PIEZUS

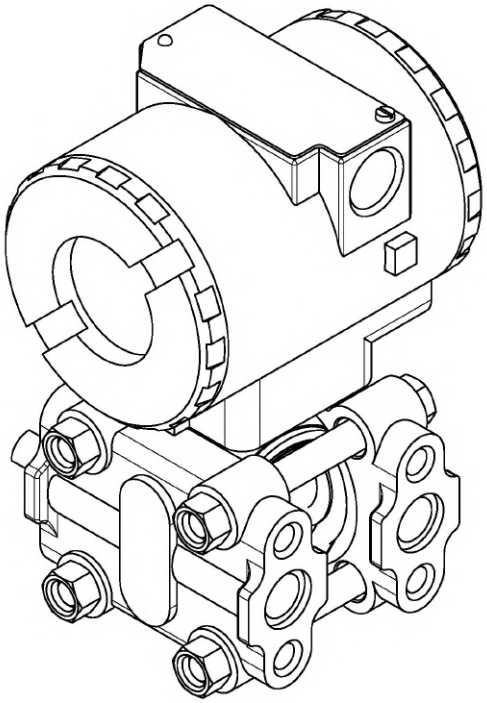
PRESSURE TRANSMITTER

AMZ

(models 5050, 5450)

Operation Manual
(abridged)

This is an abridged version of the operation manual. You can find comprehensive datasheets and manuals at
www.piezus.ru



HART COMMUNICATION PROTOCOL

Table of Contents

This manual covers mounting and operation of AMZ 5050 and AMZ 5450 pressure transmitter (hereinafter referred to as "transmitter" or "device"); it contains technical data, description of design and other information necessary for proper application and maintenance of the device.

Design and features of the device comply with TU 4212-000-7722857693–2015 (terms of reference). The available versions differ in measurement range and specifics of the housing. Version peculiarities are reflected in ordering codes described in Supplement A.

In accordance with GOST R 52931, the device:

- is electrical (as it is powered by electricity);
- can communicate with other devices;
- belongs to group R1 (atmospheric pressure resistance classification);
- belongs to group V2 (vibration resistance classification);

Explosion protection types of Ex versions:

- intrinsically safe electrical circuits - "ia" (0Ex ia IIC T4 Ga X);
- flameproof enclosure - "d" (1Ex d IIC T5, T6 Gb X).

See Supplement B for possible housing dimensions.

Terms and abbreviations

MR – measurement range.
URL – upper range limit, also referred to as "upper range value".
MV – measured value.
LRL – lower range limit, also referred to as "lower range value".
PC – personal computer.
P_{set} – set range.
P_{url} – Upper range limit (URL)
AC – alternating current.
DC – direct current

Please pay special attention to paragraphs accompanied by this mark.

NOTE: Manufacturer reserves the right to modify the design and circuitry of the device without degrading its performance.

1 Designed functions

1.1 AMZ 5050 is a differential, gauge and absolute pressure transmitter, flange version, outputting analog (current 4 ... 20 mA) and digital (HART) signals and showing the measured value on the digital display. The transmitter measures pressure of liquids and gases.

1.2 AMZ 5450 is a differential, gauge and absolute pressure transmitter, choke version, outputting analog (current 4 ... 20 mA) and digital (HART) signals and showing the measured value on the digital display. The transmitter measures pressure of liquids and gases.

1.3 Areas of application: technological process automated control systems (various industries), heat and power plants and installations, air conditioning systems, research and development setups.

2 Technical specifications

2.1 General technical data

2.1.1 See transmitter's datasheet and label for span and accuracy info.

2.1.2 URL and LRL are freely adjustable with the help of a HART modem/communicator or a magnetic pen (locally). See Tables 2.1-2.3 for adjustment range (relative to nominal URL).

Table 2.1 - AMZ 5050 URL, differential and gauge pressure

Unit of measurement	kPa					MPa	
URL (P_{url})	1.5	7.5	37	187	690	2	7
Range adjustment scale (Pset / P_{url}) *	1:20	1:40	1:100				
Permissible static pressure, MPa	1 MPa	4 MPa	13.8 MPa				
Permissible overpressure, MPa	1 MPa	4 MPa	13.8 MPa				

* The default lower range limit (LRL) is 0. Differential pressure transmitters can have LRL equal to URL in modulus but negative. Gauge pressure transmitters can have LRL equal to URL in modulus but negative, or equal to -100 kPa if its URL is ≥187 kPa.

Table 2.2 - AMZ 5050 ranges, absolute pressure

Unit of measurement	kPa			MPa	
URL (P_{url})	37	187	690	2	7
Range adjustment scale (P_{set} / P_{url})*	1:100				
Permissible overpressure	13.8 MPa				

Table 2.3 - AMZ 5450 URL

Gauge pressure transmitter:									
Unit of measurement	kPa					MPa			
URL (P_{url})	1.5	7.5	37	187	690	2	7	20	40
Range adjustment scale (P_{set} / P_{url})*	1:20	1:40	1:100						
Permissible overpressure	1 MPa	4 MPa	13.8 MPa					30 MPa	60 MPa
Absolute pressure transmitter:									
Unit of measurement	kPa					MPa			
URL (P_{url})	37	187	690			2	7	20	
Range adjustment scale (P_{set} / P_{url}) *	1:100								
Permissible overpressure	13.8 MPa							30 MPa	

* The default lower range limit (LRL) is 0. Gauge pressure transmitters can have LRL equal to URL in modulus but negative, or equal to -100 kPa if its URL is ≥187 kPa.

2.1.3 See tables 2.4 and 2.5 for accuracy.

Table 2.4 - AMZ 5050 accuracy.

Differential and gauge pressure		
P_{url}	Set range	Accuracy, % of span
1.5 kPa	$P_{url}/5 \le P_{set}$	± 0.1
	$P_{url}/20 \le P_{set} < P_{url}/5$	$\pm[0.015\cdot(P_{url}/P_{set})+0.025]$
From 7.5 kPa to 7000 kPa	$P_{url}/10 \le P_{set}$	± 0.075
	$P_{url}/40 \le P_{set} < P_{url}/10$	$\pm[0.00375\cdot(P_{url}/P_{set})+0.0375]$
	$P_{url}/100 \le P_{set} < P_{url}/40$	$\pm[0.00465\cdot(P_{url}/P_{set})+0.0015]$
Absolute pressure		
From 37 kPa to 7000 kPa	$Pn/10 \le P_{set}$	± 0.1
	$P_{url}/40 \le P_{set} < P_{url}/10$	$\pm[0.005\cdot(P_{url}/P_{set})+0.05]$
	$P_{url}/100 \le P_{set} < P_{url}/40$	$\pm[0.06\cdot(P_{url}/P_{set})+0.01]$

* Non-linearity, hysteresis, non-repeatability accounted for.

Table 2.5 - AMZ 5450 accuracy

Gauge pressure		
P_{url}	Set range	Accuracy*, % of span
1.5 kPa	$P_{url}/5 \le P_{set}$	± 0.1
	$P_{url}/20 \le P_{set} <$ Purl/5	±[0.015·(P_{url}/P_{set})+0.025]
From 7.5 kPa to 40 MPa	$P_{url}/10 \le P_{set}$	± 0.075
	$P_{url}/40 \le P_{set} <$ Purl/10	±[0.00375·(P_{url}/P_{set}) + 0.0375]
	$P_{url}/100 \le P_{set} <$ Purl/40	±[0.00465·(P_{url}/P_{set}) + 0.0015]

Absolute pressure		
Purl	Set range	Accuracy*, % of span
from 37 kPa to 20 MPa	$Pn/10 \le P_{set}$	± 0.1
	$P_{url}/40 \le P_{set} <$ Purl/10	±[0.005·(P_{url}/P_{set}) + 0.05]
	$P_{url}/100 \le P_{set} <$ Purl/40	±[0.06·(P_{url}/P_{set}) + 0.01]

* Non-linearity, hysteresis, non-repeatability accounted for.

2.1.4 See tables 2.4-2.8 for temperature, line pressure and operation term effects.
Table 2.6 - Temperature, line pressure, operation term effects on AMZ 5050 accuracy

Medium temperature effect		
Purl	Set range	Temperature effect, % of span / 10 °C
1.5 kPa	$P_{url}/5 \le P_{set}$	±[0.075·(P_{url}/P_{set})+0.025]
	$P_{url}/20 \le P_{set} <$ Purl/5	±[0.05·(P_{url}/P_{set})+0.015]
7.5 kPa	$P_{url}/5 \le P_{set}$	±[0.04·(P_{url}/P_{set})+0.025]
	$P_{url}/40 \le P_{set} <$ Purl/5	±[0.03·(P_{url}/P_{set}) + 0.075]
From 37 kPa to 7000 kPa	$P_{url}/5 \le P_{set}$	±[0.01·(P_{url}/P_{set})+0.03]
	$P_{url}/100 \le P_{set} <$ Purl/5	±[0.012·(P_{url}/P_{set}) + 0.023]

Line pressure effect		
Purl	Line pressure effect	
	– on zero*	– on span
1.5 kPa	±0.1% URL / 1 MPa	±±0.2% MV** / 1 MPa
7.5 kPa	±0.03% URL / 1 MPa	±0.06% MV / 1 MPa
From 37 kPa to 7000 kPa	±0.005% URL / 1 MPa	±0.03% MV / 1 MPa

* Effect eliminated through calibrating zero when line pressure is at operational level.
** MV – measured value (relative accuracy).

AMZ 5050 - operation term effect	
Purl	Long term stability, normal operation conditions
1; 7.5	±0.2% URL / year
From 37 to 7000	±0.15% URL / 5 years

Table 2.7 - Temperature, line pressure, operation term effects on AMZ 5450 accuracy

Medium temperature effect		
Purl	Set range	Temperature effect, % of span / 10 °C
1.5 kPa	$P_{url}/5 \le P_{set}$	$\pm[0.075\cdot(P_{url}/P_{set})+0.025]$
	$P_{url}/20 \le P_{set} < P_{url}/5$	$\pm[0.05\cdot(P_{url}/P_{set})+0.015]$
7.5 kPa	$P_{url}/5 \le P_{set}$	$\pm[0.04\cdot(P_{url}/P_{set})+0.025]$
	$P_{url}/40 \le P_{set} < P_{url}/5$	$\pm[0.03\cdot(P_{url}/P_{set}) + 0.075]$
From 37 kPa to 40 MPa	$P_{url}/5 \le P_{set}$	$\pm[0.01\cdot(P_{url}/P_{set})+0.03]$
	$P_{url}/100 \le P_{set} < P_{url}/5$	$\pm[0.012\cdot(P_{url}/P_{set}) + 0.023]$

AMZ 5450 - operation term effect	
Purl	Long term stability, normal operation conditions
1.5 kPa to 7.5 kPa	±0.2% URL / year
From 37 kPa to 40 MPa	±0.15% URL / 5 years

See Table 2.8 for effect of external conditions on performance.

Table 2.8 - General characteristics of AMZ 5050 and AMZ 5450

Name	Value
Compensated	-20...+80 °C; -40...+60 °C (optional)
Power supply effect (rated supply voltage - 24 V ± 10%)	≤ ± 0.05% of span / 10 V
Load resistance effect	≤ ±0.5% of span / kOhm
Startup time (after powering the device, pressure snubbing at 0 s)	2 s max

2.1.5 See Table 2.9 for output signal parameters.

Table 2.9 - Output signal parameters

Name	Value (properties)
Number of analog measuring channels	one
Output signal	4 ... 20 mA (2-wire) / HART
Output signal emergency mode, current	3.6 mA or 21 mA
Power supply (Usupply)	from 9 to 44 V (DC) (*)
Load resistance	≤1500 Ohm (**)
Insulation strength	500 V
Galvanic insulation resistance	≥100 MOhm

(*) - Supply voltage ≥14 V when transmitter sends data via HART. Transmitter supply with backlight on ≥ 12 V / 17 V (no HART / HART).

(**) - Resistance ≥250 Ohm when transmitter sends data via HART.

2.1.6 Output signal variation - linear.

2.1.7 The device can have a display (see Table 2.10 for specifications).

Table 2.10 - Display specifications

Name	Value
Range of displayed values	-1999…+9999
Primary / secondary line height	7/5 mm
Displayed accuracy	0.1% of span ± low-order digit as % of span
Readings display time (with pressure snubbing off), max	0.2 s
Ambient temperature limits	-30(*) to +85 °C;

(*) - at temperatures below -30 °C the display shows no value and remains operational.

2.1.8 See Table 2.11 for design features.

Table 2.11 - Design features

Name	Value (properties)
Electrical connection	cable gland 1/2"- 14 NPT; cable gland M20x1.5
Pressure port	1/4" - 18 NPT int.; 1/2" - 14 NPT (with adapter).
Wetted parts	flanges, diaphragm, seals
Housing, flanges	stainless steel 316L (1.4404)
Diaphragm	stainless steel 316L (1.4435)
Seal	EPDM; FKM; NBR; PTFE
Mounting kit, mounting bracket	carbon steel, stainless steel
Ingress protection (GOST 14254)	IP67
Dimensions, mm, max	177×116×110
Weight, kg, max	3.5

2.1.9 See Table 2.12 for operation parameters.

Table 2.12 - Operation parameters

Name	Value (properties)
Vibration resistance (GOST R 52931)	V2 group
Impact resistance	random impacts acceleration up to 100 g, duration 11 ms
Sensor service life	> 100 × 106 loading cycles
Response time	≤ 200 ms

2.1.10 See Supplement E for Explosion protection parameters.

2.2 Operating conditions

The device was designed to function in the following conditions:

- enclosed explosion-proof or explosion-prone (according to explosion rating) spaces free from aggressive vapors and gases;
- atmospheric pressure from 84 to 106.7 kPa;
- ambient temperature from -50 to +85 °C;
- permissible media temperatures from -40 to +105 °C (depends on the seal type). Medium: gas, steam and liquids (including petroleum products) non-aggressive to structural materials of the device.

2.3 Operational limitations

Medium should be free from crystallizable impurities, contaminations and dust.

Connect the device where the medium is still or almost still and produces no vortices.

Never allow contamination of the diaphragm with silt, sand etc when mounting the device.

2.4 Electromagnetic interference resistance and emission

Electromagnetic emission: the device is a Class A equipment under GOST R 51318.22 (CISPR 22: 2006).

Electromagnetic interference resistance: the device is a class 3 equipment under GOST R 51317.4.3 (IEC 61000-4-3).

3 Design and operation

3.1 Structure

Figure 3.1 explains the principle of operation of the device. Analog-to-digital converter (ADC) receives a signal from the sensor and sends it to the microprocessor that filters, corrects and scales it, then delivers a value to the display and digital-to-analog converter (DAC), which outputs a normalized current signal 4 ... 20 mA with a HART digital signal. Digital and analog signals run to external devices simultaneously, through a single pair of wires.

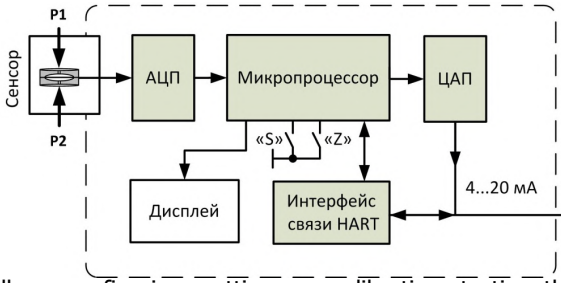


Figure 3.1. Block d - medium pressure)

HART protocol allows configuring, setting up, calibrating, testing the device and retrieving data describing process variables (in the current units of measurement).

3.2 Design features

The housing of the device is cast; see Figure 3.2. for its components. The housing includes:

1- display cover; 2 - display (turnable in 90° increments);
3 - locking screw (unscrewed to turn the housing);
4 – main body; 5 - local adjustment holes cover;

6 - cover screw; 7 - terminal board cover;
8 - plugs with drain valve (two plugs for differential pressure and three plugs for absolute pressure);
9 - internal (female) thread flanges, pressure port;
10 - flange bolts; 11, 12 - O-rings (seals);
13 - sensor (pressure sensitive element);
14 - threaded hole for housing ground screw;
15 - flange locking nuts.
16 – pressure port.
17 - adapter.

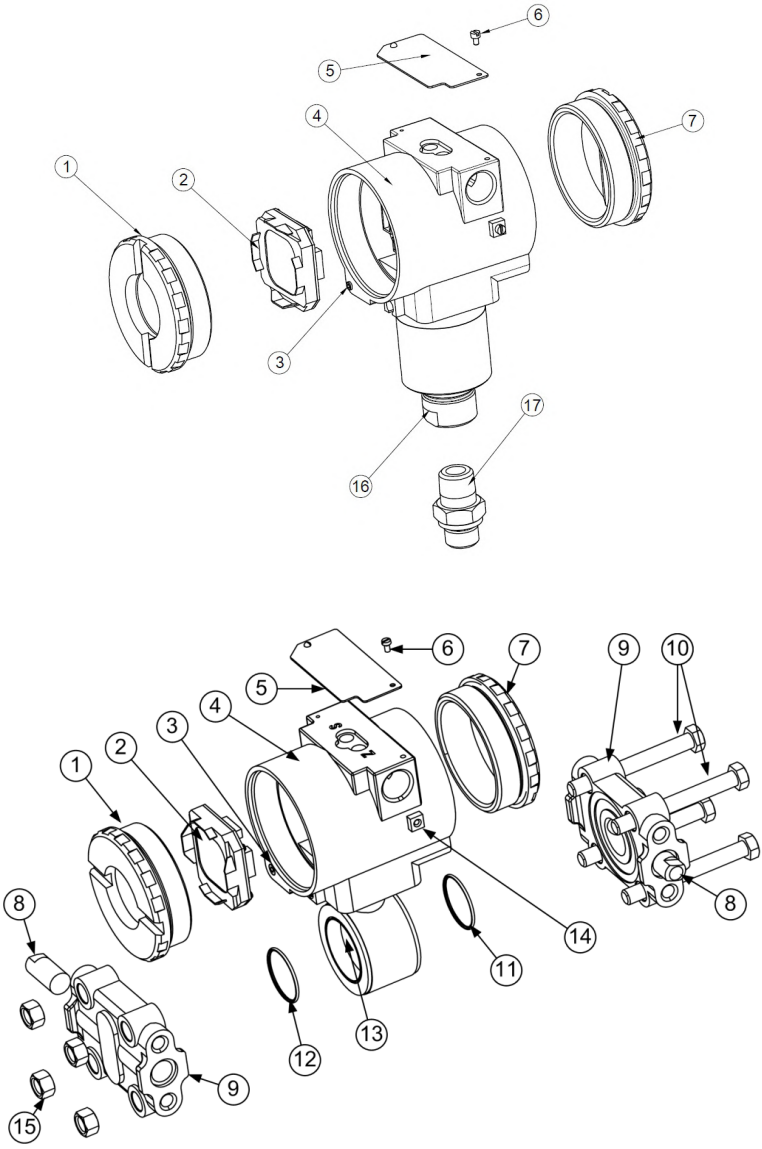


Figure 3.2 - Components of AMZ 5050, AMZ 5450

Signal cable enters the housing through the cable gland (½" NPT internal thread). There are slots for the cable gland on right and left sides of the housing; select one which simplifies device mounting. Unused slot receives a screwed-in metal plug.

The pressure-sensitive element is a capacitive sensor. Figure 3.3 is a simplified drawing of this sensor. It consists of a central diaphragm in a profiled cavity filled with fill liquid (silicone oil). With the two metallized surfaces of the profiled cavity, the diaphragm forms two capacitors that share a movable central plate. Through the diaphragm seals and the fill liquid, medium pressure reaches the central diaphragm, which leads to bidirectional changes in capacitance of the capacitors (proportionally to the measured pressure). These changes are converted into a normalized electrical signal.

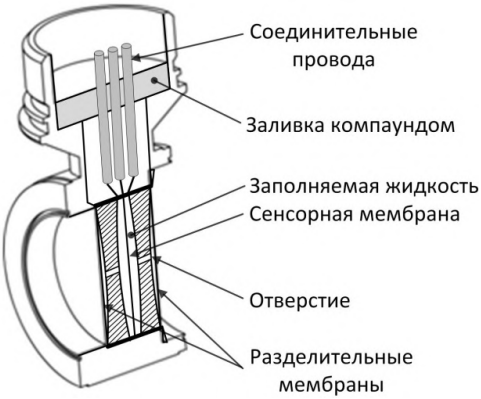
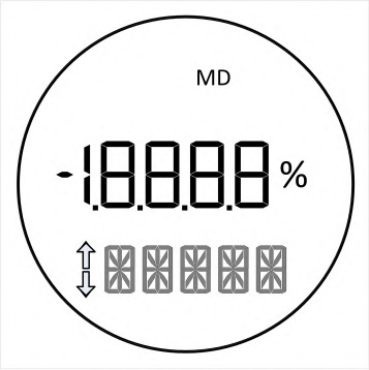


Figure 3.3 - Capacitive sensor design

3.3 Built-in display

There is an LCD display on the front side of the device. See Figure 3.4 for description of its elements.



Device controller operation mode:
< MD - address mode active (address not equal to 0).

< Measured pressure value (in selected units or % of span).

< Units of measurement, UoM (menu items in setup mode).

Figure 3.4 - Display elements

The display can show one or two values (e.g., measured pressure and output current, with UoM attached). Each of the values is displayed for 3 seconds. The display also shows system codes (see Table 3.1).

Table 3.1 - System codes

Error code	Description
0864	Sensor is disconnected; check the connection between sensor cable and electronic unit
0080	Sensor malfunctions
0040	Built-in temperature sensor malfunctions. The device continues to measure pressure, but the accuracy may deteriorate.
********	Other codes require professional assistance; contact manufacturer for their interpretation.

Error code are shown at start-up, when the device receives power.
NOTE: Manufacturer reserves the right to modify the design and circuitry of the device without degrading its performance.

4 Safety precautions

4.1 The source of danger associated with pressure transmitters, their mounting and/or operation, is the medium, which is typically under pressure. Always close the valve up the medium line when mounting or disconnecting pressure transmitters. Disconnect the transmitter only after medium pressure equalizes with atmospheric pressure.

4.2 GOST 12.3.019, "Consumer Electrical Installations Operation Rules" and "Safety Rules For Consumer Electrical Installations Operation" must be observed when operating, servicing and calibrating the devices.

4.3 The electric shock hazard class of the device is III (no dangerous voltage); see GOST 12.2.007.0 for full classification.

4.4 Only qualified specialists that have read and understood this manual are allowed to mount, connect, adjust, calibrate, do maintenance on the device.

NEVER use the device with aggressive media, i.e. media containing acids, alkalies, oils etc.

4.5 Following documents regulate mounting of explosion-proof transmitters: GOST R IEC 60079-0, GOST R IEC 60079-14, other documents regulating use of electrical equipment in explosive environments.

ATTENTION! You must adhere to "Rules of Performing Hot Works in Explosion Hazard Zones or Outside of Explosion Hazard Zones" when adjusting output signal of a device housed in flameproof enclosure.

5 Mounting instructions

5.1 General requirements

5.1 Only trained specialists that have read and understood this manual are allowed to mount and operate the transmitter.

5.1.2 Ex versions of transmitters can be used in explosion hazard zones IIA, IIB, IIC, as prescribed by regulations setting framework for application of electrical equipment in explosion hazard zones.

5.1.3 Always check the exterior of the device before mounting it. Check for visible mechanical damage and see if the Ex markings match the zone's category and class. The transmitter's surface must be dry and clean.

5.1.4 Connect or disconnect the transmitter to/from the medium only when its pressure equalizes with atmospheric pressure; alternatively, close valve up the medium line. Valves simplify routine control and maintenance operations.

5.1.5 Install the device with maintenance convenience in mind (incl. mounting, dismantling). The device can be mounted directly on a process pipeline with the help of U or T brackets (see Figures B.2 and B.3, Appendix B).

NOTE: We recommend mounting the device vertically or horizontally.

5.1.6 The display's orientation is adjustable, you can position it the way you need to simplify reading the values shown. The movement increment is 90°; to adjust the display's orientation along the axis perpendicular to its plane, remove the cover first and then move the display; to adjust the display's position along its vertical axis, loosen the locking screw at the base of its outdoor housing.

5.1.7 Connect or disconnect the transmitter to/from the medium only when its pressure equalizes with atmospheric pressure; alternatively, close valve up the medium line. Two valves located before the device on the line simplify routine control and maintenance operations.

5.1.8 Reliable operation of the device requires finding correct spots to connect pressure take-off tubes to. The tubes should run the shortest distance possible. We recommend connecting them where the medium flows slowest and there are no vortices, i.e. to straight runs of pipe as far away from valves, hydraulic units etc as possible.

5.1.9 If the medium is gaseous, position the transmitter so that the pressure take-off tubes slope up uniformly (≥ 1:10) to the device and slope down if the medium is liquid. In case such installation positions are impossible, mount settling vessels at lower portions of pressure take-off tubes for gaseous media and gas holders at their higher portions for liquid media.

5.1.10 The most expedient way to connect the transmitter to medium is through a triple valve block, which allows cutting off the medium and equalizing the pressure at inputs for calibration (Figure 5.1).

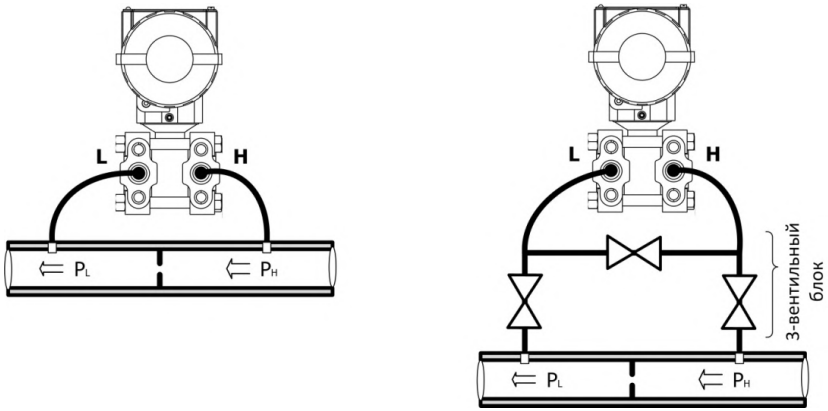


Figure 5.1. Mounting transmitter to measure pressure of liquid medium (examples).

See Figures 5.2 and 5.3 for more application variants. Typically, when measuring pressure of liquid media (metering it), take-off tubes connect to the top or side of the pipeline.

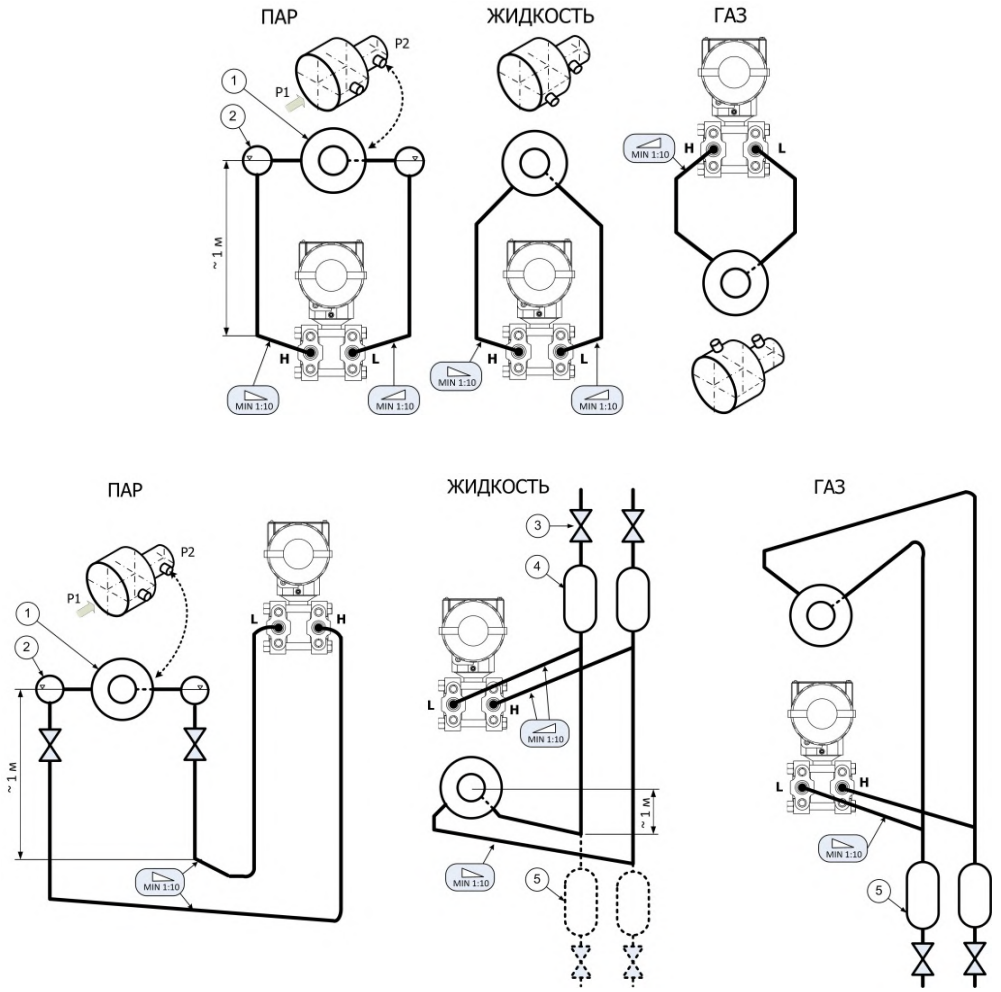
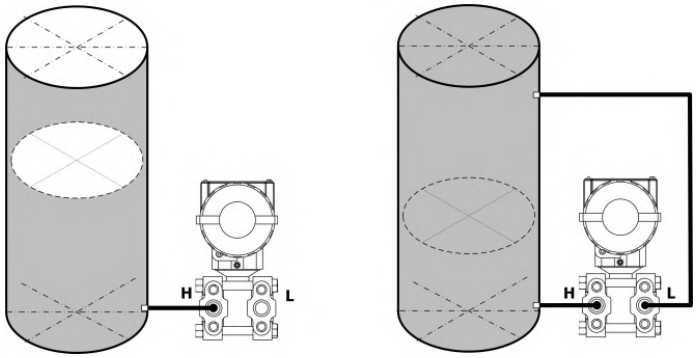


Figure 5.2. Examples of connecting tubes to measure pressure of steam, gas or liquid. 1 - pressure take-off; 2 - condensing vessel; 3 - valve; 4 - gas holder; 5 - condensate settling vessel



A) open vessel B) closed vessel

Figure 5.3 - Connection of the transmitter to a process vessel (examples)

ATTENTION! Take measures to prevent low pressure (reference atmospheric pressure) input port clogging when using AMZ 5050 as a gauge pressure transmitter. Mount the device to allow unhindered contaminants drainage.

5.1.11 Connect the device to a DC power source; max permissible voltage ripple is 0.5%.

5.1.12 Always cut off power when connecting the device's circuits.

5.1.13 Remove the cover and connect the circuits as shown on diagrams (Supplement B) through the cable gland. Mind the polarity when connecting the circuits.

NOTE: transmitters come with reverse polarity protection.

5.1.14 Use a shielded copper cable with insulating jacket when mounting the device.

5.1.15 Stable communication via the HART protocol requires a shielded twisted pair or a special cable; minimal cross-section -- 0.2 mm2, maximal length -- 1500 m).

5.1.16 Ground the cable at the receiving side only (at load resistance of the line).

5.1.17 Always ground the device's housing.

5.1.18 Use a fitting circular cross-section wire to make the cable gland seal reliable. The default cable gland supplied accepts cables with the diameter of 6 to 11 mm.

NOTE: shut off the unused cable gland with the plug (supplied) when connecting through one gland only.

5.1.19 Prevent moisture from getting into the housing. Screw in all covers tightly when done mounting to seal the device.

5.1.20 See Figure 5.4 for cable positioning recommendation.

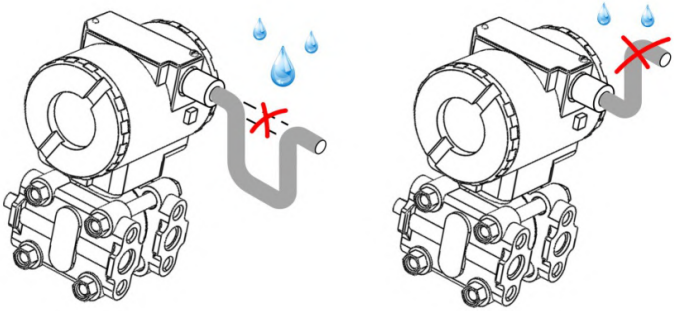


Figure 5.4 - Cable entry

5.1.21 Do not run signal cables through a conduit/channel together with power cables; avoid running signal cables next to powerful electrical equipment.

5.2 Explosion protection

5.2.1 Ex versions of transmitters can be used in explosion hazard zones and outdoor installations rated B-I and B-II, temperature classes T1 ... T4, as prescribed by regulations setting framework for application of electrical equipment in explosion hazard conditions.

5.2.2 Please observe the following documents when mounting the device:

- Electrical Installations Code, Chapter 7.3 "Electrical Installations in Explosion Hazard Zones";

- Electrical Equipment Operation Rules, Chapter 3.4 "Electrical Installations in Explosion Hazard Zones";

- GOST R IEC 60079-0;

- GOST R IEC 60079-11;

- VSN332-74 Installation of Electrical Equipment, Power and Lighting Lines in Explosion Hazard Zones: Instructions.

6 Setup

6.1 Factory settings

Factory settings follow the ordering code submitted by the customer. You can find values of the most important settings in the device's passport. Values of other settings are as follows.

- output signal increases linearly, in proportion to inlet pressure;

- pressure snubbing time - 0 s;
- displays: 1st display shows pressure in selected units of measurement; 2nd display doubles the 1st display;
- HART address - 0 (can be set to a number from 1 to 15 to enable multichannel communication);
- HART protocol version - 7.

NOTE: use a HART communicator to learn the software version and other configuration parameters.

Operational parameters of the device can be adjusted to best fit the operating conditions. Supplement C contains connection diagrams; follow them to connect the device and adjust settings. See table 6.1 for positions of setup mode switches (Figure C.1, Supplement C) allowing adjustment of operation parameters.

Table 6.1 - Positions of setup mode switches

Contact status		Settings mode
1	2	
OFF	OFF	Configuration via HART not allowed. Manual configuration not allowed.
OFF	ON	
ON	OFF	HART configuration enabled. Manual adjustment of URL and LRL with supply of reference pressure.
ON	ON	HART configuration enabled. Manual adjustment of all parameters via the menu.

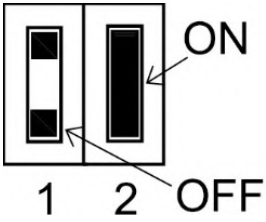


Figure 6.1 - Switch on contacts 2

6.2 Zero and scale adjustment - device without display

This procedure allows cross-referencing device readings with accurate input pressure. First, supply reference pressure equal to URL or LRL to the transmitter and wait for it to stabilize.

NOTE: for the duration of the procedure, make the 1st setup mode switch ON and the 2nd one OFF.

Next:

- remove the top cover and insert magnetic pen into hole Z or S (Figure 6.2);

Figure 6.2. Location of Z (zero) and S (span) controls, local configuration

- in 2 seconds, the output signal is 4 mA / 20 mA;
- remove the magnetic pen and put the cover back on.

6.3 Local configuration - device with display

NOTE: for the duration of the procedure, make the 1st setup mode switch ON and the 2nd one ON.

Configuration process:

- remove the top cover and insert magnetic pen into hole S (Figure 6.3); the device switches to the operation parameters setup mode, display shows one of the menu items;

- insert the magnetic pen into hole Z to browse the menu, find the menu item you need (see Supplement D for list of adjustable parameters);

- insert the magnetic pen into hole S to select the menu item;

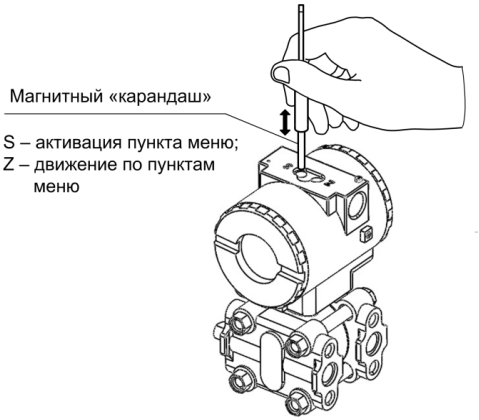


Figure 6.3. Local configuration process

- remove the magnetic pen and put the cover back on to have the device switch back to the operating mode.

To configure or adjust the parameters, proceed as follows.

URL and LRL values setup:

- shut off pressure at the device's inlet;

- Select LRV/URV (up and down arrows) in the tOP RANGE menu, set the values in units selected in rAnG UNIT menu. The arrow indicates the direction in which the value changes when a magnetic screwdriver is put into hole S. If it points up, the values will increase, down - decrease.

Configuration. Setting URL/LRL with reference pressure supplied:

- supply pressure equal to URL or LRL to the transmitter's inlet, wait for it to stabilize;

- select LRVP/URVP in the tOP RANGE menu; the output signal is set at 4 mA/20 mA, accordingly.

The output signal is shown as % of span: 0% is 4 mA, 100% – 20 mA.

Configuration. Pressure snubbing:

- select dAMP item in the tOP RANGE menu (with up or down arrow);

- set its value (within the range from 0 to 128 s).

This function allows smoothing out output signal fluctuations when the medium pressure drops or spikes abruptly for very short periods of time.

Configuration. Units of measurement:

- select rAnG UNIT item in the tOP RANGE menu;

- select the needed unit of measurement in from the list (see Table D.1, Supplement D).

Adjustment of parameters

To adjust parameters of the device, find the needed item in the tOP TRIM menu (ZTRIM/LTRIM/UTRIM) and select it when the inlet pressure is right.

6.4 Setup using HART communicator

Portable HART communicator allows adjusting operating parameters of the device. See figures C.5-C.8 (Supplement C) for the communicator connection diagrams.

Note: HART-communicator can be connected to the device at any point of the current loop; the resistance of the circuit between communicator connection points should always be at least 250 Ohms.

We recommend using universal HART-communicators, e.g., HART 375 Communicator BR.

See Supplement E for features of HART 375 Communicator.

6.5 Setup using PC and HART modem

Portable HART communicator allows adjusting operating parameters of the device remotely. See figure C.3 (Supplement C) for communicator connection diagrams.

We recommend using HART modems MH-02, ESH232U etc.

7 Operation

7.1 Write down the date the device was put into operation into its passport.

7.2 Routine checkups of the device in operation follow data specified in its passport. See the device's passport for its calibration interval.

7.3 Write down notes describing operation of the device into its passport: routine checkups, malfunctions etc.

DO NOT:

1. **allow voltage exceeding maximum specified for the transmitter;**
2. **use any objects to touch or otherwise apply mechanical force to the diaphragm;**
3. **use transmitters bearing visible signs of mechanical damage;**
4. **use transmitters in inappropriate climatic conditions;**
5. **allow medium temperatures above or below the limits specified for the transmitter.**

7.4 All and any repairs are done by the manufacturer exclusively.

7.5 The manufacturer refuses all claims, reclamations, complaints related to devices with damaged manufacturer seals and showing signs of damage resulting from inappropriate operation, transportation or storage.

8 Maintenance

8.1 Always follow safety precautions described in section 3 when doing maintenance.

8.2 Routine maintenance frequency - at least once every 6 months; it includes removal of dust and dirt and inspections. Check:

- integrity of the housing, corrosion, dents and visible mechanical damage;

- reliability of screw connections and mounting;

- signs of loss of tightness in the pressure supply lines;

- integrity of insulation of the connecting electrical cables.

- grounding (grounding bolts should be rust-free and tightened - clean and tighten if necessary);

- electrical contacts of the terminal block (should be intact; tighten the terminal block screws if necessary);

– seal of the supply cable.

8.3 Check the diaphragm (it should be clean) and electrical connections on a regular basis after putting the transmitter into operation. Never apply high pressure to the transmitter when cleaning it.

8.4 Drainage valves in the sensor flange plugs enable purging its chambers and draining condensate.

ATTENTION! Never purge connection lines through the transmitter.

8.5 When switched on, the device self-tests. If everything is in working order, its current is set to match the measured pressure. Malfunctions (related to data or system) are detected by the integrated controller. If a malfunction is detected (at startup or during operation), the device outputs a constant current as provided in Table 8.1 and records messages to the logs (see Table 3.1).

8.6 There may occur malfunctions requiring intervention during operation of the device. Table 8.1 contains the relevant troubleshooting information.

8.7 Contact the manufacturer for guidance in case a specific malfunction is not covered in Table 8.1.

8.1 Troubleshooting

Condition	Remedy
1. Output signal lacking	Check the power source connection polarity; change if necessary.
	Check for voltage at the power terminals; provide power if necessary
2. The device is unaccessible via the HART protocol	Check voltage at the terminals; take measures to ensure its stability, if necessary
	Check the supply circuit load resistance; correct it if necessary (min. value - 250 Ohms)
	Check if the HART address used is correct
	Check operability of the HART modem
3. Output current >20 mA or <3.8 mA	The device switched to the FAILURE mode; switch it off, wait 5...10 seconds and switch it on again
	Check the medium pressure
4. The device does not respond to changes of pressure at the input	Check for blockages in the tubes delivering pressure to the sensor; restore them to the working order if necessary.
	Check if the input pressure is within the span; readjust span or replace with a model covering the span needed if necessary
5. Output signal unstable, accuracy below limits	Check sealing of pressure supply line and sensor; tighten plugs, replace sealing ring if necessary.
	Switch on the electronic pressure snubber (Settings) if medium pressure fluctuates. Replace with a working device if medium pressure is stable

9 Marking and packaging

9.1 You can identify the device by its marking. It is sticker that bears the following information:

- name of the manufacturer;
- code of the device;
- measured pressure range;
- output signal range;
- rated supply voltage and its type;
- rated power consumption;
- electric shock protection class (GOST 12.2.007.0);
- ingress protection rate (GOST 14254);
- serial number and production date;
- numbers of circuit terminals (for connector);
- bar code (QR code);

Stickers on Ex versions also bear:

- number of the certificate of conformity;
- type of explosion protection: 0Ex iaIIC T4 Ga X, 1Ex d IIC T5, T6 Gb X;
- explosion protection of electrical circuits.

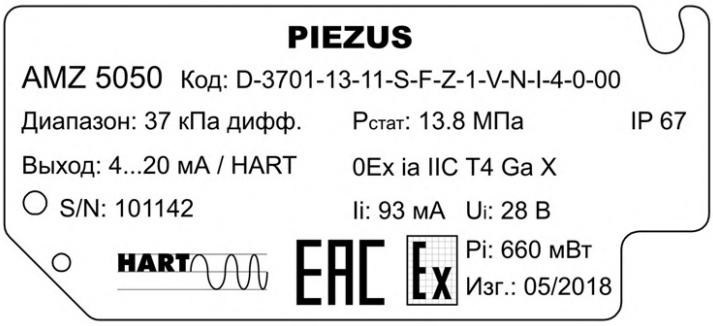


Figure 9.1. Main technical specifications on the sticker

9.2 There is a grounding mark on the body of the device near grounding wire holes.

9.3 The device is delivered in a corrugated cardboard container. Mailed package complies with GOST 9181.

10 Package contents

See Table 10.1 for the delivery package contents.

Table 10.1 - Package contents

Name	Quantity
AMZ 5050 or AMZ 5450 pressure transmitter	1 pc
Passport	1 copy
Operation manual (abridged)	1 copy*
Local setup tool (magnetic pen)	1 pc**
Mounting bracket (ordering code: 1 - U-shaped, 2 - T-shaped)	1 pc**
Fasteners	1 set**
Explosion-proof transmitters: Standard - explosion-proof cable gland KHB1NHK / FEC1NB for un-armored cable (cable diameter 6-12 mm, 1/2 NPT) On request - explosion-proof cable gland KOB1NHK / FECA1NB for armored cable (cable diameter 6-12 mm, armor diameter 9-17 mm, 1/2 NPT) **Regular transmitters (no explosion protection):** Plastic cable gland NPA21-10G (cable diameter 6-11 mm, 1/2 NPT)	1 set
Calibration leaflet (CM 62291-15)	1 copy**

* 1 copy per 10 transmitters for batch supplies to the same address. You can request a hard copy of the comprehensive Operation Manual to be included into the package or download it from www.piezus.ru.

** Supplied on request.

11 Transportation and storage

11.1 Use roofed transport to deliver transmitters to any destination needed; place individual packages into shipping containers if required.

11.2 Protect devices from impacts and vibrations while in transit; permissible temperature for transportation in shipping containers ranges from -40 to +85 °C.◦

11.3 Store devices in shipping containers in a heated (+5 to +40 °C) ventilated space. The air in the space should be devoid of dust, acid and alkali vapors or corrosive gases (GOST 15150 group 1).◦

12 Manufacturer's warranty

12.1 Manufacturer's warranty covers 24 months from the date of sale.

12.2 If the device fails during the warranty period, the manufacturer shall repair or replace it free of charge, provided the customer observes the rules of transportation, storage, mounting and operation.

12.3 Please send your repairs-related inquiries to the address specified at www.piezus.ru.

13 Resource and service life

13.1 Operating mode: continuous.

13.2 Mean time between failures: 120,000 h.

13.3 Service life - 12 years (normal working conditions: non-aggressive medium, temperature at +23 ± 3 °C, no vibrations and shaking).

14 Disposal

14.1 The device contains no precious metals.

14.2 Dispose of as prescribed by regulations adopted by the operator.

SUPPLEMENT A Ordering Information

AMZ 5050 ordering code

AMZ 5050	-X	-XXXX	-XX	-XX	-X	-X	-X	-X	-X	-X	-X	-X	-X	-XX
PRESSURE TYPE														
differential	**D**													
absolute	**A**													
gauge	**G**													
UPPER RANGE LIMIT (a.k.a "upper range value").														
1.5 kPa		**1500**												
7.5 kPa		**7500**												
37 kPa		**3701**												
187 kPa		**1872**												
690 kPa		**6902**												
2000 kPa		**2003**												
7000 kPa		**7003**												
LINE PRESSURE/OVERPRESSURE														
1 MPa (URL of 1.5 kPa)			**01**											
4 MPa (URL of 7.5 kPa)			**04**											
13.8 MPa (URL ≥187 kPa)			**13**											
DIAPHRAGM MATERIAL/fill liquid														
316L steel / silicone oil				**11**										
FLANGE MATERIAL														
316L stainless steel					**S**									
SEALS														
FKM						**F**								
NBR						**N**								
EPDM						**E**								
PTFE						**P**								
ACCURACY														
0.075% (transmitters with URL of 7.5 to 7000 kPa)							**Z**							
0.1% (transmitters with URL of 1.5 kPa and absolute pressure transmitters)							**A**							
DISPLAY														
no								**0**						
available								**1**						
DRAIN VALVES LOCATION														
no drain valves									**V**					
opposite pressure ports									**A**					
ELECTRICAL CONNECTION														
cable gland 1/2"- 14 NPT										**N**				
cable gland M20x1.5										**M**				
OUTPUT SIGNAL														
current 4 ... 20 mA / HART											**H**			
4...20 mA / HART / 0Ex ia IIC T4 Ga X											**I**			
4...20 mA / HART / 1Ex d IIC T5, T6 Gb X											**P**			
PRESSURE PORT														
1/2" - 14 NPT (with adapters)												**2**		

1/4" - 18 NPT (standard)	**4**		
MOUNTING KIT			
no fasteners		**0**	
U-shaped bracket		**1**	
T-shaped bracket		**2**	
VERSION			
standard			**00**
special			**99**

Example: AMZ 5050-D-7003-13-11-S-F-A-1-V-N-H-2-1-00.

Supplement A - Continued

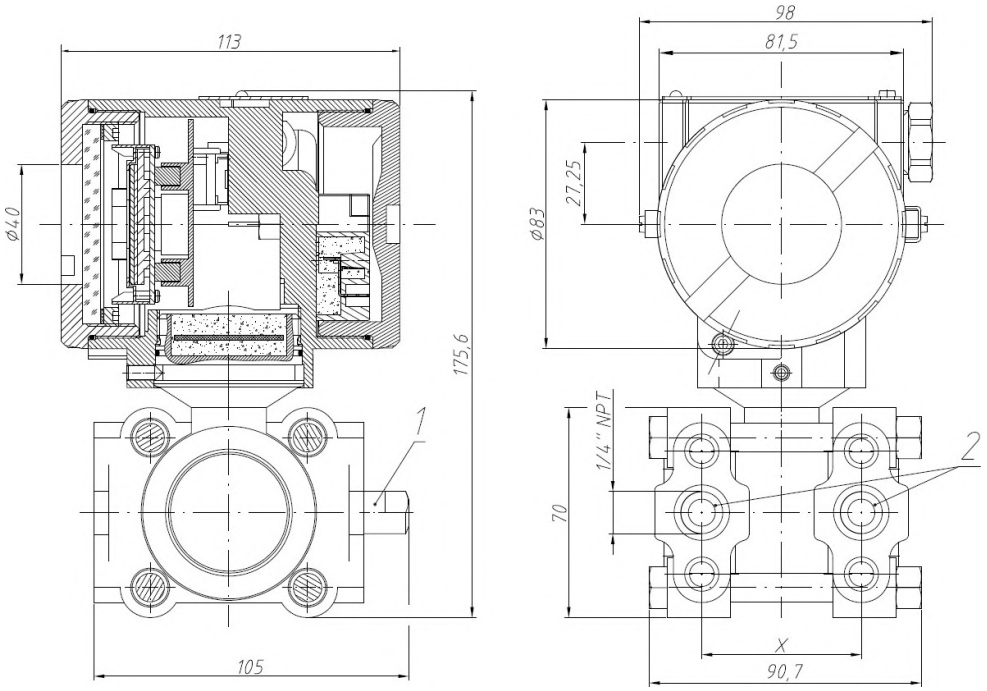
AMZ 5450 ordering code

AMZ 5450	-X	-XXXX	-XX	-X	-X	-X	-X	-X	-X	-X	-X	-X	-XX
PRESSURE TYPE													
absolute	**A**												
gauge	**G**												
UPPER RANGE LIMIT (a.k.a "upper range value").													
Gauge / Absolute													
1.5 kPa / –		**1500**											
7.5 kPa / –		**7500**											
37 kPa / 37 kPa		**3701**											
187 kPa / 187 kPa		**1872**											
690 kPa / 690 kPa		**6902**											
2 MPa / 2 MPa		**2003**											
7 MPa / 7 MPa		**7003**											
20 MPa / –		**2004**											
DIAPHRAGM MATERIAL/fill liquid													
steel/silicone oil			**11**										
PRESSURE PORT MATERIAL													
316L stainless steel				**S**									
SEALS													
FKM only for mechanical DIN connections					**F**								
NBR only for mechanical DIN connections					**N**								
EPDM only for mechanical DIN connections					**E**								
without sealing (standard)					**W**								
ACCURACY													
0.075% (transmitters with URL of 7.5 to 7000 kPa)						**Z**							
0.1% (transmitters with URL of 1.5 kPa and absolute pressure transmitters)						**A**							
DISPLAY													
No							**0**						
Yes							**1**						
ELECTRICAL CONNECTION													
cable gland 1/2"- 14 NPT								**N**					
cable gland M20x1.5								**M**					
OUTPUT SIGNAL													
current 4 ... 20 mA / HART									**H**				
4...20 mA / HART / 0Ex ia IIC T4 Ga X									**I**				
4...20 mA / HART / 1Ex d IIC T5, T6 Gb X									**P**				
PRESSURE PORT													
1/2" - 14 NPT internal thread (standard)										**2**			
M20x1.5 EN 837 (with adapter)										**5**			

M20x1.5 DIN 3852 (with adapter)	**6**			
G1/2" EN 837 (with adapter)	**7**			
G1/2" DIN 3852 (with adapter)	**8**			
MOUNTING KIT				
no fasteners		**0**		
pipe bracket		**1**		
VERSION				
standard			**00**	
special			**99**	

Example: AMZ 5450-G-7003-11-S-F-A-1-N-H-2-1-00.

SUPPLEMENT B Overall housing dimensions



* Reference size (depends on X dimension)

AMZ 5050:

Unit of measurement	kPa					MPa	
URL	1.5	7.5	37	187	690	2	7
Dim. X, mm	54				55	56	57

Figure B.1 - AMZ 5050 housing dimensions
(1 - plug; 2 - inlet pressure ports)

As an option, the delivery package may include a bracket (see Figures B.2 and B.3) to mount the device onto a vertical surface or a pipe.

Supplement B - Continued

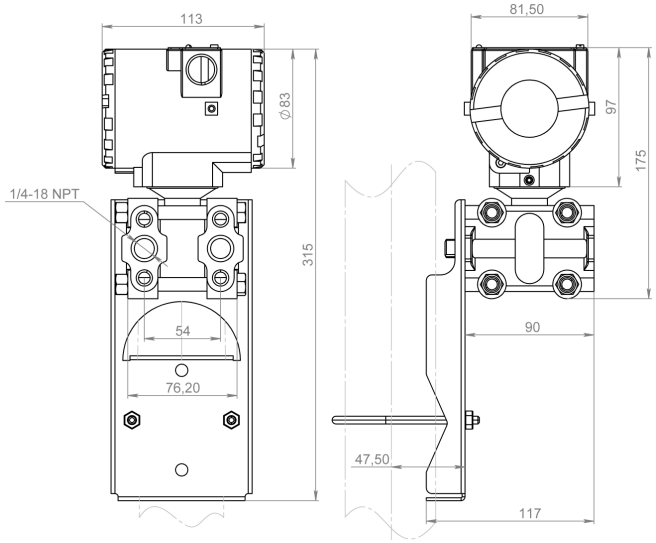


Figure B.2 - Mounting AMZ 5050 to a 2" pipe, straight bracket

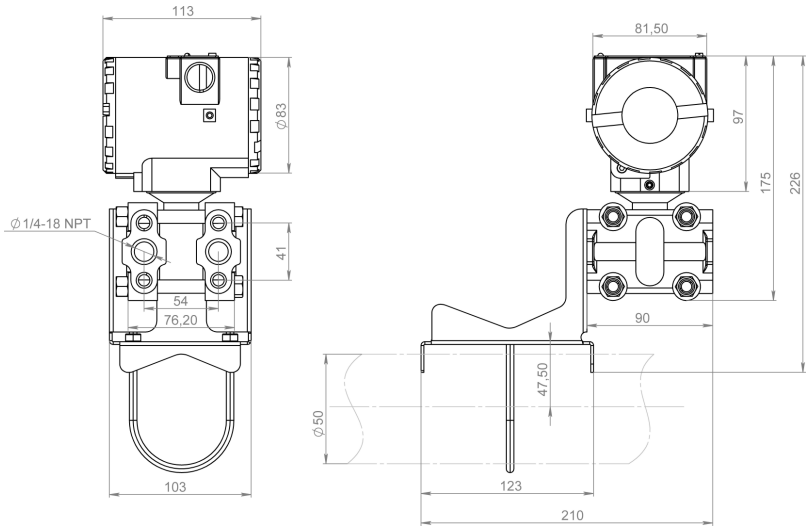


Figure B.3 - Mounting AMZ 5050 to a 2" pipe, angle bracket

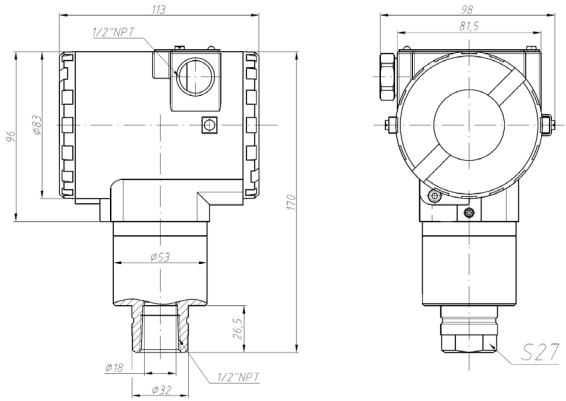


Figure B.4 - AMZ 5450 housing dimensions

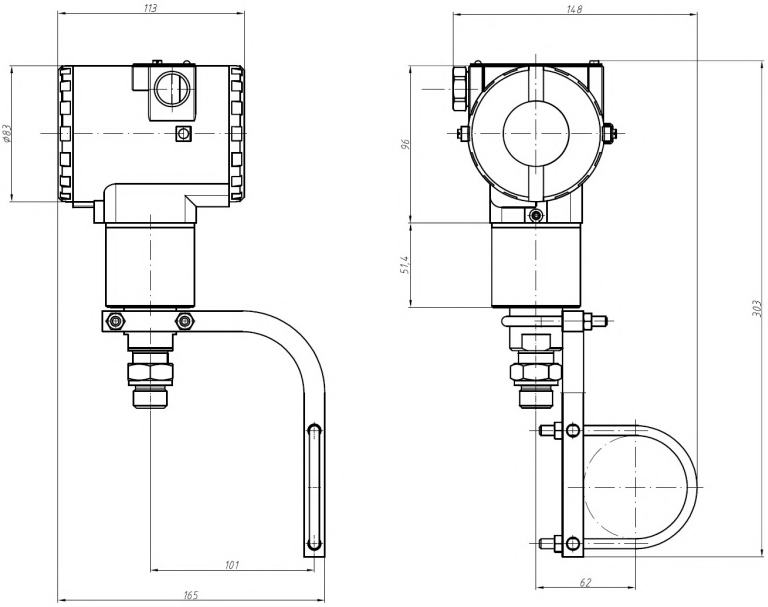


Figure B.5 - Mounting AMZ 5450 to a 2" pipe, angle bracket

SUPPLEMENT C Connection diagrams

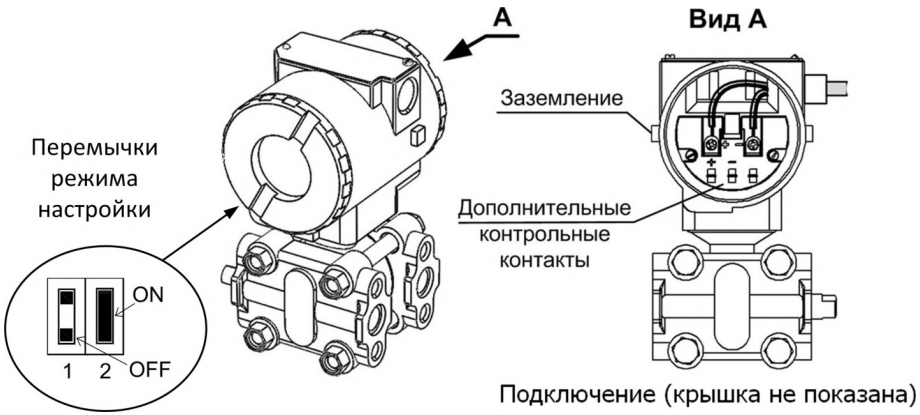


Figure C.1 - Terminal board contacts and setup mode switches (covered)

Explosion-proof zone

Connect the HART communicator to set up the device (see Figure C.2).

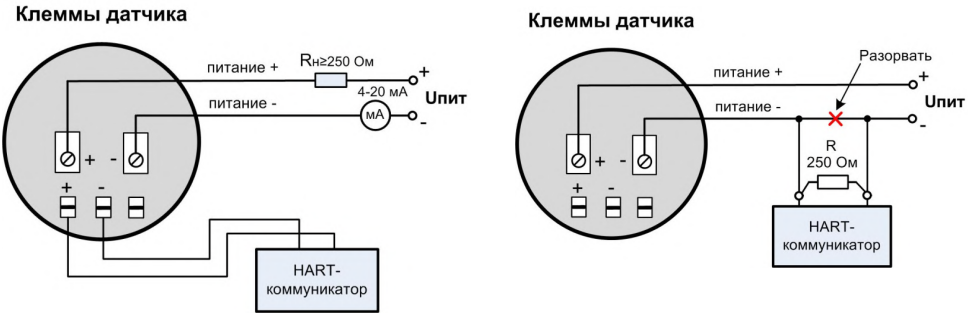
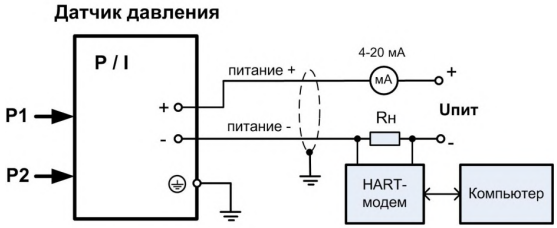


Figure C.2 - HART communicator connection diagrams

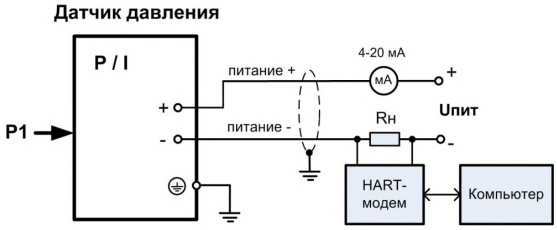
See Figure C.3 for HART modem connection instructions (when the device operates in an explosion-proof zone).

Supplement C - continued



2-проводная линия (вых. сигнал – ток и HART)

а) AMZ 5050



2-проводная линия (вых. сигнал – ток и HART)

б) AMZ 5450/5050

Figure C.3 - Electrical connections diagram

Connecting several devices to one circuit

You can connect up to 15 devices to a single circuit. Multichannel mode requires each device having its individual communication address, a numerical value from 1 to 15 (address set at the factory - 0).

You can change the addresses via the HART protocol, using a portable HART communicator or a HART modem and a PC (see Supplement E).

When in multichannel mode, the device stops outputting analog signal; its value is fixed at 4 mA. The measured values are digitalized and transmitted to the computer; the devices are polled sequentially. Figure C.4 is a diagram depicting connection of a cluster of devices to a single power circuit.

Supplement C - continued

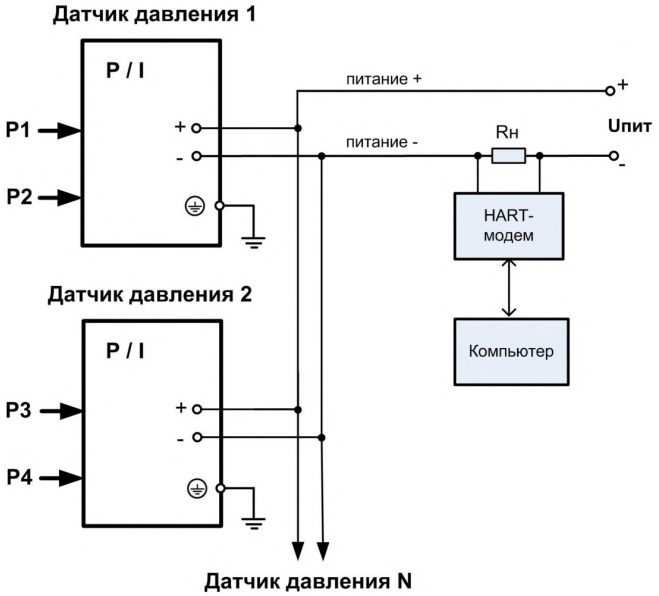


Figure C.4 - Connection of several AMZ 5050/AMZ 5450 transmitters to a singe power circuit (P1-P4 - medium pressure)

HART communicator connection

See Figure C.5 for typical HART-circuit connection; see Figures C.6-C.8 for options.

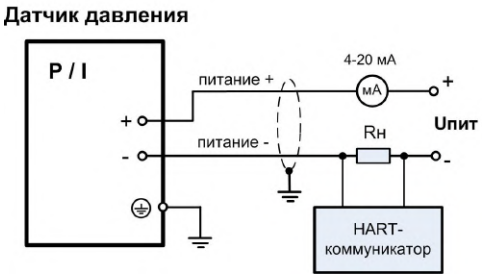


Figure C.5 - HART communicator connection to AMZ 5050/5450

Supplement C - continued

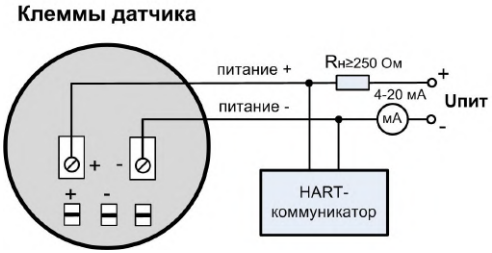


Figure C.6 - HART communicator connection directly to communication terminals

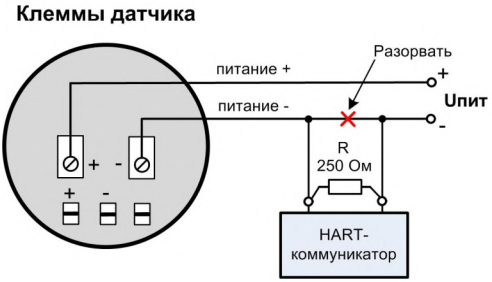


Figure C.7 - HART communicator connection to the additional checking contacts on the housing

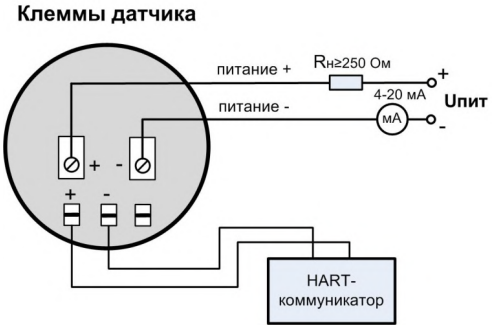
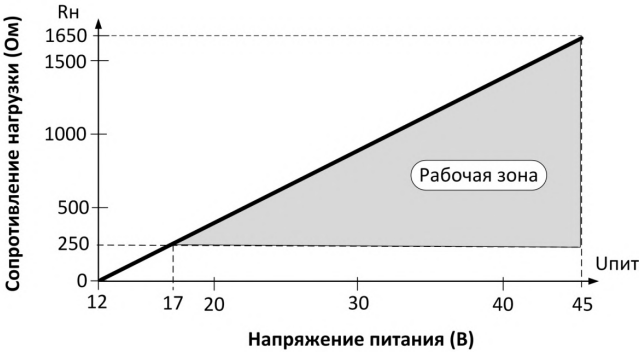


Figure C.8 - HART communicator connection with a temporal load resistor (250 Ohm) at the input

Supplement C - continued

Both regular and explosion-proof versions of the device are powered by a 17 to 45 V DC power source. The permissible load resistance (Rl) for the 4–20 mA output signal should be from 250 to 1650 Ohm (Figure C.9).



Output signal function

During operation, the device registered linear-increasing connection between output signal and pressure measured (Figure C.10). The output current value Iout is derived from the formula

$$I\text{выхмА} = 4\text{мА} + 16\text{мА} \times \text{P} - \text{РНПИРВПИ} - \text{РНПИ}\,, \qquad (1)$$

where P - difference of medium pressure at inputs P1, P2;

P_{lrl} – lower range limit pressure;

P_{url} – upper range limit pressure;

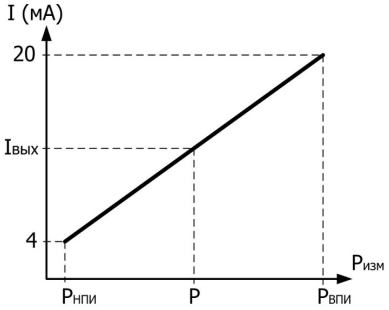


Figure C.10 - Output signal (current) alteration depending on the input pressure (P)

SUPPLEMENT C List of configurable parameters

Menu item			Function
tOP RANGE			Values adjusted and set up:
	rAnG UNIT		Browse through the menu items with button "S", select with button "Z":
		Unit kPa	- selection of the unit of measurement (Table D.1, button "Z")
	↑LRV		- setting the lower range limit, LRL (a.k.a "lower range value"). The up / down arrow indicates the direction in which the value changes when selected with button "S"
	↓LRV		
	↑URV		- setting the upper range limit, URL (a.k.a "upper range value"). The up / down arrow indicates the direction in which the value changes when selected with button "S"
	↓URV		
	↑SPAN		- setting the measurement range (difference between the URL and LRL). The arrow indicates the direction in which the values change when selected with button "S"
	↓SPAN		
	LRVP		- setting LRL with reference pressure
	URVP		- setting URL with reference pressure
	↑DAMP		- setting the pressure snubbing time (values from 0 to 128 s); setting the output signal averaging time. The arrow indicates the direction in which the values change when selected with button "S"
	↓DAMP		
	rAnG RESET		Reset all settings to factory settings
	rAnG SAVE		Save changed settings
	rAnG ESC		Quit to main menu without changing settings
tOP TRIM			Parameters adjustment*:
	PSWD		- password setup (set to "1" at the factory)
	ZTRIM		- zero adjustment
	↑LTRIM		- LRL adjustment (measured value of LRL). The arrow indicates the direction in which the values change when button "S" is pressed
	↓LTRIM		
	↑UTRIM		- URL adjustment (measured value of URL). The arrow indicates the direction in which the values change when button "S" is pressed
	↓UTRIM		
	triin RESET		Reset all settings to factory settings
	triin SAVE		Save changed settings
	triin ESC		Quit to main menu
tOP DISP			Displayed values setup*:
	Lcd LCD1		First screen (displayed for 3 seconds):
		Lcd1 PR	- pressure in selected UoM
		Lcd1 PR%	- pressure in % of span
		Lcd1 CURR	- output current in mA
		Lcd1 TEMP	- temperature in °C
		Lcd1 ESC	Quit screen 1 submenu

* Browsed with button "Z", selected with button "S".

Supplement D - continued

Menu item			Function
	Lcd LCD2		Second screen (displayed for 3 seconds):
		Lcd2 PR	- pressure in selected UoM
		Lcd2 PR%	- pressure in % of span
		Lcd2 CURR	- output current in mA
		Lcd2 TEMP	- temperature in °C
		Lcd2 NULL	- zero value
		Lcd2 ESC	Quit screen 2 submenu
	Lcd SAVE		Save changed settings
	Lcd ESC		Quit to main menu without changing settings
tOP ALAR			Emergency mode setup
	ALAR Mode		Setting output signal values for emergency mode:
		odE LO	- output signal fixed at 3.6 mA;
		odE HI	- output signal fixed at 21 mA;
		odE LAST	- output signal fixed at level registered before emergency;
		odE USER	- output signal fixed at user-defined level (see parameters ↑Ia and ↓Ia).
	↑Ia		Setting output current value for emergency mode (in milliamperes). The arrow indicates the direction in which the values change when button "S" is pressed
	↓Ia		
	ALAR SAVE		Save changed settings
	ALAR ESC		Quit to main menu without changing settings
tOP ESC			Switching to operating mode

Units of measurement (UNIT)

The device displays values in units listed in Table D.1 (selected with button "Z").

Table D.1 - Displayed units of measurements

Displayed	Unit of measurement
Torr	torr (1 torr ≈ 133.3 Pa)
inH2O	inch of water column (at 20 °C)°
inHg	inch of mercury column (at 0 °C)°
ftH2O	ft of water column (at 20 °C)°
mmH2O	millimeter of water column (at 20 °C)°
mmHg	millimeter of mercury column (at 0 °C)°
PSI	pound per square inch
bar	bar
mbar	mbar
g/cm2	g/cm2
kg/cm2	kg/cm2
Pa	Pa, pascal
kPa	kPa, kilopascal
atm	atmosphere
ESC	Quit the menu (press button "S")

SUPPLEMENT D HART Communicator (Model 375)

General information

Model 375 portable communicator can operate autonomously for up to 10 hours at ambient temperatures from -10 to +50 °C. It can be deployed in explosion hazard zones. See Supplement C for typical wiring diagrams (any connection polarity).

See Figure E.1 for the front panel of the communicator.

Figure E.1 - Model 375 communicator controls descriptions

Press the On/off button for 2 seconds to switch on the communicator.

Use buttons or stylus and touchscreen to control the communicator. See Table E.1 for description of the main controls.

Supplement E - continued
Table E.1 - Communicator controls descriptions

Button	Name	Action
	On/off	Switches the communicator on and off, switches it to the standby mode
	Backlight	Backlight brightness adjustment (4 levels)
	Bksp, Delete, Page Up, Page Dn	Navigate through the application selection menu, open and exit menu items
	Enter	Executes the operation selected, finishes editing; opens main menu or Settings items; selects any highlighted button
	Tab	Switches buttons and fields when selecting the controls method
	Function	Enables alt functions of buttons
	Alphanumeric keys	Enter data (numbers, letters and characters, press repeatedly to get the required letter or number) or run functions indicated on the keys

Functionality

When the connection to the controlled device is established and HART communicator is on, its display shows the default HART application.

HART communicator allows configuring the following parameters:

– LRL;
– URL;
– pressure snubbing time;
– units of measurement.

SUPPLEMENT E Explosion protection parameters

General info

AMZ 5450 and AMZ 5050 can measure pressure of combustible media. The explosion protection options are:

- Ex d, electrical parts (incl. sensor) are in the mechanically strong explosion-proof GOST R 51330.10 casing or a special design GOST 22782.3 casing. This type of protection contains explosion inside the enclosure and prevents ignition of the combustible medium.

Ex i, current and voltage in circuits limited to intrinsically safe values as prescribed by GOST R 51330.11 (subgroup IIC, combustible mixtures); design follows requirements of GOST 22782.5.

The devices receive power from intrinsically safe circuits of barriers (power supply units) located outside of the hazardous zones. These devices must have "Ex ia" certification good for the explosive mixtures they can come into contact with.

Connection

Ex versions of the devices receive power from intrinsically safe circuits of barriers (blocks); the protection type is "intrinsically safe circuit", level is "ia" (fit for explosion-proof mixtures of subgroup IIC under GOST R 51330.11). Such circuits allow HART signal, and the maximum output voltage of the barriers is U0 ≤28 V, maximum output current - I0 ≤93 mA.

See figure G.1 for Ex version connection diagram.

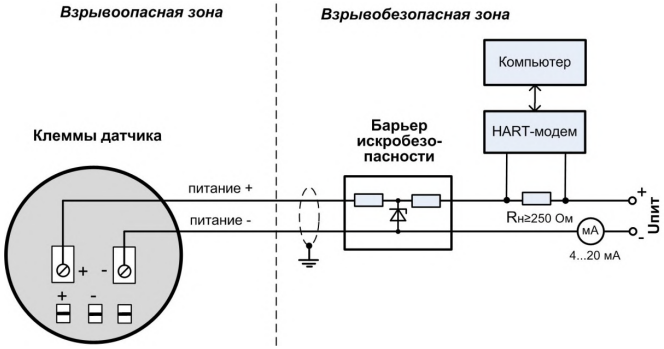
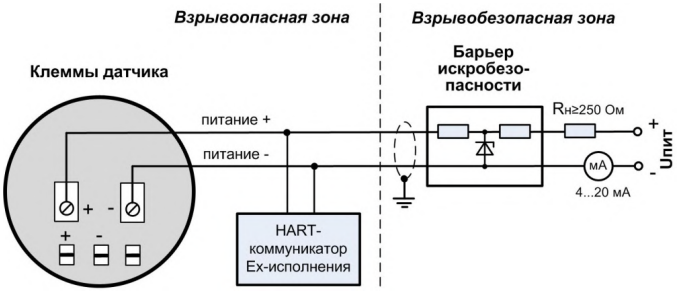


Figure G.1 - Connection of a HART modem to an Ex version of AMZ 5050/5450 (Rl - load resistance)

a)



b)

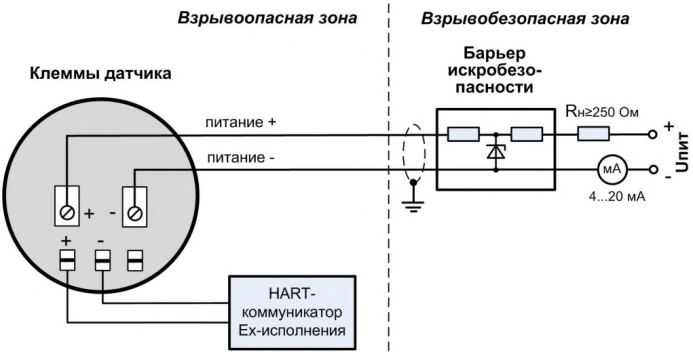


Figure G.2 - HART communicator connection to AMZ 5050/5450:
a) directly to the communication terminals;
b) to additional control terminals of the housing

Notes

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