POSITIONER

TYPE A703

CONTENTS

1. APPLICATION

The positioner of the A703 type is designed to cooperate with a pneumatic actuator in the systems of automatic adjustment of the industrial processes in the chemical, foodstuff, energetic industry, etc.

It is used to increase usage power, developed by a actuator and to assure the unambiguity between the input signal and a shift of the actuator's pin. Through the usage of proper corrective cams, one can obtain a desired dependence of the servo actuator's shift on the input pressure. The positioner of the A703 type can work in the normal operation version, it means: the increase of the input signal results in increasing the pressure provided to the cooperating actuators or in the reverse operation version.

The positioner can cooperate both with the normal operation / closing operation / and reverse operation / opening actuators. The positioner of the A703 type is intended to work on the principle of cooperation with the membrane actuators manufactured by Z.A. POLNA S.A. in Przemyśl, Poland or by the MASONEILAN company.

The positioner can cooperate with actuators manufactured by others after using proper interface elements.

2. TECHNICAL DESCRIPTION

2.1. Construction

The positioner consists of a block of valves 1, housing, a set of manometers, a connection block.

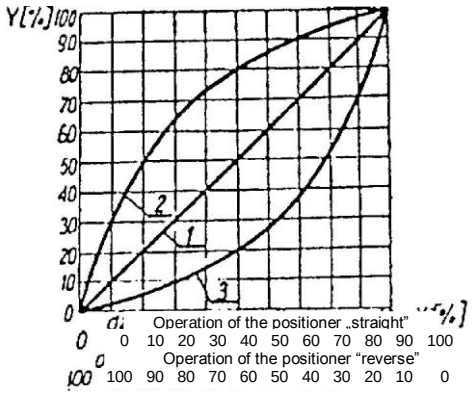
A block of valves is screwed to the positioner's housing by means of three screws. By unscrewing the screws and turning a block of valves by 180° we obtain a reversed method of the positioner's operation. The block of valves consists of a membrane 7, an upper and a lower corpus and a complete plate of valves. In the positioner's housing there is a spring 2 with a zero bolt, a cam 6 with a lever coupled with a actuator's pin 4.

NOTE:
Parts marked with figures are shown on drawing No. 2.
Depending on the scope of changes of the input pressure, the springs are marked with the following colours:

Green	input pressure 20....100 kPa
Orange	input pressure 20....60 kPa
White	input pressure 60....100 kPa

The cover is screwed with two bolts M5 to the housing. Also the hollow-core slab is screwed to the housing, in which a side switch "by-pass" is inbuilt depending on the performance and three manometers indicating the pressures:
Z – power
R – input
V – steering

One exchangeable cam is connected to the positioner which realizes one of three work characteristics:



Drawing No.1.

1 – linear characteristics (cam L) – shows the characteristics of the valve's fungus
2 – accelerated characteristics (cam %) – approximates the fungus's characteristics: linear to fast-opening one,
whereas constant-percentage to the linear one
3 – delayed characteristics (cam Q.O) – approximates the fungus's characteristics: linear to the constant-percentage whereas, fast-opening to the linear
X – input pressure
Y – stroke of the servo motor's pin

The change in operation of the positioner straight to the reverse and the possibility to cooperate with a servo motor with a normal or reverse operation is obtained by the change in the assembly of some positioner's elements.

The housing, the cover, the channel plate and a corpus are made from the aluminum alloys covered with enamel.

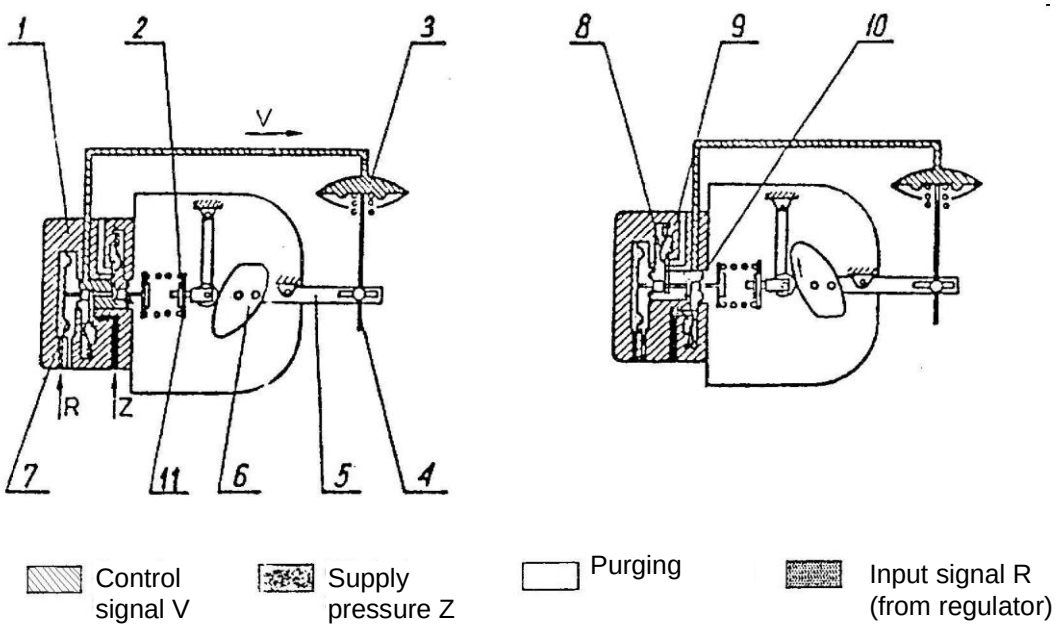
The seals are made from gum and cork – gum plates and membranes from gum with polyester insert.

Other details are made from stainless steel and carbon steel secured with zinc layer.

2.2. Working rules

The working rule of the positioner is based on the principle of the forces' comparison. In the block of valves 1 (drawing No. 2) the force on the spring 2 is compared tensed by the pin 4 which cooperates with the actuator 3 , by means of the setting lever 5 and a cam 6 , with the force coming from the input pressure operating on the membrane 7. The input signal from the positioner is a deviation function of the actuator's pin's location. In the „norm" location of the block of valves, the increase in the input pressure results in opening the supplying valve and as a consequence the increase of the input pressure. The actuator's motion forced in this way causes the revolution of the cam and the tension of the spring's feedback. This motion takes place until the force of the input pressure and the spring's feedback do not balance each other and the actuator will not take a new location.

The operation direction of the positioner is reversable and can be changed from the „normal" into „ reversed „ by means of a revolution of the valves by 180°. Then the sockets of the supply and a purging air valves are exchanged, due to which the increase of the input pressure results in closing the supply valve and opening the purging air one. Then, the input pressure drops. The attention should be paid to the arrow on the cam which should be in accordance with the direction of the cooperating pin of the actuator with an increasing input pressure.

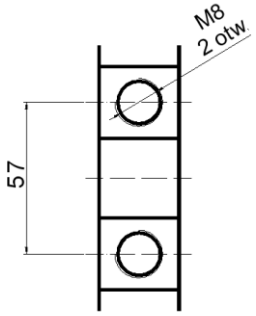


Drawing no. 2. The functional diagram of the positioner.

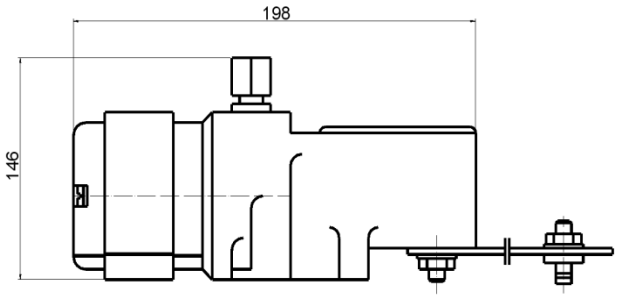
1 – block of valves
2 – spring
3 – cooperating servo motor
4 – servo motor's pin
5 – setting lever
6 – cam
7 – membrane
8 – flat spring
9 – shield
10 – membrane
11 – zero plate

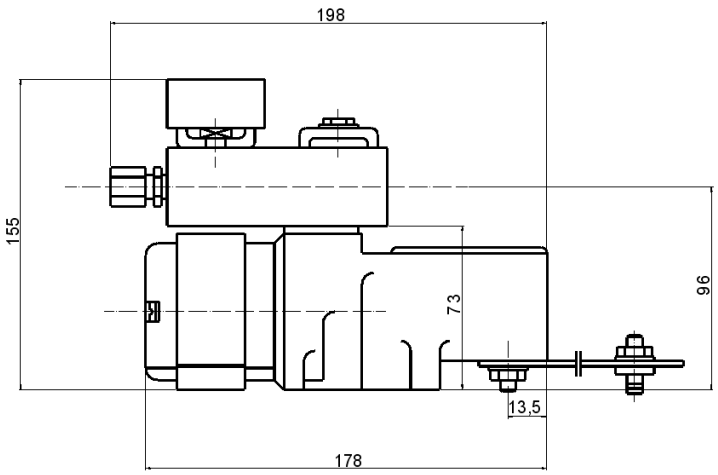
2.3. Dimensions of the positioner and types of performances.

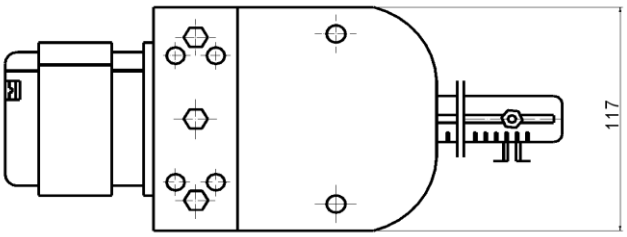
Positioners with manometers and switch

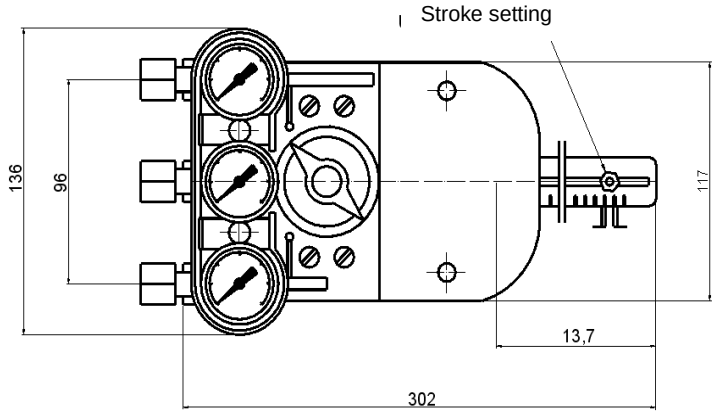


Positioners without manometers and switch









Drawing No. 3. Dimensions of the positioner type A703

Pneumatic positioners of the A703 type are manufactured in the following versions:

Pneumatic positioner **A703 – XXXX/XXXX**

VERSION:

- input signal 20…100 kPa, without pressure gauges and a switch A001
- input signal 20...60 kPa, without pressure gauges and a switch A002
- input signal 60...100 kPa, without pressure gauges and a switch A003
- input signal 20...100 kPa, with pressure gauges and a switch A007
- input signal 20...60 kPa, with pressure gauges and a switch A008
- input signal 60...100 kPa, with pressure gauges and a switch A009

Pneumatic connectors:

- for copper pipes ø 6 mm R971
- for copper pipes ø 8 mm R972
- for polyethylene pipes ø 6 mm R973

The positioners in basic version A703-A001…A009 are equipped with an L cam (lineary) and a set of assembly parts on the yoke actuators for e.g: type 37 or 38 manufactured by Polna S.A., Przemyśl Poland

The positioners in the special version A703-A001…A009-S01 are equipped with a cam % (accelerating).

The positioners in the special version A703-A001…A009-S02 are equipped with a cam Q.O (delaying).

The positioners in the special version A703-A001…A009-S03 are equipped with a set of cams and a set of assembly parts on the column actuators.

The positioners in the special version A703-A001…A009-S04 are equipped with a set of cams.

EXAMPLES OF ORDER:

The positioner of the A703 type, an input signal 60...100 kPa, equipped with manometers and a switch, pneumatic connectors for the copper pipes ø 6 mm with the marking:

Positioner A703 – A009/R971

The positioner of the A703 type, an input signal 60…100kPa, equipped with manometers and a switch, pneumatic connectors for the copper pipes ø 6 mm, equipped with a set of cams with the marking:

Positioner A703 – A009/R971 – S04

3. TECHNICAL DATA

Supply pressure	140....600kPa
Input signal	20...100kPa 20.... 60kPa 60....100kPa
Control signal	0.....100% of the supply pressure
Stroke of the cooperating actuator	10.... 101,6 mm
Non-linear feature	< 1,5%
Hysteresis	< 1%
Sensitivity (dead zone)	0,06%
Own consumption of air	0,26...0,68kg/h with the supply pressure 40...600kPa
Air volume stream at the actuator's output	min.15....36kg/h with the supply pressure 140...600kPa and input signal 60kPa
Permitted surrounding temperature	- 25...+ 70°C
Permitted additional error from the change of the supply pressure by 10%	0,3% of the width of range the control signal
Housing protection degree	IP54 in acc.PN – EN 60529: 2003.
Weight	1,8 kg for version A703-A001..A003 3,8 kg for version A703-A007..A009

4. WORKING CONDITIONS

The positioner of the A703 type is intended to be operated in the following conditions:

a) working factor – the air not including the dust, oil, aggressive contamination and having relative humidity so that the temperature of the dew point was lower no less than 10°C (10°K) than the surrounding temperature (in acc. PN-EN 60654-2:1999)

b) surrounding temperature –25...+ 70°C

c) permitted vibrations:
10... 60 Hz, amplitude < 0,35mm, 60…500 Hz, acceleration 5g
(in acc.PN-EN 60654-3:2000, class VH6)

d) working location – any

5. TRANSPORT MANUALS

The positioner with the quality certificate, with a bag containing parts for connection with a actuator and a bag containing a hydroscopic preparation, is placed in a waterproof bag of plastics and then put into the cardboard box with an amortization insert, constituting a unit packaging of the product.

For transport, the positioner in the abovementioned packaging are placed in a collective packaging, which protects them against damage and atmospheric events.

The weight of the box with the goods up to 50kg. During the transport, the surrounding temperature should not exceed the limits of the scope –40....+60°C.

The positioners in the transport / collective packaging are protected against the influence of the atmospheric precipitations.

6. UNPACKING AND STORING MANUALS

The recipient, after obtaining the shipment, should state the condition of the transport packaging. Then he should take out the devices in the unit packaging, unpack them and check visually whether the goods were not damaged without opening the plastic bag. The devices should be stored in the unit packaging in the closed rooms. The air in the storage places should not contain the admixtures of aggressive steams and gases.

7. INSTALLING MANUALS

7.1. Assembly the positioner on the actuator

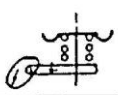
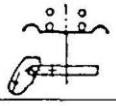
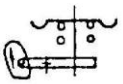
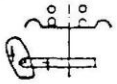
The positioner is mounted to the actuator by means of the bracket with M8 bolts. The pin of the actuator is coupled with a setting lever of the positioner by means of the parts included in the equipment in the manner shown on the drawings No.4 and 5.

The positioner with normal or reverse operation can be used both for the opening and closing actuators. Switching the positioner for the cooperation with one or the other type of the actuator takes place by unscrewing three M6 screws and a revolution of the block of valves by 180° and proper mounting of the cam.

The assembly of the positioner on the servo motor should be conducted in the following sequence:

a) define the operation of the positioner depending on the type of the cooperating servo motor and design requirements while using the table.

Mount a block of valves properly and a required cam.

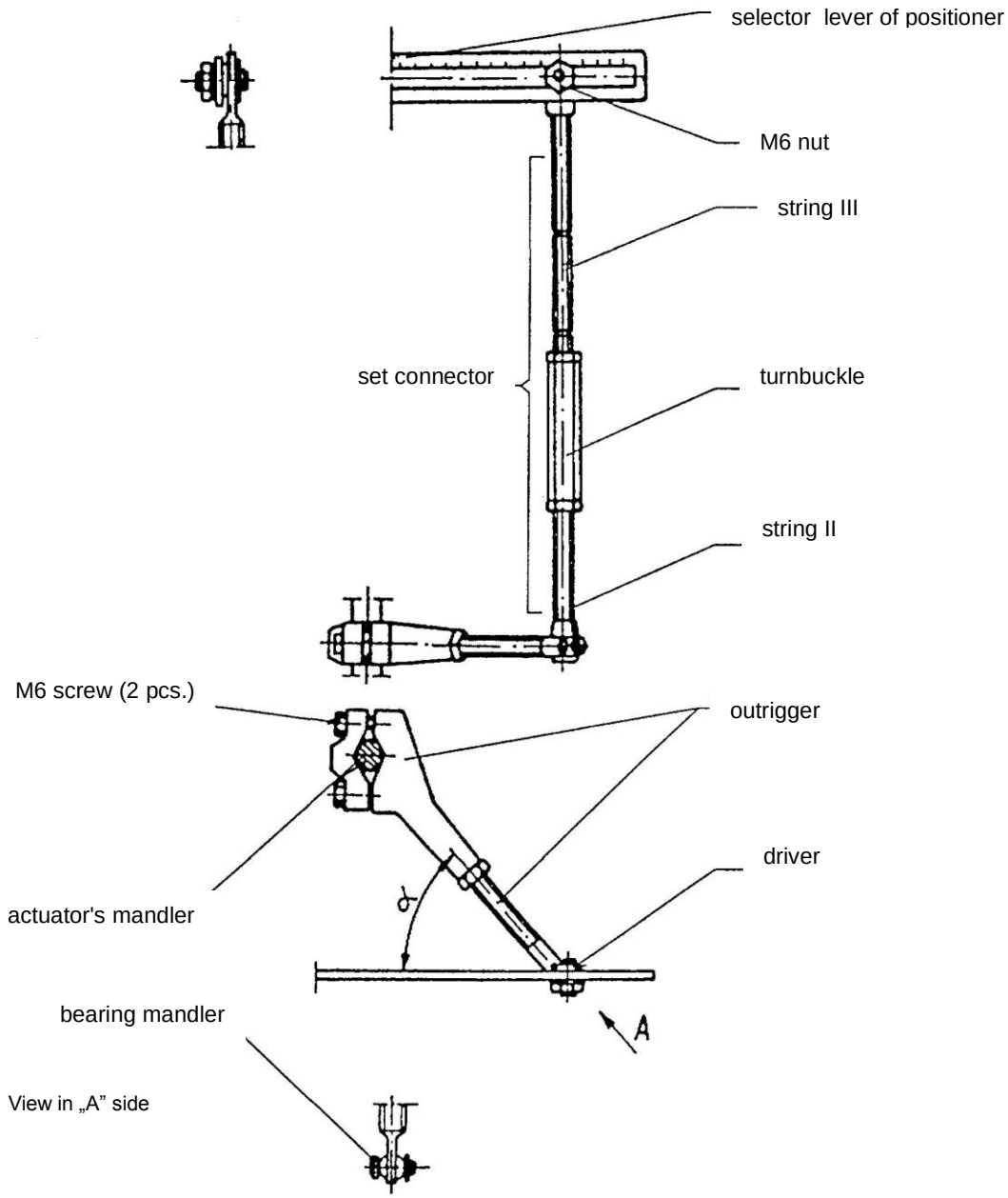
	Standard actuator	Reverse actuator
Increase of the input signal closes the valve (pin of the servo motor shifts towards the valve)	N 	R 
Increase of the input signal opens the valve	R 	N 

N – a block of valves mounted in the „norm" position
R – a block of valves mounted in the „odwrotnie/reverse" position

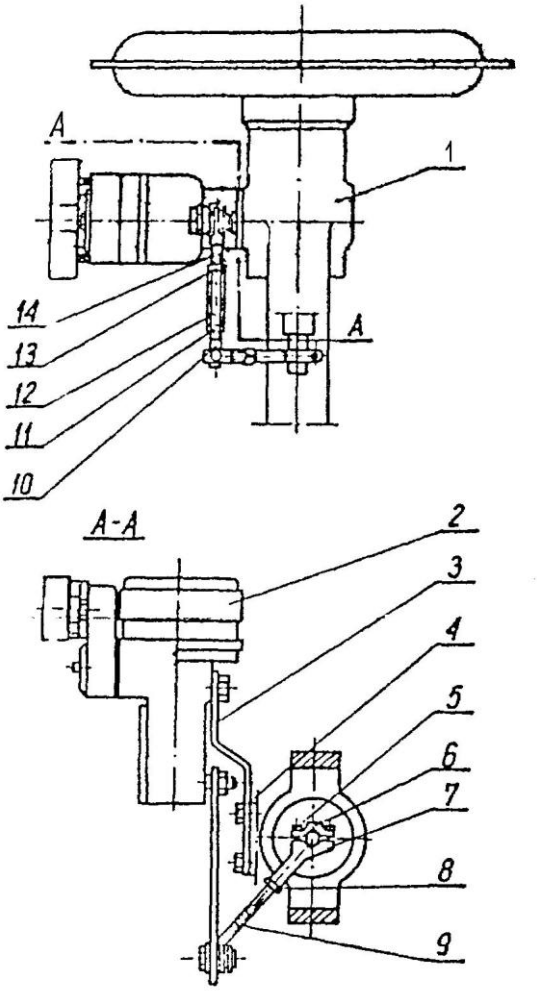
Pay attention to whether the stroke of the actuator is consistent with the description on the cam.

b) mount the positioner with the bracket to the actuator by means of M8 bolts
c) mount the jaw clutch on the setting lever of the actuator in the place corresponding to the actuator's stroke
d) mount on the jaw clutch a set of connectors consisting of two bands and a tensing nut with a left and right screw
e) screw the jib to the actuator's pin so that the set of connectors mounted to it later was parallel to the actuator's pin (adjust properly the length of the jib)
f) adjust the length of the set of connectors so that at the horizontally set lever / in the 50% location / the end of the set of connectors was away from the jib at the half distance of the actuator's stroke

After coupling of the set of connectors with a jib, the movement of the lever corresponding to the full stroke of the actuator should be symetrically placed with reference to the perpendicular axis of the actuator. If need be, the band of the se of connectors should be shortened in places intended for that. The connection of the band with a setting lever and a jib should be secured with a springing deposit plate and all bolts should be tightly screwed.



Drawing no. 4. The connection of the positioner with the actuator's pin



Drawing No. 5. Mounting of the positioner on the actuator with the straight operation
(e.g. 37 type, manufactured by Polna S.A., Przemyśl, Poland)

1 – actuator
2 - positioner
3 - bracket
4 - bolt M8x16
5 - screw M6x30
6 – grip
7 – outrigger
8 - nut M8
9 - band
10 – set of a band II
11 – nut
12 – special nut
13 - nut M6
14 – set of a band III

7.2. Installment principles of the pneumatic ducts

Pneumatic ducts to the supply pressure reducer should be as short as possible. The ducts and accessories should be mounted so that they are not exposed to any mechanical loadings.

While conducting the ducts, the sharp bendings should be avoided. Before connecting the ducts, this should blown with warm air in order to dry them and remove the contamination. For the ducts, the copper pipe etched from inside / removal of scale are recommended with the dimensions ø 6x1 or ø 8x1 covered from outside with a protective layer of lacquer.

8. OPERATION MANUALS

8.1. Start-up

8.1.1. General information

Before the start-up of the positioner it should be checked whether the stroke provided on the nominal plate of the actuator corresponds to the default settings of the positioner's stroke. This value should be checked on the nominal plate and on the setting lever's scale, on which the jaw clutch. The jaw clutch should be placed in the area of the plot marked with the stroke of the value provided on the nominal plate.

In the event of the lack of the default settings of the required value of the positioner's stroke, the adjustment should be conducted in accordance with the point 8.1.2.

8.1.2. Adjustment of the actuator's stroke

The adjustment of the stroke is conducted on the positioner mounted and initially selected length of the set of the connectors in accordance with the point.7.1.

a) set required supply pressure (140...600 kPa)
b) increase slowly the input pressure of the positioner while observing the actuator's pin. The beginning of the movement should be made with the input pressure equal to 20 kPa (or 60 kPa for the range of 60 ÷ 100 kPa).
   It is recommended to measure the movement of the pin with the device assuring the readout with the exactness of ± 0,05 mm, and the input pressure with the exactness of ± 0,5 kPa.
   If the beginning of the movement takes place with different pressure, the length of the set of connectors should be properly changed and with a slight deviation the positioner can be zeroed by turning the zero plate accessible with the cover off.
c) Increase the input pressure until the actuator's pin reaches the second extreme location. The end of the pin's movement should take place with the input pressure of100 kPa (60 kPa for the range of 20...60kPa). If reaching 100% of the pin's movement takes place with lower input pressure, the jaw clutch should be shifted on the positioner's lever towards smaller strokes or with the higher input pressure towards bigger strokes.
   Repeat the adjustment in accordance with the point 8.1.2. b) and c) until the required characteristics is obtained. Pay attention so that all bolts and nuts are tightly screwed, the bearing elements are secured with a springing deposit plate and the jig is mounted in such manner that the set of connectors is parallel to the actuator's pin.
   The set of connectors should be freely able to turn in bearings.

8.2. Switching on the positioner for commissioning

Switching on the positioner for commissioning is conducted by supplying the supply pressure established within the range between 0,14...0,6 MPa selected properly to the cooperating servo motor and supplying proper input signal from the regulator or the operation unit.

8.3. Exploitation

The positioner which is correctly installed and prepared for operation does not require any service during exploitation. The condition for proper exploitation is properly prepared supply air. The periodical control of the filtering devices placed in the pneumatic supply line should be obeyed.

8.4. Switching off from movement and disassembly of the setting unit

If it is necessary to supply the input pressure directly to the actuator, the bolt of the side connector should be loosened by means of the flat wrench S = 10 and the positioner – bypass connector should be placed in the “bypass” position.

Switching off the supply pressure is not necessary. The “bypass” position of the connector allows for disassembly of the setting set of the positioner with the possibility to conduct the process further on with the aid of input pressure supplied directly to the actuator. For that purpose, after switching the switch in the „bypass” position, disconnect the set of connectors from the setting lever. The connector block left with manometers and connected pneumatic ducts should be mounted to the actuator rough-and-ready. After remounting of the sets previously disassembled, it is necessary to conduct initial setting of the working point in accordance with the point 8.1.2. b).

8.5. Disassembly of the positioner from the actuator

If it is necessary to disassemble the positioner from the actuator the following steps should be taken:

a) switch off the steering pressure supplied to the positioner
b) lower the supply pressure to zero
c) disconnect the steering pressure, supply and output ducts and pneumatic connectors from the positioner and actuator and secure before contamination
d) unscrew the bolts mounting the positioner to the actuator and remove the positioner with the bracket from the actuator
e) disassemble the jig from the actuator and the set of connectors and mount them to the positioner in the manner which excludes losing.

Further storage and any packaging of the positioner for the purpose of its shipment should be consistent with the requirements listed in point 5 and 6.

9. MAINTENANCE

During the positioner's operation, the tightness of the pneumatic ducts should be checked every six months or more often and the connecting nuts of the connectors should be tightened. The discovered leakages should be immediately removed. In order to ensure proper cleanliness of the working factor, periodical control of the filtering devices should be assured placed in the supply line of the positioner.

10. POSITIONER'S EQUIPMENT

A set of the parts enabling to conduct mounting on the actuator is attached to every positioner as well as a set of parts enabling to perform pneumatic connections by means of the polyethylene ducts ø 6x1.

11. DEFECTS AND REPAIRS

Item	Damage	Cause for damage	Method of removal
1	Input pressure manometer does not indicate	Damage of the input part Damage of the supply line Damage of the manometer	Defect outside the positioner Remove leakage of the line Exchange manometer
2	Supply manometer pressure does not indicate	Supply reducer is damaged or switched off manometer is damaged	Defects outside the positioner Exchange manometer
3	Steering pressure manometer does not indicate actuator operates well	Manometer is damaged	Exchange manometer
4	Actuator does not react to the changes of the steering pressure from the positioner	The duct connecting the positioner with the servo motor is bended or damaged	Exchange the duct
5	The positioner does not react to the changes of the input pressure. Steering pressure is equal 0 or equal to supply pressure	Block of valves is damaged	Check and exchange a block of valves for any damaged part

NOTE:

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.

12. SPARE PARTS

No.	Name of the part or a set	No. the drawing	Notes
1.	Block of valves	A703-B009-100	It.1, drawing No. 2.
2.	Membrane II	HP29-6700-001	It.7, drawing No. 2
3.	Seal	HP29-6715-001	Enter the block of valves
4.	Seal	HP29-6703-100	
5.	Spring	A703-C040-100	It.2, drawing No. 2 (input signal 20...100 kPa)
		A703-C038-100	It.2, drawing No. 2 (input signal 20...60 kPa)
		A703-C039-100	It.2, drawing No. 2 (input signal 60...100 kPa)
6.	Cam L	HP29-9738-001	It.6, drawing No. 2 Lineary characteristics
7.	Seal	HP29-6719-100	Under the bypass switch
8.	Manometer	R110-H005-100	Range 0...0,6 MPa
9.	Set of parts for assembly	A703-L002-100	Yoke actuator e.g. type 37, 38 manufactured by Polna S.A., Przemyśl, Poland
10.	Set of parts for assembly	A703-L001-100	Column actuator e.g. type P, R manufactured by Polna S.A., Przemyśl, Poland

13. SCOPE OF DELIVERY

- Positioner with spare parts
- Technical Product Documentation
- Acceptance Certificate
- Packaging

CONTROLMATICA ZAP-PNEFAL Sp. z o.o.
ul. Krotoszynska 35; PL-63-400 Ostrow Wlkp., Poland
tel.: +48627372250, fax: +48627372724, controlmatica@controlmatica.com.pl
www.controlmatica.com.pl