

**EP500**  
**Standard Electropneumatic Positioner**  
Installation and Maintenance Instructions

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1. Safety information
2. Technical information
3. Installation
4. Commissioning
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**EP500 Standard Electropneumatic Positioner**



# 1. Safety information

Safe operation of these products can only be guaranteed if they are properly installed, commissioned, used and maintained by qualified personnel (see Section 1.11) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.



**WARNING:** The maximum process fluid temperature must be suitable for use if the unit is to be used in any potential explosive atmosphere. For the device maintenance in a potentially explosive atmosphere, we recommend the usage of tools which do not produce and/or propagate sparks.

## 1.1 Intended use

Referring to the Installation and Maintenance Instructions, product markings and Technical Information Sheet, check that the product is suitable for the intended use/application. These products comply with the requirements of the EU Pressure Equipment Directive/UK Pressure Equipment (Safety) Regulations and all fall within category 'SEP'.

It should be noted that products within this category are required by the Directive not to carry the  mark.

- i) This product has been specifically designed for use on compressed air, which is in Group 2 of the above mentioned Pressure Equipment Directive. The products' use on other fluids may be possible but, if this is contemplated, Spirax Sarco should be contacted to confirm the suitability of the product for the application being considered.
- ii) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- iii) Determine the correct installation situation and direction of fluid flow.
- iv) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.
- v) Remove protection covers from all connections, before installation.

## **1.2 Access**

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

## **1.3 Lighting**

Ensure adequate lighting, particularly where detailed or intricate work is required.

## **1.4 Hazardous liquids or gases in the pipeline**

Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extremes of temperature.

## **1.5 Hazardous environment around the product**

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

## **1.6 The system**

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are opened and closed progressively to avoid system shocks.

## **1.7 Pressure systems**

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

## **1.8 Temperature**

Allow time for temperature to normalise after isolation to avoid the danger of burns.

## **1.9 Tools and consumables**

Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco replacement parts.

## **1.10 Protective clothing**

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high /low temperature, radiation, noise, falling objects, and dangers to eyes and face.

## 1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

## 1.12 Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

## 1.13 Residual hazards

In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature may reach temperatures in excess of 167 °F.

Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions').

## 1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

## 1.15 Disposal

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

## 1.16 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

## 2. General product information

### 2.1 Introduction

The EP500 is a 2 wire loop powered positioner requiring a 4-20 mA control signal, and is designed 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. A mounting kit is supplied to suit all pneumatic actuators compliant with the NAMUR standard.

### 2.2 Operating principle

The current signal (1) flows in the coil (2) and generates a magnetic field which attracts the flapper (3) tapping the nozzle (4). As a consequence of this the pressure inside the actuator increases and the valve moves. When the valve stem (5) moves it generates through the feedback lever (6) and the feedback spring (7) a negative feedback which moves the flapper away from the nozzle and stops the valve movement.

Changes in the current signal will induce changes in the valve positioning.

This mechanism will build a linear correspondence between the current signal and the valve position expressed in percentage of the valve stroke. The valve opening at 4 mA and at 20 mA can be adjusted manually as illustrated in Figure 1.

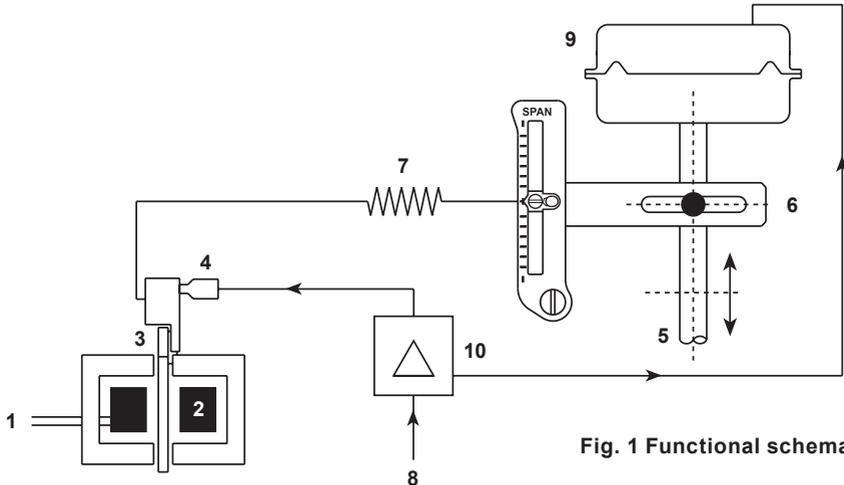


Fig. 1 Functional schematic

#### Key:

- |                    |                        |
|--------------------|------------------------|
| 1 = Current signal | 6 = Feedback lever     |
| 2 = Coil           | 7 = Feedback spring    |
| 3 = Flapper        | 8 = Pneumatic relay    |
| 4 = Nozzle         | 9 = Pneumatic actuator |
| 5 = Valve stem     | 10 = Span lever        |

## 2.3 Applications

The EP500 can be used with any actuator that conforms to NAMUR, this includes all of the following Spirax Sarco pneumatic actuators:

**PN1000 and PN2000 series**

**PNS3000 and PNS4000 series**

**PN9000 series**

**TN2000 series**

## 2.4 Materials

Part	Material	Finish
Case and cover	Die cast aluminium	Anti-corrosive paint to RAL9006

## 2.5 Technical data

Input signal range	4-20 mA (split range minimum amplitude 4 mA)
Input resistance	228 $\Omega$
Air supply	1.4 to 6.0 bar (regulate 5 to 10 psi above actuator spring range)
Air quality	Air must be free of water, oil and dust
Output pressure	0 to 100% supply pressure
Actuator stroke	10 mm to 100 mm
Action	Single acting/fail vent
Operating temperature	-20 °C to +75 °C
Air flow	3.20 Nm <sup>3</sup> /h @ 1.4 bar
Steady state air consumption	0.1 Nm <sup>3</sup> /h @ 1.4 bar
Air connections	¼" NPT female
Sensitivity	≤0.2% F.S. (Full Scale)
Histerisis	≤0.4% F.S.
Linearity	≤1.0% F.S.
Repeatability	≤0.5% F.S.
Electrical connections	Cable gland M20 internal terminals for conductors from 0.5 to 2.5 mm <sup>2</sup> wire
Degree of protection	IP65
Characteristic	Linear
Shipping weight	2.35 kg

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# 3. Installation

**Note:** Before starting any installation observe the 'Safety information' in Section 1.

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

## 3.1 Location

The positioner should be mounted in sufficient space to allow opening 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 -20 °C to +75 °C. The positioner enclosure is rated to IP65. Connection of air supply pressure (1.4 to 6 bar g) and control signal (4 - 20 mA) should be considered prior to choice of location.

## 3.2 Connecting up

### 3.2.1 Pneumatic connections

**Warning:** Air supply must be dry, oil and dust free. Dirty air supply may damage the product and invalidate warranty.

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 EP500 bleeds air in normal operation at a rate of approximately 0.1 Nm<sup>3</sup>/hour at 1.4 bar supply pressure.

Pneumatic connections are located at the right hand side of the positioner and are identified as follows 'SUPPLY' and 'OUT':

SUPPLY - Air supply - 1.4 bar g to 6 bar g, depending upon required actuator spring range.

OUT - Output signal to the actuator.

Connections are 1/4" NPT female. Interconnection between the positioner and the actuator should be at least 6 mm OD tube.

### 3.2.2 Electrical connections

The EP500 only requires a 4 - 20 mA signal. Remove the front.

**Note:** Ensure resistance from earth post to local earth (e.g. pipework) is less than 1 Ohm. Connection to the unit is through the M20 cable gland (as supplied), which when used with suitable cable will ensure the IP65 protection rating. Appropriate conduit connections may be used instead.

Connect conductors (0.5 to 2.5 mm<sup>2</sup>) to the terminal blocks and earth noting the polarity +/- . Refer to the table below for the suitable connection:

Action	4-20 mA polarity	EP500 terminal block
Direct	+	Red
	-	Black
Reverse	+	Black
	-	Red

**Direct action** - the air pressure increases when current signal increases and vice versa.

**Reverse action** - the air pressure decreases when the current signal increases and vice versa

### 3.3 Mounting the positioner onto the actuator

The EP500 can be attached onto any type of valve and actuator conforming to NAMUR standards. The unit can be attached in the traditional centered position (Figures 2 and 3) in line with the actuator central axis or side mounted (Figures 4 and 5) to enable the operator to view frontally the stem of the valve.

#### Step 1

Attach the mounting bracket on one of the two positions shown below with the two M8 x 14 screws and washers.

#### Centre mounting



Fig. 2



Fig. 3

#### Side mounting

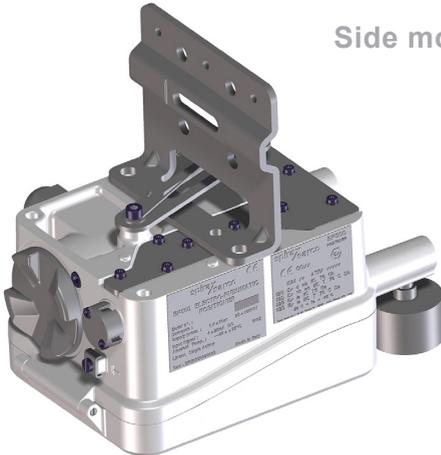


Fig. 4



Fig. 5

## Step 2

Using the 2 off M6 pan head screws, securely attach the 'T' shaped sliding pin holder to the valve actuator coupling block (Figure 6).

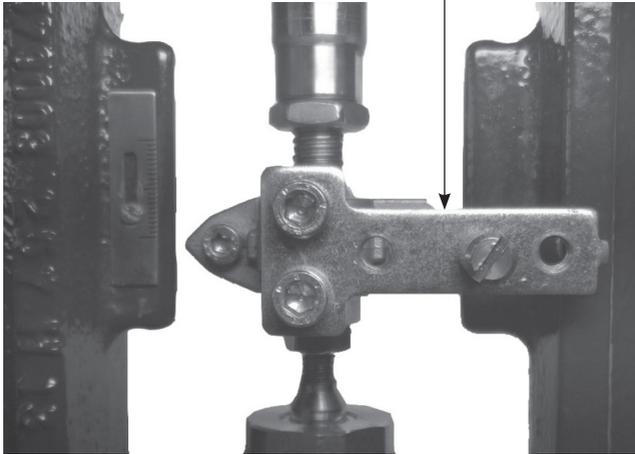


Fig. 6

Depending on the travel of the valve actuator and depending on the actuator yoke, apply a medium strength thread locker to the sliding pin and screw into the correct hole on the sliding pin holder and tighten. Use Figure 7 and Table 1 to determine the correct hole to use.

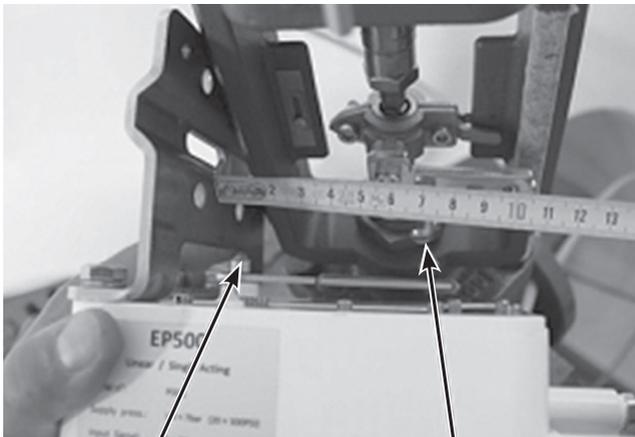


Fig. 7

Feedback lever fulcrum

Pin

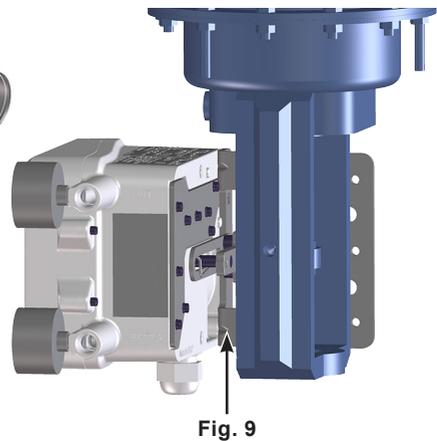
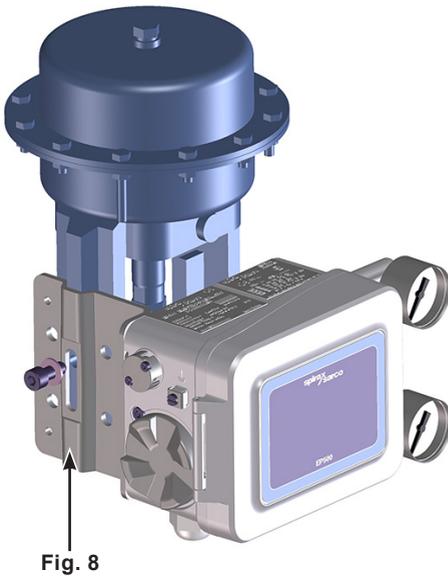
**Table 1**

The 'T' bracket can be moved towards the right or towards the left. This allows the adjustment as displayed below between the lever fulcrum and the pin:

Actuator stroke (mm)	Distance between feedback lever fulcrum and pin	Feedback lever
20	70	
30	70	
50	80	
70	80	
75	115	
100	115	

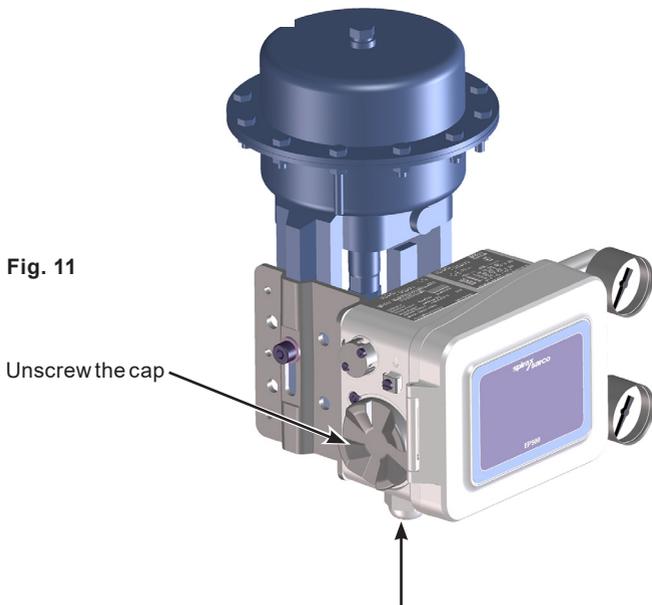
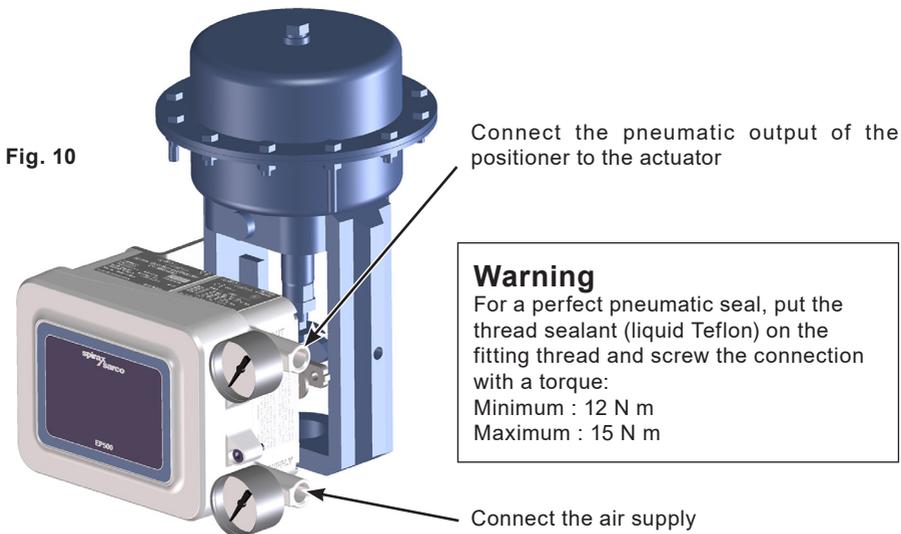
**Step 3**

Attach the bracket to the actuator with the screw M8 x 20 with washers (Figure 8). Take care to insert the feedback pin in the slot of the feedback lever while you attach the positioner (Figure 9).



## Step 4

Air connections and electrical connections.



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## Step 5

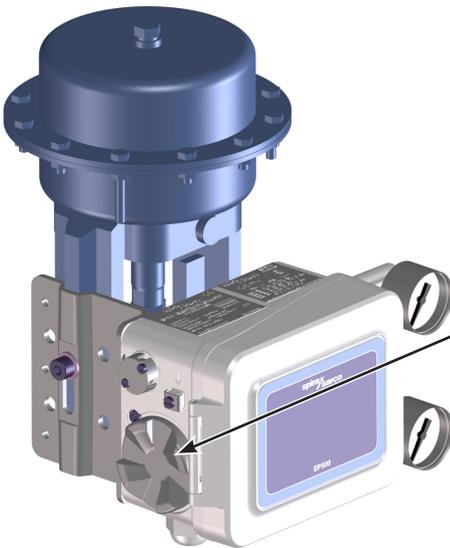
Fig. 12

After finishing the electrical connections before replacing the cap, M50, make sure the screw M5 x 10 is completely screwed (using a 4 mm Allen key)



Fig. 13

After manually screwing the cap M50, unscrew the screw M5 x 10 (using a 4 mm Allen key), creating a slight pressure between the screw head and stopper M50



## Step 6

Open the lid of the positioner.

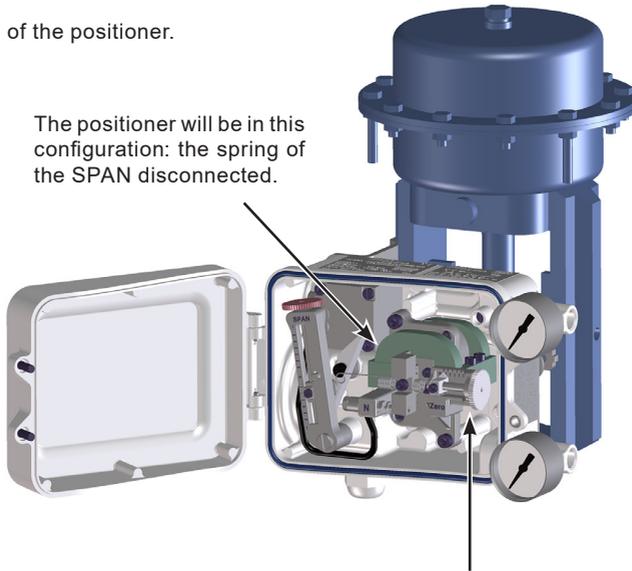


Fig. 14

Turn the ZERO dial (the green one), until the valve is opened at 50%

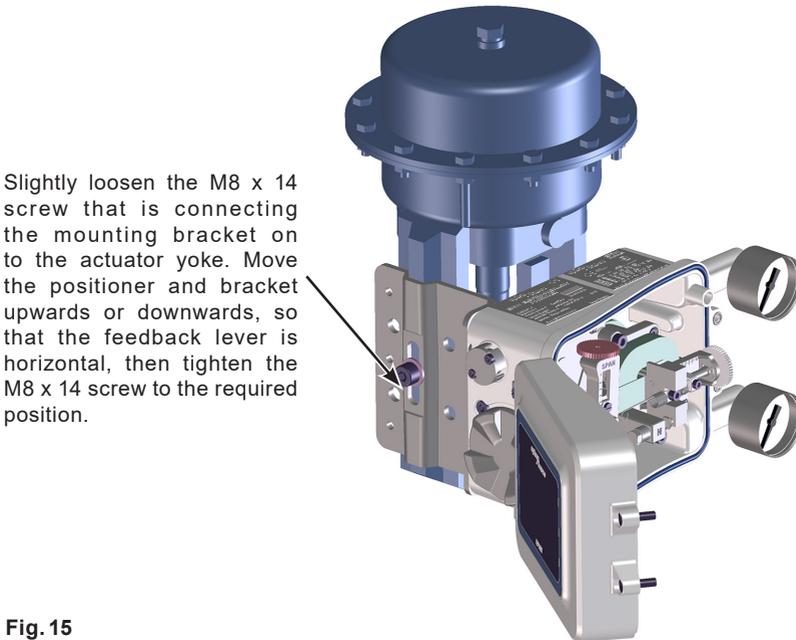
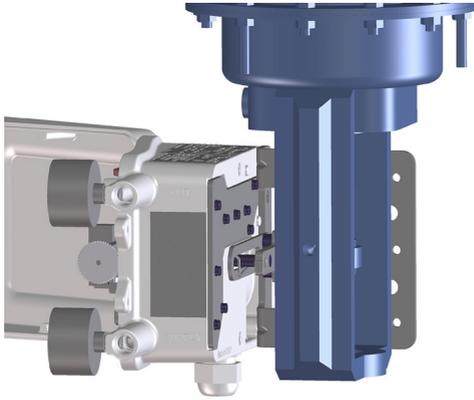


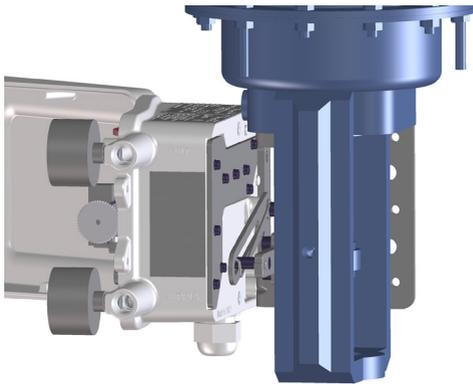
Fig. 15

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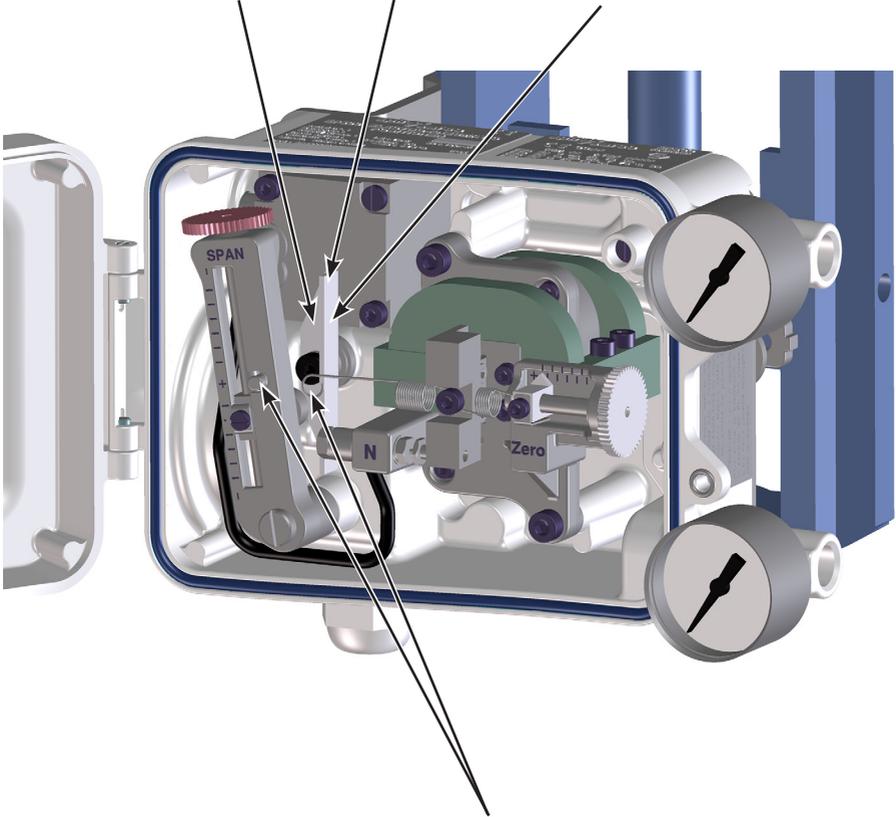


**Fig. 16 Correct placement**



**Fig. 17 Incorrect placement**

1. Loosen the allen screw (black), with a 4 mm key
2. Rotate the lever to the vertical position
3. Tighten the allen screw (black), with a 4 mm key



**Fig. 18**

4. Hook the spring to the respective pin on the SPAN

# 4. Commissioning

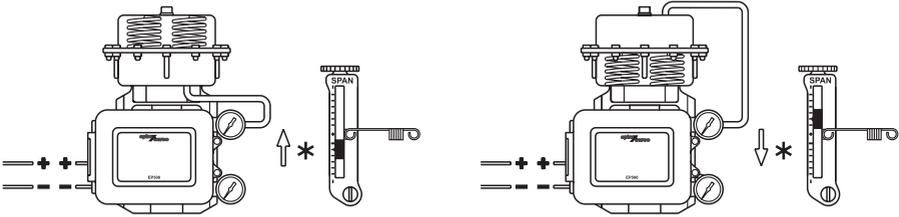
## 4.1 Set the valve action

Firstly, with reference to Figure 19, determine the action that is relevant to your application.

To change the slider turn the red gear until the slider is positioned into the correct half of the span arm.

\* **Please note** that the arrow illustrates the stem movement direction when the input control signal increases.

### Direct action



### Reverse action (inverse polarity input signal)

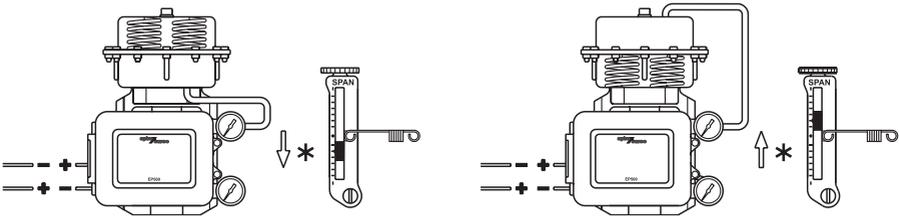


Fig. 19

## 4.2 Set sensitivity

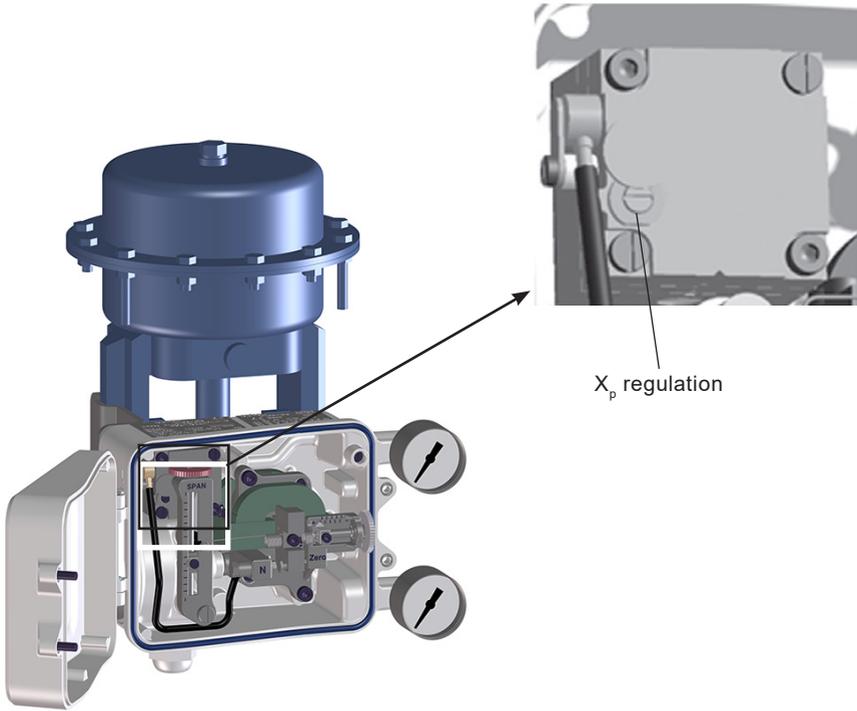


Fig. 20

**We recommend not to change the Xp regulation until you familiarise with the product and with this regulation.**

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

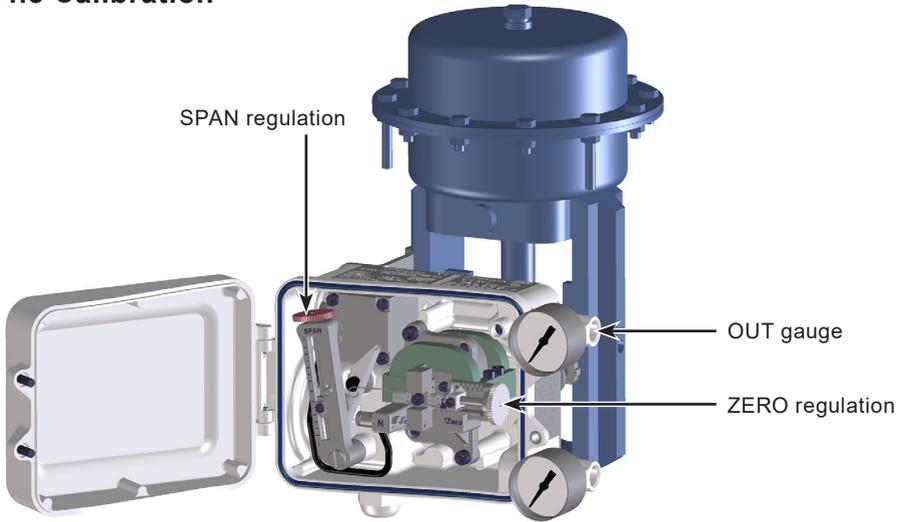
Xp closed means the positioner is very reactive and consuming a small amount of air. However on small valves this could result in valve hunting. In this case, unscrew slightly (in steps of 1/8 turns) the Xp screw, until the oscillation disappear.

Xp opened means that the unit is less reactive wastes more air, but is more stable.

**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 after any changes.

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

## 4.3 Calibration



**Fig. 21**

Feed the EP500 with a current input of 4 mA, turn the ZERO (green knob), till it reaches the value of the desired pressure and the valve opening reaches the starting position.

Feed the EP500 with an input current of 20 mA, turn the SPAN (red knob), until it reaches the desired pressure and the valve is fully opened or reaches the desired opening percentage according to the application requirements.

In order to refine the values of ZERO and SPAN repeat the operation more times till the required configuration is achieved.

### **Split range operation**

EP500 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 as described above.

## 4.4 Recommended current range values

During commissioning and calibration, SxS recommend to use the following start opening current and fully open current range values when EP500 is used in combination with PN9000E actuators (direct action mode).

SxS Actuator PN9000E	Spring range (bar g)	Pressure at 4mA (bar)	Start opening current range (mA)	Fully open current range 0.2 ... 1	
<b>PN91x</b>	0	0.2 ... 1	0	5 ... 5.5	18.5 ... 19
	0	0.4 ... 1.2	0	5 ... 5.5	18.5 ... 19
	6	1 ... 2	0	5.5 ... 6	18.5 ... 19
	3	2 ... 4	0	5.5 ... 6	18.5 ... 19
<b>PN92x</b>	0	0.2 ... 1	0	5.5 ... 6	18.5 ... 19
	0	0.4 ... 1.2	0	5.5 ... 6	18.5 ... 19
	6	1 ... 2	0	6 ... 6.5	18.5 ... 19
	3	2 ... 4	0	6 ... 6.5	18.5 ... 19
<b>PN93x</b>	0	0.2 ... 1	0	5.5 ... 6	18.5 ... 19
	0	0.4 ... 1.2	0	5.5 ... 6	18.5 ... 19
	6	1 ... 2	0	6 ... 6.5	18.5 ... 19
	7	2.5 ... 3.5	0	6 ... 6.5	18.5 ... 19

# 5. Maintenance

## 5.1 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 3.3.2 and refer to the actuator TI).
3. Make visual checks to ensure that the valve is operating correctly.

## 5.2 Corrective maintenance

### 5.2.1 Removal and cleaning of sensitivity adjuster (see Figure 22):

- Loosen and remove the lock.
- Note setting then remove the sensitivity screw.
- Wash the adjuster with solvent, checking the condition of the cone and ensuring that the hole is clear.
- Dry with clean compressed air to ensure that there is no remaining contaminants.
- Refit the the cleaned adjuster and unscrew it  $\frac{1}{4}$  turn from its stop.

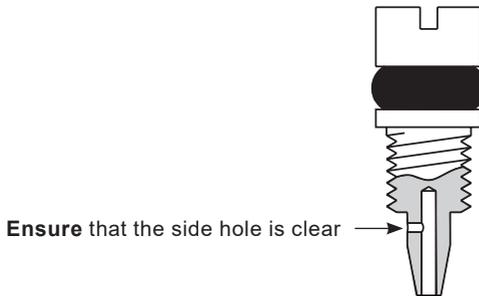


Fig. 22

- Refit the lock to touch the adjuster top and secure it with the lock-nut.
- Set the sensitivity see Step 2, Section 4, Commissioning.
- Reset zero and span if required.

## 6. Spare parts

The spare parts available are detailed below. No other parts are available as spares.

### Available spares

Gauges	Full scale 0 - 2 bar	1
	Full scale 0 - 4 bar	2
	Full scale 0 - 7 bar	3
Back plate and gasket		4
Amplifying relay set		5
Gasket set	<b>Note:</b> Spare parts 5, 6 and 7 are not visible in Figure 23.	6
Mounting kit		7

### How to order spares and accessories

Always order spares by using the description in the column headed 'Available spares' and a description of the product.

#### Example:

1 off Gauge 0-2 bar for a Spirax Sarco EP500 standard electropneumatic positioner.

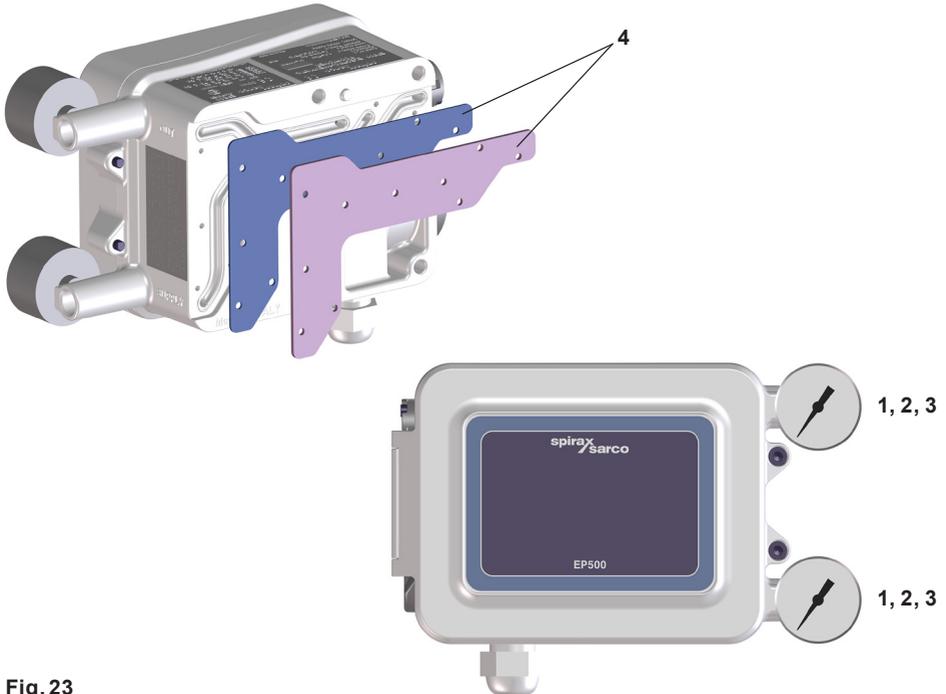


Fig. 23

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## 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 your local Spirax Sarco branch.**

Please ensure all items are suitably packed for transit (preferably in the original cartons).

# 7. Fault Finding

## Output pressure too low or zero

Cause	Remedy
a. No control signal	a. Restore mA signal
b. Low air supply pressure	b. Verify actuator air pressure requirement
c. Clogged or dirty sensitivity adjuster	c. Clean adjuster see Section 5.2.1
d. Incorrect set-up	e. Recalibrate
e. Damaged pneumatic actuator or piping	f. Verify replace as necessary

## Output pressure too high

Cause	Remedy
a. Sensitivity adjuster open too far	a. Recalibrate

## Actuator movement too slow

Cause	Remedy
a. Low air supply capacity	a. Check supply capacity and pipe sizes

## Actuator failing to close

Cause	Remedy
a. Output pressure too low	a. Refer to previous fault
b. Incorrect zero point	b. Recalibrate
c. Valve/actuator coupling incorrect	d. Reset (refer to valve/actuator IMI's)
d. Actuator too small	e. Fit correct actuator

**Fault finding continued on next page**

### Actuator failing to fully open valve

Cause	Remedy
a. Output pressure too low	a. Refer to previous fault
b. Incorrect travel adjustment	b. Recalibrate see
c. Valve/actuator coupling incorrect	d. Reset (refer to valve/actuator IMI's)
d. Actuator too small	e. Fit correct actuator

### Hunting

Cause	Remedy
a. Incorrect controller set up (P, I, and D)	a. Verify and adjust according to process requirement
b. Sensitivity orifice closed too far	b. Adjust by opening sensitivity screw
c. Excessive valve friction	c. Verify and maintain as valve IMI
d. Control valve over-sizing	d. Verify operating conditions against valve capacity

# 8. Approvals

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**DICHIARAZIONE DI CONFORMITA' UE - N°RDS002-st Rev.00**  
**EU DECLARATION OF CONFORMITY - N°RDS002-st Rev.00**

Spirax-Sarco S.r.l. Via per Cinisello 18,  
20834 - Nova Milanese (MB) Italia,  
Con la presente dichiara che il prodotto sotto descritto, è stato sottoposto alla procedura di controllo di  
fabbricazione interno ed è conforme alle disposizioni della Direttiva di compatibilità elettromagnetica  
Hereby declares that the product below is approved with an internal made check in accordance with  
the standards stipulated electro magnetic compatibility :

**POSIZIONATORE ELETTROPNEUMATICO EP500**  
**ELECTRO PNEUMATIC POSITIONER EP500**

che ottemperano ai requisiti richiesti dalla  
which comply with the requirements requested by

**EMC 2014/30/UE**

Nova Milanese, 25-11-2016

Il Direttore di Stabilimento  
Plant Manager  
Federico Usienghi



Sede legale: Via per Cinisello, 18-20054 Nova Milanese (MI)  
Iscrizione Reg.Imprese e Cod.Fisc. 06527950585 - Iscrizione R.E.A. Milano 1172330 - Partita Iva 11339630151

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