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Pressure transmitters EMIS-BAR

Operation manual



EAC

CE

High accuracy

*Accuracy does not
depend on process
parameters*

Ex-proof application

LCD display

In-built self-check

*Complies with
NAMUR NE 43*

*Complies with
NAMUR NE 107*



HART
COMMUNICATION PROTOCOL

HART
REGISTERED

www.emis-meter.com

EMIS CJSC
Russia, Chelyabinsk

EMIS
flowmeters manufacturer

CONTENTS

QUICK START	5
1 DESCRIPTION AND OPERATION	6
1.1 Application	6
1.2 Specification	7
1.3 Explosion protection	14
1.4 Pressure transmitter configuration and operation	16
1.5 Pressure transmitter adjustment	17
1.6 Operating via HART	27
1.7 Error archive	27
1.8 Supply scope	28
1.9 Marking and sealing	29
1.10 Package	30
2 APPLICATION	30
2.1 Operating features	30
2.2 Mounting requirements	31
2.3 Operation	36
2.4 HART connection	37
2.5 Communication cable parameters	38
3 MAINTENANCE AND REPAIR	40
4 CALIBRATION	40
5 LIST OF POSSIBLE FAILURES	40
6 PERSONELL ACTIONS IN CASE OF ACCIDENT, CRITICAL FAILURE OR BREAKDOWN	42
7 LIMIT STATE CRITERIA	42
8 STORAGE	42
9 TRANSPORTATION	42
10 RECYCLING	43
11 PRECIOUS MATERIALS CONTENT	43
Appendix A <i>List of reference documents</i>	44
Appendix B <i>Connection schemes</i>	45
Appendix C <i>Diagrams for calculating the length of the HART cable</i>	47
Appendix D <i>Order sheet EMIS-BAR pressure transmitters</i>	49

Appendix E <i>Mounting kit order sheet</i>	63
Appendix F <i>Dimensions and connection sizes of pressure transmitters</i> <i>Dimensions and connection sizes of flanges</i>	69 83
Appendix G <i>Mounting kit</i>	87
Appendix H <i>Explosion protection scheme</i>	93
Appendix I <i>Installation on a bracket</i>	95
Appendix J <i>List of cable glands</i>	97

Present Manual is used for studying the structure, operation, operating rules, maintenance and calibration of the pressure transmitters EMIS-BAR. Technical characteristics in present manual does not apply to the customized devices.

This operation manual contains general technical parameters, directions for usage, calibration, transportation and storage, and other information to ensure correct operation of the pressure transmitter. Manufacturer does not cover defects or malfunction caused by misuse, abuse or improper maintenance.

The design of the transmitter is constantly being improved, so the device you purchased may have minor differences from the description given in this document which do not affect the performance, technical characteristics and usability.

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Manufacturer has the right to update the product and documents without prior notice if it does not affect product performance.

Symbols and abbreviations

Present document contains the following abbreviations and symbols:

ADC - analog-to-digital converter;

DAC - digital-to-analog converter;

CPU - Central Processing Unit;

LCD - liquid crystal indicator for displaying alphanumeric information;

SVS - state verification system;

CS - checksum;

Software - device software;

DDL - (Device Description Language) Device description language for HART. The language allows you to describe a device in detail and unambiguously, and then read out information about it in a digital exchange process.

DD - (Device Description) a PC application written in DDL;

RFI - Radio Frequency Interference filter. Designed to control the Radio frequency interference on transmitter values.

QUICK START

- First, see 1.4 " Pressure transmitter configuration and operation " which contain information of pressure transmitter mounting requirements, menu control with menu line review function, detailed described menu structure.

- Item 1.5.1 describes pressure transmitter input buttons control.

- **ATTENTION.** If HART communicator or HART modem *not available* in your device, **do not set a mode** of the Keypad and menu lock menu: b1 - b4 in item 7. Unlocking is possible **only** with a HART communicator or PC, HART modem and firmware - DDL library: EMIS-BAR_DD.

- Item 2 describes in detail the installation of the device on site.

- Section 2.4 shows the connection diagrams to the HART.

- Appendix B - connection diagrams of pressure transmitter Intrinsic Safety barriers.

1. DESCRIPTION AND OPERATION

1.1 Application

1.1.1 EMIS-BAR pressure transmitters (hereinafter "transmitters") are designed for continuous measurement of pressure (gauge, vacuum, absolute, hydrostatic and differential (pressure difference)) and conversion of the measured pressure into a rated DC output signal 4-20 mA overlapped with digital HART signal, as well as displaying the measured value on the display.

EMIS-BAR pressure transmitters can be used in automatic control, adjustment and operation systems at various industries.

Pressure transmitter can be used on sea-going ships for pressure measurement in specialized and fuel systems (order code RMRS).

In case of delivery of pressure transmitters to on sea-going ships the pressure transmitters complies with the requirements of Russian Maritime Register of Shipping (hereafter RMRS). In case of delivery of pressure transmitters to a chemical carrier the pressure transmitters complies with the requirements of Technical regulations on safety of sea transport objects. National product classification code 29 0000 – valves of cargo pipeline systems of chemical carriers.

1.1.2 Transmitters can be operated and adjusted using an inbuilt keyboard or remotely using HART-compatible device.

1.1.3 Transmitters with HART can transfer information about measuring value in digital form via the 2-wire connection line along with 4-20 mA current signal. Digital signal can be received and converted by any HART-compatible device. Digital output is used to connect transmitter with portable HART communicator or PC via standard serial interface and additional HART modem. The following operation can be executed: setup transmitter, select main parameters, read measured pressure, etc. HART-protocol allows two master devices are connected to the system: HART-compatible PC and portable HART communicator. Transmitter can receive and execute commands of each of the control devices with different addresses and exchanging data in the time sharing mode.

Measured value is displayed in selected units on the transmitter indicator or HART communicator in measuring mode.

1.1.4 Transmitter meets the requirements of the technical regulations: TR CU 020/2011, TR CU 032/2013.

1.1.5 Transmitter can be used for both safe and explosive environments. Ex-proof transmitters comply with the technical regulations TR CU 012/2011 and directive 2014/34/EU of The European parliament and of the council.

Transmitters of Mine type explosion proof configuration intended for use in underground mines and its overground facilities, with explosive mixtures of subgroup I, intrinsically safe electrical circuit and PO I M1 Ex ia explosion proof mark. Special operating conditions of Mine type transmitters:

- LCD display works under temperature not lower than minus 42 ° C;
- before turning on the power, close the head cover tightly;
- explosion protection provided when the excess / differential pressure of the measured medium does not exceed the maximum value allowed for transmitter.
- use only stainless steel cable glands.
- If heating at a cable insertion above 70 ° C, use a cable with insulation and outer sheath of the appropriate class of heat resistance.

Transmitters of Ex ia configuration intended for use in explosive environments hazardous with explosive mixtures of IIC, IIB, IIIC, IIIB category, have flame proof enclosure "Exi" and II 1G Ex ia IIC T6...T4 Ga, II 1 G Ex ia IIB T6...T4 Ga, II 1D Ex ia IIIB 85° C Da, II 1D Ex ia IIIB 100 ° C Da, II 1D Ex ia IIIB 135 ° C Da, II 1D Ex ia IIIC 85° C Da, II 1D Ex ia IIIC 100 ° C Da, II 1D Ex ia IIIC 135 ° C Da. Special operating conditions of the "Exia" type transmitters:

- LCD display works under temperature not lower than minus 42 ° C;
- painted housing might bring a potential electrostatic charge danger. Wipe clean only with a damp or anti-static material;
- before turning on the power, close the head cover tightly;
- explosion protection is provided when the excess / differential pressure of the measured medium does not exceed the maximum value allowed for transmitter.

– If heating at a cable insertion above 70 ° C, use a cable with insulation and outer sheath of the appropriate class of heat resistance.

1.1.6 Please specify transmitter symbolic designation when placing order. Use **Annex D** for reference.

1.1.7 If transmitter is mentioned in the documents related to other products, the following shall be specified:

- transmitter symbolic designation;
- technical parameters: TU 26.51.52-080-14145564-2018.

1.1.8 See **Annex E** for mounting kit order codes. Drawings and mounting kit are shown in the **Annex G**.

1.2 Specification

1.2.1 Type of measurement pressure, transmitter model, order codes, full range of pressure measurement, min $P_{u\ min}$ and max $P_{u\ max}$ upper limit (range) of measurement are specified in the Table 1,2.

1.2.2 Measurement range and upper limit can be adjusted to required values from $P_{u\ min}$ to $P_{u\ max}$, as provided in the Tables 1 and 2.

1.2.3 Overload pressure for absolute pressure and gauge pressure transmitters is specified in the Table 1. Overload working pressure limit for differential and level pressure transmitters is specified in the Table 2.

Table 1 – Measuring ranges of gauge and absolute pressure transmitters

Type of measurement pressure	Transmitter model	Order code	Full range of measurement	Min upper level (range) of measurement, $P_{u\ min}$	Max upper level (range) of measurement, P	Overload pressure, MPa	Range adjustment
1	2	3	4	5	6	7	8
Gauge pressure	103	(-100...100)kPa	-100...100 kPa	5 kPa	100 kPa	0,6	1:20
		(-100...400)kPa	-100...400 kPa	10 kPa	400 kPa	1	1:40
		(-0,1...1,6)MPa	-0,1...1,6 MPa	16 kPa	1,6 MPa	3,2	1:100
		(-0,1...6,3)MPa	-0,1...6,3 MPa	63 kPa	6,3 MPa	10	1:100
		(-0,1...16)MPa	-0,1...16 MPa	160 kPa	16 MPa	25	1:100
		(-0,1...40)MPa	-0,1...40 MPa	400 kPa	40 MPa	60	1:100
	105	(-100...100)kPa	-100...100 kPa	5 kPa	100 kPa	0,6	1:20
		(-100...400)kPa	-100...400 kPa	10 kPa	400 kPa	1	1:40
		(-0,1...1,6)MPa	-0,1...1,6 MPa	16 kPa	1,6 MPa	3,2	1:100
		(-0,1...6,3)MPa	-0,1...6,3 MPa	63 kPa	6,3 MPa	10	1:100
		(-0,1...16)MPa	-0,1...16 MPa	160 kPa	16 MPa	25	1:100
	173 174	(-100...100)kPa	-100...100 kPa	5 kPa	100 kPa	0,6	1:20
		(-100...400)kPa	-100...400 kPa	20 kPa	400 kPa	1	1:20
		(-0,1...1,6)MPa	-0,1...1,6 MPa	80 kPa	1,6 MPa	3,2	1:20
		(-0,1...6,3)MPa	-0,1...6,3 MPa	320 kPa	6,3 MPa	10	1:20
		(-0,1...16)MPa	-0,1...16 MPa	800 kPa	16 MPa	25	1:20
		(-0,1...40)MPa	-0,1...40 MPa	2 MPa	40 MPa	60	1:20

Type of measurement pressure	Transmitter model	Order code	Full range of measurement	Min upper level (range) of measurement, $P_{u\ min}$	Max upper level (range) of measurement, $P_{u\ max}$	Overload pressure, MPa	Range adjustment
1	2	3	4	5	6	7	8
Absolute pressure	123	(0...25)kPa	0...25 kPa	0,83 kPa	25 kPa	0,6	1:30
		(0...130)kPa	0...130 kPa	4,3 kPa	130 kPa	1	1:30
		(0...500)kPa	0...500 kPa	16 kPa	500 kPa	3,2	1:30
		(0...3)MPa	0...3MPa	100 kPa	3 MPa	10	1:30
		(0...16)MPa	0...16MPa	600 kPa	16 MPa	25	1:25
		(0...40)MPa	0...40 MPa	1,4 MPa	40 MPa	60	1:28
	133	(0...25)kPa	0...25 kPa	0,83 kPa	25 kPa	3,2	1:30
		(0...130)kPa	0...130 kPa	4,3 kPa	130 kPa	3,2	1:30
		(0...500)kPa	0...500 kPa	16 kPa	500 kPa	3,2	1:30
		(0...3)MPa	0...3 MPa	100 kPa	3 MPa	16	1:30
		(0...10)MPa	0...10 MPa	530 kPa	10 MPa	25	1:18
	175 176	(0...25)kPa	0...25 kPa	5 kPa	25 kPa	0,6	1:5
		(0...130)kPa	0...130 kPa	10 kPa	130 kPa	1	1:13
		(0...500)kPa	0...500 kPa	25 kPa	500 kPa	3,2	1:20
		(0...3)MPa	0...3 MPa	150 kPa	3 MPa	10	1:20
		(0...16)MPa	0...16 MPa	600 kPa	16 MPa	25	1:26
		(0...40)MPa	0...40 MPa	1,4 MPa	40 MPa	60	1:28

Table 2 – Measuring ranges of differential and hydrostatic pressure transmitters

Type of measurement pressure	Model	Order code	Full range of measurement $P_{l\ min} \dots P_{u\ max}$	Min upper level (range) of measurement, $P_{u\ min}$	Max upper level (range) of measurement, $P_{u\ max}$	Overload pressure, MPa	Range adjustment
1	2	3	4	5	6	7	8
Differential pressure (pressure difference)	143	(-25...25)kPa	-25...25 kPa	1 kPa	25 kPa	16	1:25
		(-60...60)kPa	-60...60 kPa	1 kPa	60 kPa	16	1:60
		(-160...160)kPa	-160...160 kPa	1,6 kPa	160 kPa	16	1:100
		(-500...500)kPa	-500...500 kPa	5 kPa	500 kPa	16	1:100
		(-0,5...3)MPa	-0,5...3 MPa	30 kPa	3 MPa	16	1:100

Type of measurement pressure	Model	Order code	Full range of measurement $P_{l\ min} \dots P_{u\ max}$	Min upper level (range) of measurement, $P_{u\ min}$	Max upper level (range) of measurement, $P_{u\ max}$	Overload pressure, MPa	Range adjustment
1	2	3	4	5	6	7	8
Differential pressure (pressure difference)	153	(-25...25)kPa	-25...25 kPa	1 kPa	25 kPa	42	1:25
		(-60...60)kPa	-60...60 kPa	1 kPa	60 kPa	42	1:60
		(-160...160)kPa	-160...160 kPa	1,6 kPa	160 kPa	42	1:100
		(-500...500)kPa	-500...500 kPa	5 kPa	500 kPa	42	1:100
		(-0,5...3)MPa	-0,5...3 MPa	30 kPa	3 MPa	42	1:100
		(-0,5...20)MPa	-0,5...20 MPa	200 kPa	20 MPa	42	1:100
	183	(-25...25)kPa	-25...25 kPa	2,5 kPa	25 kPa	0,6	1:10
	184	(-60...60)kPa	-60...60 kPa	3 kPa	60 kPa	1	1:20
	185	(-160...160)kPa	-160...160 kPa	8 kPa	160 kPa	3,2	1:20
	186	(-500...500)kPa	-500...500 kPa	25 kPa	500 kPa	10	1:20
187	(-0,5...3)MPa	-0,5...3 MPa	150 kPa	3 MPa	16	1:20	
188	(-0,5...3)MPa	-0,5...3 MPa	150 kPa	3 MPa	16	1:20	
193	(-2...2)kPa	-2...2 kPa	0,1 kPa	2 kPa	0,2	1:20	
Hydrostatic pressure	163 164	(-10...10)kPa	-10...10 kPa	2 kPa	10 kPa	Depends on flange size See Table. C.3	1:5
		(-25...25)kPa	-25...25 kPa	2,5 kPa	25 kPa		1:10
		(-60...60)kPa	-60...60 kPa	2,5 kPa	60 kPa		1:24
		(-160...160)kPa	-160...160 kPa	5,3 kPa	160 kPa		1:30
		(-500...500)kPa	-500...500 kPa	16 kPa	500 kPa		1:30
		(-0,5...3)MPa	-0,5...3 MPa	100 kPa	3 MPa		1:30

1.2.4 The limits of the permissible basic reduced error γ for models with an analog output signal expressed as percentage of the upper limit or output signal measurement range do not exceed the values shown in the Tables 3 – 4.

Table 3 - Limits of the permissible basic reduced error for transmitters with analog output signal

The limits of the permissible basic reduced error depending on the coefficient of adjustment of the measuring range γ , %			Application based on the model
$r \leq 10$	$10 < r \leq 30$	$30 < r \leq 100^{**}$	
$\pm 0,04$	$\pm(0,004 \cdot r)$	-	103, 105, 113, 123, 133, 143
$\pm 0,065$	$\pm(0,0065 \cdot r)$	$\pm(0,005 \cdot r + 0,071)$	
$\pm 0,074$	$\pm(0,0074 \cdot r)$	-	163, 164
$\pm 0,1; \pm 0,15; \pm 0,2; \pm 0,25; \pm 0,4; \pm 0,5; \pm 1,0$	$\pm(\gamma/10 \cdot r)$	$\pm(\gamma/10 \cdot r + 0,071)$	103, 105, 113, 123, 133, 143, 163, 164

Note
 r – coefficient of adjustment of the measuring range of the pressure transmitter, calculated using the formula:

$$r = \frac{P_{u \max}}{\Delta P}$$

where $\Delta P = P_u - P_l$ – is the new measurement range
 $** r$ adjustment from 30 to 100 is possible only for models 103, 105 and 143.

Table 4 - Limits of the permissible basic reduced error γ for transmitters with analog output signal

The limits of the permissible basic reduced error depending on the measuring range adjustment coefficient. γ , %		Application based on the model
$r \leq 5$	$5 < r \leq 20$	
$\pm 0,086$	$\pm(0,071 + 0,0029 \cdot r)$	193
$\pm(0,09 + 0,01 \cdot r)$	$\pm(0,09 + 0,012 \cdot r)$	173, 174
$\pm 0,15; \pm 0,2; \pm 0,25; \pm 0,4; \pm 0,5; \pm 1,0$	$\pm(0,09 + \gamma/10 \cdot r)$	
$\pm 0,15$	$\pm(0,09 + 0,012 \cdot r)$	175, 176, 183, 184, 185, 186, 187, 188, 193
$\pm 0,2; \pm 0,25; \pm 0,4; \pm 0,5; \pm 1,0$	$\pm(0,09 + \gamma/10 \cdot r)$	

1.2.5 The limits of the permissible basic reduced error γ for models with digital output signal expressed as percentage of the upper limit or output signal measurement range do not exceed the values shown in the Table 5

Table 5 - Limits of the permissible basic reduced error for transmitters with digital output signal

Limits of the permissible basic reduced error γ , %	Application based on the model
$\pm 0,04; \pm 0,065$	103, 105, 113, 123, 133, 143
$\pm 0,074$	163, 164
$\pm 0,1; \pm 0,15; \pm 0,2; \pm 0,25; \pm 0,4; \pm 0,5; \pm 1,0$	103, 105, 113, 123, 133, 143, 163, 164, 173, 174
$\pm 0,086$	193
$\pm 0,15; \pm 0,2; \pm 0,25; \pm 0,4; \pm 0,5; \pm 1,0$	175, 176, 183, 184, 185, 186, 187, 188, 193

1.2.6 Output signal variability γ_{Γ} , does not exceed absolute limit of the permissible basic reduced error $|\gamma|$.

1.2.7 Output signal ripple in the range from 0,06 to 5Hz does not exceed $0,7|\gamma|$.

1.2.8 Analog signal ripple in the range from 5 to 106Hz shall not exceed 0, 5% of the measuring range. Analog signal ripple higher than 106Hz is not rated. Output signal ripple is rated at load resistance of 250 Ohm (in the absence of communication with the transmitter via HART).

Note: signal ripple is rated at minimum averaging time of the measuring results.

1.2.9 Output signal is linear dependent or proportional to square root of the input measuring value.

1.2.10 The nominal static characteristic of the transmitter with a linearly increasing dependence of the analog output signal on the input measuring value corresponds to:

$$I = I_l + \frac{I_u - I_l}{P_u - P_l} \times (P - P_l) \quad (1)$$

where I – current value of the output signal, mA;

P – measured value in stated units;

$I_l = 4 \text{ mA}$, $I_u = 20 \text{ mA}$ – respectively, upper and lower limits of the output signal.

P_u , P_l – respectively, upper and lower limits of the output signal in stated units;

The nominal static characteristic of the transmitter with a linearly decreasing dependence of the analog output signal on the input measuring value corresponds to:

$$I = I_u - \frac{I_u - I_l}{P_u - P_l} \times (P - P_l) \quad (2)$$

The nominal static characteristic of the transmitter with the function of converting the input measured value according to the square root law corresponds to:

$$I = I_H + (I_B - I_H) \times \sqrt{\frac{P - P_l}{P_u - P_l}} \quad (3)$$

where P – input measured value - pressure difference in stated units.

1.2.11 General purpose industrial transmitter shall be connected to 10.5 (off-load) to 45VDC supply unit.

1.2.12 Ex-proof version with protection type "intrinsically safe electrical circuit "i" shall be connected to 10.5 to 28VDC supply unit.

1.2.13 Electrical wiring diagrams are given in the **Annex B**.

1.2.14 Power consumption not exceed 0,65 V·A.

1.2.15 The limits of the permissible load resistance (resistance of resistor and communication lines) depends on the stated transmitter supply voltage and should not go beyond the boundaries of the working area shown in Figure 1 in the range from R_{min} to R_{max} .

R_{max} are calculated as below:

$$R_{max} \leq \frac{U - 10,5}{0,023} \quad (4)$$

where U - transmitter supply power, V.

$R_{min} = 0$ if HART signal is not available.

$R_{min} = 230 \text{ Ohm}$ if using HART communication.

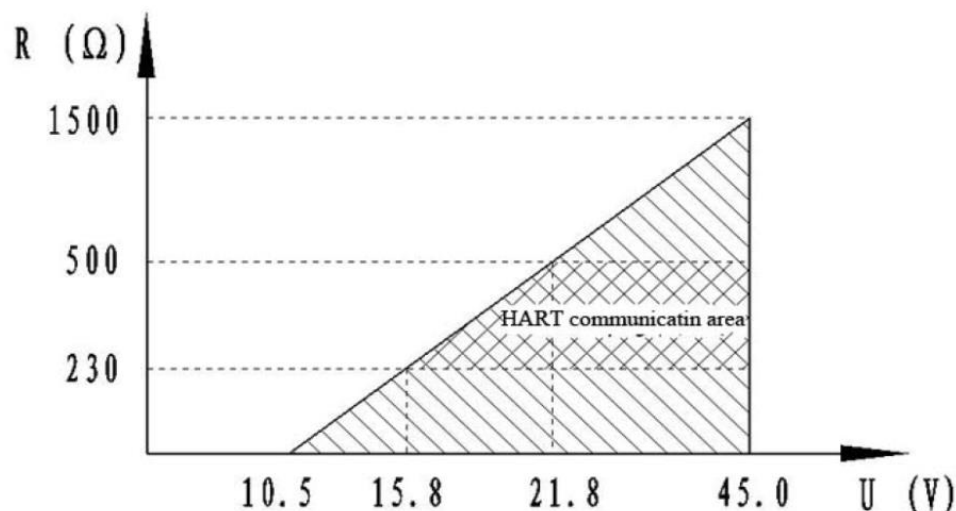


Fig.1 - Graph of dependence between the load resistor resistance and transmitter supply voltage

1.2.16 Transmitter has electronic damping of the output signal, which represents measuring results averaging time. Transmitter time is selected from: to 0,1 s; 0,5 s; 1 s; 2,5 s; 5 s; 10 s; 20 s; 50 s; 100 s. Averaging time of measurement influence output signal detection time.

1.2.17 Response time of the transmitter shall not exceed 100ms.

1.2.18 Saturation current when measured value goes beyond the stated limits:

(3,6 – 4,0) mA range of the lower limit of the saturation current (as standard - 3,8 mA);

(20,0 – 21,0) mA range of the upper limit of the saturation current (as standard - 20,5 mA);

The exact values of the saturation current set when setting up the device.

1.2.19 The transmitters are protected against reverse polarity of the supply voltage.

1.2.20 Ambient temperature range for general industrial transmitters, including LCD versions, from -60° to $+85^{\circ}\text{C}$. Ambient temperature range for ex-proof transmitters, including LCD versions, is specified in the Table 9.

1.2.21 Additional reduced error γ_t caused by ambient temperature changes within working temperature range does not exceed the values given in the Table 6 for each 10°C .

Table 6 - Limits of additional reduced error γ_t

Additional reduced error to the measuring range caused by changes in ambient temperature γ_t , %	Application based on the model
with analog output	
$\pm(0,023 \cdot r + 0,02)$	103, 105, 113, 123, 133, 143
$\pm(0,04 \cdot r + 0,04)$	163...188
$\pm(0,046 \cdot r + 0,04)$	193
for versions with digital output signal	
$\pm 0,043$	103, 105, 113, 123, 133, 143
$\pm 0,08$	163...188
$\pm 0,086$	193

1.2.22 Medium temperature range from -40°C to $+120^{\circ}\text{C}$ for pressure transmitters models 105, 113, 133, 143, 153, 163, 164, 193 and the medium temperature range from -60°C to $+120^{\circ}\text{C}$ for pressure transmitters models 103 and 123. For models 173...188 temperature range depends on the operating temperature of the liquid in capillaries ("Capillaries liquid" in the order line). At a temperature of the measured medium from 120 to 400°C , it is necessary to use an assembly with a capillary line at least 1 m long; it is allowed to use an assembly with a radiator between the body and the separating membrane for models 173 ... 188 at a temperature of the measured medium not higher than 200°C .

1.2.23 The transmitters are resistant to $95 \pm 5\%$ relative humidity at $+35^{\circ}\text{C}$ and lower temperatures with moisture condensation.

1.2.24 In terms of resistance to the effects of environmental factors, pressure transmitters can be operated in boreal climates location class 1 under GOST 15150 and OM1 (in case of delivery of pressure

transmitters to on sea-going ships). Boreal climates location class 1 allow the operation of pressure transmitters in boreal climates location $-60...+40^{\circ}$ C, temperate climate $-45...+40^{\circ}$ C and frigid climate $-60...+40^{\circ}$ C of 1-4 category.

1.2.25 Transmitter is resistant to external magnetic field up to 400 A/m under GOST P 50648 (IEC 1000-4-8-93).

1.2.26 Transmitter is resistant to industrial radio interference:

- 1) GOST R 51317.4.4 3rd test severity level;
- 2) GOST R 51317.4.3 3rd test severity level at 80-1000 MHz;
- 3) GOST R 51317.4.2 4th test severity level;
- 4) GOST R 51317.4.6, 2nd and 3rd test severity level with HART test operated under noises;
- 5) GOST R 50648, 5th test severity level;
- 6) GOST R 50649, 5th test severity level;
- 7) GOST R 50652, 5th test severity level;
- 8) GOST R 51317.4.5 2nd test severity level "wire-to-wire" interference and 3rd test severity level "wire-to-ground" interference. Interference resistance - A.

1.2.27 The transmitters comply with the emission standards established for class B by GOST R 51318.11.

1.2.28 Transmitter protection against dust and water comply with IP65, IP66, IP67, IP68 under GOST 14254, and depends on selected cable gland or plug adapter according to the **Annex J**.

1.2.29 Average service life is at least 30 years, provided proper maintenance and normal operating conditions:

- environment temperature plus $(23\pm 10)^{\circ}\text{C}$;
- relative humidity from 20 to 95%;
- atmospheric pressure from 84 to 106.7 kPa;
- power supply $24\pm 0,5\text{V DC}$;
- no external electrical and magnetic fields (except for earth) influence device operation;
- no vibration, shaking, bumps affecting the operation of the transmitter;
- non-corrosive medium.

1.2.30 Mean time before failure shall not be less than 150000 hours and depends on maintenance as specified in the manual.

1.2.31 Transmitters are resistant to vibrations with frequency 10 to 2000Hz and acceleration not exceeding 98m/s^2 , refers to G2 group under GOST R 52931-2008.

1.2.32 Pressure transmitters are earthquake resistant if exposed to earthquakes with an intensity of 9 points on the MSK-64 scale.

1.2.33 Dimensions and connection size of pressure transmitter with mounting kit are show in the **Annex D**.

1.2.34 Transmitters are equipped with protection unit (LP code as additional option) against transient phenomena in communication lines caused by lightning, welding, the operation of powerful electrical equipment and switching mechanisms.

1.2.35 Transmitters with LCD can be adjusted using inbuilt control functions.

1.2.36 Transmitters without LCD can be adjusted via HART compatible control unit.

1.2.37 Transmitter service life is 20 years provided that transmitter is made of corrosion resistant materials.

1.2.38 For transmitters with remote diaphragm seal bending of capillary lines with a radius of not less than 5 cm is allowed. The material of the capillaries is 316 stainless steel.

1.2.39 Transmitter body is equipped with ground clamp and marked with earth sign under GOST 21130.

1.2.40 Transmitter parts materials which contact measuring medium are specified in the **Annex C**.

1.2.41 Transmitter weight does not exceed the values specified in the Table 7.

1.2.42 According to operating principle and design of transmitter, it's not flammable. The probability of a fire in the sensors does not exceed 10^{-6} per year in accordance with GOST 12.1.004-91. A fire is considered to be the occurrence of an open fire on the outer surfaces of the converters or the release of burning particles.

Table 7 - Transmitter weight

Transmitter model	Weight depend on transmitter body material, kg, not more than	
	aluminium (code Al)	stainless steel (code S)
103, 123	1,6	4,0
113	1,8	4,0
105, 133, 143, 193	3,6	6,0
153	4,0	6,0
163, 164	3,6 without flanges	6,0 without flanges
173, 174, 175, 176	1,6 without flanges	4,0 without flanges
183, 184, 185, 186, 187, 188	3,6 without flanges B	6,0 without flanges

1.3 Explosion protection

1.3.1 Explosion protection "intrinsically safe circuit "ia" is provided by the following means:

– power supply shall be provided from 24V DC voltage intrinsically safe unit with output circuits of "ia" level and electrical parameters complying with GOST 31610.11 and EN IEC 60079-11 for intrinsically safe circuits of electrical equipment IIC class for Exia transmitters;

Table 8 - Supply circuit input parameters for ExiaC, ExiaCD, ExiaB, ExiaBD, RO

Parameter	ExiaB ExiaBD	ExiaC, ExiaCD	RO
Max input voltage range U_i , V	30	30	30
Max input current I_i , A	0,12	0,12	0,48
Max input current P_i , W	0,8	0,8	2,6
Max internal capacity C_i , μ F	0,01	0,01	0,01
Max internal inductance L_i , μ H	0,7	0,7	0,7

– connection of external devices to current and tests outputs shall be provided via intrinsically safe barriers with output circuits of "ia" level and electrical parameters complying with GOST 31610.11 and EN IEC 60079-11 for intrinsically safe electrical circuits of equipment of IIC subgroup ;

– electrical load of spark-proof elements of transmitter intrinsically circuits shall not exceed 2/3 of the stated value;

– clearances and creepage distances complying with GOST 31610.11 (EN IEC 60079-11);

– leakage path, clearance and insulation strength, electrical parameters of circuit boards and connections comply with GOST 31610.11-2014;

– electrical insulation between the body of protective jacket and electrical circuits withstands the testing a.c. voltage of 500V AC;

– transmitter circuit does not contain electric energy sources hazardous due to spark ignition of gas mixtures of category IIC, coal dust and dust according to category IIID;

– current- carrying connections and electronic components are protected against environmental exposure with IP65-68 enclosure complying with GOST 14254 and corresponded high degree of mechanical strength complying with GOST 31610.11 (EN IEC 60079-11).

1.3.2 Ex-proof transmitters have an additional plate with the explosion protection marking indicated in the Table 9.

Table 9 - Ex-proof marking

Modification	Maximum process temperature *, °C	Ambient temperature range, °C	Explosion-proof marking
"ExiaB"	+85	$-60 \leq T_a \leq +70$	II 1G Ex ia IIB T6 Ga
	+100	$-60 \leq T_a \leq +85$	II 1G Ex ia IIB T5 Ga
	+135	$-60 \leq T_a \leq +85$	II 1G Ex ia IIB T4 Ga
"ExiaC"	+85	$-60 \leq T_a \leq +70$	II 1G Ex ia IIC T6 Ga
	+100	$-60 \leq T_a \leq +85$	II 1G Ex ia IIC T5 Ga
	+135	$-60 \leq T_a \leq +85$	II 1G Ex ia IIC T4 Ga

"RO"	+135	$-60 \leq T_a \leq +70$	I M1 Ex ia I Ma
«ExiaBD»	+85	$-60 \leq T_a \leq +70$	II 1D Ex ia IIIB 85 °C Da
	+100	$-60 \leq T_a \leq +85$	II 1D Ex ia IIIB 100 °C Da
	+135	$-60 \leq T_a \leq +85$	II 1D Ex ia IIIB 135 °C Da
«ExiaCD»	+85	$-60 \leq T_a \leq +70$	II 1D Ex ia IIIC 85 °C Da
	+100	$-60 \leq T_a \leq +85$	II 1D Ex ia IIIC 100 °C Da
	+135	$-60 \leq T_a \leq +85$	II 1D Ex ia IIIC 135 °C Da

* - The actual maximum temperature of the measured medium can be in the range of $-90 \dots +400$ °C, but the temperature in the measuring chambers should not go beyond the range of $-60 \dots +120$ °C for models 103 and 123, for other models the temperature in the measuring chambers should not go beyond the range of $-40 \dots +120$ °C.

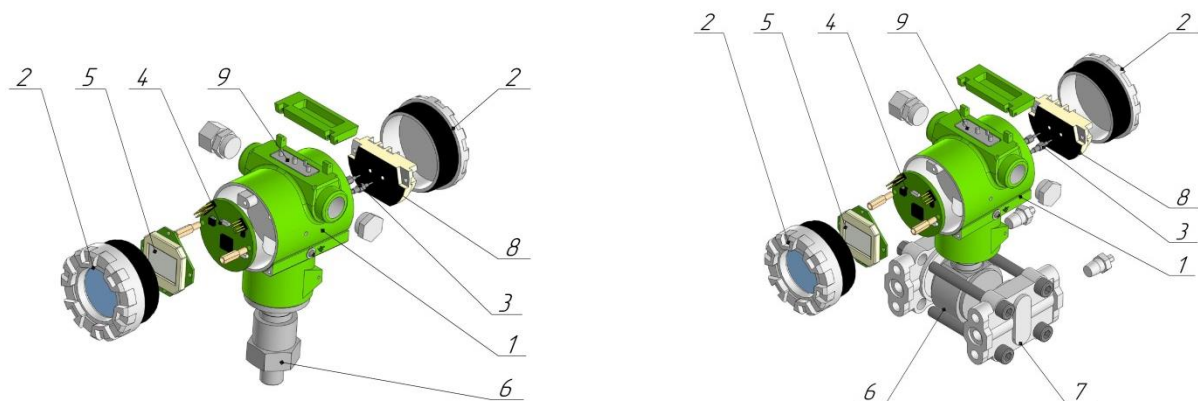
The body of RO ex-proof transmitter versions operated in underground mines and pits and its overground facilities hazardous with gas and dust are made of stainless steel.

ATTENTION:

- during operation it is necessary to take measures of protection against excess temperature of the transmitter elements due to heating from the measured medium above the value acceptable for the temperature class T6 ... T4;
- painted transmitters can present a risk of potential electrostatic charge. Wipe only with wet or antistatic cloth;
- close transmitter cover before switch it on;
- the explosion protection is valid for the medium pressure below the maximum level permitted for that type of transmitter.

1.4 Configuration and operation

1.4.1 Transmitter structure is shown in the fig.2.



a) Transmitter with in-line mount connection

b) Transmitter with traditional mount connection

Fig.2 - Pressure transmitter structure

Pressure transmitter consists of pressure sensor and electronic unit (fig.2). Electronic unit is attached to the threaded socket of the pressure sensor. Transmitter includes: electronic board (4), sealed covers (2), LCD unit (5), RFI filters (3), terminal board (8), adjusting buttons (9).

The difference between the in-line mount and the traditional mount versions is in the design of the pressure sensor (6). For in-line mount version, the pressure transmitter consists of a housing and a socket, where the sensor and measuring diaphragm are located. For traditional mount version, the pressure transmitter consists of the sensor with measuring diaphragms located at the positive side (high pressure side) and the negative side (low pressure), flanges (7) and fasteners.

1.4.2 The transmitter work is based on a piezoresistive method of pressure measurement, which is based on measuring the voltage difference across the resistances of the bridge circuit of an integrated sensitive element made of single-crystal silicon under mechanical action. Sensor is fixed on the silicon lining, which itself fixed on the measuring diaphragm. When the pressure of the working medium

changes, the geometry of the resistances of the Wheatstone bridge and the potential difference at its outputs change. After double conversion of an analog-digital and digital-analog signal in the electronic unit, amplification, filtering, modulation, the current signal at the output is proportional to the change in the pressure of medium.

1.4.3 The structure allows to rotate transmitter for 270° around the common vertical axis, while the rotation angle is limited to the design of the rotation assembly (fig.3).

After rotation is done, tighten the lock screw to avoid accidental rotation.

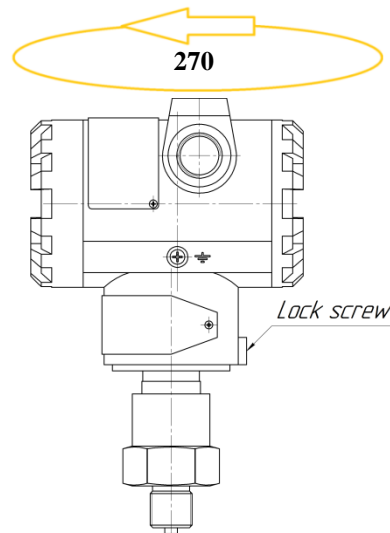


Fig.3 - Transmitter rotation angle

1.4.4 LCD can be rotated for 360° with fixation at each 90° for convenient reading. To rotate transmitter follow the steps below: unscrew two screws, pull up the display, rotate and put it back down, screw two screws.

1.5 Pressure transmitter adjustment

1.5.1 To adjust the transmitter use the input buttons (fig. 4) located at the transmitter body.

The control unit is installed in the upper part of the housing and allows you to adjust the transmitter in the hazardous area without violating the seal of the transmitter casing.

To access the buttons unscrew two screws in the upper side of the casing and fold back the plastic cover. Use M button to navigate and «↑» («+») and «↓» («-») to change.

To save changes in the nonvolatile device memory simultaneously press «↑» and «↓» buttons. At the same time at LCD display 2 (Fig.5) will be shown momentary message «SAVE»



Figure 4 - Input buttons

Follow the operating rules below:

- To configure the device using the keyboard, unlock the input buttons.
- Digital device parameters always changing via successive value increments, starting from the lowest digit of the displayed parameter. If the button "↑" or "↓" is held down for a while, the transition to the setting of the value corresponding to the next digit will occur. This method is used to coarsely adjust the value over a wide range. For more fine adjustment, release the "↑" or "↓" button, then press it again.
- If more than one minute have passed since the last press of the enter button, device automatically switches to the measured value display mode and all unsaved settings will be lost.

• Any write commands via HART are disabled while the transmitter is being configured using the buttons. Reading of measured parameters is allowed.

1.5.2 LCD displays the following:

- 1 – measured pressure;
- 3 – selected units, parameter name in configuration mode, messages and errors;
- 3 – quadratic dependence of the output signal;
- 4 – menu line and buttons lock mode;
- 5 – error symbol for “Under lower limit”;
- 6 – measured pressure symbol;
- 7 – error symbol for “Over upper limit”;
- 8 – communication indicator (blinking means that data are being transferred via HART).

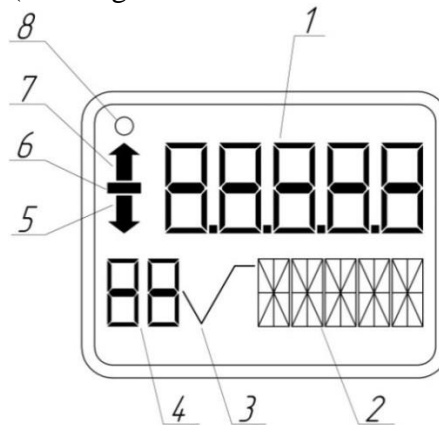


Figure 5 – LCD display

Adjustable parameters are given in the Table 10.

Table 10 – Adjustable parameters

Parameter	Description	Adjustment	
		via keyboard	via HART
Lower limit	Setup lower limit with reference pressure applied. (available only without LCD display).	+	+
Upper limit	Setup upper limit with reference pressure applied. (available only without LCD display).	+	+
Damping time	Setup damping time within stated limits.	+	+
Lower limit of measurement	Setup the lower limit without reference pressure.	+	+
Upper limit of measurement	Setup the upper limit without reference pressure.	+	+
Zero point	Setup zero value when no external pressure applied.	+	+
2 point pressure calibration	2 point pressure calibration of reference pressure from the range.	-	+
Fixed value current	Setup fixed value of current 3,6; 4; 12; 20; 22; 22,8 mA.	+	+
Emergency current value	Setup the emergency current value from the ranges: (3.3 – 3.6) mA, or (21.0 – 23.0) mA.	+	+
Voltage-saturation current	Setup lower and upper values of saturation currents, respectively from the ranges: (3.6 – 4.0) mA and (20.0 – 21.0) mA.	+	+
Control interlock	Setup control interlock	+	+

Measurement units	Measurement units selection	+	+
Pressure value indication	Pressure indication mode: in stated units, as percentage of the measuring range, in current output signal.	+	+
Output signal mode	Select output signal mode.	+	+
The point of application of the quadratic dependence of the output signal	Setup quadratic dependence start point within 5 to 15% with step 0,1%.	+	+
Diagnostic function	Self-diagnostic function activation.	-	+
Menu language	Set language: Russian, English.	+	+
Inbuilt clock	Setup inbuilt clock.	-	+
Error log	See error log.	-	+

1.5.3 Menu structure is showed in the Table 11.

Table 11 – Menu structure

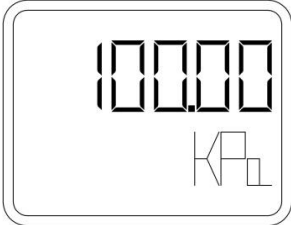
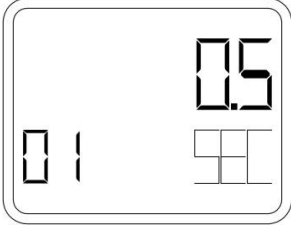
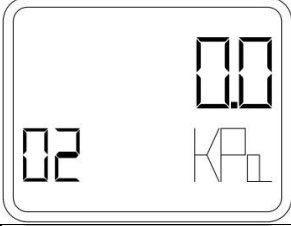
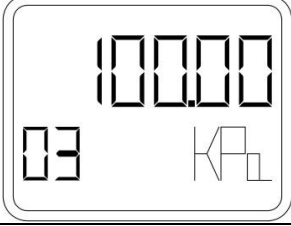
Menu line	Parameter	Indication in English
-	Measured pressure value normally displayed	
01	Damping time	
02	Setup lower limit without reference pressure	
03	Setup upper limit without reference pressure.	

Table 11 continued

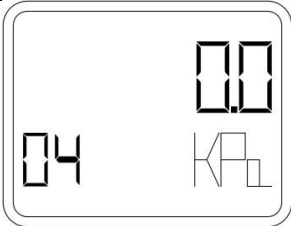
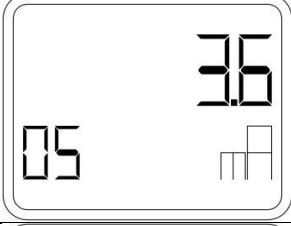

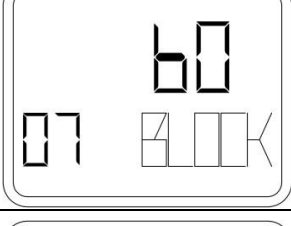
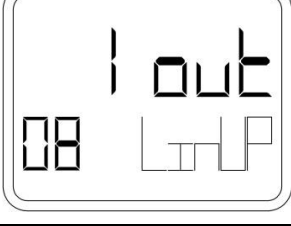
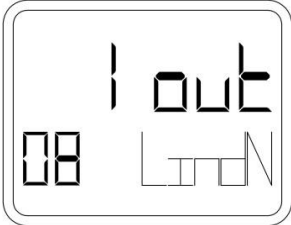
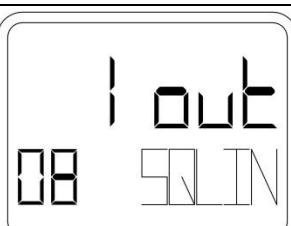
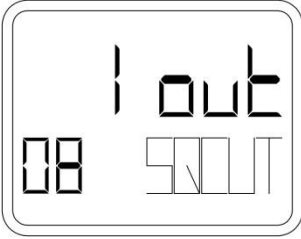
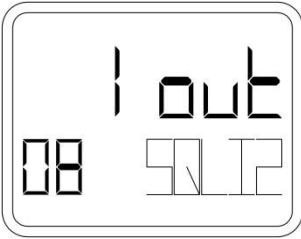
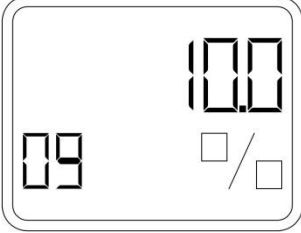
Menu line	Parameter	Display image, english
04	Zero calibration	
05	Fixed current value	
06	Emergency current value	
07	Control lock	
08	Lineary - increasing	
	Lineary - decreasing	
	Linear until specified point, then quadratic	

Table 11 continued

Menu line	Parameter		Display image, english
08	Output signal mode	4 mA until specified point, then quadratic	
		Linear kinked until specified point, then quadratic	
09	The point of application of the quadratic dependence of the output signal		

1.5.4 Adjustment using buttons for LCD version:

1 – Damping time

Follow the steps below to select damping time:

- Press "M" button to enter menu line 01 (figure 11).
- Press «↑» and «↓» buttons to select required damping time.
- Simultaneously press «↑» and «↓» to save changes.

2 – Setup lower measuring limit in no reference pressure

Follow the steps below to setup lower measuring limit in no reference pressure mode:

- Press "M" button to enter menu line 02 (figure 11).
- Select pressure value complying with lower measuring limit using «↑» and «↓» buttons.
- Simultaneously press button «↑» and «↓» to save changes.

This adjustment is possible even if the lock modes b2 or b3 activated (menu item 07).

3 – Setup upper measuring limit in no reference pressure

Follow the steps below to setup upper measuring limit in no reference pressure mode:

- Press "M" button to enter menu line 03 (figure 11).
- Select pressure value complying with upper measuring limit using «↑» and «↓» buttons.
- Simultaneously press button «↑» and «↓» to save changes.

This adjustment is possible even if the lock mode b3 activated (menu item 07).

4 – Zero point adjustment

Adjustment of zero point eliminates measurement errors caused by the location of the transmitter and the temporal drift of the zero point.

Follow the steps below to reset transmitter:

- Setup input pressure corresponding with zero point.
- Press "M" button to enter menu line 04 (figure 11).
- Simultaneously press button «↑» and «↓» to save changes.

5 – Fixed value of current

Operation fixed current mode allows to connect an external current meter. In this case, the current no longer depends on the process pressure

Follow the steps below to setup fixed value of current:

- Press "M" button to enter menu line 05 (figure 11).
- Select current value using «↑» and «↓» buttons: 3,6 mA, 4,0 mA, 12,0 mA, 20,0 mA, 22 mA, 22,8 mA (figure 15).

- Simultaneously press button «M» to save changes

- To fixed current interruption, exit the menu line 05 by pressing "M" button.

Setup of the intermediate current values via HART protocol.

6 – Emergency current value (complying with NAMUR NE43)

In the event of emergency, the transmitter reports stated output signal.

Follow the steps below to setup emergency current value:

- Press "M" button to enter menu line 06 (figure 11).
- Select emergency current value using «↑» and «↓» buttons: 3,6 mA, 22,0 mA or 22,8 mA (figure 16).

- Simultaneously press buttons «↑» and «↓» to save changes.

7 – Control lock

Follow the steps below to lock transmitter control:

- Press "M" button to enter menu line 07 (figure 11).

- Use «↑» and «↓» buttons to select lock mode:

«b0» – allowed HART and buttons adjustment;

«b1» – HART and buttons adjustment not allowed;

«b2» – buttons adjustment not allowed. Allowed HART adjustment.

«b3» – buttons adjustment allowed only for 02 menu line. HART adjustment allowed.

«b4» – buttons adjustment allowed only for 02 and 03 menu line. HART adjustment allowed.

- Simultaneously press buttons «↑» and «↓» to save changes.

Cancel b1, b2, b3 or b4 control lock allowed only via HART.

Without LCD display blocking mode b0 recommended, in which using the buttons adjustment can only calibrate the zero value and adjust the upper and lower measurement limits. If you want to permanently parameterize a device without LCD display, make sure that blocking mode b0 is always active.

8 – Output signal mode

Follow the steps below to adjust the curve, which shows the dependence of output current on medium pressure:

- Press "M" button to enter menu line 08 (table 11).

- Use «↑» and «↓» buttons to select output signal mode:

«LIN UP» - Linearly increasing (item 1.2.9, figure 6);

«LIN dN» - Linear decreasing (item 1.2.9, figure 6);

«SQLIN» - Linear until specified point, then quadratic (item 1.2.9, figure 7);

«SQOUT» - DC current 4 mA until specified point, then quadratic;

«SQLI2» - linear kinked until specified point, then quadratic (figure 9).

- Simultaneously press buttons «↑» and «↓» to save changes.

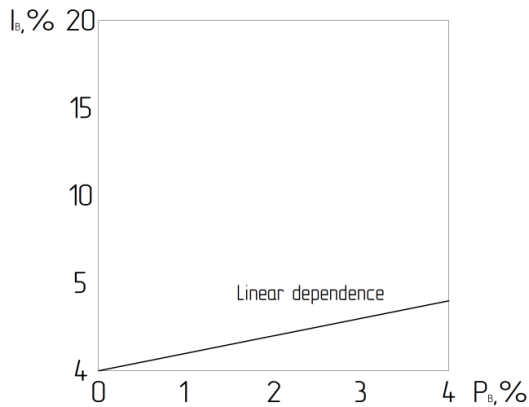


Figure 6 - LIN graph

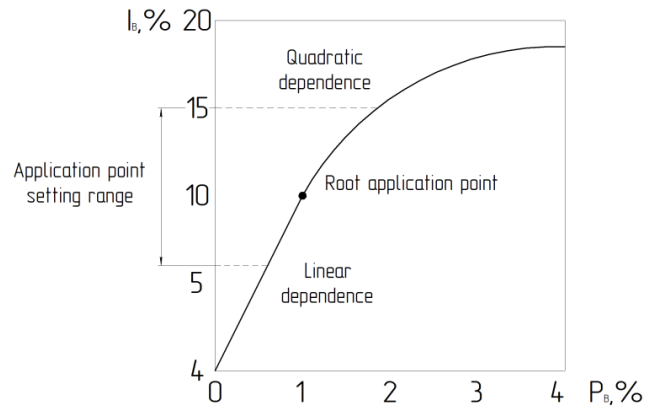


Figure 7 - SQLIN graph

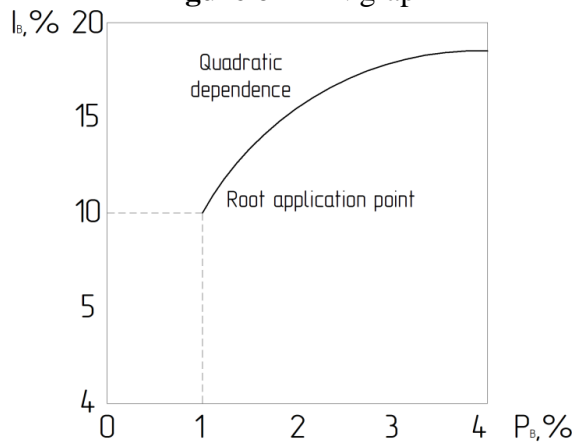


Figure 8 - SQOUT graph

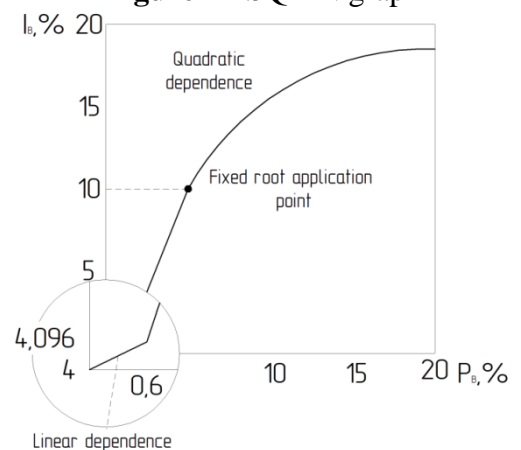


Figure 9 - SQLI2 graph

Static square root characteristics curve to flow variations only available for differential pressure transmitters.

09 – The point of application of the quadratic dependence of the output signal

The point of application is the pressure value where the nominal static characteristic of the transmitter goes from linear to square root. This pressure value is expressed in percent of setted measuring range and varies from 5 to 15% in 0.1% steps.

The setting of the application point is available only if any of the three square-law modes of the output signal is selected (menu line 08): "SQLIN", "SQOUT", "SQLI2".

Follow the steps below to adjust root application point quadratic dependence:

- Press "M" button to enter menu line 09 (table 11).
- Use «↑» and «↓» buttons to select the point of application value
- Simultaneously press buttons «↑» and «↓» to save changes

For the "SQLIN" function, the nominal static characteristic is linear to the point of application, then square root function. The linear portion is similar to the "LIN-B" function.

For the "SQOUT" function, up to the point of application the value of the output current is fixed and equal to 4 mA.

The point of application with fixed value of 10% is used for «SQLI2» function. Up to the point of application, two linear sections are applied. First linear in the range from zero point to 0, 6% of output signal and 0, 6% of pressure value. Second linear has a higher degree and goes up to the point of application (10% of output value and 1% of pressure value).

10 – Pressure indication

Follow the steps below to adjust pressure indication mode:


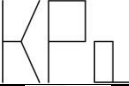


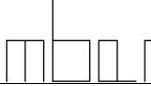



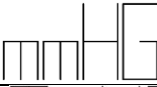




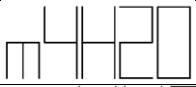
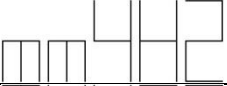



- Press "M" button to enter menu line 10 (table 11).
- Use «↑» and «↓» buttons to select indication mode: output signal mA, percentage of the scale, pressure value in stated units.
- Simultaneously press button «↑» and «↓» to save changes.

11 – Measuring units

Follow the steps below to select measuring units:

- Press "M" button to enter menu line 11.
- Use «↑» and «↓» to select required units (see Table 12).
- Simultaneously press button «↑» and «↓» to save changes.

Table 11 – Measuring units

Pressure units	Display image, english
MPa	
kPa	
Pa	
bar	
mBar	
atm	
kgf/cm2	
gf/cm2	
mm Hg.	
inch Hg	
mm H2O (at +20°C)	
ft.H2O (at +20°C)	
inch H2O (at +20°C)	
m H2O (at +4°C)	
mm H2O (at +4°C)	
inch H2O (at +4°C)	
Torr	
Pa	

12 – Menu language

Follow the steps below to select menu language:

- Press "M" button to enter menu line 12.
- Use «↑» and «↓» to select required language: Russian or English.
- Simultaneously press button «↑» and «↓» to save changes.

Parameter settings via buttons if the LCD display not available.

Without LCD display, the following transmitter settings available via buttons:

- Setup lower measuring limit with reference pressure applied.
- Setup upper measuring limit with reference pressure applied.
- Zero calibration.

Follow the steps below to setup lower measuring limit:

- Apply the reference pressure complying with lower measuring limit.
- Simultaneously press «M» and «↓» buttons to enter lower measuring limit setup mode.
- Simultaneously press button «↑» and «↓» to save changes. Transmitter will automatically

switch to mode 0.

This adjustment is possible even if the lock mode b2 and b3 activated (menu item 07)

Follow the steps below to setup upper measuring limit:

- Apply the reference pressure complying with upper measuring limit.
- Simultaneously press «M» and «↑» buttons to enter upper measuring limit setup mode.
- Simultaneously press button «↑» and «↓» to save changes. Transmitter will automatically

switch to mode 0.

This adjustment is possible even if the lock mode b3 activated (menu item 07)

If pressure go out of accepted range during adjustment, adjustment default. In this case, the previous values will be saved.

Follow the steps below to calibrate the zero value of transmitter:

- Apply "zero" pressure value.
- Simultaneously press button «↑» and «↓» to enter zero value setting mode.
- Simultaneously press button «↑» and «↓» to save changes.

Save the change by simultaneously pressing the "↑" and "↓" buttons. Then the sensor will automatically switch to mode 0. Transmitter will automatically switch to mode 0.

Warning! Zero calibration for absolute pressure transmitters is not available in this mode.

1.6 Pressure transmitter control via HART

Digital HART signal impress an analog signal without affecting its direct component. HART protocol allows the simultaneous presence of two control devices in the system: a control system (PC with a HART modem) and a HART handheld communicator. These two devices exchange in a time-sharing mode of the communication channel, so that the transmitter can receive and execute commands from each of them. Connection of pressure transmitters to HART devices conducted by using the main terminals.

All of control functions described above, as well as some additional functions, are available via the HART protocol. Additional control functions include:

- pressure measurement calibration at two points of the range under normal temperature;
- setting the time and date of the internal clock;
- viewing the archive of hardware errors (item 1.7) that occur during the operation of transmitter.

Attention! Explosion-proof transmitters do not have an additional battery. Therefore, when the external power supply is disconnected, the real time clock will be stopped. After turning on the device, the countdown will start from 12:00:00, 06.08.2021.

1.7 Error log

Distinctive feature of transmitters is internal error log. All hardware operation errors (see 5.2) are stored in nonvolatile memory. Circular logging keeps records in a ring. Each records contains:

- Error date and time;
- 3-byte error register.

Error register digits description is presented in the Table 13.

Log volume is 883 records. When the files are full, it goes back to the first file in the ring and starts all over again. You can check error log only using additional means of HART protocol:

- HART-modem + DD software for PC;
- HART communicator.

Table 13 – Error log digits description

Byte	Bit	Description	Class	Device Status Bits Set
0	0	ADC calibration coefficients error (coefficients are false)	Error	1
	1	Error DAC calibration coefficients (coefficients are false)	Error	1
	2	Temperature sensor error	Error	1
	3	DAC error	Error	1
	4	ADC data not ready. ADC data read error	Error	1
	5	CPU initializing error	Error	1
	6	EEPROM read-write error	Error	1
1	7	FRAM read-write error	Error	1
	0	Low supply voltage	Error	1
	1	Emergency reload	Error	1
	2	Pressure lower than lower limit	Error	1
	3	Pressure beyond upper limit	Error	1
	4	Internal temperature out of range:(-40...+85)°C	Warning	1
	5	Pressure lower than stated range	Warning	1
	6	Pressure beyond stated range	Warning	1
2	7	Calibration error	Error	1
	0	No LCD	Warning	1
	1	Output current in saturation state 3.8mA - lower saturation limit, 20.5mA - upper saturation limit.	Warning	1
	2	DAC overheating ($T \geq +100^{\circ}\text{C}$)	Error	1
	3	Output current does not corresponds to DAC code	Error	1
	4	Break or fault of transmitter	Error	1
5 - 7	Not used	-	0	

1.8 Supply scope

1.8.1 Scope of supply is specified in the Table 14. Mounting kit is supplied separately according to the customer order sheet. Mounting kit depends on transmitter version and shown in **Appendix E**.

Table 14 - Supply scope

Item	Name	Qty
Pressure transmitter	EMIS-BAR	1 pcs.
Data sheet	EB 100.000.00 DS	1 pcs.
Operation manual	EB 100.000.00 OM	1 pcs. ²⁾
Calibration method	EB 100.000.00 CM	1 pcs for the batch
"Unauthorized access" sticker	-	6 pcs.
Mounting kit	-	upon request
Spare parts kit	-	upon request

¹⁾ The model and type of transmitter depending on the order, questionnaire.
²⁾ Allowed to supply 1 copy for every 10 transmitters (or other quantity as agreed with the customer), that would be delivered to one address.

1.8.2 Spare parts kit is supplied separately according to the customer order sheet. Spare parts kit includes mounting gaskets according to transmitter version, and sealing rings for electrical connection. Other accessories can be included according to customer needs.

1.9 Marking and sealing

1.9.1 The plate attached to the transmitter contains the following data:

- manufacturer trade mark;
- measuring tool approval mark;
- common Mark of Products Circulation in the Market of the Customs Union member-states;
- transmitter name;
- transmitter model;
- maximum upper P_{max} and minimum lower P_{min} limits in units, if P_{min} is zero, value is not indicated;
- IP level according to GOST 14254;
- maximum allowed operating pressure (for differential and level pressure transmitters) in units;
- manufacturer serial number;
- input voltage;
- output signal, mA;
- month and year of manufacture.

1.9.2 For ex-proof versions a special plate is attached to the transmitter as shown in the Table 9. As well the following:

- special ex-proof sign according to the Annex 2 of TR CU 012/2011 and directive 2014/34/eu of. The european parliament and of the council.;
- Common Mark of Products Circulating in the Market of the Customs Union member-states;
- certificate number.

1.9.3 "H" and "L" signs on the transmitter body mark the point of measuring product connection. In flange-type transmitters, the "H" mark corresponds to the point of supply of the measured pressure or the greater of the measured pressures, and the "L" mark indicates the chamber communicating with the static pressure, or the chamber for supplying the smaller of the measured pressures.

1.9.4 The transmitter is sealed at the factory to prevent unauthorized access to the control unit. The seal is in the form of a warning sticker. To operate the transmitter, you have to remove the sticker and, after the operation, install a new one. Operation shall be performed by duly authorized manufacturer employee. Sticker location is shown in the figure 10.

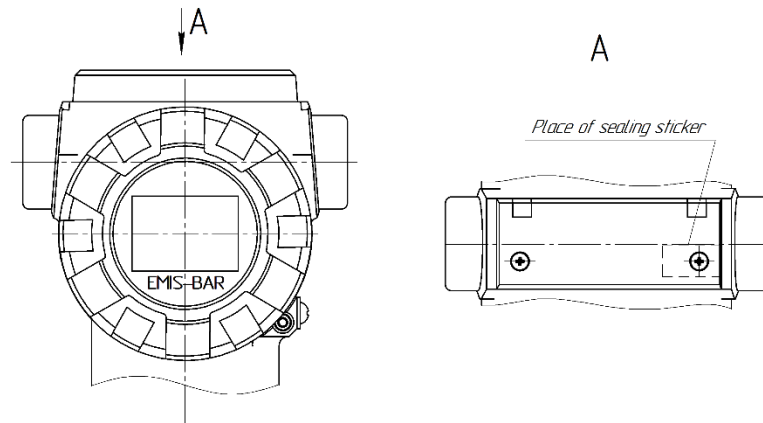


Figure 10 – Sealing sticker

1.10 Package

1.10.1 The transmitter packaging is performed in closed ventilated premises at an ambient temperature of 15 to 40 ° C and a relative humidity of up to 80% with no corrosive impurities in the environment.

1.10.2 The holes for cables, the holes of the fittings, flanges, the threads of the fittings are closed with caps or plugs before packing to protect the internal cavity from contamination, and the thread from mechanical damage. Degreasing and cleaning of working cavities, plugs, fittings of transmitters are performed before packing ("Filling liquid" code 2 or 3 in the order sheet).

1.10.3 Preservation is provided by placing a cardboard box with a transmitter in a film case with a drying agent - silica gel. It is allowed to directly place the transmitter in a film case with a drying agent. Conservation products must comply with protection type B3-10 GOST 9.014. Preservation is effective through 1 year.

1.10.4 Mounting kit parts, which have been and have not been cleaned and degreased, are wrapped separately from each other. Transmitters and mounting parts must be separated from each other and sealed in a box using gaskets made of packaging material. Technical documentation is placed in the box (on top of the product) together with the transmitter and mounting parts. Technical documentation is placed in a plastic bag with a Zip-lock clip. Boxes are packed in transport containers - wooden, plywood boxes. The boxes are lined with paper. The free space between the cartons and the box is filled with cushioning material or gaskets. When transporting in containers, it is allowed to use corrugated cardboard transport packaging according to GOST R 52901.

1.10.5 The gross weight of transportation package (crate made of plywood or fiberboard) with transmitters does not exceed 50 kg. Transportation package weight (wooden according to GOST 2991) does not exceed 70kg. The weight of transport packaging made of corrugated cardboard does not exceed 30 kg.

2 APPLICATION

2.1 Operating features

2.1.1 Transmitter are delivered in the manufacturer tare. Check tare for damages after receiving the goods. In case of any damages to the package, make a report to indicate damage severity.

2.1.2 In winter time, keep boxes unpacked in warm premises for 12 hours.

2.1.3 Check the supply scope according to the data sheet immediately after unpacking.

2.1.4 Write down the commissioning date in the data sheet. Remember to fill the operation data in the data sheet: maintenance records with the list of failures and their causes; calibration data, etc.

2.1.5 Remove the transportation plugs from the dynamic, static chambers and cable glands before the operation.

2.1.6 Transmitter can be installed indoors and outdoors.

2.1.7 The transmitter supplied to the client is configured by the manufacturer in accordance with the order sheet for a specified process. You can change the configuration either using the buttons on the transmitter housing or via HART. In the latter case, HART modem or a HART communicator must be used to communicate with transmitter.

2.1.8 After exposure to maximum or minimum operating temperatures, a “zero” point calibration is recommended.

2.1.9 Self check automatically starts after the power is on. Self-check lasts for 2 to 5 sec, then the transmitter switches to normal operation - pressure measurement. In the event of an error, the transmitter will display a message and adjust loop current value based on the specified value.

2.1.10 For corrosive, toxic, and other environments, make sure that the selected version of the transmitter is suitable for operation in these environments.

2.1.11 During installation it is necessary to make sure that the used mounting parts correspond to the transmitter model and application conditions.

2.1.12 Operation beyond the maximum permissible pressure, temperature of the measuring medium and/or environment can lead to the failure of the transmitter and an accident (the severity of the consequences depends on the level of violation and the operation conditions).

2.1.14 Transmitter body and sight window shall not be exposed to direct sunlight.

2.1.15 If operating in sub-zero temperatures, avoid the following: accumulation and freezing of condensate in the working chambers and inside the connecting tubes when measuring the parameters of gaseous medium, freezing, crystallization of the medium or crystallization of its individual components when measuring liquid medium.

2.1.16 LCD can be operated in the ambient temperature range of -42 to +85°C. Exposure to the temperatures below -42°C will not lead to LCD failure but influence readability and screen refresh rate.

2.1.17 Short-term pressure jumps (water hammer, pulsating pressure) that exceed the permissible values are not allowed during the operation of the transmitter. In these cases, the transmitter may fail due to damage or destruction of its transmitter. If pulsating pressure, water hammer cannot be excluded, pulsation dampers or other means must be applied to prevent damage or destruction of the transmitter.

2.1.18 Differential pressure transmitters withstand the impact of one-side overload with operating gauge pressure equally both from the positive chamber and from negative one within 1 min. (Table 2). In some cases, one-side overload with operating gauge pressure may lead to minor changes in rated parameters of the transmitter. We recommend to adjust initial value of output signal to eliminate the consequences.

2.1.19 It is recommended that pressure tap performed in the segments with lowest medium velocity and with no flow turbulence, i.e. in straight sections of the pipeline at a maximum distance from valves, elbows, expansion joints and other hydraulic connections. To reduce the influence of the pulsation of the measuring medium on the measurement result, it is allowed to use damping devices.

2.1.20 Shock loads and vibration exceeding the specified values can lead to failure of the transmitter and lead to emergency situations.

Attention: An increase in damping time leads to an increase in the accuracy of slow processes, but increases the reaction time by damping time.

Attention: Follow low and high pressure chambers connection order for differential pressure transmitter (marked as: L for low pressure, H for high pressure).

2.2 Mounting requirements

2.2.1 General rules of mounting

Mounting (dismantling), electric connection, adjustment, operation shall be performed by by duly authorized and electrically trained personnel who carefully read present manual.

Please follow mandatory rules when proceeding the transmitter installation:

- Provide free access to the transmitter;
- The installation site should ensure its operation without possible mechanical damage;
- It is not allowed to install the transmitter in flooded underground heating facilities;
- The transmitter can be installed in vertical, horizontal or inclined sections of the pipeline.
- Installation in areas with strong magnetic interference (e.g. near supply transformer) is not permitted;
- Switch off the transmitter before performing any works;
- It is prohibited to perform any work using non-grounded devices and electrical tools to avoid damage to the transmitter by static electricity;
- Unused cable glands shall be securely plugged;
- Connection of external circuits shall be performed after installation in the pipeline is done, disconnection shall be done before dismantling;
- Transmitter grounding shall be carried out before connecting the power supply and measuring lines by connecting a ground wire to the terminal marked with the ground sign;
- Operation of transmitter with signs of external damage is not allowed.
- Recommended location of pressure tap nozzles (see figure 11).

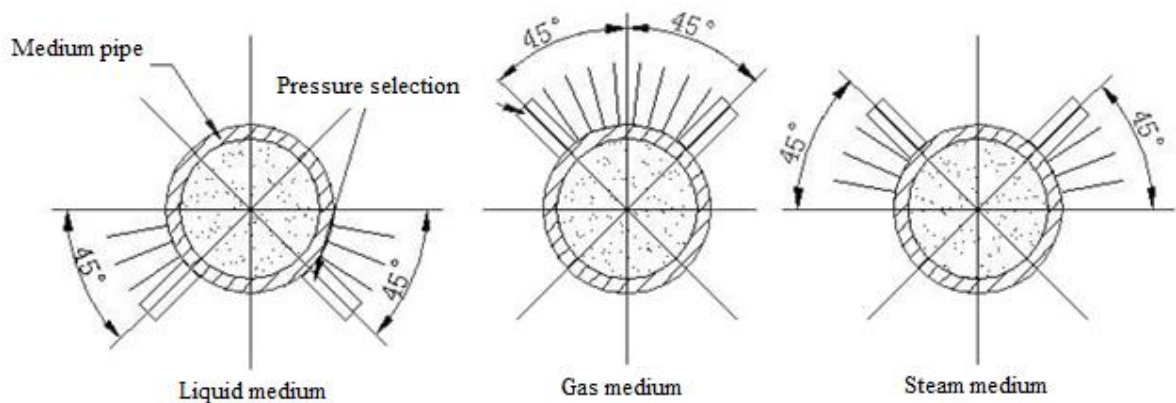


Figure 11 – Pressure tap nozzles location

2.2.2 The transmitter can be installed directly at the point of connection to the process or using the mounting bracket. Installation options using the mounting bracket:

- on the wall using 4 screws
- on the vertical or horizontal mounting pipe (50-60mm) using brackets, pressure transmitter is fixed to the bracket using 4 supplied screws. Bracket dimensions are presented in the **Annex I**.

WARNING! When mounting the transmitter rotated in relation to the vertical axis, it is necessary to carry out a zero calibration before commissioning!

2.2.3 Installation in the pipeline with high temperature medium inside To install transmitter in the pipeline with high temperature medium inside (more than 85°C) follow the recommendations below:

- It is not allowed to cover support bar with heat insulation. Otherwise, it may lead to electronic unit overheating even if ambient temperature does not exceed +70°C.
- To decrease convection heating of electronic unit we recommend to install the flow meter so that it is located below or on the side of the pipeline, not above it (support bar placed horizontally or vertically downward).

2.2.4 Electrical installation

For electrical installation please follow recommendations below:

- Do not place transmitter communication lines near power cables;

- We recommend placing cables and wires between transmitter and control gauges inside metal hoses or metal pipes;
- For wire laying we recommend to use control cables coated with rubber or plastic insulation, signal cables coated with PVC insulation;
- It is allowed to put transmitter supply wire and output signal wires in the same cable;
- We recommend to use shielded cable to lay near 0,5kVA electric units communication lines;
- Insulated wires of the same cable can be used as signal and supply wires, provided that insulation resistance shall be not less than 10 MOhm. No shielding required between output signal circuit and transmitter supply circuit;
- Wiring of cables connecting the transmitter with secondary devices shall be carried out according to the schemes given in the **Annex B**.
- Test cable for continuity and mark each end, than connect them to terminal box of the transmitter. Perform visual inspection to check if all wires connected to the right gland;
- Transmitter grounding shall be made using not less than 0,5mm² wire installed between earth bus and earth clamp of the transmitter.

2.2.5 Mounting of ex-proof pressure transmitter.

Carefully check the transmitter before installation. Pay attention to ex-proof marks, warning signs, check for damages of ex-proof enclosure and transmitter, check for ground clamp, seals for cables and covers, supply cable condition.

No scratches, indentation, shears on the surfaces marked as ex-proof on the drawing in the **Annex H** is allowed.

Wiring shall be carried out in accordance with the wiring diagrams given in the **Annex B**.

Connections can be made using any type of cable not less than **0,35 mm²** according to the chapter 7 of the Rules of electrical installation design.

It is not allowed to ground any circuits when using intrinsically safe power supply sources galvanically coupled with earth or load.

Transmitter body shall be grounded using not less than **0,5mm²** cable. Check ground resistance after installation, it shall not exceed **4 Ohm**.

If only one cable gland is used, another one shall be plugged.

At a temperature above of 80 ° C in the cable gland (cable entry and cable termination), it is necessary to use an external cable with insulation and an outer sheath comply with temperature resistance class.

After electrical installation make sure that all covers of the transmitter case are tightened and locked according to the drawing in **Annex H**.

ATTENTION, if reliable seal of cable glands, pressure transmitter cover and the plug during installation is not provided, the pressure transmitter fault may occur due to ingress of water, moisture or an aggressive environment. In this case, the manufacturer is not responsible for the failure of the transmitter.

Installation, operation and maintenance of the transmitter should be carried out in accordance with the Russian Electrical Code, GOST 31610.0 (EN IEC 60079.0), “Rules for the technical operation of electrical installations of consumers”, “Order of the Ministry of Labor of Russia dated July 24, 2013 No. 328n” and this operating manual.

2.2.6 The pressure of the filling liquid in the capillary on the measuring diaphragm must be considered, when using pressure transmitter of a special flange or transmitters connected by capillary tubes with a diaphragm seal for measuring up to 1 MPa. Transmitter install recommendation: minimal distance between tap (diaphragm seal) and diaphragm of the pressure transmitter (Distance H, see figure 12).

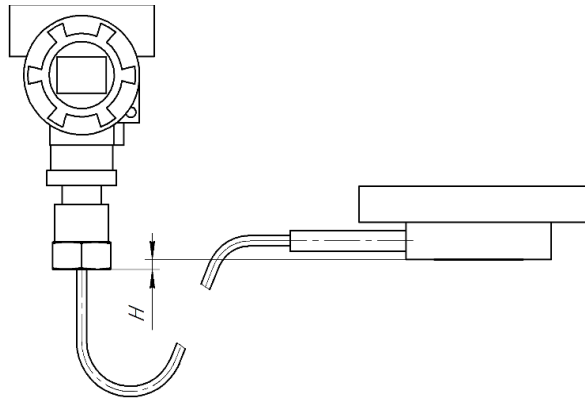


Figure 12 – Capillary tubes transmitter mounting

When using gauge, differential, hydrostatic pressure transmitters, after transmitter mounting the zeroing operation be required, which will compensate zero drift from the liquid pressure in the capillaries.

Absolute pressure transmitters install recommendation: install transmitter below the seal diaphragm. This will prevent a vacuum load on the diaphragm seal due to the oil pressure in the capillaries. Allowed to mount the transmitter above the diaphragm seal without exceeding the permissible height H (see Figure 13). Allowable height depends on the density of the filled oil and the lowest allowed pressure that effect diaphragm from the higher pressure side.

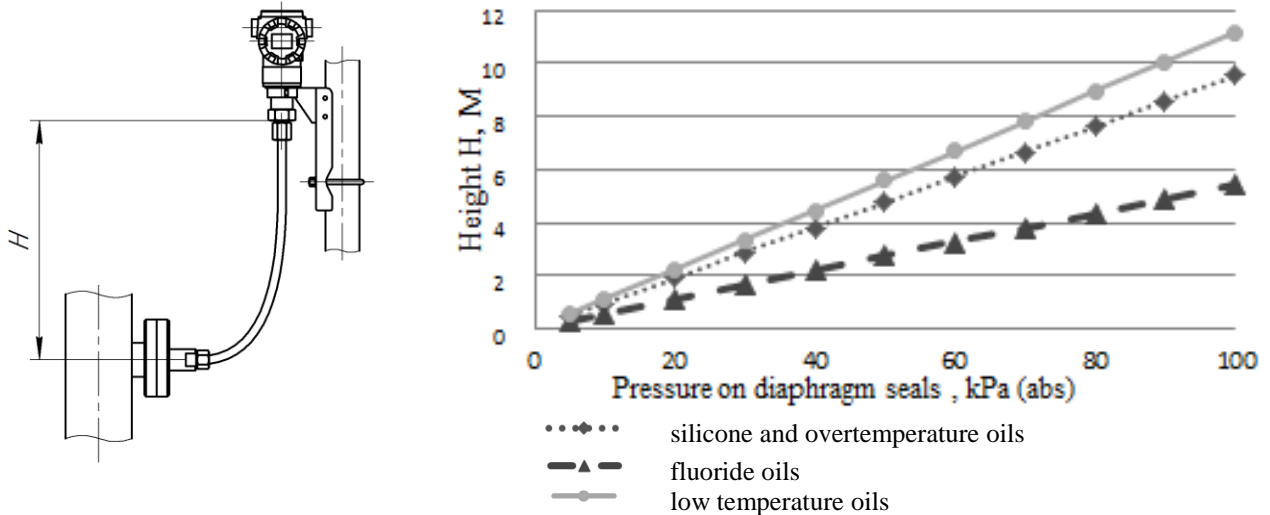


Figure 13 - Installation under vacuum conditions

2.2.7 Install the flanges so that the seal does not come into contact with the diaphragm, as this will affect the measurement result.

2.2.8 Pressure accuracy depends on the correct installation of transmitter and the capillary lines from the pressure tap to the transmitter. Recommended to lay capillary lines along the shortest distance. Capillary lines must have an outlets in the form of loop-shaped dampers, if the medium pressure is pulsating, the pressure hammer or gas shocks is possible. Capillary lines must have a one-sided slope of at least 1:10 from the pressure take-off point up to the transmitter, if the measured medium is gas (steam), down to the transmitter, if the measured medium is liquid.

If this is not possible, when measuring the pressure or differential pressure of the gas at the lowest points of the connecting line, settling vessels should be installed, and when measuring the pressure or differential pressure of the liquid at the highest points, gas collectors should be installed.

It is recommended to install settling vessels in front of transmitter and in other cases, especially with long capillary lines and when transmitter is located below the pressure tapping point.

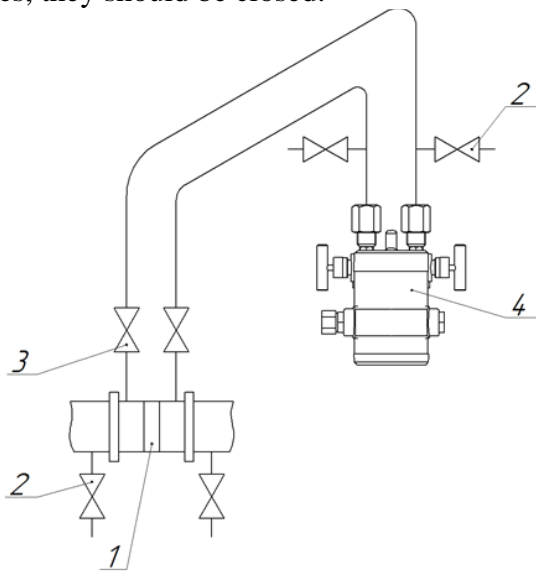
2.2.9 When measuring steam temperature above 121 ° C, it is recommended to fill the capillary tube with water to prevent direct contact of the transmitter with steam and to ensure measurement accuracy in the early stages.

In capillary lines from the flow restrictor to the differential pressure transmitter, it is recommended to install a valve on each of the lines to connect the line to the atmosphere and a valve to disconnect transmitter. Recommended schemes of capillary lines when measuring the flow rate of gas, vapor, liquid are shown in fig. 14, 15, 16.

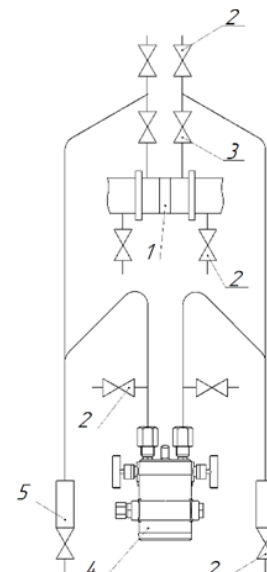
It is necessary to ensure that line pipes and valves not clogged and sealably. There should be no gas plugs in the pipes and valves (when measuring the pressure difference of liquid medium) or liquid (when measuring gas pressure difference). For this purpose, it is recommended to periodically purge the tubes, while avoiding transmitter overloading; the frequency is set by the consumer depending on the operating conditions.

Forbidden to purge and fill the connecting lines with the working medium through the receiving cavities and drain valves of transmitter. To purge and fill the connecting lines, use standard purging devices, or use detachable connections of transmitter receiving cavities with the valve or valve block system to disconnect transmitter before purging the lines, or, if the valve and valve block system has built-in purge valves, use these valves for purging lines with closed isolating valves of the valve and valve block system.

When filling the measuring chambers of transmitter, it is necessary to ensure that there are no gas plugs left in transmitter chambers (when measuring the pressure difference of liquid medium) or liquid (when measuring the difference in gas pressure). Transmitter chambers filled with liquid after it is installed in the operating position. Liquid supplied under low pressure (preferably by gravity) into both chambers simultaneously with the needle valves open. After liquid begins to flow out through the needle valves, they should be closed.

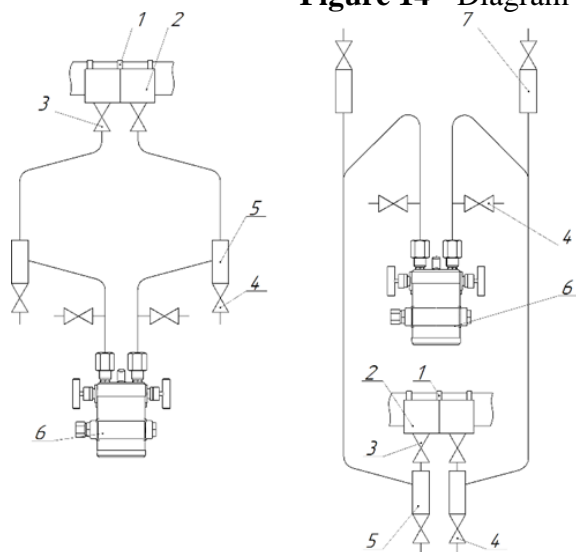


1 - flow restrictor; 2 - vent valve; 3 - valve; 4 - sensor.



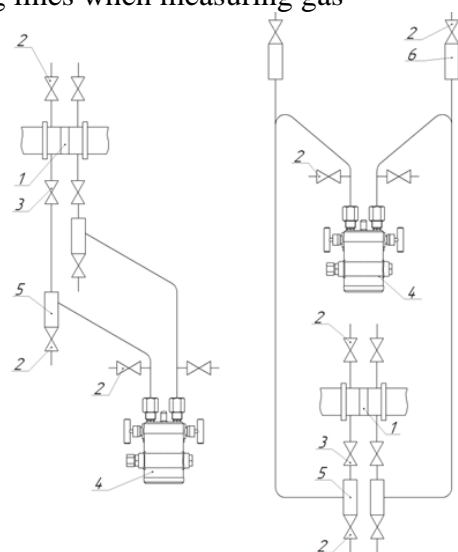
1 - flow restrictor; 2- vent valve; 3 - valve; 4 - sensor; 5 - sedimentation vessel.

Figure 14 - Diagram of connecting lines when measuring gas



1 - flow restrictor; 2 - leveling vessel; 3 - valve; 4 - vent valve; 5 - sedimentation vessel; 6 - pressure sensor; 7 - gas collector

Figure 15 - Diagram of connecting lines when measuring steam



1 - flow restrictor; 2 - vent valve; 3 - valve; 4 - sensor; 5 - sedimentation vessel; 6 - gas collector.

Figure 16 - Diagram of connecting lines when measuring liquid

2.2.10 Level gauge must be located at the lowest measuring point. It is not allowed to install the transmitter in the flow of the loaded medium or in the place of the tank not protected against pressure surges (suction zone of pump unit, agitator). For ease of operation, the transmitter should be installed behind the shut-off device. Installation examples are shown in figure 17.

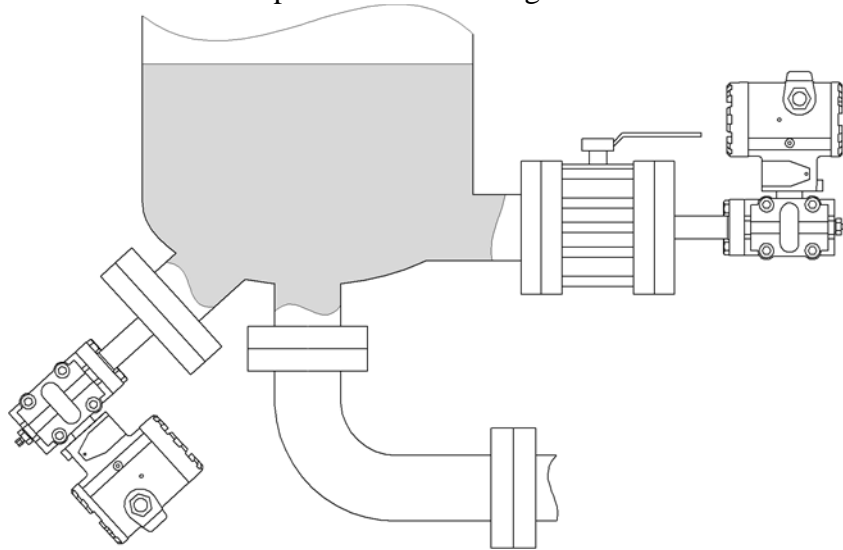


Figure 17 - Installation diagram of the level measurement sensor

2.2.11 The actual maximum temperature of the measured medium is $-90 \dots 400 \text{ }^\circ\text{C}$, while meeting the installation requirements the temperature in the measuring chambers of the pressure transmitter does not exceed $120 \text{ }^\circ\text{C}$.

2.3 Operation

2.3.1 Preparation

2.3.1.1 Before the first launch do the following:

- check whether installation on the pipeline is done correctly;
- check power supply parameters;
- check whether grounding is done correctly;
- check whether external sources are connected correctly.

2.3.1.2 Transmitter parameters according to customer requirements are specified in the data sheet:

- pressure measuring range;
- serial number;
- accuracy class;

2.3.2 Adjust zero point before commissioning, see 1.5.7.

2.3.3 Commissioning

It shall be accepted for operation by making acceptance act.

Acceptance date should be specified in the data sheet and approved by an authorized person.

2.4 HART connection

2.4.1 Figure 18 shows a simple communication network with transmitter connected in series in a current loop via a two-wire line.

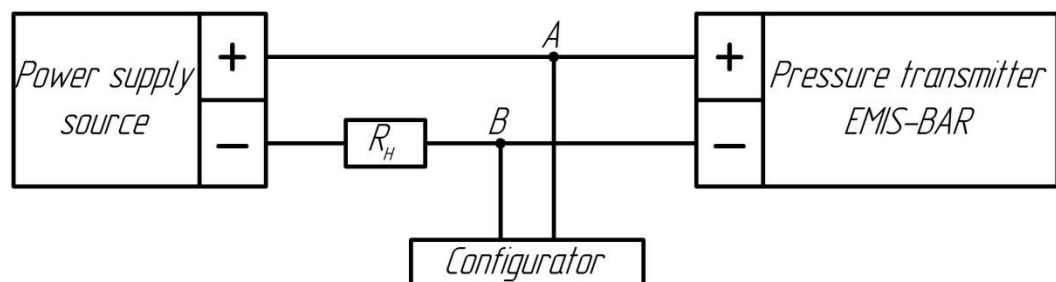


Figure 18 – Connection of HART transmitters

HART communication device (Configurator) shall be connected to A and B points or in parallel with resistor (B point). Transmitter reading can be digital or analog. In this scheme, the output current from the transmitter does not transfer data and can be restricted (4mA DC)

2.4.2 Figure 19 shows communication chain where transmitter is connected to control pipeline valve using controller I/P. Control is performed by 4-20mA output current. Output current shall always be permitted.

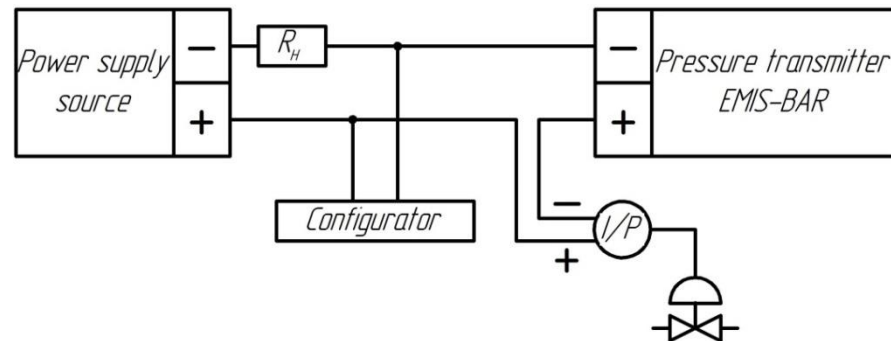


Figure 19 - Communication chain where transmitter is connected to control pipeline valve using controller I/P.

2.4.3 Figure 20 shows communication chain with the transmitter connected to multipoint HART network. Up to 15 transmitters can be connected to the same line, and they shall be connected in parallel. Current signal (4mA DC) shall be restricted at all transmitters. In this case, total power consumption is decreased.

IMPORTANT. For multipoint operation HART transmitters shall have it own address (Polling Address) in the range fo 0 - 63. Polling Address 0 is specified by default. Specify the address of each device before connecting to the HART network.

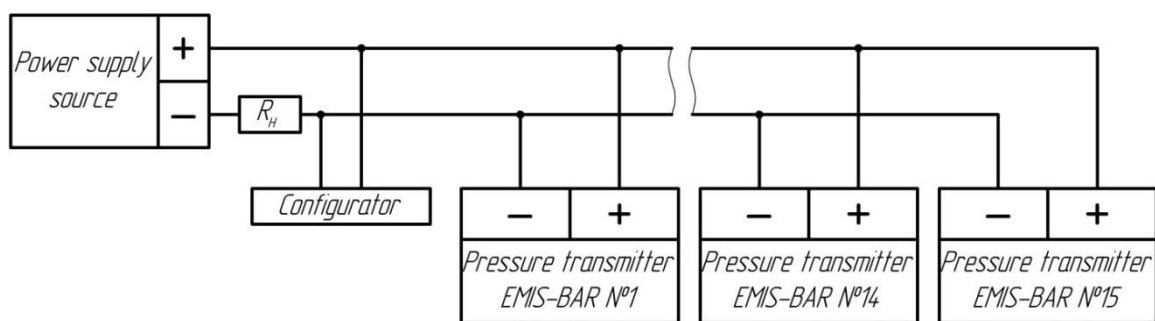


Figure 20 - Connection scheme for multipoint HART network

2.4.4. If "point-to-point" scheme is applied (see fig.18, 19), the main variable can be transferred in both analog and digital form. For multipoint scheme, analog data is not available and variable transferred only in digital form.

2.4.5. When building a multidrop network, it is necessary to correctly select the voltage of the power source: due to the total current of the sensors, the voltage drop across the 250 Ohm resistor will be significant. Select correct voltage of power supply unit for multipoint network: due to the high total current, voltage drop at the 250Ohm resistor will be significant.

2.4.6 Portable HART communicator can be connected to the transmitter communication clamps or any point of the signal line using alligator clips.

2.4. It is recommended to ground shielded cables braid from the one end only. Non-grounded end shall be carefully insulated. Ensure circuit integrity of the multipoint loop, and pay attention to prevent short circuit between the circuit and the body.

2.5 Communication cable parameters

For wiring in a HART system, a shielded twisted pair cable must be used, or with a common shield over a cable containing many twisted pairs. In the latter case, it is important not to use other signal pairs that could interfere with HART communication. They can be used for other HART communication lines, or for purely analog lines, if the level of the induced HART noise in them is of an acceptable level.

If the cable length exceeds several tens of meters, its linear electrical parameters - resistance and capacitance - must be taken into account in order to prevent the maximum level of distortion of the HART signal. This condition is fulfilled if the product of the total resistance R and the capacity C of the network satisfies the relation: $R * C \leq 65 \mu s$

In the simplest HART system, R is the sum of the resistance of the load resistor R_H , the resistance of the twisted pair cable (loop), the internal resistance of the Ex-barrier (if any). In addition, the value of the resistance R must be taken into account when calculating the voltage drop in the circuit. The cable (loop) resistance is measured for both conductors connected in series.

Capacitance C is the total cable capacitance and the total capacitance of the connected devices (the maximum internal capacitance of EMIS-BAR is 11000 pF). The capacitance of a cable is measured from one conductor to all the others and to the shield. To allow high capacitance, lower the load resistance as much as possible - usually the value $R_n = 250 \text{ Ohm}$ is used.

Table 2.5 shows the standard parameters of some types of cables (shielded twisted pair). More accurate values of linear electrical parameters depend on the specific brand of the cable manufacturer.

Table 2.5 – Standard parameters of cables

AWG/sectional view	Diamete, mm	Copper conductor capacitance per unit length, Ohm/m	Conductor capacitance per unit length, pF/m
18 AWG /0.823 mm ²	1.024	0.021	300 - 420
20 AWG /0.518 mm ²	0.812	0.033	150 - 200
22 AWG /0.326 mm ²	0.644	0.053	100 - 150
24 AWG /0.205 mm ²	0.511	0.084	75 – 100

2.5.1 Cable parameters limitation.

There are maximum cable length limitation, depending on its size. The “HART FSK Physical Layer Specification” limits the minimum cable thickness to 0.51 mm (24 AWG), with the maximum cable length not exceeding 1500 m. If the cable length exceeds 1500 m, the minimum cable thickness is 0.81 mm (20 AWG).

2.5.2 Calculation methods for the cable length.

For the quick length calculation of the HART network cable, you can use diagrams B-1 - B-4 in Annex B. Diagrams shows the dependence of the total allowable cable capacitance on the resistance value R_p (which is calculated as the equivalent of the parallel resistances of all connected devices and loads) for various values the total capacities of the connected devices.

Resistance of EMIS-BAR is $R_x = 71430 \text{ Ohm}$. Even with a parallel connection of 10 EMIS-BAR devices and a load resistance $R_H = 250 \text{ Ohm}$, in the first approximation, the resistance of the devices can be neglected. The R_p value could set to 250 Ohm.

Calculated ratio of the linear parameters of the C_c / R_c cable is rounded to the nearest value from the series: 1000, 2000, 5000, 10000 and select the corresponding graph B-1 - B-4 of Appendix B. Based on the value of the total capacity of the C_{Σ} devices, we select the corresponding function on the graph.

Based on the value of R_p , using the function, we determine the value of the total allowable cable capacity C_{max} .

Formula for maximum cable length calculation:

$$L_{max} = \frac{C_{max}}{C_c}$$

2.5.3 Example. Calculate the maximum cable length when two EMIS-BAR pressure transmitters and one HART modem connected to the network.

Source data:

- Load resistance - 250 Ohm;
- EMIS-BAR capacity- 11000 pF;
- EMIS-BAR resistance - 71430 Ohm
- Modem resistance - 100 kOhm
- Modem capacity - 3000 pF;
- 24 AWG cable: $R_c = 0.084 \text{ Ohm / m}$, $C_c = 100 \text{ pF / m}$

Calculated parameters:

- Devices total capacity: $C_{\Sigma} = 2 * 11000 + 3000 = 25000 \text{ pF}$.
- C_c / R_c ratio = $100 / 0.084 = 1190$.
- $R_p = 250 \text{ Ohm}$.

Round 1190 to 1000, which corresponds to the graph in Figure B.1. According to the graph, proceeding from $C_{\Sigma} = 25000 \text{ pF}$ (the second function from the top) and $R_p = 250 \text{ Ohm}$, determine:

$C_{max} = 112000 \text{ pF}$.

Maximum cable length: $L_{max} = 112000/100 = 1120 \text{ m}$.

3. MAINTENANCE AND REPAIR

3.1 Maintenance of the ex-proof transmitter shall be performed according to GOST 31610.0 (EN IEC 60079-0).

3.2 The transmitter does not require special maintenance other than periodic inspection to verify operation conditions during the operation.

3.3 Inspection interval depends on the operating conditions and shall be scheduled by the service party.

3.4 Violation of operating conditions may cause transmitter failure or severe measuring errors.

3.5 Repair is performed at the manufacturer once the failure is detected.

4. CALIBRATION

The transmitter is subject to initial calibration at manufacturer after being tested and approved by QC for compliance with the technical requirements.

Calibration to the extent of initial calibration shall be performed in the following cases :

- before commissioning after long storage if the calibration validity has expired ;
- after repair if the transmitter was dismantled ;

Periodical calibration shall be performed for flowmeters in operation and after repair.

Calibration interval is 5 (five) years.

Calibration shall be performed according to the Calibration method EB 100.000.00 CM.

Note: unscheduled calibration can be performed during operation when it is necessary to check transmitter operating conditions, after seal removal or loss of calibration worksheet.

5. LIST OF POSSIBLE FAILURES

5.1 During the operation of the sensor, there is a continuous process of checking the sensor signal, electronic module: temperature sensor, ADC, DAC, memory. All moments of errors and malfunctions are recorded in the internal archive of the sensor and displayed on the LCD screen.

5.2 Sensor error data can also be obtained remotely via the HART interface (see section 7.3 “HART® 7.x Field Device Specification for EMIS-BAR Pressure Transmitter”).

5.3 Table 15 list of major failures of transmitter operation and provides recommendations to address those gaps.

Table 15 - List of major failures

№	Description	Remedial procedure
1	No output signal	Check voltage at the transmitter terminals. Check connection polarity
2	No connection between commutator and pressure transmitter	Check load resistance Check devices addresses Check output signal current Check voltage at the terminals of the transmitter
3	Transmitter does not read the pressure changes	Check connection tightness Check valve/pulse or others lines for blockage Check measurement equipment operating conditions Check whether transmitter setting comply with the pressure parameters
4	Unstable output signal (floating value)	Check connection tightness

5.4 NE 107 recommendation of NAMUR classifies diagnostic information into specific categories. List of categories is presented in Table 16.

Table 16 - List of messages according to Namur NE 107

Category number	Category	Description
F	Failure	Off-nominal condition, leading to further operation failure.
C	Function check	Execution of function on the device, measured value invalid for the moment.
S	Out of specification (Warning)	Measured value is out of the measuring range. However, the device continue to operate.
M	Maintenance required	The function is limited due to external influences. There is an influence on the measured value.

Table 17 shows the main malfunctions of the electronic unit (error indicated in LCD) and recommendations for their remedy.

Table 17 - List of failures codes

Error	NAMUR NE 107	Error description	Remedial procedure
Err-1	M	ADC calibration coefficient error	Send to manufacturer for pressure characterization
Err-2	M	DAC calibration coefficient error	Send to manufacturer for current characterization
Err-3	F	#1 Temperature sensor error	Reload the device If the error repeats, replace DAC unit
Err-4	F	DAC work error	Reload the device If the error repeats, replace DAC unit
Err-5	F	ADC work error	Reload the device If the error repeats, replace ADC unit
Err-6	F	CPU initializing error	Reload the device In the error repeats, replace DAC unit
Err-7	F	EEPROM error	Reload the device If the error repeats, replace ADC unit
Err-8	F	FRAM error	Reload the device In the error repeats, replace DAC unit
Err-9	S	Supply voltage is lower than 10.5V	Check supply voltage
Err10	F	Emergency reload	Reload the device In the error repeats, replace DAC unit
Err11	S	Pressure is lower than rated minimum.	Check system pressure Send to manufacturer for repair.
Err12	S	Pressure is beyond rated maximum.	Check system pressure Send to manufacturer for repair.
Err15	M	DAC overheating ($T > +100$ C)	Turn off and cool the device. In the error repeats, replace DAC unit
Err16	C	Loop current does not corresponds to DAC code	Reload the device In the error repeats, replace DAC unit
Err17	F	Pressure transmitter break or failure	Reload the device In the error repeats, replace DAC unit Send to manufacturer for repair.

5.5 The list of possible failures associated with working under pressure (including critical). The danger of injury of citizens and animals, damage to the environment, property of individuals and legal entities, arising from the product as a result of their critical failure may be caused by the following:

- destruction, fully or partially, of body parts and loss of material density of the parts operating under the pressure;
- sealing failure in relation to the environment as the result of gasket damage;
- change of geometry of the body parts exceeding the permissible values;

In the event of failure to fulfill the intended function, the danger of injury of citizens and animals, damage to the environment, property of individuals and legal entities, arising from the product as a result of their critical failure may be caused by the following:

- transmitter parameters does not comply with the operating conditions and the parameters of the working environment;
- violation of labor protection requirements during the operation of the device;
- incorrect installation of the device;

5.6 Personnel mistakes leading to failure, emergency or accidents

To provide safety operation, it is prohibited to:

- use the device under conditions different from specified in the data sheet;
- use the tools which does not match the size of the fasteners;
- perform installation, de-installation, service works or repair under pressure applied;
- operate the transmitter without operation data sheets.

6 PERSONELL ACTIONS IN CASE OF ACCIDENT, FAILURE OR BREAKDOWN

Stop medium supply in case of failure or breakdown.

7 LIMIT STATE CRITERIA

- reach of specified values
- violation of geometry and elements size preventing from normal operation;
- irreversible damage of elements caused by corrosion, erosion and ageing.

8 STORAGE

8.1 Keep flow meter indoor on the shelf after unpacking. Storage conditions after unpacking shall comply with GOST 15150 under ambient temperature of -60 to 50°C and relative humidity of 95% non-condensing at 25°C.

8.2 Do not pile the transmitters one on top of the other.

8.3 In winter time keep for 12 hours in heated premises before unpacking.

8.4 Long-term storage shall be provided in the manufacturer's package.

9 TRANSPORTATION

9.1 Transmitters can be transported in manufacturer's packaging by any means of transport according to GOST 15150 under ambient temperature of -60 to +50°C and relative humidity of 100 % non-condensing at 25°C.

9.2 Transit time shall not exceed 1 month;

9.3 Follow the requirements of handling marks while loading, transporting and unloading.

9.4 Protect equipment from precipitations.

10 RECYCLING

10.1 Transmitter does not contain hazardous materials or components dangerous to people health or the environment during service life and recycling

10.2 Recycling shall be performed divided by groups of materials: plastic elements, metal elements of the body and fasteners.

11 PRECIOUS MATERIALS CONTENT

Does not contain precious metals.

LIST OF REFERENCE DOCUMENTS

- 1 GOST 22520-85 Transmitters for pressure, vacuum and difference pressure measurement with analog output signals General specifications.
- 2 GOST P 52931-2008 Instruments for process monitoring and control. General specifications.
- 3 GOST R 51318.22-2006 (CISPR 22:2006) Electromagnetic compatibility information technology equipment. Industrial radio interference. Measurement regulations and methods.
- 4 GOST 31610.0 (EN IEC 60079-0:) Explosive atmospheres. Part 0. Equipment. General requirements
- 5 GOST 31610.11 (EN 60079-11) Explosive atmospheres. Part 11. Equipment with protection type "intrinsically safe circuit "i".
- 6 GOST 14254-2015 (IEC 60529:2013) Protection levels provided by the enclosure (IP code)
- 7 GOST 15150-69 Machines, instruments and other industrial products Modifications for different climatic regions. Categories, operating, storage and transportation conditions as to environment climatic aspects influence.
- 8 GOST R 50648-94 (IEC 1000-4-8-93) Electromagnetic compatibility of technical equipment. Resistant to external magnetic field. General technical requirements and test methods
- 9 TR CU certificate 012/2011 on "The safety of equipment in explosive environments"
- 10 TR CU 020/2011 Electromagnetic compatibility of technical equipment
- 11 TR CU 032/2013 on "The Safety of equipment working under excessive pressure ".
- 12 Directive 2014/34/EU of the european parliament and of the council on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres

Connection schemes

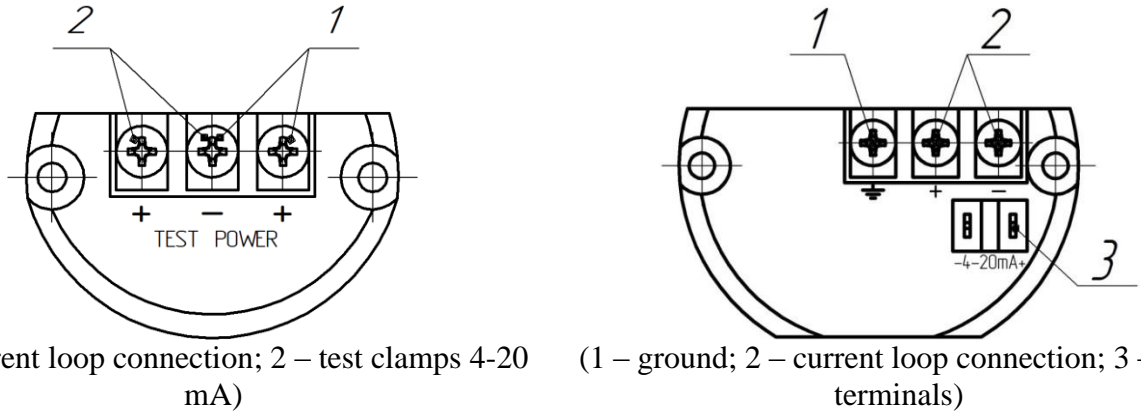


Fig.B.1 - Terminal block view

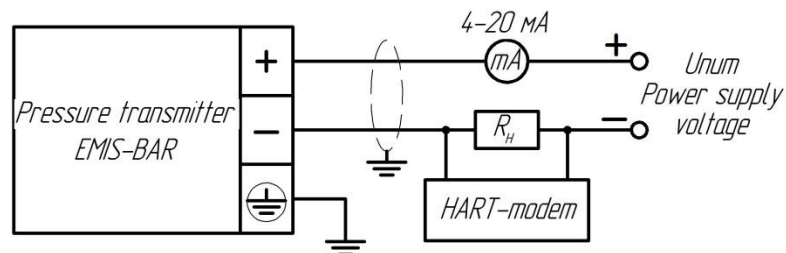


Fig.B.2 - Two point connection to HART modem

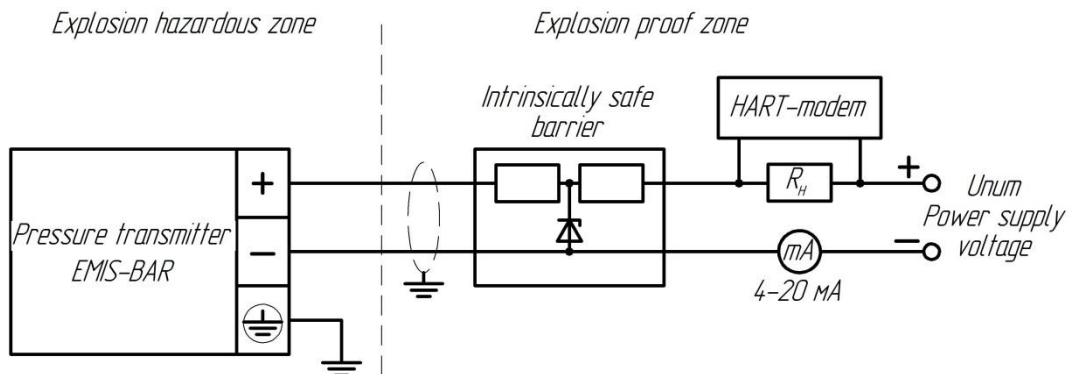


Fig.B.3 - Connection using zener barrier

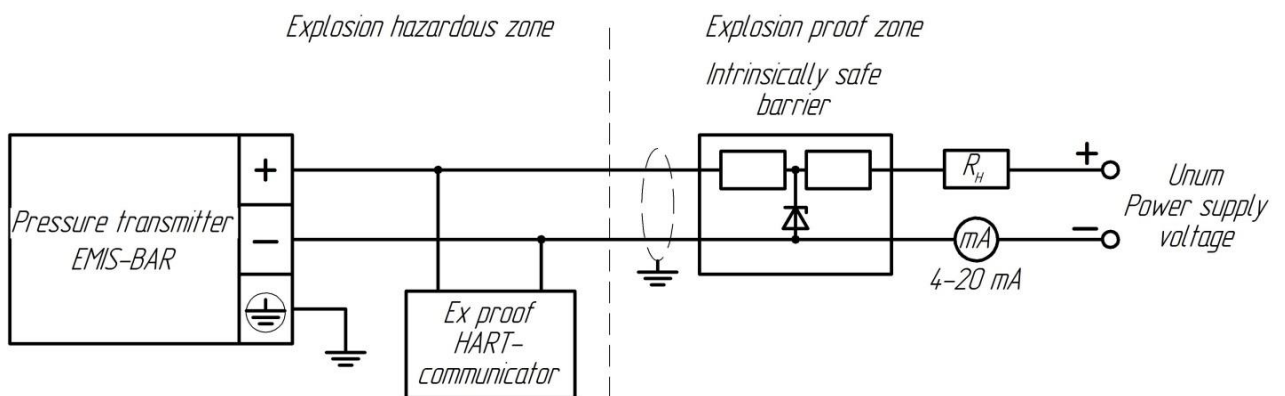
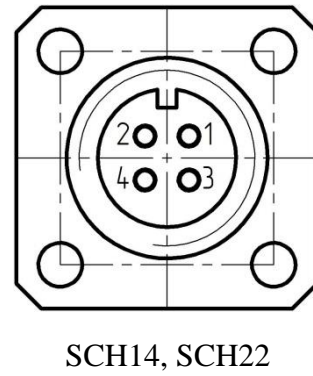
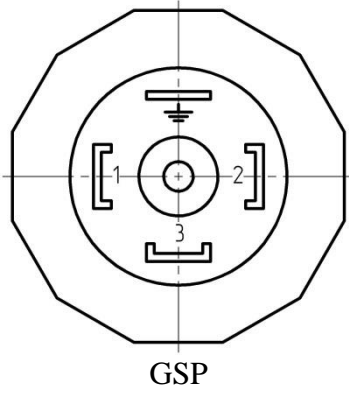


Fig.B.4 - Connection to ex-proof HART communicator using zener barrier




Terminal No	Connection scheme	
	GSP	SCH14, SCH22
1	«+»	«+»
2	«-»	«-»
3	-	«Grounding»
4	-	
	«Grounding»	-

Fig.B.5 - Terminal No with connection codes GSP, SCH14, SCH22

HART cable length diagrams

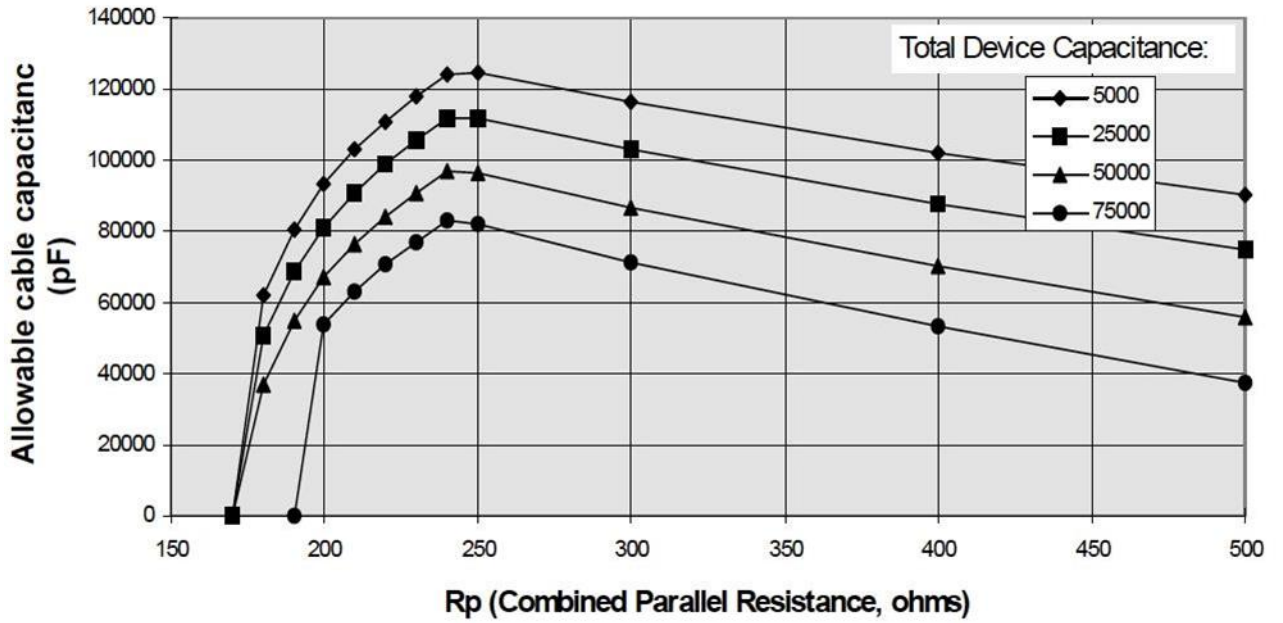


Figure B.1 - Allowable cable capacitance $C_c/R_c = 1000$

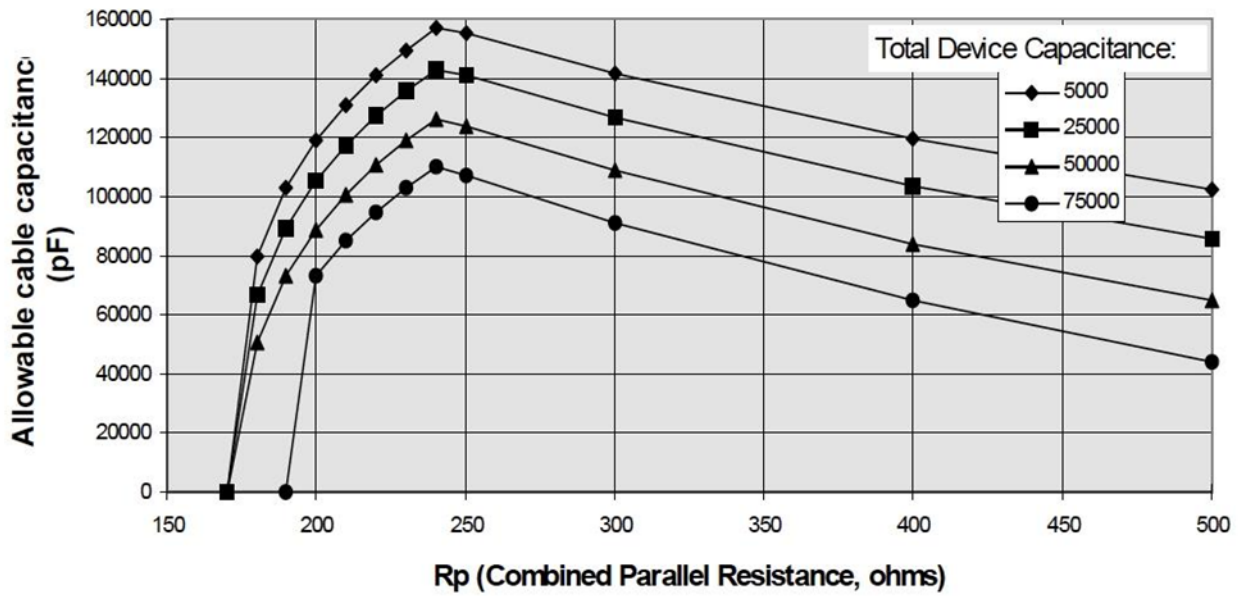


Figure B.2 - Allowable cable capacitance $C_c/R_c = 2000$

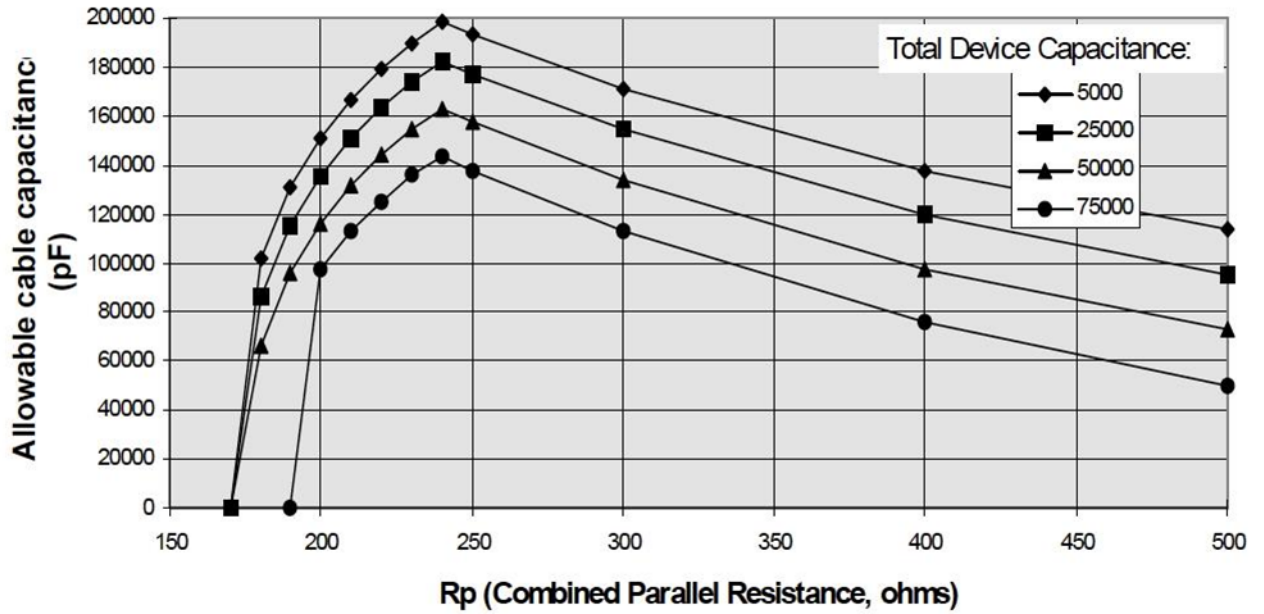


Figure B.3 - Allowable cable capacitance $C_c/R_c = 5000$

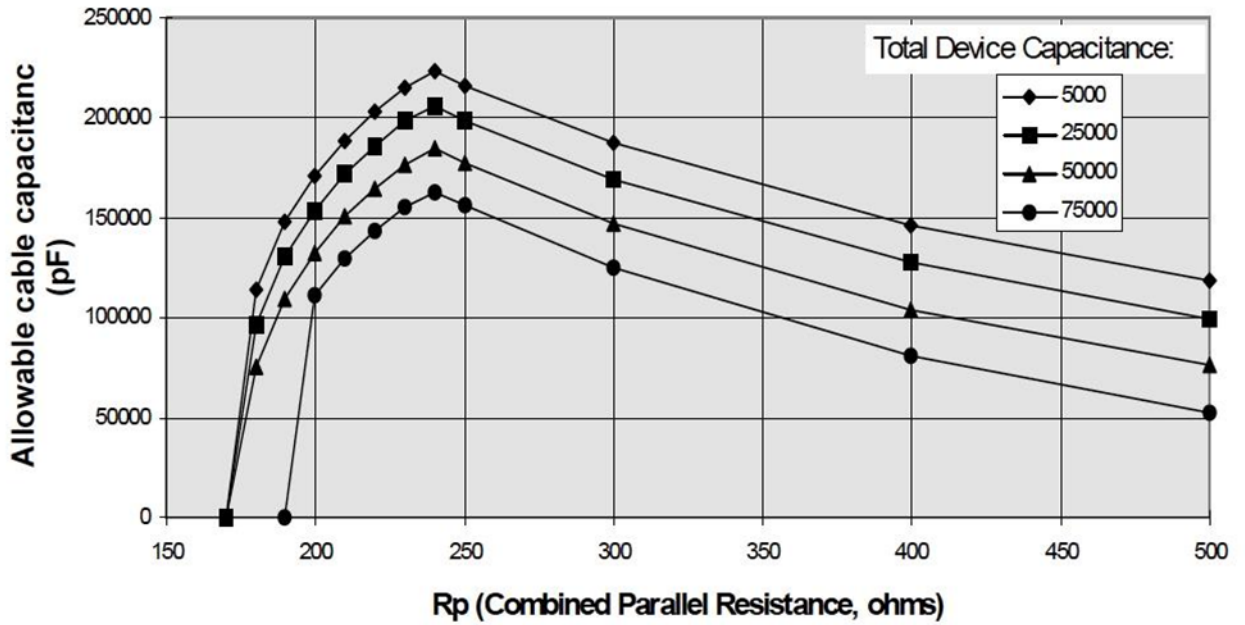


Figure B.4 - Allowable cable capacitance $C_c/R_c = 10000$

Order sheet EMIS-BAR pressure transmitter

Table D.1 - Order sheet for in-line mount connection transmitters

Item name		
EMIS-BAR	Pressure transmitter	
1	Model	
103	gauge pressure transmitter, vacuum pressure; in-line mount	
123	absolute pressure transmitter; in-line mount connection	
2	Digital protocol	
H	from 4 to 20 mA/HART	
3	Explosion protection	
-	No explosion protection	
ExiaB	II 1 G Ex ia IIB T6...T4 Ga;	
ExiaC	II 1G Ex ia IIC T6...T4 Ga	
RO	I M1 Ex ia I Ma	
ExiaBD	II 1D Ex ia IIIB 85/100/135°C Da	
ExiaCD	II 1D Ex ia IIIC 85/100/135°C Da	
4	Measuring ranges	
	See Table 1.1	
5	Accuracy	
0,04%	0,04%	
0,065%	0,065%	
0,10%	0,10%	
0,15%	0,15%	
0,20%	0,20%	
0,25%	0,25%	
0,50%	0,50%	
6	Materials ¹⁾	
	Diaphragm material	
S	Stainless steel 316L	
H	Hastelloy HC-276	
G	316L with gold-plated	
	Wetted parts material	
S	Stainless steel 316L	
HH	Hastelloy HC-276 (for diaphragm Hastelloy HC-276)	
	Filling fluid	Cleaning measuring part
1	Silicon oil	Common cleaning
2	Silicon oil	Degreasing
3	Fluorocarbon oil	Degreasing

7	Process connections
	Process connection thread
M20	M20x1,5 male thread
G1/2	G1/2 male thread
1/2NPTF	1/2NPT female thread
1/2NPT	1/2NPT male thread
X	Special version
8	Transmitter material
Al	Aluminum
S	Stainless steel
X	Aluminum (special coating)
9	LCD display
-	w/o LCD
LCD	with LCD in Russian
LCDe	with LCD in English
10	Electrical connection
	See Appendix I
11	Additional protection
-	n/a
PT	Pressure transmitter external protection
12	Transmitter lightning protection
-	n/a
LP	Lightning protection
13	High-temperature version
-	n/a
14	Special version
-	Standard version
AST ²⁾	Hydrogen sulfide medium application
15	Calibration
-	Manufacturer calibration
SC	State calibration
16	Valve block
-	Valve block not installed
KBU ³⁾	Valve block installed
17	Medium separator
-	Medium separator installation not required
DS ⁴⁾	Installation of medium separators of third party manufacturing
18	Additional certificates
-	Not required
RMRS	Russian Maritime Register of Shipping Type Approval Certificate

Note

¹⁾ The following combinations of diaphragm and chamber material are available: SS, HS, HHH.

For other materials, please contact our technical specialists.

²⁾ AST models are designed for operation when the content of hydrogen sulfide in the environment in normal mode does not exceed 10 mg / m³, in an emergency mode- up to 100 mg / m³ during 1 hour. The content of dissolved hydrogen sulfide in the liquid is up to 6% by volume.

³⁾ Valve block is selected separately. Transmitter is assembled with valve block and tested for leakage, which is marked in the data sheet.

⁴⁾ DS code in the order sheet means that transmitter shall be assembled with medium separator manufactured by a third party and specified separately. Specify transmitter accuracy in the order sheet, accuracy for transmitter-medium separator assembly is tested while calibration and specified in the calibration sheet. Calibration sheet is attached to the data sheet.

Symbols for EMIS-BAR in-line mount connection:

Pressure transmitter EMIS-BAR 103-H- ExiaB (-100...100)kPa-0,1%-SS1-M20-Al-LCDe-M1-MS-LP-SC

Description:

103 – gauge pressure, vacuum pressure transmitter; in-line mount connection;

H – digital protocol 4-20mA/HART;

ExiaB - intrinsically safe circuit;

For explosive gas atmospheres: II 1G Ex ia IIB T6...T4 Ga;

(-100...100)kPa – measuring range (-100...100) kPa;

0,1% – accuracy 0.1%;

SS1 – diaphragm material stainless steel 316L, wetted parts material - stainless steel 316L, filling fluid-silicon oil, common cleaning;

M20 – connection to the process M20x1,5 male thread;

Al – transmitter body made of aluminum;

LCD – LCD, Russian language;

M1 – cable gland for unshielded cable is made of nickel plated brass, crimping diameter from 6 to 12mm, cable entry thread M20x1,5;

MS - supplied with the plug made of nickel plated brass;

LP – electronic unit lightning protection;

SC – state calibration.

Table D.2 - Order sheet for traditional-mount connection transmitters

	Item name	Application based on the version
EMIS-BAR	Pressure transmitters	
	Model	
105	gauge pressure transmitter, vacuum pressure; traditional-mount connection	
133	absolute pressure transmitter; traditional-mount connection	
143	differential pressure transmitter; traditional-mount connection	
153	differential pressure transmitter; traditional-mount connection	
193	micro differential pressure transmitter	
2	Digital protocol	
H	from 4 to 20 mA/HART	
3	Explosion protection	
-	No explosion protection	
ExiaB	II 1G Ex ia IIB T6...T4 Ga	
ExiaC	II 1G Ex ia IIC T6...T4 Ga	
RO	I M1 Ex ia I Ma	
ExiaBD	II 1D Ex ia IIIB 85/100/135°C Da	
ExiaCD	II 1D Ex ia IIIC 85/100/135°C Da	
4	Measuring ranges	
	See Table 1.1	
5	Accuracy	
0,04%	0,04%	105, 133, 143
0,065%	0,065%	
0,086%	0,086%	193
0,10%	0,10%	for all
0,15%	0,15%	
0,20%	0,20%	
0,25%	0,25%	
0,50%	0,50%	
6	Materials ¹⁾	
	Diaphragm material	
S	Stainless steel 316L	for all
H	Hastelloy HC-276	
T	Tantalum	
M	Monel	105, 133, 143
G	316L gold-plated	
	Wetted parts material	
S	Stainless steel 316L	для всех
HH	Hastelloy HC-276 (for diaphragm Hastelloy HC-276)	105, 143
HG	Hastelloy HC-276 (for diaphragm - 316L with gold coating)	105, 133, 143
HT	Hastelloy HC-276 (for diaphragm - Tantalum)	
	Filling fluid	Cleaning measuring rate
1	Silicon oil	Common cleaning
2	Silicon oil	Degreasing
3	Inert oil	Degreasing

7	Process connections	
1/4F	Connection to the pipeline	
1/4FS	inside the flange 1/4NPT internal thread, drain valve at the back	
X	inside the flange 1/4NPT internal thread, drain valve at the side	
8	Transmitter material	
Al	Aluminum	
S	Stainless steel	
X	Aluminum (special coating)	
9	LCD display	
-	w/o LCD	
LCD	with LCD in Russian	
LCDe	with LCD in English	
10	Electrical connection	
	See Annex I	
11	Additional protection	
-	n/a	
	Protection	
PT	Pressure transmitter external protection	
	Pressure sensor bolts material	
-	Carbon steel with protective coating	
B304	304	
B316	316	
12	Transmitter lightning protection	
-	n/a	
LP	Lightning protection	
13	High temperature version	
-	n/a	
14	Special version	
-	Standard version	
AST ²⁾	Hydrogen sulfide medium application	
15	Calibration	
-	Manufacturer calibration	
SC	State calibration	
16	Valve block	
-	Valve block not installed	except for 193
KBU ³⁾	Valve block installed	
17	Medium separator	
-	Medium separator installation not required	
DS ⁴⁾	Installation of medium separators of third party manufacturing	
18	Additional certificates	
-	Not required	
RMRS	Russian Maritime Register of Shipping Type Approval Certificate	

Note

¹⁾ The following combinations of diaphragm and wetted parts material are available:

SS, HS for versions 105, 113, 143, 193;

HHH for versions 105, 133, 143, 193;

GS for versions 105, 133, 143;

TS, MS, THT, GHG for versions 105, 133, 143;

For other materials, please contact our technical specialists.

²⁾ AST models are designed for operation when the content of hydrogen sulfide in the environment in

normal mode does not exceed 10 mg / m³, in an emergency mode- up to 100 mg / m³ during 1 hour. The content of dissolved hydrogen sulfide in the liquid is up to 6% by volume.

³⁾ Valve block is selected separately. Transmitter is assembled with valve block and tested for leakage, which is marked in the data sheet.

⁴⁾ DS code in the order sheet means that transmitter shall be assembled with medium separator manufactured by a third party and specified separately. Specify transmitter accuracy in the order sheet, accuracy for transmitter-medium separator assembly is tested while calibration and specified in the calibration sheet. Calibration sheet is attached to the data sheet.

Symbols for EMIS-BAR traditional-mount connection:

Pressure transmitter EMIS-BAR **143-H- ExiaB** **(-160...160)kPa-0,065%-SS1-1/4F-Al-M1-MS-B316-SC**

Description:

143- gauge pressure, vacuum pressure transmitter; traditional-mount connection;

H - digital protocol 4-20mA/HART;

ExiaB - Intrinsically safe circuit:

For gas hazardous environments: II 1G Ex ia IIB T6...T4 Ga;

(-160...160)kPa - measuring range (-160...160) kPa;

0,065% - accuracy 0.065%.

SS1 - diaphragm material stainless steel 316L, chamber cavity material - stainless steel 316L, filling fluid - silicon oil, general cleaning;

1/4F connection with the flange 1/4NPT internal thread, drain valve at the back;

Al - transmitter body made of aluminum;

M1 - cable gland for unshielded cable is made of nickel plated brass, crimping diameter from 6 to 12mm, cable entry thread M20x1,5

MS - supplied with the plug made of nickel plated brass;

B316 - bolts material stainless steel 316;

SC - state calibration.

Table D.3 - Order sheet for special versions of traditional-mount transmitters

	Item name	
EMIS-BAR	Pressure transmitters	
1	Model	Application based on the version
163	Pressure transmitter for level measurement with remote diaphragm seal	
164	Pressure transmitter for level measurement with remote extended diaphragm seal	
173	Gauge pressure transmitter with remote diaphragm seal	
174	Gauge pressure transmitter with remote extended diaphragm seal	
175	Absolute pressure transmitter with remote diaphragm seal	
176	Absolute pressure transmitter with remote extended diaphragm seal	
183	Differential pressure transmitter with remote diaphragm seals (static pressure up to -50 kPa)	
184	Differential pressure transmitter with remote extended diaphragm seals (static pressure up to -50 kPa)	
185	Differential pressure transmitter with one remote diaphragm seal and one remote extended diaphragm seal (static pressure up to -50 kPa)	
186	Differential pressure transmitter with remote diaphragm seal (static pressure up to -100 kPa)	
187	Differential pressure transmitter with remote extended diaphragm seal (static pressure up to -100 kPa)	
188	Differential pressure transmitter with one remote diaphragm seal and one remote extended diaphragm seal (static pressure up to -100 kPa)	
2	Digital protocol	
H	from 4 to 20 mA/HART	
3	Explosion protection	
-	No explosion protection	
ExiaB	II 1G Ex ia IIB T6...T4 Ga	
ExiaC	II 1G Ex ia IIC T6...T4 Ga	
RO	I M1 Ex ia I Ma	
ExiaBD	II 1D Ex ia IIIB 85/100/135°C Da	
ExiaCD	II 1D Ex ia IIIC 85/100/135°C Da	
4	Measuring ranges	
	See Table 1.1	
5	Accuracy	
0,074%	0,074%	163, 164
0,10%	0,10%	163, 164, 173, 174
0,15%	0,15%	for all
0,20%	0,20%	
0,25%	0,25%	
0,50%	0,50%	

6	Material		
	Diaphragm material		
S	Stainless steel 316L		
H	Hastelloy HC-276		
T	Tantalum		
M	Monel		
G	316L with gold-plated		
N	Nickel		
	Filling fluid	Cleaning measuring part	
1	Silicon oil	Common cleaning	for all
2	Silicon oil	Degreasing	163, 164
3	Fluorocarbon oil	Degreasing	
7	Process connections		
	Flange size		
A	DN 25 (1 inch)		163, 164, 173, 175, 183, 186
B	DN 50 (2 inch)		163...188
C	DN 80 (3 inch)		
D	DN 100 (4 inches)		
X	Special version		
	Remote extended diaphragm seal flange size ¹⁾		
C	DN 80 (3 inch)		185, 188
D	DN 100 (4 inches)		
X	Special version		
	Flange type	Max pressure	
A02	class 150, ASME B16.5	2 MPa	163...188
A05	class 300, ASME B16.5	5 MPa	
A11	class 600, ASME B16.5	11 MPa	
A15	class 900, ASME B16.5	15 MPa	173...188
A26	class 1500, ASME B16.5 ²⁾	26 MPa	173...176
A40	class 2500, ASME B16.5	40 MPa	
D1,6	PN 10/16, DIN EN 1092-1	1,6 MPa	163...188
D4,0	PN 25/40, DIN EN 1092-1	4 MPa	
D6,3	PN 63, DIN EN 1092-1	6,3 MPa	
D10	PN 100, DIN EN 1092-1	10 MPa	
D16	PN 160, DIN EN 1092-1	16 MPa	173...188
X	Special version		163...188
	Flange sealing type	Application depends on flange type	
-	Raised face	A02; A05; D1,6; D4,0	For all
E	Male face	A02; A05; A11; A15; D1,6; D4,0; D6,3; D10; D16	
F	Female face		
C	Tongue		
D	Groove		
J	For oval gasket	A02; A05; A11; A15; A26; A40	
X	Special version		
	Flange material		
CS	Carbon steel with protective coating		For all
304	Stainless steel 304		
316	Stainless steel 316		
316L	Stainless steel 316L		
X	Special version		

Connection from negative side			
-	n/a		Except for 163, 164
1/4FS	inside the flange 1/4NPT internal thread, drain valve at the side		163, 164
Length of submersible part of the remote diaphragm seal³⁾			
-	n/a		163, 173, 175, 183, 186
Length of submersible part of the positive chamber			
1	X2 = 50 mm		164, 174, 176, 184, 185, 187, 188
2	X2 = 100 mm		
3	X2 = 150 mm		
4	X2 = 200 mm		
5	X2 = 250 mm		
X	Special version		
Length of submersible part of the negative chamber			
0	X2 = 0 mm		164, 174, 176, 185, 188
1	X2 = 50 mm		184, 187
2	X2 = 100 mm		
3	X2 = 150 mm		
4	X2 = 200 mm		
5	X2 = 250 mm		
X	Special version		
Capillaries			
-	No		163, 164
Filling liquid⁴⁾		Temperature⁵⁾	
S	Silicon oil	-10...250°C	173, 174, 183, 184, 185
LS	Silicon oil	-30...180°C	173...188
HT	High temperature	10...300°C	173, 174, 183, 184, 185
F	Fluorocarbon oil	-50...150°C	173...188
LT	Low temperature	-90...120°C	173...188
UHT	Ultra high temperature	-20...400°C	173, 174, 183, 184, 185
X	Special version		173...188
Cleaning measuring part			
1	Common cleaning		173...188
2	Degreasing		

	Capillary length in the positive chamber ⁶⁾	
00	W/o capillary	173...188
01	1 meter	
02	2 meters	
03	3 meters	
04	4 meters	
05	5 meters	
06	6 meters	
07	7 meters	
08	8 meters	
09	9 meters	
10	10 meters	
11	11 meters	
12	12 meters	
13	13 meters	
14	14 meters	
15	15 meters	
X	Special version	
	Pipe length in the negative chamber	
01	1 meter	183...188
02	2 meters	
03	3 meters	
04	4 meters	
05	5 meters	
06	6 meters	
07	7 meters	
08	8 meters	
09	9 meters	
10	10 meters	
11	11 meters	
12	12 meters	
13	13 meters	
14	14 meters	
15	15 meters	
X	Special version	
8	Transmitter material	
Al	Aluminum	
S	Stainless steel	
X	Aluminum (special coating)	
9	LCD display	
-	W/o LCD	
LCD	with LCD in Russian	
LCDe	with LCD in English	
10	Electrical connection	
	See Annex I	
11	Additional protection	
-	n/a	
	Protection	
PT	Pressure transmitter external protection	

	Pressure sensor bolts material	
-	Carbon steel with protective coating	163, 164, 183...188
B304	304	
B316	316	
12	Transmitter lightning protection	
-	n/a	
LP	Lightning protection	
13	High-temperature version	
-	n/a	
R ⁷⁾	With a radiator between the transmitter housing and the diaphragm, for use with a measuring medium temperature of up to 200 ° C	173, 174, 183...188
14	Special version	
-	Standard version	
AST ⁸⁾	Hydrogen sulfide medium application	
15	Calibration	
-	Manufacturer calibration	
SC	State calibration	
16	Valve block	
-	Valve block not installed	
17	Medium separator	
-	Not required	
18	Additional certificates	
-	Not required	
RMRS	Russian Maritime Register of Shipping Type Approval Certificate	

Note

¹⁾ Remote diaphragm flange size is specified only for versions 185, 188. Available options: BC, CD, CC, DD. The first letter stands for the flange size at the positive side, the second letter for the flange size at the negative side.

²⁾ Flange type A26, A40, D16 is not available for Dn25.

³⁾ Code consists of two digits «_ _»: first digit stands for remote seal of the positive chamber, the second - for negative chamber. For versions 164, 174, 176, 185, 188 only positive side remote diaphragm size shall be selected, the second digit goes as 0.

⁴⁾ For models 173, 175, 183, 186, 188 if selected flange size B (Dn50), as well as for models 174, 176, 184, 187 with flange C (DN80) and 185, 188 with flange BC (DN50-DN80) and if filling liquid selected as LS the length of capillaries does not exceed 10 m. When choosing other types of liquids, the length of the capillaries does not exceed 8 m. For models 174, 176, 184, 187 with flange B (DN50) the temperature should be above -10 ° C, and capillary length does not exceed 3 m. If you need to increase the length, please contact our technical service.

⁵⁾ Filling liquid shall be selected according to the ambient and medium temperatures variation range.

⁶⁾ Code consists of four digits «_ _/_ _»: first two digits stand for positive side capillary length, the second two- for the negative side.

If there is no capillary, the pressure should be below 10 MPa, and the temperature below 120°C. For models 173, 174, 183, 184, 185, 186, 187, 188 and temperatures from 120°C to 200°C, choose High-temperature configuration of the transmitter.

If there is no capillary, 316L only is available for flange material.

⁷⁾ For High-temperature configuration of versions 173,174 the capillary is not applicable (code 00), for models 183, 184, 185, 186, 187, 188 no capillary installed at the positive side (code 00).

⁸⁾ AST models are designed for operation when the content of hydrogen sulfide in the environment in normal mode does not exceed 10 mg / m³, in an emergency mode- up to 100 mg / m³ during 1 hour. The content of dissolved hydrogen sulfide in the liquid is up to 6% by volume.

Symbols for EMIS-BAR special version of traditional-mount connection pressure transmitter:

Pressure transmitter 183-H-(-60...60)kPa-0,15%-S1-CD4,0316L-S101/01-Al-NS-N1-SC

Description:

183 - differential pressure transmitter with remote diaphragm seals (static pressure up to -50 kPa)

H - digital protocol 4-20mA/HART;

(-60...60)kPa - measuring range (-60...60) kPa;

0,15% - accuracy 0.15%.

S1 - diaphragm material stainless steel; filling fluid- silicon oil, common cleaning;

CD4,0316L - flange size Dn80, flange type DIN EN 1092-1 PN 25/40, max.pressure 4 MPa, seal type - raised face, flange material - stainless steel 316L;

S101/01 - capillary filling fluid is silicon oil, operation temp. -10- to 250°C, common cleaning, capillary length at positive side is 1m, at negative side is 2m;

Al - transmitter body made of aluminum;

NS - cable gland NPT1/2 unshielded cable, nickel brass;

N1 - plug NPT1/2, nickel brass;

SC - state calibration.

Table D.4 - Order sheet for transmitters with fully-welded diaphragm seal

Item name		
EMIS-BAR	Pressure transmitters	
1	Model	
113	Gauge pressure transmitter with fully-welded diaphragm seal	
2	Digital protocol	
H	from 4 to 20 mA/HART	
3	Explosion protection	
-	No ex-proof	
ExiaB	II 1G Ex ia IIB T6...T4 Ga	
ExiaC	II 1G Ex ia IIC T6...T4 Ga	
RO	I M1 Ex ia I Ma	
ExiaBD	II 1D Ex ia IIIB 85/100/135°C Da	
ExiaCD	II 1D Ex ia IIIC 85/100/135°C Da	
4	Measuring ranges	
	See Table 1.1	
5	Accuracy	
0,10%	0,10%	
0,15%	0,15%	
0,20%	0,20%	
0,25%	0,25%	
0,50%	0,50%	
6	Materials ¹⁾	
	Diaphragm material	
S	Stainless steel 316L	
H	Hastelloy HC-276	
	Wetted parts material	
S	Stainless steel 316L	
	Filling fluid	Cleaning measuring part
1	Silicon oil	Common cleaning
2	Silicon oil	Degreasing
7	Process connections	
M44	M44x1,25 treaded connection without welded counterpart	
M44W	M44x1,25 treaded connection with welded counterpart	
X	Special version	
8	Transmitter material	
Al	Aluminum	
S	Stainless steel	
X	Aluminum (special coating)	
9	LCD display	
-	W/o LCD	
LCD	with LCD in Russian	
LCDe	with LCD in English	

10	Electrical connection
	See Annex I
11	Additional protection
-	n/a
PT	Pressure transmitter external protection
12	Transmitter lightning protection
-	n/a
LP	Lightning protection
13	High-temperature version
-	n/a
14	Special version
-	Standard version
AST ²⁾	Hydrogen sulfide medium application
15	Calibration
-	Manufacturer calibration
SC	State calibration
16	Valve block
-	Valve block not installed
17	Medium separator
-	Not required
18	Additional certificates
-	Not required
RMRS	Russian Maritime Register of Shipping Type Approval Certificate
<p>Note</p> <p>¹⁾ The following combinations of diaphragm and chamber material are available: SS, HS. For other materials, please contact our technical specialists.</p> <p>²⁾ AST models are designed for operation when the content of hydrogen sulfide in the environment in normal mode does not exceed 10 mg / m³, in an emergency mode- up to 100 mg / m³ during 1 hour. The content of dissolved hydrogen sulfide in the liquid is up to 6% by volume.</p>	

Symbols for EMIS-BAR pressure transmitter with fully-welded diaphragm seal:

Pressure transmitter EMIS-BAR 113-H-(0...1,6)MPa-0,10%-SS1-M44W-Al-LCDe-M1-MS-SC

Description:

113- gauge pressure transmitter, vacuum pressure transmitter; in-line mount connection;

H - digital protocol 4-20mA/HART;

(0...1,6)MPa - measuring range (-100...100) kPa;

0,10% - accuracy 0.10%;

SS1 - diaphragm material stainless steel 316L, wetted parts material - stainless steel 316L, filling fluid - silicon oil, general cleaning;

M44W - connection M44x1,25 with welded counter part;

Al - transmitter body made of aluminum;

LCDe - LCD, English language;

M1 - cable gland for unshielded cable made of nickel plated brass, crimping diameter from 6 to 12mm, cable entry thread M20x1,5;

MS - supplied with the plug made of nickel plated brass;

SC - state calibration.

EMIS-BAR mounting kit order sheet

0	Item name		Application based on the model
Mounting kit for EMIS-BAR	Mounting kit		
1	Transmitter version		
	See Table 1.1		
2	Nipple with cap nut		
	Parts	Material	
SM1	Nipple with cap nut for connection to the outer diameter of the pipe 14 mm	12X18H10T	103, 123
CSM1		carbon steel	
3	Mounting flange		
	Thread	Parts	Material
S4K2	K1/4	Two mounting flanges with fitting, fasteners	12X18H10T
S4N2	1/4NPT		
S2K2	K1/2		
S2N2	1/2NPT		
SF3	-	Two mounting flanges, nipple for connection to the outer diameter of the pipe 14 mm	Nipple made of 12X18H10T
CSF3	-		Nipple made of carbon steel
S4K4	K1/4	Two mounting flanges with threaded hole, fasteners	12X18H10T
S4N4	1/4NPT		
S2K4	K1/2		
S2N4	1/2NPT		
SM5	M20x1,5	Two mounting flanges with threaded fitting of M20x1,5 size, fasteners, nipple with cap nut for connection to the outer diameter of the pipe 14 mm	Nipple 12X18H10T Flanges 12X18H10T
CSM5			Nipple made of carbon steel Flanges 12X18H10T

4	Connection adapter ¹⁾		Application based on the model
	Medium inlet-outlet thread	Material	
A3	K1/2 female thread - M20x1,5 female thread	12X18H10T	103...164, 193
A4	K1/4 female thread - M20x1,5 female thread		
A7	1/4NPT male thread - M20x1,5 female thread		
A8	1/2NPT male thread - M20x1,5 female thread		
A9	1/4NPT female thread - M20x1,5 male thread		
A10	1/2NPT female thread - M20x1,5 female thread		
A11	1/2NPT male thread - M20x1,5 male thread		
A13	1/4NPT male thread - M20x1,5 male thread		
A15	1/2NPT male thread - M22x1,5 male thread		
A17	1/4NPT male thread - M12x1,25 male thread		
A19	1/2NPT male thread - M20x1,5 male thread		
A20	G1/2 male thread - M20x1,5 female thread		
A22	1/2NPT male thread - G1/2 female thread		
A24	1/2NPT male thread - 3/4NPT male thread		
A25	1/4NPT male thread - M14x1,5 female thread		
A26	1/2NPT male thread - M14x1,5 female thread		
A29	K1/2 male thread - G1/2 female thread		
A30	1/2NPT male thread - G1/2 male thread		
A31	3/4NPT male thread - G1/2 female thread		
A32	1/2NPT female thread- G1/2 male thread		
A34	M27x1,5 male thread - G1/2 female thread		
A35	1/2NPT male thread - 1/4NPT male thread		

5	Flange connection characteristics		Application based on the model
	Flange size		163, 164, 173, 174, 175, 176, 183, 184, 185, 186, 186, 187, 188
A	DN 25 (1 inch)		
B	DN 50 (2 inch)		
C	DN 80 (3 inch)		
D	DN 100 (4 inch)		
X	Special order		
	Flange size with remote seal³⁾		185, 188
C	DN 80 (3 inch)		
D	DN 100 (4 inch)		
X	Special order		
	Flange type	Max pressure under 23°C	163, 164, 173, 174, 175, 176, 183, 184, 185, 186, 187, 188
A02	class 150, ASME B16.5	2 MPa	
A05	class 300, ASME B16.5	5 MPa	
A11	class 600, ASME B16.5	11 MPa	
A15	class 900, ASME B16.5	15 MPa	
A26	class 1500, ASME B16.5	26 MPa	
A40	class 2500, ASME B16.5	40 MPa	
D1,6	PN 10/16, DIN EN 1092-1	1.6 MPa	
D4,0	PN 25/40, DIN EN 1092-1	4 MPa	
D6,3	PN 63, DIN EN 1092-1	6.3 MPa	
D10	PN 100, DIN EN 1092-1	10 MPa	
D16	PN 160, DIN EN 1092-1	16 MPa	
X	Special order		
	Flange sealing type	Application depends on flange type	
-	Raised face (by default)	A02; A05; D1,6; D4,0	
E	Male	A02; A05; A11; A15; D1,6; D4,0; D6,3; D10; D16	
F	Female		
C	Male pin		
D	Slot		
J	For oval gasket	A02; A05; A11; A15; A26; A40	
X	Special order		
6	Counter flange⁴⁾		
	Flange welding type	Max. permissible pressure	163, 164, 173, 174, 175, 176, 183, 184, 185, 186, 187, 188
WN	Welding neck	over 2.5 MPa	
PL	Plate flange	up to 2.5 MPa	
X	Special order		
	Flange sealing type	Application depends on flange type	
-	Raised face (by default)	A02; A05; D1,6; D4,0	
E	Male	A02; A05; A11; A15; D1,6; D4,0; D6,3; D10; D16	
F	Female		
C	Male pin		
D	Slot		
J	For oval gasket	A02; A05; A11; A15; A26; A40	
X	Special order		
	Material of counter flange		
09CS	09CS		
CS	Steel 20		
S	Stainless steel 12X18H10T		
X	Special order		

7	Flushing ring ⁵⁾		163, 164, 173, 174, 175, 176, 183, 184, 185, 186, 187, 188
	Flushing ring sealing surface⁶⁾		
B	Connection face (from each side)		
F/E	Male/Female		
D/C	Tongue/Groove		
J	Ring type joint (at each side)		
X	Special order		
	Plug hole size		
1/4NPT	1/4NPT		
1/2NPT	1/2NPT		
X	Special order		
	Number of holes		
1	1		
2	2		
8	Fasteners		163, 164, 173, 174, 175, 176, 183, 184, 185, 186, 187, 188
	Gasket		
F	Flat gasket		
SW	Spiral wound gasket		
RJ	Oval gasket		
X	Special order		
	Gasket material	Application depends on gasket type	
09CS	09CS	Oval	
S	Analog 316		
GR	Thermal packed graphite	Spiral wound gasket	
P	PGP ⁴⁾	Flat gasket	
PO	POAG ⁴⁾		
X	Special order		
	Fastener material⁸⁾		
CS	Steel 20		
35CS	Steel 35		
09CS	09CS		
S	Stainless steel 12X18H10T		
X	Special order		
	Fasteners⁹⁾		
-	Standard type		
X	Special order		
9	Bracket		
	Type		
H	Horizontal		
A	Corner		
	Material		
CS	Carbon steel		
S	Stainless steel		
Note			
1) For models 105, 133, 163, 164 one set of flanges applies, for models 143, 153, 193 two set of flanges applies.			
2) Medium pressure up to 40 MPa.			
3) Remote diaphragm flange size is specified only for versions 185, 188. Available options: BC, CD, CC, DD. The first letter stands for the flange size at the positive side(specified in block 5 "Flange connection characteristics" transmitter), the second letter for the flange size at the negative side.. Counter part consists of the flange, gasket and fasteners.			
4) Remote diaphragm flange flushing ring size complies with the size of the main flange.			

- ⁵⁾ The flushing ring is supplied with plugs, the number of which corresponds to the number of holes. Flushing ring is made of stainless steel.
- ⁶⁾ Flushing ring surface is selected according to the counter side. For example, sealing surface is female, and then the flushing ring surface shall be male at the transmitter side and female at the counter flange (code F/E).
- ⁷⁾ RMRS type not available
- ⁸⁾ By default, the counter flange is made of the same material as the main flange.
- ⁹⁾ Code X fastener are used to assemble a pressure transmitter with a third-party supplier components (non-standard flanges, flushing rings, not included in mounting kit, etc.)
- ¹⁰⁾ Only the codes of the required parameters indicated on the order line.

Symbols for mounting kit parts:

Mounting kit for EMIS-BAR 143-SM5-HSSWGRCS

143 – transmitter model;

SM5 - two mounting flanges with threaded fitting of M20x1,5 size, fasteners, nipple with cap nut for connection to the outer diameter of the pipe 14 mm. Nipple and mounting flange are made of stainless steel;

HS – horizontal bracket made of stainless steel.

Mounting kit for EMIS-BAR 173-BD4, 0E-WNFCS-SWGRCS

B – flange size DN50;

D4,0 – flange type DIN EN 1092-1 PN 25/40;

E – transmitter sealing surface is male

WN – welding type - steel welding neck;

F – sealing surface of counter flange is female;

CS – counter flange material is Steel 20;

SW – spirally-wounded gasket;

GR – gasket material is thermal packed graphite;

CS – fastener material is Steel 20.

Mounting kit for EMIS-BAR 163 – CA05F-F/E1/2NPT2

C – flange size DN80;

A05 –ANSI 300 type;

F – transmitter sealing surface is female;

F/E – sealing surfaces of flushing ring is female/male;

1/2NPT – flushing holes thread size;

2 – number of flushing holes.

Mounting kit for EMIS-BAR 163 – BA05E-CSX

B – flange size DN50;

A05 –ANSI 300 type;

E – transmitter sealing surface is male;

CS – fastener material is Steel 20;

X – Fastener only for the pressure transmitter with third-party supplier.

DIMENSIONS AND CONNECTION SIZES OF PRESSURE TRANSMITTERS

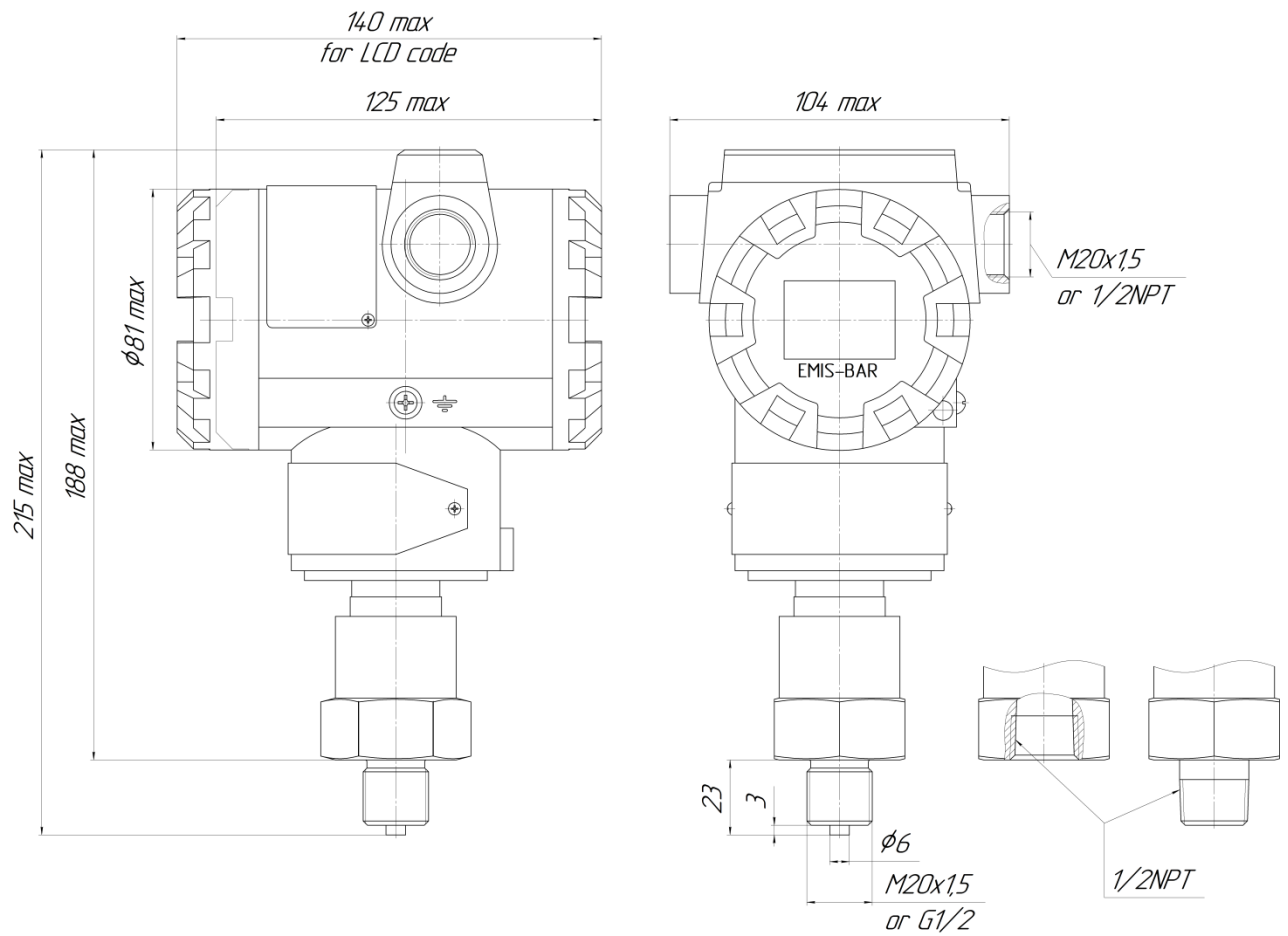


Fig.F.1 - Dimensions and connection sizes of in-line mount pressure transmitters EMIS-BAR 103 and 123

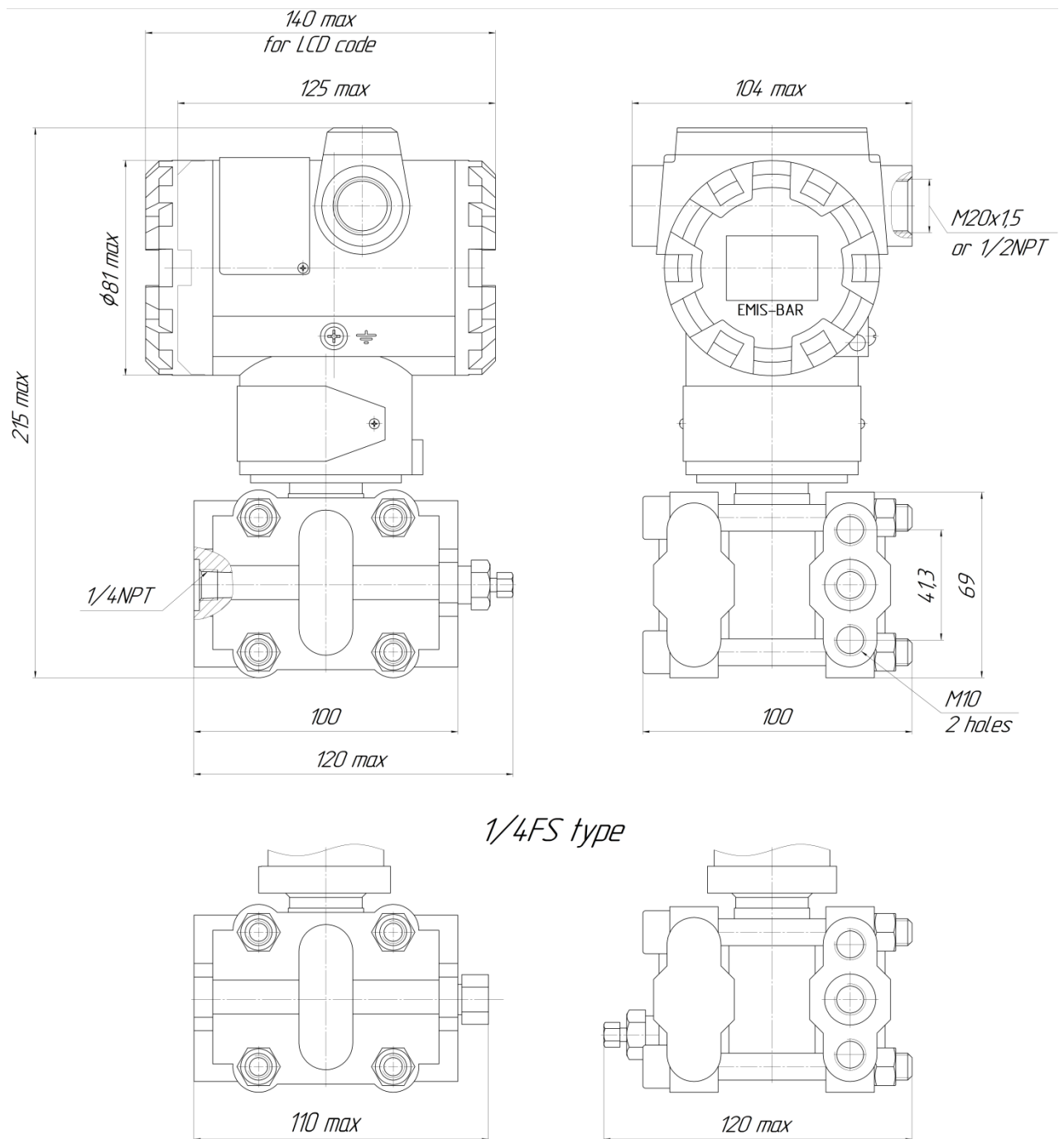


Fig.F.2 - Dimensions and connection sizes of traditional-mount pressure transmitters EMIS-BAR 105 and 133

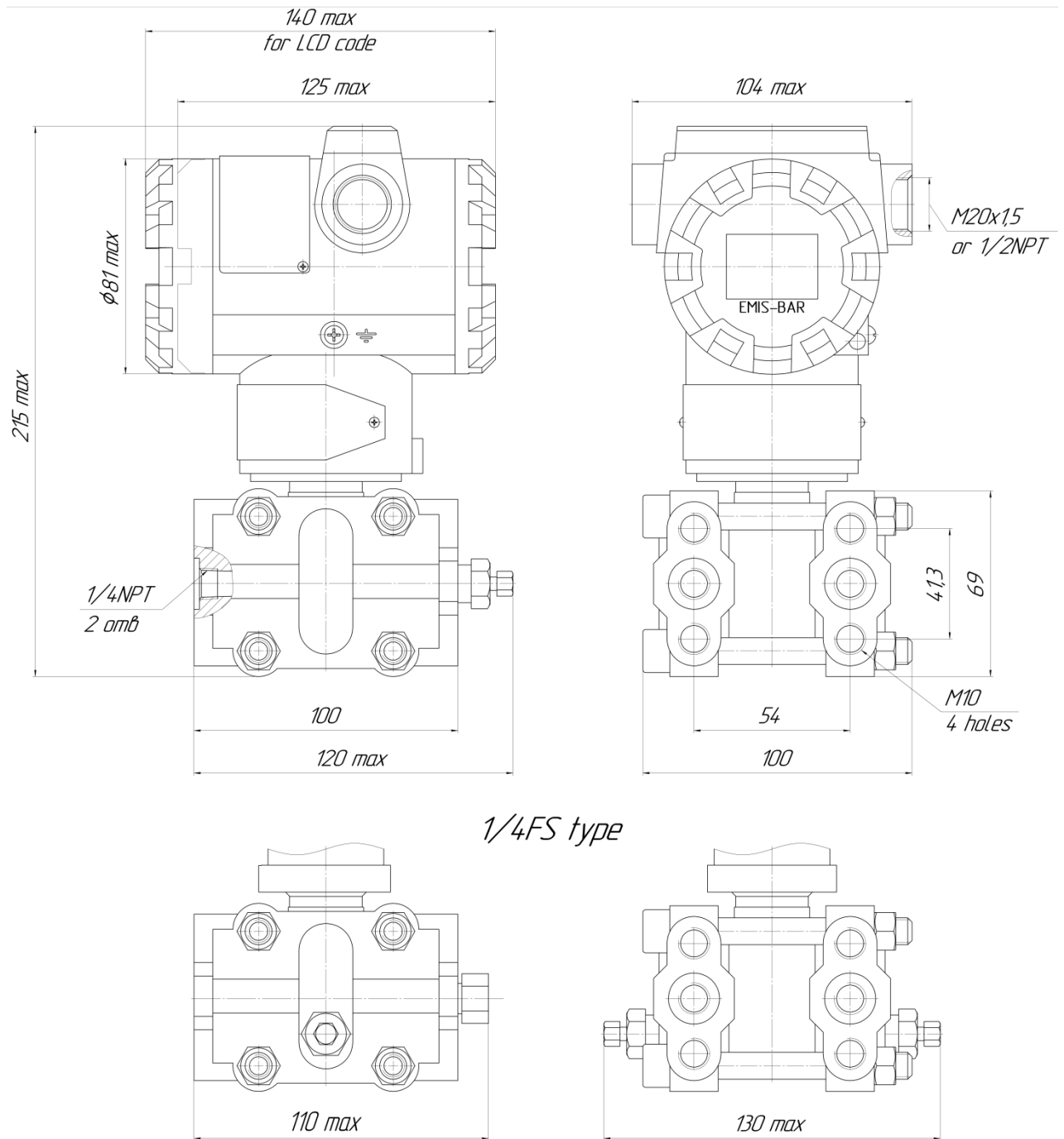


Fig.F.3 – Dimensions and connection sizes of traditional-mount pressure transmitters EMIS-BAR 143, 153, 193

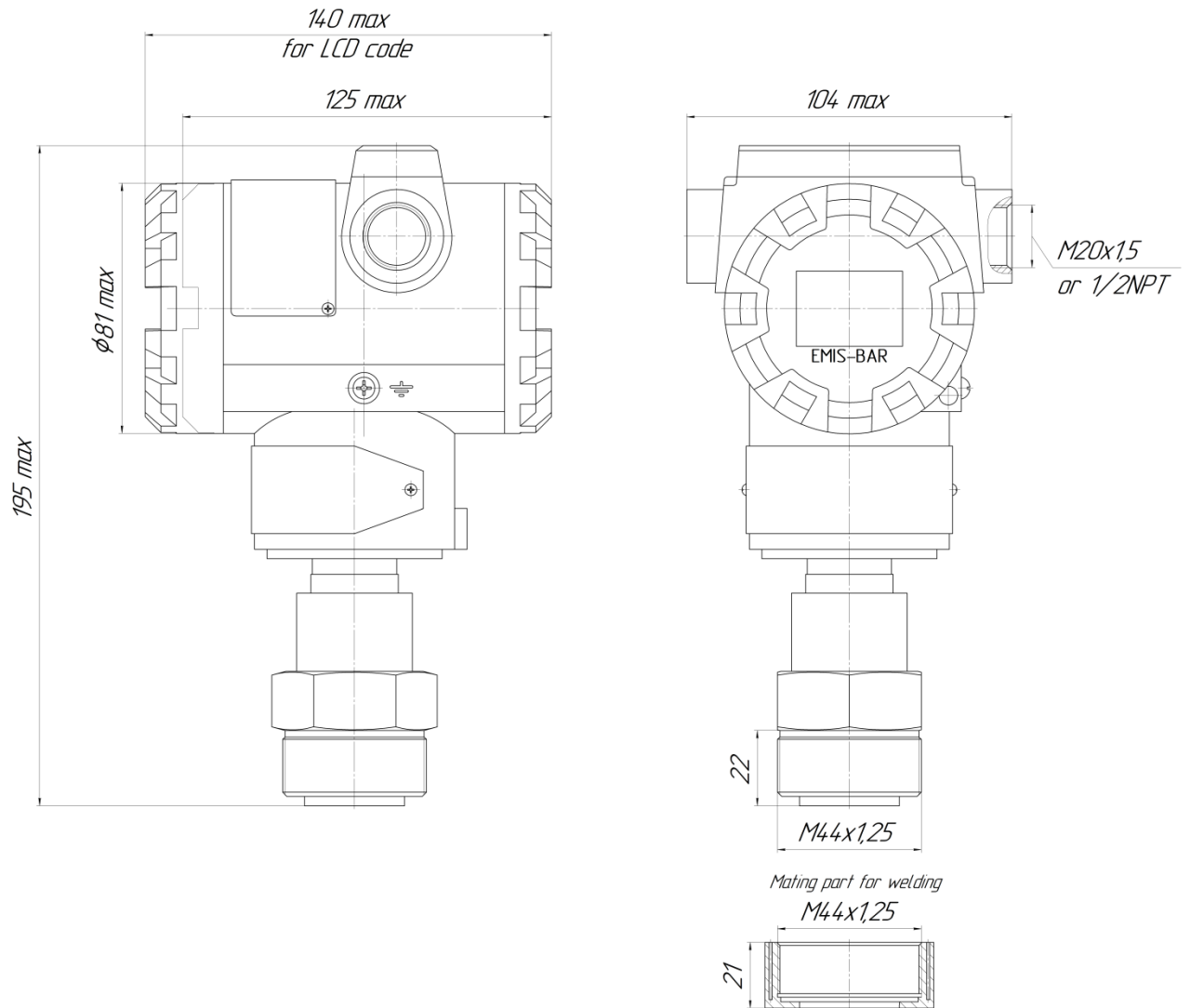
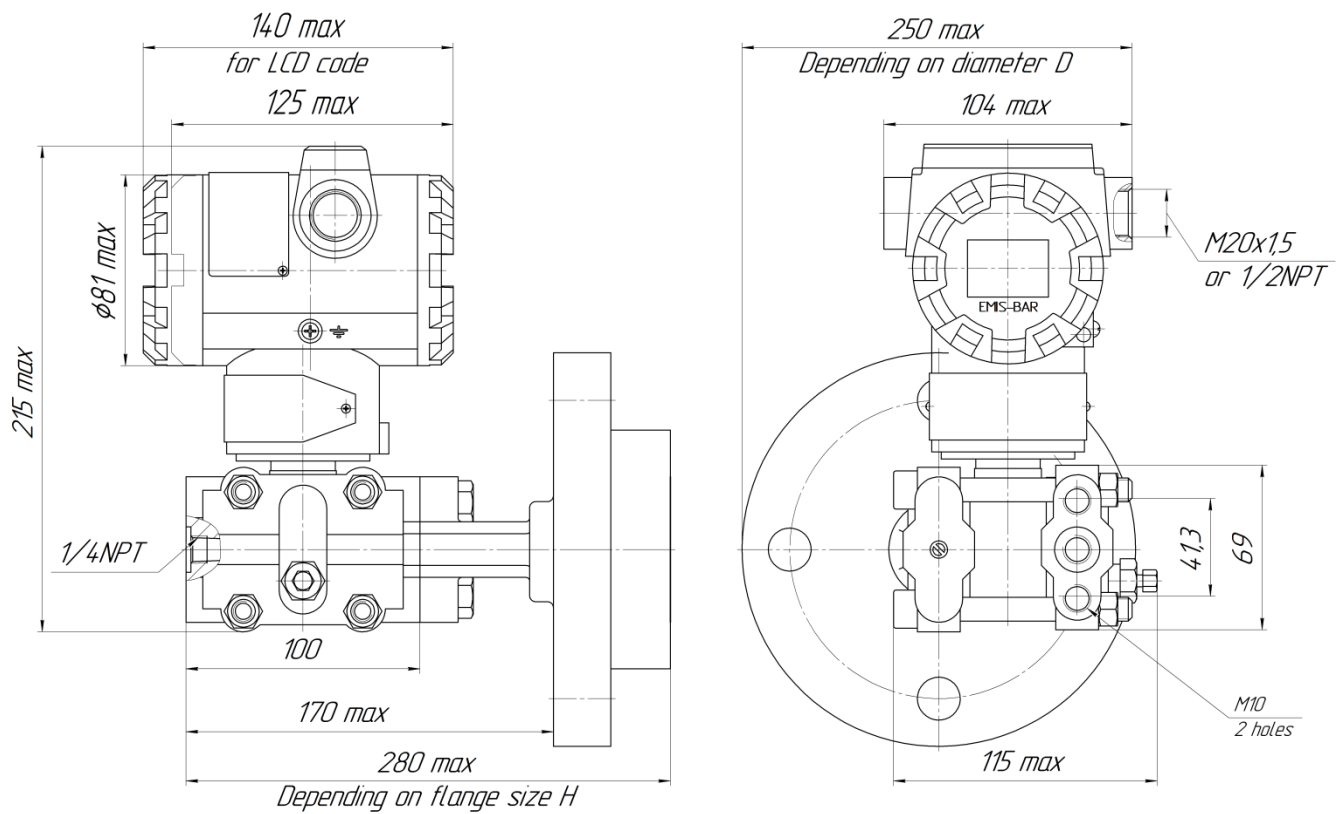


Fig.F.4 – Dimensions and connection sizes of in-line mount pressure transmitters EMIS-BAR 113 with fully-welded diaphragm seal



High-temperature version
(code in order sheet R)

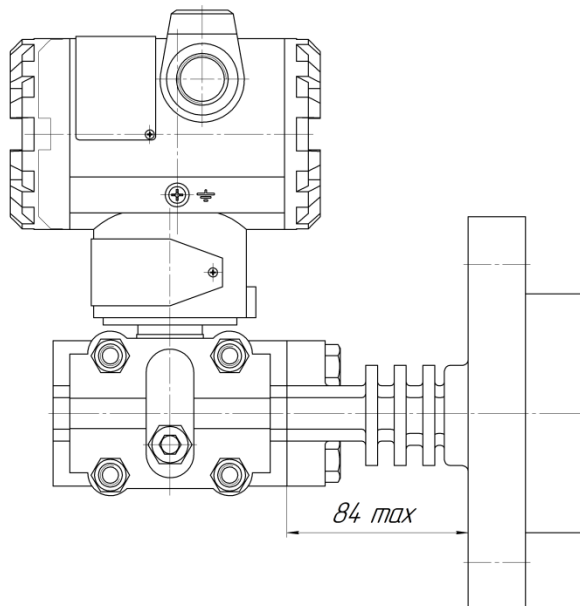


Fig.F.5 - Dimensions and connection sizes of special version of traditional-mount pressure transmitters EMIS-BAR 163. Flange sizes are given in the pages 73-76.

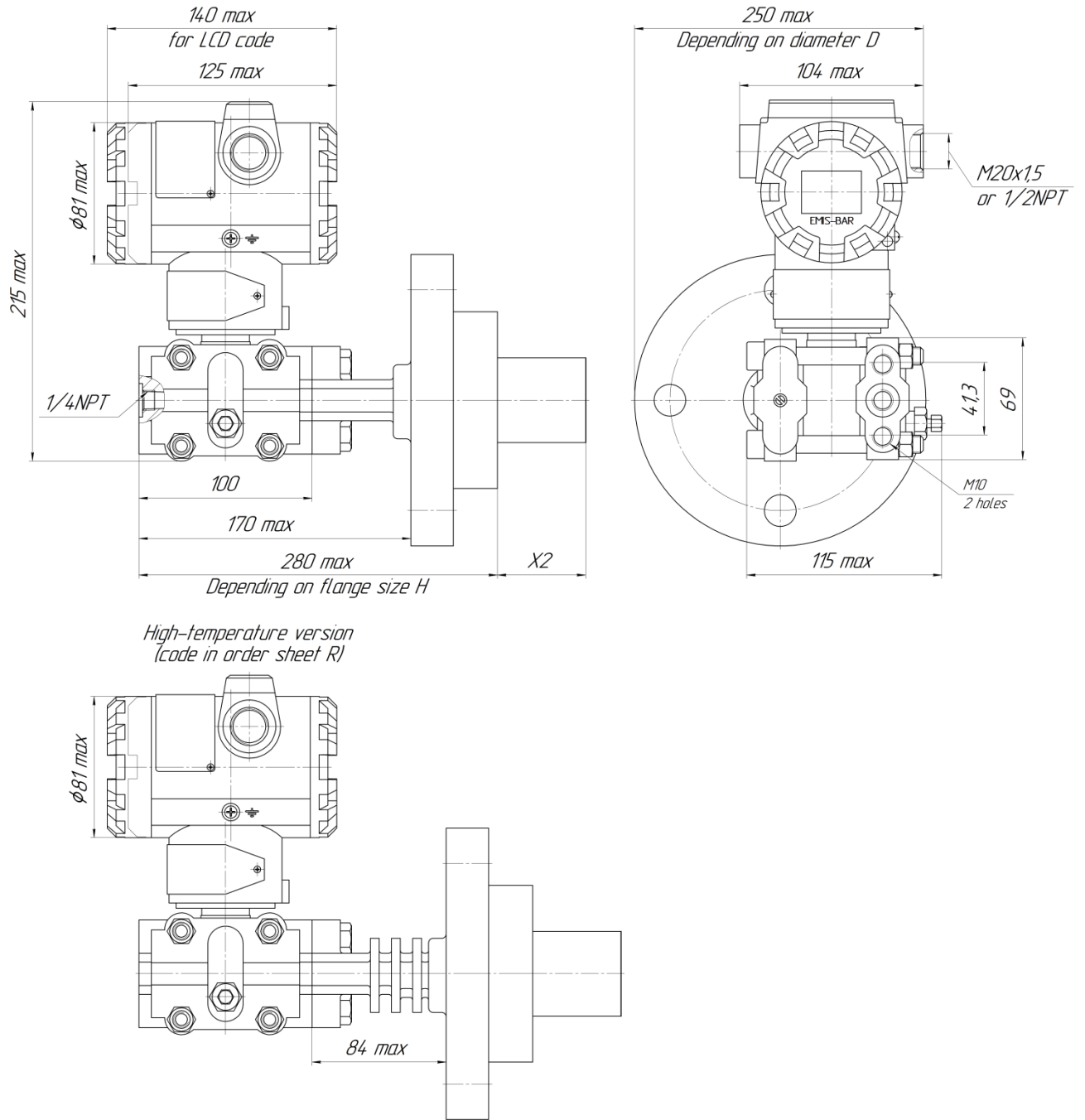


Fig.F.6 - Dimensions and connection sizes of special version of traditional-mount transmitters EMIS-BAR 164. Flange sizes are given in the pages 73-76.

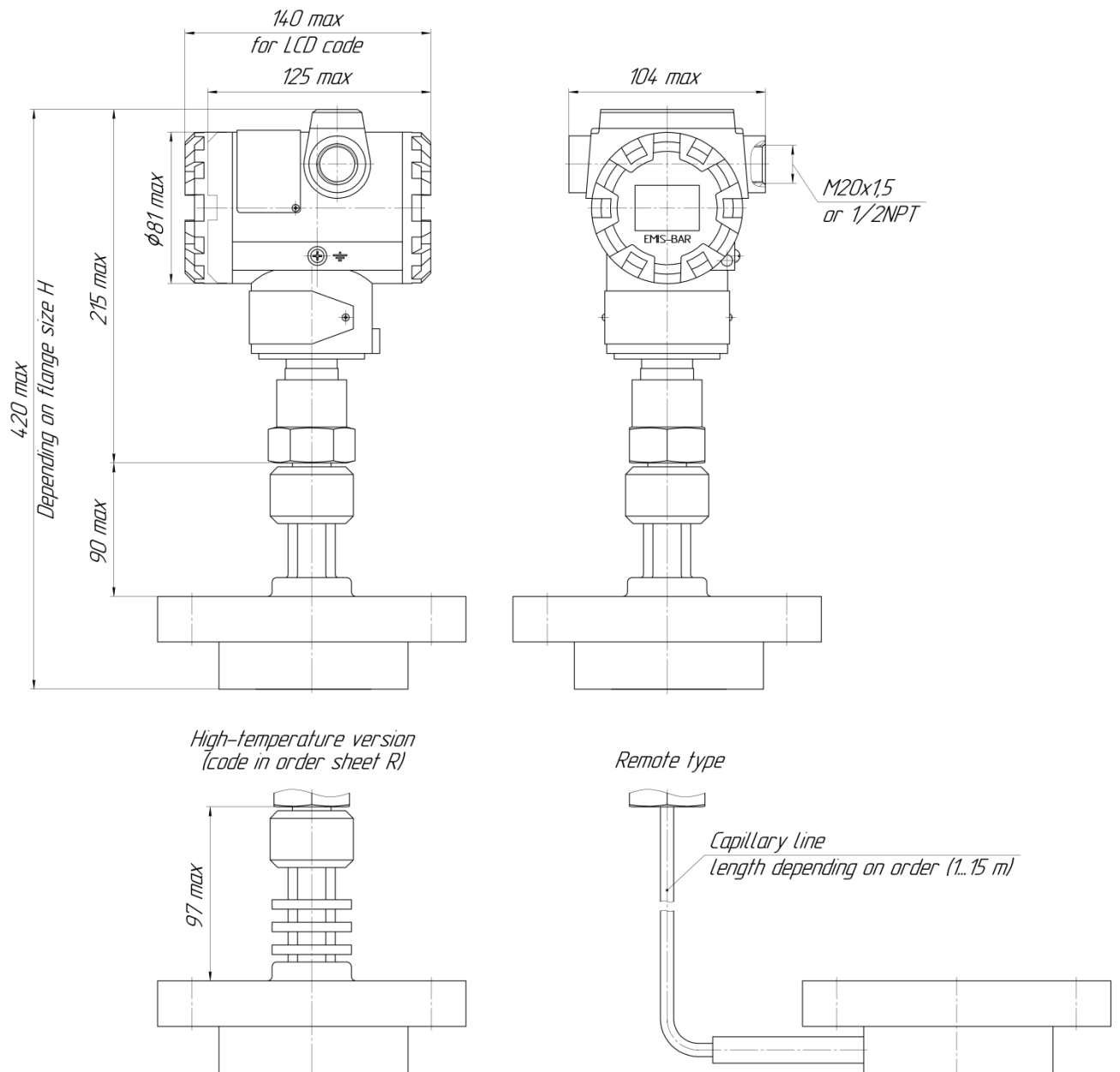


Fig.F.7 - Dimensions and connection sizes of special version of traditional-mount pressure transmitters EMIS-BAR 173 and 175. Flange sizes are given in the pages 69-72.

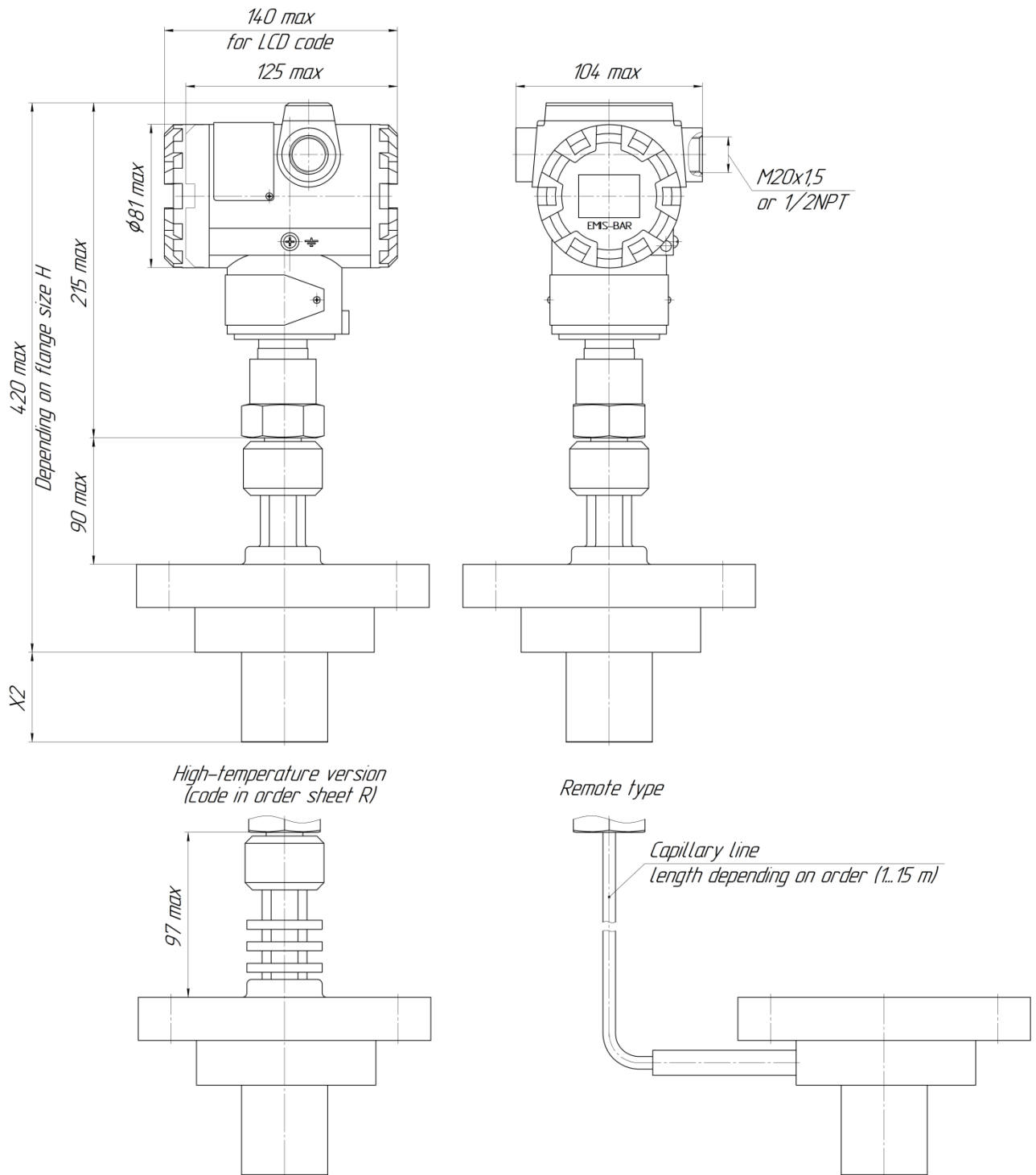


Fig.E.8 - Dimensions and connection sizes of special version of traditional-mount pressure transmitters EMIS-BAR 174 and 176. Flange sizes are given in the pages 73-76.

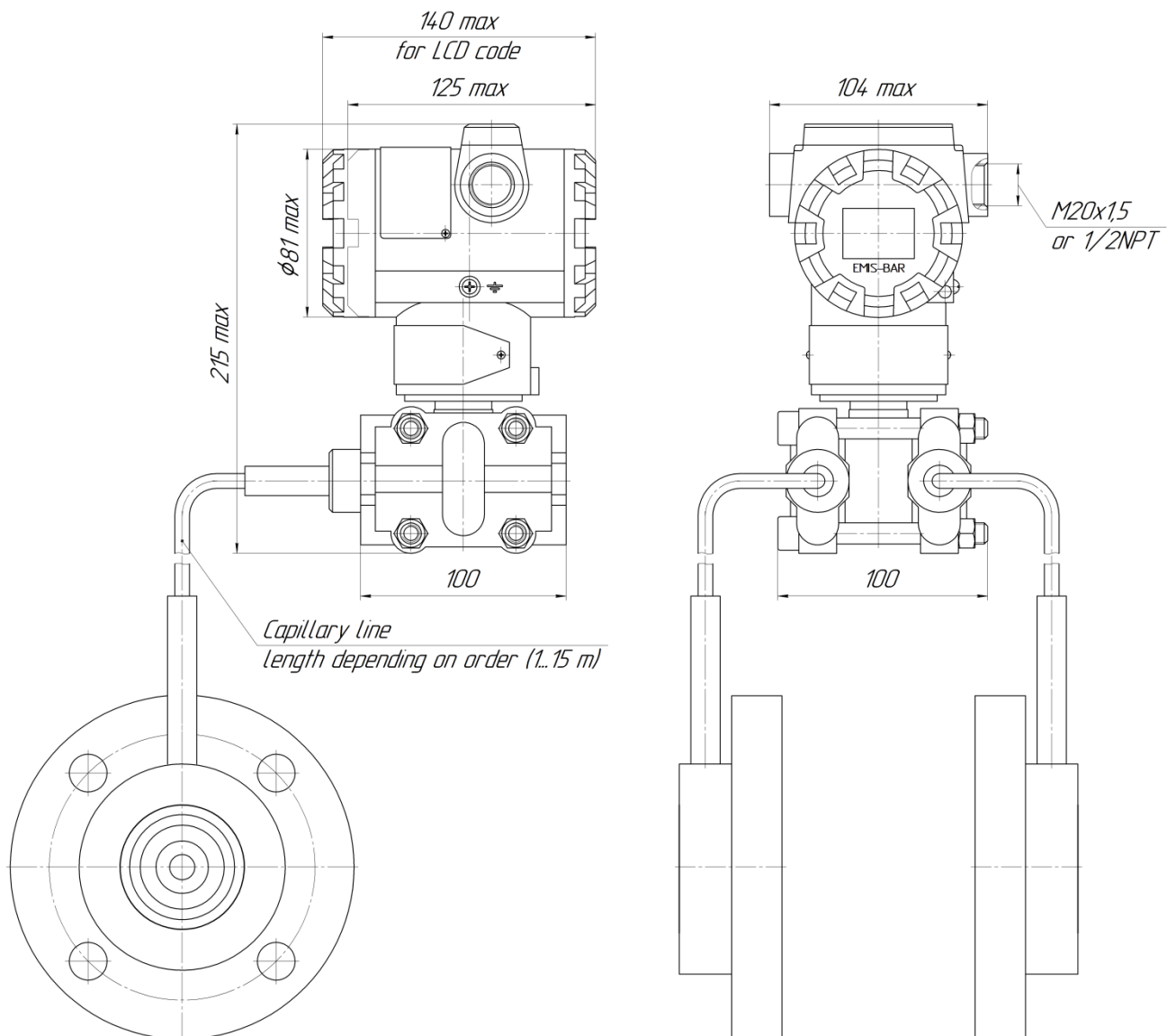


Fig.F.9 - Dimensions and connection sizes of special version of traditional-mount pressure transmitters EMIS-BAR 183 and 186. Flange sizes are given in the pages 73-76.

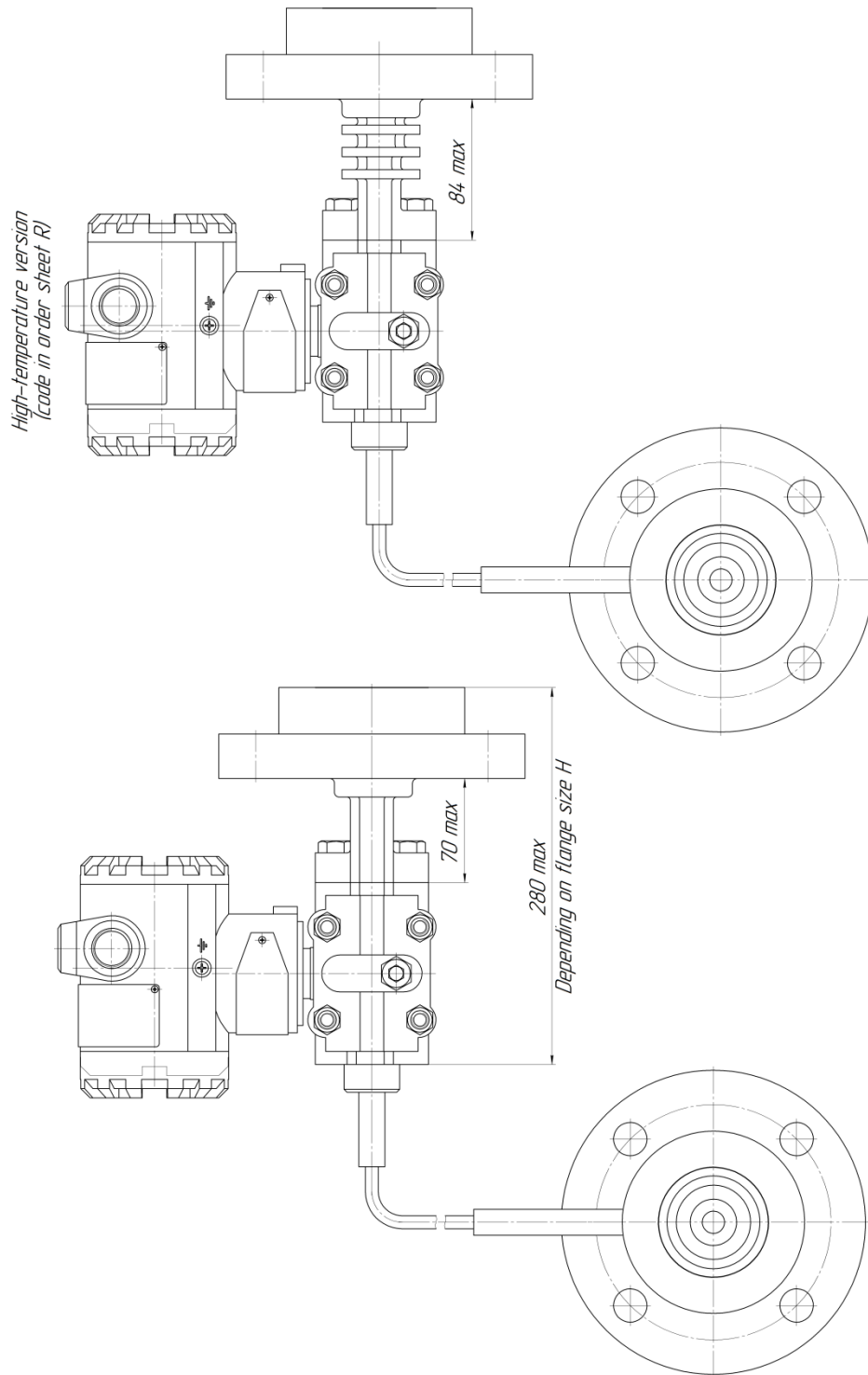


Fig.F.10 - Dimensions and connection sizes of special version of traditional mount pressure transmitters EMIS-BAR 183 and 186 without capillary line at the positive side (order sheet code 00). For other sizes see Fig.F.9.

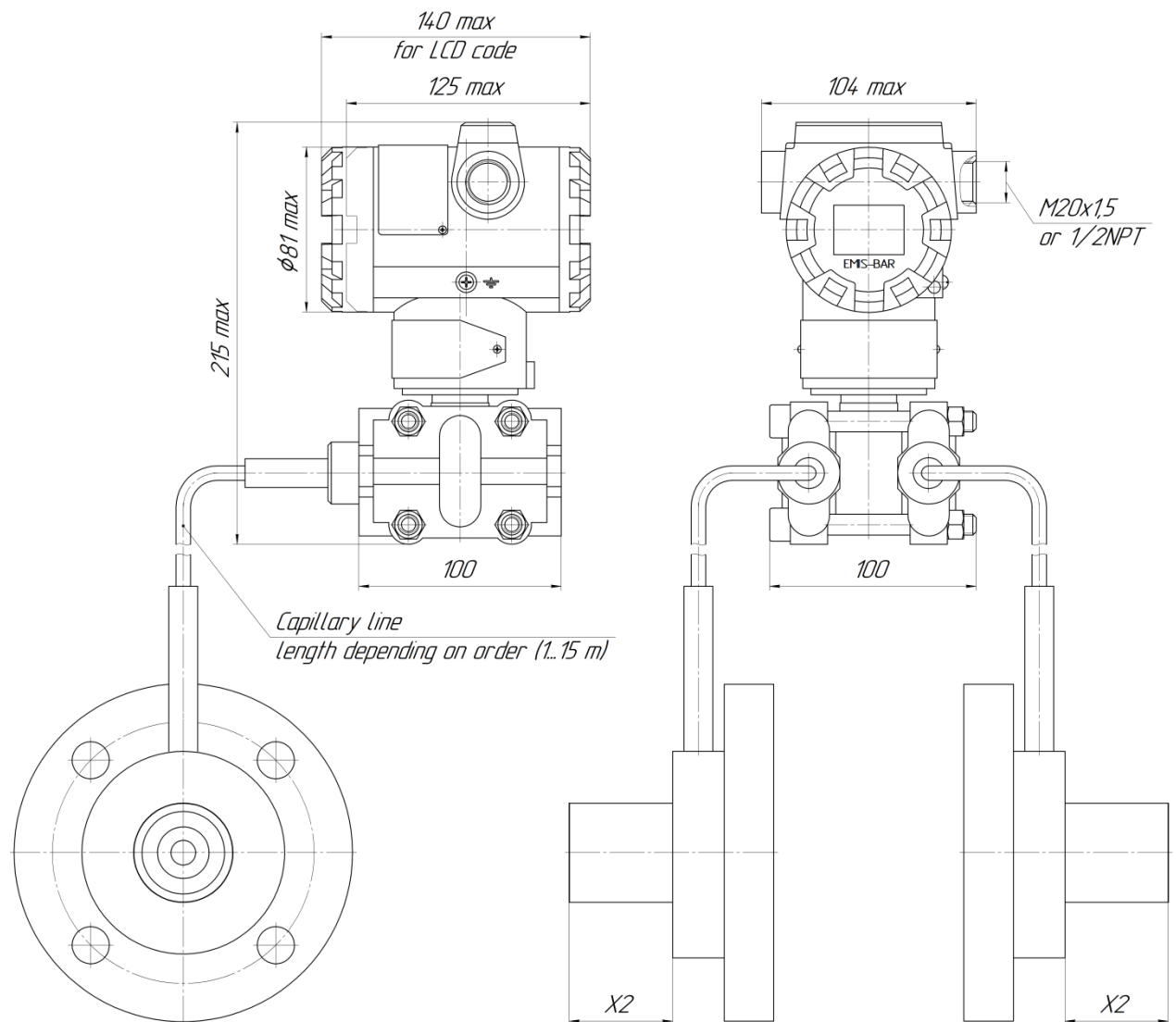


Fig.F.11 - Dimensions and connection sizes of special version of traditional-mount pressure transmitters EMIS-BAR 184 and 187. Flange sizes are given in the pages 73-76.

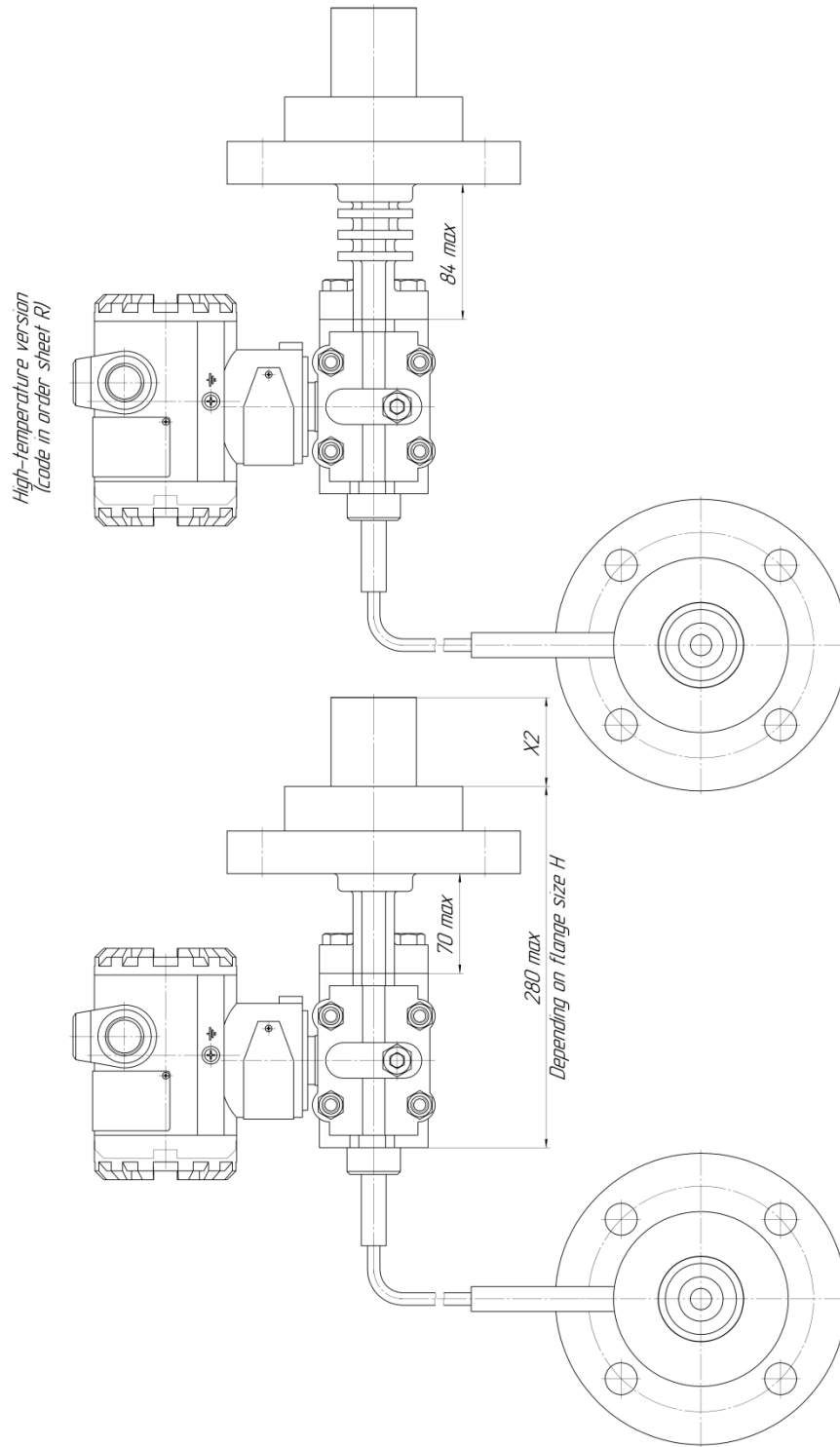


Fig.F.12 - Dimensions and connection sizes of special version of traditional mount pressure transmitters EMIS-BAR 184 and 187 without capillary line at the positive side (order sheet code 00). For other sizes see Fig.F.11

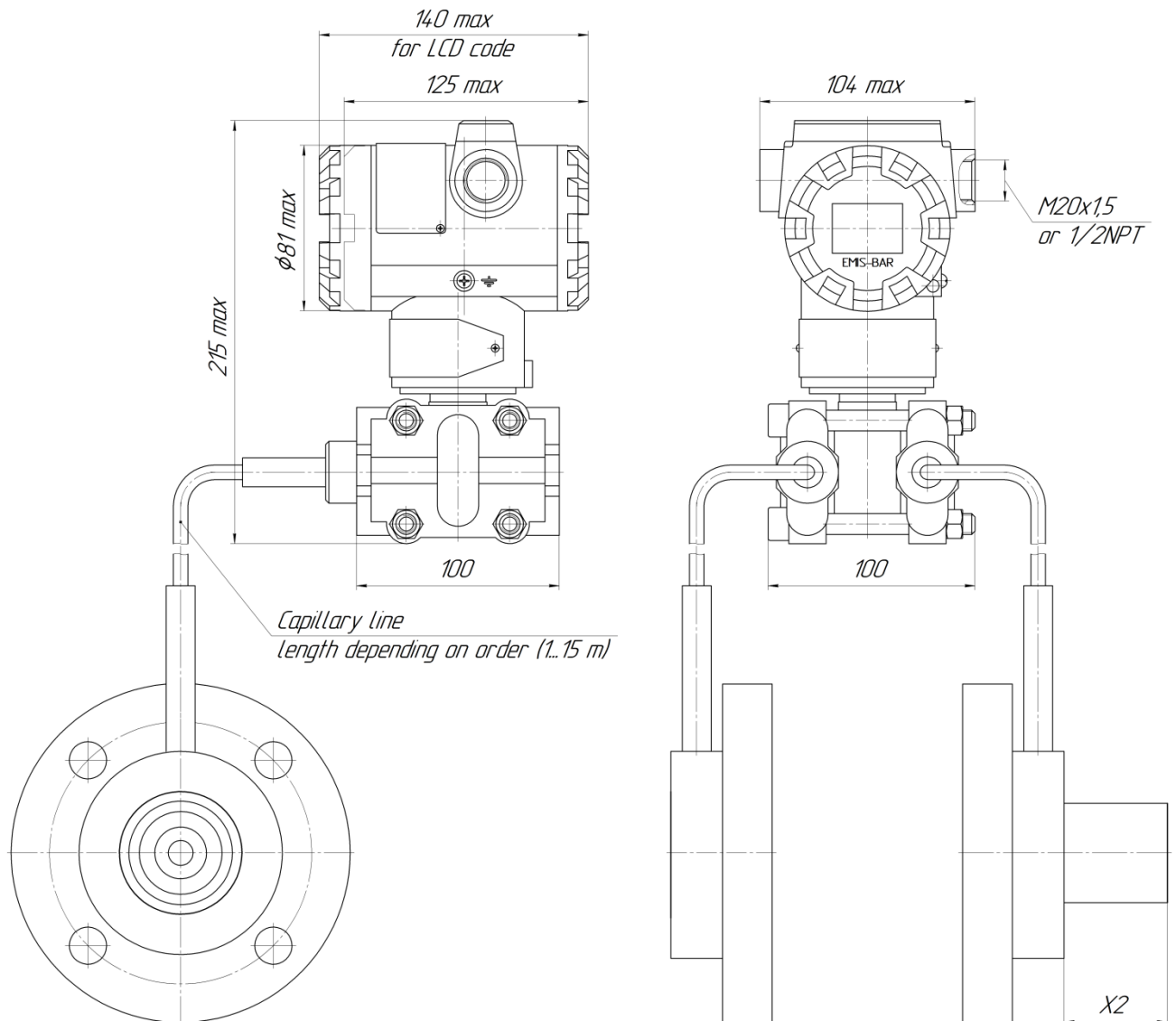


Fig.F.13 - Dimensions and connection sizes of special version of traditional-mount pressure transmitters EMIS-BAR 185 and 188. Flange sizes are given in the pages 73-76.

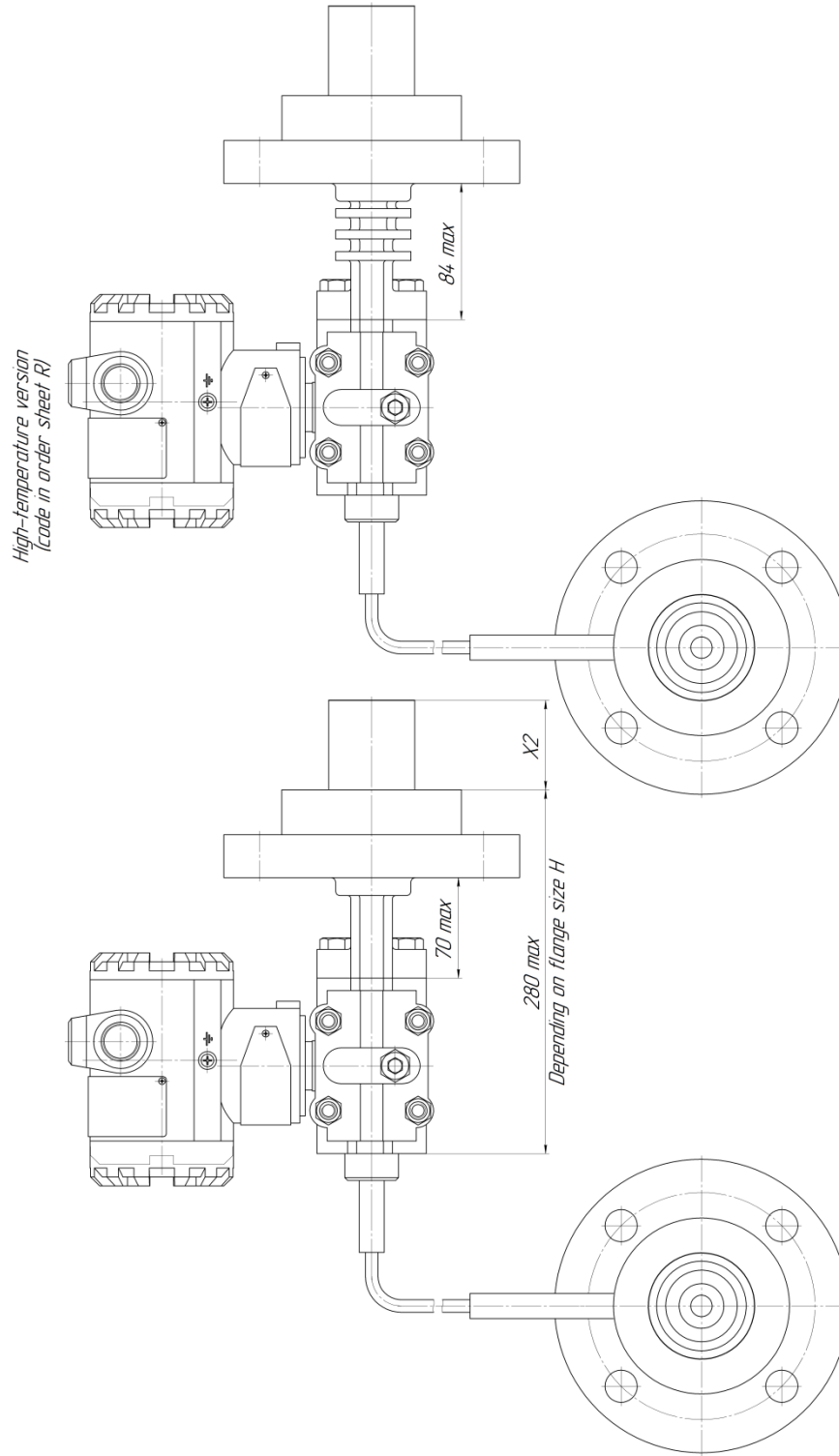
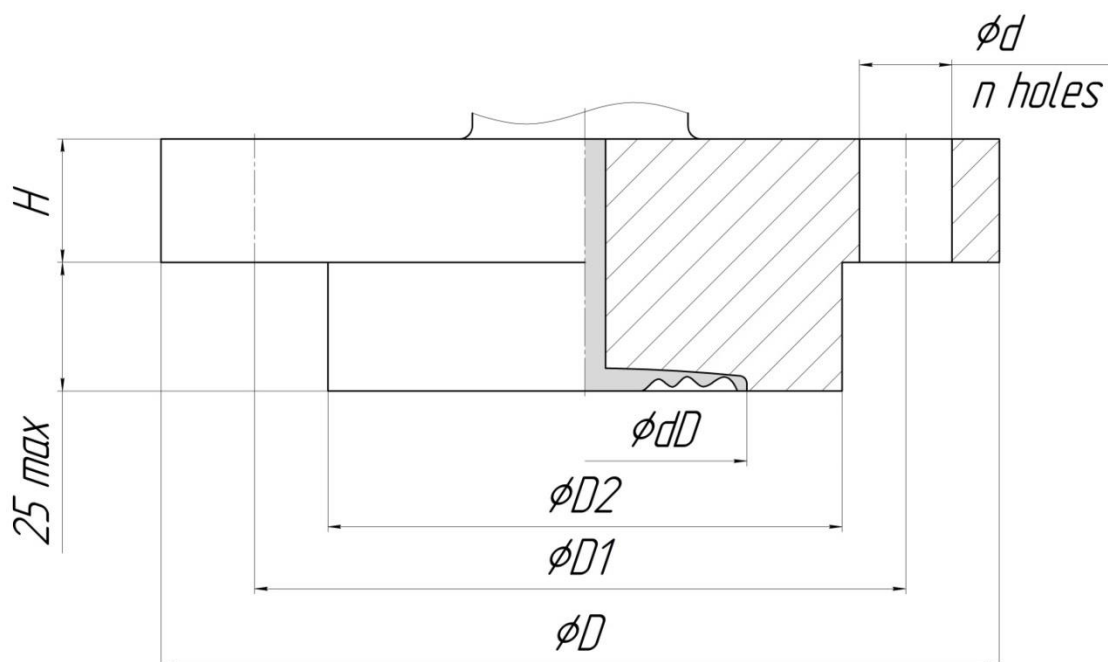


Fig.E.14 - Dimensions and connection sizes of special version of traditional mount pressure transmitters EMIS-BAR 185 and 188 without capillary line at the positive side (order sheet code 00). For other sizes see Fig.F.13

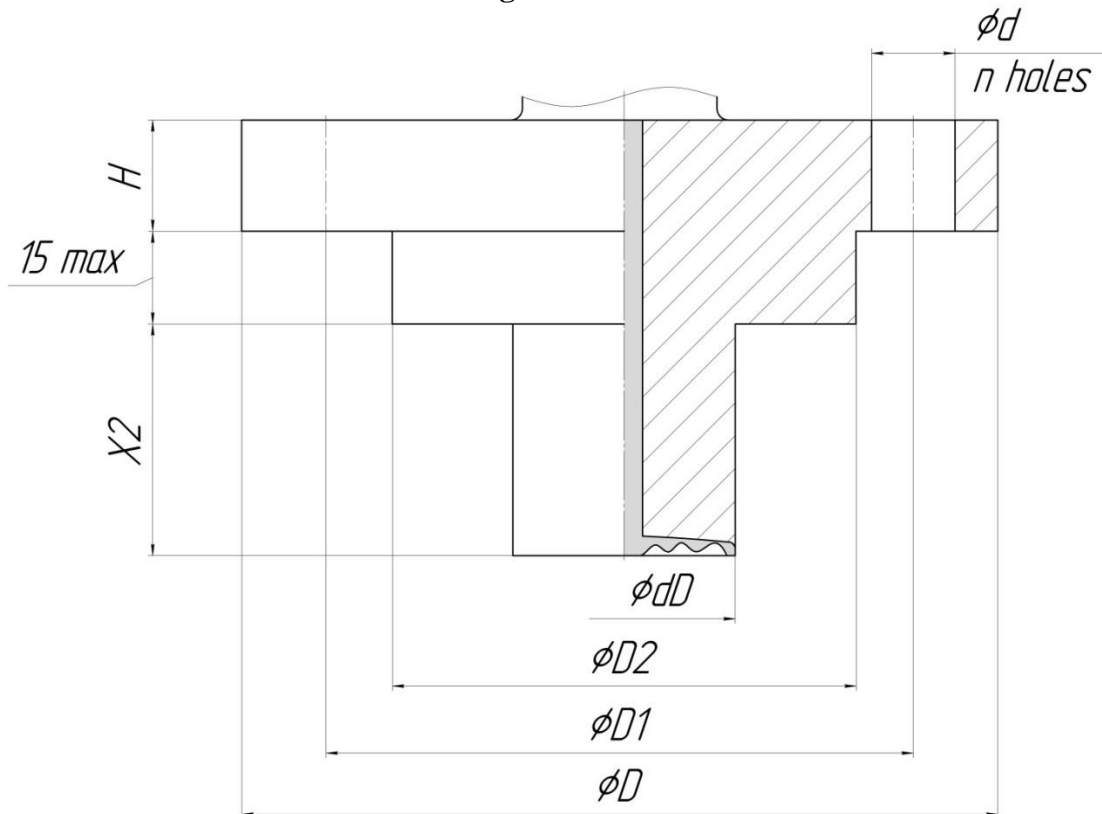
Dimensions and connection sizes of flanges

Dimensions and connection sizes of flanges with remote diaphragm seal according to DIN EN 1092-1



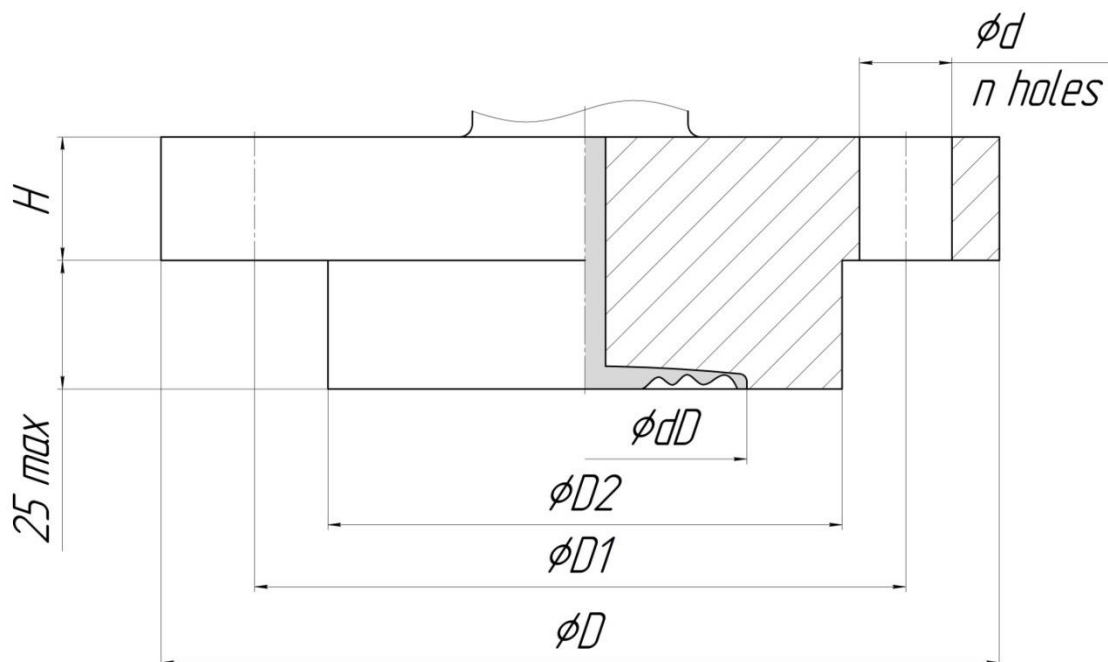
Flange size	Pressure class	D	D1	D2	dD	H	Number of bolts, n	Hole diameter, d
DN25	PN10/16	115	85	66	34	18	4	14
	PN25/40	115	85	66	34	18	4	14
	PN63	140	100	66	34	24	4	18
	PN100	140	100	66	34	24	4	18
DN50	PN10/16	165	125	100	61	18	4	18
	PN25/40	165	125	100	61	20	4	18
	PN63	180	135	100	61	26	4	22
	PN100	195	145	100	61	28	4	26
	PN160	195	145	100	61	30	4	26
DN80	PN10/16	200	160	130	89	20	8	18
	PN25/40	200	160	130	89	24	8	18
	PN63	215	170	130	89	28	8	22
	PN100	230	180	130	89	32	8	26
	PN160	230	180	130	89	36	8	26
DN100	PN10/16	220	180	155	115	20	8	18
	PN25/40	235	190	155	115	24	8	22
	PN63	250	200	155	115	30	8	26
	PN100	265	210	155	115	36	8	30
	PN160	265	210	155	115	40	8	30

Dimensions and connection size of flanges with remote extended diaphragm seal
according to DIN EN 1092-1



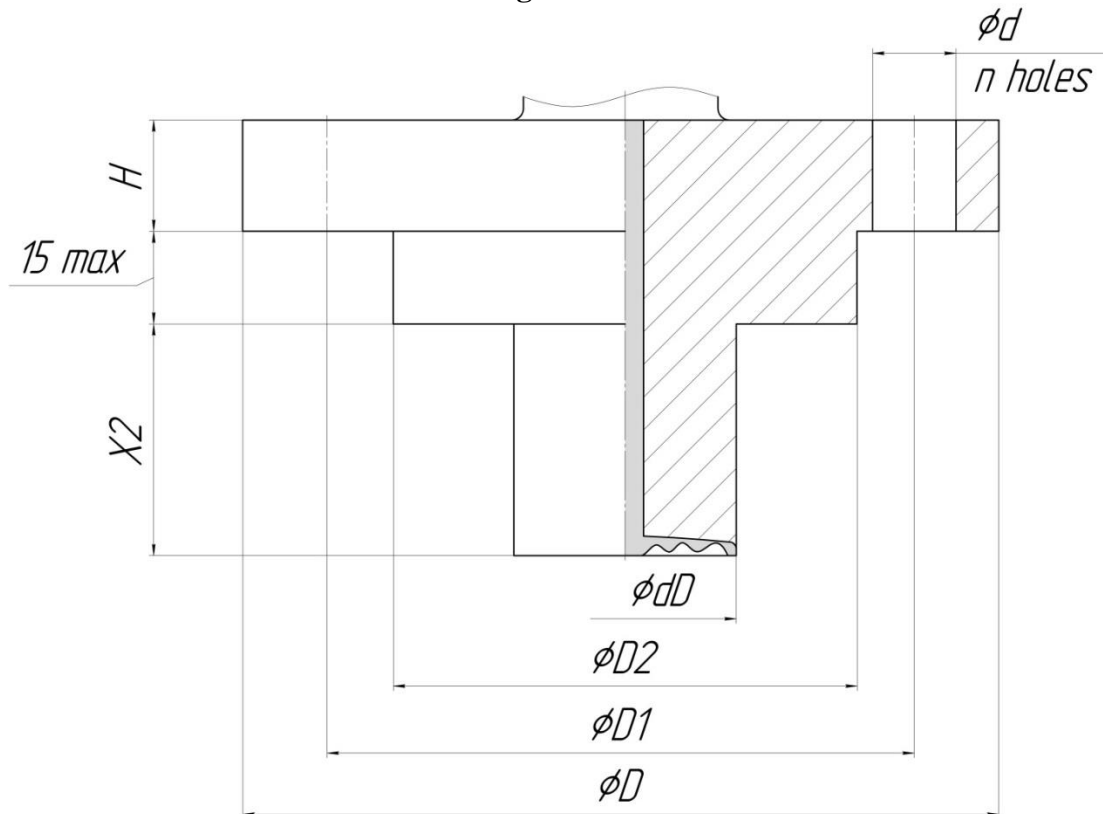
Flange size	Pressure class	D	D1	D2	dD	H	Number of bolts, n	Hole diameter, d
DN50	PN10/16	165	125	100	48	18	4	18
	PN25/40	165	125	100	48	20	4	18
	PN63	180	135	100	48	26	4	22
	PN100	195	145	100	48	28	4	26
	PN160	195	145	100	48	30	4	26
DN80	PN10/16	200	160	130	71	20	8	18
	PN25/40	200	160	130	71	24	8	18
	PN63	215	170	130	71	28	8	22
	PN100	230	180	130	71	32	8	26
	PN160	230	180	130	71	36	8	26
DN100	PN10/16	220	180	155	96	20	8	18
	PN25/40	235	190	155	96	24	8	22
	PN63	250	200	155	96	30	8	26
	PN100	265	210	155	96	36	8	30
	PN160	265	210	155	96	40	8	30

**Dimensions and connection size of flanges with remote diaphragm seal
according to ASME B16.5**



Flange size	Pressure class	D	D1	D2	dD	H	Number of bolts, n	Hole diameter, d
DN25 (1 inch)	150	110	79.4	66	34	12.7	4	16
	300	125	88.9	66	34	15.9	4	18
	600	125	88.9	66	34	17.5	4	18
	900	150	101.6	66	34	28.6	4	26
DN50 (2 inch)	150	150	120.7	100	61	19.5	4	18
	300	165	127	100	61	22.7	8	18
	600	165	127	100	61	32.4	8	18
	900	215	165.1	100	61	45.1	8	26
	1500	215	165.1	100	61	45.1	8	26
	2500	235	171.4	100	61	57.9	8	30
DN50 (3 inch)	150	190	152.4	130	89	24.3	4	18
	300	210	168.3	130	89	29	8	22
	600	210	168.3	130	89	38.8	8	22
	900	240	190.5	130	89	45.1	8	26
	1500	265	203.2	130	89	54.7	8	33
	2500	305	228.6	130	89	73.7	8	36
DN100 (4 inch)	150	230	190.5	155	115	24.3	8	18
	300	255	200	155	115	32.2	8	22
	600	275	215.9	155	115	45.1	8	26
	900	290	235	155	115	51.5	8	33
	1500	310	241.3	155	115	61.0	8	36
	2500	355	273	155	115	83.2	8	42

Dimensions and connection size of flanges with remote diaphragm seal
according to ASME B16.5

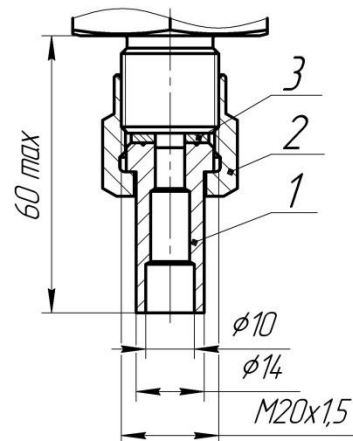


Flange size	Pressure class	D	D1	D2	dD	H	Number of bolts, n	Hole diameter, d
DN50 (2 inches)	150	150	120.7	100	48	19.5	4	18
	300	165	127	100	48	22.7	8	18
	600	165	127	100	48	32.4	8	18
	900	215	165.1	100	48	45.1	8	26
	1500	215	165.1	100	48	45.1	8	26
	2500	235	171.4	100	48	57.9	8	30
DN50 (3 inches)	150	190	152.4	130	71	24.3	4	18
	300	210	168.3	130	71	29	8	22
	600	210	168.3	130	71	38.8	8	22
	900	240	190.5	130	71	45.1	8	26
	1500	265	203.2	130	71	54.7	8	33
	2500	305	228.6	130	71	73.7	8	36
DN100 (4 inches)	150	230	190.5	155	96	24.3	8	18
	300	255	200	155	96	32.2	8	22
	600	275	215.9	155	96	45.1	8	26
	900	290	235	155	96	51.5	8	33
	1500	310	241.3	155	96	61.0	8	36
	2500	355	273	155	96	83.2	8	42

MOUNTING KIT

Nipple with cap nut (order code SM1, CSM1)

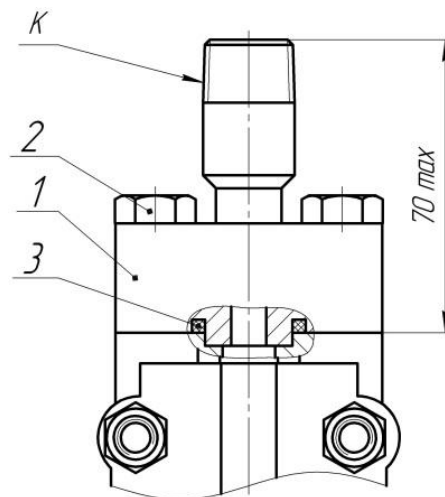
Item	Parts	Qty.pcs.
1	Nipple for outer diameter of the pipe 14mm (material depends on the specified code in the order sheet)	1
2	Cap nut M20x1,5 made of carbon steel with zinc coating	1
3	Copper gasket	1



Mounting flange

Mounting flange with fitting (order code S4K2, S4N2, S2K2, S2N2)

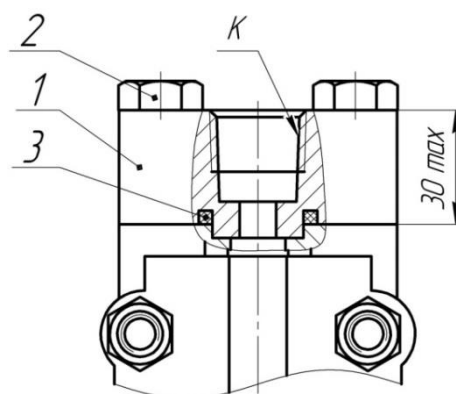
Item	Parts	Qty.pcs.
1	Mounting flange with fitting (thread size depends on the code specified in the order sheet)	2
2	Bolts M10	4
3	Rubber sealing ring	2



Thread K	Code
K1/2	S2K2
K1/4	S4K2
1/2NPT	S2N2
1/4NPT	S4N2

Mounting flange with threaded joint (order code S4K4, S4N4, S2K4, S2N4)

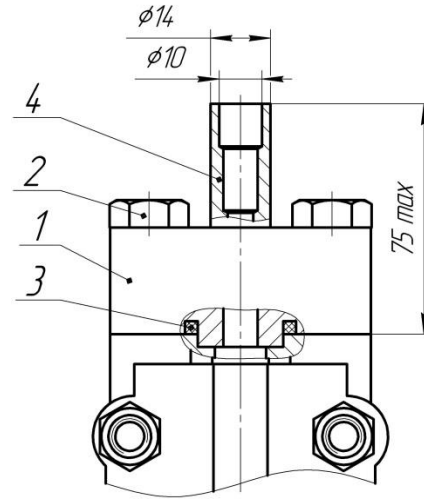
Item	Parts	Qty.pcs.
1	Mounting flange with threaded hole (thread size depends on the code specified in the order sheet)	2
2	Bolts M10	4
3	Rubber sealing ring	2



Thread K	Code
K1/2	S2K4
K1/4	S4K4
1/2NPT	S2N4
1/4NPT	S4N4

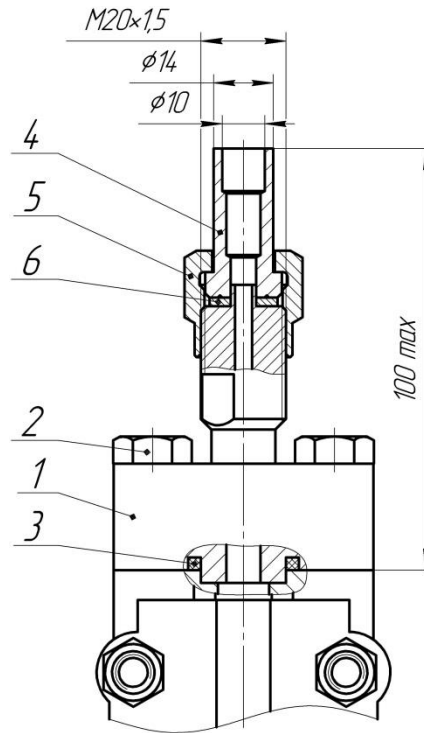
Mounting flange with nipple (order code SF3, CSF3)

Item	Parts	Qty.pcs.
1	Mounting flange with nipple hole	2
2	Bolts M10	4
3	Rubber sealing ring	2
4	Nipple for outer diameter of the pipe 14mm (material depends on the specified code in the order sheet)	2

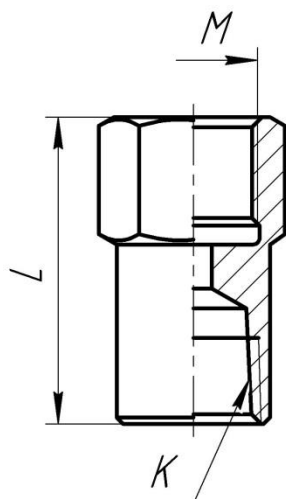


Mounting kint wit nipple and cap nut (order code SM5, CSM5)

Item	Parts	Qty.pcs.
1	Mounting flange with fitting M20x1,5	2
2	Bolts M10	4
3	Rubber sealing ring	2
4	Nipple for outer diameter of the pipe 14mm (material depends on the specified code in the order sheet)	2
5	Cap nut M20x1,5 made of carbon steel with zinc coating	2
6	Copper gasket	2

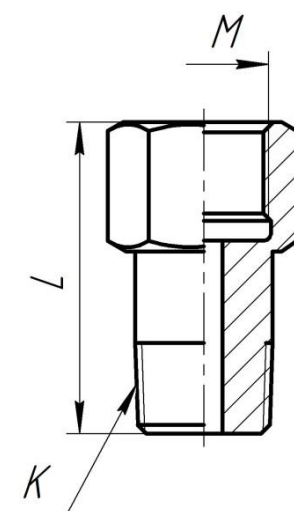


Adapter



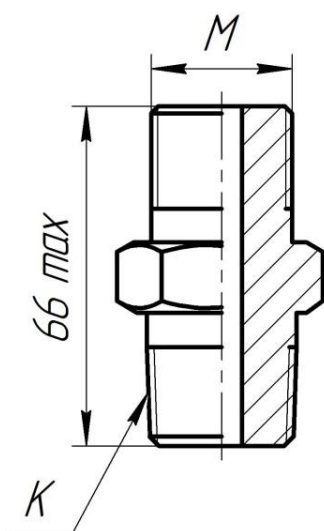
Код	Резьба М (внутр.)	Резьба К (внутр.)	L, мм
A3	M20x1,5	K1/2	50
A4	M20x1,5	K1/4	42
A9	M20x1,5	1/4NPT	42
A10	M20x1,5	1/2NPT	50

Inlet female thread - outlet female thread



Code	Thread M (female)	Thread K (male)	L, mm
A7	M20x1,5	1/4NPT	50
A8	M20x1,5	1/2NPT	50
A19	1/2NPT	M20x1,5	66
A20	M20x1,5	G1/2	66
A22	G1/2	1/2NPT	50
A25	M14x1,5	1/4NPT	50
A26	M14x1,5	1/2NPT	50
A29	G1/2	K1/2	50
A31	G1/2	3/4NPT	50
A32	1/2NPT	G1/2	66
A34	G1/2	M27x1,5	66

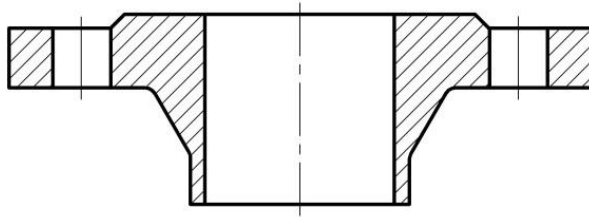
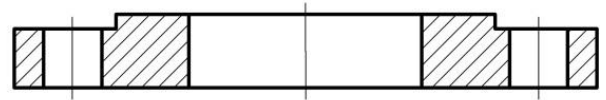
Inlet male thread - outlet female thread



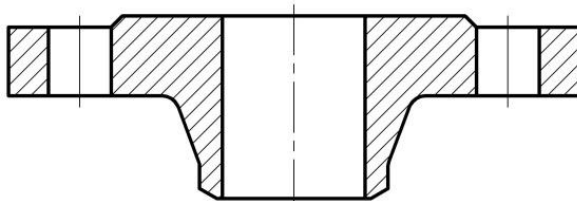
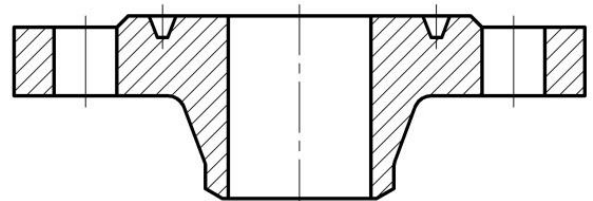
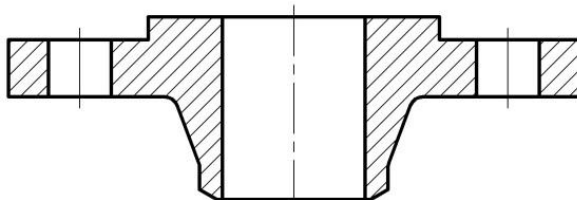
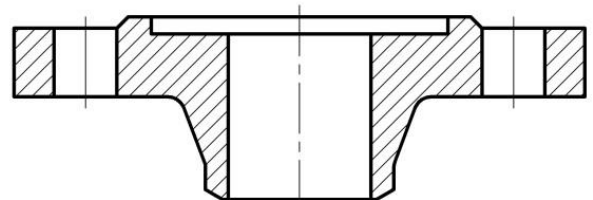
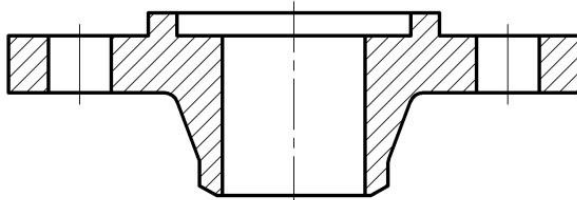
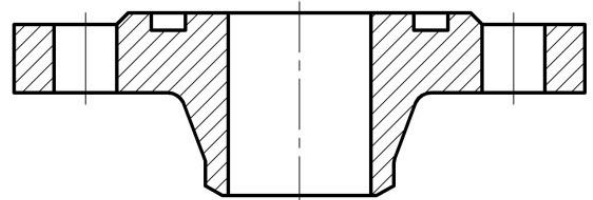
Code	Thread M (male)	Thread K (male)
A11	M20x1,5	1/2NPT
A13	M20x1,5	1/4NPT
A15	M22x1,5	1/2NPT
A17	M12x1,5	1/4NPT
A24	1/2NPT	3/4NPT
A30	G1/2	1/2NPT
A35	1/2NPT	1/4NPT

Inlet male thread - outlet male thread

Counter flange

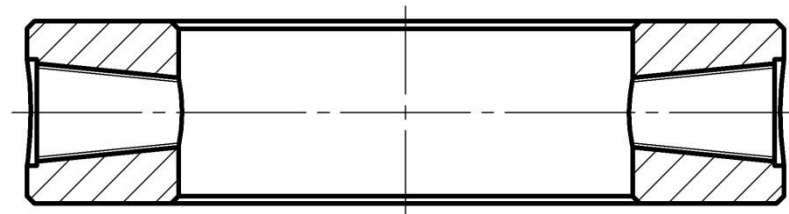
*WN – Welding neck**PL – Plate welded*

Flange seal type

*Raised face**J – For oval gasket**E – Male face**F – Female face**C – Tongue**D – Groove*

Counter flange size according to mounting kit order sheet (**Annex E**).

Flushing ring



Flushing ring size according to mounting kit order sheet (**Annex E**).

Bracket

Name	Parts	Item	Pcs.	Application based on the model	
Horizontal bracket made of carbon steel (HCS)	Horizontal bracket, steel (A)	1	1	for all	
	mounting kits for horizontal bracket type 1, steel (A) (fig.G.1)	Steel bracket	2	1	103, 113, 123, 173, 174, 175, 176
		Steel hook	3	1	
		Bolt M8x16 DIN 933 steel 8.8	4	4	
		Nut M8 DIN 934 steel	5	4	
		Clamp M8 stainless	6	1	
		Nut M8 DIN 934 stainless A4-80	7	2	
	Mounting kit for horiz.bracket type 2, steel (A) (fig.G.2)	Clamp M8 stainless	6	1	105, 133, 143, 183, 184, 185, 186, 187, 188, 193
		Nut M8 DIN 934 stainless A4-80	7	2	
		Bolt M10x16 DIN 933 steel 8.8	8	4	

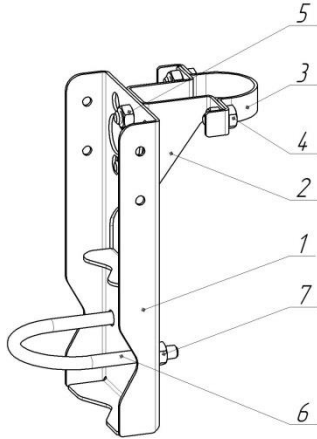


Fig.G.1 - Steel horizontal bracket. Mounting kit type 1

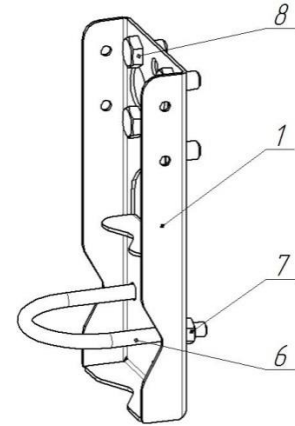


Fig.G.2 - Steel horizontal bracket. Mounting kit type 2

Name	Parts	Item	Pcs.	Application based on the model	
Horizontal bracket made of stainless steel (HS)	Horizontal bracket, stainless (E)	1	1	for all	
	Mounting kit for horizontal bracket type 1, stainless (E) (fig.G.3)	Stainless bracket	2	1	103, 113, 123, 173, 174, 175, 176
		Stainless hook	3	1	
		Bolt M8x16 DIN 933 stainless A4-70	4	4	
		Nut M8 DIN 934 stainless A4-80	5	6	
		Clamp M8 stainless	6	1	
	Mounting kit for horizontal bracket type 2, stainless (E) (fig.G.4)	Clamp M8 stainless	6	1	105, 133, 143, 183, 184, 185, 186, 187, 188, 193
		Nut M8 stainless DIN 934 stainless A4-80	5	2	
		Bolt M10x16 DIN 933 stainless A4-80	7	4	

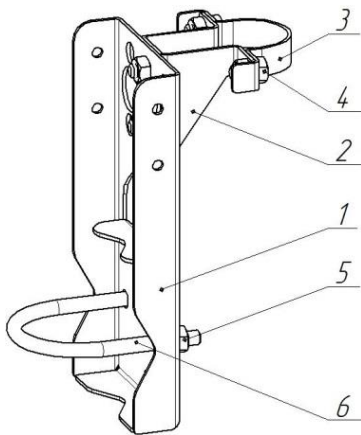


Fig.G.3 - Stainless horizontal bracket. Mounting kit type 1

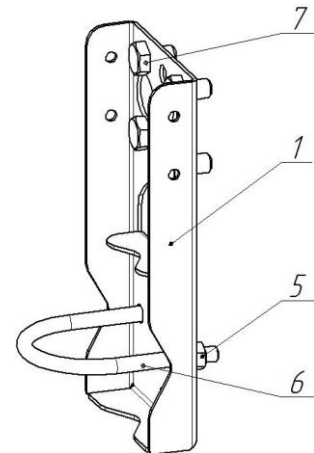


Fig.G.4 - Stainless horizontal bracket. Mounting kit type 2

Name	Parts	Item	Pcs.	Application based on the model	
Corner bracket made of carbon steel (ACS)	Corner bracket, steel (C)	1	1	for all	
	mounting kits for corner bracket type 1, steel (C) (fig.G.5)	Steel bracket	2	1	103, 113, 123, 173, 174, 175, 176
		Steel hook	3	1	
		Bolt M8x16 DIN 933 steel 8.8	4	4	
		Nut M8 DIN 934 steel	5	4	
		Washer M8 DIN 125 steel	6	4	
		Clamp M8 stainless	7	1	
		Nut M8 stainless DIN 934 stainless A4-80	8	2	
	mounting kits for corner bracket type 2, steel (C) (fig.G.6)	Bolt M10x16 DIN 933 steel 8.8	9	4	105, 133, 143, 183, 184, 185, 186, 187, 188, 193
		Clamp M8 stainless	7	1	
Nut M8 stainless DIN 934 stainless A4-80		8	2		

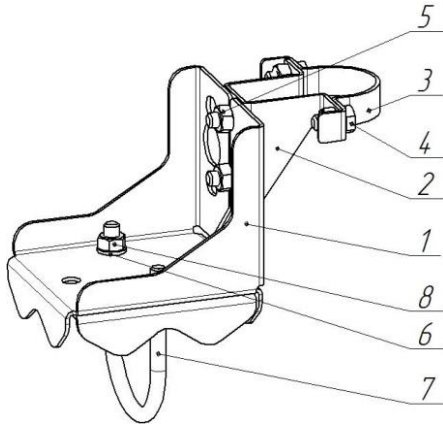


Fig.G.5 - Steel corner bracket. Mounting kit type 1

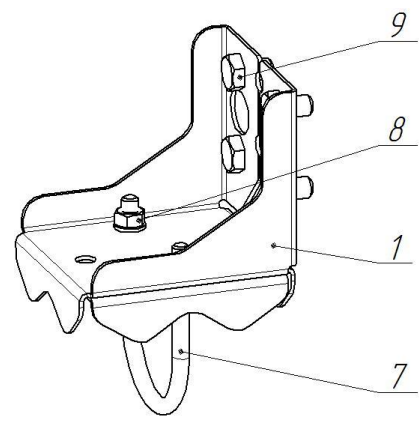


Fig.G.6 - Steel corner bracket. Mounting kit type 2

Name	Parts	Item	Pcs.	Application based on the model	
Corner bracket made of stainless steel (AS)	Corner bracket, stainless (F)	1	1	for all	
	mounting kits for corner bracket type 1, stainless (F) (fig.G.7)	Clamp M8 stainless	2	1	103, 113, 123, 173, 174, 175, 176
		Stainless plate	3	1	
		P- shaped plate (stainless steel)	4	1	
		Nut M8 DIN 934 stainless	5	2	
		Clamp M10 stainless	6	1	
		Nut M10 stainless DIN934 stainless A4-80	7	2	
		Gasket (Grover) DIN127 stainless	8	2	
	mounting kits for corner bracket type 2, stainless (F) (fig.G.8)	Bolt M10x16 stainless DIN 933 stainless A4-80	9	4	105, 133, 143, 183, 184, 185, 186, 187, 188, 193
		Clamp M10 stainless	6	1	
		Nut M10 stainless DIN 934 stainless A4-80	7	2	
		Gasket (Grover) DIN127 stainless	8	2	

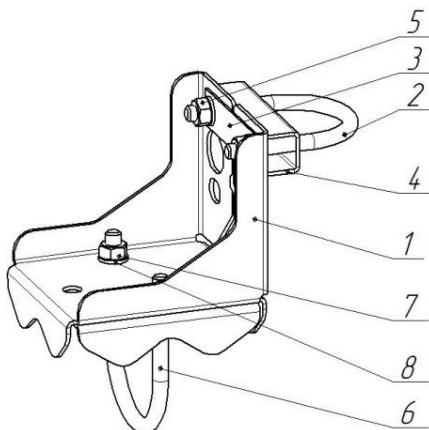


Fig.G.7 - Stainless corner bracket. Mounting kit type 1

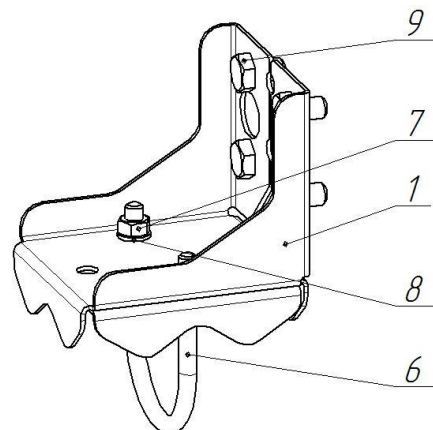


Fig.G.8 - Stainless corner bracket. Mounting kit type 2

Installation on a bracket

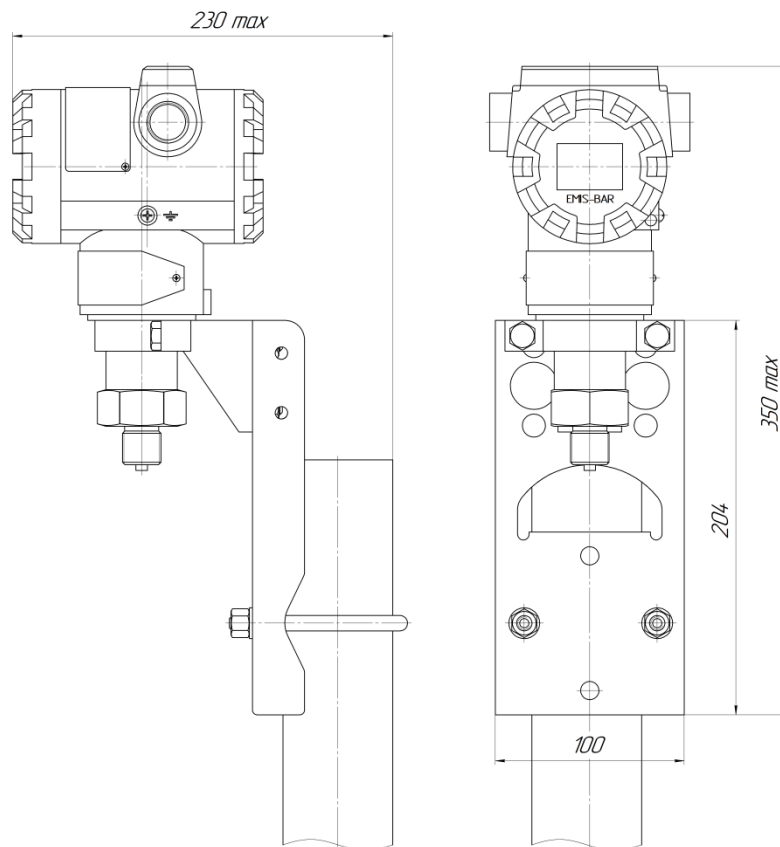


Fig.I.1 - Horizontal bracket installation of in-line mount transmitter

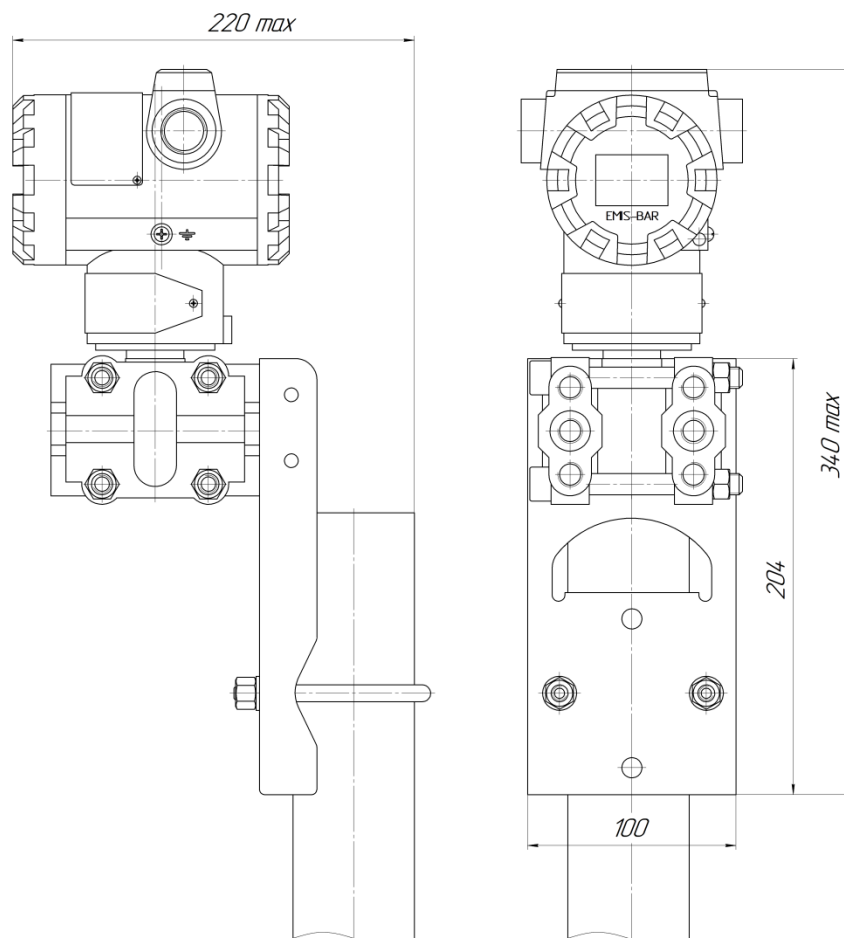


Fig.I.2 - Horizontal bracket of traditional-mount pressure transmitter

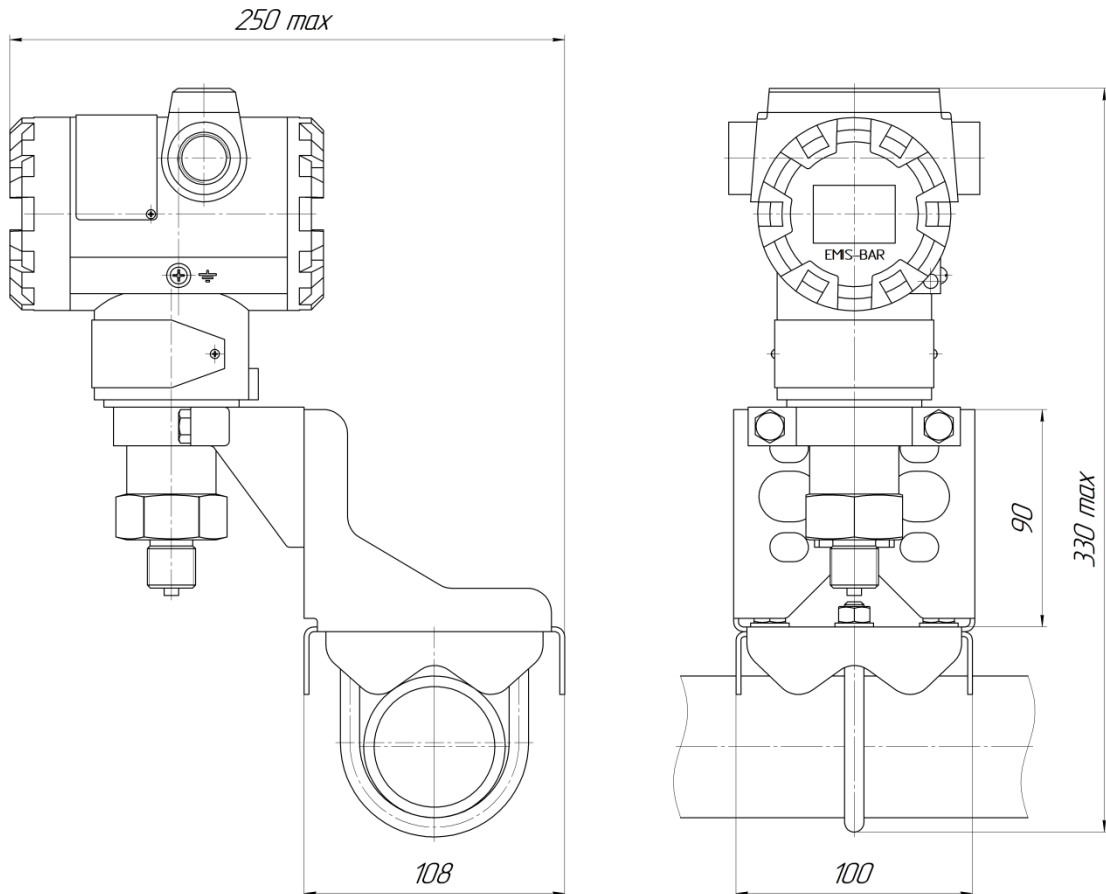


Fig.I.3 - Angle bracket installation of in-line mount transmitter

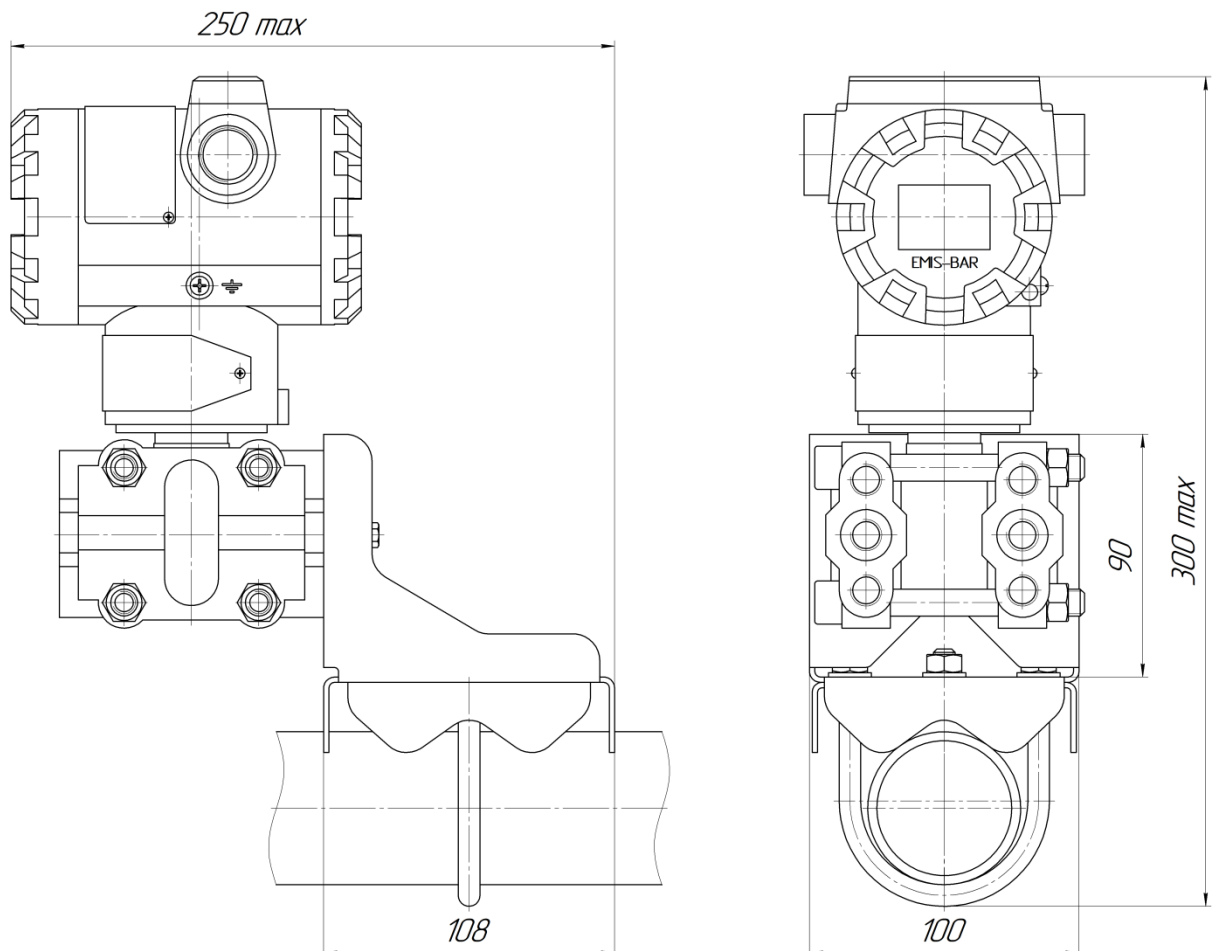


Fig.I.4 - Angle bracket installation of traditional mount pressure transmitter

List of cable glands

Order sheet code	Description	Material	Protection level according to GOST 14254, not higher	Application of ex-proof models
Cable glands with thread size M20x1,5				
M0 ¹⁾	Cable gland is not applicable. Transmitter connection electrical interface thread M20x1,5	-	-	-
M1	Non-armoured cable, cable crimping diameter 6 ... 14 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
M2	Non-armoured cable, cable crimping diameter 6,5...13,9 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
M3	Non-armoured cable, cable crimping diameter 6,5...13,9 mm	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
M4	Non-armoured cable, cable crimping diameter 6 ... 12 mm	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD, RO, RMRS
MB1	Armoured cable, crimping diameter 6...12 (inner coat), 8...16 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MB2	Armoured cable, crimping diameter 6.5...13.9 (inner coat), 12.5...20.9 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MB4	Armoured cable, crimping diameter 3.8...8.4 (inner coat), 6.7...10 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MB5	Armoured cable, crimping diameter 6...12 (inner coat), 9...17 (outer coat)	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD, RO, RMRS
MB6s	Armoured cable, crimping diameter 3,4...8,4(inner coat) 8,4...13,5(outer coat)	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD, RO, RMRS
MBH18	Armoured cable, in metal hose DN18, cable crimping diameter 9,4...14 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH15	Non-armoured cable, in metal hose DN15, DN16, cable crimping diameter 6...14 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD

Order sheet code	Description	Material	Protection level according to GOST 14254, not higher	Application of explosion-proof models
MH15s	Non-armoured cable, in metal hose DN15 (diameter 15,6...21 mm), cable crimping diameter 6,5...14 mm	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH18	Non-armoured cable, in metal hose DN18, cable crimping diameter 9,4...14 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH18s	Non-armoured cable diameter 6,5-14 mm, in metal hose in flexible metal hose DN18 (diameter 17,5...21 mm)	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH20	Non-armoured cable, in metal hose DN20, cable crimping diameter 6...14 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH20s	Non-armoured cable, in metal hose DN20 (diameter 20...27 mm), cable crimping diameter 6,5...14 mm	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH20r	Non-armoured cable, in metal hose DN20, cable crimping diameter 6...17 mm	Nickel-plated brass	IP66/67	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH20rs	Non-armoured cable, in metal hose DN20, cable crimping diameter 6...17 mm	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH201	Non-armoured cable, in metal hose DN20, cable crimping diameter 6...12 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MBH20	Armoured cable, in metal hose DN20, crimping diameter 6...12 (inner coat), 9...17 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH22	Non-armoured cable, in metal hose DN22, cable crimping diameter 9,4...14 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH22s	Non-armoured cable, in metal hose DN22, cable crimping diameter 9,4...14 mm	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH25	Armoured cable, in metal hose DN25, crimping diameter 6...12 (inner coat), 9...17 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH25s	Non-armoured cable diameter 12,6-18 mm option to connect to metal hose DN25	Stainless steel	IP66	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD

Order sheet code	Description	Material	Protection level according to GOST 14254, not higher	Application of ex-proof models
MH25sr	Non-armoured cable diameter 6-17 mm, option to connect to metal hose DN25	Stainless steel	IP66/67	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MH25r	Non-armoured cable diameter 11,3-19,9 mm, option to connect to metal hose DN25	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MT	Armoured cable, in the pipeline, connection to the pipe G3/4 outer thread, crimping diameter 6...12 (inner coat), 9...17 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MT1/2	Non-armoured cable (crimping diameter 6-12 mm), in the pipeline, connection to the pipe G1/2 outer thread	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MP1	Non-armoured cable, cable crimping diameter 6 ... 12 mm	PVC	IP65	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
GSP	Plug GSP 3 Type A DIN 43650, socket GDM 3016 Type A DIN 43650	PVC	IP65	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
SCH14	Plug connection: plug 2PM14, socket 2PM14 and straight pipe with shielded nut	Aluminum	IP65	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
SCH22	Plug connection: plug 2PM22, socket 2PM22 and straight pipe with shielded nut	Aluminum	IP65	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MS	Ex-proof plug	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MSP	Plug	PVC	IP65	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
MR	Ex-proof plug	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD, RO, RMRS
Cable glands 1/2NPT thread				
N0 ¹⁾	Cable gland is not applicable. Transmitter connection electrical interface thread 1/2NPT	-	-	-
N1	Non-armoured cable, cable crimping diameter 6 ... 12 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD

Order sheet code	Description	Material	Protection level according to GOST 14254, not higher	Application of ex-proof models
N2	Non-armoured cable, cable crimping diameter 9.4 ... 14 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
N3	Non-armoured cable, cable crimping diameter 4 ... 8.5mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
N3s	Non-armoured cable, cable crimping diameter 4 ... 8.5mm	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NB1	Armoured cable, crimping diameter 6...12 (inner coat), 9...17 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NB2	Armoured cable, crimping diameter 6...12 (inner coat), 15.5...21.1 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NB3	Armoured cable, crimping diameter 3.4...8.4 (inner coat), 6.7...10.3 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NB4	Armoured cable, crimping diameter 5.5...14 (inner coat), 10...19 (outer coat)	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NBH15s	Armoured cable in metal hose DN15, crimping diameter of outer coat 9.5 -15.9mm, of inner coat 6.2 - 11.7mm	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NBH20s	Armoured cable in metal hose DN20, crimping diameter of outer coat 12.5 - 20.9mm, of inner coat 6.5 - 13.9mm	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NH15	Non-armoured cable in metal hose DN15, cable crimping diameter 7.2 ... 11.7 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NH15s	Non-armoured cable 6.5...14mm diameter in flexible metal hose DN15 (diameter 15.6..21mm)	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NH18	Non-armoured cable 6.5 - 14mm in flexible metal hose DN18 (diameter 17.5...21mm)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NH18s	Non-armoured cable 6.5 - 14mm in flexible metal hose DN18 (diameter 17.5...21mm)	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NH20	Non-armoured cable for metal hoses DN20, cable crimping diameter 9.4 ... 14 mm	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD

NH20s	Non-armoured cable 6.5 - 14mm in flexible metal hose DN20 (diameter 20...27mm)	Stainless steel	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NT	Armoured cable in metal hose, connection to the pipe G3/4 outer thread, crimping diameter 6...12 (inner coat), 9...17 (outer coat)	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NP1	Non-armoured cable, cable crimping diameter 10 ... 14 mm	PVC	IP65	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NS	Ex-proof plug	Nickel-plated brass	IP66/68	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD
NSN	Ex-proof plug	Stainless steel	IP66/67	General industrial version, ExiaB, ExiaC, ExiaBD, ExiaCD

Note

¹⁾ If the code M0 or N0 is specified, the degree of protection IP66 / 68 is marked on the transmitter; the actual degree of protection depends on installed by the customer cable gland.

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