

For two-position operation of dampers or valves in heating, ventilating and air conditioning systems and similar applications where return to normal position is not required.

These unidirectional actuators (clockwise rotation) require a three-wire control circuit; SPDT snap-acting switch or its equivalent such as a thermostat, pressure switch or relay. A built-in cam operated, snap-acting, adjustable SPDT auxiliary switch is standard. It is factory set to make at mid-stroke. One contact closes at end of stroke; other contact closes at end of next stroke.

Ambient Temperature Limitations: -40 to 136°F (-40 to 58°C).

Dimensions: 7" (178 mm) high × 5-3/8" (137 mm) wide × 6-5/16" (160 mm) deep.

Options: Available 24, 120, 208, 240 Vac; 50 or 60 Hz. 50 Hz specify MC5-XXX. For hazardous locations, specify MC6-XXX (60 Hz), MC7-XXX (50 Hz). Actuators factory assembled in AM-401, UL listed, CSA certified.

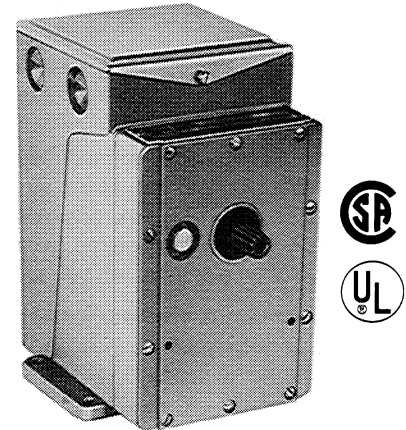


Figure 1

ACCESSORIES

Damper Linkage Accessories (Ref. Fig. 4)

- AM-111 Crank arm for 5/16" diameter damper shaft
- AM-112 Crank arm for 3/8" diameter damper shaft
- AM-113 Crank arm for actuator or 1/2" diameter damper shaft
- AM-115 Crank arm for 7/16" diameter damper shaft
- AM-116 Splined crank arm for actuator
- AM-122 Linkage connector straight type
- AM-123 Damper clip
- AM-125 5/16" diameter × 20" damper rod
- AM-125-048 5/16" diameter × 48" damper rod
- AM-132 Ball joint connector
- AM-161 Damper linkage kit
- AM-161-1 Damper linkage kit
- AM-301 90 degree mounting bracket

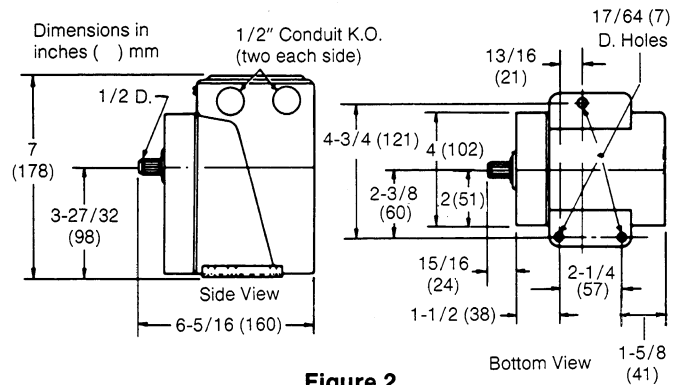


Figure 2

Adjustable Auxiliary Switch SPDT Rating Amps		
Type	120V	240V
Running	5.8	2.9
Locked Rotor	34.8	17.4
Non-Inductive	12	6

Valve Linkage Accessories (Ref. Fig. 5)

- AV-330 Valve linkage for 2-1/2" & 3" VB-9323
- AV-352 Valve linkage for 2-1/2" to 6" VB-9213 or VB-9313 valve bodies and 4" to 6" for VB-9323
- AV-393 Valve linkage for 1/2" to 1-1/4" VB-92X3 or VB-93X3
- AV-394 Valve linkage for 1-1/2" & 2" VB-92X3 or VB-93X3
- AV-396 Valve linkage for 2-1/2" to 4" VB-9213 or VB-9313

Miscellaneous Actuator Accessories

- AM-321 Two step switch kit
- AM-341 Four step switch kit
- AM-363 NEMA 4 rated gasket kit
- AM-401 Hazardous location housing

Part No.	Input				No Load Timing (Sec/180°)	Rated Torque Lb.-In. (N-m)	Nominal Damper* Area Sq. Ft. (m²)	
	Volts	Hz	Watts	VA Rating			Parallel Blade	Opposed Blade
MC-351	24	60	28	53	70	220 (25)	122 (11)	157 (15)
MC-421	120	60	50	96	20	175 (20)	97 (9)	125 (12)
MC-431	120	60	50	96	30	220 (25)	122 (11)	157 (15)
MC-4311	240	60	50	96	30	220 (25)	122 (11)	157 (15)
MC5-4311	240	50	50	96	36	220 (25)	122 (11)	157 (15)

*Damper ratings are nominal and based on standard (not low leakage) dampers at 1" (25.4 mm) W.C. static pressure and 2000 FPM (10 ml/s) velocity.

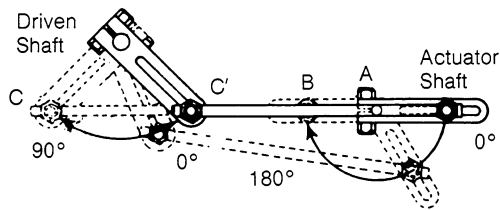


Figure 3

PRE-INSTALLATION

The MC actuators are shipped without mounting hardware or linkage. In damper applications, crank arms (AM-113), connectors (AM-122 or AM-132), link rods (AM-125) and mounting brackets (AM-301) will be required. In valve applications, a valve body and AV type linkage will be required.

Before installing the actuator, check for bent or broken parts or oil leaks. Actuators may be connected to power supply to check operation prior to installation.

INSTALLATION

Requirements

Preferred mounting for the actuator is in the upright position, but other positions are acceptable. Adjustable speed units should never be mounted upside down or with the output shaft pointing upward. Allow six inches clearance above the actuator wiring compartment. If an AM type mounting bracket is not used, the base of the actuator may be used as a template for marking mounting holes.

Procedure

Actuator may be used in damper and valve control applications. Figure 3 illustrates linkage operating an arm through a 90° arc. To fasten damper linkage proceed as follows.

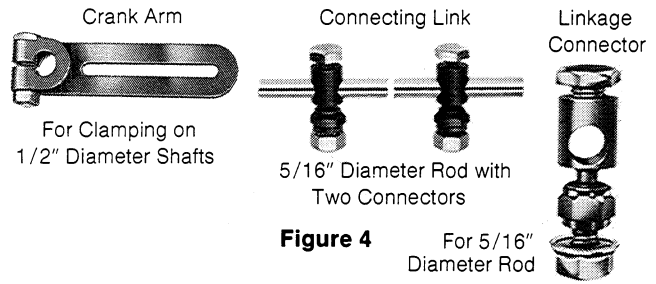


Figure 4 For 5/16" Diameter Rod

Damper Installation

1. Fasten linkage connector at end of damper crank arm.
2. Fasten linkage connector at punch mark on actuator crank arm (about .707 of the radius).
3. Move damper to normal position and clamp connecting link to connectors.
4. Check adjustment for proper operation by running actuator and driven shaft between limits of travel.

CAUTION

If crank arm does not provide proper travel, reset connecting link in linkage connector. Never attempt to turn the actuator shaft with a wrench or a crank. This may damage the gears.

Valve Installation

Install all valves with pressure under seat. Refer to flow arrow on body or piping information on valve body tag. Three way mixing valves should be installed with two inlets and one outlet. Three way diverting valves should be installed with one inlet and two outlets.

To assemble an actuator to a valve, refer to detailed instructions on AV-3XX General Instruction Sheet F-19068.

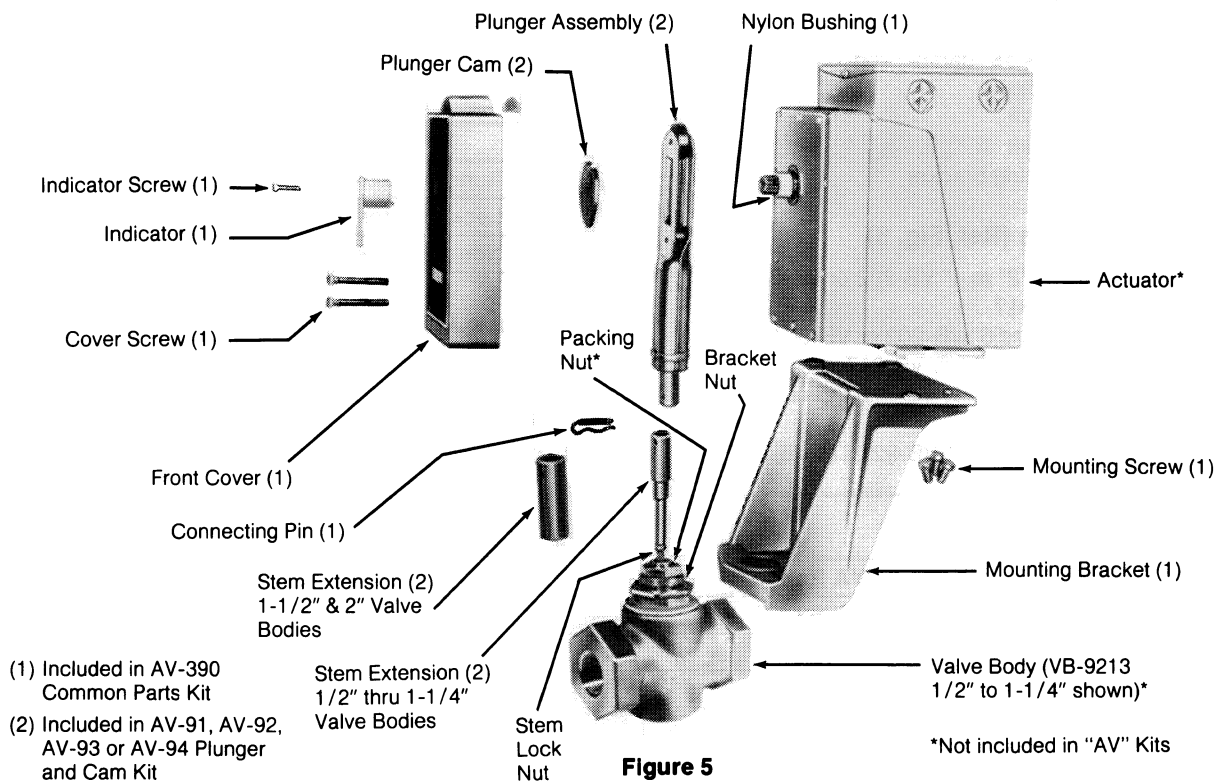


Figure 5

- (1) Included in AV-390 Common Parts Kit
 (2) Included in AV-91, AV-92, AV-93 or AV-94 Plunger and Cam Kit

*Not included in "AV" Kits

Note: Items (1) & (2) included in AV-391, 392, 393 and 394 Valve Linkage Kits

NOTE: See AV-300 General Instruction Sheet F-19068 for detailed instructions when used as a valve actuator.

Wiring

Make all electrical connections in compliance with the job wiring diagram and the national and local electric codes. Typical connections are shown in Figure 6.

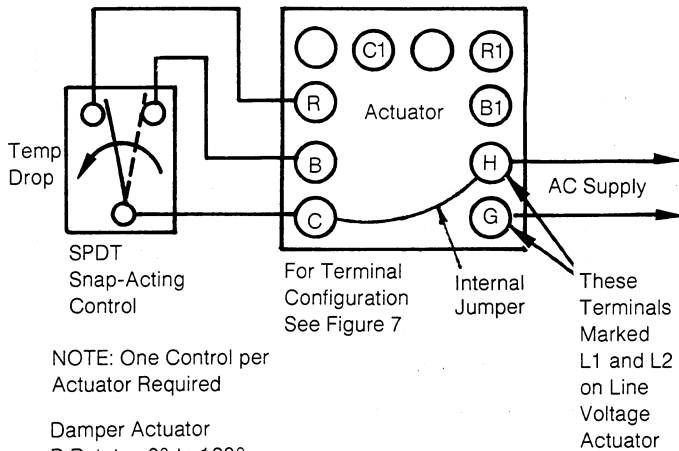


Figure 6. External Wiring for Heating Application

For control and power wiring on low voltage actuators (H, G, R, B, and C terminals), use No. 14 wire on runs under 140 feet and No. 12 wire on longer runs. On line voltage units (L1, L2, R, B, and C terminals), use No. 14 wire on runs up to 1300 feet.

Class I circuits must be used for connections to the control and power terminals (L1, L2, R, B, and C terminals) on line voltage actuators. Class II circuits may be used for connections to the control and power terminals (H, G, R, B, and C terminals) on 24 Vac actuators. Connections to the auxiliary switch terminals (R1, B1, and C1) may be per Class II circuits except when the switch is used on line voltage applications in which case Class I circuit must be used. When powering actuators from a common transformer, the G terminals must all connect to the same side to prevent transformer damage.

CHECKOUT

After the entire system has been installed, the following checks for proper operation must be made.

1. Be sure that the system power is connected, and on.
2. Turn thermostat to call for cool. Actuator should rotate clockwise from 0° to 180°, turning off the heating media. [View actuator from output shaft end (front).]
3. Turn thermostat to call for heat. Actuator should rotate clockwise from 180° to 360° (also 0°), and turn on heating media.
4. If the room temperature varies excessively, see System Repair.

Actuator Checkout: Turn power off and connect terminals as follows:

1. Connect terminal C to B and actuator should run clockwise (when energized) to end of travel (usually 180°).
2. Connect terminal C to R and actuator should run clockwise (when energized) from 180° to 360° (or 0°).

RUN/ADJUST

Theory of Operation

Unidirectional Three-Wire, Two-Position Actuators: The motor, gear-train assembly with limit switches to stop the movement (usually at the end of 180° CW travel) is built in two types. The damper actuator output shaft gives rotary motion. The valve actuator has a cam-operated plunger which transforms rotary motion to linear motion to operate the valve stem. Three-wire actuators require a SPDT switching action in the controller.

“R” contact of the thermostat is made on a call for heat; “B” contact is made on a call for less heat; “C” terminal is common. “R” of the actuator (assume a valve) is a starting switch that starts to open the valve; “B” starts to close the valve; and “C” is the limit switch. Auxiliary cam-operated switches are available for the operation of additional valves, actuators, relays, etc.

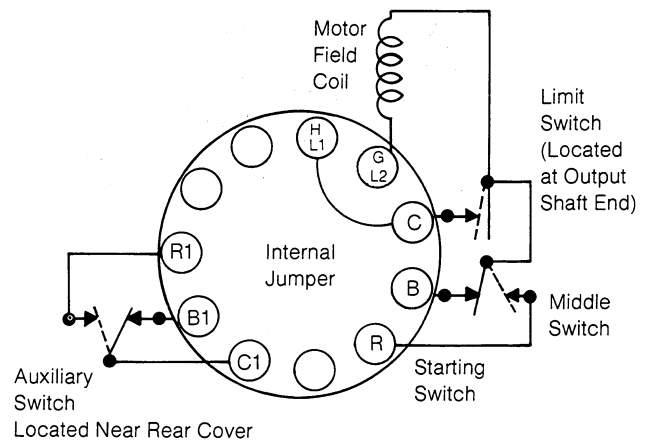


Figure 7. Internal Wiring Diagram and Cam Chart

Auxiliary Switch Adjustment

The adjustable built-in SPDT auxiliary switch is actuated by the cam nearest to the back of the actuator. Although it can be adjusted to operate at any point in the actuator rotation, it is factory set to operate at approximately mid-stroke. This operating point may be changed by inserting a screwdriver through the opening in the top plate directly behind the terminal block, and engaging the screwdriver with the gear-like plastic disc. Turning the disc clockwise causes the switch to operate nearer the counterclockwise end of actuator travel. Each click of the switch actuating cam represents approximately 3 angular degrees change in operating point.

Speed Adjustment (Special Order Models Only)

The timing of actuators having the adjustable speed feature is varied by means of a slotted adjustment screw on the lower left side of the front housing. Total timing can be increased to about ten times the normal timing of the actuator. For example, an actuator whose timing is normally 140 seconds per revolution can be reduced in speed to approximately 1400 seconds per revolution. Turning the screw clockwise decreases the speed of rotation of the output shaft. Take care not to turn the adjustment screw too far clockwise as this will stall, although not damage, the actuator. If stalling occurs, turn screw counterclockwise until the actuator resumes operation. The adjustable range is about 3-1/2 turns of the adjusting screw. This is only on Special Order units with the third digit a 2.

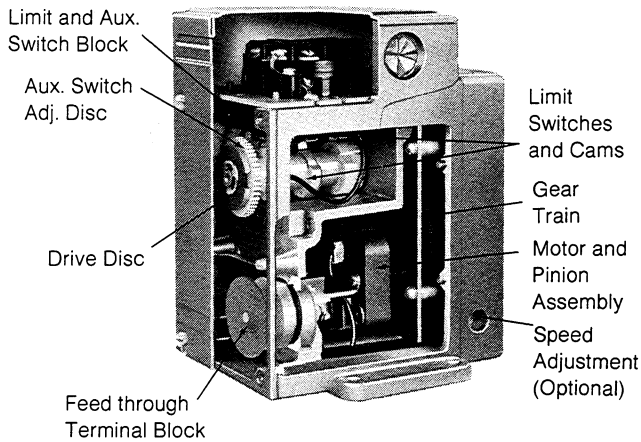


Figure 8

MAINTENANCE

A minimum of maintenance is required since the motor and gear train are submerged in oil (BYZP-195) for continuous lubrication and cooling. If necessary to refill with oil, always use Barber-Colman immersion oil, available in one quart cans (refill capacity — 1 to 1-1/4 pints). Oil level (with the actuator upright) should be up to the edge of the oil fill hole which is located just left of the output shaft.

REPAIR

System

If the procedures in the CHECKOUT Section of this sheet indicate that the actuator and thermostat are functioning properly, but correct temperature control is not obtained, refer to the list below for possible causes:

1. Thermostat in wrong location for proper sensing.
2. Improper air distribution.
3. Thermostat not properly calibrated.
4. Thermostat has dirty contacts.
5. Thermostat cover has slots blocked.
6. Heating media unavailable.
7. Heating media will not shut off.

Device

When ordering replacement parts, always include the part number of the motor actuator along with the description of the part required. For example, one motor and pinion assembly for a MC-351 actuator.