



# 35 and 70 in-lb. Non-Spring Return Direct Coupled Actuators

KA-35-P, KA-35-VAV, KA-70-2T, KA-70-P

## INSTALLATION INSTRUCTIONS

### APPLICATION

The 35 and 70 in-lb. Non-Spring Return Direct Coupled Actuators (DCA) are control actuators that provide tri-state or proportioning control for valves and dampers. Proportioning actuators accept a current or voltage signal from a controller to position the damper or valve at any chosen point between fully open and fully closed. Tri-state actuators are suitable for use with floating thermostats or two-position control systems.

### SPECIFICATIONS

**Models:** See Table 1.

**Dimensions:** See Fig. 1 through 3.

**Electrical Ratings:**

Power Input: 24 Vac  $\pm 20\%$ , 50/60 Hz

Power Consumption: See Table 2.

Auxiliary Switch Ratings:

Electrical: Selective NO or NC, not simultaneous.

Pilot Duty: 50 VA, 24 Vac.

Switch Differential: Three angular degree maximum.

**Torque Ratings (at Rated Voltages):** See Table 3.

**Actuator Stroke:**

Selectable: 45°, 60°, and 90°.

Rotation: Clockwise (cw) and counterclockwise (ccw).

NOTE: Reversing KA-35-P or KA-70-P drive rotation requires a control signal change (2-10 Vdc to 10-2 Vdc).

**Device Weight:** 1.3 lb (0.58 kg).

**Environmental Protection Ratings:** NEMA1.

**Actuator Timing for 90° Stroke:**

At 60 Hz: 90 seconds.

At 50 Hz: 108 seconds.

**Mounting:** Mounts directly on 3/8 in. to 1/2 in. (10 to 13 mm) round or square shaft. Can be mounted with shaft in any position with two 1/4 in. (6 mm) 28 NF Allen screws. Minimum Shaft Length Required: 1-3/4 in. (45 mm).

**Noise Output:** 45 dBA at 1 meter maximum.

**Temperature Ratings:**

Ambient: 20°F to 125°F (-18°C to 50°C).

Derated Timing to: -20°F (-29°C).

Shipping and Storage: -20°F to 130°F (-29°C to 54°C).

Humidity Ratings: 5% to 95% RH noncondensing.

**Actuator Minimum Design Life:**

Full Cycles: 100,000.

Repositions: 1,500,000.

**Approvals:**

Underwriter's Laboratories Inc. Recognized Component:

File No. E179109;

Guide No. XAPX2 (for U.S.) / XAPX8 (for Canada).

UL94-5V: Meets plenum requirements.

Canadian Standards Association Certified (includes Auxiliary Switch).

**Accessories:**

201052A Auxiliary Switch (one).

201052B Auxiliary Switch (two).

201391 Shaft Adapter (included).

205649 Anti-Rotation Strap.

4074ENJ Bag Assembly—includes stop pin, shaft adapter, and two minimum-position screws.

4074ENY Bag Assembly—includes stop pin and shaft adapter.

4074EVK Short Shaft Extender and small anti-rotation strap.

7640QW Metal Enclosure—for attaching conduit to KA35-P and KA-70-P actuators.

**Table 1. 35 and 75 in-lb. Non-Spring Return DCA models.**

KA Kele Actuator				
KA	-	35	35 in-lb. (4 N•m)	
		70	70 in-lb. (8 N•m)	
			P	4-20 mA/2-10 Vdc Control
			VAV	Tri-state Control for VAV
KA	-	35	-	P



**Table 2. Power Consumption.**

Model	Power Consumption
KA-35-VAV	1.8 VA
KA-35-P	4.8 VA
KA-70-2T	2.4 VA
KA-70-P	5.4 VA

**Table 3. Torque Ratings.**

	KA-35-VAV, KA-35-P	KA-70-2T, KA-70-P
Running	35 (4)	70 (8)
Breakaway		
Stall Minimum	45 (5)	
Stall Maximum	70 (8)	130 (14)

## 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.

### **WARNING**

#### **Explosion Hazard.**

**A spark from the actuator or attached accessories can result in serious injury or death.**

Install the actuator in areas free of escaping gas and other explosive vapors.

### **CAUTION**

**Electrical Shock or Equipment Damage Hazard.**  
**Can shock individuals or short equipment circuitry.**

Disconnect all power supplies before installation. Actuators with auxiliary switches can have more than one disconnect.

### **CAUTION**

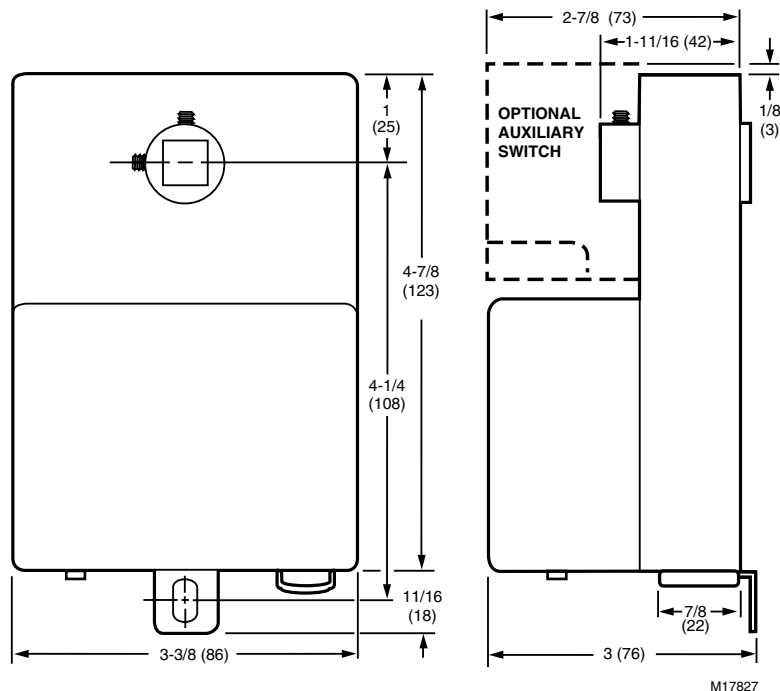
#### **Actuator Damage Hazard.**

**Deteriorating vapors and acid fumes can damage the actuator metal parts.**

Install actuator in areas free of acid fumes and deteriorating vapors.

#### **IMPORTANT**

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



**Fig. 1. Approximate dimensions of KA-35-P, KA-70-P DCA in in. (mm).**

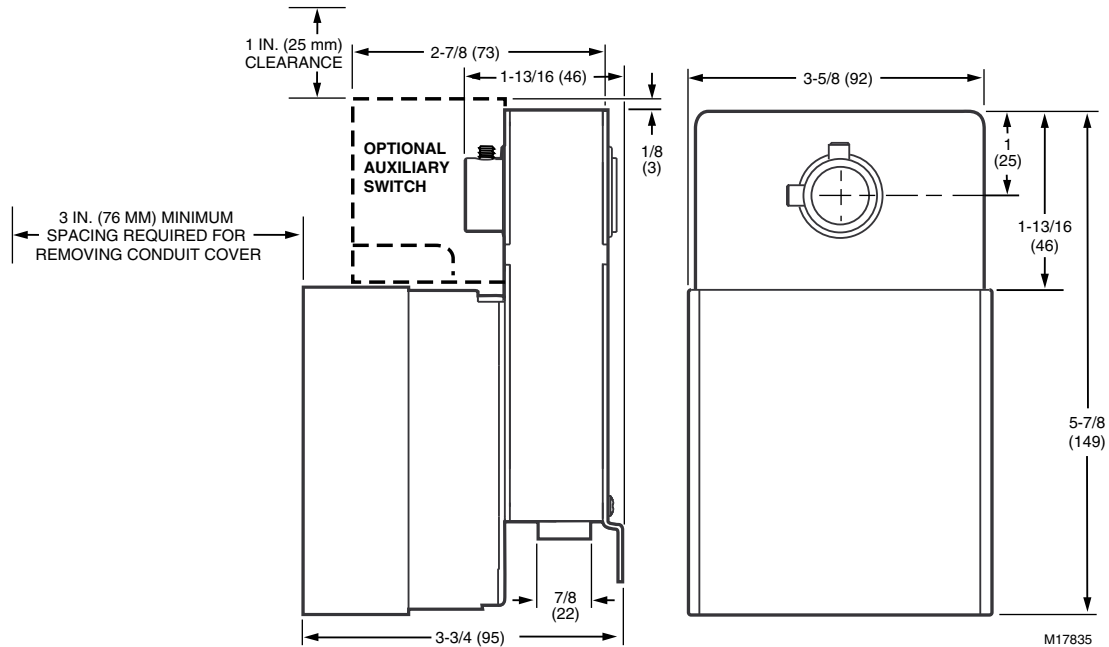


Fig. 2. Approximate dimensions of KA-70-2T DCA in in. (mm).

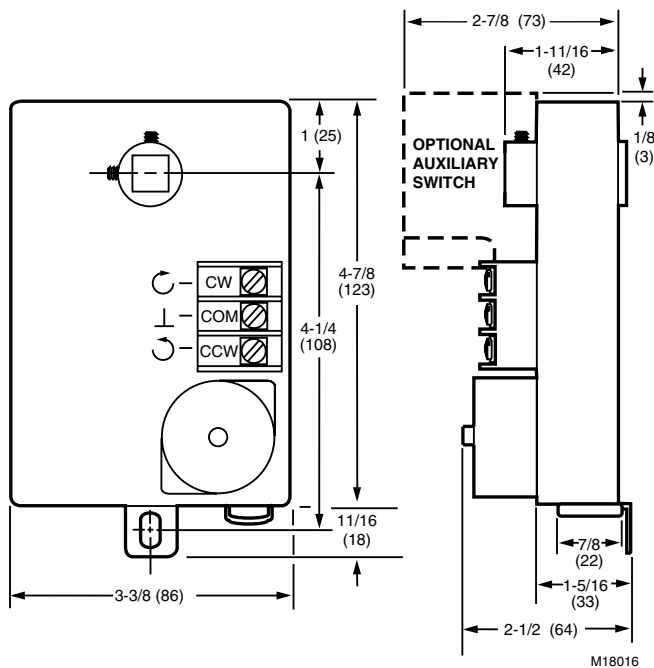


Fig. 3. Approximate dimensions of KA-35-VAV DCA in in. (mm).

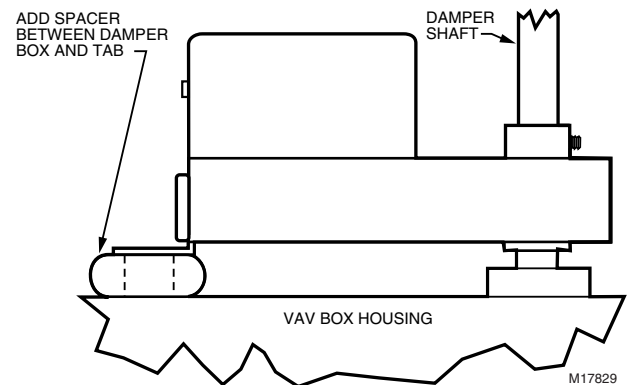


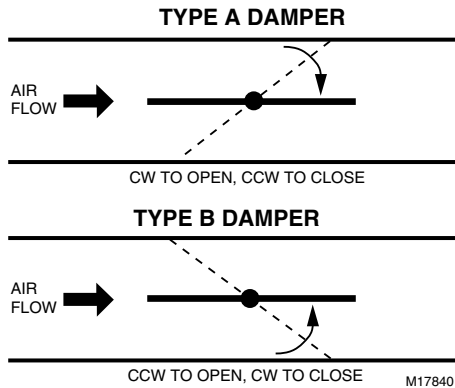
Fig. 4. Mounting actuator to VAV box when actuator is not flush with box.

## Preparation

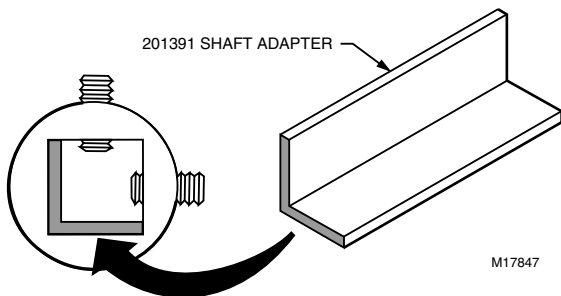
Before mounting the actuator onto the shaft, determine the following:

1. Size of the shaft (3/8 in. to 1/2 in.).
2. Direction the shaft rotates to open the device (cw or ccw). See Fig. 5.
3. Degrees of actuator stroke for opening device (45°, 60°, or 90°).

If the shaft is 3/8 in. round or square, use part number 201391 Shaft Adapter provided inside the bag assembly shipped with the actuator. Place the adapter opposite the setscrews (see Fig. 6).



**Fig. 5. Determining direction damper shaft rotates when opening.**



**Fig. 6. Using 201391 Shaft Adapter for 3/8 in. shafts.**

## Manual Operation (Declutch)

### CAUTION

**Product Damage Hazard.**  
Do not use manual declutch without supporting the load.  
Support actuator load independently immediately before and during use of manual declutch lever.

Use the manual declutch lever to manually adjust the actuator setting. Fig. 7 shows the location of the manual declutch lever. To operate, push the lever in the direction of the arrow on the lever cover.

## Installation

After determining the direction of the shaft rotation (cw or ccw), install the device. For valve linkage mounting, refer to the instructions shipped with the linkage. For damper mounting, proceed as follows:

1. Place the actuator onto the damper shaft.

### CAUTION

**Equipment Damage Hazard.**  
Improper range stop selection can damage light-duty dampers.  
Be sure to select the proper range stop.

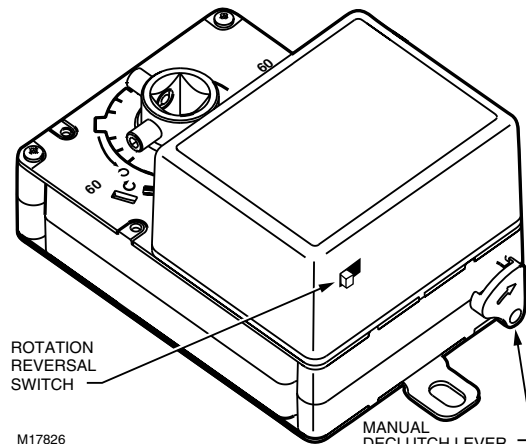
**NOTE:** Dampers with 90° stroke do not require a range stop pin.

2. If the damper stroke is either 45° or 60°, a range stop pin is required:
  - a. Disengage the hub using the declutch lever; see Manual Operation (Declutch) section.
  - b. Rotate the hub until the actuator gear train passes the proper 45° or 60° setting. (Do not insert the pin until after the actuator passes this point.)
  - c. Release the declutch lever.
  - d. Insert the range stop pin into the appropriate (cw or ccw) 45° or 60° slot. The range stop pin is clipped into its final position only after the pin passes through both actuator plates (see Fig. 8). The range stop pin should snap into position and not be removable manually (see Fig. 9).

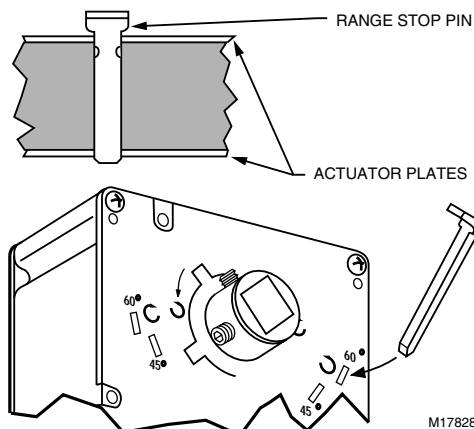
### IMPORTANT

*Do not fully tighten the mounting screw; the actuator must be allowed to float.*

3. With the actuator placed in its final position, secure the mounting tab to the damper box with a sheet metal screw or anti-rotation strap.
4. Position the damper in the open position and securely tighten the Allen screws into the damper shaft.



**Fig. 7. Location of manual declutch lever. (KA-70-P Shown.)**



**Fig. 8. Range stop pin properly inserted.**

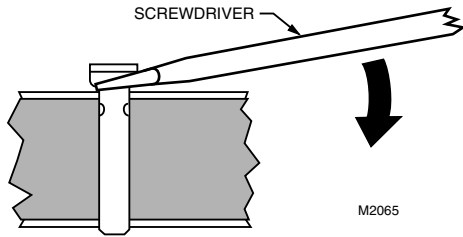


Fig. 9. Lifting range stop pin out of its slot.

## Minimum Position Setscrew (Requires 4074ENJ)

All KA-35-VAV, KA-70-2T, KA-35-P, and KA-70-P models are equipped with two tapped holes located in the plastic housing at the top of the actuator. These holes can be used with the minimum position setscrew and locknut inside the 4074ENJ Bag Assembly (see Fig. 10). The setscrew provides for a 0° to 30° minimum position adjustment.

NOTE: Before starting operation, note that the minimum position setscrew limits closing motion, while the range stop pin limits opening motion.

1. Determine the direction of the desired closing rotation.
2. Move the actuator to the position fully opposite the desired closing rotation (if cw closing rotation is desired, move the actuator to the full ccw position).
3. Determine the correct hole for the setscrew using Fig. 10 and the results of step 1.



## CAUTION

**Equipment Damage Hazard.**  
Improper hub positioning or hole selection can permanently damage the device.  
Avoid backdriving the actuator with the setscrew.

4. Remove the red cap from the desired hole. Leave the other cap in position. The caps ensure that dust and other impurities do not enter the gear train through unused holes.
5. Thread the locknut fully onto the setscrew.
6. Insert setscrew into desired hole, turning clockwise until resistance is encountered or locknut contacts housing.
7. If resistance is met before the setscrew is fully inserted, stop and review the initial setup procedures as detailed in steps 1 through 3.
8. Determine the minimum position angle required for the application. With the setscrew fully inserted, the minimum position is 30°. With the setscrew fully out, the minimum position is 0°.
9. Using the conversion of approximately 1.7 angular degrees per setscrew turn, back the screw out of the housing and stop slightly short of the calculated position. This allows accurate setscrew setting while taking air flow measurements.

## IMPORTANT

After initiating step 10, the setscrew cannot be turned into the housing without returning the actuator to the fully open position (as determined in step 1). The actuator follows the setscrew without damaging the housing only when backed out of the housing (turned ccw).

10. Rotate actuator to minimum position using the manual declutch; see Manual Operation (Declutch) section.
11. With actuator at minimum position, adjust the position more accurately using air flow measurements.

## NOTES:

1. After each adjustment, ensure the actuator is completely stopped before proceeding with the next adjustment.
2. To reduce the minimum position, turn out the setscrew (ccw). The actuator then drives toward the closed position.
3. Turning the setscrew in (cw) damages the actuator housing.
4. If the device is too far closed, return to step 1.

12. When proper air flow is achieved, loosen the locknut from the setscrew until it contacts the actuator housing, then turn it an additional 1/8 turn to lock the setscrew in place.

## IMPORTANT

Run an entire check of the operation after completing this procedure.

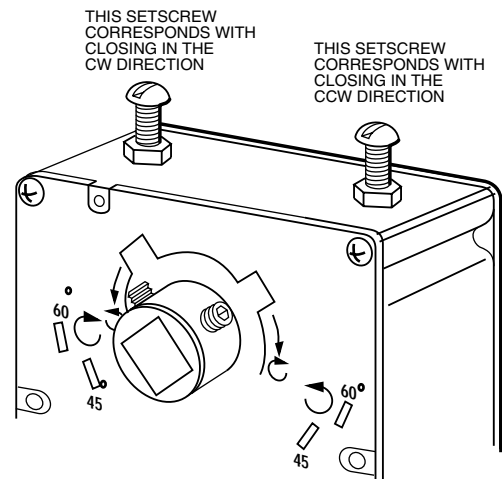


Fig. 10. Setscrew location for KA-35-VAV and KA-70-2T.

## WIRING



### CAUTION

**Electrical Shock or Equipment Damage Hazard.**  
Can shock individuals or short equipment circuitry.  
Disconnect all power supplies before installation.  
Actuators with auxiliary switches can have more than one disconnect.

All wiring must comply with local electrical codes, ordinances and regulations. Voltage and frequency of the transformer used with the actuator must correspond with characteristics of both the power supply and the actuator. Screw terminals are provided for easy hookup. See Fig. 12 through 15 for typical wiring hookups.

### Wiring to KA-35-VAV and KA-70-2T Actuators (Fig. 11)

1. Remove the cover from the actuator by lifting the top and pivoting the cover to the rear of the actuator.
2. Remove the conduit knockouts with a flat-bladed screwdriver. Discard the knockouts.
3. Install the conduit connector.
4. Run the connecting wire through the conduit connector, strip the wire ends (if necessary) and connect to the CW, COM and CCW terminals using Fig. 12, 13, 16, 17, or the control manufacturer instructions.
5. Apply power to the actuator.
6. After operational checkout, replace the cover by reversing the procedure outlined in step 1.

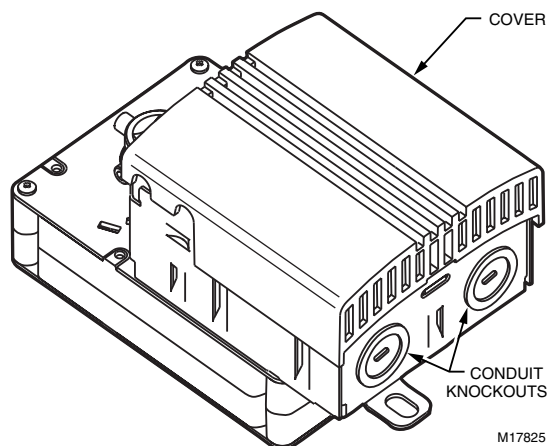


Fig. 11. Conduit cover KA-70-2T Actuators.

NOTE: KA-35-VAV does not include conduit cover.

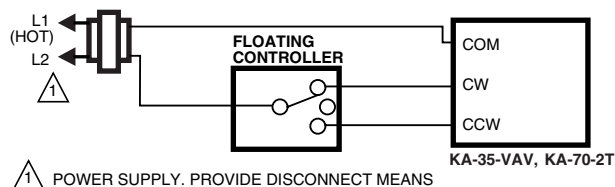
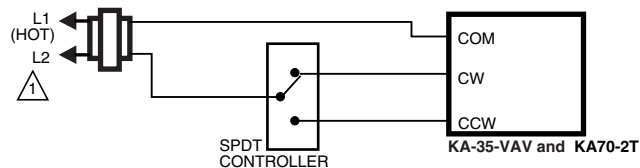


Fig. 12. Typical KA-35-VAV, KA-70-2T wiring.



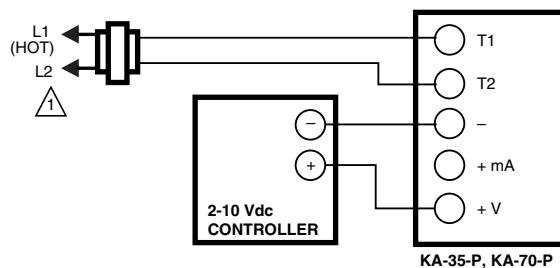
POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

M17834A

Fig. 13. Two-position control KA-35-VAV, KA-70-2T wiring.

### Wiring to KA-35-P and KA-70-P Actuators (Fig. 7)

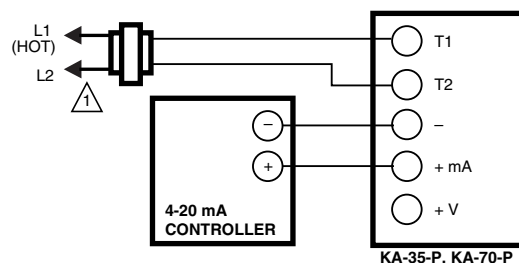
1. Run the connecting wire through the conduit connector, strip the wire ends (if necessary) and connect to the CW, COM and CCW terminals using Fig. 14 or 15.
2. Check polarity and control manufacturer instructions.
3. Apply power to the actuator.
4. Run operational checkout (see Checkout section).



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

M17837

Fig. 14. KA-35-P or KA-70-P used with 2-10 Vdc control.



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

M17836

Fig. 15. KA-35-P or KA-70-P used with 4-20 mA control.

## Auxiliary Switches

The 201052A or B Auxiliary Switch is used in conjunction with the actuator. It allows for control of equipment external to the actuator (for example, electric reheat coils and fan) at an adjustable point in the stroke ( $0^\circ$  to  $90^\circ$ ) of the actuator.

The 201052A and B Auxiliary Switches are field-addable. For mounting instructions, see form 63-2218, provided with the device.

## Parallel Actuators

### IMPORTANT

Over time, parallel-driving actuators can become out of sync with each other. Normally, driving all actuators to the fully-open or fully-closed position puts them back in sync.

### KA-35-VAV, KA-70-2T Actuators

Using Fig. 16 or 17, parallel the CW, COM and CCW terminals. Make certain the total connected load does not exceed the current capacity of the controller or thermostat.

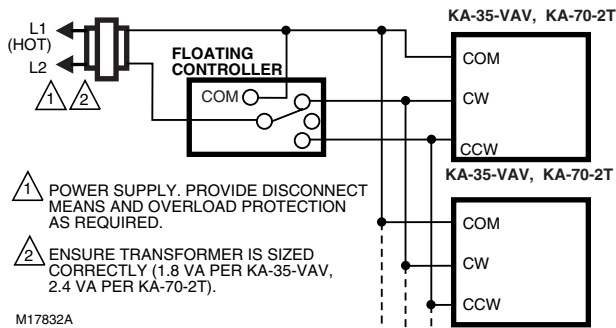


Fig. 16. Spdt control of parallel KA-35-VAV, or KA-70-2T Actuators (with a common connection).

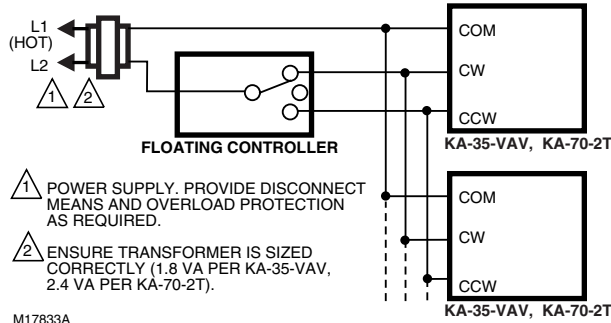


Fig. 17. Spdt control of parallel KA-35-VAV, or KA-70-2T Actuators (with no common connection).

### KA-35-P, KA-70-P Actuators

#### VOLTAGE INPUT (2 TO 10 VDC)

Wire the (+Vdc) and (-) terminals of each actuator in parallel. Make certain the total connected load does not exceed the current capacity of the voltage signal source.

#### CURRENT INPUT (4 TO 20 MA)

When using a current controller, wire the KA-35-P, KA-70-P voltage input terminals (+Vdc) and (-) in parallel. Use a bridging resistor in parallel with the 4 to 20 mA signal. See Fig. 19 for resistor values.

NOTE: The actuator has 45,000 ohm impedance.

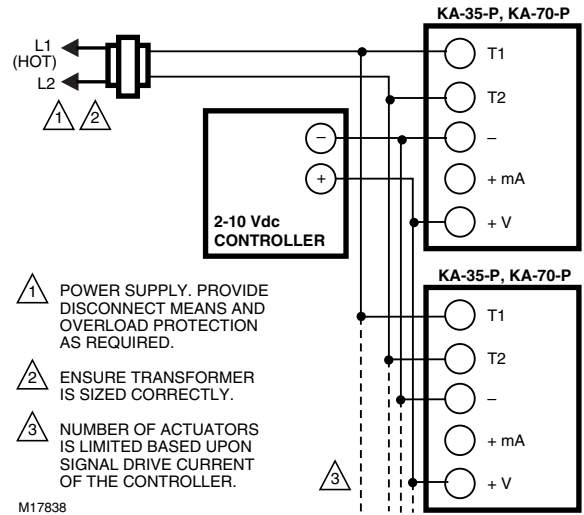


Fig. 18. 2-10 Vdc signal control of parallel KA-35-P or KA-70-P Actuators.

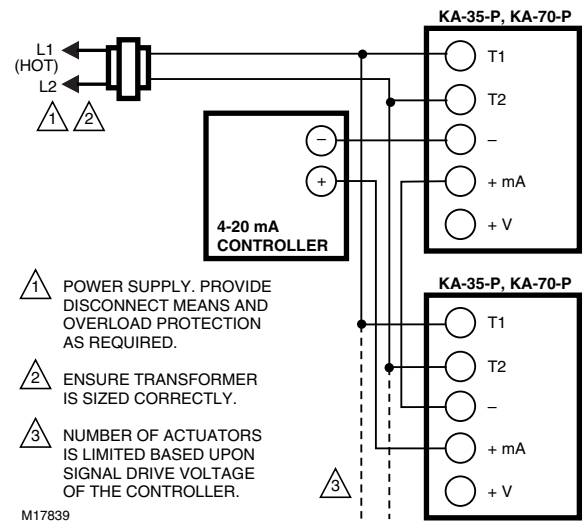


Fig. 19. 4-20 mA signal control of parallel KA-35-P or KA-70-P Actuators.


## Rotation Reversal

### KA-35-VAV, KA-70-2T

Reverse wiring to the cw and ccw terminals.

NOTE: This can also be accomplished at the controller contacts.

### KA-35-P, KA-70-P

Use the rotation reversal slide switch to reverse the actuator rotation. The switch is located on the bottom of the actuator housing (see Fig. 7). To change rotation to counterclockwise (ccw) , change the slide switch. In direct, 2 volts is fully ccw and 10 volts is fully clockwise (cw); in reverse, 2 volts is fully cw and 10 volts is fully ccw.

#### IMPORTANT

*When reversing the rotation, make sure the switch is fully to one side or the other. If the switch is left in the middle, the actuator will not operate properly.*

## CHECKOUT

### KA-35-VAV, KA-70-2T

To check out KA-35-VAV, KA-70-2T Actuators controlled by electronic control systems override the control system by programming the controller to open or close the zone damper, as appropriate.

To check out the KA-35-VAV, or KA-70-2T:

1. Determine the direction the shaft moves to open the device (cw or ccw). See Fig. 5.
2. Place 24 volts across the appropriate common cw or common ccw terminals to energize the actuator. The actuator should begin to open the device.
3. If the actuator does not run, try switching the 24 volts across the opposite common cw or ccw terminals to determine if the device begins to close.
4. If the actuator does not run in either direction, replace the actuator.

### KA-35-P, KA-70-P

To check out the KA-35-P or KA-70-P:

1. Check input impedance on the actuator with an ohmmeter.

#### IMPORTANT

*Be sure to disconnect all wiring to the actuator before connecting the ohmmeter.*

2. Verify resistance readings are as follows:
  - 45K ohms  $\pm$ 5K ohms, across the (+Vdc) and (-) terminals.
  - 536 ohms  $\pm$ 10 ohms, across the (+mA) and (-) terminals.
3. If resistance readings are correct, reconnect actuator and check for 24 Vac at terminals T and T2.
4. With the correct power present at T and T2, check the shaft/actuator motion:
  - a. When using a proportional thermostat, ramp the setpoint up and down. This causes the actuator to move from one limit to the other and back (from fully ccw to fully cw and back to fully ccw).

NOTE: Remember that the actuator takes 90 seconds to move from one limit to the other.

- b. When using the actuator with electronic control systems, override the control system by programming the controller to open or close the damper, as appropriate.
  - c. When using an ASG Signal Generator, connect to the mA or voltage signal in place of the controller signal and stroke the actuator open and closed.
5. If the actuator operates incorrectly, check Table 4 for the proper input signal/actuator drive relationship at the (+Vdc) and (-) terminals.
  6. If the actuator does not operate according to Table 4 values, replace the actuator.

**Table 4. Input Signal/Actuator Drive Relationship.**

Input Signal	Actuator Drive Relationship
1.50 $\pm$ 0.2 Vdc	Actuator drives to extreme ccw position.
2.00 $\pm$ 0.2 Vdc	Actuator remains at ccw position.
3.00 $\pm$ 0.2 Vdc	Actuator leaves ccw position.
10.70 $\pm$ 0.7 Vdc	Actuator drives to extreme cw position.
10.00 $\pm$ 0.7 Vdc	Actuator remains at cw position.
8.50 $\pm$ 0.6 Vdc	Actuator leaves cw position.