M9310 Series Electric Non-Spring Return Actuators

Product Bulletin

M9310-HGA-2

Code No. LIT-12012069
Issued January 2016

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The M9310 Series Electric Non-Spring Return Actuators provide control of dampers in HVAC systems. All actuators in this series provide 88 lb·in (10 N·m) rated torque.

The series provides Automatic Signal Input Detection, which allows automatic recognition of input signals for on/off, floating, and proportional control.

These actuators are configured for direct mounting and do not require damper linkage. Actuators can be mounted directly to a damper shaft from 3/8 to 3/4 in. (9.5 to 19 mm) diameter and 3/8 to 5/8 in. (9.5 to 15 mm) square with a universal clamp.

An accessory crank arm and remote mounting kit are available for applications where the actuator cannot be direct-coupled to the damper shaft. An optional line voltage auxiliary switch kit can be field installed to indicate an end-stop position or perform switching functions within the selected rotation range. The M9310 actuators also feature a NEMA 4X weathershield for applications in harsh environments.

Figure 1: M9310 Series Electric Non-Spring Return Actuator without (left) and with Accessory Kit (right)

Table 1: Features and Benefits (Part 1 of 2)

Features	Benefits
Automatic Signal Input Detection, On/Off, Floating, and Proportional Control with Adjustable Span and Offset	Increases availability at distributors and simplifies retrofits.
Easy Conversion to Valve Operation - Same Actuator Used for Dampers or Valves	Increases availability at distributors with only one actuator to learn.
Optional Accessory Kit	Increases availability at distributors. The auxiliary switch kit provides two line-voltage-capable single-pole, double-throw (SPDT) switches with continuously adjustable switch points, and the auxiliary potentiometer kit provides several potentiometer feedback options. Facilitates safety interfacing or signaling.
Backward Compatible Auxiliary Switch Kits and Auxiliary Potentiometer	Allows for a seamless retrofit without the need to replace the controller.
88 lb·in (10 N·m) Rated Torque	Provides high torque in a compact package size to expand the range of applications in HVAC systems.
Self-Calibrating Input Signal to Adjust Stroke	Eliminates the need for a complex calibration procedure when adjusting stops.
Direct-Coupled Design	Requires no crank arm or linkage and is capable of direct mounting to a shaft up to 3/4 in. (19 mm) diameter and 5/8 in. (15 mm) square.

Table 1: Features and Benefits (Part 2 of 2)

Features	Benefits
Electronic Stall Detection	Protects from overload at all angles of rotation. The actuator may be stalled anywhere in its rotation range without the need for mechanical end switches.
Microprocessor-Controlled Brushless DC Motor	Provides constant runtime independent of torque and increases lifecycle by reducing wear.
Mode Configuration Switches	Permits calibration, input signal range selection, and control logic reversal for proportional control.
Integral Cables with Colored and Numbered Conductors	Simplify installation and field wiring.
Optional Integral 1/2 in. (13 mm) Threaded Conduit Connectors	Simplify installation and field wiring.
Plenum-Rated Models	Enable use in other environmental air spaces (plenums) in accordance with section 300.22(C) of the National Electric Code.
Small Footprint	Allows application in smaller spaces than the M9106/M9109 and M9108 actuators.
M9106, M9109, and M9108 Series Actuators Replacement	Simplifies product selection and logistics.
100,000 Cycles and 2.5 Million Repositions	Assure long time reliability.
NEMA5/IP54 Enclosure	Enhances the range of application environments.
Underwriters Laboratories Inc.® (UL), CE Mark, and RCM Compliance	Provides internationally recognized regulatory agency approvals.
Manufactured under International Standards Organization (ISO) 9001 Quality Control Standards	Ensures quality.
Bottom-Mounted Coupler	Simplifies short shaft damper applications.
Same Weathershield as M9203 and M9208 Series Actuators	Keeps logistics simple and assures quick delivery time.
5-Year Warranty	Protects consumer investment.

Product Details

M9310 Series Actuators operate with 24 VAC/DC to provide 88 lb·in. (10 N·m) rated torque. The actuators can be used with on/off, floating, or proportional controllers in HVAC systems that are controlled by an electronic controller or positioner.

Floating control is provided from a triac or relay. On/off control can be provided from a manual switch, controller, auxiliary switch from a fan motor contactor, or similar device.

The actuators include plenum-rated cables and are specially configured for installation in spaces used for environmental air-handling purposes, other than ducts and plenums, as specified in National Fire Protection Association (NFPA) 70: National Electrical Code section 300.22(C), Other Space Used for Environmental Air. The space over a hung ceiling, when used for environmental air handling purposes, is an example of the type of space for which these actuators are configured.

The actuators have 90-second constant runtime for 90° rotation, independent of supply voltage frequency and load. When combined with other actuators in a control system, this option provides flexibility in synchronizing the movement of equipment driven from a single proportional command.

When the M9310 Series Actuators are in proportional mode, the actuator responds to 0 to 10 VDC or 2 to 10 VDC control signals. With the addition of a 500 ohm resistor, the actuator responds to a 0 to 20 mA or 4 to 20 mA signal. A 0 to 10 VDC or 2 to 10 VDC feedback signal indicates position.

See Figure 2 and Figure 3 for floating and on/off control.

M9310-HGA-2 Actuators Wiring Diagrams

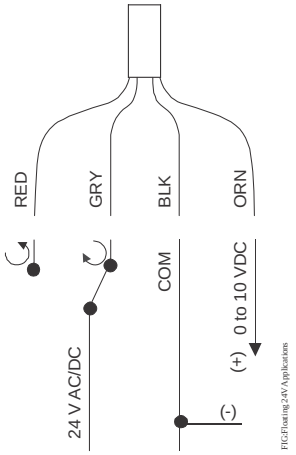

Figure 2: Floating 24 V Applications (SeeTable 2 for DIP Switch Placement)

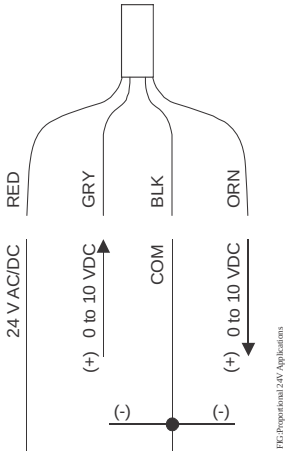

Figure 4: Proportional 24 V Applications

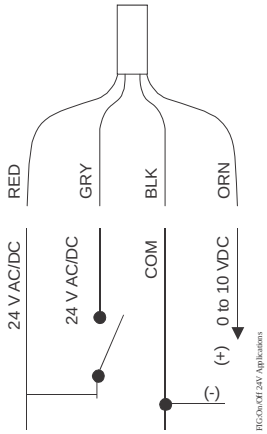

Figure 3: On/Off 24 V Applications (See Table 2 for DIP Switch Placement)

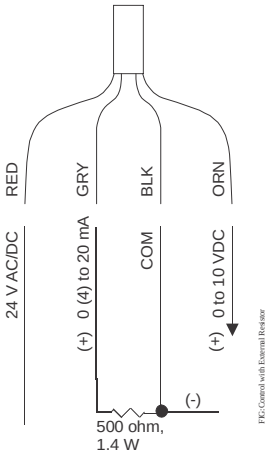

Figure 5: Proportional 24 V Applications - 0 (4) to 20 mA with External Resistor

IMPORTANT: Use these M9310 Series Electric Non-Spring Return Actuators 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.

Mounting Options

M9310 Series Damper Actuators can be converted into VA9310 Series Valve Actuators using the M9310-500 valve linkage.

Operation

M9310 Series Actuators use a brushless DC motor controlled by a microprocessor. The microprocessor drives the motor at constant speed, independent of torque. The actuator slows down before it reaches its stop position allowing it to coast, further reducing gear wear. The microprocessor also monitors the brushless DC motor's rotation to prevent damage to the actuator in a stall condition. The actuator can be stalled anywhere within its rotation range without the need for mechanical end switches.

The actuator self-calibrates the control signal when an end stop is adjusted on the stroke. An auto-calibration has to be performed to change the feedback of the actuator.

Auto-Calibration Mode

The auto-calibration mode identifies the available range of travel of the coupler. During the auto-calibration mode, the actuator moves the coupler to the maximum and minimum end stops to identify the range of travel.

DIP Switches and Status LEDs

The actuators allow easy setting of the proportional input signals. Through the DIP switches located under the removable oval cover in the front of the unit, it is possible to set reverse or direct acting and to select 0 to 10 V or 2 to 10 V input or other starting points and spans. See Figure 6 and Table 2.

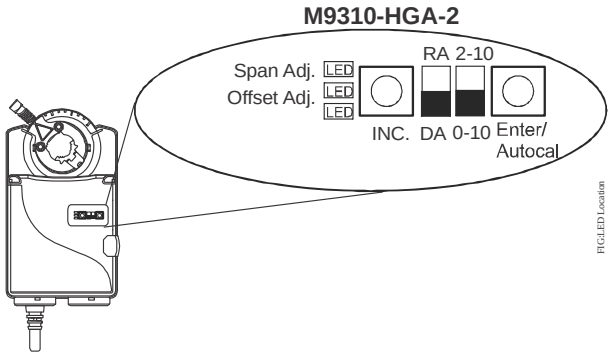

Figure 6: DIP Switches and LEDs

Table 2: DIP Switch Settings

Example	Command Signal	Feedback Signal	Settings M9310-HGA User Interface
1	0 to 10 VDC	Direct 0 to 10 VDC	
2	0 to 10 VDC	Reverse 0 to 10 VDC	
3	2 to 10 VDC	Direct 2 to 10 VDC	
	24 VAC	–	
4	Offset = 5 Span = 7	Reverse 10 to 2 VDC	

Switch Kit

For control requiring line-voltage-capable switches, an optional switch kit can couple to the actuator. The switch kit provides independent and continuously adjustable switch points throughout the full range of the actuator stroke. Auxiliary switches are double insulated so an electrical ground is not required.

Ordering Information

Table 3: Selection Chart

Code Number	Rotation Time For 90°	Power Requirement	Input Signal				Position Feedback	Electrical Connection		Auxiliary Switches
	Running (Seconds)	24 VAC (19.2 to 28.8 VAC) at 50/60, Class 2 (North America) or SELV (Europe), 4.7 VA running. 24 VDC (21.6 to 28.8 VDC) Class 2 (North America) or SELV (Europe), 1.3 W running.	On/Off	Floating	0 (2) to 10 VDC	Adjustable Span and Offset	0 (2) to 10 VDC	120 in. (3.05 m) 19 AWG Plenum Cable	1/2 in. NPSM (13 mm) Threaded Conduit Connectors	1 x SPDT or 2 x SPDT
M9310-HGA-2	90	X	X	X	X	X	X[1]	X	Optional[2]	Optional[3]

1. Feedback is only available when 0 (2) to 10 V proportional input is used.
2. Order separately M9300-100 (quantity 5).
3. Order separately M9300-1 or M9300-2.

Table 4: Accessories (Order Separately) (Part 1 of 2)

Code Number	Description
DMPR-KC003[1]	7 in. (178 mm) blade pin extension without bracket for Johnson Controls direct-mount damper applications
M9000-200	Commissioning Tool that provides a control signal to drive 24 V on/off, floating, proportional, and resistive electric actuators
M9000-322	NEMA 4x, IP66/67 Weathershield Kit for damper application of M9104, M9310, M9203, and M9208 Series Electric Actuators
M9000-400	Jackshaft Linkage Adapter Kit
M9000-604	Replacement Anti-Rotation Bracket Kit for M9310, M9203, M9208, M9210, and M9220 Series Electric Actuators
M9000-606	Position indicator (quantity 5)
M9300-1	Auxiliary Switch Kit (one single-pole, double-throw)
M9300-2	Auxiliary Switch Kit (two single-pole, double-throw)
M9300-100	Threaded Conduit Adapters for 1/2 in. electrician's fittings (quantity 5)
M9300-140	External Auxiliary Feedback Potentiometer 140 ohm
M9000-151	Remote Mounting Kit, with crank arm and damper linkage for M9108 (16) (24), and M9300 Series Actuators
M9300-1K	External Auxiliary Feedback Potentiometer 1k ohm
M9300-2K	External Auxiliary Feedback Potentiometer 2k ohm
M9300-10K	External Auxiliary Feedback Potentiometer 10k ohm

Table 4: Accessories (Order Separately) (Part 2 of 2)

Code Number	Description
M9310-500	Ball Valve Linkage Kit for converting M9310 actuators to VA9310 actuators for operating VG1000 ball valves
M9310-600	Standard Coupler Kit, M9310 Series (round 3/8 to 3/4 in. [9 to 19 mm], square 3/8 to 5/8 in. [9 to 16 mm])

1. Furnished with the damper and may be ordered separately.

Dimensions

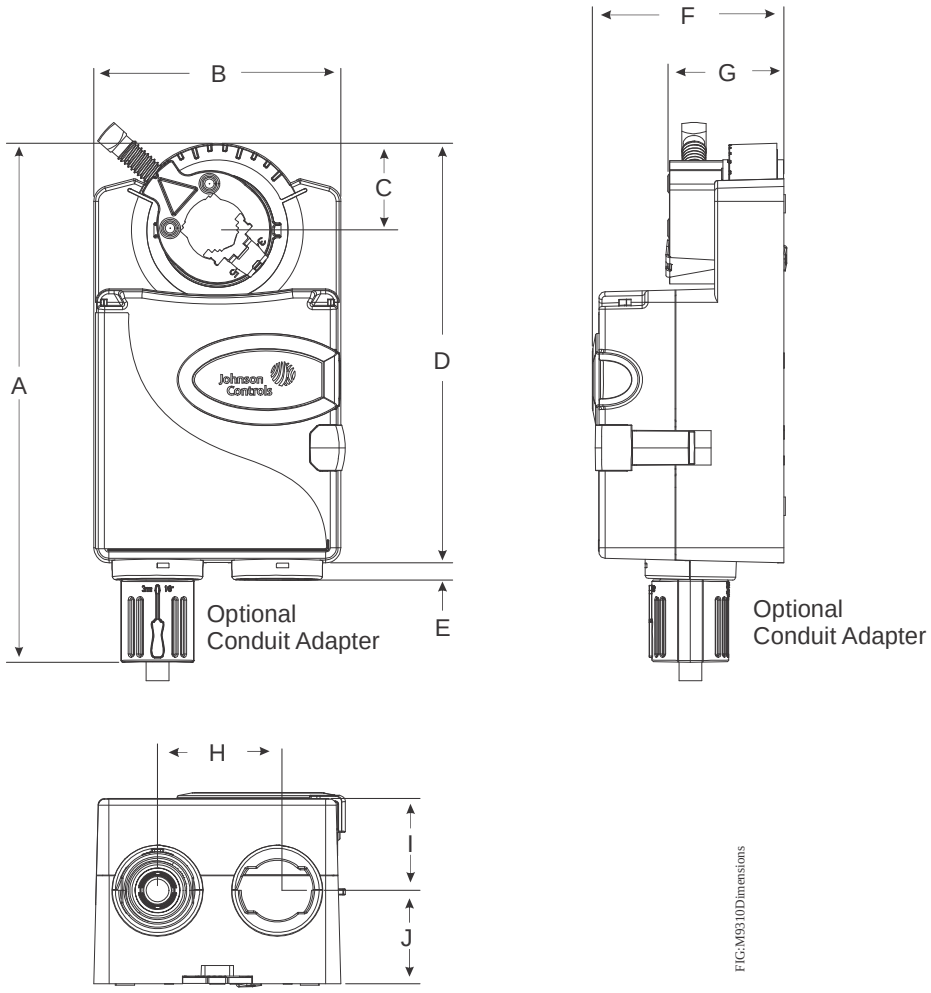

Figure 7: M9310-HGA-2 Dimensions (without accessory kit)

Table 5: M9310 Series Actuators Dimensions (without accessory kit)

Dimensions, in. (mm)	A	B	C	D	E	F	G	H	I	J
	6-21/32 (169)	3-3/16 (81)	1-3/32 (28)	5-13/32 (137)	1/4 (6)	2-7/16 (62)	1-1/2 (38)	1-17/32 (39)	1-3/16 (30)	1-7/32 (31)

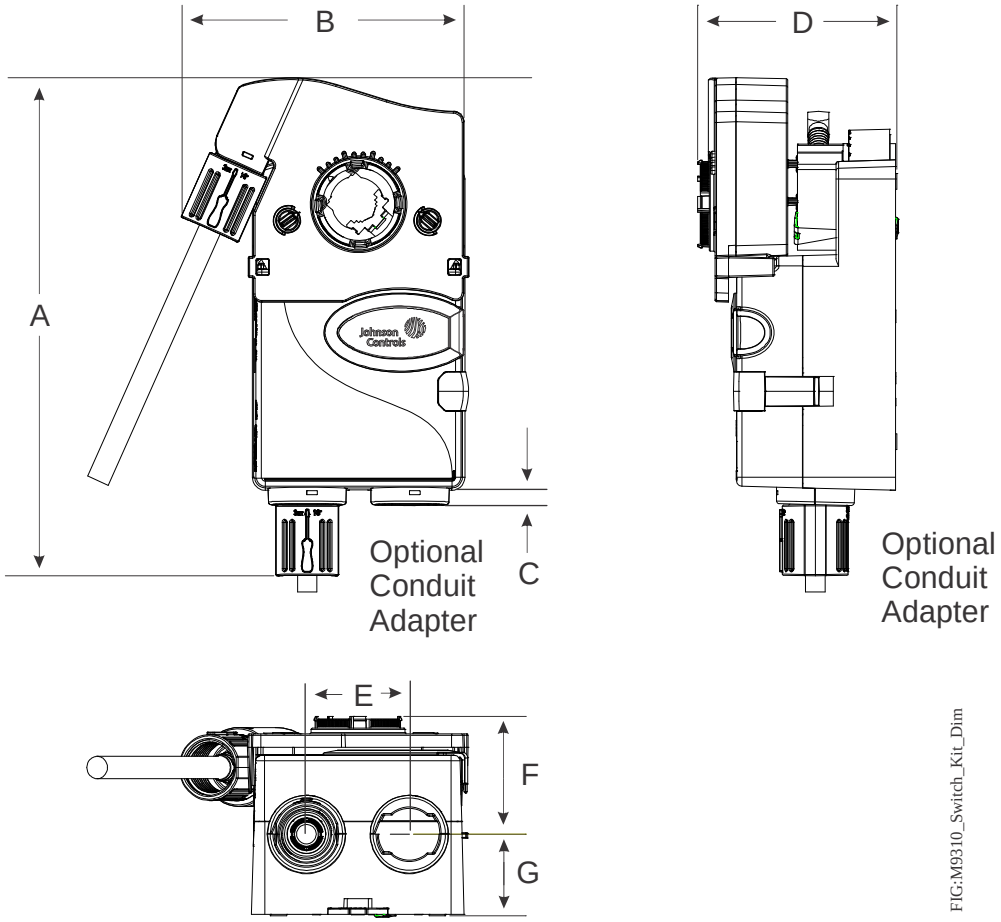

Figure 8: M9310-HGA-2 Dimensions (with accessory kit)

Table 6: M9310 Series Actuators Dimensions (with accessory kit)

Dimensions, in. (mm)	A	B	C	D	E	F	G
	7-3/16 (189)	4-3/16 (106)	1/4 (6)	2-31/32 (75)	1-17/32 (39)	1-3/4 (45)	1-7/32 (31)

Technical Specifications

M9310 Series Electric Non-Spring Return Actuator

Product Description	**M9310-HGA-2:** On/Off and floating mode	**M9310-HGA-2:** Proportional mode
Power Requirements	24 VAC (19.2 to 28.8 VAC) at 50/60, Class 2 (North America) or SELV (Europe), 4.7 VA running. 24 VDC (21.6 to 28.8 VDC) Class 2 (North America) or SELV (Europe), 1.3 W running.	
Transformer Sizing Requirements	≤6 VA	
Input Signal/Adjustments	19.2 to 28.8 VAC at 50/60 Hz or 24 VDC ±10% Class 2 (North America) or SELV (Europe)	0 (2) to 10 VDC or 0 (4) to 20 mA with field furnished 500 ohm 1/4 W resistor Offset: 0 to 10 VDC SPAN: 2 to 10 VDC
Control Impedance	4.7k ohm	100k ohm
Feedback Signal	–	0 (2) to 10 VDC
Running Torque	88 lb·in (10 N·m)	
Rotation Range	Mechanically limited 35° to 95° ±3° in 5° increments	
Rotation Time for 90° of Travel	90 seconds, constant for 0 to 88 lb·in (10 N·m) load, at all operating conditions	
Rotation Time Auto-calibration	35 seconds	
Cycles	100,000 full stroke cycles; 2,500,000 repositions	
Audible Noise	<35 dBA at 0 to 88 lb·in (10 N·m) load, at a distance of 39-13/32 in. (1 m)	
Electrical Connections	120 in. (3.05 m) UL 444 type CMP plenum rated cable with 19 AWG cable (0.75 mm²) conductors and 0.25 in. (6 mm) ferrule ends	
Conduit Connections	1/2 in. NPSM (13 mm) threaded conduit connectors with M9300-100 conduit connector (optional with the M9310-HGA-2)	
Mechanical Connections	Round 3/8 in. to 3/4 in. (centered on 1/2 in.) Square 3/8 in. to 5/8 in.	
Ambient Conditions	**Operating:** -22 to 140°F (-30 to 60°C), 90% RH, noncondensing **Storage:** -40 to 185°F (-40 to 85°C), 95% RH, noncondensing	
Enclosure	IP54/NEMA 5	
Shipping Weight	2 lb (0.9 kg)	
Compliance	**United States:** UL Listed, CCN XAPX, File E27734; to UL 60730-1: Automatic Electrical Controls for Household and Similar Use, Part 1; and UL 60730-2-14: Part 2, Particular Requirements for Electric Actuators. Plenum Rated (UL 2043). Suitable for use in Other Environmental Air Space (Plenum) in accordance with section 300.22 (c) of the National Electrical Code. **Canada:** UL Listed, CCN XAPX7, File E27734; to CAN/CSA E60730-1:02: Automatic Electrical Controls for Household and Similar Use, Part 1; and CAN/CSA-E60730-2-14, Particular Requirements for Electric Actuators.	
CE	**Europe:** CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and Low Voltage Directive. IEC 60730-1: Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements and IEC 60730-2-14, Automatic Electrical Controls for Household and Similar Use; Part 2 - Particular Requirements for Electric Actuators	
	Australia and New Zealand: RCM, Australia/NZ Emissions Compliant	

The performance specifications are nominal and conform to acceptable industry standard. 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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