



# EN53 Series Electric Non-Spring Return Actuators

## Installation

**IMPORTANT:** The EN53 Series actuator is intended to control equipment under normal operating conditions. Where failure or malfunction of an EN53 actuator could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory) intended to warn of or protect against failure or malfunction of an EN53 actuator must be incorporated into and maintained as part of the control system.

## Parts Included

- EN53 actuator
- M9000-160 anti-rotation bracket
- two No. 12-24 x 1/2 in. self-tapping hex washer-head screws
- female quick connects

## Special Tools Needed

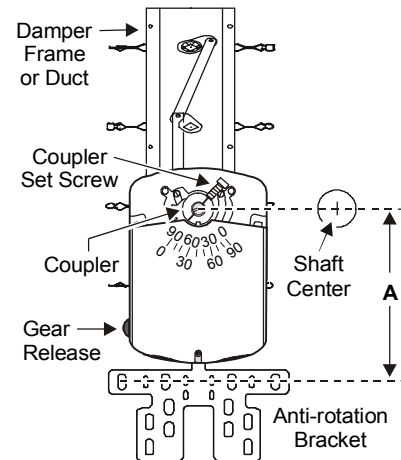
- drill with a 3/16 in. (No. 15, 4.57 mm) drill bit
- 5/16 in. (8 mm) square socket or 3/8 in. (10 mm) 12-point socket
- wire/terminal crimper

## Mounting

The actuators are not position sensitive and can be mounted in any convenient orientation. They can be installed on a 3/8 to 1/2 in. (10 to 13 mm) round shaft or a 3/8 in. (10 mm) square shaft, 1.7 in. (43 mm) or longer. If the shaft is less than 1.7 in. (43 mm), install an extension recommended by the damper manufacturer.

To mount the actuator, proceed as follows:

1. Press and hold the gear release lever, and rotate the coupler to the 0 or 90° position. Release the gear release lever. (See Figure 1.)



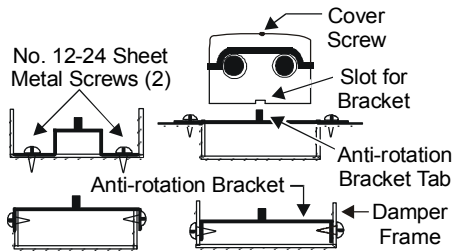
Note: "A" is the distance from the center of the holes in the anti-rotation bracket to the center of the shaft. (See Table 1.)

**Figure 1: Mounting Positions**

**Table 1: Distances from the Anti-rotation Bracket to the Shaft Center**

Shaft Diameter	1/2 in.	3/8 in.
"A" Dimensions (See Figure 1.)	5-1/8 in. 130 mm	5-1/16 in. 128 mm

- Bend or cut the anti-rotation bracket to fit the damper frame or duct as shown in Figure 2.



**Figure 2: Anti-rotation Bracket Positions**

- Close the damper.
- Insert the anti-rotation bracket tab into the slot at the bottom of the actuator (shown in Figure 2), and slide the actuator onto the shaft.
- Refer to the “A” Dimensions in Table 1 and Figure 1 to position the anti-rotation bracket tab midway in the actuator slot.

**IMPORTANT:** The anti-rotation bracket tab must be placed midway in the actuator slot to prevent actuator binding and premature wear.

- Use the anti-rotation bracket as a guide, and drill the holes in the damper frame or duct for the bracket (based on the measurements obtained in Table 1 and Figure 1).
- Attach the anti-rotation bracket to the damper frame or duct with the two self-tapping screws provided, using a 1/4 in. (7 mm) flat-blade screwdriver or 5/16 in. (8 mm) nut driver.

**IMPORTANT:** Do not overtighten the mounting screws to avoid stripping the threads.

- Secure the coupler to the shaft using a 5/16 in. (8 mm) square socket or 3/8 in. (10 mm) 12-point socket to tighten the coupler set screw against the damper shaft. (See Figure 1.)
- Continue tightening the coupler set screw to achieve a torque of 150 to 180 lb·in (17 to 20 N·m).

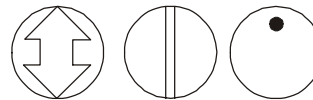
**Note:** Keep the actuator parallel to the mounting surface while tightening the set screw.

- Press and hold the gear release lever, and turn the shaft by hand to ensure the damper rotates from its fully closed to fully open position.
- Release the gear release lever.

### Rotation Range

The damper must be checked as follows:

- Make sure that the damper blade is visually accessible or its position is permanently marked on the end of the damper shaft as shown in Figure 3.



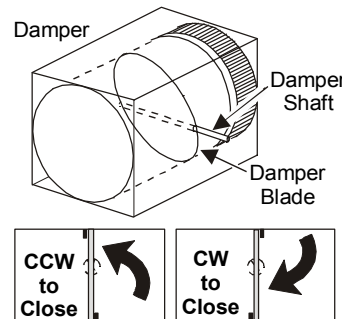
**Figure 3: Damper Position Icons**

- Grasp the damper shaft firmly with pliers and manually turn the damper to fully open.

### 90 Degrees

If the damper shaft rotation is 90°:

- Press and hold the gear release lever shown in Figure 1, and rotate the actuator coupler and damper shaft to the fully closed position as shown in Figure 4.



**Figure 4: Damper Rotation**

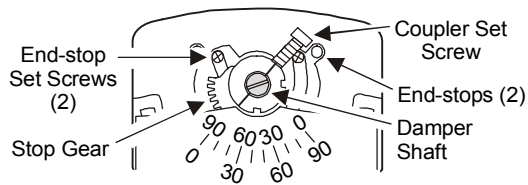
- Note the rotation travel (30 to 90°) and direction, either Clockwise (CW) or Counterclockwise (CCW), required to close the damper.

If rotation is less than 90°, proceed to the *Less than 90 Degrees* section.

- Release the gear release lever.

### Less than 90 Degrees

If the damper shaft rotation is less than 90°, adjust the rotation range of the actuator using the scale on the actuator cover. (See Figure 5.)



**Figure 5: Setting the Rotation Range**

Use the center of the coupler set screw as a pointer to observe the position on the scale when rotating the coupler from one side to the other.

Examples:

- For a rotation range of 90°, move both end-stop set screws fully up as shown in Figure 5.
- To set a rotation range of 60°, leave one end-stop set screw fully up, and adjust the other set screw so the coupler rotates between the 30 and 90° indicator marks on the scale.
- For a rotation range of 45°, adjust both end-stop set screws so the coupler rotates between the 30 and 75° indicator marks on the scale.
- To set a rotation range of 30°, move both end-stop set screws so the coupler rotates between the 30 and 60° indicator marks on the scale.

To accurately set the end stops:

1. Press and hold the gear release lever. Turn the actuator coupler to the minimum rotation position for the minimum ventilation flow required.
2. Release the gear release lever.
3. Use a No. 2 Phillips screwdriver to loosen the end-stop set screw on the actuator that is closest to the stop gear, and move it in its slot so it is tight against the stop gear. (See Figure 5.)

**IMPORTANT:** Do not remove the end-stop set screws, as this could interfere with the actuator's operation.

4. Repeat Steps 1 through 3 to set the desired maximum rotation position.
5. Tighten both end-stop set screws to a minimum of 25 lb·in (2.8 N·m).
6. Turn the actuator coupler and the damper shaft to the minimum rotation position.

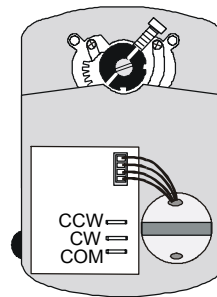
## Setup and Adjustments

### Direction of Action

In the Direct Acting (DA) mode, a minimum control signal drives the actuator to the full CCW position, and a maximum control signal drives it fully CW. For Reverse Acting (RA) operation, a minimum control signal drives the actuator to the full CW position, and a maximum control signal will drive it fully CCW. To set an actuator for RA, proceed to the appropriate section for the actuator model.

### Floating Application: C2 Models Only

For CW rotation and RA operation, apply 24 VAC to the Common (COM) and CW Terminals. For CCW rotation and DA operation, apply 24 VAC to the COM and CCW Terminals. (See Figure 6.)



**Figure 6: Direction of Action**

### On/Off Application: A2 Models Only

Drive the A2 model as an On/Off actuator by wiring continuous 24 VAC power to the COM and CW Terminals. At the same time, command the actuator to open by powering the CCW Terminal with 24 VAC. To drive the actuator back to the full CW position, remove the 24 VAC signal from the CCW Terminal.

### B2 Models

The proportional actuators are factory set for Direct Acting (DA) with Jumper W1 in the DA position. Remove Jumper W1 and place it in the RA position. (See Figure 7.)

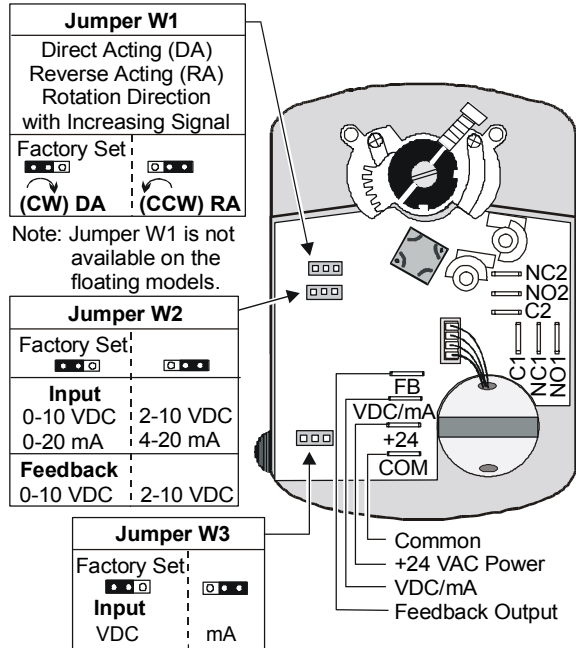


Figure 7: Calibration

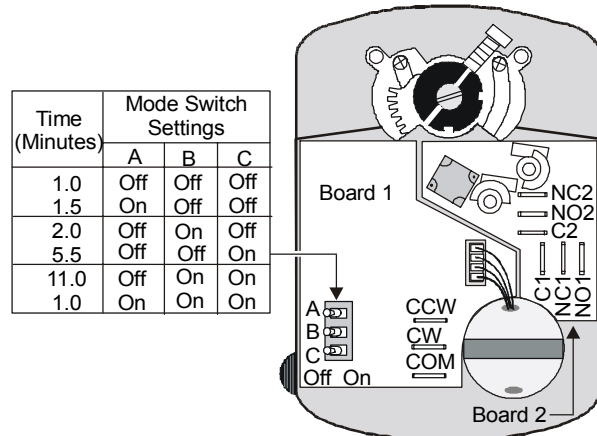
### Jumpers (B2 Models)

The proportional actuators are factory set with Jumper W2 in the 0 to 10 VDC position and Jumper W3 in the VDC position.

The VDC/mA terminal is the control input signal. Jumper W3 must be in the VDC position for voltage input and in the mA position for current input. The FB terminal is the feedback output. (See Figure 7.)

### Mode Switches (A2 Models)

These actuators offer adjustable rotation times of 1, 1.5, 2, 5.5, and 11 minutes. Switch settings determine the rotation time of the EN53A2 and EN53A2-S models. Refer to Figure 8 to position the mode switches for the desired rotation time.

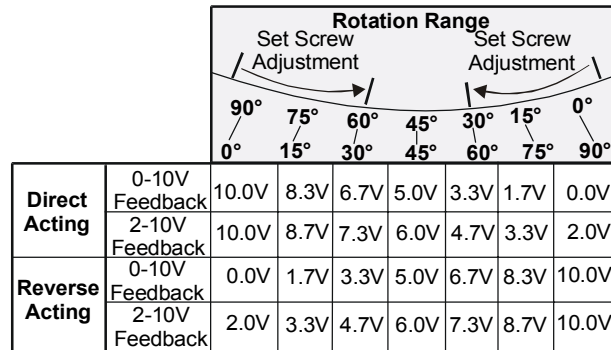


Note: The A2 models have Board 1, and the A2-S models have both Board 1 and Board 2.

Figure 8: Mode Switch Settings

### Feedback Signal

The feedback signal varies with a change to the rotation range. For the B2 and B2-S models, a change to the rotation range changes the feedback signal and the operating range proportionally. (See Figure 9.)



Note: 0-10V is available on EN53B2 and EN53B2-S models.

Figure 9: Nominal Feedback Signal Relative to the Rotation Range

## Wiring



### CAUTION: Equipment Damage Hazard.

Disconnect all power supplies before wiring connections are made or prior to performing maintenance. Check all wiring connections before applying power to the system. Short-circuited or improperly connected wires will result in permanent damage to the equipment.

**IMPORTANT:** Make all wiring connections in accordance with the National Electrical Code and all local regulations.

The actuator requires a 24 VAC control signal and is compatible with a variety of controllers. (See Figure 10.)

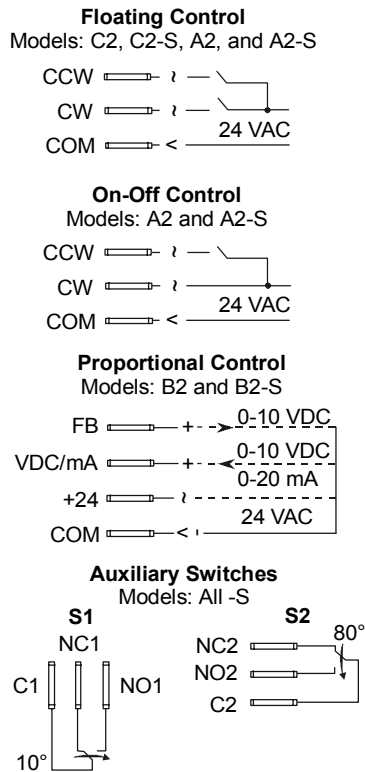


Figure 10: Wiring for EN53 Models

**Note:** To avoid excessive wear or drive time on the motor for the EN53C2 models, use a controller and/or software that provides a time-out function to remove the signal at the end of rotation (stall). The EN53B2 and EN53A2 models have an auto shutoff to avoid excessive wear or drive time on the motor.

### Through the Conduit Openings

Depending on the actuator model selected, one or both conduit openings are used.

1. Loosen the cover screw and remove the actuator cover.
2. Push the plastic conduit plug out of the conduit opening with fingertip. (See Figure 11.)

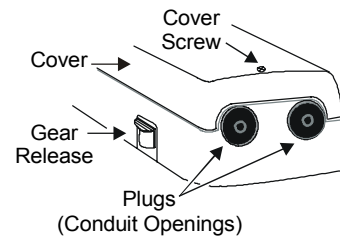


Figure 11: Location of the Conduit Openings

3. Use the Phillips No. 1 screwdriver to puncture a hole through the center of the plastic conduit plug. Reinsert the plug into the conduit opening.

**Note:** For applications requiring metal conduit, thread the conduit fitting into the conduit opening and hand tighten.

4. Insert the cable wires through the plastic plug, compression fitting, or conduit fitting, and connect to the terminals using the appropriate wiring diagram in Figure 10.

**IMPORTANT:** Install all quick-connect terminals in the same direction to prevent shorting. (See Figure 12.)



Figure 12: Orientation of Terminals

**Note:** If using optional pluggable terminal blocks (M9000-105 or M9000-106), insert the cable wires through the conduit opening, then connect the wires to the terminals.

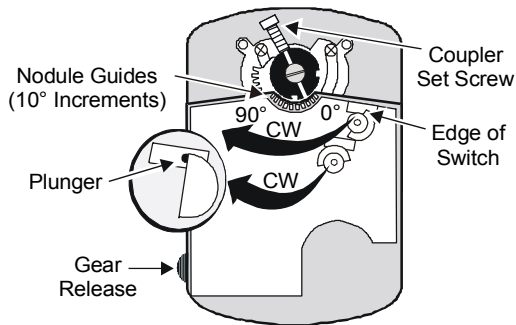
### Auxiliary Switches (-S Models)

The -S models have two built-in auxiliary switches that can be set for any angle between 0 and 90° (factory set for 10 and 80°, nominal). Refer to *Technical Data* section for auxiliary switch ratings.

The following procedures serve as examples to change the position of the auxiliary switch angles when starting at full CCW position.

#### Switch S1

To change the angle of Switch S1 to 20°, refer to Figure 13 and proceed as follows:



**Figure 13: Switch Angle Settings**

1. Press and hold the gear release. Using the 0 to 90° nodule guides, rotate the coupler until the center of the coupler set screw is at 20°.
2. Rotate Switch S1 CW, and align the edge of the switch with the plunger until the plunger rises. (See Figure 13.)

**Note:** At this point, the normally closed contact closes, and the normally open contact opens. (See Auxiliary Switches in Figure 10.)

#### Switch S2

To change the angle of Switch S2 to 70°, refer to Figure 13 and proceed as follows:

1. Press and hold the gear release. Using the 0 to 90° nodule guides, rotate the coupler until the center of the coupler set screw is at 70°.
2. Rotate Switch S2 CW and align the edge of the switch with the plunger until the plunger rises. (See Figure 13.)

**Note:** At this point, the normally closed contact opens and the normally open contact closes. (See Auxiliary Switches in Figure 10.)

3. Press and hold the gear release. Rotate the coupler until the center of the coupler set screw is back to 0°.
4. Check all the wiring, system settings, and apply power to the controller. Provide signals to the actuator to drive it at least one complete cycle open and closed to verify proper operation.

### Repairs and Replacement

Field repairs must not be made. For a replacement or an accessory, refer to the *EN53 Series Electric Non-spring Return Actuators Product Bulletin (LIT-10000053)*.

## Technical Data

<b>Product</b>	EN53 Series Electric Non-Spring Return Actuators	
<b>Power Requirements</b>	C2:	20 to 30 VAC at 50/60 Hz; 2.5 VA supply, Class 2
	A2:	20 to 30 VAC at 50/60 Hz; 2.8 VA supply, Class 2
	B2:	20 to 30 VAC at 50/60 Hz; 3.2 VA supply, Class 2
<b>Input Signal</b>	C2 and A2:	20 to 30 VAC at 50/60 Hz
	B2:	0 to 10 VDC or 0 to 20 mA
<b>Input Signal Adjustments</b>	C2 and A2:	CW and COM Terminals, CW rotation; CCW and COM Terminals, CCW rotation
	B2 (Voltage Input or Current Input):	Jumper Selectable: 0 (2) to 10 VDC or 0 (4) to 20 mA Factory Setting: 0 to 10 VDC, CW rotation with signal increase Action is jumper selectable Direct (CW) or Reverse (CCW) with signal increase.
<b>Input Impedance</b>	C2:	200 ohms, nominal
	A2:	160 ohms, nominal
	B2:	Voltage Input, 150,000 ohms; Current Input, 500 ohms
<b>Feedback Signal</b>	B2:	0 to 10 VDC or 2 to 10 VDC for 90° (1 mA at 10 VDC); Corresponds to input signal span selection
<b>Auxiliary Switch Rating</b>	-S Models:	Two Single-Pole, Double-Throw (SPDT) switches rated at 24 VAC, 1.5 A inductive, 3.0 A resistive, 35 VA maximum per switch, Class 2
<b>Mechanical Output (Running Torque)</b>	1-, 1.5-, and 2-minute Settings:	53 lb·in (6 N·m)
	5.5- and 11-minute Settings:	35 lb·in (4 N·m)
<b>Cycles</b>	100,000 full cycles; 2,500,000 repositions rated at 53 lb·in (6 N·m)	
<b>Audible Noise Rating</b>	35 dBA maximum at 1 m	
<b>Rotation Range</b>	Adjustable from 30 to 90° CW or CCW	
<b>Rotation Time</b>	A2:	Adjustable with switch settings (Factory set for 1 minute; see Figure 8.) 60, 90, 120, 330, or 660 seconds (1, 1.5, 2, 5.5, or 11 minutes) at 60 Hz and 72, 108, 144, 396, or 792 sec at 50 Hz All Other Models: Nominal 60 seconds at 60 Hz and 72 seconds at 50 Hz for 90°
<b>Electrical Connection</b>	1/4 in. spade terminals (Optional pluggable terminal blocks are available.)	
<b>Mechanical Connection</b>	3/8 to 1/2 in. (10 to 13 mm) round shaft or 3/8 in. (10 mm) square shaft	
<b>Enclosure</b>	NEMA 2, IP32	
<b>Ambient Operating Conditions</b>	-4 to 125°F (-20 to 52°C); 90% RH maximum, noncondensing	
<b>Ambient Storage Conditions</b>	A2:	-40 to 186°F (-40 to 86°C); 90% RH maximum, noncondensing
	All Other Models:	-40 to 176°F (-40 to 80°C); 90% RH maximum, noncondensing
<b>Dimensions (H x W x D)</b>	5.9 x 4.2 x 2.64 in. (150.1 x 106.5 x 67 mm)	
<b>Shipping Weight</b>	2.4 lb (1.08 kg)	
<b>Agency Compliance</b>	UL 873 Listed, File E191697, CCN XAPX CSA C22.2 No. 139 Certified, File LR703163, Class 3221 02 CE Mark, EMC Directive 89/336/EEC	

*The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local DEI - Dodge Engineering & Controls, Inc. office. DEI - Dodge Engineering & Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.*



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Printed in U.S.A.