

## Pneumatic Positioner PY-1010-3000 (PR10)

### **General:**

These service and data information (in brief SDI) are operating instructions and contain instructions for the safe installation and operation of the pneumatic positioner. Should difficulties occur, during installation, which cannot be solved with the help of this SDI please ask your supplier for further information.

These SDI are in accordance with the relevant EN safety standards regulations and control boards of the Federal Republic of Germany. When operating the positioner outside the Federal Republic of Germany, it is the responsibility of the control system administrator or operator to ensure that

valid national control standards are met. The manufacturer maintains all rights for technical changes and improvements at any time.

### **Qualified personnel**

These are persons conversant with the erection, installation, commissioning, operation and service of the product and in possession of the respective qualifications through their activities and functions, e.g.:

- Instruction about and obligation to maintain adherence to all operative regional and factory-internal directives and requirements, conditional to application.
- Training or instruction in accordance with standards of safety in maintenance and utilisation of adequate safety- and protective equipment.

Training in first aid, etc. (See TRB 700).

### **Application:**

The mod-kit can, in accordance with DIN IEC 534, part 6 (Namur), be used with almost any actuator. Principally however the positioner mod-kit is to be used with Johnson Controls pneumatic actuators.

### **Danger:**

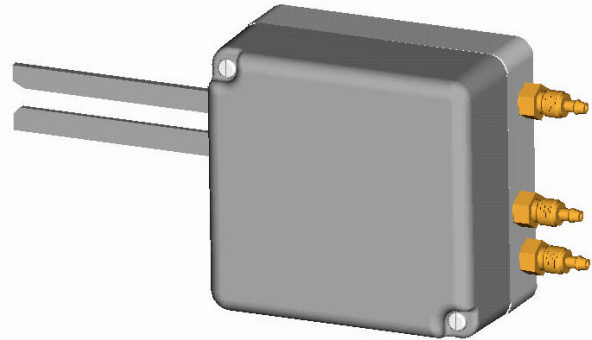
Safe operation of the valve is only ensured if the valve is installed, commissioned and serviced by qualified personnel in compliance with warning references in this SDI. In addition, the general installation and safety regulations for piping, installation construction and the professional use of tools and safety equipment must be guaranteed. Observe unconditionally during all work on the control valve. Ignoring this information may cause physical or material damage.

### **Storage:**

- Storage temperature  $-30^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$ , dry and free of dirt.
- Do not damage the lacquer. The lacquer is a foundation intended only as a protection against corrosion while in storage and during transport.
- In rooms where moisture or condensation is present, use heating or a drying agent to maintain moisture free atmosphere.

### **Transport:**

- Transport temperature  $-30^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$ .
- Protect against external forces (shock, Vibration etc.).
- Do not damage the protective lacquer.



**Installation site information:**

The installation site should be easily accessible and provide sufficient room for service and removal of actuators with positioner. Manual shut-off valves should be located up and downstream of the control valve, to facilitate service and repairs without draining the piping system. The control valve should preferably be installed vertically with the actuator in the upright position. When carrying out inclined to horizontal installation of actuators the stanchions must be aligned vertically one above the other.

Piping should be insulated to protect actuators against high temperatures; here sufficient room is to be left for servicing the stem seal pack. For trouble free function of the control valve the pipe immediately upstream of the valve should be straight for the length of at least 2x DN and the pipe immediately downstream for the length of at least 6x DN.

**Positioner mounting and removal information:**

The control valve is normally supplied complete with actuator and positioner. It is not permitted to remove or replace an actuator on systems in operation, under operating temperature and pressure. When modifying or servicing the actuator, the mounting procedure should follow the actuator SDI.

**De-installing the positioner**

In addition to general mounting guidelines and TRB 700 the following points should be observed:

- Pressure free pipe system
- Cooled fluid
- Drained pipe system
- Work to be performed by qualified personnel only.

**Functional description**

A positioner ensures an exact proportional correlation between input signal and valve stroke, irrespective of external forces, (such as upstream pressure on the valve plug, packing friction, spring hysteresis, etc.) Gain, damping and start-point of stroke movement are adjustable.

Single action positioner means:

An increasing input signal factor  $X_s$  results in an increase in control pressure  $Y$ .

In addition to this basic function, the positioner offers the following properties:

- a. The positioner can be operated with higher air pressure than standard positioners, so that the following can be achieved:  
  
Actuators can be equipped with springs which deviate from the standard range of 20 ...100 kPa. For instance, on valves closed by actuator spring force, the spring reaction point pre-tensioning is set relatively high to achieve higher close-off forces. On valves closed by actuator air pressure, the actuator spring selected usually has a low reaction and a narrow range. The usual spring ranges can be found in the actuator manufacturers technical documentation.
- b. The positioner's integrated power amplifier shortens the shut off time, due to its voluminous air delivery.
- c. The input signal from the actuator is transferred via the positioner and transformed into the different sequence ranges, independent of the actuator spring range.

### Technical Data

(Reading in accordance with VDI / VDE 2177 with amplification factor 200)

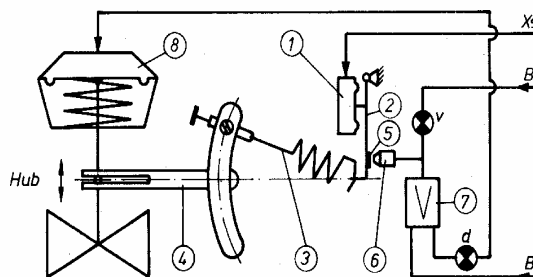
<b>Input signal factor:</b>	20...100 kPa
<b>Air supply:</b>	140 to max. 200 kPa
<b>Air supply deviation:</b>	0.15% per 10 kPa change
<b>Linearity deviation:</b>	1%
<b>Hysteresis:</b>	0.5%
<b>Reaction sensitivity:</b>	0.1%
<b>Proportional range:</b>	0.8 to 0.4%, adjustable
<b>Amplification factor:</b>	125 to 200, adjustable
<b>Air consumption (at 140 kPa):</b>	Approx. 25 l/h
<b>Air supply (at 140 kPa):</b>	1000 l/h
<b>Max. Rotation angle on Feedback transfer lever:</b>	32°
<b>Stroke Range:</b>	12...80mm
<b>Action mode:</b>	Adjustable; can be fitted to direct or reverse action actuators without changing the mod-kit assembly position.

### Function

The positioner works on a comparison of forces system.

The input signal and the valve stroke are transformed into forces that enable the comparison. The input signal is transformed via a feedback diaphragm (1) and the valve stroke via a lever system (4) and calibrated spring (3). Both acting in opposition to one another, are compared on a lever arm (2). The baffle plate (5) changes its distance to the nozzle (6) in accordance with the difference of the forces, changing also the cascade pressure to the amplifier relay (7).

If for instance, the input signal is increased, then, in the first moment the force of the feedback diaphragm on lever arm (2) is greater. The baffle plate is moved towards the nozzle, thereby increasing the cascade pressure to the amplifier relay (7) and also operating pressure Y. The increased operating pressure changes the actuator stroke position (8) and also via the lever system (4), the force on the calibrated spring (3). This causes the baffle plate to move away from the nozzle, to a position where the forces are equalised. In a balanced position the stroke corresponds to the input signal.



Positioner function diagram

### Selection of positioner calibrated springs for pneumatic actuators.

The calibrated springs supplied with the positioner are matched to strokes and distance ratios of JCI Regelungstechnik pneumatic actuators.

Calibrated spring Order No.	Specified actuator
150 4245 011	MP82 and PA13
150 2704 011	PA20
150 2705 011	PA25, PA35 and PA42
150 2706 011	PA60

All the calibrated springs listed above are part of the associated actuator delivery

The calibrated springs listed on the previous page allow the positioner to be adapted to all actuator strokes from 12 to 80 mm. The following describes the selection of suitable calibrated springs for specific applications.

Initially, the stroke factor U is determined from the quotient of the specified stroke (X) and the appropriate change in input signal  $\Delta X_s$ . (Smallest  $\Delta X_s = 20$  kPa).

$$U = \frac{\text{Stroke} \cdot 100}{\text{Input signal}} \frac{X \text{ [mm]}}{\Delta X_s \text{ [kPa]}}$$

The spring, chosen from the diagrams has the stroke factor nearest to the smallest possible stroke factor specified for lever length l

Stroke factors for Johnson Controls actuators

Actuator	Stroke factor [mm/100 kPa]	Lever length l [mm]
MP82 / PA13	17 ... 65	84
PA20	25 ... 100	89
PA25	32 ... 125	84
PA35	44 ... 175	96
PA42	53 ... 210	114
PA60	75 ... 300	118

**Example:**

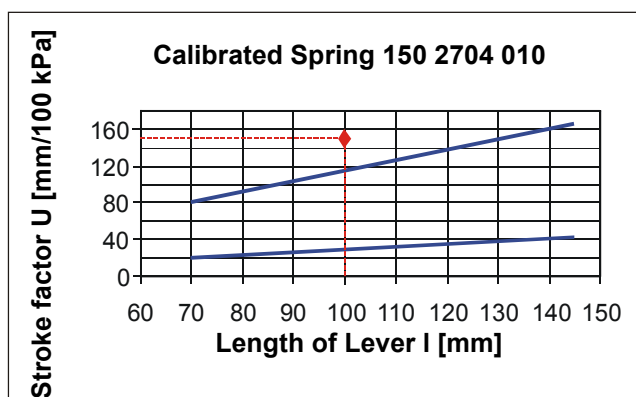
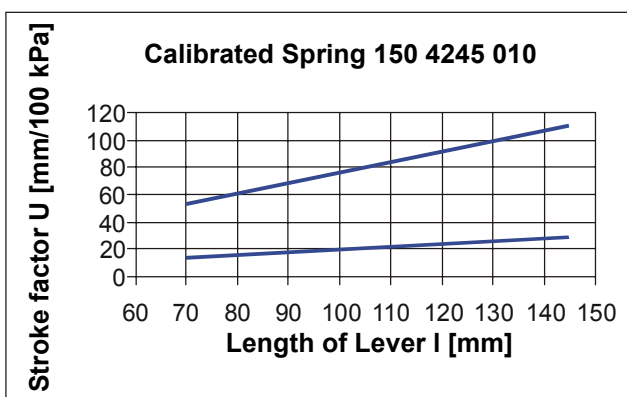
Required: Calibrated spring for pneumatic actuator with 30 mm stroke and lever length 100 mm with a change of signal from 60 to 80 kPa

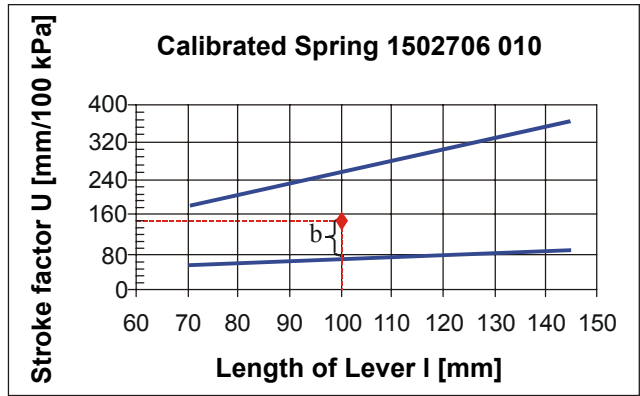
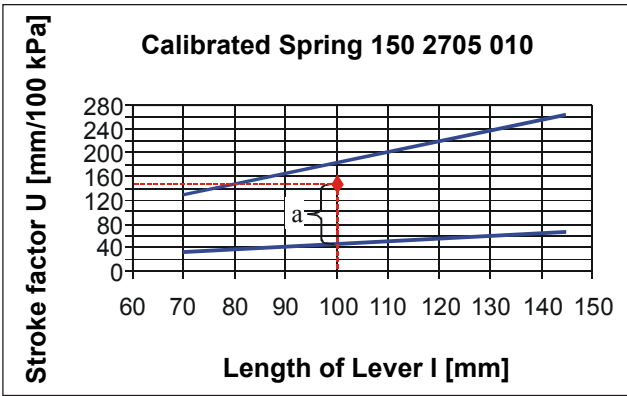
Solution:  $\Delta X_s = 80 - 60 = 20$  kPa  
 $U = 30 \text{ mm} \cdot 100 / 20 \text{ kPa} = 150 \text{ mm} / 100 \text{ kPa}$

Enter intersecting lines of U and l into all diagrams. The intersection for calibrated spring 150 4245 010 and 150 2704 010 are outside the possible stroke factor range. They are not suitable for this application.

Suitable calibrated springs are 150 2705 010 and 150 2706 010, although 150 2706 010 is the more advantageous because the line intersection for this spring is closer to the smallest stroke factor than for 150 2705 010.

Distance b < distance a .





**Positioner installation and commissioning**

**Installation:**

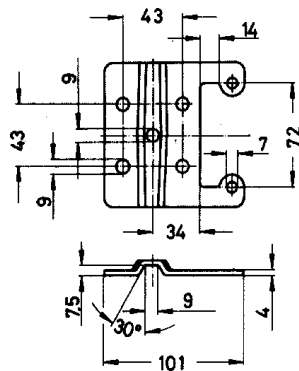
The positioner is usually mounted to the front, on the right hand side of the actuator.

It is important to mount the positioner at the correct height. To install, the centre axis of the positioner must correspond with the centre of stroke. The feedback transfer lever should then be horizontal. This often results when the mounting bracket is fixed to the actuator stanchion with an M8 hex. headed bolt.

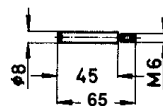
Universal Mounting kit

Order No. PQ-2713-3011, consisting of the following plus associated nuts and bolts:

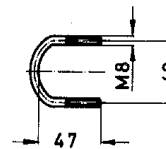
**Namur-mounting bracket**



**Transfer stud**



**Fixing clamp**

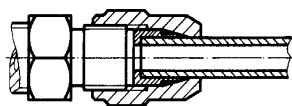


The mod kit enables fitting of the Namur mounting bracket to the appropriately formed stanchion with M8 hex. headed bolt or with 2 fixing clamps on other stanchion.

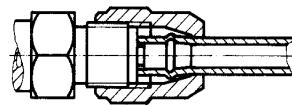
**Commissioning:**

Correct connection of air pressure lines to the positioner is a requirement for trouble free operation. All air pressure lines in the system must be airtight and clean.

All 3 connections of the positioner are equipped with combination fittings, which allow 6-mm-copper pipe or 4 x 6-mm plastic tube connections. To fit the pipe the tube nipple must be broken off at the break off point.



Pipe connection



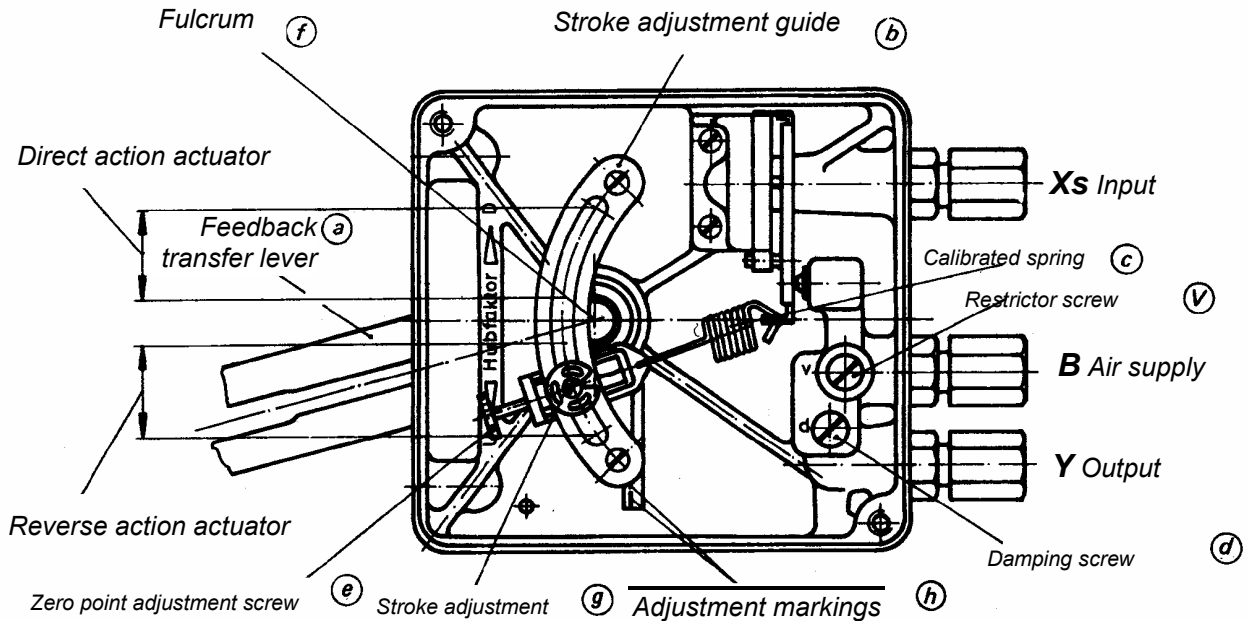
Tube connection

Connection inlet B (Supply air) must be connected to compressor, the lead parameter Xs with the input inlet and the output outlet Y with the actuator connection.

Air supply: 140...max. 200 kPa  
Signal: 20...100 kPa

### Adjustments and settings

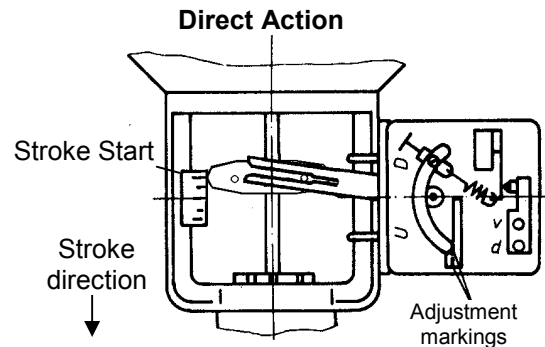
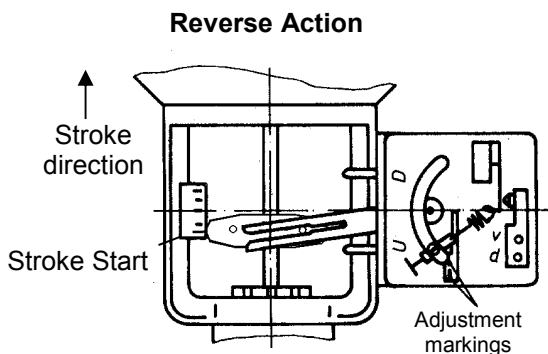
#### Adjusting the stroke



There should be no air pressure on the actuator when adjustment is carried out. The rest of the description is based on the "normal" fitted position.

#### Adjustment steps:

- Positioner air supply disconnected. Air supply (B= 0 kPa) and no signal (Xs = 0 kPa). Feedback transfer lever (a) hanging loose or not fitted
  - Match adjustment scale marks (h) on the stroke adjustment guide (b) to those on the base plate.
  - Fix feedback transfer lever (a) and ensure that position of adjustment marks is not disturbed.
  - Insert selected calibrated spring.
  - Move stroke adjustment (g) to the respective end of the adjustment guide (b) as applicable for direct or reverse positioner action (DA or RA)
- D (DA) = Direct action, actuator stem extends  
U (RA) = Reverse action, actuator stem retracts
- Set air supply to inlet B. Set control pressure Xs with a pressure-metering tool, to the start pressure required in order to set the stroke
  - If the actuator shows no movement, relieve tension on calibrated spring (c) with zero point adjustment screw (e) until stroke movement starts.



- h) Should the actuator stem move arbitrarily, increase tension on the calibrated spring (c) with zero point adjustment screw (e) until stroke starts with set signal Xs.
- i) Set signal to pressure at which stroke is to stop. Adjust distance between stroke adjustment (g) and fulcrum (f) until the desired stroke is achieved.

#### Distance Stroke Adjustment - Fulcrum

**Smaller** ⇒ **increased stroke**

**Greater** ⇒ **reduced stroke**

- j) Change and ascertain that the reaction point and stroke correspond within the pre-set range. Adjust when necessary.
- k) If the actuator should start to cycle during the adjustment procedure, screw in damping adjustment screw (d) until cycling stops.

#### Damping Adjustment Screw (d)

Damping can influence the stability of this elementary control loop, consisting of actuator and positioner. Adjustment of the damping adjustment screw (d) regulates positioner air output and thus the actuator stroke speed of response.

#### Amplification Adjustment Screw V

It is also possible to influence the control loop through the restrictor screw (V) unscrew with max. one full turn. This influences the stability.

When use is made of this method of stabilisation then damping can be reduced accordingly

#### Sequence Operation

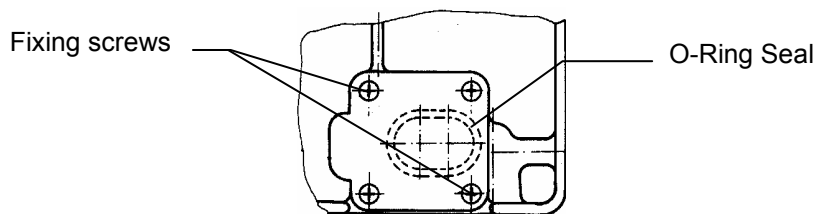
Calibrated springs, supplied with the product, are matched to stroke and positioner transfer lever lengths of Johnson Controls actuators. Each actuator has an assigned calibrated spring, which can accommodate max. 4 sequence ranges within the standard control signal range (split range) of 20 to 100 kPa.

The positioner can be mounted on pneumatic actuators of various manufacturers. Mounting accessories in accordance with NAMUR recommendations supports universal side mounting. Although stroke length and yoke dimensions, with reference to stem centre position, are relatively different. In order to determine the suitable calibrated spring for these applications refer to selection diagrams in section 4.

#### Trouble shooting

Functional disturbances may occur if:

- Dust and oil free air supply are not available
- Filters in connection B (air supply) and outlet Y (Output) are clogged.
- The restrictor V (Order No. 150 2708 011) is congested. Remove restrictor screw V and clean with thin wire of 0.15-mm diameter.
- The amplification relay is defective (Relay for PY1010 order no. 150 2720 011, the fixing screws and 2 O-ring seals are included in delivery and should be replaced). Replace amplification relay (see drawing below). The amplification relay is a plug-in type, facilitating rapid and simple replacement. Loosen retention screws; remove amplification relay from base plate and replace.



## Declaration of conformity

**We**

**Johnson Controls  
JCI-Regelungstechnik GmbH  
Westendhof 8  
D-45143 Essen**

**Declare under our sole responsibility that the product:**

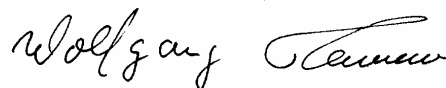
**PY-1010-3000**

**Pneumatic positioner**

**To which this declaration relates, conforms to the following standard(s)**

**DIN IEC 534, part 6 from March 1987**

D-45143 Essen, 05.06.2000



W. Tessmer (Managing director)