## CONTENTS

- Description .......................................................... 5
- Use Statement ......................................................... 5
- Specific Conditions of Use ........................................... 5
- Unpacking & Inspection ............................................... 5
- Storage ................................................................. 5
- Identification Label .................................................... 5
- Safety Considerations ................................................ 6
  - Terminology and Symbols ........................................ 6
  - General SEVA Safety ............................................... 6
  - Conduit Entries .................................................... 6
  - Safety Instructions .................................................. 7
- Approvals / Ratings .................................................. 8
- Specifications .......................................................... 9
  - Materials ............................................................ 9
  - Part Numbering Construction .................................... 10
- Installation and Setup ................................................ 11
  - Attachment ........................................................ 14
  - Interconnection .................................................... 14
  - Final Assembly ...................................................... 14
  - Operation .......................................................... 14
  - Maintenance ......................................................... 15
- Wiring Connections .................................................... 16
  - SEVA Controller Board ............................................ 16
  - SEVA Power Board ................................................ 17
  - Wiring Terminal Ratings .......................................... 18
  - Wiring to J, 1 AC Power Input (115…230V AC) .............. 18
  - Wiring to J2, DC Power Input (24V DC) ....................... 18
  - Wiring to J4, Analog IO (0…5V DC or 0…10V DC or 4…20 mA) 18
- SoloCUE ............................................................... 19
  - Connecting SEVA to SoloCUE ................................... 19
- Adjust Parameters .................................................... 20
  - Deadband Adjust (%) ............................................. 20
  - Split-Range .......................................................... 20
  - Operation Limits .................................................... 20
DESCRIPTION

The SEVA is our next generation Smart Electric Valve Actuator that provides our customers with an electric actuator with best-in-class features. This product was designed for extreme conditions with military grade components while providing the accuracy and repeatability the market demands. Industrial Ethernet is an option. The SEVA is a solution to the ongoing challenges within the industrial world.

The SEVA is manufactured by Badger Meter® Inc., 6116 E. 15th St., Tulsa, OK 74112.

Use Statement

Acceptable uses for the Badger Meter Smart Electric Valve Actuator (hereafter referred to as SEVA) are solely for direct mounting and actuation of linear-motion, rising-stem control valves with limited stroke lengths under 1.5 in. as described in this manual. All other uses are considered misuse and may result in equipment damage, property damage or personal injury. Badger Meter accepts no responsibility or liability for misuse or damage as a result of misuse.

Specific Conditions of Use

Flameproof joints are not intended for repair. Contact Badger Meter for more information if flameproof joints or components that affect the flameproof ratings are damaged. See “Materials” on page 9 for specifications of suitable replacement fasteners. An external bonding conductor is not present and proper installation requires the equipment to be part of a bonded system.

Unpacking & Inspection

Upon opening the shipping container, visually inspect the product and applicable accessories for any physical damage such as scratches, loose or broken parts, or any other sign of damage that may have occurred during shipment.

NOTE: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damage in transit is the sole responsibility of the purchaser.

Carefully inspect the actuator for shipping damage. Damage to the shipping container is evidence of rough handling and may have resulted in equipment damage. Report all damage immediately to the freight carrier and Badger Meter. Verify that all items received are included on packing list and agree with the purchasing and freight documentation. Badger Meter is not responsible for product deterioration caused on-site once the covers are removed. Every Badger Meter actuator has been fully tested and properly sealed against environmental ingress before leaving the factory.

Storage

If the actuator cannot be installed immediately, store it in a dry place at a temperature below 95° C (203° F) until ready to connect power. If the actuator has to be installed but not powered immediately, seal the conduit entries with plastic or metal cable entry plugs. See "Conduit Entries" on page 6. The actuator should be stored in a non-corrosive environment. The actuator is not sealed to NEMA 4 until the conduit entries are properly connected.

Identification Label

An identification label is attached to each actuator base. When ordering parts, requesting information or service assistance, provide all of the label information.
SAFETY CONSIDERATIONS

Terminology and Symbols

![DANGER] Indicates a hazardous situation, which, if not avoided, is estimated to be capable of causing death or serious personal injury.

![WARNING] Indicates a hazardous situation, which, if not avoided, could result in severe personal injury or death.

![CAUTION] Indicates a hazardous situation, which, if not avoided, is estimated to be capable of causing minor or moderate personal injury or damage to property.

**NOTE:** Please consult the user manual in all cases where this symbol is used in order to find out the nature of potential hazards, and any actions which have to be taken to avoid them.

Operating temperature is –4…122° F (–20…50° C) with a maximum humidity of 85% non condensing. Always select a mounting location with proper ventilation and environmental protection.

Wiring used to supply power and/or data must be rated to 203° F (95° C) or higher.

General SEVA Safety

The actuator is intended as a component for professional incorporation into complete equipment of a system. If installed incorrectly, the actuator may present a safety hazard. The actuator uses high voltages and currents and is used to control equipment that can cause injury. Pay close attention to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction.

Maintenance must be performed by trained, experienced personnel who have carefully read the safety information and this manual. None of the functions or features of the SEVA may be used for safety of personnel. Give careful consideration to the functions of the actuator that might result in a hazard, either through their intended behavior or through incorrect operation due to a fault. In any application where a malfunction of the actuator or its control system could lead to or allow damage, loss or injury, perform a risk analysis. Where necessary, take further measures to reduce the risk.

**WARNING! CRUSH HAZARD. KEEP HANDS CLEAR OF MOVING PARTS.**

**ATTENTION! RISQUE D’ÉCRASEMENT. TENIR LES MAINS À L’ÉCART DES PIÈCES EN MOUVEMENT.**

Conduit Entries

The SEVA has three conduit entry ports—one for power, one for analog controls and one for industrial communications. Entry ports are either 3/4-14 NPT or M25×1.5 as selected by the purchaser and identified on the model number. If the threaded hole has a slight taper, it is 3/4-14 NPT. If it is a straight or parallel thread, it is M25×1.5. A typical installation will require the use of two of the three ports. One hazardous location rated plug is provided to seal a port that is not used. Blanking plates or plugs to seal other remaining unused conduit entries are not provided with the actuator. It is the responsibility of the installer or owner to ensure that appropriate plugs are installed in all unused conduit. The plugs must be in full compliance with the rating of the equipment and hazardous area classification. An external bonding conductor is not present and proper installation requires either metallic conduit or armored cable in accordance with the hazardous area classification.

For installation, all conduits must be sealed within 18 in. (0.5 m), as required by the location’s electrical code.

**CAUTION**

**USE SUPPLY WIRES SUITABLE FOR AT LEAST 90° C. SEAL ALL CONDUITS WITHIN 18 INCHES.**

**PRÉCAUTION**

**EMPLOYER DES FILS D’ALIMENTATION QUI CONVAINNNENT POUR AU MOINS 90° C. SCeller tous les conduits à moins 0.5 mètre.**
Safety Instructions

The installation of the SEVA electric actuator must comply with all applicable federal, state, and local rules, regulations, and codes. Failure to read and follow these instructions can lead to misapplication or misuse of the product, resulting in personal injury and damage to equipment.

- Read and save all instructions prior to installing, operating and servicing this product.
- Follow all warnings, cautions and instructions marked on, and supplied with, the product.
- Inform and educate personnel in the proper installation, operation and maintenance of the product.
- Install equipment as specified in the installation instructions and per applicable local and national codes. Connect all products to the proper electrical sources.
- A means of electrical disconnection must be installed per local
- A switch or circuit breaker must be included in the installation. It must be suitably located, easily reached, and it must be marked as the disconnecting device for the equipment.
- For proper performance, use qualified personnel to install, operate, update, tune and maintain the product.
- When replacement parts are required, ensure that the qualified service technician uses factory replacement parts. Substitutions may result in fire, electrical shock, other hazards, or improper equipment operation.
- Keep all product protective covers in place (except when installing, or when maintenance is being performed by qualified personnel) to prevent electrical shock, personal injury or damage to the actuator.

⚠️ WARNING

SHOCK HAZARD! INSTALLATION AND SERVICING MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL.

⚠️ AVERTISSEMENT

RISQUE D’ÉLECTROCUTION! L’INSTALLATION ET L’ENTRETIEN DOIVENT ÊTRE ACCOMPLIS SEULEMENT PAR UN PERSONNEL QUALIFIÉ.

⚠️ WARNING

ELECTROSTATIC DISCHARGE! THIS ELECTRONIC CONTROL IS STATIC-SENSITIVE. TO PROTECT THE INTERNAL COMPONENTS FROM DAMAGE, NEVER TOUCH THE PRINTED CIRCUIT CARDS WITHOUT USING ELECTROSTATIC DISCHARGE (ESD) CONTROL PROCEDURES.

⚠️ AVERTISSEMENT

DÉCHARGE ÉLECTROSTATIQUE! CE CONTRÔLEUR ÉLECTRONIQUE EST SENSIBLE AUX DÉCHARGES ÉLECTROSTATIQUES. POUR PROTÉGER LES COMPOSANTS INTERNES DE TOUT DOMMAGE, NE JAMAIS TOUCHEZ LES CIRCUITS IMPRIMÉS SANS RESPECTER LES PROCÉDURES DE CONTROLE DES DÉCHARGES ÉLECTROSTATIQUES (ESD).

⚠️ CAUTION

WHEN REASSEMBLING THE UNIT, ENSURE THE COVER O-RING IS IN PLACE, PROPERLY LUBRICATED AND UNDAMAGED. ALSO ENSURE THAT THE COVER BOLTS ARE FULLY THREADED INTO THE BASE AND TORQUED TO THE VALUE IDENTIFIED IN THE USER MANUAL.

⚠️ PRÉCAUTION

LORSQUE VOUS RÉASSEMBLEZ L’UNITÉ, VEILLEZ À CE QUE LES JOINTS TORIQUES SOIENT EN PLACE, CORRECTEMENT LUBRIÉS ET EN BON ÉTAT. ASSUREZ-VOUS ÉGALEMENT QUE LES BOULONS DU COUVERCLE SOIENT TOTALEMENT ENLÈS DANS LA BASE ET COULÉS SUR LA VALEUR IDENTIÉE DANS LE GUIDE D’UTILISATEUR.
CAUTION

DO NOT REMOVE COVER, PIPE PLUGS, OR DISASSEMBLE ANY PART OF THIS ACTUATOR WHEN FLAMMABLE ATMOSPHERES ARE PRESENT, UNLESS POWER AND SIGNAL ARE OFF. EXPOSURE OF ELECTRICAL COMPONENTS IN THE PRESENCE OF COMBUSTIBLE VAPORS MAY CAUSE IGNITION. EXPLOSION-PROOF RATINGS ARE NOT IN EFFECT IF NOT PROPERLY AND COMPLETELY ASSEMBLED.

PRÉCAUTION

NE PAS RETIRER LE COUVERCLE, LE BOUCHON LETÉ, NI DÉMONTER UNE PARTIE DE CET ACTIONNEUR EN PRÉSENCE DE GAZ ET VAPEURS INAMMABLES, SAUF SI L'ALIMENTATION EST Coupée ET QUE LE SIGNAL EST ÉTEINT. L'EXPOSITION DES COMPOSANTS ÉLECTRIQUES EN PRÉSENCE DE VAPEURS DE COMBUSTIBLE PEUT PROVOQUER UN INCENDIE. LES ANTIDÉAGRANTS NE SERONT PAS OPÉRATIONNELS S'ILS NE SONT PAS ASSEMBLÉS CORRECTEMENT ET TOTALEMENT.

WARNING

EXPLOSION HAZARD – DO NOT OPEN WHILE THE ELECTRICAL CIRCUIT IS POWERED UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS. DISCONNECT POWER BEFORE SERVICING.

AVERTISSEMENT

RISQUE D’EXPLOSION – NE PAS OUVIR LE ÉLECTRIQUE EST ALIMENTÉ SI L’ENVIRONMENT N’EST PAS DANGEREUX. DÉCONNECTER LE COURANT AVANT L’ENTRETIEN.

APPROVALS / RATINGS

• Class 1, Div 1, Group C, D T6
• Class 1, Zone 1, AEx/Ex db IIB T6 Gb FM16US0247X
• TYPE 4X IP66, Ta –20…50° C

• II 2 G Ex db IIB T6 Gb IP66 FM16ATEX0073X
  (ATEX Directive 2014/34/EU)
• Ex db IIB T6 Gb Ta –20…50° C IP66 IECExFMG16.0034X

• Class I, Div 1, Groups C, D T6
• Ex d IIB T6 Gb CSA17CA70119932X
• Type 4X IP66, Ta -20...50° C

• Compliance with Safety Standards EN 61010-1:2010
• CE Directives:
  Low Voltage Directive 2014/35/EU
  EMC Directive 2014/30/EU
  Machinery Directive 2006/42/EC
SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model</th>
<th>SEVA 100</th>
<th>SEVA 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Power/Standard</td>
<td>24V DC, Universal AC Input 115…230V AC, 60Hz</td>
<td></td>
</tr>
<tr>
<td>Control Input</td>
<td>Standard 4…20 mA; Configurable 0…5/10V DC</td>
<td></td>
</tr>
<tr>
<td>Position Accuracy</td>
<td>±1% of full scale</td>
<td>±1% of full scale</td>
</tr>
<tr>
<td>Humidity</td>
<td>85% non-condensing</td>
<td>85% non-condensing</td>
</tr>
<tr>
<td>Stroke</td>
<td>Up to 1.5 in. (38.10 mm)</td>
<td>Up to 1.5 in. (38.10 mm)</td>
</tr>
<tr>
<td>Stem Thread</td>
<td>3/8 ACME</td>
<td>3/8 ACME</td>
</tr>
<tr>
<td>Motor Size</td>
<td>NEMA 23</td>
<td>NEMA 23</td>
</tr>
<tr>
<td>Motor Power Consumption</td>
<td>13W</td>
<td>25W</td>
</tr>
<tr>
<td>Maximum Thrust</td>
<td>100 lbF (445 N)</td>
<td>200 lbF (890 N)</td>
</tr>
<tr>
<td>Height</td>
<td>12.35 in. (313.69 mm), diameter 7.65 in. (194.31 mm)</td>
<td>12.35 in. (313.69 mm), diameter 7.65 in. (194.31 mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt; 10 lb (4.55 kg)</td>
<td>&lt; 10 lb (4.55 kg)</td>
</tr>
<tr>
<td>Max. Surface Temperature</td>
<td>140° F (60° C)</td>
<td>140° F (60° C)</td>
</tr>
</tbody>
</table>

Table 1: Specifications

Materials

The enclosure of the SEVA is manufactured from aluminum alloy with stainless steel fasteners. Yoke and cover fasteners are metric and of A4-80 grade material (austenitic, 316 alloy with a minimum tensile strength of 800 MPa). The thread fit tolerance of the fasteners is 6g. When replacement parts are needed, make sure that they meet the minimum requirements specified by Badger Meter. ONLY IDENTICAL FASTENERS CAN BE USED IN ORDER TO MAINTAIN THE HAZARDOUS LOCATION RATING OF THE UNIT. Substitutions not meeting the requirements will invalidate any hazardous area certifications of the product and may result in fire, shock, or other improper and hazardous operation.

<table>
<thead>
<tr>
<th>SEVA-100/200</th>
<th>Type</th>
<th>Thread</th>
<th>Length</th>
<th>Material</th>
<th>Assembly Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover Fastener</td>
<td>Socket Head Cap Screw per ISO 4762</td>
<td>M10 × 1.5 6 g</td>
<td>1.57 in. (40 mm)</td>
<td>A4-80 (800 MPa tensile)</td>
<td>40…50 N•m</td>
</tr>
<tr>
<td>Yoke Fastener</td>
<td>Socket Head Cap Screw per ISO 4762</td>
<td>M5 × 0.8 6 g</td>
<td>1.18 in. (30 mm)</td>
<td>A4-90 (800 MPa tensile)</td>
<td>4…6 N•m</td>
</tr>
</tbody>
</table>

Table 2: Fastener materials

<table>
<thead>
<tr>
<th>SEVA-100/200</th>
<th>Size (SAE No.)</th>
<th>Material</th>
<th>Operating Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover/Base O-ring</td>
<td>-258</td>
<td>Buna-N 70</td>
<td>–4…122° F (–20…50° C)</td>
</tr>
<tr>
<td>Base/Yoke O-ring</td>
<td>-025</td>
<td>Buna-N 70</td>
<td>–4…122° F (–20…50° C)</td>
</tr>
<tr>
<td>Yoke/Stem O-ring</td>
<td>-114</td>
<td>Parker ELF N1090</td>
<td>–4…122° F (–20…50° C)</td>
</tr>
</tbody>
</table>

Table 3: Cover, base and yoke materials
## Part Numbering Construction

<table>
<thead>
<tr>
<th>Model</th>
<th>SEVA 100 - 100# maximum thrust</th>
<th>SEVA 200 - 200# maximum thrust</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td>Pick initial configuration. All are available.</td>
<td></td>
</tr>
<tr>
<td>4…20 mA (Signal to Open)</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>0…5V DC (Signal to Open)</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>0…10V DC (Signal to Open)</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>3 Point</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>4…20 mA (Signal to Close)</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>0…5V DC (Signal to Close)</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>0…10V DC (Signal to Close)</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td><strong>Protocols</strong></td>
<td>No Communication</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Modbus RTU (485)</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>Modbus TCP/IP (Dual Port)</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>EtherNet/IP (Dual Port)</td>
<td>E</td>
</tr>
<tr>
<td><strong>Conduit Entry Threads</strong></td>
<td>3/4 in. NPT</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>M25 X 1.5</td>
<td>M</td>
</tr>
<tr>
<td><strong>Yoke Hole Diameter</strong></td>
<td>0.625 in. (Used on 1/4&quot; RCV valves)</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>0.875 in. (Used on 1/2&quot;, 3/4&quot; and 1&quot; RCV valves)</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>1 in. (Used on Kynar Model valves)</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>1.125 in. (Used on the following models 9000, 9100 and 1711 RCV valves)</td>
<td>D</td>
</tr>
<tr>
<td><strong>Stem Thread</strong></td>
<td>#6-32 (Used on 1/4&quot; RCV valves)</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>#10-32 (Used on 1/2&quot;, 3/4&quot; and 1&quot; RCV valves)</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>#1/4-28 (Used on the following models 9000 and 1711 RCV valves)</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>#5/16-23 (Used on 9100 model RCV valves)</td>
<td>D</td>
</tr>
<tr>
<td><strong>Limit Switch</strong></td>
<td>Mechanical Limit Switch</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>Z</td>
</tr>
</tbody>
</table>
INSTALLATION AND SETUP

The SEVA should only be installed on valves that are appropriately designed for their application and certified, when required.

• Qualified personnel must perform all wiring in accordance with prevailing codes.

• Fusing must be installed in line power, and should be of the slow-blow type. Badger Meter recommends a 50 × 20 mm, 1 Ampere, 250V AC fuse for AC inputs.

• Route the wiring to the actuator through one of the conduit openings. See “Conduit Entries” on page 6. Generally, one conduit contains input power and earth ground wires. The other conduit contains low level input and output signal wiring.

• All low level signal wiring should be a shielded type with the shield grounded at source common. After installation, seal all conduits to prevent water damage. All wiring used must be rated to 208° F (98° C) or higher.

• Strip 0.22 inch (5.6 mm) of insulation from the wire and insert the bare end into the appropriate terminal location, using an insertion tool or a small screwdriver.

⚠️ WARNING

THE ENCLOSURE IS MADE OF AN ALUMINUM-BASED MATERIAL, TO AVOID CORROSION. USE A CERTIFIED PLATED RING TERMINAL TO ATTACH THE EQUIPMENT GROUNDING CONDUCTOR TO THE ENCLOSURE’S PROTECTIVE EARTH TERMINAL.

⚠️ AVERTISSEMENT

LE BOÎTIER EST COMPOSÉ D’UN MATÉRIAUX À BASE D’ALUMINIUM, PERMETTANT AINSI D’ÉVITER TOUTE CORROSION. UTILISER UN TERMINAL ANNEAU PLAQUÉ CERTIFIÉ POUR CONNECTER LE CONDUCTEUR DE TERRE DE L’ÉQUIPEMENT AU TERMINAL DE TERRE DE PROTECTION DU BOÎTIER.
During installation, refer to the location of parts listed in Figure 1 on page 13 and the descriptions in Table 4.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Base</td>
<td>23</td>
<td>Caution decal 2</td>
</tr>
<tr>
<td>2</td>
<td>Cover</td>
<td>24</td>
<td>Travel scale</td>
</tr>
<tr>
<td>3</td>
<td>O-Ring</td>
<td>25</td>
<td>Washer</td>
</tr>
<tr>
<td>4</td>
<td>Screw</td>
<td>26</td>
<td>Screw</td>
</tr>
<tr>
<td>5</td>
<td>Motor</td>
<td>27</td>
<td>Plug</td>
</tr>
<tr>
<td>6</td>
<td>Screw</td>
<td>28</td>
<td>Connector</td>
</tr>
<tr>
<td>7</td>
<td>Screw</td>
<td>29</td>
<td>Travel pointer</td>
</tr>
<tr>
<td>8</td>
<td>Circuit board</td>
<td>30</td>
<td>Hex nut</td>
</tr>
<tr>
<td>9</td>
<td>Stem assembly</td>
<td>31</td>
<td>Screw</td>
</tr>
<tr>
<td>10</td>
<td>Yoke</td>
<td>32</td>
<td>Washer</td>
</tr>
<tr>
<td>11</td>
<td>Screw</td>
<td>33</td>
<td>Flat washer</td>
</tr>
<tr>
<td>12</td>
<td>Lockwasher</td>
<td>34</td>
<td>Lockwasher</td>
</tr>
<tr>
<td>13</td>
<td>O-Ring</td>
<td>35</td>
<td>Pipe plug</td>
</tr>
<tr>
<td>14</td>
<td>Bearing</td>
<td>36</td>
<td>Ferrite core base</td>
</tr>
<tr>
<td>16</td>
<td>Pin dowel</td>
<td>37</td>
<td>Screw</td>
</tr>
<tr>
<td>17</td>
<td>Thermal pad pedestal</td>
<td>38</td>
<td>Potentiometer coupling</td>
</tr>
<tr>
<td>18</td>
<td>Nameplate</td>
<td>39</td>
<td>Potentiometer bracket</td>
</tr>
<tr>
<td>19</td>
<td>Wall mount bracket</td>
<td>40</td>
<td>Potentiometer assembly</td>
</tr>
<tr>
<td>20</td>
<td>Screw</td>
<td>41</td>
<td>TORX® screw</td>
</tr>
<tr>
<td>21</td>
<td>Screw</td>
<td>42</td>
<td>Hex nut</td>
</tr>
<tr>
<td>22</td>
<td>Caution decal 1</td>
<td>43</td>
<td>Downstop ring</td>
</tr>
</tbody>
</table>

Table 4: SEVA parts descriptions
Figure 1: SEVA parts
Attachment

Most actuators come pre-installed on a Badger Meter Research Control Valve. To mount the actuator to a linear-motion, rising stem control valve, follow the instructions below.

1. Remove the cover by loosening the cover screws and carefully separating the cover from the base. Take care not to scratch or mar the interface surfaces, use a wooden pry bar if necessary. Do not force the cover off with a screwdriver or other metallic device. The hazardous location rating of the actuator is dependent upon the surface finish and interface of the base to cover joint. Damage to the surfaces could jeopardize the safety features of the device.

2. Do not apply power yet.

3. Advance or retract the connection point by rotating the motor shaft with a socket and ratchet to provide adequate clearance over the stem of the control valve.

4. Place the actuator assembly over the yoke mount feature of the control valve.

5. Install and hand-tighten the actuator locknut onto the valve bonnet.

6. Advance or lower the connection point by rotating the motor shaft until the actuator shaft and valve stem/shaft are almost touching.

7. Verify proper alignment between the actuator shaft and valve shaft.

8. Thread an appropriate sized nut to the actuator shaft and valve shaft for proper thread engagement.

9. Install and tighten at least one end with a jam nut to prevent rotation and decoupling of the valve/actuator shafts.

10. Continue with the electrical connections and complete the commissioning.

**WARNING**

DO NOT OPEN WHILE AN EXPLOSIVE ATMOSPHERE IS PRESENT.
DISCONNECT POWER BEFORE OPENING.

**AVERTISSEMENT**

NE PAS OUVIR DANS UNE ATMOSPHÈRE EXPLOSIVE.
DÉCONNECTER LA SOURCE D'ALIMENTATION AVANT L'OUVERTURE.

Interconnection

1. With the valve and actuator assembly installed in the process line, connect the conduit to the Power and Signal Ports. Place the wire in the conduit and insert the conduit into the SEVA base before making this connection.

2. Install the power wires in the Power Terminal Block. Route the wires below the terminal and against the Power Supply Printed Circuit Board. The power line must be equipped with a fuse.

3. Install the input and output (optional) signal wires to the Signal Terminal Blocks. Observe polarity and all appropriate ratings as indicated within this manual when wiring up the unit.

Final Assembly

1. Apply a liberal amount of lubricant (Dow Corning Gn Paste is recommended) to the SEVA housing threads and O-ring seal.

2. Carefully thread the cover to the housing and secure.

3. Fasten the bracket at the base of the actuator to an adjacent supporting structure.

4. Secure the plug in the Setup/Service port to meet NEMA specifications.

Operation

To confirm basic mechanical operation, the manual override feature of the actuator can be used. In a safe place with power disconnected and the cover removed, rotate the motor shaft with a socket and ratchet. A counter-clockwise (CCW) motor rotation lowers the stem, while a clockwise (CW) rotation raises the stem. It should require less than 2.5 lb-in of torque applied directly to the motor shaft to stroke the actuator with no resistive load. The 2.5 lb-in of torque is needed to overcome the internal resistance of the motor, and the frictional losses of the stem nut and shaft bearing and elastomer seals. If equipped with limit switches, the limit switches can be set and checked for proper engagement / disengagement with a multi-meter.
Maintenance
The SEVA is designed for extended life with little or no maintenance. If decreased performance is observed it is likely the result of dirt or dust ingress to the moving parts or lubricant breakdown. To re-lubricate, follow the instructions below.

**NOTE:** Check annually for any loss of lubricant to the motor shaft. Under maximum temperature operating at full load 15 times per day and 200 days per year, re-apply motor shaft lubrication within a 5-year period.

1. Disconnect all power sources to the actuator. Follow applicable site specific lock-out tag-out procedures as required.

**WARNING**

DO NOT OPEN WHILE AN EXPLOSIVE ATMOSPHERE IS PRESENT.
DISCONNECT POWER BEFORE OPENING.

2. Remove the cover by loosening the cover cap screws and carefully separating the cover from the base. Take care not to scratch or mar the interface surfaces, use a wooden pry bar if necessary. Do not force the cover off with a screwdriver or other metallic device. The hazardous location rating of the actuator is dependent upon the surface finish and interface of the base to cover joint. Damage to the surfaces could jeopardize the safety features of the device.

3. Decouple the actuator from the valve, if necessary.

4. Advance the actuator by rotating the motor shaft with a socket and ratchet to its lowest most point. Apply a small amount of lubricant (Heydon Kerk HSS-17) to the motor shaft threads just above the acetal stem nut. This grease is specifically formulated for the materials of construction of the actuator. The use of alternate grease is not recommended and may result in excessive wear, decreased performance, binding, equipment damage and property damage.

5. With the actuator stem O-ring exposed, clean the surface of the stem nut and the O-ring.

6. Apply a small amount of DuPont Krytox GLP 206 grease to the O-ring and actuator shaft covering the exposed surfaces with a light uniform coat. The use of alternate grease is not recommended and may result in excessive wear, decreased performance, binding, equipment damage and property damage.

7. The stem O-ring can be replaced at this point if necessary. See “Materials” on page 9 for seal specifications.

8. Retract the actuator by rotating the motor shaft with a ratchet to its upper most point.

9. Apply a small amount of DuPont Krytox GLP 206 grease to the stem shaft where it meets the actuator base covering the exposed surface with a light uniform coat. The use of alternate grease is not recommended and may result in excessive wear, decreased performance, binding, equipment damage and property damage.

10. Advance and retract the actuator by rotating the motor shaft several times to assist in the even spreading of the lubricants between the mating parts.

11. If excessive dirt or dust is present, damage to components is noted, or performance is not restored after lubrication, see “Securing the SEVA Actuator” on page 26.

12. Recouple the actuator to the valve, if necessary.

13. Inspect the cover O-ring for damage, replace if necessary. See “Materials” on page 9 for seal specifications.

14. Install the cover and tighten the cover cap screws per the torque chart of the assembly drawing.
WIRING CONNECTIONS

SEVA Controller Board

---

**Notes:**
- Open and Closed positions are managed by our software.
- Overvoltage Protection is built in.

---

*SEVA Active Feedback (Analog Output Signal)*

---

**Passive Load Connection**

**Active Load Connection**

---

Figure 2: SEVA wiring block diagram
**SEVA Power Board**

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**Notes:**
- AC and DC power can be run simultaneously or separately.
- Open and Closed positions are managed by our software.
- Overvoltage Protection is built in.

**Terminate ground conductor at screw (green) terminal on housing.**

---

**Figure 3: SEVA power board**
Wiring Terminal Ratings

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>AC POWER INPUT</td>
<td>115…230 V AC</td>
</tr>
<tr>
<td>J2</td>
<td>DC POWER INPUT</td>
<td>24V DC</td>
</tr>
<tr>
<td>J4</td>
<td>ANALOG I/O</td>
<td>0…5V DC OR 0…10V DC OR 4…20 mA</td>
</tr>
</tbody>
</table>

⚠️ **CAUTION**

**ONLY CIRCUITS, DOUBLE OR REINFORCED INSULATED, FROM MAINS CAN BE CONNECTED TO THE J6, J4 AND MINI USB TERMINALS.**

⚠️ **PRÉCAUTION**

**DES CIRCUITS SECTEUR DOUBLES OU À L'ISOLATION RENFORCÉE SEULEMENT PEUVENT ÊTRE CONNECTÉS AUX TERMINAUX J6, J4 ET MINI-USB.**

⚠️ **CAUTION**

**ANALOG OUTPUT IS POWERED BY THE ACTUATOR. WHEN A FEEDBACK LOOP IS CONNECTED TO THE ACTUATOR, DAMAGE TO EQUIPMENT MAY OCCUR IF ADDITIONAL EXTERNAL POWER IS INCLUDED IN THE CIRCUIT.**

⚠️ **PRÉCAUTION**

**LA SORTIE ANALOGIQUE EST ENTRAÎNÉE PAR L'ACTIONNEUR. LORSQU'UNE BOUCLE DE RÉTROACTION EST LIÉE À UN ACTIONNEUR, L'ÉQUIPEMENT EST SUSCEPTIBLE D'ÊTRE ENDOMMAGÉ EN CAS D'AJOUT D'UNE PUISSANCE EXTERNE SUPPLÉMENTAIRE DANS LE CIRCUIT.**

**Wiring to J, 1 AC Power Input (115…230V AC)**

The SEVA has an auto-detect feature for input power at J1. For AC applications, terminal L is line and terminal L2/N is neutral. The incoming power supply earth ground should be securely connected to the green ground screw located inside the actuator base between the two conduit entries.

**Wiring to J2, DC Power Input (24V DC)**

The SEVA can use either AC or DC power. For DC power, (–) 24V DC and (+) +24V DC are identified on the board. Both the AC and the DC terminals can be wired at the same time. The SEVA can use the DC power if the AC power stops for power outage situations. Terminal strip tabs are pressed down to insert wires.

**Wiring to J4, Analog IO (0…5V DC or 0…10V DC or 4…20 mA)**

Current command (4…12 mA, 12…20 mA, or 4…20 mA) wiring terminates on terminals 5 (AIN 1+), 6 (AIN Ground) and the Shield is 7.

The SEVA has an internally powered (active) feedback option. The analog feedback signal is active by wiring terminal 8 (AOUT 1+) and 9 (AOUT Ground). The SEVA is returning a 4…20 mA powered feedback when operating in all run modes except Mode 0 and Mode 1. The SEVA outputs a 0…5V DC signal when operating in run Mode 0, and a 0…10V DC signal when operating in run Mode 1. This type of feedback sends a powered signal from the SEVA to its controlled system. If your system requires a non-powered/Loop Powered/Passive signal, adjust your wiring setup to accept the SEVA's Powered (active) feedback signal.
SOLOCUE

Connecting SEVA to SoloCUE

To download SoloCUE, please visit www.badgermeter.com and look under Support/Software Downloads.

Badger Meter measuring or control devices use either a Micro B or Mini B USB cable to communicate with a computer.

1. Power up the device.
2. Connect the Micro B or Mini B to the Badger Meter device USB communication port and the Type A USB to the computer.
3. On the computer, double-click the SoloCUE icon to start the software.

4. To add a device, click + in the device list or select Device > Add Device from the menu bar.

5. Select either Auto or Manual Scan Mode to find the device.
   ◊ For the Manual mode, select the Com Port the device is connected to, then select the Baud Rate.
6. Click Scan to find the device.

7. When found, the device appears in the found devices list. Click the checkbox to select Add to Device List, then click OK to complete the device-adding process.
**ADJUST PARAMETERS**

**Deadband Adjust (%)**
The Deadband factory setting is 0.20 with its lowest setting at 0.00. Use the Deadband Adjust (%) box to adjust the deadband setting appropriately to the application.

**Split-Range**
The SEVA can split the incoming 4...20 mA signal and use the “Lower Range” of the signal (4...12 mA) or the “Higher Range” of the signal (12...20 mA) for full stroke operation. Use the Split-Range drop-down menu to change the type of split-range.

Example: The split-range splits the signal into a 4...12 mA (Lower) or a 12...20 mA (Upper). If the signal is higher or lower than the limits of the defined range, the signal will respond to the closest limit.

**Operation Limits**
Operational limits restrict the actuator’s range of operation. This can be used to intentionally prevent the actuator from fully achieving either the Zero or Span position. A Low Limit >0.0% will prevent the actuator from fully achieving the Zero position. A High Limit <100% will prevent the actuator from fully achieving the Span position.

**Speed (steps/sec)**
The steps selected are designed to affect both the speed and the thrust. You can change the factory preset steps depending on your application and sizing.

<table>
<thead>
<tr>
<th>Model</th>
<th>Steps</th>
<th>Thrust</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEVA 100</td>
<td>500</td>
<td>100</td>
</tr>
<tr>
<td>SEVA 200</td>
<td>317</td>
<td>200</td>
</tr>
</tbody>
</table>

**Reverse Acting**
The 4-20mA signal normally closes the actuator at 4mA and opens it at 20mA. The Reverse Acting feature allows you to reverse that function, causing the signal to open the actuator at 4mA and close it at 20mA. You can enable or disable this feature with the Reverse Acting drop-down menu.

**Tag ID**
This feature allows you to mark each actuator with the proper TAG associated with it. Enter the tag ID into the text box.
**VIEW PARAMETERS**

**Thrust**
Thrust shows what the max trust is set at. This can be altered thru the Speed (steps/sec) parameter.

**Power**
Power shows the type of power currently connected to the valve. The SEVA offers a Universal AC power which accepts 115…230V AC.

**Built Date**
Built date shows when the actuator was manufactured.

**Actuator Position (dash board window)**
This shows what current the position of the actuator within the span.

**Position Command (dash board window)**
This shows what current the position command by percentile.

**Signal Applied (dash board window)**
This shows the input signal from the external source.

**Internal Temperature (dash board window)**
This shows the temperature inside of the SEVA.

**Mode Selection**
The Mode Selection is identified to reflect the position of the dial within the actuator. See “Mode Selection” on page 22 for instructions on selecting the mode.
MODE SELECTION

The SEVA includes a mode selector dial and a set of four push-button switches. Use the Mode Dial to select operating modes as well as to configure the actuator locally. The modes are identified below by their functional operation and what the push-buttons do in each mode.

Set up the SEVA’s Input Span and Zero first because the Input Span and Zero reference values that are based on the feedback potentiometer are used in the output signal span and zero adjustment. When the SEVA is mounted on a valve from the factory, the Input Span and Zero are set. When adding a new SEVA to a valve, follow the directions for setting up a new valve in "Mode 6, Trim Cal Mode".

Mode 0, Run Mode 0…5V DC

Mode 0 operates with the input and output process signals set to respond to, and transmit, a 0…5V DC transducer signal. By default, while in this run mode, the actuator is under closed-loop control, constantly attempting to force error of commanded position versus measured position to zero, unless the unit has been configured to run using open-loop control.

Mode 1, Run Mode 0…10V DC

Mode 1 operates with the input and output process signals set to respond to, and transmit, a 0…10V DC transducer signal. By default, while in this run mode, the actuator is under closed-loop control, constantly attempting to force error of commanded position versus measured position to zero, unless the unit has been configured to run using open-loop control.

Mode 3, Run Mode 4…20 mA

Mode 3 operates with the input and output process signals set to respond to, and transmit, a 4…20 mA transducer signal. By default, while in this run mode, the actuator is under closed-loop control, constantly attempting to force error of commanded position versus measured position to zero, unless the unit has been configured to run using open-loop control. While in this run mode, communication to the device via the Virtual Communication Port is disabled. You will not be able to configure the unit with the command line interface while operating in this run mode.

Mode 4, Not Used

Mode 4 is not applicable at this time.

Mode 5, Run Mode ANYBUS (Ethernet/IP, Modbus, TCP/IP and Modbus RTU)

Mode 5 operates with the input and output process signals overridden, and surrenders the real-time control and operation to the ANYBUS interface. By default, while in this run mode, the actuator is under closed-loop control, constantly attempting to force error of commanded position versus measured position to zero, unless the unit has been configured to run using open-loop control. In this mode, the push-buttons are disabled. Input and output analog signals remain active, but the input does not command the servo and the output offers a 4…20 mA indication of the current position of the actuator.

Mode 6, Trim Cal Mode

Mode 6 provides a manual means of setting the valve trim span for the actuator. In this mode, the push-buttons 3 and 4 manually override the actuator open and closed, respectively. Once the adjustment has been made, you can capture the position with push-button 1 for open (or span) or push-button 2 for closed (or zero).

Mode 7, Split-Range Setup Mode

Mode 7 sets the configuration of the optional split-range input using the push-buttons as described in Table 5.
Mode 8, Test Mode

Mode 8 causes the actuator to continuously run between the upper and lower set limits. This mode also allows you to adjust the speed using the push-buttons as described in Table 5.

Push-Button Function Defined by SEVA Mode Selection Switch

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>Mode Description</th>
<th>Push-button Function Defined by Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Push-button 1</td>
</tr>
<tr>
<td>0</td>
<td>Run Mode (0…5V DC)</td>
<td>Not Functional</td>
</tr>
<tr>
<td>1</td>
<td>Run Mode (0…10V DC)</td>
<td>Not Functional</td>
</tr>
<tr>
<td>2</td>
<td>Run Mode Triple Pt</td>
<td>Not Functional</td>
</tr>
<tr>
<td>3</td>
<td>Run Mode (4…20 mA)</td>
<td>Not Functional</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Not Functional</td>
</tr>
<tr>
<td>5</td>
<td>Run Mode Anybus</td>
<td>Not Functional</td>
</tr>
<tr>
<td>6</td>
<td>Trim/Cal Mode</td>
<td>Set Open Point</td>
</tr>
<tr>
<td>7</td>
<td>Split-Range Setup Mode</td>
<td>Set Full Range Input</td>
</tr>
<tr>
<td>8</td>
<td>Test Mode</td>
<td>Start Cycle Testing</td>
</tr>
<tr>
<td>9</td>
<td>Offline Mode</td>
<td>Not Functional</td>
</tr>
</tbody>
</table>

Table 5: SEVA push-button functions
FAILURE MODES

Loss of Power
The SEVA features an ability to select one of five positions when there is a loss of power (Continue Operations, Full Closed, Full Open, Hold Position or Target Value). Both the Full Closed and Full Open positions are defined during the setup of the actuator. The Hold Position is the last position defined from the input signal. The Target Value is the percentile of the actuator’s travel, which you can define. This percentile can be defined through the SoloCue. Continue Operations occur only if operating in dual power mode with AC power input at J1 and CD power input at J2. Use SoloCUE to alter the parameters.

Loss of Signal
The SEVA features an ability to select one of four positions when there is a loss of signal (Full Closed, Full Open, Hold Position or Target Value). Both the Full Closed and Full Open positions are defined during the setup of the actuator. The Hold Position is the last position defined from the input signal. The Target Value is a percentile of the actuator’s travel, which you can define. This percentile can be defined through SoloCUE.

Feedback Signal
The SEVA has an internally powered (active) feedback option. The electric actuator can actively communicate its stroke position to the control system via feedback sensors. The feedback sensors are important in critical applications. The SEVA electric actuator is a powered feedback returning a 4…20 mA signal. This type of feedback sends a powered signal from the SEVA to its controlled system. If your system requires a non-powered/Loop Powered/Passive signal, adjust the wiring setup to accept the SEVA actuator’s Powered (active) feedback signal.

NOTE: Refer to drawings within user manual for more detail.
LIMIT SWITCHES (OPTIONAL)

The SEVA assembly has the option to include two user-adjustable limit switch outputs. The switches themselves must be positioned between 0…100% of the applicable stroke distance. The sensor termination is a SPDT changeover switch. The switching occurs when the set screw attached to the output shaft passes through the sensor housing. The leads of the sensors come pre-wired into a screw terminal block fastened to the SEVA circuit board mounting bracket. See Table 6 and Table 7 below for the wiring description and sensor specifications.

<table>
<thead>
<tr>
<th>Wire Color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Normally Closed</td>
</tr>
<tr>
<td>Blue</td>
<td>Normally Open</td>
</tr>
<tr>
<td>White</td>
<td>Common</td>
</tr>
</tbody>
</table>

Table 6: Limit switch wiring description

<table>
<thead>
<tr>
<th>Rating</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Watt (max)</td>
<td>5</td>
</tr>
<tr>
<td>Switching Voltage</td>
<td>V DC (max)</td>
<td>175</td>
</tr>
<tr>
<td>Breakdown Voltage</td>
<td>V DC (max)</td>
<td>200</td>
</tr>
<tr>
<td>Switching Current</td>
<td>A (max)</td>
<td>0.25</td>
</tr>
<tr>
<td>Breakdown Current</td>
<td>A (max)</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Table 7: Limit switch specifications

Benefits of the SEVA Limit Switches

- Hermetically sealed, magnetically operated contacts continue to operate long after optical and other technologies fail due to contamination
- Quick and reliable single screw mounting with location feature
- No standby power requirement

To configure the trim range into the controller board:
1. Set the rotary mode selector switch into position 6.
2. Press push-button switch 1 to set the upper limit of travel (fully open).
3. Press push-button switch 2 to set the lower limit of travel (fully closed).

If the optional limit switches are installed, their outputs are tested during this test. The limit switches are initially configured so that the setscrew (part of stem assembly) passes through the sensors at the fully-open position and the fully-closed position.

4. Confirm the operation (proper engagement/disengagement) of each limit switch with a multi-meter. [Pass/Fail]
Securing the SEVA Actuator

Connecting to an External Source
You can monitor multiple positions with the SEVA limit switches. The *open* and *closed* definitions are based on positive or negative contact. The positive contact (normally closed, 3 or 6) in both the upper and the lower position communicates either the *open* or *closed* position of the valve. The negative contact (normally open, 1 or 4) in both the upper or the lower position communicates that the valve is *open*. This provides the flexibility to communicate different positions of the SEVA to various external sources.

SECURING THE SEVA ACTUATOR
The SEVA comes standard with a side-mounted bracket which provides a secure means to brace the actuator within the system.

![Figure 6: Side-mounted bracket](image)

Manual Override
To manually operate the SEVA actuator:
1. Disconnect all power sources to the actuator. Follow local lockout/tagout procedures as needed.
2. Remove the plug from the top of the cover.
3. Install a 5 mm socket onto a 3…4 in. extension and a ratchet.
4. Place the socket through the top hole in the cover and engage the hex on the motor shaft.
5. Rotate the socket to raise or lower the stem.

**IMPORTANT**
*DO NOT* use a powered device such as a drill, driver, or pneumatic tool to drive the socket. Doing so will damage the motor and/or PCBs.
6. Replace the plug into the cover.

**IMPORTANT**
*DO NOT* apply power to actuator without first installing all plugs into the cover.

DISMANTLING OR DISASSEMBLING
The SEVA is designed for extended life with little or no maintenance. If degraded performance is observed, please contact Badger Meter. Do not attempt to repair or replace items that are not specifically identified as replacement or serviceable components. Disassembly should only be performed by factory trained service technicians. For product service or training, please contact Badger Meter.
CE DECLARATIONS

**EU Declaration of Conformity**

We, Badger Meter, Inc.  
4545 W. Brown Deer Rd.  
Milwaukee, WI 53223, USA

Declare under our sole responsibility that our Smart Electronic Valve Actuator (SEVA) to which this declaration relates is in conformity with the following Directives and standards when installed per the applicable Badger Meter installation requirements:

<table>
<thead>
<tr>
<th>Directive</th>
<th>Standards</th>
</tr>
</thead>
</table>
EN 60079-1:2014  
| II 2 G Ex db IIB T6 Gb IP66 | Certificate No: FM16ATEX0073X |
| Low Voltage Directive 2014/35/EU | EN 61010-1:2010 |
| EMC Directive 2014/30/EU | IEC 61000-4-2:2008  
IEC 61000-4-4:2004 with A:2010  
IEC 61000-4-5:2005  
IEC 61000-4-6:2008  
IEC 61000-4-11:2004  
IEC 61000-4-2007  
IEC 61326-1:2012  

Signed:  
Name:  
Position:  
Date: 4/26/17

Authorized Representative in the EU  
Name: Jürgen Stix  
Address: Nürtingerstr. 76 D-72699 Neuffen  
Germany  

Badger Meter GmbH  
Nürtingerstr. 76  
72699 Neuffen (Germany)

Figure 7: CE declarations
Control. Manage. Optimize.

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