



Scientific production enterprise



Electronic manometers ЭKM-2005

Operating Manual
HKГЖ.406233.053РЭ



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1. INTRODUCTION

1.1. Operating Manual contains information on the design, operating principle, and characteristics of ЭКМ-2005 electronic manometers and instructions necessary for their proper and safe operation.

2. DESCRIPTION AND OPERATION

2.1 Products application

2.1.1 ЭКМ-2005 electronic manometers (hereinafter referred to as ЭКМ) are designed to measure and control the values of absolute pressure, gauge pressure, gauge-and-vacuum pressure and pressure difference of liquid and gaseous (including corrosive) media.

ЭКМ are used in systems for automatic monitoring, adjustment and control of technological processes.

ЭКМ may include a converter of the measured quantity into a unified 0-5, 0-20 or 4-20 mA output current signal.

ЭКМ are available in the following designs:

- ЭКМ-2005-ДА – absolute pressure manometers;
- ЭКМ-2005-ДИ – gauge pressure manometers;
- ЭКМ-2005-ДИВ – gauge-and-vacuum pressure manometers;
- ЭКМ-2005-ДД – differential pressure manometers;
- ЭКМ-2005-ДФ – hydrostatic pressure manometers.

2.1.2 ЭКМ have the designs given in Tables 2.1, 2.2.

Table 2.1 – Design type

Design type	Design code	Order code	Housing type code
General industrial	-	-	АГ-16, АГ-17
Nuclear (increased reliability)	A	A	
Explosion-proof "explosion-proof enclosure"	Exd*	Exd*	АГ-17
Note * Except models xKxxx, ДНxxx, ВНxxx.			

Table 2.2 – Housing design code

Display type	Housing type and built-in display type codes when ordering	
	АГ-16 (single-section)	АГ-17 (double-section)
LCD display	A16И1	-
Optically variable LED display	A16И2	A17И2

2.1.3 ЭКМ have two setpoints and two electromechanical vibration-resistant relays (hereinafter referred to as relays) of alarm channels, type and value of setpoints are selected by the consumer.

2.1.4 ЭКМ perform the function of alarm and automatic control of monitored parameters by means of alarms.

The alarms ensure switching of:

- line frequency AC:
 - at a voltage of 250 V to 5 A per active load,
 - at a voltage of 250 V, up to 1 A, to inductive load ($\cos \varphi \geq 0.4$);
- DC:
 - at a voltage of 250 V, up to 0.1 A, to active and inductive loads,
 - at a voltage of 40 V, up to 2 A, to active and inductive loads;
- minimum switching voltage of 18 V at a current of ≥ 10 mA.

The alarm device for external circuits connection has design options according to GOST 2405-88, see Table 2.3.

Table 2.3 – Alarm device design code

Order code	External circuits connection according to GOST 2405-88	Design option according to GOST 2405-88
III	Two break contacts (two normally closed contacts)	III
IV	Two circuit closing contacts (two normally open contacts)	IV
V*	One contact is circuit opening, the other is circuit closing (the first contact is normally closed, the second contact is normally open)	V
VI	One contact is circuit closing, the other is circuit opening (the first contact is normally open, the second contact is normally closed)	VI
Note – * Basic design		

In terms of contact system type, alarm devices have the designs listed in Table 2.3.1.

Table 2.3.1 — Design type codes of alarm devices

Order code	Alarm device design
-	monostable*
P	bistable (polarized)
Note – * Basic design	

2.1.5 ЭКМ are consumer-configurable instruments with indication of an actual converted value. Viewing and changing the ЭКМ configuration parameters is carried out using a push-button keypad on the front panel. The measured quantity, units, setpoints, configuration parameters and information about the activation of the alarm channel relays are displayed on the integrated display. The measured value is displayed simultaneously on a four-digit display and as a discrete graphic scale indicating the setpoints position relative to the measurement range.

2.1.6 The upper and lower measurement limits, as well as the indicated value, can be normalized in the following units (designations of measurement units shown on ЭКМ display are indicated in brackets):

- kPa, MPa, kgf/cm²;
- percent (%) – if the display range of 0...100 is set and scaling or root extraction is enabled;
- on special order*: Pa, atm., bar, mbar, mm H₂O, m H₂O, mm Hg, psi;
- scalable display range**.

Note - * Displayed as a symbol ☼ .

** - if scaling to the display range is enabled, pressure units are not displayed.

2.1.7 In accordance with GOST 22520-85, ЭКМ are:

- by the number of input and output signals to be converted – single-channel;
- based on the output-input signal dependence - with linear dependence or with square rooting function;
- in terms of measurement range adjustment capability – multi-range, reconfigurable.

2.1.8 Explosion-proof ЭКМ-1005Exd have ““d” flameproof enclosure” protection type according to GOST IEC 60079-1-2013, explosion protection marking:

1Ex db IIA T6 Gb X; 1Ex db IIB T6 Gb X; 1Ex db IIC T6 Gb X;

1Ex db IIA T5 Gb X; 1Ex db IIB T5 Gb X; 1Ex db IIC T5 Gb X;

1Ex db IIA T4 Gb X; 1Ex db IIB T4 Gb X; 1Ex db IIC T4 Gb X;

1Ex db IIA T3 Gb X; 1Ex db IIB T3 Gb X; 1Ex db IIC T3 Gb X and can be used in hazardous areas in accordance with TR CU 012/2-11, GOST 31610.0-2019 (IEC 60079-0:2017) and GOST IEC 60079-1-2013.

2.1.9 ЭКМ-2005A (increased-reliability) are used as part of process control systems of nuclear power plants (NPPs) and nuclear fuel cycle facilities (NFCF).

2.1.9.1 In accordance with GOST 25804.1-83, ЭKM-2005A are referred to:

- category “Б” by the nature of application (equipment for continuous use);
- by the number of performance levels — type I (equipment having two performance levels: the rated level and failure)

2.1.9.2 By operating conditions at a NPP, ЭKM-2005A correspond to placement groups 1.3, 1.4, 2.1-2.3 according to Table 6.1 of STO 1.1.1.07.001.0675-2008.

2.1.9.3 ЭKM-2005A correspond to design type УХЛ3.1 according to GOST 15150-69 (for placement groups 1.3, 1.4, 2.1, 2.2, and УХЛ4.1 for placement group 2.3) with distinctive influencing factors given in Appendix A of STO 1.1.1.07.001.0675-2008, but in the extended ambient air temperature range given in par. 2.1.12 of this OM.

2.1.9.4 ЭKM-2005A, intended for operation at the Kudankulam NPP, correspond to climatic design type TB4.1 according to GOST 15150-69 and according to R01.KK.0.0.AP.TT.WD001 are operable at ambient temperature from plus 5 to plus 50 °C, as well as also during 6 hrs at maximum ambient air temperature values from plus 1 to plus 60 °C and relative air humidity up to 98% at a temperature of 35 °C and lower without moisture condensation.

2.1.9.5 ЭKM-2005A meet the reliability requirements of STO 1.1.1.07.001.0675-2008 and the requirements of par. 2.2.47 of this operating manual.

2.1.9.6 ЭKM-2005A comply with decontamination requirements of STO 1.1.1.07.001.0675-2008 and the requirements of par. 2.2.45 of this operating manual.

2.1.9.7 ЭKM-2005A correspond to qualification category R1, R2, R3, R4 (depending on the design) in accordance with Section 6.4 of STO 1.1.1.07.001.0675-2008.

2.1.9.8 ЭKM-2005A are subject to acceptance according to the requirements of STO 1.1.1.07.001.0675-2008.

2.1.9.9 In terms of resistance to mechanical impacts during operation, ЭKM are referred to the design group M6 as per GOST 17516.1-90.

2.1.9.10 ЭKM-2005A are referred to category I of seismic resistance according to NP-031-01 and to group Б of design 3 according to RD 25 818-87.

ЭKM-2005A are stable, durable, and earthquake-resistant with a seismicity level of 8 points on the MSK-64 scale above zero mark over 40 m in accordance with GOST 25804.3-83.

2.1.9.11 ЭKM-2005A (increased reliability) in accordance with NP-001-15, NP-016-05 (OPB NFCF), NP-033 are referred to NPP and NFCF elements of safety classes 2, 3 or 4:

- by application — to the elements of normal operation;
- by the effect on safety — to safety-relevant elements;
- by the nature of the functions performed — to the control elements.

Example of classified designation 2, 2H, 2Y, 2HY, 3, 3H, 3Y, 3HY or 4, 4H.

2.1.9.12 In terms of protection against environmental exposure, in accordance with GOST 15150-69, ЭKM-2005A:

- are manufactured in corrosion-resistant design T II;
- are designed for operation at NPPs (for atmosphere type II), resistant to presence of corrosive agents in the open air atmosphere, characterized by the following parameters:

Substance	Concentration, mg/m ³	Deposition rate, cm/c	Deposition flux, mg/(m ² ·day)
Chlorides	0.0212	0.1	1.83
Sulfates	0.58	0.1	50
Sulfur dioxide	0.006	0.9	4.7
Nitrogen oxides	0.004	-	-

2.1.10 In terms of immunity to electromagnetic interference, ЭKM-2005A correspond to TR CU 020/2011, GOST 32137-2013 and tables 2.4, 2.4.1.

2.1.10.1 In terms of immunity to electromagnetic interference, ЭKM-2005 correspond to TR CU 020/12, GOST R IEC 61326-1-2014. Basic types of electromagnetic interference are given in Table 2.4.2.

Table 2.4 - ЭКМ-2005A immunity to electromagnetic interference (ЭКМ-2005A with 220 V power supply)

Electromagnetic environment severity degree as per	Characteristics of interference types		Value	Design group	Performance criteria as per GOST 32137-2013
3 GOST R 51317.4.5-99	High-energy microsecond impulse interference (MPI): - signal ports, control ports, input-output ports (wire-to-ground)		2 kV	IV	A
3 GOST R 51317.4.5-99	High-energy microsecond impulse interference (MPI): - input and output AC power supply ports, interference feed:	(wire-to-wire)	2 kV	IV	A
4 GOST R 51317.4.5-99		(wire-to-wire)	4 kV		
4 GOST 30804.4.4-2013	Nanosecond pulse interference (NPI): - signal ports, control ports, input-output ports		2 kV	IV	A
	Nanosecond pulse interference (NPI): - AC input and output ports		4 kV	IV	A
4 GOST 308047.4.2-2013	Electrostatic discharge: - contact discharge		8 kV	IV	A
	- air discharge		15 kV		
5 GOST R 50648-94	Industrial frequency magnetic field: - long magnetic field - short magnetic field 3 s		40 A/m 600 A/m	IV	A
5 GOST R 50649-94	Pulse magnetic field		600 A/m	IV	A
3 GOST 30804.4.3-2013	Radio-frequency electromagnetic fields in the 80-1000 MHz frequency band		10 V/m	IV	A*
3 GOST R 51317.4.6-99	Conductive noise in the frequency band of 0.15 - 80 MHz: - I/O circuits - power circuits		10 V 10 V	IV IV	A A
4 GOST 30804.4.11-2013	Dynamic changes in the supply voltage: - voltage dips		70 100 / 2000	IV	A
3 GOST 30804.4.11-2013	- voltage interruption		0 10 / 200		
4 GOST 30804.4.11-2013	- voltage spikes		120 100 / 2000		
GOST 30805.22-2013	Industrial noise emission: - in the frequency band 30-230 MHz to the surrounding space		30 dB	-	Corresponds for class A*** TC**
	Industrial noise emission: - frequency band 230-1000 MHz to the surrounding space		37 dB		
Notes 1 - * The permissible additional error does not exceed 0.6% of the upper limit of output signal variation for the time of exposure to interference. 2 - **TC – technical resources. 3 – *** Class A — equipment category as per GOST 30805.22-2013 4 - ЭКМ operate normally and do not create interference in conditions of joint operation with the equipment of systems and elements, for which they are intended, as well as with other-purpose equipment- that can be used together with these ЭКМ in a typical interference situation.					

Table 2.4.1 – ЭKM-2005A immunity to electromagnetic interference (ЭKM-2005 with 24V DC power supply)

Electromagnetic environment severity degree as per GOST	Characteristics of interference types		Value	Design group	Performance quality in accordance with GOST 32137-2013
3 GOST R 51317.4.5-99	High-energy microsecond impulse interference (MPI): - interference pulse amplitude in the input-output circuit (wire-to-ground)		2 kV	IV	A
2 GOST R 51317.4.5-99	High-energy microsecond pulse interference (MPI):	(wire-to-wire)	1 kV	IV	A
3 GOST R 51317.4.5-99	- amplitude of interference pulses in DC power circuit	(wire-to-ground)	2 kV	IV	A
4 GOST 308047.4.4-2013	Nanosecond pulse interference (NPI): - I/O circuits		2 kV	IV	A
3 GOST 30804.4.4-2013	Nanosecond pulse interference (NPI): - DC power input circuits		2 kV	IV	A
4 GOST 30804.4.2-2013	Electrostatic discharge: - contact discharge - air discharge		8 kV	IV	A
			15 kV	IV	A
3 GOST 30804.4.3-2013	Radio frequency electromagnetic fields in the frequency band: - 80-1000 MHz		10 V/m	IV	A
4 GOST 30804.4.3-2013	- 800-960 MHz - 1400-2000 MHz				
3 GOST R 51317.4.6-99	Conductive noise in the frequency band: - 0.15-80 MHz*		10 V	IV	A
5 GOST R 50648-94	Magnetic field of industrial frequency prolonged magnetic field		40 A/m	IV	A
5 GOST R 50648-94	Industrial frequency magnetic field short-term magnetic field 3 s		600 A/m	IV	A
5 GOST R 50648-94	Pulse magnetic field		600 A/m	IV	A
GOST 30805.22-2013	Industrial noise emission: - in the frequency band of 30-230 MHz to the surrounding space		30 dB	-	Corresponds for class A*** TC
	Industrial noise emission: - frequency band of 230-1000 MHz to the surrounding space		37 dB		
Notes 1 - * TC – technical resources. 2 - ** Class A - equipment category according to GOST 30805.22-2013. 3 - ЭKM operate normally and do not create interference in conditions of joint operation with the equipment of systems and elements, for which they are intended, as well as with other-purpose equipment- that can be used together with these ЭKM in a typical interference situation.					

Table 2.4.2 – ЭKM-2005 immunity to electromagnetic interference (ЭKM-2005 with 24V DC power supply)

Electromagnetic environment severity degree as per GOST		Characteristics of interference types		Value	Quality of operation
3 GOST R 51317.4.5-99	High-energy microsecond pulse interference (MPI): - interference pulse amplitude in the input-output circuit (wire-to-ground)			2 kV	A
2 GOST R 51317.4.5-99	High-energy microsecond pulse interference (MPI): - amplitude of interference pulses in DC power circuit		(wire-to-wire)	1 kV	A
3 GOST R 51317.4.5-99			(wire-to-ground)	2 kV	A
4 GOST 308047.4.4-2013	Nanosecond pulse interference (NPI): - I/O circuits			2 kV	A
3 GOST 30804.4.4-2013	Nanosecond pulse interference (NPI): - DC power input circuits			2 kV	B
4 GOST 30804.4.2-2013	Electrostatic discharge: - contact discharge - air discharge			8 kV	B
				15 kV	B
3 GOST 30804.4.3-2013	Radio frequency electromagnetic fields in the frequency band: - 80-1000 MHz			10 V/m	A
3 GOST R 51317.4.6-99	Conductive noise in the frequency band: - 0.15-80 MHz*			10 V	A
5 GOST R 50648-94	Magnetic field of industrial frequency prolonged magnetic field			40 A/m	A
5 GOST R 50648-94	Industrial frequency magnetic field short-term magnetic field 3 s			600 A/m	A
5 GOST R 50648-94	Pulse magnetic field			600 A/m	A
GOST 30805.22-2013	Emission of industrial interference: - in the frequency band of 30-230 MHz to the surrounding space			30 dB	Corresponds for class A*** TC
	Emission of industrial interference: - frequency band of 230-1000 MHz to the surrounding space			37 dB	
Notes 1 - **TC – technical resources. 2 - *** Class A — equipment category as per GOST 30805.22-2013. 3 - ЭKM operate normally and do not create interference in conditions of joint operation with the equipment of systems and elements, for which they are intended, as well as with other-purpose equipment- that can be used together with these ЭKM in a typical interference situation.					

2.1.11 In terms of environmental effect protection, in accordance with GOST 14254-2015, ЭKM have degree of protection against dust and water ingress in ЭKM, as shown in Table B.2 of Appendix B.

2.1.12 ЭKM are resistant to climatic effects during operation in accordance with tables 2.5 and 2.5.1.

Table 2.5 — Climatic design for ЭКМ-2005, ЭКМ-2005Exd

Group	Type	GOST	Ambient air temperature range	Order code
C3	-	R 52931-2008	-5 °C to +50 °C	t0550*
C2***			-25 °C to +70 °C	t2570
			-40 °C to +70 °C	t4070**
			-50 °C to +80 °C	t5080***
			-55 °C to +70 °C	t5570***
			-60 °C to +70 °C	t6070***
-	УХЛ1 (Moderately Cold Climate)	15150-69	from -40 to +70 °C	t4070 УХЛ1***
			-50 °C to +80 °C	t5080 УХЛ1***
			-60 °C to +70 °C	t6070 УХЛ1***

Notes

1 - * Basic design.

2 — ** Except for ДМxxx, ГМxxx, ДНxxx, ВНxxx.

3 — *** Only for АМxx, ИМxxx, ВМxxx models with 11N, 12N, 16N material design codes and ДМФВxxx models with 11P, 16P material design codes.

4 - LCD display is resistant to ambient temperatures from minus 30 to plus 60 °C. The use of LCD display in other ambient temperature ranges will not cause its damage.

Table 2.5.1 — Climatic design for ЭКМ-2005А

Design group according to GOST R 52931-2008	Design type according to GOST 15150-69	Placement group according to STO 1.1.1.07.001.067 5-2008	Ambient air temperature range	Order code***
C3*	УХЛ3.1*	1.3, 1.4, 2.1, 2.2	-25 °C to +70 °C	t2570 (УХЛ3.1)
C3	УХЛ4.1*	2.3	-5 °C to +50 °C	t0550 (УХЛ4.1)
C3	TB3	-	-25 °C to +70 °C	T2570 (TB3)
B4**	TB4.1	-	-5 °C to +50 °C	t0550 (TB4.1)
C2****	У1*	-	-40 °C to +70 °C	t4070 (У1)

Notes

1 — * The design has an extended temperature range. Distinctive influencing factors according to Appendix A of STO 1.1.1.07.001.0675-2008.

2 — **The design has an extended temperature range.

The design maintains operability for 6 hours at ambient temperatures of +1 °C to +60 °C and relative humidity up to 98% at 35 °C and lower temperatures without condensation.

3 — *** The climatic design (type or group) is specified additionally.

4 - **** Except for ДМxxx, ГМxxx, ДНxxx, ВНxxx

5 - LCD display is resistant to ambient temperatures from minus 30 to plus 60 °C. The use of LCD display in other ambient temperature ranges will not cause its damage.

2.2 Technical Specifications

2.2.1 ЭKM-2005 modification, design, model code, maximum upper measurement limit $P_{UP,MAX}$, range of upper measurement limits P_{UP} , maximum (test) pressure P_{test} and permissible operating gauge pressure $P_{OP,G}$ correspond to the data listed in Table 2.6. The permissible basic reduced error limits expressed as a percentage of the upper range of measurements correspond to those listed in Table 2.7.

The model designation consists of two letters and a number (for models, for which kPa as units of measurement) and of two letters and a number with the letter M (for models, for which MPa as units of measurement).

The first letter indicates the type of pressure to be measured:

A – absolute pressure;

И – gauge pressure;

B – gauge-and-vacuum pressure;

Д – pressure difference;

Г – hydrostatic pressure.

The second letter represents the diaphragm material:

M – metal;

K – ceramics;

H – no protective diaphragm (ДHxxx, BHxxx).

The third letter, “Φ”, designates the flanged design of differential pressure manometers.

The fourth letter, “B”, designates the high value of the maximum operating gauge pressure (25 MPa).

The number in the model designation corresponds to the upper measurement limit in kPa (MPa).

Table 2.6 – Maximum upper measurement limits $P_{UP,MAX}$, range of upper measurement limits P_{UP} according to GOST 22520-85, maximum (test) pressure P_{TEST} and permissible operating gauge pressure $P_{OP,G}$.

Model and design	Model Code	Upper measurement limit (range) number, readjustment ratio ($P_{UP}:P_{UP,MAX}$) and span of upper measurement limits (ranges)				P_{TEST}	$P_{OP,G}^*$
		1 ($P_{UP,MAX}$)	2	3	4		
		1:1	1:1.6	1:2.5	1:4		
Absolute pressure electronic manometers ЭКМ-2005-ДА ЭКМ-2005А-ДА ЭКМ-200Exd-ДА ЭКМ-2005АExd-ДА	AM250	250 kPa	160 kPa	100 kPa	60 kPa	1,000 kPa	-
	AM2.5M	2.5 MPa	1.6 MPa	1.0 MPa	0.6 MPa	10 MPa	-
Excess pressure electronic manometers ЭКМ-2005-ДИ ЭКМ-2005А-ДИ ЭКМ-200Exd-ДИ ЭКМ-2005АExd-ДИ	ИМ16	16 kPa	10 kPa	6.0 kPa	4.0 kPa	50 kPa	-
	ИМ100	100 kPa	60 kPa	40 kPa	25 kPa	400 kPa	-
	ИМ250	250 kPa	160 kPa	100 kPa	60 kPa	1000 kPa	-
	ИМ600	600 kPa	400 kPa	250 kPa	160 kPa	2,500 kPa	-
	ИМ1,6M	1.6 MPa	1.0 MPa	0.6 MPa	0.4 MPa	10 MPa	-
	ИМ2,5M	2.5 MPa	1.6 MPa	1.0 MPa	0.6 MPa	10 MPa	-
	ИМ6M	6.0 MPa	4.0 MPa	2.5 MPa	1.6 MPa	25 MPa	-
	ИМ16M	16 MPa	10 MPa	6.0 MPa	4.0 MPa	40 MPa	-
	ИМ60M	60 MPa	40 MPa	25 MPa	16 MPa	150 MPa	-
	ИМ100M	100 MPa	60 MPa	40 MPa	25 MPa	150 MPa	-
Gauge-and-vacuum pressure electronic manometers ЭКМ-2005-ДИВ ЭКМ-2005А-ДИВ ЭКМ-200Exd-ДИВ ЭКМ-2005АExd-ДИВ	ВН2,5	-1.25 kPa	-0.8 kPa	-0.5 kPa	-0.3 kPa	20 kPa	
		1.25 kPa	0.8 kPa	0.5 kPa	0.3 kPa		
	ВН6	-3 kPa	-2 kPa	-1.25 kPa	-0.8 kPa	20 kPa	
		3 kPa	2 kPa	1.25 kPa	0.8 kPa		
	ВМ150	-100 kPa	-100 kPa	-50 kPa	-30 kPa	1,000 kPa	-
		150 kPa	60 kPa	50 kPa	30 kPa		
	ВМ300	-100 kPa	-100 kPa	-100 kPa	-50 kPa	1,200 kPa	-
		300 kPa	150 kPa	60 kPa	50 kPa		
	ВМ500	-100 kPa	-100 kPa	-100 kPa	-100 kPa	2,500 kPa	-
		500 kPa	300 kPa	150 kPa	60 kPa		
	ВМ1,5M	-0.1 MPa	-0.1 MPa	-0.1 MPa	-0.1 MPa	10 MPa	-
		1.5 MPa	0.9 MPa	0.5 MPa	0.3 MPa		
	ВМ2,4M	-0.1 MPa	-0.1 MPa	-0.1 MPa	-0.1 MPa	10 MPa	-
		2.4 MPa	1.5 MPa	0.9 MPa	0.5 MPa		

Table 2.6 continued

Differential pressure electronic manometers ЭКМ-2005-ДД ЭКМ-2005А-ДД ЭКМ-2005АExd-ДВ ЭКМ-2005АExd-ДД	ДМ40	40 kPa	25 kPa	16 kPa	10 kPa	-	4 MPa
	ДМ100	100 kPa	63 kPa	40 kPa	25 kPa	-	4 MPa
	ДМ250	250 kPa	160 kPa	100 kPa	63 kPa	-	4 MPa
	ДМ630	630 kPa	400 kPa	250 kPa	160 kPa	-	4 MPa
	ДМ2,5М	2.5 MPa	1.6 MPa	1.0 MPa	0.63 MPa	-	4 MPa
	ДМФВ10	10 kPa	6.3 kPa	4.0 kPa	2.5 kPa	-	10 MPa
	ДМФВ40	40 kPa	25 kPa	16 kPa	10 kPa	-	25 MPa
	ДМФВ250	250 kPa	160 kPa	100 kPa	63 kPa	-	25 MPa
	ДМФВ2,5М	2.5 MPa	1.6 MPa	1.0 MPa	0.63 MPa	-	25 MPa
Hydrostatic pressure (level) electronic manometers ЭКМ-2005-ДГ ЭКМ-2005А-ДГ ЭКМ-2005АExd-ДГ ЭКМ-2005АExd-ДГ	ДН1	1 kPa	0.6 kPa	0.4 kPa	0.25 kPa	-	100 kPa
	ДН2,5	2.5 kPa	1.6 kPa	1.0 kPa	0.6 kPa	-	100 kPa
	ГМ16	16 kPa	10 kPa	6.0 kPa	4 kPa	-	50 kPa
	ГМ100	100 kPa	60 kPa	40 kPa	25 kPa	-	400 kPa
	ГМ250	250 kPa	160 kPa	100 kPa	60 kPa	-	500 kPa

Notes

1 - * The value of permissible operating gauge pressure at temperatures below -40 °C is limited to 10 MPa for ДМФВ40, ДМФВ250, ДМФВ2, 5М models with 11P, 12P, and 16P material design codes. ($P_{OP,G.} = 10 \text{ MPa at } -60^{\circ}\text{C} \leq t \leq -40^{\circ}\text{C}$).

2 - Symbol “-” means under-pressure.

3 - The lower measurement limit is equal to zero.

4 - For ЭКМ-2005-ДИБ, the number in the upper line is the upper under-pressure limit, and the number in the lower line is the upper gauge pressure limit.

Table 2.7 — Permissible basic reduced error limits.

Accuracy class code	Permissible basic reduced error limits, $\gamma\%$, for upper limit (range) numbers			
	1	2	3	4
B	$\pm(0.25+)^*$	$\pm(0.4+)^*$	$\pm(0.5+)^*$	$\pm(0.6+)^*$
C	$\pm(0.4+)^*$	$\pm(0.6+)^*$	$\pm(0.8+)^*$	$\pm(1.0+)^*$
D**	$\pm(0.6+)^*$	$\pm(1.0+)^*$	$\pm(1.2+)^*$	$\pm(1.5+)^*$

Notes

1 - * One unit of the last digit expressed as a measurement range percentage.

2 - ** Basic design.

3 - For ЭКМ with root-extracting dependence, the basic error is determined in the subrange of 2% to 100% of the measurement range and corresponds to γ .

2.2.2 The standardized output signal range – 0-5, 0-20, 4-20 mA is selected at the time of ЭКМ configuration.

2.2.3 ЭКМ subrange (“OdPL” and “OdPH” parameters in Table 2.15) is selected during configuration and shall not exceed the measurement range limits for this model (“IdPL” and “IdPH” parameters in Table 2.15).

The nominal static characteristic of ЭКМ with a linear dependence corresponds to the following form

$$A=P, \quad (2.1)$$

where A –is the actual value of the display reading, corresponding to the measured pressure;

P –is the measured pressure value in the set measurement units.

2.2.4 The scalable ЭКМ range (“ScEn”, “ScdL” and “ScdH” parameters in Table 2.15) is selected during configuration and does not depend on the measurement range limit for this model (“IdPL” and “IdPH” parameters in Table 2.15).

The nominal static characteristic of ЭКМ with scalable display range corresponds to the following form

$$A = \frac{P-A_L}{A_{UP}-A_L} * (S_{UP} - S_L) + S_L \quad (2.2)$$

where A_{UP} and A_L – are upper and lower limits of the selected measurement subrange (“OdPL” and “OdPH” parameters in Table 2.16),

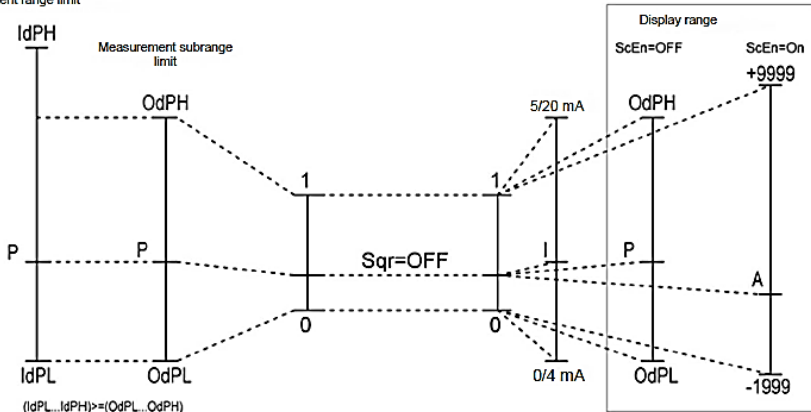
S_{UP} and S_L – are upper and lower limits of the display range (параметры “ScdL” and “ScdH” parameters in Table 2.16).

In particular, when $S_L=0$ and $S_{UP}=100$, the measured pressure P in the range of A_L to A_{UP} is displayed as a percentage of the set measurement subrange.

2.2.4.1 The nominal static characteristic of ЭКМ with root-extracting dependence (regardless of the “ScEn” parameter value) corresponds to the following form

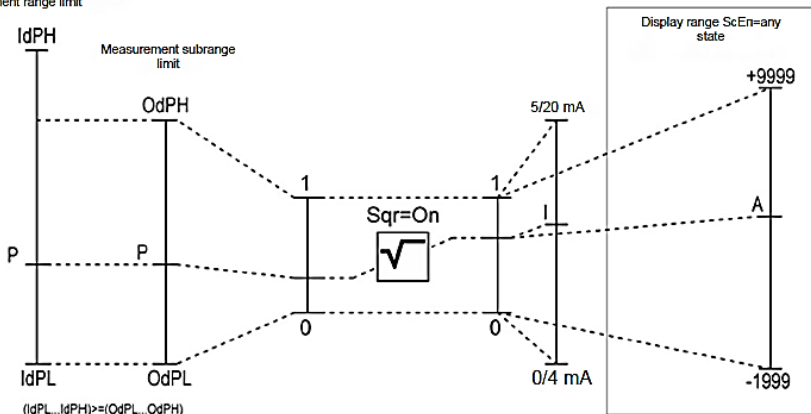
$$A = \sqrt{\frac{P-A_L}{A_{UP}-A_L}} * (S_{UP} - S_L) + S_L \quad (2.3)$$

Measurement range limit



Linear range conversion

Measurement range limit



Conversion of ranges with enabled root extraction function

2.2.5 The nominal static characteristic of ЭКМ with current output corresponds to the following form

$$I = \frac{P - A_L}{A_{UP} - A_L} \cdot (I_{UP} - I_L) + I_L, \quad (2.4)$$

where I – is the actual value of the output current signal corresponding to the measured pressure, mA;

I_{UP} and I_L – are the upper and lower limits of the output current signal.

2.2.6 The nominal static characteristic of ЭКМ with root-extracting dependence for the output current corresponds to the following form

$$I = \sqrt{\frac{P-A_L}{A_{UP}-A_L}} \cdot (I_{UP} - I_L) + I_L. \quad (2.5)$$

2.2.7 The output signal variation does not exceed 0.5 of the permissible basic error limit.

2.2.8 ЭКМ are resistant to high frequency sinusoidal vibrations (with transition frequency from 57 to 62 Hz) with the following parameters:

- frequency – (5-80) Hz;
- offset amplitude for frequency below transition frequency – 0.15 mm;
- acceleration amplitude for frequency above transition frequency – 19.6 m/s².

2.2.9 The ЭКМ permissible additional error limit during exposure to vibration does not exceed the permissible basic error limit.

2.2.10 The ЭКМ-2005-ДД output signal value change, caused by variation of the operating gauge pressure in the range from zero to the permissible limit and from the permissible limit to zero (see Table 2.6), expressed as a percentage of the output signal change range, does not exceed the values of γ_p , determined using the formula

$$\gamma_p = K_p \Delta P_{op.} \cdot \frac{P_{UP MAX}}{P_{UP}}, \quad (2.6)$$

where $\Delta P_{op.}$ – is variation of the operating gauge pressure, MPa;

$P_{UP MAX}$, P_{UP} – is the maximum upper measurement limit and the upper measurement limit, respectively, for this model, MPa;

K_p – is the ratio from Table 2.8.

Table 2.8– K_p ratios

Model designation	$P_{OP.G.}$, MPa	K_p , %/MPa
ДН1, ДН2,5	0.1	1
ДМ2,5М, ДМ630	4	0.15
ДМ250	4	0.22
ДМ100	4	0.3
ДМ40	4	0.4
ДМФВ10	10	0.02
ДМФВ2,5М, ДМФВ250, ДМФВ40	25	0.02

2.2.11 The ЭКМ-2005-ДА output signal change (absolute pressure), caused by atmospheric pressure variation by ± 10 kPa (75 mm Hg) relative to the steady-state value in the range of 84 to 106.7 kPa (630 to 800 mm Hg), does not exceed 0.2 of the basic error limit.

2.2.12 The Δ KM additional error, caused by ambient air temperature variation from normal (23 ± 2) °C to any temperature within the operating temperature range for every 10 °C of the temperature variation ($\gamma_T, \%/10^\circ\text{C}$), does not exceed the values given in Table 2.9.

Table 2.9 – Additional temperature error

Upper measurement limit (range) number	$ \gamma_T , \%/10^\circ\text{C}$ for accuracy class code		
	B	C	D
1	± 0.20	± 0.25	± 0.25
2	± 0.25	± 0.30	± 0.30
3	± 0.30	± 0.35	± 0.35
4	± 0.35	± 0.40	± 0.40

2.2.13 The additional error of Δ KM caused by exposure to increased humidity does not exceed 0.2 of the permissible basic error limit.

2.2.14 The additional error of Δ KM caused by exposure to constant magnetic fields and (or) variable fields of network (industrial) frequency with an intensity of up to 400 A/m, does not exceed 0.2 of the permissible basic error limit.

2.2.15 The setpoint setting range corresponds to the measured quantity range.

2.2.16 The setpoints actuation hysteresis is asymmetrical, is programmed independently for each setpoint and adjusted within the entire range of the measured quantity.

2.2.17 The limit of alarm triggering permissible basic error does not exceed the permissible basic error limit of the measured pressure.

2.2.18 The limit of alarm triggering permissible basic error caused by the ambient air temperature variation from normal to any value within the operating temperature range for every 10 °C temperature change does not exceed the values given in Table 2.9.

2.2.19 The limit of alarm triggering permissible basic error caused by supply voltage variation from normal to any value within the application conditions, does not exceed 0.2 of the permissible basic error limit for alarm triggering.

2.2.20 ЭКМ is powered from:

- AC mains with a sinusoidal waveform, frequencies of 40 Hz to 100 Hz and voltages of 110 V to 249 V at rated values 50 Hz for frequency and 220 V for voltage
and from DC mains in the range of 150 V to 249 V at a rated voltage of 220 V (order code — 220);
- AC mains with a sinusoidal waveform, frequencies of 40 Hz to 100 Hz and voltages of 110 V to 249 V at rated values 50 Hz for frequency and 220 V for voltage
and from DC mains in the range of 150 V to 249 V at a rated voltage of 220 V with galvanically isolated power supply and switching circuits (no current output) [order code – 220Г];
- DC mains with voltages of 20 V to 40 V at a rated voltage of (24 ± 0.48) V or (36 ± 0.72) V (order code – 24);
- DC mains with voltages of 20 V to 40 V at a rated voltage of (24 ± 0.48) V or (36 ± 0.72) V with galvanically isolated power supply and switching circuits (no current output) [order code – 24Г].

2.2.21 The ЭКМ consumed power does not exceed 8 W.

2.2.22 The limit of permissible additional error caused by supply voltage variation from the rated to the minimum and maximum values specified in par. 2.2.20, does not exceed 0.2 of the permissible basic error limit.

2.2.23 Load resistance for the current output does not exceed:

- 2 k Ω – for a 0–5 mA output signal;
- 0.4 k Ω – for 0-20, 4-20 mA output signal.

2.2.24 After connecting any external load with a resistance not exceeding the values given in par. 2.2.23, the basic error of ЭКМ and output signal variation meet the requirements given in paragraphs 2.2.1 and 2.2.7.

2.2.25 The setting time for ЭКМ output signal (when the set damping time is equal to 0) at a ramp pressure change that is 90% of the measurement range, does not exceed:

- 0.1 s - for all models except for ДМxxx, ДМФВxxx models;
- 0.2 s for ДМxxx models,
- 3 s for ДМФВxxx models.

The criterion for setting the output signal is achieving the difference between the actual and set pressure values, not exceeding 5% of the measuring range.

2.2.26 ЭКМ-2005-ДА, ЭКМ-2005-ДИ, ЭКМ-2005-ДИВ are robust and leakproof at the test pressures given in Table 2.6.

ЭКМ-2005-ДА, ЭКМ-2005-ДИ, ЭКМ-2005-ДИВ withstand exposure to overload with the corresponding test pressure for 15 min.

15 minutes after the end of the specified exposure, ЭКМ-2005-ДА, ЭКМ-2005-ДИ, ЭКМ-2005-ДИВ meet the requirements specified in paragraphs 2.2.1 and 2.2.7.

2.2.26.1 ЭКМ-2005-ДД withstand the strength test with the test pressure in accordance with GOST 356-80 and leak tightness test with the maximum permissible operating gauge pressure given in Table 2.6, while the maximum permissible operating gauge pressure is taken as the nominal pressure P_y according to GOST 356-80.

2.2.26.2. ЭКМ-2005-ДД (ДМxxx models) withstand overload from the side of positive and negative chambers by one-sided exposure of pressure, the values of which are given in Table 2.10.

Table 2.10 – Values of maximum one-side pressure for ЭКМ-2005-ДД (ДМxxx models).

Model	Maximum one-side pressure from the positive chamber side, MPa	Maximum one-side pressure from the negative chamber side, MPa
ДМ40	1	0.5
ДМ100	2	1
ДМ250	4	2
ДМ630	6	3
ДМ2,5М	12	4

12 hours after exposure to overload, ЭКМ-2005-ДД meet the requirements specified in paragraphs 2.2.1 and 2.2.7.

2.2.26.3 ЭКМ-2005-ДД (ДМФВxxx and ДНxxx models) withstand overload for 15 minutes from the side of positive and negative chambers by one-sided exposure of pressure equal to 400 % of the upper limit without characteristics change.

ЭКМ-2005-ДД (ДМФВxxx and ДНxxx models) withstand overload for 1 minute from the side of positive and negative chambers by one-sided exposure of pressure equal to the maximum permissible operating gauge pressure.

After removing the overload, perform zero adjustment to eliminate possible impact on characteristics.

2.2.27 Electrical insulation resistance of 24 V power supply circuits and ЭKM current output relative to the housing and between themselves at a test voltage of 100 V shall not be less than:

- 20 MΩ at an ambient temperature of (20 ± 5) °C and relative humidity from 30% to 80%;
- 5 MΩ at the upper value of the temperature of working conditions and relative humidity from 30 to 80%;
- 1 MΩ at the upper value of the relative humidity of working conditions and ambient air temperature (35 ± 3) °C.

2.2.27.1 Electrical insulation resistance of 220 V power supply circuits and ЭKM alarm relative to the housing and between themselves at a test voltage of 500 V shall not be less than:

- 20 MΩ at an ambient temperature of (20 ± 5) °C and relative humidity from 30% to 80%;
- 5 MΩ at the upper value of the temperature of working conditions and relative humidity from 30 to 80%;
- 1 MΩ at the upper value of the relative humidity of working conditions and ambient air temperature (35 ± 3) °C.

2.2.28 Insulation of the 220 V electrical power supply circuits and alarm relative to the housing and current output, depending on the test conditions, withstands for 1 min exposure to test voltage with almost sinusoidal waveform with a frequency of 45 to 65 Hz:

- 1500 V at ambient air temperature (20 ± 5) °C and relative humidity from 30 to 80%;
- 900 V at relative humidity of (95 ± 3) % and an ambient temperature of (35 ± 3) °C.

2.2.28.1 Depending on the test conditions, insulation of current output circuits relative to the housing withstands for 1 minute the test voltage with almost sinusoidal waveform and a frequency of 45 Hz to 65 Hz:

- 500 V at an ambient air temperature of (20 ± 5) °C and 30–80% relative humidity;
- 300 V at relative humidity of (95 ± 3) % and an ambient temperature of (35 ± 3) °C.

2.2.28.2 Insulation of the 24 V (36 V) electrical power supply circuits and ЭKM current output relative to the housing and between themselves withstands for 1 minute exposure to test voltage:

- 500 V at ambient temperature (20 ± 5) °C and relative humidity from 30 to 80%;
- 300 V at relative humidity of (95 ± 3) % and an ambient temperature of (35 ± 3) °C.

2.2.29 ЭKM parts contacting with the measured medium are made of corrosion-resistant material and correspond to those specified in Tables 2.11, 2.12, and 2.13.

When ordering ЭКМ-2005-ДД, process connection code “-” should be indicated.

Table 2.11 – Material design code

Design code	Materials of construction		
	diaphragm	fitting	sealing rings (x)
11x	03X17H14M3 (316L)	03X17H14M3 (316L)	x=V, P, N
12x	03X17H14M3 (316L)	12X18H10T	x=V, P, N
16x	XH65MB (Hastelloy C)	XH65MB (Hastelloy C)	x=P, N
0D*	Without protective diaphragm	12X18H10T (316L)	x=V

Note – * For non-aggressive gas media.

Table 2.12 — Sealing rings

Material	Application	Designations in the design code
Viton	Oil products, acids	V
Fluoroplastic	All media	P
Without sealing rings	All media	N

Table 2.13 - Materials of construction for general industrial design and Exd

Models	Design code	Basic design
AMxxx, ИМxxx, ВМxxx	11x, 16x	11N
ДМxxx	11V	11V
ДМФВxxx	11V, 11P, 16P	11V
ГМxxx	12N	12N
ДНxxx, ВНxxx	0D	0D

Note – For versions 16x and 0D, coordination is required at the order placement stage.

Table 2.13.1 - Materials of construction for design type A (nuclear)

Models	Design code	Basic design
AMxxx, ИМxxx, ВМxxx	12x, 16x	12N
ДМxxx	11V	11V
ДМФВxxx	12V, 12P, 16P	12V
ГМxxx	12N	12N

Note – For versions 16x coordination is required at the order placement stage.

2.2.30 Measured medium temperature in ЭКМ working cavity:

- from -25 to +120°C for ЭКМ with an ambient air temperature range from -5 to +50°C, from -25 to +70°C;

- from -40 to +120°C for ЭКМ with an ambient air temperature range from -40 to +70°C;
- from -50 to +120°C for ЭКМ with an ambient air temperature range from -50 to +80°C;
- from -55 to +120°C for ЭКМ with an ambient air temperature range from -55 to +70°C;
- from -60 to +120°C for ЭКМ with an ambient air temperature range from -60 to +70°C.

2.2.31 Overall, connection and mounting dimensions of ЭКМ correspond to those shown in Figures A.1 – A.6 of Appendix A.

2.2.32 ЭКМ weight is max.:

- 1.0 kg for ЭКМ-2005-ДА, ЭКМ-2005-ДИ, ЭКМ-2005-ДИВ, ЭКМ-2005-ДД of ДМxxx, ДНxxx models;
- 6.5 kg for ЭКМ-2005-ДД of ДМФВxxx models.

2.2.33 ЭКМ are resistant to ambient air temperature in accordance with par. 2.1.12.

2.2.34 ЭКМ are resistant to humidity:

- up to 100% at a temperature of 30°C and lower, with condensation for climatic design C2 as per GOST 52931-2008;
- up to 95% at a temperature of 35°C and lower, without condensation for climatic design C3 as per GOST 52931-2008.

2.2.35 ЭКМ in transport packaging withstand the temperatures up to +50 °C.

2.2.36 ЭКМ in transport packaging withstand temperatures down to -50 °C.

2.2.37 ЭКМ in transport packaging are resistant to air exposure with a relative humidity of 98% at a temperature of 35 °C.

2.2.38 ЭКМ are resistant to bumps up to 80 impacts per minute with a RMS acceleration of 98 m/s² and exposure during 1 hour.

2.2.39 ЭКМ are resistant and durable to sinusoidal vibration in the frequency range from 1 to 100 Hz at an acceleration amplitude of 20 m/s².

2.2.39.1 ЭКМ-2005А are resistant and durable to sinusoidal vibration in the frequency range from 1 to 120 Hz at an acceleration amplitude of 20 m/s² and correspond to vibration resistance group 2 or 1 (respectively) according to STO.1.1.1.07.001.0675-2008.

The additional error caused by vibration within the entire frequency range, expressed as a percentage of the output signal variation range, does not exceed:

- (+1.5%) for the measurement range below 2.5 kPa (250 kgf/m²);
- (+0.6%) for the measurement ranges of 2.5 kPa (250 kgf/m²) and higher.

The output signal ripple amplitude with a frequency within the ЭKM-2005A bandwidth does not exceed 0.6% of the output signal variation range.

2.2.40 ЭKM have no structural elements and assemblies with resonance frequencies from 5 to 25 Hz.

2.2.41 ЭKM are resistant and durable to single-action mechanical shocks with a peak impact acceleration of 20 m/s², an impact pulse duration of 2 to 20 ms, and 30 impacts in total.

2.2.42 ЭKM are resistant and durable to multiple mechanical impacts with a peak impact acceleration of 30 m/s², a recommended impact acceleration duration of 10 ms (permissible duration from 2 to 20 ms), and 20 impacts in each direction.

2.2.43 ЭKM are durable when exposed to seismic impacts equivalent to vibration impacts with the parameters specified in Table 2.14.

Table 2.14 - Seismic impact parameters

Frequency, Hz	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0	15.0	20.0	30.0
Acceleration, m/s ²	6.0	15.0	29.0	51.0	48.0	43.0	38.0	31.0	20.0	19.0	14.0

2.2.43.1 Variation of ЭKM-2005A output signal, expressed as a percentage of the output signal variation range, does not exceed the values of γ_s determined by the formula

$$\gamma_s = K_c \cdot \Delta P_{OP-} \cdot \frac{P_{UP.MAX}}{P_{UP}}, \quad (2.7)$$

where $P_{OP.MAX}$, P_{UP} - are the same as in formula (2.6);

K_c - coefficient, the values of which are shown in Table 2.14.1.

Table 2.14.1

Vibration direction	K_c value depending on the upper measurement limit, %			
	less than 2.5 kPa	2.5 to 10 kPa	10 to 250 kPa	0.4 to 100 MPa
Vertical	3.00	1.00	0.50	0.25
Horizontal	10.00	5.00	3.00	0.25

2.2.43.2 ЭКМ-2005A shall withstand an alternating pressure varying from 20–30% to 70–80% of the upper measurement limit, with the following number of cycles:

- 20,000 – for the upper measurement limit up to 25 MPa;
- 15,000 – for the upper measurement limit of 40, 60, 100 MPa.

After exposure to alternating pressure, ЭКМ-2005A shall comply with the requirements of par. 2.2.1.

2.2.43.3 ЭКМ-2005A, supplied to nuclear power facilities (NPFs) must be resistant to effects of falling aircraft impact (AI) and air shock wave (ASW) according to Table 2.14.2.

Table 2.14.2

Frequency, Hz	Acceleration in m/s^2 at relative damping, %							
	1		2		5		10	
	AI	ASW	AI	ASW	AI	ASW	AI	ASW
0	0	0	0	0	0	0	0	0
10	0	140	23	110	20	70	16	60
30	24	140	23	110	20	70	16	60
50	25	120	23	90	22	70	18	6
100	25	90	23	85	22	55	18	50
150	15	40	15	40	15	40	15	40
200	15	25	15	25	15	25	15	25
300	10		10		10		10	
400	10		10		10		10	

Note -Table 2.14.2 shows the generalized response spectra on building structures for the AI and ASW effects depending on the decrement of vibrations.

2.2.44 Electromagnetic compatibility and interference immunity assurance

2.2.44.1 According to GOST 32137-2013, ЭКМ resistant to electromagnetic interference specified in Tables 2.4 and 2.4.1.

2.2.44.2 ЭКМ operate normally and do not create interference in conditions of joint operation with the equipment of systems and elements, for which they are intended, as well as with other-purpose equipment that can be used together with these ЭКМ in a typical interference situation.

2.2.45 ЭКМ housing coatings ensure:

- the necessary resistance to decontaminating solutions:

rectified technical ethyl alcohol according to GOST 18300-72 and (or) 5% solution of citric acid in C_2H_5OH (density 96%) plus three times washing with synthetic detergents in accordance with GOST 29075-91;

- reliable operation of ЭКМ electronic manometers and compliance with the requirements for preservation during storage and transportation.

2.2.45.1 External surfaces of ЭКМ-2005A can be decontaminated (guaranteed by materials selection) during decontamination of premises using decontaminating solutions:

- the first solution - caustic soda (NaOH) - 50-60 g/l, potassium permanganate ($KMnO_4$) - 5-10 g/l;
- second solution - 20-40 g/l of oxalic acid ($H_2C_2O_4$).

Dust and moisture removal from the coating is without difficulty.

Technical requirements for applying paint coatings technology comply with OCT 107.9.4003-96.

Assessment of ЭКМ compliance with the coatings quality requirements is performed according to GOST 25804.8-83.

2.2.46 ЭКМ-2005A are resistant to the effects of the absorbed dose rate for placement groups 1.3, 1.4, 2.1-2.3 in accordance with Table A.1 of Appendix A to STO 1.1.1.07.001.0675-2008.

2.2.47 Reliability indices

2.2.47.1 Mean time between failures, at least:

- 150,000 h for ЭКМ-2005;
- 270,000 h for ЭКМ-2005A.

2.2.47.2 Failure free operation probability during 8,000 hours in NPP operating conditions should be at least 0.97 for ЭКМ-2005A.

2.2.47.3 Average recovery time is max. 1 h.

2.2.47.4 Average service life is at least 15 years.

2.2.47.5 Average service life of ЭКМ-2005A, ЭКМ-2005Exd, ЭКМ-2005AExd is at least 30 years.

2.3 Explosion safety assurance

2.3.1 ЭКМ-2005Exd explosion safety assurance

2.3.1.1 Explosion safety of ЭКМ-2005Exd is ensured by means of "explosion-proof enclosure d" in accordance with TR CU 012/2011, GOST 31610-0-2019 (IEC 60079-0:2017) and GOST IEC 60079-1-2013 and is achieved by enclosing ЭКМ-2005Exd electric circuits in an explosion-proof enclosure that withstands the explosion pressure and prevents explosion transfer into the surrounding explosive environment. The enclosure is tested for strength according to GOST 31610.0-2019 (IEC 60079-0:2017) and GOST IEC 60079-1-2013. Each enclosure is tested with static hydraulic pressure of 2,000 kPa during a period sufficient for inspection but not less than (10+2) seconds.

2.3.1.2 The interface means provide explosion protection of the "explosion-proof enclosure" type. These interfaces are indicated in the drawing with the "Взрыв" (Explosion) word indicating the explosion protection parameters allowed according to GOST IEC 60079-1 the minimum axial thread length, thread pitch, the number of full continuous intact threads (at least 5) in the engagement of the flameproof threaded connection. All fastening parts of enclosure, fittings, cable entries are protected against self-unscrewing using anaerobic adhesive or primer, which retain their properties over the entire operating temperature range. A locking screw prevents the ЭКМ-2005Exd cover connections from self-unscrewing. The screw is secured with a hex wrench after adjustment and installation at the operation site. Perform sealing after installation at the operation site.

2.3.1.3 The display unit with glass is tightly secured with the front cover.

2.3.1.4 The explosion-proof surfaces of ЭКМ-2005Exd enclosure are protected against corrosion by applying the ЦИАТИМ-221 lubricant on surfaces according to GOST 9433-80 or with sealants.

2.3.1.5 The enclosure surface temperature does not exceed the permissible value in accordance with GOST IEC 60079-1-2013 for equipment of temperature class T6 at any permissible ЭКМ-2005Exd operating mode.

2.4 Structure and operation

2.4.1 ЭКМ consists of a sensor module, a power supply and relay module, a system module that controls the alarm channels, a display, a current output module and a keyboard. The measured medium is fed into the primary transducer chamber, and pressure deforms the measuring membrane, which changes electrical resistance of strain gauges located on it, and as a result, the primary transducer generates voltage. The system module measures the voltage signal received from the sensor module and calculates the current value of the measured pressure, outputs information

to the display, controls the alarm channels, the current output module and polls the keyboard. The power supply and relay module powers all ЭКМ units and performs switching of alarm circuits. The current output module generates a standardized current signal – 0-5 mA, 0-20 mA or 4-20 mA, the type of current output is set by the user at the time of ЭКМ configuration. ЭКМ current output operation does not require additional power sources. When connecting the ЭКМ to DC voltage sources, the connection polarity does not matter.

ЭКМ-2005 front panel with LCD display

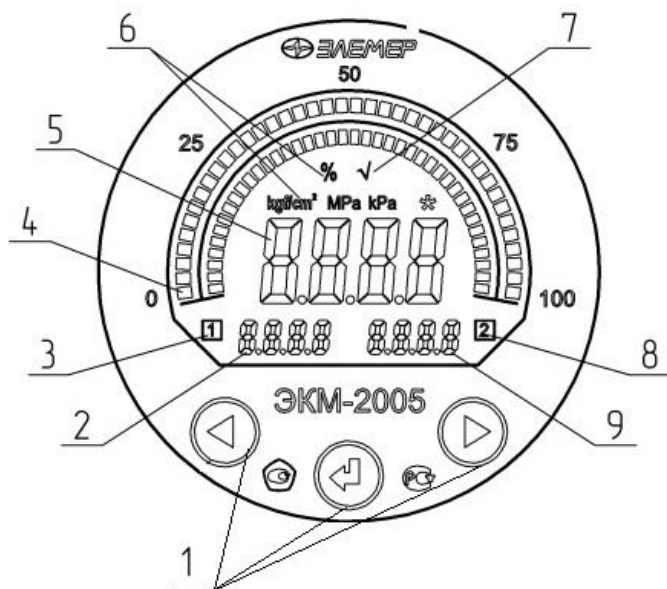


Figure 2.1

ЭKM-2005 front panel with LED display

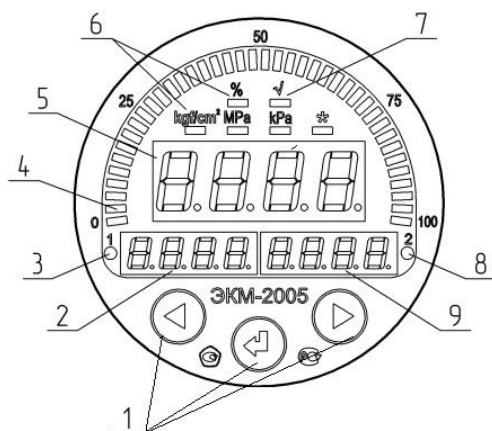


Figure 2.2

Designations for Figures 2.1 and 2.2:

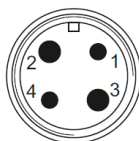
- 1 – buttons «- 2 – setpoint field 1;
- 3 – indication field of the relay 1 activation (actuation);
- 4 – bar display field;
- 5 – main display field: LCD display (see Figure 2.1) and LED display (see Figure 2.2);
- 6 – measurement units indication field;
- 7 – root extraction indication field;
- 8 – indication field of the relay 2 activation (actuation);
- 9 – setpoint field 2.

Plug pin arrangement

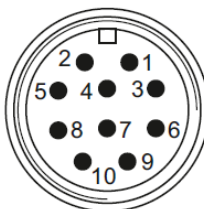
GSSNA 300
plug



2PM14 (ШП14),
2PM22 (ШП22)
plugs



2PM22-10 plug



GSP 311 plug

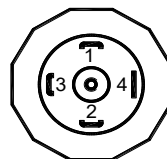
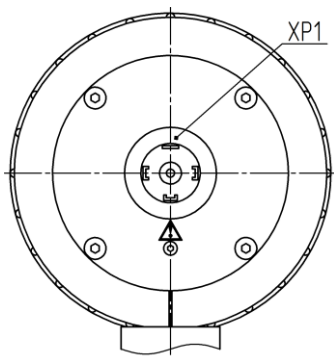
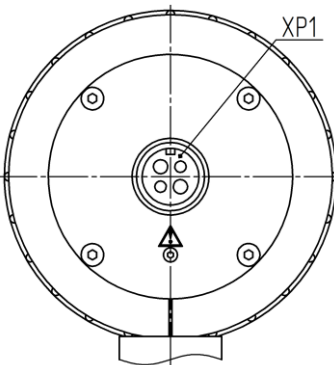


Figure 2.3

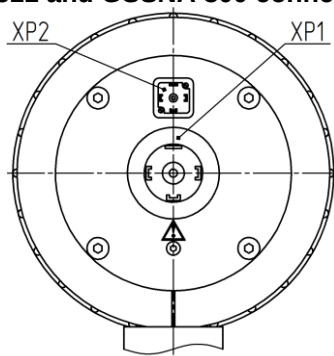
Basic design with GSP 311 connector



Basic design with 2PM22 connector



Design with and without current output with galvanically isolated power and switching circuits with GSP 311 and GSSNA 300 connectors



Design with and without current output with galvanically isolated power and switching circuits with 2PM22 and 2PM14 connectors

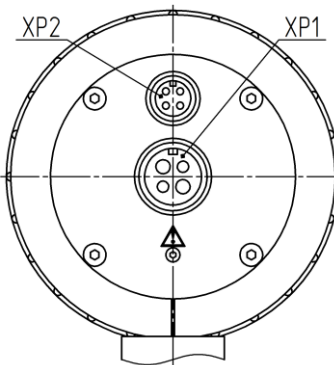
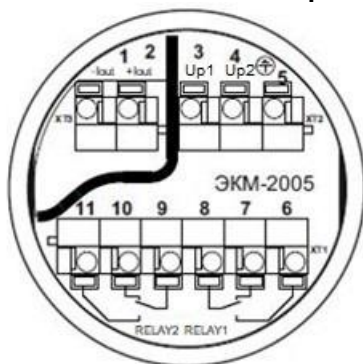


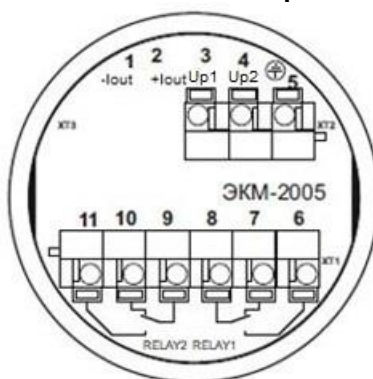
Figure 2.4

External view of the switchboard (for ЭКМ in АГ-17 housing)

With current output



Without current output



Alarm circuits

XT1

CIRCUIT	—
K1 NO	6
K1 NC	7
Common 1	8
Common 2	9
K2 NC	10
K2 NO	11

Power supply circuits

XT2

CIRCUIT	—
Up1	3
Up2	4
Housing	5

Current output circuits

XT3

CIRCUIT	—
-Iout	1
+Iout	2

Figure 2.5

2.4.1.1 For a better indicator view and easy access to switching elements, the housing of ЭКМ electronic unit for differential pressure models can be rotated relative to the sensor unit by $\pm 180^\circ$.

To rotate the electronic unit housing relative to that of the differential pressure sensor unit:

- loosen the locking screws (see Figures 2.6, 2.7);
- rotate the electronic unit housing (see Figures 2.6, 2.7);
- tighten the locking screws.

General view of ЭКМ АГ-16 housing

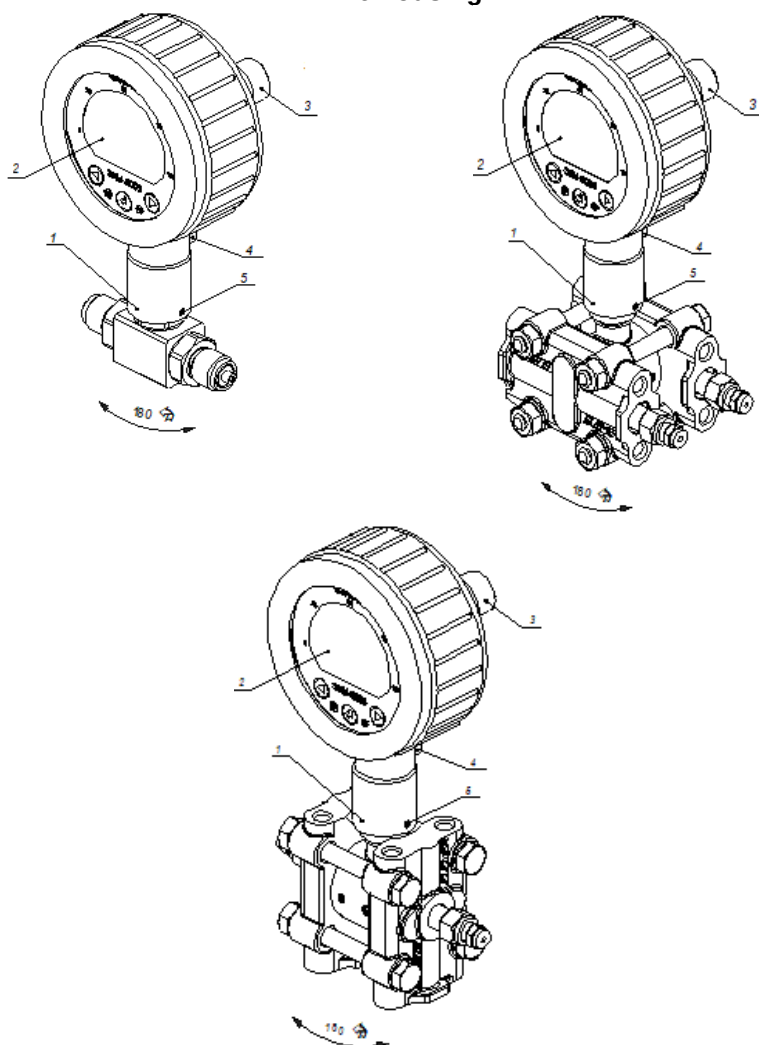


Figure 2.6

Designations for Figure 2.6:

- 1 – sensor unit housing.
- 2 – display glass;
- 3 - connector;
- 4 - electronic unit housing;
- 5 - locking screw.

General view of ЭКМ АГ-17 housing

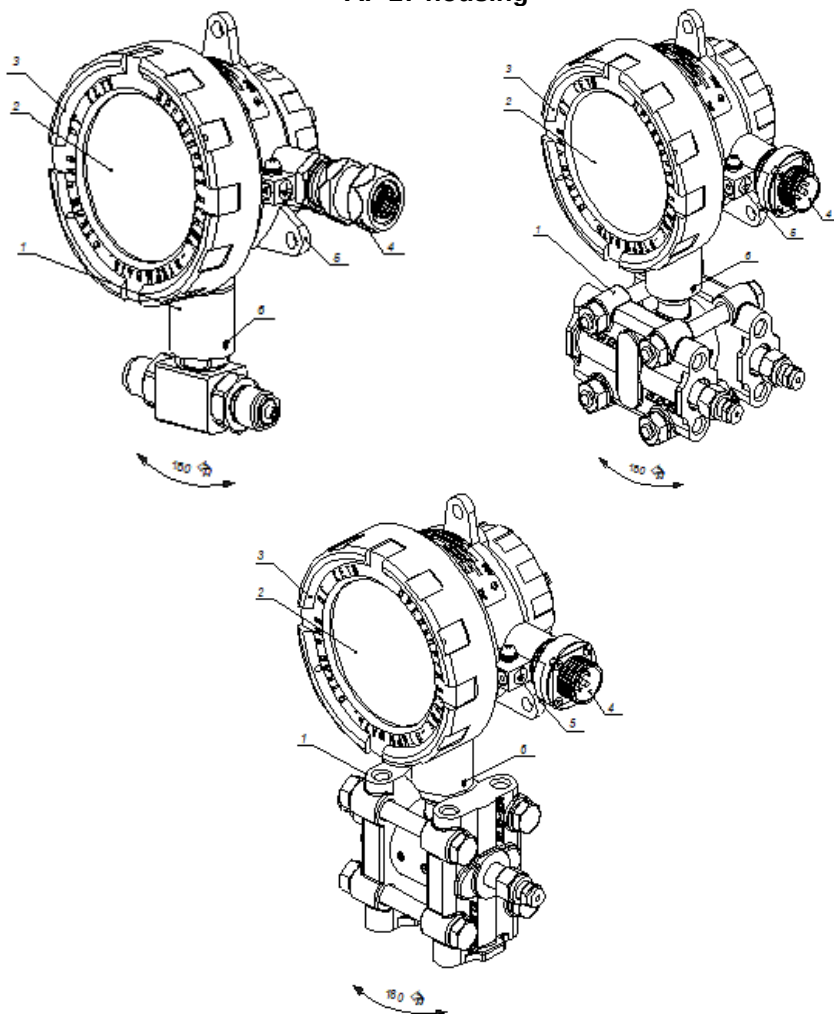


Figure 2.7

- Designations for Figure 2.7:
- 1 – sensor unit housing;
 - 2 – display glass;
 - 3 – front cover;
 - 3 – display glass;
 - 4 – cable entry or connector;
 - 5 – electronic unit housing;
 - 6 – locking screw.

2.4.2 The front panel of ЭКМ contains (see Figures 2.1, 2.2):

- combined display;
- buttons “”, “”, “” to work with the device menu.

2.4.2.1 The main display is a four-digit seven-segment indicator designed to indicate:

- measured quantity values;
- names of menu items/configuration parameter;
- configuration parameter values;
- diagnostic error messages.

ЭКМ display may be negative LCD with backlight (code И1) - light symbols on a dark background, or a color-changing LED (code И2) - the color changes depending on the type of information displayed and the state of the alarm channels relay.

2.4.2.2 The bar display is a semicircular linear scale consisting of 40 segments and is designed for indication and visual evaluation of the measured quantity current value in the set measurement range. If the measured value exceeds the measurement range by 0.2 %, the outermost scale segments corresponding to the lower and upper limit of the input signal conversion range start to flash.

Setpoint values are shown on the bar display in the form of elongated segments (for display code И1) or as red color segments (for display code И2).

2.4.2.3 The relay activation indication field displays the number of the activated relay (for display code И1) or the number of activated relay is highlighted by single red indicators (for display code И2).

2.4.2.4 The measurement units indication field displays the mnemonic name of the set measurement units (for the display code И1) or the selected measurement units are highlighted by single yellow indicators (for the display code И2). If scaling to the display range is enabled (“**ScEn**” parameter) – measurement units are not displayed, regardless of the set measurement units. If the display range (“**ScdL**”, “**ScdH**” parameters) is equal to 0...100 - the symbol “%” is displayed (for the display code И1) or the symbol “%” will be highlighted by single yellow indicator (for the display code И2), the number of decimal places will be equal to “1” regardless of the “**PrcS**” parameter value.

2.4.2.5 If the root extracting function is enables, the mnemonic designation “ $\sqrt{\text{ }}$ ” si displayed (for the display code И1) or the designation “ $\sqrt{\text{ }}$ ” is highlighted by single yellow indicator (for the display code И2). The display

range is determined by the values set for “ScdL”, “ScdH” parameters, regardless of the “ScEn” parameter state.

2.4.2.6 Кнопки “”, “”, “” are used for:

- entering (exiting) the menu;
- menu navigation;
- editing the values of configuration parameters;
- setting values, hysteresis, delay of relay operation, setpoint testing.

2.4.3 Contacts 1, 2, 3 of XP1 connector (see Figures 2.3, 2.4) are used to connect alarm channels: 1 – common, 2 – first alarm channel output, 3 – second alarm channel output. ЭКМ supply voltage is supplied to contacts 1 and 4.

2.4.3.1 Contacts 1 (+) and 2 (-) of XP2 connector (see Figures 2.3, 2.4) are used for connection to ЭКМ current output.

2.4.3.2. The ЭКМ switchboard appearance in the АГ-17 housing is shown in Figure 2.5.

Terminals 1 (“-I_{out}”), 2 (“+I_{out}”) are used for connection to 0-5, 0-20 or 4-20 mA standardized output current signal of ЭКМ.

Terminals 3 («U_{p1}»), 4 («U_{p2}») are used for connecting ЭКМ to the power supply mains.

Terminal 5 () – ground.

Terminals 6-11 are used for connecting alarm channel circuits.

Group of terminals 6-8 corresponds to the 1st alarm channel relay:

- terminals 6-8 are normally open;
- terminals 7-8 are normally closed.

Group of terminals 9-11 corresponds to the 2nd alarm channel relay:

- terminals 9-10 are normally open;
- terminals 9-11 are normally closed.

Note - Relay 1 and relay 2 are not galvanic coupled.

2.4.5 Readjustment of ЭКМ measurement range limits is performed in the following sequence:

- using the instructions in paragraphs 2.5 and 2.6, configure ЭКМ according to the required measurement subrange (menu parameters “OdPL”, “OdPH”, “PrcS”, “Unit”);
apply zero gauge pressure at the input for ЭКМ-2005-ДИ, ЭКМ-2005-ДИВ, or zero absolute pressure (absolute pressure at the input should not exceed 0.05% of the upper measurement limit) for ЭКМ-2005-ДА, or zero pressure difference – for ЭКМ-2005-ДД;

- using the parameter “SHFn” set the display readings value corresponding to the lower measurement range limit;
- apply gauge (for ЭКМ-2005-ДИ, ЭКМ-2005-ДИВ), absolute pressure (for ЭКМ-2005-ДА), or pressure difference (for ЭКМ-2005-ДД) at the input, the values of which correspond to the set upper limit;
- using “GAin” parameter, set the display readings value corresponding to the upper measurement range limit;
- repeat the "zero" adjustment and range adjustment until the measurement error is obtained in accordance with paragraph 2.2.1.

Note — When performing the above procedures, it is recommended to use the ЭЛЕМЕНТ-ПКДС-210 pressure and standard signal verification system.

2.5 Menu navigation

2.5.1. Viewing and changing the values of parameters that determine ЭКМ operation is performed in the menu mode. The changed parameter value is stored in the non-volatile memory and is applied immediately after editing. When entering the menu mode, the measurement and regulation process does not stop.

2.5.2 The list of configuration parameters has a two-level structure. The top level is the menu and the bottom level is the submenu (see Table 2.15).

2.5.3 Button  is used to enter the mode for setting the values of setpoints, hysteresis, relay actuation delay, testing the setpoints, menu parameters, as well as entering (recording) updated parameter values into the ЭКМ microprocessor unit memory. In the selected parameter change mode, the current parameter value flashes; flashing stops after entering (recording).

2.5.4 Button  is used to view (select) the setpoints and hysteresis upwards, to select menu parameters forwards, and to change parameter values upwards.

In measurement mode, press and hold the  button over 1 s to display the diagnostic message about the ЭКМ sensor temperature. The temperature value is displayed in degrees (°C) and is not a metrologically significant parameter of ЭКМ; it is used for an approximate assessment of the sensor temperature. Exit from the sensor temperature display mode to the measurement mode is performed by pressing any ЭКМ button or automatically after 10 s.

2.5.5 Button " is used to enter the ЭKM relay manual testing mode, view (select) setpoints and hysteresis downwards, select menu parameters backwards and change parameter values downwards.

2.5.6 Setting (editing) the numerical values of the parameters is performed using the buttons ", " in two modes: step-by-step and scanning.

Step-by-step mode - pressing and releasing the button once, as a result of which the value of the parameter changes by one unit of the least significant digit.

Scanning mode – changing the parameter value by holding the button down. When the button is held down, the value is changed digit by digit, starting from the least significant digit and ending with the most significant one. The value of each digit is changed by ten units, starting from the current value. After changing the value of the current digit by ten units, a transition to scan the next higher digit occurs.

Scanning stops:

- when the button is released;
- when reaching the upper (9999) or lower (-1999 for conversion limits and settings, 0 for hysteresis, damping time and relay delay) numerical range limits;
- at the transition of the decimal point to the next digit.

Note – To speed up the setting, it is recommended to reduce the number of decimal places by changing the "PrcS" parameter value in advance.

After the scanning stops, the new parameter value flashes. To record the updated value to the ЭKM memory, press the button ".

2.5.7 To enter to the configuration mode, simultaneously press the buttons , . A "UPAS" message will appear on the ЭКМ display, which is a request to enter a password (if the password has been set for parameter editing). After pressing any button, a flashing zero will appear on the display. Use ,  buttons to set the numeric password value (an integer number from the range from 1 to 9999) and press the  button. The first main menu item "InP" (see Table 2.15) will appear on the display if the password is entered correctly. If the password is entered incorrectly, when the  button is pressed, the display will show "AcdE" for 1 second, which means that editing of parameters is prohibited (only viewing is allowed), after that the "InP" message will appear. If no password was set (equal to 0), the "InP" message will appear immediately after the pressing the buttons , . Using buttons  or  select the required main menu item according to Table 2.15. In case of password loss, it can be reset by simultaneous pressing the buttons , ,  and holding them for 15 s. After pressing and holding the buttons , ,  for 10 seconds, the message "UPAS" will appear and after another 5 seconds of holding down the buttons the previously set password will be reset with automatic switching to the password editing mode to set a new password value. If the , ,  or one of the buttons is released before entering the password editing mode, the password will not be reset.

2.5.8 Press the button  to navigate from the main menu to the submenu. Using the buttons ,  select the required submenu parameter and press the button  to enter the parameter value change mode, the current value of the parameter will flash.

2.5.9 In the parameter value change mode, use the buttons  or  to set the selected value. Press the button . The parameter will stop flashing and the set value will be recorded to the ЭКМ memory.

2.5.10 If the password was entered incorrectly, the instrument will allow to enter the parameter values viewing mode, but when trying to change the parameter value using the buttons , , the ЭКМ display will show the message "AcdE" - access is denied. Pressing the button  will not change the parameter value.

2.5.11 Return from the submenu mode to the main menu and from the main menu to the measurement mode is performed by selecting the “rEt” parameter and pressing the button .

2.5.12 Quick return to the measurement mode from any menu level is made by pressing the buttons ,  simultaneously, provided that the parameter value on the display is not flashing (i.e. the parameter editing mode is not activated). The instrument will return to the measurement mode and the message "A in" will be displayed for 1 s.

The instrument also returns to the measurement mode without saving changes if no buttons are pressed within the time set in the parameter "trEt" (auto-exit).

Table 2.15 - Menu structure

Main menu item	Submenu	Parameter name	Note
InP		ЭKM input parameters configuration	Entering the menu for setting ЭKM input parameters
	PrcS	Number of decimal places	0, 1, 2 or 3
	IdPL	Lower limit of ЭKM measurement range	This parameter is set during manufacturing and corresponds to ЭKM model; available for viewing only
	IdPH	Upper limit of ЭKM measurement range	This parameter is set during manufacturing and corresponds to ЭKM model; available for viewing only
	Unit	Measurement units	Selection from the list of measurement units displayed
	t_63	Damping time	Set in the range from 0 to 255 seconds
	trEt	Auto exit time	Set in the range from 1 to 60 minutes
	Sqr	Square root extraction function	Enabling/disabling the square root extraction function (On/OFF)
	SHFn	Zero correction	Correction of the manometer lower measurement ranger limit
	GAin	Range correction	Correction of the manometer upper measurement ranger limit
	rEt	Exit the sub-menu	Command to return to the main menu
rLY1		Relay 1 actuation parameter configuration	

Table 2.15 continued

Main menu item	Submenu	Parameter name	Note
	rL1.1	Relay 1 communication with setpoint 1	OFF - the relay state does not change, StP1 - the relay is on if the measured value is less than the setpoint ("lower" setpoint), StP2 - the relay is on if the measured value is greater than the setpoint ("upper" setpoint)
	rL1.2	Relay 1 communication with setpoint 2	See " rL1.1 " parameter description
	rL1.C	Relay status 1 when outside the measuring range	ON - on, OFF - off
	rEt	Exit the sub-menu	Command to return to the main menu
rLY2		Relay 2 actuation parameter configuration	
	rL2.1	Relay 2 communication with setpoint 1	See " rL1.1 " parameter description
	rL2.2	Relay 2 communication with setpoint 2	See " rL1.1 " parameter description
	rL2.C	Relay status 2 when outside the measuring range	ON - on, OFF - off
	rEt	Exit the sub-menu	Command to return to the main menu
Out		ЭKM output parameters configuration	Entering the menu for setting ЭKM output parameters
	OtYP*	Current output range	Selecting the range of the standardized output current signal
	OdPL	Lower limit of the ЭKM measurement subrange	Lower conversion limit for current output and indication (ScEn= OFF)
	OdPH	Upper limit of the ЭKM measurement subrange	Upper conversion limit for current output and indication (ScEn= OFF)
	ScEn	Enabling scaling to the display range	ON - on, OFF - off
	ScdL	Lower limit of the ЭKM display range	Lower conversion limit for display (ScEn=On)
	ScdH	Upper limit of the ЭKM display range	Upper conversion limit for display (ScEn=On)
	ErEn*	Enabling error current	ON - on, OFF - off

Table 2.15 continued

Main menu item	Submenu	Parameter name	Note
	OErr*	Error current value	Error current for the standardized output signal, mA
	rEt	Exit the sub-menu	Command to return to the main menu
UPAS**		Password setting	Value from 0 to 9999
rEt		Exit the menu	Command to return to measurement mode
Notes 1 - * The parameter is displayed when the current output module is installed. 2 - ** Factory setting is 0.			

2.6 ЭКМ configuration parameters setting

2.6.1 ЭКМ configuration parameters and the factory settings are shown in Table 2.16.

Table 2.16 — ЭКМ configuration parameters

Parameter name	Designation on the display (indicator)	Seq. No.	Permissible parameter values	Factory setting
Number of decimal places	PrcS	2.6.2	0, 1, 2 or 3	*
Lower limit of ЭКМ measurement range	IdPL	2.6.3	-1999...9999	*
Upper limit of ЭКМ measurement range	IdPH	2.6.3	-1999...9999	*
Units	Unit	2.6.4	kgf/cm ² , MPa, kPa upon order: Pa, atm., bar, mbar, mm H ₂ O, m H ₂ O, mm Hg, psi	*
Damping time	t 63	2.6.5	0...255	0.1
Auto exit time	trEt	2.6.5.1	1...60	10
Square root extraction function	Sqr	2.6.6	ON - on OFF - off	OFF
Zero correction	SHFn	2.6.7	+2.5 %	-
Range correction	GAin	2.6.8	+2.5 %	-
Setpoint 1	SEt1	2.6.9	-1999...9999	-
Setpoint 1 hysteresis	HYS1	2.6.10	0...9999	-
Delayed activation of relay 1	trL1	2.6.11	0...255	0.1

Table 2.16 continued

Setpoint 2	Set2	2.6.9	-1999...9999	-
Setpoint 2 hysteresis	HYS2	2.6.10	0...9999	-
Delayed activation of relay 2	trL2	2.6.11	0...255	0.1
Relay 1 communication with setpoint 1	rL1.1	2.6.12	OFF – none StP1 - “decrease” StP2 – “increase”	StP2
Relay 1 communication with setpoint 2	rL1.2	2.6.12	See “ rL1.1 ” parameter description	OFF
Relay status 1 when outside the measuring range	rL1.C	2.6.13	ON - on OFF - off	OFF
Relay 2 communication with setpoint 1	rL2.1	2.6.12	See “ rL1.1 ” parameter description	OFF
Relay 2 communication with setpoint 2	rL2.2	2.6.12	See “ rL1.1 ” parameter description	StP2
Relay status 2 when outside the measuring range	rL2.C	2.6.13	ON - on OFF - off	OFF
Current output range	OtYP	2.6.14	Selected from the list 0-5, 0-20, 4-20, OFF	4–20
Lower limit of the Σ KM measurement subrange	OdPL	2.6.15	-1999...9999	*
Upper limit of the Σ KM measurement subrange	OdPH	2.6.15	-1999...9999	*
Enabling scaling to the display range	ScEn		ON - on OFF - off	OFF
Lower limit of the Σ KM display range	ScdL		-1999...9999	0
Upper limit of the Σ KM display range	ScdH		-1999...9999	100
Enabling error current	ErEn	2.6.16	ON - on OFF - off	On
Error current value	OErr	2.6.16	Current value in the range – 0...6, 0...22.5, 3.7...22.5 mA	3.7
Note — * The factory setting corresponds to the order form				

2.6.2 The number of decimal places "PrcS" is the maximum number of digits after the decimal point for the value displayed. The measured pressure value is represented by a number with a floating decimal point, which automatically shifts to the right when the value of the measured parameter increases due to the limited digit capacity of the display. Permissible values: 0, 1, 2 and 3.

2.6.3 Lower and upper limits of the measuring range "IdPL", "IdPH": permissible values from -1999 to +9999. The range is set during the ЭKM manufacture according to the sensor measurement range. These parameters are available for viewing only, when trying to edit a parameter, the message "AcdE" is displayed

2.6.4 "Unit" measurement units are physical units of measurement of the input signal displayed. Selected from the list - kgf/cm², MPa, kPa, * (for display code I1) and from the list - kgf/cm², MPa, kPa, * (for display code I2). When changing measurement units, the number of decimal places, the ЭKM measurement limits, the current output conversion limits, the setpoint values and hysteresis are automatically recalculated to the selected measurement units. If scaling to the display range ("ScEn" parameter) or root extraction mode ("Sqr" parameter) are enabled, measurement units are not displayed, regardless of the "Unit" parameter value. If the display range ("ScdL", "ScdH" parameters) is equal to 0...100 - the symbol "%" will appear (for the display code I1) or the symbol "%" will be highlighted by single yellow indicator (for the display code I2), the number of decimal places will be equal to "1" regardless of the "PrcS" parameter value.

2.6.5 The damping time "t_63" is the time constant of the first-order filter, a parameter that allows to reduce the variation (noise) of measurements. When setting the value of this parameter, it is necessary to take into account that at a stepwise pressure variation by 100% of the measurement range, the output signal will reach a value of 63% of the measurement range within the time set in the parameter "t_63". Permissible values are from 0 to 255 s. The discreteness of values setting is 0.1 s for the interval from 0 to 1 s and 1 s for the interval from 1 to 255 s. When setting the parameter value, the symbol "s" - seconds - will appear on the display (for the display code I1 only). To reset the damping time to factory settings ("t_63"

= 0.1 s), enter the editing mode for "t_63" parameter using the button 
 “, and after that, perform a reset by simultaneous pressing the buttons 
 “, “. Exit the "t_63" parameter editing mode using the button .

2.6.5.1 Auto exit time "trEt" is the time of automatic exit from the menu to the measurement mode. The time, after which the instrument returns to the measurement mode without saving changes. Permissible values are from 1 to 60 min. The values setting discreteness is 1 min.

To reset the auto exit time to factory settings ("trEt" = 10 min), enter the editing mode for "trEt" parameter using the button , and after that, perform a reset by simultaneous pressing the buttons , . Exit the "trEt" parameter editing mode using the button .

2.6.6 The square root extraction function "Sqr" is a parameter that allows the square root extraction from the measured pressure value. If the parameter value is "OFF", then measurement is performed according to the linear law. When the square root extraction function is enabled, the " $\sqrt{}$ " symbol will appear on the display (for the display code I1) or the " $\sqrt{}$ " symbol will be highlighted by a single yellow indicator (for the display code I2). The display range is determined by the values set in "ScdL", "ScdH" parameters, regardless of the "ScEn" parameter state. If the scalable display range ("ScdL", "ScdH" parameters) is equal to 0...100 - the symbol "%" will appear (for the display code I1) or the symbol "%" will be highlighted by single yellow indicator (for the display code I2), the number of decimal places will be equal to "1" regardless of the "PrcS" parameter value. In this case the measured pressure range with a standardized error will be from 6.25 to 100% for the pressure difference set by "OdPL" and "OdPH" parameters, and the range of measured flow will be in the range from 25.0 to 100.0 %. When the root extraction function is enabled/disabled, the values of setpoints and hysteresis are not automatically recalculated (setpoint and hysteresis values need to be re-set). The root extraction function can be enabled/disabled only during ЭKM configuration, it is prohibited to enable/disable the ЭKM root extraction function in the process control mode, as this may lead to false triggering of the alarm channel relays.

To reduce noise near zero at input pressures less than 1% of the measurement range, a linear conversion function is used.

2.6.7 Zero correction "SHFn" causes the ЭKM zero offset. For zero offset, apply zero gauge pressure to the ЭKM input for ЭKM-2005-ДИ, ЭKM-2005-ДИВ, or zero absolute pressure (absolute inlet pressure should not exceed 0.05% of the upper measurement limit) for ЭKM-2005-ДА, or zero

pressure difference for ЭКМ-2005-ДД. Using the buttons "" and "" (backward, forward), set the value of ЭКМ readings corresponding to the applied pressure with a fixed step of 0.025% of the upper measurement limit. To reset the entered offset, press the buttons "" and "" simultaneously in this menu. The possible zero offset value is $\pm 2.5\%$ of the difference between the ЭКМ measurement range upper and lower limits.

2.6.8 The "GAin" range correction causes variation of the ЭКМ measurement range. To correct the range, apply to the ЭКМ input gauge pressure (for ЭКМ-2005-ДИ, ЭКМ-2005-ДИВ) or absolute pressure (for ЭКМ-2005-ДА), or the pressure difference (for ЭКМ-2005-ДД) corresponding to the set upper limit. Using the buttons "" and "" the value of ЭКМ readings corresponding to the applied pressure is set. To reset the entered offset, press the buttons "" and "" simultaneously in this menu. The possible range correction value is $\pm 2.5\%$ of the ЭКМ upper measurement range.

2.6.9 "SEt1", "SEt2" are values of the first and the second setpoints, specified in units of values shown on the display. ЭКМ has two independent setpoint comparators that can be configured to work with control relays of two alarm channels.

2.6.10 Setpoints hysteresis "HYS1", "HYS2" is the value of setpoints disabling delay, set in the units of values displayed and used to reduce the contacts "chatter". The parameter always has a positive value (or zero). Disabling delay is asymmetrical with respect to the setpoint value. The "decrease" setpoint will be triggered at $A \leq \text{Set}$ and reset at $A \geq \text{SEt} + \text{HYS}$, "increase" setpoint will be triggered at $A \geq \text{Set}$ and reset at $A \leq \text{SEt} - \text{HYS}$, where A is the measured quantity.

2.6.11 The relays triggering delay values "trL1", "trL2" are parameters that protect against false relay triggering under conditions of interference and fast-flowing processes. The parameters set the delay time for each relay. When the setpoint is activated, the relay delay timer starts counting down, and the relay activation symbol on the display flashes (for the display code И1) or a single relay status indicator flashes (for the display code И2). After the delay is counted down, the relay will turn on at the setpoint triggering, and the relay activation symbol/indicator will stop flashing. If the setpoint is switched off during the countdown, the time counter will be reset and the relay will not turn on. Permissible values are from 0 to 255 s. The

discreteness of values setting is 0.1 s for the interval from 0 to 1 s and 1 s for the interval from 1 to 255 s. When setting the parameter value, the symbol "s" - seconds - will appear on the display (for the display code I11). These parameters allow to implement in the ЭКМ the function of time relay with delay time from 0 to 255 s for each alarm channel. The instrument has a programmed 10-second relay operation delay when the ЭКМ is powered on. When the delay is counted down, the relay number will flash on the display (for the display code I11) or a single status indicator will flash (for the display code I12) for the relay to be activated according to the triggered setpoints.

2.6.12 Communication of relay with setpoints "rL" is a parameter that determines the logic of relay operation when the setpoints are triggered. Table 2.17 shows the values of the relay communication parameter with the states of the setpoint comparators.

Table 2.17 – Communication of relay with setpoints

Value of relay communication parameter with setpoints	Setpoint type
OFF	No communication of relay with setpoint
StP1	"Decrease" setpoint, relay is on, if the measured value is less than the setpoint
StP2	"Increase" setpoint, relay is on, if the measured value is greater than the setpoint

Factory settings: rL1.1 - StP2, rL1.2 - OFF, rL2.1 - OFF, rL2.2 - StP2.

2.6.13 The relay state when the signal is outside the measurement subrange "rL1.C", "rL2.C" is a parameter that may have two values: "OFF" - off or "On" - on. If the parameter value is "OFF", the relay is disabled when the signal goes beyond the user-set measurement subrange; if the value is "ON", it is enabled. Factory setting: "OFF".

2.6.14 Current output range "OtYP" is a parameter that determines the standardized current output range: "0-5" - 0-5 mA output, "0-20" - 0-20 mA output, "4-20" - 4-20 mA output, "OFF" - current output is disabled. The parameter can be found in the menu only if a current output module is installed in ЭКМ.

2.6.15 The measurement subrange lower and upper limits "OdPL", "OdPH" are parameters that determine the set subrange of measured pressures and the conversion range for the current output. The subrange limit values must be within the measurement range set by the "IdPL" and "IdPH" parameters during the ЭКМ manufacture. Permissible values are from -1999 to +9999.

2.6.15.1 The subrange lower limit "OdPL" (A_L) is the set lower limit of pressure measurement.

2.6.15.2 The subrange upper limit "OdPH" (A_{UP}) is the set upper limit of pressure measurement.

2.6.15.3 Enabling of the scalable display range "ScEn" determines the operating mode of ЭКМ display. Permissible parameter values:

"OFF" - scaling to the display range is disabled, the display and ЭКМ current signal conversion ranges correspond to the ЭКМ measurement subrange ("OdPL", "OdPH" parameters);

"On" - scaling to the display range is enabled, the measured values within the measurement subrange are scaled to the set display range ("ScdL", "ScdH" parameters).

2.6.15.4 The lower limit of the ЭКМ display range "ScdL" is a number that is set to correspond to the lower limit of the measured pressure subrange "OdPL" (parameter "ScEn"="On").

2.6.15.5 The upper limit of the ЭКМ display range "ScdH" is a number that is set to correspond to the upper limit of the measured pressure subrange "OdPH" (parameter "ScEn"="On").

2.6.16 "ErEn" and "OErr" determine the operating mode of the current output when the pressure values are outside the measurement range. The "ErEn" parameter enables generation of error current. Permissible parameter values are "OFF" – the error current is off, "On" – on. The "OErr" parameter sets the error current value depending on the current output range set in the "OtYP" parameter. The error current value may be from 0 to 6 mA for 0-5 mA current output, from 0 to 22.5 mA for 0-20 mA current output, and from 3.7 to 22.5 mA for 4-20 mA current output. When changing the current output range ("OtYP" parameter), the error current value is not automatically recalculated; the required error current value ("OErr" parameter) should be set after changing the current output range. The "ErEn" and "OErr" parameters in the menu are available only if ЭКМ is equipped with a current output module.

2.7 Setpoint values setting, testing setpoints

2.7.1 Setting (viewing) of setpoints, hysteresis, relay operation delays, setpoints testing.

2.7.1.1 Press the button . A "UPAS" message will appear on the ЭКМ display, which is a request to enter a password (if the password has been set for parameter editing). Press any button, a flashing zero will appear. Use the buttons  and  to set the numeric password value (an integer number from the range from 1 to 9999) and press the button . "SEt1" will appear on the display if the password is entered correctly. If the password is entered incorrectly, when the button  is pressed, the dis-

play will show "AcdE" for 1 second, which means that editing of parameters is prohibited (only viewing is allowed), after that the "SEt1" message will appear. If no password was set (equal to 0), the "SEt1" message will appear immediately after the pressing the button .

2.7.1.2 Use the buttons ,  to select the required parameter.

Using the button , the parameters are selected cyclically forward: "SEt1" → "HYS1" → "SEt2" → "HYS2" → "trL1" → "trL2" → "biSt/SiSt"* → "tESt" → "rEt" → "SEt1", using the button  - cyclically backward: "SEt1" → "rEt" → "tESt" → "biSt/SiSt"* → "trL2" → "trL1" → "HYS2" → "SEt2" → "HYS1" → "SEt1".

"SEt1" and "SEt2" are setpoint values, "HYS1" and "HYS2" are hysteresis values, "trL1", "trL2" - relay operation delay values, "biSt/SiSt"* is the alarm channel relay type, biSt - bistable (polarized), SiSt - monostable (basic version), "tESt" - entering the setpoint test mode, "rEt" - command to return to measurement mode.

2.7.1.3 To change the value of setpoint, hysteresis or delay, select the required parameter, press the button  to enter the parameter value change mode, and the parameter value will flash. Use the buttons ,  to set the required parameter value. Press the button . The parameter will stop flashing and the set value will be recorded to the ЭKM memory. If the parameter value should not be changed, press the button , and the existing value will be saved.

2.7.1.4 To enter the setpoint and relay testing mode, select the parameter "tESt" and press the button , the relay will be disabled regardless of the measured quantity state. Use the buttons ,  to select the required test: "tSt1" - test of the first setpoint, "tSt2" - test of the second setpoint, "tStF" - relay testing when the measured quantity is outside the measuring range. Use the button  to cycle the parameters forward: "tSt1" → "tSt2" → "tStF" → "rEt" → "tSt1"; use the button  to cycle the parameters backward: "tSt1" → "rEt" → "tStF" → "tSt2" → "tSt1". After selecting the parameter "tSt1" or "tSt2", press the button  to enter the setpoint testing mode. After that ЭKM will switch to the mode of measured quantity emulation close to the setpoint value, and the emulated value will flash. When the emulated value reaches the setpoint value, the setpoint

and the relay associated with this setpoint will be triggered, taking into account the set hysteresis, damping time and relay operation delay time.

To accelerate the relay testing process, it is recommended to set the damping time and the relay operation delay time to zero ("t_63", "trL1" and "trL2" parameters).

After selecting the "tStF" parameter, press the button , a flashing message "-FL-" will appear indicating that the measured quantity is outside the measurement subrange. In this case the relay will actuate in accordance with the "Off" or "On" value set in the "rL1.C" and "rL2.C" parameters.

Press the button  to stop the current test. To exit the testing mode, select the "rEt" parameter and press the button , the message "tEst" will appear.

2.7.1.5 After completing the setpoints testing, entering the values of setpoints, hysteresis, delay time, use the buttons ,  to select the "rEt" command and press the button . ЭKM will save the entered changes in memory and return to the measurement mode, displaying the message "A in" for 1 s.

ЭKM also returns to the measurement mode if no buttons are pressed within the time set in the parameter "trEt" (auto-exit). In the relay testing mode, the auto-ext time increases taking into account the values of parameters "trL1", "trL2", and "t_63".

2.8 Manual relay testing

2.8.1 To enter the manual relay testing menu, press the button  for more than 1 s. A "UPAS" message will appear on the ЭKM display, which is a request to enter a password (if the password has been set for parameter editing). After pressing any button, a flashing zero will appear on the display. Use the buttons ,  to set the numeric password value (an integer number from the range from 1 to 9999) and press the button . The menu item "tSr" will appear on the display if the password is entered correctly. If the password is entered incorrectly, when the button  is pressed, the display will show "Acde" for 1 second, which means that entering the manual relay testing mode is prohibited, after which ЭKM will automatically return to the measurement mode. If no password has been set (equal to 0), the "tSr" message will appear immediately after pressing the

button  for more than 1 s. Using the buttons  or , select the menu item "tSr" (to continue working in the manual relay testing mode) or "rEt" (to enter the measurement mode).

2.8.2 Simultaneous pressing of the buttons  and  or holding the button  pressed with subsequent pressing of the button  in the "tSr" menu starts the manual testing mode of relay 1, which will change the relay 1 state to the opposite, regardless of the measured pressure value and setpoints - relay communication. The relay state is changed without delay, regardless of the "trL1" parameter. Repeated simultaneous pressing of the buttons  and  or holding the button  pressed with subsequent pressing of the button  changes the state of relay 1 to the opposite. In the manual testing mode of relay 1, the system message "tSr1" flashes on the ЭКМ display. The relay 1 trigger indicator is displayed according to the manually set state of relay 1.

2.8.3 Simultaneous pressing of the buttons  and  or holding the button  pressed with subsequent pressing of the button  in the "tSr" menu starts the manual testing mode of relay 2, which will change the relay 2 state to the opposite, regardless of the measured pressure value and setpoints - relay communication. The relay state is changed without delay, regardless of the "trL2" parameter. Repeated simultaneous pressing of the buttons  and  or holding the button  pressed with subsequent pressing of the button  changes the state of relay 2 to the opposite. In the manual testing mode of relay 2, the system message "tSr2" flashes on the ЭКМ display. The relay 2 trigger indicator is displayed according to the manually set state of relay 2.

2.8.4. In the manual testing mode of relay 1 (par. 2.8.2), it is possible to switch to relay 2 testing (par. 2.8.3) and vice versa, while the relay states will remain in accordance with those set manually at the time of switching to another relay testing.

2.8.4. Exit from the manual relay testing mode is performed by simultaneous pressing of the buttons ,  followed by switching to the manual relay testing menu "tSr" or automatically after the auto-exit time has elapsed ("trEt" parameter) with switching to the measurement mode. Exiting the manual relay testing mode is accompanied by switching of the alarm channel relay to a state determined by the measured pressure value

and setpoints - relay communication. Select the "rEt" parameter and press the button " " to exit to the measurement mode from the manual testing menu of "tSr" relay.

2.9 Error messages

2.9.1 ЭКМ has the function of displaying messages on the instrument status and errors occurring during operation. Possible error messages and their descriptions are given in Table 2.18.

Table 2.18 – Error messages

Text message	Error content
"nrdY"	Occurs when the ЭКМ is turned on until completion of data processing during preparation of correct measurement results output
"Lo"	The measured pressure is in the range from -1.25 to -6.25 % of the measurement subrange
"AcdE"	Incorrect password or access to parameter editing is denied
"Hi"	Measured pressure is in the range from 112.5 to 115.6 % of the measurement subrange
"Cut"	Input pressure is less than -6.25 % of the measurement subrange or sensor is defective
"Fl"	Measured pressure is more than 115.6 % of the measurement range or sensor is defective
Note – Message "Err" appears in case of ЭКМ failures. If this message does not disappear after turning off (for at least 3 seconds) and on the ЭКМ power again, the ЭКМ requires service maintenance at the manufacturer's facility.	

2.10 Marking

2.10.1 ЭКМ marking is performed in accordance with GOST 26828-86, GOST 22520-85, and the drawing HKГЖ.406233.053СБ.

2.10.2 Marking of explosion-proof ЭКМ-2005Exd

2.10.2.1. The outer surface of the ЭКМ-2005Exd head cover contains the following:

- explosion protection marking in accordance with the order:
- WARNING – UNPLUG BEFORE OPENING warning notice.

The side surface of explosion-proof ЭKM-2005Exd housing contains indication of the ambient temperature range (depending on the design):

- $(-5\text{ }^{\circ}\text{C} \leq t_a \leq +50\text{ }^{\circ}\text{C})$;
- $(-25\text{ }^{\circ}\text{C} \leq t_a \leq +70\text{ }^{\circ}\text{C})$;
- $(-40\text{ }^{\circ}\text{C} \leq t_a \leq +70\text{ }^{\circ}\text{C})$;
- $(-50\text{ }^{\circ}\text{C} \leq t_a \leq +80\text{ }^{\circ}\text{C})$.

2.10.2.2. Marking is applied by sticking a plate made on the film by thermal transfer method, ensuring the marking preservation throughout the entire service life.

2.11 Packaging

2.11.1. Packaging is performed in accordance with GOST 23170-78 and ensures complete preservation ability of ЭKM.

2.11.2. ЭKM are packaged in closed premises at an ambient air temperature of +15 to +40 °C and relative humidity of 80 % of the environment free from aggressive admixtures.

2.11.3. Before packaging, the fitting openings are closed with caps or plugs protecting the internal cavity from contamination and threads from mechanical damage.

3. PRODUCTS INTENDED USE

3.1. Products preparation for use

3.1.1 Safety precautions

3.1.1.1. Operational safety of ЭKM is ensured by:

- strength of the measuring chambers complying with the standards specified in paragraph 2.2.1;
- insulation of electrical circuits in accordance with the standards specified in paragraphs 2.2.27 to 2.2.28.2;
- reliable fastening during installation at the facility;
- the design (all ЭKM components under voltage are placed in the housing, ensuring personnel protection against contact with parts and assemblies under voltage).

3.1.1.2. In terms of human protection against electric shock, ЭKM with a supply voltage of 220 V correspond to class I in accordance with GOST 12.2.007.0-75 and meet safety requirements in accordance with TR CU 004/2011, GOST IEC 61010-1, GOST 12.2.091.

3.1.1.2.1. In terms of human protection against electric shock, ЭKM with a supply voltage of 24 V or 36 V correspond to class III in accordance with GOST 12.2.007.0-75 and meet safety requirements in accordance with TR CU 004/2011, GOST IEC 61010-1, GOST 12.2.091.

3.1.1.3. Grounding is implemented by means of screws with washers located on the ЭKM housing.

3.1.1.4. During testing of ЭKM, it is necessary to comply with the general safety requirements of GOST 12.3.019-80, and during operation - with the "Rules of technical operation of electrical installations of consumers" and "Safety rules for operation of consumer electrical installations" for installations with voltage of up to 1000 V, approved by the State Energy Supervision Authority (Gosenergonadzor).

3.1.1.5. Maintenance of ЭKM must be performed by personnel who have a safety qualification group of at least II in accordance with the "Safety rules for operation of consumer electrical installations".

3.1.1.6. When testing insulation and measuring its resistance, it is necessary to take into account safety requirements established for the testing equipment.

3.1.1.7. Replacement, connection and disconnection of ЭKM from the main lines which supply the measured medium shall be done after closing the valve on the line before ЭKM and disconnecting the power supply. ЭKM

must be disconnected after the pressure in it has been released to the atmospheric pressure.

3.1.1.8. In accordance with NP-001-15, NP-016-05, NP-033-11, ЭКМ-2005A (increased reliability) are referred to safety classes 2, 3, 4:

- by application — to the elements of normal operation;
- by the effect on safety — to safety-relevant elements;
- according to the nature of functions - to elements of safety control systems.

Example of classified designation 2, 2H, 2Y, 2HY, 3, 3H, 3Y, 3HY or 4, 4H.

3.1.1.9 ЭКМ-2005A are fireproof, i.e. probability of a fire in ЭКМ-2005A does not exceed 10^{-6} per year in accordance with GOST 12.1.004-91 both in normal and emergency modes of NPP operation. Fire is considered the occurrence of open fire on the outer surfaces of transducers or the release of burning particles from them.

3.1.1.10 When testing and operating ЭКМ-2005A, it is also necessary to comply with the requirements of NP-001-15, NP-082-07.

3.1.2 Visual inspection

3.1.2.1 Absence of mechanical damages, conformity of marking and completeness are checked during visual inspection.

In the presence of defects affecting ЭКМ performance, inconsistencies in completeness, or marking, determine the possibility of their further use.

3.1.2.2 Each ЭКМ is checked for availability of a data sheet with a QCD mark.

3.1.3 Testing

3.1.3.1 Connect ЭКМ to the power source and a measuring instrument in accordance with Figures 3.1 - 3.15.

3.1.3.2 Hold ЭКМ in switched on state for 5 minutes.

3.1.3.3 Verify that ЭКМ is operational based on the display and measuring instrument readings.

3.1.3.4 If necessary, set the required measurement range using the instructions in paragraph 2.4.5.

3.1.3.5 Check and, if necessary, perform "zero" adjustment, to do this:

- apply zero gauge pressure at the input for ЭКМ-2005-ДИ, ЭКМ-2005-ДИВ, or zero absolute pressure (absolute pressure at the input should

not exceed 0.05 % of the upper measurement limit) for ЭКМ-2005-ДА, or zero pressure difference – for ЭКМ-2005-ДД;

- using the parameter “SHFn”, set the display readings value corresponding to the lower measurement range limit.

3.1.3.6 Check and, if necessary, adjust the upper measurement limit, to do this:

- apply to the input gauge pressure for ЭКМ-2005-ДИ, ЭКМ-2005-ДИВ or absolute pressure for ЭКМ-2005-ДА, or the pressure difference for ЭКМ-2005-ДД corresponding to the set upper limit;
- using the parameter “GAin”, set the display readings value corresponding to the measurement range upper limit;
- repeat the procedures in accordance with paragraph 3.1.3.5; if “zero” adjustment was performed, then also repeat the procedures described in paragraph 3.1.3.6.

Note – When performing the above procedures, it is recommended to use the “ЭЛЕМЕР-ПКДС-210” pressure and standard signal verification system.

3.1.3.6.1 Adjustment of the upper and lower measurement limits is necessary when setting the upper and (or) lower limit of the measurement range other than the factory one.

3.1.3.6.2 The factory setting of the measurement range is indicated in the ЭКМ data sheet.

Electrical connection diagram of ЭKM-2005 in АГ-16 housing without current output with a supply voltage of ~ 220 V or = 220 V

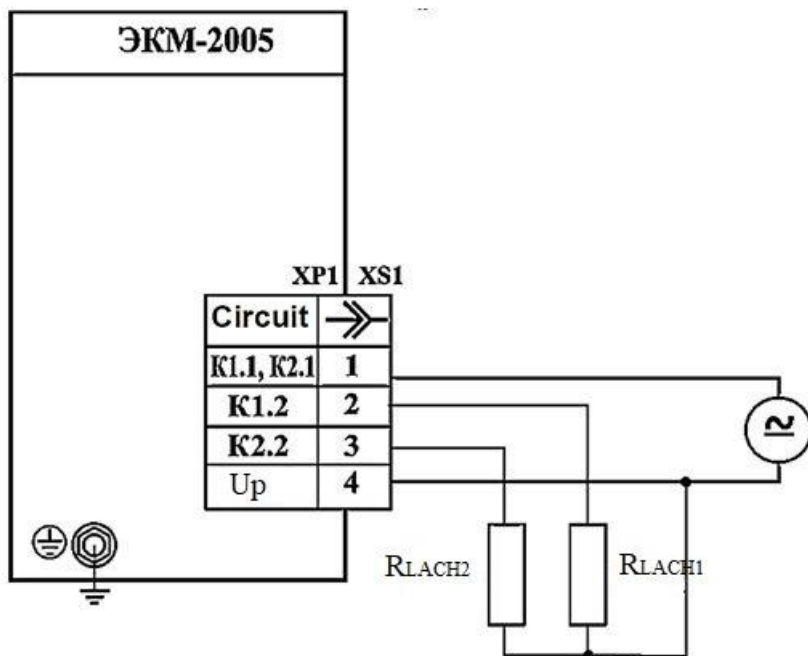


Figure 3.1

Electrical connection diagram of ЭKM-2005 in АГ-16 housing without current output with a supply voltage of = 24 V or = 36 V

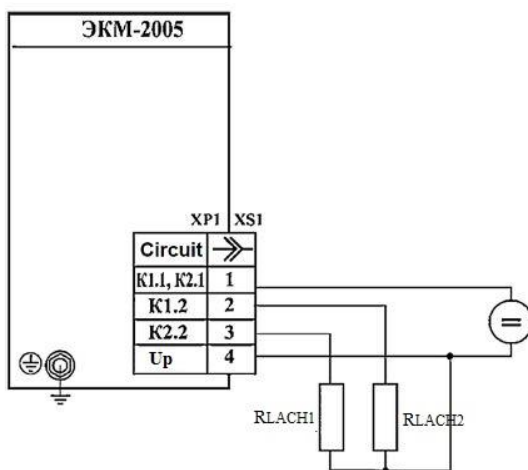


Figure 3.2

Electrical connection diagram of ЭKM-2005 in АГ-16 housing with current output with a supply voltage of ~ 220 V or = 220 V

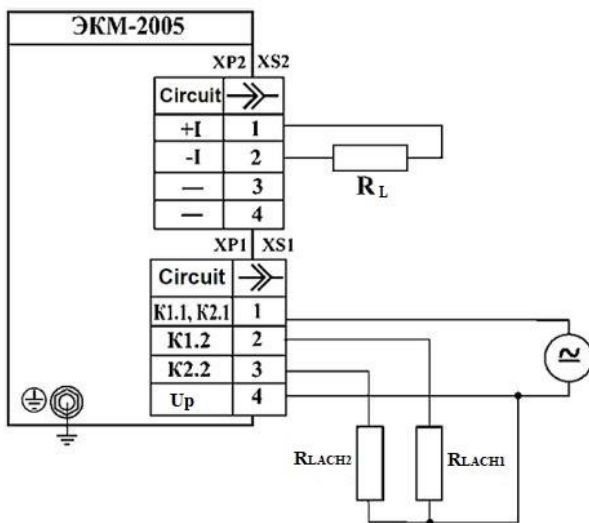


Figure 3.3

Electrical connection diagram of ЭKM-2005 in АГ-16 housing with current output with a supply voltage of = 24 V or = 36 V

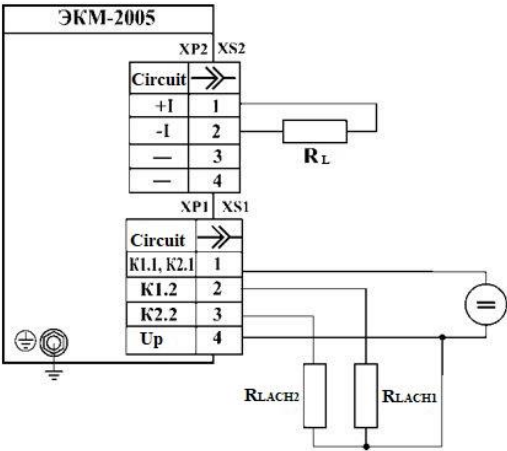


Figure 3.4

Electrical connection diagram of ЭKM-2005 in АГ-16 housing without current output with a supply voltage of ~ 220 V or = 220 V with galvanically isolated power supply and switching circuits

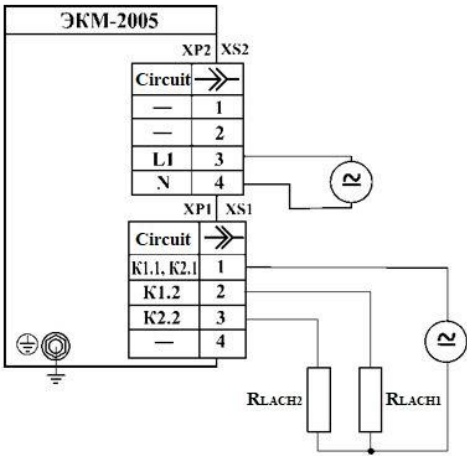


Figure 3.5

Electrical connection diagram of ЭКМ-2005 in АГ-16 housing without current output with a supply voltage of = 24 V or = 36 V with galvanically isolated power supply and switching circuits

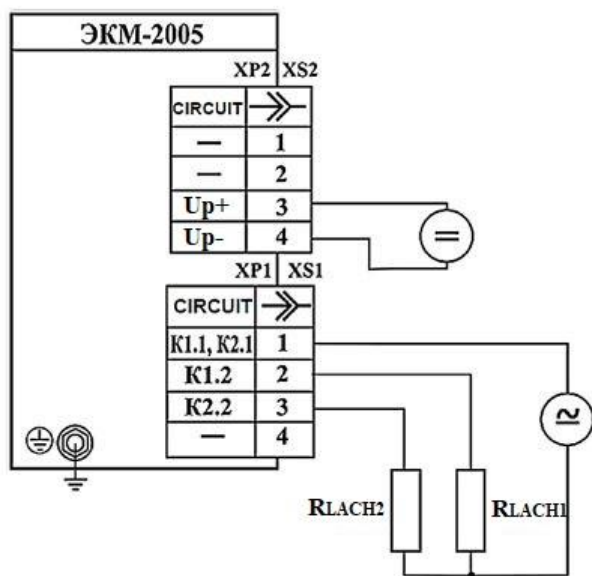


Figure 3.6

Designations for Figures 3.1 to 3.6:

XP1 – GSP 311 plug (A type) or 2PM22 plug

XS1 – GDM 3009 socket (A type) or 2PM22 socket

XP2 – GSSNA 300 plug (C type) or 2PMГ14 plug

XS2 – GDSN 307 socket (C type) or 2PM14 socket

⊜ – AC (110-249 V) or DC (150-249 V) power supply (for ЭКМ and alarm channels power supply)

= – DC (18-40 V) power supply (for ЭКМ and alarm channels power supply)

RLACH – load in the alarm channel circuits

RL – current output load

Electrical connection diagram of ЭKM-2005 in АГ-17 housing with current output with a supply voltage of ~220 V (=220 V) or = 24 V or = 36 V to terminal block through cable entries

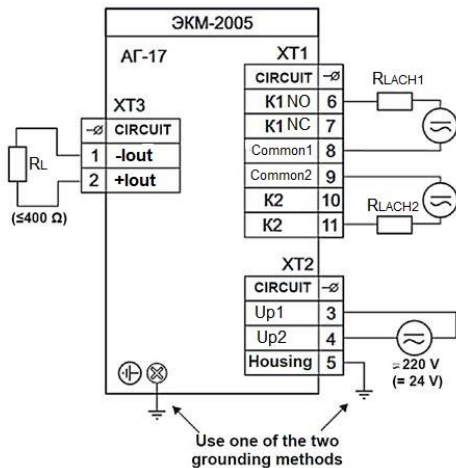


Figure 3.7

Electrical connection diagram of ЭKM-2005 in АГ-17 housing without current output with a supply voltage of ~220 V (=220 V) or = 24 V or = 36 V to terminal block through cable entries

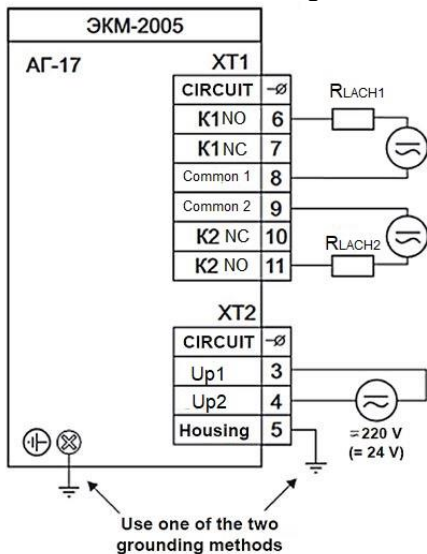


Figure 3.8

Electrical connection diagram of ЭKM-2005 in АГ-17 housing without current output with a supply voltage of ~ 220 V or = 220 V with galvanically isolated power supply and switching circuits via 2PM22-10 connector (order code "ШП")

Power supply and alarm circuits via 2PM22-10 connector

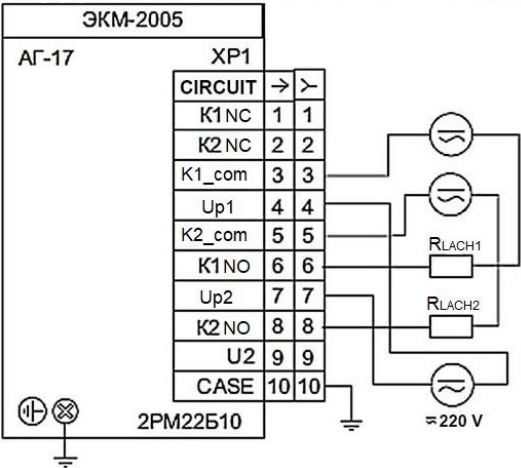


Figure 3.9

Electrical connection diagram of ЭKM-2005 in АГ-17 housing without current output with a supply voltage of = 24 V or = 36 V with galvanically isolated power supply and switching circuits via 2PM22-10 connector (order code "ШП")

Power supply and alarm circuits via 2PM22-10 connector

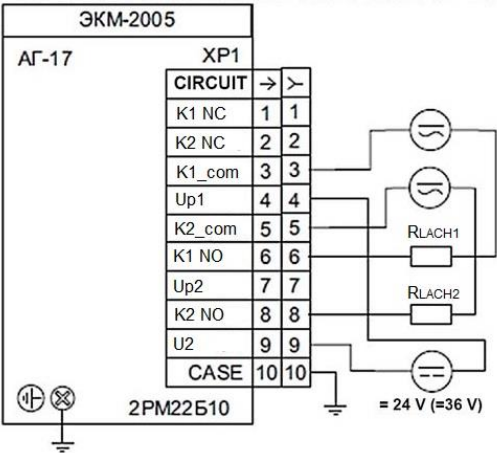


Figure 3.10

Electrical connection diagram of ЭKM-2005 in АГ-17 housing without current output with a supply voltage of ~ 220 V or = 220 V with galvanically isolated power supply and switching circuits via 2PM22 and 2PM22-10 connectors (order code “2xШП”)

Power supply circuits via a separate 2PM22 connector
Alarm circuits via a separate connector 2PM22-10

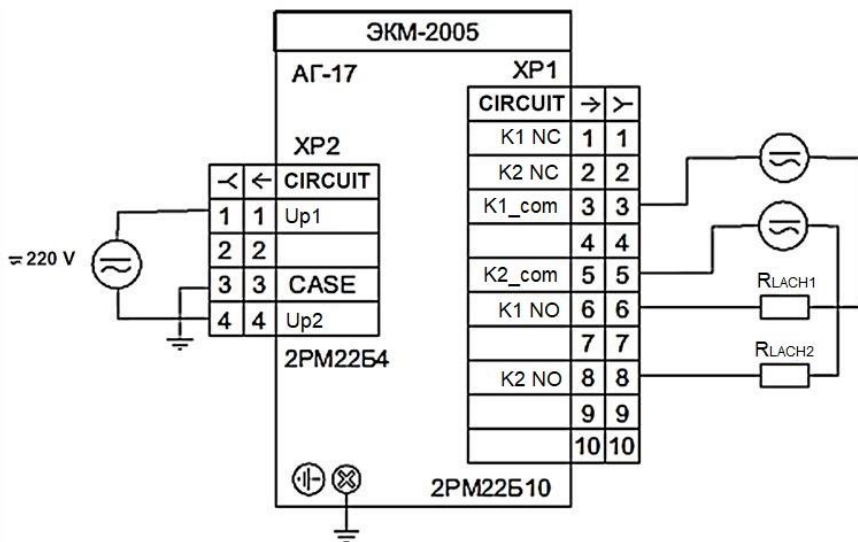


Figure 3.11

Electrical connection diagram of ЭKM-2005 in АГ-17 housing without current output with a supply voltage of = 24 V or = 36 V with galvanically isolated power supply and switching circuits via 2PM22 and 2PM22-10 connectors (order code “2xШП”)

Power supply circuits via a separate 2PM22 connector
Alarm circuits via a separate connector 2PM22-10

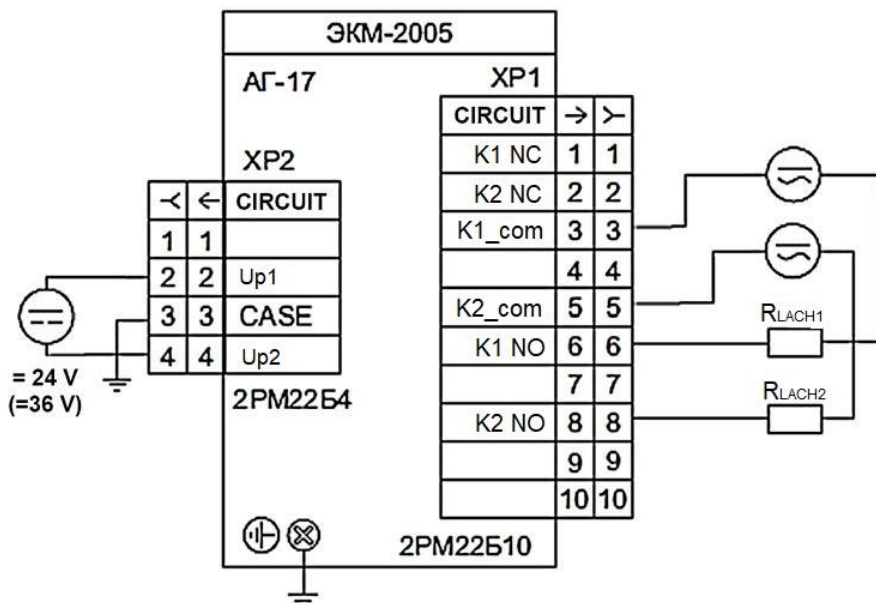


Figure 3.12

Electrical connection diagram of ЭКМ-2005 in АГ-17 housing with current output with a supply voltage of ~ 220 V or $= 220$ V with galvanically isolated power supply and switching circuits via 2PM22 and 2PM22-10 connectors (order code “2xШП”)

Current output circuits via a separate 2PM22 connector
 Power supply and alarm circuits via a separate 2PM22-10 connector

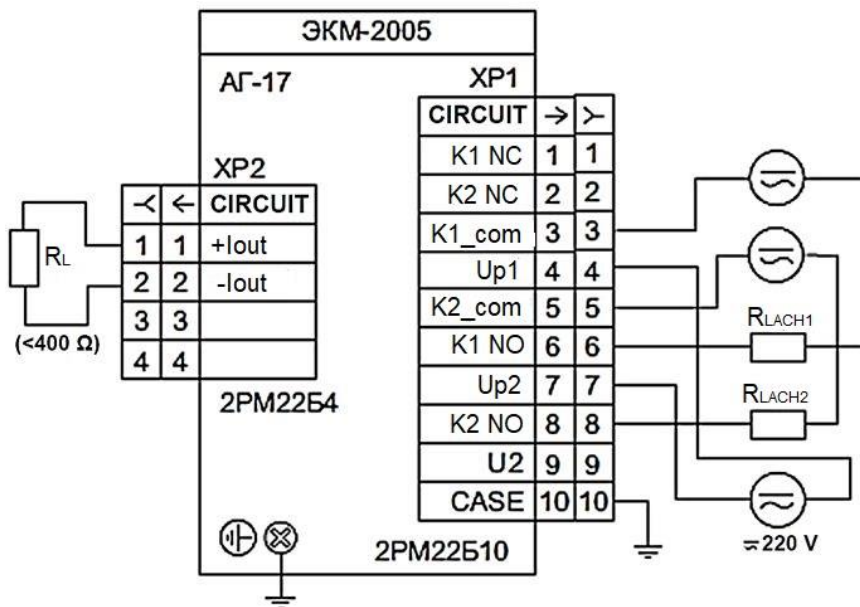


Figure 3.13

Electrical connection diagram of ЭКМ-2005 in АГ-17 housing with current output with a supply voltage of = 24 V or = 36 V with galvanically isolated power supply and switching circuits via 2PM22 and 2PM22-10 connectors (order code “2xШП”)

Current output circuits via a separate 2PM22 connector
Power supply and alarm circuits via a separate 2PM22-10 connector

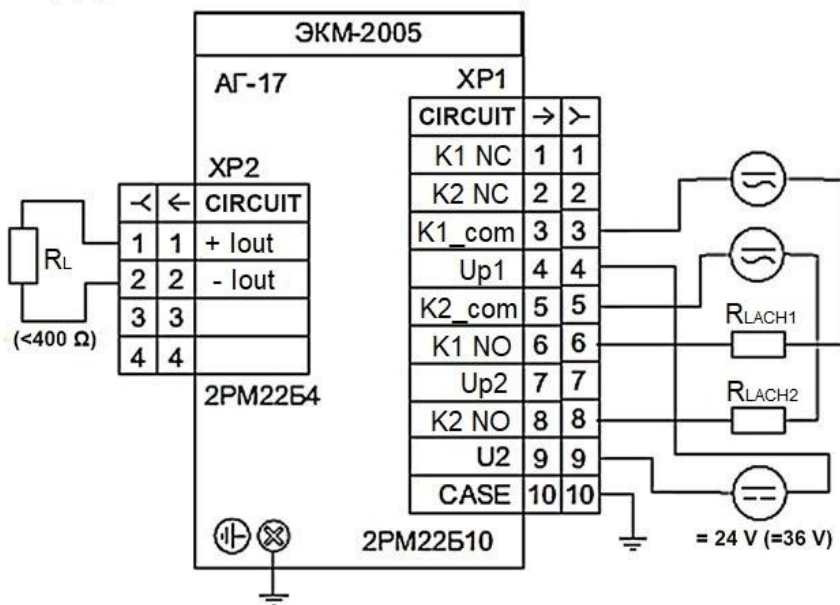
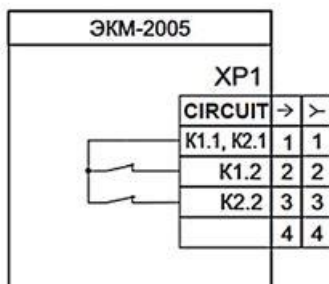


Figure 3.14

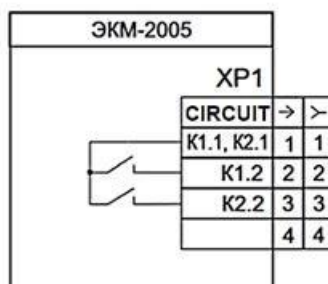
Designations for Figures 3.7 to 3.14:

- XP1 - 2PM22B10 plug
- XP2- 2PM14B4 plug
- RLACH1, RLACH2 - load in the alarm channel circuits
- RL - current output load
-  - AC (110-249 V) or DC (150-249 V) power supply (for ЭКМ and alarm channels power supply)
-  - DC (18-40 V) power supply (for ЭКМ and alarm channels power supply)

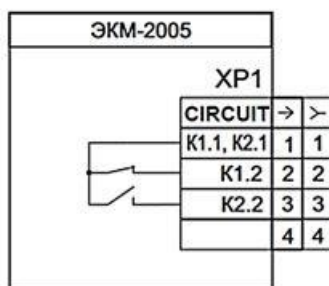
Electrical diagram of alarm channels connection to ЭКМ-2005 in АГ-16 housing



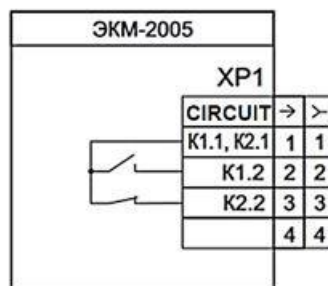
Alarm device design code - III



Alarm device design code - IV



Alarm device design code - V



Alarm device design code - VI

When ЭКМ operates from 220 V alternating voltage, the supply voltage phase is supplied to contact 1, and the neutral is applied to contact 4.

The voltage supplied to contact 1 is switched. Contact 4 is common for the switched voltage.

The state of relay contacts is shown in absence of control voltage on the relay windings - the relay on indicators are inactive.

Figure 3.15

3.1.4 Installation of products

3.1.4.1 ЭKM are mounted in a position that is convenient for operation and maintenance.

3.1.4.2 Consider the following when selecting the ЭKM mounting location:

- ЭKM installation locations must ensure convenient maintenance and dismantling conditions;
- ambient air temperature and relative humidity, as well as vibration parameters should not exceed the values specified in the "Technical characteristics" section of this operating manual;
- the intensity of magnetic fields caused by external AC sources with a frequency of 50 Hz must not exceed 400 A/m;
- connection of ЭKM to the power supply and switched circuits is performed using a single-core or multi-core wire of cross-section 0.35...0.7 mm²;
- to ensure reliable operation of ЭKM in harsh and extremely harsh electromagnetic conditions, electrical connections should be made by twisted pairs or twisted pairs in the screen. The screen must be grounded.

3.1.4.3 A valve block designed for the appropriate environmental parameters shall be installed directly before ЭKM.

When pressure of the measured medium is higher than 0.3 MPa, and the pulse line length is more than 3 m, shut-off valve should be installed at the pressure sampling point.

Connecting lines to the instruments should be laid so as to prevent gas (when measuring liquid pressure) or hydraulic (when measuring gas pressure) pockets formation.

Before starting ЭKM operation, the valve block before the instrument must be closed until the connecting line is filled with cooled liquid.

Connection to main pipelines should be made in areas where the flow speed is the lowest, and the flow is without turbulence, i.e. at a sufficient distance from connecting elements and bends.

3.1.4.4 When measuring the aggressive gas, aggressive or viscous liquid pressure, the pulse lines should include separation vessels.

3.1.4.5 Pulse lines should not have sharp bends and should be laid from the main pipeline to ЭКМ with a slope of at least 1:10. Pulse lines from the pressure sampling point to ЭКМ must be laid at the shortest distance. The line length must be sufficient to ensure that the temperature of medium entering ЭКМ does not exceed the permissible ambient air temperature. Recommended length – max. 15 m.

Pulse lines must have a one-sided slope (at least 1:10) from the pressure sampling point, upwards to ЭКМ if the measured medium is gas, and downwards to ЭКМ if the measured medium is liquid.

For horizontal or inclined pipelines, the pulse line tap at the pipeline tie-in must be arranged (see Figure 3.16):

- horizontally or inclined downwards from the horizontal at an angle of 0° to 45° – when measuring liquid pressure;
- horizontally or tilted upward from the horizontal at an angle of 0° to 45° – when measuring steam pressure;
- vertically or inclined downwards from the vertical at an angle of 0° to 45° – when measuring gas pressure.

Pulse line connection to a horizontal pipeline

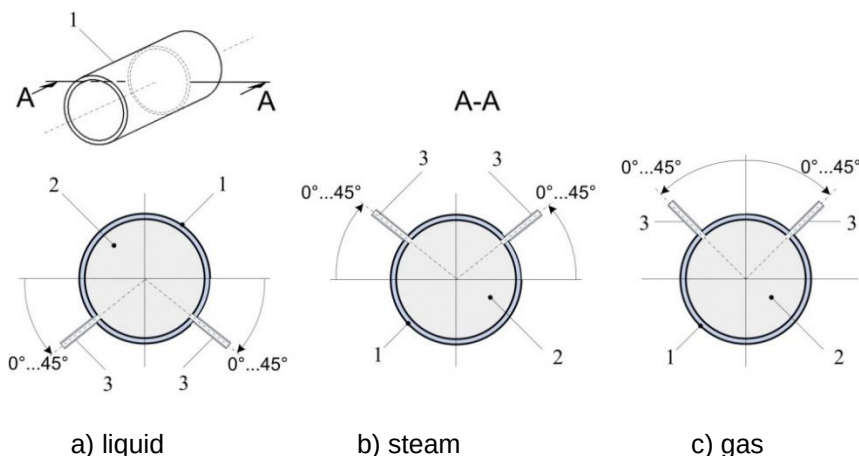


Figure 3.16

Designations for Figure 3.16:

- 1 – pipeline;
- 2 – measured medium;
- 3 – impulse line tap.

If this is not possible, settling vessels should be installed when measuring gas pressure at the lower pulse line points, and gas collectors should be installed when measuring liquid pressure at the highest points. When measuring the pressure of a wet non-aggressive gas, a condensate collector is installed at the lowest pulse line point.

It is recommended to install settling vessels before ЭKM and in other cases, especially in case of long connecting lines, and when ЭKM is located below the pressure sampling point.

Before connecting to ЭKM, the lines must be thoroughly purged to reduce the possibility of ЭKM sensor unit chambers contamination.

ЭKM connection to the pulse line is performed using a mounting kit (available upon special order).

Special devices must be provided for purging connecting lines.

3.1.4.5 To protect ЭKM against hydraulic shocks, as well as when measuring pressure in an highly pulsed medium, it is recommended to install a ДУ damping device before ЭKM in accordance with ELEMER Scientific Production Enterprise catalog.

3.1.4.6 Ground the ЭKM housing by connecting a wire with a cross-section of at least 1 mm² to the ЭKM housing contact $\frac{1}{2}$.

3.1.4.7 After connecting ЭKM to the measured medium, a “zero” check must be performed; if necessary, perform an adjustment; the “zero” adjustment procedure is defined in paragraph 3.1.3.5.

3.1.4.8 ЭKM-2005 electrical installation must be performed in accordance with the electrical connection diagrams (see Figures 3.1 to 3.15).

3.2. Use of Products

3.2.1 When the measured pressure P , is supplied to ЭKM its value is determined by display readings in the corresponding measurement units.

In case of ЭKM with current output, the pressure value is determined using the formula:

$$P = \frac{(I - I_L)}{(I_{UP} - I_L)} \cdot (A_{UP} - A_L) + A_L, \quad (3.1)$$

where I_{UP} and I_L are explained in par. 2.2.5;

A_{UP} and A_L are explained in par. 2.2.3.

4. VERIFICATION PROCEDURE

4.1 ЭКМ shall be verified by the State Metrological Service bodies or other organizations accredited for the right of verification. Requirements for arrangement, verification procedure and the form of presenting verification results are determined by the document "Procedure for conducting verification of measuring instruments, requirements for verification mark and the content of verification certificate", approved by the Order of the Russian Ministry of Industry and Trade No. 1815 of July 2, 2015 and the document "ЭКМ electronic manometers. Verification Procedure" НКГЖ.406233.053МП, approved according to the established procedure.

4.2 When verifying ЭКМ-2005 electronic contact manometer with a diaphragm seal (PC), the total error γ is calculated using the formula

$$\gamma = |\gamma_0 + \gamma_1|,$$

where γ_0 is a permissible basic reduced error limit of ЭКМ-2005 (see Table 2.7 "Permissible basic reduced error limits");

γ_1 is additional error introduced by PC (see Table B.6 "Installation of diaphragm seal").

4.3 Verification interval is 5 years.

4.4 The НКГЖ.406233.053МП Verification procedure may be applied for ЭКМ calibration.

5. MAINTENANCE

5.1 ЭKM maintenance is limited to compliance with the rules of operation, storage and transportation set forth in this Operating Manual, preventive inspections, periodic verification, and repair work.

5.2 Preventive inspections are performed in accordance with the procedure established at ЭKM operation facilities and include:

- 1) external inspection;
- 2) system tightness test (if necessary);
- 3) checking ЭKM attachment reliability, cable connection strength and grounding wire breakdown;
- 4) functional test (including alarm channels operation check);
- 5) checking the value of ЭKM output signal corresponding to the measured pressure zero value in accordance with paragraph 3.1.3.

5.3 Periodic verification of ЭKM shall be conducted at least once every three years in accordance with the instructions given in Section 4 of this Operating Manual.

5.4 ЭKM with defects that cannot be eliminated during preventive inspection, or that have not passed periodic verification, are subject to routine repairs.

ЭKM shall be repaired at the manufacturer's facility.

6. STORAGE

6.1 The conditions for storing ЭKM in transport packaging at the manufacturer's and consumer's warehouse shall comply with conditions 3 of GOST 15150-69.

No aggressive impurities shall be present in the air.

6.2 When locating ЭKM in storage facilities, provide enough space to ensure their free access.

6.3 ЭKM must be stored on racks.

6.4 Provide at least 100 mm distance between the storage facility walls, floor and ЭKM.

7. TRANSPORTATION

7.1 ЭKM are transported by all types of transport in covered vehicles. Container securing in vehicles shall be performed in accordance with valid regulations for the corresponding types of transport.

7.2 Conditions of ЭKM-2005 transportation correspond to conditions 5 of GOST 15150-69 at ambient air temperature:

- from -40 °C to +50 °C - for models with climatic design codes t0550; t0550 (УХЛ4.1); t0550 (ТБ4.1); t2570; t2570 (УХЛ3.1); t4070; t4070 УХЛ1; t4070 (У1);
- from -60 °C to +50 °C - for models with climatic design codes t5570; t6070; t6070 УХЛ1; t5080; t5080 УХЛ1

with observance of protective measures against shock and vibration.

7.3 ЭKM should be transported packed in bags or individually.

7.4 ЭKM shall be transported in boxes in accordance with the requirements of GOST 21929-76.

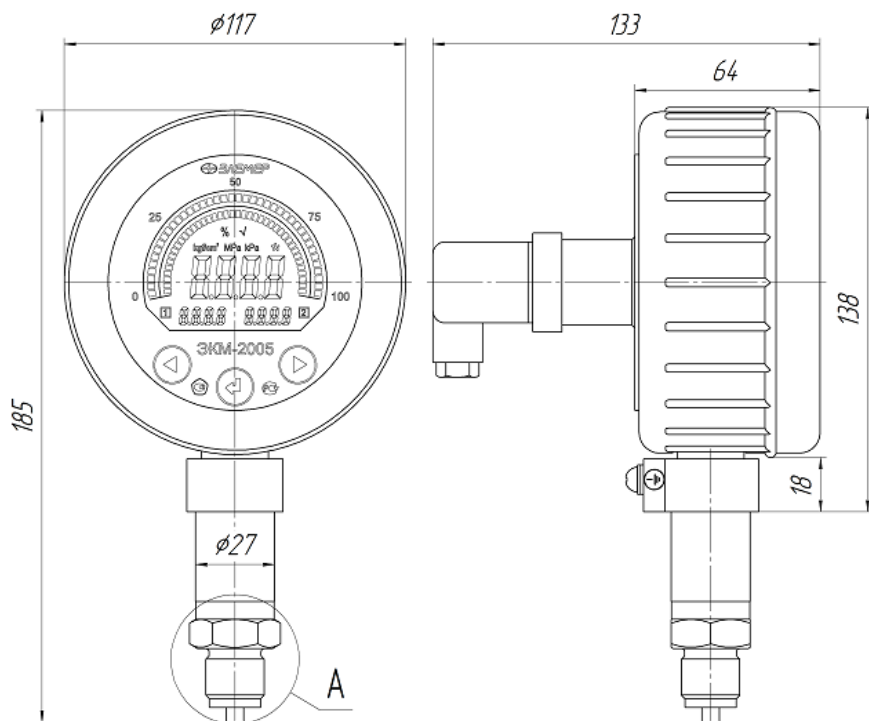
8. DISPOSAL

8.1 ЭKM contain no harmful materials and substances that require special disposal methods.

8.2 After the end of their service life, ЭKM are subject to preparation and dispatch for disposal. The regulatory and technical documents on disposal adopted by the operating organization shall be observed in this case.

APPENDIX A

Overall, connection and mounting dimensions of ЭКМ-2005 electronic manometers
АГ-16И1 housing (single-section)



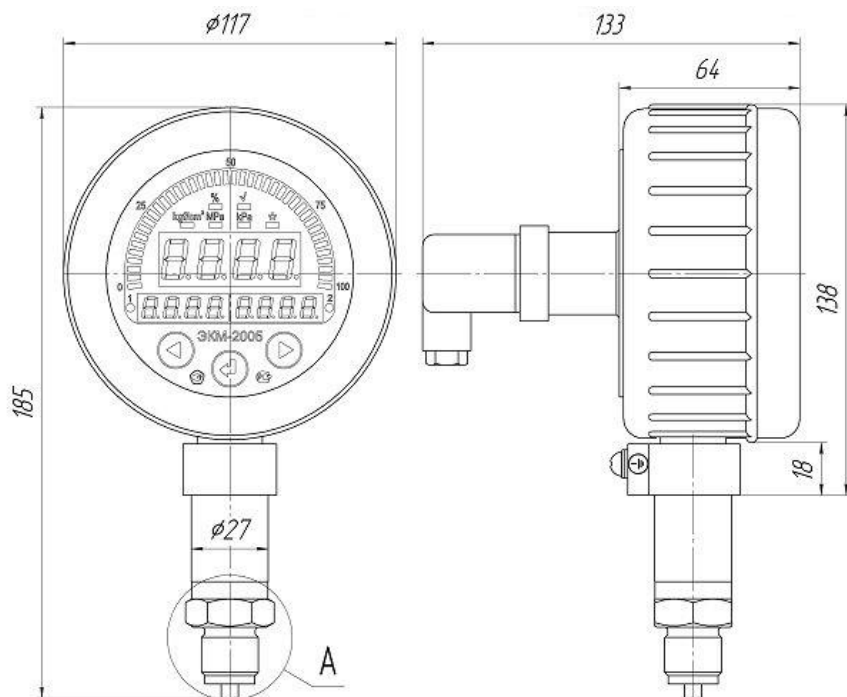
The design with current output is shown in Figure 2.4.

Figure A.1

Appendix A continued

Overall, connection and mounting dimensions of ЭКМ-2005 electronic manometers
АГ-16И2 housing (single-section)

ЭКМ-2005-ДА, ЭКМ-2005-ДИ, ЭКМ-2005-ДИВ



The design with current output is shown in Figure 2.4.

Figure A.2

Appendix A continued

Overall, connection and mounting dimensions of ЭКМ-2005 electronic manometers
АГ-17И2 housing (double-section)

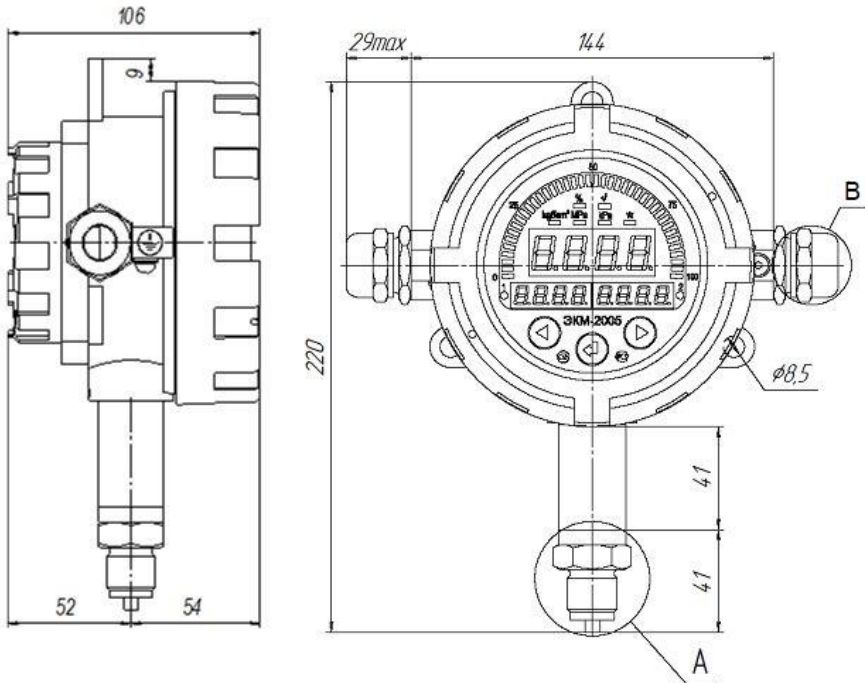
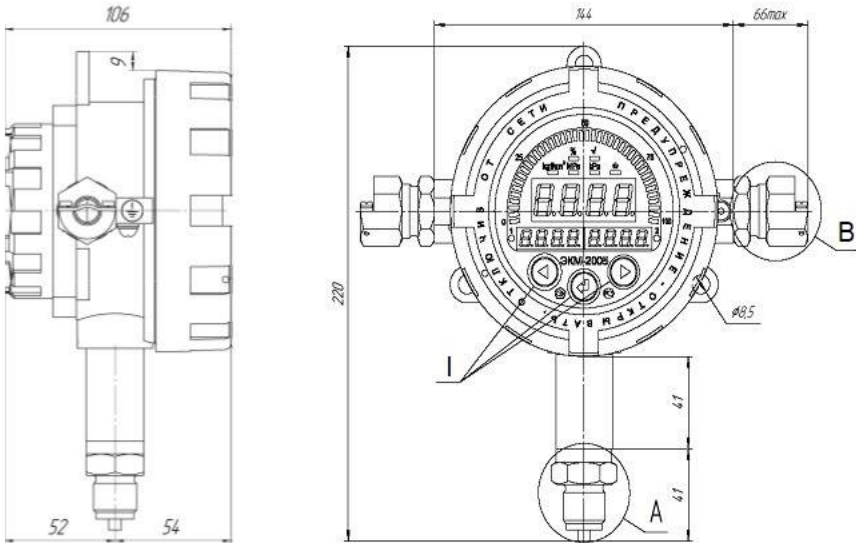


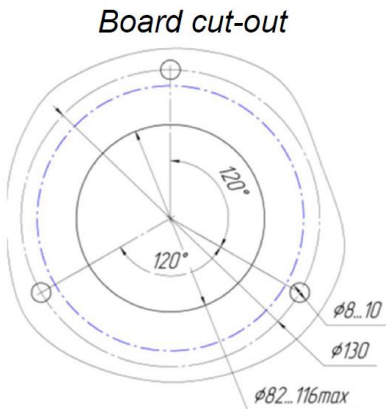
Figure A.3

Appendix A continued

Overall, connection and mounting dimensions of ЭKM-2005Exd electronic manometers АГ-17И2 housing (double-section)



Protect the buttons location area (location I) from impacts and mechanical damage



Sealing place

Holes in the covers for plastic cable seal

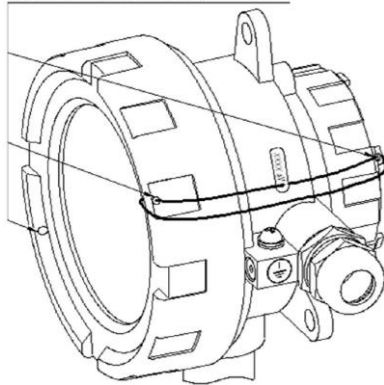


Figure A.4

Appendix A continued

Plates with marking АГ-16 housing

	ЭKM-2005 -	
IP65	Model:	
Max. upper limit:	Error:	
Set range:		
Output signal:	Power supply:	
Alarm device:	$\approx 250 \text{ V}, 5 \text{ A}; = 40 \text{ V}, 2 \text{ A}$	
Alarm device design code:		
Serial number:	Date of release:	
Made in Russia	Tmed from -XX to +XXXX	

АГ-17 housing

	ЭKM-2005 -	Model:	
Max. upper limit:	Tmed from -XX to +XXXX		
Set range:	Error:		
Output signal:	Power supply:		
Alarm device: $\approx 250 \text{ V}, 5 \text{ A}; = 40 \text{ V}, 2 \text{ A}$			
IP Serial number: 20	Made in Russia		

	IP ЭKM-2005 -	Model:	
Max. upper limit:	Tmed from -XX to +XXXX		
Set range:	Output signal:	Error:	
Alarm device: $\approx 250 \text{ V}, 5 \text{ A}; = 40 \text{ V}, 2 \text{ A}$	Power supply:		
Serial number: 20 yr.	Made in Russia		
1Exd IIC T6 Gb X TC RU C-RU.	$\square^\circ\text{C} \leq t_a \leq \square^\circ\text{C}$		

	ЭKM-2005 - ДД	Model:	
Max. upper limit:	Tmed from -XX to +XXX		
Max. gauge pressure:	Error:		
Set range:	Output signal:	Power supply:	
Alarm device: $\approx 250 \text{ V}, 5 \text{ A}; = 40 \text{ V}, 2 \text{ A}$			
IP Serial number: 20	Made in Russia		

	IP ЭKM-2005 - ДД	Model:	Tmed from -XX to +XXX	
Max. upper limit:	Max. gauge pressure:			
Set range:	OUTPUT signal:	Error:		
Alarm device: $\approx 250 \text{ V}, 5 \text{ A}; = 40 \text{ V}, 2 \text{ A}$	Power supply:			
Serial number: 20 yr.	Made in Russia			
1Ex db IIC T6 Gb X TC RU C-RU.	$\square^\circ\text{C} \leq t_a \leq \square^\circ\text{C}$			

Figure A.5

Appendix A continued

Method of ЭКМ mounting in the АГ-17И2 housing using the KP9 bracket

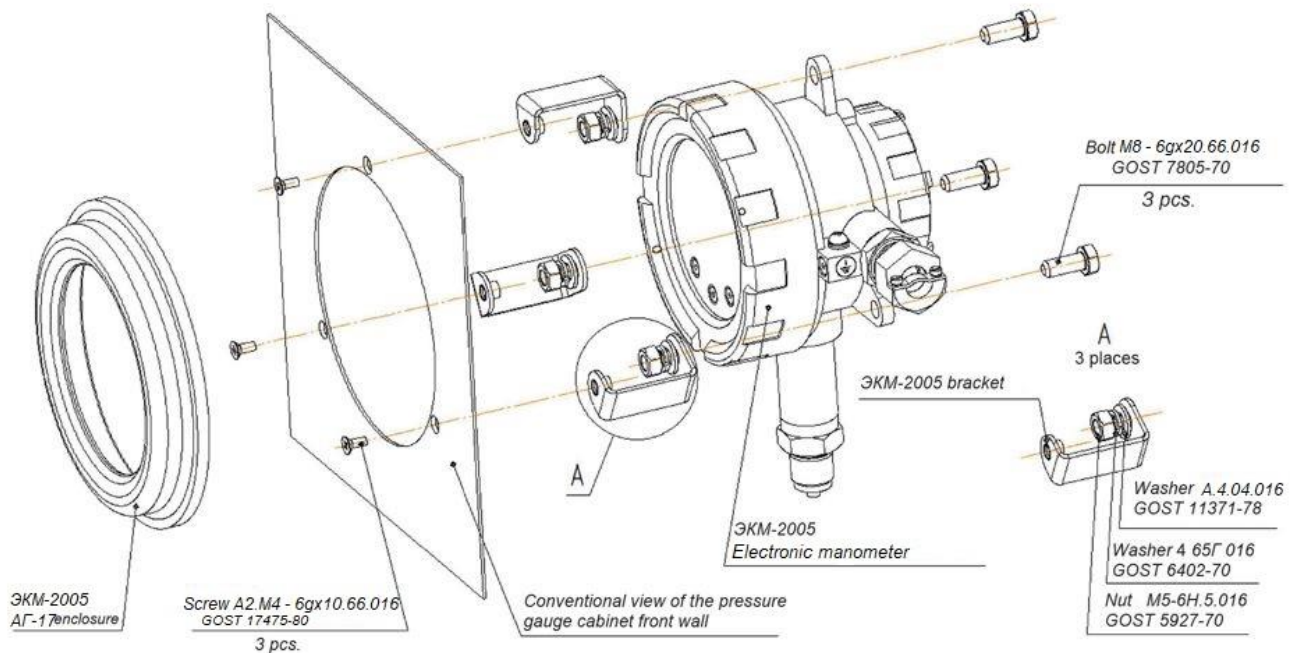
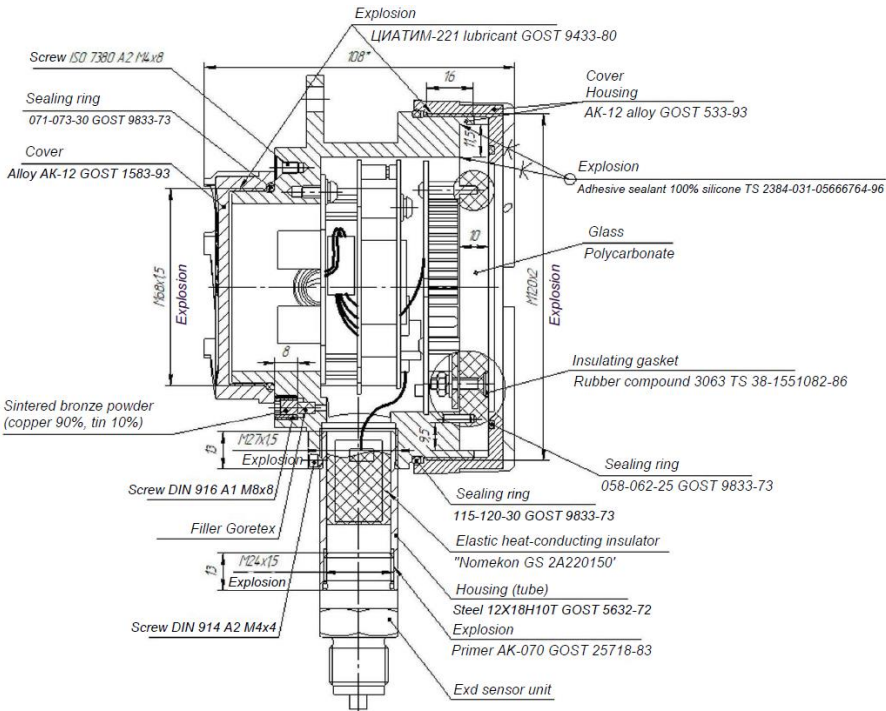


Figure A.6

Drawing of explosion protection equipment ЭKM 2005Exd



The free volume of the explosion-proof enclosure is 330 cm³.

Treat the cover threads and the rubber ring with ЦИАТИМ-221 lubricant, ГОСТ 9433-80.

Wall thickness in the thinnest places shall be at least 3 mm.

Chipping, cracks, sinks, and other defects are not allowed on the surfaces marked with the “Explosion” word.

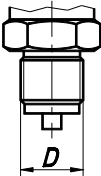
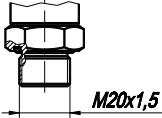
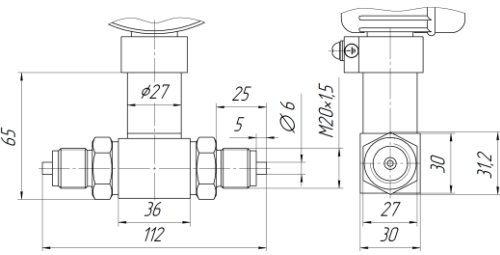
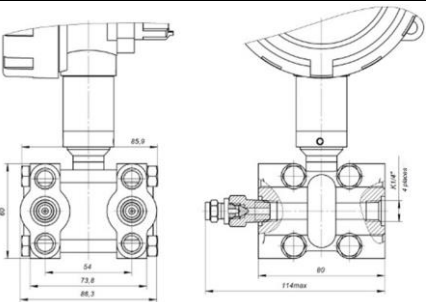
At least 5 complete continuous and undamaged turns engaged shall be provided in the threaded joints marked with “Взрыв” (Explosion).

Figure A.7

Appendix A continued

Process connection (area A) option for ЭКМ-2005-ДД

Table A.1 – Process connection code

Model	General view and overall dimensions	Thread type	Order code
АМxxx, ИМxxx, ВМxxx, ВКxxx, ВНxxx		Male M20x1.5	M20*
		Male G1/2	G2
		Male K1/2 (1/2 NPT)	K2
АМxxx, ИМxxx, ВМxxx		Male with open mem- brane M20x1.5	OM20**
ДМxxx, ДНxx		Male M20x1.5	M20*
ДМФВxxx with stand- ard sensor location		Female K1/4	“ ”*

Appendix A continued

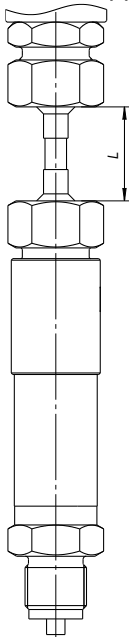
Table A.1 continued

Model	General view and overall dimensions	Thread type	Order code
ДМФВxxx with radial sensor loca- tion		Female K1/4	"R"
ГМxxx		-	" "
Notes 1. *Standard version. 2. ** Only models with 11N and 12N material design codes (Tables 2.11, 2.13, 2.13.1).			

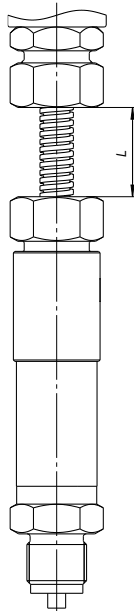
Appendix A continued

Process connection option for ЭКМ with remote sensor (code BC)

ЭКМ-2005-ДА,
ЭКМ-2005-ДИ,
ЭКМ-2005-ДИВ



ЭКМ-2005Exd-ДА,
ЭКМ-2005Exd-ДИ,
ЭКМ-2005Exd-ДИВ



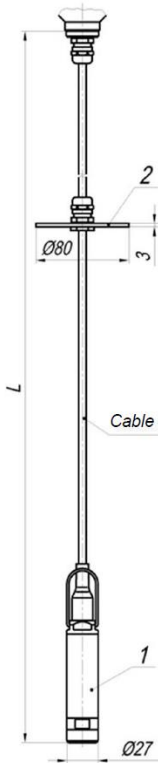
Note – Cable length L is as specified in the order,
but shall not exceed 25 m.

Figure A.6

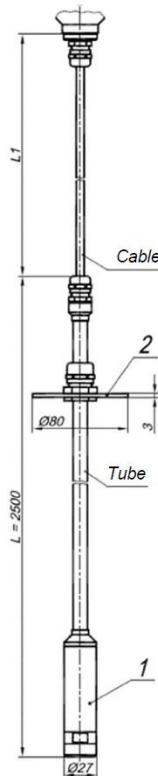
Appendix A continued

Process connection options for ЭКМ-2005-ДГ

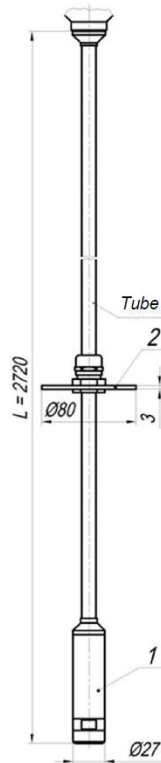
Option 1



Option 2



Option 3



Model code	Design options	L, mm (m)	L1 mm (m)
ГМ16	1	≤ 30,000 (30)	-
	2	≤ 27,500 (27.5)	≤ 2,500 (2.5)
	3	-	≤ 2,500 (2.5)
ГМ100	1	≤ 30,000 (30)	-
	2	≤ 27,500 (27.5)	≤ 2,500 (2.5)
ГМ250	1	≤ 30,000 (30)	-

Notes:

1 The cable length L must be specified when ordering ($L+L1 \leq 30$ m).

For version 3, a "-" is indicated in place of the cable length and cable material.

2 For versions 2 and 3, the standard configuration is $L1 = 2.5$ m (2500 mm).

3 Any change to the length $L1$ is only possible via a custom-order approval document.

Figure A.6.1

ЭKM-2005 electronic manometers

Example of order designation

No.	Parameter name	Basic design
1.	Manometer type	ЭКМ-2005
2.	Design type (Table 2.1)	-
3.	Type of measured pressure: – absolute - ДА – gauge - ДИ – gauge-and-vacuum pressure - ДИВ – pressure difference - ДД – hydrostatic pressure - ДГ	see Table 2.1
4.	Model code (Table 2.6) For ГМ16, ГМ100, ГМ250 models, indicate the design option (see Figure A.6.1 in Appendix A), cable length in meters and cable material code (U — polyurethane, P — fluoroplastic), for example, ГМ250/1/4U.	see Table 2.6
5.	Upper measurement limit (range) and measurement units: kPa, MPa, kgf/cm ² , (Pa, atm, bar, mbar, mm H ₂ O, m H ₂ O, mm of Hg, psi — upon special order after agreement with the customer).	see Table 2.6
6.	Safety class for instruments with order code A as per NP-001, NP-016, NP-033: – 2, 2H, 2Y, 2HY, 3, 3H, 3Y, 3HY – 4, 4H	-
7.	Explosion-protection marking (Table B.1)	- (for ОП) 1Ex d IIB T4 Gb X (for Exd)
8.	Accuracy class code: B, C, D (Table 2.7)	D
9.	Alarm device design code (Table 2.3, 2.3.1) If a bistable (polarized) relay is selected, “P” index is added.	V
10.	Housing and built-in display type code (Table 2.2)	A16И1
11.	Climatic design code (Tables 2.5, 2.5.1)	t0550

Appendix B Continued

12.	Supply voltage code (Table B.1.1 of Appendix B)	220 for АГ-16 220Г for АГ-17
13.	Code of 4-20 mA current output availability (Table B.1 of Appendix B): – not available – code “–” – available – code 42	“-“ (option)
14.	Electrical connection options code (Table B.2 of Appendix B) АГ-16 housing — supplied with one connector, or two connectors if “42” option is available (current output) АГ-17 housing — supplied with two connectors (cable glands) A single connector or cable gland can be selected for АГ-17 housing, e.g: КВМ-16Вн	GSP for АГ-16 2xPGM for АГ-17 2xK-13 for АГ-17 (Exd design)
15.	Structural design of the sensor module: - built-in sensor – code “–” - remote sensor with cable length L (m) – code BC”L” (see Figure A.6 in Appendix A). <i>Cable length of not more than 25 m.</i>	-
16.	Process connection code (Tables A.1, A.2 of Appendix A)	M20 (except for ДМФВ, ГМ models) “-“ (for ДМФВ, ГМ models)
17.	Material design code (Tables 2.11, 2.12. 2.13. 2.13.1)	see Tables 2.11, 2.12, 2.13, 2.13.1
18.	Code of mounting kit (КМЧ) for process connection (option - Table B.3 of Appendix B)	“-“ (option)
19.	Mounting bracket code (option – B.4 of Appendix B)	“-“ (option)
20.	Valve block installation on ЭКМ and pressure testing (option “Y (XXX)” - Table B.5 of Appendix B)	“-“ (option)
21.	Installation of diaphragm seal (option - Table B.6 of Appendix B). When installing a diaphragm seal, only the vacuum method of filling with individually selected oil is used.	“-“ (option)
22.	Stainless steel tag with position designation (optional) – KKS (tag size 25x60 mm)	“-“ (option)
23.	Approval Sheet for a Non-Standard Order* (option “ЛС” – Appendix 1 to the Ф3 (order form))	“-“ (option)
24.	Additional bench tests for 360 h (“360П” option)	-

25.	Verification (order index — “ГП”). When choosing “Installation of a diaphragm seal on ЭКМ-2005” option in item 18 of the order form, you will be additionally provided with the calibration protocol for the “instrument + diaphragm seal” set.	ГП
26.	Designation of technical specifications (TS 4212-082-13282997-09)	TS 4212-082-13282997-09

ATTENTION! All items are mandatory for filling in, except for those with the note “basic version”, “factory installation” and an “option” mark.

All unfilled items will be basic.

Example of minimum order form filling:

ЭКМ-2005	ДИ	ИМ250
1	3	4

ORDER EXAMPLE

Example 1

ЭКМ-2005	A	ДИ	ИМ2,5М	2,5 MPa	ЗНУ	-	D	VP	A17И2	t6070	220	42	ШР
1	2	3	4	5	6	7	8	9	10	11	12	13	14
-	M20	12N	T1M	KP1	Y(E12)	-	KKS	ЛС	360П	ГП	TS 4212-082-13282997-09		
15	16	17	18	19	20	21	22	23	24	25	26		

Example 2

ЭКМ-2005	Exd	ДД	ДМФВ250	160kPa	-	-	D	V	A17И2	t4070	24Г	-	КБ-13
1	2	3	4	5	6	7	8	9	10	11	12	13	14
-	-	11V	-	KP2	Y(C30)	-	-	ЛС	-	ГП	TS 4212-082-13282997-09		
15	16	17	18	19	20	21	22	23	24	25	25		

Example 3

ЭКМ-2005	-	ДГ	ГМ250/1/4U	100kPa	-	-	D	V	A16И2	t2570	-	-	GSP	-	-
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
11V	-	KP2	Y(C30)	-	-	-	-	ГП	TS 4212-082-13282997-09						
17	18	19	20	21	22	23	24	25	26						

Appendix B Continued

Table B.1 – Design type and explosion-protection marking

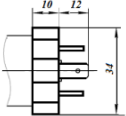
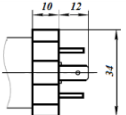
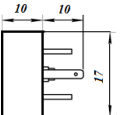
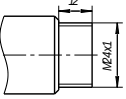
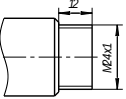
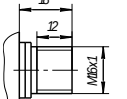
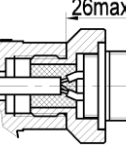
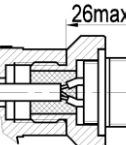
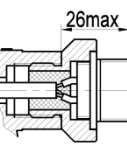
Design type	Design code	Order code	Explosion protection marking	Explosion-proof marking code for ordering	Housing type code
General industrial	Exd	Exd	-	-	АГ-16 АГ-17
Explosion-proof "explosion-proof enclosure"*	AExd	AExd	1Ex db IIA T6 Gb X; 1Ex db IIB T6 Gb X; 1Ex db IIC T6 Gb X; 1Ex db IIA T5 Gb X; 1Ex db IIB T5 Gb X; 1Ex db IIC T5 Gb X; 1Ex db IIA T4 Gb X; 1Ex db IIB T4 Gb X* ; 1Ex db IIC T4 Gb X; 1Ex db IIA T3 Gb X; 1Ex db IIB T3 Gb X; 1Ex db IIC T3 Gb X	db IIA T6; db IIB T6; db IIC T6; db IIA T5; db IIB T5; db IIC T5; db IIA T4; db IIB T4* ; db IIC T4; db IIA T3; db IIB T3; db IIC T3	АГ-17
Nuclear (increased reliability)	A	A	-	-	АГ-16 АГ-17

Table B.1.1 – Supply voltage code

	Supply voltage	Current output	Housing and indication design version
Order code	Description	Order code	
220*	~ 220 V or = 220 V	“42” or “—	A16W1
24	=24 V or =36 V	“42” or “—	
220Г	~220 V or =220 V with galvanically isolated power supply and switching circuits	“—	
24Г	=24 V or =36 V with galvanically isolated power supply and switching circuits	“—	
220Г*	~220 V or =220 V with galvanically isolated power supply and switching circuits	“42” or “—	A17W2
24Г	=24 V or =36 V with galvanically isolated power supply and switching circuits	“42” or “—	
Примечание — * Basic version.			

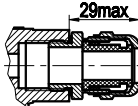
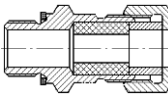
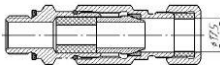
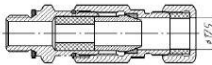
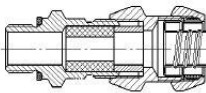
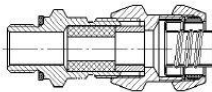
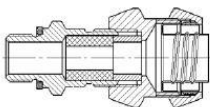
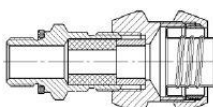
Appendix B Continued

Table B.2 - Electrical connection options code

Order code	Electric connection options			Protection degree GOST 14254-96	Design type	Housing type
	Name and description		General view and overall dimensions			
	Power supply circuit	Alarm circuit		Current output circuit		
GSP*	GSP 311 plug		-	 GSP 311 plug	-	АГ-16
2xGSP**	GSS-NA 300 plug	GSP 311 plug	-	 GSP 311 plug	 GSSNA 300 plug	
2xGSP***	GSP 311 plug		GSSNA 300 plug	GSP 311 plug	GSSNA 300 plug	
ШП	2PM22 plug		-	 PM22 plug	-	
2xШП**	2PM14 plug	2PM22 plug	-	 PM22 plug	 2PM14 plug	
2xШП***	2PM22 plug		2PM14 plug	PM22 plug	2PM14 plug	
ШП**	2PM22-10 plug		-	 PM22-10 plug	-	
2xШП**	2PM22 plug	2PM22-10 plug	-	 PM22-10 plug	 PM22 plug	
2xШП***	2PM22-10 plug		2PM22 plug	PM22-10 plug	PM22 plug	

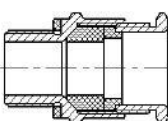
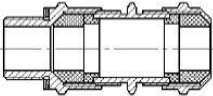
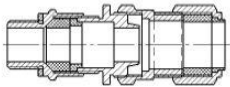
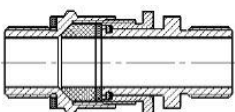
Appendix B Continued

Table B.2 continued

Order code	Name	General view and overall dimensions	Protection degree GOST 14254-96	Design type	Housing type
PGM****	Metal cable entry (cable Ø 7 to 11 mm)		IP65	OP, A	АГ-17*6
K-13*5	Cable gland for unarmored cable (diameter of the cable to be crimped: 6...13 mm)			ОП, А, Exd	
КБ-13	Cable gland for armored (shielded) cable (diameter of the cable to be crimped: 6...13 mm) (diameter of the armor to be crimped: 13.5 mm)				
КБ-17	Cable gland for armored (shielded) cable (diameter of the cable to be crimped: 6...13 mm) (diameter of the armor being crimped: 17.5 mm)				
КБМ-15Вн	Cable gland for unarmored cable for metal conduit. (diameter of cable to be crimped: 6–13 mm) Metal conduit: МРПИ-15, РЗЦП-15, ШЭМ-15, РЗ-Ц-15, РЗ-ЦХ-15, РЗ-ЦА-15, РЗ-Н-15				
КБМ-16Вн	Cable gland for unarmored cable for metal conduit. (diameter of cable to be crimped: 6–13 mm). Exclusively for use with "Gerda" SPE metal conduit. Metal conduit: ГЕРДА-МГ-16, ГЕРДА-МГ-16-П, ГЕРДА-МГ-16-Н				
КБМ-20Вн	Cable gland for unarmored cable for metal conduit. (diameter of cable to be crimped: 6–13 mm) Metal conduit: МРПИ-20, РЗЦП-20, ШЭМ-20, РЗ-Ц-20, РЗ-ЦХ-20, РЗ-ЦА-20, РЗ-Н-20				
КБМ-22Вн	Cable gland for unarmored cable for metal conduit. (diameter of cable to be crimped: 6–13 mm). Exclusively for use with "Gerda" SPE metal conduit. Metal conduit: ГЕРДА-МГ-22, ГЕРДА-МГ-22-П, ГЕРДА-МГ-22-Н				

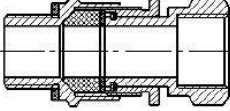
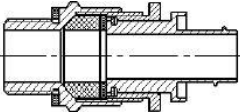
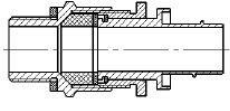
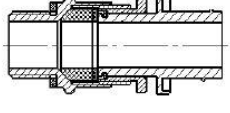
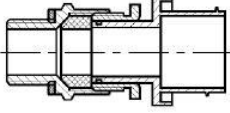
Appendix B Continued

Table B.2 continued

Order code	Name	General view and overall dimensions	Protection degree GOST 14254-96	Design type	Housing type
20 PH Ni	BLOCK plug, turn-key, M20x1.5 Ex d IIC Gb U / Ex e IIC Cb U / Ex ta IIIC Da U		IP65	ОП, А, Exd	АГ-17
20 KHK Ni	BLOCK 20 cable gland for 6.5–13.9 mm unarmored cable, M20x1.5 6g, 1Ex d IIC Gb X / 1Ex e IIC Gb X / 2Ex nR IIC Gc X / Ex ta IIIC Da X				
20 KHH Ni	BLOCK cable gland for 6.5–13.9 mm unarmored cable with a double seal, M20 x 1.5 6g, 1Ex d IIC Gb X / 1Ex e IIC Gb X / 2Ex nR IIC Gc X / Ex ta IIIC Da X				
20 KBY Ni	BLOCK cable gland for armored cable, din 6.5–13.9 mm, d out. 12.5–20.9 mm, M20x1.5 6g, 1Ex d IIC Gb X / 1Ex e IIC Gb X / 2Ex nR IIC Gc X / Ex ta IIIC D				
20 KHX Ni	BLOCK cable gland for 6.5–13.9 mm unarmored cable in a tube, out. M20x1.5 6g, out. ext. M20x1.5 6H, 1Ex d IIC Gb X / 1Ex e IIC Gb X / 2Ex nR IIC Gc X / Ex ta IIIC Da X				

Appendix B Continued

Table B.2 continued

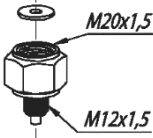
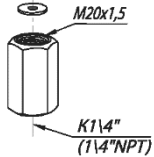
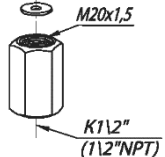
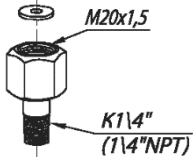
Order code	Name	General view and overall dimensions	Protection degree GOST 14254-96	Design type	Housing type
20 KHT Ni	BLOCK cable gland for 6.5–13.9 mm unarmored cable in a tube, out. M20x1.5 6g, inner M20x1.5 6H, 1Ex d IIC Gb X / 1Ex e IIC Gb X / 2Ex nR IIC Gc X / Ex ta IIIC Da X		IP65	ОП, А, Exd	АГ-17
20s KMP 045 Ni	BLOCK cable gland for 6.1–11.7 mm unarmored cable in metal conduit Dy15 mm, M20x1.5, 1Ex d IIC Gb X / 1Ex e IIC Gb X / 2Ex nR IIC Gc X / Ex ta IIIC Da X				
20 KMP 050 Ni	BLOCK cable gland for 6.5–13.0 mm unarmored cable in metal conduit Dy15 mm, M20x1.5, 1Ex d IIC Gb X / 1Ex e IIC Gb X / 2Ex nR IIC Gc X / Ex ta IIIC Da X				
20 KMP 080 Ni	BLOCK cable gland for 6.5–13.9 mm unarmored cable in metal conduit Dy20 mm, M20x1.5, 1Ex d IIC Gb X / 1Ex e IIC Gb X / 2Ex nR IIC Gc X / Ex ta IIIC Da X				
20 KMP 120 Ni	BLOCK 20 KMP cable gland (nickel-plated brass) for 6.5–13.9 mm unarmored cable in metal conduit Dy25 mm, M20x1.5 6g, 1Ex d IIC Gb X / 1Ex e IIC Gb X / 2Ex nR IIC Gc X / Ex ta IIIC Da X				

Appendix B Continued

Table B.2 continued

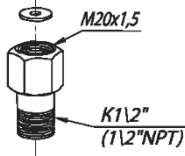
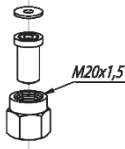
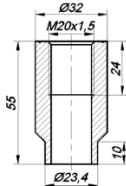
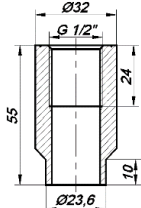
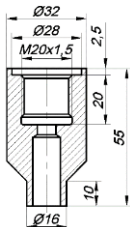
Notes	
1 - *	Basic design — without galvanic isolation of power supply and switching circuits.
2 - **	For 24Г and 220Г designs with galvanically isolated power supply and alarm circuits (no current output).
3 - ***	ЭКМ-2005 electronic contact manometer is equipped with a current output when ordering the option specified in para. 12 "4-20 mA current output".
4 - ****	Basic 2x PGM design for ЭКМ 2005 in АГ-17 housing.
5 - *5	Basic 2xК-13 design for ЭКМ 2005Exd electronic manometers in АГ-17 housing.
6 - *6	Basic design for АГ-17 housing - two connectors (cable glands), e.g: 2xPGM
7 - A	A single connector or cable gland can be selected for АГ-17 housing, e.g: KBM-16ВН

Table B.3 - Mounting kit (KMЧ) code

Order code	MK content	Figure
T1Φ T1M	Gasket	
T2Φ T2M	Adapter from M20x1.5 to male thread M12x1.5. Gasket	
T3Φ T3M	Adapter from M20x1.5 to female thread K1/4"(1/4"NPT). Gasket	
T4Φ T4M	Adapter from M20x1.5 to female thread K1/2"(1/2"NPT). Gasket	
T5Φ T5M	Adapter from M20x1.5 to male thread K1/4"(1/4"NPT). Gasket	

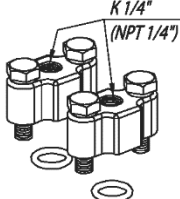
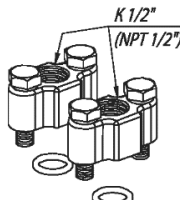
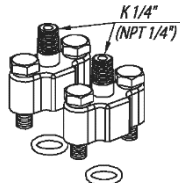
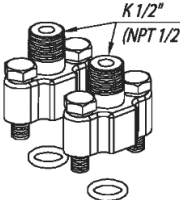
Appendix B Continued

Table B.3 continued

T6Φ T6M	Adapter from M20x1.5 to male thread K1/2"(1/2"NPT) Gasket	
T7Φ, T7ΦY or T7M, T7MY	Nut M20x1.5. Nipple. Gasket	
T8 T8Y	Lobe M20x1.5. Gasket	
T11 T11Y	Lobe G1/2". Gasket.	
T12 T12Y	Manometric lobe M20x1.5. Sealing ring	

Appendix B Continued

Table B.3 continued

C1P C1Φ	Two mounting flanges with threaded hole K1/4" (1/4"NPT). Two sealing rings. Fastener.	 The diagram shows a mechanical assembly with two main vertical flanges. Each flange has a threaded hole at the top. A dimension line points to one of these holes with the label 'K 1/4" (NPT 1/4")'. Below the main assembly, two separate circular sealing rings are shown.
C2P C2Φ	Two mounting flanges with threaded hole K1/2" (1/2 "NPT). Two sealing rings. Fastener.	 The diagram shows a mechanical assembly similar to the first one, but with larger threaded holes. A dimension line points to one of these holes with the label 'K 1/2" (NPT 1/2")'. Below the main assembly, two separate circular sealing rings are shown.
C3P C3Φ	Two mounting flanges with fitting with thread K1/4" (1/4 "NPT). Two sealing rings. Fastener.	 The diagram shows a mechanical assembly with two main vertical flanges. Each flange has a fitting with a threaded hole at the top. A dimension line points to one of these holes with the label 'K 1/4" (NPT 1/4")'. Below the main assembly, two separate circular sealing rings are shown.
C4P C4Φ	Two mounting flanges with fitting with thread K1/2" (1/2"NPT). Two sealing rings. Fastener.	 The diagram shows a mechanical assembly with two main vertical flanges. Each flange has a fitting with a threaded hole at the top. A dimension line points to one of these holes with the label 'K 1/2" (NPT 1/2")'. Below the main assembly, two separate circular sealing rings are shown.

Appendix B Continued

Table B.3 continued

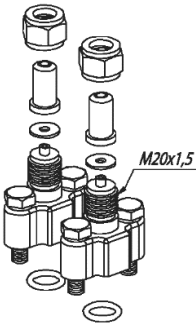
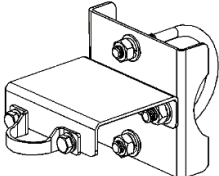
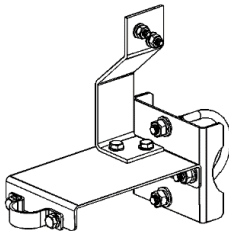
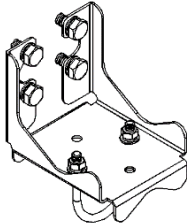
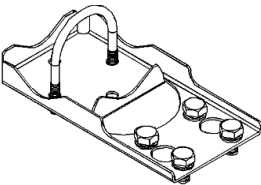
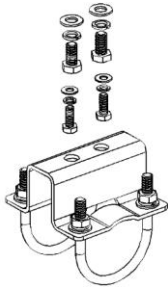
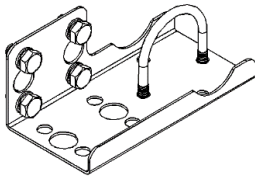
C5PΦ C5PΦY or C5ΦΦ, C5ΦΦY or C5PM, C5PMY or C5ΦM, C5ΦMY	Two mounting flanges with fitting with thread M20x1.5. Two sealing rings. Two nuts M20x1.5. Two nipples Two gaskets. Fastener.	
Notes 1 Letters Φ or M in the Txx code denote the gasket material: fluoroplastic Φ-4УВ15 (for pressures up to 16 MPa) or copper M1 (for pressures over 16 MPa), respectively. 2 Letters P or Φ on the 3rd position in the Cxxx code denote the sealing ring material: rubber or fluoroplastic, and the letters Φ or M on the 4th position indicate the gasket material: fluoroplastic or copper. 3 Letter Y at the end of the code indicates the nipple and lobe material: carbon steel. In its absence, they are made of stainless steel, 12X18H10T.		

Table B.4 — Mounting bracket code

Order code	Type of measured pressure	Bracket name	Figure
KP1 KP1H*	AMxxx, IMxxx, BMxxx, BHxxx	KP1 bracket	
KP1ДД KP1ДДH*	ДМxxx, ДНxx	KP1ДД bracket	

Appendix B Continued

Table B.4 continued

КР3 КР3Н*	ДМФВxxx	КР3 bracket	
КР4 КР4Н*		КР4 bracket	
КР5 КР5Н*		КР5 bracket	
СК, СКН		СК bracket (attachment to sensor module flanges)	

Appendix B Continued

Table B.4 continued

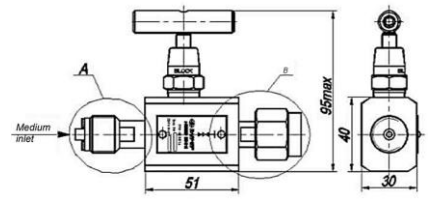
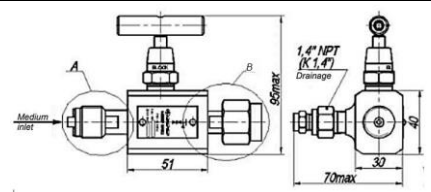
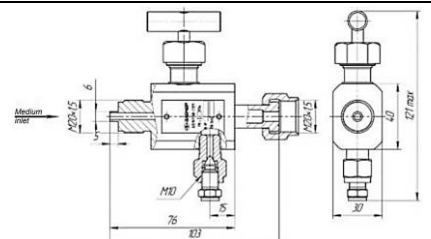
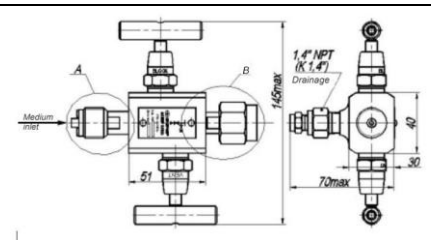
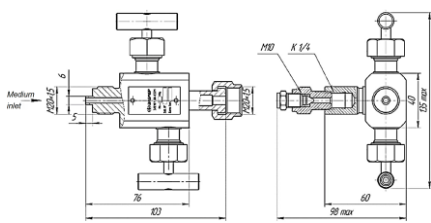
KP9	AMxxx, IMxxx, BMxxx, BHxxx, DMxxx, DHxxx, DMFBxxx	KP9 bracket and cover for fixing ЭКМ-2005 manometer in AT-17 housing inside the board	
Note. *Brackets with code KP1H, KP1ДДH, KP3H, KP4H, KP5H, CKH are made of stainless steel.			

Table B.5 – Valve block or valve system installation and pressure testing

Valve block or CBH-MЭ	Order code	Application (model)	Figure
CBH-MЭ-01	Y(CBH-MЭ-01)	ДМxxx, ДНxxx	
CBH-MЭ-03	Y(CBH-MЭ-03)	ДМxxx, ДНxxx	

Appendix B Continued

Table B.5 continued

ЭЛЕМЕР-БК-Е10	Y(E10)	АМxxx, ИМxxx, ВМxxx	
ЭЛЕМЕР-БК-Е12	Y(E12)		
ЭЛЕМЕР-БК-Е12М	Y(E12M)		
ЭЛЕМЕР-БК-Е22	Y(E22)		
ЭЛЕМЕР-БК-Е22М	Y(E22M)		

Appendix B Continued

Table B.5 continued

ЭЛЕМЕР-БК-Е22Ш	Y(E22Ш)	АМxxx, ИМxxx, ВМxxx	
ЭЛЕМЕР-БК-Е22Р	Y(E22Р)		
ЭЛЕМЕР-БК-А30	Y(A30)	ДМФВxxx	
ЭЛЕМЕР-БК-А52	Y(A52)		
ЭЛЕМЕР-БК-С20	Y(C20)		
ЭЛЕМЕР-БК-С30	Y(C30)		

Appendix B Continued

Table B.5 continued

ЭЛЕМЕР-БК-С30М	Y(C30M)	ДМФВxxx	
ЭЛЕМЕР-БК-С32	Y(C32)		
ЭЛЕМЕР-БК-С32	Y(C32)		
ЭЛЕМЕР-БК-С52	Y(C52)		
ЭЛЕМЕР-БК-С52СГ1	Y(C52СГ1)		
ЭЛЕМЕР-БК-С52Р	Y(C52Р)		

Appendix B Continued

Table B.6 - Installation of diaphragm seal

No.	Diaphragm seal name (PC)	Order code (PC)*	Order code for diaphragm seal with a capillary line (PC/L)*	Additional error γ_1 contributed by diaphragm seal/diaphragm seal with capillary line to the basic reduced error, % of P_{up}^{**}		Additional temperature error γ_2 contributed by diaphragm seal/diaphragm seal with capillary line to the basic reduced error, not exceeding, % of P_{up}^{**}		Operating pressure range, MPa**	Minimum measurement range of the diaphragm seal, kPa	Application (model)
				PC	PC/L	PC	PC/L			
1	BA Type ЭЛЕМЕР-PC-5319, ЭЛЕМЕР-PC-5320, ЭЛЕМЕР-PC-5321, ЭЛЕМЕР-PC-5322	BA PC-5319 PC-5320 PC-5321 PC-5322	Dia- phragm seal type /L	0	0.1	0.1	0.15	-0.1 to 60	0 to 60	ИМ160, ИМ600, ИМ2,5М, ИМ6М, ИМ16М, ИМ60М ИМ100М, ВМ150, ВМ500, ВМ2,4М ДМ100, ДМ250, ДМ630, ДМ2,5М, ДМФВ250, ДМФВ2,5М
				0.1	0.2	0.15	0.3			
2	BW type ЭЛЕМЕР-PC-25, ЭЛЕМЕР-PC-50, ЭЛЕМЕР-PC-250, ЭЛЕМЕР-PC-600	BW PC-25 PC-50 PC-250 PC-600		0	0.1	0.1	0.15	-0.1 to 60	0 to 60	ИМ160, ИМ600, ИМ2,5М, ИМ6М, ИМ16М, ИМ60М, ИМ100М, ВМ150, ВМ500, ВМ2,4М ДМ100, ДМ250, ДМ630, ДМ2,5М, ДМФВ250, ДМФВ2,5М
				0.1	0.2	0.15	0.3			
3	WF type	WF		0	0.1	0.1	0.15	-0.1 to 25	0 to 25	ИМ160, ИМ600, ИМ2,5М, ИМ6М, ИМ16М, ИМ60М, ИМ100М, ВМ150, ВМ500, ВМ2,4М ДМ100, ДМ250, ДМ630, ДМ2,5М, ДМФВ250, ДМФВ2,5М
				0.1	0.2	0.15	0.3			
Notes 1 - * To order a correct type of a diaphragm seal and a capillary line, use the questionnaire for diaphragm seals and the full order form (see the Fittings catalog or go to "Арматура" (Fittings) — "Арматура — Разделители сред (капиллярные линии)" (Fittings - Diaphragm seals (Capillary Lines)) section on the website www.elemer.ru) 2 — *** When readjusting ЭКМ-2005 electronic contact manometer with installed diaphragm seal to another measurement range, it is necessary to adjust the upper and lower measurement limits. Permissible depth of readjustment of ЭКМ-2005 electronic contact manometer with installed diaphragm seal is $P_{up}/P_{up,max} \geq 1/4$. 4 — *** The maximum operating range for this type of diaphragm seal. The operating pressure range for the selected diaphragm seal is specified in the order form for diaphragm seals.										

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Генеральный директор ООО «Транском» _____ Морозов В.В.

