

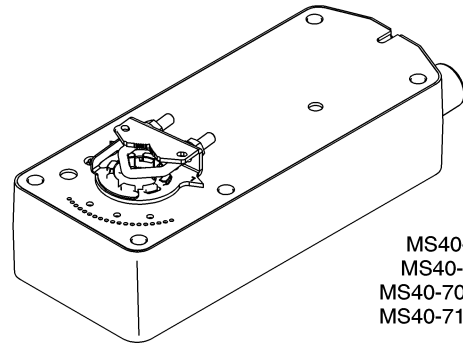
Application

DuraDrive Direct Coupled Actuators are designed to be used in both damper and valve control applications. The following general instructions are for damper applications. Refer to the Applicable Literature table for valve literature.

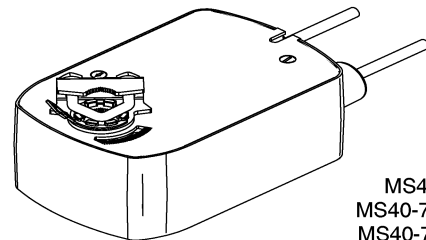
The MS4X-7XX3 series spring return actuators provide proportional modulation control of dampers and valves in HVAC systems.

Features

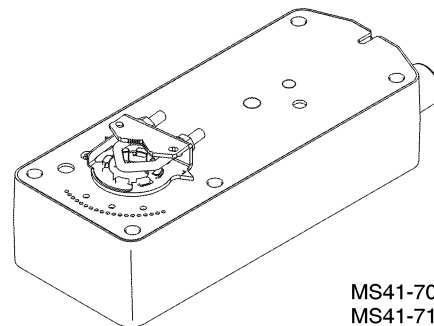
- Proportional models controlled by 6-9 Vdc, 2-10 Vdc, or 4-20 mA with the addition of a 500 ohm resistor
- 133 lb-in (15 N-m), 60 lb-in (7 N-m) or 35 lb-in (4 N-m) of torque
- Rugged die-case housings rated for NEMA 2 / IP54
- Optional built-in auxiliary switch to provide for interfacing or signaling
- Provides 95° of rotation
- Visual position indicator provided
- Provides true mechanical clockwise or counterclockwise spring return operation for reliable fail safe application and positive close-off in air tight damper applications
- MS40-7043-MPX models controlled by 6-9 Vdc with auxiliary 20 Vdc power supply provides power to controllers, replacing MP-5XXX/MPR-5XXX electrohydraulic actuators
- Direct mount to round or square damper shafts
- Switch provided for selection of direct or reverse acting control mode
- Rotation limiting available
- MS4X-7153 series actuators can be double-mounted (gang mounting) to accommodate high torque application requirements
- Five year warranty
- MS41-7073 and MS41-7153 equipped with manual override



MS40-7073
 MS40-7153
 MS40-7073-502
 MS40-7153-502



MS40-7043
 MS40-7043-501
 MS40-7043-MP
 MS40-7043-MP5



MS41-7073
 MS41-7153
 MS41-7073-502
 MS41-7153-502

Applicable Literature

F-Number	Description	Audience	Purpose
F-26750	MA4X-XXXX-2XX, MF4X-XXXX-2XX, MS4X-XXXX-2XX Series Actuator/Linkage Assemblies General Instructions	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Describes the globe valve actuator/linkage assembly's features, specifications, and possible applications. Provides step-by-step mounting instructions.
F-26751	VX-2000 Series Ball Valve Assembly Installations Instructions	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Describes the actuator/linkage/ball valve assembly's features, specifications, and possible applications. Provides step-by-step mounting instructions.
F-26646	MX4X-7XXX, MX40-6XXX Series DuraDrive Actuator Selection Guide	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Provides actuator specifications and part number cross referencing of phased out actuators with the new Invensys Building Systems direct-coupled actuators.
F-26752	VX-2000, VX-7000 Series MX4X-7XXX, MX40-6XXX Series Ball/Linked Globe Valve Assemblies Actuator/Linkage Assemblies Selection Guide	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Provides part number cross referencing of phased out globe and ball valve assemblies with the new Invensys Building Systems direct-coupled actuators.
F-26080	EN-205 Water System Guidelines	<ul style="list-style-type: none"> – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Describes Invensys Building Systems approved water treatment practices.
F-13755	CA-28 Control Valve Sizing	<ul style="list-style-type: none"> – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Provides charts, equations, and diagrams to assist in the configuration of valve system applications. TOOL-150, valve sizing slide rule may be purchased separately.
F-11080	Valve Selection Chart Water		
F-11366	Valve Selection Chart Steam (two-way valves only)		

SPECIFICATIONS

Actuator Inputs

Control Signal: See Table-1.

Power Input: See Table-1. All 24 Vac circuits are Class 2.

Connections: 3 ft. (91 cm) plenum rated cable for MS40-7043-XXX and 3 ft. (91 cm) appliance cables for MS4X-7153-XXX and MS4X-7073-XXX, 1/2" (13 mm) conduit connectors. For M20 Metric conduit, use AM-756 adaptor.

Actuator Outputs

Electrical:

Position Feedback Voltage "AO",

MS40-7043, MS4X-7153 and MS4X-7073 2 to 10 Vdc (max. 0.5 mA) output signal for position feedback or to operate up to four additional slave actuators.

Auxiliary Switches,

MS40-7043-MP5 and MS40-7043-501 One SPDT 6A (1.5A) @ 24 Vac, adjustable 0 to 95° (0 to 1 scale).

MS4X-7153-502 and MS4X-7073-502 Two SPDT 7A (2.5A) @ 250 Vac, one fixed @ 5° and one adjustable 25 to 85°.

Auxiliary Power Supply:

MS40-7043-MP and MS40-7043-MP5 +20 Vdc @ 25 mA (max).

Mechanical:

Stroke, Angle of rotation 95° ±5°. Adjustable 30° to 95° with AM-689 installed on MS4X-7153-XXX or MS4X-7073-XXX. MS40-7043-XXX models are adjustable 40° to 95° by adjusting the stop block position on the actuator.

Damper Shaft Clamp,

MS40-7043-XXX The factory installed universal clamp is used for shafts up to 5/8" (15 mm) diameter or up to 1/2" (13 mm) square. AM-710 accessory clamp is required when mounting actuators to shafts up to 3/4" (19 mm) diameter or up to 1/2" (13 mm) square.

MS4X-7153-XXX or MS4X-7073-XXX The factory installed universal clamp is used for shafts up to 3/4" (19 mm) diameter or up to 1/2" (13 mm) square. AM-687 accessory clamp is required when mounting actuators to shafts up to 1.05" (27 mm) diameter or up to 5/8" (15 mm) square.

Position Indicator, Visual indicator.

MS4X-7153 and MS4X-7073, -5 to 90° (-5° is spring return position).

MS40-7043, 0 to 1 (0 is spring return position).

Nominal Damper Area, Actuator sizing should be done in accordance with damper manufacturer's specifications.

Direction of Rotation, Clockwise or counterclockwise rotation determined by actuator mounting.

Manual Override, MS41-7073 and MS41-7153 are equipped with a manual rotation adjustment from -5° to 85°.

Right/Left Switch, Permits reverse acting/direct acting rotation.

Environment

Ambient Temperature Limits:

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

Operating, -22 to 140°F (-30 to 60°C).

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

Location:

MS4X-7153-XXX and MS4X-7073-XXX, NEMA 1 (IEC IP30). NEMA 2 (IEC IP54) with conduit connector in the down position.

MS40-7043-XXX, NEMA 2 (IEC IP54) no restrictions.

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.

Table-1 Specifications.

Part Number	Actuator Power Input							Approximate Timing in Seconds @ 70°F (21°C) ^a		Auxiliary Switch	Output Torque Rating lb.-in. (N-m)		Auxiliary Power Supply	Input
	Voltage	Running					Hold- ing	Powered	Spring Return		Min. ^b	Max. Stall		
		50 Hz		60 Hz		DC Amps	50/60 Hz							
		VA	W	VA	W									
MS40-7043	24 Vac ± 20% 22-30 Vdc	5.6	4.2	5.6	4.2	0.15	2.4	<130	<25	No	35 (4)	150 (17)	None	2-10 ^c Vdc or 4-20 ^d mA w/ 500 Ω
MS40-7043-501										One ^e				
MS4X-7073		5.8	4.6	5.8	4.6	0.17	2.3	<195	<30	No	60 (7)	250 (28)		
MS4X-7073-502										Two ^f				
MS4X-7153		9.8	7.4	9.7	7.4	0.28	2.9	<190	<30	No	133 (15)	350 (40)		
MS4X-7153-502										Two ^f				
MS40-7043-MP	24 Vac ± 20% 22-30 Vdc	6.6	5.0	6.6	5.0	0.17	3.2	<130	<25	No	35 (4)	150 (17)	+20 Vdc 25 mA Max.	6-9 ^c Vdc
MS40-7043-MP5										One				

- ^a Timing was measured with no load applied to the actuator.
- ^b De-rating is required at low temperatures.
- ^c 2-10 Vdc or 6-9 Vdc input impedance 80 k ohms.
- ^d 4-20 mA with 500 ohm input impedance 500 ohms.
- ^e One adjustable from 0° to 95° rotation (0 to 1 scale).
- ^f One adjustable from 25° to 85° rotation and one set to operate @ 5° fixed.

ACCESSORIES

- AM-671 Universal Mounting Bracket, AM-693 is required
- AM-672 Universal Mounting Bracket, AM-693 is required
- AM-673 Multiple Actuator Mounting Bracket (MA40-7153 series)
- AM-674 Weather Shield
- AM-675 Base Mounting Plate for AM-674
- AM-676 Universal Shaft Extension, AM-710 required
- AM-703 Input Rescaling Module, adjusts signals to 2-10 Vdc, zero and span adjustment
- AM-704 Interface, pulse width modulation
- AM-705 Positioner (NEMA 4 housing)
- AM-706 Min and/or Manual Positioner for flush panel mount
- AM-708 500Ω resistor for 0 to 20 mA control signal
- AM-714 Weather Shield (polycarbonate)
- AM-756 Metric Conduit Adapter M20 x 1.5 to 1/2" NPT
- AM-761 7-inch replacement anti-rotation bracket
- AM-762 9-inch replacement anti-rotation bracket

MS4X-7153-XXX and MS4X-7073-XXX

- AM-686 Damper Position Indicator
- AM-687 Universal Clamp for up to 1.05" (27 mm) diameter shafts
- AM-688 Replacement Universal Clamp
- AM-689 Rotation Limiter
- AM-690 Crank Arm for round shafts up to 3/4" (19 mm)
- AM-691 Crank Arm for jackshafts up to 1.05" (27 mm)
- AM-692 V-bolt Kit for AM-690 and AM-691 Crank Arms
- AM-693 Damper Linkage Kit
- AM-758 Short "U" mounting bracket for replacing Honeywell Mod III type actuators and new installations, AM-690 or AM-691 is required
- AM-759 Tall "U" mounting bracket for replacing Honeywell Mod IV type actuators and new installations, AM-690 or AM-691 is required
- AM-760 Slotted "L" mounting bracket, AM-690 or AM-691 is required
- AM-763 Crank for manual override

MS40-7043-XXX

AM-709	Damper Position Indicator
AM-710	Universal Clamp for up to 3/4" diameter shafts
AM-711	Crankarm for up to 1/2" round shaft
AM-712	Crankarm Adaptor Kit
AM-713	Mounting Bracket for Honeywell Mod IV, M6415 type actuators, and new installations
AM-715	Crankarm Adaptor Kit for Honeywell Mod IV M6415 type actuators, and new installations
AM-717	Replacement Universal Clamp

Table-2 Auxiliary Power Supply.

Model #	Rating	
MS40-7043-MP or MS40-7043-MP5	+ 20 Vdc, 25 mA Maximum	
Control Wires	Blue (+)	Grey (-)

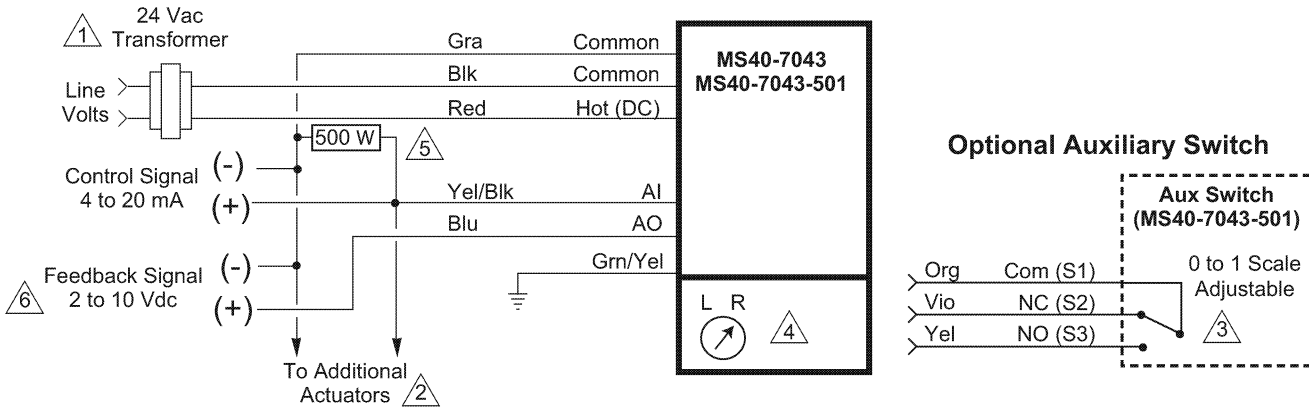
TYPICAL APPLICATIONS (wiring diagrams)

Figure-1 and Figure-2 illustrate typical wiring diagrams for spring return proportional actuators. See Table-1 for model selection and control signal specifications.

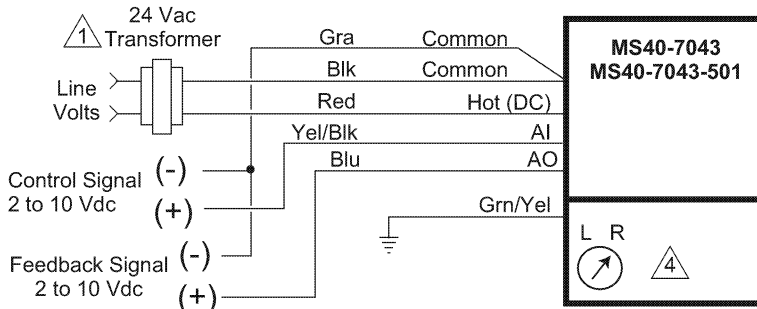
Caution: This product contains a half-wave rectifier power supply and must not be powered off transformers used to power other devices utilizing non-isolated full-wave rectifier power supplies. Refer to *EN-206, Guidelines for Powering Multiple Devices from a Common Transformer, F-26363* for detailed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

Note: DC operation is applicable to models manufactured after date code 0212.

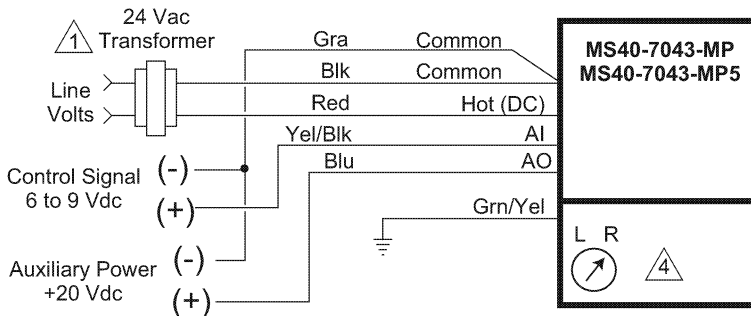
4 to 20 mAdc Proportional Control



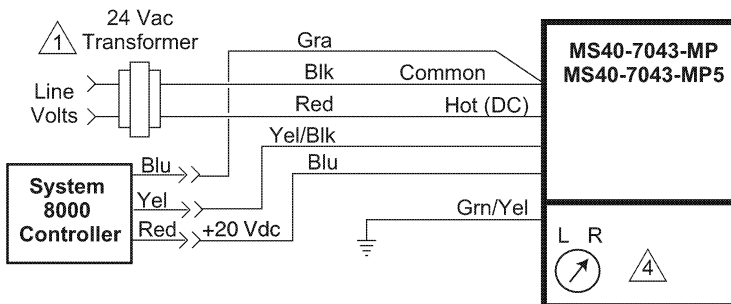
2 to 10 Vdc Proportional Control



6 to 9 Vdc Proportional Control with 20 Vdc Power Output



System 8000 6 to 9 Vdc Room Temperature Control



- 1 Provide overload protection and disconnect as required.
- 2 For parallel operation in 4 to 20 mA applications, actuators may be wired in series and mounted on separate shafts. Also, up to four actuators, mounted on separate shafts, may be wired in parallel. With four actuators wired to one 500 ohm resistor, a +2% shift of the control signal may be required. Power consumption and input impedance limits must be observed. Actuator input impedance is 80 kohm.
- 3 For end position indication, interlock control, fan startup, etc., MS40-7043-501 model incorporates one built-in auxiliary switch.
- 4 To reverse actuator rotation, use the reversing switch.
- 5 A field-supplied 500 ohm resistor (AM-708) is required between the gray and yellow/black leads to convert the 4 to 20 mA control signal to 2 to 10 Vdc.
- 6 Only connect common to negative (-) leg of control circuits.

Figure-1 Proportional Control of System 8000 Room Temperature Controller Application of MS40-7043-XXX Actuator.

MS4X-7073-XXX and MS4X-7153-XXX

Caution: This product contains a half-wave rectifier power supply. It 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 Multiple Devices from a Common Transformer, F-26363* for detailed information.

MX40-707X-502 and MX40-715X-502 units manufactured prior to the date code 0141 (October 6, 2001) used different color coding for the auxiliary switches.

Auxiliary Switch 1

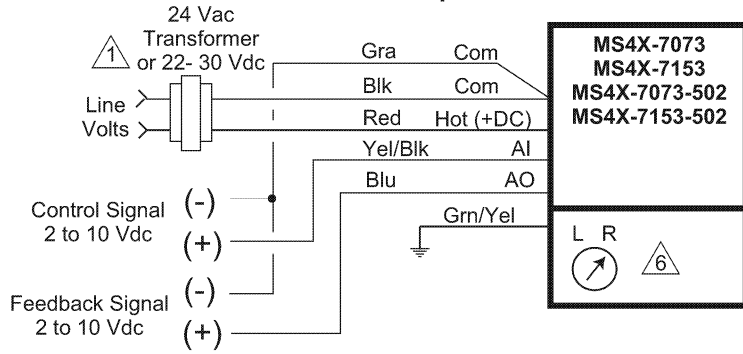
- Orange: Fixed auxiliary switch common (com)
- Yellow: Fixed auxiliary switch normally closed (NC)
- Violet: Fixed auxiliary switch normally open (NO)

Auxiliary Switch 2

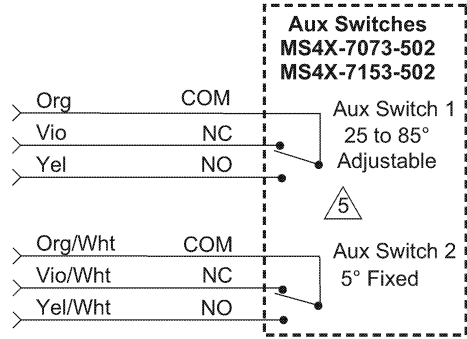
- Orange/white: Adjustable auxiliary switch common (com)
- Violet/white: Adjustable auxiliary switch normally closed (NC)
- Yellow/white: Adjustable auxiliary switch normally open (NO)

The label information on these units is incorrect. If replacing these units, the auxiliary switch operation of the replacement actuator will be per the product label and Figure-2.

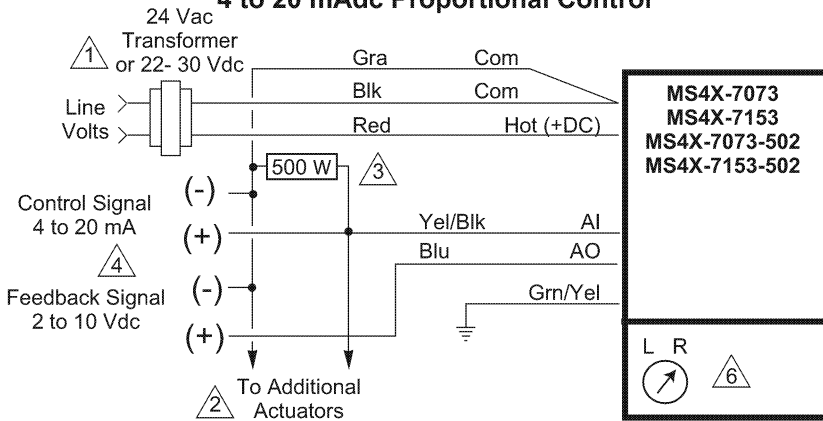
2 to 10 Vdc Proportional Control



Optional Auxiliary Switches



4 to 20 mAdc Proportional Control



- 1 Provide overload protection and disconnect as required.
- 2 With four actuators wired to one 500 ohm resistor, a +2% shift of the control signal may be required. (Actuator input impedance is 80 k ohm.)
- 3 A field-supplied 500 ohm resistor (AM-708) is required between the gray and yellow/black leads to convert the 4 to 20 mAdc control signal to 2 to 10 Vdc.
- 4 Only connect common to negative (-) leg of control circuits.
- 5 For end position indication, interlock control, fan startup, etc., MS4X-7XX3-502 models incorporate two built-in auxiliary switches.
- 6 To reverse actuator rotation, use the reversing switch.
- 7 Both actuators must be set to operate in the same direction.

Two Actuators on the Same Damper Shaft

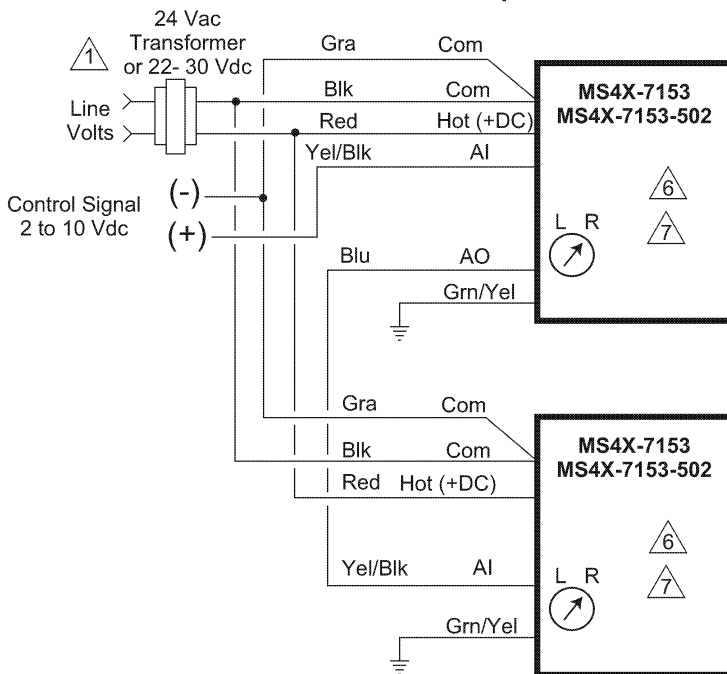


Figure-2 Typical Wiring Diagrams for Proportional Control 24 Vac Basic and Double Auxiliary Switch Models.

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
- Tools (not provided):
 - #8 sheet metal screws (Universal Bracket)
 - 10mm open end wrench or socket wrench (Universal V-clamp)
 - 1/8 inch, allen wrench (Aux. Switch)
 - Appropriate screwdriver(s)
 - Drill and appropriate bits
- Appropriate accessories
- Training: Installer must be a qualified, experienced technician

Precautions

General

Warning:

- Electrical shock hazard! Disconnect the power supply (line power) before 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.*



Caution:

- Avoid electrical noise interference. Do not install near large contactors, electrical machinery, or welding equipment.
- MX41-707X and MX41-715X Manual override to be used only when power is not applied to unit.
- When operating manual override, back off 5° from full open mechanical stop to ensure proper release.
- MX41-707X and MX41-715X Do not attempt to use the manual override with actuators mounted in tandem. Damage to the gear train may occur.
- Do not drill holes in actuator body. Six pre-drilled holes are located on each side, under 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.

Location

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

Mounting

Caution: To remain in NEMA 2/IP54 compliance, the MS4X-715X and MS4X-707X series actuators should be mounted with conduit end down.

Mount the DuraDrive Actuator directly on the damper shaft in locations that clear the maximum dimensions of the actuator case and allow the actuator to be mounted flush to the surface of the terminal box and perpendicular to the damper shaft.

MX41-707X and MX41-715X If the universal clamp is not set to 0° on the position indicator, manually wind the actuator in the direction indicated with hex wrench from -5° to 0° and lock with a screwdriver.

Note: Some terminal boxes have sheet metal screw heads or other protrusions near the damper shaft. In these cases, a spacer or shim may be added under the anti-rotation bracket of the actuator to make the actuator perpendicular to the shaft.

Damper Actuator Sizing

Correct sizing of the actuator is necessary for proper control of dampers. The area of damper that can be controlled by a given actuator is dependent upon the type of damper, the quality of the damper, the pressure drop across the damper in the closed position, and the velocity of the air flow through the damper. To obtain actual damper torque requirements, contact the damper manufacturer.

Damper Shaft Sizing

Use the “Long Damper Shaft” mounting instructions if the damper shaft is at least 3-1/2" (90 mm) long.

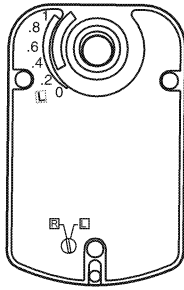
Use the “Short Damper Shaft” mounting instructions if the damper shaft is shorter than 3-1/2" (90 mm) or the area around the damper shaft is too narrow to allow standard mounting, as described in the “Short Damper Shaft” mounting section.

Changing Direction of Rotation

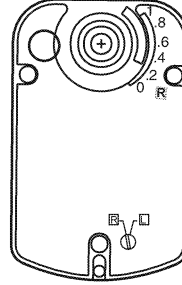
The MS40-7043, MS4X-7074, and MS4X-7153 actuators are equipped with a switch to control the direction of rotation. The switch can be set to “L” (left) or “R” (right) rotation. An actuator set to “L” will have a clockwise rotation when viewed from the left side. When viewed from the right side the rotation will be counterclockwise. Refer to Figure-3.

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.

MS40-704X

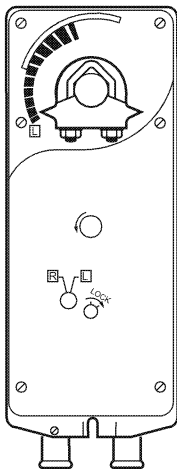


Viewed from L side:
Switch on - Clockwise rotation on increasing signal
Switch on - Counterclockwise rotation on increasing signal

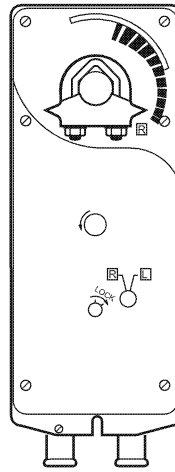


Viewed from R side:
Switch on - Counterclockwise rotation on increasing signal
Switch on - Clockwise rotation on increasing signal

MS4X-707X, MS4X-715X-XXX



Viewed from L side:
Switch on - Clockwise rotation on increasing signal
Switch on - Counterclockwise rotation on increasing signal

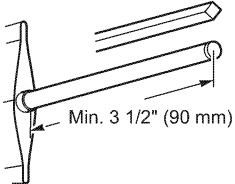
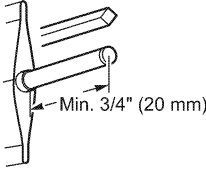
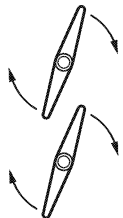
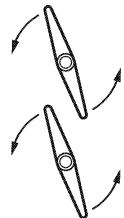


Viewed from R side:
Switch on - Counterclockwise rotation on increasing signal
Switch on - Clockwise rotation on increasing signal

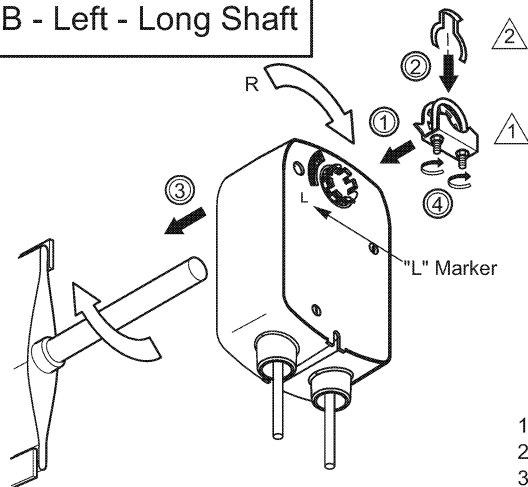
Figure-3 Rotation Switch Settings.

MS40-704X Series Installation

Note: The MS40-704X series actuator comes equipped with standard universal mounting clamp. For damper shafts larger than 5/8" (16 mm) in diameter, the AM-710 universal mounting clamp is required (order separately). The AM-710 clamp accommodates shafts sizes up to 3/4" (19 mm) diameter shafts.

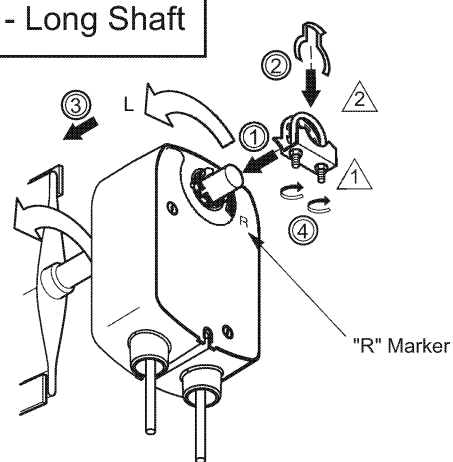
<p>Long Shaft</p>  <p>Min. 3 1/2" (90 mm)</p> <p>3/8" to 3/4" Diameter (10 mm to 20 mm) 3/8" to 1/2" Square (10 mm to 13 mm)</p>	<p>Short Shaft</p>  <p>Min. 3/4" (20 mm)</p>
<p>Move the damper to its normal position. Verify the controller action is set to match the damper application.</p> <p>Normally closed damper: when damper is closed, actuator position indicator should be at 0°. When damper is open, actuator position indicator should be at 90°.</p> <p>Normally opened damper: when damper is open, actuator position indicator should be at 0°. When damper is closed, actuator position indicator should be at 90°.</p>	
<p>A - Left</p>  <p>Shaft Rotates Clockwise To Open</p>	<p>A - Right</p>  <p>Shaft Rotates Counterclockwise To Open</p> <p>This step determines shaft rotation. Linkage may change damper direction.</p>

B - Left - Long Shaft



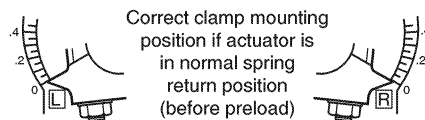
- ① Universal mounting clamp.
- ② Retaining clip.

B - Right - Long Shaft

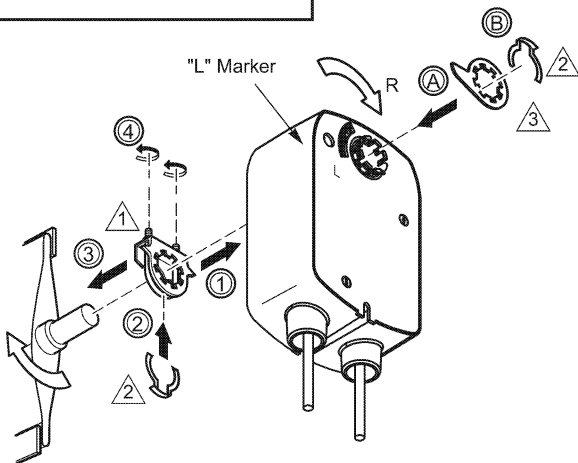


- ① Universal mounting clamp.
- ② Retaining clip.

1. Assemble mounting clamp.
2. Assemble retaining clip.
3. Place actuator over shaft.
4. Hand tighten clamp nuts.

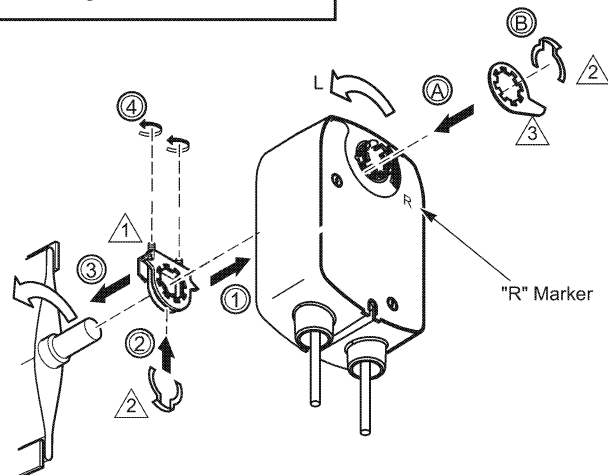


B - Left - Short Shaft



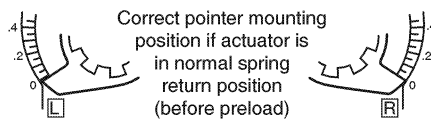
- ① Universal clamp.
- ② Retaining clip.
- ③ Damper position indicator.

B - Right - Short Shaft

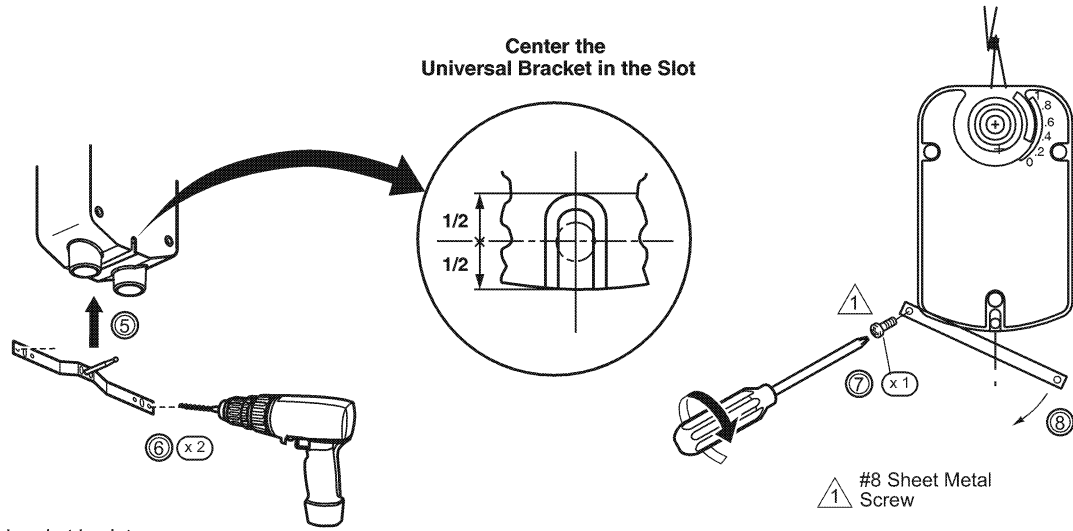


- ① Universal clamp.
- ② Retaining clip.
- ③ Damper position indicator.

- A. Assemble damper position indicator.
 - B. Assemble retaining clip.
1. Position mounting clamp.
 2. Assemble retaining clip.
 3. Slide actuator over shaft.
 4. Hand tighten clamp nuts.

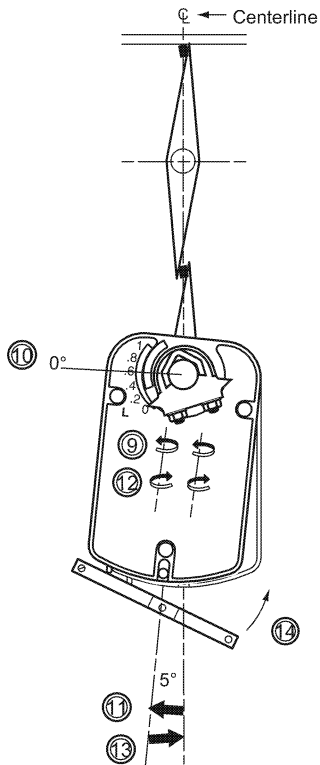


C - Left and Right

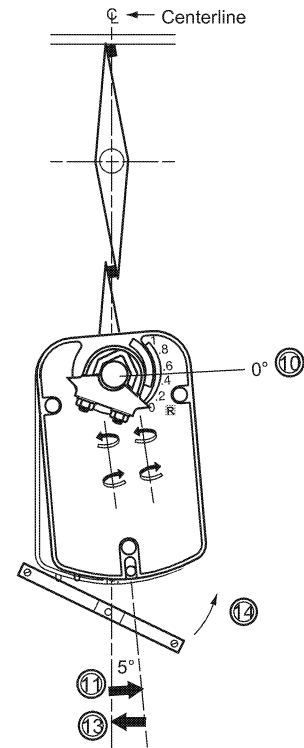


5. Center bracket in slot.
6. Drill two holes.
7. Start one screw.
8. Swing bracket down.

D- Left

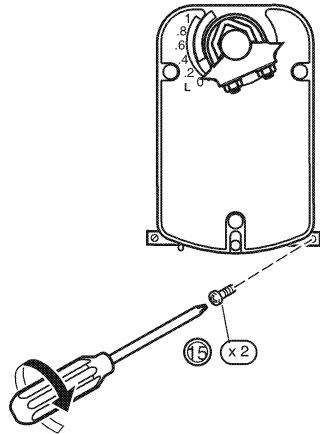


D- Right

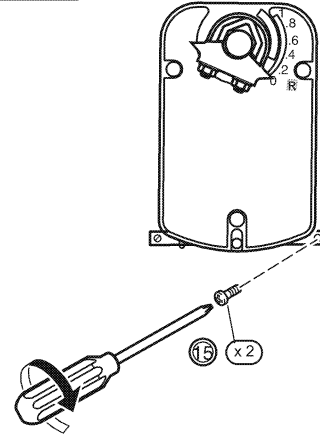


9. Loosen clamp nuts.
10. Check that the shaft is in full zero position.
11. Swing actuator 5° in the direction of travel. Do not move shaft.
12. Tighten clamp nuts to 4 to 6 lb-ft (5.4 to 8.2 N-m) of torque.
13. Move bottom of actuator back into position.
14. Pivot bracket back into position.

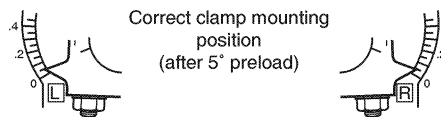
E- Left



E - Right



15. Tighten bracket screws.



MS4X-707X and MS4X-715X Series Installation

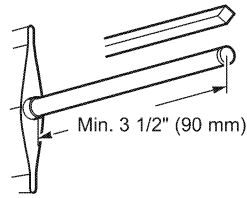
Caution: Do not drill additional holes in the actuator body. Six pre-drilled holes are located on each side, under the label, to accept #10-24 thread-forming screws for mounting accessories.

Note: The MS4X-707X and MS4X-715X series actuators come equipped with standard universal mounting clamp installed. For damper shafts larger than 3/4" (19 mm) in diameter, the AM-687 universal mounting clamp is required (order separately). The AM-687 clamp accommodates round shaft sizes up to 1.05" (27 mm) in diameter or 5/8" (16 mm) square shafts.

Caution: The MS41-707X and MS41-715X actuators are equipped with a manual override.

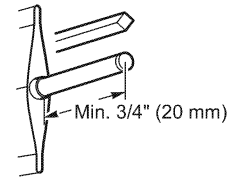
- The manual override to be used only when power is not applied to the unit.
- If the universal clamp is not set to 0° on the position indicator, manually wind the actuator in the direction indicated with hex wrench from -5° to 0° and lock with a screwdriver.
- When operating manual override, back off 5° from full open mechanical stop to ensure proper release.
- Do not attempt to use the manual override with actuators mounted in tandem. Damage to the gear train could occur.
- Using power tools to adjust the manual override will cause damage to the gears.
- To unlock manual override without power, crank the manual override in the direction indicated a minimum of 5°.

Long Shaft



3/8" to 3/4" Diameter (10 mm to 20 mm)
3/8" to 1/2" Square (10 mm to 13 mm)

Short Shaft

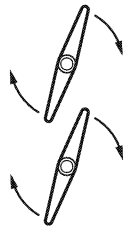


Move the damper to its normal position. Verify the controller action is set to match the damper application.

Normally closed damper: when damper is closed, actuator position indicator should be at 0°. When damper is open, actuator position indicator should be at 90°.

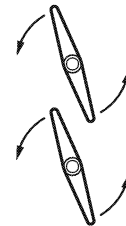
Normally opened damper: when damper is open, actuator position indicator should be at 0°. When damper is closed actuator position indicator should be at 90°.

A - Left



**Shaft Rotates
Clockwise
To Open**

A - Right



**Shaft Rotates
Counterclockwise
To Open**

This step determines shaft rotation. Linkage may change damper direction.

B

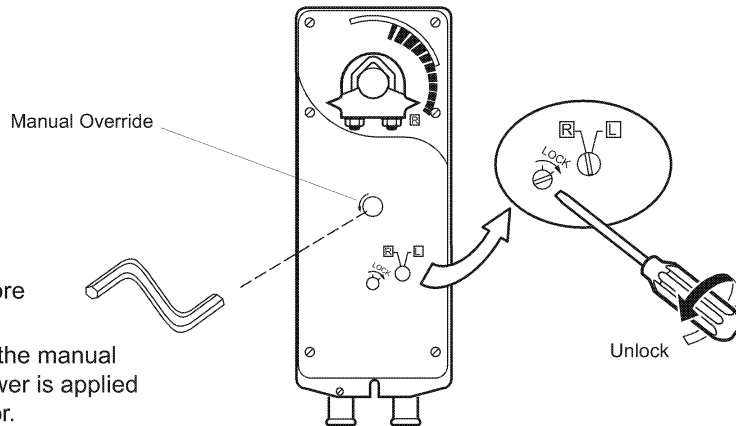
For MS41-707X and MS41-715X only (manual override).
For MS40-707X and MS40-715X, proceed to step C.

If position indicator does not point to zero: Unlock the actuator.

Insert hex wrench into manual override.

Crank the actuator so the indicator points to 0°.

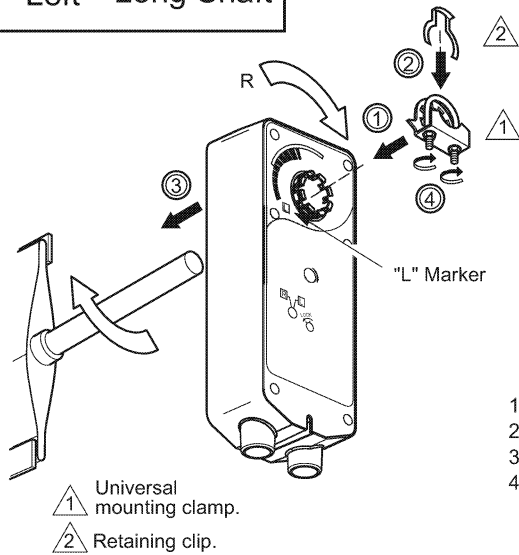
Lock the actuator.



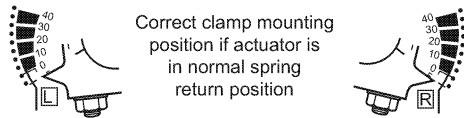
Fully engage hex wrench into manual override before winding.

Caution: Do not crank the manual override if power is applied to the actuator.

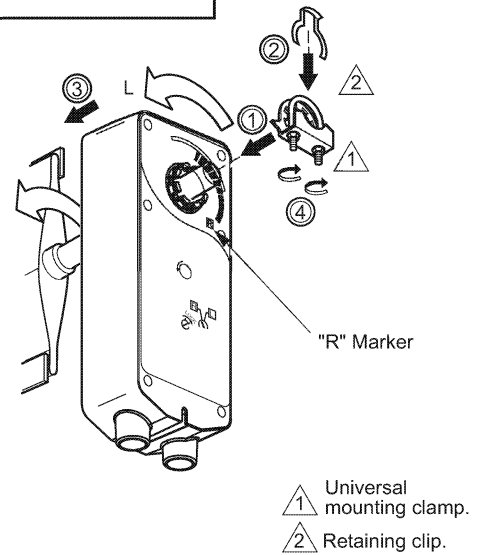
C - Left - Long Shaft



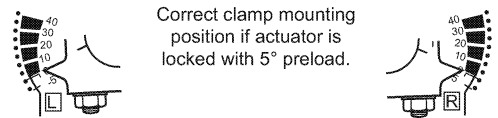
For MS40-707X and MS40-715X actuators:



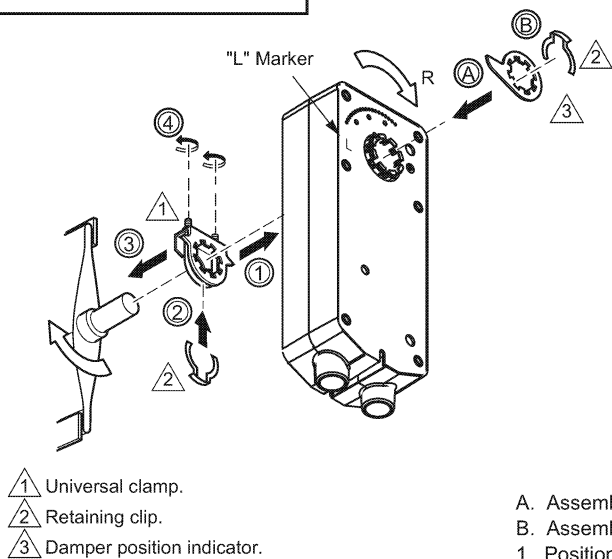
C - Right - Long Shaft



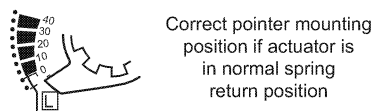
For MS41-707X and MS41-715X actuators:



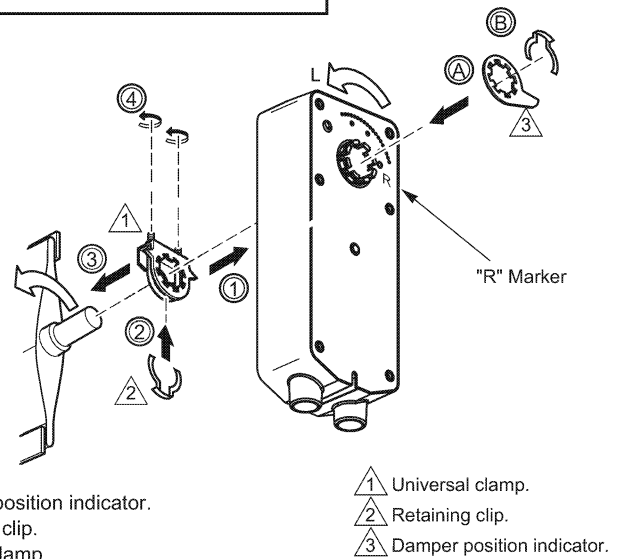
C - Left - Short Shaft



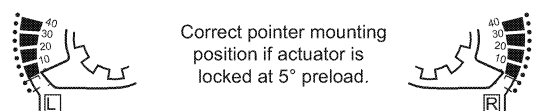
For MS40-707X and MS40-715X actuators:



C - Right - Short Shaft

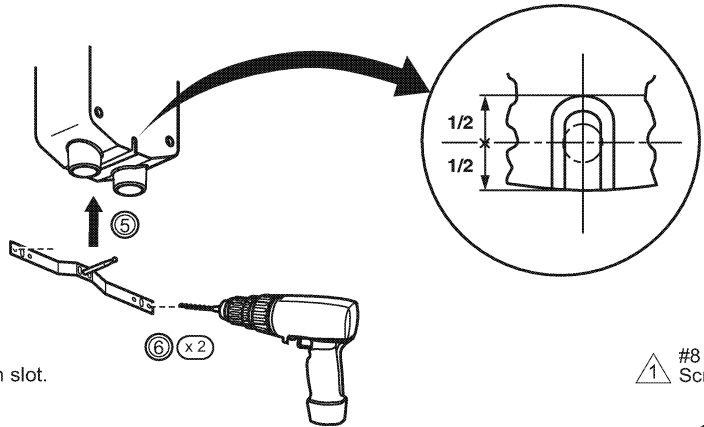


For MS41-707X and MS41-715X actuators:

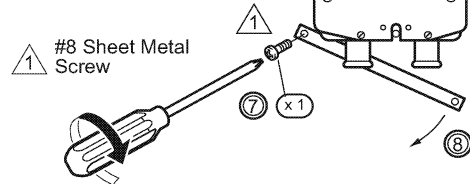


D - Left and Right

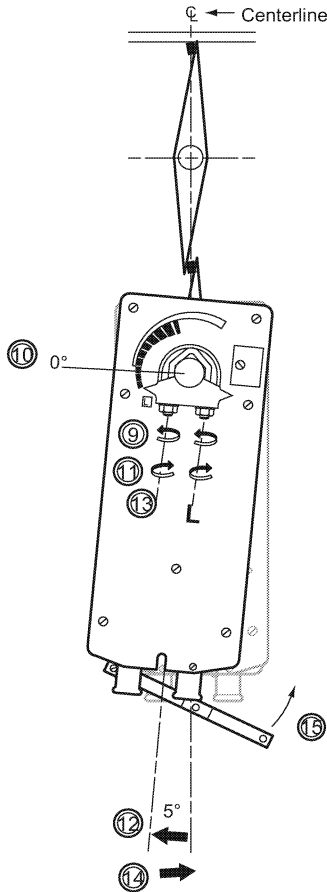
Center the
Universal Bracket in the Slot



5. Center bracket in slot.
6. Drill two holes.
7. Start one screw.
For MS41-707X and MS41-715X actuators, insert and tighten both screws.
8. Swing bracket down (MS40 actuator only).



E- Left



9. Loosen clamp nuts.
10. Check that the shaft is in full zero position.

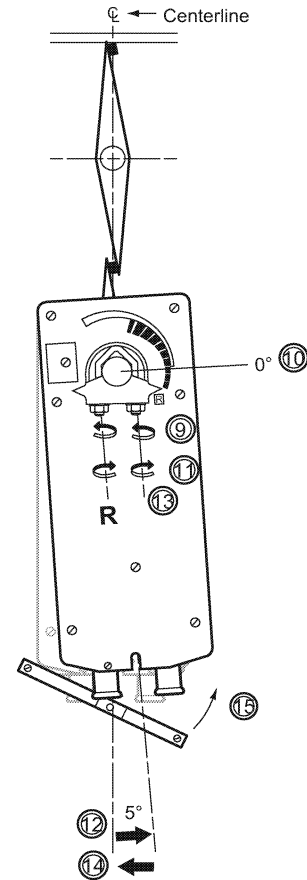
For MS41-707X and MS41-715X only:

11. Tighten clamp nuts to 6 - 8 in-lb (8.2 Nm).
This completes the installation for MA41-704X and MA41-715X.

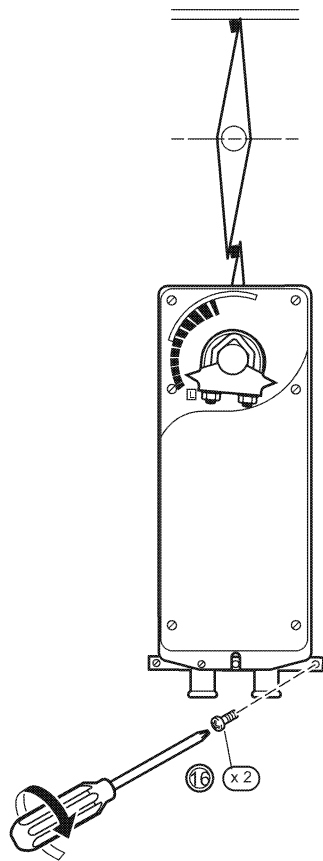
For MS40-707X and MS40-715X only:

12. Swing actuator 5° in the direction of travel. Do not move shaft.
13. Tighten clamp nuts to 6 - 8 lb-in (8.2 - 10 N-m).
14. Move bottom of actuator back into position.
15. Pivot bracket back into position.

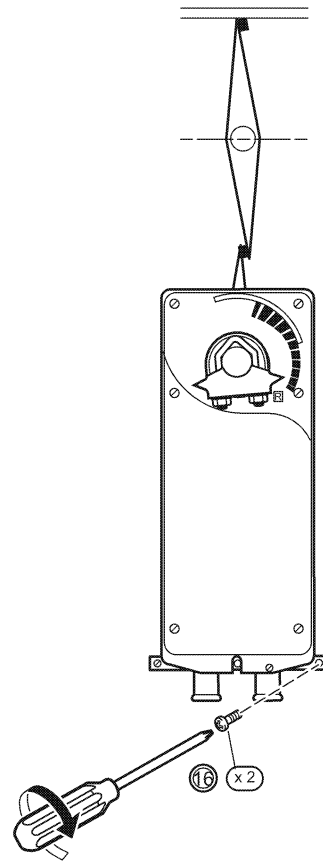
E- Right



F- Left

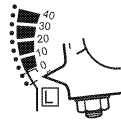


F- Right

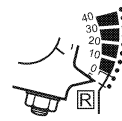


For MS40-707X and MS40-715X only:
16. Tighten bracket screws.

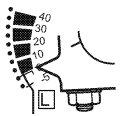
For MS40-707X and MS40-715X actuators:



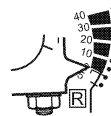
Correct pointer position
after mounting.



For MS41-707X and MS41-715X actuators:



Correct pointer position
after mounting.



The lock on MS41-707X and MS41-715X will release on first power-up.

Jackshaft Installation

(MS40-7043 Series)

The MS40-7043 actuator is designed for use with jackshafts up to 3/4" (19 mm) in diameter. In most applications, the MS40-7043 actuator may be mounted in the same manner as a standard damper shaft application. If the jackshaft diameter is larger than 5/8" (16 mm) in diameter, the optional AM-710 universal clamp must be used.

(MS4X-7153 and MS4X-7073 Series)

The MS4X-7153 and MS4X-7073 actuators are designed for use with jackshafts up to 1.05" (27 mm) in diameter. In most applications, the actuator may be mounted in the same manner as a standard damper shaft application. If the jackshaft diameter is larger than 3/4" (19 mm) in diameter, the optional AM-687 universal clamp must be used.

Multiple Actuator Mounting (MS4X-7153 only)

If more torque is required than one actuator can provide, a second actuator may be mounted to the jackshaft or standard damper shaft, using the AM-673 multiple mounting bracket. See Figure-4.

Caution: MX41-707X, 715X - Do not attempt to use the manual override with actuators mounted in tandem. Damage to the gear train may occur.

Multiple actuators may be powered from one transformer provided the following rules are followed:

- The total current draw of the actuators (VA rating) is less than, or equal to, the rating of the transformer.
- Polarity on the secondary of the transformer is strictly followed.
 - All Black wires from all actuators are connected to the common lead on the transformer.
 - All Red wires from all actuators are connected to the hot lead.

Caution: Mixing the Black and Red wires on one lead of the transformer may result in erratic operation or failure of the actuator and/or controls.

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

- The transformers are properly sized.
- All Black wires from all actuators are tied together and tied to the negative lead of the control signal.

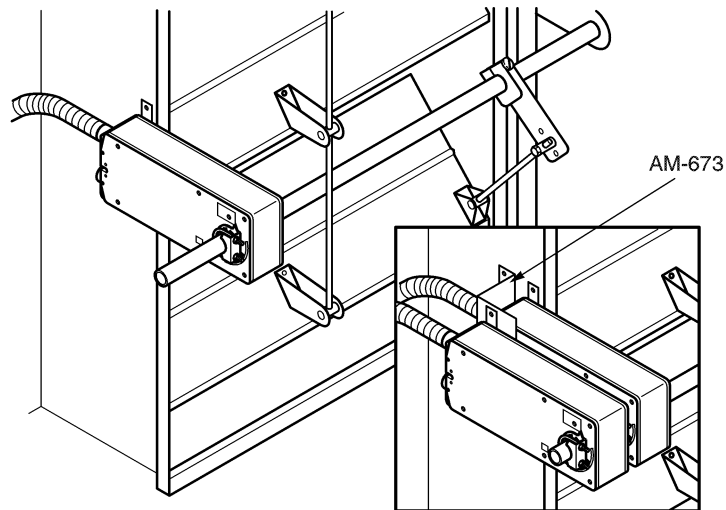


Figure-4 Mounting Multiple Actuators.

Wiring Requirements

Control Leads

See Table-3 for power wiring data. Refer to Figure-1 and Figure-2 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	MS40-7043 (-MP)	1100 (335)	700 (213)	430 (131)	270 (82)	170 (52)	110 (34)
	MS40-7043-501 (MP5)						
	MS4X-7073	1000 (305)	640 (195)	400 (122)	250 (76)	160 (49)	100 (30)
	MS4X-7073-502						
	MS4X-7153	600 (183)	380 (116)	240 (73)	150 (46)	90 (27)	60 (18)
	MS4X-7153-502						

Auxiliary Switch

The MS40-7043-501(-MP5) series actuators include one built-in SPDT auxiliary switch which can be used for interfacing or signaling (e.g., for fan start-up). The switch is adjustable between 0° and 95° of rotation (0 to 1 scale).

The MS4X-7153-502 and MS4X-7073-502 series actuators include two built-in SPDT auxiliary switches which can be used for interfacing or signaling (e.g., for fan start-up). The switch position near the normal (spring return) position is fixed at 5°. The other is adjustable between 25° and 85° of rotation.

Adjusting the Switching Point

Refer to Table-4 for auxiliary switch rating.

Adjusting the switching point for MS40-7043-501 (-MP5)

1. The actuator must be in its normal (spring return) position.
2. Use a flat screw driver to rotate the switch pointer until it is at the desired switch position on the 0 to 1 scale.

Adjusting the switching point for MS4X-7153-502 or MS4X-7073-502

1. The actuator must be in its normal (spring return) position.
2. Insert a 1/8" allen wrench into the hex hole located in the center of the adjustable switch pointer.
3. Rotate the wrench until the switch pointer is at the desired switch position in degrees, from 25 to 85°.

Table-4 Auxiliary Switch Rating.

Part Number	Voltage	Resistive Load	Inductive Load
MS40-7043-501 (MP5)	24 Vac	6A	1.5A
MS4X-7073-502	250 Vac	7A	2.5A
MS4X-7153-502			

Rotation Limitation

Rotation Limitation for MS40-7043 Series

The Stop Block is used in conjunction with the tab on the universal clamp or the AM-709 position indicator. In order to function properly, the clamp or indicator must be mounted correctly.

The Stop Block controls the rotational output of the MS40-7043 and MF40-7043-501 actuators. It is used in applications where a damper has a designed rotation that is less than 90°, for example with a 45° or 60° rotating damper. It can also be used to provide a minimum damper position which is easily set, or changed, without removing the actuator from the damper.

1. Determine the amount of damper rotation required. The actuator stop block provides limited rotation from 40° to 95°.
2. Loosen the screw securing the stop block to the actuator.

Note: The actuator is shipped with the Stop Block mounted to the “L” side. If the damper application requires the “R” side face the installer, simply remove the Stop Block and screw and move it to the new location.

3. Slide the stop block into position, so that its edge lines up with the degree graduation on the actuator face which corresponds with the required rotation. See Figure-5.
4. Secure the stop block in place.
5. Test the damper rotation by applying power and the required control signal. Re-adjust if necessary.

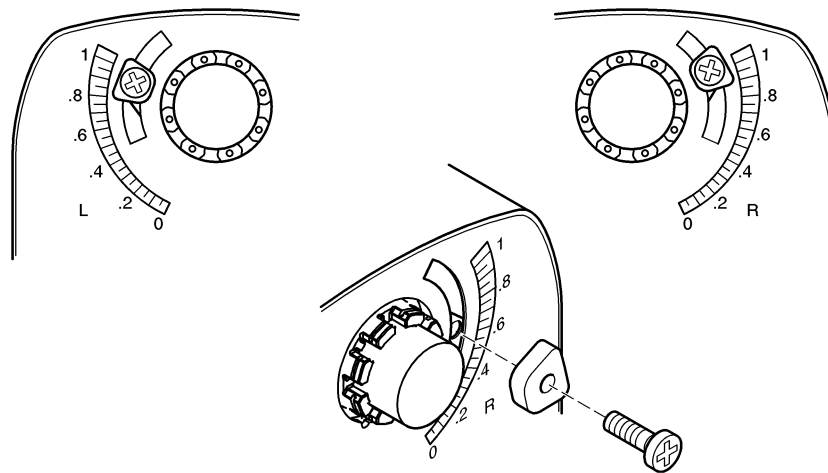


Figure-5 Adjusting Stop Block for Limited Rotation.

Rotation Limitation for MS4X-7153 and MS4X-7073 Series

The AM-689 rotation limiter is used in conjunction with the tab on the universal clamp or the AM-686 position indicator which comes with the AM-689. In order to function properly, the clamp or indicator must be mounted correctly.

The AM-689 rotation limiter controls the rotational output of the MS4X-7153, MS4X-7153-502, MS4X-7073, and MS4X-7073-502 actuators. It is used in applications where a damper has a designed rotation that is less than 90°, for example with a 45° or 60° rotating damper. It can also be used to provide a minimum damper position which is easily set, or changed, without removing the actuator from the damper.

1. Determine the amount of damper rotation required.
2. Locate the AM-689 rotation limiter on the actuator so that its edge lines up with the degree graduation on the actuator face which corresponds with the required rotation. See Figure-6.
3. Find the appropriate cross-hair location through the slot of the rotation limiter. This is the mounting location for the retaining screw.
4. Pierce through the label material to allow easy fastening of the retaining screw.
5. Position the rotation limiter back to the desired position, making sure the locating “teeth” on the rotation limiter are engaged into the locating holes on the actuator.
6. Fasten the rotation limiter to the actuator using the self-tapping screw provided.
7. Test the damper rotation by applying power and the required control signal. Re-adjust if necessary.

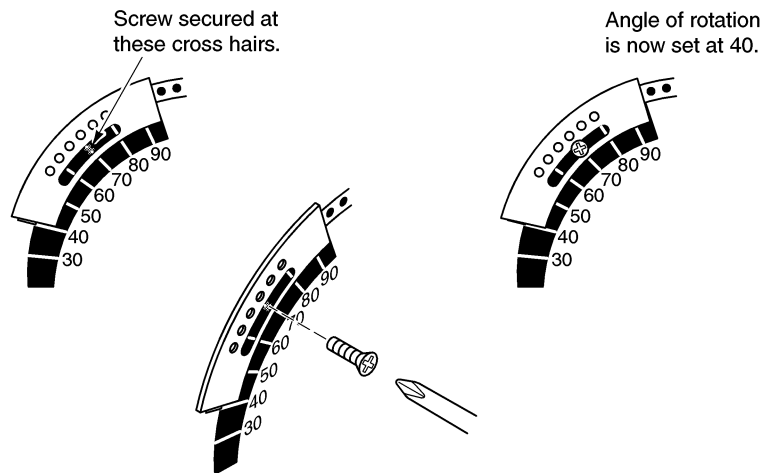


Figure-6 Securing the AM-689 Rotation Limiter.

Minimum Damper Positioning

Note: When using the AM-689 rotation limiter with an MS4X-7073 or MS4X-7153 actuator to provide a minimum damper position, the short shaft mounting procedure must be used to mount the actuator.

Caution:

- The AM-689 rotation limiter should not be used with an MS4X-7073 or MS4X-7153 actuator to provide a minimum damper position in outdoor air damper applications. The rotation limiter prevents the damper from reaching the full-closed position. This may cause coils to freeze or may cause other system problems to occur.
-

1. Position the damper to its minimum position by providing the appropriate control signal to the MS4X-7073 or MS4X-7153.
2. Place the position indicator onto the actuator spline in the approximate position shown in Figure-7. Fasten it with the retaining clip.
3. Place the AM-689 rotation limiter on the actuator so that it either makes contact with, or is as close as possible to, the edge of the indicator. See Figure-8.
4. Make sure that the locating teeth are engaged into the locating holes on the actuator. If all of the mounting teeth do not align with the holes, the mounting location of the indicator to the spline may have to be moved. The rotation limiter would then be remounted to get the best position match of both parts.
5. Find the cross-hair location through the slot of the rotation limiter. This is the mounting location for the retaining screw.
6. Pierce through the label material to allow easy fastening of the retaining screw.
7. Fasten the rotation limiter to the actuator using the self tapping screw provided.
8. Test the damper operation by applying power and the required control signal. Re-adjust if necessary.

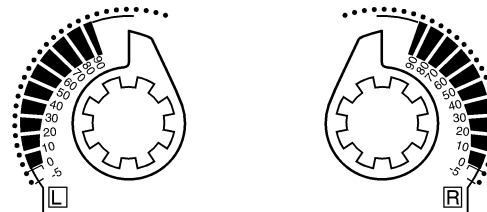


Figure-7 Installing the Position Indicator.

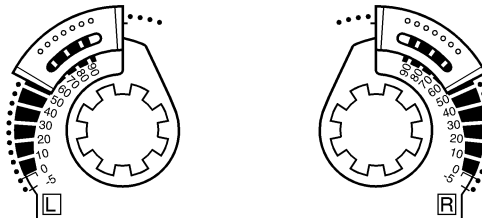


Figure-8 Positioning the Rotation Limiter.

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 damper while actuator is being stroked.

1. Apply power to the actuator. Actuator and damper should be driven to their powered position as determined by the control signal.
2. On the MS4X-7XXX-50X models, check for correct auxiliary switch operation.
3. Break power to the actuator. Actuator and damper should return to the spring return position.

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

- 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 (-).
 - Controllers and actuators must have separate 24 Vac power sources.
-

Go, No Go Test

1. Turn 24 Vac power to actuator off.
2. Disconnect and temporarily insulate the yellow/black input wire.
3. With “L” side of the actuator facing the installer, set the L/R switch to “R.”
4. Turn actuator power back on.
5. Switch the L/R switch to the “L” position.
6. The actuator should drive to the full counterclockwise position.

THEORY OF OPERATION

The actuators are mounted directly onto a damper shaft using a universal V-clamp. When the actuator is powered and a Vdc or mAdc control signal is applied to the actuator by the controller, the actuator rotates to a position determined by the control signal. At the same time the spring return mechanism is tensed. When power is removed from the actuator, the spring returns the actuator to its normal position. The actuators provide true mechanical spring return operation for reliable, positive close-off on air tight dampers.

The MS40-704X-501 models are provided with one built-in auxiliary switch. The SPDT switch is provided for interfacing or signaling, for example, fan startup. The switching function is adjustable between 0° and 95° rotation (0 to 1 scale).

All MX4X-7XX3-XXX series actuators use a brushless DC motor which is controlled by a microprocessor. The microprocessor supplies intelligence to provide a constant rotation rate and to know the actuator's exact normal position. The microprocessor monitors and controls the brushless DC motor's rotation and provides a digital 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 for mechanical end switches.

The MS4X-707X-502 and MS4X-715X-502 models are provided with two built-in auxiliary switches. The SPDT switches are provided for interfacing or signaling, for example, fan startup. The switching function is adjustable on one switch between 25° and 95° rotation, and the other switch is fixed to operation at 5° rotation.

All MS4X-7XX3 and MS4X-7XX3-5XX actuators provide a 2 to 10 Vdc feedback signal corresponding to the actuator position as determined by the control signal. MS40-7043-MP and MS40-7043-MP5 models provide a 20 Vdc, 25 mA power supply used to power System 8000 controllers in lieu of position feedback.

The MS41-707X-XXX and MS41-715X-XXX actuators are equipped with a manual override mechanism. This allows the actuator to be manually positioned at any point between -5° and 85° rotation. This mechanism is accessible on both sides of the actuator and can be used to ensure tight close-offs for valves and dampers. The manual override should not be used while a unit is powered or on units that are mounted in tandem.

MAINTENANCE

Regular maintenance of the total system is recommended to assure sustained optimum performance. The MS4X series actuators are maintenance free.

FIELD REPAIR

None. Replace with a functional actuator.

DIMENSIONAL DATA

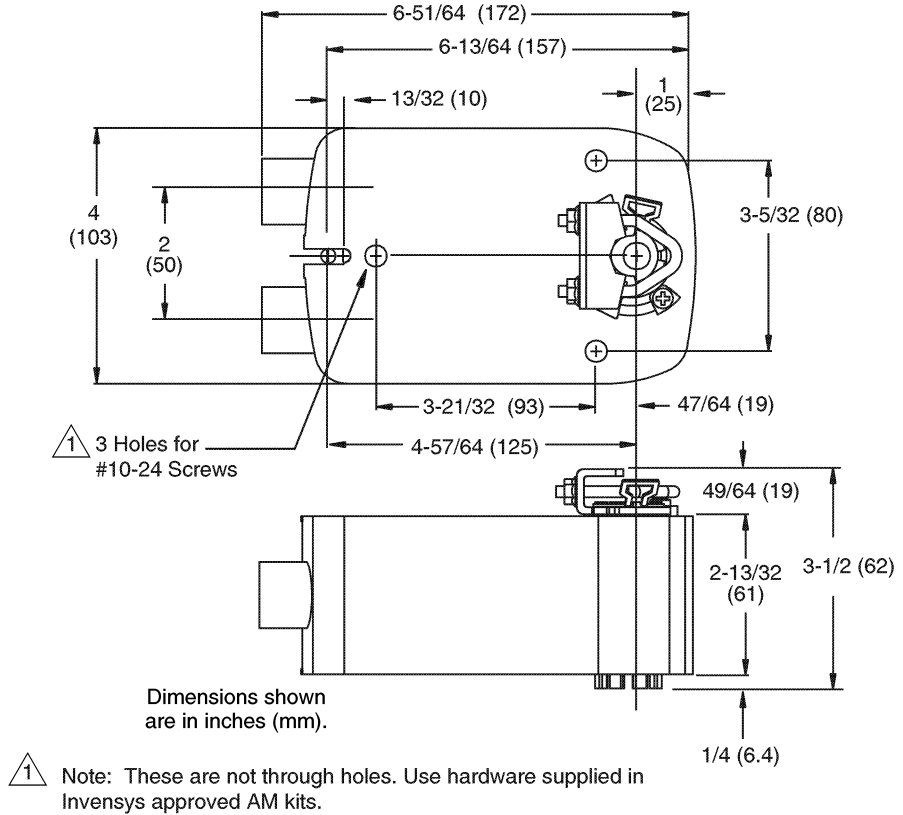
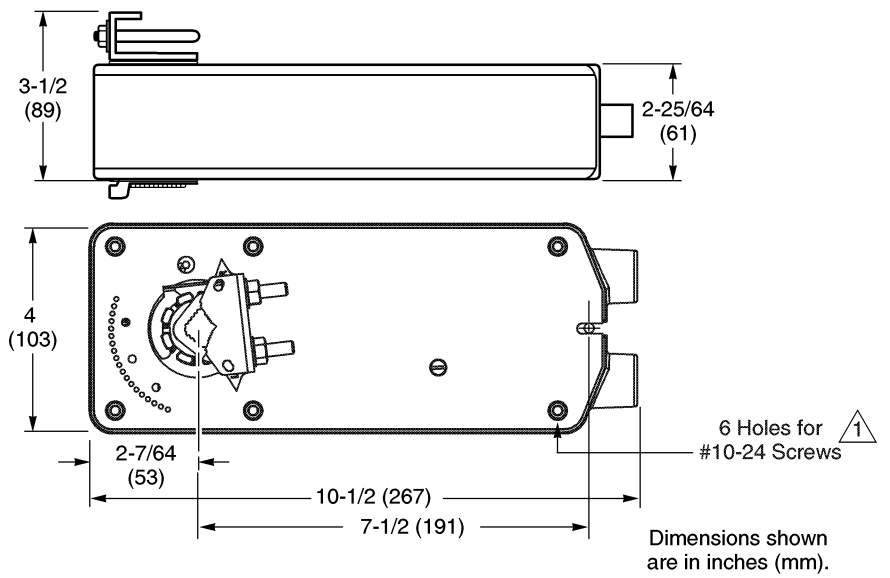


Figure-9 MS40-7043 Spring Return Damper Actuator Dimensions.



$\triangle 1$ Note: These are not through holes. Use hardware supplied in Invensys approved AM kits.

Figure-10 MS4X-7073 and MS4X-7153 Spring Return Damper Actuator Dimensions.

Invensys and DuraDrive are trademarks of Invensys plc and its subsidiaries and affiliates.

Invensys and DuraDrive are trademarks of Invensys plc and its subsidiaries and affiliates.