

M9104 Series Electric Actuator

Installation

IMPORTANT: Use this M9104 actuator only to control equipment under normal operating conditions. Where failure or malfunction of the 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 actuator.

IMPORTANT : Utiliser ce M9104 actuator uniquement pour commander des équipements dans des conditions normales de fonctionnement. Lorsqu'une défaillance ou un dysfonctionnement du actuator risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du actuator.

Tools Required

- 1/4 in. (7 mm) flat-blade screwdriver
- Phillips No. 1 screwdriver
- center punch
- 5/16 in. (8 mm) square socket or 3/8 in. (10 mm) 12-point socket
- needle-nose pliers

Mounting

The M9104 actuators are not position sensitive, and can be mounted in any convenient orientation. They can be installed on a 3/8 in. to 1/2 in. (10 to 13 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.)

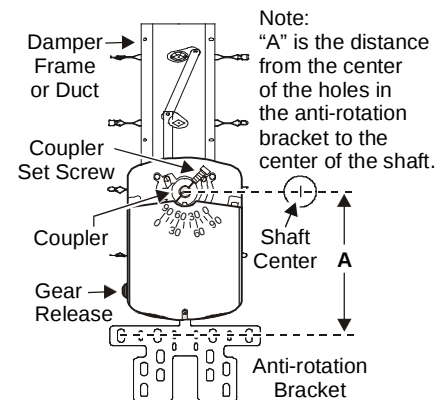


Figure 1: Mounting Positions

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

Parts Included

- M9104 Series actuator
- anti-rotation bracket
- two No. 12-24 sheet metal screws
- spade terminals

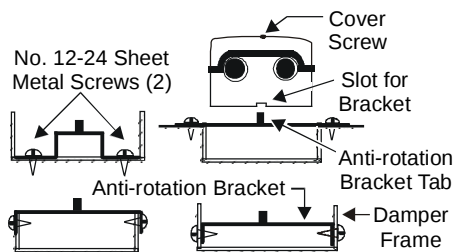


Figure 2: Anti-Rotation Bracket Positions

3. Close the damper.
4. 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.
5. 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.

Table 1: Distances from the Anti-Rotation Bracket to 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

6. Attach the anti-rotation bracket to the damper or duct using the two No. 12-24 sheet metal screws provided.

IMPORTANT: Do not overtighten the sheet metal screws, or the mounting surface can be stripped.

7. 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.)
8. 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.

9. 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.
10. Release the gear release lever.

Setting the Actuator Stroke

The damper must be checked as follows:

1. 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.)

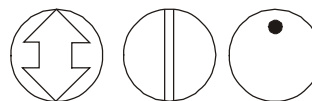


Figure 3: Damper Position Icons

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

Rotation of 90°

If the damper shaft rotation is 90°:

1. 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.

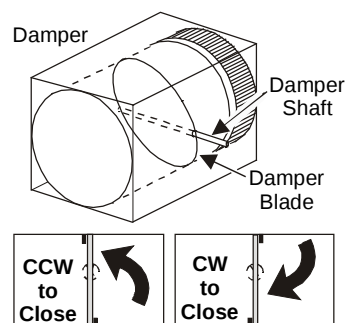


Figure 4: Damper Rotation

2. 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 *Rotation Less than 90°* section.

3. Release the gear release lever.

Rotation Less than 90°

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

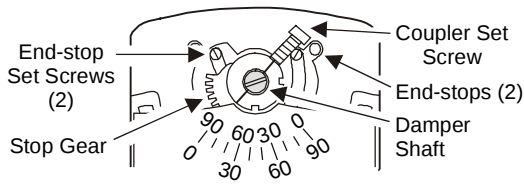


Figure 5: Setting the Rotation Range

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 the 90° indicator marks on the scale.
- To set 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 flat-blade 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.

Calibration

Jumper Settings

The M9104-AGx-2 floating actuators do not have jumper settings. The M9104-GGx-2 proportional actuators are factory set for Direct Acting (DA) with Jumper W1 in the DA position, Jumper W2 in the 0 to 10 VDC position, and Jumper W3 in the VDC position.

The VDC/mA terminal is the control signal input. 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 6.)

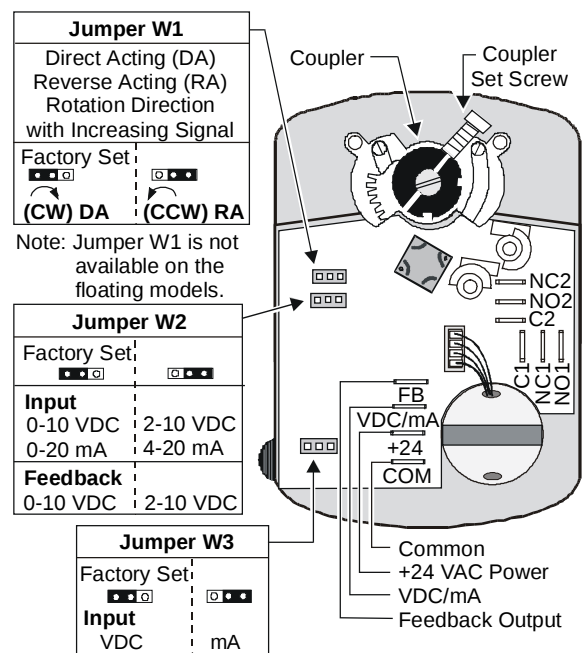


Figure 6: Calibrating M9104-GGx-2 Models

Direction of Action

In the DA mode, a minimum control signal will drive the actuator to the full CCW position, and a maximum control signal will drive it fully CW. For Reverse Acting (RA) operation, a minimum control signal will drive the actuator to the full CW position, and a maximum control signal will drive it fully CCW.

To set an actuator for RA, perform the procedures that follow for the appropriate model.

Floating (AGA, AGC, and AGF) Models

Loosen the cover screw, and remove the actuator cover. For CW rotation, apply 24 VAC to the COM and CW Terminals. For CCW rotation, apply 24 VAC to the COM and CCW Terminals. (See Figure 7.)

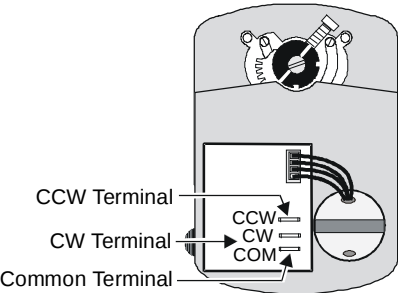


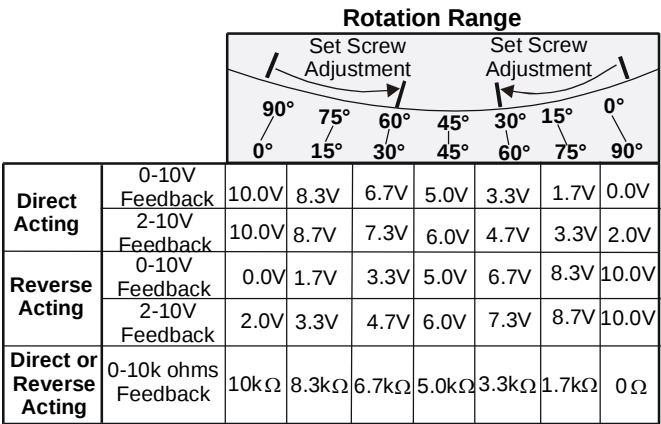
Figure 7: Rotation for Floating Models

Proportional (GGA and GGC) Models

Remove Jumper W1, and place it in the RA position. (See Figure 6.)

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 8.)



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

Figure 8: Nominal Feedback Signal Relative to the Rotation Range

Wiring



CAUTION: Risk of Electric Shock.

Disconnect the power supply before making electrical connections to avoid electric shock.

MISE EN GARDE : Risque de décharge

électrique. Débrancher l'alimentation avant de réaliser tout raccordement électrique afin d'éviter tout risque de décharge électrique.



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.

MISE EN GARDE : Risque de dégâts matériels.

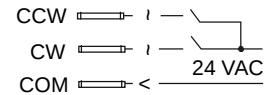
Ne pas mettre le système sous tension avant d'avoir vérifié tous les raccords de câblage. Des fils formant un court-circuit ou connectés de façon incorrecte risquent d'endommager irrémédiablement l'équipement.

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

The M9104 actuator requires a 24 VAC control signal and is compatible with a variety of controllers. (See Figure 9.)

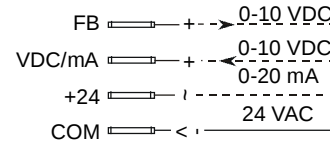
Floating Control

Models: AGA, AGC, and AGF



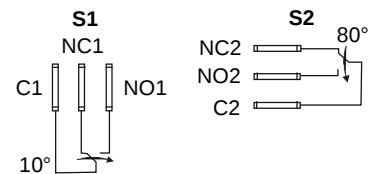
Proportional Control

Models: GGA and GGC



Auxiliary Switches

Models: AGC and GGC



Feedback Potentiometer

Model: AGF (0-10,000 ohms)

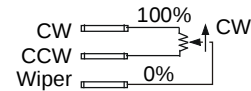


Figure 9: Wiring Diagrams for the M9104 Series

Depending on the M9104 model selected, one or both conduit openings are used.

1. Push the plastic conduit plug out of the conduit opening with fingertip. (See Figure 10.)

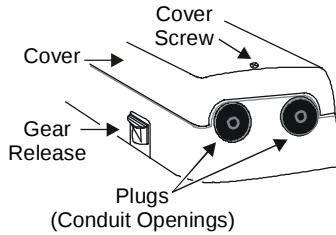


Figure 10: Location of the Conduit Openings

2. Use the Phillips 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.

3. 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 the quick-connect terminals in the same direction to each other to prevent the terminals from shorting. (See Figure 11.)



Figure 11: Orientation of Terminals

IMPORTANT: Because of the actuator's movement during operation, some form of wire strain reliefs must be used.

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 (M9104-xGC)

The built-in auxiliary switches can be set for any angle between 0 and 90° (factory set for 10 and 80°). Refer to the *Specifications* 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.

Adjusting Switch Cam S1

To change the angle of Switch Cam S1 to 20°:

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 Cam S1 CW, and align the edge of the switch cam with the switch plunger until the plunger rises. (See Figure 12.)

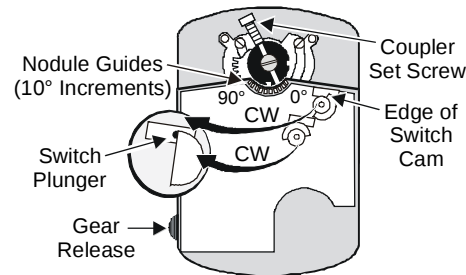


Figure 12: Switch Cam Angle Settings

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

Adjusting Switch Cam S2

To change the angle of Switch Cam S2 to 70°:

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 Cam S2 CW, and align the edge of the switch cam with the switch plunger until the plunger rises. (See Figure 12.)

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

3. Press and hold the gear release. Rotate the coupler until the center of the coupler set screw is back to 0°.

Additional Information

Refer to Table 2 for accessories available, and contact the nearest Johnson Controls representative. See Table 3 for M9104 specifications.

Table 2: Accessories Available

Product Code Number	Description
CBL-2000-2	Plenum Rated Wiring Harness, 20 in. (0.5 m)
CBL-2000-3	Plenum Rated Wiring Harness, 72 in. (1.8 m)
DMPR-KR003*	Sleeve Pin Kit
DMPR-KC003**	Blade Pin Extension without Bracket
M9000-105	Pluggable 3-Terminal Block
M9000-106	Pluggable 4-Terminal Block
M9000-200	Commissioning Tool
M9000-512	Valve Linkage Kit for field mounting an M9104 actuator to 1/2 in. two way VG1000 Series ball valve

* For use with round dampers that have a 5/16 in. (8 mm) shaft; furnished with the damper and can be ordered separately.

** Supplied with CD-1300 dampers and can be ordered separately for all direct mount applications.

Table 3: Specifications

Product	M9104 Series Electric Actuator
Power Requirements	Floating: 20 to 30 VAC at 50/60 Hz; 3.4 VA supply, minimum; Class 2 Proportional: 20 to 30 VAC at 50/60 Hz; 5.0 VA supply, minimum; Class 2
Input Signal	Floating: 20 to 30 VAC at 50/60 Hz Proportional: 0 to 10 VDC or 0 to 20 mA
Input Signal Adjustments	Floating: CW and COM Terminals, CW rotation; CCW and COM Terminals, CCW rotation Proportional (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	Floating: 250 ohms, nominal Proportional: Voltage Input, 150,000 ohms; Current Input, 500 ohms
Feedback Signal	Floating (AGF models): 10,000 ohm potentiometer, 1 W Proportional (GGx models): 0 to 10 VDC or 2 to 10 VDC for 90° (1 mA at 10 VDC) Corresponds to input signal span selection
Switch Contact Rating	Two Single-Pole, Double-Throw (SPDT) rated at 24 VAC 1.5A inductive, 3A resistive, 35 VA maximum per switch
Electrical Connections	1/4 in. spade terminals (optional Pluggable Terminal Blocks)
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
Torque	Running: 35 lb·in (4 N·m) Breakaway: 35 lb·in (4 N·m) minimum Stall: 40 lb·in (4.5 N·m) minimum
Cycles	100,000 full cycles, 2,500,000 repositions rated at 35 lb·in (4 N·m)
Audible Noise Rating	35 dBA maximum at 1 m
Rotation	Adjustable from 30 to 90°, CW or CCW
90° Rotation Time	Nominal 90 seconds at 60 Hz Nominal 108 seconds at 50 Hz
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 873 Listed, File E27734, Guide XAPX CSA C22.2 No. 139, File LR85083, Class 3221 02 CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.

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.

Notes

European Single Point of Contact:

JOHNSON CONTROLS
WESTENDHOF 3
45143 ESSEN
GERMANY

NA/SA Single Point of Contact:

JOHNSON CONTROLS
507 E MICHIGAN ST
MILWAUKEE WI 53202
USA

APAC Single Point of Contact:

JOHNSON CONTROLS
C/O CONTROLS PRODUCT
MANAGEMENT
NO. 22 BLOCK D NEW DISTRICT
WUXI JIANGSU PROVINCE 214142
CHINA



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