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POSITIONER

TYPE A705

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1. INTRODUCTION

1.1 Usage and safety instruction

The positioner of the A705 type is designed to cooperate with a 2-side pneumatic-piston-type actuator in the systems of automatic adjustment of the industrial processes in the chemical, foodstuff, energetic industry, etc.

Other applications should be agreement with the manufacturer.

Other applications should be consulted with manufacturer.

Manufacturer doesn't bear responsibility for any damages which result from using positioner in method not acc. to application. Risk is on user side only.

Right using of positioner is make everything according to this technical product documentation.

1.2 Connection of pneumatic supply

Assembly and starting works should be done only by electricians with qualifications or staff instructed by them – according to actual law rules and recommendations of automatic. .

1.3 Instructions and warnings

Body damage and/or serious material damages might be formed if user doesn't keep of instructions and warnings. Servicing staff have to be instructed and acquaint with whole safety instructions and warnings.

For well and safe positioner's working there has to be assured right transport, storage, assembly, starting and recommendations at 10th chapter of this documentation.

Main attentions of safety in mentioned operation and maintenance manual were marked as pictograms:

	This sign means: Pointer. „Pointer” indicates on action or any process important for well-working of product. Material damages might be formed if user doesn't keep of instructions.
	This sign means: Warning. „Warning ” indicates on action or any process, which might be danger for staff or makes material damages if those aren't made correctly.

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2. APPLICATION

The pneumatic positioner type A705 is designed to make higher actuator useful force making by the actuator and for make sure precise actuator mandrel position which is using to uniqueness between the input signal and movement of actuator mandrel positions. The pneumatic positioner type A705 is designed in fact for cooperation with 2term pneumatic-piston-type actuator made acc. to ISO6431 standards (manufacturer PREMA Kielce, Poland or Festo). It may cooperate with other than mentioned actuators after use appropriate the coupling elements.

3. TECHNICAL DESCRIPTION

3.1. Housing

The positioner type A705 consists of the two basic assemblies: pneumatic unit (1) and feedback unit (2) – (drawing no. 1).

The distributing unit placed in the positioner housing consists of the following: distributor (2), piston (11), two membranes (12) and feedback lever unit, together with system of the two pneumatic cascade and spring bellows wherein the input signal is applied – drawing no. 2.

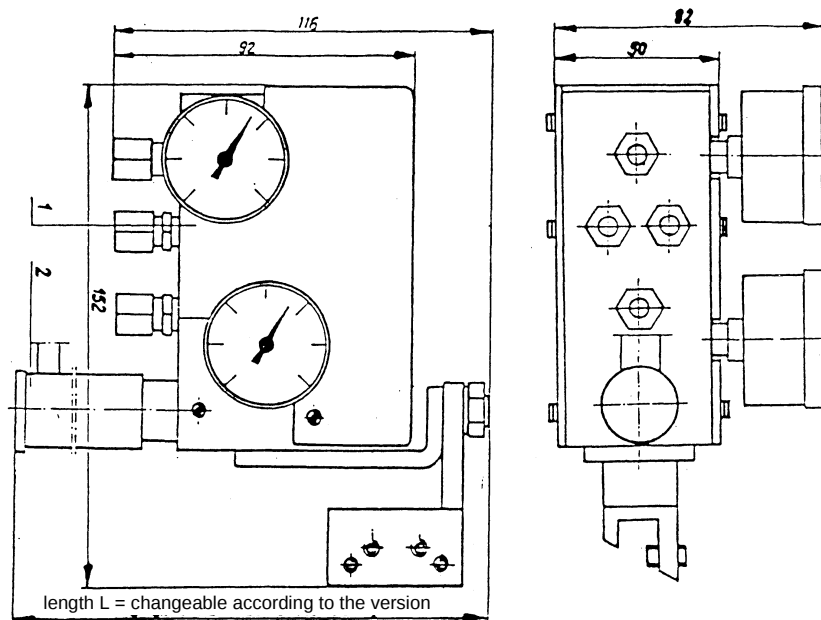
A set of telescope tubes, with the feedback spring and rotary holder fixing the positioner to the actuator, are attached to the body. The rotary holder enables to rotate the positioner by 90°, which allows to reduce the overall dimensions of servomechanism – drawing no. 3.

The positioner is equipped with two manometers for measurement of supply pressure and input pressure.

The body is made of aluminium alloy, the cover is made of steel covered with enamel, the seals are made from rubber and diaphragms are made of rubber with polyester insert. The remaining details are made from brass, stainless steel and carbon steel protected with zinc coating.

3.2. Working rules

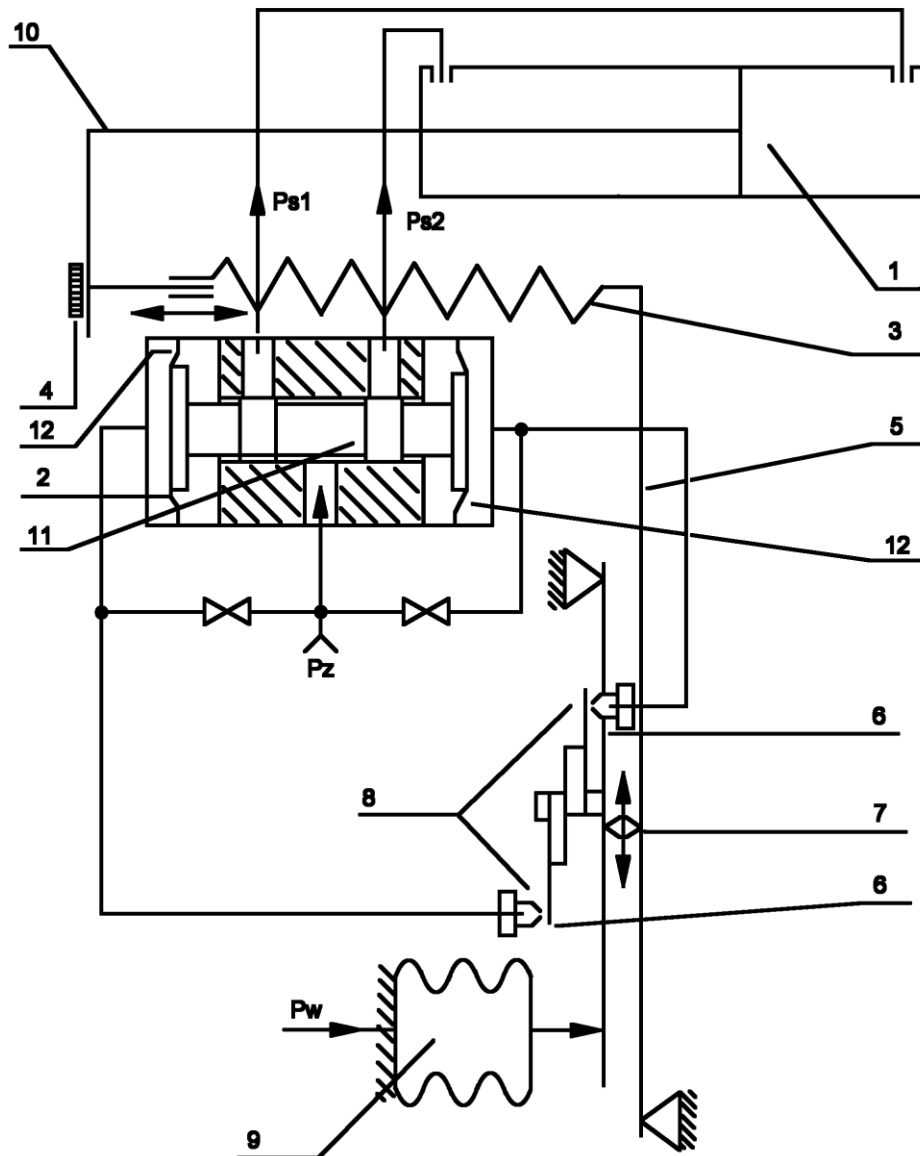
Working of the positioner is based on forces compare. In the pneumatic unit (drawing no. 2) a force coming from the input pressure p_w is compared, the pressure acting on the bellows (9) with a force from the feedback spring (3), tensioned by the stem, piston rod (10) of the co-operating actuator (1). A change in output pressure causes a change of the cascade pressures of the nozzle - diaphragm unit, which acting on the piston (11) causes a change in control pressures p_{s1} and p_{s2} . The actuator movement forced in this way causes a change in the feedback spring tension. This movement occurs as long as the forces from input pressure p_w and the feedback spring do not balance, and until the actuator takes a new position (then $p_{s1} = p_{s2}$).



Drawing no. 1. Dimension and basic elements of positioners type A705.

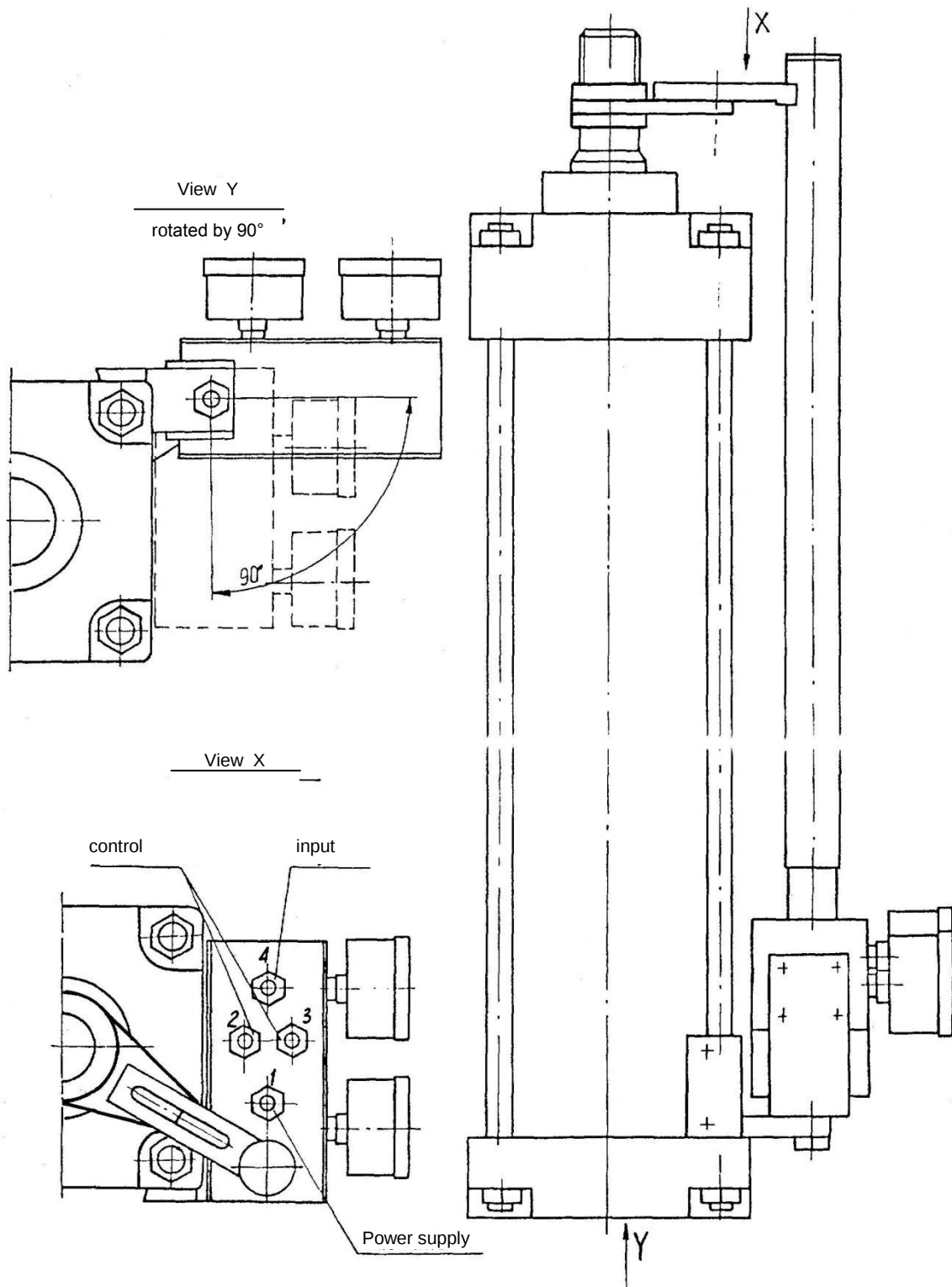
1 – pneumatic unit

2 – feedback unit



Drawing no. 2. Functional diagram of positioner

1 – actuator, 2 – distributor, 3 – feedback spring, 4 - zeroing screw, 5 – feedback lever,
6 – nozzle - diaphragm unit, 7 – range adjustment, 8 – operation point control, 9 - spring-type bellows,
10 – piston rod, 11 – piston, 12 – membrane, p_z - supply pressure, p_w - input pressure,
 p_{s1} and p_{s2} - control pressure



Drawing no. 3. Connecting of positioner with piston-type actuator

3.3. Positioner dimensions and versions

The dimensions of positioners are shown on drawing no. 1.
 Pneumatic positioners type A705 are made in version as follows:

Positioner for piston-type actuators

Version:

- input signal 20...100kPa

A705 – A 0 XX

0

ACTUATOR'S DIMENSION		CODE			
		Cylinder diameter (mm)			
		80	100	125	160; 200
Piston rod thread		M20x1,5	M20x1,5	M27x2	M36x2
pressure stop pipe holes		G 3/8"	G 1/2"	G 1/2"	G 3/4"
80	travel (mm)	-	-	41	51
100		-	22	42	52
125		-	23	43	53
150		04	24	44	54
160		05	25	45	55
200		06	26	46	56
250		07	27	47	57
300		08	28	48	58
320		09	29	49	59
400		10	30	40	60
500		11	31	38	61
600		12	32	39	62

EXAMPLE OF ORDERING:

Positioner type A705, actuator's travel 200 mm, cylinder diameter ø100

Positioner type A705 – A026

4. TECHNICAL DATA

Input pressure	20....100kPa
Supply pressure	0,25...1MPa
Control signal	two variable signals, with 0...100% of supply pressure
Travel of co-operating actuator	80...600mm, depending on version
Permissible ambient temperature	-25...+70°C
Basic error	max. 1.6% of rated actuator travel
Sensitivity (dead zone)	0,4% of minimum input pressure range
Proportionality range for both control signals	1.2 ± 0.5%
Additional error caused by supply pressure change of 10%	0.8% of rated actuator travel
Additional error caused by ambient temperature change	1%/10°C
Additional error caused by sinusoidal vibrations of 10...60 Hz , amplitude <0,35 mm	
60...500Hz, acceleration 5g	max. 1.6%
Additional error caused by overload with input signal of 154kPa	max. 1.6%
Air volume stream at positioner outputs:	min. 3,5 m ³ /h at p _z = 0,25MPa

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Air stream at steady:

min. 3,5 m³/h at p_z = 0,6MPa

max. 1kg/h at p_z = 0,25MPa

maks. 2kg/h at p_z = 0,6MPa

IP44, acc. to standard PN-EN 60529:2002

Casing protection degree

Pressure gauges:

- for input signal

- for supply pressure

dia. 40mm, class 2.5; range: 0 ... 0.25 MPa

dia. 40mm, class 2.5; range: 0 ... 1MPa

Mass (weight)

1.7 – 2.2 kg, depending on version

5. WORKING CONDITIONS

The positioner type A705 is designed for operation with:

- working medium – air should be free from any dust, oil and corrosive contamination as well as should have such relative humidity that dew point temperature must not be lower by 10°C (10°K) from the ambient temperature (acc. to PN-EN 60654-2:1999)
- at ambient temperature: –25...+70°C
- permissible vibrations:
10...60Hz, amplitude <0.35 mm, 60...500Hz, acceleration 5g
(acc. to PN-EN 60654-3: 1997, class VH6)
- working position – arbitrary

6. TRANSPORT MANUALS

The positioner, together with quality certificate, needle bag containing parts using for connection the actuator and a bag containing the hygroscopic medium, is placed in a tight plastic bag and then put into paperboard with absorbing insert, being the unit packaging of the product.

The units in the above mentioned packing are placed for transport in larger packing boxes, protecting the instruments against possible damages and atmospheric effects.

The weight of box with products should not be bigger than 50 kg. Ambient temperature during the transport should not exceed the range of –40...+60°C.

The positioners in transport packing (boxes) should be protected against direct effects of precipitations.

7. UNPACKING AND STORING MANUALS

The recipient after receive of shipment should check the state of transport packing. Then one ought to take the positioners out of single packages, unpack them and not opening the plastic bag, check by inspection if the product was not damaged. The instruments should be stored in single packages, in closed rooms. Air in the storage room should not contain any additions of aggressive vapours and gases.

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8. INSTALING MANUALS

8.1. General instructions

The positioner type A705 can co-operate with various types of double-sided action actuators, supplied with dry air, free from oil. The parts connecting the positioner with actuator, being the positioner equipment are adapted for assembling on actuators made acc. to ISO 6431, e.g. FESTO actuators type DN or PREMA of Kielce, Poland.

While selecting the actuator, one should pay attention to the following requirements:

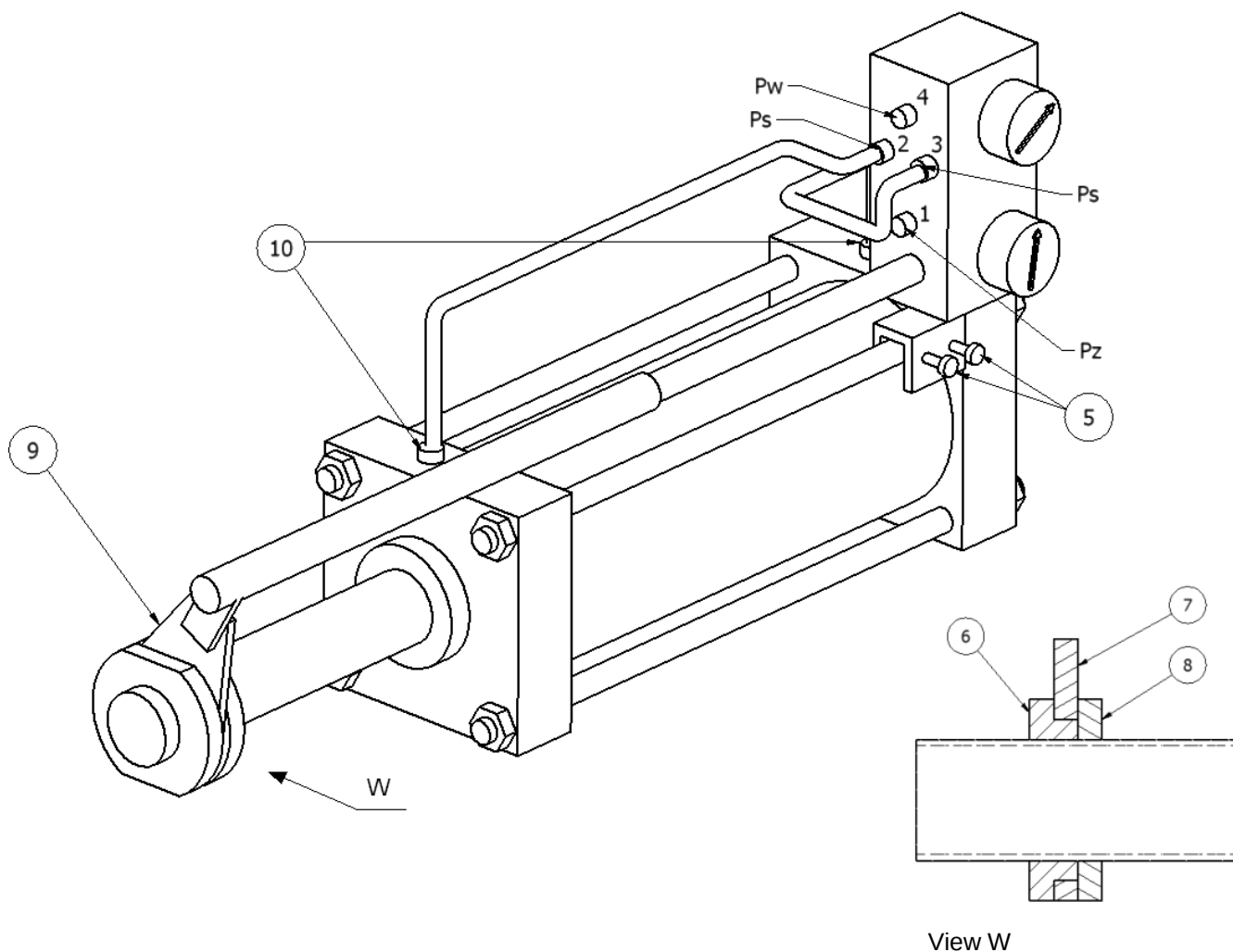
- movement resistances should be as low as possible: actuator is considered to be good if the piston rod moves without any vibrations and stops at air supply of 5 kPa,
- full external and internal tightness of actuator should be kept,
- connection of actuator with final control element should protect the piston rod against rotating,
- actuator co-operating with positioner should have sufficient margin of generated force. Its diameter should be so big that a force necessary to maintain the driven final control element at the set position will be achieved at the differential pressure above and under the piston not higher than 12% of supply pressure,
- the final control element, driven by the actuator co-operating with the positioner, should not have too large inertia (mass) and should be connected with actuator without any clearances. Too high inertia of the driven elements may become a cause of exciting the own vibrations of the system: driven element – actuator – positioner.

8.2. Assembly the positioner to the actuator

The positioner is assembled to the actuator in the way shown in drawing no. 4.

Sequence of assembling:

- a) One should check if the version of positioner is appropriate for the given actuator (see point 3.3).
- b) Initially the positioner is fixed to the actuator pin by means of two M6 screws, item 5 – drawing no. 4, and coupled with actuator stem by means of elements, items 6...9.
- c) One should set the position of positioner on the actuator pin so that the end of external pipe covering the spring, at the maximum actuator piston rod retraction, will be distant from the positioner body 10 mm (see drawing no.5).
One should rotate around the bracket screw so as not to expose it to damage.
- d) one should screw in the fasteners, being the positioner equipment, screw into the actuator connectors to apply control pressure.
- e) one should connect the positioner with the actuator by means of pneumatic connectors, acc. to drawing no. 4. The pneumatic connectors for supply pressure and input pressure should be led to the positioner.



- 1 - Supply pressure - p_z
- 2, 3 - Control pressure - p_s
- 4 - Input pressure - p_w

Drawing no. 4. Connecting of positioner with piston-type actuator.

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8.3. Installing rules of the pneumatic tubes

The pneumatic tubes from the supply pressure reducer should be as short as possible. The tubes and fittings should be fixed so that as not to be exposed to action of any mechanical loads. While leading the tubes, one should avoid sharp curves. Before connecting of tubes one should blow them with clean air in order to dry them and removing all the impurities. The best recommended material is copper tube diameter 6 x 1, etched from inside (removing of burr), covered outside with protective lacquer coating.

9. OPERATION MANUALS

9.1. Start-up and regulation

The positioner is delivered as factory-regulated for actuator travel corresponding to its version, with accuracy of 1.6%, and after attaching on the actuator, the unit requires 'zero' adjustment only. Zero adjustment is done in the following way:

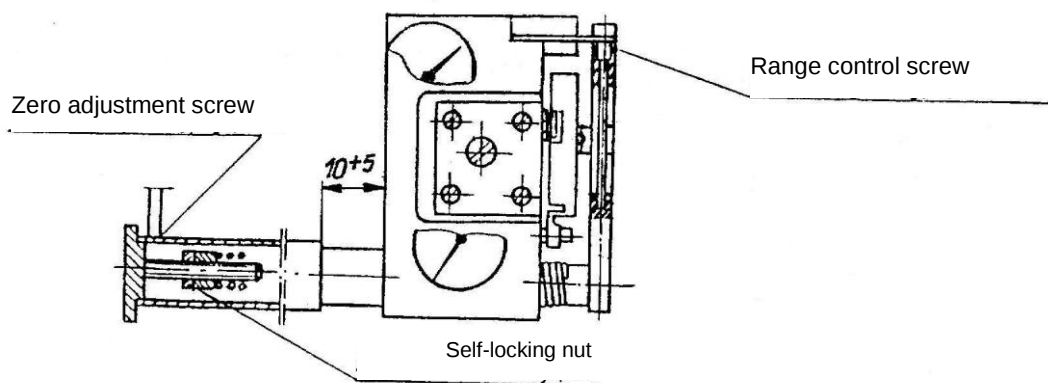
- check if the positioner is mounted on the actuator, according to point actuator 8.1.
- apply the supply pressure and set the input pressure $p_w = 5\%$ of the range. The input pressure measurement should be performed with manometer of 100 kPa and it should have the class not less than 0.4. The accuracy of manometer installed in the positioner is not sufficient enough.



The actuator with positioner should be placed in such way that protruding of piston rod should not cause any damage. An uncontrolled protruding of piston rod may be dangerous.

- turning the zeroing screw one can set the piston rod position corresponding to a value of preset input pressure, and then lock the spring holder with the self-locking nut (drawing no. 5). The zero adjustment may be performed at the input pressure value different from that in point b), if the specific data of positioner operation require so, with reservation that at travel 0 ... 5% and 95 ... 100% of the range, the positioner operation accuracy, due to piston rod movement resistance, is not guaranteed and it is not recommended to do zero adjustment at such travel values.

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Drawing no. 5. 'Zero' adjustment of the positioner

9.2. Checking and correct of positioner's regulation

Checking and possible range correction is performed in case of repairs or periodical checking of positioner operation as follows:

- Apply the supply pressure,
- Set the input pressure $p_w = 5\%$ of the range and check it by means of adequate measuring instrument (e.g. slide caliper), next set the initial piston rod travel which should be equal to $5\% \pm 1.6\%$ value of full actuator travel. If needed please make correction of "zero" regulation.
- Increase p_w to the value corresponding to 95% of piston rod travel range which should move to $95\% \pm 1.6\%$ value of full actuator travel.
- Any possible range discrepancy should be corrected by means of range control screw (drawing no. 5). For this purpose one should loosen the locking setting screw, situated at the lever side, suitably turn the range control screw and lock it once again. Rotating of control screw to the right causes *shortening* of actuator travel, corresponding to the input pressure range, while to the left – elongation.
- Check the adjustment, performing the steps b) and c).

The operations a) ... d) are to be repeated until the moment when one obtains the actuator travel compliance to the requirements, mentioned under steps b) and c).



During the adjustment and checking, acc. to 9.1 and 9.2, the input pressure should be applied in slow way, with small advance in relation to the actuator piston rod movement.

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9.3. Switching on the positioners for commissioning

Switching the positioner with actuator into normal operation at site, one performs it by applying the proper supply pressure p_z and input signal p_w from the regulator or from operation unit. .

9.4. Exploitation

The positioner properly installed and prepared for operation does not require any service, during the exploitation, except maintenance.

In order to obtain proper exploitation, the following conditions should be met:

- properly prepared supply pressure
- keeping of the friction parameters of the movable actuator parts at such level so as to fulfil the requirements mentioned under section 8, point 8.1
- it is recommended that the input pressure should be applied slowly, without great jumps so as to make the actuator piston rod position follow its changes, with a delay not greater than 15% of standard actuator travel.

9.5 Disassembly the positioner

In case when it becomes necessary to disassembly the positioner from the actuator, one should do the following:

- a) switch off the input pressure applied to the positioner
- b) reduce the supply pressure to zero value
- c) disconnect the tubes of input pressure, supply pressure and control pressure from the positioner; the end positioner connectors are to be protected against contamination
- d) unscrew the elements coupling the positioner with the actuator stem and fix them to the positioner in such way so as not to lose them
- e) unscrew the screws fixing the positioner to the actuator and remove the positioner.

Any further storing and possible packaging of the positioner to be dispatched should be in accordance with the requirements described under points 6 and 7.

10. MAINTENANCE

During the operation of positioner, once in six months or more frequently, one should check tightness of pneumatic tubes and tighten the nuts of the connectors. Any leakages found are to be immediately removed. In order to provide proper cleanness of working medium, one should observe the periodical inspection of filtering devices, installed in the supply line of the positioner. It is recommended to check periodically – once a year – the adjustments of positioner, acc. to point 9.2 and correct them if required.

11. POSITIONER'S EQUIPMENT

Each positioner is delivered with spare parts make possible to fixing on the actuator and completed unit which make possible pneumatic connections by copper tubes at diameter 6 x 1.

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12. DEFECTS AND REPAIRS

Item	DEFECTS	REASONS OF DEFECT	REMOVING
1.	Input pressure manometer does not indicate	Defect of input element Defect of supply line Damage of manometer	Defect out of positioner Remove line leakage Replace the manometer
2.	Supply pressure manometer does not indicate	Supply reducer is damaged or switched off Manometer is damaged	Defect out of positioner Replace the manometer
3.	Actuator does not respond to control pressure changes from the positioner	The tube, connecting the positioner with the actuator, is collapsed or damaged	Replace the tube
4.	Positioner does not respond to the input pressure changes. Control pressure is zero or equal to supply pressure	The gland, delivering pressure to control chambers, is choked; or the nozzles are choked	Blow the gland, nozzle



Any repairs should be conducted by the manufacturer or authorized service. In the event of the repairs performed by the third persons, the manufacturer shall not bear any responsibility for security and proper operation of the product.

13. SPARE PARTS

Item	The name of part or the set	Drawing number	Remarks
1.	Membrane	A705-C036-100	Poz.12, rys.2
2.	Bellows set	A705-B006-100	Poz.9, rys.2
3.	Small piston	A705-C032-100	Poz.11. rys.2.
4.	Sealing ring	Y812-C105-100	
5.	Sealing ring	Y812-C101-100	
6.	Manometr	R110-H005-300	It shows input pressure
7.	Manometr	R110-H005-200	It shows supply pressure

14. SCOPE OF DELIVERY

- Positioner
- Technical Product Documentation
- Acceptance Certificate
- Packaging

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