

M9106-xGx-2 Series Electric Non-Spring Return Actuators

Installation

IMPORTANT: The M9106-xGx-2 Series actuator is intended to control equipment under normal operating conditions. Where failure or malfunction of an M9106-xGx-2 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 M9106-xGx-2 actuator must be incorporated into and maintained as part of the control system.

Parts Included

- M9106-xGx-2 actuator
- M9000-160 anti-rotation bracket
- two No. 12-24 x 1/2 in. self-tapping hex washer-head screws
- spade terminals

Special Tools Needed

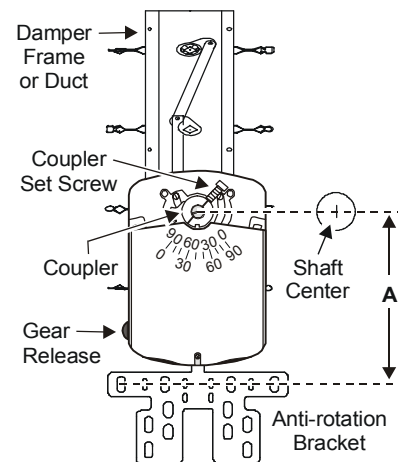
- drill with a 3/16 in. (No. 15, 4.57 mm) drill bit
- 5/16 in. (8 mm) square socket or 3/8 in. (10 mm) 12-point socket
- wire/terminal crimper

Mounting

The actuators are not position sensitive, and may be mounted in any convenient orientation. They may be installed on a 3/8 to 1/2 in. (10 to 12.7 mm) round shaft or a 3/8 in. (10 mm) square 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.

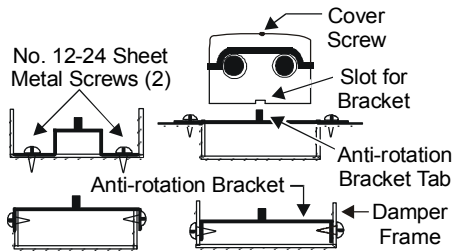


Figure 2: Anti-rotation Bracket Positions

- 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.)

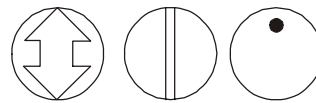


Figure 3: Damper Position Icons

- 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.

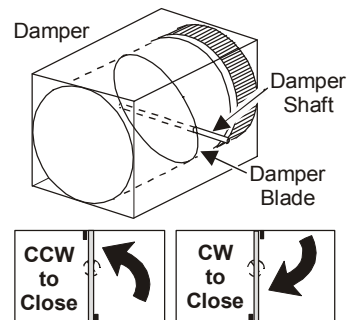


Figure 4: Damper Rotation

- 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.)

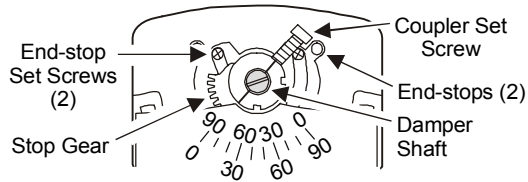


Figure 5: Setting the Rotation Range

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, proceed to the appropriate section for the actuator model.

Floating Application: AGx and IGx Models

For CW rotation and RA operation, 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.)

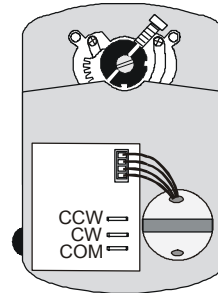


Figure 6: Direction of Action on AGx and IGx Model

On/Off Application: IGx Model Only

Drive the IGx model as an On/Off actuator by wiring continuous 24 VAC power to the COM and CW Terminals. At the same time, command the actuator to open by powering the CCW Terminal with 24 VAC. To drive the actuator back to the full CW position, remove the 24 VAC signal from the CCW Terminal.

GGx Models

The M9106-GGx-2 proportional actuators are factory set for Direct Acting (DA) mode with Jumper W1 in the DA position. Remove Jumper W1 and place it in the RA position. (See Figure 7.)

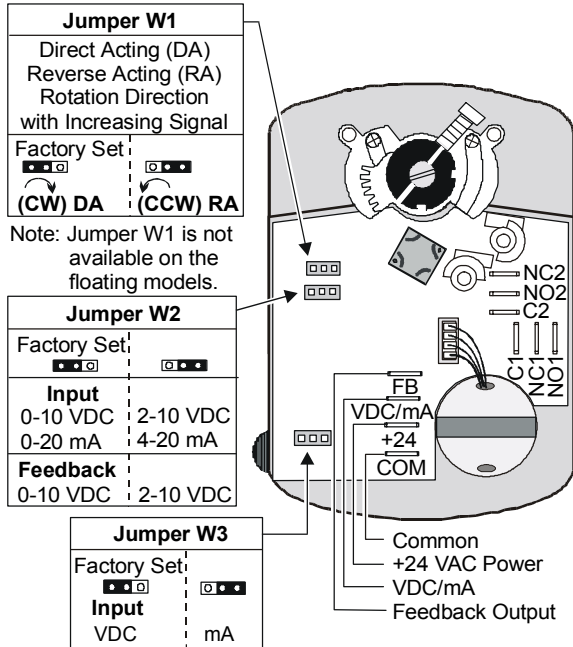


Figure 7: Calibrating the GGx Models

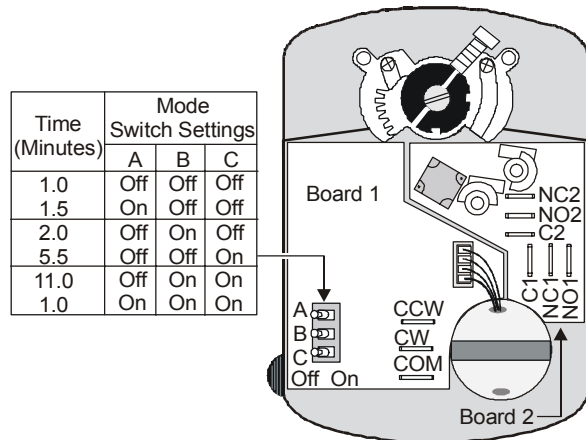
Jumpers (GGx Models)

The M9106-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.)

Mode Switches (IGx Models)

The M9106-IGx-2 models offer adjustable rotation times of 1, 1.5, 2, 5.5, and 11 minutes (factory set for 1 minute). Switch settings determine the rotation time of the IGx models. Refer to Figure 8 to position the mode switches for the desired rotation time.



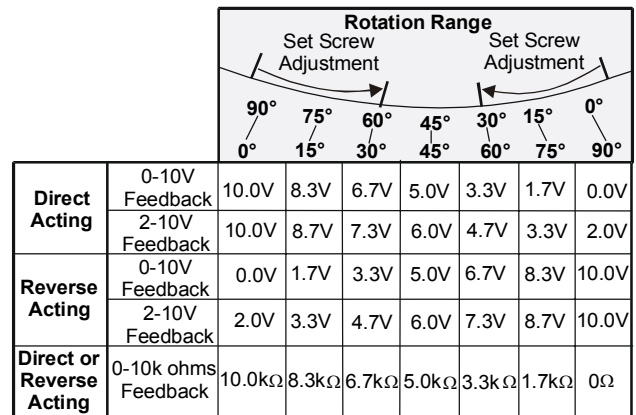
Note: The IGA models have Board 1, and the IGC models have both Board 1 and Board 2.

Figure 8: Mode Switch Settings on IGx Models

The 1-, 1.5-, and 2-minute settings are ideal for on/off and floating applications, and replace the M9104-xGx-2 1.5-minute models. The 5.5- and 11-minute settings are replacements for the 35 lb-in (4 N·m) EDA-2040 and the ATP-2040 models.

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. For the AGF model, resistance feedback is reduced corresponding to the reduced rotation range. (See Figure 9.)



Note: 0-10V is available on GGA and GGC models.
 0-10k ohms feedback is available on AGF models.

Figure 9: Nominal Feedback Signal Relative to the Rotation Range

Wiring

CAUTION: Equipment Damage Hazard.
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 10.)

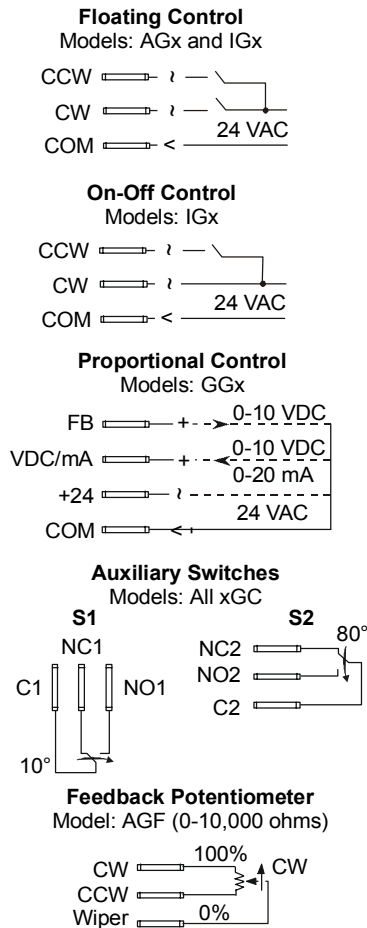


Figure 10: Wiring for M9106 Models

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 and IGx models have an auto shutoff to avoid excessive wear or drive time on the motor.

Through the Conduit Openings

Depending on the M9106 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 11.)

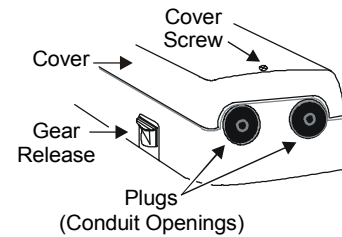


Figure 11: Location of the Conduit Openings

3. Use the 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 10.

IMPORTANT: Install all quick-connect terminals in the same direction to prevent shorting. (See Figure 12.)



Figure 12: Orientation of Terminals

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

Auxiliary Switches (xGC Models)

The M9106-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 13 and proceed as follows:

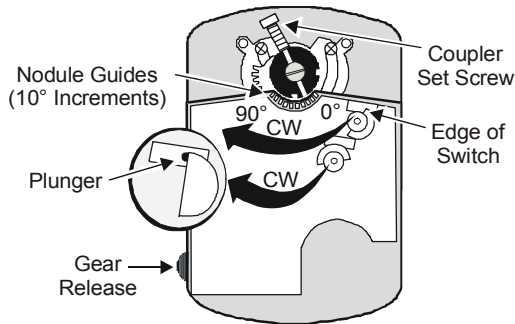


Figure 13: Switch Angle Settings

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 13.)

Note: At this point, the normally closed contact closes, and the normally open contact opens. (See Auxiliary Switches in Figure 10.)

Switch S2

To change the angle of Switch S2 to 70°, refer to Figure 13 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 13.)

Note: At this point, the normally closed contact opens, and the normally open contact closes. (See Auxiliary Switches in Figure 10.)

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 *Ordering Information* section in the *M9106-xGx-2 Series Electric Non-spring Return Actuators Product Bulletin (LIT-2681123)*.

Technical Data

Product	M9106-xGx-2 Series Electric Non-Spring Return Actuators	
Power Requirements	AGx:	20 to 30 VAC at 50/60 Hz; 2.5 VA supply, Class 2
	IGx:	20 to 30 VAC at 50/60 Hz; 2.8 VA supply, Class 2
	GGx:	20 to 30 VAC at 50/60 Hz; 3.2 VA supply, Class 2
Input Signal	AGx and IGx:	20 to 30 VAC at 50/60 Hz
	GGx:	0 to 10 VDC or 0 to 20 mA
Input Signal Adjustments	AGx and IGx:	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
	IGx:	160 ohms, nominal
	GGx:	Voltage Input, 150,000 ohms; Current Input, 500 ohms
Feedback Signal	AGF:	10,000 ohm potentiometer, 1 W
	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)	1-, 1.5-, and 2-minute settings:	53 lb-in (6 N·m)
	5.5- and 11-minute settings:	35 lb-in (4 N·m)
Cycles	100,000 full cycles; 2,500,000 repositions rated at 53 lb-in (6 N·m)	
Audible Noise Rating	35 dBA maximum at 1 m	
Rotation Range	Adjustable from 30 to 90°, CW or CCW	
Rotation Time	IGx:	Adjustable with switch settings (Factory set for 1 minute. See Figure 12.) 60, 90, 120, 330, or 660 seconds (1, 1.5, 2, 5.5 or 11 min.) at 60 Hz; and 72, 108, 144, 396, or 792 seconds (1.2, 1.8, 2.4, 6.6, or 13.2 minutes) at 50 Hz All Other Models: 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 12.7 mm) round shaft or 3/8 in. (10 mm) square shaft	
Enclosure	NEMA 2, IP32	
Ambient Operating Conditions	-4 to 125°F (-20 to 52°C); 90% RH maximum, non-condensing	
Ambient Storage Conditions	IGx:	-40 to 186°F (-40 to 86°C); 90% RH maximum, non-condensing
	All Other Models:	-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 873 Listed, File E27734, CCN XAPX CSA C22.2 No. 139 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.



Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

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