Electropneumatic Positioner Series EP5, ISP5
Installation and Maintenance Instructions

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1. Introduction

1.1 Introduction
The EP5 is a 2 wire loop powered positioner requiring a 4 - 20 mA control signal, and is for use with linear pneumatic valve actuators. The positioner compares the electrical signal from a controller with the actual valve position and varies a pneumatic output signal to the actuator accordingly. The desired valve position is therefore maintained for any control signal and the effects of varying differential pressure, stem friction and hysteresis are overcome. A mounting kit is supplied to suit all NAMUR standard columns or yokes.

Note: An intrinsically safe version ISP5 is also available.

1.2 Operating principle
The EP5 operates on a force balance principle by means of a nozzle/flapper mechanism and a feedback spring (refer to Fig. 1).

The electrical control signal (A) is converted into a proportional air pressure (I). This pressure is applied to the flapper (5) via the receiver (1), causing a deflection of the flapper relative to the nozzles U1 / U2. From the air supply (S) a reduced bleed of air is fed to the amplifier relay (2) and into one of the nozzles U1 / U2. As the flapper moves the pressure drop through the nozzle is sensed by the amplifier relay. The amplifier relay outputs a signal (O) to the actuator which is proportional to the pressure drop through the nozzle.

As the actuator moves, connecting lever (8) causes a change in tension of the reaction spring (6). This tension is applied to the flapper causing it to move to a new position at which the forces applied by the spring and the applied pressure (I) balance.

Important: This instrument bleeds air in normal operation at a rate of approximately 0.7 N m³ / hour at 6 bar.
2. Installation

This publication is provided as a guide and it is recommended that it is read thoroughly prior to installation. See separate Installation and Maintenance Instructions for the control valve and actuator.

2.1 Safety Information

The flawless and safe operation of the EP5 and ISP5 positioners is reliant on proper transportation, storage, installation and commissioning by qualified personnel, proper use, and careful maintenance.

Your attention is drawn to the general Spirax Sarco Information leaflet IM-GCM-10. Prior to installing / using / maintaining the positioner, consideration should be given to:

- Working environment
- Access
- Lighting
- Pipeline fluid hazards
- Temperature
- System isolation

2.2 Location

The positioner should be mounted in sufficient space to allow removal of the cover and provide access to connections. When fitting to an actuator, ensure the positioner will not be exposed to an ambient temperature outside the range -15°C to +65°C. The positioner enclosure is rated to IP54 see BS EN 60534-6-1 1998.

Connection of air supply pressure (1.4 to 6 bar g) and control signal (4 - 20 mA or 0 - 10 Vdc) should be considered prior to choice of location.

2.3 Mounting the positioner onto the actuator

The EP5 positioner may have been supplied already factory fitted onto the valve actuator. However, using the mounting kit provided it can be attached retrospectively onto any other type of valve and actuator conforming to NAMUR standards.

Step 1 Identify actuator type

For correct operation it is important to know two factors which will affect optimum movement of the positioner feedback mechanism:

- The distance between the axes of the valve / actuator stem and the positioner slide pin.
- The travel of the valve actuator.

To ensure these are set correctly, please note the following:

- When attaching EP5 to any Spirax Sarco valve actuator, ignore step 3.
- For non-Spirax Sarco actuators, ignore step 2.
Step 2 For attachment to Spirax Sarco actuators
Using the 2 off M6 pan head screws, securely attach the 'T' shaped sliding pin holder to the valve actuator coupling block (Fig. 2). Apply Loctite to the sliding pin and screw into hole 'Y' (as shown) on the sliding pin holder and tighten.

![Fig. 2](image)
Close-up of sliding pin holder fitted to valve coupling.

Using the 2 off M8 x 15 hex head screws and 8 mm spring washers, attach the mounting plate to the back of the positioner, utilising holes No. 2 in the bracket (Fig. 3). Take care not to over-tighten these screws and strip the threads.

![Fig. 3](image)

Step 3 For attachment to non-Spirax Sarco actuators
Using the 2 off M6 pan head screws, securely attach the 'T' shaped sliding pin holder to the valve actuator coupling block (Fig. 2). Depending on the travel of the valve actuator, apply Loctite to sliding pin and screw into the correct hole on the sliding pin holder and tighten. Use Fig. 2 and Table 1 to determine the correct hole to use.

### Table 1

<table>
<thead>
<tr>
<th>Valve travel</th>
<th>Hole to be used</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 - 15 mm</td>
<td>X</td>
</tr>
<tr>
<td>15 - 30 mm</td>
<td>Y</td>
</tr>
<tr>
<td>above 30 mm</td>
<td>Z</td>
</tr>
</tbody>
</table>

Using the 2 off M8 x 15 hex head screws and 8 mm spring washers, attach the mounting plate to the back of the positioner. The correct fixing hole may be determined by reference to Fig. 3, Table 2 and Fig. 4. Take care not to over-tighten these screws and strip the threads.
Step 4 Temporarily apply adequate air pressure directly into the actuator so that the valve is at 50 % of travel (Fig. 5).

Step 5 Engage the slide pin into the positioner lever (see Fig. 5, noting the position of the spring, above the pin) and loosely fix the positioner to the actuator. For yoke actuators use the single elongated screw hole with the M8 x 20 screw and spring washer, for pillars use the U-clamps.

**Important**: Slide positioner vertically up or down the yoke/pillars so the positioner lever is horizontal at 50 % travel, and the indicator at LHS is aligned (Fig. 5). Secure the tightening screws/nuts.

Table 2

<table>
<thead>
<tr>
<th>D</th>
<th>Hole to be used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 125 mm</td>
<td>1</td>
</tr>
<tr>
<td>125 to 150 mm</td>
<td>2</td>
</tr>
<tr>
<td>150 to 175 mm</td>
<td>3</td>
</tr>
<tr>
<td>above 175 mm</td>
<td>4</td>
</tr>
</tbody>
</table>

Fig. 4 Pillar/yoke spacing, showing 50 % travel.

Fig. 5 Pillar/yoke spacing, showing 50 % travel.
Step 6  Fit the angled protection plate to the rear of the positioner using the 2 off captive M3 pan head screws. Access to these captive screws is from inside the positioner.

Step 7  Adjust the air supply pressure to stroke the actuator from 0 % to 100 % and ensure the positioner lever rotates freely. Remove the temporary air supply from the actuator.

Step 8  Fitting a gauge block (optional)
To aid commissioning it is recommended to fit a gauge block and pressure gauges to all EP5s. Please note that gauges and gauge block can be supplied as spare parts if required.

Fit gauges to the block before attaching the block to the EP5. Use thread sealant to ensure air tight connections. The upper gauge displays the output of the I/P converter, and is normally 0 - 2 bar g. The lower gauge displays the positioner output pressure, so the gauge range will depend on the actuator.

Remove any air fittings and blanking plug from the EP5, then attach the assembled block to the EP5 using the 2 off socket head cap screws supplied. Ensure the sealing 'O' rings are correctly fitted to seal the joints between the EP5 body and the gauge block. Replace the fittings and blanking plug into the corresponding ports on the gauge block.

2.4  Connecting up

2.4.1  Pneumatic connections (with or without a gauge block)
Pneumatic connections are located at the right hand end of the positioner and identified I, S and O as follows:
- I - Not used on EP5, fit ¼” NPT plug.
- S - Air supply - 1.4 bar g to 6 bar g, depending upon required actuator spring range.
- O - Output signal to the actuator.
Connections are ¼” NPT female. Interconnection between positioner and actuator should be at least 6 mm OD tube.

2.4.2  Air supply
The results which can be obtained with pneumatic instrumentation are dependent upon the air supply quality, so the air supply should be dry, oil and dust free. It is therefore strongly recommended that a coalescing filter regulator (MPC2) is fitted between the compressed air supply and the positioner inlet (S). Avoid use of ferrous pipe work after the MPC2. For best performance, set the air supply pressure to about 0.5 bar g above the pressure required to fully travel the actuator. Check all connections for leaks. Please note however that the EP5 bleeds air in normal operation at a rate of approximately 0.7 N m³/hour at 6 bar supply pressure.

2.4.3  Electrical connections
The EP5 only requires a 4 - 20 mA (standard) or 2 - 10 Vdc (if requested) signal. Remove the front cover and locate the terminal block and earth terminal post (Fig. 6).

Connection to the unit is through the Pg 13.5 cable gland (as supplied), which when used with suitable cable will ensure the IP54 protection rating. Appropriate conduit connections may be used instead.

Connect conductors (0.5 to 2 mm²) to the terminal block and earth post (3 mm²) noting the polarity +/- shown in Fig. 6.

In hazardous areas use model ISP5 with intrinsic protection (type EEx ia IIC T6, T5, T4) ensuring the power supply from adjoining equipment is certified in accordance with EN 50.014 and EN 50.020 standards, in respect of the limits of electric features shown at approval stage. Refer to approval certificate supplied with each ISP5 product.
3. Commissioning

Once the positioner has been mounted and connected up, proceed as follows.

Step 1 Set the valve action
Establishing the correct action of the valve is done by:

a. Connection to either U1 or U2 nozzles (see Fig. 7) and

b. Setting the slider in the upper or lower portion of the crescent-shaped sector lever (Fig. 8).

U1 = Increase action = With increasing electrical control signal the air pressure to the actuator will increase.

U2 = Decrease action = With increasing electrical control signal the air pressure to the actuator will decrease.
To change the working nozzle connections (U1 or U2):
Disconnect the air supply. Loosen the retaining plate and rotate it clear of the tube holder. Pull the tube holder clear of its seat and re-insert the tube holder into the alternative seat location. Lock in place with alternative retaining plate (lock unused retaining plate to prevent loss of plate). Reconnect air supply.

To change the slider location:
Refer to Fig. 8 to determine the correct portion. To change the slider slacken the screw and slide it into the correct portion of the arm.

Fig. 8a Increase action and spring extend

Upper sector

Fig. 8b Increase action and spring retract

Lower sector

Fig. 8c Decrease action and spring extend

Lower sector

Fig. 8d Decrease action and spring retract

* The arrow shows the stem movement direction when the input control signal increases.
Step 2  Set sensitivity
The positioner sensitivity is adjusted using the sensitivity screw (Xp %, see Fig. 10). It is set depending on air supply pressure. Before the commissioning stage it is essential to set the sensitivity within a proportional band of (3 % to 6 %). Use Fig. 10 to adjust the sensitivity screw by firstly fully closing the screw (clockwise), then reopen the screw:-

Supply pressure (S)    1.4 bar - Screw open ¾ of a turn
                         4.0 bar - Screw open ¼ of a turn
                         6.0 bar - Screw open ⅛ of a turn

Fig. 9

To increase positioner sensitivity close the adjusting screw, to decrease sensitivity open the screw. Do not open the screw beyond the mechanical lock.

Fig. 10

Note: Adjustment of the Xp % screw causes a change of positioner 'zero' point, and it is therefore important to repeat the zeroing and travel setting procedures (Steps 4 and 5) after any changes.
Step 3  Set damping
The final adjustment of damping screw should be performed with plant in operation, in order to limit, if necessary, the actuation speed. During the commissioning set the damp screw flush with the body see Fig. 10.

![Damp screw](image)

The reduction of air flowrate capacity to the actuator will slow down the valve movement to limit the effect of cycling hunting. Closing the screw (clockwise) increases damping, and vice versa.

Step 4  Set zero point
Check all air and electrical connections are in place. Check air supply pressure (S) is correct (see Section 2.4.2). Check electrical control signal (A) (see Section 2.4.3) is at the minimum required (normally 4 mA or 0 V), but the application may require a different setting. It may also be advisable to increase the minimum by 0.5 mA or 0.25 V to ensure the valve is completely closed. For 3-port valves (or if the action has been reversed for 2-port valves) a higher electrical signal corresponds to the closed valve position, it may be beneficial to decrease the maximum electrical control signal to 19.5 mA or 9.75 V. This will ensure that the valve is firmly seated when the full electrical signal of 20 mA or 10 V is applied.

Locate zero point adjustment screw (see Fig. 12) and release the locking ring. Adjust screw until the valve starts to move and lock the adjuster in place.

Check the zero point by reducing the electrical control signal (A) (see Section 2.4.3) to zero. Slowly increase the electrical control signal towards the minimum level whilst monitoring valve movement. Should movement take place before or after the minimum control signal then repeat adjustment until movement coincides with minimum control signal.
Note: Positioners fitted with a gauge block have the benefit of anticipating valve movement by indicating increases of output air pressure.

Step 5 Set travel
Increase the electrical control signal to the upper value (normally 20 mA or 10 V, but this depends on the application) and now check the travel of the valve. If required, slacken the central locking screw (see Fig. 12) and adjust the slider up or down the upper or lower portion of the crescent shaped sector lever. Moving the slider away from the pivot will reduce the travel, and vice versa. Normally, except with 3-port valves, the fully open position is achieved before the valve plug hits the upper mechanical stop of the valve / actuator. Avoid settings of the positioner that allow contact with this mechanical stop. Vary the electrical control signal around the upper value to verify the travel setting, and if necessary repeat the adjustment of the slider until the required travel occurs at the upper value.

Important: Zero and travel settings on EP5 are not independent of each other, so re-check the zero setting as described in Step 4. It may prove necessary to repeat Steps 4 and 5 several times until acceptable zero and travel settings are achieved. For fine adjustment of the travel, the potentiometer shown in Fig. 12 can be used. This should only be used for final adjustment of +/- 5%.

When complete, lock both zero and travel adjustments.

Split range operation
EP5 may be split ranged to sequentially actuate two valves from one control signal (e.g. valve 1 set 4 - 12 mA, valve 2 set 12 - 20 mA). Split ranging is achieved by adjustment of the zero and travel settings refer to Steps 4 and 5.
4. Maintenance

4.1 Regular maintenance
1. Drain any build-up within the air supply filter set as impurities such as oil, water and dirt will cause inconsistent operation.
2. Ensure air supply is at the correct pressure (see Section 2.4.2 and refer to actuator TI).
3. Make visual checks to ensure the valve is operating correctly.

4.2 Corrective maintenance
4.2.1 Removal and cleaning of sensitivity adjuster (see Fig. 14)
   - Loosen and remove lock.
   - Note setting then remove sensitivity screw.
   - Wash adjuster with solvent, checking condition of the cone and ensuring 0.35 mm side hole is clear.
   - Dry with clean compressed air to ensure no remaining contaminants.
   - Refit the cleaned adjuster and unscrew it 1 turn from its stop.

   Fig. 14

   - Refit the lock to touch the adjuster top and secure with lock-nut.
   - Set sensitivity see Step 2, Section 3, Commissioning.
   - Reset zero and span if required.

4.2.2 Removal and cleaning of capillary orifice (see Fig. 15)
   - Loosen locking plate screw.
   - Rotate locking plate to expose capillary orifice.
   - Using supplied extractor / cleaner pull the orifice from the body.
   - Clean the small orifice and cross drilling using only the special cleaning wire supplied.
   - Reassemble the orifice ensuring both 'O' rings are in place and the lock plate covers the orifice.
4.2.3 Check damping grease

- Ensure gap of 1 mm exists between faces of damper. Adjust if necessary.
- Verify grease is present between faces.
- Replace grease if necessary (contact Spirax Sarco for details).
### 5. Fault finding

<table>
<thead>
<tr>
<th>Output pressure too low or zero</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. No control signal</td>
<td>a. Restore mA signal</td>
</tr>
<tr>
<td>b. Low air supply pressure</td>
<td>b. Verify actuator air pressure requirement</td>
</tr>
<tr>
<td>c. Clogged or dirty sensitivity adjuster</td>
<td>c. Clean adjuster see Section 4.2.1</td>
</tr>
<tr>
<td>d. Clogged or dirty capillary orifice</td>
<td>d. Clean orifice see Section 4.2.2</td>
</tr>
<tr>
<td>e. Incorrect set-up</td>
<td>e. Recalibrate see Section 3, Steps 1 to 5</td>
</tr>
<tr>
<td>f. Damaged pneumatic actuator or piping</td>
<td>f. Verify replace as necessary</td>
</tr>
<tr>
<td>g. Port I not blanked or leaking</td>
<td>g. Insert ¼” NPT blank in port I</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output pressure too high</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Sensitivity adjuster open too far</td>
<td>a. Recalibrate see Section 3, Step 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actuator movement too slow</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Low air supply capacity</td>
<td>a. Check supply capacity and pipe sizes</td>
</tr>
<tr>
<td>b. Damping screw closed too far or clogged</td>
<td>b. Recalibrate see Section 3, Step 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actuator failing to close</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Output pressure too low</td>
<td>a. Refer to previous fault</td>
</tr>
<tr>
<td>b. Incorrect zero point</td>
<td>b. Recalibrate see Section 3, step 4</td>
</tr>
<tr>
<td>c. Damping screw closed or clogged</td>
<td>c. Clean screw and recalibrate see Section 3, Step 3</td>
</tr>
<tr>
<td>d. Valve / actuator coupling incorrect</td>
<td>d. Reset (refer to valve / actuator IMIs)</td>
</tr>
<tr>
<td>e. Actuator too small</td>
<td>e. Fit correct actuator</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actuator failing to fully open valve</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Output pressure too low</td>
<td>a. Refer to previous fault</td>
</tr>
<tr>
<td>b. Incorrect travel adjustment</td>
<td>b. Recalibrate see Section 3, Step 5</td>
</tr>
<tr>
<td>c. Damping screw closed or clogged</td>
<td>c. Clean screw and recalibrate see Section 3, Step 3</td>
</tr>
<tr>
<td>d. Valve / actuator coupling incorrect</td>
<td>d. Reset (refer to valve / actuator IMIs)</td>
</tr>
<tr>
<td>e. Actuator too small</td>
<td>e. Fit correct actuator</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hunting</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Incorrect controller set up (P, I, and D)</td>
<td>a. Verify and adjust according to process requirement</td>
</tr>
<tr>
<td>b. Sensitivity orifice closed too far</td>
<td>b. Adjust by opening sensitivity screw see Section 3, Step 2</td>
</tr>
<tr>
<td>c. Excessive valve friction</td>
<td>c. Verify and maintain as valve IMI</td>
</tr>
<tr>
<td>d. Control valve over-sizing</td>
<td>d. Verify operating conditions against valve capacity.</td>
</tr>
</tbody>
</table>

**Note:** The effects of hunting caused by valve over-sizing or unstable process conditions can be reduced by adjustment of damping screw see Section 3, Step 3.
6. Spare parts

Available spare

<table>
<thead>
<tr>
<th>Description</th>
<th>TAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge block (without gauges)</td>
<td>1</td>
</tr>
<tr>
<td>Gauge 0 - 2 bar</td>
<td>2</td>
</tr>
<tr>
<td>Gauge 0 - 4 bar</td>
<td>3</td>
</tr>
<tr>
<td>Gauge 0 - 7 bar</td>
<td>4</td>
</tr>
<tr>
<td>Springs and tubes</td>
<td>5</td>
</tr>
<tr>
<td>Set of gaskets, diaphragms and orifice</td>
<td>6</td>
</tr>
<tr>
<td>Amplifying relay set</td>
<td>7</td>
</tr>
</tbody>
</table>

How to order spares and accessories

Always order spares by using the description in the column headed ‘Available spare’ and a description of the product, together with the TAG number.

Example: Gauge 0-2 bar for Spirax Sarco EP5 positioner, TAG 907.

Product return procedure

Please provide the following information with any equipment being returned:

1. Your name, Company name, address and telephone number, order number and invoice and return delivery address.
2. Description of equipment being returned.
3. Description of the fault.
4. If the equipment is being returned under warranty, please indicate:
   i. Date of purchase
   ii. Original order number

Please return all items to:

Returns Investigations Department
Runnings Road,
Kingsditch Trading Estate
Cheltenham
Glos, GL51 9NX
United Kingdom

Alternatively, please return any items to your local Spirax Sarco branch. Please ensure all items are suitably packed for transit (preferably in the original cartons).