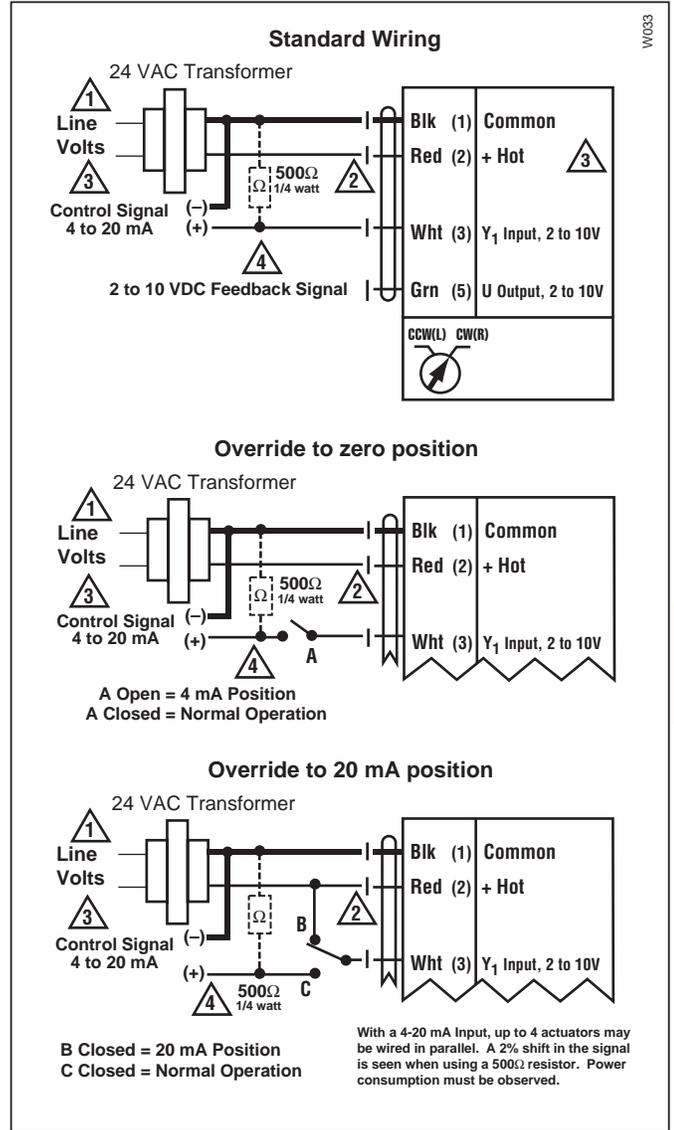


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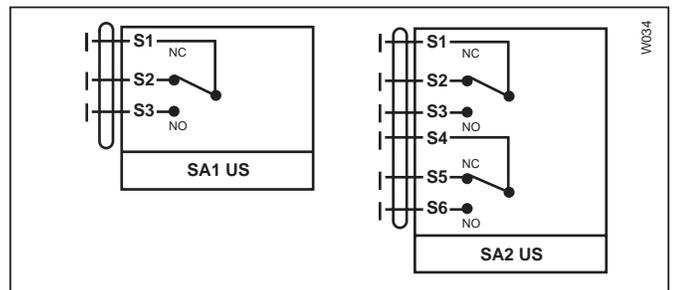


W0032



W0033

**4 to 20 mA Control Signal**



W0034

**Auxiliary Switches for AM24-MFT US**

**Notes**

- 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 Actuator may also be powered by 24 VDC.
- 4 ZG-R01 may be used.

# AM24-MFT95 US



Proportional damper actuator, non-spring return, 24 V for use with Honeywell® electronic Series 90, or a 0 to 135Ω input



- Torque min. 160 in-lb
- Control 0 to 135Ω
- Feedback 2 to 10 VDC (DEFAULT)

### Application

For proportional modulation of dampers in HVAC systems. The AM24-MFT95 US is a non-spring return type actuator. When supply power is removed the actuator will maintain its last position.

### Default/Configuration

The default parameters for 0 to 135Ω input applications of the AM24-MFT95 US actuator are assigned during manufacturing. If necessary, custom versions of the actuators can be ordered. However the control input cannot be modified via MFT-Handy tool or PC-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-Handy® or the MFT-Actuate™ PC software application.

### Operation

The AM24-MFT95 US actuator provides 95° of rotation and is provided with a position indicator. The actuator will synchronize its mechanical stop or the damper or valves mechanical stop and use this point for its zero position during normal control operations.

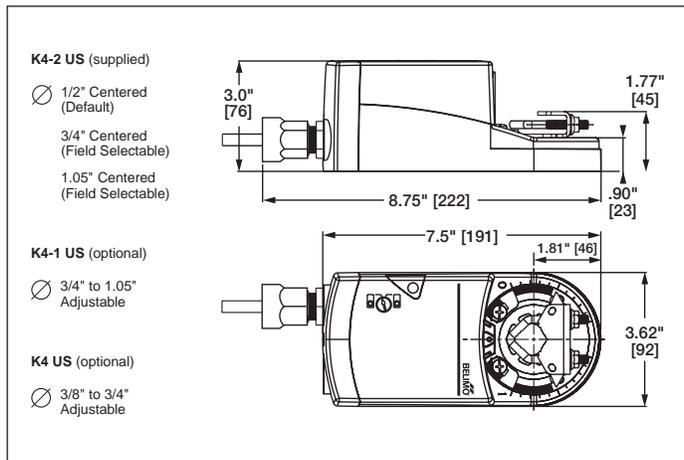
The actuator uses a brushless DC motor which is controlled by an Application Specific Integrated Circuit (ASIC) and a micro-processor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and to know the actuator's exact position. The ASIC monitors and controls 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 AM24-MFT95 US is mounted directly to control shafts up to 1.05" diameter by means of its universal clamp and anti-rotation bracket. A crankarm and several mounting brackets are available for damper applications where the actuator cannot be direct coupled to the damper shaft. The actuator provides constant torque to the application with and without power applied to the actuator. The AM24-MFT95 US actuator is shipped in a Mid position, compression against seats or gaskets for tight shut-off is accomplished manually.

Technical Data	AM24-MFT95 US
Power supply	24 VAC, ± 20%, 50/60 Hz 24 VDC, ±10%
Power consumption	2.5 W running; 1.2 W holding
Transformer sizing	5 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 WRB (Not selectable via MFT)	0 to 135Ω Honeywell electronic series 90, or a 0 to 135 Ω input
Feedback output U*	2 to 10 VDC, 0.5 mA max
Torque*	min 160 in-lb (18 Nm)
Direction of rotation*	reversible with switch CW/CCW CW=CCW with decrease in signal CCW=CCW with a decrease in signal
Angle of rotation*	0 to 95°, adjust with mechanical stops
Running time*	150 seconds constant
Angle of Rotation Adaptation*	Off (Default)
Override control*	Min. (Min Position) = 0% ZS (Mid. Position) = 50% Max. (Max. Position) = 100%
Manual override	Manual push button
Position indication	clip on indicator
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 (with cable entry down)
Housing material	UL 94-5V (flammability rating)
Noise level	less than 45 dB (A)
Agency listings	UL 873 listed, CE, CSA C22.2 No. 24 certified
Quality standard	ISO 9001
Servicing	maintenance free
Weight	2.8 lbs. (1.3kg.)

\* Variable when configured with MFT options

### Dimensions [All numbers in brackets are in millimeters.]

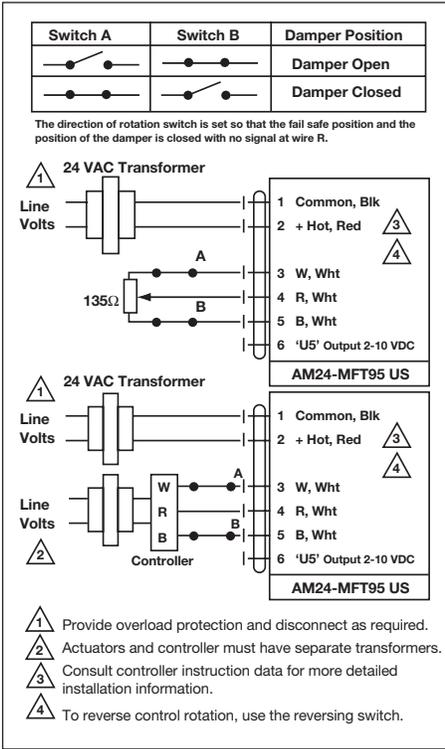


G20492-IG-Subject to change. © Belimo Aircontrols (USA), Inc.

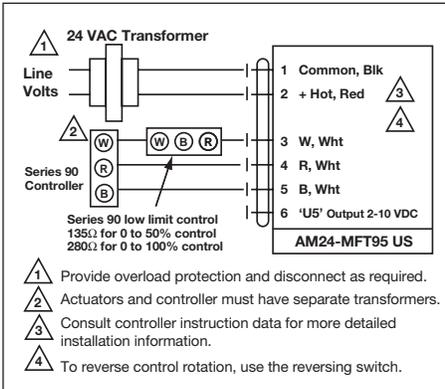
D007

Proportional damper actuator, non-spring return, 24 V for use with Honeywell® electronic Series 90, or a 0 to 135Ω input

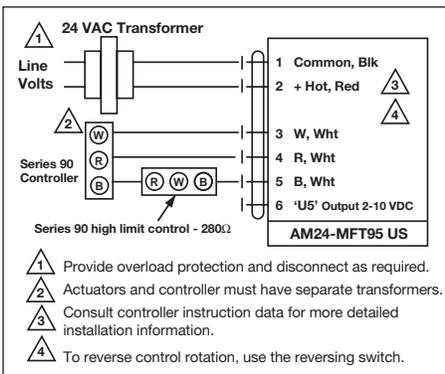
## Proportional Potentiometric Control



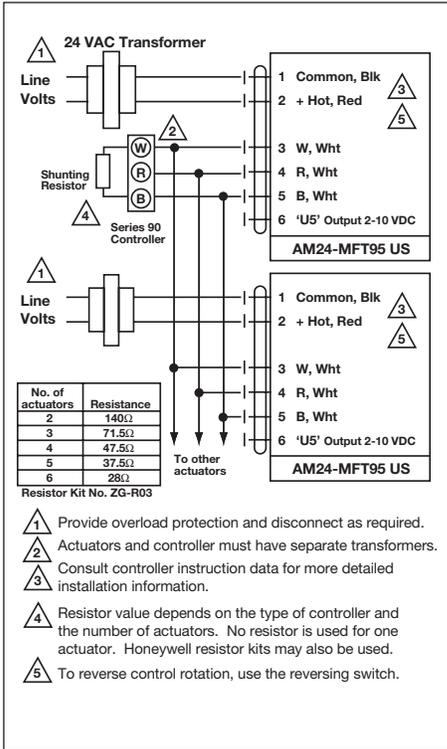
## Override of AM24-MFT95 US



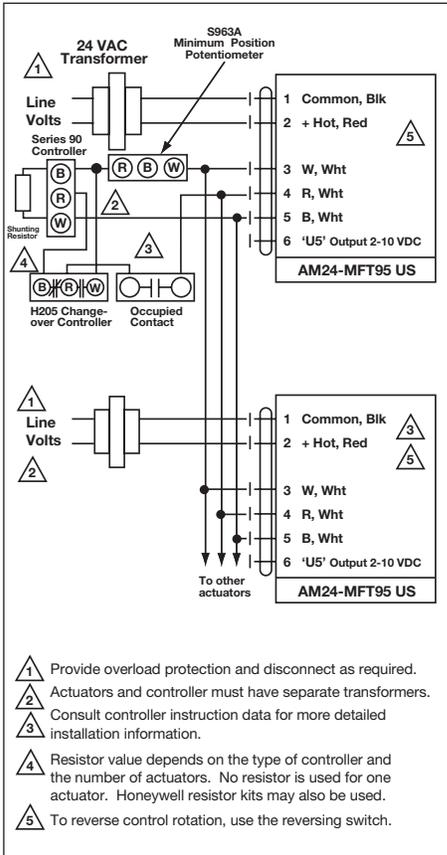
## AM24-MFT95 US used with a Series 90 controller and a Series 90 low limit control



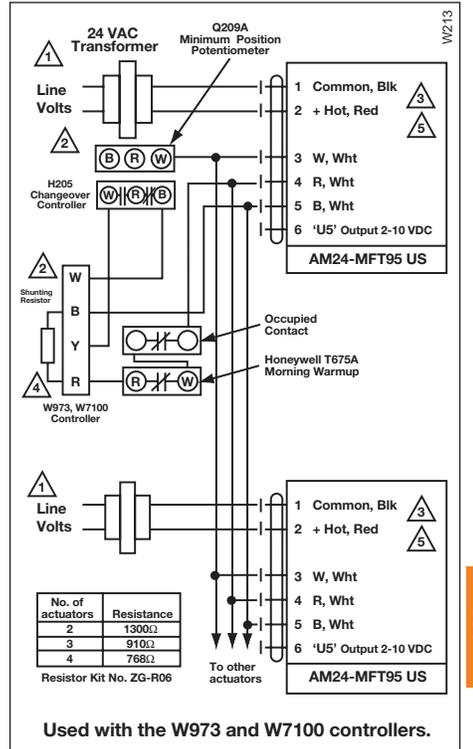
## AM24-MFT95 US used with a Series 90 controller and a Series 90 high limit control



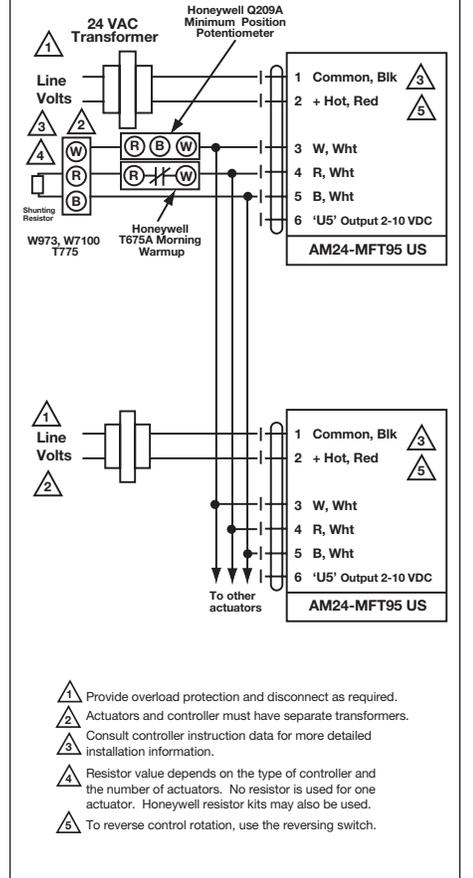
## Wiring multiple actuators to a Series 90 controller.



## Wiring multiple actuators to a Series 90 controller using a minimum position potentiometer.



Used with the W973 and W7100 controllers.



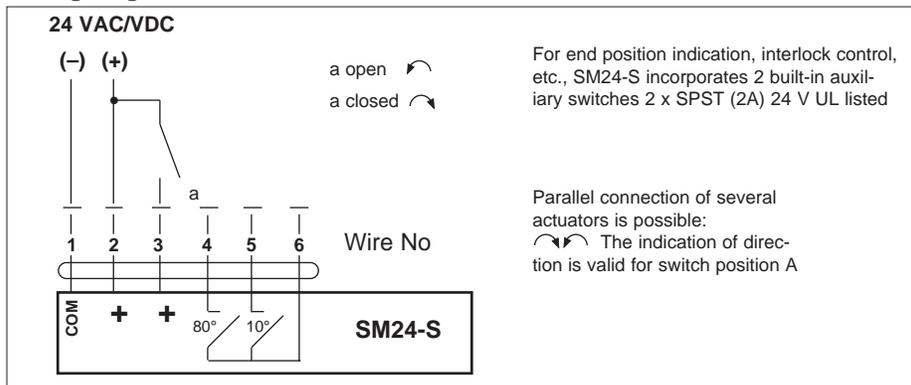
## Typical wiring diagrams for multiple actuators used with the W973, W7100 and T775 controllers.

# SM24-S US

On-off, non-spring return, direct coupled, fast running, 24 V with built-in auxiliary switches



## Wiring diagram



Technical Data	SM24 -S
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption AC	Stand-by 1.2 W Full Load 9.5 W
Transformer sizing	12 VA
Electrical connection	3 ft, 18 GA cable 1/2" conduit connector
Angle of rotation	mechanically limited to 95°
Torque at rated voltage	133 in-lb [15 Nm]
Direction of rotation	reversible with switch A / B
Position indication	0 . . . 10 and reversible indicator
Running time	Load Free approx. 16 seconds Full Load approx. 19 seconds
Auxiliary switch Open/Closed	2 SPST 2A, 24 V
Humidity	5 to 95% RH non-condensing
Housing type	NEMA type 2
Housing material rating	UL 94V-0 (flammability rating)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Noise level	45 dB (A)
Servicing	maintenance free
Service life	minimum 10,000 operations
Weight	3.3 lbs. [1.5 kg]

**Torque min. 133 in-lb, for control of damper surface up to 35 ft².**

## Application

For on-off, fast-acting, control of dampers up to approximately 35 ft² [3 m²] (based on 4 in-lb per sq. ft.). Actual actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is on-off, two position, from an auxiliary contactor or a manual switch. The direction of rotation is reversible by the use of a switch located on the actuator cover.

## Operation

The actuator is, by means of a special clamp, directly mounted onto the damper shaft.

The universal mounting bracket supplied with the actuator will prevent lateral movement of the actuator. The damper actuator is not provided with and does not require any limiting switches, but is protected against overloading.

The angle of rotation is mechanically limited to 95°. When reaching the damper or actuator end position, the motor stops automatically.

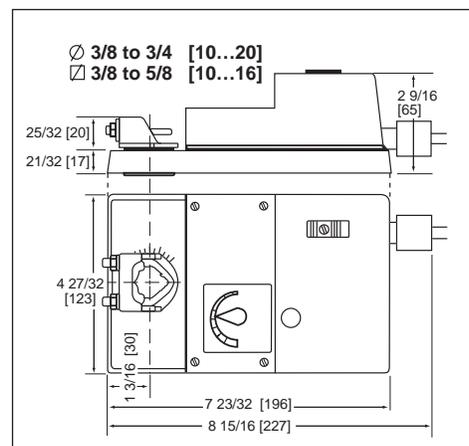
The gears can be manually disengaged by simply pressing down the spring loaded button on the actuator cover. When the button is pressed down, the damper blades can be adjusted by hand. The position of the actuator is indicated by means of a scale reading 0 . . . 10.

For end position indication, interlock control, etc., two built-in, non-adjustable auxiliary switches are provided with the actuator.

## Accessories

- ZG-SM2 Crank arm adaptor kit
- ZDB Angle of rotation limiter
- ZG-100 Universal mounting bracket
- ZG-101 Universal mounting bracket
- ZG-102 Multiple actuator mounting bracket
- ZG-H2 Actuator operator handle
- ZS-100 Weather shield, metal
- ZG-150 Weather shield, polycarbonate

## Dimensions [All numbers in brackets are in millimeters.]



G20492-IG-Subject to change. © Belimo Aircontrols (USA), Inc.

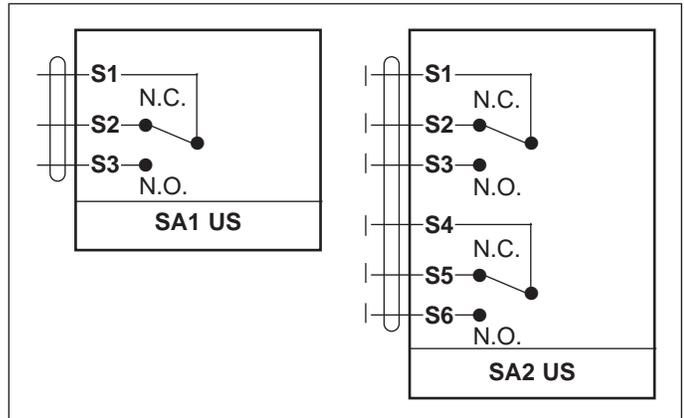


Technical Data	SA1 US	SA2 US
No. of switches	1xSPDT	2xSPDT
Switching capacity	6 A (2.5A) 250 VAC	
Switching point	adjustable over full actuator rotation 0 to 1. Pre-setting with scale possible.	
Electrical connection	3 ft, 18 GA appliance cable 1/2" conduit connector	
Humidity	5 to 95% RH non-condensing	
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 type	NEMA type 2	
Housing material rating	UL 94-5VA (flammability rating)	
Agency listings	UL 873 listed, CSA C22.2 No.24 certified, CE	
Weight	8 oz [225 g]	9.3 oz [265 g]
Electrical protection	auxiliary switches are double insulated	

## Operation

The SA1 US and SA2 US 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. They are modular units that mount directly onto the AM type actuators and held in place with a prefitted screw. A driver disk is attached to the actuator clamp and offers direct transmission of the actuator position to the microswitch operating cams. The switching points can be set over the full scale of 0 to 1 simply by adjusting the slotted discs.

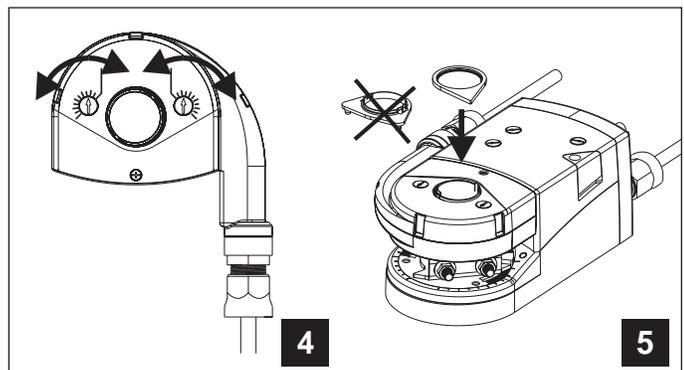
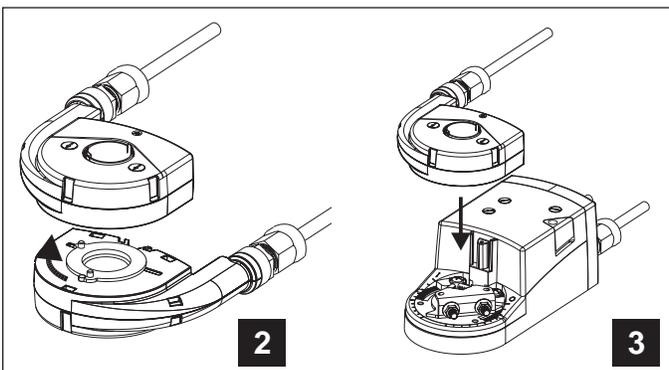
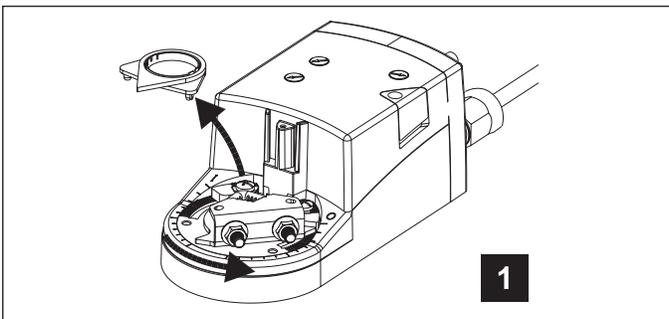
## Wiring Diagrams



Voltage	Resistive	Inductive
120	6.0 A	5.0 A
250	6.0 A	2.5 A

## Mounting Instructions

1. Remove pointer assembly from the actuator. Press down the manual override button and rotate the actuator fully counter-clockwise.
2. Invert SA... US switch and turn the driver disk fully clockwise as indicated.
3. Slide SA... US switch onto actuator and check for the correct mating of the driver disk to the universal clamp. Secure with screw.
4. Adjust switch dials as necessary
5. Remount the white plastic pointer only onto SA... US switch.

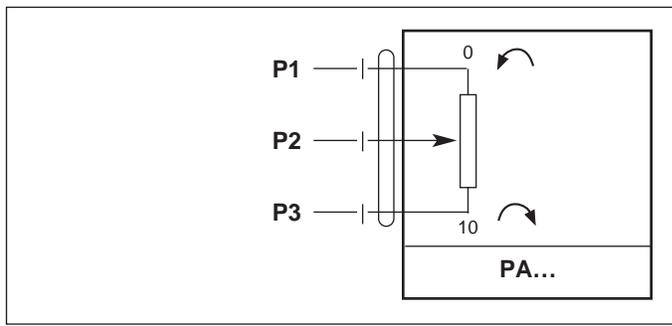


# Feedback Potentiometer PA...US

For the direct coupled actuator AM2...



## Wiring diagram



## Types

PA500 US	Feedback potentiometer	500Ω
PA1000 US	Feedback potentiometer	1000Ω
PA2800 US	Feedback potentiometer	2800Ω

## Technical Data PA... US

Resistance values	as above
Output	1W
Tolerance	± 5%
Linearity	± 2%
Resolution	min. 1%
Residual resistance	max. 5% on both sides
Electrical connection	3 ft, 18 GA appliance cable 1/2" 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 type 2
Housing rating	UL94-5V (flammability rating)
Servicing	maintenance free
Agency listings	UL 873 listed, CSA C22.2 No.24 certified, CE
Quality standard	ISO 9001
Weight	8.8 oz [250 g]
Electrical protection	Class 2 circuits

## Application

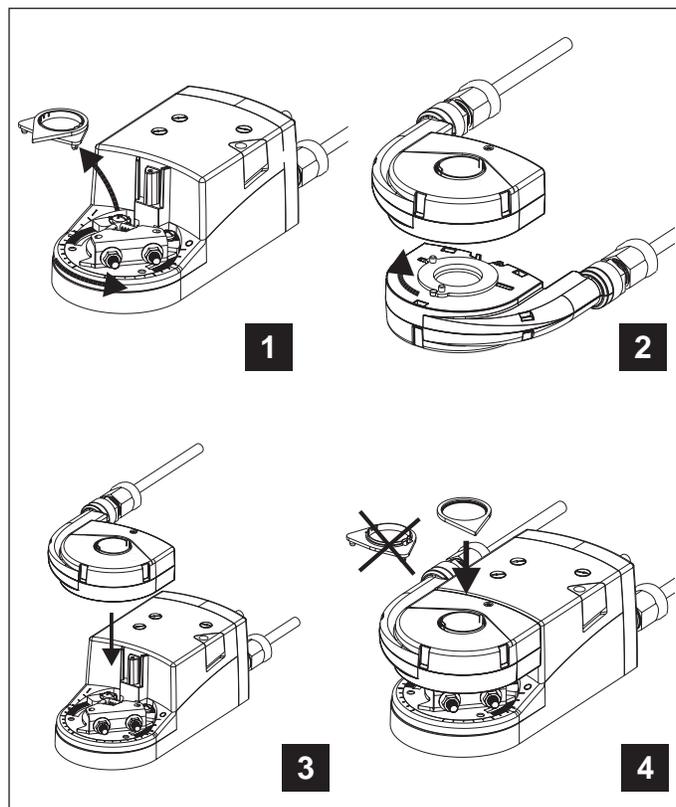
The PA... US feedback potentiometers are used with AM actuators to provide a resistive signal which varies with damper position. The PA... US units are applied with commercial proportional temperature controllers to provide feedback of the damper position, or with electric or electronic meters to provide position indication. The signal can also be used as a positioner for parallel operation of multiple actuators.

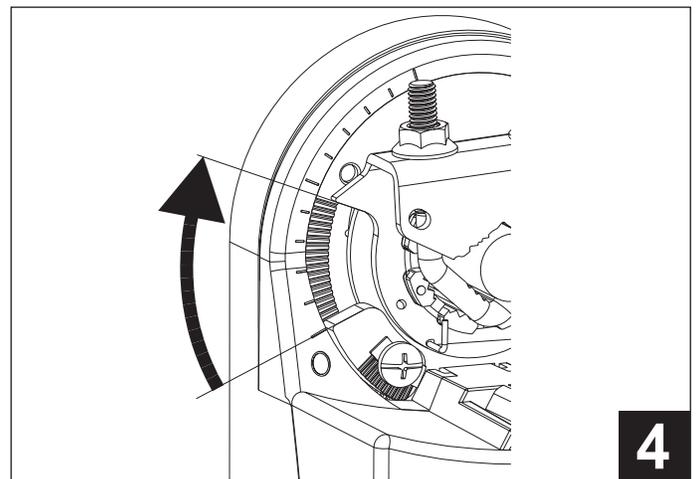
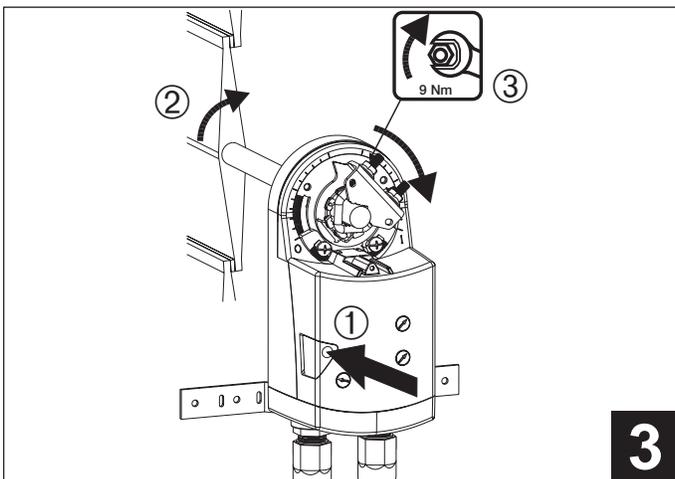
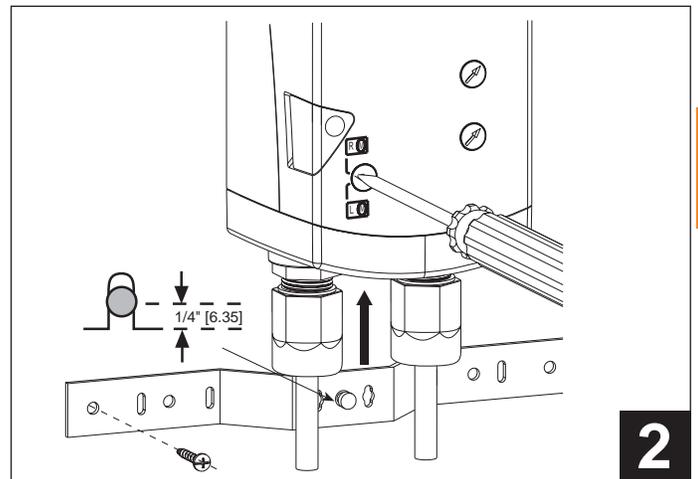
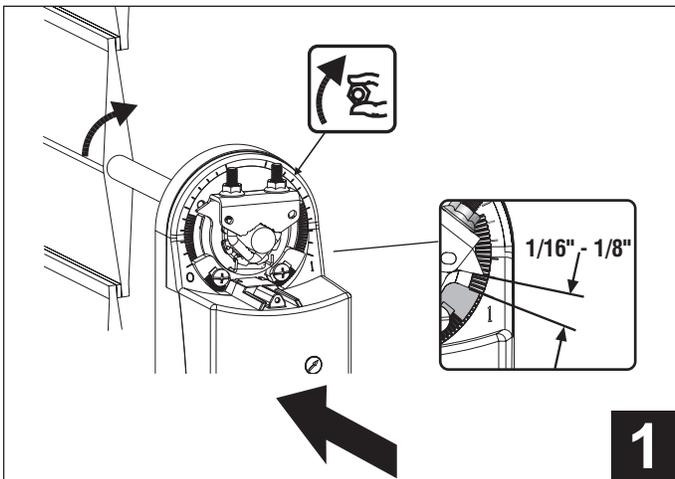
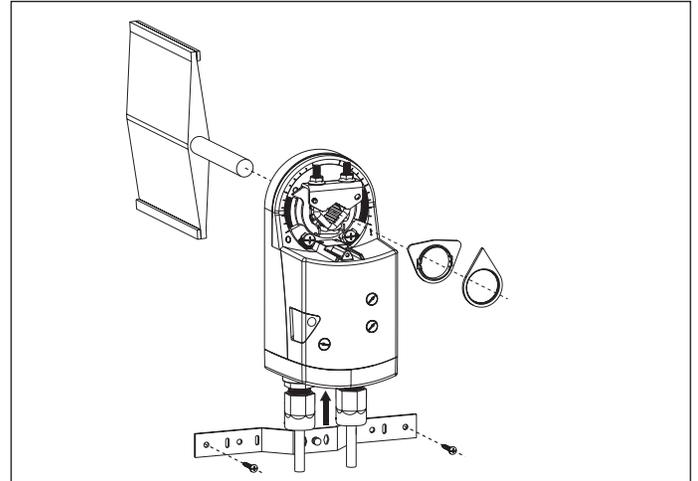
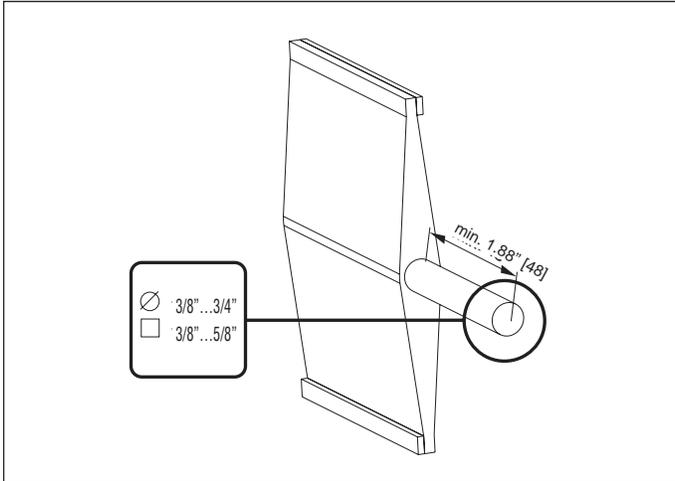
## Operation

The PA... US feedback potentiometer is mounted onto the damper actuator. A driver disk is attached to the actuator clamp and offers direct transmission of the actuator to the potentiometer.

## Mounting Instructions

1. Remove pointer assembly from the actuator. Press down the manual override button and rotate the actuator fully counter-clockwise.
2. Invert PA... US and turn the driver disk fully clockwise as indicated.
3. Slide PA... US onto actuator and check for the correct mating of the driver disk to the universal clamp. Secure with screw.
4. Remount the white plastic pointer only, from the pointer assembly, onto PA... US.



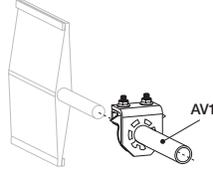


1. Turn damper blade to its fully closed position. With manual override button depressed, rotate actuator clamp to about 1/16" - 1/8" between actuator stop and clamp, depending on damper seal design. Slide actuator over shaft and finger-tighten nuts.
2. Using a screwdriver, Select clockwise or counterclockwise rotation. (Example shown is for clockwise closing damper). Slide anti-rotation bracket up under actuator engaging center cut-out on actuator back. Secure bracket with self-tapping screws.

3. Tighten the two nuts on the universal clamp with 10 mm wrench, 6-8 ft-lb torque. (On dampers with edge seals, actuator will compress damper blades when reaching end position for air-tight damper.)
4. Adjust end stops, if required.

### Preliminary steps

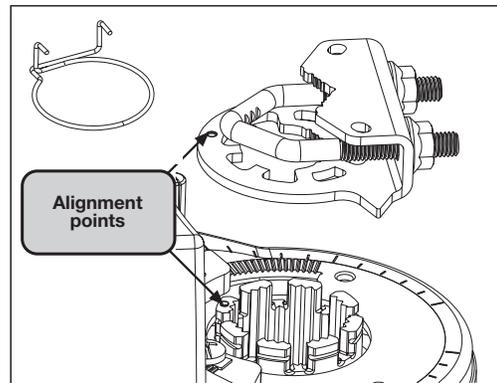
1. Belimo actuators should be mounted indoors in dry, relatively clean environment free from corrosive fumes. If the actuator is to be mounted outdoors, a protective enclosure must be used to shield the actuator. (See *Mechanical Accessories* Section)
2. For new construction work, **order dampers with extended shafts**. Instruct the installing contractor to allow space for mounting and service of the Belimo actuator on the shaft.
3. The AM Series actuator requires a minimum shaft length of 1.88". Use the AV1 for short shaft installations on 1/2" diameter shafts.



### Replacement or mounting of optional mounting clamp

1. Squeeze tabs of retaining ring and lift off of actuator.
2. Remove clamp.
3. Replacement clamp has an alignment mark. Match this mark with the similar mark on the actuator and mount clamp.
4. Squeeze tabs of retaining ring and fit it into the retaining slot.

Note: If retaining ring is not fully seated, the clamp may come loose from the actuator.



### AM actuators which may be used on one shaft:

Model	Max Quantity Per Shaft
AM24 (-S) US	4
AM24-SR US	4
AM24-MFT US	4

**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 AM Series actuators require a 24 VAC class 2 transformer and draw a maximum of 5 VA. 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.*

### Operational Information for AM24-SR US and AM24-MFT US

#### Initialization

The AM24-SR US and AM24-MFT US must go through an initialization procedure to learn the zero signal position. When the power is first applied to the actuator, or the gear release button is depressed, the actuator will move to its zero signal position. After the actuator learns this, it will drive to its control position.

*Note: If power is lost to the actuator, and the actuator is moved by use of its manual override, the actuator must be re-initialized when power is returned, by pushing the override button.*

### 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 AM Series actuators

Keep power wire runs below the limits listed in the Fig. 1. 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.

### 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

Fig. 1

Example for AM... US: 3 actuators, 18 Ga wire  
 $450 \text{ Ft} \div 3 \text{ Actuators} = 150 \text{ Ft. Maximum wire run.}$

### Wire Type and Wire Installation Tips

For most installations, 18 or 16 Ga. cable works well with the AM24 type 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.

### Overload protection

All Belimo actuators are electronically protected against overload. In the AM series an electronic circuit maintains the current at a level which will not damage the motor while providing adequate holding torque.

### 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.

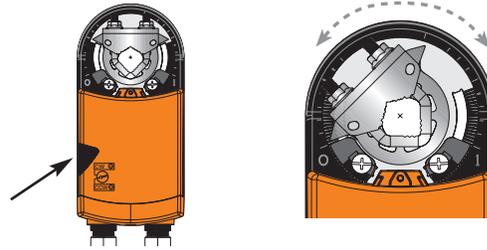
## Feature operation

### Manual Override

A button on the actuator cover disengages the gear train 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.

Gear release button

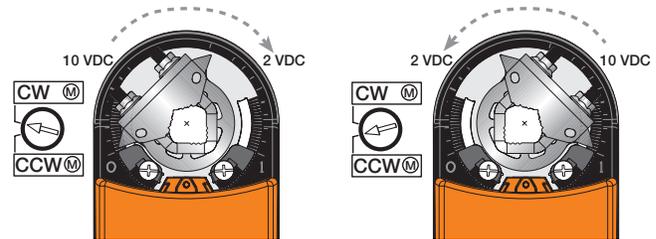


### Direction of Rotation Switch

AM actuators have a reversing switch on the cover labeled “CW/CCW”. Switch position indicates start point. For the AM24-SR US, with the switch in position “CW”, the actuator rotates clockwise with an decrease in voltage or current. With the switch in position “CCW”, the actuator rotates counterclockwise with an decrease in voltage or current.

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.**

The AM24 (-S) US rotates clockwise when the switch is in the “CW” position and power is applied to wire #2. When power is applied to wire #3 the actuator rotates counter clockwise. Rotating the “CW/CCW” switch to “CCW” reverses the control logic.

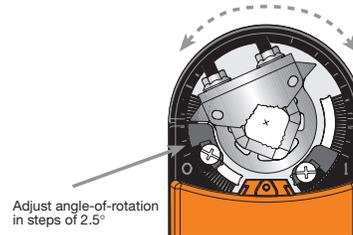


AM24-SR US, AM24-SRS US

### 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 AM actuator 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.

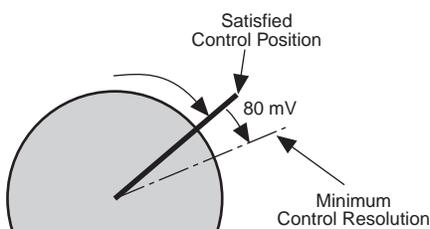


### Control Accuracy and Stability

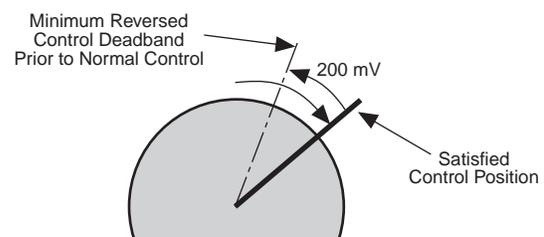
AM Series proportional actuators have built-in brushless DC motors which provide better accuracy and longer service life.

The AM Series 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.

**AM Actuator responds to a 80 mV signal when not changing direction from stop position.**



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



The AM24-MFT US control accuracy and stability can be found in the MFT specifications, page 187.

### Adjustable Auxiliary Switches

The AM24-S US actuator is equipped with two adjustable auxiliary switches used to indicate damper position or to interface additional controls or equipment. Switching positions can be set over the full scale of 0 to 95° simply by setting switch on the actuator cover.

#### Method A

1. Push the manual override button and rotate the clamp to the "0" position.
2. Set the desired switch position: example: 20% of rotation is ".2" on the setting scale.
3. Check the switch operation. As the indicator passes the "0" switch position, the contact between S1 and S2, or S4 and S5, is broken and the contact between S1 and S3, or S5 and S6 is made.

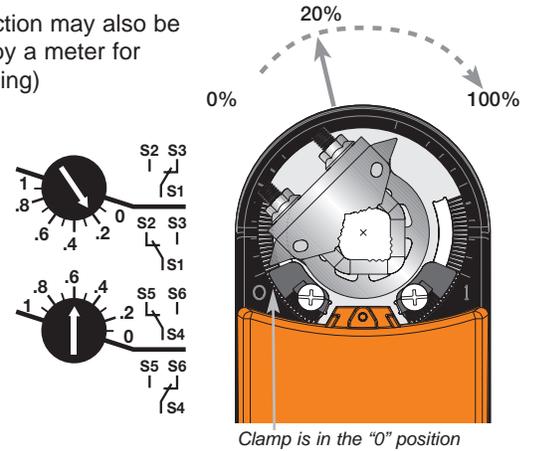
#### Switch Rating

Voltage	Resistive load	Inductive load
24 VAC	3 A	0.5 A

#### Method B

1. Use manual override to position universal clamp to desired switch position.
2. Turn switch pointer to "0".

(switch function may also be monitored by a meter for precise setting)



## Accessories

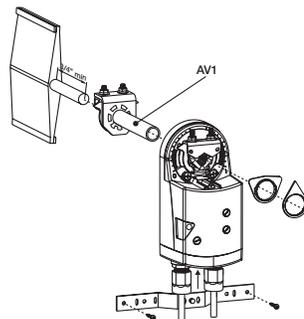
### Mounting brackets

- ZG-100 Mounting bracket
- ZG-101 Mounting bracket
- ZG-103 Mounting bracket
- ZG-104 Mounting bracket



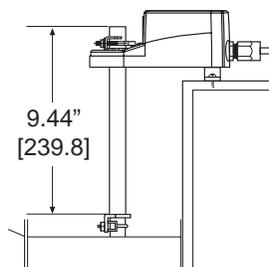
### AV1 Short shaft adaptor

Used on 3/8" to 3/4" diameter shafts that are shorter than 1.875" and mounting space is minimal.



### AV 10-18 Shaft extension

For damper shafts 3/8 to 11/16 in [10 to 18] dia or 3/8 to 9/16 in [10 to 14] square.

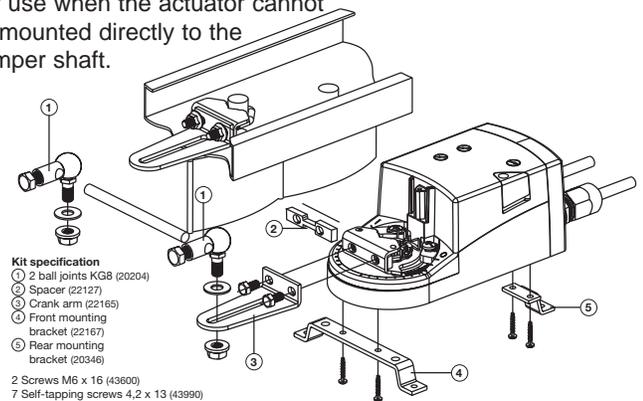


#### Dimensions

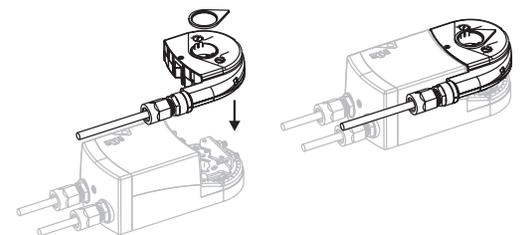
[All numbers in brackets are in millimeters.]

### ZG-AM - Crank arm adaptor kit

For use when the actuator cannot be mounted directly to the damper shaft.



### SA...us Auxiliary switches, PA...us Feedback potentiometers



### SGA24/SGF24

Minimum and/or manual positioner (electronic), SGA24 is enclosed in a NEMA 4 housing. The SGF24 is for flush panel mounting.



# Startup and Checkout



Instructions for AM24-SR US and AM24-MFT US + P-100...

## AM24-SR US and AM24-MFT US + 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 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>See Note 1.</b>	Power supply rating should be $\geq$ 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.	Actuator will move to its "Control Signal" position.	Actuator operates properly. <b>Step 9</b>	Does not drive toward "Control Signal Position" <b>Step 4</b>
4.	Push manual override button. (If clamp is at min signal position, move damper to fully closed position)	Actuator will drive to 0 position and back to control position	Actuator operates properly. <b>Step 9</b>	<b>Step 5</b>
5.	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 6</b>
6.	Check input signal with a digital volt meter (DVM). Make sure the input is within the range of the actuator. For AM24SR US this is 0 to 10 VDC or 0 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 7</b>	Reprogram, adjust repair or replace controller as needed. <b>Step 1</b>
7.	Use the manual override button to 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 8</b>	Find cause of damper jam and repair. <b>Step 1</b>
8.	Check damper torque requirement.	Torque requirement is $\leq$ actuator's minimum torque.	Defective Actuator. Replace Actuator - <b>See Note 2</b>	Recalculate actuator requirement and correct installation.
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.
- Note 2** If failure occurs within 5 years from original installation date, notify Belimo and give details of the application.

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