Table of Contents

1 GENERAL .................................................. 3
   1.1 Description ............................................. 3
   1.2 Foundation Fieldbus Provisions ...................... 3
   1.3 Operation for Applications
       with Foundation Fieldbus ......................... 4
   1.3.1 Set Up for Operation .............................. 4
   1.3.2 Setting Actuator Stop Positions ................ 4

2 I-SERIES STANDARD OPTIONS ......................... 4
   2.1 Option “H” – Tropical Heater and Thermostat ..... 4
   2.2 Option “I” – ISO 5211 Output ....................... 4
   2.3 Option “K” – Mechanical Brake .................... 5
   2.4 Option “S2” – Two Auxiliary Network
       Limit Switches ...................................... 5
   2.5 Option “T” – Heater and Thermostat ............... 5
   2.6 Option “Y” – Keyed Output .......................... 5
   2.7 Option “Z” – Handwheel Override ................. 5
   2.8 Voltage .................................................. 5

3 GENERAL OPERATING INFORMATION ............... 6
   3.1 NEMA Ratings ........................................... 6
   3.2 Wiring .................................................... 6
   3.3 Duty Cycle and Motor Protection ................... 6
   3.4 Operating Temperature Limits ..................... 6
   3.5 Actuator Mounting .................................... 6
   3.6 Manual Override ....................................... 6
   3.7 Lubrication .............................................. 6
   3.8 Problem Prevention ................................... 7
   3.9 Warranty .................................................. 7
   3.10 Technical Assistance ............................... 7

4 SPECIFICATIONS & TECHNICAL INFO .............. 7
   4.1 Dimensions .............................................. 8

5 I-SERIES ACTUATORS BY PART NUMBERS .......... 9

6 ADDITIONAL ACTUATOR PRODUCTS .............. 10

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!

Subject to change without notice.
All trademarks are property of their respective owners.
1 GENERAL

This instruction manual contains important information regarding the installation, maintenance and troubleshooting of I-Series I6700 Option “FF” FOUNDATION FIELDBUS Protocol. Please read these instructions carefully and save them for future reference.

1.1 Description

The I-Series FOUNDATION FIELDBUS Option is an option for 115/230 VAC actuators that provides digital control via the FOUNDATION FIELDBUS Protocol. Communications data (FOUNDATION FIELDBUS Signal) is carried over two wires (FB+, FB-); a second pair of wires carries Network power (+/- 24 VDC). Each actuator has its own address on the network, and can be operated as a discrete modulating device.

The FOUNDATION FIELDBUS option consists of the Valvcon (FOUNDATION FIELDBUS I/O Module), which is wired to the Valvcon Interface/Controller Board. Line power (115/230 VAC) is connected to the motor board. Both the FOUNDATION FIELDBUS signal (FB+, FB-) and the FOUNDATION FIELDBUS Network power (+/- 24 VDC) are connected directly to the FOUNDATION FIELDBUS I/O module.

1.2 FOUNDATION FIELDBUS Provisions

- Supervisory control via a mode selector switch and on-board Manual Control, clockwise (CW) and counterclockwise (CCW) push buttons. The supervisory control mode overrides the remote signal for simple and uninterrupted system set-up.

- FOUNDATION FIELDBUS input signals from auxiliary limit switches (Valvcon P/N 99400) which provide status indication via red and green LEDs on the “FF” module.

![Wiring Diagram – FOUNDATION FIELDBUS Digital Control](image-url)
1.3 Operation for Applications with Foundation Fieldbus Protocol

1.3.1 Set Up for Operation

Two limit switches operated by the cams on the output shaft determine the exact positions where the actuator will stop at each end of travel. The bottom limit switch determines the clockwise stop position. The next limit switch up from the bottom determines the counter-clockwise stop position. The end of travel limit switches can be adjusted to provide from 5 to 320 degrees of actuator rotation.

The two standard limit switches may be used to indicate the open and closed status of the actuator. Terminals 5 (counter-clockwise) and 6 (clockwise) provide the position indication at line voltage. If dry contacts or intermediate position indication are needed, additional limit switches and cams may be installed in the actuator. When additional limit switches are installed, they can be set in any position and are wired to a separate terminal block provided with the option. See (Section 2), I-Series Standard Options.

1.3.2 Setting Actuator Stop Positions

**Note:** To gain more access to cams, move the capacitor and terminal strip, if installed.

1. Loosen the set screw in the cam using a 1/16” hex wrench. Clockwise for the bottom cam and counter-clockwise for the next cam up from the bottom cam as indicated in (Figure 2).
2. Move the actuator to the desired STOP position
3. Apply Foundation Fieldbus signal to drive [CCW] or [CW] to desired position (see Figure 1) or use the manual override.
4. Remove the power and rotate cam in the direction of travel to the exact point the switch “clicks” closed.
5. Tighten the set screw.
6. Repeat this procedure to set the opposite end of the travel limit.

2 I-SERIES STANDARD OPTIONS

All I-Series options are designed to be easily installed in the field. Options for all standard I-Series actuators are universal and completely interchangeable with each enclosure size. For additional I-Series Options, see (Table 3). Voltage is not field changeable.

2.1 Option “H” – Tropical Heater and Thermostat P/N VC099716, VC099723

The tropical heater and thermostat option is a self-adhesive, resistance heater strip which is applied to the primary gear-box. It installs with a plug-in connector and is recommended in high-humidity applications. The tropical heater option is also recommended in 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 @ 115 VAC; 40 watts @ 230 VAC.

This option can be installed in the field; for 115 VAC applications, order kit P/N VC099716 and for 230 VAC applications order kit P/N VC099723.

2.2 Option “I” – ISO 5211 Output

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.
2.3 Option “K” – Mechanical Brake
P/N VC099715

The highly efficient hardened steel spur gear system requires that the brake option be installed on all butterfly valve and damper applications. It is also recommended on PVC ball valves and resilient seated valves. The brake will hold the valve in position against a force as great as the torque rating of the actuator. The brake option draws 4 watts and is universal to all standard I-Series actuators.

It is simple to install with a plug-in connector and two phillips head mounting screws. No additional brackets are required. This option can be installed in the field; order kit P/N VC099715.

2.4 Option “S2” – Two Auxiliary Network Limit Switches P/N VC099400

The extra switches and stainless steel cams provide dry contacts and are fully adjustable to trip at any position. The switches connect to the Network Module to provide position feedback to the network. The switches are single pole, double throw switches rated for 0.1 amps @ 125 VAC with gold alloy contacts, CSA certified. Auxiliary Network switch kit P/N VC099400. This option can be installed in the field; order kit P/N VC099400.

2.5 Option “T” – Heater and Thermostat
P/N VC099515, P/N VC099523

The heater and thermostat option is a self-adhesive, resistance heater strip which is applied to the primary gearbox. It installs with a plug-in connector 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. Thermostat is pre-set to activate at or below 40°F and deactivate at or above 60°F. The heater draws 15 watts @ 115 VAC; 40 watts @ 230 VAC. This option can be installed in the field; for 115 VAC applications, order kit P/N VC099515 and for 230 VAC applications order kit P/N VC099523. (see Figure 3)

2.6 Option “Y” – Keyed Output

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

This option is factory installed only.

2.7 Option “Z” – Handwheel Override
P/N VC009098

All I-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 1000 – 3000 in-lb models order kit P/N VC009098.

2.8 Voltage

115 VAC or 230 VAC. I-Series actuators are rated for full torque at +/- 10% of the nominal voltage at 50 Hz or 60 Hz. At 50 Hz operation, the duty cycle decreases proportionally and the cycle time increase. I-Series actuators are rated for a minimum of 75%* duty cycle @ 60 Hz @ 104°F. They provide a 75% duty cycle and are rated for 50 Hz or 60 Hz as a standard feature.

* 55% duty cycle for 3000 in-lb actuators.
3 GENERAL OPERATING INFORMATION

For enclosure specifications and dimensions, see (Tables 1-2 and Figure 6)

3.1 NEMA Ratings

Metso manufactures two styles of I-Series actuator enclosures: the "W" enclosure is weathertight and designed to NEMA 4/4X standards the "WX" enclosure is "explosion-proof" and designed to 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) standards.

The "WX" option must specified at the time of ordering and can only be installed at the factory. 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 specifications.

3.2 Wiring

Metso AC voltage actuators use reversing induction motors which cause high voltages Devices connected to terminal 3 and to terminal 4 must be rated for minimum 250 VAC (440 VAC for 230 VAC applications). Controllers with solid state outputs must be rated for more than 250 VAC. We strongly recommend that relay outputs be used on connected devices. Due to the induction feedback voltage, multiple actuators can not be wired in parallel. Separate (isolated contacts) must be provided for each actuator. If the actuator is driven by contacts on a PC or PLC, make sure the contacts have the proper ratings.

3.3 Duty Cycle and Motor Protection

I-Series actuators can operate continuously for up to 15 minutes at 104°F. After 15 minutes of continuous operation they are rated for 75% duty cycle operation at 104°F and for 30 starts per minute. Duty cycles decrease at temperatures in excess of 104°F. Duty cycle is the maximum proportion of "on" time and the minimum required "off" time to prevent thermal overloading. Actuators with cycle times of 30 seconds must rest at least 10 seconds between cycles. Higher temperature applications decrease duty cycle.

Metso’s AC motors contain thermal overload protection. Exceeding the rated duty cycle may cause the thermal overload switch to temporarily remove power to the motor and cause it to stall. After the motor cools, the actuator will resume normal operation. The thermal protector is a safety device, designed for infrequent use. Constant tripping of the thermal overload protector may cause premature motor failure.

3.4 Operating Temperature Limits

I-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.

3.5 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 6) for output drive dimensions and mounting hardware specifications.

3.6 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. 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; it is possible to damage installed options such as a feedback potentiometer. 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!

3.7 Lubrication

All rotating power train components are permanently lubricated with multi-purpose Lithium grease suitable for the operating temperature range of the actuator. Additional lubrication is not required in normal operation.
3.8 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.

3.9 Warranty

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

3.10 Technical Assistance, Replacement Parts, Options and Repairs

All replacement parts, plug-in options, accessories, and repair services for I-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.

4 SPECIFICATIONS & TECHNICAL INFORMATION

<table>
<thead>
<tr>
<th>Torque @ breakaway</th>
<th>Speed (seconds per 90° rotation)</th>
<th>Duty Cycle</th>
<th>VA Rating</th>
<th>Max Running Current at Full Load (True MS)</th>
<th>Max Effective Peak Inrush Current (= .66 x) Peak rush</th>
</tr>
</thead>
<tbody>
<tr>
<td>115 VAC</td>
<td>230 VAC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000 in•lb</td>
<td>25</td>
<td>75%</td>
<td>92 vA</td>
<td>.8 amps</td>
<td>1.66 amps</td>
</tr>
<tr>
<td>1500 in•lb</td>
<td>40</td>
<td>75%</td>
<td>92 vA</td>
<td>.8 amps</td>
<td>1.66 amps</td>
</tr>
<tr>
<td>2000 in•lb</td>
<td>55</td>
<td>75%</td>
<td>92 vA</td>
<td>.8 amps</td>
<td>1.66 amps</td>
</tr>
<tr>
<td>2500 in•lb</td>
<td>70</td>
<td>75%</td>
<td>92 vA</td>
<td>.8 amps</td>
<td>1.66 amps</td>
</tr>
<tr>
<td>3000 in•lb</td>
<td>75</td>
<td>55%</td>
<td>92 vA</td>
<td>.8 amps</td>
<td>1.66 amps</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2 - Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Range</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Conduit Connections</td>
</tr>
<tr>
<td>Output</td>
</tr>
<tr>
<td>Duty Cycle</td>
</tr>
<tr>
<td>Voltage</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Limit Switches (End-of-Travel)</td>
</tr>
<tr>
<td>Motor</td>
</tr>
<tr>
<td>Lubrication</td>
</tr>
<tr>
<td>Gear Train</td>
</tr>
<tr>
<td>Approximate Weight</td>
</tr>
<tr>
<td>Enclosure</td>
</tr>
<tr>
<td>Auxiliary Limit Switches</td>
</tr>
<tr>
<td>Discrete Outputs</td>
</tr>
<tr>
<td>Operating Voltage</td>
</tr>
<tr>
<td>Current Consumption</td>
</tr>
<tr>
<td>External Voltage</td>
</tr>
<tr>
<td>Data Rate</td>
</tr>
</tbody>
</table>
LI-SERIES

4.1 DIMENSIONS

Figure 6

All Dimensions in inches unless otherwise stated

<table>
<thead>
<tr>
<th>Actuator Size</th>
<th>Drive Option</th>
<th>Drive Type</th>
<th>Drive Size</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000-3000 lb-in</td>
<td>Standard Square</td>
<td>1.000 (25mm)</td>
<td>1.20 (30.5mm)</td>
<td></td>
</tr>
<tr>
<td>1000 lb-in</td>
<td>Option &quot;I&quot; Square</td>
<td>0.748 (19mm)</td>
<td>1.20 (30.5mm)</td>
<td></td>
</tr>
<tr>
<td>1500-3000 lb-in</td>
<td>Option &quot;I&quot; Square</td>
<td>0.866 (22mm)</td>
<td>1.20 (30.5mm)</td>
<td></td>
</tr>
<tr>
<td>1000-3000 lb-in</td>
<td>Option &quot;Y&quot; Keyed</td>
<td>0.787 (20mm)</td>
<td>31 lb</td>
<td></td>
</tr>
</tbody>
</table>

Approximate Weight 31 lb

TO REMOVE COVER REQUIRES AN ADDITIONAL 5.75"
For enclosure specifications and dimensions see (Tables 1-2 and Figure 6).

- **Enclosure “W”** (weathertight) is designed to meet specifications for NEMA 4/4X for weathertight and dusttight, environments. It is intended for non-hazardous locations in indoor or outdoor use and provides a degree of protection against corrosion, wind-blown dust and rain, splashing water, hose-directed water, and damage from external ice formation. It is not designed to be submersible.

- **Enclosure “WX”** (explosionproof & weathertight) is designed to meet specifications for NEMA 7&9, explosionproof environments as well as to meet NEMA 4/4X specifications. 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, naptha, 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)
  
  NEMA Class III

- **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.

---

**Table 3**

<table>
<thead>
<tr>
<th>Series</th>
<th>Enclosure Type</th>
<th>Torque</th>
<th>Protocol Options</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>
<td>Code Description</td>
</tr>
<tr>
<td>LI</td>
<td>W Weathertight</td>
<td>1000</td>
<td>1000 in•lb</td>
<td>AS AS-i</td>
<td>H Tropical Heater/Thermostat</td>
</tr>
<tr>
<td></td>
<td>NEMA 4/4X</td>
<td>1500</td>
<td>1500 in•lb</td>
<td>DN DeviceNet</td>
<td>I' ISO 5211 Output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000</td>
<td>2000 in•lb</td>
<td>FF' Foundation Fieldbus</td>
<td>K Brake</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2500</td>
<td>2500 in•lb</td>
<td>MB' MODBUS</td>
<td>S2' Two Auxiliary Limit Switches</td>
</tr>
<tr>
<td></td>
<td>WX Weathertight &amp; Explosionproof</td>
<td>3000</td>
<td>3000 in•lb</td>
<td>T' Heater/Thermostat</td>
<td>Y' Keyed Output</td>
</tr>
<tr>
<td></td>
<td>NEMA 4/4X/7&amp;9</td>
<td></td>
<td></td>
<td></td>
<td>Z Handwheel</td>
</tr>
</tbody>
</table>

Notes:
1. Must select only one protocol option.
2. This heater option activates at or below 90˚F and deactivates at 110˚F; it is recommended in high-humidity applications.
3. 1000 in•lb models with "I" option are supplied with a 19 mm female square and 1500 – 3000 in•lb models are supplied with a 22 mm female square (note that without option "I" the female square is 1")
4. These switches have gold contacts for use in Network applications.
5. 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.
6. This option only available in the LI-Series enclosure.
7. 1000 - 3000 lb-in models with "Y" option are supplied with a 20mm female keyed output.

**Sample Model Code:** LIWX15000ASHIKS2N230AC
6 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/TimerBoard, 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

**QX-Series**
- Up to 3000 inch pounds for On/Off applications
- Economical NEMA 4/4X/7&9 solution
- 12VDC & 24VDC voltages
- 80% Duty Cycle
- CSA (C US) Certification

**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)

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