

| Revisions |             |          |          |     | Document No. | Issue No. |
|-----------|-------------|----------|----------|-----|--------------|-----------|
| Issue     | Description | Date     | FM Apvd  | By  | 940910       | 01.14     |
| 1.11      | 8183        | 4/6/93   | 5/11/93  | MAL |              |           |
| 1.12      | 8355        | 12/24/94 | 2/23/95  | MAL |              |           |
| 01.13     | 8665        | 8/26/96  | 12/16/96 | MAL |              |           |
| 01.14     | ECN 9518    | 09-23-02 | 10-29-02 | MAL |              |           |

NOTE: ALL CHANGES TO THIS DOCUMENT MUST BE APPROVED BY  
FACTORY MUTUAL RESEARCH PER PROCEDURE #940968.

**BADGER METER INC.**  
Industrial Division  
Research Control Valves

**OPERATING INSTRUCTIONS**


Product: Electronic Valve Actuator

| <u>Model Number</u> | <u>Assembly Number</u> | <u>Description</u>                     |
|---------------------|------------------------|--|
| EVA-1XAA-O          | 543010-0002            | 6-32 stem, .625" mtg, 115 VAC/12 VDC   |
| EVA-1XAB-O          | 543010-0006            | 6-32 stem, .625" mtg, 230 VAC/12 VDC   |
| EVA-1XAC-O          | 543722-0002            | 6-32 stem, .625" mtg, 24 VDC           |
| EVA-1XBA-O          | 543010-0001            | 10-32 stem, .875" mtg, 115 VAC/12 VDC  |
| EVA-1XBB-O          | 543010-0005            | 10-32 stem, .875" mtg, 230 VAC/12 VDC  |
| EVA-1XBC-O          | 543722-0001            | 10-32 stem, .875" mtg, 24 VDC          |
| EVA-1XCA-O          | 543010-0004            | 10-32 stem, 1.00" mtg, 115 VAC/12 VDC  |
| EVA-1XCC-O          | 543722-0003            | 10-32 stem, 1.00" mtg, 24 VDC          |
| EVA-1XDA-O          | 543010-0008            | 10-32 stem, 1.125" mtg, 115 VAC/12 VDC |

Product Description

The Electronic Valve Actuator, EVA-1, is designed to position the metering trim in the Research Control Valve. It may be used with any of the conventional RCV models in applications requiring less than 40 pounds of actuator force. The EVA-1 converts a 4 to 20 mA instrument signal to a proportional amount of valve stem travel. An independent position transmitter is included which yields a 4-20 mA signal proportional to the travel position of the trim stem.

1. Installation (Refer to Figure 1)
  - A. Remove the cover using an adjustable open-end wrench on the hex protrusion at the top or a strap wrench around the ribbed section. The yoke should be clamped in a vise, or a short piece of 1/2 inch NPT pipe may be inserted in the set-up/service port to resist the torque applied to the cover.
  - B. Connection to Valve
    - 1) Apply power to the Power Terminal Block. For dual-power versions, the power line must be equipped with a slow-blow fuse rated at 1 ampere if 12VDC is applied, 1/4 ampere for 115 VAC, or 1/8 ampere for 230 VAC. The 24 VDC versions require 1 ampere fuses. (Note: AC versions built before January 1, 1989 required smaller fuses. Check original documentation for correct sizes).

|                      |         |   |   |               |
|----------------------|---------|---|---|---------------|
| Drawn: M. A. Lobo    | 8/31/88 | Title:<br><b>INSTALLATION AND<br/>OPERATION - ELECTRONIC<br/>VALVE ACTUATOR - EVA-1</b> | <b>Badger Meter, Inc.</b>  |               |
| Checked: C. Warne    | 9/8/03  |   | Document No.  | Issue         |
| Engineer: M. A. Lobo | 9/8/03  |   | <b>940910</b>   | <b>01.14</b>  |
| Approvals            | Date    |   | Product Code: 29  | Sheet: 1 of 6 |

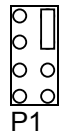
- 2) Thread the Travel Pointer lock nut up the actuator stem. Activate the Travel Switch to cause the actuator to stroke full open. Remove power.
- 3) Install the EVA-1 on the valve bonnet with the yoke lock nut supplied with the valve. Do not secure.
- 4) The Stem Connector should be locked to the valve stem by the interference threads. Thread the actuator stem into the Stem Connector until it contacts the valve stem (Note: the entire actuator must be rotated if attached to a bellows- or diaphragm- type seal valve). Tighten the yoke lock nut using the appropriate yoke lock nut wrench. Secure the travel pointer lock nut across the Travel Pointer.

### C. Interconnection

- 1) With the valve and actuator assembly installed in the process line, connect conduit to the Power and Signal Ports. It is recommended that wire be in place in the conduit and inserted into the EVA-1 base before this connection is made.
- 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 per 1.B.1. above.
- 3) Install the input and output (optional) signal wires to the Signal Terminal Blocks. Observe the polarity indicated on the connectors.

## 2. Adjustments

Refer to Figure 2. For A and B below, P1 jumper must be set as shown at right



### A. Zero Position


- 1) Apply power to the EVA-1.
- 2) Apply a signal corresponding to a "valve closed" position to the Input Signal terminals.
- 3) Move the Travel Switch to the "Down" position until the valve trim is closed. A pulsating noise will be heard that is the best indication of this condition.
- 4) Release the Travel Switch and move the Span/Zero switch down to enter this position into the EVA-1 memory.
- 5) Adjust the Travel Scale to make the "Closed" arrow indicate opposite the Travel Pointer.

### B. Span Position

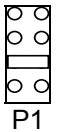
- 1) Apply a signal corresponding to a "valve open" position to the Input Signal terminals.
- 2) Move the Travel Switch to the "up" position and observe the Travel Pointer. Release the switch when the full open position is reached.
- 3) Move the Span/Zero Switch up to enter this position in the EVA-1 memory.

### C. Output Zero Setting (Optional)

- 1) Refer to Figure 2 for location of P1. The EVA-1 must have power applied, the output loop must be powered (12-48 VDC) and the display device indicating output must be within view.

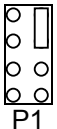
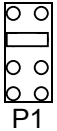
|  |   |                       |
|--|---|-----------------------|
| Title:<br>INSTALLATION AND<br>OPERATION - ELECTRONIC<br>VALVE ACTUATOR - EVA-1 | <b>Badger Meter, Inc.</b>  |                       |
|  | Document No.<br><b>940910</b>   | Issue<br><b>01.14</b> |
|  | Sheet: <b>2</b> of <b>6</b>   |                       |

- 2) Apply the input signal current to the actuator necessary to drive the valve closed.
- 3) Move the jumper to the position shown at right. Use the Travel Switch to adjust the current to 4mA.
- 4) When the desired current is reached, store the value by pushing the Span/Zero Switch to Zero.



D. Output Span Setting (Optional)

- 1) Apply the input signal current to the actuator necessary to drive the valve to the desired full-open position.
- 3) Move the jumper to the position shown at right. Use the Travel Switch to adjust this current to 20mA
- 4) When the desired current is reached store the value by pushing the Span/Zero Switch to Span.
- 5) Place the jumper in the position shown at right for normal operation.



3. Final Assembly

Apply a liberal amount of lubricant (Dow Corning Gn Paste is recommended) to the EVA-1 housing threads and o-ring seal. Carefully thread the cover to the housing and secure. The bracket provided at the base of the actuator should then be fastened to adjacent supporting structure. The plug in the Set-up/Service port must be secure to meet NEMA specifications.

4. Maintenance

Although the EVA-1 is designed to be trouble-free for its entire service life, the motor lead-screw shaft may require lubrication if the unit is subjected to severe service. To affect this, remove the yoke and run the shaft out the bottom of the actuator. Record the orientation of the square portion of the stem connector assembly with respect to the actuator base. Clean the shaft thoroughly and re-coat with Dow Corning Gn Paste. To re-assemble the actuator, first orient the unit such that the base is facing up. Re-install the stem connector assembly and yoke by reversing the above steps. Allow the yoke to center on the stem connector assembly before tightening the 4 yoke fasteners. Alignment of the yoke with the center axis of the motor is crucial to allow free running of the stem connector assembly within the yoke bore.

5. Communication

- A. The communication interface for the actuator conforms to RS-232 specifications. Any ASCII terminal may be connected to allow the user to perform certain query and set-up functions.
- B. The actuator is provided with a DIN type N, 8 pin receptacle with the following contacts used for communication:

| <u>Contact Number</u> | <u>Description</u> |
|-----------------------|--------------------|
| 2                     | Received Data      |
| 3                     | Transmitted Data   |
| 7                     | Signal Ground      |

C. The communication configuration is:

Baud Rate: 9600  
Data Bits: 8  
Stop Bit: 1  
Flow Control: none  
Parity: none  
Terminal Emulation: VT52

D. The functions available through the communication interface are accessed through a series of menus. The messages below are generated by Issue 4.03 of the EVA-1- firmware; earlier versions of firmware may cause different messages to be displayed.

- 1) Position of the Actuator/Valve stem relative to the travel corresponding to the current span and zero settings. This is a "read-only" menu.

-STEM POSITION -  
XXX % Travel

As an ASCII "M" or "m" is sent from a terminal, the messages below will be displayed in sequence. To change the value of the displayed variable (xxx stands for an integer, AAA stands for an alphabetic character) press the *UP* or *DOWN* arrow keys, then *ENTER* to set the value. The *UP* arrow corresponds to an ASCII "U" or "u", the *DOWN* to a "D" or "d", and the *ENTER* to an "E" or "e".

- 2) Zero Setting:

APPLY ZERO SIGNL  
Adj W/Arrow keys

- 3) Span Setting:

APPLY SPAN SIGNL  
Adj W/Arrow keys

- 4) Output Zero Setting:

4-20 mA ZERO OUT  
Adj W/Arrow keys


- 5) Output Span Setting:

4-20 mA SPAN OUT  
Adj W/Arrow keys

- 6) Actuator Speed:  
(Default Factory Setting: 340)

-ACTUATOR SPEED-  
xxx Steps/Second

The following menus are read-only:

|  |   |                       |
|--|---|-----------------------|
| Title:<br>INSTALLATION AND<br>OPERATION - ELECTRONIC<br>VALVE ACTUATOR - EVA-1 | <b>Badger Meter, Inc.</b>  |                       |
|  | Document No.<br><b>940910</b>   | Issue<br><b>01.14</b> |
|  | Sheet: <b>4</b> of <b>6</b>   |                       |

7) Input Signal monitor:

```
--INPUT SIGNAL--  
xxx % Full Scale
```

8) Temperature of the EVA-1:

```
-INTERNAL TEMP -  
xxx Degrees C
```

9) Motor Current:

```
-MOTOR CURRENT -  
xxx mA per phase
```

The following parameter may be changed in the manner of 2) thru 4) above:

10) Servo Deadband:  
(Default Factory Setting: 0.3%)

```
-SERVO DEADBAND-  
x.x% STEM TRAVEL
```

11) Diagnostic Test: (Read-only messages):

```
DIAGNOSTICS-KEY  
ENTER TO BEGIN
```

After "ENTER" is pressed the following messages will be displayed in sequence:

```
RAM TESTED OK  
EEPROM TESTED OK  
A>D TESTED OK  
+5&+12 TEST OK  
---COMPLETED--
```

If any test fails, the "OK" in the messages above will be replaced by "FAIL". Call factory.

12) Endpoint Overdrive Option (AAA=ON/OFF), set like 2) thru 6) above:

```
-SET OVERDRIVE-  
AAA<---ENTER---
```

After the Overdrive is set or if the "MENU" key is pressed the first menu selection will be displayed.

E. The communication interface can be disconnected at any time. It can also be connected with power applied to the EVA-1.

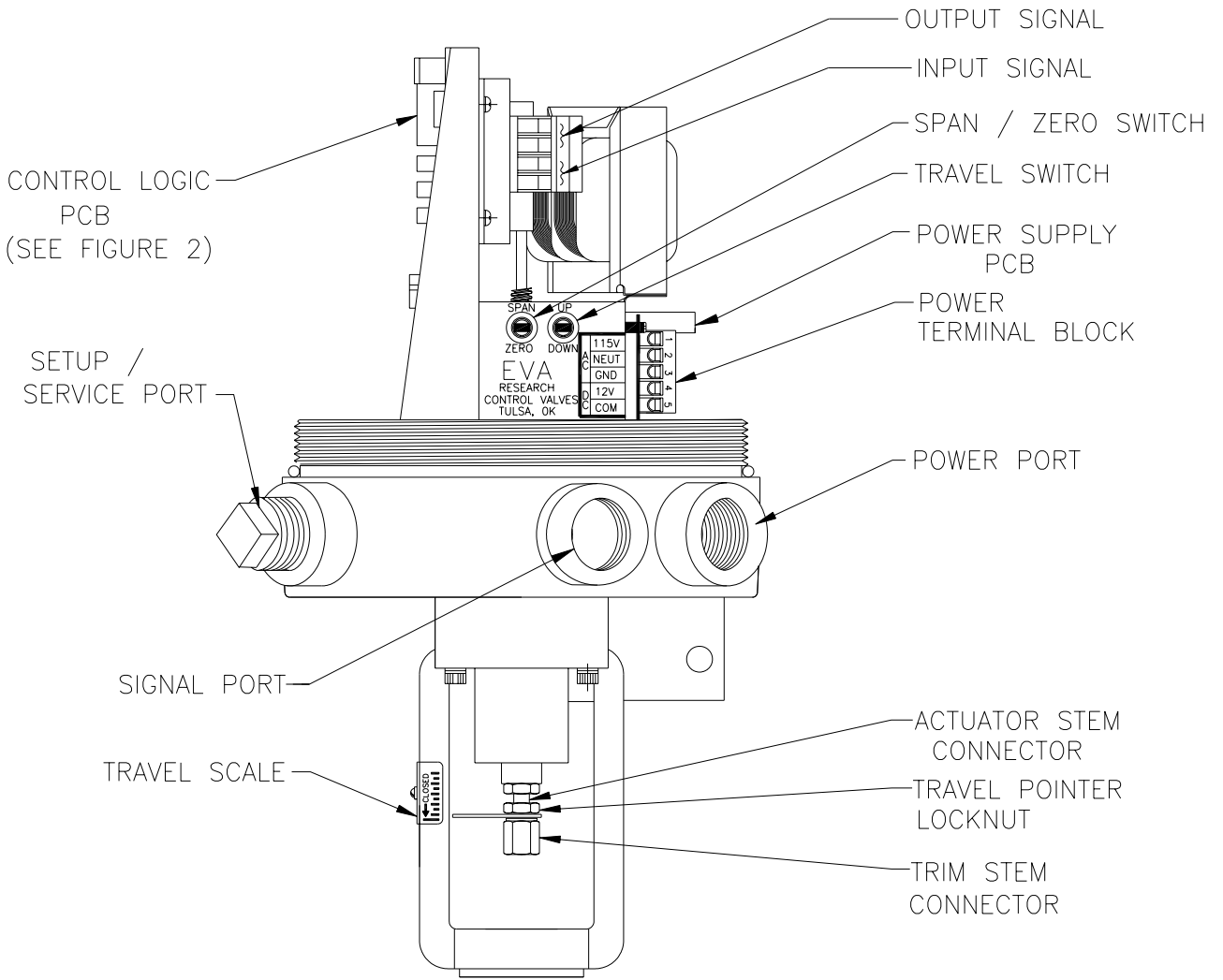


Figure 1

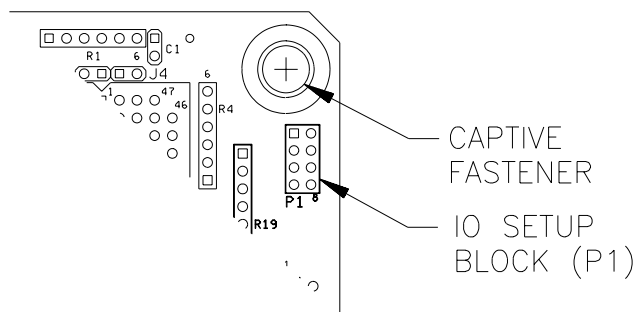


Figure 2