VALVCON
QX-Series
ELECTRIC ACTUATORS

Installation, Maintenance and
Operating Instructions
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READ THESE INSTRUCTIONS FIRST!

These instructions provide information about safe handling and operation of the actuator.
If you require additional assistance, please contact the manufacturer or manufacturer’s representative.
Addresses and phone numbers are printed on the back cover.
See also www.metso.com/valvcon for the latest documentation.

SAVE THESE INSTRUCTIONS!

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1 GENERAL

1.1 QX-Series Electric Actuators

QX-Series Electric Actuators are designed to provide reliable, efficient operation of final control elements, such as 1/4 turn valves, with torque requirements up to 3,000 inch pounds. QX-Series actuators are available in 12 VDC & 24 VDC.

2 OPERATION

2.1 QX-Series Operation

The QX-Series actuator is designed for On/Off (Open/Close) operation. The default position/direction of travel is clockwise, power must be applied to terminals 1 (NEG/-) and 2 (POS/+). To drive in the counter-clockwise direction, an additional “control signal” must be applied to terminal 3 (POS/+); when this “control signal” is de-energized, (and power is still present at terminals 1 and 2) the actuator will return to the clockwise position. Two single-pole, double-throw limit switches control the ends of travel; the actuator will continue to drive in the “powered” direction until power is removed or a cam trips an end-of-travel switch. Power may be removed mid-stroke to position the final drive device. Once the actuator reaches an end-of-travel switch, power and the “control signal” may be removed or left applied without damaging the actuator. The actuator includes two auxiliary limit switches that maybe used for position indication or for interlocking other devices.

The actuator includes two auxiliary limit switches that may be used for position indication or for interlocking other devices.

2.2 Wiring Diagram

The QX-Series actuator operates from the customer’s supplied external power (DC+/POS and DC-/NEG). When power is applied to terminals 1 (NEG/-) and 2 (POS+/+) the actuator will drive in the clockwise direction. When a “control signal” is applied to terminal 3 (POS/+), and power is still present at terminals 1 and 2, the actuator will drive in the counter-clockwise direction. (Refer to Figure 1 for the power and control wiring connections.)

Figure 1

QX Actuator Wiring for 12 AND 24 VDC – Small Enclosure (top), Large Enclosure (bottom)
2.2.1 Wiring

To drive the actuator CW, apply DC -/NEG to terminal 1 and DC +/POS to terminal 2. To drive the actuator CCW, apply DC +/POS to terminal 1, DC -/NEG to terminal 2 and an additional "control signal", DC +/POS to terminal 3. Removing the "control signal" at terminal 3 will cause the actuator to drive CW. Power may be removed mid-stroke to position final drive device. Power and the "control signal" can be left applied or removed after end-of-travel limit switch is tripped. Be sure to follow local wiring codes.

2.3 Adjustment of End-Of-Travel Limit Switches

Two limit switches operated by cams on the output shaft determine the exact positions where the actuator will stop at the end of each cycle. Counting from the bottom, the first switch determines the CW end-of-travel position. The second switch determines the CCW end-of-travel position. The limit switches can be adjusted from 5° to 270° of actuator rotation. If adjustment of the open or closed position is required, proceed as follows:

Caution: Disconnect power supply circuit before opening enclosure.

A. Remove the cover

Remove the actuator cover by removing the screws securing the cover to the base.

B. Drive the actuator to the full CCW position.

C. Adjust the CCW limit switch cam

1) Using a 1/16 inch hex wrench, loosen the set screw in the CCW limit switch cam (the second from the bottom).
2) Rotate the cam toward the limit switch arm until the switch just clicks closed.
3) Re-tighten the set screw on the limit switch cam (Be careful not to over-tighten the screw).

D. Drive the actuator to the full CW position.

E. Adjust the CW limit switch cam

1) Using a 1/16 inch hex wrench, loosen the set screw in the CW limit switch cam (the bottom one).
2) Rotate the cam toward the limit switch arm until the switch just clicks closed.
3) Re-tighten the set screw on the limit switch cam (Be careful not to over-tighten the screw).

F. Replace the cover

2.3.1 Additional Limit Switches

These switches are factory set to trip just before the end-of-travel limit switches. If adjustment is desired, the switches are set in the same manner as the end-of-travel limit switches.

CW Indication Switch: (3rd from bottom) NO to Terminal 7  
COM to Terminal 8  
NC to Terminal 9

CCW Indication Switch: (4th from bottom) NO to Terminal 10  
COM to Terminal 11  
NC to Terminal 12

2.4 Temperature Limits

2.4.1 Low Ambient Temperatures

The minimum recommended ambient temperature is -40°F.

2.4.2 High Ambient Temperatures

The maximum recommended ambient operating temperature is 150°F. NOTE: Actuators mounted outdoors must be shaded from direct sunlight to keep the internal temperature below 150°F. Sustained exposure to temperatures over 150°F can damage the internal components.

2.4.3 High Media Temperatures

For media temperatures between 200°F and 300°F, a shielding plate (about one inch larger than the actuator in each dimension, and at least a 1/16" thick) should be placed between the actuator and the mounting bracket. In addition, the actuator should not be mounted directly above the pipe. For media temperatures above 300°F, a valve with an extended shaft mounting arrangement should be used.

3 MOUNTING THE ACTUATOR

CAUTION: Dangerous voltages are present inside the actuator cover unless the power supply to the actuator has been shut off or disconnected. Use extreme caution whenever working on the actuator with the cover removed.

3.1 Tools Required

1/16 inch hex wrench (cam set screw wrench)  
3/16 inch hex wrench (cover bolts)  
Small flat blade screwdriver
3.2 Actuator Installation

Verify that the output torque of the actuator is appropriate for the torque requirements of the valve. The output torque is listed on the actuator’s base nameplate.

Actuator Drive Output - QX-Series actuators are furnished with a female drive output. Two bolt hole patterns (ISO 5211) are provided for actuator mounting (See figure 3).

Bracket requirements - It is mandatory that the actuator be firmly secured to a sturdy mounting bracket. A minimum of four bolts with lock-washers should be used to secure the actuator to the bracket. No flexibility in the bracket is allowed, and backlash, or "play", in the coupling should be minimized. The actuator output shaft must be in-line (centered) with the valve shaft to avoid side-loading the shaft.

4 MANUAL OVERRIDE

To use the manual override, push the override shaft down approximately 1/4 inch to disengage the motor from the gear train. Failure to disengage motor prior to turning override will cause damage to the actuator. While holding the shaft down, turn the shaft with a wrench or handle to the desired position. The override shaft on actuators below 1000 in•lb must be rotated in the opposite direction of the desired direction of the output shaft. In actuators 1000 in•lb and above, the override and the output shaft turn in the same direction.

Do not drive the actuator beyond the limit switch settings. The manual override shaft must be returned to its fully upward position before the motor is re-engaged. Rotate the shaft slightly to align the spur gears until the shaft "springs" back to its re-engaged position. Note: The rotation direction of the output may not be the same as the rotation of the override shaft!

5 TROUBLESHOOTING

If the actuator fails to operate:

- Check that proper voltages are present at the actuator’s terminal connections.
- Check that all connections are properly made.
- Check that the limit switches are properly set.
- Check that the actuator has enough torque output for the application.

6 QX-SERIES STANDARD OPTIONS

6.1 Option “H” - Tropical Heater and Thermostat

The tropical heater and thermostat option is a self-adhesive, resistant heater strip which is applied to primary gear-box. It is hard-wired to the terminal block and is recommended in high-humidity applications. The tropical heater option is also recommended installations that experience wide temperature swings in order to evaporate any condensation. Thermostat is pre-set to activate at or below 90°F and deactivate at or above 110°F. The tropical heater draws 15 watts @ 12 VDC and 24VDC. This option is factory installed only.

6.2 Option “I” – ISO 5211 Output

150 – 600 in-lb models are supplied with a 3/4” female square output coupling; when the “I” option is selected they are supplied with a 14 mm female square.

1000 – 3000 in-lb models are supplied with a 1” female square output coupling; when the “I” option is selected, 1000 in-lb models are supplied with a 19 mm female square and 1500 – 3000 in-lb models are supplied with a 22 mm female square.

This option is factory installed only.

6.3 Option “T” – Heater and Thermostat

The heater and thermostat option is a self-adhesive, resistance heater strip which is applied to the primary gearbox. It is hard-wired to the terminal block and is required in installations where the ambient temperatures drop below 32°F. The heater option is also recommended in installations that experience wide temperature swings in order to evaporate any condensation. The thermostat is pre-set to activate at or below 40°F and deactivate at or above 60°F. The heater draws 15 watts @ 12 VDC and 24VDC. This option is factory installed only.

6.4 Option “Y” – Keyed Output

150 – 600 in-lb models are supplied with a 3/4” female square output coupling as standard; when the “Y” option is selected they are supplied with a 15mm female keyed output.

1000 – 3000 in-lb models are supplied with a 1” female square output coupling as standard; when the “Y” option is selected they are supplied with a 20mm female keyed output.

This option is factory installed only.
6.5 Option “Z” – Handwheel Override
P/N VC009097, P/N VC009098

All QX-Series actuators are supplied with a wrench-operated manual override shaft. If the Handwheel Override option is selected the shaft is replaced by a declutchable shaft and a six-inch handwheel.

This option can also be installed in the field; for 150 – 600 in•lb models order kit P/N VC009097 and for 1000 – 3000 in•lb models order kit P/N VC009098.

7 VOLTAGE

12 VDC & 24 VDC. QX-Series actuators are rated for full torque at +/- 10% of the nominal voltage. QX-Series actuators are rated 80% duty.

8 GENERAL OPERATING INFORMATION

For enclosure specifications and dimensions, see (Table 1 and Figure 3)

8.1 NEMA Ratings and CSA Certification

Metso QX-Series actuator enclosures are certified weather-tight (NEMA 4/4X) and "explosionproof" (NEMA 4/4X/7&9 - Class 1, Division 1, Groups C and D, Class 2, Division 1, Groups E, F and G and Class 3) by CSA. The enclosures are certified to meet both Canadian and U.S. standards for applications in both Hazardous and Non-Hazardous locations. Ensure that the actuator’s ratings are appropriate for the application environment prior to installation. Use extreme care when removing the cover. Scratches or nicks on the flanges may cause the enclosure not to meet NEMA or CSA specifications.

8.2 Duty Cycle and Motor Protection

QX-Series actuators are equipped with a brushed DC motor and are rated for 80% duty cycle operation up to 104°F and for a maximum of 30 starts per minute. Higher temperature applications decrease the available duty cycle.

8.3 Operating Temperature Limits

QX-Series actuators are designed to operate in ambient environments between 32°F and 150°F. If the ambient temperature may drop below 32°F, the heater and thermostat option must be installed. The actuator is rated to operate at -40°F with the heater and thermostat option installed. In outdoor applications where ambient temperatures exceed 80°F, actuators should be shielded from direct sunlight. In applications with high media temperatures, insulating blankets, heat shields and/or extended mounting shafts should be used to maintain ambient temperatures at the actuator within normal operating limits.

Heaters and thermostats are required for all outdoor applications and may also be used to dry condensation in high-humidity environments.

8.4 Actuator Mounting

The actuator may be mounted in any position including upside-down. It must be firmly secured to a direct mount flange or sturdy mounting bracket. A minimum of four bolts with lock washers should be used to secure the actuator to the bracket. Flexibility in the bracket is not allowed, and backlash, or "play," in the coupling should be minimized. The actuator output shaft must be in line (centered) with the valve shaft to avoid side-loading the shaft. (See Figure 3 for output drive dimensions and mounting hardware specifications.)

8.5 Lubrication

All rotating power train components are permanently lubricated with multi-purpose Teflon grease suitable for the operating temperature range of the actuator. Additional lubrication is not required in normal operation.

8.6 Problem Prevention

Most actuator problems result from improper installation.

Incorrect Wiring and Set Up - Make certain the actuator is wired correctly and travel stops are properly set before power is applied.

Coupling, Alignment, and Mounting - Do not add extra torque! Make certain that the mounting arrangement is sturdy, centered, properly aligned, and that all mounting hardware is secure and properly tightened.

Moisture - Replace the cover tightly and make certain conduit entry holes are sealed properly to prevent moisture infiltration.

Temperature - Excessive temperatures affect duty cycle, actuator performance and the condition of the internal power storage. QX-Series actuators are designed to operate in environments below 150°F. In applications with high media temperatures, insulating blankets, heat shields, extended mounting shafts or off-set mounting may be used to maintain ambient temperatures at the actuator within normal operating limits.

8.7 Warranty

All QX-Series actuators are backed by a 2 year warranty that covers materials and workmanship.

8.8 Technical Assistance, Replacement Parts, Options and Repairs

All replacement parts, plug-in options, accessories, and repair services for QX-Series actuators are available through a network of qualified Metso Stocking Representatives. For further technical information or to locate the Metso Stocking Representative closest to you, contact www.metso.com/valvcon.
## Table 1 - Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature Range</strong></td>
<td>32°F to 150°F (0°C to 70°C) without heater and thermostat&lt;br&gt;-40°F to 150°F (-40°C to 70°C) with heater and thermostat</td>
</tr>
<tr>
<td><strong>Conduit Connections</strong></td>
<td>(2) 3/4&quot; NPT</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>150 to 600 in-lbs: ISO 5211 F05 and F07 bolt circles, 3/4&quot; female square (14mm female square w/ &quot;I&quot; Option; 15mm female keyed output w/ &quot;Y&quot; Option).&lt;br&gt;1000 to 3000 in-lbs: ISO 5211 F07 and F10 bolt circles, 1&quot; female square (1000 in-lbs: 19mm female square w/ &quot;I&quot; Option; 1500 - 3000 in-lbs: 22mm female square w/ &quot;I&quot; Option; 1000 to 3000 in-lbs: 20mm female keyed output w/ &quot;Y&quot; Option).</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>12 VDC: 10.8 to 13.2 VDC&lt;br&gt;24 VDC: 21.6 to 26.4 VDC</td>
</tr>
<tr>
<td><strong>Limit Switches</strong></td>
<td>(2) Single pole, double throw switches rated for 1/3 HP, 11 amps @ 125/230 VAC, CSA certified, used for end of travel control only. Two additional switches may be added as dry contacts for pilot or position indication applications.</td>
</tr>
<tr>
<td><strong>Motor</strong></td>
<td>Brushed DC, sub-fractional horsepower</td>
</tr>
<tr>
<td><strong>Lubrication</strong></td>
<td>Permanently lubricated gear train and bearings</td>
</tr>
<tr>
<td><strong>Gear Train</strong></td>
<td>Hardened steel spur gears</td>
</tr>
<tr>
<td><strong>Enclosure</strong></td>
<td>Cast aluminum</td>
</tr>
<tr>
<td><strong>Approximate Weight</strong></td>
<td>17 lbs (150-600 lb-in); 32 lbs (1,000-3,000 lb-in)</td>
</tr>
</tbody>
</table>
9.1 DIMENSIONS

QX-SERIES (1,000-3,000 lb-in)

QX-SERIES (150-600 lb-in)

Figure 3
### 9.2 QX-SERIES ACTUATORS BY PART NUMBERS

#### Table 3

<table>
<thead>
<tr>
<th>Series</th>
<th>Enclosure Type</th>
<th>Torque</th>
<th>Other Options</th>
<th>Operating Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Description</td>
<td>Code</td>
<td>Description</td>
<td>Code</td>
</tr>
<tr>
<td>QX³</td>
<td>Weathertight &amp; Explosionproof</td>
<td>150</td>
<td>150 in-lb</td>
<td>H² Tropical Heater/Thermostat</td>
</tr>
<tr>
<td></td>
<td>NEMA 4/4X/7&amp;9</td>
<td>300</td>
<td>300 in-lb</td>
<td>I³ ISO 5211 Output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600</td>
<td>600 in-lb</td>
<td>T⁴ Heater/Thermostat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000</td>
<td>1000 in-lb</td>
<td>Y⁵ Keyed Output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1500</td>
<td>1500 in-lb</td>
<td>Z Handwheel Override</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000</td>
<td>2000 in-lb</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>2500</td>
<td>2500 in-lb</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3000</td>
<td>3000 in-lb</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. All QX-Series actuators include a holding brake, two auxiliary limit switches, visual position indication, a wrench-operated manual override, a NEMA 4/4X/7&9 enclosure and CSA (C US) Certification as standard features. 1000 lb-in models with “I” option are supplied with a 19mm female square and 1500 - 3000 lb-in models are supplied with a 22mm female square.
2. This heater option activates at or below 90°F and deactivates at 110°F; it is recommended in high humidity applications.
3. 150-600 lb-in models with “I” option are supplied with a 14mm female square (note that without option “I” the female square is 3/4”). 1000 lb-in models with “I” option are supplied with a 19mm female square and 1500-3000 lb-in models are supplied with a 22mm female square (note that without option “I” the female square is 1”).
4. This heater option activates at or below 40°F and deactivates at 60°F; it is recommended in applications where the temperature may drop below 32°F.
5. 150-600 lb-in models with “Y” option are supplied with a 15mm female keyed output; 1000-3000 lb-in models are supplied with a 20mm female keyed output.

- The QX-Series Enclosure is certified by CSA to meet specifications for NEMA 7&9, explosionproof environments as well as to meet NEMA 4/4X specifications for weathertight and dust-tight environments. Explosionproof means that an internal explosion will be contained, with no sparking that could ignite external atmospheric gases. The enclosure is rated for the following environments:
  - NEMA Class I, Division 1, Group C (Ethyl-ether vapors, ethylene or cyclopropane)
  - NEMA Class I, Division 1, Group D (Gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, lacquer, solvent, vapors or natural gas)
  - NEMA Class II, Division 1, Group E (Metal dust, including aluminum, magnesium, their commercial alloys, and other metals of similarly hazardous characteristics)
  - NEMA Class II, Division 1, Group F (Carbon black, coal or coke dust)
  - NEMA Class II, Division 1, Group G (Flour, starch or grain dust)

#### Sample Model Code: QX2000IZS12DC

<table>
<thead>
<tr>
<th>Actuator Series</th>
<th>Torque</th>
<th>Options</th>
<th>Operating Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>QX</td>
<td>2000</td>
<td>I</td>
<td>S12DC 12 VDC</td>
</tr>
</tbody>
</table>

- **Torque = Breakaway Torque** Valcon actuators are rated at breakaway torque; the amount of torque the actuator will provide from a fully loaded stop upon immediate power-up. With running momentum and inertia, the amount of torque supplied by the actuator at full speed (running torque) or upon entering a stall condition (stall torque) always exceeds the minimum rated breakaway torque. Since valves require most torque at breakaway, only breakaway torque should be considered when sizing actuators.
### 10  ADDITIONAL ACTUATOR PRODUCTS AND ACCESSORIES FROM METSO

#### V-Series
- Up to 3000 inch pounds for On/Off, Modulating or Automatic Cycling applications
- 75% Duty Cycle
- 115VAC and 230VAC voltages
- NEMA 4/4X and NEMA 4/4X/7&9 enclosures
- CSA Certified (Canadian & U.S. Standards)
- Options include Modulating Control Board, Speed Control/Timer Board, Iso/Readback Board, extra limit switches, heater/thermostats, motor brake, feedback potentiometer and handwheel override

#### ADC-Series
- Up to 3000 inch pounds for On/Off or Modulating applications
- Optional Internal Battery Back-Up
- Continuous Duty Cycle
- 115VAC, 230VAC, 24VAC, 12VDC and 24VDC voltages
- Options include extra limit switches, heater/thermostats and handwheel override

#### ESR-Series
- Up to 600 inch pounds for True "Two-Wire" On/Off applications
- 80% Duty Cycle
- 115VAC and 230VAC voltages
- Options include extra limit switches and heater/thermostats

#### LC Series
- Up to 600 inch pounds
- Economical actuators for Reversing or Unidirectional applications
- 25% duty cycle
- NEMA 4/4X enclosures
- 115VAC, 230VAC, 24VAC, 12 VDC and 24VDC voltages
- Options include extra limit switches and heater/thermostats
- Male output (standard) or female output (optional)

#### I-Series Network Capable
- Modbus®
- AS-Interface
- DeviceNet™
- Foundation Fieldbus
- Other fieldbus protocols (consult factory)

#### Q6-Series for Remote Solar Applications
- 600 inch pounds
- 12VDC
- Low current draw