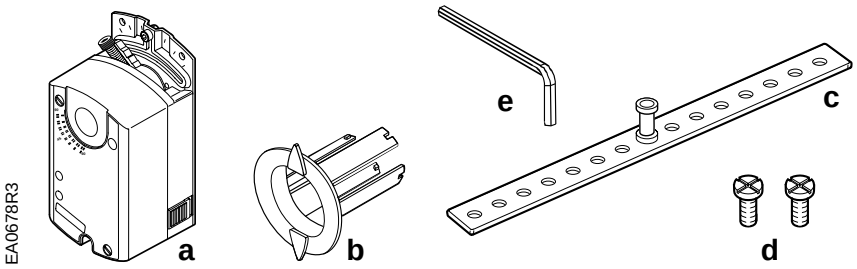
Dodge Engineering & Controls, Inc.
Toll Free (877) 334-2875 Fax: (978) 244-1422

EN44 and EN88 Non-Spring Return Electronic Actuators



a. Actuator
b. Position indicator
c. Mounting bracket (for dampers)
d. Mounting screws
e. 4 mm hex wrench

Figure 1. Parts of the EN44 and EN88 Actuators.

Product Description

This installation instruction describes the steps for direct-coupled mounting of the EN44 and EN88 series non-spring return electronic actuator.

Product Numbers

EN44 (all versions)

EN88 (all versions)

Required Tools

- 4 mm hex wrench (provided)
- 4 mm (5/32 in.) drill bit and drill
- Phillips screwdriver
- Marker or pencil

Expected Installation Time

30 minutes

Installation Conventions

Warning Personal injury or loss of life may occur if you do not perform a procedure as specified.

Caution Equipment damage or loss of data may occur if you do not follow a procedure as specified.

Instructions

Warning: Do not open the actuator.

NOTE: Place the actuator on the damper shaft of that the front of the actuator is accessible. The label is on the front side.

1. Determine whether the damper blades will rotate clockwise or counterclockwise to open. (See Figure 2.)
2. If the blades will rotate counterclockwise, slide the manual override switch to manual and move the adjustment lever to the right. (See Figure 5.) Return the switch to automatic.

0-10V Control

To mount a (modulating) EN44B and EN88B, set the Dual In-line Package (DIP) switches to the required positions.

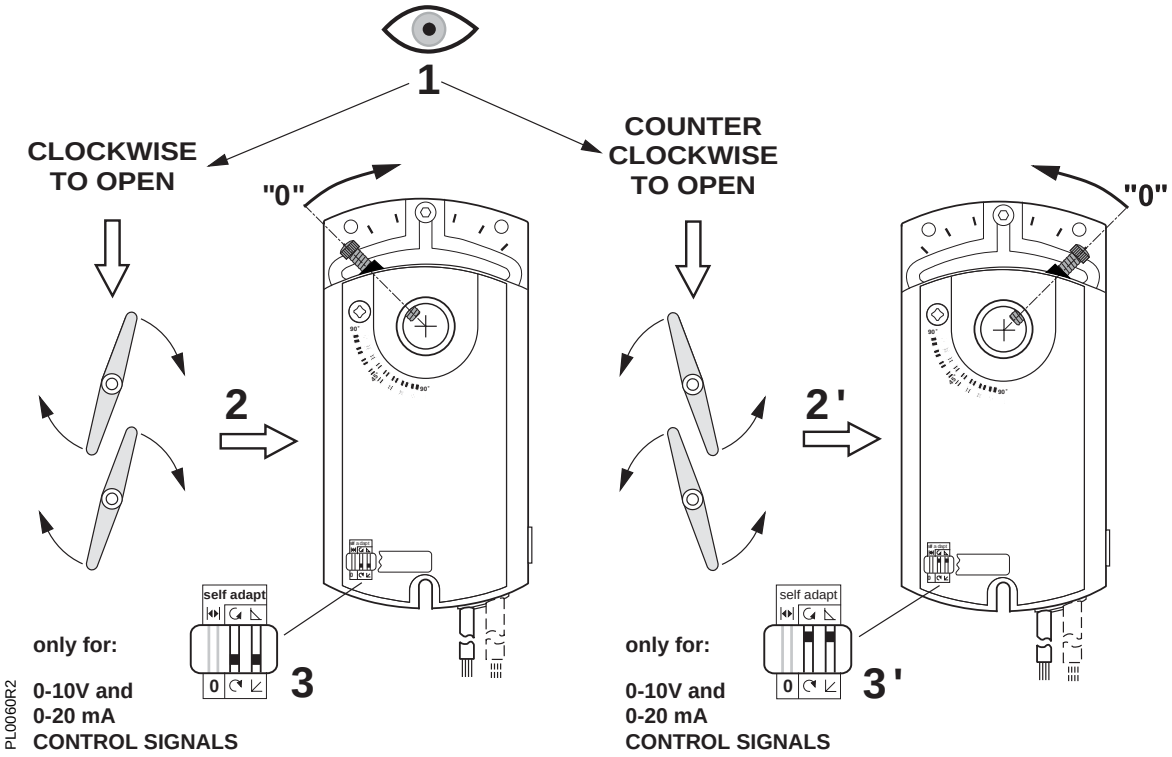
1. To address the DIP switches, raise the tab on the lower left side of the actuator. (See Figure 2). The factory setting is clockwise (middle switch), with a direct-acting feedback signal (right switch).
2. Close the tab over the DIP switches.

3-Position Control

To mount a (3-position) EN44C and EN88C for counterclockwise rotation, follow the *Counterclockwise Damper Rotation* instructions located in the *Wiring Diagrams* section when wiring the actuator to the controller.

EN44 and EN88 Non-Spring Return Electronic Actuators

Installation



NOTE: For a direct-acting feedback signal to track the actuator position, set both DIP switches as shown.

Figure 2. Setting Direction of Rotation.

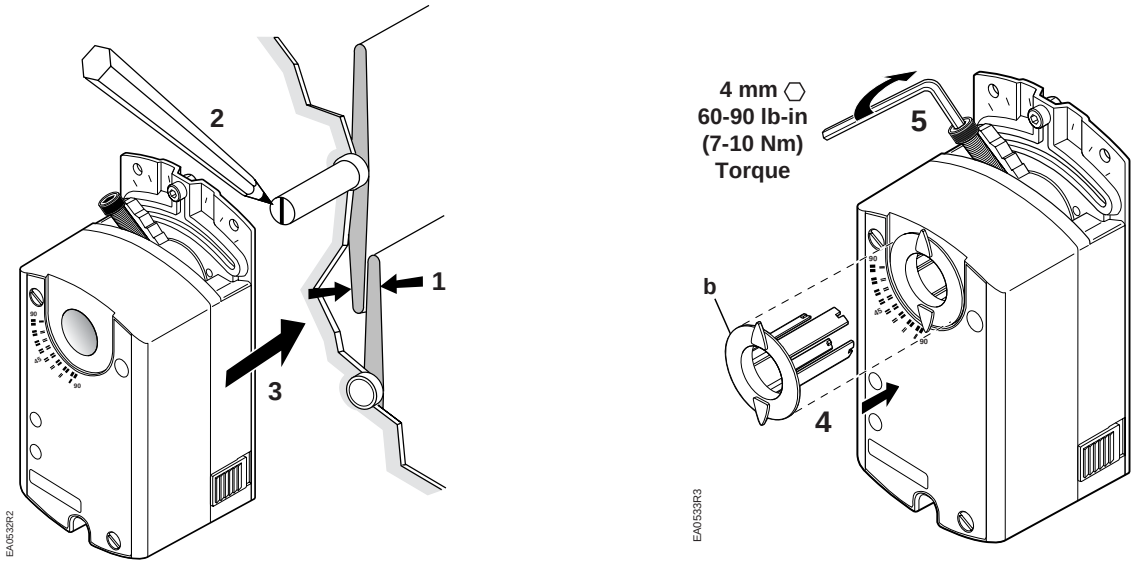


Figure 3. Mounting the Actuator to the Damper Shaft.

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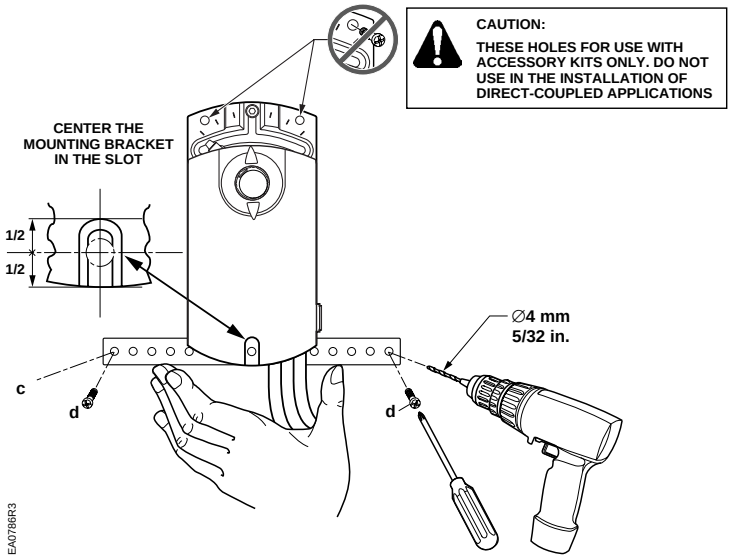

Figure 4. Attaching the Mounting Bracket.

Manual Override

To move the damper blades and lock in the position with no power present:

1. Slide the red manual override switch toward the back of the actuator.
2. Make adjustments to the damper position.
3. Slide the red manual override switch toward the front of the actuator.

Once power is restored, the actuator returns to automated control.

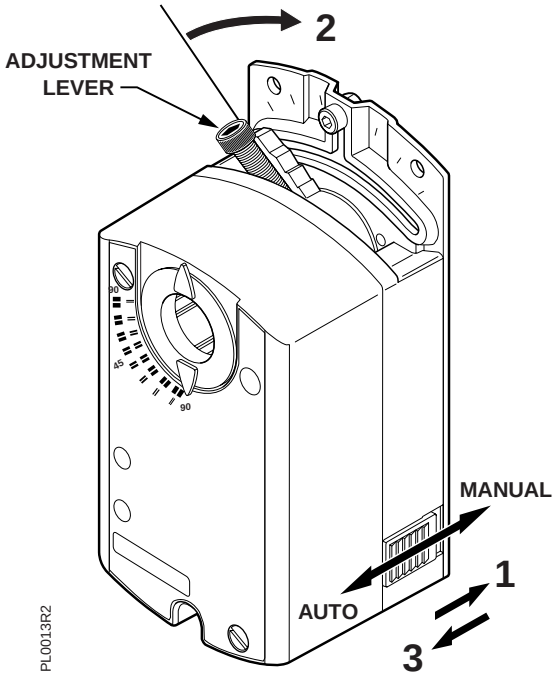

Figure 5. Manual Override.

EN44 and EN88 Non-Spring Return Electronic Actuators

Mechanical Range Adjustment

1. Loosen the stop set screw.
2. Move the screw along the track to the desired position, and fasten it in place.

Mechanical range Limitation and Self-adapt Feature

1. To use the entire 0 to 10 V input signal to control the adjusted range, raise the tab located on the lower left hand side of the actuator and locate the DIP switches (Figures 2 and 7).

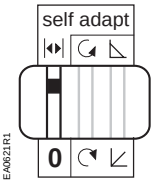

Figure 7. Self-Adapt Switch in the ON Position (Factory Setting = 0, OFF).

2. Set the self-adapt DIP switch to ◀▶ (On).
3. Close the tab over the DIP switches.

For example, if you set the locking screw at 70° and turn the self-adapt switch ON, a 5 V input signal will drive the damper to 35° (50% of its adjusted range).

NOTE: On versions with the slope and offset features, this example assumes offset U0 = 0 VDC and slope ΔU = 10 VDC.

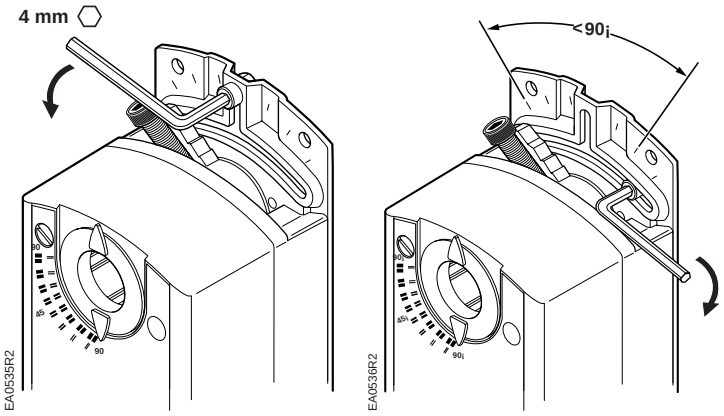

Figure 6. Moving the Mechanical Range Stop.

CAUTION:

When turning the self-adaptive feature on, or after software reset with the feature on, the actuator will enter a five-minute calibration cycle as the actuator adjusts to the rotation limits of the system. The software reset happens after power on, or may be caused by electrostatic discharge (ESD) at levels of 2 kV and above.

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Dual Auxiliary Switch (-S option)

Figure 8 shows the adjustable switching values for the Auxiliary switches A and B.

Actuator Scale: clockwise

Adjustment range for Switches A and B:

Setting interval: 5°
Switching hysteresis: 2°

Actuator Scale: counterclockwise

Factory Setting:

A = 5°
B = 85°

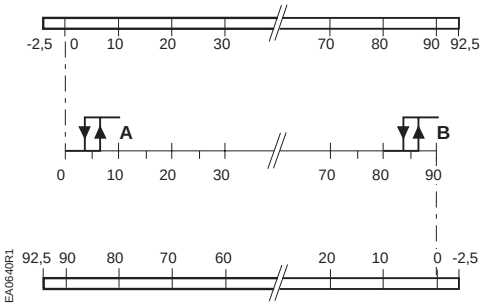

Figure 8. Adjustable Switching Values for the Dual Auxiliary Switches.

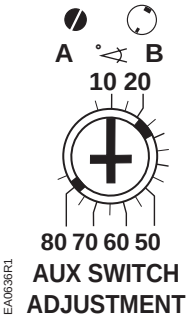

Figure 9.

NOTE: The auxiliary switch setting shafts rotate with the actuator. The scale is valid only when the actuator is in the 0 position on clockwise motion.

Use the long arm of the cross on the Aux Switch Adjustment (Figure 9) to point to the position of switch A. Use the narrower tab on the red ring to point to the position of switch B.

Zero Span Control Signal Adjustment (-ZS option)

EN44B2-ZS(-S) and
EN88B2-ZS(-S) :
For sequencing and the electronic limitation of the angle of rotation.

Use the U0 potentiometer to set the offset (start point) between 0 and 5 VDC.

Use the ∆U potentiometer to set the slope between 2 to 30 VDC.

NOTE:
The ∆U adjustment becomes virtual when the offset and slope setting is greater than 10 V. The Y input is limited to a maximum of 10 VDC. Above 10 V, the angle of rotation is reduced, providing the feature of electronic limitation of the angle of rotation.

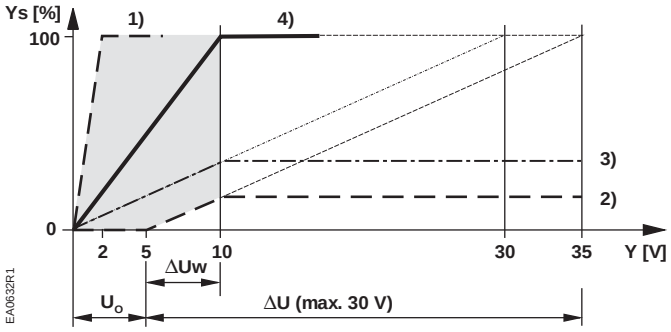

Figure 10.

Ys	Actuator position (100% = angle of rotation 90° *)
Y	Control input signal
U0	Offset (start point)
∆U	Slope
∆Uw	Active voltage range (Ys change)

* When the mechanical limitation of the angle of rotation and self-adapt function are ON (100% does not equal 90°).

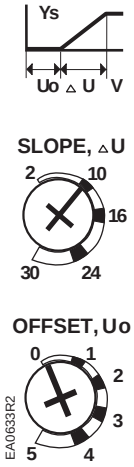

Figure 11.

EN44 and EN88 Non-Spring Return Electronic Actuators

Table 1.

Examples in Figure 10	U0 Offset	ΔU Slope	Active Voltage Range	Ys Actuator Position
1) Minimum slope	0 VDC	2 VDC	0 to 2 VDC	0 to 100 %
2) Limitation of rotation	5 VDC	30 VDC	5 to 10 VDC	0 to 16.7 %
3) Limitation of rotation	0 VDC	30 VDC	0 to 10 VDC	0 to 33.3%
4) Setting shown in Figure 11	0 VDC	10 VDC	0 to 10 VDC	0 to 100 %

Example:
Determine the setting needed to electronically limit the angle of rotation between 0 to 50% (0 to 45°) using a 2 to 10 VDC input.

Calculating the value of ΔU:

$$\Delta U = \frac{100[\%]}{\text{working angle of rotation Ys}[\%]} \times (10[\text{Vdc}] - \text{Uo}[\text{Vdc}]) = \frac{100\%}{50\%} \times (10\text{Vdc} - 2\text{Vdc}) = 16\text{Vdc}$$

Settings:
U0 = 2, ΔU = 16V
Electronic limitation of the angle of rotation: Ys = 50% (45°)
Slope: ΔU = 16 VDC
Active voltage range: ΔUw = 2 to 10 VDC

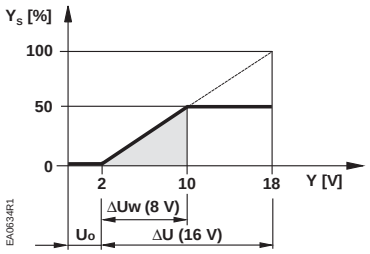

Figure 12. Example.

Dual In-line Package (DIP) Switches

Raise the protective cover from left to right to locate the DIP switches (see Figure 2).

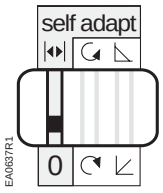

Figure 13. Self-adapt Switch.

The factory setting is 0 (OFF).

When using the mechanical range stop to limit the angle of rotation, turn the self-adapt switch ◀▶ ON so that the adjusted range will become the new 0 to 100% for the actuator logic. In this case, 0 to 100% is not equal to 90°.

When the self-adapt feature is ON, it will automatically check the range after a voltage failure, or after the switch has been turned off and on with operating voltage supplied.

NOTES:

1. Keep the self-adapt feature OFF if the daily, up to five-minute calibration routine causes interference in the control loop.
2. The position output signal U is not influenced by the self-adapt function. The 0 to 10V feedback signal U is always proportional to 0 to 90° (or 90 to 0°).

EN44 and EN88 Non-Spring Return Electronic Actuators

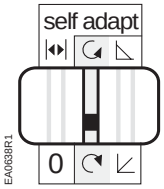

Figure 14. Direction of Rotation Switch.

The factory setting is clockwise.

The direction of rotation switch should match the damper rotation movement.

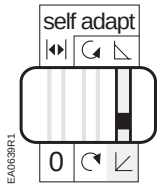

Figure 15. Output Signal Switch.

The factory setting is direct acting.

As the clockwise angle of rotation increases, the output voltage increases.

If the direction of rotation is counterclockwise, the output signal switch should be set at reverse acting to match the direction of the rotation switch.

Wiring

24 VAC

All wiring must conform to NEC and local codes and regulations. Use earth ground isolating step-down Class 2 transformers. Do not use auto transformers. Determine the supply transformer rating by summing the total VA of all actuators used. It is recommended that no more than 10 actuators be powered by one transformer.

Warning:
The switching outputs are rated maximum 24 VAC/24 VDC and a maximum 4A resistive (2A inductive).

Warning:
Installations requiring CE Conformance:

- All wiring for CE rated actuators must only be separated extra low voltage (SELV) or protective extra low voltage (PELV) per HD384-4-41.
- Use safety isolating transformers (Class III transformer) per EN 61558. They must be rated for 100% duty cycle.
- Overcurrent protection for supply lines is maximum 10A.

EN44 and EN88 Non-Spring Return Electronic Actuators

Wiring Diagrams

EN44C2/EN88C2
Two- and Three-Position Control (24 VAC)

Direction of Damper Rotation (EN44C2/EN88C2)
If the damper blades turn counterclockwise to open (CCW), reverse the 6 (violet) and 7 (orange) wires at the controller.

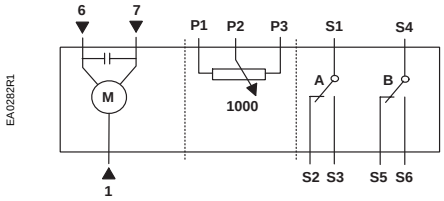

Figure 16.

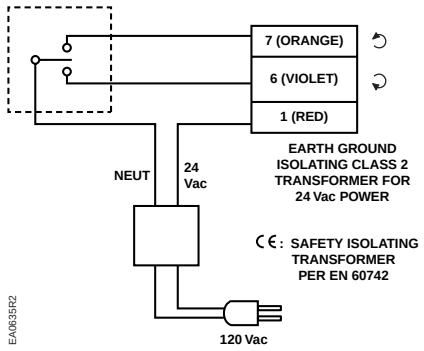

Figure 17.

Table 2. Two or Three-Position Control 24 VAC.

Standard Symbol	Function	Color
		Plenum
1	(+)	Red
6	Control signal clockwise	Violet
7	Control signal counterclockwise	Orange
S1	Switch A Common	Black
S2	Switch A N.C.	Black
S3	Switch A N.O.	Black
S4	Switch B Common	Black
S5	Switch B N.C.	Black
S6	Switch B N.O.	Black
P1	Feedback Potentiometer 0 to 100% P1 - P2	Black
P2	Feedback Potentiometer Common	Black
P3	Feedback Potentiometer 100 to 0% P3 - P2	Black

Caution:

- Do not wire different types of actuators (such as EN177C, EN310C or EN142C) in parallel with these models.
- Do not use Form A relays.

EN44 and EN88 Non-Spring Return Electronic Actuators

EN44B2/EN88B2
Modulating Control (24 VAC)
(0-10 V or 0-20 mA *)

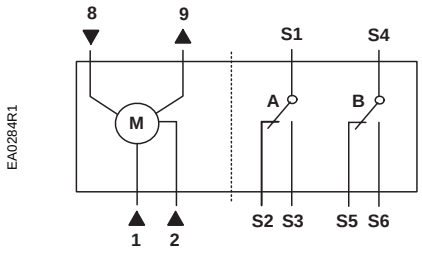

Figure 18.

Warning:
Do not use tandem mount 0-20 mA actuators.

* Add 500 ohm resister across pins 2 and 8 to accept input signal of 0-20 mA.

Table 2. Modulating Control 24 VAC.

Standard Symbol	Function	Color
		Plenum
1	(+)	Red
2	Com	Black
8	0 to 10 V input signal or 0 to 20 mA	Gray
9	Output for 0 to 10 VDC position indication	Pink
S1	Switch A Common	Black
S2	Switch A N.C.	Black
S3	Switch A N.O.	Black
S4	Switch B Common	Black
S5	Switch B N.C.	Black
S6	Switch B N.O.	Black

EN44 and EN88 Non-Spring Return Electronic Actuators

Start-Up/Commissioning

Two or Three-Position Control, EN44C2 and EN88C2

1. Check that the wires are connected correctly.
2. Connect wires 1 (red) and 6 (violet) to a Digital Multimeter (DMM) with the dial set at VAC. Apply a control signal (24 VAC) to wire 6 to verify that the operating voltage is within range.
3. Connect wires 1 (red) and 7 (orange) to a DMM with the dial set at VAC. Apply a control signal (24 VAC) to wire 7 to verify that the operating voltage is within range.

4. Check operation:
   a. Connect wire 1 (red) to the actuator.
   b. Apply a control signal (24 VAC) to wire 6 (violet).
   c. Allow the actuator shaft coupling to rotate from 0 to 90°.
   d. Stop applying a control signal to wire 6 (violet).
   e. Apply a control signal (24 VAC) to wire 7 (orange).
   f. Allow the actuator shaft coupling to rotate from 90 to 0°.

5. Check feedback:
   a. Set the DMM dial to OHMS.
   b. Connect wires P1 and P2 to the DMM. The DMM should indicate a resistive value.
   c. Apply a control signal (24 VAC) to wire 6 (violet).
   d. The reading of the DMM should increase.
   e. Connect wires P2 and P3 to the DMM. The DMM should indicate a resistive value.
   f. Apply a control signal (24 VAC) to wire 7 (orange).
   g. The reading of the DMM should increase.

6. Check the auxiliary switch A (-S option):
   a. Set the DMM dial to OHMS (resistance) or continuity check.
   b. Connect wires S1 and S3 to the DMM. The DMM should indicate an open circuit or no resistance.
   c. Apply a 24 VAC signal to wire 6 (violet).
   d. The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
   e. Stop applying a control signal to wire 6 (violet).
   f. Connect wires S1 and S2 to the DMM. The DMM should indicate an open circuit or no resistance.
   g. Apply a 24 VAC signal to wire 7 (orange).
   h. The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.

7. Check the auxiliary switch B (-S option):
   a. Set the DMM dial to OHMS (resistance) or continuity check.
   b. Connect wires S4 and S6 to the DMM. The DMM should indicate an open circuit or no resistance.
   c. Apply a 24 VAC signal to wire 6 (violet).
   d. The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.
   e. Connect wires S4 and S5 to the DMM. The DMM should indicate an open circuit or no resistance.
   f. Apply a 24 VAC signal to wire 7 (orange).
   g. The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.

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EN44 and EN88 Non-Spring Return Electronic Actuators

Modulating Control, EN44B2 & EN88B2

1. Check that the wires are connected correctly.
2. Check that the offset (start point) and span are set correctly, if used.
3. Check that the direction of rotation switch matches the rotation of the damper shaft.
4. Connect wires 1 (red) and 2 (black) to a Digital Multimeter (DMM) with the dial set at VAC to verify that the operating voltage is within range.
5. Check operation:
   a. Connect wires 1 (red) and 2 (black) to the actuator.
   b. Set the DMM dial to VDC.
   c. Connect wires 2 (black) and 8 (gray) to DMM.
   d. Apply a full scale input signal (10 VDC) to wire 8 (gray).
   e. Allow the actuator shaft coupling to rotate from 0° to 90°.
   f. Disconnect wire 8 (gray).
      The shaft coupling returns to the 0 position.
6. Check feedback:
   a. Set the DMM dial to VDC.
   b. Attach wires 2 (black) and 9 (pink) to the DMM.
   c. Apply a full scale input signal to wire 8 (gray).
      The reading at the DMM should increase.
   d. Remove the signal from wire 8 (gray).
      The reading at the DMM should decrease and the actuator shaft coupling returns to the 0 position.
7. Check the auxiliary switch A (-S option):
   a. Set the DMM dial to OHMS (resistance) or continuity check.
   b. Connect wires S1 and S3 to the DMM.
      The DMM should indicate an open circuit or no resistance.
   c. Apply a full scale input signal to wire 8 (gray).
      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
   d. Connect wires S1 and S2 to the DMM.
      The DMM should indicate an open circuit or no resistance.
   e. Stop the signal to wire 8 (gray).
      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
8. Check the auxiliary switch B (-S option):
   a. Set the DMM dial to OHMS (resistance) or continuity check.
   b. Connect wires S4 and S6 to the DMM.
      The DMM should indicate an open circuit or no resistance.
   c. Apply a full scale input signal to wire 8 (gray).
      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.
   d. Connect wires S4 and S5 to the DMM.
      The DMM should indicate an open circuit or no resistance.
   e. Stop the signal to wire 8 (gray).
      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.

EN44 and EN88 Non-Spring Return Electronic Actuators

Dimensions

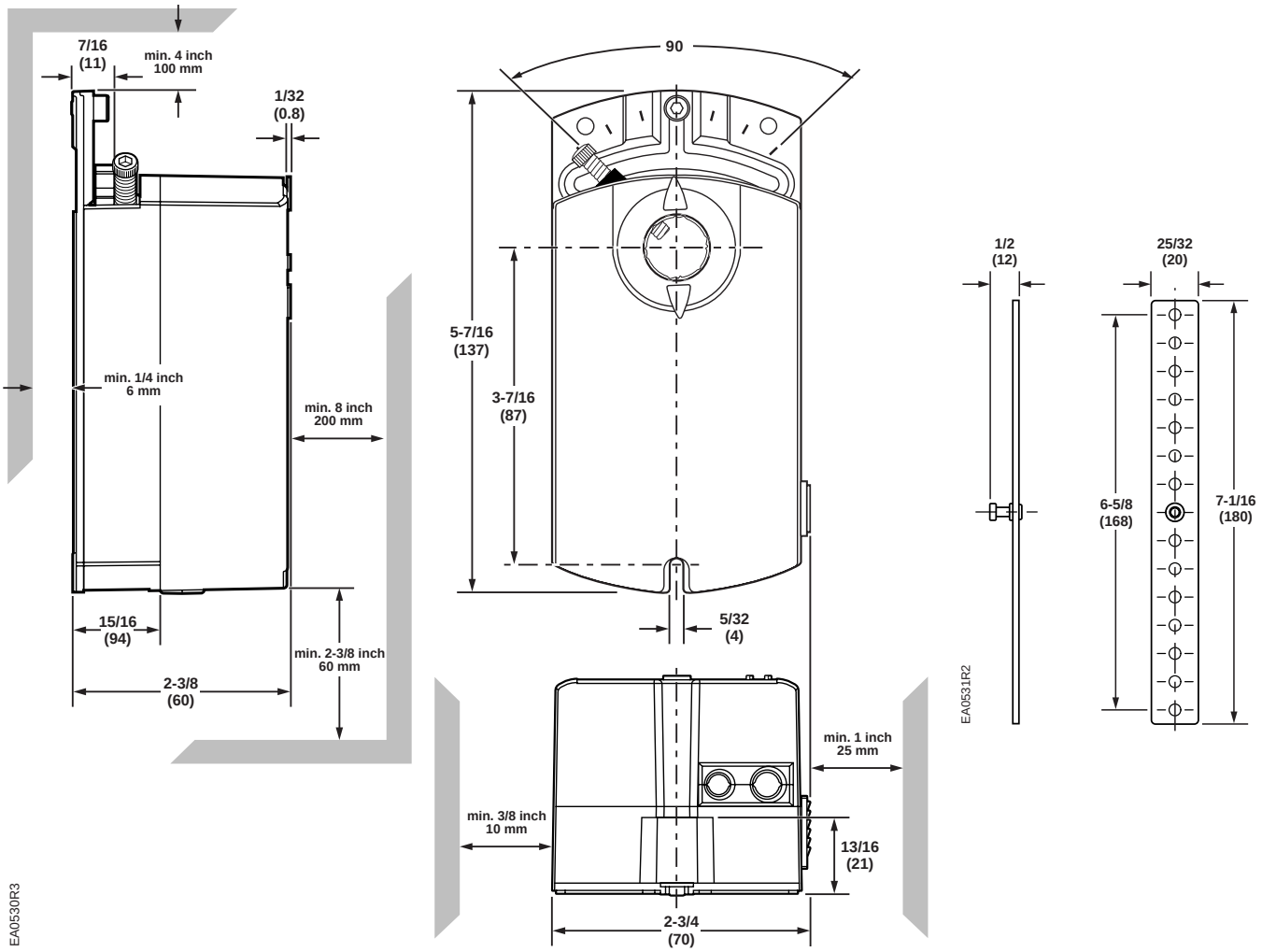


Figure 19. Dimensions of the EN44/EN88 Actuator and Mounting Bracket.

EN44 and EN88 Non-Spring Return Electronic Actuators

Sizing Actuators for Damper Applications

To determine the actuators required for the installation:

- Obtain damper torque ratings (ft-lb/ft^2 or Nm/m^2) from the damper manufacturer.
- Determine the area of the damper.
- Calculate the total torque required to move the damper:

$$\textbf{Total Torque} = \textbf{Torque Rating x Damper Area}$$

- Determine the torque that the actuator must provide:

$$\textbf{Actuator Torque Required} = \frac{\textbf{Total Torque}}{\textbf{SF}}$$

(See note below)

NOTE: Safety Factor: When determining the torque of an actuator required, a safety factor should be included for unaccountable variables such as slight misalignments, aging of the damper, etc. A suggested safety factor is 0.80 (or 80%) of the rated torque.

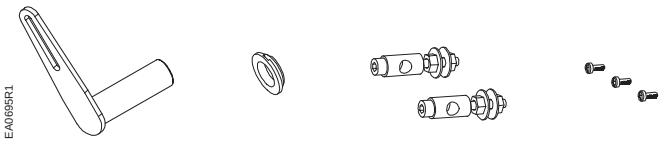
EN44 = 44 lb-in (5 Nm)
EN88 = 88 lb-in (8.5 Nm)

Other actuators are available with higher torques. Please consult the Actuator Selection Guide.

EN44 and EN88 Non-Spring Return Electronic Actuators

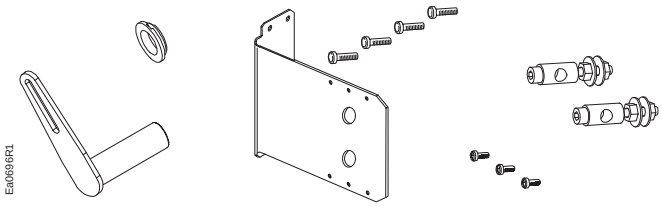
ACCESSORIES

NOTE: The auxiliary switches cannot be added in the field. Order the product number that includes the option, if required.



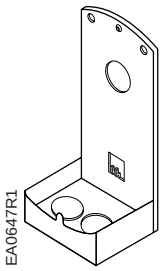
Rotary to Linear.

ASK71.5 This kit allows a direct coupled actuator to provide an auxiliary linear drive.



Rotary to Linear with Bracket.

ASK71.6 This kit allows economical mounting of an actuator to a variety of surfaces. This kit should be used in applications where the actuator can be mounted to a rigid surface and a linear stroke output is needed.



Conduit Adapter.

ASK76.1U This kit provides the connection between the actuator and conduit.

EN44 and EN88 Non-Spring Return Electronic Actuator Installation Guide

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Dual Auxiliary Switch (-S option) ..... EAI/EN4 – 5

Slope and Offset Control Signal Adjustment (-ZS option) ..... EAI/EN4 – 5-6

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- Modulating Control (24 VAC) ..... EAI/EN4 – 11

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