



**ELECTRO-PNEUMATIC SYSTEM  
TRANSMITTER  
type A201**

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## 1. APPLICATION

The electro-pneumatic system transmitter type A201 is designed for conversion of the standard analogue electric signal, in the range of 20 – 100 kPa, into the standard pneumatic signal in the automatic control or control systems of technological processes in chemical industry, petrochemical industry, food industry, power engineering industry, etc.

The transmitter enables co-operation of electronic automatic controls with the elements of pneumatic control system.

The input signal can be generated by electric controller, measuring amplifier, or any other current source. The output signal can be used as the input signal of the typical pneumatic automation elements such as controllers, recorders, measuring instruments or meters, or as the control signal controlling the pneumatic final control elements.

Spark-safety version of electro-pneumatic system transmitter type A201 is made in spark-safety degree as follows:

 II 2G Ex ia IIC T6/T5/T4 Gb z with certificate KDB 04ATEX026X

## 2. TECHNICAL DESCRIPTION

### 2.1. Construction

The electro-pneumatic transmitter type A201 consists of the two basic assemblies:

- force balance,
- pneumatic amplifier,
- assembly of electric connectors,
- casing (housing).

The balance unit consists of the body to which permanent magnet, nozzle and diaphragm are fixed, the diaphragm is fixed on the spring cross holders, with lever, bellows unit base and zeroing spring tensioning control elements.

The electric coil, moving in the permanent magnet gap, is attached to the lever.

The spark-safe version of transmitter in the lever tray has got the voltage limiter PCB, filled with epoxy resin compound. The voltage limiter PCB includes the stabilitrons, made of three branches connected in parallel, each of them contains two push-pull connected stabilitrons (Zener diodes). The stabilitron circuit is permanently (connecting wires - filled with resin) connected with coil winding. The coil with magnet assembly is properly isolated from the remaining mechanical parts of the transmitter.

The balance circuit is screwed to the casing bottom.

The pneumatic amplifier is built of spring bellows assembly controlling the operation of valves: supply valve and deaerating valve. The amplifier body is screwed to the base plate placed in the casing.

The transmitter casing, consisting of tub and cover, is an aluminum casting. The casing is of such design that it provides protection degree IP54.

The PCB of electric connectors assembly is attached to protrusions in the casing bottom, PCB is equipped with terminal strip and checking sockets for input signal measurement.

The two diodes, connected in parallel and reversely polarized, are placed on the PCB. The diode circuit is connected in series with input signal circuit to enable taking of input current value measurement, without breaking the circuit.

The external earth clamp which is stable connect with casing tank is using for earthing.

The gland for fixing electric tubes and connectors of pneumatic tubes are turned into a casing wall.

The transmitter is equipped into a bracket for assembly on the wall.

## 2.2. Operation rules

Operation of transmitter type A201 is based on the principle of comparing the force moment, generated by the coil placed in steady magnetic field, proportional to the input signal, with moment of force generated by the metal feedback bellows, wherein the pneumatic output signal is led to.

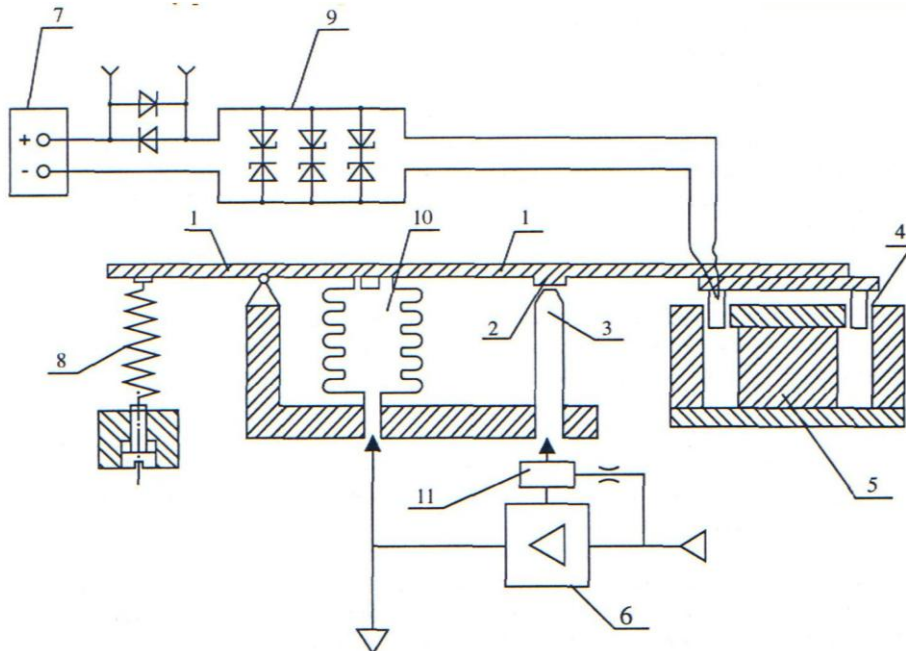
An increase in input current causes an increase of force generated by the coil, makes a loss of lever balance and shifting of control cascade nozzle. A change in cascade pressure, amplified by pneumatic amplifier causes an increase of output pressure, an increase of feedback moment and thus balances the input signal action.

Then a new state of equilibrium occurs, wherein the output pressure reaches a value proportional to the actual value of input current.

Setting of the proportionality factor is realized by adjusting the arm operating on balance lever of the feedback bellows. This adjustment is carried out by rotating the bellows round the eccentric fixation axis.

A change in direction of transmitter operation ("forward", or "reverse" action) can be realized by a change in current flow direction through the coil, corresponding to the zeroing spring tension and range width correction.

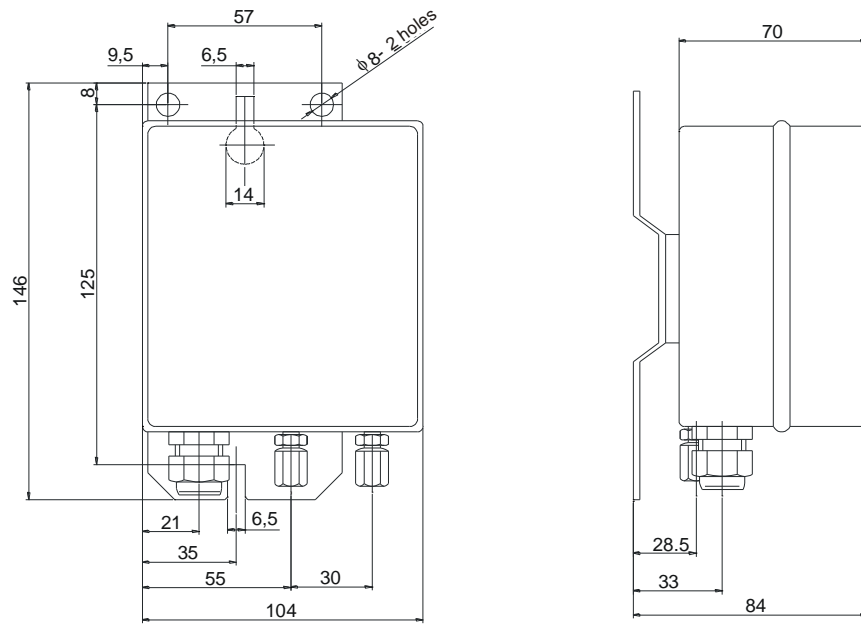
The functional diagram of transmitter unit is shown in drawing no. 1.



1. lever
2. diaphragm
3. nozzle
4. electromagnetic coil
5. permanent magnet
6. pneumatic amplifier
7. electric connector
8. zeroing spring
9. voltage limiter (only in intrinsic safety version)
10. flexible bellows
11. damping volume

Drawing no. 1. Functional diagram of transmitter type A201


### 2.3. Transmitter dimensions and kinds of version



Drawing no. 2. Overall dimensions of electro-pneumatic system transmitter type A201

Electro-pneumatic system transmitter type A201 are made in versions as follows:

<b>A201-A</b>	<b>Electro-pneumatic system transmitter</b>
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CODE 1	VERSION
1	Standard
2	Spark-safety with ATEX certificate  II 2G Ex ia IIC T6/T5/T4 Gb

CODE 2	INPUT SIGNAL
0	4 ... 20 mA, optional 0 ... 20mA *

CODE 3	PNEUMATIC CONNECTORS
0	Without connectors
1	Connectors for copper or polyethylene pipes $\Phi$ 6mm
2	Connectors for copper or polyethylene pipes $\Phi$ 8mm
4	Quick joint connector for polyethylene pipes $\varnothing$ 6 mm (operational temp. -20°C...+80°C)
5	Quick joint connector for polyethylene pipes $\varnothing$ 8 mm (operational temp. -20°C...+80°C)

CODE 4	INPUT OF ELECTRIC CABLE
-D1	Metal connecting cable diameter 5 ... 8 mm (temperature range -40 ... 80 ° C) housing thread M20x1.5 in the body
-D2	With plastic connecting cable diameter of 5 ... 8mm (temperature range -35 ° C ... 80 ° C) housing thread M20x1.5 in the body

CODE 5	OUTPUT SIGNAL
-W1	Range from 20...100 kPa
-W2	Range form 60...300 kPa **

- \* Optional input signal 0 ... 20 mA  
- upon agreement with the Aplisens consultant
- \*\* Output signal 60 ... 300 kPa  
- upon agreement with the Aplisens consultant  
(not available with Ex version)

#### Example of ordering:

Electro-pneumatic system transmitter type A201 in standard version with input signal 4...20 mA, with connector for pipe dia. 6x1 mm with standard - metallic cable key and output signal from 20...100 kPa has denotation:

***Electro-pneumatic system transmitter type A201-A101 -D1-W1***

### 3. TECHNICAL DATA

input signal	4...20 mA; 0...20 mA 20...4 mA; 20...0 mA (inversion signal)
output signal	20...100 kPa; 60...300 kPa
pressure supply	140 ±14 kPa; 400 ±40 kPa
input resistance	≤ 250 Ω
basis mistake	0,6%
hysteresis	0,25%
additional mistakes:	
- from changes of pressure supply by 10%	max 0,5%
- from change of ambient temperature	max 0,8% on each 10°C
- form vibrations in range: 10 ... 60 Hz, amplitude<0,35 mm 60 ... 500 Hz, acceleration 5g	max 1%
- form reaction the magnetic constant and commutative field at intensity 100 A/m, 50 Hz (acc. to PN-EN 6100-4-8:1998)	max 0,5 permissible basis mistake
- form disturbances radiated magnetic field at radio frequency 10 V/m., at frequency in range 80 MHz do 1 GHz (acc. to PN-EN 6100-4-3:2002)	max 0,5 permissible basis mistake
- from series of quick transient states made by voltage at peak value 2 KV (acc. To PN-EN 6100-4-4:2002)	max 0,5 permissible basis mistake
- from surge at voltage 0,5 KV (acc. to PN-EN 6100-4-5:1998)	max 0,5 permissible basis mistake
working position	optionally, subject to 0 correction in choosed position
own air consumption	max 0,35 kg/h at p <sub>z</sub> = 140 kPa
max rate	7,5 kg/h at p <sub>z</sub> = 140 kPa
spark-safety characteristic	II 2G Ex ia IIC T6/T5/T4 Gb
certificate	KDB 04 ATEX 026X

#### CONDITIONS OF USING IN EXPLOSION-RISK ZONE:

1. Electro-pneumatic system transmitter type A201-A2XX-XX-XX, ... may cooperate only with spark-safety circuit at parameters:

$$U_i = 28 \text{ V DC}, I_i = 100 \text{ mA}, P_i = 0,7 \text{ W}$$

2. Transmitter connection with cooperating devices should be made by separate conductors pair or by cable, which **OLNY** spark-safety circuits will be connected. L and C parameters of external circuit should be the same like for device cooperates with transmitter.

3. Acceptable ambient temperature - depending on temperature class

Temperature class of gases and steam		T6	T5	T4
Acceptable ambient temperature (Ta)	Metal cable gland	-40°C ... +50°C	-40°C ... +65°C	-40°C ... +70°C
	Plastic cable gland	-35°C ... +50°C	-35°C ... +65°C	-35°C ... +70°C

housing protection degree	IP54 acc. to PN-EN 60529:2002
mass	1,1 kg
connectors:	
- electric	screw clamps for transmitter at diameter to 2,5 mm <sup>2</sup>
- pneumatic	threaded holes St. B1/8" or connectors

## 4. WORKING CONDITIONS

The electro-pneumatic system transmitter type A201 is designed for operation in industrial conditions, in roofed places, booths at site, non-heated rooms or in control room background in conditions as follows:

Ambient temperature:	–40 up to +80°C
Relative humidity:	100%
Sinusoidal vibrations:	10 ... 60 Hz, amplitude < 0,35 mm, (class VH6 acc. to PN-EN 60654:1996)
Working position:	optionally, subject to 0 correction in choosed position
Working medium:	air without dust, oil and aggressive pollution, at relative humidity when dew temperature should be lesser than ambient temperature at the value not lesser than 10°C (10°K) (PN-EN 60654-2:1999)

## 5. TRANSPORT INSTRUCTION

The electro-pneumatic system transmitter type A201, together with quality certificate and a foil bag containing the spare parts and 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 – up to 50 kg.

Ambient temperature during the transport should not exceed the range of –40...+80°C. The instruments in transport packing (boxes) should be protected against direct effects of precipitations.

## 6. UNPACKING AND STORAGE INSTRUCTION

Customer should inspect boxes state after receiving.

After taking reducer out of box, without opening plastic bag, inspect it visually for damages.

Before removing plastic bag keep reducer in room, where it is unpacked, until it reaches environment temperature.

Reducers should be stored in original boxes in closed rooms at ambient temperature 20±10°C and relative humidity up to 80% .

Air in storage area should not contain aggressive vapours and gases.

## 7. INSTALLATION INSTRUCTION

### 7.1. Place of installation

The place and way of installing should provide easy access to transmitter and operation conditions acc. to point 4. These should protect against mechanical damage, contamination, great ambient temperature changes, vibrations and shocks.

### 7.2. Assembly of transmitter

Before installing the transmitters, after taking them out of cardboard, should be kept in the foil bags until their temperature is equal to the temperature of room wherein they are mounted.

After taking the transmitter out of foil bag, one ought to fix at the installation place on a wall of the room, or to construction elements of protective booth, using the bracket screwed to the rear wall of transmitter casing.

### 7.3. Connecting of pneumatic tubes

Connecting of the supply pressure and output signal tubes is performed with universal connectors for tubes of 6 dia. x 1. One ought to use the seamless tubes, made of materials resistant to action of industrial atmosphere, mechanical damage, thermal exposure and chemical contamination occurring at installation place.

Polyethylene or copper tubes are most often used.

Before connecting of tubes they should be thoroughly cleaned and blown with compressed air to dry them.

The tubes should not carry any mechanical loads. Connections of tubes ought to be completely tight.

**At the transmitter output it is necessary to connect the volume of 700 cm<sup>3</sup> or a tube of 6 dia. x 1, minimum 20 metres long.**

### 7.4. Connecting of electric wires

A terminal placed on external side of lower casing wall is designed for transmitter grounding.

The input signal wires should be screwed to a terminal strip accessible after removing of casing cover.

The wire '+' for "Forward" operation is to be connected to terminal 1, while wire '-' to terminal 2. To obtain reverse (REV) operation – do in opposite way. Leads of wires outside the transmitter - through the cable glands.

### 7.5. Installation of transmitters in spark-safety version

While installing the transmitter in version A201-A2XX (spark-safety version), one ought to observe meeting of installation conditions given in the certificate KDB 04 ATEX 026X.

Assuring of intrinsic safety of the circuits co-operating with transmitter one can obtain by using the protective barrier and fulfilling the requirements specified in the certificate for this barrier.

## 8. OPERATION INSTRUCTION

### 8.1. Start-up

Before starting the transmitter one ought to check and possibly correct the transmitter grounding, operating acc. to point 8.2. One checks the grounding, system of electric connections as well as tightness and patency of pneumatic connectors.

One starts the transmitter up by applying the supply pressure and leading of input signal from the controller or from A/M operational station.

### 8.2. Checking and regulation

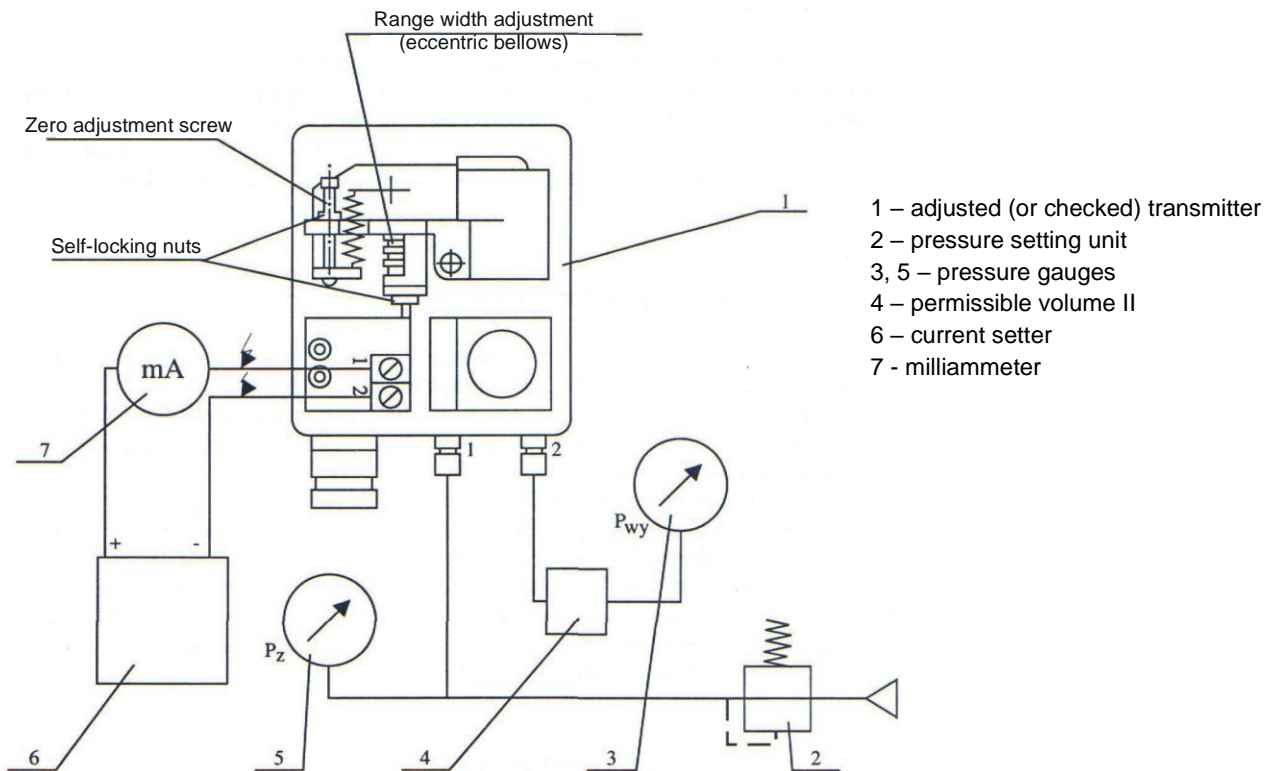
Checking and possible zero correction is performed before start-up and during the periodical inspections at the transmitter installation place.

Adjustment of range width is essentially carried out only in case of repairs or change of transmitter application (change in range or operation mode from NORM to REV); it is recommended to perform it by special service staff.

Checking and adjustment is carried out, after connecting the measuring circuit to transmitter (at the place of input and output signal wires), operating acc. to drawing no. 3 as follows:

#### a) Zeroing

Set the pressure  $p_z = 140$  kPa and input signal equal to the lower limit range value. Required accuracy of input signal settings is  $\pm 0.1\%$  of range width. Output pressure from the transmitter should be  $20 \pm 0.4$  kPa. If this condition cannot be met, one should correct the zeroing screw tension by loosening of lock nut and shifting adequately the control screw, marked with "ZERO". For this purpose one should lock the setting screw and check output pressure value once again.



Drawing no. 3

### b) Range checking and control

After zeroing of transmitter one should set the input signal equal to the upper limit range value, with accuracy of  $\pm 0.1\%$ . The corresponding output pressure value should be  $100 \pm 0.48$  kPa.

Any possible range width control should be carried out by means of rotating the feedback bellows round the eccentric fixing axis. The bellows is rotated with knurled base after the previous loosening of locking nut.

Touching the bellows gives a risk of its damage.

Turning the bellows anticlockwise causes the output pressure range changes widening, while turning it clockwise – narrowing / contraction. Each time after shifting the bellows one should tighten the locking screw, repeat the zeroing and check output pressure value, corresponding to the upper limit value of input signal.

These operations are to be repeated until we obtain full compatibility with the requirements.

### 8.3. Connect the transmitter into exploitation

The connection of transmitter into exploitation is done by supply the pressure supply and supply the accurate control signal.

### 8.4. Exploitation

The properly installed and prepared for operation transmitter during the exploitation does not require any service. The point of proper working of the transmitter is accurate prepared supply air. The periodical inspections of filtering devices which are in pneumatic line of power should be observe.

## 8.5. Disassembly

In order to dismount the transmitter out of the installation, one should do the following:

- switch off the input pressure applied,
- reduce the input signal to zero value and disconnect the electric wires,
- disconnect the supply pressure and output pressure tubes,
- the pneumatic connectors of transmitter are to be protected against contamination,
- unscrew the fixing screws and remove the transmitter, together with bracket, from the installation place.

Any further storing and possible packaging of the transmitter for its dispatching should be in accordance with the requirements described under points 5 and 6.

## 9. CONSERVATION

The periodical inspections consist in checking of tightness of pneumatic connections, condition of electric wires insulation, fixing of transmitter and zeroing check. any defects found should be immediately removed. Frequency of inspections depends on transmitter operation conditions – they should be carried out at least once in six months' time. A condition of proper operation is properly prepared supply air. In order to provide adequate purity of working medium, the following conditions should be observed: periodical checking and cleaning, or replacing of filtering devices placed in the transmitter supply line.

## 10. TRANSMITTER'S EQUIPMENT

Mentioned equipments are delivered with the transmitter:

Seal ring	Y812-C111-100	2 pcs.
Seal ring	Y812-C117-100	2 pcs.
Seal ring	Y812-C102-100	2 pcs.
Seal ring	Y812-C114-100	1 pc.
Seal ring	Y812-C101-100	3 pcs.
Sleeve	R906-C005-100	2 pcs.
Seal ring	R906-C003-100	2 pcs.

## 11. DAMAGES AND REPAIRS

Item	DEFECTS	REASONS OF DEFECT	DEFECT REMOVING
1.	Transmitter does not respond to the input signal changes. Output pressure equal to zero	Defect in supply pressure line. (defect outside transmitter)	
		Control cascade gland contaminated	Clean or replace the gland
		Tank in control cascade not tight	Replace the tank
		Damaged amplifier	Replace the amplifier
		Damaged diaphragm in the balance circuit	Replace the diaphragm
2.	Transmitter does not respond to the input signal changes.	Tube connecting the feedback bellows with amplifier - contaminated or non-tight	Clean or replace the pneumatic tube
		Gland in the control cascade is not tight	Tighten or replace the gland.
		Amplifier - contaminated or damaged	Clean or replace the amplifier

	Output pressure equal to the supply pressure	Feedback bellows is not tight In the "reverse" mode versions – the input signal connector is loosened, or electric wires are damaged	Replace the bellows. Tighten the connectors
3.	Output pressure does not reach the upper range values	To little supply pressure	Defect in the supply pressure line
4.	Hysteresis exceeds the permissible value and/or at mechanical shocks occurs a steady input signal change	The balance lever suspension is damaged	Replace the complete holders
		Friction in the balance circuit	Remove the friction source in the balance circuit.
		Air gap in the magnet contaminated	Clean the air gap in the permanent magnet



**ATTENTION: All repairs should be performed by producer or authorized service company. In case of repairs performed by unauthorized persons producer bears no responsibility for safety and proper product operation.**

## 12. SPARE PARTS

Item	Name of spare part or unit	Drawing number	Remarks
1.	Lever	A201-B001-100	One includes spare parts marked for "1" to "5" and from "8" to "10" – Drawing no.1
2.	Pneumatic amplifier	E206-A002	One includes spare part marked „6: on drawing no. 1
3.	Seal ring	Y812-C111-100	One includes spare parts marked for "3" to "7" – the unit of seal rings
4.	Seal ring	Y812-C117-100	
5.	Seal ring	Y812-C114-100	
6.	Seal ring	Y812-C102-100	
7.	Seal ring	Y812-C101-100	

## 13. SCOPE OF DELIVERY

For electro-pneumatic system transmitter should be added:

- Technical Product Documentation
- Guaranty card
- Compatibility declaration