

M9109 Series Electric Non-spring Return Actuators

Installation

IMPORTANT: The M9109 Series actuator is intended to control equipment under normal operating conditions. Where failure or malfunction of an M9109 actuator could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory) intended to warn of, or protect against, failure or malfunction of an M9109 actuator must be incorporated into and maintained as part of the control system.

Parts Included

- M9109 actuator
- M9000-160 anti-rotation bracket
- two No. 12-24 x 1/2 in. self-tapping hex washer-head screws
- female quick connects

Special Tools Needed

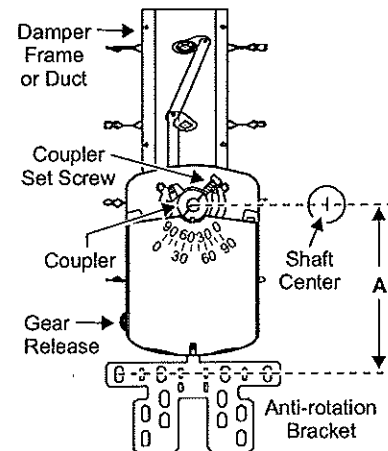
- drill with a 3/16 in. (No. 15, 4.57 mm) drill bit
- 5/16 in. (8 mm) square socket or 3/8 in. (10 mm) 12-point socket
- wire/terminal crimper

Mounting

The actuators are not position sensitive. Mount them in any convenient orientation. Install the actuators on a 3/8 to 1/2 in. (10 to 13 mm) round steel shaft or a 3/8 in. (10 mm) square steel shaft, 1.7 in. (43 mm) or longer. If the shaft is less than 1.7 in. (43 mm), install an extension recommended by the damper manufacturer.

To mount the actuator, proceed as follows:

1. Press and hold the gear release lever, and rotate the coupler to the 0 or 90° position. Release the gear release lever. (See Figure 1.)



Note: "A" is the distance from the center of the holes in the anti-rotation bracket to the center of the shaft. (See Table 1.)

Figure 1: Mounting Positions

Table 1: Distances from the Anti-rotation Bracket to the Shaft Center

Shaft Diameter	1/2 in.	3/8 in.
"A" Dimensions	5-1/8 in.	5-1/16 in.
(See Figure 1.)	130 mm	128 mm

- Bend or cut the anti-rotation bracket to fit the damper frame or duct as shown in Figure 2.

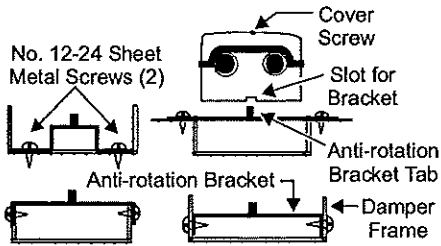


Figure 2: Anti-rotation Bracket Positions

- Close the damper.
- Insert the anti-rotation bracket tab into the slot at the bottom of the actuator (shown in Figure 2), and slide the actuator onto the shaft.
- Refer to the "A" Dimensions in Table 1 and Figure 1 to position the anti-rotation bracket tab midway in the actuator slot.

IMPORTANT: The anti-rotation bracket tab must be placed midway in the actuator slot to prevent actuator binding and premature wear.

- Use the anti-rotation bracket as a guide, and drill the holes in the damper frame or duct for the bracket (based on the measurements obtained in Table 1 and Figure 1).

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

- Attach the anti-rotation bracket to the damper frame or duct with the two self-tapping screws provided, using a 1/4 in. (7 mm) flat-blade screwdriver or 5/16 in. (8 mm) nut driver.

IMPORTANT: Do not overtighten the mounting screws to avoid stripping the threads.

- Secure the coupler to the shaft using a 5/16 in. (8 mm) square socket or 3/8 in. (10 mm) 12-point socket to tighten the coupler set screw against the damper shaft. (See Figure 1.)

- Continue tightening the coupler set screw to achieve a torque of 150 to 180 lb·in (17 to 20 N·m).

Note: Keep the actuator parallel to the mounting surface while tightening the set screw.

- Press and hold the gear release lever, and turn the shaft by hand to ensure the damper rotates from its fully closed to fully open position.
- Release the gear release lever.

Rotation Range

The damper must be checked as follows:

- Make sure that the damper blade is visually accessible or its position is permanently marked on the end of the damper shaft as shown in Figure 3.

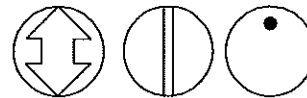


Figure 3: Damper Position Icons

- Grasp the damper shaft firmly with a pliers and manually turn the damper to fully open.

90 Degrees

If the damper shaft rotation is 90°:

- Press and hold the gear release lever shown in Figure 1, and rotate the actuator coupler and damper shaft to the fully closed position as shown in Figure 4.

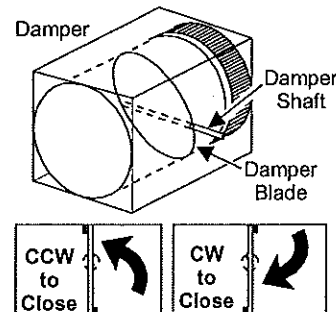


Figure 4: Damper Rotation

- Note the rotation travel (30 to 90°) and direction, either Clockwise (CW) or Counterclockwise (CCW), required to close the damper.

If rotation is less than 90°, proceed to the *Less Than 90 Degrees* section.

- Release the gear release lever.

Less Than 90 Degrees

If the damper shaft rotation is less than 90°, the rotation range of the actuator has to be adjusted with the scale on the actuator cover. (See Figure 5.)

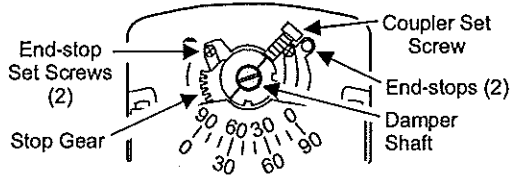


Figure 5: Setting the Rotation Range

Use the center of the coupler set screw as a pointer to observe the position on the scale when rotating the coupler from one side to the other.

Examples:

- For a rotation range of 90°, move both end-stop set screws fully up as shown in Figure 5.
- To set a rotation range of 60°, leave one end-stop set screw fully up, and adjust the other set screw so the coupler rotates between the 30 and 90° indicator marks on the scale.
- For a rotation range of 45°, adjust both end-stop set screws so the coupler rotates between the 30 and 75° indicator marks on the scale.
- To set a rotation range of 30°, move both end-stop set screws so the coupler rotates between the 30 and 60° indicator marks on the scale.

To accurately set the end stops:

1. Press and hold the gear release lever. Turn the actuator coupler to the minimum rotation position for the minimum ventilation flow required.
2. Release the gear release lever.
3. Use a No. 2 Phillips screwdriver to loosen the end-stop set screw on the actuator that is closest to the stop gear, and move it in its slot so it is tight against the stop gear. (See Figure 5.)

IMPORTANT: Do not remove the end-stop set screws, as this could interfere with the actuator's operation.

4. Repeat Steps 1 through 3 to set the desired maximum rotation position.
5. Tighten both end-stop set screws to a minimum of 25 lb·in (2.8 N·m).
6. Turn the actuator coupler and the damper shaft to the minimum rotation position.

Setup and Adjustments

Direction of Action

In the Direct Acting (DA) mode, a minimum control signal drives the actuator to the full CCW position, and a maximum control signal drives it fully CW. For Reverse Acting (RA) operation, a minimum control signal drives the actuator to the full CW position, and a maximum control signal drives it fully CCW. To set an actuator for RA operation. See the AGX or GGx Models section below.

AGx Models

For CW rotation and RA operation on the AGx models, apply 24 VAC to the Common (COM) and CW Terminals. For CCW rotation and DA operation, apply 24 VAC to the COM and CCW Terminals. (See Figure 6.)

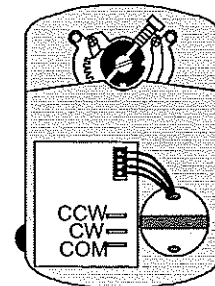


Figure 6: Direction of Action on AGx Models

GGx Models

The M9109-GGx-2 proportional actuators are factory set for DA mode with Jumper W1 in the DA position. Remove Jumper W1, and place it in the RA position. (See Figure 7.)

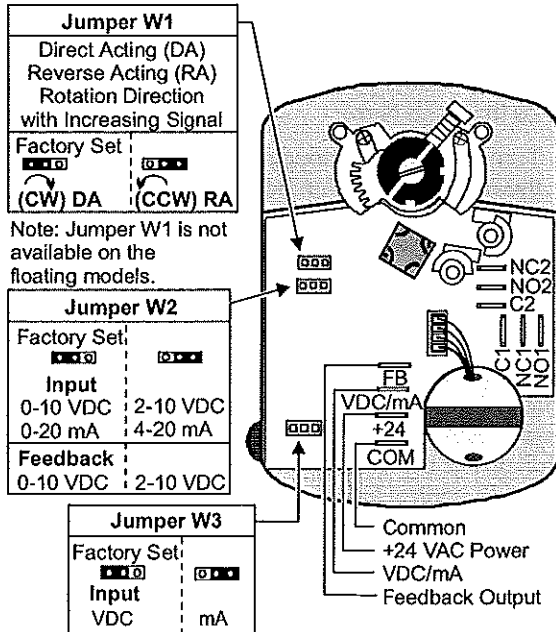


Figure 7: Calibrating the GGx Models

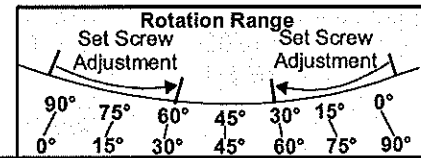
Jumpers (GGx Models)

The M9109-GGx-2 proportional actuators are factory set with Jumper W2 in the 0 to 10 VDC position, and Jumper W3 in the VDC position.

The VDC/mA terminal is the control input signal. Jumper W3 must be in the VDC position for voltage input and in the mA position for current input. The FB Terminal is the feedback output. (See Figure 7.)

Feedback Signal

The feedback signal will vary with a change to the rotation range. For the GGA and GGC models, a change to the rotation range changes the feedback signal and the operating range proportionally. (See Figure 8.)



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

Note: 0-10 V is available on GGA and GGC models.

Figure 8: Nominal Feedback Signal Relative to the Rotation Range

Wiring

CAUTION: Risk of Equipment Damage. Disconnect all power supplies before wiring connections are made or prior to performing maintenance. Check all wiring connections before applying power to the system. Short-circuited or improperly connected wires will result in permanent damage to the equipment.

IMPORTANT: Make all wiring connections in accordance with the National Electrical Code and all local regulations.

The actuator requires a 24 VAC control signal and is compatible with a variety of controllers. (See Figure 9.)

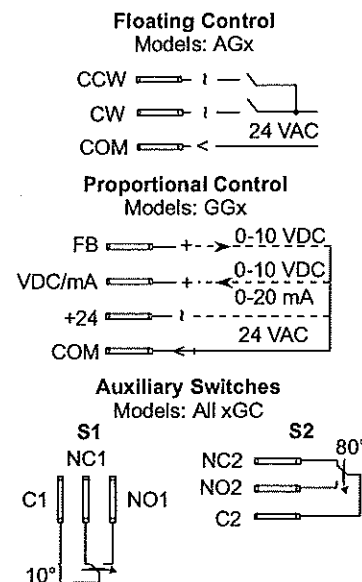


Figure 9: Wiring for M9109 Models

Note: To avoid excessive wear or drive time on the motor for the AGx models, use a controller and/or software that provides a time-out function to remove the signal at the end of rotation (stall). The GGx models have an auto shutoff to avoid excessive wear or drive time on the motor.

Through the Conduit Openings

Depending on the M9109 model selected, one or both conduit openings are used.

1. Loosen the cover screw, and remove the actuator cover.
2. Push the plastic conduit plug out of the conduit opening with fingertip. (See Figure 10.)

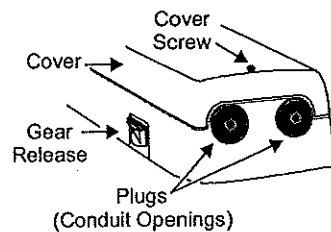


Figure 10: Location of the Conduit Openings

3. Use a Phillips No. 1 screwdriver to puncture a hole through the center of the plastic conduit plug. Reinsert the plug into the conduit opening.

Note: For applications requiring metal conduit, thread the conduit fitting into the conduit opening and hand tighten.

4. Insert the cable wires through the plastic plug, compression fitting, or conduit fitting, and connect to the terminals using the appropriate wiring diagram in Figure 9.

IMPORTANT: Install all quick-connect terminals in the same direction to prevent shorting. (See Figure 11.)



Figure 11: Orientation of Terminals

Note: If using optional pluggable terminal blocks (M9000-105 or M9000-106), insert the cable wires through the conduit opening, then connect the wires to the terminals.

Auxiliary Switches (xGC Models)

The M9109-xGC-2 models have two built-in auxiliary switches that may be set for any angle between 0 and 90° (factory set for 10 and 80°, nominal). Refer to the *Technical Data* section for auxiliary switch ratings.

The following procedures serve as examples to change the position of the auxiliary switch angles when starting at full CCW position.

Switch S1

To change the angle of Switch S1 to 20°, refer to Figure 12 and proceed as follows:

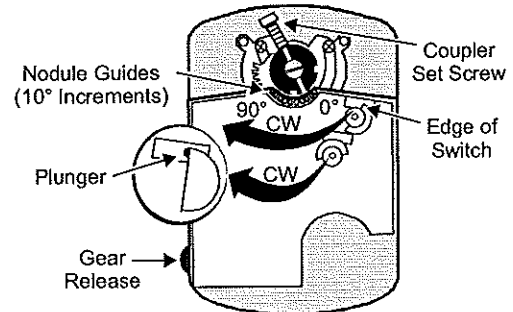


Figure 12: Switch Angle Settings

1. Press and hold the gear release. Using the 0 to 90° nodule guides, rotate the coupler until the center of the coupler set screw is at 20°.
2. Rotate Switch S1 CW, and align the edge of the switch with the plunger until the plunger rises. (See Figure 12.)

Note: At this point, the normally closed contact closes, and the normally open contact opens. (See Auxiliary Switches in Figure 9.)

Switch S2

To change the angle of Switch S2 to 70°, refer to Figure 12 and proceed as follows:

1. Press and hold the gear release. Using the 0 to 90° nodule guides, rotate the coupler until the center of the coupler set screw is at 70°.
2. Rotate Switch S2 CW, and align the edge of the switch with the plunger until the plunger rises. (See Figure 12.)

Note: At this point, the normally closed contact opens, and the normally open contact closes. (See Auxiliary Switches in Figure 9.)

3. Press and hold the gear release. Rotate the coupler until the center of the coupler set screw is back to 0°.
4. Check all the wiring, and system settings, and apply power to the controller. Provide signals to the actuator to drive it at least one complete cycle open and closed to verify proper operation.

Repairs and Replacement

Field repairs must not be made. For a replacement or an accessory, refer to the *M9109 Series Electric Non-spring Return Actuators Product Bulletin (LIT-120112)*.

Technical Data

Product	M9109 Series Electric Non-spring Return Actuators
Power Requirements	AGx: 20 to 30 VAC at 50/60 Hz; 2.5 VA supply, Class 2 GGx: 20 to 30 VAC at 50/60 Hz; 3.2 VA supply, Class 2
Input Signal	AGx: 20 to 30 VAC at 50/60 Hz GGx: 0 to 10 VDC or 0 to 20 mA
Input Signal Adjustments	AGx: CW and COM Terminals, CW rotation; CCW and COM Terminals, CCW rotation GGx (Voltage Input or Current Input): Jumper Selectable: 0 (2) to 10 VDC or 0 (4) to 20 mA Factory Setting: 0 to 10 VDC, CW rotation with signal increase Action is jumper selectable Direct (CW) or Reverse (CCW) with signal increase.
Input Impedance	AGx: 200 ohms, nominal GGx: Voltage Input, 150,000 ohms; Current Input, 500 ohms
Feedback Signal	GGx: 0 to 10 VDC or 2 to 10 VDC for 90° (10 VDC at 1 mA); Corresponds to input signal span selection
Auxiliary Switch Rating	xGC: Two Single-Pole, Double-Throw (SPDT) switches rated at 24 VAC, 1.5 A inductive, 3.0 A resistive, 35 VA maximum per switch, Class 2
Mechanical Output	Running Torque: 80 lb-in (9 N-m)
Cycles	60,000 full cycles; 2,500,000 repositions rated at 80 lb-in (9 N-m)
Audible Noise Rating	35 dBA maximum at 1 m
Rotation Range	Adjustable from 30 to 90° CW or CCW; mechanically limited to 93°
Rotation Time	Nominal 60 seconds at 60 Hz and 72 seconds at 50 Hz for 90°
Electrical Connection	1/4 in. spade terminals (Optional pluggable terminal blocks are available.)
Mechanical Connection	3/8 to 1/2 in. (10 to 13 mm) round steel shaft or 3/8 in. (10 mm) square steel shaft
Enclosure	NEMA 2, IP32
Ambient Operating Conditions	-4 to 125°F (-20 to 52°C); 90% RH maximum, non-condensing
Ambient Storage Conditions	-40 to 176°F (-40 to 80°C); 90% RH maximum, non-condensing
Dimensions (H x W x D)	5.9 x 4.2 x 2.64 in. (150.1 x 106.5 x 67 mm)
Shipping Weight	2.4 lb (1.08 kg)
Agency Compliance	UL Listed, File E27734, CCN XAPX CSA Certified, File LR85083, Class 3221 02 CE Mark, EMC Directive 89/336/EEC

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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