

# M9210-xxx-3 Series Electric Spring Return Actuators

## Product Bulletin

Code No. LIT-12011056  
Issued March 9, 2006

The M9210-xxx-3 Series Actuators are direct mount, spring return electric actuators that operate on these available power options:

- AC 24 V at 50/60 Hz or DC 24 V (AGx, Bxx, GGx, HGx)
- AC 120 V at 60 Hz (BAx)
- AC 230 V at 50/60 Hz (BDx)

These bidirectional actuators do not require a damper linkage, and are easily installed on dampers with 1/2 to 3/4 in. or 12 to 19 mm round shafts, or 3/8 and 1/2 in. or 10, 12, and 14 mm square shafts using the standard shaft clamp included with the actuator. An optional M9220-600 Jackshaft Coupler Kit is available for 3/4 to 1-1/16 in. or 19 to 27 mm round shafts, or 5/8 and 3/4 in. or 16, 18, and 19 mm square shafts.

The M9210-xxx-3 Series Electric Spring Return Actuators provide running and spring return torques of 89 lb-in (10 N·m). Integral line voltage auxiliary switches are available on the xxC models to indicate end-stop position, or to perform switching functions within the selected rotation range.



Figure 1: M9210-xxx-3 Series Electric Spring Return Actuator

Table 1: Features and Benefits

Features	Benefits
Reversible Mounting Design	Simplifies installation and enables the actuator to spring return in either direction
Electronic Stall Detection throughout Entire Rotation Range	Extends the life of the actuator by deactivating the actuator motor when an overload condition is detected
Removable Coupler	Adapts to a shorter damper shaft
Integral 48 in. (1.2 m) Halogen Free Cables with Colored and Numbered Conductors	Simplify field wiring
Integral Auxiliary Switches (xxC Models)	Provide one fixed and one adjustable switch point with line voltage capability
NEMA 2 (IP54) Rated Aluminum Enclosure	Protects the internal components of the actuator from dirt and moisture
Easy-to-Use Locking Manual Override with Auto Release and Crank Storage	Allows for manual positioning of the actuator hub
Integral Connectors for 3/8 in. (10 mm) Flexible Metal Conduit	Simplify installation and field wiring

## Product Overview

The M9210-xxx-3 Series Electric Spring Return Actuators provide reliable control of dampers and valves in Heating, Ventilating, and Air Conditioning (HVAC) Systems.

**IMPORTANT:** Use this M9210-xxx-3 Series 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.

**IMPORTANT:** Do not install or use this M9210-xxx-3 Series 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.

## Operation

The M9210-xxx-3 Series Actuators are available for use with on/off, floating, and proportional controllers.

### **On/Off Control (M9210-Bxx-3)**

When power is applied, the actuator drives open and the output hub rotates against the spring from -5 to 90°. The actuator is electronically overload protected should the actuator stall before reaching 90°. It holds position at the end of the stroke until power is removed. When power is removed, the actuator spring returns to the -5° position. An M9220-603 adjustable stop kit is available to limit the stroke of the actuator between 30 and 90° in 5° increments. M9210-BxC-3 actuators include two integral Single-Pole, Double-Throw (SPDT) auxiliary switches. One switch is set to trip at 11° as the actuator is spring return closed.

### **Floating Control (M9210-Axx-3)**

**Note:** The information in this section assumes that Side A of the actuator (Counterclockwise [CCW] spring return) is facing you and the Direct Acting/Reverse Acting (DA/RA) selector switch is set in the DA position.

The actuator receives power by applying AC/DC 24 V between the black (common) and red (+AC/DC 24 V) wires. A controller applies power between the black and gray or black and orange wires to command the actuator to drive Clockwise (CW) or CCW at a constant speed, independent of load.

Applying AC/DC 24 V between the black and gray wires causes the actuator to drive CW from -5 toward 90° at a constant speed, independent of load. The time required to drive full stroke from 0 to 90° is nominally 150 seconds. When AC/DC 24 V power between the black and gray wires is removed, the actuator stops and holds its position. The longer power is applied between the black and gray wires, the farther the actuator rotates toward the 90° position.

Applying AC/DC 24 V power between the black and orange wires causes the actuator to drive CCW toward the -5° position. The longer AC/DC 24 V power is applied between the black and orange wires, the farther the actuator travels toward the -5° position. When power between the black and orange wires is removed, the actuator stops and holds its position.

Changing the DA/RA switch from DA to RA reverses the direction the actuator drives when power is applied between the black and gray or black and orange wires. The actuator is overload protected should it stall anywhere within its stroke. If the actuator stalls, it retries once after 2 minutes, assuming AC/DC 24 V is still applied.

If power is lost between the black (common) and red (+AC/DC 24 V) wires, the actuator spring returns to the -5° position. If power between the black and red wires is momentarily interrupted, the actuator drives to the -5° position and waits for the controller to command it in either the CW or CCW direction.

### **Proportional Control (M9210-GGx-3)**

**Note:** The information in this section assumes that Side A of the actuator (CCW spring return) is facing you and the control selector switch is set to the 0...10 V CW position.

The actuator is powered with AC/DC 24 V power between the black (common) and red (+AC/DC 24 V) wires. A proportional controller provides a DC 0 to 10 V signal between the black (common) and gray (control signal input) wires.

As the control signal increases from DC 0 to 10 V, the actuator drives CW from the -5 to 90° position. The position at which the actuator stops is proportional to the control signal. The actuator provides about 120 steps of control.

As the signal decreases, the actuator reverses direction and drives CCW toward the -5° position. A DC 0 to 10 V feedback signal is provided between the black (common) and orange (DC 0 to 10 V feedback signal output) to indicate the position of the actuator.

The direction in which the actuator drives with an increasing control signal can be reversed by positioning the selector switch to the DC 0...10 V CCW position. When the actuator is placed in this position, and it is at the 90° position with a DC 0 V control signal, the actuator proportionally drives to the -5° position as the control signal increases.

The actuator spring returns when power is interrupted between the black and red wires. When power returns, the actuator drives to the fully spring-return position to establish an end-of-stroke position, then drives to the position commanded by the DC 0 to 10 V controller.

This model has a selector switch that provides operation for DC 2 to 10 V controllers. This switch allows a CW or CCW rotation as the control signal increases from DC 2 to 10 V. The feedback signal between the black and orange wires changes to DC 2 to 10 V when the input signal selector is positioned to the DC 2 to 10 V CW or CCW position.

The M9210-GGx-3 actuators can be controlled by a DC 0 to 20 mA or DC 4 to 20 mA controller by placing a field furnished 1/4 watt 500 ohm resistor between the black (common) and orange (+DC 0(4) to 20 mA control signal input) wires.

### ***Proportional Control/Adjustable (M9210-HGx-3)***

The M9210-HGx-3 operates in a similar manner to the M9210-GGx-2, except the M9210-HGx-3 has an adjustable start voltage, which can be programmed between DC 0 to 10 V. The span adjustment can be programmed between a DC 2 to 10 V range, allowing the actuator to operate between DC 0 to 20 V. The M9210-HGx-3 is programmed in the factory for DC 0 to 10 V.

For this model, the feedback signal between the black and orange wires always provides a DC 0 to 10 V output, regardless of the start voltage or span selected.

### **Repairs and Replacements**

A number of replacement parts are available; see Table 2 for more details. If the M9210-xxx-3 Series Electric Spring Return Actuator fails to operate within its specifications, replace the unit. For a replacement electric actuator, contact the nearest Johnson Controls® representative.

## **Ordering Information**

**Table 2: Electric Spring Return Actuator Models**

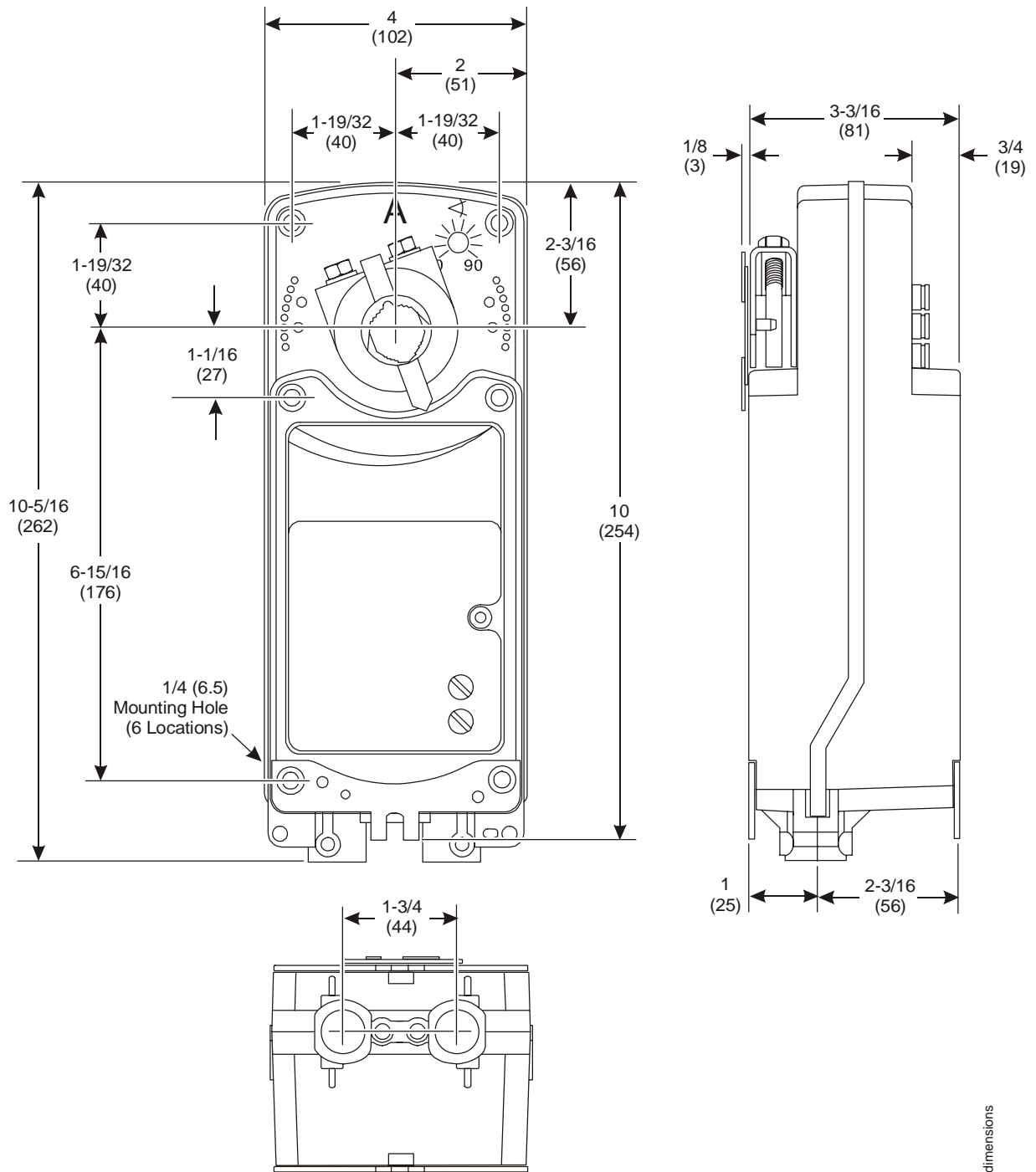
<b>Code Number</b>	<b>Control Type</b>	<b>Auxiliary Switches</b>	<b>Power Requirements</b>
<b>M9210-AGA-3</b>	Floating	None	AC 24 V at 50/60 Hz or DC 24 V
<b>M9210-AGC-3</b>	Floating	Two	AC 24 V at 50/60 Hz or DC 24 V
<b>M9210-BAA-3</b>	On/Off	None	AC 120 V at 60 Hz
<b>M9210-BAC-3</b>	On/Off	Two	AC 120 V at 60 Hz
<b>M9210-BDA-3</b>	On/Off	None	AC 230 V at 50/60 Hz
<b>M9210-BDC-3</b>	On/Off	Two	AC 230 V at 50/60 Hz
<b>M9210-BGA-3</b>	On/Off	None	AC 24 V at 50/60 Hz or DC 24 V
<b>M9210-BGC-3</b>	On/Off	Two	AC 24 V at 50/60 Hz or DC 24 V
<b>M9210-GGA-3</b>	Proportional	None	AC 24 V at 50/60 Hz or DC 24 V
<b>M9210-GGC-3</b>	Proportional	Two	AC 24 V at 50/60 Hz or DC 24 V
<b>M9210-HGA-3</b>	Proportional w/Adjustable Zero and Span	None	AC 24 V at 50/60 Hz or DC 24 V
<b>M9210-HGC-3</b>	Proportional w/Adjustable Zero and Span	Two	AC 24 V at 50/60 Hz or DC 24 V

**Table 3: Accessories and Replacement Parts (Order Separately)**

<b>Code Number</b>	<b>Description</b>
<b>DMPR-KC003<sup>1</sup></b>	7 in. (178 mm) Blade Pin Extension (without Bracket) for Johnson Controls Direct-Mount Damper Applications
<b>M9000-200</b>	Commissioning Tool that Provides a Control Signal to Drive 24 V On/Off, Floating, Proportional, and/or Resistive Electric Actuators
<b>M9000-153</b>	Crank arm
<b>M9000-170</b>	Remote Mounting Kit, Horizontal. Kit includes Mounting Bracket, M9000-153 Crank Arm, Ball Joint, and Mounting Bolts
<b>M9000-171</b>	Remote Mounting Kit, Vertical. Kit includes Mounting Bracket, M9000-153 Crank Arm, Ball Joint, and Mounting Bolts
<b>M9000-604</b>	Replacement Anti-rotation Bracket Kit (with Screws) for M9210-xxx-3 Series Proportional Electric Spring Return Actuators
<b>M9220-600</b>	1 in. (25 mm) Jackshaft Coupler Kit (with Locking Clip) for Mounting M9210-xxx-3 Series Proportional Electric Spring Return Actuators on Dampers with 3/4 to 1-1/16 in. or 19 to 27 mm Round Shafts, or 5/8 and 3/4 in. or 16, 18, and 19 mm Square Shafts
<b>M9220-601</b>	Replacement Coupler Kit (with Locking Clip) for Mounting M9210-xxx-3 Series Proportional Electric Spring Return Actuators on Dampers with 1/2 to 3/4 in. or 12 to 19 mm Round Shafts, or 3/8 and 1/2 in. or 10, 12, and 14 mm Square Shafts
<b>M9220-602</b>	Replacement Locking Clips for M9210-xxx-3 Series Proportional Electric Spring Return Actuators (Five per Bag)
<b>M9220-603</b>	Adjustable Stop Kit for M9210-xxx-3 Series Proportional Electric Spring Return Actuators
<b>M9220-604</b>	Replacement Manual Override Cranks for M9210-xxx-3 Series Proportional Electric Spring Return Actuators (Five per Bag)
<b>M9220-610</b>	Replacement Shaft Gripper, 10 mm Square Shaft with Locking Clip
<b>M9220-612</b>	Replacement Shaft Gripper, 12 mm Square Shaft with Locking Clip
<b>M9220-614</b>	Replacement Shaft Gripper, 14 mm Square Shaft with Locking Clip

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

## Dimensions



**Figure 2: M9210-xxx-3 Series  
Electric Spring Return Actuator Dimensions, in. (mm)**

dimensions

## Technical Specifications

### M9210-xxx Series Electric Spring Return Actuators (Part 1 of 3)

<b>Product Codes</b>		M9210-AGx-3 Series Floating M9210-Bxx-3 Series On/Off M9210-GGx-3 Series Proportional M9210-HGx-3 Series Proportional Adjustable
<b>Power Requirements</b>	<b>AGx, GGx, HGx Models</b>	AC 24 V (19.2 to 30 V) at 50/60 Hz: Class 2, 9.6 VA Running, 6 VA Holding Position; DC 24 V (21.6 to 26.4 V); Class 2, 3.9 W Running, 2.1 W Holding Position
	<b>BAx Models</b>	Nominal AC 120 V at 60 Hz: 0.20 A Running, 0.12 A Holding Position
	<b>BDx Models</b>	Nominal AC 230 V at 50/60 Hz: 0.12 A Running, 0.09 A Holding Position
	<b>BGx Models</b>	AC 24 V (19.2 to 30 V) at 50/60 Hz: Class 2, 17.7 VA Running, 5.1 VA Holding Position; DC 24 V (21.6 to 26.4 V): Class 2, 15.6 W Running, 2.6 W Holding Position
<b>Transformer Sizing Requirements</b>	<b>AGx, GGx, HGx Models</b>	15 VA Minimum per Actuator
	<b>Bxx Models</b>	20 VA Minimum per Actuator
<b>Input Signal/ Adjustments</b>	<b>AGx Models</b>	DC 0 (2) to 10 V or 0 (4) to 20 mA with Field Furnished 500 ohm resistor; Switch Selectable Direct or Reverse Action with Signal Increase
	<b>GGx Models</b>	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
	<b>HGx Models</b>	Factory Set DC 0 to 10 V, CW Rotation with Signal Increase; Selectable DC 0 to 10 V or 0 to 20 mA with Field Furnished 500 ohm, 0.25 W minimum resistor; Start Point Programmable DC 0 to 10 V; Span Programmable DC 2 to 10 V; Switch Selectable Direct or Reverse Action with Signal Increase
<b>Control Input Impedance</b>	<b>GGx, HGx Models</b>	Voltage Input: 200,000 ohms; Current Input: 500 ohms with Field Furnished 500 ohm Resistor
<b>Feedback Signal</b>	<b>HGx Models</b>	DC 0 to 10 V for Desired Rotation Range up to 90°; Corresponds to Rotation Limits, 500 mA maximum
	<b>GGx Models</b>	DC 0 (2) to 10 V for Desired Rotation Range up to 90°; Corresponds to Rotation Limits, 500 mA maximum
<b>Auxiliary Switch Rating</b>	<b>xxC Models</b>	Two Single-Pole, Double-Throw (SPDT), Double-Insulated Switches with Gold Flash Contacts: AC 24 V, 50 VA Pilot Duty; AC 120 V, 5.8 A Resistive, 1/4 hp, 275 VA Pilot Duty; AC 240 V, 5.0 A Resistive, 1/4 hp, 275 VA Pilot Duty
<b>Spring Return</b>		Direction is Selectable with Mounting Position of Actuator: Side A, Actuator Face Away from Damper for CCW Spring Return; Side B, Actuator Face Away from Damper for CW Spring Return
<b>Running and Spring Return Torque</b>		89 lb-in (10 N-m)
<b>Rotation Range</b>		Adjustable from 30 to 90° CW or CCW with Optional M9210-603 Adjustable Stop Kit; Mechanically Limited to 90°

### M9210-xxx Series Electric Spring Return Actuators (Part 2 of 3)

<b>Rotation Time Power On (Running)</b>	<b>AGx, GGx, HGx Models</b>	150 Seconds for 0 to 89 lb-in (0 to 10 N-m) at All Operating Conditions; Independent of Load
	<b>Bxx Models</b>	24 to 57 Seconds for 0 to 89 lb-in (0 to 10 N-m) at All Operating Conditions; 35 Seconds Nominal at Full Rated Load
<b>Rotation Time Power Off (Spring Returning)</b>	<b>AGx, GGx, HGx Models</b>	26 Seconds for 0 to 89 lb-in (0 to 10 N-m) at Room Temperature
	<b>Bxx Models</b>	11 to 15 Seconds for 0 to 89 lb-in (0 to 10 N-m) at Room Temperature; 35 Seconds Maximum for 0 to 89 lb-in (0 to 10 N-m) at -22°F (-30°C) 130 Seconds Maximum for 0 to 89 lb-in (0 to 10 N-m) at -40°F (-40°C)
<b>Cycles</b>		60,000 Full Stroke Cycles, 1,500,000 repositions
<b>Audible Noise Rating (AGx, HGx, GGx Models)</b>	<b>Power On (Running)</b>	<40 dBA at 39-13/32 in. (1 m)
	<b>Power On (Holding)</b>	<20 dBA at 39-13/32 in. (1 m)
	<b>Power Off (Spring Returning)</b>	<55 dBA at 39-13/32 in. (1 m)
<b>Audible Noise Rating (Bxx Models)</b>	<b>Power On (Running)</b>	<66 dBA at 39-13/32 in. (1 m)
	<b>Power On (Holding)</b>	<18 dBA at 39-13/32 in. (1 m)
	<b>Power Off (Spring Returning)</b>	<66 dBA at 39-13/32 in. (1 m)
<b>Electrical Connections</b>	<b>Actuator (All Models)</b>	48 in. (1.2 m) Halogen-Free Cable with 18 AWG (0.75 mm <sup>2</sup> ) Wire Leads
	<b>Auxiliary Switches (GGC Models)</b>	48 in. (1.2 m) Halogen-Free Cable with 18 AWG (0.75 mm <sup>2</sup> ) Wire Leads
<b>Conduit Connections</b>		Integral Connectors for 3/8 in. (10 mm) Flexible Metal Conduit
<b>Mechanical Connections</b>	<b>Standard Shaft Clamp Included with Actuator</b>	1/2 to 3/4 in. or 12 to 19 mm Diameter Round Shafts, or 3/8 and 1/2 in. or 10, 12, and 14 mm Square Shafts
	<b>Optional M9210-600 Jackshaft Coupler Kit</b>	3/4 to 1-1/16 in. or 19 to 27 mm Diameter Round Shafts, or 5/8 and 3/4 in. or 16, 18, and 19 mm Square Shafts
<b>Aluminum Enclosure</b>		NEMA 2 (IP54) for All Mounting Orientations
<b>Ambient Conditions</b>	<b>Operating</b>	-40 to 131°F (-40 to 55°C); 90% RH Maximum, Noncondensing
	<b>Storage</b>	-85 to 185°F (-65 to 85°C); 95% RH Maximum, Noncondensing
<b>Dimensions</b>		See Figure 2.

**M9210-xxx Series Electric Spring Return Actuators (Part 3 of 3)**

<b>Compliance</b>	<b>North America</b>	UL Listed, File E27734, CCN XAPX (United States) and XAPX7 (Canada)
	<b>European Union</b>	CE Mark, EMC Directive 89/336/EEC (M9210-xGA-3 Models)
		CE Mark, Low Voltage Directive 73/23/EEC (M9210-BDA-3 and M9210-xxC-3 Models)
<b>Australia and New Zealand</b>	C-Tick Mark, Australia/NZ Emissions Compliant (M9210-xGx-3 and M9210-BDx Models)	
<b>Shipping Weight</b>	<b>xGx Models</b>	6.4 lb (2.9 kg)
	<b>BAx and BDx Models</b>	7.6 lb (3.5 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.*



**Controls Group**  
507 E. Michigan Street  
Milwaukee, WI 53202

*All other marks herein are the marks of their respective owners.  
© 2006 Johnson Controls, Inc.*