DESIGN BUREAU "FIZELEKTRONPRIBOR"

Russian Classification of Production 42 1550

Moisture Analyzers (Moisture Meters) FIZEPR-SW100

Technical specification and operation manual

VIGT.415210.100 RE

Part 1

(rev. 3.03)

Samara, 2018

TABLE OF CONTENTS

1. Introduction

1.1. This technical specification and operation manual are designed for familiarization with the device, principle of operation, installation, preparation, inspection and maintenance rules of moisture analyzers (moisture meters) FIZEPR-SW100 VIGT.415210.100.

1.2. Moisture analyzers FIZEPR-SW100 are entered into the State Register of Measuring Equipment of the Russian Federation, Registration No. 58390-14, Pattern Approval Certificate of Measuring Instruments RU.C.31.001.A No. 56698, 04.09.2014, Method of Verification MP 242-1715-2014.

1.3. Moisture analyzers FIZEPR-SW100 are entered into the Register of the State System for Ensuring the Uniformity of Measurements of the Republic of Kazakhstan under No. KZ.02.03.06827-2015/58390-14 dated 27.10.2015, Certificate No. 12284.

1.4. Moisture analyzers FIZEPR-SW100 are certified for use in hazardous areas, Certificate of Conformity No. TC RU C-RU.AA87.B.00300, Series RU No. 0406218, dated 02.08.2016, issued by LLC "NANIO TSSVE".

In explosion-proof moisture analyzers, the electronic unit is labeled as **1Exd[ia]IIBT5**, the sensor – **0ExiaIIBT5** and can be installed in an explosion hazard zone of Category **0** where the explosive gas mixture is present continuously or for a long period.

1.5. Moisture analyzers FIZEPR-SW100 correspond to Class III of electrical shock protection in accordance with GOST 12.2.007.0-75. Moisture analyzers are designed to operate at a safe ultra-low voltage (24V) and have neither external nor internal electrical circuits operating at a higher voltage.

1.6. The manufacturer retains the right to make changes in the design and scheme of the moisture analyzer that do not affect its specifications, without adjusting operating and maintenance documentation.

2. Purpose and general description of moisture meters

2.1. Moisture analyzers (moisture meters) FIZEPR-SW100 (hereinafter – "moisture meters") are designed to measure moisture content – water grain size (in percentage terms) in non-aqueous liquids, aqueous suspensions, solid, granular or paste-like materials.

Note: the operating manual "Moisture analyzers (moisture meters) FIZEPR-SW100 for measuring petroleum and petroleum products. Technical specification and operation manual VIGT.415210.100 RE. Part 1" applies to moisture meters FIZEPR-SW100 designed to measure water content in petroleum and petroleum products. These moisture meters meet requirements of GOST 8.614-2013 GSI. "State system for ensuring the uniformity of measurements. State verification schedule for instruments measuring the volumetric water cut of oil and oil products" and their verification is carried out according to the document "GSI Instructions. Moisture analyzers (moisture meters) FIZEPR-SW100. Method of Verification MP 0919-6-2018" approved by FSUE "All-Russian Research Institute for Flow Metering" on 15.11.2018.

2.2. Due to the principle of operation the moisture meter FIZEPR-SW100 is a radiowave device – dielectric moisture meter. The method of dielectric capacity (ε_r) measurement is direct, based on measuring deceleration factor (k_{dec}) of an electromagnetic wave in the controlled material. Deceleration factor, also called refractive index, is the ratio of electromagnetic wave propagation speed in air (i.e. light speed) to its propagation speed in the controlled material.

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Measurements are made by probing the medium with radio waves at frequencies of the 2 ... 750 MHz range. To find k_{dec}, the moisture meter calculates the ratio of sensor resonant frequency in air to its resonant frequency in the controlled material. Based on the found deceleration factor value, the moisture meter processor calculates water content taking into account the material temperature. The calculation is made based on calibration tables prepared for each type of the controlled material and stored in the moisture meter memory.

The moisture measuring method used provides high accuracy and repeatability of measurement results. The moisture meter metrological characteristics do not depend on external conditions, and measurements are not affected by the temperature of semiconductor converters and the electronic unit itself.

It is important to note that to ensure high accuracy of moisture measurement, calibration of the moisture meter (preparation of calibration tables) must be performed on the material to be measured.

2.3. Moisture content – a parameter measured by the moisture meter – is a ratio between the weight of water contained in the material to the wet material weight and is defined by the following formula:

$$W = \frac{m_w - m_d}{m_w} \times 100\% \ ,$$

where W - material moisture content;

m_w - weight of the wet material sample

m_d - weight of the same material sample after drying.

At the customer's request, for liquid materials, the moisture meter can be fitted with a calibration corresponding to the volumetric water content of the material defined by the following formula:

$$W = \frac{V_{water}}{V_{sample}} \times 100\% ,$$

V_{water} - volume of water in the sample

V_{sample} - volume of the sample.

2.4. The moisture meter consists of an electronic unit and a sensor connected by a cable. Cable connection with the sensor is non-separable and filled with compound. Cable connection with the electronic unit is detachable.

Depending on application conditions and controlled material, the following versions of moisture meters are available:

- Probe version permanently installed in hoppers, tanks, augers, trays, on conveyor belts and in mixers (VIGT.415210.100-**10, -11, -12** and higher)
- In-line version with flange mounting installed in pipelines (VIGT.415210.100-**20, -21** and higher)
- Laboratory version (VIGT.415210.100-**30, -31** and higher).

All these moisture meter versions are distinguished by sensor design. All alternate sensor designs include a probe made of stainless steel (AISI 321, AISI 420, AISI 316Ti, etc.) that is

introduced into the controlled material. Electronic units in all moisture meter versions are interchangeable. Electronic units of moisture meters used under the conditions of explosion-hazardous production facilities are made in an explosion-proof enclosure and is labeled 1Exd [ia] IIBT5. The sensor is labeled 0ExiaIIBT5.

Sensors in all moisture meter versions include a thermal detector (thermocouple or thermal resistor) to ensure measurement of controlled material temperature.

2.5. Refer to Tables 1-4 for the list of moisture meter designs and versions.

Table 1

Probe moisture analyzers FIZEPR-SW100.1x.x

Moisture meter reference code*	Purpose, controlled materials	Moisture meter version
"FIZEPR-SW100" VIGT.415210.100 **-10.21**	Bulk materials in hoppers, augers, trays, pipes, on conveyor belts and in drying units (grain, sand, etc.). For materials with grain size up to 30 mm	Sensor VIGT.415210.100-10.21 with a flat-topped probe complete with a panel with coupling holders. The additional shield conductor is installed on the panel. Probe-to-panel clearance is at least 45 mm.
"FIZEPR-SW100" VIGT.415210.100 **-10.4**	Bulk materials (sand, gravel, ore, grain, wood chips, etc.) in hoppers and dispensers including materials that adhere to the walls and the probe. For materials with grain size up to 150 mm	Sensor VIGT.415210.100-10.4 contains a probe made as a straight rod with cross section 27 mm and length up to 1.0 m made of stainless steel AISI 321 with a set of coupling holders.
"FIZEPR-SW100" VIGT.415210.100 **-10.41**	Bulk materials (incl. sawdust, wood chips, wood wool, grain, etc.) in hoppers, pipes or collecting containers above the conveyor belt	Sensor VIGT.415210.100-10.41 made as a straight rod with a diameter of 14 mm and length of 0.6 m made of stainless steel AISI 321) with a set of coupling holders.
"FIZEPR-SW100" VIGT.415210.100 **-10.42**	Ore and other bulk materials in hoppers, dispensers or collecting containers above the conveyor belt including materials that adhere to the walls and the probe. For materials with grain size up to 150 mm	Sensor VIGT.415210.100-10.42 contains a probe made as a straight rod with a cross section of 27 mm up to 1.0 m long. It is made of corrosion-resistant steel AISI 321, AISI 420, etc. Sensor feature: the probe is removable to allow its replacement in operation.
"FIZEPR-SW100" VIGT.415210.100 **-10.43**	Bulk materials (wood chip waste, sawdust, alburnum, etc.) in augers or pipes	Sensor VIGT.415210.100-10.43 contains a probe made as a 14 mm diameter radiussed rod made of stainless steel AISI 321 with a set of holders.

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"FIZEPR-SW100" VIGT.415210.100 **-10.44**	Bulk materials (sand, gravel, ore, grain, etc.) in hoppers and dispensers including materials that adhere to the walls and the probe.	Sensor VIGT.415210.100-10.44 contains a probe made as a straight rod with cross section 27 mm and length up to 1.0 m made of stainless steel AISI 321 with a set of coupling holders.
"FIZEPR-SW100" VIGT.415210.100 **-10.46**	Bulk materials (coal including anthracite, iron ore, and other bulk materials) featuring by high electrical conductivity. For materials with grain size up to 100 mm	Sensor VIGT.415210.100-10.46 contains a probe made as a straight pipe segment 32 x 5.5 mm, length up to 1.0 m made of stainless steel AISI 321 with a set of holders.
"FIZEPR-SW100" VIGT.415210.100 **-10.5**	Bulk materials (sand, fine gravel, grain, etc.) in a stream on a conveyor belt. For materials with grain size up to 30 mm	Sensor VIGT.415210.100-10.5 contains a flat probe with a thickness of 14 mm. It is installed along the material flow above the conveyor belt.
"FIZEPR-SW100" VIGT.415210.100 **-10.6**	Bulk materials in hoppers, augers, trays, pipes or on conveyor belts. For materials with grain size up to 30 ... 40 mm	Sensor VIGT.415210.100-10.6 with a flat-topped probe complete with a panel with coupling holders. Probe-to-panel clearance is at least 45 mm.
"FIZEPR-SW100" VIGT.415210.100 **-10.61**	Bulk materials (sand, gravel, grain, etc.) in hoppers or in a flow on a conveyor belt. For materials with grain size up to 30 ... 40 mm. Operating temperature up to + 200 °C.	Sensor VIGT.415210.100-10.61 made as a panel with couplings and a flat-topped probe. Probe-to-panel clearance is at least 45 mm.
"FIZEPR-SW100" VIGT.415210.100 **-10.16**	Bulk materials featuring by high electrical conductivity (anthracite, iron ore, etc.) in hoppers, trays or in a flow on a conveyor belt. For materials with grain size up to 30 ... 40 mm	Sensor VIGT.415210.100-10.16 made as a panel with a flat-topped probe. Probe diameter is 14 mm. Probe-to-panel clearance is at least 45 mm.
"FIZEPR-SW100" VIGT.415210.100 **-10.161**	Bulk materials featuring by high electrical conductivity (anthracite, iron ore, etc.) in hoppers, trays or in a flow on a conveyor belt. For materials with grain size up to 50 ... 60 mm	Sensor VIGT.415210.100-10.16 made as a panel with a flat-topped probe. Probe diameter is 14 mm. Probe-to-panel clearance is at least 65 mm.

"FIZEPR-SW100" VIGT.415210.100 **-10.162**	Bulk materials featuring by high electrical conductivity (anthracite, iron ore, etc.) in hoppers, trays or in a flow on a conveyor belt. For materials with grain size up to 30 ... 40 mm	Sensor VIGT.415210.100-10.16 made as a panel with a flat-topped probe. Probe diameter is 20 mm. Probe-to-panel clearance is at least 45 mm.
"FIZEPR-SW100" VIGT.415210.100 **-10.163**	Bulk materials featuring by high electrical conductivity (coal, ore, etc.) in hoppers, trays or in a flow on a conveyor belt. For materials with maximum grain sizes up to 50 mm	Sensor VIGT.415210.100-10.16 made as a panel with a flat-topped probe. Probe diameter is 20 mm. Probe-to-panel clearance is 60 mm.
"FIZEPR-SW100" VIGT.415210.100 **-11.3**	Bulk and paste-like materials in hoppers or mixers	Sensor VIGT.415210.100-11.3 with a two-pinned probe. Enclosure is equipped with a G1 thread fitting for mounting to a 1" pipe. Operating temperature up to + 85 °C.
"FIZEPR-SW100" VIGT.415210.100 **-11.32**	Bulk and paste-like materials in hoppers, mixers or clamps	Sensor VIGT.415210.100-11.3 with a two-pinned probe. Enclosure is equipped with a G1 thread fitting for mounting to a 1" pipe. Operating temperature up to + 85 °C.
"FIZEPR-SW100" VIGT.415210.100 **-11.33**	Bulk and paste-like materials on a conveyor belt, liquid materials in a tray (i.e., a silicate mixture on a conveyor belt or cement production sludge in a tray)	Sensor VIGT.415210.100-11.3 with a two-pinned probe. Enclosure is equipped with a G1 (G1,25) thread fitting for mounting to a 1" (1,25") pipe. Operating temperature up to + 85 °C.
"FIZEPR-SW100" VIGT.415210.100 **-11.4**	To control soil moisture and measure the moisture content of bulk materials	Sensor VIGT.415210.100-11.4 with a two-pinned probe. Probe is equipped with a tip to immerse the sensor into the controlled material including into the soil. Enclosure is equipped with a G1 thread fitting for mounting to a 1" pipe. Operating temperature up to + 85 °C.
"FIZEPR-SW100" VIGT.415210.100 **-11.41**	Grain and other bulk materials	Sensor VIGT.415210.100-11.41 with a two-pinned probe. Enclosure is equipped with a G1 thread fitting for mounting to a 1" pipe. Enclosure diameter is 48 mm. Operating temperature up to + 85 °C.

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"FIZEPR-SW100" VIGT.415210.100 **-11.411**	Liquid or paste-like materials at high temperatures, for example, in boiling vessels	Sensor VIGT.415210.100-11.411 with a two-pinned probe. Enclosure is equipped with a G1 thread fitting for mounting to a 1" pipe. Enclosure diameter is 48 mm. Operating temperature up to + 180 °C.
"FIZEPR-SW100" VIGT.415210.100 **-11.42**	To control soil moisture and measure the moisture content of bulk materials	Sensor VIGT.415210.100-11.42 with a two-pinned probe. Probe is equipped with a tip to immerse the sensor into the controlled material including into the soil. Enclosure is equipped with a G1 thread fitting for mounting to a 1" pipe. G2 thread is made on the sensor enclosure.
"FIZEPR-SW100" VIGT.415210.100 **-12**	Liquid materials in tanks, incl. cement production sludge and diesel oil emulsion	Submersible sensor VIGT.415210.100-12 with a center pin and 4 perimeter-wise pins installed inside a tank and fixed to a 1" pipe (or 2").
"FIZEPR-SW100" VIGT.415210.100 **-14**	Syrup, meat and bone meal in boiling vessels, cement production sludge, water and sand pulp of dredge and other liquid and paste-like materials in pipelines and tanks Operating pressure up to 6.0 at	Probe sensor VIGT.415210.100-14, the probe made as a rod with a diameter of 24 mm. Probe length 400 ... 1000 mm (on request). Sensor is mounted to the boiler (tank, pipeline) using a G1 pipe coupling. Operating temperature up to + 180 °C.
"FIZEPR-SW100" VIGT.415210.100 **-17**	Bulk or paste-like materials in mixers, on conveyor belts or in augers, for example: concrete mixture, coal (not anthracite)	Sensor VIGT.415210.100-17 (70) is made in a cylindrical enclosure with a diameter of 108 mm (supplied with a mounting kit).
"FIZEPR-SW100" VIGT.415210.100 **-17.1**	Bulk or paste-like materials in mixers, on conveyor belts or in augers, for example: concrete mixture, coal	The VIGT.415210.100-17.1 (71) sensor is made in a cylindrical enclosure with a diameter of 80 mm (supplied with a mounting kit).
"FIZEPR-SW100" VIGT.415210.100 **-17.2**	Measurement of bulk or paste-like materials in sampling systems made as a pipe	Sensor VIGT.415210.100-17.2 (72) is made in a cylindrical enclosure with a diameter of 80 mm (supplied with a mounting kit). Sensor front surface is made as part of the round cylinder surface to allow its installation inside the sampling system pipe.

"FIZEPR-SW100" VIGT.415210.100 **-17.3**	Measurement of bulk or paste-like materials in cylindrical sampling systems	Sensor VIGT.415210.100-17.3 (73) is made as a piston with a diameter of 50 mm. Allowable force on the piston is 5000 N.
"FIZEPR-SW100" VIGT.415210.100 **-17.7**	Bulk materials on conveyor belts or in augers. Sensor feature is high impact resistance.	Sensor VIGT.415210.100-17.7 (77) is made in a cylindrical enclosure with a diameter of 108 mm (supplied with a mounting kit).
"FIZEPR-SW100" VIGT.415210.100 **-17.8**	Bulk or paste-like materials in mixers, on conveyor belts or in augers. Sensor head is removable.	Sensor VIGT.415210.100-17.8 (78) is made in a cylindrical enclosure with a diameter of 108 mm (supplied with a mounting kit).

Table 2

In-line moisture analyzers for liquid materials FIZEPR-SW100.2x.x

Moisture meter reference code	Purpose, pipeline parameters	Moisture meter version
Direct-flow moisture analyzer FIZEPR-SW100.20.x/ 20.x.K		
"FIZEPR-SW100" VIGT.415210.100 **-20.3**	Liquid materials in DN50 pipelines, pressure up to 6 at	Direct-flow sensor VIGT.415210.100-20.5 made as a pipe section with flanges ver. 1-50-25 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.4**	Liquid materials in DN50 pipelines, pressure up to 10 at	Direct-flow sensor VIGT.415210.100-20.4 made as a pipe section with flanges ver. 1-50-10 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.5**	Liquid materials in DN50 pipelines, pressure up to 25 at	Direct-flow sensor VIGT.415210.100-20.5 made as a pipe section with flanges ver. 1-50-25 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.51**	Liquid materials in DN50 pipelines, pressure up to 25 at, temperature up to +180ºC	Direct-flow sensor VIGT.415210.100-20.51 made as a pipe section with flanges ver. 1-50-25 GOST 12820-80. Range of operating temperatures: -20 … +180°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.6**	Liquid materials in DN80 pipelines, pressure up to 16 at	Direct-flow sensor VIGT.415210.100-20.6 made as a pipe section with flanges ver. 1-80-16 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.61**	Liquid materials in DN80 pipelines, pressure up to 16 at, temperature up to +180ºC	Direct-flow sensor VIGT.415210.100-20.61 made as a pipe section with flanges ver. 1-80-16 GOST 12820-80. Range of operating temperatures: -20 … +180°C.

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"FIZEPR-SW100" VIGT.415210.100 **-20.7**	Liquid materials in DN80 pipelines, pressure up to 25 at	Direct-flow sensor VIGT.415210.100-20.7 made as a pipe section with flanges ver. 1-80-25 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.71**	Liquid materials in DN80 pipelines, pressure up to 25 at, temperature up to +180ºC	Direct-flow sensor VIGT.415210.100-20.71 made as a pipe section with flanges ver. 1-80-25 GOST 12820-80. Range of operating temperatures: -20 … +180°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.8**	Liquid materials in DN50 pipelines, pressure up to 40 at	Direct-flow sensor VIGT.415210.100-20.8 made as a pipe section with flanges ver. 2-50-40 and ver. 3-50-40 GOST 12821-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.81**	Liquid materials in DN50 pipelines, pressure up to 40 at, temperature up to +180ºC	Direct-flow sensor VIGT.415210.100-20.8 made as a pipe section with flanges ver. 2-50-40 and ver. 3-50-40 GOST 12821-80. Range of operating temperatures: -20 … +180°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.9** **-20.9.K**	Liquid materials in DN80 pipelines, pressure up to 40 at	Direct-flow sensor VIGT.415210.100-20.9 / -20.9.K made as a pipe section with flanges ver. 2-80-40 and ver. 3-80-40 GOST 12821-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.91** **-20.91.K**	Liquid materials in DN80 pipelines, pressure up to 40 at, temperature up to +180ºC	Direct-flow sensor VIGT.415210.100-20.91 / -20.91.K made as a pipe section with flanges ver. 2-80-40 and ver. 3-80-40 GOST 12821-80. Range of operating temperatures: -20 … +180°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.10**	Liquid materials in DN125 pipelines, pressure up to 6.0 at	Direct-flow sensor VIGT.415210.100-20.10 made as a pipe section with flanges ver. 1-125-6 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.11**	Liquid materials in DN50 pipelines, pressure up to 63 at	Direct-flow sensor VIGT.415210.100-20.11 made as a pipe section with flanges ver. 2-50-63 and ver. 3-50-63 (or ver. 7-50-63) GOST 12821-80. Range of operating temperatures: -20 … +120(145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.12** **-20.12.K**	Liquid materials in DN80 pipelines, pressure up to 63 at	Direct-flow sensor VIGT.415210.100-20.12 / -20.12.K made as a section with flanges ver. 2-80-63 and ver. 3-80-63 (or ver. 7-80-63) GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.14**	Liquid materials in DN100 pipelines, pressure up to 6.0 at	Direct-flow sensor VIGT.415210.100-20.14 made as a pipe section with flanges ver. 1-100-6 GOST 12820-80. Range of operating temperatures: -20 … +120°C.

"FIZEPR-SW100" VIGT.415210.100 **-20.15** **-20.15.K**	Liquid materials in DN80 pipelines, pressure up to 100 at	Direct-flow sensor VIGT.415210.100-20.15 / -20.15.K made as a pipe section with flanges ver. 2-80-100 and ver. 3-80-100 (or ver. 7-80-100) GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.16**	Liquid materials in DN100 pipelines, pressure up to 16 at	Direct-flow sensor VIGT.415210.100-20.16 made as a pipe section with flanges ver. 1-50-16 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.17**	Liquid materials in DN100 pipelines, pressure up to 25 at	Direct-flow sensor VIGT.415210.100-20.17 made as a pipe section with flanges ver. 1-100-25 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.18**	Liquid materials in DN50 pipelines, pressure up to 160 at	Direct-flow sensor VIGT.415210.100-20.18 made as a pipe section with flanges ver. 7-50-16 GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
«FIZEPR-SW100» VIGT.415210.100- **20.65**	Liquid materials in DN65 pipelines pressure up to 160 at	Direct-flow sensor VIGT.415210.100-20.65 made as a pipe section with flanges ver. 7-65-160 GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.19**	Liquid materials in DN150 pipelines, pressure up to 10 at	Direct-flow sensor VIGT.415210.100-20.19 made as a pipe section with flanges ver. 1-150-10 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.20** **-20.20.K**	Liquid materials in DN100 pipelines, pressure up to 40 at	Direct-flow sensor VIGT.415210.100-20.20 / -20.20.K made as a pipe section with flanges ver. 2-100-40 and ver. 3-100-40 GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.21** **-20.21.K**	Liquid materials in DN100 pipelines, pressure up to 63 at	Direct-flow sensor VIGT.415210.100-20.21 / -20.21.K made as a pipe section with flanges ver. 2-100-63 and ver. 3-100-63 (or ver. 7-100-63) GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-20.22** **-20.22.K**	Liquid materials in DN100 pipelines, pressure up to 100 at	Direct-flow sensor VIGT.415210.100-20.22 / -20.22.K made as a pipe section with flanges ver. 2-100-100 and ver. 3-100-100 (or ver. 7-100-100) GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
Full-flow moisture analyzer FIZEPR-SW100.21.x/ 21.x.K		

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"FIZEPR-SW100" VIGT.415210.100 **-21.01** **-21.01.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 6.0 at	Full-flow sensor VIGT.415210.100-21.01 / -21.01.K with a diameter of 89 mm, contains one flange ver. 1-100-6 GOST 12820-80. Flanged branch welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120°C.
"FIZEPR-SW100" VIGT.415210.100 **-21.011** **-21.011.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 6.0 at	Full-flow sensor VIGT.415210.100-21.011 / -21.011.K with a diameter of 89 mm, contains one flange ver. 1-65-6 GOST12820-80. Flanged branch welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120°C.
"FIZEPR-SW100" VIGT.415210.100 **-21.02** **-21.02.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 16.0 at	Full-flow sensor VIGT.415210.100-21.02 / -21.02.K with a diameter of 89 mm, contains one flange ver. 1-100-16 GOST12820-80. Flanged branch welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120°C.
"FIZEPR-SW100" VIGT.415210.100 **-21.021** **-21.021.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 16.0 at	Full-flow Sensor VIGT.415210.100-21.021 / -21.021.K with a diameter of 89 mm, contains one flange ver. 1-65-16 GOST12820-80. Flanged branch welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120°C.
"FIZEPR-SW100" VIGT.415210.100 **-21.03** **-21.03.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 40 at	Full-flow sensor VIGT.415210.100-21.03 / -21.03.K with a diameter of 89 mm, contains one flange ver. 2-100-40 GOST12821-80. Flanged branch ver. 3-100-40 GOST 12821 welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120°C.
"FIZEPR-SW100" VIGT.415210.100 **-21.031** **-21.031.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 25 at	Full-flow sensor VIGT.415210.100-21.031 / -21.031.K with a diameter of 57 mm, contains flange ver. 1-65-6 GOST12820-80. Flanged branch ver. 1-65-25 welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120°C.

"FIZEPR-SW100" VIGT.415210.100 **-21.032** **-21.032.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 40 at	Full-flow Sensor VIGT.415210.100-21.032 / -21.032.K with a diameter of 57 mm, contains one flange ver. 2-65-40 GOST12821-80. Flanged branch ver. 3-65-40 GOST 12821 welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120°C.
"FIZEPR-SW100" VIGT.415210.100 **-21.04** **-21.04.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 63 at	Full-flow sensor VIGT.415210.100-21.04 / -21.04.K with a diameter of 89 mm, contains one flange ver. 2-100-63 (or ver. 7-100-63) GOST12821-80. Flanged branch ver. 3-65-63 (or ver. 7-100-63) welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-21.041** **-21.041.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 63 at	Full-flow sensor VIGT.415210.100-21.041 / -21.041.K with a diameter of 57 mm, contains one flange ver. 2-65-63 (or ver. 7-65-63) GOST12821-80. Flanged branch ver. 3-65-63 (or ver. 7-65-63) welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-21.042** **-21.042.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 63 at	Full-flow sensor VIGT.415210.100-21.042 / -21.042.K with a diameter of 73 mm, contains one flange ver. 2-80-63 (or ver. 7-80-63) GOST12821-80. Flanged branch ver. 3-80-63 (or ver. 7-80-63) welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-21.05** **-21.05.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 100 at	Full-flow sensor VIGT.415210.100-21.05 / -21.05.K with a diameter of 89 mm, contains one flange ver. 2-100-100 (or ver. 7-100-100) GOST12821-80. Flanged branch ver. 3-65-100 (or ver. 7-100-100) welded on the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-21.051** **-21.051.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 160 at	Full-flow sensor VIGT.415210.100-21.051 / -26.051 with a diameter of 57 mm, contains flange ver. 2-65-160 (or ver. 7-65-160) GOST 12821-80. Flanged branch ver. 3-65-160 (or ver. 7-65-160) welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120 (145)°C.

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"FIZEPR-SW100" VIGT.415210.100 **-21.061** **-21.061.K**	Liquid materials in pipelines with a diameter of 200 mm and more when installing the sensor perpendicular to the flow. Pressure up to 200 at	Full-flow Sensor VIGT.415210.100-21.061 / -21.061.K with a diameter of 57 mm, contains flange ver. 7-65-200 GOST 12821-80 Flanged branch ver. 7-65-200 welded on the side of the pipeline is used for sensor mounting. Range of operating temperatures: -20…+120 (145)°C.
Bypass moisture analyzer FIZEPR-SW100.22.x		
"FIZEPR-SW100" VIGT.415210.100 **-22.5**	Liquid materials in DN50 pipelines, pressure up to 25 at	Sensor VIGT.415210.100-22.5 made as a U-type pipe section; flanges ver. 1-50-25 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-22.6**	Liquid materials in DN80 pipelines, pressure up to 16 at	Sensor VIGT.415210.100-22.6 made as a U-type pipe section; flanges ver. 1-80-16 GOST 12820-80. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-22.8**	Liquid materials in DN50 pipelines, pressure up to 40 at	Sensor VIGT.415210.100-22.8 made as a U-type pipe section; flanges ver. 2-50-40 GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-22.9**	Liquid materials in DN80 pipelines, pressure up to 40 at	Sensor VIGT.415210.100-22.9 made as a U-type pipe section; flanges ver. 2-80-40 GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-22.11**	Liquid materials in DN50 pipelines, pressure up to 63 at	Sensor VIGT.415210.100-22.11 made as a U-type pipe section; flanges ver. 2-50-63 (or ver. 7-50-63) GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-22.12**	Liquid materials in DN80 pipelines, pressure up to 63 at	Sensor VIGT.415210.100-22.12 made as a U-type pipe section; flanges ver. 2-80-63 (or ver. 7-80-63) GOST 12821-80. Range of operating temperatures: -20 … +120 (145)°C.
Angled moisture analyzer FIZEPR-SW100.24.x		
"FIZEPR-SW100" VIGT.415210.100 **-24.5**	Liquid materials in DN50 pipelines, pressure up to 25 at	Sensor VIGT.415210.100-22.11 made as an L-type pipe section, contains two flanges ver. 1-50-25 GOST 12820-80, one of which is located on the axis of the pipe, the second one is on the side of the pipe section. Range of operating temperatures: -20 … +120°C.
"FIZEPR-SW100" VIGT.415210.100 **-24.8**	Liquid materials in DN50 pipelines, pressure up to 40 at	Sensor VIGT.415210.100-24.8 made as an L-type pipe section, contains two flanges ver. 2-50-40 GOST 12821-80, one of which is located on the axis of the pipe, the second one is on the side of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.

"FIZEPR-SW100" VIGT.415210.100 **-24.9**	Liquid materials in DN80 pipelines, pressure up to 40 at	Sensor VIGT.415210.100-24.9 made as an L-type pipe section, contains two flanges ver. 2-80-25 GOST 12821-80, one of which is located on the axis of the pipe, the second one is on the side of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-24.11**	Liquid materials in DN50 pipelines, pressure up to 63 at	Sensor VIGT.415210.100-24.11 made as an L-type pipe section, contains two flanges ver. 2-50-63 (or ver. 7-50-63) GOST 12821-80, one of which is located on the axis of the pipe, the second one is on the side of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-24.12**	Liquid materials in DN80 pipelines, pressure up to 63 at	Sensor VIGT.415210.100-24.12 made as an L-type pipe section, contains two flanges ver. 2-80-63 (or ver. 7-80-63) GOST 12821-80, one of which is located on the axis of the pipe, the second one is on the side of the pipe section. Range of operating temperatures -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-24.18**	Liquid materials in DN50 pipelines, pressure up to 160 at	Sensor VIGT.415210.100-24.18 made as an L-type pipe section, contains two flanges ver. 7-50-160 GOST 12821-80, one of which is located on the axis of the pipe, the second one is on the side of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-24.20**	Liquid materials in DN100 pipelines, pressure up to 40 at	Sensor VIGT.415210.100-24.20 made as an L-type pipe section, contains two flanges ver. 2-100-40 GOST 12821-80, one of which is located on the axis of the pipe, the second one is on the side of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-24.21**	Liquid materials in DN100 pipelines, pressure up to 63 at	Sensor VIGT.415210.100-24.21 made as an L-type pipe section, contains two flanges ver. 2-100-63 (or ver. 7-100-63) GOST 12821-80, one of which is located on the axis of the pipe, the second one is on the side of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
Z-type moisture analyzer FIZEPR-SW100.25.x		
"FIZEPR-SW100" VIGT.415210.100 **-25.8**	Liquid materials in DN50 pipelines, pressure up to 40 at	Sensor VIGT.415210.100-25.8 made as a Z-type pipe section; flanges ver. 2-50-40 GOST 12821-80 are located on different sides of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-25.9**	Liquid materials in DN80 pipelines, pressure up to 40 at	Sensor VIGT.415210.100-25.9 made as a Z-type pipe section; flanges ver. 2-80-40 GOST 12821-80 are located on different sides of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.

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"FIZEPR-SW100" VIGT.415210.100 **-25.11**	Liquid materials in DN50 pipelines, pressure up to 63 at	Sensor VIGT.415210.100-25.11 made as a Z-type pipe section; flanges ver. 2-50-63 (or ver. 7-50-63) GOST 12821-80 are located on different sides of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-25.12**	Liquid materials in DN80 pipelines, pressure up to 63 at	Sensor VIGT.415210.100-25.12 made as a Z-type pipe section; flanges ver. 2-80-63 (or ver. 7-80-63) GOST 12821-80 are located on different sides of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-25.18**	Liquid materials in DN50 pipelines, pressure up to 160 at	Sensor VIGT.415210.100-25.18 made as a Z-type pipe section; flanges ver. 7-50-160 GOST 12821-80 are located on different sides (or at right angle) of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-25.20**	Liquid materials in DN100 pipelines, pressure up to 40 at	Sensor VIGT.415210.100-25.20 made as a Z-type pipe section; flanges ver. 2-100-40 GOST 12821-80 are located on different sides (or at right angle) of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
"FIZEPR-SW100" VIGT.415210.100 **-25.21**	Liquid materials in DN100 pipelines, pressure up to 63 at	Sensor VIGT.415210.100-25.21 made as a Z-type pipe section; flanges ver. 2-100-63 (or ver. 7-100-63) GOST 12821-80 are located on different sides (or at right angle) of the pipe section. Range of operating temperatures: -20 … +120 (145)°C.
Direct-flow moisture analyzer FIZEPR-SW100.27.x (for materials with high electrical conductivity)		
"FIZEPR-SW100" VIGT.415210.100 **-27.4**	Liquid materials with high electrical conductivity in DN50 pipelines, pressure up to 10 at.	Direct-flow sensor VIGT.415210.100-27.4 made as a DN50 PN10 pipe section; flanges ver. 1-50-10 GOST 12820-80. Range of operating temperatures: -20 … +90°C.
"FIZEPR-SW100" VIGT.415210.100 **-27.5**	Liquid materials with high electrical conductivity in DN50 pipelines, pressure up to 25 at.	Direct-flow sensor VIGT.415210.100-27.5 made as a DN50 PN25 pipe section; flanges ver. 1-50-25 GOST 12820-80. Range of operating temperatures: -20 … +90°C.
"FIZEPR-SW100" VIGT.415210.100 **-27.6**	Liquid materials with high electrical conductivity in DN80 pipelines, pressure up to 16 at.	Direct-flow sensor VIGT.415210.100-27.6 made as a DN80 PN16 pipe section; flanges ver. 1-80-16 GOST 12820-80. Range of operating temperatures: -20 … +145°C.

"FIZEPR-SW100" VIGT.415210.100 **-27.14**	Liquid materials featuring by high electrical conductivity in DN100 pipelines, pressure up to 6 at.	Direct-flow sensor VIGT.415210.100-27.17 made as a DN100 PN6 pipe section; flanges ver. 1-100-6 GOST 12820-80. Range of operating temperatures: -20 … +145°C.
"FIZEPR-SW100" VIGT.415210.100 **-27.17**	Liquid materials featuring by high electrical conductivity in DN100 pipelines, pressure up to 25 at.	Direct-flow sensor VIGT.415210.100-27.17 made as a DN100 PN25 pipe section; flanges ver. 1-100-25 GOST 12820-80. Range of operating temperatures: -20 … +90°C.
"FIZEPR-SW100" VIGT.415210.100 **-27.19**	Liquid materials featuring by high electrical conductivity in DN150 pipelines, pressure up to 16 at.	Direct-flow sensor VIGT.415210.100-27.19 made as a DN150 PN16 pipe section; flanges ver. 1-150-16 GOST 12820-80. Range of operating temperatures: -20 … +90°C.
"FIZEPR-SW100" VIGT.415210.100 **-27.24**	Liquid materials featuring by high electrical conductivity in DN150 pipelines, pressure up to 6 at.	Direct-flow sensor VIGT.415210.100-27.24 made as a DN150 PN6 pipe section; flanges ver. 1-150-6 GOST 12820-80. Range of operating temperatures: -20 … +90°C.

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Table 3

In-line moisture analyzers for liquid materials FIZEPR-SW100.2x.x

In-line moisture meter FIZEPR-SW100.2x.x versions								
- **20.x/ -20.x.К, -27.x – direct-flow** (with two flanges on the same axis); - **22.x - U-type** (bypass, two flanges on the one side of the sensor); - **23.x – direct-flow,** for extreme temperatures and pressures; - **24.x - L-type** (angled, two flanges at an angle of 90°); - **25.x – Z-type** (two flanges on the side of the sensor, turned 90° or 180°)							**-21.x / -21.x.К - submersible, full-flow**	
							Sensor with one **DN100** flange, sensor diameter not exceeding **89 mm**	Sensor with one **DN65** flange**,** sensor diameter is **57 mm**
PN, atm	**DN, mm**						For **DN ≥ 200**, it is set perpendicular to the flow. For **DN65...150** it can be installed using the service tee-joint	
	50	**65**	**80**	**100**	**125**	**150**		
6	**20.3**			**20.14 27.14**	**20.10**	**27.24**	**21.01**	**21.011**
10	**20.4, 27.4**		**20.6, 22.6, 27.6**	**20.16**		**20.19 27.19**	**21.02**	**21.021**
16	**20.5 22.5 24.5 25.5 27.5**							
25			**20.7**	**20.17 27.17**			**21.03**	**21.031**
40	**20.8 22.8 24.8 25.8**		**20.9 22.9 24.9 25.9**	**20.20 24.20 25.20**	**20.23**			**21.032**
63	**20.11 22.11 24.11 25.11**		**20.12 22.12 24.12 25.12**	**20.21 24.21 25.21**			**21.04**	**21.041**
100	**20.18 23.01 24.18 25.18**		**20.15**	**20.22**			**21.05**	**21.051**
160		**23.65 20.65**						
200	**23.02**							**21.061**

Таблица 4

Laboratory moisture analyzers FIZEPR-SW100.30.x

Moisture meter reference code*	Purpose, controlled materials	Moisture meter version
"FIZEPR-SW100" VIGT.415210.100 **-30.1**	Laboratory measurements of liquid and paste-like materials	Sensor VIGT.415210.100-30.1 with a diameter of 46 mm, designed to measure in vessels and in standard measuring cylinders of 500 ml GOST 1770-74. Controlled sample volume – 450 ml.
"FIZEPR-SW100" VIGT.415210.100 **-30.11**	Laboratory measurements of liquid and paste-like materials including measurements in tanks at different depths	Sensor VIGT.415210.100-30.11 with a diameter of 46 mm, can be used to measure in 500 ml measuring cylinders GOST 1770-74 as well as in tanks. Controlled sample volume – 450 ml. Sensor is equipped with a G 3/4 or G 1 pipe fitting for fastening to the stem (pipe) when immersed in the tank.
"FIZEPR-SW100" VIGT.415210.100 **-30.2**	Laboratory measurements of bulk, paste-like and liquid materials	Sensor VIGT.415210.100-30.2 made as a rectangular measuring cell. Internal measuring cell dimensions – 220 x 100 x 100 mm, controlled sample volume – 1.8 l.
"FIZEPR-SW100" VIGT.415210.100 **-30.26**	Laboratory measurements of bulk, paste-like and liquid materials with high electrical conductivity	Sensor VIGT.415210.100-30.26 made as a rectangular measuring cell. Internal measuring cell dimensions – 220 x 100 x 100 mm, controlled sample volume – 1.8 l.
"FIZEPR-SW100" VIGT.415210.100 **-30.3**	Laboratory measurement of liquid materials	Sensor VIGT.415210. 100-30.3 with a diameter of Ø17.5 mm and a length of 190 mm for P1-21-200 and P2-21-200 test tubes GOST 25336-82. Controlled sample volume – 15 ml.

****Note:*** decimal number of the moisture meter version corresponds to decimal number of the sensor used.

2.6. Refer to Table 5 for the list of electronic unit versions.

Table 5

Electronic unit reference code (decimal number)	Version
VIGT.415210.101	General purpose industrial electronic unit with cable lead-in couplings. Add. unit marking: N - with extended frequency range P - with phase measurement.
VIGT.415210.101-**01**	General purpose industrial electronic unit with RF connectors.

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VIGT.415210.101-**02**	General purpose industrial electronic unit in a certified explosion-proof enclosure. Explosion proof mark on the unit enclosure: 1ExdIIBT5 IP66 Add. unit marking: N - with extended frequency range P - with phase measurement.

3. Technical requirements

3.1. Main parameters and characteristics

Moisture meters are manufactured in accordance with technical specifications 4215-010-21161167-2014TU (VIGT.415210.100TU) based on the set of design documentation VIGT.415210.100.

Table 6 lists main technical parameters of moisture meters.

Table 6

TS No.	Parameter description	Characteristic value for analyzer versions		
		-10…-19 **(probe)**	**-20…-29** **(in-line)**	**-30…-39** **(laboratory)**
3.1.1	Display range of moisture (mass water content), W, % ***(see Note 1)***	0 to 100		
3.1.2	Measurement range of moisture (mass water content), W, % ***(see Note 1)***	0.1 to 100		
3.1.2a	Measurement range of cement production sludge moisture, W, % ***(see Note 1)***	30 to 60		
3.1.3	Limits of absolute error of mass water content measurement, Δ, % ***(see Note 1)***	Δ=0.035+0.05*W	Δ= 0.02+0.025*W	
3.1.4	Measurement range of permittivity in controlled materials: - real component - dielectric loss tangent ***(see Note 3)***	1 … 100 0 … 100		
3.1.5	Temperature range of analyzer calibration, °C ***(see Note 4)***	plus 5 to plus 80		

3.1.6	Range of sensor operating temperatures, °C: - general purpose industrial version - extended temperature range version - extreme temperatures version ***(see Note 5)***	minus 20 to plus 120 minus 20 to plus 145	minus 20 to plus 120 minus 45 to plus 145 minus 20 to plus 300	0 to plus 90
3.1.7.1	Range of electronic unit operating temperatures, °C	minus 20 to plus 80		
3.1.7.2	Operating temperature range of the electronic unit with extended temperature range, °C	minus 40 to plus 80		
3.1.7.3	Range of explosion-proof electronic unit operating temperatures, °C	minus 20 to plus 55		
3.1.7.4	Operating temperature range of the explosion-proof electronic unit with extended temperature range, °C	minus 40 to plus 55		
3.1.8	Indication range of temperature, °C: - general purpose industrial version - extreme temperatures version	minus 50 to plus 150 minus 50 to plus 340		
3.1.8a	Measurement range of temperature (standardized error), °C	plus 5 to plus 80		
3.1.9	Measurement period, sec	1		
3.1.10	Output interface - digital - current, mA	RS485 Modbus RTU 4-20		
3.1.11	Supply voltage, V nominal allowable	24 18...36		
3.1.12	Current consumption, not more than, mA	200		
3.1.13	Sensor probe length, mm ***(see Note 6)***	200…1000	200…250	170…220
3.1.14	Nominal bore DN, mm (for in-line analyzer made as a pipe section) ***(see Note 7)***		50; 65; 80; 100; 125; 150	
3.1.14a	Nominal bore DN, mm, not less than (for in-line analyzer version **-21.x** made as a probe with a flange) ***(see Note 7)***		200	

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3.1.15	Maximum excess pressure of the controlled material, MPa (for in-line analyzer made as a pipe section) ***(see Note 7)***		20.0	
3.1.16	Sensor weight, kg	1…8	10…35	1..3
3.1.17	Dimensions of electronic unit in general purpose industrial version, mm	255 x 170 x 60		
3.1.18	Dimensions of electronic unit in version with 1ExdIIBT5 certified explosion-proof enclosure, mm	285 x 230 x 120		
3.1.19	Weight of electronic unit in general purpose industrial version, kg	2		
3.1.20	Weight of electronic unit in version with 1ExdIIBT5 certified explosion-proof enclosure, kg	7		
3.1.21	Dust and moisture ingress protection rating of electronic unit in general purpose industrial version	IP54 GOST 14254-96		
3.1.22	Dust and moisture ingress protection rating of electronic unit in version with 1ExdIIBT5 certified explosion-proof enclosure	IP66 GOST 14254-96		
3.1.23	Dust and moisture ingress protection rating of sensor	IP67 GOST 14254-96		
3.1.24	Length of communications cable between sensor and electronic unit, m ***(see Note 8)***	1.5 … 4		
3.1.25	Maximum length of digital signal cable RS485 between electronic unit and external control device (controller, computer), not less than, m	1000		
3.1.26	Maximum length of analog signal cable 4-20 mA between electronic unit and external indicating device, not less than, m	100		
3.1.27	Average time between failures, h	25 000		
3.1.28	Average life, years	10		

Notes:

1. It is acceptable to graduate sensor in moisture volume units in the same measurement range.

2. Calculation of given mathematical expressions (formulas) provides the following values of absolute error Δ:

Analyzer design	Moisture value, W	Limits of absolute error

(version)		value Δ
In-line (**-20**…**-29**) Laboratory (**-30** …**-39**)	0.5% 3% 7% 10% 20% 40% 100%	0.03% 0.1% 0.2% 0.3% 0.5% 1% 2.5%
Probe (**-10**… **-19**)	5% 10% 20% 50% 100%	0.3% 0.5% 1% 2.5% 5%

3. The dielectric loss tangent value of the controlled material for -10.x, -11.x, -12.x, -20.x, -21.x, -23.x, -30.x, -30.1 and -30.2 moisture analyzer versions may be in the range 0 ... 0.5.
   For -10.16, -10.46, -27.x, -30.26 moisture analyzer versions the possible value of dielectric loss tangent is in a range 0 … 100 and may exceed 1000 in some cases.
   At the customer's request, the dielectric loss tangent value of the controlled material can be displayed on an external indicating device.

4. The user can freely update analyzer calibration with data for extension of moisture measuring temperature range using supplied software by the method described in the operation manual.

5. When measuring materials containing ice, the moisture meter detects only unfrozen water. Measurement accuracy for materials containing ice is not regulated.
   In order to operate on materials with a temperature of +120 ... + 145°C, sensors are available with a measuring cell mounted on a branch at a distance from the sensor enclosure.
   In order to measure materials with a temperature over + 145°C, sensors are available with a measuring cell placed in a separate enclosure thermally insulated from the sensor enclosure.

6. The table specifies the nominal length of the probe made as a rod. This design parameter can range from 160 to 1200 mm (optionally up to 1500 mm). The accuracy of moisture measurement is not affected by the specified design parameter since moisture content is calculated as a ratio between the resonant frequency of the probe in the controlled material and in the air, and the resonant frequency ratio is independent of the probe length.
   For -17, -17.1 and -17.2 sensor versions, the probe is made as a composite plate with an outer diameter of 108 mm (-17 and -17.8 versions) or 80 mm (-17.1 and -17.2 versions).

7. The in-line analyzer is designed to measure liquid (including paste-like) materials and is produced in versions given in Tables 2 and 3.

8. The required cable length between the sensor and the electronic unit is agreed when ordering. Maximum cable length of general purpose industrial analyzer is 10 m and 4 m for explosion-proof version.

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3.2. Moisture meters explosion protection is ensured by fulfilling the requirements of:

1) GOST 30852.1-2002 (IEC 60079-1:1998) Explosion-proof electrical equipment.
Part 1. "Flameproof enclosure" type explosion protection

2) GOST 30852.10-2002 (IEC 60079-1:1999) Electrical apparatus for explosive atmospheres.
Part 11. Intrinsic safety i

3) GOST 30852.0-2002 (IEC 60079-0:1998) Explosion-proof electrical apparatus.
Part 0. General requirements.

Intrinsically safe electrical parameters of the electronic unit:

– maximum output voltage, Uo, V	10.5
– maximum output current, Io, A	1.11
– maximum external capacity, Co, μF	14
– maximum external inductance, Lo, mH	0.02

3.3. Due to metrological properties the moisture meter is considered a measuring tool when used in the areas subject to state supervision and control in the Russian Federation.

3.4. The moisture meter is designed for continuous operation.

4. Scope of supply

4.1. Analyzer scope of supply:

1. Sensor
2. Electronic unit
3. Technical specification and operation manual VIGT.415210.100 PS
4. Equipment certificate VIGT.415210.100 PS
5. CD with software "SW100" and "SWPro"
6. Counter flanges (for in-line moisture meter versions).

4.2. The items listed in Table 7 may be additionally included in the scope of supply at the customer's request.

Table 7

Item description	Type, brand
Protocol converter USB – RS485 (power supply – 24 V mains)	"OWEN -AC4" by "Owen"
Protocol converter USB – RS485 (power supply – PC USB port)	"ATDR.426469.032" by RPE "Bolid"
Measuring and regulating device with digital indication (input signal – current 4-20 mA)	"OWEN TRM-201" by "Owen"
Operator panel with digital indication (MODBUS RTU RS485 input)	"OWEN SMI1" by "Owen"
Measuring and regulating device (input signal – current 4-20 mA)	"METAKON -1105" by "KontrAvt"
Power supply 24 V	"OWEN BP30B-D3-24" by "Owen"
Laptop	by agreement with the customer
Instrumentation cabinet	by agreement with the customer

Explosion-proof thermal cover for electronic unit, used when operating at temperatures below -40°C. Included: - thermal cover (wear-resistant, water-oil repellent fabric); - self-regulating heating tape 25 NTR2-VT, 50Hz, 220V, 2ExellT6 with power cable in the 3 m metal hose; - terminal box.	"EkoTerm" Ex-02 by "EkoTerm"

4.3. Example of the moisture meter designation in the order and technical documentation of other products:

"Moisture analyzer "FIZEPR-SW100" VIGT.415210.100-10.6"

5. Design features of moisture meter versions and moisture meter operation

5.1. The probe moisture meters VIGT.415210.100-**10.x** are designed to control moisture content in powdery, granular, paste-like and bulk materials including crushed stone, gravel, sand, ore, grain products, peat, sawdust, etc.

The sensor probe is made of AISI 321 corrosion-resistant steel rod (optionally sensors can be made of steel grades AISI 420, AISI 316Ti, etc.). The probe is placed in a controlled material. VIGT.415210.100-**10.x** sensor versions can be mounted in hoppers, silos, on trays or above conveyor belts. The probe is fixed with coupling holders mounted on a metal base. Moisture meter design allows for a fairly simple installation and dismantling of a sensor while in service.

5.1.1. The VIGT.415210.100-**10.21** and VIGT.415210.100-**10.6** moisture meter sensor versions are shown in Appendices 1 - 3. The flat-topped senor probe is fixed in coupling holders welded to a panel. Moreover, the probe is removable to allow shield sensor fastening the on the hopper wall by welding (during welding, the probe must be removed from couplings). The VIGT.415210.100-**10.21** moisture meter version is distinguished from VIGT.415210.100-**10.6** by an additional shield made as flat-topped rod installed parallel to the probe. The additional shield allows eliminating the influence of metal structures located near the sensor.

This moisture meter designs can be used to control bulk materials in tanks and drying units as well as for measurement of materials on a conveyor belt. Controlled material must completely fill the space between the probe and the panel, as well as the space around the probe at a distance of 10 ... 15 cm and more.

5.1.2. The VIGT.415210.100-**10.16** moisture meter version (shown in Appendix 4) repeats the design and application specifics of the **-10.6** moisture meter version, but is designed to control materials with high electrical conductivity such as anthracite or concentrates of various ores.

5.1.3. The VIGT.415210.100-**10.5** moisture meter version (see Appendix 5) is designed to control bulk materials on conveyor belts only. The sensor is installed along the material flow. A special shape of the sensor and a "bucket" located in front of it ensure complete sensor filling with controlled material.

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5.1.4. The VIGT.415210.100-**10.4** moisture meter version (shown in Appendices 6-9) is equipped with a sensor probe made as a straight AISI 321 stainless steel rod with a diameter of 27 mm (27 mm cross section hex rod can be used). The probe is fixed on the opposite hopper walls with coupling holders (see Appendix 10). Probe length in this moisture meter design is selectable in the range from 50 cm to 120 cm (up to 1.5 m on request). This design provides averaged measurement results throughout the hopper volume and thus differences in moisture content of particular local areas do not lead to errors when determining average moisture content. In concrete production such averaging may reduce errors in the proportioning of components caused by uneven moisture distribution in sand and crushed stone.

The specified moisture meter is indispensable for controlling materials adhering to the hopper walls. Even if 5 ... 10 liters of material adhere to a steel pin, the adhered layer will not affect measurement results since the measured volume is hundreds of liters.

The sensor of the VIGT.415210.100-**10.46** moisture meter version is similar in design to the **-10.4** version, but this moisture meter is intended to measure materials with high electrical conductivity in hoppers.

5.1.5. The VIGT.415210.100-**10.41** moisture meter version (shown in Appendices 6, 11 and 12) is equipped with a sensor probe made as a straight AISI 321 stainless steel rod with a diameter of 14 mm. The probe is fixed on the opposite hopper walls with coupling holders. Probe length in this moisture meter design is selectable in the range from 25 cm to 55 cm. This design provides averaged measurement results throughout the hopper volume and thus differences in moisture content of particular local areas do not lead to errors when determining average moisture content. It is mainly designed to control wood waste including sawdust, wood chips, and wood wool, and grain products.

5.1.6. The VIGT.415210.100-**11.x** probe moisture meters include a sensor formed by two pins (sensor versions are shown in Appendices 13 and 14). This moisture meter is designed to control both bulk (e.g., grain in hoppers) and liquid (paste-like) materials. The sensor is hermetically sealed and can be immersed into a tank with liquid material (e.g. fuel oil). The sensor is mounted on the 1" or 1.25" pipe. The sensor cable runs through the specified pipe. Appendix 15 shows the **-11.41** sensor mount.

Due to pin design of the sensor, the **-11.x** moisture meter can also be used for moisture control of soil, peat and plant products in clamps. Unlike other-**11.x** series versions, the **-11.33** sensor pins are turned relative to the sensor axis. This sensor is designed to measure bulk materials on a conveyor belt (e.g., raw materials for silicate brick production), as well as liquid materials in trays. When installing, the sensor **-11.33** is recommended to be positioned so that its pins are directed toward the material flow.

5.1.7. The VIGT.415210.100-**12** probe moisture meter includes a sensor that consists of a center probe pin and four guard pins located around the center pin (see Appendix 16). The sensor probe and enclosure are made of AISI 321 stainless steel. This sensor is designed for installation in tanks with liquid materials: fuel oil, cement production sludge, etc. The sensor can be fixed to a pipe with 1" (G1) cylindrical pipe thread in accordance with GOST 6357-81, and to a pipe with 2" (G2) internal thread. The sensor cable runs through the specified pipe. Such mounting allows

the user to adjust depth of sensor immersion into a tank, and thereby control moisture at different levels. It is recommended to use silicone sealants in order to hermetically seal the junction of a sensor and a pipe.

5.1.8. The VIGT.415210.100-**17** (70), -**17.1** (71), -**17.2** (72), -**17.8** (78) probe moisture meters (see Appendix 17) are designed to measure bulk and paste-like materials in hoppers, on a conveyor belt, in augers, in mixers (including materials featuring by high electrical conductivity: coal, concrete, etc.). The sensing element (probe) of the -**17,** -**17.1** and -**17.8** sensors is a flat surface made of hardened corrosion-resistant steel (AISI 420). The probe surface of the -**17.2** sensor version is curved along the radius, which allows this sensor version to be installed in the sampling system pipe.

5.2. The VIGT.415210.100-**20.xx** series in-line moisture meters are designed for in-line measuring of liquid (as well as paste-like) materials including oil, sludge, etc. The enclosure and probe material is stainless steel (AISI 321 or AISI 316Ti).

The sensors are available in the following versions:

- -**20.x** version (in-line). The sensor is made as a pipe section with two flanges installed on the pipe axis.
- -**20.x. K** version (in-line). The sensor is made as a pipe section with two flanges installed on the pipe axis. The sensor probe is placed in a dielectric shell (ceramic tube) to measure materials with high electrical conductivity.
- -**21.x** version (full-flow). The sensor is made as a probe with a flange for installation on pipelines with nominal bore of 200 mm or more. The sensor of this version can also be used for measurements in tanks.
- -**21.x.K** version (full-flow). The sensor is made as a probe with a flange for installation on pipelines with nominal bore of 200 mm or more. The sensor of this version can also be used for measurements in tanks. The sensor probe is placed in a dielectric shell (ceramic tube) to measure materials with high electrical conductivity.
- -**22.x** version (bypass, U-type). The sensor is made as a pipe section with the flanges located on the side of the pipe section, in the same plane.
- -**23.x** version (direct-flow). The sensor is made as a pipe section with two flanges installed on the pipe axis. The moisture meter is designed to measure steam and water mixtures, as well as liquid materials at extreme temperatures and pressures.
- -**24.x** version (angled, L-type). The sensor is made as a pipe section and contains two flanges one of which is located on the axis of the pipe and the second one is on the side of the pipe section.
- -**25.x** version (Z-type). The sensor contains a pipe section with two flanges located on the different sides of the pipe (it is possible to make flanges with a turn at 90° relative to each other).
- -**27.x** version (in-line). The sensor is made as a pipe section with two flanges installed on the pipe axis. The moisture meter is designed to measure liquid materials with high electrical conductivity.

5.2.1. The VIGT.415210.100-**20.x**, **-20.x.K** series in-line moisture meters, direct-flow version. The sensor is designed as a pipe section with two flanges located on the same axis.

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Nominal pipe size: DN50, DN65, DN 80, DN100, DN125 and DN150, nominal pressure PN - up to 160 kgf/cm^2. The flat-topped sensor is installed inside the pipe. A temperature sensor is installed inside the probe to monitor the temperature of measured environment. Pipe section length together with flat flanges is 400 mm or 500 ... 550 mm for versions with collar flanges.

Permissible temperature of the controlled material is up to + 120°C. For operation on materials with a temperature of up to + 120 ... + 145°C, the sensors are manufactured in "extended temperature range" design with the measuring cell installed on the nozzle far from the sensor enclosure to reduce the temperature of sensor semiconductor elements to values not exceeding +90 ... 100°C. To measure materials with a temperature over + 145 ° C, the sensors are manufactured in "for extreme temperatures" design with the measuring cell placed in a separate enclosure insulated from the sensor enclosure.

Moisture measurement range in the FIZEPR-SW100.**20**.x moisture meter version is 0 ... 20% with a salt content in the aqueous phase up to 250 g/l and 0 ... 100% with the salt content up to 0.5 g/l.

The sensor probe in the FIZEPR-SW100.**20**.x.K moisture meter version is covered with a ceramic tube. Moisture measurement range is 0 ... 100% with a salt content in the aqueous phase up to 250 g/l. Nominal pipe size: DN80, DN100, DN125 and DN150.

5.2.2. Full-flow in-line VIGT.415210.100-**21.x** series of the moisture meter (see Appendices 20 and 21) are designed for measurements in pipelines with a diameter of 200 mm and more, and operating pressure PN up to 200 kgf/cm^2. The sensor is made as a pipe with a probe inside where both are fixed on one flange. Windows are made on the side surface of the pipe. Flanges are available in the following sizes: DN100, DN80 and DN65.

To install the sensor on the side of the pipeline, a branch with a flange corresponding to the sensor flange (see Table 2) must be welded to the pipeline. A sensor of this version can also be used to measure liquid products in tanks.

The sensor of this version can also be used for measurements in pipelines of smaller diameter (DN65 ... 150) when using pipe tee joints that allow sensor installation along the axis of the pipeline section.

Moisture measurement range in the FIZEPR-SW100.**21**.x moisture meter version is 0 ... 20% with a salt content in the aqueous phase up to 250 g/l and 0 ... 100% with the salt content up to 0.5 g/l.

The sensor probe in the FIZEPR-SW100.**21**.x.K moisture meter version is covered with a ceramic tube. Moisture measurement range is 0 ... 100% with a salt content in the aqueous phase up to 250 g/l.

5.2.3. The VIGT.415210.100-**22.x** series bypass U-type in-line moisture meters (see Appendix 22) contain a sensor made as a pipe section with flanges located on the side of the pipe section and on the same plane. There is a straight probe installed in a dielectric shell (ceramic tube) inside the pipe. The probe is equipped with a thermal sensor to control the temperature of measured environment.

Nominal bore: DN50, DN65, DN80 (DN40, DN32 and DN25 sensors are available on request); pressure PN - up to 63 kgf/cm^2. Moisture measurement range is 0 ... 100% with a salt content in the aqueous phase up to 250 g/l.

5.2.4. The VIGT.415210.100-**23.x** series direct-flow in-line moisture meters (see Appendix 23) are a version of the VIGT.415210.100-**20.x** series moisture meters designed for measuring materials with a temperature up to + 320°C. The sensor measuring cell is made is made as two modules in two separate housings located on both sides of the sensor pipe and at a distance from it. Both housings are thermally insulated. This design prevents sensor semiconductor elements from overheating. The second design feature: increased sensitivity at small dielectric constant values that is fundamentally important when controlling steam and water environments.

5.2.5. The VIGT.415210.100-**24.x** series angled L-type in-line moisture meters (see Appendix 24) contain a sensor made as a pipe section with two flanges, one of which is located on the axis of the pipe, the second one is on the side of the pipe section. Nominal bore: DN50, DN65, DN80 DN100, DN125 and DN150 (DN40, DN32 and DN25 sensors are available on request); pressure PN - up to 63 kgf/cm^2. The sensor probe is covered with a ceramic tube. Moisture measurement range is 0 ... 100% with a salt content in the aqueous phase up to 250 g/l.

5.2.6. The VIGT.415210.100-**25.x** series Z-type in-line moisture meters include a sensor made as a pipe section with two flanges located on the different sides of the pipe (it is possible to make flanges with a turn at 90° relative to each other). Nominal pipe size: DN50, DN65, DN80, DN100 (DN40, DN32 and DN25 sensors are available on request); pressure PN - up to 160 kgf/cm^2. The sensor probe is covered with a ceramic tube. Moisture measurement range is 0 ... 100% with a salt content in the aqueous phase up to 250 g/l.

5.2.7. The VIGT.415210.100-**27.x** series direct-flow in-line moisture meters (see Appendices 27 and 28) are a version of the VIGT.415210.100-**20.x** series moisture meters designed for measuring materials with high electrical conductivity including saturated salt solutions. The sensors of this moisture meter are available in two versions: with the transverse and longitudinal probe positioning relative to the axis of the sensor pipe. Nominal pipe size: DN50, DN80, DN100 and DN150.

5.3. The VIGT.415210.100-**30.x** laboratory moisture meters are used to control liquid, bulk and paste-like materials.

5.3.1. The VIGT.415210.100-**30.1** moisture meter version (see Appendix 29) contains a sensor with a diameter of 46 mm to control liquid materials in standard 500 ml measuring cylinders according to GOST 1770-74. Controlled sample volume is 450 ml.

5.3.2. The VIGT.415210.100-**30.11** moisture meter version contains a sensor that does not externally differ from the VIGT.415210.100-**30.1** sensor, but can be used to monitor liquids in tanks. The sensor is equipped with a G 3/4 (or G1) pipe fitting for fastening to the stem (pipe) when immersed in the tank.

5.3.3. The VIGT.415210.100-**30.2** moisture meter version (see Appendix 30) is made as a rectangular measuring cell that can be filled with either controlled bulk material or liquid. The measuring cell is made of AISI 321 stainless steel. Internal dimensions of the measuring cell: 220 x 100 x 100 mm, controlled sample volume is 1.8 l.

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5.3.4. The VIGT.415210.100-**30.26** moisture meter version (see Appendix 30) is made as a rectangular measuring cell that can be filled with either controlled bulk material or liquid. The measuring cell is made of AISI 321 stainless steel. Internal dimensions of the measuring cell: 220 x 100 x 100 mm, controlled sample volume is 1.8 l. Unlike the VIGT.415210.**100-30.2** version, this moisture meter is designed to control materials with high electrical conductivity.

5.3.5. The VIGT.415210.100-**30.3** moisture meter version is made as a small diameter probe to measure liquid materials inside test tubes of P1-21-200 and P2-21-200 types according to GOST 25336-82 widely used in chemical laboratories. Controlled sample volume is 15 ml.

5.4. Appendices 31 and 32 show three versions of electronic units. The moisture meter can be equipped with electronic units in general purpose industrial version and version with 1ExdIIBT5, IP66 certified explosion-proof enclosure.

The electronic unit in general purpose industrial version is equipped with two LEDs mounted on its enclosure to monitor moisture meter operation. One LED is connected to the +24 V input power supply circuit and illuminates when power is supplied. The second LED is bi-color. Green light indicates RS-485 network communication. Red light illuminates when the instrument responds to requests from an external device (computer, controller, etc.).

The electronic unit of a permanently installed moisture meter is fixed near the sensor at a distance determined by the connection cable length specified in the order. If cable is 1.5 m long, the electronic unit is installed at a distance of no more than 1.2 m from the sensor.

5.5. The principle of moisture meter operation is as follows:

Moisture meter operation is based on measuring electromagnetic wave deceleration factor (k_{dec}) in the controlled material. As the water content in the material increases, the dielectric constant of the material rises and so the wave propagation velocity decreases. The proportion of water - material moisture content W - is calculated according to the deceleration factor value.

Deceleration factor k_{dec} is the ratio of the electromagnetic wave velocity in air (i.e. the speed of light) to its propagation speed in the controlled material. Measurements are made by probing the medium with radio waves at frequencies of 2 ... 750 MHz (this range can be expanded, measurements can be made in the range from hundreds of kHz to 1.5 GHz). k_{dec} is determined by the characteristic (resonant) frequencies in the sensor signal spectrum, i.e. the frequencies at which a whole number of half-waves of the electromagnetic signal fits within the sensor primary transducer length. At these frequencies, the sensor signal spectrum has minimum values (spectrum example is shown in Fig. 1 in Part 2 of this manual).

Electromagnetic wave deceleration factor in the material k_{dec} is calculated according to the formula:

$$K_{dec} = f_0 / f_M \ ,$$

where f_0 – empty sensor (sensor filled with air) resonant frequency;

f_M – sensor resonant frequency when it is filled with controlled material.

The measurement consists in periodical measurements of resonant frequency f_M and k_{dec} deceleration factor value calculation. k_{dec} value conversion to W moisture content is performed

using calibration tables providing correspondence between k_{dec} deceleration factor, moisture and temperature.

Thus, the moisture meter principle of operation is to periodically search for sensor resonant (characteristic) frequency f_M, measure temperature and calculate moisture content based on these parameters.

A tunable generator forming a harmonic probing signal and a sensor signal processing device are located in the moisture meter electronic unit. The sensor includes a primary transducer (i.e. a probe) and an electronic detector that converts a high-frequency signal at the sensor output into low-frequency voltage.

In **-30.x**, **-11.x**, **-12.x** sensor versions, the primary transducer **(**probe) is formed by two (or more) rods that form a segment of a so-called long transmission line.

In **-30.x** and **-2.x.x** sensor versions, the probe also is a segment of a two-conductor line, but it is formed by a metal rod and a shield conductor (steel panel or metal pipe/hopper surface). In **-17.x** sensor version, the primary transducer is a capacitive structure forming a capacitor, in parallel with which an inductive element is connected.

As shown above, the moisture meter generator is periodically automatically tuned in the frequency range, and the moisture meter finds resonant (characteristic) frequencies f_M in the spectrum obtained as a result of scanning. The moisture meter calculates electromagnetic wave deceleration factor in the material from the lowest found frequency f_M, as well as frequency f_0. Then, according to the calibration tables compiled for a set of temperatures and stored in the electronic unit memory for the selected material, the moisture meter microcontroller calculates the material moisture content W. Calibration tables for different materials (sand, gravel, sunflower oil, cement production sludge, etc.) are entered into the electronic unit memory from the computer. The total number of such tables stored in the moisture meter memory is almost unlimited.

It must be noted that water permittivity is about 80, and permittivity of most materials lies in the range from 2 to 4 (30 for spirits). Significant difference between permittivity of water and other materials is exactly what allows to measure water content in the mixture due to a noticeable increase of total mixture permittivity if moisture is present in the material.

Please note: ice permittivity is about 3, so these moisture meters (as well as all known industrial moisture meters of other types) do not allow ice amount measurements.

The resulting measured moisture value is transmitted from the electronic unit output via digital interface (RS-485) and, simultaneously, via 4-20 mA current signal to the external indicator or industrial controller that controls process.

6. Labeling

6.1. The electronic unit enclosure is labeled with the following markings:

Instrument type - on the front panel (on the cover)

Moisture meter serial number - on the enclosure side wall or also on the cover.

The electronic unit front panel is also labeled with a pattern approval mark – a holographic sticker.

6.2. When using a moisture meter for commercial accounting, a seal is installed on one of the screws that fix the protective cover inside the electronic unit.

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7. Transport and consumer packaging

7.1. Transport and consumer packaging is designed to store and transport the moisture meter, and to ensure its safety during transportation for the entire storage period.

7.2. The moisture meter, parts and components included in the scope of supply complete with operational documentation must be packed in a transport packaging.

7.3. Supplied products and operational documentation must be wrapped in a polyethylene film.

7.4. Together with the delivery set, transport packaging must contain a packing list indicating description and quantity of supplied products.

8. General operation instructions

8.1. The moisture meter consists of an electronic unit and a sensor connected by a cable. Cable connection with the sensor is non-separable and filled with compound. **Opening the sensor is not allowed and leads to loss of warranty.** Cable connection with the electronic unit is detachable. If it is necessary to disconnect the sensor and the electronic unit, open the electronic unit cover, disconnect the cable wires from the terminal block, disconnect the RF connector, then loosen the cable entry clamp. After that the cable must be carefully removed from the electronic unit cable entry.

8.2. The moisture meter must be powered from a general-purpose stabilized DC voltage source with the output voltage of 24 V (maximum permissible supply voltage values are 18 ... 36 V). Own power consumption of the moisture meter electronic unit does not exceed 3.6 W.

8.3. Information is transmitted simultaneously and independently via two lines:

- Digital communication line, RS-485 Modbus RTU interface
- 4-20 mA current loop.

8.4. The moisture meter is ready for operation in 1-2 minutes after the supply voltage is applied.

8.5. Unpacking rules

8.5.1. Upon receipt of the container with a moisture meter, visually inspect it together with the person responsible for transportation. It is necessary to ensure the complete container integrity. In case of damage to the packaging prepare a report signed by the persons responsible for acceptance and transportation, seal and send to the transport company.

8.5.2. During the cold season, containers must be unpacked only after holding them in a warm room for 2 hours at a temperature not lower than 18-20°C.

8.5.3. After unpacking, check the contents of packages against the inventory in the packing lists and check the completeness in the “Kitting” section of the equipment certificate. Description, designation, serial number and quantity of products listed in the equipment certificate shall correspond to the records in packing lists.

8.6. Inspection rules.

8.6.1. Perform visual inspection in order to check safety and integrity of the moisture meter enclosure. The product shall be free from scratches, cracks, dents, corrosion and other defects that can be detected by visual examination.

8.6.2. All defects and irregularities detected during unpacking, visual inspection and completeness check shall be reported in a damage complaint report that shall be signed by persons responsible for acceptance of the moisture meter, approved by the Director of the customer company, and sent to the manufacturer.

9. Safety precautions

9.1. A 24 VDC voltage source used to power the moisture meter must be a power source that converts a higher voltage to a safe extra-low voltage by an isolation transformer or a converter with separate windings. For example, OWEN BP30B-D3-24 series 24V power supplies that meet the above requirements can be used as a source for powering the moisture meter.

The moisture meter corresponds to Electric Shock Protection Class III in accordance with GOST 12.2.007.0-75 when using a source for powering the moisture meter that meets the above requirement.

9.2. Do not operate the moisture meter if the electronic unit cover is removed.

9.3. Do not operate the moisture meter with poorly attached connectors or poor contact in terminal connectors.

9.4. Do not operate the moisture meter in explosive production conditions without grounding the moisture meter electronic unit.

9.5. The moisture meter electronic unit and sensor must be installed on grounded metal structures.

9.5. Only persons who have studied this technical description, and have been instructed in safety precautions when working with electrical installations and electronic equipment, shall be allowed to install (dismantle), operate, maintain and repair the moisture meter.

9.6. All types of maintenance, repair and installation associated with the replacement of fuses, disconnection and switching of wires, etc., as well as moisture meter dismantling must be performed only when it is disconnected from the power source.

10. Installation procedure

10.1. Safety regulations set out in Section 9 of this manual and in regulatory technical documents applicable at the customer plant shall be strictly observed during the moisture meter installation.

10.2. The moisture meter supplied for on-site installation has passed in-plant testing.

10.3. First choose mounting locations for a sensor and an electronic unit. Take into account permissible operating conditions when choosing mounting locations. Prepare mounting locations for moisture meter components in accordance with overall and mounting dimensions.

10.4. The moisture meter on-site installation is carried out in the following order:

- Mount the sensor in a prepared location in accordance with Section 10.7
- Fix the electronic unit in a prepared location in accordance with Section 10.8.
- Remove the electronic unit cover and make electrical installation.

10.5. Possible moisture meter wiring diagrams are presented in Appendices 32 and 33. Measurement results can be displayed on a controller or a computer via RS-485 Modbus RTU interface. Besides, measurement results can be displayed on any display device with 4-20 mA current input. For example, the measuring and regulating device OWEN TRM-201 (see Appendix 33) or METAKON-1105 (see Appendix 34), as well as other similar measuring devices manufactured by a number of companies, can be connected to the moisture meter current output. Calibration instructions for the OWEN TRM-201 measuring and regulating device are given in Appendix 35.

The moisture meter must be powered from a 24 VDC voltage source, e.g. OWEN BP 30B-D3-24.

If it is necessary to set the current output parameters, obtain diagnostic information about the moisture meter operation, record its characteristics, adjust the moisture meter or change the communication parameters, connect a computer (laptop) to the electronic unit using the RS485-USB interface adapter converter. Parameter adjustment instructions are provided in Part 2 of this manual.

10.6. Electrical connection of the moisture meter shall be carried out in the following order:

10.6.1. Connect the grounding contact on the enclosure of the explosion-proof electronic unit with the ground bus.

10.6.2. Connect the digital interface cable to the RS-485 terminals (if a digital data transmission channel from the moisture meter is used).

10.6.3. Connect the communication cable to the 4-20 mA "+ I GND Current" terminals of the current output (if a data transmission channel from the moisture meter is used via the current loop).

Note: "+ I GND Current" current output and RS485 signal circuits are not galvanically isolated from 24V power circuits.

10.6.4. Cable connection with the sensor is non-separable and filled with compound. Cable connection with the electronic unit is detachable. If the sensor cable is disconnected from the electronic unit, cable wires must be connected in accordance with the marking on the terminals as provided by the diagram given in Appendices 33 and 34.

Note: Upon delivery of moisture meters, their packaging shall be carried out with the sensor cable connected to the electronic unit.

10.6.5. Connect the power cable to the "24V" terminals.

10.7. Assembly and disassembly features of -**10.21**, -**10.6** sensor versions

10.7.1. The panel must be pre-assembled on the hopper wall.

NOTE: THE MOISTURE METER PROBE MUST BE REMOVED FROM THE COUPLINGS AND UNPLUGGED FROM THE ELECTRONIC UNIT DURING WELDING

10.7.2. Removing the probe from the couplings (see Appendices 2 and 3) is performed in the following order. First, unscrew fixing covers 1, 2. This allows both ends 3, 4 of rod 5 together with enclosure 6 to be pulled out simultaneously. Next, unscrew nut 8 and remove bushing 7 at end 4 of rod 5. Then, turn rod 5 at an angle to the base plane and begin to remove its end 3 from the hole, while end 4 of the rod enters the base hole. After that, the whole rod together with enclosure 6 is removed entirely.

Assemble the sensor in reverse order.

10.8. Assembly and disassembly features of -**10.4**, -**10.41** sensor versions on metal hopper walls

NOTE: THE MOISTURE METER PROBE MUST BE REMOVED FROM THE COUPLINGS AND UNPLUGGED FROM THE ELECTRONIC UNIT DURING WELDING

10.8.1. Sensors -**10.4** and -**10.41** with a probe made as a straight rod (Appendices 6-12) are installed in the following order: insert end 4 of rod 5 into the hole in coupling 9 and pass it through the hole in coupling 8. Press enclosure 6 to the base by screwing fixing cover 1 (or by a flange fixed with four bolts). Then, screw bushing 7 with internal thread onto another end 4 of rod 5, and twist it until tight against the bottom of coupling 8. Fix bushing 7 in this position with

fixing cover 2. This ensures reliable contact of the primary transducer high-frequency circuits without the need to precisely select the probe length (rod 5) for hopper dimensions.

10.8.2. Once installation is complete, calibrate the -**10.4** and -**10.41** sensor versions with an empty hopper in accordance with Section 5, Part 2 of this operating manual. Calibration is necessary since the probe length is matched to couplings mounted on the hopper. For example, with the specified length of 950 mm, the probe length can be in the range of 750-900 mm (allowable values) when couplings are welded to hopper walls.

Disassemble the probe in reverse order.

10.9. Features of assembly and disassembly of -**11.x**, -**12** sensor versions

When attaching these sensors to a pipe, apply silicone sealant to threaded connection to prevent liquid ingress to the pipe used for routing the cable connecting the sensor to the electronic unit.

11. Pre-starting and operation procedure, measurement procedure

11.1. The moisture meter must be serviced by an operator who is familiar with the operation of electronic equipment, has studied this technical specification and operating manual and have been instructed in safety precautions when working with electrical equipment.

11.2. Preparation for work is performed in the following order:

11.2.1. Make sure that electrical connections correspond to the wiring diagram. Check reliability of wire connection to terminal clamps.

11.2.2. Energize the moisture meter.

11.2.3. Make sure that the "POWER" LED on the electronic unit side panel is illuminated.

11.2.4. Make sure that the "CONTROL" LED on the electronic unit side panel is flashing (when RS485 line is connected).

Note: LEDs of electronic units made in explosion-proof enclosure are located on a top panel – connection board.

11.2.5. Once all the above actions are performed the moisture meter is ready for operation.

11.2.6. If any moisture meter failure is detected, turn off power, identify and correct the occurred failure as described in Sections 13 and 14 of this manual (Part 1).

11.3. Measurement procedure

Before taking measurements, make sure that the moisture meter sensor is completely filled with the controlled material. Read measurement results from the indicator device (OWEN TRM-201 measuring and regulating device or a computer screen).

11.4. Evaluation of measurement reliability

Evaluation of measurement reliability (accuracy) is performed by comparing moisture meter readings with laboratory test results.

These data are entered into the "Measurement Reliability Evaluation Report" (see Appendix 36) with the date of sampling and the temperature of the material.

When taking samples for laboratory measurements from the controlled material volume with the moisture meter, the moisture meter readings are recorded in the report, and once the laboratory analysis is completed, the results are recorded in a corresponding line. Then the difference between obtained values is calculated taking into account the sign.

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The frequency of sampling is determined by the company.

In case of systematic unacceptable differences between moisture meter and laboratory data perform the analysis of possible causes.

Below is a list of possible reasons for such differences:

- The instrument was not calibrated on an empty hopper after installation
- The plant laboratory a moisture calculation method different from that given in Section 2.2 of this manual
- An unrepresentative sample is taken for laboratory analysis
- The structure of controlled material is unstable.
- Controlled material has a composition unstable in terms of moisture content.

The following solutions are recommended for the above causes for discrepancies:

Cause 1: the instrument was not calibrated on an empty hopper after installation

After installation of pin-type sensors (**-10.4**, **-10.4x**) it is necessary to calibrate the moisture meter to determine resonant frequency on an empty hopper in accordance with Section 10.8.2 of this operating manual. Failure to perform such calibration may shift readings towards overestimation or underestimation of results. Calibration shall be carried out when the hopper is completely emptied. In order to assess operating quality and calibration accuracy of the moisture meter, you may use the manufacturer's warranty services by sending a configuration file to: info@fizepr.ru. This file must be saved immediately after calibration using the software included in the scope of supply (see Section 2.2, Part 2 of the operating manual).

Cause 2: the plant laboratory uses a different method of moisture calculation

There are two main moisture measurement methods as specified in the industry standards:

1) Moisture content is calculated as a ratio between water mass and wet material weight
2) Moisture content is calculated as a ratio between water mass and dry material weight.

FIZEPR-SW100 moisture meters usually use the first method (see Section 2.2, Part 1 of this manual). If measurement by the second method or using moisture volume units is required, calibration tables shall be modified for the selected method and moisture volume units by recalculating table values. Such recalculation can be done unassisted or using the manufacturer's services (warranty service) after moisture meter delivery or at the ordering stage.

Cause 3: an unrepresentative sample is taken for laboratory analysis

When sampling the material for laboratory analysis, the following mandatory condition shall be fulfilled: moisture content in a sample must be equal to the average moisture content in the material volume measured with the moisture meter. The measured volume for **-10.4** and **-10.4x** versions of probe moisture meters ranges from hundreds of liters to one cubic meter. For **-10.21** and **-10.6** versions of moisture meters, the measured volume is tens of liters.

For example, in a standard dispenser, the moisture content of sand prepared for a concrete mixer may differ by 1% or more at different points in volume (about 0.5 cubic meters). Therefore, there are certain features of sampling for laboratory analysis. A representative sample must contain material from different parts of the entire volume, which can be achieved, for example, by repeated gradual discharging material in small doses from a hopper (dispenser). Otherwise, the calculated accuracy of the laboratory analysis will not be achieved and its result cannot be considered reliable.

We can recommend another method for obtaining samples: at least 8...10 samples must be taken from different parts of the volume controlled by the moisture meter. Use the laboratory method for each sample to determine the moisture. Determine the resulting moisture by mathematical averaging. The advantage of this method is that it also allows estimating the accuracy of laboratory analysis by the magnitude of the variation in the sample measurement results.

Cause 4: controlled material has an unstable composition changing over time

The results of measuring the moisture content of bulk materials are affected by the material grain particle-size distribution, fine dust included as an impurity, salt content and bulk density changing over time. All these physical factors may affect material dielectric parameters and standard calibration used by the manufacturer may not be suitable. In this case, it is necessary to create a new calibration based on a comparison of measurement results obtained by the moisture meter with laboratory analysis results. Based on the comparative statistics of moisture meter readings and their corresponding laboratory results, the user can create a new calibration on his own or contact the moisture meter manufacturer.

12. Description of communication protocol

12.1. Digital communication with the moisture meter is carried out via MODBUS RTU protocol with the following parameters:

- Connection speed - 9600, 14400, 19200, 38400; 57600 or 115200 baud
- Parity - none
- Number of stop bits - 2 or 1.

Default communication parameters (factory settings):

- Connection speed – 19200 baud
- Number of stop bits - 2
- Address – 127
- Timeout between requests 100 ms.

12.2. Features of MODBUS RTU protocol implementation:

- Register reading by 03 (03h) command
- Support of echoing back testing 08 (08h) command
- When attempting to read address range that exceeds limits specified in the table, the moisture meter gives no response
- Register record by 16 (10h) command
- Register record is possible only in those registers for which record is allowed. In addition, recording must additionally be allowed by writing the password to 0020 (0014h) register. When trying to record in registers that are read-only or if there is no password, the moisture meter gives no response.

12.3. Table 8 shows MODBUS RTU registers.

Table 8

Register address (DEC)	Register address (HEX)	Description	R/W

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0000	0000	Measured moisture expressed in hundredths of a percent. True humidity must be calculated according to the formula: W = reg[0000] / 100 with an accuracy of 2 decimal places.	R
0001	0001	Temperature in degrees Kelvin. Temperature in degrees Celsius must be calculated according to the formula: t = reg[0001] – 273.	R
0002	0002	Not used	R
0003	0003	Moisture meter firmware version number	R
0007	0007	***For firmware version 33 and earlier.*** Deceleration factor *k* measured by the moisture meter and multiplied by 5000. Deceleration factor is calculated according to the formula: *k* = reg[0007] / 5000 with an accuracy of 4 decimal places.	R
0020	0014	Record protection register	R/W
0163	00A3	Total number of moisture meter calibrations	R
0164	00A4	Number of current calibration	R/W
0224	00E0	Temperature in degrees Celsius. ***(Register value is relevant only for positive temperatures)***	R
0229-0230	00E5-00E6	***For firmware version 34 and later.*** Refined refractive index (x100000). Deceleration factor is calculated according to the formula: *k* = (reg[0230]+reg[0229]*65536) / 100000 with an accuracy of 5 decimal places.	R
0231	00E7	***For firmware version 34 and later.*** Temperature in tenths of Kelvin. Temperature in degrees Celsius must be calculated according to the formula: t = reg[0231] / 10 – 273 with precision in tenths.	R

13. Maintenance check

Table 9 contains the list of main maintenance checks.

Table 9

Checking procedure	Technical specifications
1. Grounding check with an ohmmeter	Transitional resistance value standard for wires and grounding contacts determined by the in-plant regulatory documents and Electrical Installation Code.
2. Insulation resistance check with a megger	Not less than 20 MΩ at relative humidity from 30 to 80% and temperature of 20°C.
3. Visual inspection	See Section 15 "Maintenance".

14. Troubleshooting

14.1. It is allowed to eliminate detected failures directly on site only when the moisture meter is disconnected from the power supply.

14.2. When replacing failed components, strictly follow instructions specified in Section 15 "Maintenance" of this manual.

14.3. Replacing the failed components and checking the moisture meter after the elimination of detected failures must be carried out by a service technician.

14.4. Table 10 contains a list of the most possible failures.

Table 10

Failure description, outer indicators and additional symptoms	Possible cause	Troubleshooting method
1. Power LED is off when the moisture meter is energized. Additional symptoms: - supply voltage at the input of communication line power cable is 24VDC; - power supply circuit current is absent or less than 20 mA.	Broken power wire. Reversing the power wires. Burnt-out FU1 fuse.	Persons responsible for electrical installation and operation of communication lines shall correct the failure in accordance with regulations in force. Disconnect moisture from the grid. Open the cover of the electronic unit and replace the FU1 fuse.
2. Power LED is off when the moisture meter is energized.	Short circuit in the moisture meter power supply circuit	Persons responsible for electrical installation and operation of communication lines, as well as for moisture meter operation, shall correct the failure in accordance with regulations in force.
3. No connection with the moisture meter.	Breakdown or reversal of the communication cable, incorrect network settings of the moisture meter	Persons responsible for electrical installation and operation of communication lines, as well as for moisture meter operation, shall correct the failure in accordance with regulations in force. If cable is OK, but there is still no connection, check network settings of the moisture meter. Press and hold "Reset" button for at least 5 seconds to reset moisture meter network settings (restore default network settings). The button is located on the bottom board of the electronic unit under the cut in the top board. Button location is shown in Appendix 31 and marked with an arrow.

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15. Maintenance

15.1. General instructions.

15.1.1. Maintenance is carried out to ensure normal operation and preserve the operational and technical characteristics of the moisture meter throughout its service life.

15.1.2. Maintenance is the systematic monitoring of the moisture meter technical condition, regular technical inspection and elimination of any failures.

15.1.3. After troubleshooting, check the moisture meter technical state for normal operation.

15.2. Types and frequency of maintenance.

15.2.1. Depending on frequency and scope of work the following maintenance types are specified as listed in Table 11.

Table 11

Maintenance types	Frequency	Person responsible for maintenance
1. Scheduled maintenance: - weekly maintenance - preventative maintenance	 Once a week Every six months	 Operator handling the moisture meter Specialist handling the moisture meter
2. Unscheduled maintenance	When a moisture meter failure is detected	Specialist handling the moisture meter

15.2.2. Dates of preventive maintenance can be changed and brought in line with the production plans and terms adopted at the plant operating moisture meters. . At the same time, preventative maintenance frequency shall be at least once a year.

15.2.3. Weekly maintenance includes a visual inspection to ensure:

- Reliability of connection, as well as the absence of breaks or damage of the connecting cable insulation.
- Absence of dents and visible mechanical damage to the moisture meter enclosure.

15.2.4. During preventive maintenance, the following works shall be carried out:

- Removal of dust and dirt from external surfaces of the electronic unit and the moisture meter sensor.
- Visual inspection.
- Checking the status of communication cables and connecting wires.
- Measurement of current consumption and supply voltage.

15.2.5. Unscheduled maintenance is carried out in case of failure and includes moisture meter repair.

16. Storage and transportation

Moisture meter storage and transportation conditions are in accordance with GOST 15150-69 for Groups 3 and 5, respectively.

16.1. The moisture meter components in the manufacturer's package can be stored under conditions of heated hard-wall rooms with the air free from acid vapors, alkalis and other hazardous substances that cause corrosion.

16.2. Moisture meter shelf life in the manufacturer's package is 1 year.

16.3. The moisture meter packed in a shipping container can be transported by any means of transport in closed vehicles at any distance.

16.4. Transportation must be carried out with all precautionary measures. Boxes with packaging must not be thrown or turned over.

17. Recycling

17.1. The moisture meter contains no precious metals or other substances subject to mandatory recycling.

17.2. The moisture meter is not dangerous to human life and health, as well as the environment. After the end of the service (operation) life, it can be disposed according to the technology adopted by the company operating the moisture meter.

18. Moisture meter verification

18.1. The need for initial verification depends on the planned application. For devices used for process control, initial verification may not be performed. The need for initial verification is determined by the moisture meter customer. Initial verification is performed when the moisture meter is released from production and after repair works.

18.2. While in service, periodic verification of the moisture meter that has passed initial verification shall be performed at least once a year.

18.3. Unscheduled verification of the moisture meter is carried out:

- After repair
- When moisture meter operability must be proved
- When the seal is damaged and documents confirming periodic verification of the moisture meter are missing.

18.4. Verification of the moisture meter after elimination of failures that do not affect its metrological characteristics (replacement of fuses, wires or connectors) is not performed.

18.5. It is only allowed to use instruments that have passed metrological certification and meet the measuring instrument accuracy regulations.

18.6. Verification of moisture meters is carried out according to the document "Moisture Analyzers FIZEPR-SW100. Verification Method MP242-1715-2014" approved by the State Centre for Testing Measuring Instruments FSUE D.I. Mendeleyev Institute for Metrology (VNIIM) on March 16, 2014.

Verification of moisture meters designed to measure oil and oil products is carried out according to the document "Instructions of the State System for Ensuring Uniform Measurement. Moisture Analyzer (Moisture Meter) FIZEPR-SW100. Verification Method MP 0919-6-2018" approved by FSUE All-Russian Research Institute for Flow Metering (VNIIR) on November 15, 2018.

19. Warranty

Warranty period is at least 24 months from the date of delivery to the customer.

Warranty obligations are subject to the conditions and rules of operation, transportation and storage specified in this operating manual.

20. Appendices

List of appendices

1. Sensors of moisture meters VIGT.415210.100-10.6 and VIGT.415210.100-10.21 for bulk materials
2. Design of the sensor VIGT.415210.100-10.6 (- 10.21) equipped with a flat-topped probe for bulk materials
3. Sensor VIGT.415210.100-10.6 equipped with a flat-topped probe, probe installation in the panel
4. Explosion-proof moisture meter VIGT.415210.100-10.16 for bulk materials featuring high electrical conductivity
5. Sensor of the moisture meter VIGT.415210.100-10.5 for bulk materials on a conveyor belt
6. Sensor VIGT.415210.100-10.4 (-10.41) equipped with a probe made as a straight rod
7. Sensor of the moisture meter VIGT.415210.100-10.4 for bulk materials in hoppers
8. Sensor of the moisture meter VIGT.415210.100-10.4 (front coupling)
9. Sensor of the moisture meter VIGT.415210.100-10.4 (latch-in rear coupling)
10. Installation option of the moisture meter sensor VIGT.415210.100-10.4
11. Sensor of the moisture meter VIGT.415210.100-10.41 for bulk materials
12. Sensor of the moisture meter VIGT.415210.100-10.41 (coupling design)
13. Sensors VIGT.415210.100-11.32 and -11.33
14. Sensor of the moisture meter VIGT.415210.100-11.41 for hoppers with grain
15. Sensor of the moisture meter VIGT.415210.100-11.41, drawing of installation options in a hopper
16. Sensor of the moisture meter VIGT.415210.100-12
17. Sensors of moisture meters VIGT.415210.100-17 and -17.1
18. Moisture meters FIZEPR-SW100 VIGT.415210.100-20.5 and -20.6
19. Sensor of the moisture meter VIGT.415210.100-20.5, outline drawing
20. Sensor of the moisture meter VIGT.415210.100-21.02
21. Moisture meter VIGT.415210.100-21.051
22. Sensor of the moisture meter VIGT.415210.100-22.x, outline drawing
23. Sensor of the moisture meter VIGT.415210.100-23.01 for steam humidity control at extreme temperatures and pressures
24. Sensor of the moisture meter VIGT.415210.100-24.x, outline drawing and photo
25. Sensor of the moisture meter VIGT.415210.100-25.x, outline drawing for DN25...50 mm
26. Sensor of the moisture meter VIGT.415210.100-25.9 (-25.12), outline drawing
27. Moisture meter VIGT.415210.100-27.4 for materials with high electrical conductivity (version equipped with a transverse probe)
28. Moisture meter VIGT.415210.100-27.6 for materials featuring high electrical conductivity (version equipped with a longitudinal probe)
29. Sensor of the laboratory moisture meter VIGT.415210.100-30.1
30. Sensors of the laboratory moisture meter VIGT.415210.100-30.2 and -30.26
31. Three versions of electronic units

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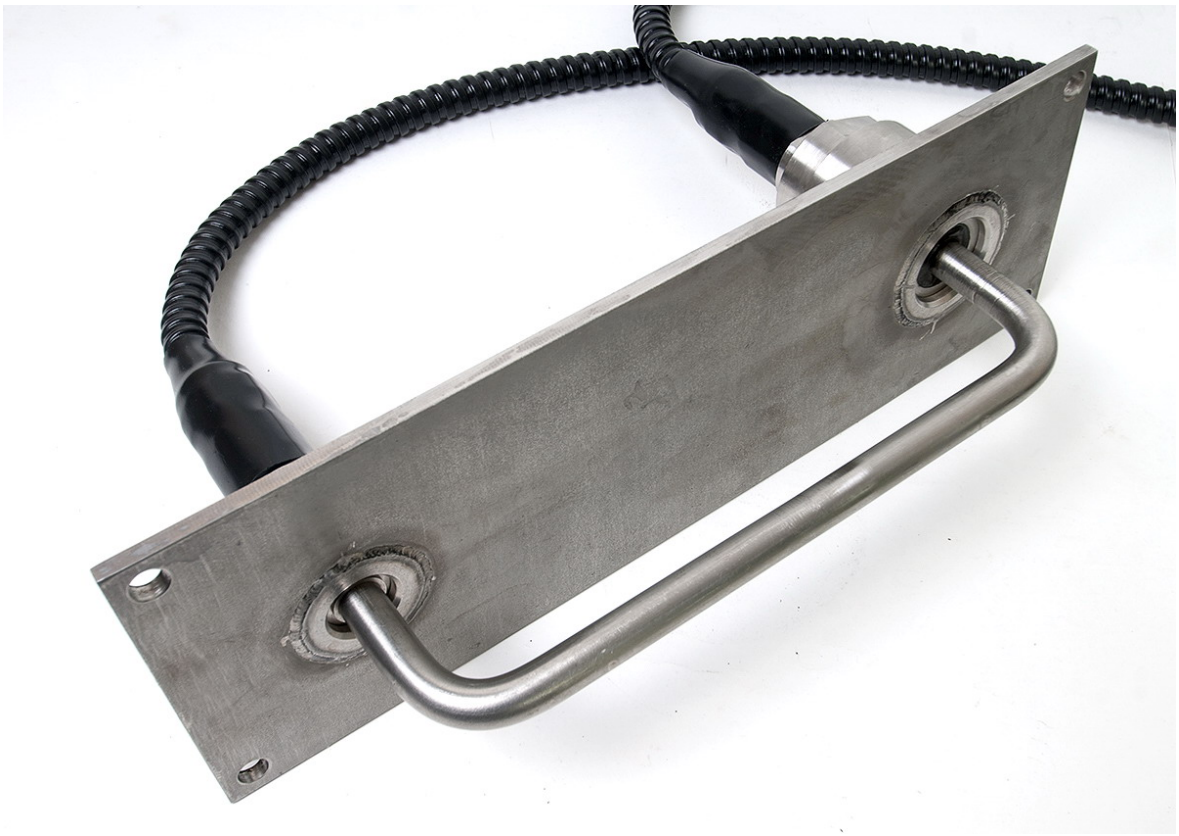
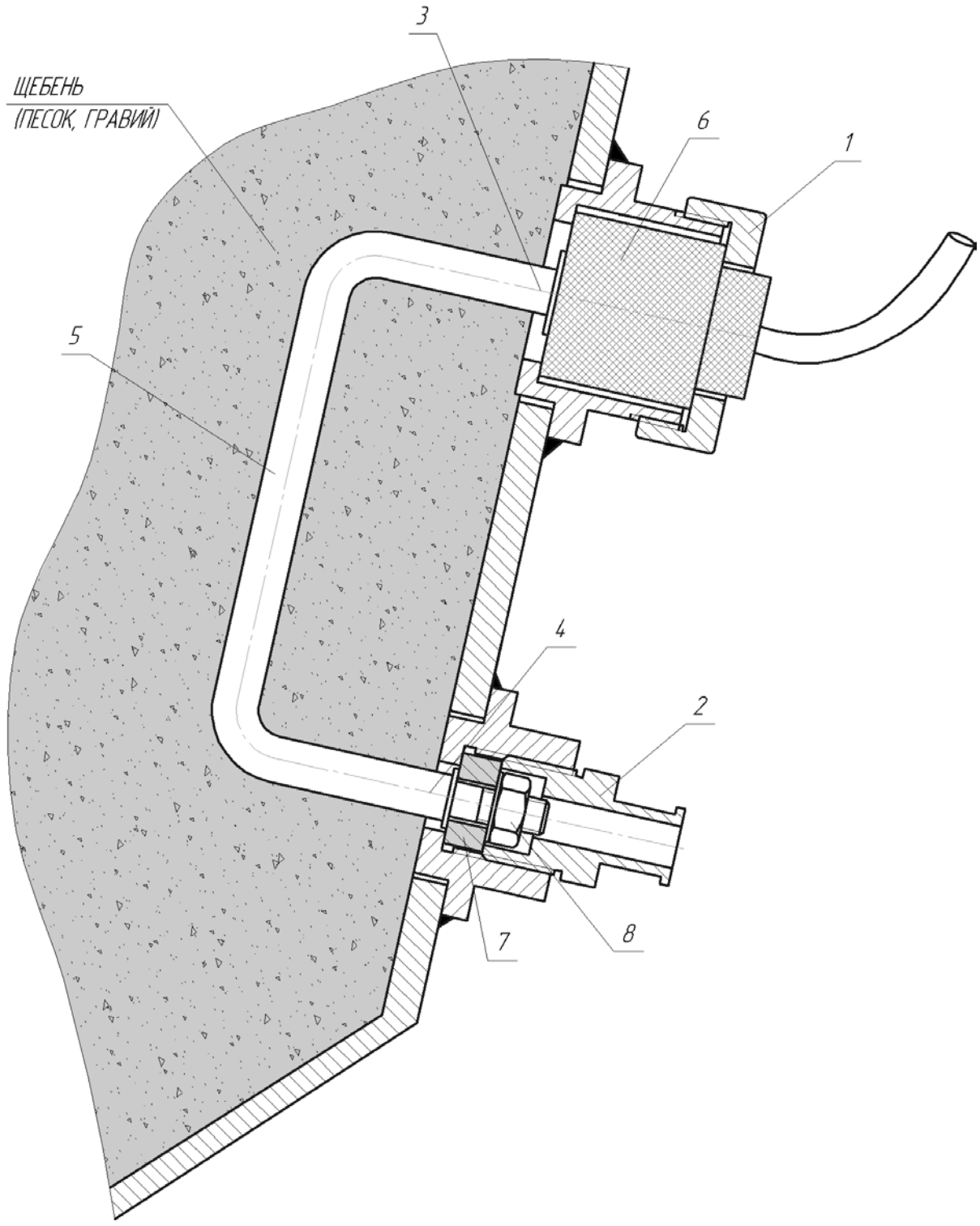
Sensors of moisture meters VIGT.415210.100-10.6 and VIGT.415210.100-10.21 for bulk materials



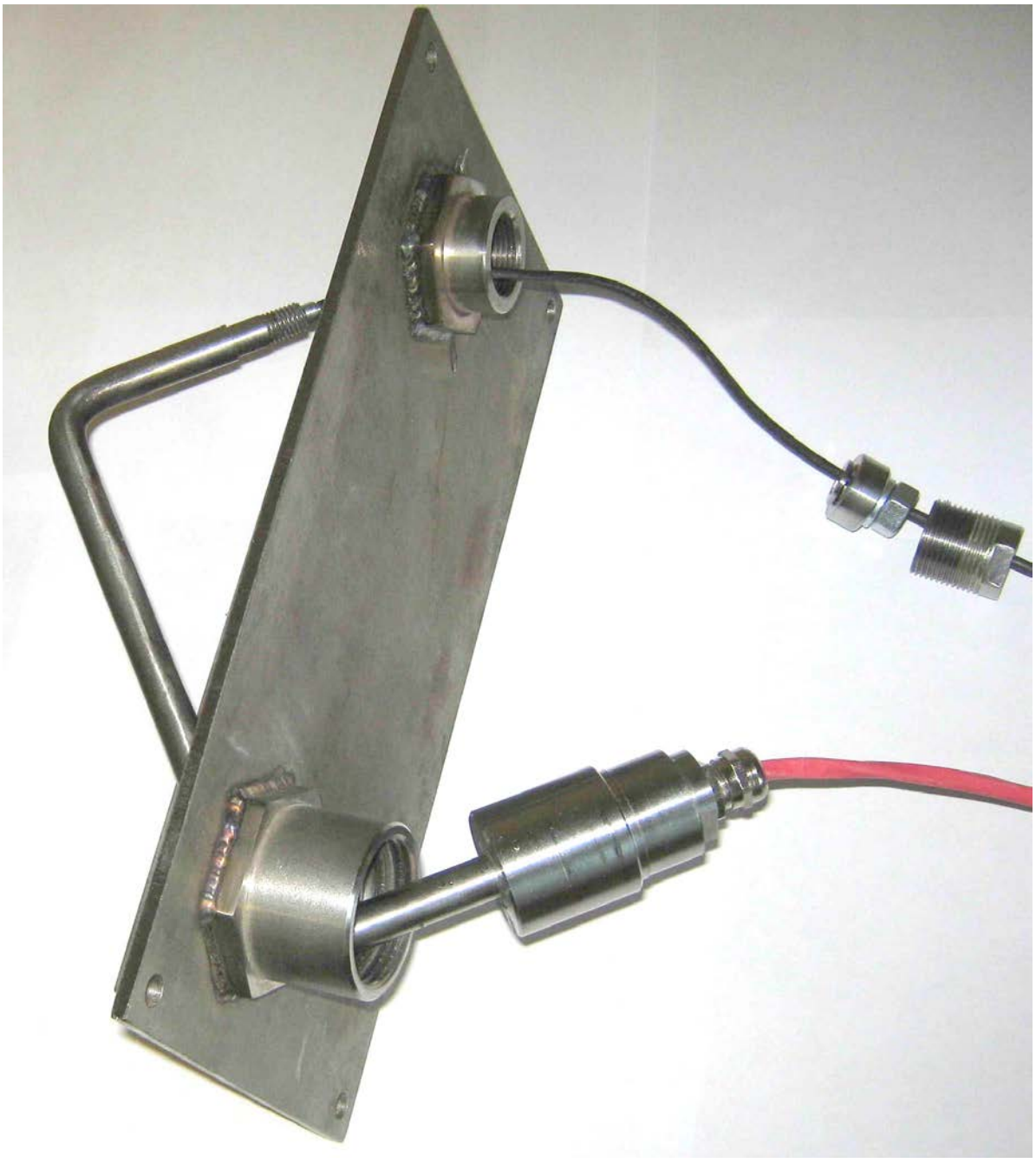
Sensor VIGT.415210.100-10.6

Sensor VIGT.415210.100-10.21

Design of the sensor VIGT.415210.100-10.6 (-10.21) equipped with a flat-topped probe for bulk materials

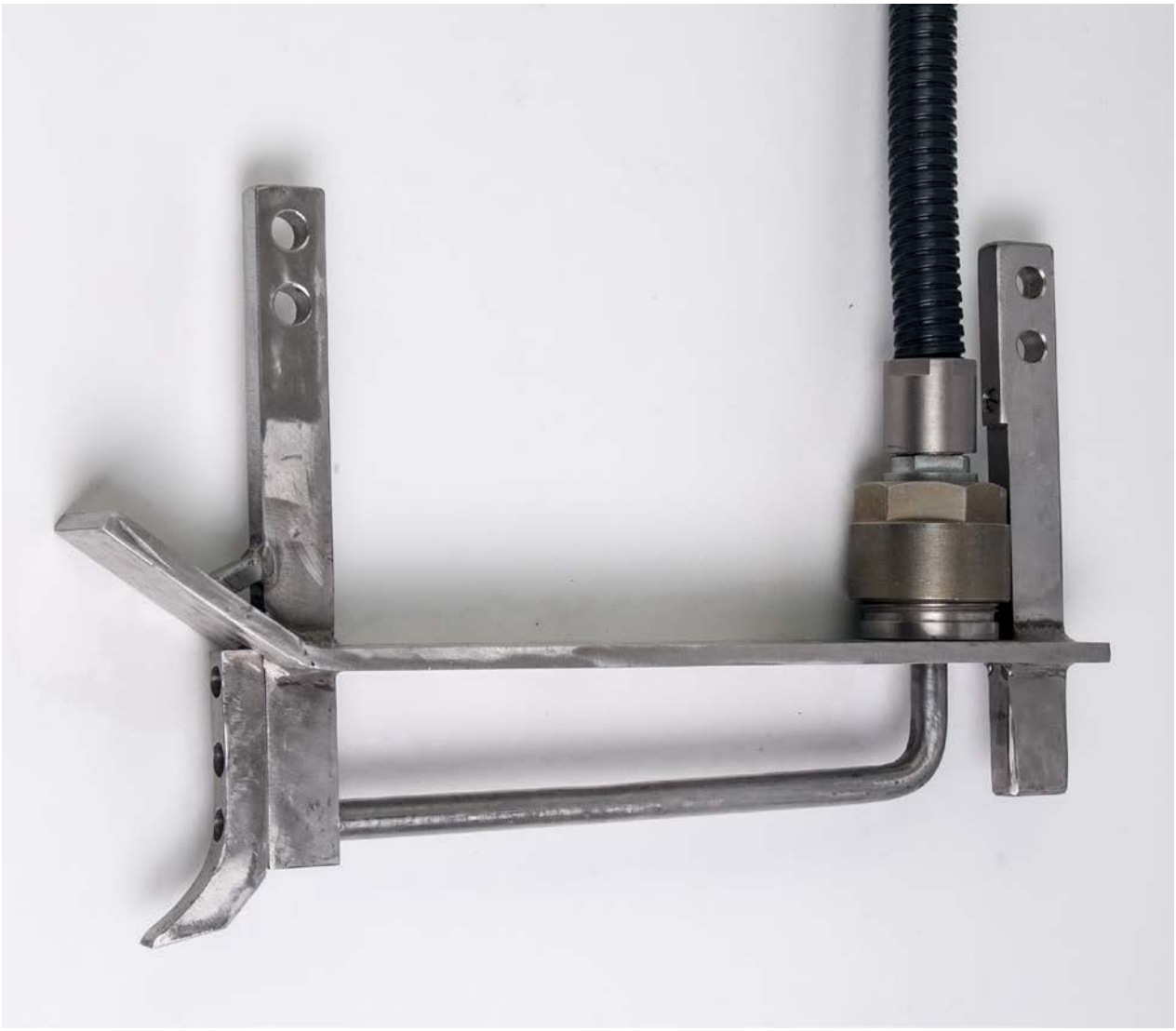


Sensor VIGT.415210.100-10.6 equipped with a flat-topped probe, probe mounting in the panel

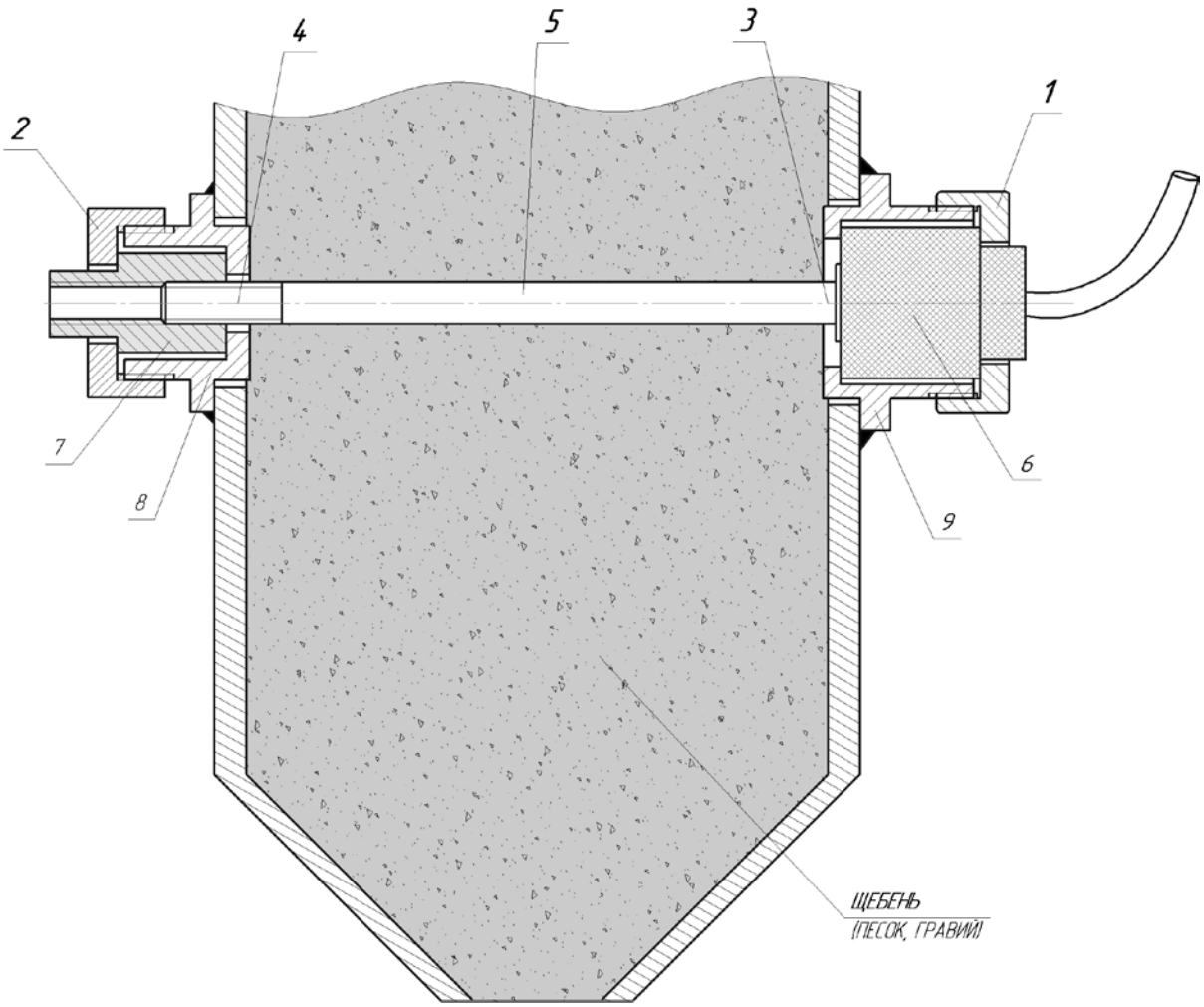


Moisture meter VIGT.415210.100-10.16 (explosion-proof version) for bulk materials featuring high electrical conductivity

Sensor of the moisture meter VIGT.415210.100-10.5 for bulk materials on a conveyor belt



Sensor VIGT.415210.100-10.4 (-10.41) equipped with a probe made as a straight rod



Sensor of the moisture meter VIGT.415210.100-10.4 for bulk materials in hoppers

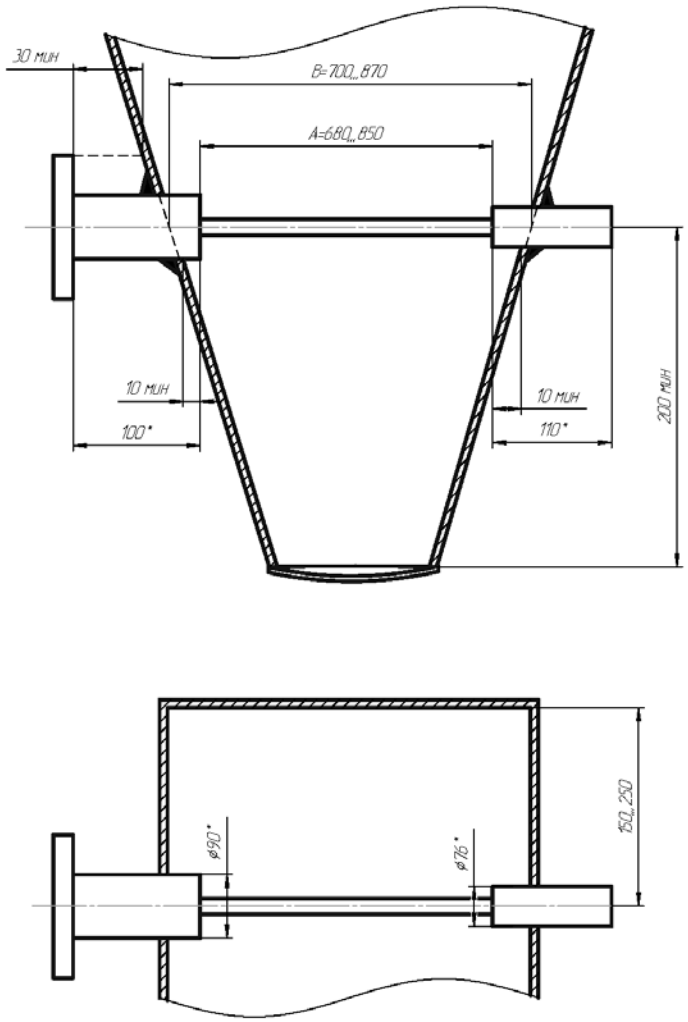
Sensor of the moisture meter VIGT.415210.100-10.4
(front coupling)

Probe with a front coupling and flange assembly

Probe with a front coupling,
assembly appearance before probe flanging

Sensor of the moisture meter VIGT.415210.100-10.4 (latch-in rear coupling)

Installation option of the moisture meter sensor VIGT.415210.100-10.4



1.* Размеры для справок.
2. Допустимо размер А уменьшить до 400 мм, при этом на штыре следует продлить резьбу М27х2.
ОБРАТИТЕ ВНИМАНИЕ! При выполнении резьбы датчик следует закреплять только за штырь.

Sensor of the moisture meter VIGT.415210.100-10.41 for bulk materials

Sensor of the moisture meter VIGT.415210.100-10.41 (coupling design)

Front coupling assembly

Disassembled front coupling before probe fixing

Disassembled rear coupling

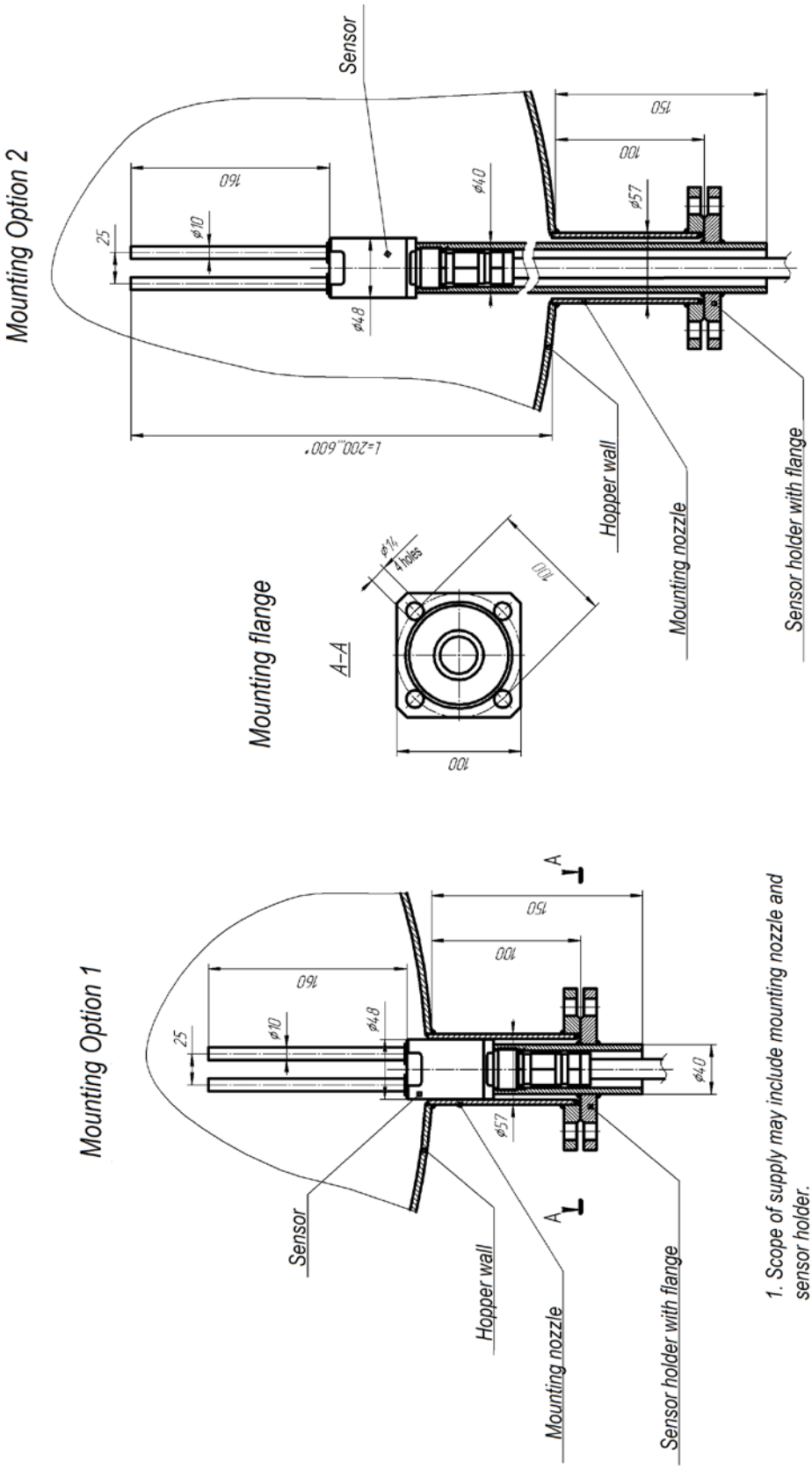
Sensors VIGT.415210.100-11.32 and -11.33

Sensor VIGT.415210.100-11.32

Sensor VIGT.415210.100-11.33 for conveyors

Sensor of the moisture meter VIGT.415210.100-11.41 for hoppers with grain

Sensor of the moisture meter VIGT.415210.100-11.41, drawing of installation options in a hopper



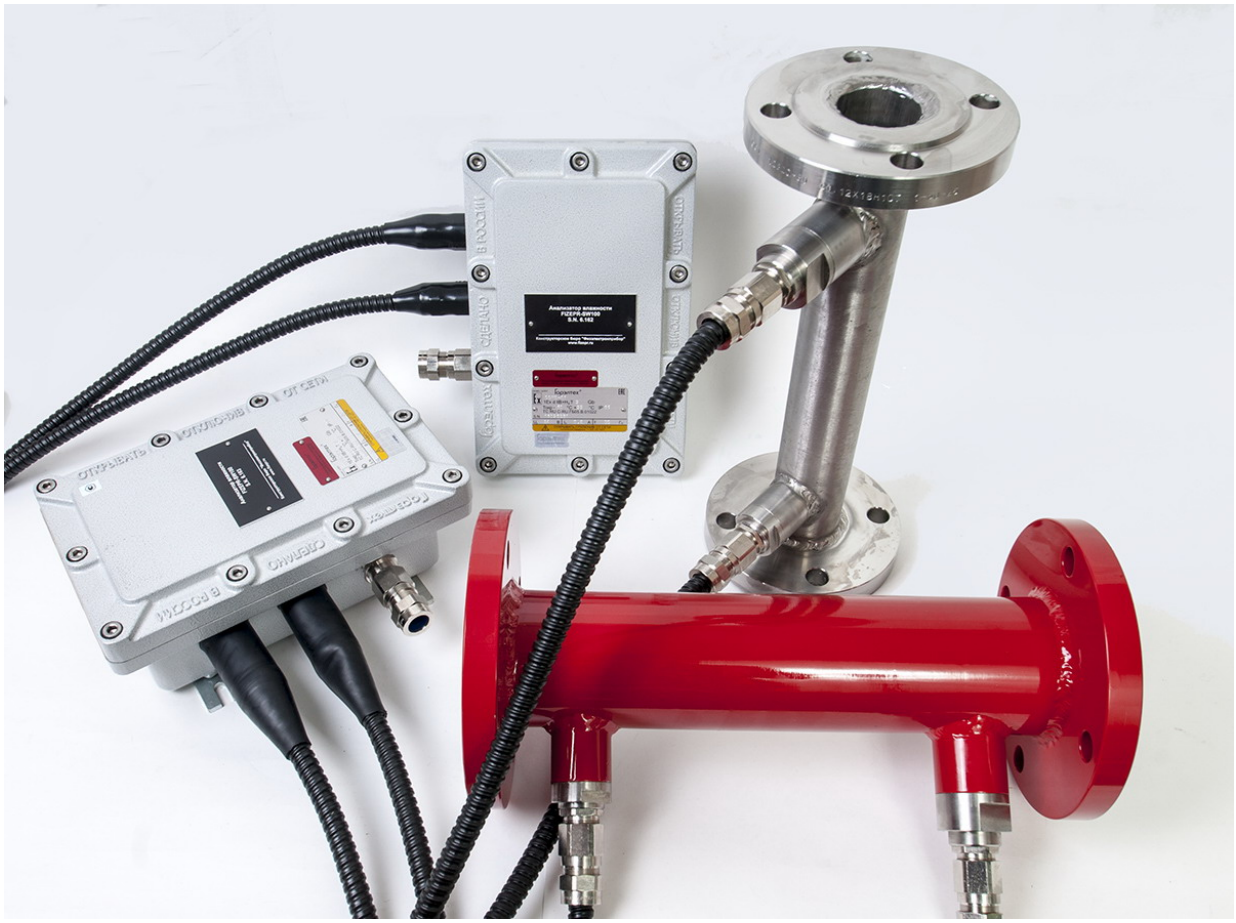
Sensor of the moisture meter VIGT.415210.100-12

Sensors of moisture meters VIGT.415210.100-17 and -17.1

Sensor VIGT.415210.100-17 with fasteners

Sensors VIGT.415210.100-17 and -17.1

Moisture meters FIZEPR-SW100 VIGT.415210.100-20.5 and -20.6



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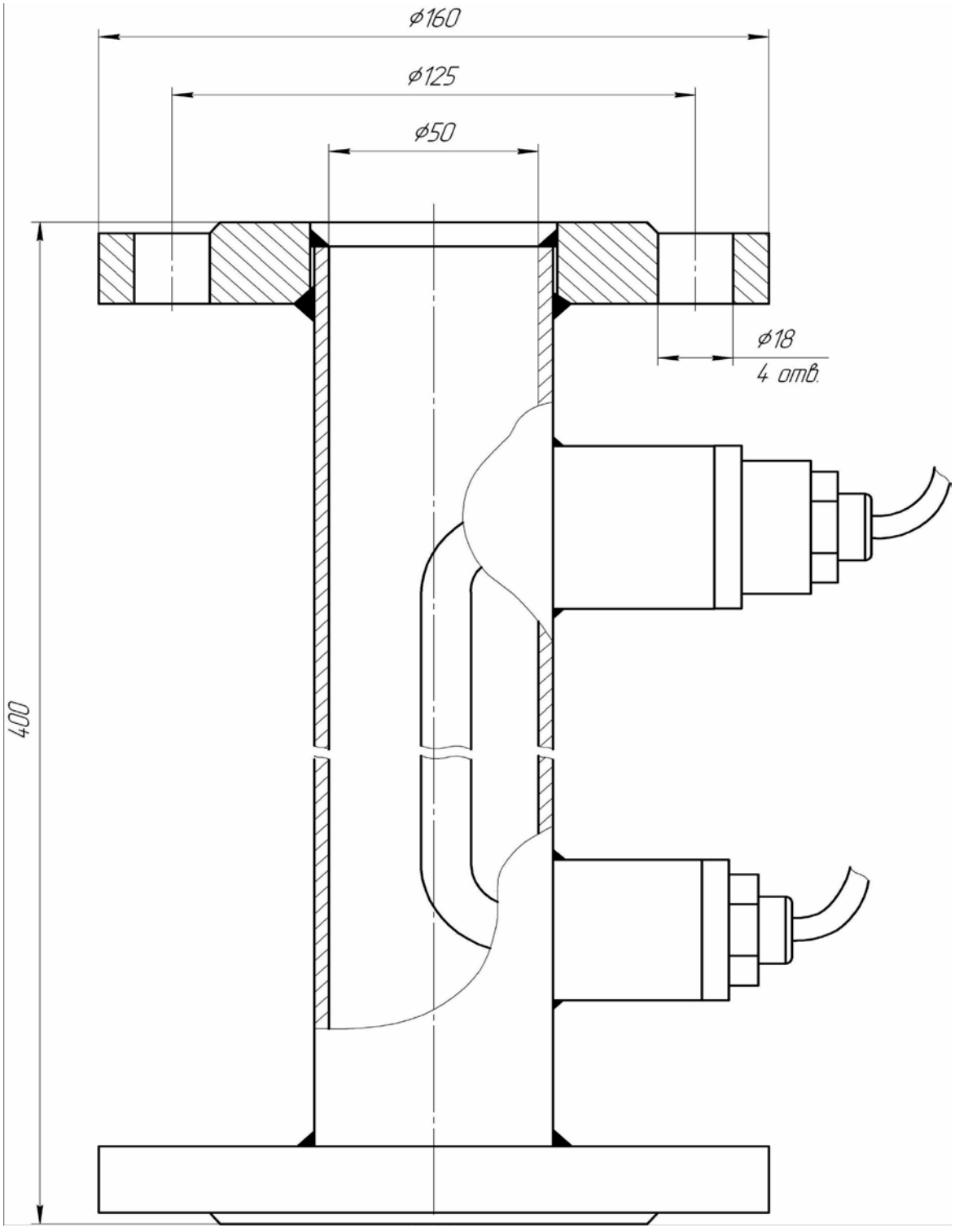
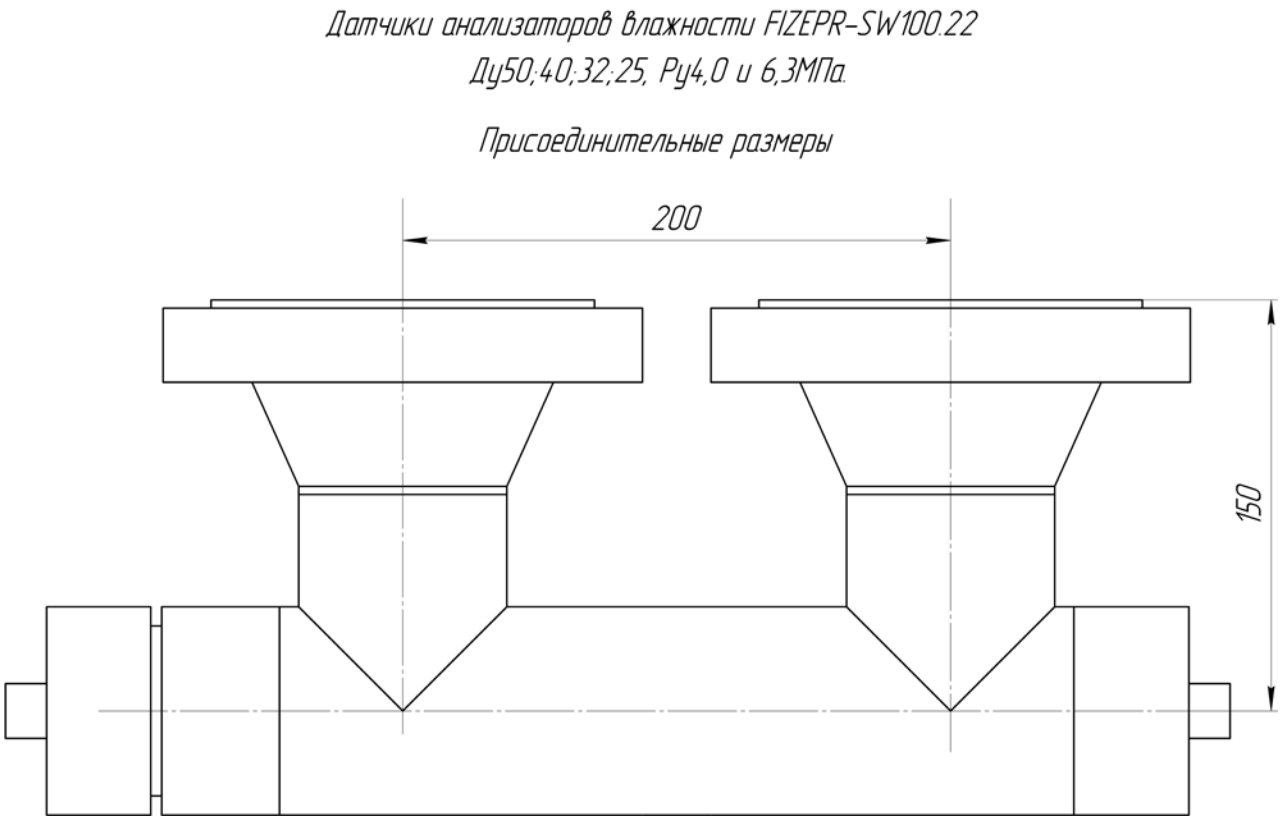
Sensor of the moisture meter VIGT.415210.100-20.5, outline drawing



Sensor of the moisture meter VIGT.415210.100-21.02

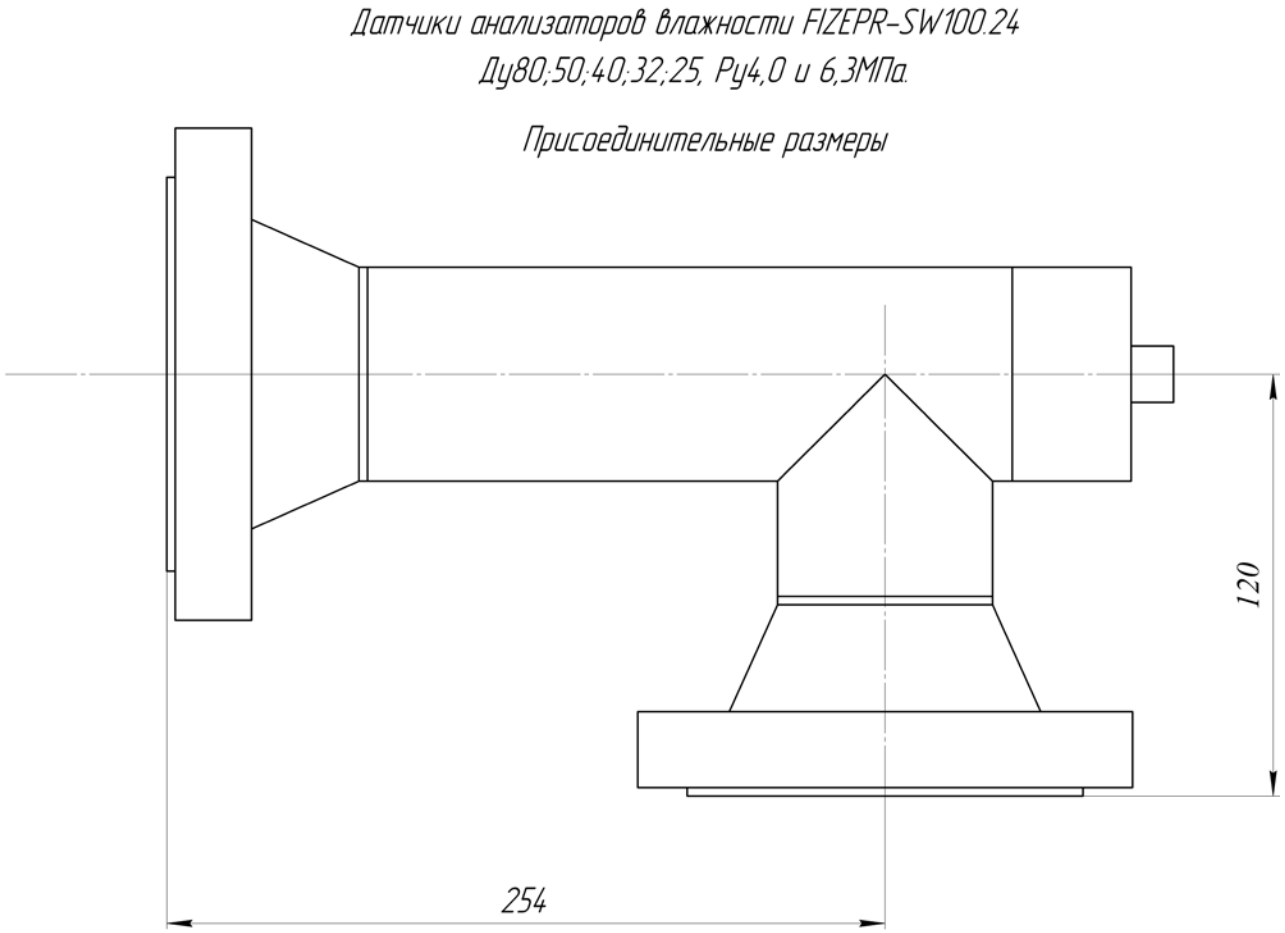
Moisture meter VIGT.415210.100-21.051

**Sensor of the moisture meter VIGT.415210.100-22.x,
outline drawing**

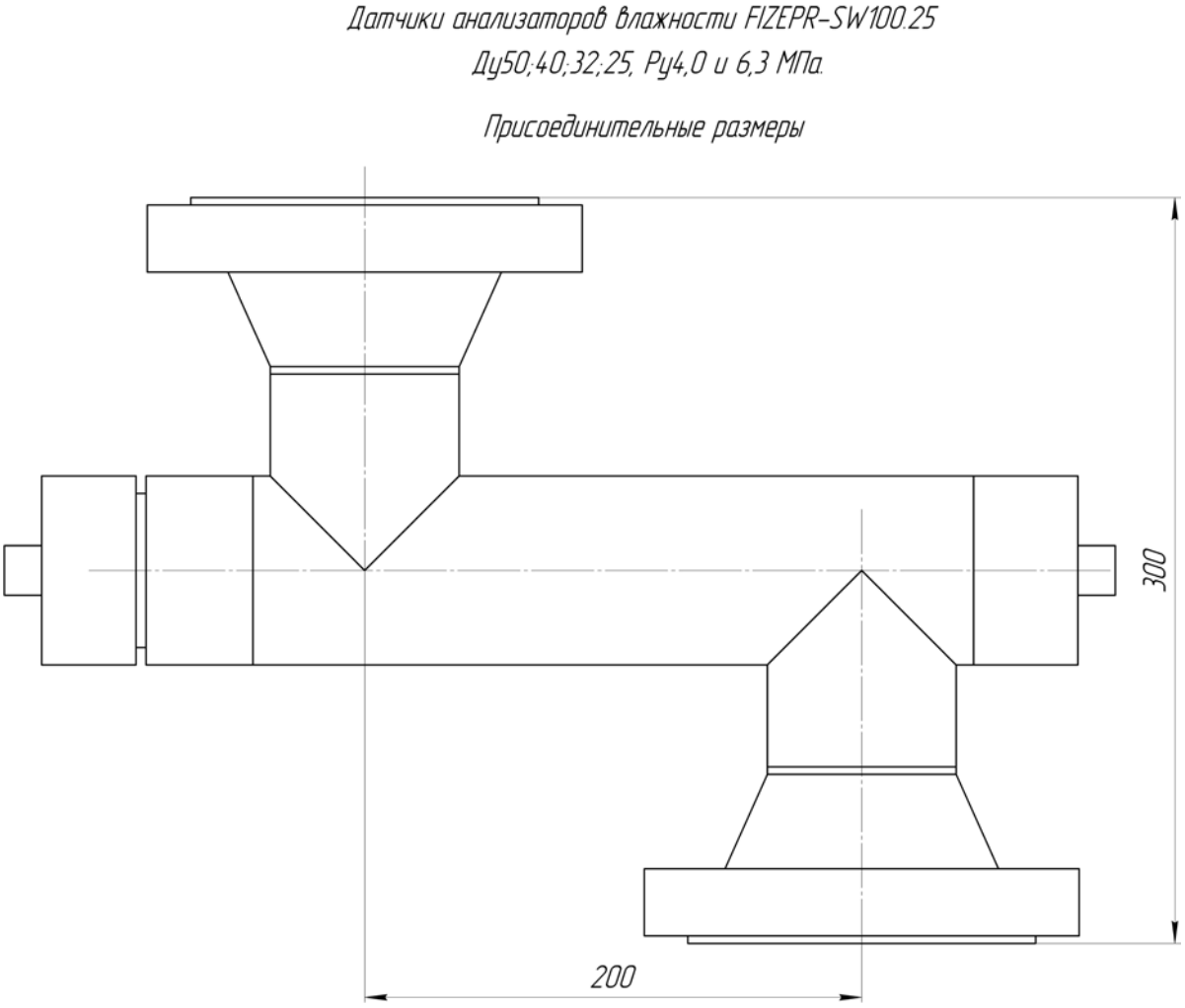


Sensor of the moisture meter VIGT.415210.100-23.01
for steam humidity control
at extreme temperatures and pressures

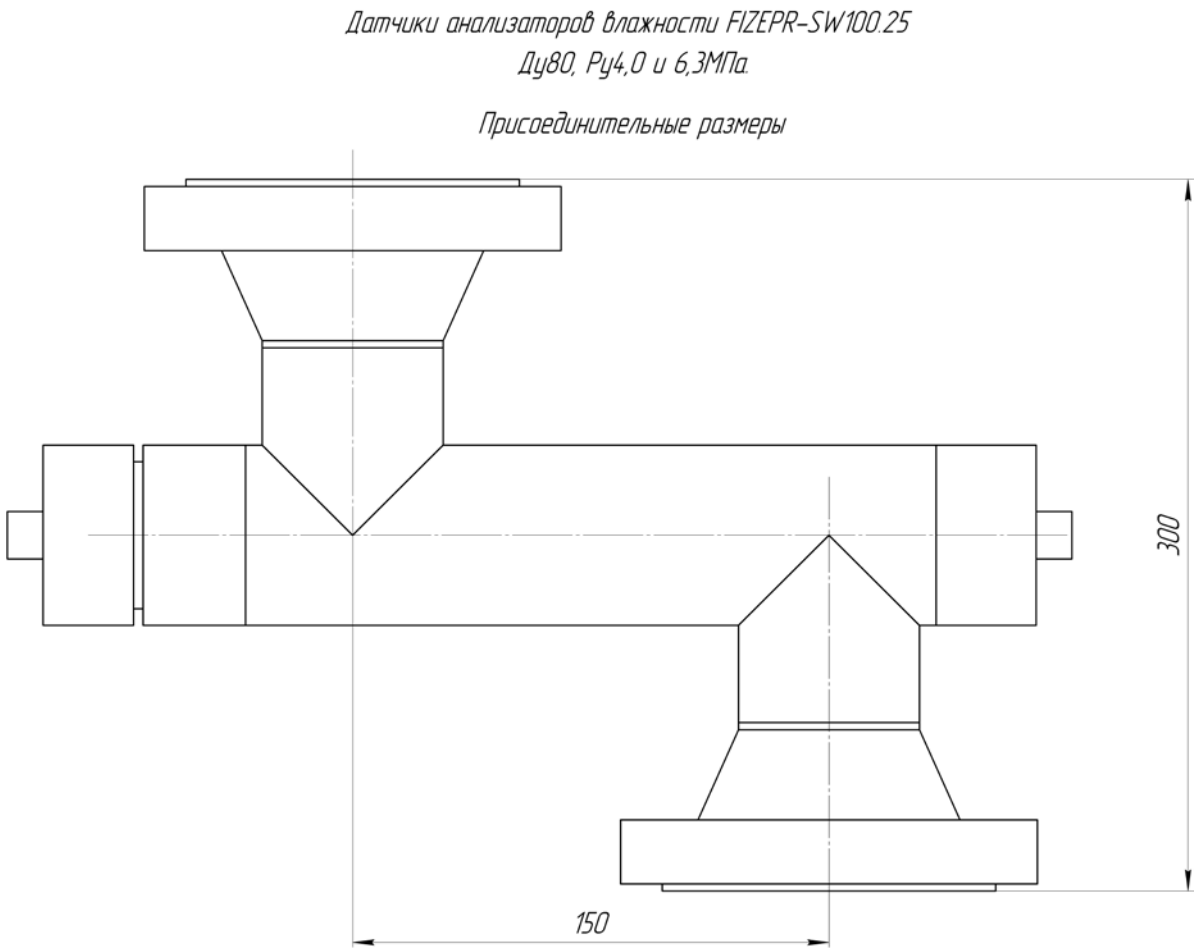
Sensor of the moisture meter VIGT.415210.100-24.x, outline drawing and photo



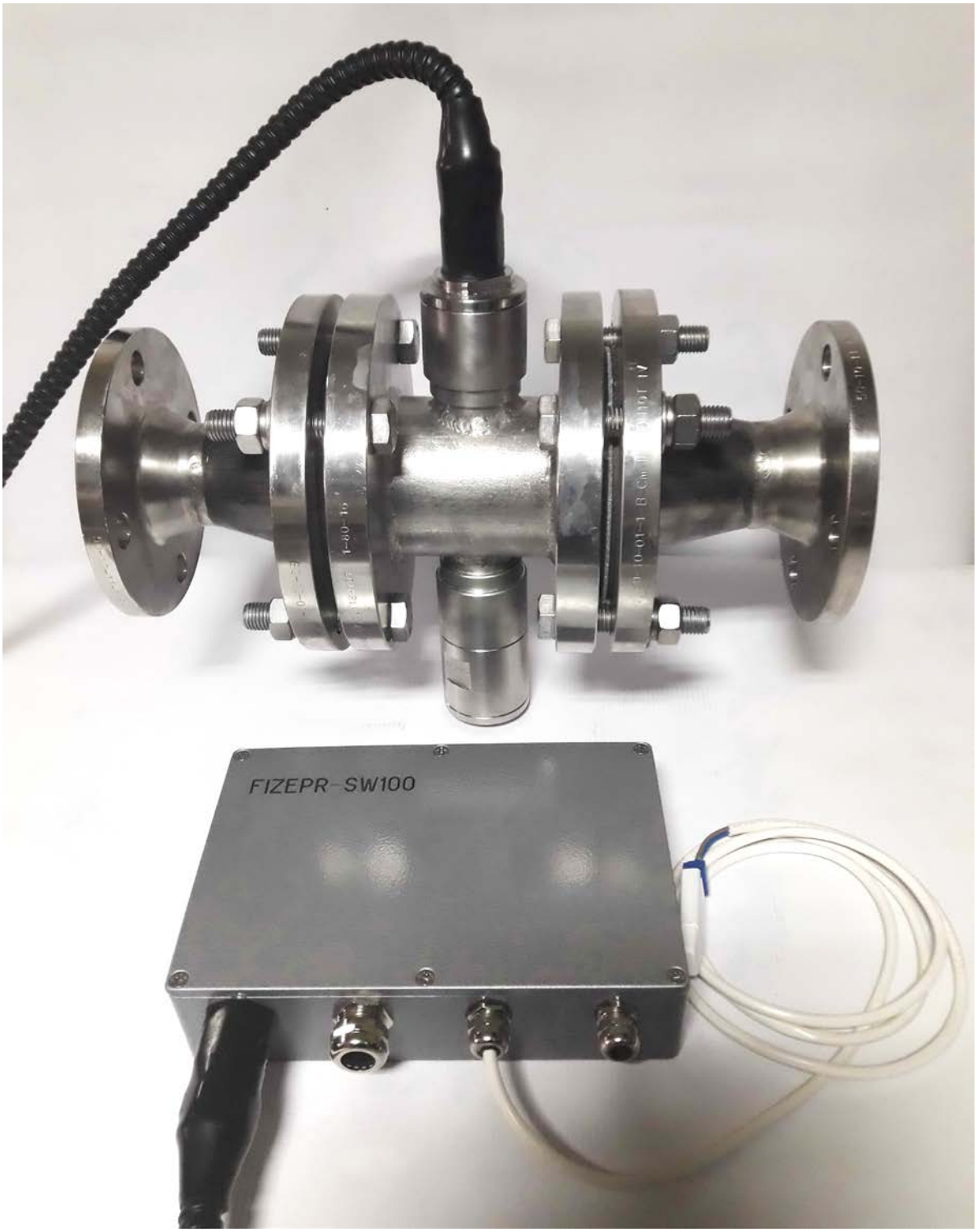
**Sensor of the moisture meter VIGT.415210.100-25.x,
outline drawing for DN25…50 mm**



Sensor of the moisture meter VIGT.415210.100-25.9 (-25.12), outline drawing



Moisture meter VIGT.415210.100-27.4 for materials featuring high electrical conductivity (version equipped with a transverse probe)



Moisture meter VIGT.415210.100-27.6 for materials featuring high electrical conductivity (version equipped with a longitudinal probe)

Tel. +7(846)925-63-53, 244-89-51, 952-83-82
http://www.fizepr.ru

Sensor of the laboratory moisture meter VIGT.415210.100-30.1

Sensors of the laboratory moisture meters VIGT.415210.100-30.2 and -30.26

Sensor VIGT.415210.100-30.2

Sensor VIGT.415210.100-30.26

Three versions of electronic units

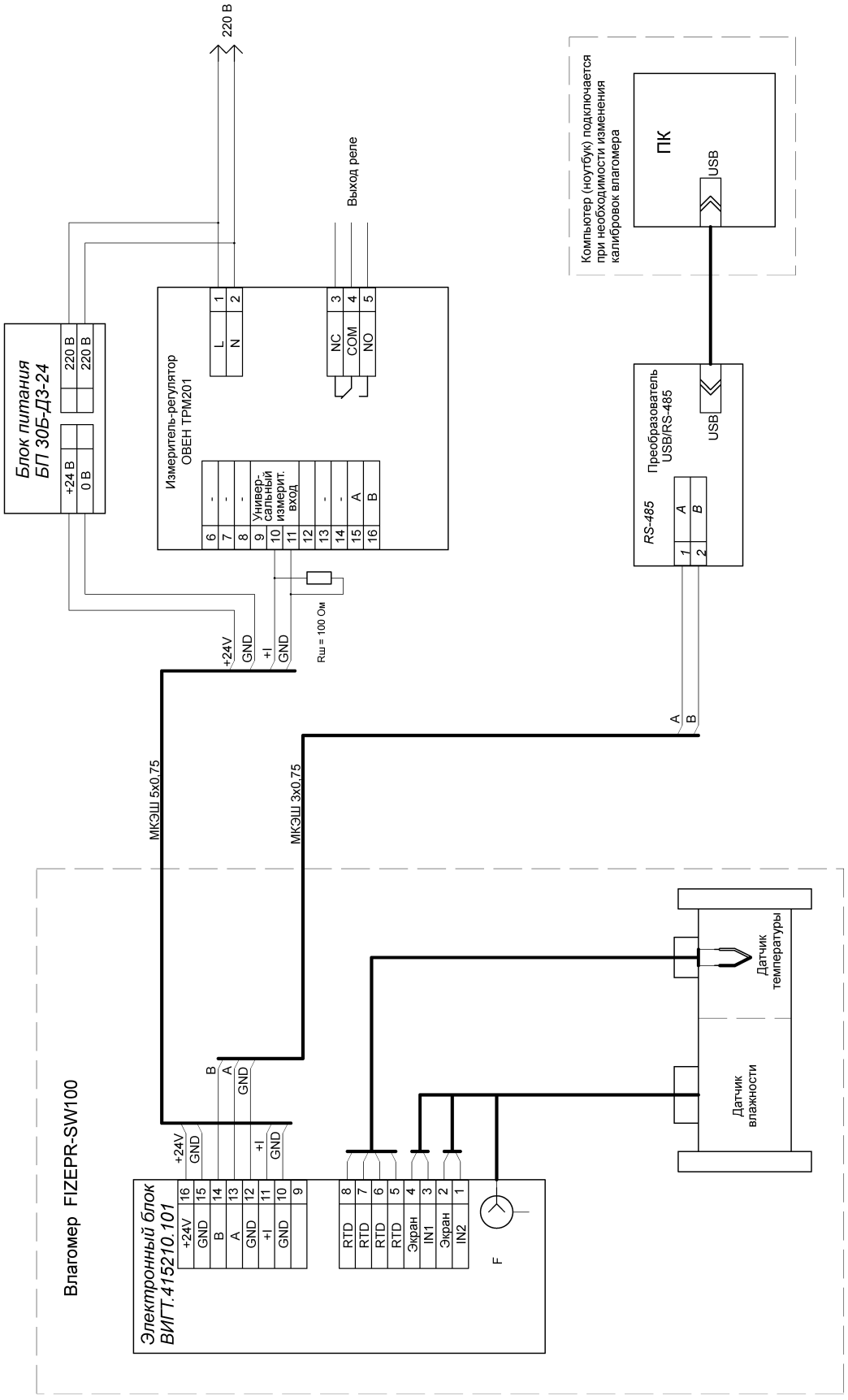
Unit VIGT.415210.101 of a general-purpose industrial version

Unit VIGT.415210.101-01 of a general-purpose industrial version with connectors

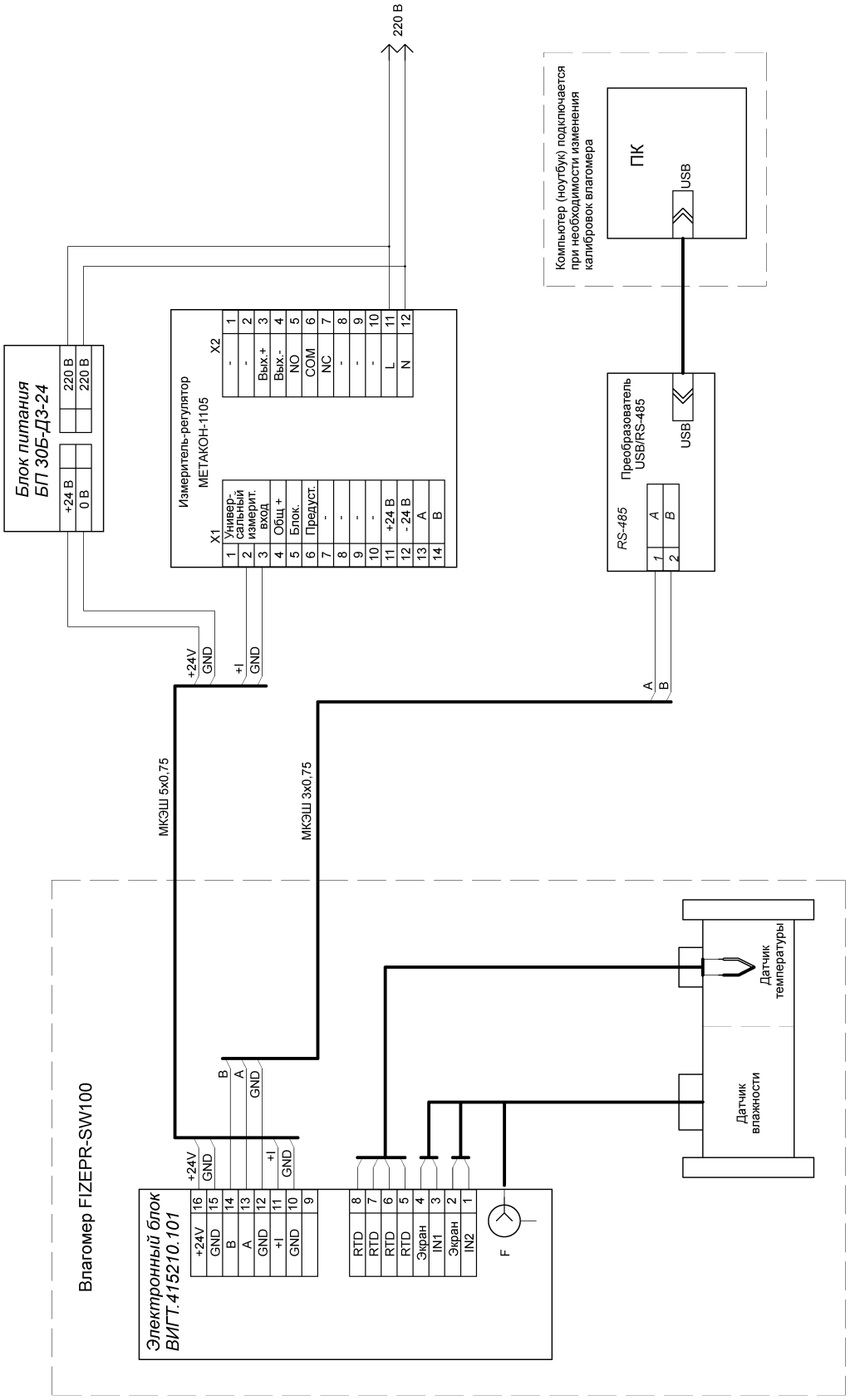
Unit VIGT.415210.101-02 in explosion-proof housing 1ExdIIBT5

Appearance of the electronic unit VIGT.415210.101-02 in 1ExdIIBT5 explosion-proof enclosure with the top cover removed

Wiring diagram for moisture meter FIZEPR-SW100 connection to external circuits (OWEN TRM201 measuring and regulating device as an indicator)



Wiring diagram for moisture meter FIZEPR-SW100 connection to external circuits (METAKON-1105 measuring and regulating device as an indicator)



Setting actuation parameters for the OWEN TRM-201 measuring and regulating device relay

The following example shows how to program the measuring and regulating device in order to control the water valve depending on the moisture content in diesel oil emulsion.

Let us consider the following case:

The water valve must be closed if moisture content in diesel oil emulsion rises to 15% or higher;

If moisture content in emulsion drops to 10% or lower, the water valve must be opened.

For this case the OWEN-TRM201 measuring and regulating device is set as follows: **threshold - 12.5%; hysteresis - 2.5%.**

1. ***Selection of the trigger threshold*** (trigger threshold value is displayed on the lower green display).

1.1. The required trigger threshold can be set with "up" and "down" arrow buttons. We set the threshold value of 12.5 (press and hold to speed up searching process).

1.2. Briefly press "PROG." button.

2. Hysteresis setting

2.1. Enter the menu by pressing and holding "PROG." button for 3 - 6 sec.
The upper display will indicate the 'nEnU' caption (the first letter is 'n' with an overscore); the lower display shall indicate the 'LuōP' caption (menu items are indicated on the green display).

2.2. Press "Up" button repeatedly to find 'LuōU' menu item.

2.3. Briefly press "PROG." button ('SL.L' caption appears on the upper red display).

2.4. Press (repeatedly) "PROG." button to find a submenu item labeled 'HYS' on the upper red display.

2.5. Use "up" and "down" arrow buttons to set the required hysteresis value. We set the value of **2.5.**

2.6. Briefly press "PROG." button.

2.7. To exit to the initial menu:

2.7.1. Press and hold "PROG." button until the following captions appear: 'nEnU' – on the upper red display (the first letter is 'n' with an overscore), 'LuōU' – on the lower display).

2.7.2. Use "down" arrow button to find 'LuōP' menu item.

2.7.3. Press "PROG." button (switch to indication mode: the red display shows the measured parameter value, the green display shows the trigger threshold).

3. Setting relay actuation method

Go through Sections 2.1 - 2.3.

3.1. Briefly press "PROG." button until the 'CnP' caption appears ('n' letter with an overscore) on the upper display.

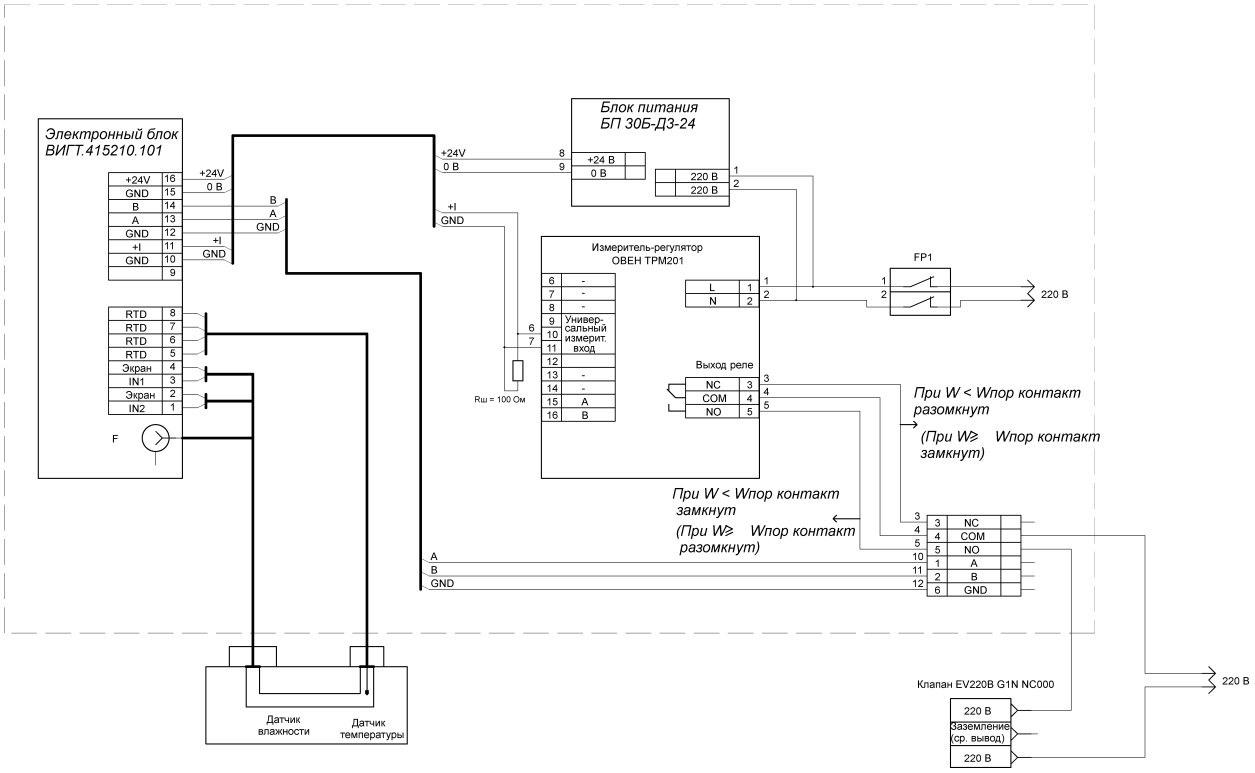
3.2. Use arrow buttons to select parameter value: 1. If 1 is selected, the relay is actuated (relay contacts 3,4 are open, the valve is open) if the moisture value is below 10%, and disabled (valve closed) if the moisture value is above 15%.

Note. When the specified parameter value is set to 2, the relay is disabled if moisture drops below the threshold, and actuated if moisture exceeds the threshold.

3.3. Briefly press "PROG." button.

3.4. Go through Section 2.7.

Please note that if zero voltage is applied to the valve, water supply is cut off. The valve is connected to normally open relay contacts (5, 6) in accordance with the diagram below.



Wiring diagram for moisture meter FIZEPR-SW100 connection
to control water supply valve (normally closed valve)

Measurement Reliability Evaluation Report

Sampling time and date	Material temperature, ˚C	Moisture measured with the moisture meter, %	Moisture measured in laboratory, %	Difference in readings, %	Remarks