

M9206-GGx-2S Series Proportional Electric Spring Return Actuators

Applications

The M9206-GGx-2S Series Proportional Actuators are direct-mount, spring return electric actuators that operate on AC/DC 24 V power. These bidirectional actuators do not require a damper linkage, and are easily installed on a damper with a round shaft up to 1/2 in. (13 mm) in diameter or a square shaft up to 3/8 in. (10 mm). They may also be mounted onto Johnson Controls® VG1000 Series Forged Brass Ball Valves using the M9000-513 or M9000-520 Ball Valve Linkage Kit.

The M9206-GGx-2S Series Proportional Electric Spring Return Actuators provide a running torque of 53 lb-in (6 N·m). The rotation range is mechanically adjustable. An integral line voltage auxiliary switch is available on the GGB model to indicate end-stop position, or to perform switching functions within the selected rotation range.

IMPORTANT: Use this M9206-GGx-2S Series Proportional Electric Spring Return Actuator only to control equipment under normal operating conditions. Where failure or malfunction of the electric actuator could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices such as supervisory or alarm systems or safety or limit controls intended to warn of, or protect against, failure or malfunction of the electric actuator.

Installation

The M9206-GGx-2S Series Proportional Electric Spring Return Actuators mount directly to the surface in any convenient orientation using two No. 12-24 self-drilling sheet metal screws (included with the actuator). Electrical connections on the actuator are clearly labeled to simplify installation.

IMPORTANT: Before specifying M9206-GGx-2S Series Proportional Electric Spring Return Actuators for plenum applications, verify acceptance of exposed plastic materials in plenum areas with the local building authority. Building codes for plenum requirements vary by location. Some local building authorities accept compliance to UL 1995, Heating and Cooling Equipment, while others use different acceptance criteria.

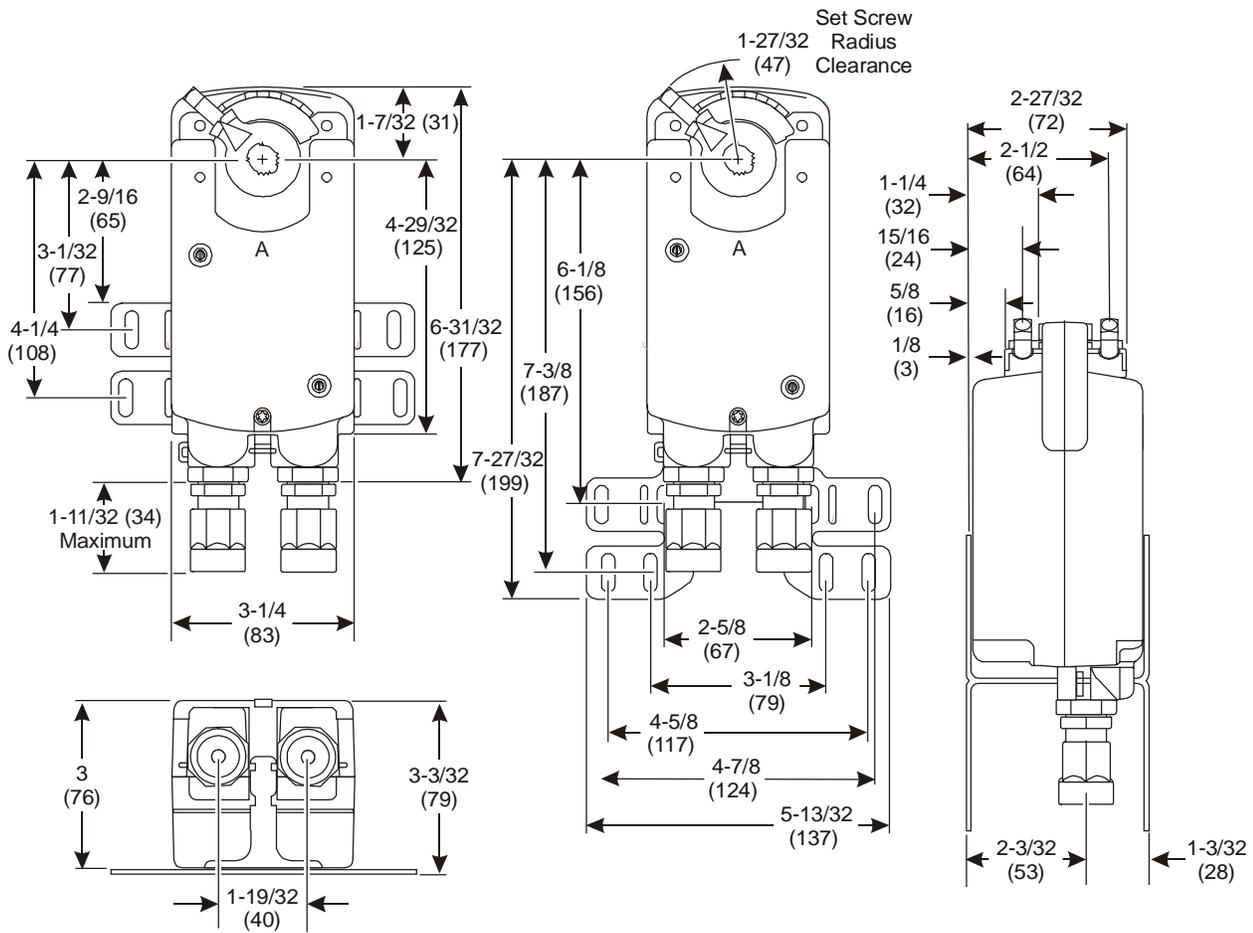
IMPORTANT: Do not install or use this M9206-GGx-2S Series Proportional Electric Spring Return Actuator in or near environments where corrosive substances or vapors could be present. Exposure of the electric actuator to corrosive environments may damage the internal components of the device, and will void the warranty.

Parts Included

- proportional electric spring return actuator
- anti-rotation bracket
- two No. 12-24 self-drilling sheet metal screws

Special Tools Needed

- 5/16 in. (8 mm) nut driver
- 5/16 in. (8 mm) square socket or 3/8 in. (10 mm) 12-point socket
- drill with 3/16 in. (5 mm) drill bit
- digital voltmeter or M9000-200 Commissioning Tool



**Figure 1: M9206-GGx-2S Series
Proportional Electric Spring Return Actuator Dimensions, in. (mm)**

Accessories

Table 1: Accessories and Replacement Parts (Order Separately)

Code Number	Description
DMPR-KC003*	7 in. (178 mm) Blade Pin Extension without Bracket for Johnson Controls Direct-Mount Damper Applications
DMPR-KR003*	Sleeve Pin Kit for Johnson Controls Round Dampers with a 5/16 in. (8 mm) Diameter Shaft
M9000-161	Replacement Anti-Rotation Bracket for M9206-GGx-2S Series Proportional Electric Spring Return Actuators
M9000-165	Mounting Kit Used to Mount M9206-GGx-2S Series Proportional Electric Spring Return Actuators in Remote-Mount, Linkage-Driven Applications
M9000-200	Commissioning Tool that Provides a Control Signal to Drive 24 V On/Off, Floating, Proportional, and/or Resistive Electric Actuators
M9000-513	Linkage Kit Used to Mount M9206-GGx-2S Series Proportional Electric Spring Return Actuators to Johnson Controls 1/2 and 3/4 in. (DN15 and DN20) VG1243 Series, and 1/2 in. (DN15) VG1644 Series Forged Brass Ball Valves
M9000-520	Linkage Kit Used to Mount M9206-GGx-2S Series Proportional Electric Spring Return Actuators to Johnson Controls 1/2 through 1-1/2 in. (DN15 through DN40) VG12x1, VG12x5, VG18x1, and VG18x5 Series Forged Brass Ball Valves
M9206-600	Replacement Coupler, Set Screw, and Locking Clip Kit for Mounting M9206-GGx-2S Series Proportional Electric Spring Return Actuators to a Round Shaft Up to 1/2 in. (13 mm) or a Square Shaft Up to 3/8 in. (10 mm)
M9206-601	Replacement Coupler, Set Screw, and Locking Clip Kit for Mounting M9206-GGx-2S Series Proportional Electric Spring Return Actuators to a Round Shaft Up to 5/8 in. (16 mm) or a Square Shaft Up to 9/16 in. (14 mm)
M9206-602	Replacement Locking Clips for M9206-GGx-2S Series Proportional Electric Spring Return Actuators (Five per Bag)
Y65A13-0	40 VA Transformer, AC 120/24 V, 60 Hz, Class 2
Y65S13-0	40 VA Transformer, AC 240/24 V, 60 Hz, Class 2

* Furnished with the damper and may be ordered separately.

Mounting

Ball Valve Installations

The M9206-GGx-2S Series Proportional Electric Spring Return Actuators can be mounted on Johnson Controls® VG1000 Series Forged Brass Ball Valves using the M9000-513 or M9000-520 Ball Valve Linkage Kit; refer to the instructions included with each linkage kit for more details.

For M9000-513 installations, refer to the *M9000-51x Series Valve Linkage Kits Installation Instructions (Part No. 14-1201-13)*. For M9000-520 installations, refer to the *M9000-520 Ball Valve Linkage Kit Installation Instructions (Part No. 14-1297-5)*.

Damper Installations

The M9206-GGx-2S Series Proportional Electric Spring Return Actuators can be easily installed on a damper with a round shaft from 3/8 to 1/2 in. (10 to 13 mm) in diameter, or a 3/8 in. (10 mm) square shaft. An M9206-601 Replacement Coupler is available for a round shaft up to 5/8 in. (16 mm) or a square shaft up to 9/16 in. (14 mm); see Table 1 for more details. If the damper shaft extends less than 3-3/16 in. (81 mm), see the *Removable Coupler* section for further instructions. If the damper shaft extends less than 1-11/16 in. (43 mm), install an extension recommended by the damper manufacturer.

Spring Return Direction – Counterclockwise (CCW) Operation

For CCW spring return operation, mount the actuator to the damper shaft so that the CCW face of the actuator is away from the damper as illustrated in Figure 2. The coupler is at the 0° position to drive Clockwise (CW) and spring return CCW.

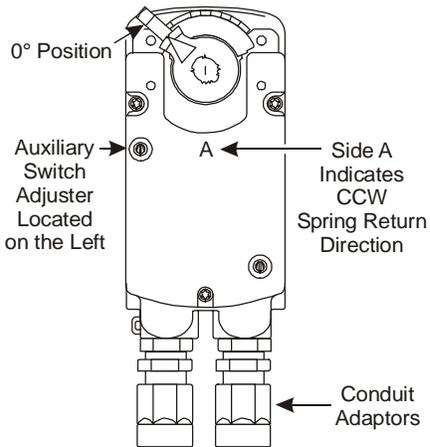


Figure 2: CCW Face of Actuator

Spring Return Direction – CW Operation

To change the spring return direction to CW, mount the actuator to the damper shaft so that the CW face of the actuator is away from the damper as illustrated in Figure 3. The actuator now drives CCW from the 0° position.

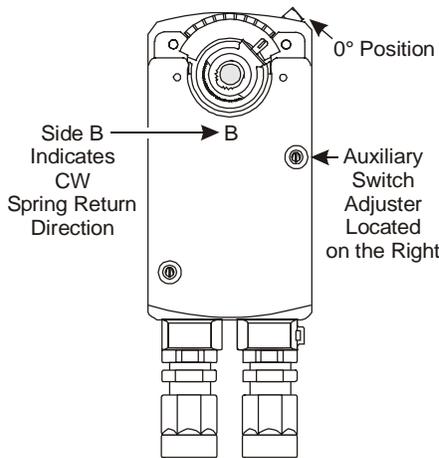


Figure 3: CW Face of Actuator

The coupler can be inserted on the CW face of the actuator for easier access to the coupler clamp screws. See the *Removable Coupler* section for more details.

Removable Coupler

If the damper shaft is less than 3-3/16 in. (81 mm) long, insert the coupler in the face of the actuator closest to the damper.

To change the position of the coupler, see Figure 4 and proceed as follows:

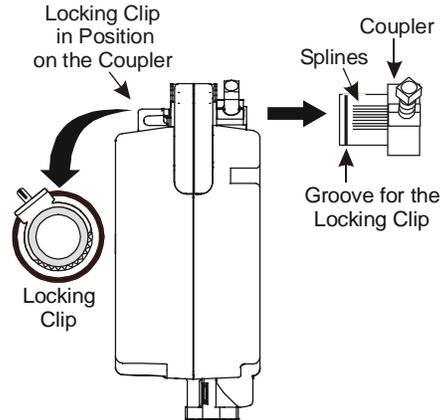


Figure 4: Changing the Position of the Coupler

1. Pull the locking clip off the coupler, and remove the coupler from the actuator.

Note: See the *Rotation Range* section for setting a rotation range of less than 90°.

For 0 to 93° rotation, the coupler must fit as closely as possible to, but not on top of, the metal plate at the spring return position.

2. Mount the coupler on either the CW or CCW face of the actuator, as determined by the shaft length.

Note: The coupler teeth illustrated in Figure 4 are designed to prevent insertion of the coupler in the wrong angular position.

3. Snap the locking clip securely into the coupler retention groove to retain the coupler.

Mounting the Actuator

To mount the actuator, proceed as follows:

1. Bend or cut the anti-rotation bracket to fit the damper frame or duct as illustrated in Figure 5.

Note: The anti-rotation bracket can be bent to fit a round damper.

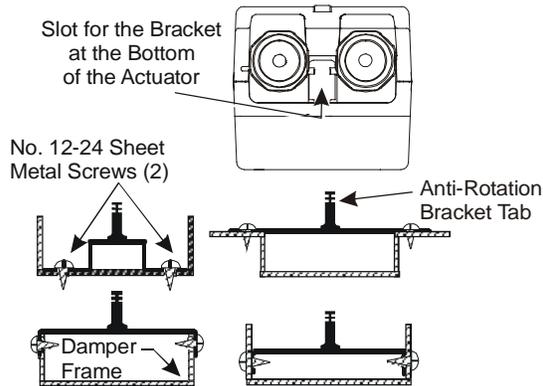


Figure 5: Fitting the Anti-Rotation Bracket on the Damper Frame or Duct

2. Slide the actuator onto the damper shaft.



CAUTION: Risk of Property Damage.

Mount the actuator perpendicular to the shaft. Failure to mount the actuator perpendicular to the shaft may cause the shaft to bind. Binding may result in damage to the actuator or other property, and will void the warranty.

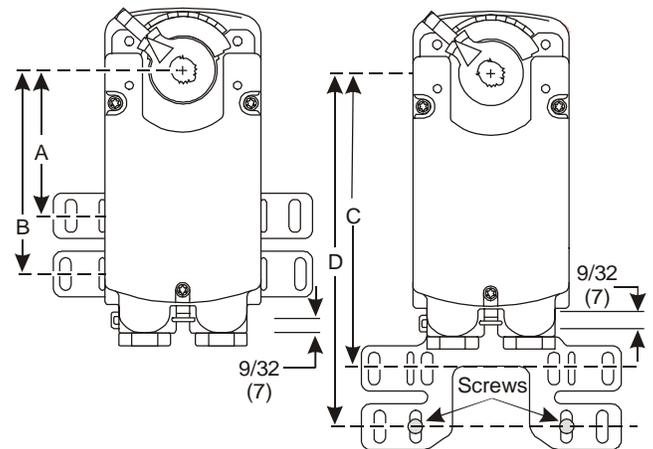
3. Position the tab of the anti-rotation bracket into the slot at the bottom of the actuator as illustrated in Figure 5.

IMPORTANT: The tab on the anti-rotation bracket must fit midpoint in the actuator slot. Positioning the tab midpoint in the slot prevents actuator binding and premature wear, and makes actuator removal easier.

4. See the dimensions in Table 2 and Figure 6 to ensure correct positioning of the anti-rotation bracket.

Table 2: Dimensions from Anti-Rotation Bracket to Shaft Center

Dimensions, in. (mm)	Shaft Diameter	
	1/2 in.	3/8 in.
A	3 (76)	2-15/16 (75)
B	4-7/32 (107)	4-5/32 (106)
C	6-3/32 (155)	6-1/16 (154)
D	7-11/32 (187)	7-9/32 (185)



(Recommended Mounting Method on Johnson Controls Dampers)

Figure 6: Positioning the Anti-Rotation Bracket

5. Drill mounting holes in the damper frame or duct using the anti-rotation bracket as a guide (based on the measurements from Table 2 and Figure 6).

Note: When installing the actuator onto a Johnson Controls damper, use the existing holes in the damper frame.

6. Rotate the damper blade(s) to the desired position if the power is lost. To ensure a tight seal, rotate the actuator 3° away from the spring return direction.
7. Tighten the coupler set screw onto the damper shaft. The recommended torque for the set screw is 150 to 180 lb-in (17 to 20 N·m).

- Secure the anti-rotation bracket to the damper frame or duct using the two No. 12-24 self-drilling sheet metal screws provided and a 5/16 in. (8 mm) nut driver.

IMPORTANT: Do not overtighten the mounting screws. Overtightening may strip the threads and will void the warranty.

IMPORTANT: Place the anti-rotation bracket tab midway in the actuator slot. Failure to do so may cause the actuator to bind, may cause premature wear, and will void the warranty.

- Apply power and a control input of DC 10 V long enough for the actuator to travel a full stroke, and verify that the actuator rotates freely throughout the range.

Rotation Range

The actuator is factory set for 93° rotation, and the rotation range is limited to a minimum of 34.5°. To reduce the rotation range, reposition the coupler as follows:

- Check that the damper blade is visually accessible or that its position is permanently marked on the end of the damper shaft as illustrated in Figure 7.

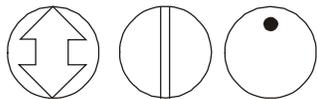
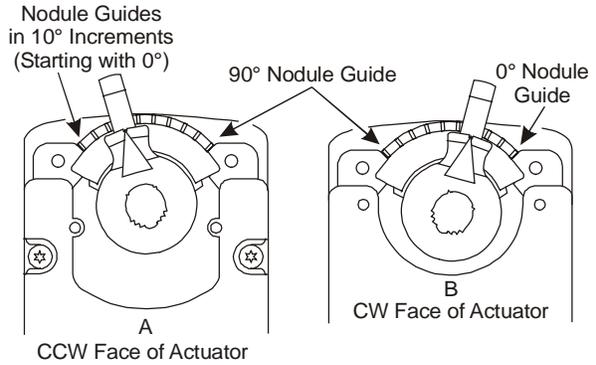


Figure 7: Damper Position Icons

- Determine the desired rotation range, and subtract that number from 90°.
- Pull the locking clip off the coupler as illustrated in Figure 4.
- Manually reposition the coupler so that the coupler set screw aligns with the nodule guide that corresponds to the value determined in Step 2.

Example:

For a rotation range of 60°, move the coupler so that the coupler set screw is at the 30° nodule guide (90° – 60° = 30°) as illustrated in Figure 8.



Note: Coupler set screw is shown at 30° in both applications.

Figure 8: Actuator Set for 60°

Example:

For a rotation range of 45°, move the coupler so that the coupler set screw is midway between the 40° and 50° nodule guides (90° – 45° = 45°).

- Snap the locking clip securely into the coupler groove to retain the coupler on the actuator.

Feedback Signal

Figure 9 illustrates the nominal feedback signal relative to the rotation position within a 0 to 90° rotation range.

Direction	Feedback	Rotation Position							
		0°*	15°	30°	45°	60°	75°	90°	
Direct Acting	0-10V	0.0V	1.7V	3.3V	5.0V	6.7V	8.3V	10.0V	
	2-10V	2.0V	3.3V	4.7V	6.0V	7.3V	8.7V	10.0V	
Reverse Acting	0-10V	10.0V	8.3V	6.7V	5.0V	3.3V	1.7V	0.0V	
	2-10V	10.0V	8.7V	7.3V	6.0V	4.7V	3.3V	2.0V	

* 0° is the spring return position.

Figure 9: Nominal Feedback Signal Relative to Rotation Position

If the end-stop positions are changed and the CAL function is initiated, the feedback signal is scaled proportionally between the new end-stops.

Wiring

When combined with a controller, the M9206-GGx-2S Series Proportional Electric Spring Return Actuator provides reliable, integrated damper or valve control. A DC 0 (2) to 10 V or 0 (4) to 20 mA input signal from the controller to the electric actuator causes the motor to rotate in the proper direction. Upon loss of power, the electric actuator returns to its spring return position. Rotation is mechanically limited to 93° by integral end-stops. An anti-rotation bracket prevents lateral movement of the electric actuator.

See Figures 10 and 11 for proper wiring of the M9206-GGx-2S Series Proportional Spring Return Actuator.

CAUTION: Risk of Electric Shock.
Disconnect the power supply before making electrical connections to avoid electric shock.

CAUTION: Risk of Property Damage.
Do not apply power to the system before checking all wiring connections. Short circuited or improperly connected wires may result in permanent damage to the equipment.

IMPORTANT: Make all wiring connections in accordance with local, national, and regional regulations. Do not exceed the electrical ratings of the M9206-GGx-2S Series Proportional Electric Spring Return Actuator.

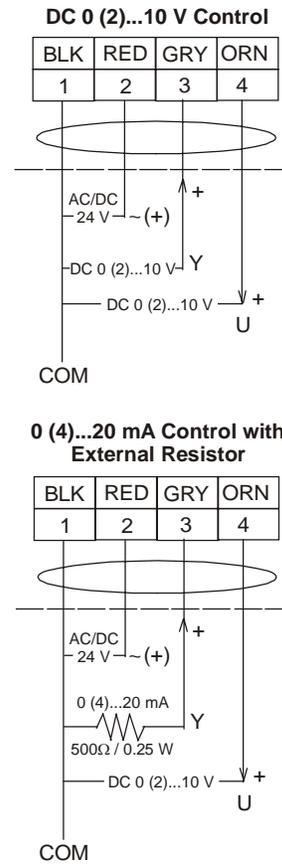


Figure 10: Wiring Diagrams for Proportional Control

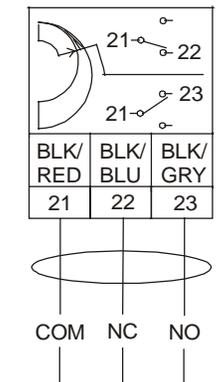


Figure 11: Auxiliary Switch Wiring Diagram for xxB Models

Conduit Connections

If using conduit or other electrical fittings, see Figure 2 and proceed as follows:

1. Insert the conduit fitting (field furnished) into the 1/2 in. conduit adaptor, and hand tighten the fitting in the CW direction.

IMPORTANT: Use flexible metallic conduit or its equivalent with the conduit fitting. Use a tool to grasp the conduit housing when installing the fitting, to avoid stressing the mounted actuator. Do not overtighten the fitting into the actuator, to avoid damaging the actuator housing.

2. Feed the wiring cable through the field supplied conduit assembly.
3. Attach the conduit assembly to the fitting from Step 1, and finish wiring the actuator.



WARNING: Risk of Electric Shock.

Do not remove the conduit adaptor on the M9206-GGx-2S Series Proportional Electric Spring Return Actuator. Removing the adaptor defeats the double insulation and strain relief features and can result in electric shock leading to severe personal injury or death.

Setup and Adjustments

Direction of Action

The M9206-GGx-2S Series Proportional Electric Spring Return Actuators are factory set for Direct Acting (DA) operation. In this mode, applying an increasing input signal to the control input drives the actuator away from the spring return position. For Reverse Acting (RA) operation, move the mode selection switch from DA to RA. In this mode, applying an increasing input signal to the control input drives the actuator toward the spring return position.

The drive direction for the actuator depends on the position of the mode selection switch and the spring return direction indicated in Table 3.

Table 3: Settings for Drive Direction

GRY 3 (Control Input)	CCW Face of Actuator		CW Face of Actuator	
	Mode Selection Switch Setting			
	DA	RA	RA	DA
Increasing Signal				
Decreasing Signal				

Mode Selection Switch and CAL Function

The M9206-GGx-2S Series Proportional Electric Spring Return Actuators are factory set at DA, DC 0 to 10 V control input as illustrated in Figure 12. The DC 0 to 10 V input signal corresponds to 0 to 93° rotation. If the rotation range is reduced, the end-stop is reached with a reduced input signal. For example, if a DC 0 to 10 V input signal is selected and the rotation range is limited to 75°, the end-stop is reached at DC 8.3 V.

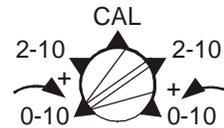


Figure 12: Mode Selection Switch

The CAL function enables the actuator to redefine the selected control input range proportionally across a reduced rotation range. The actuator stores the reduced rotation range in nonvolatile memory (retains data when power is lost or removed).

To calibrate the control input range, proceed as follows:

1. With power applied, move the mode selection switch to the CAL position and leave it in this position for approximately 5 seconds.
2. Return the mode selection switch to the desired selection (example: DA, DC 0 to 10 V control input). The actuator automatically rotates until the end-stops are found, and proportionally reconfigures the control input range to the reduced rotation range.

Note: During normal operation, if the actuator stroke increases due to seal or seat wear, the input is redefined to the increased rotation range in approximately 0.5° increments.

- If the actuator mounting position is changed or if the linkage is adjusted, repeat Steps 1 and 2 to reinitiate the CAL function.

Note: The mode selection switch must remain out of the CAL position for at least 2 seconds before returning it to the CAL position.

Auxiliary Switch (M9206-GGB-2S)

The M9206-GGB-2S Proportional Electric Spring Return Actuator includes one auxiliary switch with a switch adjuster accessible on either face of the actuator (as illustrated in Figures 2 and 3). The nominal factory setting for this auxiliary switch is 20° opening. See the *Technical Specifications* table for the auxiliary switch rating.

 **WARNING: Risk of Electric Shock.** Disconnect each of multiple power supplies before making electrical connections. More than one disconnect may be required to completely de-energize equipment. Contact with components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

 **WARNING: Risk of Electric Shock and Property Damage.** Insulate and secure each unused wire lead before applying power to the M9206-GGB-2S Proportional Electric Spring Return Actuator. Failure to insulate and secure each unused wire lead may result in property damage, electric shock, and severe personal injury or death.

The switch point is adjustable from 0 to 90°. See Figure 13 and use the method in the following example for the most accurate positioning of the auxiliary switch.

To change the switch point of the auxiliary switch, proceed as follows:

- Position the actuator in the full spring return position.

Note: The auxiliary switch is factory set to trip when the actuator reaches the 20° position.

- Rotate the switch adjuster until it points to the desired switch point.

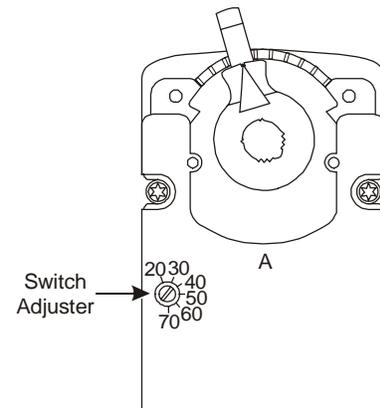


Figure 13: Switch Point Settings

- Connect the auxiliary switch to a power source or an ohmmeter, and apply power to the actuator.
- Observe the switch point. If required, rotate the switch adjuster again to reset the switch point.

Repairs and Replacements

If the M9206-GGx-2S Series Proportional Electric Spring Return Actuator fails to operate within its specifications, replace the unit. For a replacement electric actuator, contact the nearest Johnson Controls representative.

Preliminary—This information may change.

Technical Specifications

Product	M9206-GGx-2S Series Proportional Electric Spring Return Actuators	
Power Requirements	Nominal AC 24 V \pm 25% at 50/60 Hz, Class 2, Typical 12.0 VA Running, 5.0 VA Holding Position; DC 24 V \pm 10%, Class 2, Typical 5.6 W Running, 2.2 W Holding Position	
Transformer Sizing Requirements	14 VA Minimum per Actuator	
Input Signal	DC 0 (2) to 10 V or 0 (4) to 20 mA with Field Furnished 500 ohm Resistor	
Input Signal Adjustments	Factory Set at DC 0 to 10 V, CW Rotation with Signal Increase; Selectable DC 0 (2) to 10 V or 0 (4) to 20 mA with Field Furnished 500 ohm, 0.25 W Minimum Resistor; Switch Selectable Direct or Reverse Action with Signal Increase	
Control Input Impedance	Voltage Input: 200,000 ohms; Current Input: 500 ohms with Field Furnished 500 ohm Resistor	
Feedback Signal	DC 0 (2) to 10 V for Desired Rotation Range Up to 90°; Corresponds to Rotation Limits	
Auxiliary Switch Rating	GGB Model	One Single-Pole, Double-Throw (SPDT), Double-Insulated Switch; AC 24 V, 50 VA Pilot Duty; AC 120 V, 5.8 A Resistive, 1/4 hp, 275 VA Pilot Duty; AC 240 V, 2.9 A Inductive, 5.0 A Resistive, 1/4 hp, 275 VA Pilot Duty
Spring Return	Direction is Selectable with Mounting Position of Actuator: CCW Actuator Face Away from Damper/Valve for CCW Spring Return; CW Actuator Face Away from Damper/Valve for CW Spring Return	
Running Torque	53 lb-in (6 N-m)	
Rotation Range	Adjustable from 34.5 to 90° CW or CCW; Mechanically Limited to 93°	
Rotation Time	25 to 40 Seconds for 0 to 53 lb-in (6 N-m) at All Operating Conditions	
Spring Return Time No Power (Off)	Nominal 35 Seconds; 90 Seconds Maximum	
Cycles	60,000 Full Stroke Cycles; 1,500,000 Repositions Rated at 53 lb-in (6 N-m)	
Audible Noise Rating	51 dBA Nominal at 39-13/32 in. (1 m)	
Electrical Connections	48 in. (1.2 m) 18 AWG UL CMP Plenum Cable(s) with 1/4 in. (6 mm) Stripped Wire Leads	
Conduit Exit	xxA Models	One 1/2 in. National Pipe Straight Loose (NPSL) Exit
	xxB Models	Two 1/2 in. National Pipe Straight Loose (NPSL) Exits
Mechanical Connections	Damper Applications	3/8 to 1/2 in. (10 to 13 mm) Diameter Round Shaft or 3/8 in. (10 mm) Square Shaft
	Valve Applications	Mounted onto Johnson Controls 1/2 and 3/4 in. (DN15 and DN20) VG1243 Series, and 1/2 in. (DN15) VG1644 Series Forged Brass Ball Valves using M9000-513 Ball Valve Linkage Kit; Mounted onto Johnson Controls 1/2 through 1-1/2 in. (DN15 through DN40) VG12x1, VG12x5, VG18x1, and VG18x5 Series Forged Brass Ball Valves using M9000-520 Ball Valve Linkage Kit
Enclosure	NEMA 2, IP42	
Ambient Conditions	Operating	-25 to 140°F (-32 to 60°C); 90% RH Maximum, Noncondensing
	Storage	-40 to 185°F (-40 to 85°C); 95% RH Maximum, Noncondensing
Continued on next page . . .		

Technical Specifications (Cont.)

Compliance	North America	UL Listed, File E27734, CCN XAPX (United States) and XAPX7 (Canada)
		Actuator Housing is Plenum Rated per CSA C22.2 No. 236/UL 1995, Heating and Cooling Equipment
	European Union	CE Mark, EMC Directive 89/336/EEC
		CE Mark, Low Voltage Directive 73/23/EEC (GGB Model)
	Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant
Shipping Weight		3.5 lb (1.6 kg)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.



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