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# PS-150 Signal Transducer Operation Manual

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## **Introduction**

This "Operation Manual" provides the study of work and proper operation of PS-150 signal transducers and contains information necessary for their proper, safe operation and maintenance.

The use of signal transducers PS-150 is allowed for service personnel who have studied this manual, a set of exploitation documentation and passed safety training.

## **1. Definition and work**

### **1.1. Signal transducer purpose**

1.1.1. The sensor is designed to convert analogue signals of current 0-20 mA (current loop) or voltage of 0-10 V into a digital signal and transfer them to the device DEL-150 via the RS-485 interface. The sensor also has discrete inputs for determining the state (on / off), counting the number (counter) of pulses, measuring the frequency and the period of the signal following. The signal converter has a non-volatile memory where necessary parameters for operation are stored. The setting of the type of analogue signal (current / voltage) is set using jumpers on the board, and the range of change of the signal is programmed through the menu.

1.1.2. The principle of operation of the converter is based on the following. The sensor has analogue-digital converter module, signals are run on protected inputs from connected sensors. Then these signals are digitized, scaled and transmitted upon request by the foreman using the Modbus RTU / ASCII protocol. The microcontroller determines the state of the pulse signals through the protected discrete inputs. Current input status information is displayed on a graphic display.

1.1.3. The power supply of the signal converter is carried out from external DC power source. The maximum current consumption of the connected analogue sensors is set by the current-limiting circuits of the signal converter. If the current consumption is exceeded, external sensors are de-energized with electronic switches. Limiting the consumed current of sensors with discrete outputs is carried out using current-limiting resistors. In this case, the sensors do not de-energize.

1.1.4. Signal transducer works in RS-485 interface via Modbus RTU/ASCII protocol.

## 2. Signal Transducer technical characteristics and operating conditions

### 2.1. Main technical characteristics of a signal transducer

Table 1

Technical characteristics	Value
Max acceptable basic percentage error, %	±0,25
Number of analogue inputs	2
Number of discrete inputs	2
Range of current input signal, mA	0 - 20
Range of current input signal, mA	4 - 20
Range of voltage input signal, mA	0 - 10
Number of D/A, bit	16
Transducer function of input signal	lin
Resistor resistance of current loop, Om	100
Power voltage range, V	12 - 30
Digital interface connection	RS-485
Exchange speed via RS-485 interface, bit/sec	57600
Connection protocol used for data transfer	ModBus RTU/ASCII
Ex marking EAC	1Exib[ib]IIBT5Gb 1ExibIIBT5Gb
Ex marking ATEX	II2GExib[ib]IIAT3Gb
Max length of connection line RS-485 with external digital sensors while digital signal transfer, m, no more than	100
Ingress protection GOST 14254-2015, no below than	IP65
Average lifetime, years, no less than	8
Nonfailure operating probability for 10000 hours	0,95
Dimensions, mm, no more	150x150x60
Weight, kg, no more	1,5

### 2.2. Operating Conditions of Signal Transducer

- 2.2.1. Operating temperature range, °C: from - 45 to +65.
- 2.2.2. Relative Humidity no more than 80%.
- 2.2.3. By resistance to climatic influences, the signal transducer corresponds to NF according to GOST 15150.
- 2.2.4. In terms of stability and strength to the effects of sinusoidal vibrations of high frequency (with a transition frequency from 57 to 62 Hz), the signal converter corresponds to V3 version according to GOST R 52931.

## 3. Signal Transducer system

### 3.1. Signal Transducer construction

- 3.1.1. Signal converters are available in a metal case made of aluminum, with a mounting plate for mounting on the wall. Overall and mounting dimensions are indicated on drawings in Appendix A
- 3.1.2. On the transducer enclosure there are connectors for connecting the RS-485 interface cable, hermetic cable glands for analogue and discrete signals. The number and set of input elements is determined by the versions depending on the functional purpose of the signal transducers.

3.1.3. Signal transducer enclosure has removable cover with screws, where electronic printed board is mounted underneath fig1

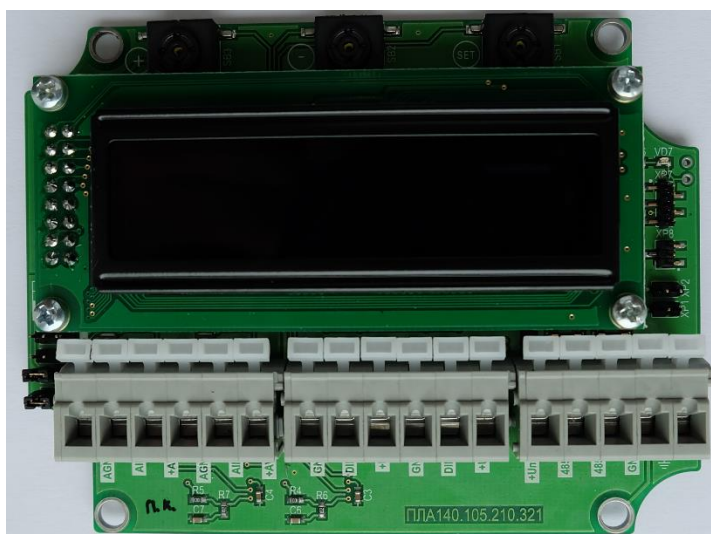


Figure.1 Printed board of signal transducer

3.1.4. The following elements are placed on electronic board:

- control buttons for navigation along with software menu and value editing ;
- display for reflecting of current values and software menu;
- block of spring clamps for connecting of entrance cables.

3.1.5. In order to set analogue inputs for current acceptance or voltage it is necessary to set special jumpers in a definite place, see fig2 and fig3.

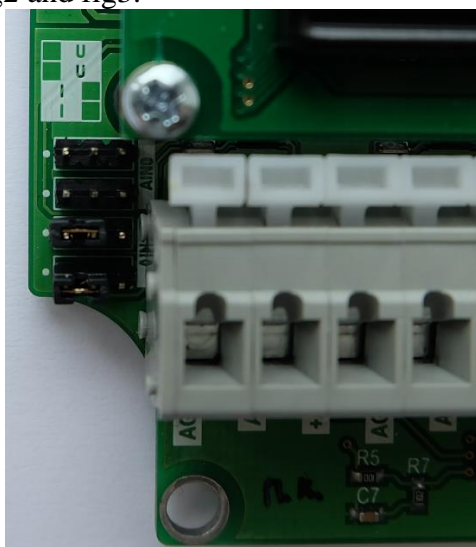


Fig.2 Jumpers placement on the board

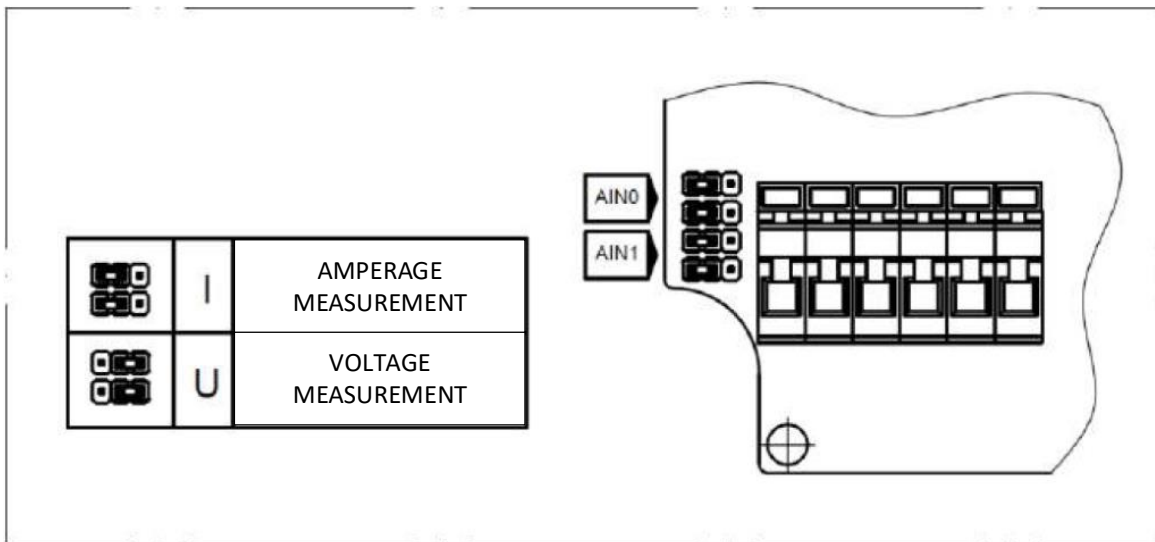


Fig.3 Type choose of input signal

### 3.2. Signal transducer structure scheme

3.2.1. Structure scheme of signal transducer is showed on fig.1.

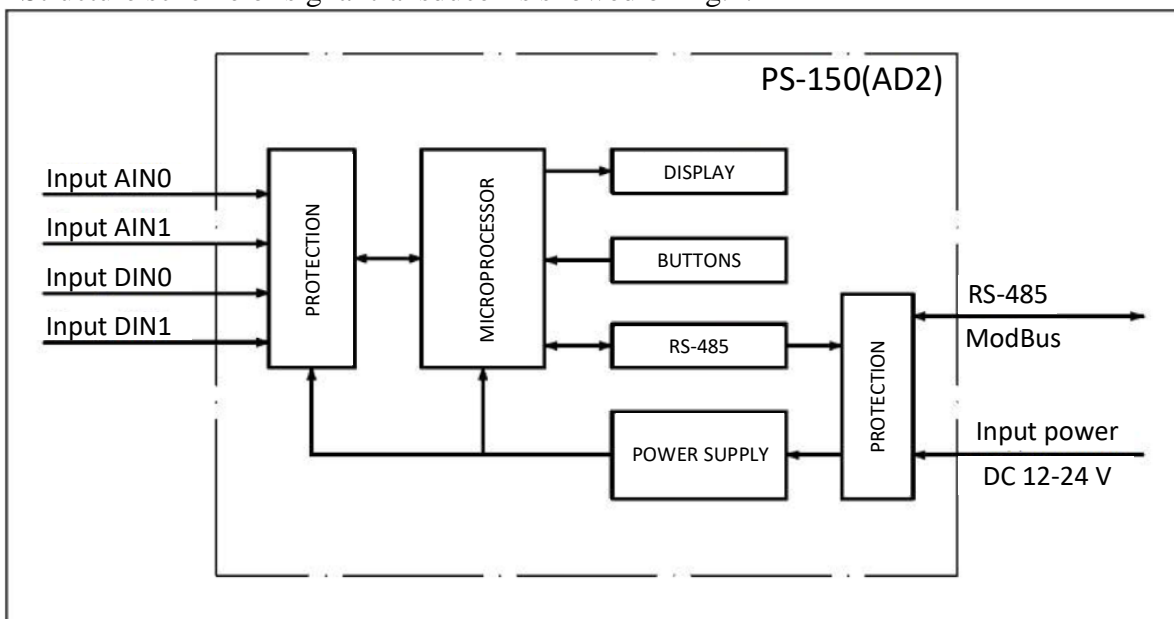


Fig.4 Structure scheme

#### 4. Work with signal transducer

4.1. The basic parameters of the signal transducer, which required for operation, are configured using the built-in buttons and the display. Calibration of analogue measuring channels is carried out only with the help of specialized software, which is not included in the scope of delivery.

4.2. The screen in the measurement mode, as well as the menu structure are shown in Fig.5. To enter the menu mode, press and hold the button for more than 3 seconds.

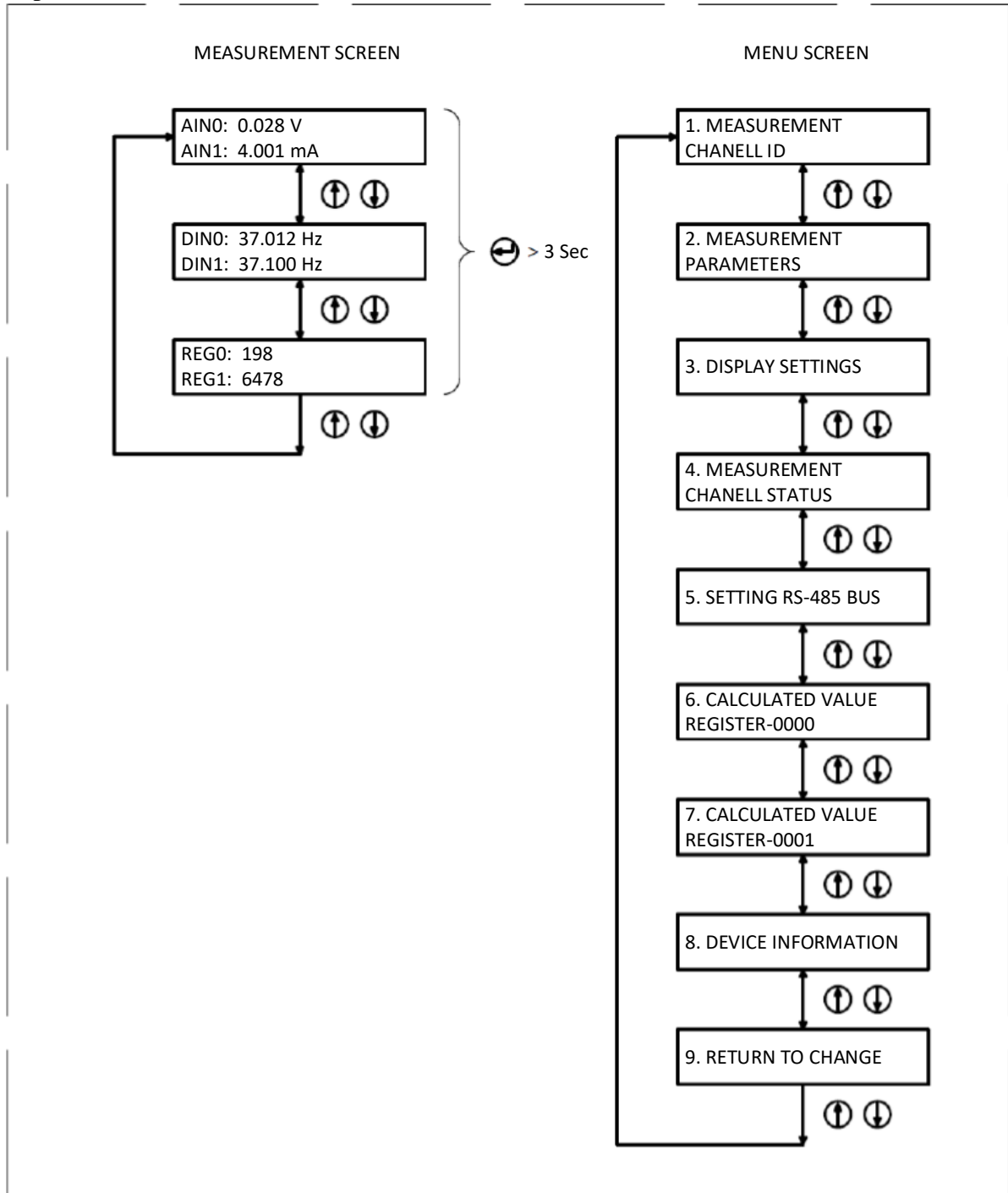


Fig.5 Menu structure and screen of measurings



4.3. To identify the measuring channels, it is necessary to select the required one from the list in the menu “Identifiers of measuring channels” for each channel. If the measuring channel is not used, then it is necessary to set for it “NULL”.

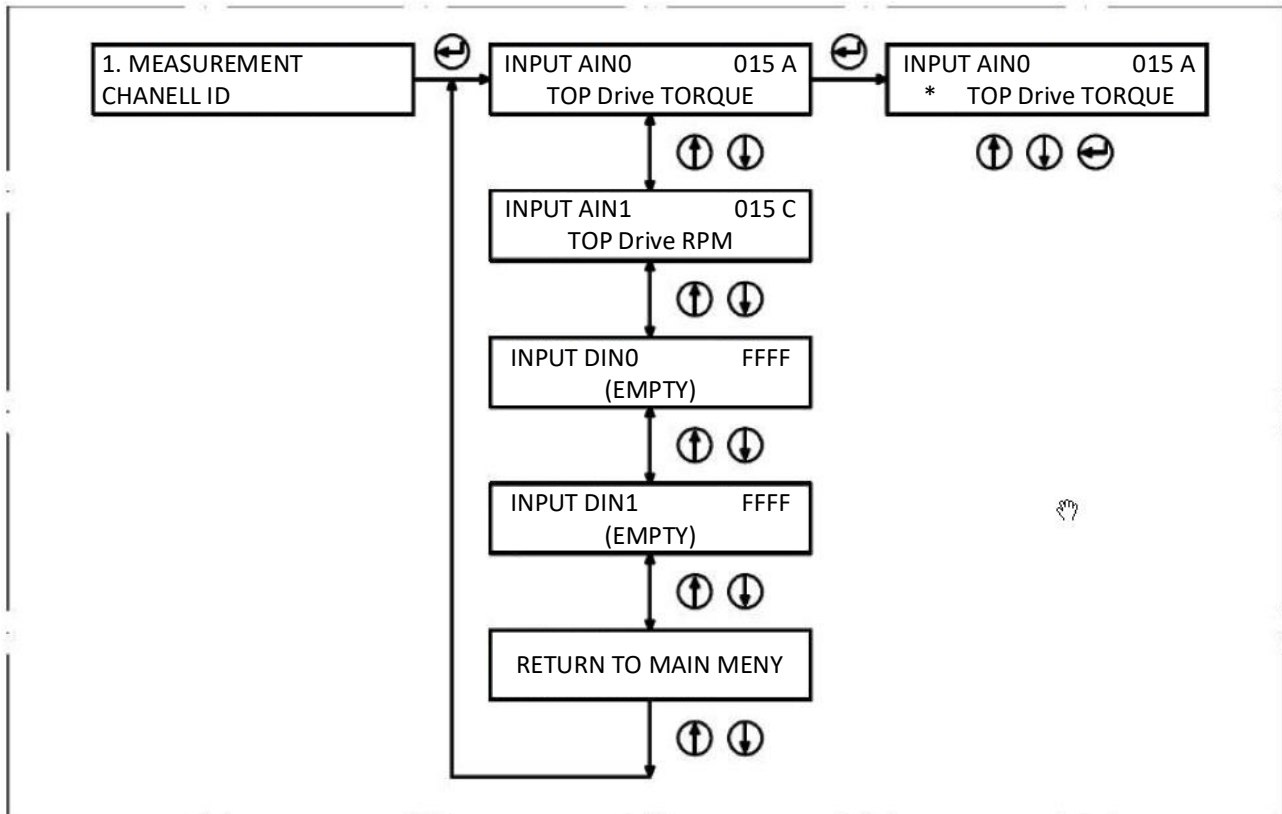


Fig.6 Setting of channel identifiers

4.4. At “Measurement Parameters” screen, you can set the cut-off frequency for the low-pass filter of the first order. If discrete channels are used to measure frequency / period, then for signals that have a long period of succession, you can set the time after which the display expires on the screen will be reset.

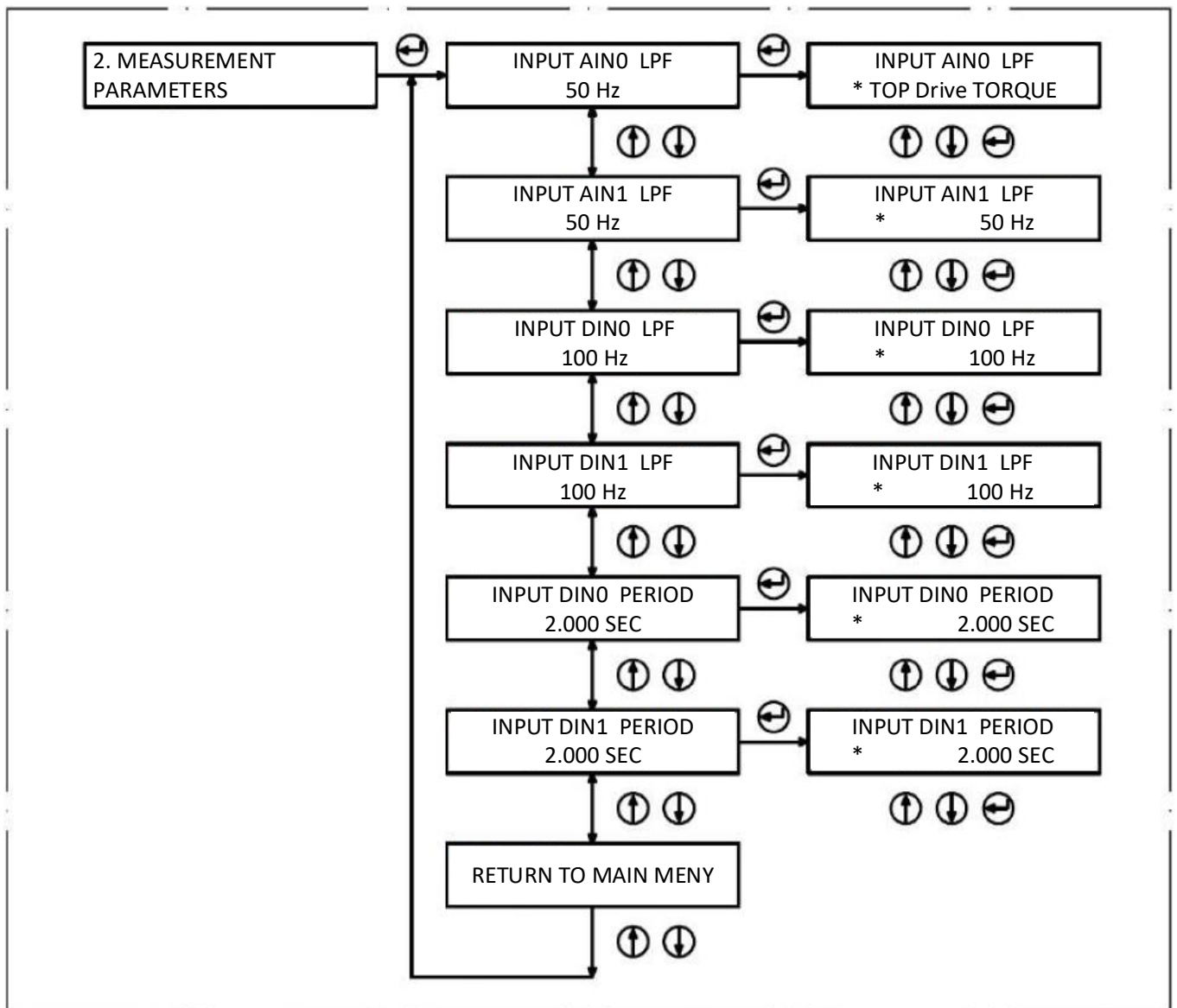


Figure.7 Setting of measuring parameters

4.5. Parameters reflection in menu «Reflection setting» defines what signal type is used at input of measuring channelso. One have to define signals for analogue and discrete inputs. Value variants are shown in fig 8.

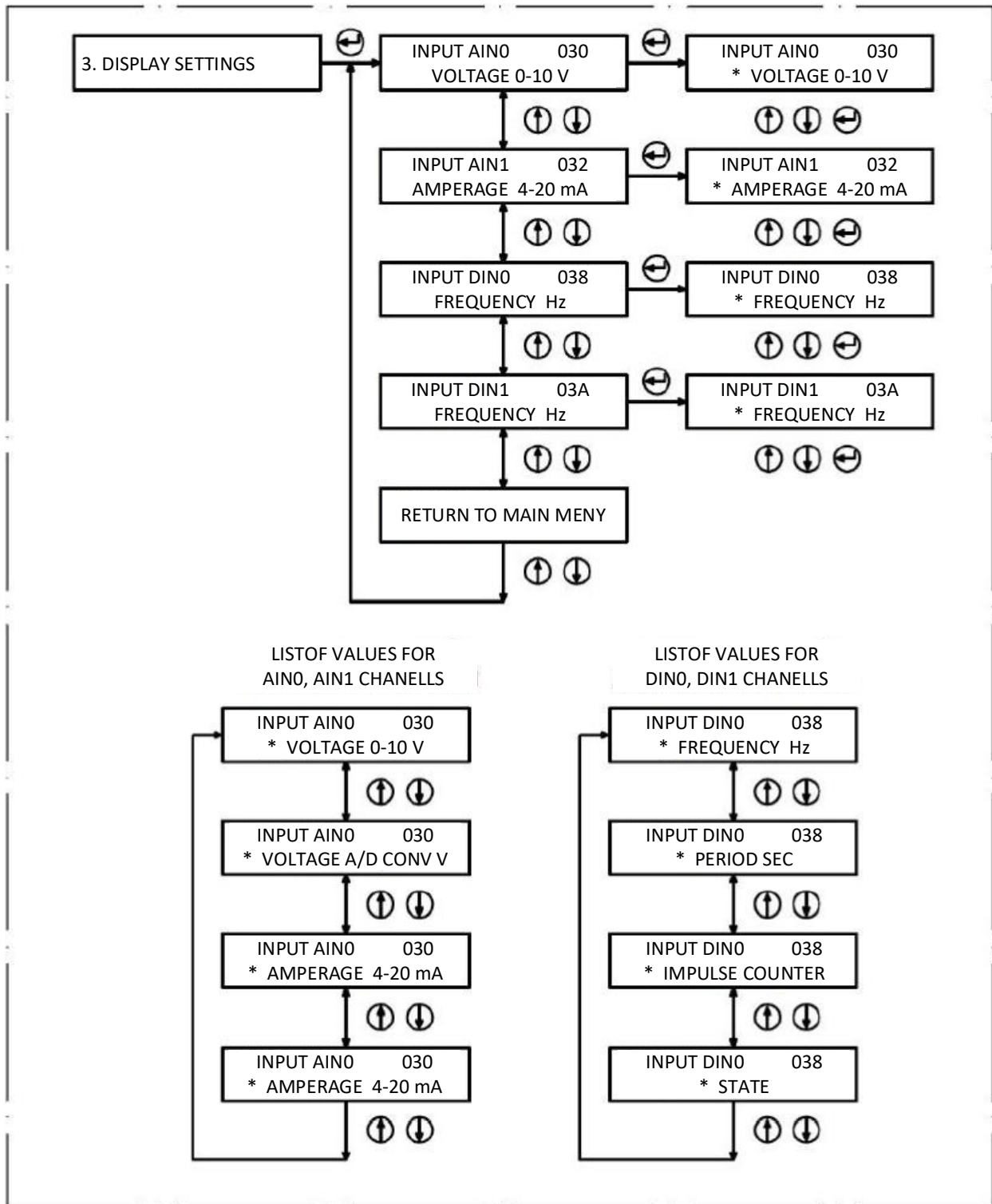


Fig.8 Reflection setting

4.6 Internal software of signal transducer controls operability of measuring channels via feed circuit. If at some channel current consumption is exceeded so it can be seen on the screen fig 9

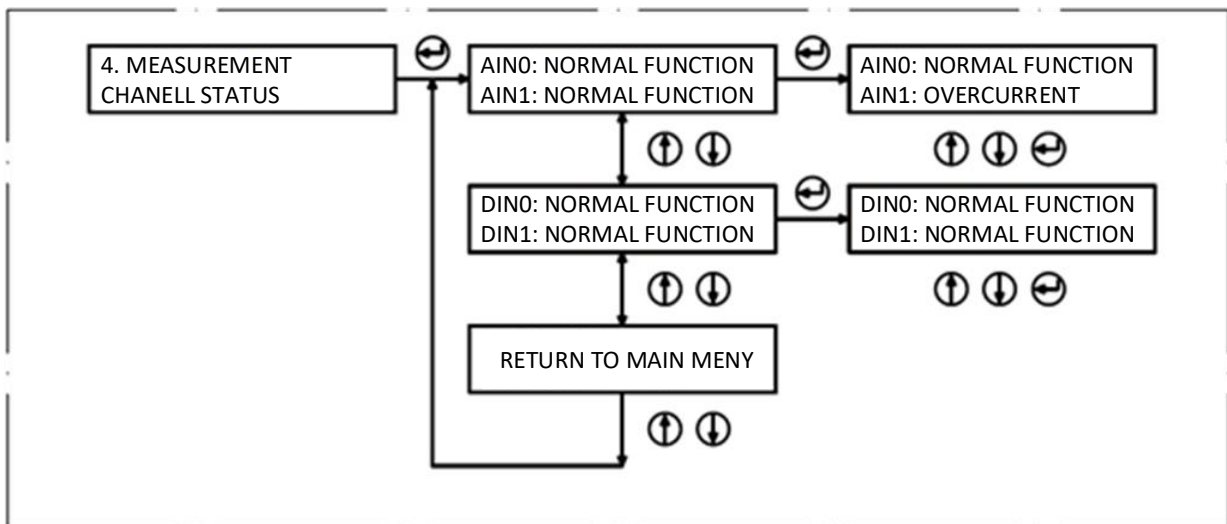


Fig.9. Measuring channels state

4.7 At menu page «Setting RS485 BUS» transducer address is filled in Modbus channel.

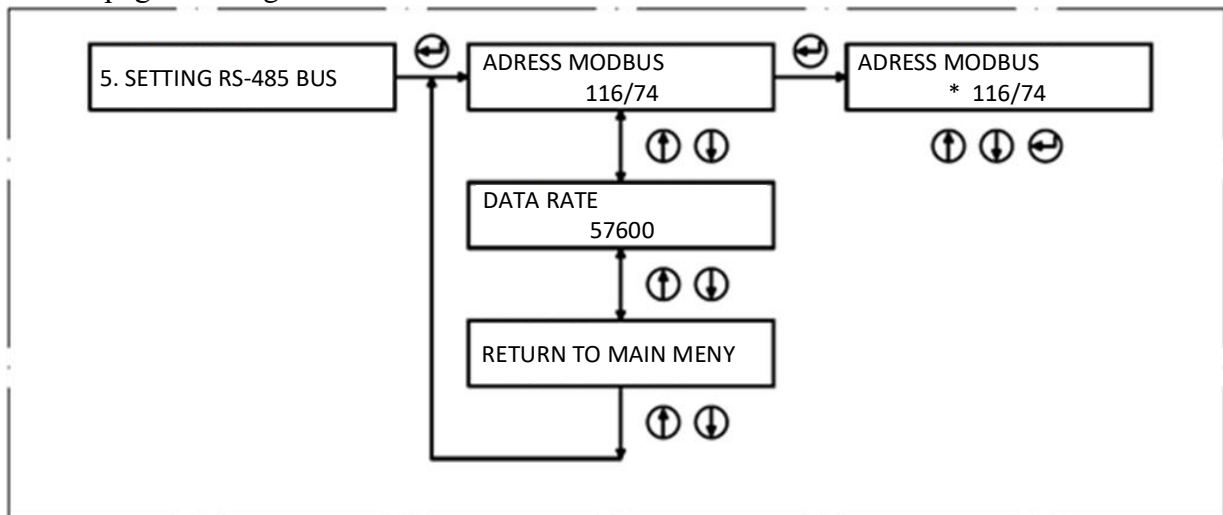


Fig.10 Measuring channels state.

4.8 The menu item “Calculated values register 0000” and “Calculated values register 0001” are used to set parameters for calculating physical quantities. The result of the calculation is stored in Modbus registers 0000 and 0001. To configure, you must perform the following steps.

4.8.1. Assign the signal source for the calculation: AIN0, AIN1, DIN0 DIN1.

4.8.2. Set two points to calculate the output physical quantity, which is calculated by the following formula:

$$REG0000 = (Tu - T1u) \frac{T2\phi - T1\phi}{T2u - T1u} + T1\phi,$$

where  $REG0000$  – calculated value of physical unit (int16),

$Tu$  – current measured value,

$T1u, T2u$  – installed measuring points,

$T1\phi, T2\phi$  – installed points of physical values .

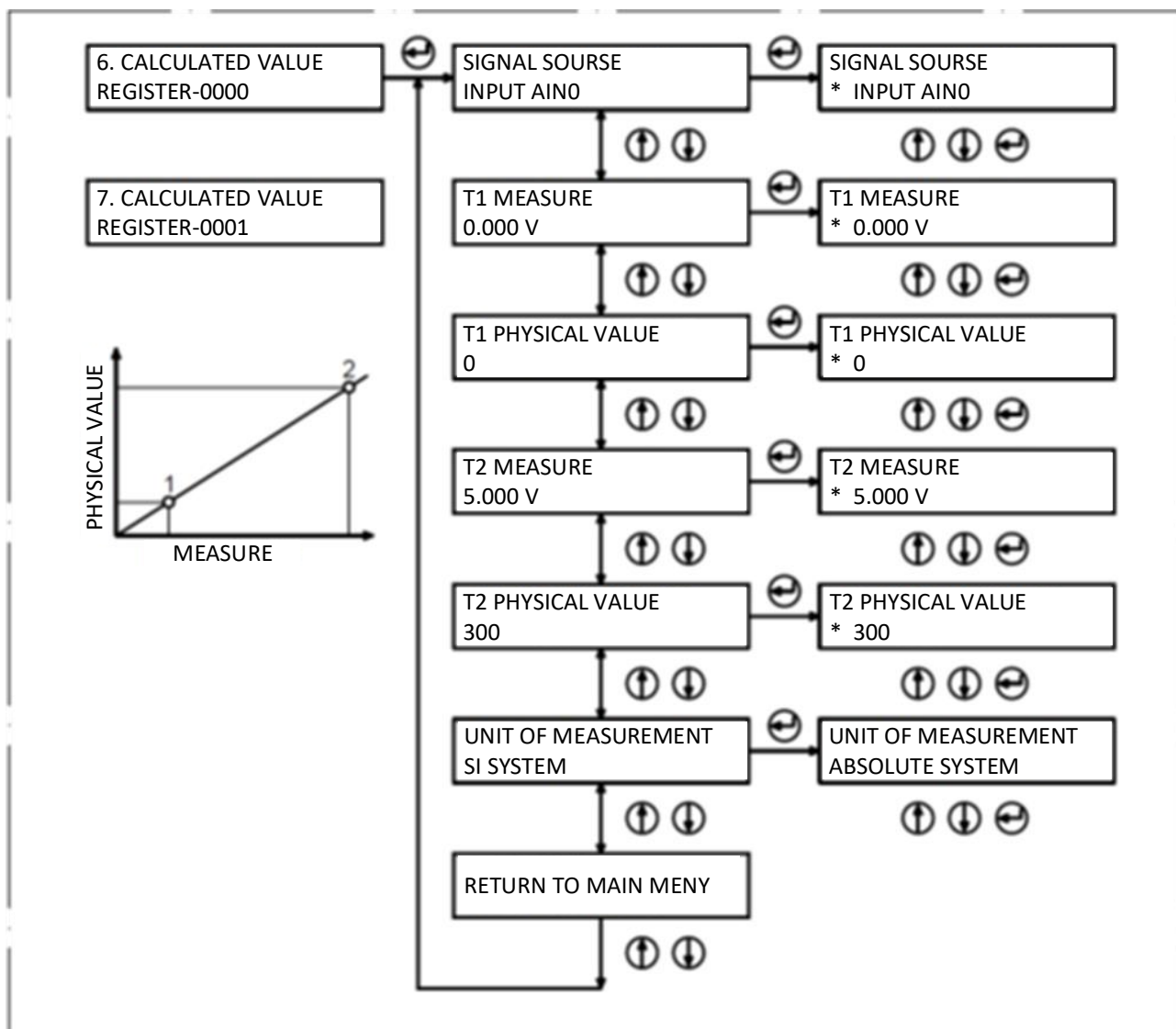


Fig.11 Register calculated values

4.9. It is possible to see serial number of signal transducer and version of internal software on menu screen «Information about the sensor».

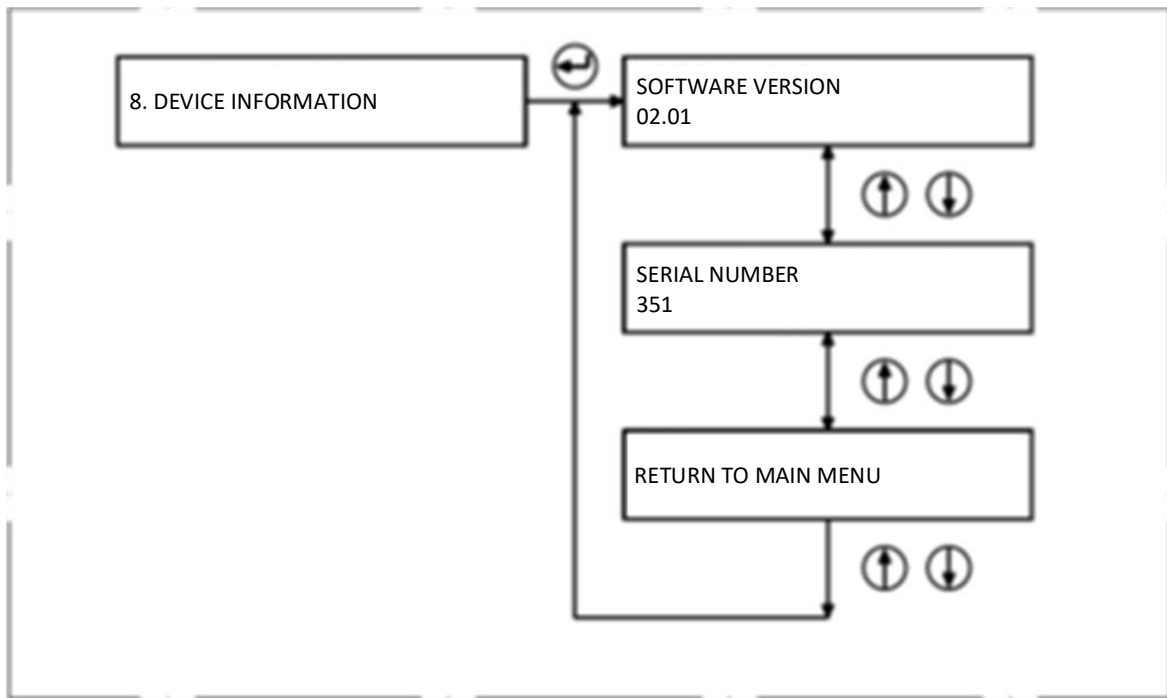


Fig.12 Information about the sensor

## 5 Safety precautions at operating

5.1. Personnel who has studied this operation manual following Electrical Installation Code and passed safety trainings have permission for mounting and operating PS-150 signal transducer.

5.2. К эксплуатации допускаются технически исправные преобразователи сигналов.

## 6. Marking and sealing

6.1. PS-150 signal transducer has marking:

- Manufacturer trademark
- Type of ingress protection;
- Serial number;
- voltage range;
- year of manufacturing

Repair is made manufacturer or specialized enterprise which is delegated repairing

## 7. Preparation of signal transducer to work

7.1. Before installation and operation of PS-150 signal transducers, it is necessary to carry out the following preparatory operations:

- unpack the signal transducer;
- check the absence of visible damage of the enclosures and connectors;
- get acquainted with the accompanying documentation;
- check the availability and compliance with the marking;

During operation, periodically check the condition of the signal converter housing, communication cables and connectors.

7.2. Prepare a mounting place for the signal transducer

7.3. Fix signal transducer and provide connection with reference to scheme in Appendix B

## 8. Maintenance

8.1. To ensure safety, maintain the signal transducer with the power off.

- 8.2. To carry out maintenance of the signal transducer upon request, but at least once every three months:
- 8.2.1. Perform an external examination. Check the availability and durability of the mounting hardware.
  - 8.2.2. Clean the surface of the signal converter from dirt and sediment, rinse with benzine.
  - 8.2.3. Wash the connectors with alcohol-gasoline mixture (0.5 ml) with a soft brush.
  - 8.2.4. Inspect the communication cables; if visible, replace the cable with a working one.

### **9. Current maintenance and providing safety while repair**

All types of repair are carried out only by specialists of the manufacturer or specialized repair center according to the technical documentation of the manufacturer, after their dismounting from the technological equipment in compliance with the requirements of this manual and safety for the enterprise.

### **10. Storage**

Signal transducer in a package must be stored at temperature range from -45 to +65 ° C and relative humidity up to 80%.

### **11. Transportation**

Transportation of a signal transducer in a packed form is allowed by all types of closed transport. A signal transducer in a package for transportation allows the impact of a transport shake with an acceleration of 30 m / s<sup>2</sup> with a frequency of 100 beats per minute or 15000 beats with the same acceleration.

### **12. Disposal**

Disposal of the signal transducer is carried out in accordance with the requirements and standards adopted for enterprises operating these devices.