

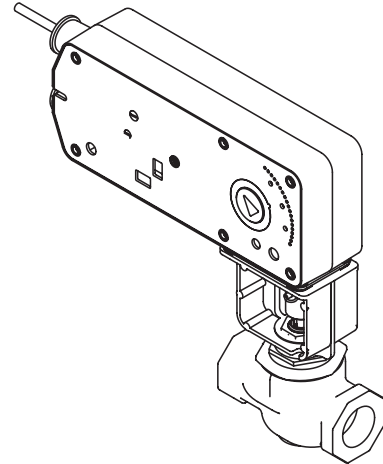
Application

DuraDrive Linear Actuators are designed to mount directly onto two-way or three-way valves. They provide linear travel to economically operate 1-1/4" to 2" VB-7xxx, 2-1/2" to 5" VB-8xxx, 2-1/2" to 4" VB-931x, and discontinued 1-1/2" to 4" VB-9xxx valves in hot water, chilled water, and steam applications up to 366°F (186°C) fluid temperature.

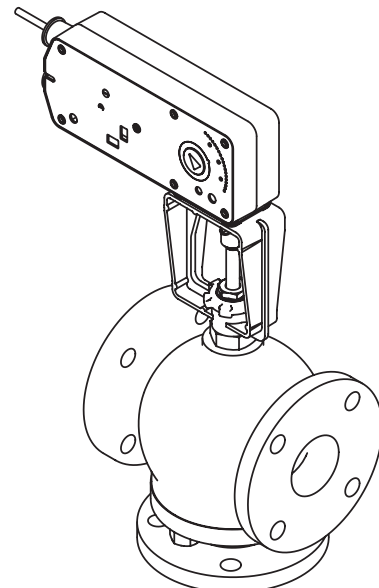
The linear spring return actuators provide either two position, floating or proportional modulation control (depending on model selection) of valves in HVAC systems.

Features

- Two position models controlled by SPST controller
- Floating models controlled by SPDT floating controllers
- Proportional models controlled by 2-10 Vdc, or 4-20 mAdc with the addition of a 500 ohm resistor. Control function direct/reverse action is switch selectable
- 220 lb force (979 newton) with 1/2" (13 mm) or 1" (25 mm) nominal linear stroke
- Automatically sets control signal input span to match valve travel
- 24 Vac, 120 Vac, and 230 Vac models
- Rugged die-cast enclosures rated for NEMA 2, UL Type 2/IP54
- Overload protection throughout stroke
- Compact size for application flexibility
- Manual override to allow positioning of valve and preload
- Integral linkage for direct mount to valves
- Five year warranty



Mx51-720x



Mx61-720x

Applicable Literature

- DuraDrive Linear Series Spring Return Actuator Submittal Sheet, F-27165
- Two-Way and Three-Way Globe Valve Assemblies with DuraDrive Linear Series Spring Return Actuators Submittal Sheet, F-27167
- EN-205 Water System Guidelines, F-26080
- Vx-7xxx, Vx-9xxx Series Linked Globe Valves with DuraDrive Linear Series Actuators Selection Guide, F-27252
- Vx-8xxx Valve Selection Guide, F-27199
- AM-731, AM-732, AM-733, AM-734, Kit General Instructions, F-27203
- VB-7213 Series 1/2" to 2" Screwed NPT, Stem Up Open, Two-Way Valves, General Instructions, F-26075
- VB-7214 Series 1/2" to 2" Union Sweat, Solder Joint Stem Up Open, Two-Way Valves, General Instructions, F-25675
- VB-7215 Series 15 mm to 50 mm Screwed Rp, Stem Up Open, Two-Way Valves, General Instructions, F-26077
- VB-7223 Series 1/2" to 2" Screwed NPT, Stem Up Closed, Two-Way Valves, General Instructions, F-26073
- VB-7224 Series 1/2" to 2" Union Sweat, Solder Joint Stem Up Closed, Two-Way Valves, General Instructions, F-24387
- VB-7225 Series 15 mm to 50 mm Screwed Rp, Stem Up Closed, Two-Way Valves, General Instructions, F-26079
- VB-7253 Series 1/2" to 2" Screwed NPT, Stainless Steel Trim with Teflon Disc, Stem Up Open, Two-Way Valves, General Instructions, F-24388
- VB-7263 Series 1/2" to 2" Screwed NPT, Stainless Steel Trim with Teflon Disc, Stem Up Closed, Two-Way Valves, General Instructions, F-24389
- VB-7273 Series 1/2" to 2" Screwed NPT, Stainless Steel Trim, Stem Up Open, Two-Way Valves, General Instructions, F-24390
- VB-7283 Series 1/2" to 2" Screwed NPT, Stainless Steel Trim, Stem Up Closed, Two-Way Valves, General Instructions, F-24391
- VB-7313 Series 1/2" to 2" Screwed NPT, Three-Way Mixing Valves, General Instructions, F-26074
- VB-7314 Series 1/2" to 2" Union Sweat, Solder Joint, Three-Way Mixing Valves, General Instructions, F-24394
- VB-7315 Series 15 mm to 50 mm Screwed Rp, Three-Way Mixing Valves, General Instructions, F-26078
- VB-7323 Series 1/2" to 2" Screwed NPT Three-way Diverting Valves, General Instruction, F-26076
- VB-8213 Series 2-1/2" to 6" Flanged, Stem Up Open, Two-Way Valves, General Instructions, F-27193
- VB-8223 Series 2-1/2" to 6" Flanged, Stem Up Closed Two-Way Valves, General Instructions, F-27194
- VB-8303 Series 2-1/2" to 6" Flanged, Three-Way Diverting/Mixing Valves, General Instructions, F-27197
- VB-9213 Series, 2-1/2" and 3" Screwed NPT, 2-1/2" to 6" 125 Lb. Flanged, Stem Down to Close Two-Way Valves, General Instructions, F-24382
- VB-9215 Series, 65 mm and 80 mm Screwed Rp, Stem Down to Close Two-Way Valves, General Instructions, F-25672
- VB-9223 Series, 2-1/2" and 3" Screwed NPT, 2-1/2" to 6" 125 Lb. Flanged, Stem Up to Close Two-Way Valves, General Instructions, F-24386
- VB-9225 Series, 65 mm and 80 mm Screwed Rp, Stem Up to Close Two-Way Valves, General Instructions, F-25673
- VB-9313 Series, 2-1/2" and 3" Screwed NPT, 2-1/2" to 6" 125 Lb. Flanged, Three-Way Mixing Valves, General Instructions, F-24393
- VB-9315 Series, 65 mm and 80 mm Screwed Rp, Three-Way Mixing Valves, General Instructions, F-25674

SPECIFICATIONS

Actuator Inputs

Control Signal: Mx1-720x—On-off spring return, SPST control contacts or Triacs (500mA rated). **MFx1-7203**—Floating point, SPDT control contacts or Triacs (500 mA rated) 24 Vac. **MSx1-7203**—Proportional, 2 to 10 Vdc or 4 to 20 mAdc with 500 Ω resistor.

Power Input: Mx1-720x—24 Vac ± 20%, 22 to 30 Vdc, 120 Vac ± 10%, 230 Vac ± 10%, 50/60 Hz. All 24 Vac circuits are Class 2. All circuits 30 Vac and above are Class 1.

MFx1-7203, MSx1-7203— 24 Vac ± 20%, Class 2, 22 to 30 Vdc.

Connections: 3 ft (91 cm) appliance cables, 1/2 inch (13 mm) conduit connectors. For M20 Metric conduit, use AM-756 adaptor.

Actuator Outputs

Electrical:

Position Feedback Voltage (proportional only):

MSx1-7203—2 to 10 Vdc (max. 0.5 mA) output signal for position feedback or to operate up to four additional slave actuators.

Mechanical:

Motor Type: Brushless DC.

Linear Stroke (Nominal): Mx51-720x—1/2" (13 mm). **Mx61-720x**—1" (25 mm).

Approx. Stroke Timing, 100 seconds for 1/2" stroke. 190 seconds for 1" stroke.

Manual Override, Allows positioning of valve and preload using manual crank.

Right/Left Switch, Permits reverse acting/direct acting linear motion (MSx1 only).

Environment:

Ambient Temperature Limits,

Shipping & Storage, -40 to 160 °F (-40 to 71 °C).

Operating, 0 to 140 °F (-18 to 60 °C).

Temperature Restrictions,

Actuator	Max. Allowable Ambient @ Max. Fluid Temperatures	Valve Body
Mx51-720x	140 °F (60 °C) @ 281 °F (138 °C)	VB-721x, 722x
	120 °F (49 °C) @ 300 °F (149 °C)	VB-73xx
	100 °F (38 °C) @ 340 °F (171 °C)	VB-725x, 726x
	90 °F (32 °C) @ 366 °F (186 °C)	VB-727x, 728x
Mx61-720x	140 °F (60 °C) @ 300 °F (149 °C)	2-1/2" to 4" VB-931x
Mx61-720x	140 °F (60 °C) @ 281 °F (138 °C)	2-1/2" to 5" VB-8xx3, 2-1/2" to 4" VB-92xx ^a

^a Discontinued

Humidity: 15 to 95% RH, non-condensing.

Location:

NEMA1. NEMA 2, UL Type 2 (IEC IP54) with customer supplied watertight conduit connectors.

Agency Listings

UL 873: Underwriters Laboratories (File #E9429 Category Temperature-Indicating and Regulating Equipment).

CUL: UL Listed for use in Canada by Underwriters Laboratories. Canadian Standards C22.2 No. 24-93.

European Community: EMC Directive (89/336/EEC). Low Voltage Directive (72/23/EEC)

Australia: This product meets requirements to bear the C-Tick Mark according to the terms specified by the Communications Authority under the Radiocommunications Act 1992.

The specifications conform to acceptable industry standards. For applications at conditions beyond these specifications, consult your local Invensys representative office. Invensys shall not be liable for damages resulting from misapplication or misuse of its products.

Table-1 Specifications.

Part Number	Control Action	Actuator Power Input							Linear Stroke Inches	Approximate Stroke Timing in Seconds @ 70°F (21°C) ^a		Output Force Rating lb. (Newton)		Valve Size
		Voltage	Running				DC Amps	50/60 Hz W		Powered	Spring Return	Min.	Max. Stall	
			50 Hz		60 Hz									
			VA	W	VA	W								
MA51-7203	2 Position	24Vac ±20% 22-30 Vdc	9.8	7.5	9.7	7.5	.29	2.8	5/8	<100	<35	220 (979)	495 (2202)	1-1/4" to 2" ^b
MA51-7200		120 Vac ±10%	11.7	8.8	10.0	8.4	N/A	3.6/5.0						
MA51-7201		230 Vac ±10%	15.5	9.5	10.6	8.5	N/A	4.6/3.3						
MA61-7203		24 Vac ±20% 22-30 Vdc	9.8	7.5	9.7	7.5	.29	2.8	1-1/16	<190	<40			2-1/2" to 4" or 5" ^c
MA61-7200		120 Vac ±10%	11.7	8.8	10.0	8.4	N/A	3.6/5.0						
MA61-7201		230 Vac ±10%	15.5	9.5	10.6	8.5	N/A	4.6/3.3						
MF51-7203	Floating	24 Vac ±20% 22-30 Vdc	9.8	7.7	9.7	7.7	.30	3.3	5/8	<100	<35	220 (979)	495 (2202)	1-1/4" to 2" ^b
MF61-7203		24 Vac ±20% 22-30 Vdc	9.8	7.7	9.7	7.7	.30	3.3	1-1/16	<190	<40			2-1/2" to 4" or 5" ^c
MS51-7203	Proportional	24 Vac ±20% 22-30 Vdc	9.8	7.4	9.7	7.4	.28	2.9	5/8	<100	<35	220 (979)	495 (2202)	1-1/4" to 2" ^b
MS61-7203		24 Vac ±20% 22-30 Vdc	9.8	7.4	9.7	7.4	.28	2.9	1-1/16	<190	<40			2-1/2" to 4" or 5" ^c

^a Timing was measured with no load applied to the actuator.

^b Current VB-7xxx series valves and discontinued 1-1/4" VB-9xxx series valves.

^c Current VB-931x Series valves (2-1/2" to 4"), current VB-8xx3 (2-1/2" to 5") Series valves, and discontinued VB-9xxx (1-1/2" to 4") Series valves.

ACCESSORIES

- AM-763 1/8" Hex crank for manual override
- AM-756 Metric conduit adapter M20 x 1.5 to 1/2" NPT
- AM-731 Mounting kit - Mx51-720x (stem extension, lock washer, jam nut, and connecting pin; included with actuator)
- AM-732 Mounting kit - Mx61-720x (stem extension, lock washer, jam nut, and connecting pin; included with actuator)
- AM-733 Retrofit kit - discontinued VB-9xxx 1-1/2 to 2" valves after 9404 date code
- AM-734 Retrofit kit - discontinued VB-9xxx -1/2 to 2" valves prior to 9404 date code

MSx1-7203

- AM-703 Input rescaling module, adjust signals to 2-10 Vac, zero and span adjust
- AM-704 Interface, pulse width modulation (PWM)
- AM-705 Positioner (NEMA 4 housing)
- AM-706 Min and/or manual positioner for flush panel mount
- AM-708 500 Ω resistor for 4 to 20 mAdc control signal

Close-Off Pressure and Maximum Operating Pressure Differential

For all valve assemblies, be sure to check that the anticipated maximum pressure drop across the valve in the closed position will not exceed the close-off pressure rating and that the pressure differential across the valve will not exceed the maximum operating pressure differential rating. For VB-7xxx and VB-9xxx valve applications, consult the Vx-7xxx & Vx-9xxx Selection Guide, F-27252. For VB-8xx3 valve applications, consult the Vx-8xxx Selection Guide, F-27199.

TYPICAL TWO POSITION CONTROL (wiring diagrams)

Figure-1 illustrates typical wiring diagrams for spring return MAx1-720x Series spring return two-position actuators. See Table-1 for model selection.

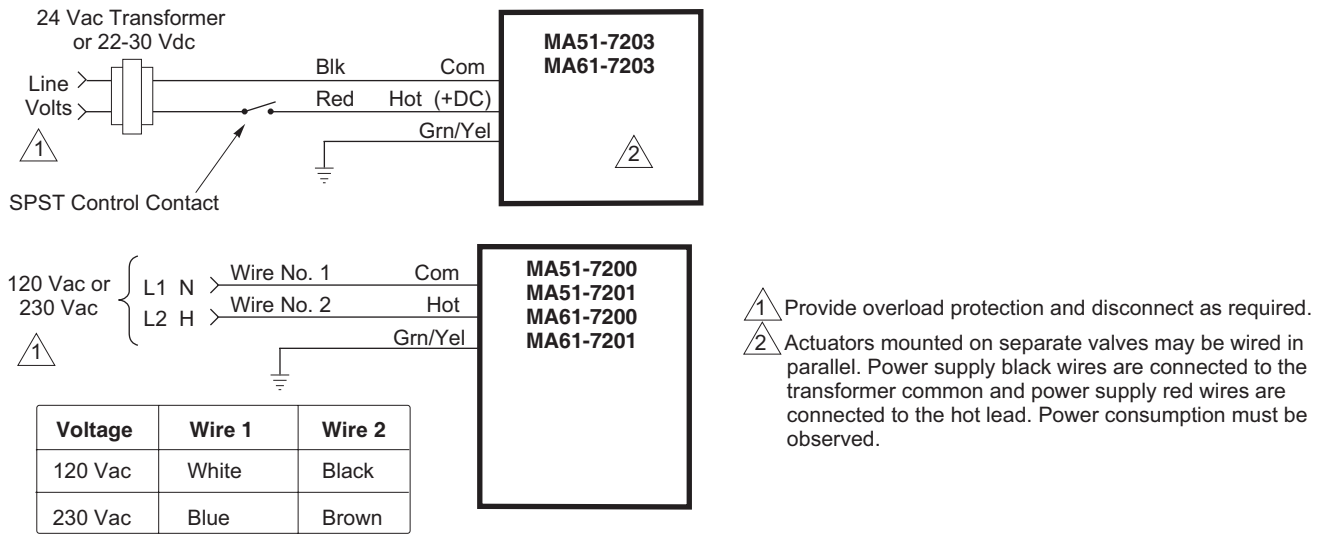


Figure-1 Typical Wiring Diagrams for Two Position Actuators.

TYPICAL FLOATING CONTROL (wiring diagrams)

Figure-2 through Figure-5 illustrate typical wiring diagrams for MFx1-7203 Series spring return floating actuators. See Table-1 for model selection.

Caution: This product contains a half-wave rectifier power supply and must not be powered off transformers used to power other devices utilizing non-isolated full-wave rectifier power supplies. Refer to *EN-206, Guidelines for Power Multiple Devices from a Common Transformer, F-26363* for detailed information.

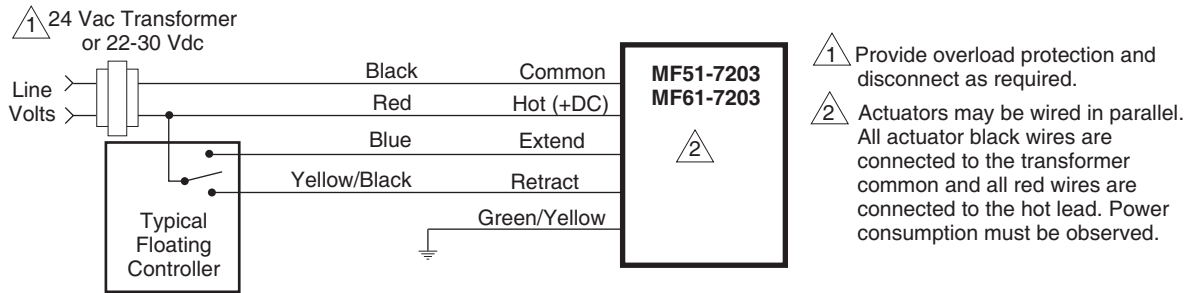


Figure-2 Floating Point Control.

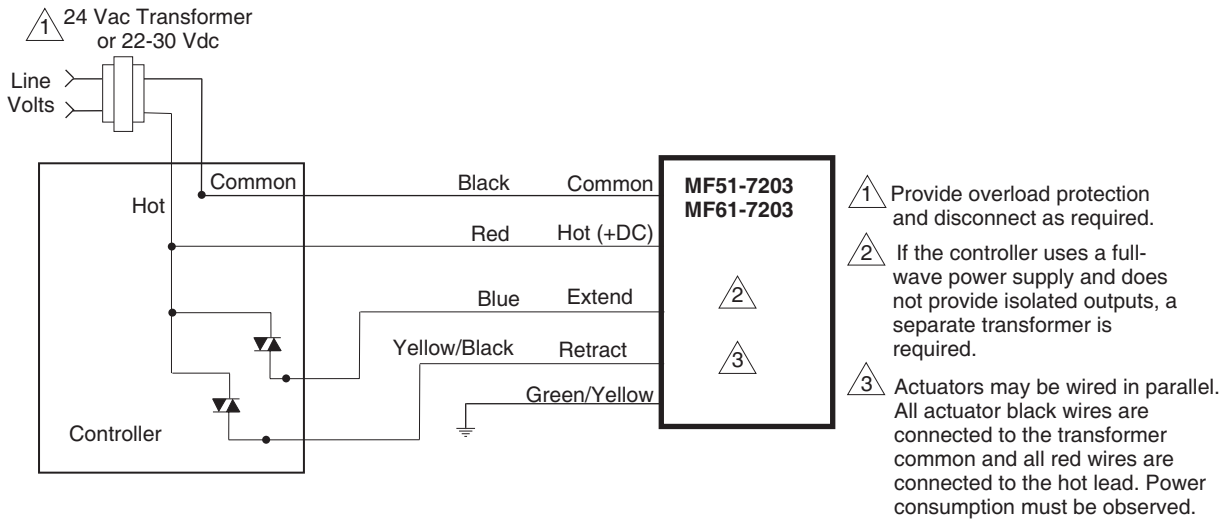
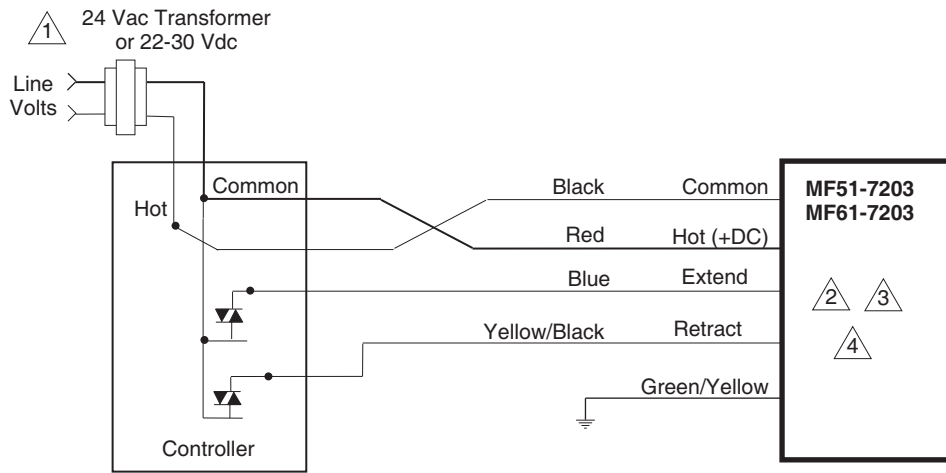
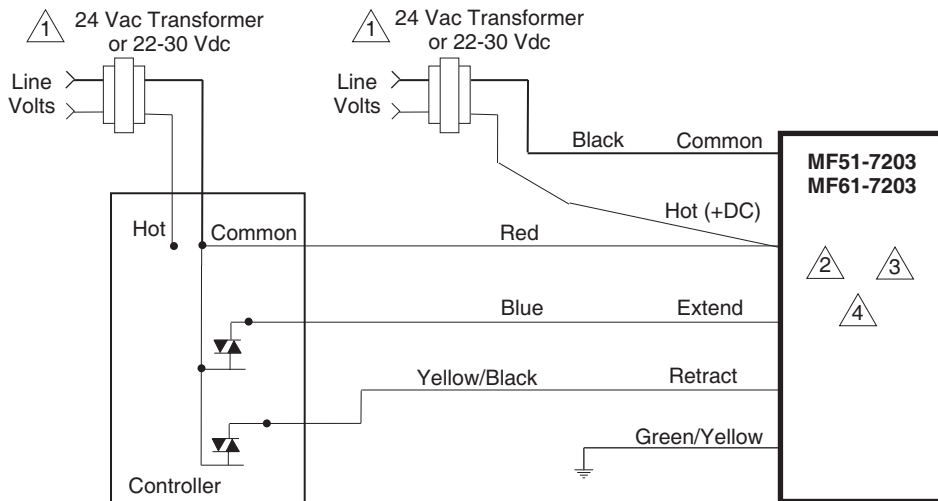


Figure-3 Triac Source.



- 1 Provide overload protection and disconnect as required.
- 2 Actuators may be wired in parallel. All actuator black wires are connected to the transformer common and all red wires are connected to the hot lead. Power consumption must be observed.
- 3 The Common connection from the actuator must be connected to the Hot connection of the controller. The actuator Hot must be connected to the controller Common.
- 4 If the controller uses a full-wave power supply and does not provide isolated outputs, a separate transformer is required.

Figure-4 Triac Sink.



- 1 Provide overload protection and disconnect as required.
- 2 Actuators may be wired in parallel. All actuator black wires are connected to the transformer common and all red wires are connected to the hot lead. Power consumption must be observed.
- 3 The actuator Hot must be connected to the controller Common.
- 4 If the controller uses a full-wave power supply and does not provide isolated outputs, a separate transformer is required.

Figure-5 Triac Sink With Separate Transformers.

TYPICAL PROPORTIONAL CONTROL (wiring diagrams)

Figure-6 illustrates typical wiring diagrams for MSx1-7203 Series proportional spring return actuators. See Table-1 for model selection.

Caution: This product contains a half-wave rectifier power supply and must not be powered off transformers used to power other devices utilizing non-isolated full-wave rectifier power supplies. Refer to *EN-206, Guidelines for Powering Multiple Devices from a Common Transformer, F-26363* for detailed information.

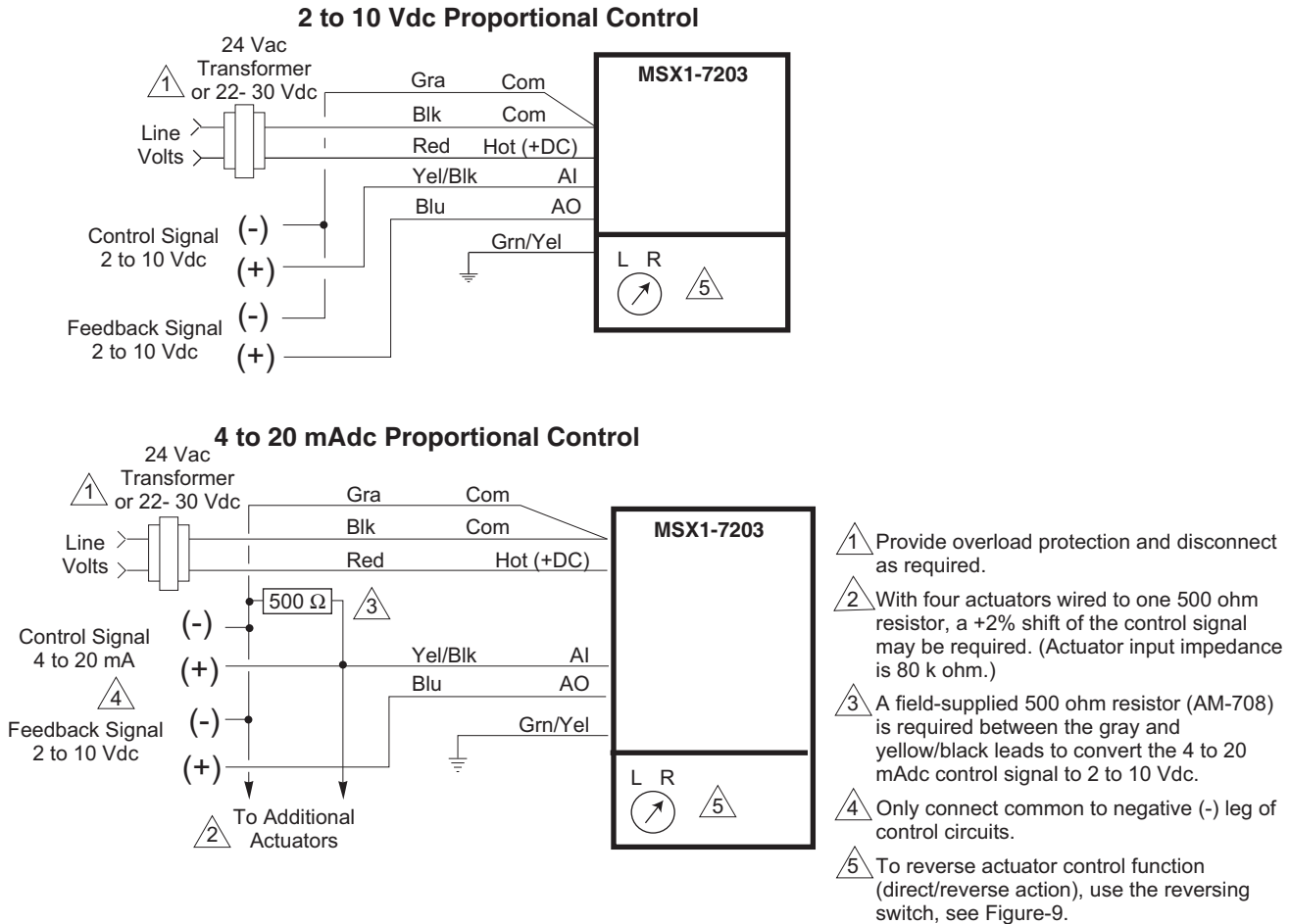


Figure-6 Typical Wiring Diagrams for Proportional Control 24 Vac Basic Models.

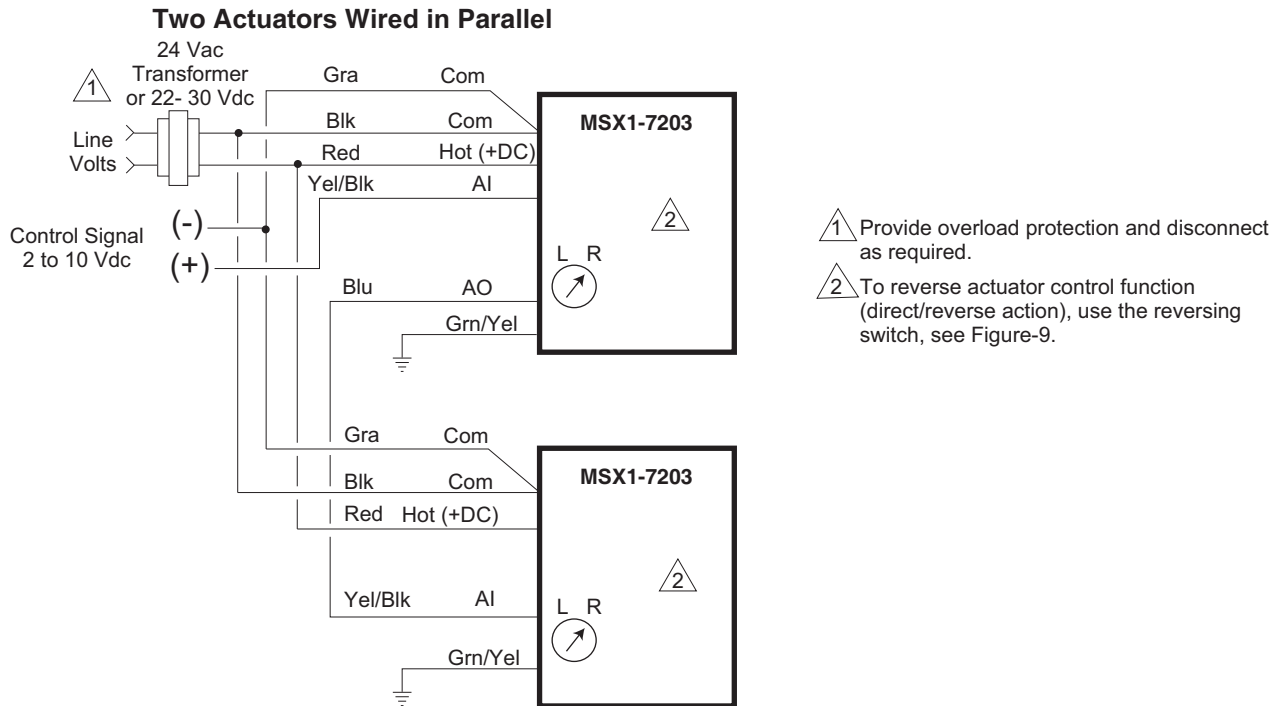


Figure-7 Typical Wiring Diagrams for Proportional Control 24 Vac Models Wired in Parallel.

INSTALLATION

Inspection

Inspect the package for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the package and inspect the device for obvious damage. Return damaged products.

Requirements

- Job wiring diagrams
- Appropriate accessories
- Pliers for removing and inserting connecting pin
- Installer must be a qualified, experienced technician
- Tool-37, 1-1/2" to 3" adjustable spanner wrench for valve mounting nut
- 5/16" (Tool-20-1) and 3/4" open-end wrench for stem jam nuts
- 1/8" Allen wrench
- Size 10 IP Torx Plus bit (Mx51 units only)

Precautions

General

Warning:

- Electrical shock hazard! Disconnect the power supply (line power) before installation to prevent electric shock and equipment damage.
- Make all connections in accordance with the job wiring diagram and in accordance with national and local electrical codes. *Use copper conductors only.*
- Floating and Proportional Models: These products contain a half-wave rectifier power supply. They must not be powered with transformers that are used to power other devices utilizing non-isolated full-wave rectifier power supplies. Refer to EN-206, Guidelines For Powering Devices From A Common Transformer, F-26363 for detailed information.

Caution:

- Avoid electrical noise interference. Do not install near large contactors, electrical machinery, or welding equipment.
- Manual override to be used only when power is not applied to unit.
- When operating manual override (observe position indicator, Figure-8), back off 5° (1/2 turn counter clockwise) from full extended mechanical stop to ensure proper release.

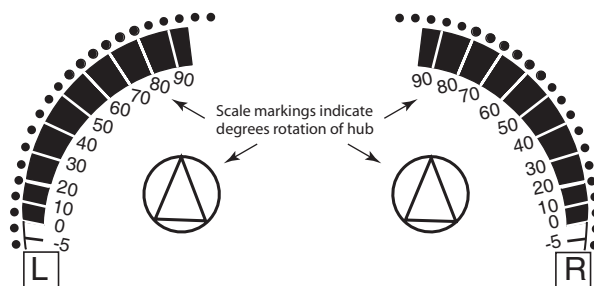


Figure-8 Position Indicator

- Do not drill holes in actuator body. Six pre-drilled holes are located on each side, under crosshairs on the label, to accept #10-24 thread-forming screws for mounting accessories.

Federal Communications Commission (FCC)

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses, and can radiate radio frequency energy and may cause harmful interference if not installed and used in accordance with the instructions. Even when instructions are followed, there is no guarantee that interference will not occur in a particular setting—Which can be determined by turning the equipment off and on—the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Canadian Department of Communications (DOC)

Note: This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Standard EN 55022

Warning: This is a Class B digital (European Classification) product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Caution: Avoid locations where excessive moisture, corrosive fumes, vibration, or explosive vapors are present.



Location

Mounting



- Mount the linear actuator directly on the valve in locations that clear the maximum dimensions of the actuator case (see Figures 19 and 20).
- Ensure that the valve body is installed correctly. The arrow must point in the direction of flow. With three-way valves observe stem position (stem up) for proper flow characteristics. See Table-2.
- The actuator must be mounted above the centerline of the valve body. This will minimize the risk of damage to the actuator in the event of condensation. Refer to Figure-15, Figure-16, and Figure-17.

Actuator Selection

Mx51 series actuators are used on 1-1/4" to 2" VB-7xxx valves. Mx61 series actuators are used on 2-1/2" to 4" VB-931x, 2-1/2" to 5" VB-8xxx, and discontinued 1-1/2" to 4" VB-9xxx valves (with AM-733 or AM-734kit purchased separately).

Changing Control Function (proportional units only)

These actuators are equipped with a switch to control the function of the signal as received. See Figure-9.

Caution: These are spring return actuators. It is possible to switch to a direction that moves the actuator against the -5° positive stop. Example: Viewing the actuator from the left side with the switch set to "R" and an increasing signal. The actuator will attempt to rotate beyond the -5° stop and will stall.

- Install all two-way valves so that they close against the flow. An arrow on the valve body or a tag indicates the proper flow direction.
- Always install three-way mixing valves with two inlets and one outlet.
- Install three-way diverting valves with one inlet and two outlets. When piped for mixing, Cv's may differ slightly.

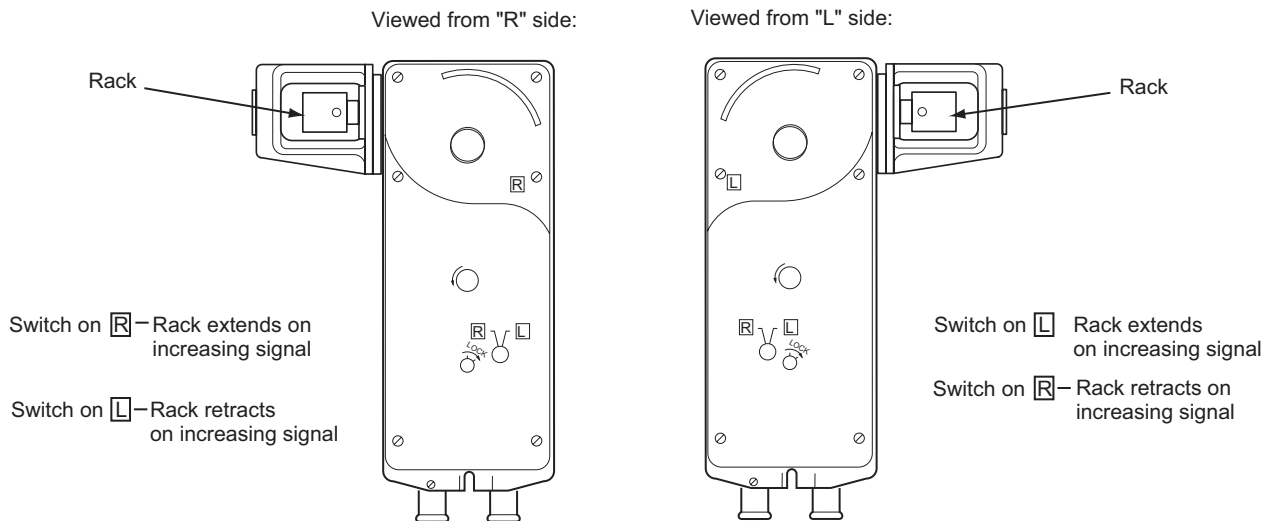


Figure-9 Rotation Switch Settings for MSx1-7203 Proportional Actuators.

Table-2 Valve Configuration Chart.

Valve Body	Valve Body Action	Normal Position		Action
		Valve Stem	Flow	
VB-721x VB-7253 VB-7273 VB-821x VB-921x ^a	Two-Way Stem Up Open	Up	Open	Port A to AB flow decreases as actuator extends
VB-722x VB-7263 VB-7283 VB-822x VB-922x ^a	Two-Way Stem Up Closed	Up	Closed	Port A to AB flow increases as actuator extends
VB-731x VB-931x	Three-Way Mixing	Up	B to AB	Port A to AB flow increases as actuator extends Port B to AB flow decreases as actuator extends
VB-732x	Three-Way Diverting	Up	B to AB	Port B to A flow increases as actuator extends Port B to AB flow decreases as actuator extends
VB-8303	Three-Way Piped as Mixing ^b	Up	AB to B	Port A to B flow increases as actuator extends Port AB to B flow decreases as actuator extends
VB-8303	Three-Way Piped as Diverting ^b	Up	B to AB	Port B to A flow increases as actuator extends Port B to AB flow decreases as actuator extends

^a Discontinued.

^b Universal diverting/mixing valve, may be piped as either mixing or diverting.

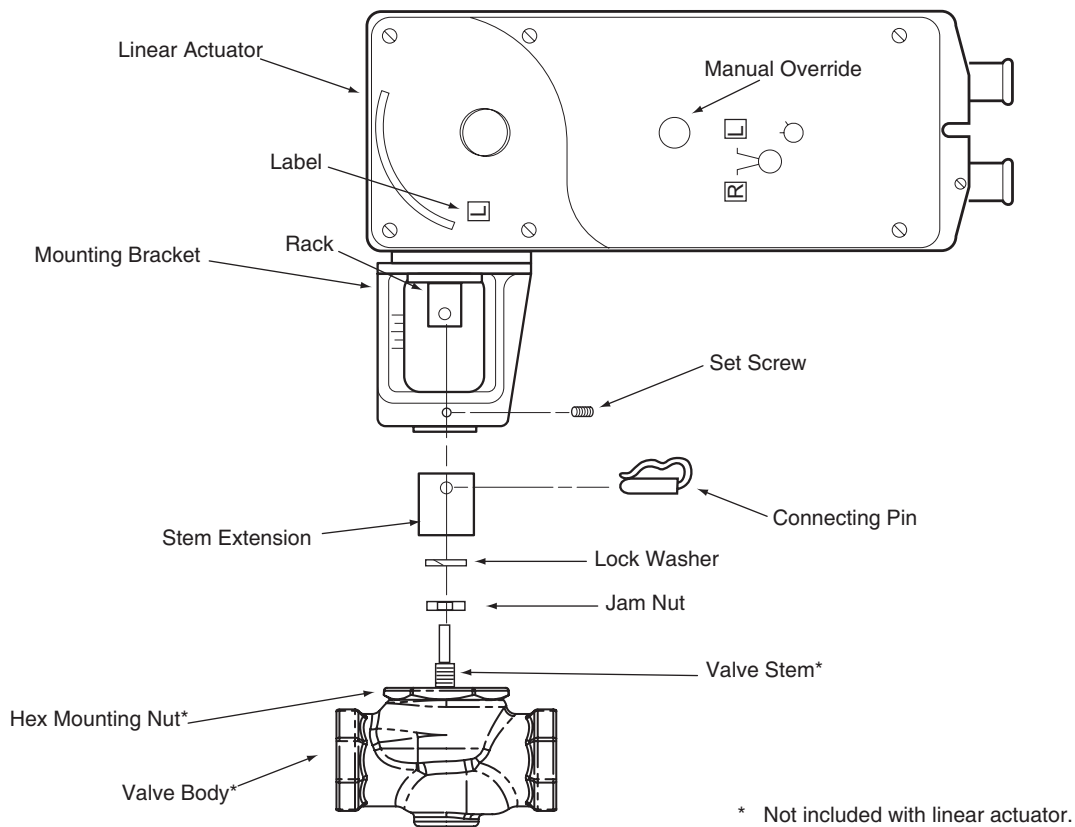
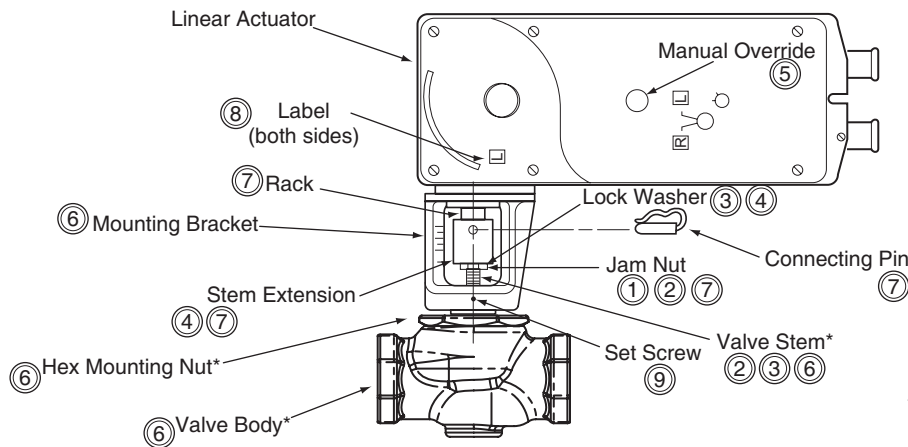


Figure-10 Mx51-720x Series Actuator Exploded View.



*Not included with linear actuator.

Figure-11 Typical Assembly and Installation of Mx51 Series Actuator to 1-1/4" to 2" VB-7xxx Series Valve Bodies, Stem-Up Closed or Open, 2-Way and 3-Way Valves.

Installation: Mx51-720x Series Actuator to 1-1/4" to 2" VB-7xxx Series Valve Bodies, Stem-Up Closed or Open, 2-Way and 3-Way

- A. Install the actuator onto the valve. Set up the assembly according to the numbered steps in Figure-11.
 1. Locate the jam nut that came packaged with the actuator.
 2. Screw the jam nut onto the valve stem all the way as far as it will go. You may need to use a 5/16" (Tool-20-1) open-end wrench. At least 1/2" of the valve stem threads should extend above the nut.
 3. Place lock washer over valve stem.
 4. Thread the stem extension onto the valve stem, making contact with the lock washer and jam nut.
 5. Ensure 15° or 1-1/2 turns of manual override for actuator preload. See Figure-18.
 6. Orient the actuator mounting bracket on the valve and tighten the mounting nut securely against the bracket using Tool-37. Raise the valve stem to the full up position.
 7. Rotate stem extension until the through hole lines up with the through hole of actuator rack. Insert connecting pin to secure stem extension and tighten jam nut against stem extension using 5/16" (Tool-20-1) open end wrench.
 8. Affix open/closed label to the indicator in the appropriate position.
 9. Insert set screw (packaged with actuator) into the most accessible side. Tighten with size 10 IP Torx Plus bit to 20 - 25 lb-in (2.3 to 2.8 N-m).
- B. Apply power to the actuator and check the system operation for heating or cooling output in response to the control signal.

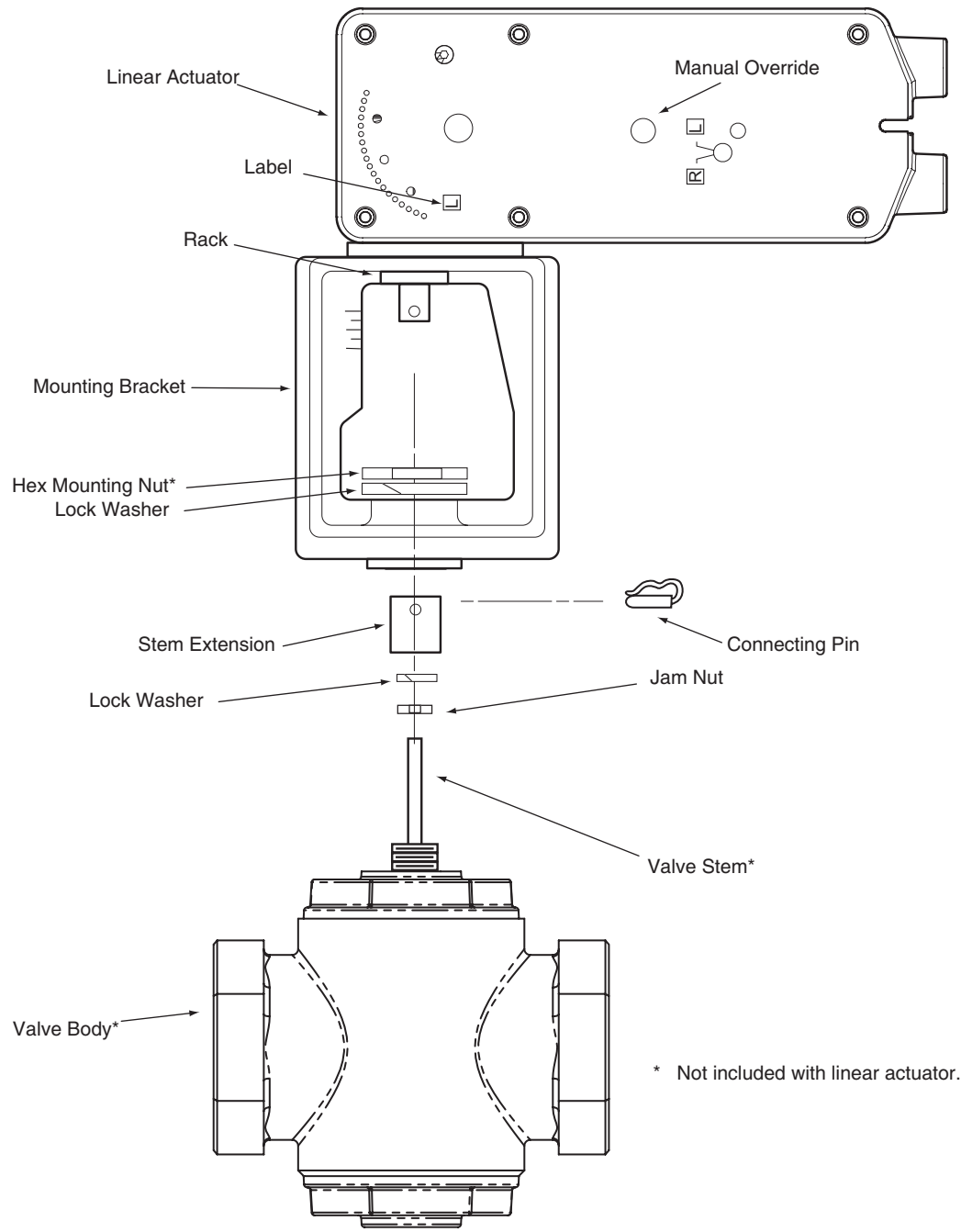


Figure-12 Mx61-720x Series Actuator Exploded View.

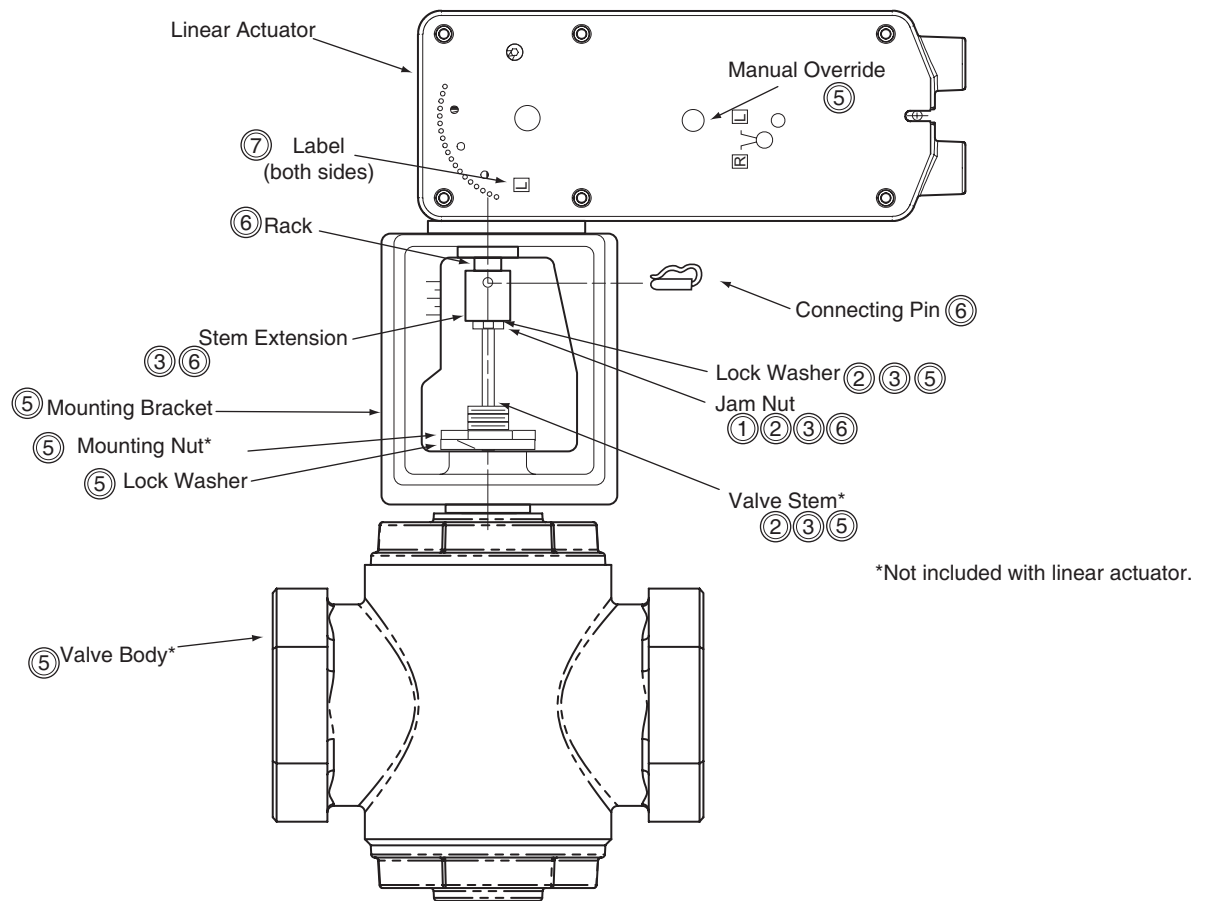


Figure-13 Typical Assembly and Installation.

Installation: Mx61-720x Series Actuator to 2-1/2" to 4" VB-9xxx and 2-1/2" to 5" VB-8xxx Series Valve Bodies, Stem-Up Closed 2-Way and 3-Way

- A. Install the actuator onto the valve. Set up the assembly according to the numbered steps in Figure-13.
 1. Locate the jam nut that came packaged with the actuator.
 2. Screw the jam nut onto the valve stem all the way as far as it will go (you may need to use a 3/4" open-end wrench). At least 1/2" of the valve stem threads should extend above the nut. Place the lock washer over the valve stem.
 3. Thread the stem extension onto the valve stem, making contact with the lock washer and jam nut.
 4. Ensure 15° or 1-1/2 turns of manual override actuator preload. See Figure-18.
 5. Orient the actuator mounting bracket on the valve, place lock washer over valve stem and tighten the mounting nut securely against the bracket using spanner wrench. Raise the valve stem to the full up position.
 6. Rotate stem extension until the through hole lines up with the through hole of actuator rack. Insert connecting pin to secure stem extension and tighten jam nut against stem extension using 3/4" open end wrench.
 7. Affix open/closed label to the indicator in the appropriate position.
- B. Apply power to the actuator and check the system operation for heating or cooling output in response to the control signal.

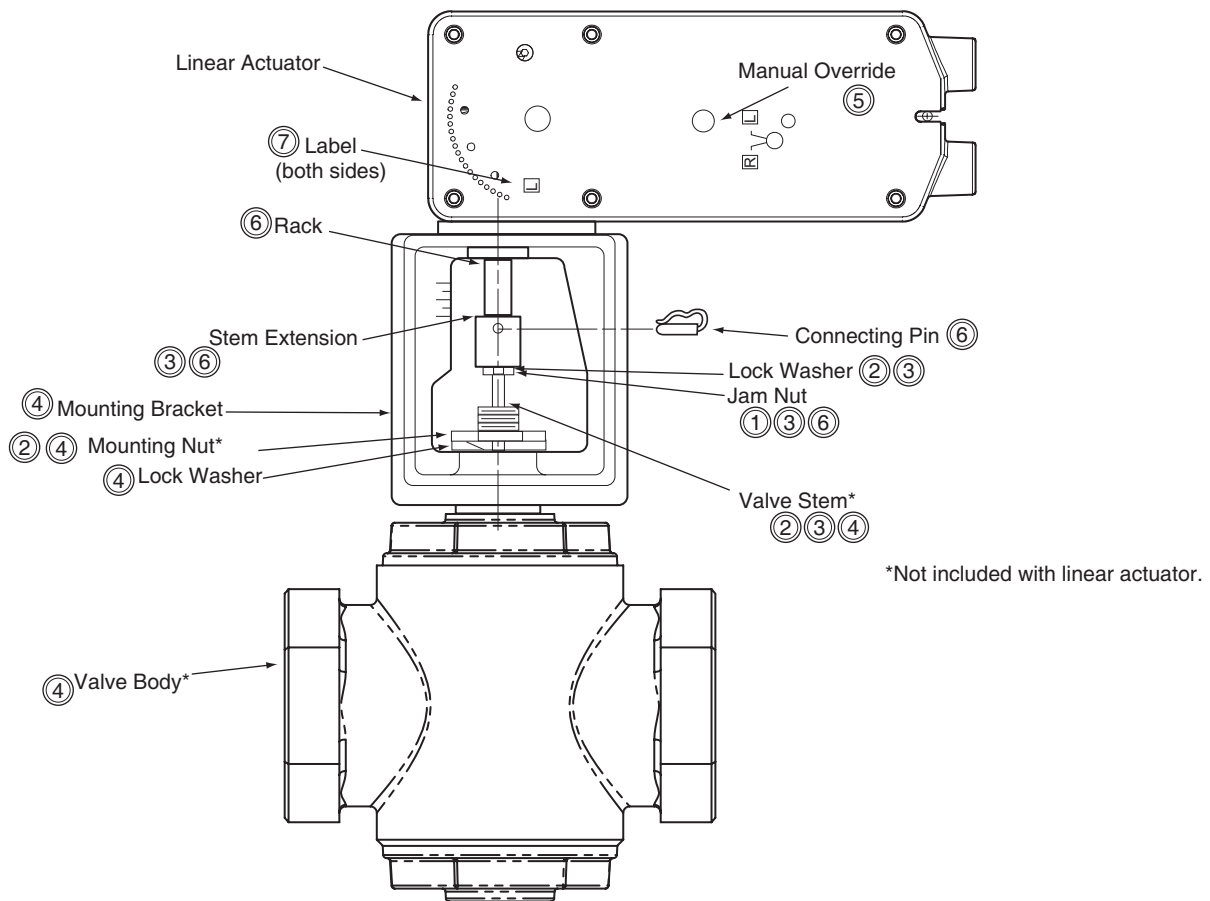


Figure-14 Typical Assembly and Installation.

Installation: Mx61-720x Series Actuator to 2-1/2" to 4" VB-9xxx Series and 2-1/2" to 5" VB-8xxx Valve Bodies, 2-Way Stem-Up Open

- A. Install the actuator onto the valve. Set up the assembly according to the numbered steps in Figure-14.
 1. Locate the jam nut that came packaged with the actuator.
 2. Screw the jam nut onto the valve stem all the way as far as it will go (you may need to use a 3/4" open-end wrench). At least 1/2" of the valve stem threads should extend above the nut. Place the lock washer over the valve stem.
 3. Thread the stem extension onto the valve stem, making contact with the lock washer and jam nut.
 4. Orient the actuator mounting bracket on the valve. Place lock washer over valve stem and tighten the mounting nut securely against the bracket using spanner wrench. Ensure the valve stem is completely pushed down.
 5. Insert the hex wrench into manual override and crank to extend the actuator rack to its fully extended position, back off 1-1/2 turn, and lock (see Figure-18). Remove hex wrench to prevent accidental spring return of the actuator.
 6. Rotate stem extension until the through hole lines up with the through hole of actuator rack. Insert connecting pin to secure the assembly. Tighten jam nut against stem extension using 3/4" open end wrench.
 7. Affix open/closed label to the indicator in the appropriate position.
- B. Apply power to the actuator and check the system operation for heating or cooling output in response to the control signal.

Valve Mounting

The valve should be mounted in a weather-protected area, in a location that is within the ambient temperature limits of the actuator. The installation of the actuator assembly should provide clearance on all sides to allow for any maintenance that may be needed (see Figure-15 and Figure-17). Install the valve according to the instructions in the appropriate valve body General Instructions sheet (see Applicable Literature, page 2).

Caution: Linear actuators are designed to effectively support its own weight. No load or weight should be resting on the actuator as long term damage may occur to the actuator, the mounting connection, or the valve.

- Do not insulate the actuator/linkage. Doing so will result in excess heat buildup within the actuator.
- On non-steam applications the globe valve assembly must be mounted so that the actuator is at least 5° above the horizontal (Figure-15) to ensure that any condensate that forms will not travel into the mounting bracket or actuator.
- On steam applications, the globe valve assembly must be mounted at 45° from vertical. (Figure-16).

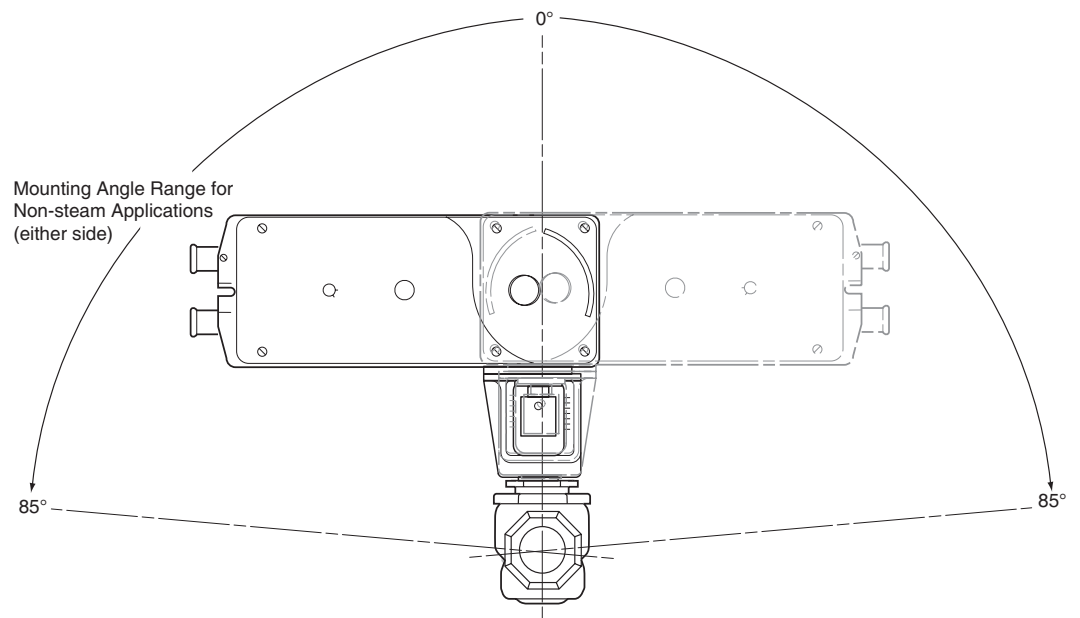


Figure-15 Typical Mounting Position.

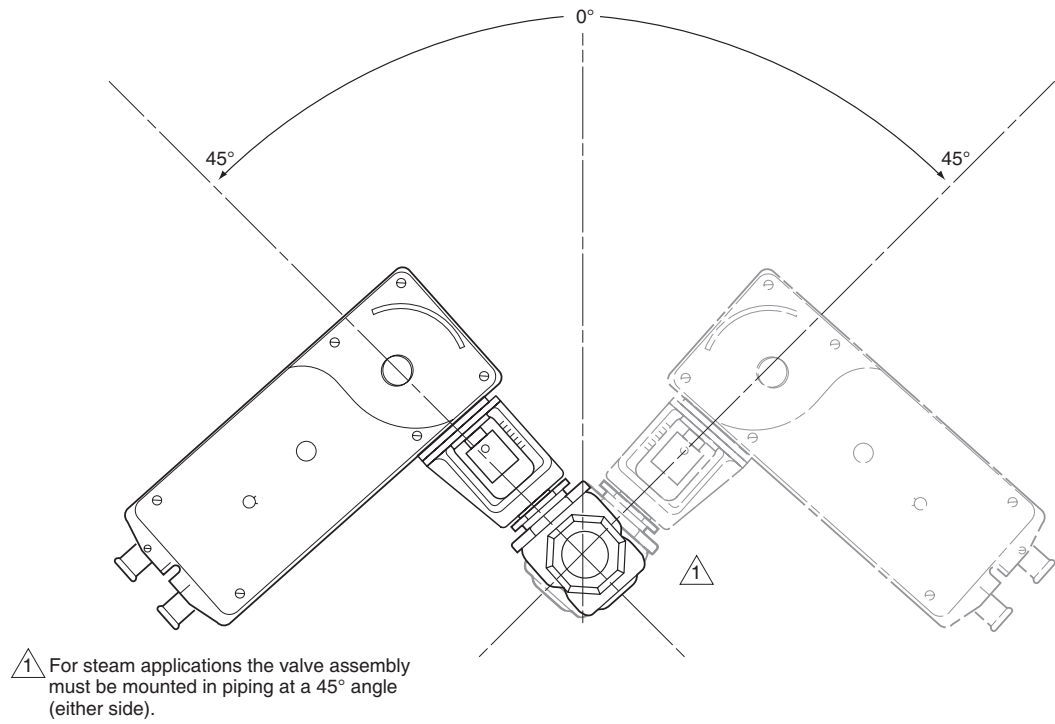


Figure-16 Typical Mounting Position for Steam Applications.

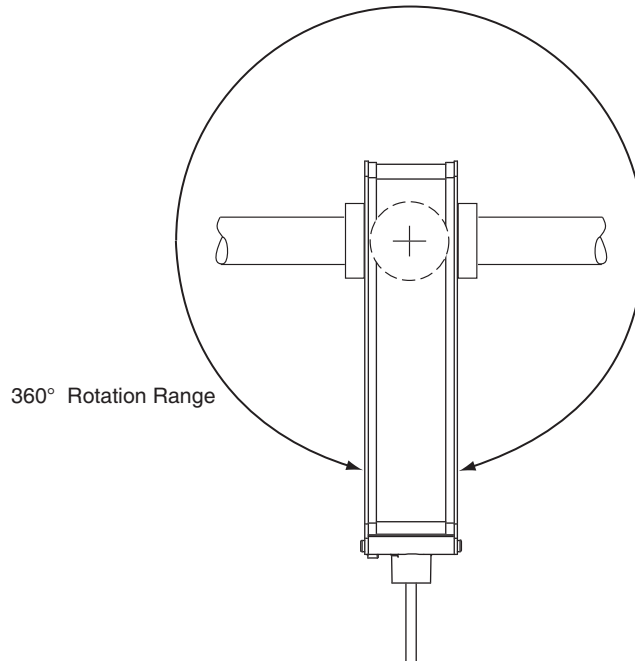
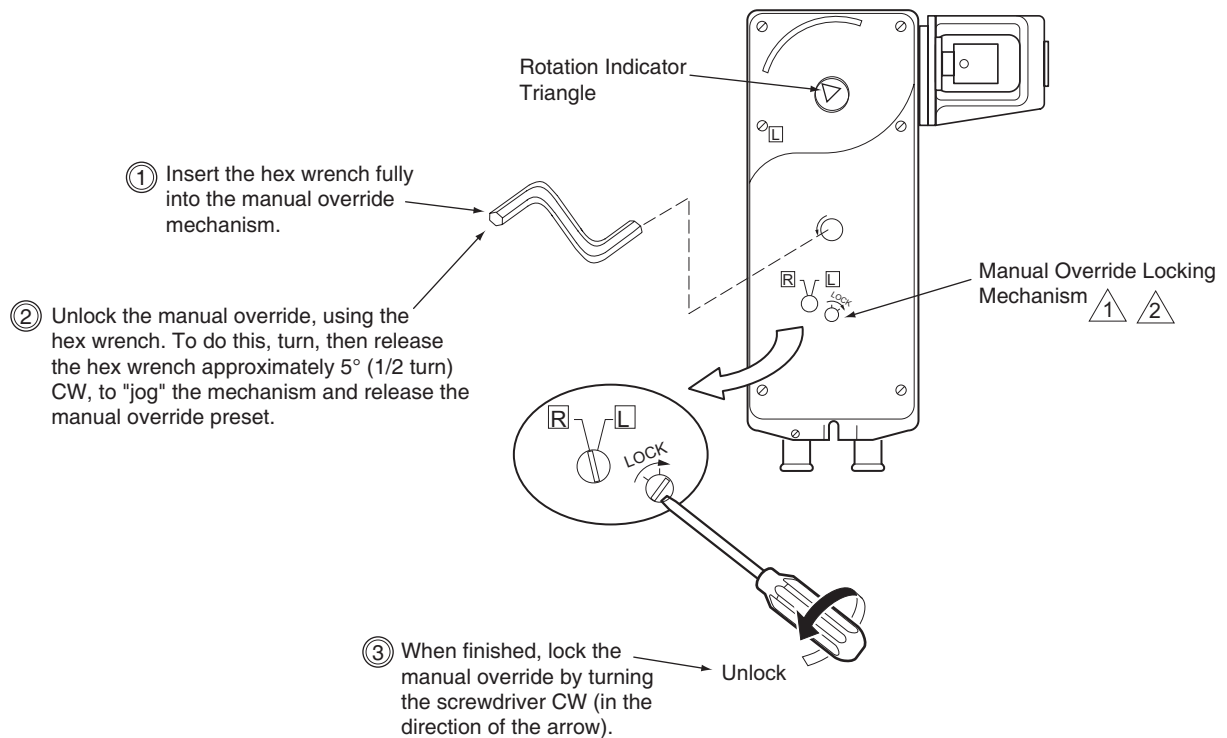


Figure-17 Actuator Positioned Anywhere Within 360 Degrees.

MANUAL OVERRIDE OPERATION



① When necessary, the manual override mechanism may be used to reposition the actuator at any point between -5° and 85°. This mechanism is accessible on both sides of the actuator and can be used to ensure tight close-offs for valves.

② When using the manual override mechanism:

- Fully engage the hex wrench in the manual override before cranking.
- When operating the manual override, ensure proper release by backing off 5° from the full extended mechanical stop.

Figure-18 Manual Override.

Caution:

- Only use manual override when the actuator drive motor is not powered.
- Engaging the manual override when the actuator is powered will cause damage to the gears.
- Using power tools to adjust the override will cause damage to the gears.
- Avoid manually repositioning the actuator beyond its adjustable travel limit setting.

Wiring Requirements

Control Leads

See Table-3 for power wiring data. Refer to Figure-1 through Figure-7 for typical wiring.

Table-3 Power Wiring.

Actuator Voltage	Part Number	Maximum Wire Run in ft. (m)					
		12 AWG	14 AWG	16 AWG	18 AWG	20 AWG	22 AWG
24 Vac 22-30 Vdc	MAx1-7203	—	330 (101)	200 (61)	130 (40)	—	—
	MFx1-7203	500 (152)	300 (91)	200 (61)	130 (40)	80 (24)	50 (15)
	MSx1-7203	600 (183)	380 (116)	240 (73)	150 (46)	90 (27)	60 (18)

CHECKOUT

After the entire system has been installed and the actuator has been powered up, the following check can be made for proper system operation. Check for correct operation of the valve while actuator is being stroked.

1. Apply power to the actuator. Actuator and valve should be driven to their powered position as determined by the control signal.
2. Remove power from the actuator. Actuator and valve should return to the spring return position.

Note: Check that the transformer(s) are sized properly. (24 Vac)

- If a common transformer is used with multiple actuators, make sure that polarity is observed on the secondary. This means connecting all black wires to one leg of the transformer and all red wires to the other leg of the transformer.
 - If multiple transformers are used with one control signal, make sure all black wires are tied together and tied to control signal negative (-).
 - If the controller uses a full-wave power supply and does not provide isolated outputs, a separate transformer is required.
-

THEORY OF OPERATION

The MA, MF and MS series actuators are directly mounted onto the valve without the use of separate linkage. They are equipped with true mechanical spring return operation for reliable, positive actuator operation in the unpowered condition.

Linear series actuators use a brushless DC motor which is controlled by a microprocessor. The microprocessor supplies the intelligence to provide a constant motion rate and to know the actuator's exact normal position and to match actuator mechanical stroke to the control input signal range on proportional (MS) models. The microprocessor monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical switches.

When power is applied to two-position (MA) models, the actuator moves to its full stroke position, at the same time tensing the spring return mechanism. When power is removed, the spring returns the actuator to its normal position.

When power is applied to floating (MF) and proportional (MS) models, the actuator first moves to its zero position, then moves to the position dictated by the control input signal. For proportional (MS) models, when the actuator encounters a stall condition (end of valve stroke), it recalibrates itself if necessary so that its mechanical stroke matches the control signal input span. The feedback signal range is also matched to the mechanical stroke. If power is lost, the actuator spring returns to its normal position.

MAINTENANCE

Regular maintenance of the total system is recommended to assure sustained optimum performance. The Linear series actuators are maintenance free.

FIELD REPAIR

Actuator: None. For replacement contact your Invensys Representative and specify the desired model number from Table 1.

Linkage parts: All are supplied with the actuator. Stem extension, jam nut, washer, and connecting pin may be purchased separately if lost. See ACCESSORIES, page 4.

DIMENSIONAL DATA

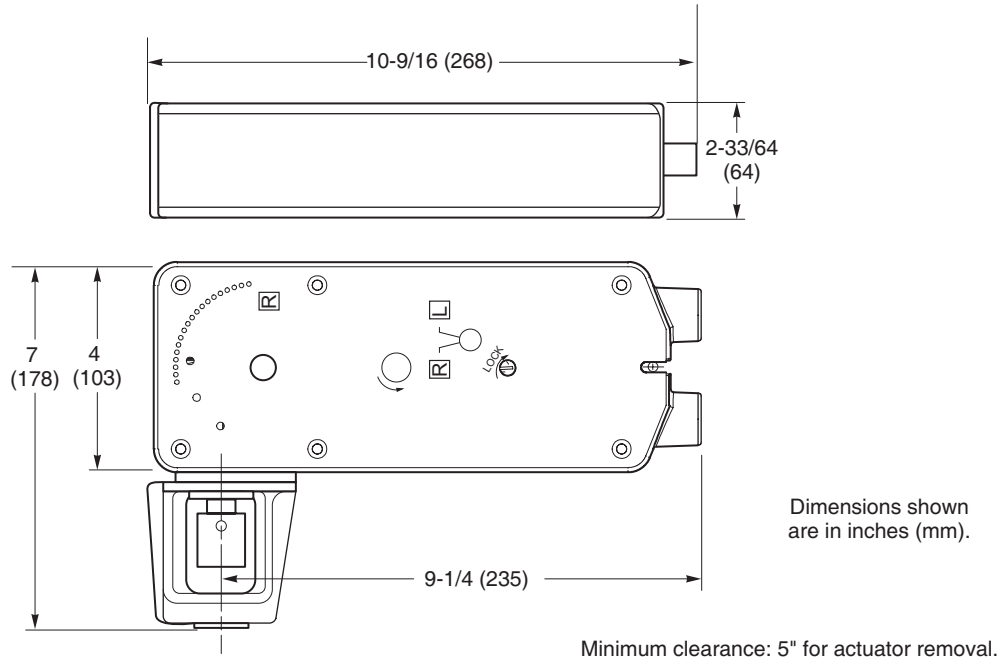


Figure-19 Mx51-720x Spring Return Valve Actuator Dimensions.

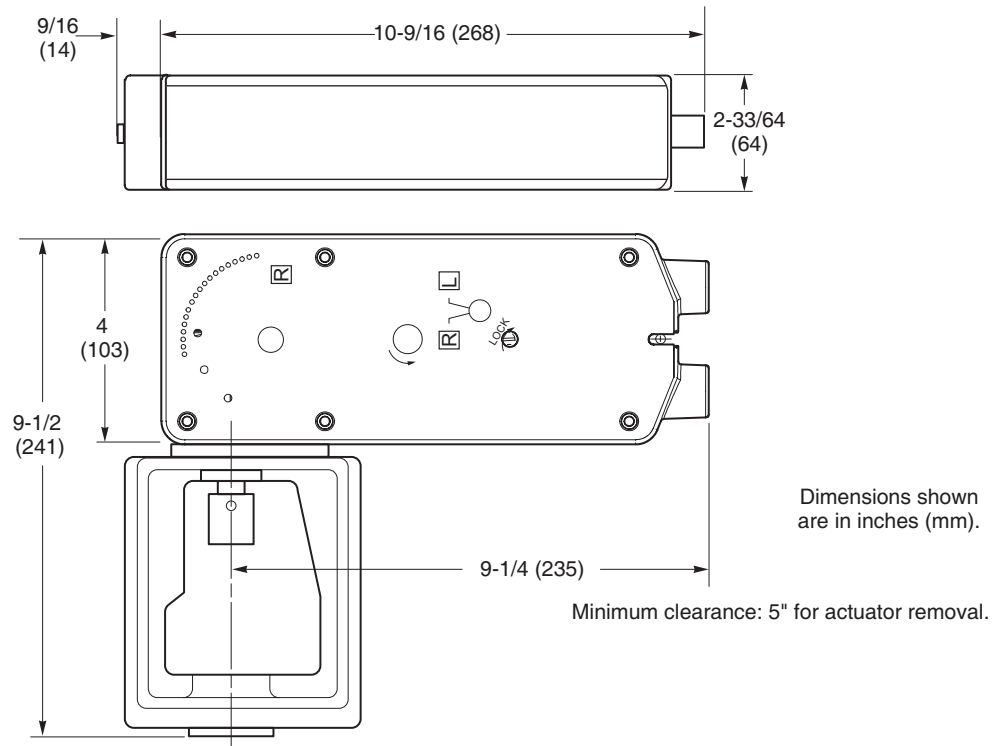


Figure-20 Mx61-720x Spring Return Valve Actuator Dimensions.

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