



## 3 Nm, 5 Nm Series Spring Return Direct Coupled Actuators

MS3103, MS3105, MS4103, MS4105, MS7403, MS7405, MS7503, MS7505, MS8103, MS8105

### INSTALLATION INSTRUCTIONS

MS3103, MS3105, MS4103, MS4105, MS7403, MS7405, MS7503, MS7505, MS8103, MS8105 Spring Return Direct Coupled Actuators (DCA) are used within heating, ventilating, and air-conditioning (HVAC) systems. They can drive a variety of quarter-turn, final control elements requiring spring return fail-safe operation.

Applications include:

- Volume control dampers, mounted directly to the drive shaft or remotely (with the use of accessory hardware).
- Quarter-turn rotary valves, such as ball or butterfly valves mounted directly to the drive shaft.
- Linear stroke globe or cage valves mounted with linkages to provide linear actuation.
- Available with cable on select models

### SPECIFICATIONS

**Models:**

- See Table 1.

**Device Weight:**

- 3.5 lbs (1.60 kg)

**Ambient Operating Temperature:**

- -40° to 150°F (-40° to 65°C)
- -22° to 150°F (-30° to 65°C) (Two position only)

**Shipping and Storage Temperature:**

- -40° to +150°F (-40° to +65°C)

Table 1. Models.

Model Number	Model Number (including 3 ft. whip)	Torque	Power Supply		Drive (sec)	Control Input/Output Description	SPDT Aux Switch			
			Voltage	VA Driving <sup>1</sup>						
MS3103J1030		27 lb-in (3 Nm)	24 Vac/dc @50/60 Hz +/- 20% 24Vdc+/-10%	6/3	90	Sylk-enabled	0			
MS7403A2030						Floating, Modulating <sup>2</sup> , Three-Position, Feedback	0			
MS7503A2030						Floating, Modulating <sup>3</sup> , and Feedback	0			
MS7503A2130							1			
MS8103A1030						45	Two-Position (SPST)	0		
MS8103A1130							1			
MS4103A1030						100-250 Vac @50/60Hz	6/9	45	Two-Position (SPST)	0
MS4103A1130									1	
MS3105J3030					44 lb-in (5 Nm)	24 Vac/dc @50/60 Hz +/- 20% 24Vdc+/-10%	6/3	90	Sylk-enabled (5 addresses & Analog Output)	0
MS3105J3130										1
MS7405A2030		Floating, Modulating <sup>2</sup> , Three-Position, Feedback	0							
MS7505A2030	MS7505W2030	Floating, Modulating <sup>3</sup> , and Feedback	0							
MS7505A2130	MS7505W2130		1							
MS8105A1030	MS8105W1030		45	Two-Position (SPST)				0		
MS8105A1130	MS8105W1130			1						
MS4105A1030			100-250 Vac @50/60Hz	6/9				45	Two-Position (SPST)	0
MS4105A1130									1	

<sup>1</sup> Number represents range

<sup>2</sup> 2-10 Vdc

<sup>3</sup> 0/2-10 Vdc



### 3 NM, 5 NM SERIES SPRING RETURN DIRECT COUPLED ACTUATORS

#### Humidity Ratings:

- 5% to 95% R.H., Non-Condensing

#### Electrical Connections:

- Field wiring 18 AWG (0.5 mm) to 14 AWG (1.5 mm) conductors (stranded or solid) and up to 2 - 14 AWG (1.5 mm) conductors (stranded) to screw terminals, located under the removable access cover.

#### Auxiliary Switch (One SPDT):

- Switch adjustable from 0-95°
- 500 uA Resistive at 5 Vdc (minimum)
- 250 Vac, 8 A resistive, 3 A inductive

#### Mounting: Self-centering shaft adapter (shaft coupling):

- Round damper shafts: 3/8 to 5/8 in. (9 to 16 mm)
- Square damper shafts: 1/4 to 1/2 in. (6 to 13 mm)

#### Minimum Damper Shaft Length:

- 1 in. (25 mm); 3 in. (76 mm) recommended.

#### Spring Return Timing (at rated load):

- < 25 seconds @ -4°F to 130°F (-20°C to 55°C)
- < 60 seconds @ -22°F (-30°C)

#### Cable Specification:

- 300 V, 75° C, Plenum Rated, 3 ft length from end of access cover, 18 AWG

#### Sylk™ Bus:

- Sylk is a two-wire, polarity insensitive bus that provides communications between a Sylk-enabled actuator and a Sylk-enabled controller. For wiring, the Sylk-enabled actuator may be mounted up to 200 ft. (61 m) from the controller; twisted pair wire is recommended for wire runs longer than 100 ft. (30.5 m). Using Sylk-enabled actuators saves I/O on the controller and is faster and cheaper to install since the bus is polarity insensitive.

**Stroke:** 95° ±3°, mechanically limited.

#### Approvals:

- UL873
- IEC 60730-1 and Part 2-14
- UL1097 for Double Insulation
- CE Certification Low Voltage Directive 2006/95/EC
- CE EMC 2004/108/EC
- C-Tick N314

#### Enclosure Ratings:

- IP54
- NEMA 2
- Flame Resistance UL94-5VA

#### Input Impedance:

- 95 kOhm minimum.

#### Feedback Signal:

- 0(2)-10 Vdc, 3 mA minimum.

#### Analog Output Signal:

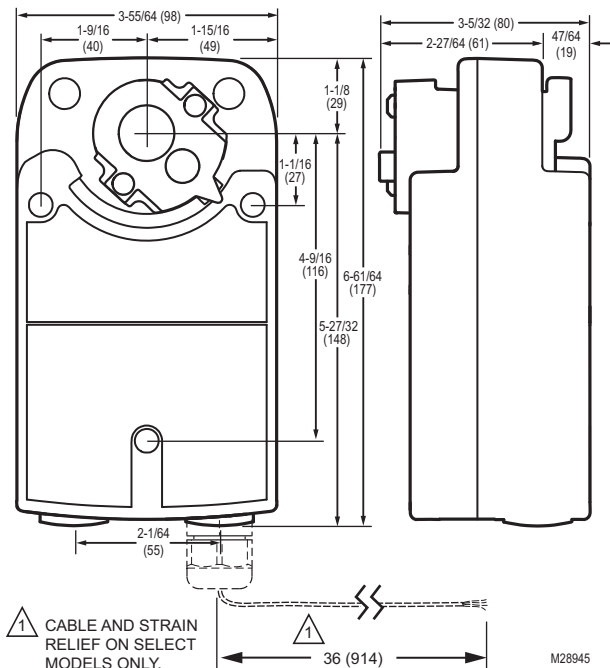
- 0(2)-10 Vdc

#### Noise Rating at 1m (Maximum):

- Driving
  - Floating/Modulating/Econ/Sylk-enabled: < 40 dB(A)
  - 2-Position: < 50 dB(A)
- Spring Return: < 60 dB(A)

#### Accessories:

- 27518 Balljoint (5/16 in.)
- 103598 Balljoint (1/4 in.)
- 27520B, C, E, G, H, K, L, Q Pushrod (5/16 in. diameter)
- STRN-STRNRLF Water-tight Cable Gland/Strain-relief Fitting (10 pack)
- STRN-WMK-01 Wall Mount Kit
- STRN-ECONO-01 Economizer Retrofit Kit
- STRN-CRK-01 Crank Arm Kit
- STRN-SCSA Self Centering Shaft Adapter
- STRN-CA-01 Crank Arm (Non-Self-Centering)
- STRN-CA-02 Crank Arm (Self-Centering)
- STRN-BRKT Anti-Rotation Bracket



**Fig. 1. Dimensional drawing of actuator in in. (mm).**

## TYPICAL SPECIFICATION

Spring return actuators shall be direct coupled type requiring neither crankarm nor linkage and be capable of direct mounting to a jackshaft of up to 5/8 in. diameter. The actuator shall connect to the shaft using a removable output hub with a self-centering shaft coupling. This coupling shall provide concentric mounting and include an integral adjustable range-stop mechanism.

The actuator shall provide two-position, floating, proportional, or Sylk bus control. Proportional control refers to direct acceptance of 0-10 Vdc, 2-10 Vdc, or (with addition of a 500 ohm resistor) a 4-20 mA input signal. Proportional and floating control models shall provide a feedback signal. Sylk-enabled models provide control and feedback via communication between the actuator and Sylk-enabled controller. Actuators shall provide wiring terminals located within an integral access cover with conduit connections. Proportional and floating actuators shall have a rotation direction control switch accessible on the cover.

All spring return actuators must be designed for either clockwise or counterclockwise fail-safe operation with a continuously engaged mechanical spring. This spring must return the valve or actuator to a fail-safe position within 25 seconds of power loss.

All actuators shall be designed for a minimum of 60,000 fullstroke cycles at rated torque and temperature, 60,000 spring return cycles and 1,500,000 repositions. Run time shall be constant and independent of: load, temperature, and supply voltage (within specifications). All actuators shall be UL60730 and cUL (CSA22.2) listed, have a five year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Honeywell.

## INSTALLATION

### When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

### CAUTION

**Electrical Shock or Equipment Damage Hazard.**  
Low voltage can shock individuals or short equipment circuitry.  
Disconnect power supply before installation.

#### IMPORTANT

*All wiring must agree with applicable codes, ordinances and regulations.*

### Location

These actuators are designed to mount directly to a damper external drive shaft. The shaft coupling fastens to the drive shaft. The actuator housing includes slots which, along with an anti-rotation bracket, secure the actuator to the damper frame or duct work (see Fig. 7).

#### NOTES:

- When mounted correctly, these slots allow the actuator to *float* without rotating relative to the damper shaft.
- Using other brackets or linkages, the actuator can be foot-mounted or tandem-mounted.

### CAUTION

**Motor Damage Hazard.**  
Corrosive vapors and acid fumes can damage metal and plastic parts.

Install motor in areas free of acid fumes and other deteriorating vapors.

### CAUTION

**Equipment Damage Hazard.**  
Tightly securing actuator to damper housing can damage actuator.



Mount actuator to allow it to float along its vertical axis.

### Preparation

Before mounting the actuator onto the damper shaft, determine the:

- Damper/valve opening direction for correct spring return rotation. The actuator can be mounted to provide clockwise or counterclockwise spring return by flipping or turning the unit over.
- Damper shaft size (see the Specifications section).

### Determine Appropriate Mounting Orientation

The actuators are designed to open a damper by driving the damper shaft in either a clockwise  or counterclockwise  direction (see Fig. 2).

#### NOTES:

- Actuators are shipped in the fully closed (spring return) position.
- An arrow on the hub points to a location on the label to indicate the hub rotary position.

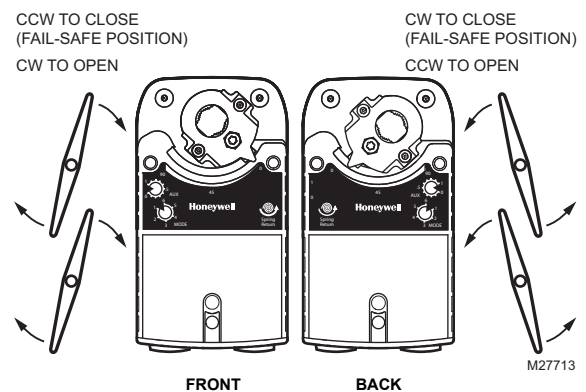


Fig. 2. Spring Return DCA mounting orientation.

### Measure Damper/Valve Shaft Length

If the shaft is less than three inches in length, the shaft coupling must be located between the damper/valve and actuator housing. If the shaft length is more than three inches, the shaft coupling may be located on either side of the actuator housing.

If the coupling must be moved from one side of the actuator to the other, reverse the spring return direction and flip the actuator. Follow these instructions (see Fig. 3):

1. Remove the retainer clip from the shaft coupling and set it aside for later use.
2. Remove shaft coupling from one side of the actuator.
3. Replace the shaft coupling on the opposite side of the actuator aligning it based on the stroke labeling.
4. Replace the retainer clip on the shaft coupling using the groove of the coupling.

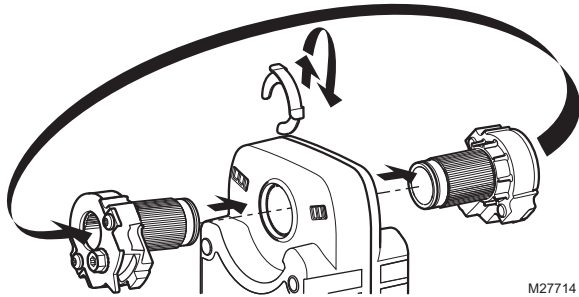


Fig. 3. Mounting shaft coupling to actuator opposite side.

### Selecting Actuator Control Signal

Selections are made using a dial that appears on both the front and back of the actuator (see Fig. 4).

To select the control signal simply turn the mode selection dial to the desired mode (as indicated on the device label) without exceeding range indicators.

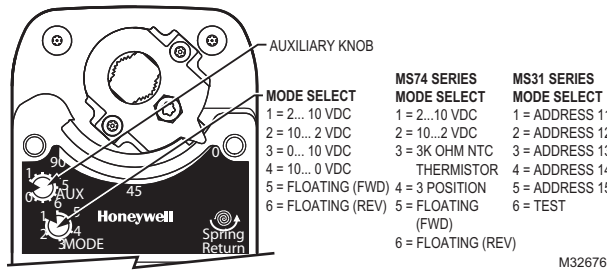


Fig. 4. Dials for control signal and switch or minimum position.

### Auxiliary Knob

The auxiliary knob can be used to control minimum position (MS74 Series) or switch position.

#### SELECT MINIMUM POSITION (MS74 SERIES)

To set the actuator minimum position, turn the AUX dial to the desired position. Alternatively, minimum position can be set with an externally connected 1kOhm potentiometer connected across common (terminal 2) and minimum position (terminal 4); the setting on the AUX dial will be overridden.

### SELECT SWITCH POSITION

For switch models, select the degree of rotation you want the switch to activate.

### Non-Standard Stroke

#### Mechanical Stroke Limit Reduction

For applications requiring a span less than 95 degrees, a simple adjustment can be made. When the rotational mounting of the shaft coupling is changed, the actuator drives less than the full 90 degrees stroke.

The stroke is adjustable in 5 degree increments. Once adjusted, the actuator drives until the shaft coupling reaches the mechanical stop (part of the housing). The stop causes the motor to discontinue driving and the shaft coupling drives no farther. When the actuator returns, it stops at the fail-safe position.

To limit the stroke range, proceed as follows:

1. Remove the retainer clip from the shaft coupling and set it aside for later use.
2. Remove shaft coupling from the actuator.
3. Rotate the coupling to the desired position, aligning it based on the stroke labelling. See Fig. 5.

NOTE: The shaft coupling location determines the travel span.

EXAMPLE: Setting shaft coupling to an approximate fail-safe position of 35 degrees (as indicated on the housing) limits stroke to 60 degrees. (See Fig. 5)

4. Install the shaft coupling at this position.
5. Replace the retainer clip on the shaft coupling using the groove of the coupling.

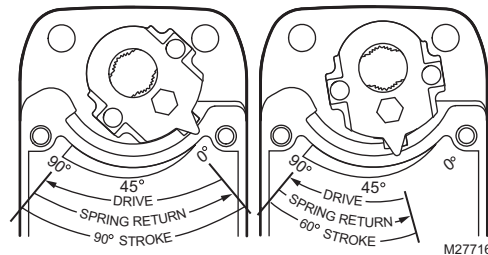


Fig. 5. Stroke reduction.

### Mounting



### CAUTION

**Device Malfunction Hazard.**

**Improper shaft coupling tightening causes device malfunction.**

Tighten shaft coupling with proper torque to prevent damper shaft slippage.

**! CAUTION**

**Actuator Damage Hazard.**  
**Using actuator as shaft bearing causes device damage.**  
 Use actuator only to supply rotational torque. Avoid any side loads to actuator output coupling bearings.

**! CAUTION**

**Equipment Damage Hazard.**  
**Can damage the motor beyond repair.**  
 Never turn the motor shaft by hand or with a wrench. Forcibly turning the motor shaft can damage the gear train.

To mount the actuator to an external drive shaft of a damper, proceed as follows:

1. Place actuator over damper shaft; and hold mounting bracket in place. See Fig. 7.
2. Mark screw holes on damper housing.
3. Remove actuator and mounting bracket.
4. Drill or center-punch holes for mounting screws (or use no.10 self-tapping sheet metal screws).
5. Turn damper blades to desired normal (closed) position.
6. Place actuator and mounting bracket back into position and secure bracket to damper box with sheet metal screws.
7. Using 10 mm wrench, tighten shaft coupling securely onto damper shaft using maximum 240 lb-in. (27.1 Nm) torque.

NOTE: See Fig. 6 for proper mounting to a square damper shaft.

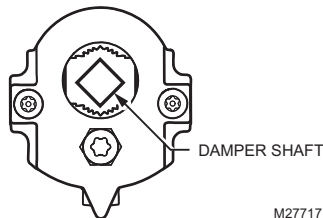
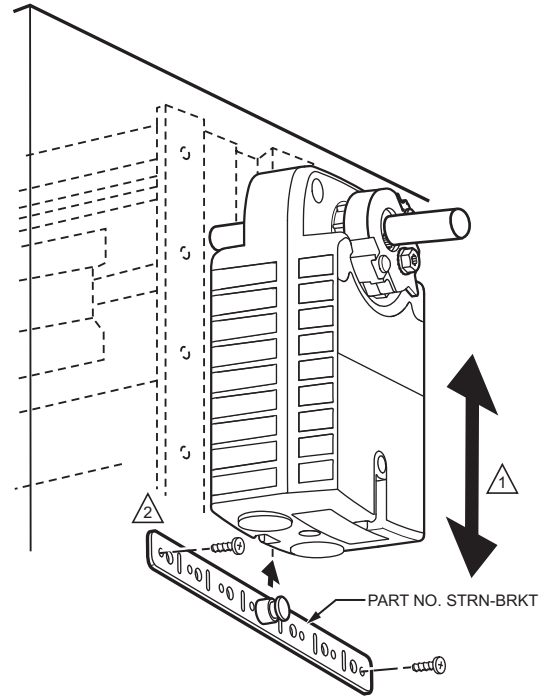


Fig. 6. Proper mounting to square damper shaft.



1. ENSURE THAT MOUNTING ASSEMBLY PREVENTS ACTUATOR ROTATION AND ALLOWS ACTUATOR TO FLOAT ALONG INDICATED AXIS. WHEN TOO TIGHT, THE RESULTING BINDING CAN DAMAGE THE ACTUATOR OR REDUCE TORQUE OUTPUT.
2. THE BRACKET CAN BE BENT TO ALLOW MOUNTING THE ACTUATOR PARALLEL TO THE MOUNTING SURFACE. M27718

Fig. 7. Mounting actuator to damper housing.

**WIRING**

**! CAUTION**

**Electrical Shock or Equipment Damage Hazard.**  
**Disconnect all power supplies before installation.**  
 Motors with auxiliary switches can have more than one disconnect.

**IMPORTANT**

*All wiring must comply with local electrical codes, ordinances and regulations.*

**Access Cover Removal (Fig. 8)**

**! CAUTION**

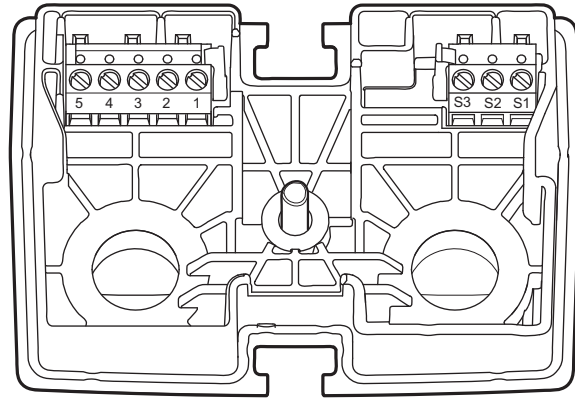
**Equipment Damage Hazard.**  
**Improper cover removal can damage electric connections.**  
 Pull the cover along the axis of the actuator. The cover contains contact sockets that must connect to actuator contact pins. Bending these pins can permanently damage the device.

NOTE: This cover can be removed before or after mounting actuator to the damper shaft or valve linkage.

In order to wire the device, the access cover must be removed as follows:

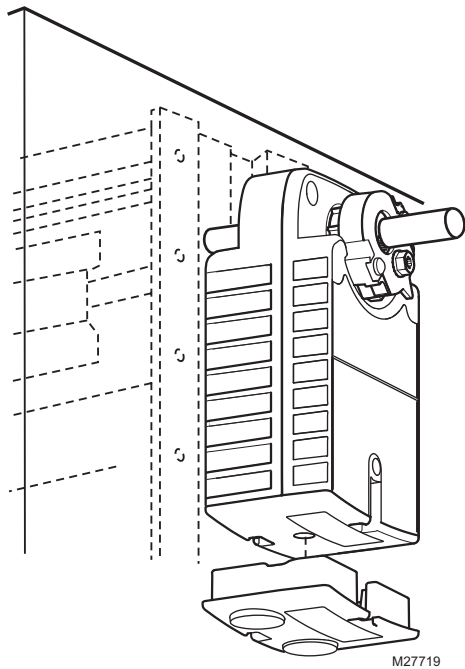
1. Remove the screw from the center of the cover, set the screw aside.
2. Pull the cover along the long axis of the actuator.
3. If the actuator is not yet mounted, set it aside.
4. Remove conduit dust covers.
5. Thread wire through conduit holes.
6. Connect wires as appropriate to the terminal block(s). (See Fig. 9 and 11.)

NOTE: Use either 1/2 in. x 14 NPS or M20 x 1.5 strain relief or conduit adapters.



M27720

Fig. 9. Terminal block details.

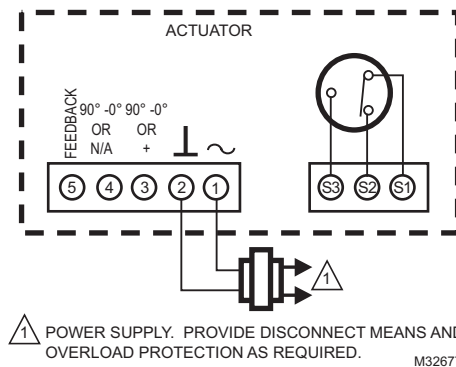


M27719

Fig. 8. Removing access cover.

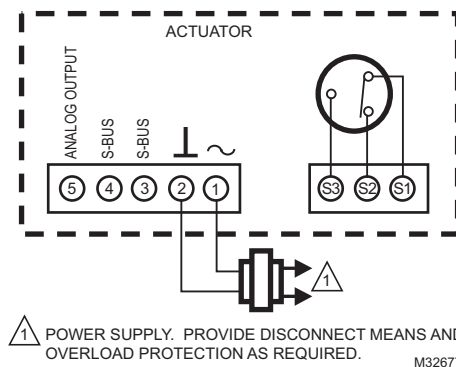
## Typical Wiring Without Cables

See Fig. 9 through 23 for typical wiring details for actuators without cables (whips). See Fig. 24 through 26 for wiring actuators with cables (whips).



M32677

Fig. 10. Terminal block details.



M32677

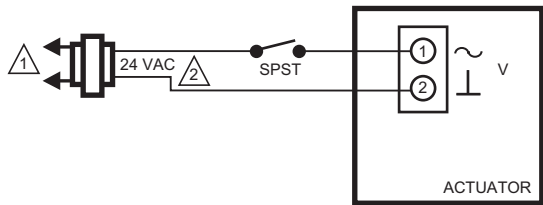
Fig. 11. S-BUS Terminal block details.



Table 2. Wiring Details.

Terminal	Floating	Modulating	3 kOhm Economizer	3 Position Economizer	Two-Position		Sylk-enabled
					24Vac/Vdc	120–250 Vac	
1	~	power	power	power	power	power	power
2	⊥	common	common	common	common	neutral	common
3	0°-90°	control signal	control signal	control signal	—	—	S-BUS
4	90°-0°	—	external minimum position potentiometer	external minimum position potentiometer	—	—	S-BUS
5	←	feedback	feedback	feedback	—	—	Analog output

Two-Position Models

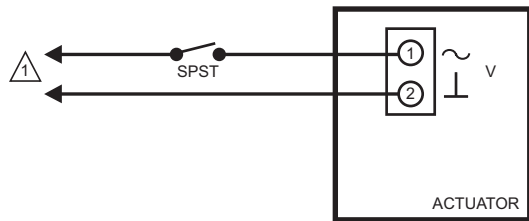


1 LINE VOLTAGE POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 24 VDC SUPPLY ACCEPTABLE.

M29121

Fig. 12. Wiring for low-voltage two-position control, MS81 series.

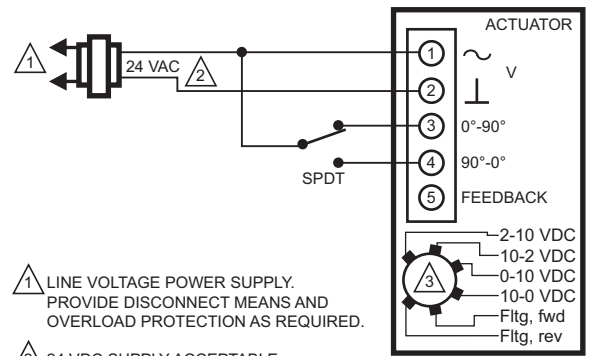


1 LINE VOLTAGE POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

M29122

Fig. 13. Wiring for line-voltage two-position control, MS41 series.

Floating, Modulating, and Economizer Models



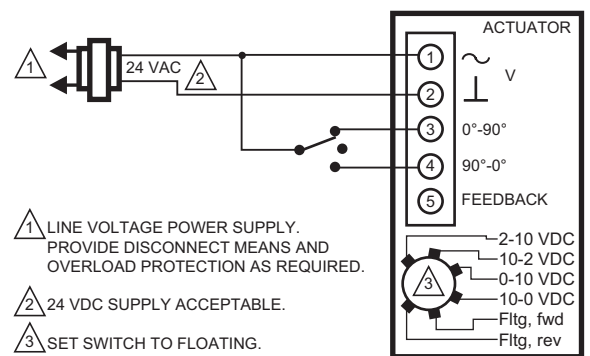
1 LINE VOLTAGE POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 24 VDC SUPPLY ACCEPTABLE.

3 SET SWITCH TO FLOATING.

M28624

Fig. 14. Wiring for SPDT on/off control, MS75 (shown) and MS74 series.



1 LINE VOLTAGE POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 24 VDC SUPPLY ACCEPTABLE.

3 SET SWITCH TO FLOATING.

M28625

Fig. 15. Wiring for floating control, MS75 (shown) and MS74 series.

3 NM, 5 NM SERIES SPRING RETURN DIRECT COUPLED ACTUATORS

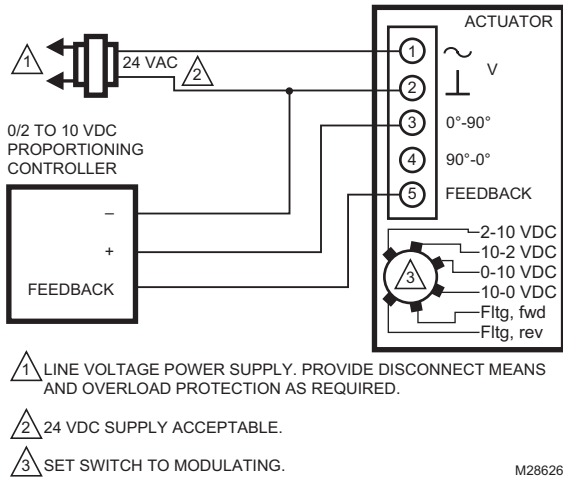


Fig. 16. Wiring for modulating (0/2-10 Vdc) proportioning control, MS75 (shown) and MS74 series.

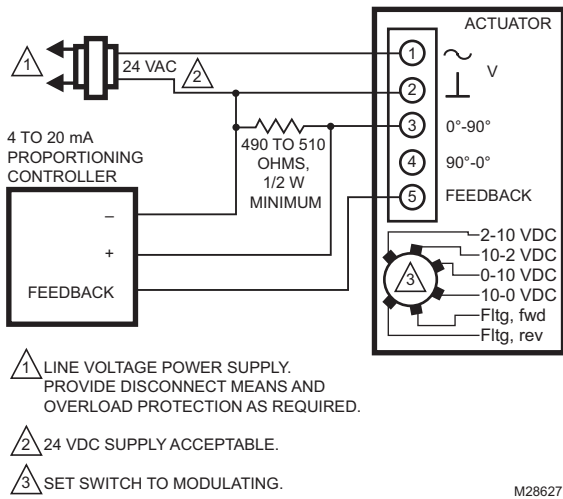


Fig. 17. Wiring for 4-20 mA proportioning controllers, MS75 (shown) and MS74 series.

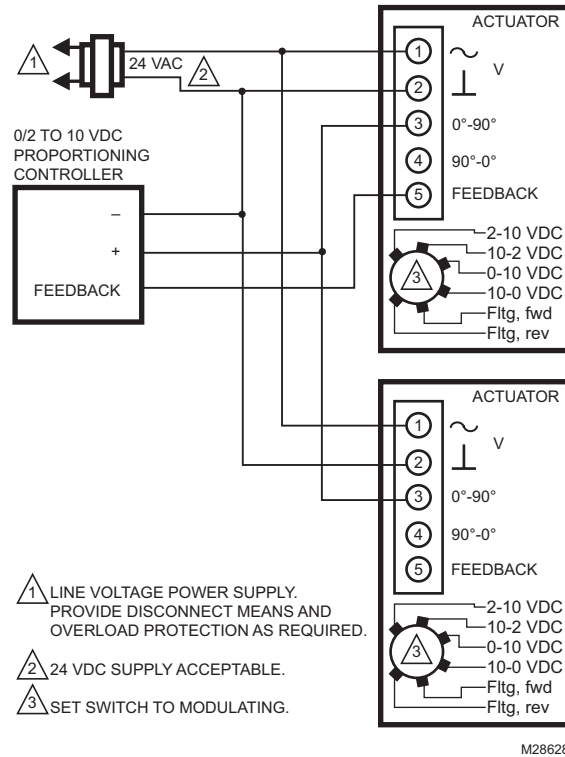


Fig. 18. Wiring for modulating (0/2-10 Vdc) proportioning control operating multiple actuators, MS75 (shown) and MS74 series.

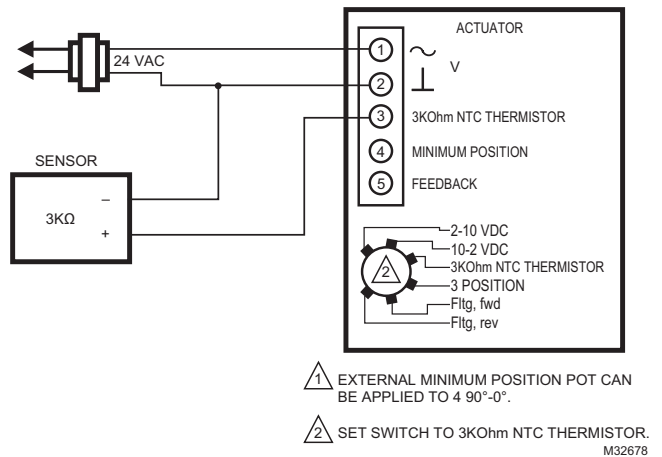


Fig. 19. Wiring for 3kOhm Economizer controllers, MS74 series.



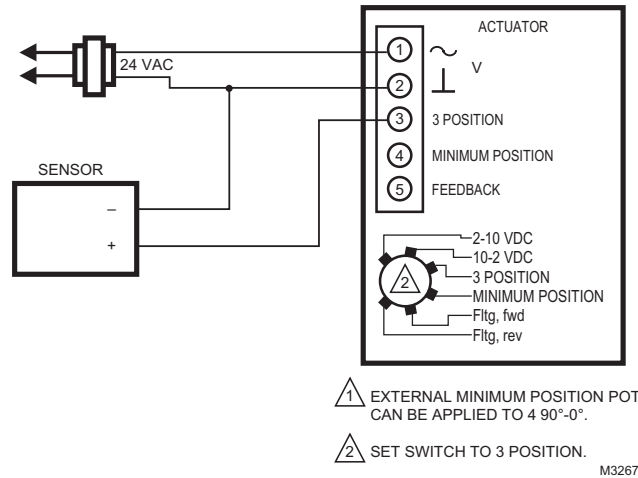


Fig. 20. Wiring for 3 position Economizer controllers, MS74 series.

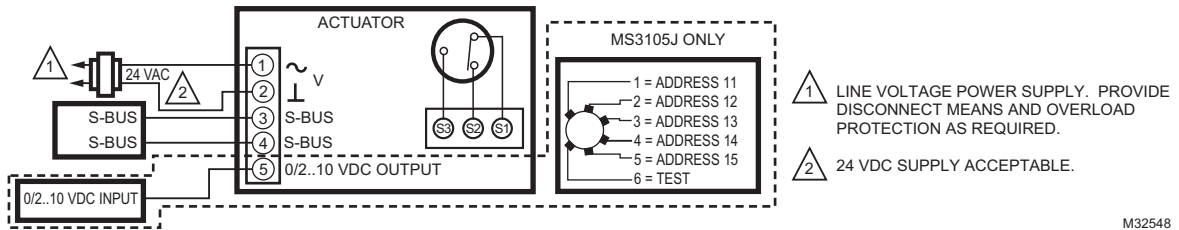


Fig. 21. Wiring for Sylk BUS, MS31 series.

## OPERATION

The actuator is designed to be used in ventilating and air conditioning installations to operate valves, dampers, ventilation flaps and louvers. (For ratings, see the Specifications section.) If the power fails, the actuator will spring return to the fail safe position.

When using a proportional controller, the actuator drives toward its fully open position when the input signal increases; the actuator drives toward the fully closed position when the input signal decreases. The actuator stops when the input signal reaches the desired proportional control point. This operates in reverse when set to a 10-2(0) position.

### IMPORTANT

*The actuator is designed to respond to DDC Controller instantaneous contact closures. Take care not to short cycle the actuator. Unstable damper control can cause premature actuator failure.*

## Actuator Override

To override the control signal (for freeze protection or similar applications):

1. Override to full open:
  - a. Disconnect the input signal (from terminal 3).
  - b. Apply 24 Vac to terminal 3.
  - c. See Fig. 22.

2. Override to full closed:
  - a. Disconnect the input signal (from terminal 3).
  - b. See Fig. 23.

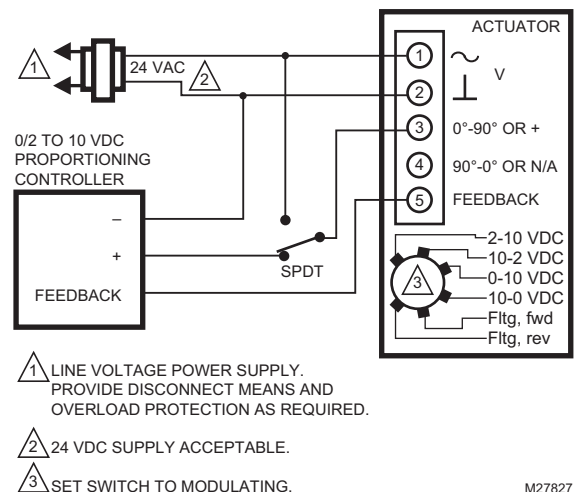


Fig. 22. Override to full open.

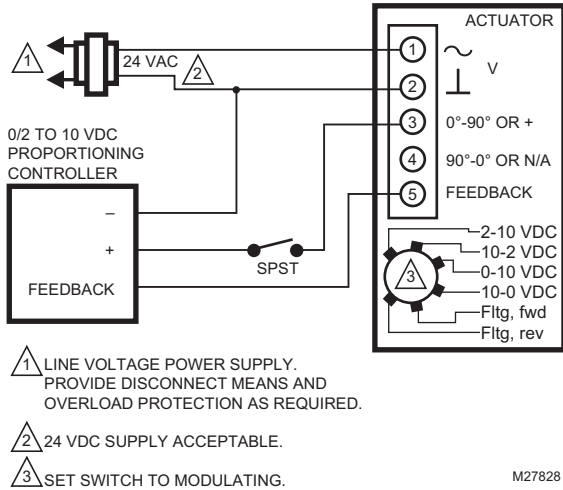


Fig. 23. Override to full close.

## Typical Wiring With Cable

See Fig. 24 through 26 for wiring actuators with cables (whips). See Fig. 9 through 23 for typical wiring details for actuators without cables (whips).

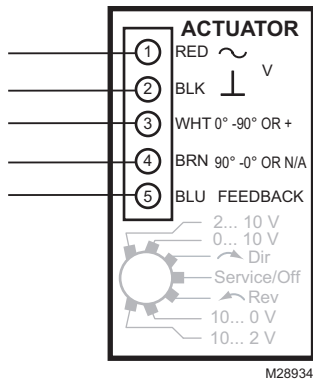


Fig. 24. Cable wiring for floating and modulating (0/2-10 Vdc) control, MS7505W series.

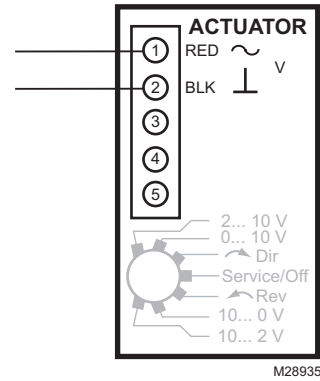


Fig. 25. Cable wiring for low voltage, two-position control, MS8105W series.

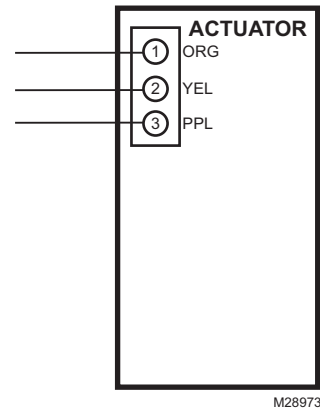


Fig. 26. Switch only models.

## End Switches

Some models include an adjustable end switch. For wiring details, see Fig. 11.



## CHECKOUT

### Modulating/Floating Operation

1. Mount actuator for required application (either clockwise ↻ or counterclockwise ↻ rotation to open the damper).
2. Connect power to terminals 1 and 2. (See Fig. 11 and Table 2.)
3. Set "Mode Select" dial to desired control signal. (See Fig. 4.)
4. Apply control signal for actuator full open or full closed position. (See Fig. 11 and Table 2.)
  - a. (0)2-10 Vdc: apply 10 Vdc signal to terminal 3.
  - b. 10-(0)2 Vdc: apply (0)2 Vdc signal to terminal 3.
  - c. (0)4-20 mA: apply 20 mA signal to terminal 3.
  - d. 20-(0)4mA: apply (0)4 mA signal to terminal 3.
  - e. Floating: apply 24 Vac to appropriate 0°-90° (3) or 90°-0° (4) terminal.
5. Actuator drives to full open or full closed position.

6. Apply control signal for actuator 0% position. (See Fig. 11 and Table 2.)
  - a. (0)2-10 Vdc: apply (0)2 Vdc signal to terminal 3.
  - b. 10-(0)2 Vdc: apply 10 Vdc signal to terminal 3.
  - c. (0)4-20 mA: apply (0)4 mA signal to terminal 3.
  - d. 20-(0)4mA: apply 20 mA signal to terminal 3.
  - e. Floating: apply 24 Vac to appropriate 0°-90° (3) or 90°-0° (4) terminal.
7. Actuator drives to full open or full closed position.

## Spring Return Operation

1. Mount actuator for required application (either clockwise  or counterclockwise  rotation to open the damper or valve).
2. Connect power to terminals 1 and 2. (See Fig. 11 and Table 2.)





NOTE: For two-position models skip to step 5.

3. Set "Mode Select" dial to desired control signal. (See Fig. 4.)
4. Apply control signal for actuator 50% position. (See Fig. 11.)
  - a. Vdc Input Signal: apply 5-6 Vdc signal to terminal 3.
  - b. mA Input Signal: apply 10-12 mA signal to terminal 3.
  - c. Floating: apply 24 Vac to appropriate 0°-90° (3) or 90°-0° (4) terminal until device reaches 50%.
5. Allow the actuator to drive to 50% position.
6. Disconnect wire from terminal 1.
7. Actuator spring returns to 0% position.
8. Re-connect wire to terminal 1, actuator drives back toward 50% position.



## Feedback Operation

1. Connect a multi-meter, set for Vdc, to terminals 2 and 5.
2. Apply the same signal as in step 4 of Modulating Operation.
3. The multi-meter reading increases to match the input signal as actuator drives towards full open or full closed position.
4. Apply the same signal as in step 6 of Modulating Operation.
5. The multi-meter reading decreases to match the input signal as actuator drives towards 0% position.

## Direct Checkout

1. Mount actuator for required application (either clockwise  or counterclockwise  rotation to open the damper or valve).
2. Check damper position and make sure that 24 Vdc/Vac is present at the appropriate connections. (See Fig. 9.)
3. Apply control signal to the appropriate connections to move the damper to the opposite position. The actuator should drive the damper or valve.
4. If actuator does not run, verify that the actuator is properly installed for either clockwise  or counterclockwise  rotation.
5. If actuator is correctly installed and still does not run, replace the actuator.

## Two-Position Checkout

1. Mount actuator for required application (either clockwise  or counterclockwise  rotation to open the damper or valve).
2. Check damper position and make sure that power is present at terminals 1 and 2.
3. Actuator drives to 100% position.
4. Disconnect power from terminals 1 and 2.
5. Actuator spring-returns to 0% position.

If actuator is correctly installed and does not run, replace the actuator.

## Sylk-enabled (S-BUS) Checkout

1. Mount actuator for required application (either clockwise or counterclockwise rotation to open the damper).
2. Connect Sylk-enabled (S-BUS) controller to terminals 3 and 4. (See Fig. 20)
3. Connect power to terminals 1 and 2. (See Fig. 20 and Table 2.)
4. Set "Mode Select" dial to desired address (MS3105 series). (See Fig. 4.) This step is not necessary for the MS3103 series.
5. Apply S-BUS command via the connected Sylk-enabled controller for actuator full open or full closed position. (See Fig. 20 and Table 2.) The MS3105 series has the option for local test by setting "Mode Select" dial to 6. Remember to reset the "Mode Select" dial to the appropriate address after the test has been completed.

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