Series 36 Electric Actuator
Installation, Operation and Maintenance Instructions

This manual includes instructions for extra limit switch and auto sequence timer options.

DESCRIPTION
Flowserve Worcester Actuation Systems Series 36 Electric Actuators are unidirectional rotary valve actuators. Standard units can provide up to 550 in-lb of torque delivered at the output shaft. The AC versions of these actuators use rugged shaded-pole motors with integral thermal overload protection and automatic reset. An internal adjustable limit switch is used for accurate control. One additional limit switch (optional) can be mounted within the unit for remote position indication or the control of an auxiliary piece of equipment.

IMPORTANT: Flowserve Worcester Actuation Systems Series 36 Electric Actuators are electromechanical devices subject to normal wear and tear. Actuator life is dependent upon application and environmental conditions. If used in hazardous services, such as but not limited to, media temperature extremes, toxins, flammables, or other services where improper or incomplete operation could produce a safety hazard, it is incumbent upon the system designer and the user to provide proper warning devices such as temperature sensors, oxygen sensors and flow sensors. Flowserve also recommends that the optional auxiliary limit switches be used for monitoring and/or electrical interlock.

I. INSTALLATION
A. Attach mounting bracket to actuator using four (4) cap screws and lockwashers, and tighten securely. For small size top-mount style valves, attach bracket such that bracket nameplate will be to side of valve.

B. Attach actuator/bracket assembly to valve as follows:

CAUTION: Ball valves can trap pressurized media in the internal cavity. If it is necessary to remove any valve body bolts, stem nuts, or remove valve from the line, and if the valve is or has been in operation, make sure there is NO pressure to or in the valve and operate valve one full cycle.

1. Valve Models 51/52 (\(\frac{1}{4}\)-2" only), 59 (2" only), 45 (2\(\frac{1}{2}\" only), 82/83 (\(\frac{1}{4}\)-2" only) and Top Mount 44 (\(\frac{1}{4}\)-2") and 59 (\(\frac{1}{8}\)-1\(\frac{1}{2}\")):

   Note: For above listed valves, it is not necessary to remove any valve body bolts or remove valve from line in order to mount actuator.

   a. Close valve (valve is closed when flats on stem are perpendicular to the line of flow). If any valve information is marked on stop plate or handle, it will be necessary to transfer this information to the bracket nameplate.

   b. For \(\frac{1}{4}\)-2", \(\frac{1}{8}\)-1\(\frac{1}{2}\") 59 series top-mount style valves and \(\frac{1}{4}\)-2" 51/52, \(\frac{1}{8}\)-1\(\frac{1}{2}\") 82/83 series valves, with high cycle stem packing as standard, remove handle nut, lockwasher, handle, separate stop plate (if any), retaining nut and stop pin(s). Add the two additional Belleville washers with their larger diameter sides touching each
other. Add the self-locking nut to the stem and tighten while holding the stem flats with a wrench. Tighten until Belleville washers are flat, the nut will ‘bottom’, and then back nut off 1/3 turn. The two additional Belleville washers and the self-locking nut are included in the mounting kit.

CAUTION: The self-locking stem nut is difficult to tighten, and must fully flatten the Belleville washers before backing off.

For 2” 59, 2 1/2” 45, and 2” 82/83 valves only, remove handle assembly, retaining nut, stop and stop screws. Replace with valve stem spacer, or with two Belleville washers (if valve has graphite stem packing), and replace retaining nut. NOTE: Belleville washers are installed with larger diameters touching each other. Using a wrench to prevent stem from turning, tighten retaining nut until stem packing is fully compressed or Bellevilles, if used, are fully flattened, then back off 1/3 turn. Excessive tightening causes higher torque and shorter seal life. NOTE: Valves with VS1 high cycle stem packing option installed, identified by two Belleville washers installed and handle assembly, stop and stop screws removed, do not require stem area disassembly.

c. Center coupling on valve stem.

d. Lower actuator/mounting bracket assembly over coupling and onto valve, making sure that the slot in the actuator shaft will engage male tang on coupling.

e. Secure bracket to valve using cap screws and lockwashers provided in mounting kit. Tighten securely. For small size top-mount style valves, the bracket nameplate will be to the side of the valve.

II. ELECTRICAL INSTALLATION AND ADJUSTMENT
(Refer to Figures 1 and 2)

Make conduit connection to NPT fitting on actuator base (1/2” NPT for 10-2036).

CAUTION: In cases where the conduit connected to the actuator may be partially or completely run underground, or through which moisture may contact energized live parts, or where the actuator and/or conduit is exposed to temperature differences, the conduit should be sealed within 18” of the actuator in accordance with the National Electrical Code.

A. Wiring Termination

The 36 Actuator wiring is done using the wire terminations provided. One “wire nut” is used to connect the actuator’s “free” motor lead to incoming power. Two other incoming leads are connected at the actuator limit switch by 3/16” “quick-connect” crimp-type wiring connectors. These wiring connectors are fitted to the NO (normally open) and NC (normally closed) terminals of the actuator limit switch.

B. Actuator Rotation

Incoming power is alternately applied between the NO or NC switch terminals and the “free” motor lead. When the proper voltage is applied to the actuator its output shaft and bull gear turn counterclockwise (CCW) when viewed from above.

C. Proper 90° Operation

The 36 Actuator is a unidirectional actuator which is designed to stop at each 90° position of one complete rotation. This interval is determined by the detents on the face of the actuator’s output gear. The arm of a limit switch rides over these detents controlling the point at which actuator motion will stop.

Mounting the actuator to the valve such that the actuator’s conduit entry is in line with the piping will allow the following operation:

<table>
<thead>
<tr>
<th>Switch Arm Position*</th>
<th>Valve Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up</td>
<td>Open</td>
</tr>
<tr>
<td>Down</td>
<td>Closed</td>
</tr>
</tbody>
</table>

*The switch arm has just hit the transition point on the gear face detent.

Rotating the entire actuator on the valve 90° (and rotating the ball 90°) so that the conduit opening is cross-line to the piping will
Flow Control

Worcester Actuation Systems

change the above details. When the switch arm is up, the valve is closed; when the switch arm is down, the valve is open.

D. Proper Alignment of Switch:
The limit switch is adjusted and set at the factory for proper 90° operation. Verify switch setting prior to operation. In the event that the switch is not at the desired setting, adjust as follows:
The limit switch of the 36 Actuator can be adjusted in two directions; up-and-down and side-to-side (refer to Fig. 2).

To adjust the limit switch, loosen the adjusting screws on the casting's switch support. Once these screws are loosened, the limit switch can move up, down and sideways a total of 3/8 inches.

Moving the switch horizontally causes both stop points to shift. Moving the switch vertically changes the 90°/90° rotation.

Adjust the switch vertically for uniform 90° cycles, then shift it horizontally to set the stop points.

Secure the switch fastening screws when proper valve indexing is verified thru one complete rotation of the valve (360°).

The actuator is now ready for operation.

III. MAINTENANCE and TROUBLESHOOTING

⚠️ WARNING: Disconnect power during cover removal.

The Series 36 Electric Actuator requires no regular maintenance. The actuator utilizes a permanently lubricated gear train. No additional lubrication is necessary.

Should the actuator fail to operate, the following are hints for troubleshooting.

Electrical Supply: Be sure the actuator is supplied with the correct voltage.

Electrical Connections: Does the wiring conform to the wiring diagram?

IV. SPARE PARTS

The following are recommended spare parts which should be kept on hand for Series 36 Electric Actuators:

1 Spare Limit Switch (Used for Valve Control Only)

NOTE: This spare limit switch can be ordered by part number and differs from the (optional) extra limit switch.

When ordering any spare parts, please specify actuator size and voltage.

V. ELECTRICAL REQUIREMENTS

The following table represents current draw in amperes at the various voltages and rated stall torque for each motor:

<table>
<thead>
<tr>
<th>Voltage (AC)</th>
<th>1036 (5 sec.)</th>
<th>2036 (5 sec.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>2.3</td>
<td>3.8</td>
</tr>
<tr>
<td>240</td>
<td>1.0</td>
<td>1.7</td>
</tr>
</tbody>
</table>

The duty cycle for all motors used in the Series 36 Actuator is 20% (at 70°F).
<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Base</td>
<td>Die Cast Aluminum</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Bearing</td>
<td>Sintered Bronze</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Seal (Base)</td>
<td>Rubber</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Spur Gear</td>
<td>Steel (Black Oxide Coating)</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Retaining Shroud</td>
<td>Steel (Black Oxide Coating)</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>Motor Module (AC)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>Motor Mounting Screw</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>O-Ring (Motor Screw)</td>
<td>Buna</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>Cover</td>
<td>Die Cast Aluminum</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>Cover Screw</td>
<td>Plated Steel</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>Flange Gasket (Cover Seal)</td>
<td>Neoprene</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>Limit Switch</td>
<td>Phenolic</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
<td>Switch Mounting Screw</td>
<td>Plated Steel</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>Spacer (Limit Switch)</td>
<td>Phenolic</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
<td>Spacer Mounting Screw</td>
<td>Plated Steel</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>Lockwasher</td>
<td>Plated Steel</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>Nut</td>
<td>Plated Steel</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>Conduit Plug</td>
<td>Polyethylene</td>
</tr>
</tbody>
</table>

To order proper parts, please specify the actuator size, model, and revision number. Use the standard nomenclature listed above.
VI. OPTIONS

1. Extra Limit Switch Installation
A. The extra limit switch, M1, is different from the limit switch used in the actuator for proper valve indexing. Tripping of the extra limit switch is advanced due to a shorter lever arm on the switch.
B. Remove the actuator cover.
C. Remove the screws attaching the actuator's limit switch to the limit switch spacer.
D. Position the extra limit switch against the existing limit switch and fix both switches to the spacer, use the longer screws provided with the extra limit switch kit and reuse the existing lockwashers (see Figure 2).

NOTE: The extra limit switch contact arm must lead (be shorter than) the contact arm of the actuator operating switch, i.e., the auxiliary switch must trip before the positioning switch.

E. Three quick-connectors are provided for fixing external wiring to this extra limit switch. Using the proper crimping tools, connect field wiring to these connectors.
F. Adjust the limit switches as necessary to obtain the necessary switch actuation through the extra limit switch’s three terminals

Common (c) Normally-Open (NO) Normally-Closed (NC)

These terminal designations are shown on the switch body.

With the switch lever arm up, the NO terminal becomes closed; with the switch lever arm down the NO terminal is open.

G. Test the actuator and check continuity of the M1 switch. It must trip before limit switch does.
H. With the switch properly adjusted, tighten all screws, tuck all wiring away from any rotating parts and replace actuator cover. Tighten each actuator cover screw insuring that cover to base seal remains properly in position.

2. Auto Sequence Timer
A. GENERAL
The Worcester Actuation Systems Auto Sequence Timer is a solid state electronic circuit board which is mounted inside the 36 actuator. It is available at 120 VAC standard. The timer allows the actuator to periodically open and close a valve for various time periods that are field-selectable. By simply opening or closing switches on the timer’s circuit board, various open and closed time periods can be selected.
B. TIME PERIODS
The following table shows the required switch position of the several switches in a small switch package mounted on the board. The first four switches, #1 through #4, control the open time, while the second four switches, #5 through #8, control the closed time.

Timer cycle operation is indicated by two board-mounted light emitting diodes (LEDs). For current boards (identified by a label containing the board part no. and revision letter), the lower LED lights when the timer is in the short-time part of its cycle, normally the open time period. The upper LED lights when the timer is in the long-time part of its cycle, normally the closed time period. The LEDs on older boards are reversed.

IMPORTANT - A minimum of one switch in the first four switches, #1 through #4, AND a minimum of one switch in the second four switches, #5 through #8, MUST BE in the “ON” position for the auto sequence timer to properly operate. (The “ON” position is marked on the switch).

The open cycle selection is independent of the closed cycle selection; “O” = Switch On, “X” = Switch Off.

<table>
<thead>
<tr>
<th>OPEN CYCLE SWITCHES</th>
<th>CLOSED CYCLE SWITCHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 TIME IN SECONDS</td>
<td>1 2 3 4 TIME IN SECONDS</td>
</tr>
<tr>
<td>O X X X 6</td>
<td>O X X X 25</td>
</tr>
<tr>
<td>X 0 X X 12</td>
<td>X 0 X X .50</td>
</tr>
<tr>
<td>0 0 X X 18</td>
<td>0 0 X X .75</td>
</tr>
<tr>
<td>X X 0 X 24</td>
<td>X X 0 X 1.00</td>
</tr>
<tr>
<td>0 X 0 X 30</td>
<td>0 X 0 X 1.25</td>
</tr>
<tr>
<td>X 0 0 X 36</td>
<td>X 0 0 X 1.50</td>
</tr>
<tr>
<td>0 0 0 X 42</td>
<td>0 0 0 X 1.75</td>
</tr>
<tr>
<td>X X X 0 48</td>
<td>X X X 0 2.00</td>
</tr>
<tr>
<td>0 X X 0 54</td>
<td>0 X X 0 2.25</td>
</tr>
<tr>
<td>X 0 X 0 60</td>
<td>X 0 X 0 2.50</td>
</tr>
<tr>
<td>0 0 X 0 66</td>
<td>0 0 X 0 2.75</td>
</tr>
<tr>
<td>X X 0 0 72</td>
<td>X X 0 0 3.00</td>
</tr>
<tr>
<td>X X 0 0 78</td>
<td>X X 0 0 3.25</td>
</tr>
<tr>
<td>X 0 0 0 84</td>
<td>X 0 0 0 3.50</td>
</tr>
<tr>
<td>0 0 0 0 90</td>
<td>0 0 0 0 3.75</td>
</tr>
</tbody>
</table>

C. WIRING
The auto sequence timer is mounted into the actuator as shown in Figure 4. Field wiring connects to the terminal block as shown in the wiring diagram, Figure 3.

D. RESET SWITCH
Included with the auto sequence timer circuit board is a reset switch that is mounted to the base of the actuator with a waterproof boot. The switch, when pressed and held, will allow the timer circuit to open the valve. (Hold down until the valve is open! Leaving the valve partly open will stall the actuator.)

Releasing the button will automatically restart the sequence that is selected on the board’s time period selection switch, starting with “on” time.

- A minimum of one switch in the first four switches, #1 through #4, AND a minimum of one switch in the second four switches, #5 through #8, MUST BE in the “ON” position for the auto sequence timer to properly operate. (The “ON” position is marked on the switch).

The open cycle selection is independent of the closed cycle selection; “O” = Switch On, “X” = Switch Off.
Figure 3

ACTUATOR OUTPUT SHAFT MUST ROTATE CCW WHEN VIEWED FROM THE MOTOR END OF THE ACTUATOR.

WIRING DIAGRAM
Located Inside Actuator Cover

WHENEVER THE RESET IS USED, IT MUST BE HELD IN THE OPERATING POSITION UNTIL THE VALVE HAS COMPLETED THE OPENING CYCLE.

Figure 4

SECTION 9-9
RESET SWITCH ASSEMBLY

BLACK LEAD FROM MOTOR TO TERMINAL B
RESET SWITCH

TIME PRESET SELECTION SWITCH

LIMIT SWITCH WIRING

RED LEAD FROM CIRCUIT BOARD
BLACK LEAD FROM CIRCUIT BOARD

SWITCH RETURNING SPRING
SWITCH RETURNING NUT
SWITCH BODY

ITEM DESCRIPTION
1. BLACK LEAD FROM MOTOR TO TERMINAL B
2. TIME PRESET SELECTION SWITCH
3. LIMIT SWITCH WIRING
4. SECTION 9-9
RESET SWITCH ASSEMBLY
5. BLACK LEAD FROM MOTOR TO TERMINAL B
6. LIMIT SWITCH WIRING
7. TIME PRESET SELECTION SWITCH

SUPPLY VOLTAGE 120 VAC

DOTTED LINES INDICATE WIRING BY CUSTOMER.
E. INSTALLATION

Install the 36 actuator per Sections I and II of this manual. Verify that the 36 actuator limit switch is properly secured.

Valve opening time (“on” time) is powered through the circuit board’s red wire and is connected to the limit switch’s (NC) normally-closed contact. Valve closed time is powered through the circuit board’s black wire and is connected to the limit switch’s (NO) normally-open contact. (See Figures 3 and 4.)

When the actuator, with its timer, is properly installed and wired, simply apply power to the actuator to begin operation.

After power is turned on, the valve will open for the required short time period and then close and stay closed for required long period.

F. TROUBLESHOOTING

Proper limit switch action in the 36 actuator is very important for proper timer operation.

If erratic operation is noted, do the following:

1. Verify that valve operates easily and is not sticking. Verify that proper AC voltage is available at terminals 1 and 2.

2. Verify that the timer board is cycling properly by observing the operation of the LED cycle indicators and/or the operation of the reset switch to force the timer board into the open cycle. (Note: If timer is already in the open part of the cycle, lower LED is lighted for current boards or upper LED for older boards. Operation of the reset switch will have no effect.) It is suggested that, for checking purposes, the shortest time periods be set into each cycle to minimize testing time. (Only switches 1 and 5 should be in the ON position.)

3. Verify proper actuator and actuator limit switch operation. Remove supply power from the actuator. Disconnect the supply power at the circuit board terminal strip and remove the circuit board’s red and black wires at the limit switch. Tape these leads’ ends and fold them back away from the limit switch contacts. Apply power between the motor common lead and the limit switch’s NO and then NC switch contacts. The actuator should open and then close as power is alternately applied between the motor common lead and these switch contacts. If problems are noted, either the limit switch or motor is defective.

4. If in Step 2 above, the motor operates properly but actuator does not stop at correct position, check the limit switch for proper adjustment. Adjust the limit switch as noted in Section II, Parts C and D. If the limit switch is defective, remove and replace the switch.

5. If the actuator motor and switch are properly operating, then erratic problems are caused by the auto sequence timer circuit board. Remove circuit board and replace with a new circuit board from Flowserve.
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