



# Pressure Independent Control Valve (PICV)

Fig. 306F (DN50-150)

## General Notes

The Hattersley Fig. 306F:

- Can be used in variable volume heating and chilled water systems
- Provides modulating control for large plant items such as Air Handling Units (AHU) when installed with a modulating actuator
- Offers flow rate pre-setting
- Has linear or equal percentage control characteristic at all pre-set flow rates
- Has built in Differential Pressure ( $\Delta P$ ) Control
- Has an operating temperature: 5°C to 120°C
- Has a maximum working  $\Delta P = 400$  kPa
- Has a maximum operating pressure: 16 bar
- Has built in pressure test points to verify operational differential pressures



## Limits of Use

These valves have been categorised in accordance with the Pressure Equipment Directive (PED).

**The fluid to be transported is limited to Group 2 liquids i.e. non-hazardous.**

**On no account must these valves be used on any Group 1 liquids, Group 1 gases or Group 2 gases.**

## Installation

These instructions are issued as guidelines only and do not cover all installed conditions. If unsure please contact our Technical Helpline before installation.

- Hattersley products are designed for installation and use within suitably designed systems reflecting CIBSE, BSRIA and HVAC guidelines. Particular care should be taking with regards to:
  - Accessibility to valve for setting/adjustment
  - Tube cutting
  - Jointing
  - Bracketing/supports
- Orientation: whilst the PICV can operate correctly in different orientations, there are recommendations regarding the orientation of actuators - see diagram in Assembly Orientation section.
- Would normally be installed on return pipework, i.e. after the equipment it is controlling, but can be installed in flow if required.
- Ensure direction of flow is correct - indicated by cast arrow on body.

## Installation (CONTINUED)

- Fig. 306F operates between a minimum and maximum pressure drop across the valve - see section for Differential Pressure Requirements.
- PICV's are not designed as isolation valves. Dedicated isolation valves should be installed to isolate against system pressure, i.e. for maintenance etc. when disconnecting/draining pipework.
- Systems should be installed with strainers to protect the PICV and other installed items.

## Flushing

Control valves, like the PICV, are sized to give good control over the system water, therefore, have been designed with small convoluted flow path. These water ways may not allow adequate water velocities for flushing of the coil, even when fully open. Therefore, in line with BSRIA recommendations, it is recommended that a flushing point be located between the coil and the PICV. This allows the coil to be flushed without the water passing through the PICV.

## Commissioning

The Fig. 306F controls the flow rate depending on its set position, therefore, removing the need to measure the flow rate.

The Fig. 306F maintains a constant differential pressure across its internal seat, any excess pressure being absorbed by the internal differential pressure controller. To ensure that sufficient pressure is available for the differential pressure controller to control the flow rate correctly, a differential pressure reading should be taken using the test points provided.

When taking differential pressure readings, it is important that the system is running at full load, i.e. with all PICVs open. This ensures that differential pressure readings are carried out in the most unfavourable conditions, guaranteeing optimum performance in normal running conditions.

To ensure that all PICVs are working at the required differential pressure, it is necessary to check the least favoured / index PICV. By verifying the least favoured PICV is set to the required differential pressure, all other PICVs must have a higher differential pressure. However, we would also recommend that a selection of other PICVs are tested along the circuit to verify this.

## Differential Pressure Requirements

Each valve size (DN50-DN150) at each % setting option requires a specific  $\Delta P$  (Differential Pressure) to ensure the PICV is within its working range. For details, please see Table 1 below.

Table 1

| DN50 | Flow               |        |     | $\Delta P$<br>kPa |
|------|--------------------|--------|-----|-------------------|
|      | m <sup>3</sup> /hr | l/hr   | l/s |                   |
| 100% | 20.0               | 20,000 | 5.6 | 50                |
| 90%  | 18.0               | 18,000 | 5.0 | 50                |
| 80%  | 16.0               | 16,000 | 4.4 | 40                |
| 70%  | 14.0               | 14,000 | 3.9 | 40                |
| 60%  | 12.0               | 12,000 | 3.3 | 40                |
| 50%  | 10.0               | 10,000 | 2.8 | 40                |
| 40%  | 8.0                | 8,000  | 2.2 | 40                |
| 30%  | 6.0                | 6,000  | 1.7 | 30                |
| 20%  | 4.0                | 4,000  | 1.1 | 30                |
| 15%  | 3.0                | 3,000  | 0.8 | 30                |

| DN65 | Flow               |        |     | $\Delta P$<br>kPa |
|------|--------------------|--------|-----|-------------------|
|      | m <sup>3</sup> /hr | l/hr   | l/s |                   |
| 100% | 30.0               | 30,000 | 8.3 | 50                |
| 90%  | 27.0               | 27,000 | 7.5 | 50                |
| 80%  | 24.0               | 24,000 | 6.7 | 40                |
| 70%  | 21.0               | 21,000 | 5.8 | 40                |
| 60%  | 18.0               | 18,000 | 5.0 | 40                |
| 50%  | 15.0               | 15,000 | 4.2 | 40                |
| 40%  | 12.0               | 12,000 | 3.3 | 40                |
| 30%  | 9.0                | 9,000  | 2.5 | 30                |
| 20%  | 6.0                | 6,000  | 1.7 | 30                |
| 17%  | 5.0                | 5,000  | 1.4 | 30                |

| DN80 | Flow               |        |     | $\Delta P$<br>kPa |
|------|--------------------|--------|-----|-------------------|
|      | m <sup>3</sup> /hr | l/hr   | l/s |                   |
| 100% | 30.0               | 30,000 | 8.3 | 50                |
| 90%  | 27.0               | 27,000 | 7.5 | 50                |
| 80%  | 24.0               | 24,000 | 6.7 | 40                |
| 70%  | 21.0               | 21,000 | 5.8 | 40                |
| 60%  | 18.0               | 18,000 | 5.0 | 40                |
| 50%  | 15.0               | 15,000 | 4.2 | 40                |
| 40%  | 12.0               | 12,000 | 3.3 | 40                |
| 30%  | 9.0                | 9,000  | 2.5 | 30                |
| 20%  | 6.0                | 6,000  | 1.7 | 30                |
| 17%  | 5.0                | 5,000  | 1.4 | 30                |

| DN100 | Flow               |        |      | $\Delta P$<br>kPa |
|-------|--------------------|--------|------|-------------------|
|       | m <sup>3</sup> /hr | l/hr   | l/s  |                   |
| 100%  | 25.0               | 55,000 | 15.3 | 50                |
| 90%   | 49.5               | 49,500 | 13.8 | 50                |
| 80%   | 44.0               | 44,000 | 12.2 | 40                |
| 70%   | 38.5               | 38,500 | 10.7 | 40                |
| 60%   | 33.0               | 33,000 | 9.2  | 40                |
| 50%   | 27.5               | 27,500 | 7.6  | 40                |
| 40%   | 22.0               | 22,000 | 6.1  | 40                |
| 30%   | 16.5               | 16,500 | 4.6  | 30                |
| 27%   | 15.0               | 15,000 | 4.2  | 30                |
| -     | -                  | -      | -    | -                 |

| DN125 | Flow               |        |      | $\Delta P$<br>kPa |
|-------|--------------------|--------|------|-------------------|
|       | m <sup>3</sup> /hr | l/hr   | l/s  |                   |
| 100%  | 90.0               | 90,000 | 25.0 | 50                |
| 90%   | 81.0               | 81,000 | 22.5 | 50                |
| 80%   | 72.0               | 72,000 | 20.0 | 40                |
| 70%   | 63.0               | 63,000 | 17.5 | 40                |
| 60%   | 54.0               | 54,000 | 15.0 | 40                |
| 50%   | 45.0               | 45,000 | 12.5 | 40                |
| 40%   | 36.0               | 36,000 | 10.0 | 40                |
| 30%   | 27.0               | 27,000 | 7.5  | 30                |
| 20%   | 18.0               | 18,000 | 5.0  | 30                |
| 17%   | 15.0               | 15,000 | 4.2  | 30                |

| DN150 | Flow               |         |      | $\Delta P$<br>kPa |
|-------|--------------------|---------|------|-------------------|
|       | m <sup>3</sup> /hr | l/hr    | l/s  |                   |
| 100%  | 150.0              | 150,000 | 41.7 | 50                |
| 90%   | 135.0              | 135,000 | 37.5 | 50                |
| 80%   | 120.0              | 120,000 | 33.3 | 40                |
| 70%   | 105.0              | 105,000 | 29.2 | 40                |
| 60%   | 90.0               | 90,000  | 25.0 | 40                |
| 50%   | 75.0               | 75,000  | 20.8 | 40                |
| 40%   | 60.0               | 60,000  | 16.7 | 40                |
| 30%   | 45.0               | 45,000  | 12.5 | 30                |
| 20%   | 30.0               | 30,000  | 8.3  | 30                |
| 10%   | 15.0               | 15,000  | 4.2  | 30                |

## Differential Pressure Requirements (CONTINUED)

For flow rates in between settings, extrapolation of position can be used.

The pump speed should be set to ensure that the required differential pressure is always available.

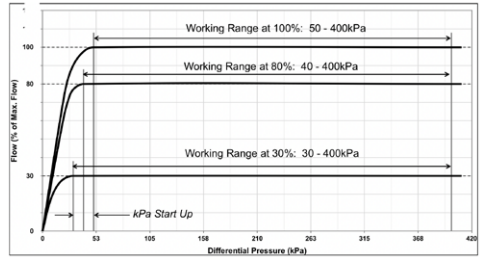
By setting the differential pressure across the least favoured PICV to the value stated in Table 1, it ensures that minimum pump energy is used, therefore, reducing system running costs and CO2 emissions.

To set pump speed to achieve this, whilst measuring  $\Delta P$  across the valve, increase pump speed until a  $\Delta P$  greater than the minimum  $\Delta P$  is achieved.

P84 test points are supplied with the valve and are to be fitted to the body for Differential Pressure measurement.

The optimum setting is achieved when there is sufficient, but not excessive, pump pressure available.

The valve characteristics show reducing minimum Differential Pressure to ensure the PICV is working – For example, when the valve is set at 100% of nominal (maximum) flow, the flow remains constant from 50kPa and the resultant working range of the valve is 50-400kPa; When the valve is set at 30% of nominal flow, the flow remains constant from 30kPa and the resultant working range of the valve is 30-400kPa.



## Pre-Setting

The PICV set position can be established by:

### 1. Calculation 2. Using Table 1

#### 1. Establish set position by calculation

- Identify installed valve from ID Plate on side of valve
- From Table 1, establish fully open flow rate (100%)
- Divide required flow rate by fully open flow rate x 100 to establish % open setting:
- Example DN100:
  - Flow rate at 100%, from Table 1 = 55 m³/hr
  - Required flow rate = 33 m³/hr
  - $(33 / 55) * 100 = 60\%$

#### 2. Use of look up table 1 on page 02

- Identify installed valve from ID Plate on side of valve
- Check flow rate required and read across chart.
- Example DN100:
  - Required flow rate = 33 m³/hr
  - Set position % = 60%

To set the valve, adjust the Maximum Flow Setting (Set 4) on the actuator (see Actuator Initialisation).

**Note:** The actuator can be configured to display flow in m³/hr or gal/min, or % setting (Set 1).

## Flow % as a Function of Actuator Control

The following values state the flow value (%) as a function of actuator control applied:

Table 2

| Actuator Voltage Applied - % | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
|------------------------------|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Linear Curve - %             | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
| Equal Percentage Curve - %   | 2 | 2 | 3  | 4  | 4  | 5  | 6  | 8  | 10 | 12 | 14 | 17 | 21 | 25 | 31 | 38 | 46 | 56 | 68 | 82 | 100 |

## Actuator Options

The Fig. 306F is designed to work with the fitted and supplied actuator only – Each actuator is configured to the valve size it has been supplied with, therefore actuator must not be interchanged.

Hattersley cannot be held responsible if actuators are removed and not re-fitted to the original PICV, which could result in loss of control function or damage to the actuator.

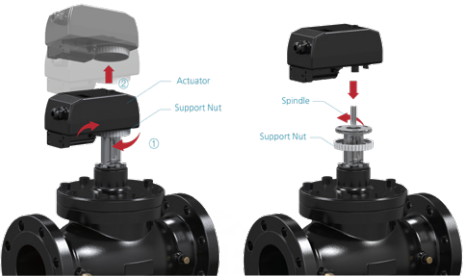
The same actuator is used for Modulating, 3 Point and On/Off function, subject to wiring and installation as detailed. This Valve is designed to function only with the actuator fitted and cannot be used as a Constant Flow Regulator i.e. without the actuator fitted.

## Actuator Assembly Method

The actuator can be removed and re-fitted by loosening/ tightening the Locking Nut.

On refitting, engage actuator correctly into the support plate, and engage the locking ring to secure.

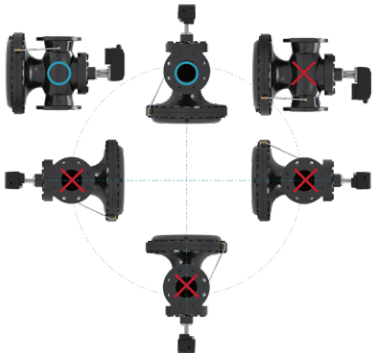
After refitting, the actuator must be recalibrated to ensure correct function and prevent damage to actuator.



## Assembly Orientation

The valve can be assembled in any orientation, but the actuator MUST be assembled only in orientations as shown.

The actuator should be installed so that it is higher than horizontal to the valve to prevent condensation ingress (refer to diagram).



## Actuator Initialisation

The Fig. 306F is set up with supplied and fitted actuator.

### Power Up:

- When power is first applied the actuator 'GO 0' will be displayed.
- The actuator will automatically cycle through its own self-calibration cycle, followed by adjustment to initial setting of the valve.
- At this point, do not adjust any setting – Allow this to complete and wait for '0' to be displayed.

### Settings Adjustment:

- Press 'MODE' button twice consecutively and the actuator will enter setting mode.
- The values can be adjusted by pressing UP and Down buttons.
- When in setting mode, use the 'MODE' button again to scroll through all setting options.
- The actuator can be re-calibrated at any time by pressing the 'Up' and 'Down' buttons simultaneously and hold for 2 seconds. 'GO 0' will be displayed.



Table 3

| Settings | Indication                  | Definition                           | Operation                                 |
|----------|-----------------------------|--------------------------------------|-------------------------------------------|
| S-01     | Input / Indication Type     | Perc                                 | '%' Input                                 |
|          |                             | Flo                                  | 'Flow' Input                              |
| S-02     | Input                       | 0-10                                 | Voltage Input                             |
|          |                             | 2-10                                 | Voltage Input                             |
|          |                             | 0-20                                 | Current Input                             |
|          |                             | 4-20                                 | Current Input                             |
|          |                             | on-F                                 | On/Off Input (24V Open, 0V Close)         |
|          |                             | R/T                                  | Controller                                |
|          |                             | 3-FL                                 | 3 Point Floating Input                    |
|          |                             | P-05                                 | PWM 5 Sec (0.1~5.0 Sec)                   |
|          |                             | P-25                                 | PWM 25 Sec (0.1~25 Sec)                   |
|          |                             | Int                                  | Internal Input                            |
| S-03     | Min. flow setting           | Minimum flow setting to be displayed | "Min" setting flow                        |
| S-04     | Max. flow setting           | Minimum flow setting to be displayed | "Max" setting flow                        |
| S-05     | Setting and Feedback values | Fd-F                                 | Display 'Flow' Feedback Value             |
|          |                             | Fd-P                                 | Display '%' Feedback Value                |
|          |                             | St-F                                 | Display 'Flow' Setting Value              |
|          |                             | St-P                                 | Display '%' Setting Value                 |
| S-06     | Rotation angle compensation | Maximum pulse value to be displayed  | Value for Compensation for rotation angle |
| S-07     | Flow offset compensation    | 0 (+/-10%)                           | Value for compensation to offset flow     |
| S-08     | Failsafe                    | OPEN                                 | Valve OPEN at power failure               |
| S-08     |                             | CLOSE                                | Valve CLOSE at power failure              |
| S-09     | Flow Unit                   | Int                                  | Unit of Flow - m <sup>3</sup> /hr         |
|          |                             | GAL                                  | Unit of Flow - GPM                        |
| S-10     | Control Characteristic      | LIN                                  | Linear Control Characteristic             |
|          |                             | EPER                                 | Equal Percentage Control Characteristic   |

## Actuator Initialisation (CONTINUED)

Table 3

| Settings | Indication                    | Definition                                 | Operation                                                   |
|----------|-------------------------------|--------------------------------------------|-------------------------------------------------------------|
| S-11     | Min. Control volt Calibration | Min. volt Analogue value Numerical display | DO NOT ADJUST                                               |
| S-12     | Max. Control Volt Calibration | Max. volt Analogue value Numerical display | DO NOT ADJUST                                               |
| S-13     | Speed of Rotation             | PE01                                       | Speed of Rotation 1 rpm                                     |
|          |                               | PE15                                       | Speed of Rotation 1.5 rpm                                   |
|          |                               | AUTO                                       | Speed of Rotation automatic adjustment (1 ~ 1.5 rpm)        |
| S-14     | Feedback Method to BMS        | 0-10                                       | Feedback method - Voltage Pin5-Pin1 Voltage: 0V-10V         |
|          |                               | 2-10                                       | Feedback method - Voltage Pin5-Pin1 Voltage: 2V-10V         |
|          |                               | 0-20                                       | Feedback method - Current Pin5-Pin1 Current: 0-20mA Control |
|          |                               | 4-20                                       | Feedback method - Current Pin5-Pin1 Current: 4-20mA Control |

## Actuator Properties

### Operating Summary

- 24VAC/DC, 50/60Hz
- Input Signal 4-20mA, 0-20mA, 2-10VDC and 0-10VDC
- IP54
- 60 ~ 330 seconds fully open to fully closed

## Maximum Ratings

- Operating Voltage 1: 33VDC
- Operating Voltage 2: 26VAC
- Operating temperature: 50°C
- CW/CCW Control Input: 28VDC
- PWM Control Input: 28VDC
- Remote Output Current: 100mA

Table 4

| No. | Item                              | Symbol               | Min. | Typ | MAX  | Unit            |
|-----|-----------------------------------|----------------------|------|-----|------|-----------------|
| 1   | Operating Voltage 1               | V <sub>IN</sub>      | 16   | 24  | 30   | V <sub>DC</sub> |
| 2   | Operating Voltage 2               | V <sub>IN</sub>      | 16   | 24  | 26   | V <sub>AC</sub> |
| 3   | Operating Current                 | I <sub>CC</sub>      | 50   | 60  | 120  | mA              |
| 4   | Power Consumption                 | P <sub>D</sub>       | 1.2  | 1.5 | 3.0  | W               |
| 5   | Lock Detecting Current (Variable) |                      | 220  | 300 | 380  | mA              |
| 6   | Operating Temperature             | Top                  | 0    | 25  | 45   | °C              |
| 7   | Storage Temperature               | T <sub>STORAGE</sub> | -20  | 25  | 80   | °C              |
| 8   | CW/CC Control Input Logic 1       |                      | 9    | -   | 28   | V <sub>DC</sub> |
| 9   | CW/CC Control Input Logic 0       |                      | 0    | -   | 1.2  | V <sub>DC</sub> |
| 10  | PWM Control Input Logic 1         |                      | 9    | -   | 28   | V <sub>DC</sub> |
| 11  | PWM Control Input Logic 0         |                      | 0    | -   | 1.2  | V <sub>DC</sub> |
| 12  | Analog Voltage Control Input      |                      | 2    | -   | 10   | V <sub>DC</sub> |
| 13  | Analog Current Control Input      |                      | 4    | -   | 20   | mA              |
| 14  | Remote Control Output Voltage     |                      | 8    | 12  | 13.8 | V <sub>DC</sub> |
| 15  | Remote Control Output Current     |                      | -    | -   | 80   | mA              |

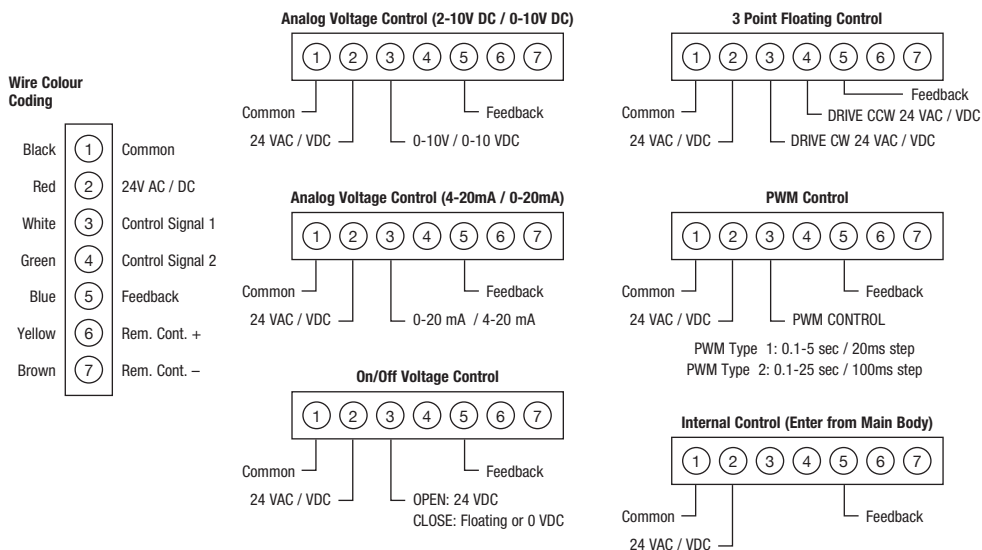
Footnote 1 - V<sub>IN</sub> = 24 VDC State of no load

## Wiring Instructions

Table 5

| Function                 | No.<br>Colour | 1<br>Black | 2<br>Red | 3<br>White                                             | 4<br>Green                | 5<br>Blue | 6<br>Yellow | 7<br>Brown |
|--------------------------|---------------|------------|----------|--------------------------------------------------------|---------------------------|-----------|-------------|------------|
| Internal Control         |               | Common     | 24VAC/DC |                                                        |                           | FEEDBACK  |             |            |
| Voltage Control          |               | Common     | 24VAC/DC | 0-10 V <sub>DC</sub>                                   |                           |           |             |            |
|                          |               |            |          | 2-10 V <sub>DC</sub>                                   |                           |           |             |            |
| Current Control          |               | Common     | 24VAC/DC | 0-20 mA                                                |                           |           |             |            |
|                          |               |            |          | 4-20 mA                                                |                           |           |             |            |
| On/Off Control           |               | Common     | 24VAC/DC | 24 V <sub>DC</sub> (open)<br>0 V <sub>DC</sub> (close) |                           |           |             |            |
| 3 POINT FLOATING Control |               | Common     | 24VAC/DC | Drive cw (open)<br>24DC (open)                         | Drive ccw (close)<br>24DC |           |             |            |
| PWM Control              |               | Common     | 24VAC/DC | PWM control signal                                     |                           |           |             |            |

**Note:** Actuators can be sensitive to Electric Noise generated by other electrical equipment, to prevent this it is recommended to connect a 1k ohm, 0.5W to Wires 3 and 4, or 4 and 1.



When servicing\* ensure that:

- The electric supply to the actuator is switched off to avoid possible damage to the equipment, personal injury or shock.
- Make sure that the line power supply is in accordance with the power supply specified on the actuator.
- All wiring should conform to local codes and must be carried out by authorized personnel only.
- Do not touch or attempt to connect or disconnect wiring when electric power is on
- Do not open or attempt to repair. Please contact our Technical Department.

\*Please note wiring should be carried out by a qualified and competent person.

## Maintenance Procedure

1. Turn off Actuator / Isolate actuator power supply. Ensure no readout on the Actuator.
2. Remove x3 screws (8mm) located between the Actuator Support and Valve Body.
3. Once Actuator has been removed, fully open the valve by rotating the Adjuster Shaft Counter- Clockwise (using an 8mm Spanner).
4. Apply oil on to the thread of the Adjuster Shaft. Recommend Oil – TAS-100EP Solid Film Lubrication Grease.
5. After applying oil, fully close the valve by rotating the Adjuster Shaft clockwise, and then returning to fully open position by rotating the Adjuster Shaft Counter-Clockwise. Repeat 2-3 times.

**Note:** Final stem position is irrelevant as actuator resets position during calibration.

6. Re-Install Actuator by refitting x3 screws.
7. Power up the Actuator. Actuator will now repeat calibration process as described in Actuator Initialisation section. Previously applied configuration settings will remain.



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