

S03, S05 Series Low-Torque Spring-Return Direct-Coupled Actuators

S0324, S03230, S03010, S0524, S05230, S05010

INSTALLATION AND OPERATING INSTRUCTIONS



S03, S05 Series Low-Torque Spring-Return Direct-Coupled Actuators (DCA) are used for floating (3-pt.), modulating, and 2-position control in 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.

SPECIFICATIONS

Models:

- See Table 1.

Device Weight:

- 1.60 kg

Ambient Operating Temperature:

- 40° to +65°C
 -30° to +65°C (Two-position only)

Shipping and Storage Temperature:

- 40° to +65°C

Table 1. Models.

OS#	Torque	Control Signal	Power Supply and Frequency	Switch	Drive Timing	VA Driving	
S0324-2POS	3Nm	Two-Position SPST	24Vac @ 50/60 Hz, +/-20% 24Vdc +/-10%	0	45 sec	7 VA	
S0324-2POS-SW1			24Vac @ 50/60 Hz, +/-20% 24Vdc +/-10%	1	45 sec	7 VA	
S03230-2POS			120/230 Vac @ 50/60 Hz, +/-10%	0	45 sec	13 VA	
S03230-2POS-SW1			120/230 Vac @ 50/60 Hz, +/-10%	1	45 sec	13 VA	
S03010	5Nm	(0)2-10 Vdc, Floating (3-pt.)	24Vac @ 50/60 Hz, +/-20% 24Vdc +/-10%	0	90 sec	7 VA	
S03010-SW1			24Vac @ 50/60 Hz, +/-20% 24Vdc +/-10%	1	90 sec	7 VA	
S0524-2POS	5Nm	Two-Position SPST	24Vac @ 50/60 Hz, +/-20% 24Vdc +/-10%	0	45 sec	8 VA	
S0524-2POS-SW1			24Vac @ 50/60 Hz, +/-20% 24Vdc +/-10%	1	45 sec	8 VA	
S05230-2 POS			120/230 Vac @ 50/60 Hz, +/-10%	0	45 sec	14 VA	
S05230-2 POS-SW1			120/230 Vac @ 50/60 Hz, +/-10%	1	45 sec	14 VA	
S05010			(0)2-10 Vdc, Floating (3-pt.)	24Vac @ 50/60 Hz, +/-20% 24Vdc +/-10%	0	90 sec	8 VA
S05010-SW1				24Vac @ 50/60 Hz, +/-20% 24Vdc +/-10%	1	90 sec	8 VA



Humidity Ratings:

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

Electrical Connections:

- Field wiring 0.5 mm² to 1.5 mm² conductors (stranded or solid) and up to 2 - 1.5 mm² 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 (min.)
- 250 Vac, 8 A resistive, 5 A inductive (max.)

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

- Round damper shafts: 9 to 16 mm
- Square damper shafts: 6 to 13 mm

Minimum Damper Shaft Length:

- 25 mm; 76 mm recommended.

Spring Return Timing (at rated load):

- < 25 seconds @ -20°C to +65°C
- < 60 seconds @ -30°C

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 kOhms minimum.

Feedback Signal:

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

Noise Rating at 1m (max.):

- Driving
 - Floating/Modulating: < 40 dB(A)
 - 2-Position: < 50 dB(A)
- Spring Return: < 60 dB(A)
- Noise Rating":

Lifetime

- Full strokes / spring returns: 60,000
- Repositions: 1.5 million

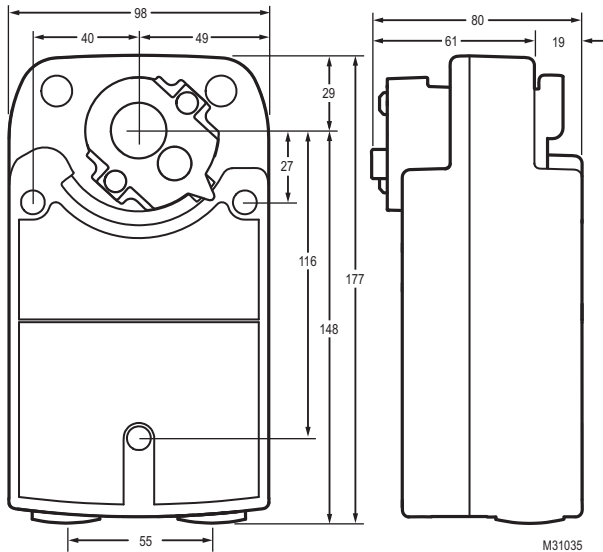


Fig. 1. Dimensional drawing of actuator in mm.

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.

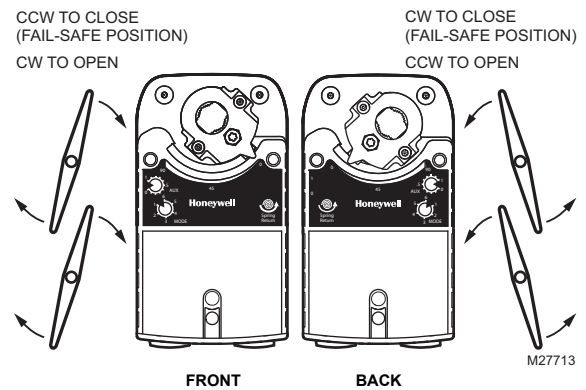


Fig. 2. Spring Return DCA mounting orientation.

Measure Damper/Valve Shaft Length

If the shaft is less than 76mm in length, the shaft coupling must be located between the damper/valve and actuator housing. If the shaft length is more than 76mm, 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.

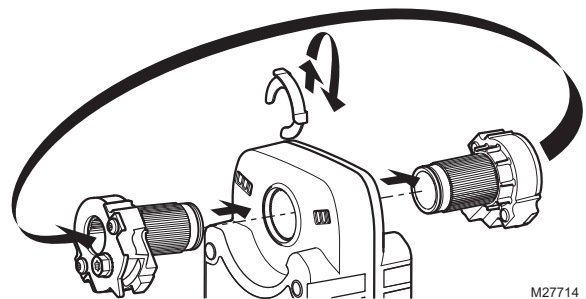


Fig. 3. Mounting shaft coupling to actuator opposite side.

Selecting Actuator Control Signal

The actuator control signal is selected using the Mode Selection Switch (see Fig. 4), which is located on both the front and back of the Sxx010 and the Sxx010-SW1. The Mode Selection Switch can be set to integer values ranging from 1 to 6. Using a screwdriver, set the switch to the mode indicated on the device label. Do not exceed the range indicators.

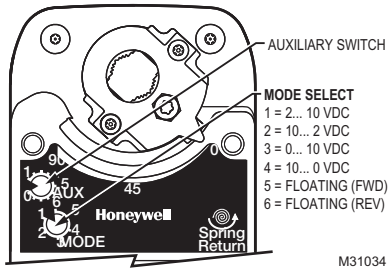


Fig. 4. Mode Selection Switch and Auxiliary Switch

Selecting Set Point of Switch

The degree at which the switch is activated is selected using the Auxiliary Switch (see Fig. 4), which is located on both the front and back of all Sxx-SW1 models.

The Auxiliary Switch can be set to fractional values ranging from 0 and 1. Using a screwdriver, set the switch to the degree of rotation at which you want the switch to activate. EXAMPLES: Setting the switch to 0 will cause the switch to activate at 0°. Setting the switch to 0.5 will cause the switch to activate at 45°. Setting the switch to 1 will cause the switch to activate at 90°.

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.

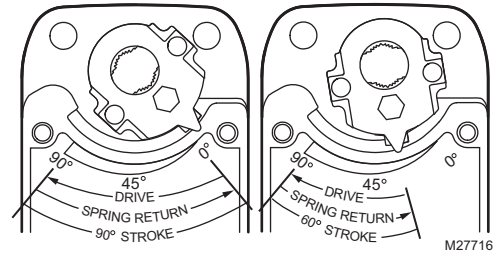


Fig. 5. Stroke reduction.

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 27.1 Nm torque.

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

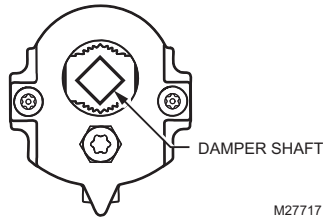
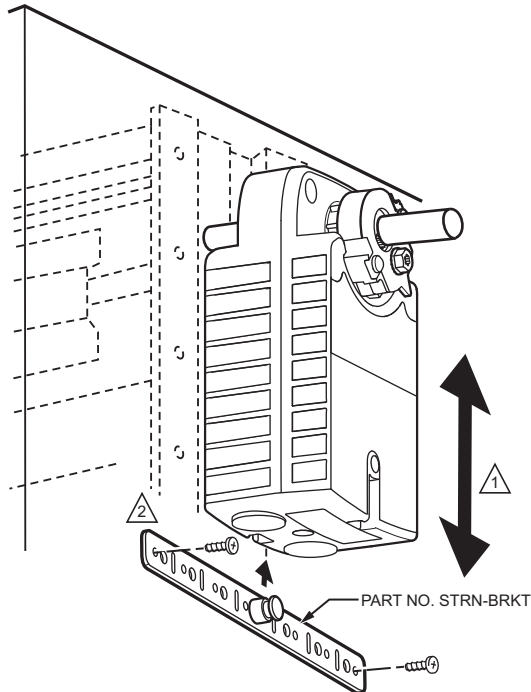


Fig. 6. Proper mounting to square damper shaft.



- 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 10.)

NOTE: Use M20 x 1.5 strain relief or conduit adapters.

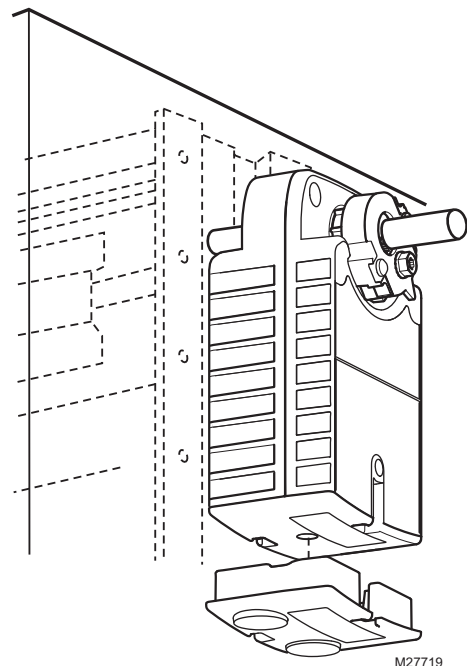


Fig. 8. Removing access cover.

Typical Wiring

See Fig. 9 through 19 for typical wiring details.

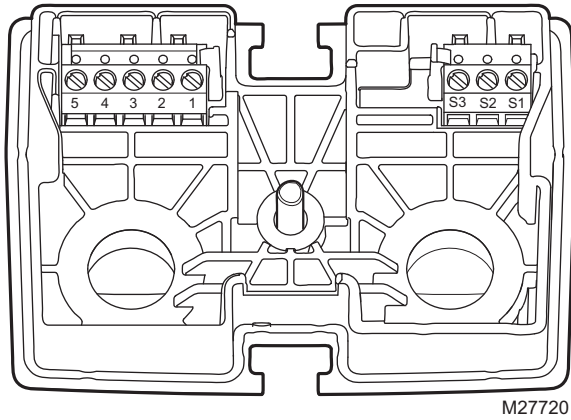
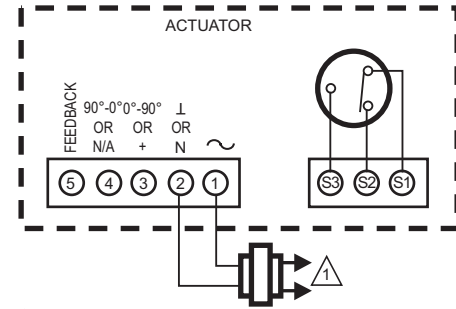


Fig. 9. Terminal block details.



⚠ POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

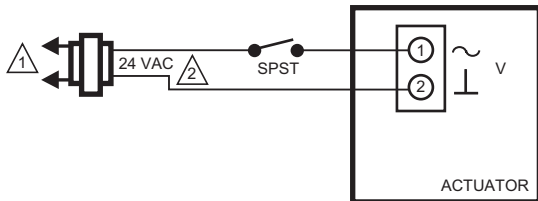
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Fig. 10. Terminal block details.

Table 2. Wiring Details.

Terminal	Floating	Modulating	Two-Position	
			24Vac/Vdc	120–275 Vac
~ 1	power	power	power	power
⊥ or N 2	common	common	common	neutral
3	0°–90° (CW)	control signal	—	—
4	90°–0° (CCW)	—	—	—
← 5	feedback	feedback	—	—

Two-Position Models

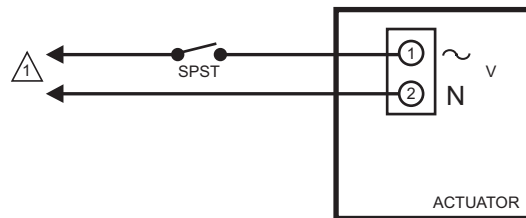


⚠ LINE VOLTAGE POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

⚡ 24 VDC SUPPLY ACCEPTABLE.

M29121

Fig. 11. Wiring for low-voltage two-position control.



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

M31298

Fig. 12. Wiring for line-voltage two-position control.

Floating and Modulating Models

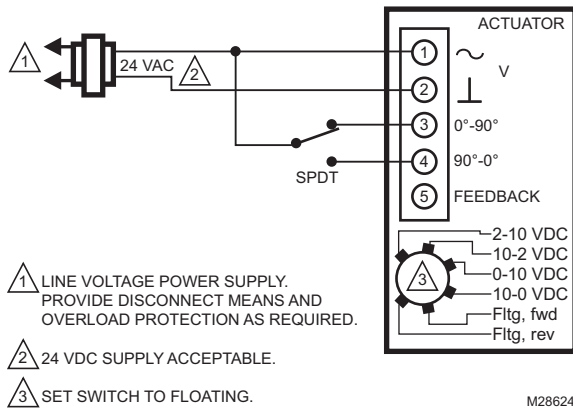


Fig. 13. Wiring for SPDT on/off control.

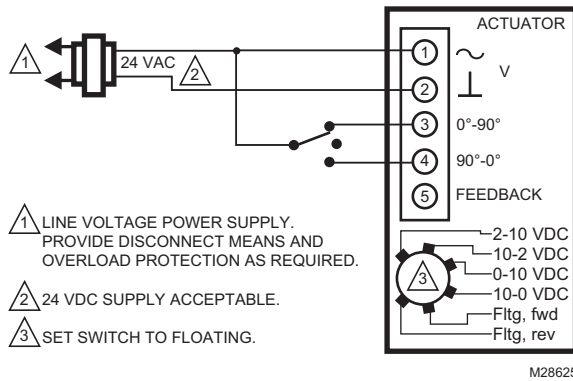


Fig. 14. Wiring for floating control.

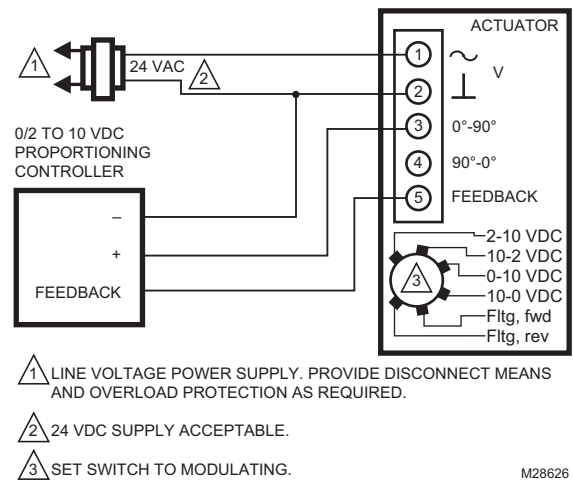


Fig. 15. Wiring for (0)2-10 Vdc proportioning controllers.

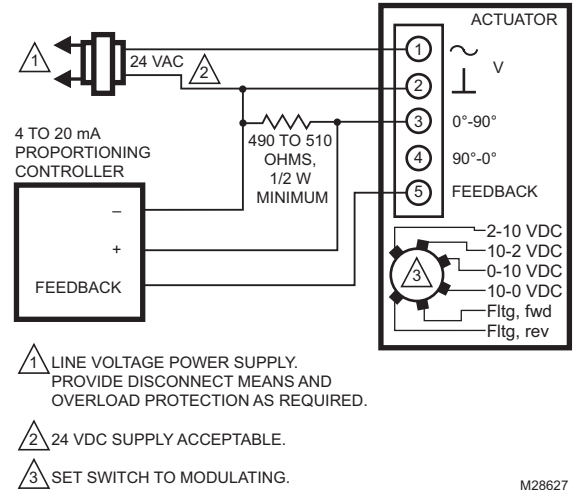


Fig. 16. Wiring for 4-20 mA proportioning controllers.

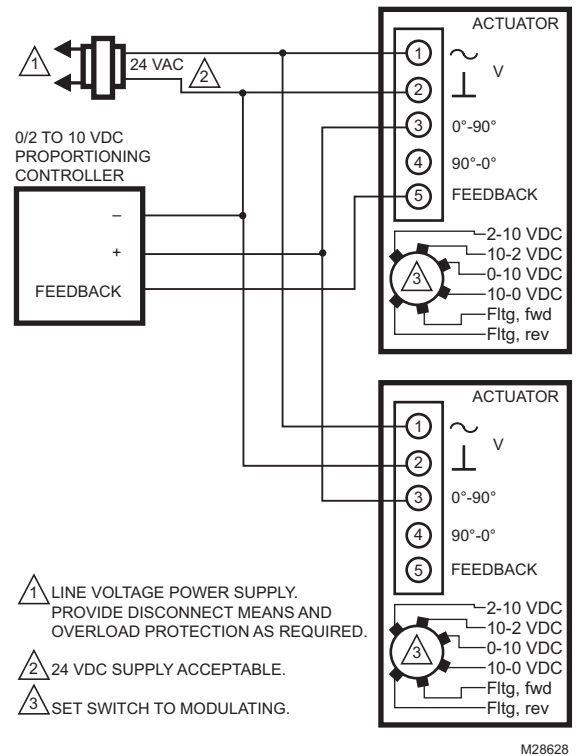


Fig. 17. Wiring for (0)2-10 Vdc proportioning controller operating multiple actuators.

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. 18.
2. Override to full closed:
 - a. Disconnect the input signal (from terminal 3).
 - b. See Fig. 19.

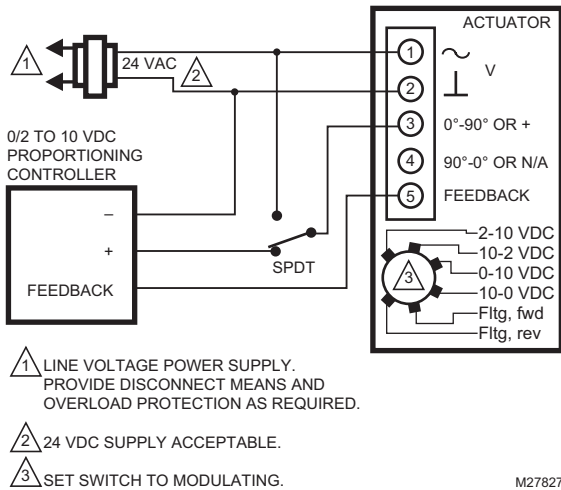


Fig. 18. Override to full open.

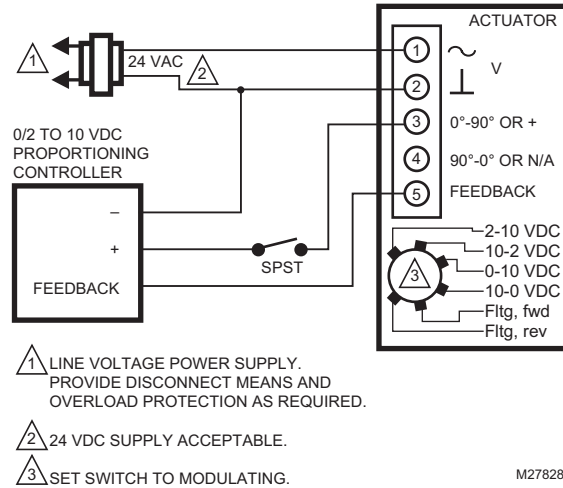


Fig. 19. Override to full close.

End Switches



Some models include an adjustable end switch. For wiring details, see Fig. 10.

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. 10 and Table 2.)
3. Set "Mode Select" dial to desired control signal. (See Fig. 7.)
4. Apply control signal for actuator full open or full closed position. (See Fig. 10 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. 10 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. 10 and Table 2.)

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





3. Set "Mode Select" dial to desired control signal. (See Fig. 5.)
4. Apply control signal for actuator 50% position. (See Fig. 10.)
 - 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.
6. If actuator is correctly installed and does not run, replace the actuator.

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