1. General Information

The positioner is suitable for either a pneumatic or electro-pneumatic control signal. It is double acting but can be used as a single acting unit by plugging one of the outlet ports.
Because of the wide range of feedback options available, this product can be fitted to virtually any linear or ¼ turn pneumatic actuators.

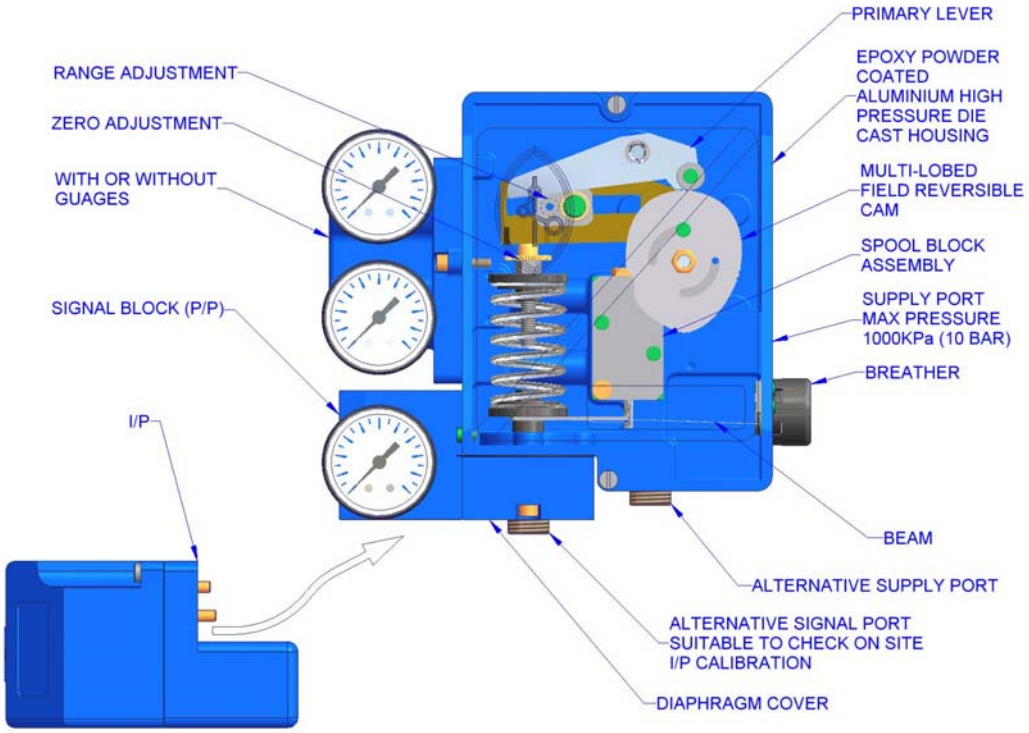


Figure 1 : Pneumatic and electro pneumatic positioner main parts

1.1 Certification

The intrinsically safe version of the detachable I/P converter carries the International P.T.B. and the local S.A.B.S. certification declaring the instrument suitable for use in the following area classifications ;

- Ex ia II T6

NB : Unless the I/P is specifically marked “Ex”, it will not be intrinsically safe

1.2 Air Supply

NB : Do not use lubricant on the air supply

Both the positioner and the I/P module can handle up to 1000 kPa air supply. Because of the close tolerance on the spool valve and the I/P module, it is recommended that an in-line air filter (5 micron) be installed on all air lines that are not clean and dry.

The I/P module requires an air supply that comforms to I.E.C. #770 specifications, which states the following :

- Oil and dust free (an oil content of not more than 1ppm and dust particles of not larger than 3 microns.
- Humidity : dew point of at least 10ºC below the transmitter body temperature.

2. Installation

2.1 Linear short strokes (up to 150mm)

The linear short stroke positioner is typically mounted to units where the stroke of the unit would be less than 150mm, i.e Globe Control Valves, small power cylinders.

The idea is to allow a feedback pin, which is attached to the actuator shaft to move up and down in the slot of the positioner feedback arm causing it to rotate. The general mounting arrangement can be determined using *figure 2.*

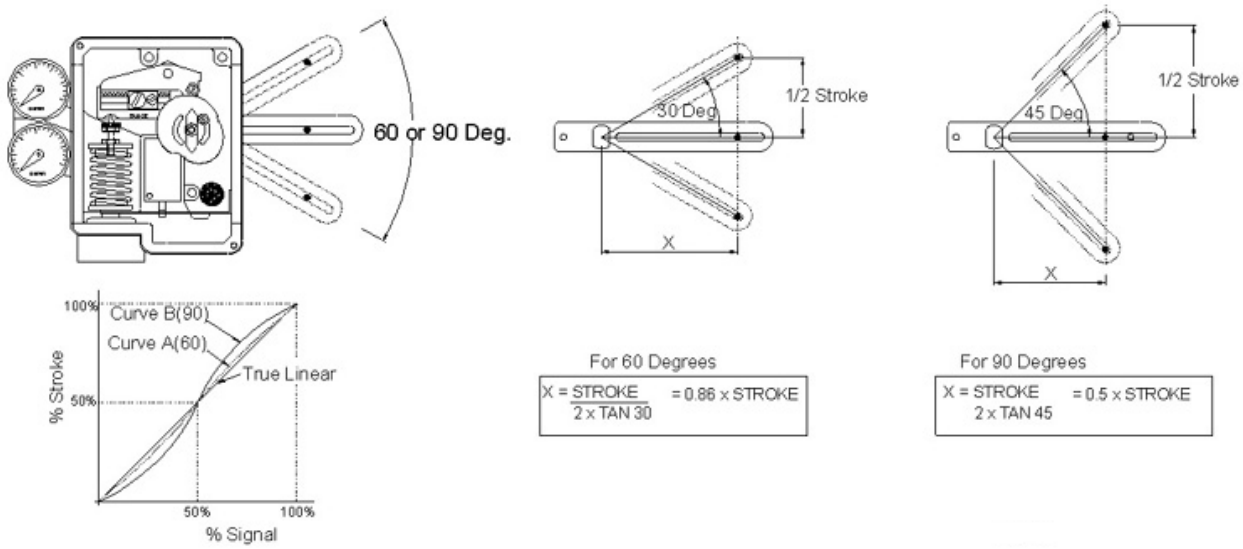


Fig 2 : Linear short stroke mounting arrangement

The feedback arm attaches to the camshaft at the back of the positioner, and is designed to rotate through 55 or 90º. Note that the more the rotation (as seen on curve B), the more the "S" error on linearity.

2.1.1 Check before start up.

The positioner bracket design should allow the feedback arm to be at 90º to the side of the positioner at mid stroke as shown in the *figure 2*.
The feedback pin position should be such that as much as possible of the selected cam profile is used up. Before attaching an air supply, check that the feedback arm has enough slot length in which to move. There should be a small amount of play between the feedback pin and the slot, but the positioner spring should ensure that this play is always taken up in the same direction.

2.1.2 The positioner bracket

The bracket must be designed to tie up to the four M6x10 Namur holes in the base of the positioner, on a PCCD of 50mm.

2.2 Linear Long Stroke (more than 150mm)

Linear long stroke positioners are typically used where the strokes required for control are greater than 150mm. Typical applications are on power cylinders with strokes ranging from 150mm to above 1500mm.

2.2.1 The general mounting arrangement is according to *Figure 3* – Note the direction and angle of the slot in the outer cam relative to the rest of the assembly.

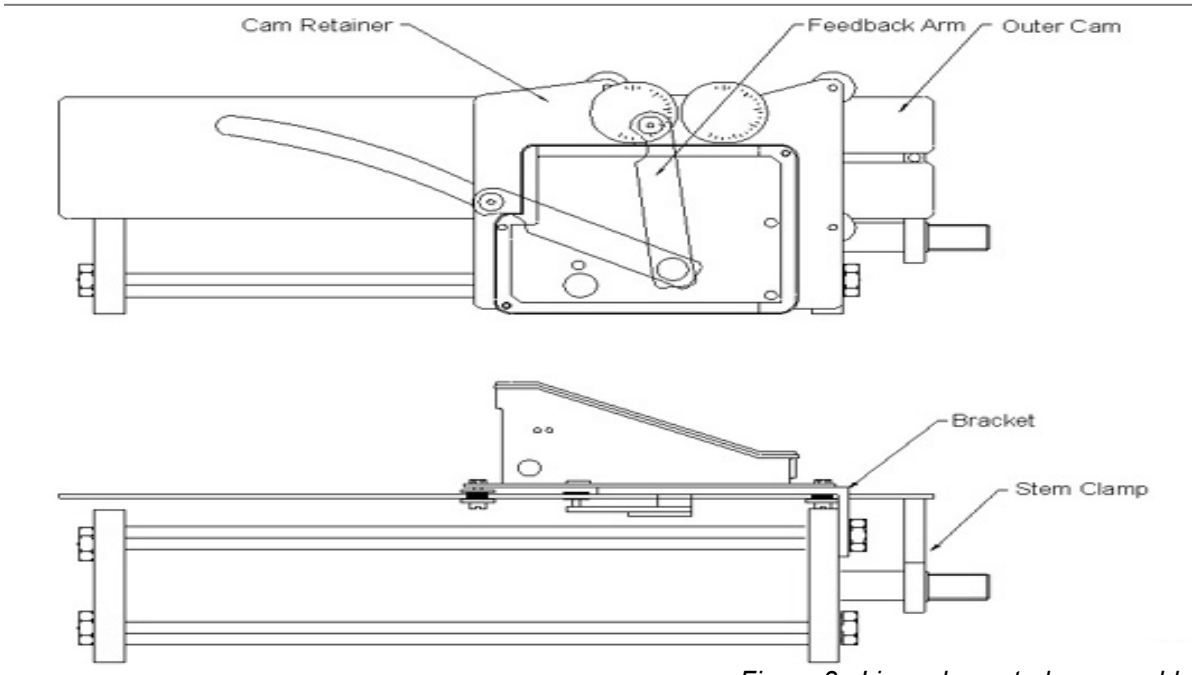


Figure 3 : Linear long stroke assembly

2.2.2 The positioner is designed to be sandwiched in between the cam retainer and the positioner bracket.
2.2.3 The bracket is to be mounted as close to the front of the cylinder as possible to ensure that when fully retracted, the outer cam does not protrude beyond the length of the cylinder.
2.2.4 Once the bracket, cam retainer and positioner are in position, slide the outer cam into the bearing channel with the slot oriented as shown in *Figure 3*.
2.2.5 Then attach the feedback arm to the camshaft so that with the cam movement, it moves within the region as shown in the *Figure 3 (top view).*
2.2.6 Before fastening the stem clamp to the outer cam, ensure that the feedback arm bearing moves within the limits of the slot. This bearing must not reach the end of either side of the slot, i.e. the cylinder stroke must not be more than what the slot is designed for.
2.2.7 The bracket design should allow for approximately 40mm clearance between the top of the cylinder and the bottom of the positioner.
2.2.8 The bracket must be open on the side where the feedback arm operates. To this end it is recommended that an L-shaped bracket is fastened onto the front of the cylinder.
2.2.9 The outer cam remains in the orientation as shown in *figure 3*, regardless of the air action.
2.2.10 The action is changed on the inner cam.

2.3 Rotary applications

Rotary applications are for positioners mounted to actuators with a 90º operation, typically where actuators are mounted to the likes of : - ball valves, butterfly valves, plug valves and disk valves etc.

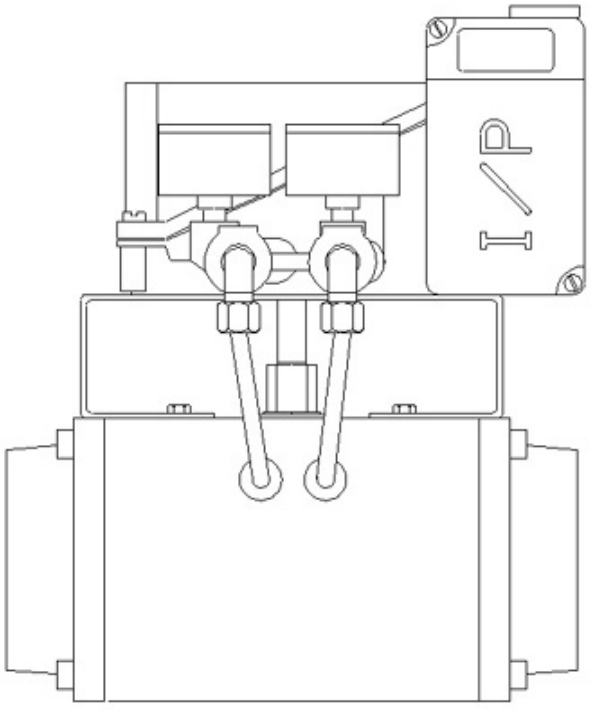


Figure 4 : 90º top mount rotary application

2.3.1 Actuators Conforming to NAMUR Standards

The positioner complies with the Namur mounting arrangement and can be supplied with the relevant bracket to suit. No coupling is necessary.

This is the recommended mounting method, where that actuator conforms to NAMUR standards

There are four possible sizes to which the actuator may conform.

- 80x30 mounting holes (M5), shaft height of 20mm (shaft slot 4mm wide x 4mm deep)
- 80x30 mounting holes (M5), shaft height of 30mm (shaft slot 4mm wide x 4mm deep)
- 130x30 mounting holes (M5), shaft height of 30mm (shaft slot 4mm wide x 4mm deep)
- 130x30 mounting holes (M5), shaft height of 50mm (shaft slot 4mm wide x 4mm deep)

2.3.2 Actuators not conforming to NAMUR Standards

Here a separate bracket and coupling is required, and will have to be manufactured to suit each actuator's unique mounting arrangement.

It is recommended that the design of the coupling is such that it locks on the flat of the positioner shaft. The attachment of the coupling on the actuator side also needs to be vibration proof.

Use either the 4 off M5x8 tapped holes or drill the other three 5.5 diameter mounting holes to secure that bracket.

2.3.3 Check before start up

There should be no axial or radial load on the cam shaft
If there is any backlash at the coupling, the positioner range spring, via the lever assembly, should ensure that the backlash is always taken up in the same direction.

3. Setting up

3.1 Piping up

Piping up the positioner will depend whether a swop over piece is fitted as part of the spool assembly or not.

3.1.1 With a swop over piece

3.1.1.1 The piping configuration is not critical because the swop over piece can always be turned over if a mistake is made (*see figure 5*).

3.1.1.2 In order to co-ordinate with the sticker inside the positioner lid, try pipe up with the output 1 (bottom) opening the actuator and Output 2 (top) closing it.

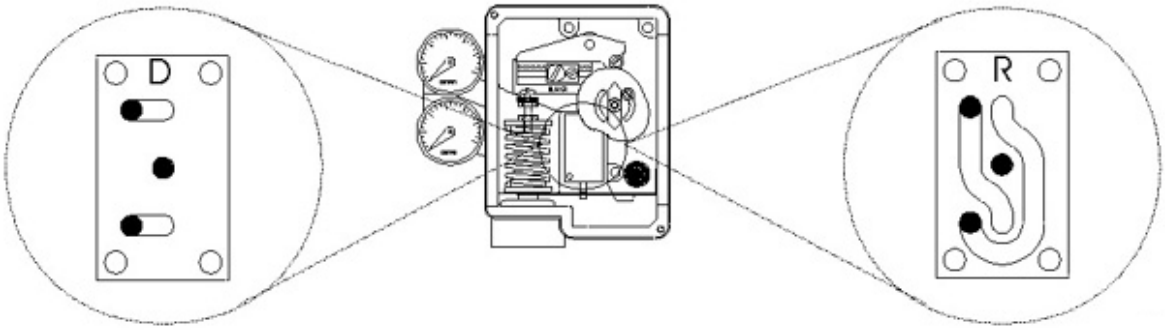


Figure 5 : Swop over piece

3.1.2 Without the swop over piece

3.1.2.1 If it is an air-to-open application, pipe output 2 to the actuator port which will open the valve

3.1.2.2 If it is an air-to-close application, pipe outlet 2 to the actuator port which will close the valve

3.1.2.3 If single acting – plug the other positioner port

3.1.2.4 If double acting – pipe it to the other actuator port

3.2 Calibrating the Positioner

3.2.1 Ensure that the cam, swop over piece (if fitted) and piping are installed for the desired action.

3.2.2 Loosen the cam lock screw and rotate the cam so as to be at the start of the desired profile. (Remember that with an increasing signal, the cam must rotate so as to lift the bearing.

3.2.3 Retighten the cam lock-screw and M5 Nylok nut.

3.2.4 Attach the signal and supply sources to the correct ports.

3.2.5 Set the signal on it's zero value (4mA or 20 kPa), loosen the zero lock-nut and adjust the zero setting so that the actuator is on the verge of moving. Retighten the lock-nut.

3.2.6 Set the signal on it's full range (20mA or 100 kPa), loosen the range lock screw and adjust the range setting until full stroke is achieved. The actuator should be on the verge of moving in the direction of the zero position.

3.2.7 If necessary, in order to increase the range, the range roller assembly can be removed and turned around. *See figure 6.*

3.2.8 Set the signal back onto it's zero value and check the actuator position. Adjust if necessary and re-check the full range position.

3.2.9 Ensure that both the zero and range settings are locked.

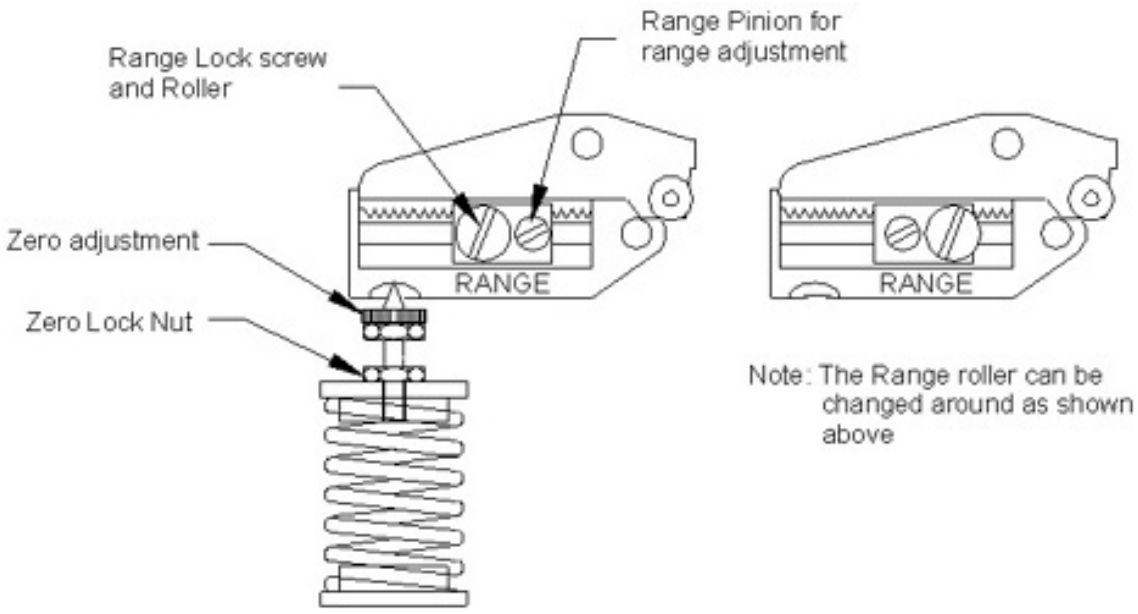


Figure 6 : Range setting

3.3 Reversing the action

The air action refers to the effect of an increasing signal on the actuator stem position.

The action is changed by doing two things :

- Turning over the cam, and
- Either turning over the swop over piece (if fitted), or swopping over the actuator piping

3.4 Cam Selection

The cams are multi lobed. The direct and reverse are on the same profile and are selected by turning the cam over. The cams are marked for various applications, i.e.

All the profiles with an "R" in them are designed to rotate anticlockwise for an increasing signal

All the profiles with an "D" in them are designed to rotate clockwise for an increasing signal

The cams are marked for various applications, for example:

STANDARD CAM

90LRF : 90=1/4 Turn; L=Linear relationship between signal and stroke; R=reverse (anticlockwise for increasing signal); F=full scale (20-100)

90EDF : As above except E = equal percentage characteristic and D = direct acting (clockwise for increasing signal)

60LRF : 60=For 60 degree rotation ; L=linear characteristic; R=reverse (anticlockwise for increasing signal); F=full scale (20-100)

60EDF : As above except E = equal percentage characteristic and D = direct acting (clockwise for increasing signal).

SPLIT RANGE CAM

60LRS1 : 60=For 60 degree rotation used on linear actuators; L=linear characteristic; R=reverse acting (anticlockwise for increasing signal) and S1 = split range (first split i.e 20-60).

90LRS2 : 90=For 90 degree rotation used on linear actuators; L=linear characteristic; R=reverse acting (anticlockwise for increasing signal) and S2 = split range (second split i.e 60-100)..

90LDS2 : 90=For 90 degree rotation used on linear actuators; L=linear characteristic; D = direct acting (clockwise for increasing signal) and S2 = split range (second split i.e 60-100)..

60LRS2 : 60=For 60 degree rotation used on linear actuators; L=linear characteristic; R=reverse acting (anticlockwise for increasing signal) and S2 = split range (second split i.e 60-100).

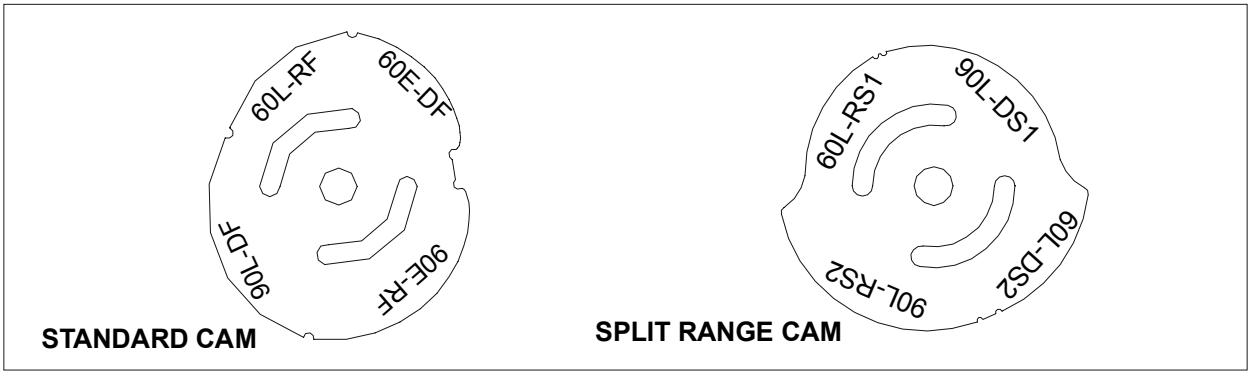


Figure 7 : Cam characteristics

3.5 Calibrating the I/P

There is one of two makes used in the Mitech positioner, i.e. Samson or Sensycon. See figure 8

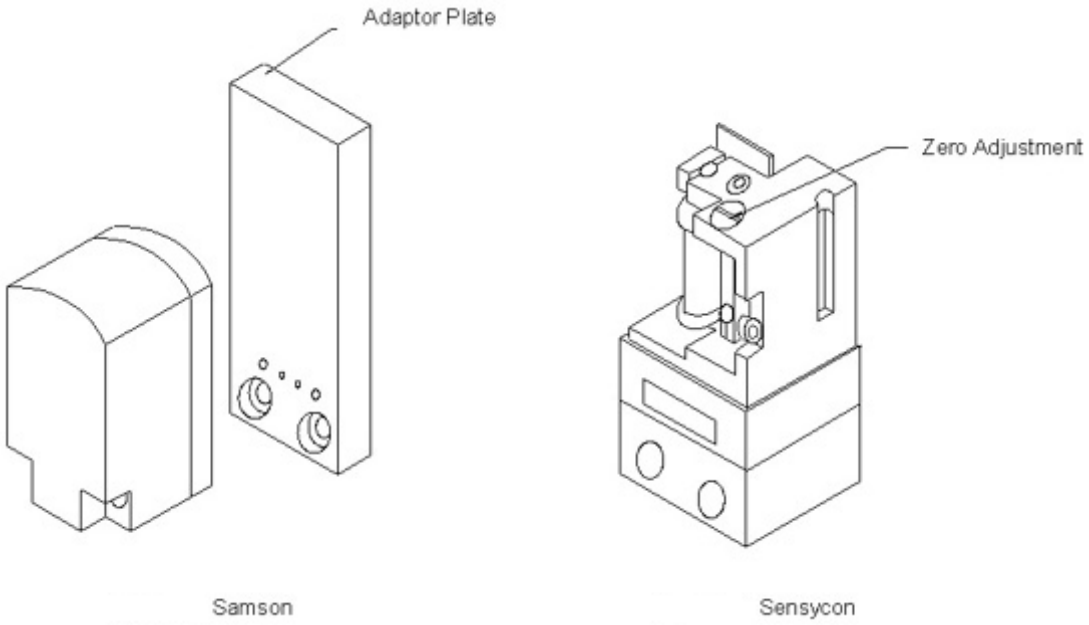


Figure 8 : I/P modules

3.5.1 Samson

3.5.1.1 The units are normally black in colour and until Feb 1997 were the standard supply for all Electro-pneumatic Mitech positioners.

3.5.1.2 The I/P is mounted on an adapter plate and is therefore interchangeable with the Sensycon units. This I/P cannot be calibrated. NB : When used on a positioner, the calibration can and should completed on the positioner.

3.5.1.3 The I/P is also intrinsically safe to Ex ia IIC T6 (PTB 92C.2068) as a standard.

3.5.2 Sensycon

3.5.2.1 These units have a white plastic lid which is removeable. Supplied in units since Feb 97.

3.5.2.2 The I/P is factory calibrated and should not be tampered with unless absolutely necessary. It has its own zero and range adjustment points.

3.5.2.3 The module need not be removed from the positioner during calibration.

3.5.2.4 Remove the plug from the diaphragm cover and fit a suitable pressure guage (1/4” NPT).

3.5.2.5 The output of the I/P can now be determined using an air supply of at least 1.5 Bar on the positioner and ensuring that the system is completely leak tight.

3.5.2.6 Only small percentage calibration changes are possible, i.e. Zero ± 3%, Range ± 2%.
3.5.2.7 Should larger changes be required, please consult your agent.
3.5.2.8 This I/P is supplied in its non-intrinsically safe form as a standard.

NOTE :

There is a small orifice for the supply air pressure (0.2mm diameter). It is important therefore to ensure that clean and dry instrument air is used. Should this orifice or any other air passage become blocked with dirt etc, it will not be able to be repaired with any guarantee of long term success.

3.6 Calibrating the Accessories

Being modular in design, the positioner is available with a number of feedback options, namely full analogue or digital position transmitting.

3.6.1 The AFB420P Analogue Feedback Module

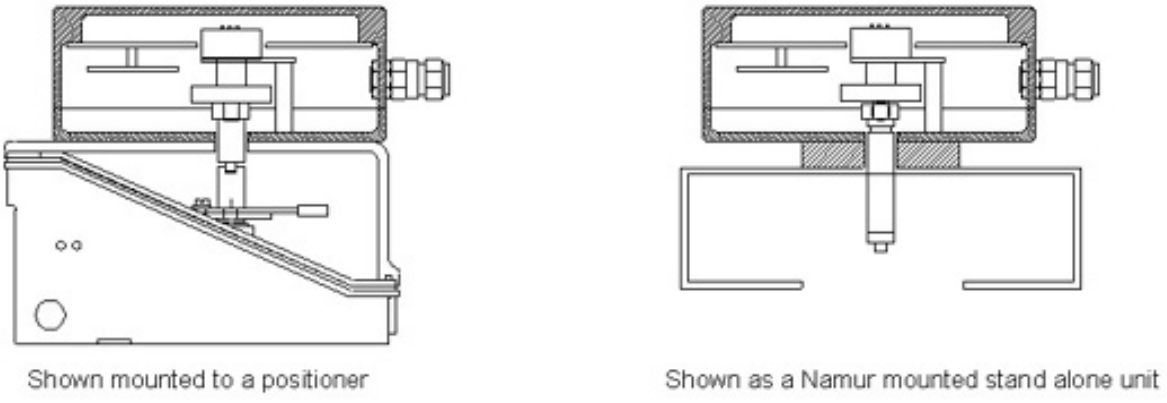


Figure 9 : Analogue feedback option

Description
The unit is designed to be used either as a stand alone position transmitter or as a module attached to our range of positioners. It is a 2 wire device and will provide a 4-20mA signal when connected in a 24vDC loop.
The potentiometer does not have mechanical limits i.e. overstroking will not damage it.

Installation
Replace the M5 nut and washer on top of the positioner cam with the special slotted drive-nut provided. Calibrate the positioner and fit the feedback module as described below.

Calibration

3.6.1.1. Remove the positioner lid / feedback module all in one.

3.6.1.2. Now calibrate the positioner.

3.6.1.3. Before the positioner lid is replaced, connect the "AFB" up to a 24vDC loop and by turning the spindle, determine if the direction of rotation, which the positioner is going to provide, coincides with the output signal which you expect. eg assume the positioner rotates clockwise from its 4mA input signal position, then by turning the "AFB" spindle clockwise, the output signal should increase - don't worry what it reads at this stage, just that it is increasing. Select switches 5 - 8 to obtain the desired action. (There are only 2 possible combinations, viz 5 and 7 ON and 6 and 8 OFF; or 5 and 7 OFF and 6 and 8 ON.)

3.6.1.4. Replace the positioner lid ensuring that the "AFB" spindle connects into the special nut on the positioner camshaft. The knurled nut below the pot will have to turned to ensure that the coil spring has approx. half a turn of pre-compression (against the direction of travel). This is to ensure that any play is taken up.

3.6.1.5. Set the actuator on its 4mA (input signal) position. In this position, loosen the two capscrews in the shaft below the knurled nut and rotate the knurled nut until approx. 4mA output is measured (3.5mA or 4.5mA is close enough at this stage).

3.6.1.6. Lock either one of the capscrews - whichever is accessible (the other one can be locked in the 20mA position or whenever it becomes accessible.)

3.6.1.7. Set the actuator on its 20mA (input signal) position and select switches 1 - 4 so that approx. 20mA is measured (19.5mA or 20.5mA is close enough at this stage.)

3.6.1.8. Now go back to the 4 mA input signal position and fine tune the zero using the zero trim pot. Similarly, at the 20mA input signal position, the range can be fine tuned using the range trim pots (Zero on the right)

The Switches

Stroke range (switches 1 - 4)

Switch 1: For 0 - 30 degrees rotation i.e switch 1 ON and switches 2,3,4 OFF
Switch 2: For 0 - 60 degrees rotation i.e switch 2 ON and switches 1,3,4 OFF
Switch 3: For 0 - 90 degrees rotation i.e switch 3 ON and switches 1,2,4 OFF
Switch 4: For 0 - 120 degrees rotation i.e switch 4 ON and switches 1,2,3 OFF

Selecting the action (switches 5 - 8)

Direct: Switch 5 and 7 must be ON and switches 6 and 8 OFF
Reverse: Switch 6 and 8 must be ON and switches 5 and 7 OFF

3.6.2 The Digital Feedback module (Switchbox)

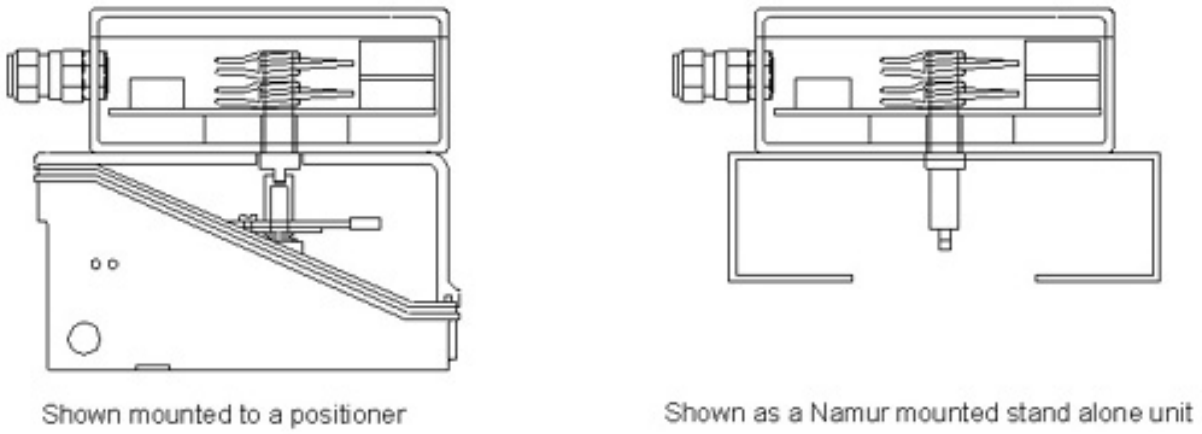


Figure 10 : Digital feedback module

Description
The unit is designed to be used either as a stand alone switch box or as a module attached to our range of positioners. It is available with either two mechanical or proximity type micro switches.

Installation
Replace the M5 nut and washer on top of the positioner cam with the special slotted drive-nut provided. Calibrate the positioner and fit the feedback module as described below.

Calibration

3.6.2.1. Remove the positioner lid / feedback module all in one. Now calibrate the positioner.
3.6.2.2. Replace the positioner lid ensuring that the feedback module spindle connects into the special nut on the positioner camshaft.
3.6.2.3. Set the switch strikers to coincide with the desired actuator positions.
3.6.2.4. This is done by simply squeezing together the “legs” of the striker and then rotating it into position.
3.6.2.5. The switches can be moved closer to, or further away from, the strikers by loosening the two retaining screws and rotating the switch about the one screw.

3.7 Changing the Signal Module

3.7.1 From P/P (without gauge) to P/P (with gauge)

3.7.1.1 Turn the positioner on it's side so that the two output ports face upwards. Below the two ports is the no-gauge blanking off plate, remove it.

3.7.1.2 Using the two 5x2 O-rings that were behind the no-gauge plate, attach the signal gauge block using the two M4x40 capscrews. Take care to ensure that the O-rings remain in the correct position. The O-rings must be installed clean don't use grease etc to hold them in position.

3.7.1.3 Block off the alternative signal port in the diaphragm cover using the ¼"NPT plug provided use thread tape to ensure an air tight seal.

3.7.2. From P/P (without gauge) to E/P

3.7.2.1. Turn the positioner on it's side so that the two output ports face upwards.

3.7.2.2. Below the two ports is the no-gauge blanking off plate remove it and the M4x6 blanking off screw.

3.7.2.3. Open up the E/P Bolt on kit and remove the I/P module (as well as the adaptor plate if fitted)

3.7.2.4. Using the two 5x2 O-rings that were behind the no-gauge plate, attach the I/P base using the three M4x16 capscrews. Take care to ensure that the O-rings remain in the correct position.

3.7.2.5. The O-rings must be installed clean don't use grease etc to hold them in position.

3.7.2.6. Reattach the I/P module to the I/P base and block off the alternative signal port in the diaphragm cover using the ¼"NPT plug provided use thread tape to ensure an air tight seal.

3.7.3. From P/P (with gauge) to E/P

3.7.3.1. Turn the positioner on it's side so that the two output ports face upwards

3.7.3.2. Below the two ports is the signal gauge block remove it and the M4x6 blanking off screw.

3.7.3.3. Open up the E/P Bolt on kit and remove the I/P module (as well as the adaptor plate if fitted)

3.7.3.4. Using the two 5x2 O-rings that were behind the signal block, attach the I/P base using the three M4x16 capscrews. Take care to ensure that the O-rings remain in the correct position.

3.7.3.5. The O-rings must be installed clean don't use grease etc to hold them in position.

3.7.3.6. Reattach the I/P module to the I/P base.

4. Periodic Checks

4.1 Ensure a clean air supply free of dust air or water. To this end, a 5 micron in-line air filter is recommended.
4.2 Ensure that the positioner and I/P breathers are un-restricted and free of dirt.
4.3 Check for and tighten any loose components.
4.4 Check that the levers move freely.
4.5 Ensure that there are no leaks at any of the signal, supply or output ports, or at any of the gasket / O-ring surfaces.
4.6 Apply a minute movement to the range lever and Ensure that the spindle (#36) moves freely in the spool assembly.

5. Disassembly and Reassembly

Please see the exploded view drawing (back page) for reference to the components

5.1 The Spoolblock Assembly

5.1.1 If the 90 deg top mount feedback option is being used, then the cam will have to be removed first.
5.1.2 Loosen the two M4 capscrews and..

5.1.2.1 Spool block with swopover piece *(see figure 5)*

5.1.2.1.1 Break the seal which the gasket may have made with the positioner box surface by gently inserting a flat screw-driver under the gasket.
5.1.2.1.2 Now move the complete assy sideways to slide the spindle off the beam and remove the assy.
5.1.2.1.3 Remove the swopover piece and the top gasket .

5.1.2.2 Spool block without swopover piece (*see Figure 5*)

5.1.2.2.1 Slide the assembly out sideways as above.
5.1.2.2.2 Also loosen the 2 x M3 Screws and the cylindrical spool block will be able to slide out of the spool retainer.

NOTE: be careful not to bend the spindle.

CHECK FOR THE FOLLOWING :

- for evidence of dirty air and if so consider using a filter
- that the spindle moves freely inside the spool block. If not, the two centre journals of the spindle can be cleaned using 1200 grit water paper. (*see figure 11*)
- This may result in the positioner consuming more air and should it not improve matters, the spindle and spool block should be replaced.

5.1.3. Reassembly

5.1.3.1. To reassemble, build the assembly on the two capscrews first.
5.1.3.2. Locate the screw furthest away from the beam first, slide the spindle onto the beam spring steel and locate the other capscrew.
5.1.3.3. Before fully tightening the capscrews, ensure that a small clearance exists between the beam and the end of the spindle slot.
5.1.3.4. Only now should the two M3 screws be tightened (version without swopover).

No lubrication is required in the spool block as it must be kept clean and dry.

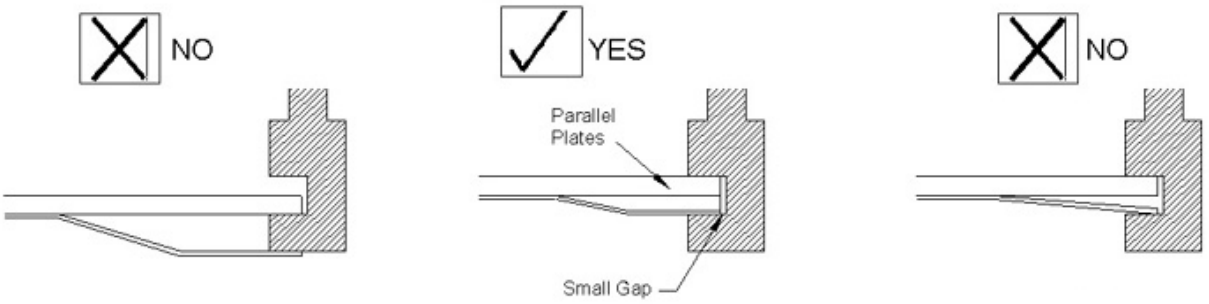


Figure 11 : Spool assembly

5.2 The Cam Assembly

5.2.1 The Internal positioner cam

5.2.1.1 Loosen both M5 nuts
5.2.1.2 The cam and anti-rotation plate can now be removed together.
5.2.1.3 Remove the E-Clip and the camshaft can be extracted.
5.2.1.4 If necessary, the camshaft retainer bushes can be pressed out and replaced. See general checks below.

5.2.2 Linear Long external cam plate

5.2.2.1 Loosen the bolt/s holding the outer cam to the stem clamp.
5.2.2.2 Then remove the M5 bolt holding the feedback-arm in position and remove the feedback-arm from the camshaft.
5.2.2.3 The outer cam can now be slid out of the bearing channel.

5.2.3 General Cam Assembly Checks

- check for worn bushes
- ensure that there is tight fit between the camshaft and cam on the flats. Always use new spring washers or nyloc nuts.
- no lubrication is to be applied - the bushes are self lubricating
- ensure that the cam and swopover piece orientation is correct for the desired action.
- on the linear long assy, check for excessive wear on the outer cam slot and that the bearing are still operational. If necessary replace the bearings with part no. 604ZZ.

5.3 The Lever Assemblies

Both the primary and range levers can be removed by first removing the E-Clips

5.3.1. Primary Lever

5.3.1.1. Remove the M3 screw and check the bearing for excessive wear.
5.3.1.2. Replace if necessary (bearing #623ZZ).
5.3.1.3. Check that the working surface of the primary lever is flat.
5.3.1.4. Replace the primary lever if this surface shows signs of excessive wear.
5.3.1.5. On reassembly, ensure that the lever can rotate freely on the lever stand and that the M3 washer is between the lever and the bearing.

5.3.2. Range Lever

5.3.2.1. Remove the range roller assembly by removing the E-Clip and unscrewing the range lock screw.
5.3.2.2. Inspect the top plate to ensure that it is straight.
5.3.2.3. If it is bent, the range roller will not be able to rotate once the range lock screw is tightened.
5.3.2.4. On reassembly, ensure that the lever can rotate freely on the lever stand and don't forget to replace the two E-Clips

5.4 The Signal Assemblies

5.4.1 The No-Gauge P/P

5.4.1.1 Remove the two capscrews and the no-gauge block.
5.4.1.2 Then check that the two O-ring seals are still capable of providing a seal.

5.4.2 P/P With Gauge

5.4.2.1 Remove the two capscrews and the signal block.
5.4.2.2 Check that the two O-rings are still capable of providing a seal and that the gauge is both leak tight and sufficiently accurate

5.4.3 E/P Assembly

5.4.3.1 Loosen the two lid screws and remove the lid.
5.4.3.2 Now loosen the two capscrews and remove the I/P module and its two O-rings.
5.4.3.3 Then loosen the three capscrews and the I/P base can be removed with its two O-rings.

5.4.4 Signal Assembly Checks :

- the supply port (very small right hand side hole) on the I/P should be clean.
- the terminal block (#53) wiring must be intact.
- the sintered bronze filter in the I/P base supply port must be able to pass pressure(flow rate is not that important). This component can be pressed out and replaced if necessary.
- reassemble, ensuring that the O-rings are properly located.
- the I/P output can be checked by replacing the plug in the diaphragm cover with a suitable gauge and pressurising the positioner to 1.5 bar. The gauge should read 100kPA at an input signal of 20mA. If this does not occur, then either the I/P is damaged or the system is loosing pressure at the O-rings or diaphragm sealing surfaces.

5.5 The Diaphragm Assembly

5.5.1 First remove the signal and spool assemblies and unclip the spring from the lower spring button.
5.5.2 Loosen the three capscrews and remove the diaphragm cover.
5.5.3 Now loosen the lock nut and diaphragm bolt.
5.5.4 This would have been assembled using Loctite 638 and may require a little force.
5.5.5 With this bolt removed, the spring assembly can be removed.

5.5.5.1 Check the following:

- the diaphragm O-ring for wear. (4.1x1.6)
- the diaphragm must be checked for tears or holes

5.5.6 Reassembly

5.5.6.1 Reassemble by simultaneously tightening bolt and aligning the diaphragm holes to those on the positioner.
5.5.6.2 The diaphragm is to be installed with the reinforced side towards the positioner.
5.5.6.3 Don't attempt to hold the diaphragm in position using the capscrews as this will tear the diaphragm.
5.5.6.4 Use Loctite 638 on the rear spring button and lock nut and don't overtighten bolt.
5.5.6.5 Replace the diaphragm cover and tighten the three capscrews evenly.

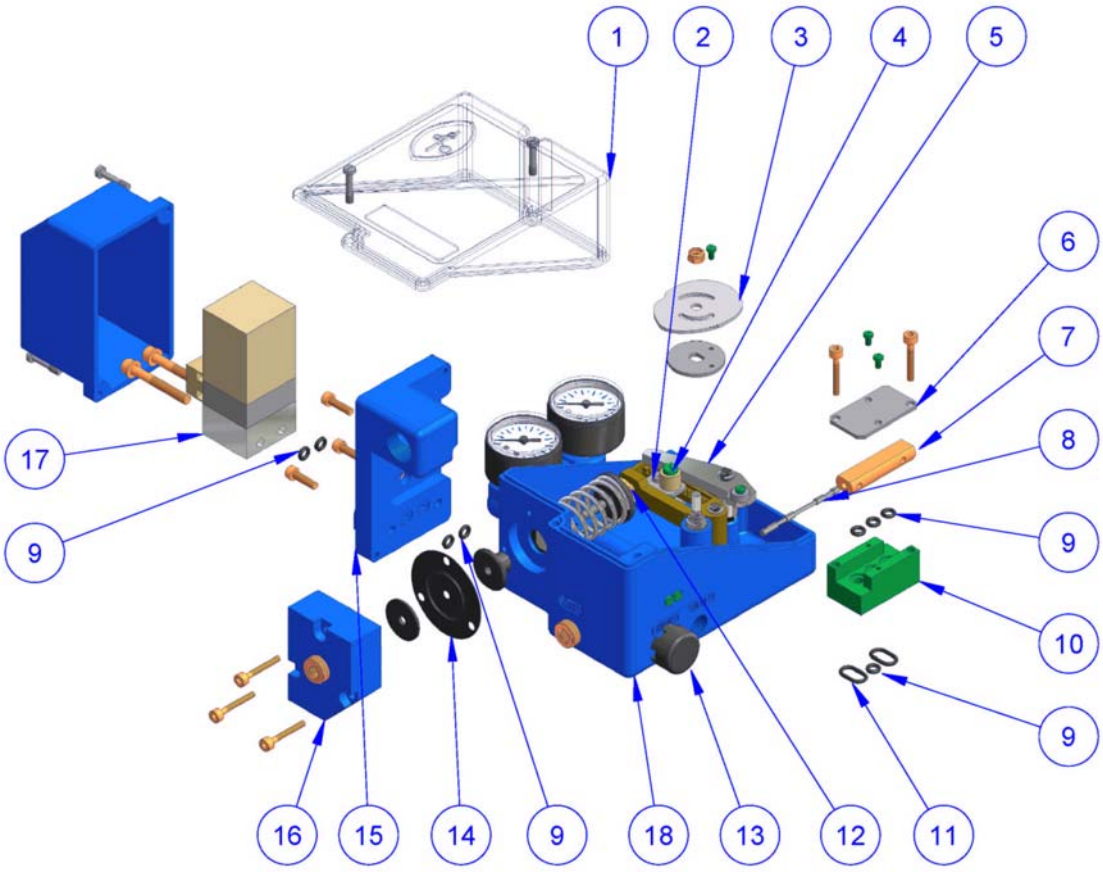
5.6 Other Components

5.6.1 With the diaphragm assy removed, the beam can be removed by loosening the two screws.
5.6.2 Check that the spring steel flap which retains the spindle has retained it's memory and that there is no play between the beam and the spindle.

6. Trouble shooting

SYMPTOMS	POSSIBLE REASONS	CORRECTIVE ACTION
Actuator won't stroke	↳ Roller bearing came off cam ↳ P/P signal leak ↳ I/P failure ↳ Spindle stuck ↳ Filters blocked ↳ Feedback assembly loose ↳ Diaphragm torn ↳ Damaged spool gaskets	↳ Check cam rotation ↳ Tighten bolt and check seal ↳ Replace the I/P ↳ Remove and clean ↳ Replace filters ↳ Tighten/repair as required ↳ Replace diaphragm ↳ Replace gaskets
Actuator goes to full signal position regardless of signal	↳ Tubing to the wrong ports or swop over piece is upside down ↳ Spindle is stuck	↳ Retube or change the swop over piece ↳ Remove and clean
Calibration shifts	↳ Loose cam ↳ Feedback assembly loose ↳ Leaking signal ↳ Loose positioner mounting ↳ Loose zero/range adjustment	↳ Tighten nut ↳ Tighten/repair as required ↳ Tighten bolts and check seals ↳ Tighten/repair as required ↳ Tighten/repair as required
Excessive air consumption	↳ Leaking gaskets/O-rings ↳ Loose tubing ↳ Guages leaking ↳ Actuator leaking ↳ Damaged spool assembly	↳ Replace as required ↳ Tighten/repair as required ↳ Tighten/repair as required ↳ Do necessary maintenance ↳ Replace
Erratic operation	↳ Damaged spool assembly ↳ Dirty spool assembly	↳ Replace ↳ Remove and clean
Positioner looses responsiveness	↳ Play between beam and spindle ↳ Damaged spool assembly ↳ Dirty spool assembly ↳ P/P signal leak ↳ I/P failure	↳ Adjust spring steel ↳ Replace ↳ Remove and clean ↳ Tighten bolts and check seals ↳ Replace the I/P module

7. Exploded View Drawing



Part No	Description	Part No	Description
1	Lid	10	Spool Block Retainer
2	Range adjustment screw	11	“O” ring
3	Cam	12	Zero stud
4	Lock Screw	13	Breather
5	Range Lever	14	Diaphragm
6	Spool retainer plate	15	I/P Base
7	Spool Block	16	Diaphragm cover
8	Spindle	17	I/P Module
9	“O” ring	18	Positioner box