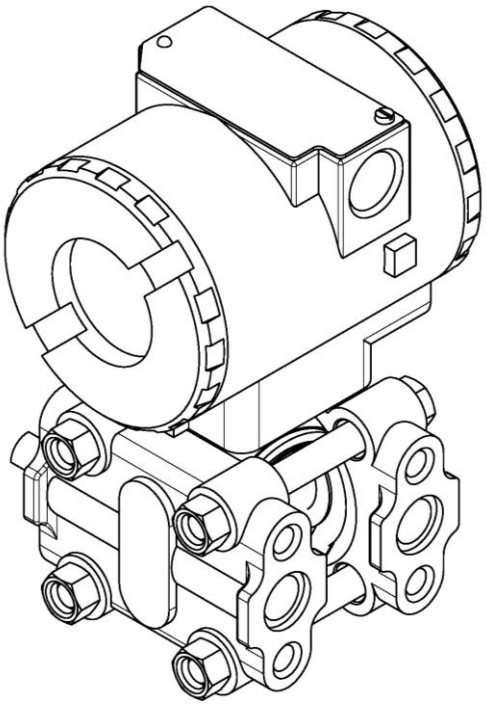
PIEZUS

AMZ

(models 5050, 5450)

Operation Manual



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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 options and housing. Version of the instrument is indicated in in ordering code on the transmitter's label and described in Appendix 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 Appendix B for 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.
SW	–	Software.
P_{set}	–	Set range.
P_{url}	–	Upper range limit (URL)
AC	–	alternating current.
DC	–	direct current

Please pay special attention to paragraphs with this mark.

NOTE: Manufacturer reserves the right to modify the design and circuits designs of the device without downgrading its performance.

1 Functions

1.1 AMZ 5050 is a flanged differential, gauge and absolute pressure transmitter with the analog (current 4...20 mA) and digital (HART) output signals and digital display. The transmitter measures pressure of liquids and gases.

1.2 AMZ 5450 is a threaded gauge and absolute pressure transmitter with analog (current 4...20 mA) and digital (HART) output signals and 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.

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 tool (locally). See Tables 2.1-2.3 for adjustment range (relative to nominal URL).

Table 2.1 - AMZ 5050 URL

Differential pressure range P_{URL}*	Range adjustment scale P_{URL}/P_{set}*	Static pressure, MPa	Overpressure, MPa
0…1.5 kPa	10:1	1	1
0…7.5 kPa	30:1	4	4
0…37 kPa	100:1	13.8	13.8
0…187 kPa	100:1	13.8	13.8
0…690 kPa	100:1	13.8	13.8
0…2 MPa	100:1	13.8	13.8
0…7 MPa	100:1	13.8	13.8

* The default differential pressure range equals upper range limit (URL), lower range limit (LRL) is 0. The set range limit is defined as difference between set upper and lower range levels.

LRL can be set (using HART-modem, communicator or locally) equal to the absolute value of the URL, but with a minus sign. Pressure transmitter supports measurement units: in WC, in Hg, ft WC, mm WC, mm Hg, psi, bar, mbar, g/cm^2, kgf/cm^2, Pa, kPa, MPa, atm., Torr. Switching between measurement units can be made by HART-modem/HART-communicator and by magnetic tool or buttons locally. When switching units of measurement, the range of digital values displayed on the display must be taken into account.
Table 2.2 - AMZ 5050 ranges

Capacitive sensor			Piezoresistive sensor		
Gauge pressure range P_{URL}*	Range adjustment scale P_{URL}/P_{set}*	Overpressure, MPa	Gauge/absolute pressure range P_{URL}*	Range adjustment scale P_{URL}/P_{set}*	Overpressure, MPa
0…1.5 kPa	10:1	1	-	-	-
0…7.5 kPa	30:1	4	-	-	-
0…37 kPa	100:1	13.8, 25 MPa (optional)	0…37 kPa	10:1	0.1
0…187 kPa	100:1	13.8, 25 MPa (optional)	0…187 kPa	10:1	0.6
0…690 kPa	100:1	13.8, 25 MPa (optional)	0…690 kPa	10:1	1.5
0…2 MPa	100:1	13.8, 25 MPa (optional)	0…2 MPa	10:1	6
0…7 MPa	100:1	13.8, 25 MPa (optional)	0…7 MPa	10:1	10
-	-		0…20 MPa	10:1	30
-	-		0…40 MPa	10:1	105
-	-		0…60 MPa	10:1	105

* The default differential pressure range equals upper range limit (URL), lower range limit (LRL) is 0.

LRL of a gauge pressure transmitter can be set equal to the absolute value of the URL, but with a minus sign or -100 kPa, if the URL is ≥187 kPa. The set range limit (P_{set}) is defined as difference between set upper and lower range levels. Pressure transmitter supports measurement units: in WC, in Hg, ft WC, mm WC, mm Hg, psi, bar, mbar, g/cm^2, kgf/cm^2, Pa, kPa, MPa, atm., Torr. Switching between measurement units can be made by HART-modem/HART-communicator and by magnetic tool or buttons locally. When switching units of measurement, the range of digital values displayed on the display must be taken into account.

Table 2.3 - AMZ 5450 parameters after range adjustment.

Pressure range	Set pressure range	Accuracy, % of span*	
		Capacitive sensor	Piezoresistive sensor
P_{URL} = 1.5 kPa	$P_{URL}/P_{set} \le 2$	±0.1	-
	$2 < P_{URL}/P_{set} \le 10$	$\pm[0.02\cdot(P_{URL}/P_{set}) + 0.06]$	-
7.5 kPa ≤ P_{URL} ≤ 60 MPa	$P_{URL}/P_{set} \le 10$	±0.075	$\pm[0.02\cdot(P_{URL}/P_{set}) + 0.08]$
	$10 < P_{URL}/P_{set} \le 40$	$\pm[0.00375\cdot(P_{URL}/P_{set}) + 0.0375]$	-
	$40 < P_{URL}/P_{set} \le 100$	$\pm[0.00465\cdot(P_{URL}/P_{set}) + 0.0015]$	-

Table 2.4 - Temperature effect and long-term stability of AMZ 5450.

Pressure range	Set pressure range, P_{set}	Temperature effect, % of span / 10 °C		Long-term stability	
		Capacitive sensor	Piezoresistive sensor	Capacitive/ Piezoresistive sensor	Capacitive/ Piezoresistive sensor
P_{URL} = 1.5 kPa	$P_{URL}/P_{set} \le 2$	$\pm[0.075\cdot(P_{URL}/P_{set}) + 0.025]$	-	±0.2% of span / year	±0.2% of span / year
	$2 < P_{URL}/P_{set} \le 10$	$\pm[0.050\cdot(P_{URL}/P_{set}) + 0.075]$	-		
P_{URL} = 7.5 kPa	$P_{URL}/P_{set} \le 5$	$\pm[0.040\cdot(P_{URL}/P_{set}) + 0.025]$	-		
	$5 < P_{URL}/P_{set} \le 40$	$\pm[0.030\cdot(P_{URL}/P_{set}) + 0.075]$	-		
37 kPa ≤ P_{URL} ≤ 60 MPa	$P_{URL}/P_{set} \le 5$	$\pm[0.010\cdot(P_{URL}/P_{set}) + 0.030]$	$[0.02\cdot(P_{URL}/P_{set})]$	±0.15% of span / 5 years	±0.15% of span / 5 years
	$5 < P_{URL}/P_{set} \le 100$	$\pm[0.012\cdot(P_{URL}/P_{set}) + 0.023]$	$[0.02\cdot(P_{URL}/P_{set})]$		

* Accuracy includes non-linearity, hysteresis and non-repeatability.
** Eliminated through zero trim when static pressure is at operational level

Table 2.5 - AMZ 5050 parameters after range adjustment.

Pressure range	Set pressure range	Accuracy, % of span*
P_{URL} = 1.5 kPa	$P_{URL}/P_{set} \le 2$	±0.1
	$2 < P_{URL}/P_{set} \le 10$	$\pm[0.02\cdot(P_{URL}/P_{set}) + 0.06]$
7.5 kPa ≤ P_{URL} ≤ 7 MPa	$P_{URL}/P_{set} \le 10$	±0.075
	$10 < P_{URL}/P_{set} \le 40$	$\pm[0.00375\cdot(P_{URL}/P_{set}) + 0.0375]$
	$40 < P_{URL}/P_{set} \le 100$	$\pm[0.00465\cdot(P_{URL}/P_{set}) + 0.0015]$

Table 2.6 - Temperature effect and long-term stability of AMZ 5050.

Pressure range	Set pressure range, P_{set}	Temperature effect, % of span / 10 °C	Long-term stability	Static pressure effect	
				To zero value**	To span
P_{URL} = 1.5 kPa	$P_{URL}/P_{set} \le 2$	$\pm[0.075\cdot(P_{URL}/P_{set}) + 0.025]$	±0.2% URL / year	±0.1% URL / 1 MPa ±0.2% MV*** / 1 MPa	±0.1% URL / 1 MPa ±0.2% MV*** / 1 MPa
	$2 < P_{URL}/P_{set} \le 10$	$\pm[0.050\cdot(P_{URL}/P_{set}) + 0.075]$			
P_{URL} = 7.5 kPa	$P_{URL}/P_{set} \le 5$	$\pm[0.040\cdot(P_{URL}/P_{set}) + 0.025]$		±0.03% URL / 1 MPa ±0.06% MV / 1 MPa	±0.03% URL / 1 MPa ±0.06% MV / 1 MPa
	$5 < P_{URL}/P_{set} \le 40$	$\pm[0.030\cdot(P_{URL}/P_{set}) + 0.075]$			

37 kPa ≤ P_{URL} ≤ 7 MPa	P_{URL}/P_{set} ≤ 5	±[0.010·(P_{URL}/P_{set}) + 0.030]	±0,15% URL / 5 years	±0.05% URL / 1 MPa ±0.03% MV / 1 MPa	±0.05% URL / 1 MPa ±0.03% MV / 1 MPa
	5 < P_{URL}/P_{set} ≤ 100	±[0.012·(P_{URL}/P_{set}) + 0.023]			

* Accuracy includes non-linearity, hysteresis and non-repeatability.

Table 2.7 - General characteristics of AMZ 5050 and AMZ 5450

Name	Value
Compensated range	-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

2.1.3 See Table 2.8 for output signal parameters.

Table 2.8 - 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 (U_{supply})	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 (without HART / with HART).
**Resistance ≥250 Ohm when transmitter sends data via HART.

2.1.4 Output signal - linear.

2.1.5 The device can have a display (see Table 2.9 for specifications).

Table 2.9 - Display specifications

Name	Value
Display digits	-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	From -30* to +85 °C

(*) - at temperatures below -30 °C the display shows no value and does not fail.

2.1.6 See Table 2.10 for mechanical specifications.

Table 2.10 - Mechanical specifications

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

2.1.7 See Table 2.11 for operating conditions.

Table 2.11 - Operating conditions.

Name	Value (properties)
Vibration resistance (GOST R 52931)	V2 group
Shock resistance	100 g / 11 ms
Sensor service life	> 100 × 10^6 loading cycles
Response time	≤ 200 ms (another value optional)

2.1.8 See Appendix 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;
- media temperatures from -40 to +105 °C (depends on the seal type). Medium: gas, steam and liquids (including petroleum products) non-aggressive to materials of the device.

2.3 Operational limitations

Medium should be free from crystallizing additions, contaminations and dust.

Arrange the device connection where the medium is still or almost still and have no vortices.

Never allow contamination of the diaphragm when mounting the device.

2.4 Electromagnetic interference resistance and interference 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 Device design and operation

3.1 Diagram

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

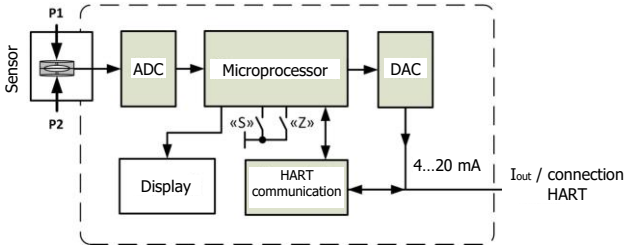


Figure 3.1. Block diagram of the device outputting a 4...20 mA and HART digital signals (P1, P2 - medium pressure)

HART protocol allows configuring, setting up, calibrating, testing the device and retrieving data process variables (in the chosen 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°);
3 - locking screw (unscrew to turn the housing);
4 - housing;
5 - local adjustment holes cover;
6 – setting buttons optional

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

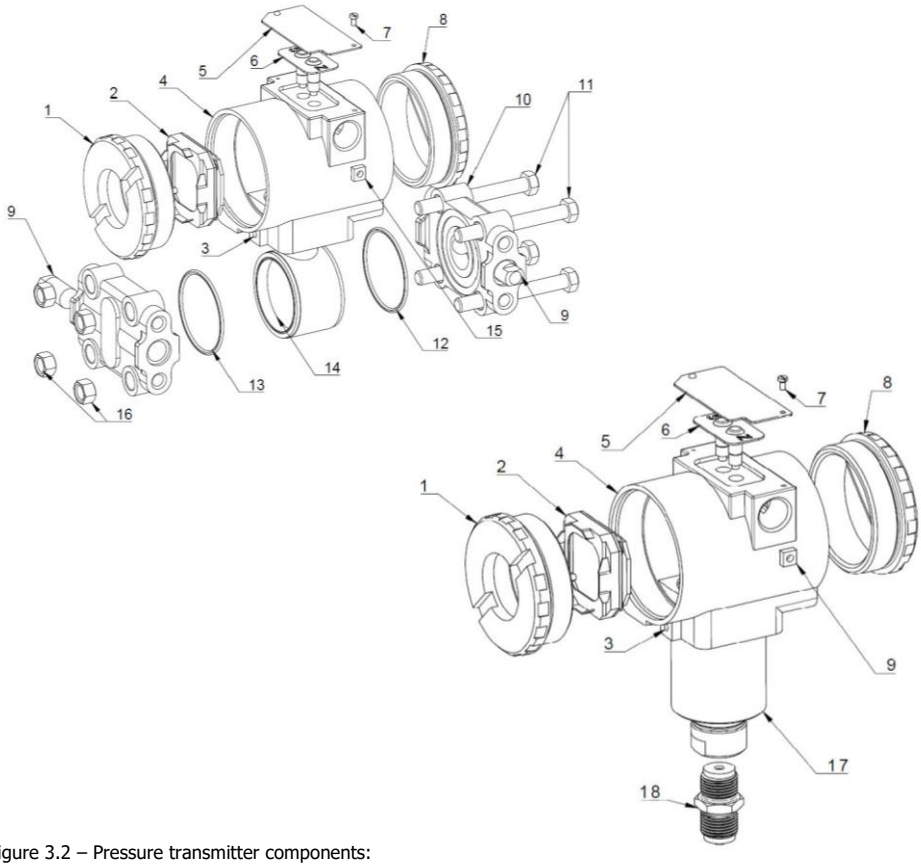


Figure 3.2 – Pressure transmitter components:
a) AMZ 5050; b) AMZ 5450

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. A screwed-in metal plug is used for the slot which is not used.

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

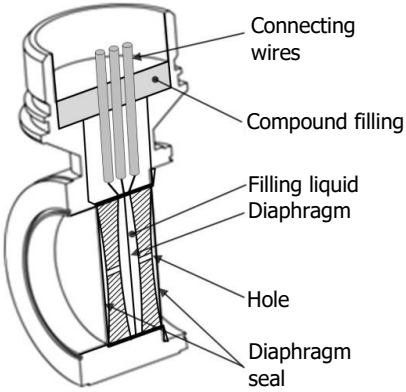
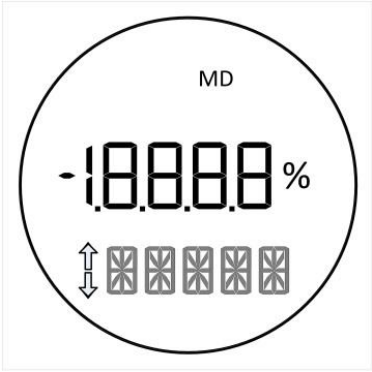


Figure 3.3 - Capacitive sensor design

3.3 Built-in display

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



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 indicated). 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 decline.
********	Other codes require professional assistance; contact manufacturer for their interpretation.

Error code are shown at start-up.
NOTE: Manufacturer reserves the right to modify the design and circuits designs of the device without downgrading 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 must be observed when operating, servicing and calibrating 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 who have read this manual are allowed to mount, connect, adjust, calibrate and do maintenance of 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 observe "Rules for works in explosive zones or outside the explosive zone" when adjusting output signal of a device in a flameproof enclosure.

5 Mounting instructions

5.1 General requirements

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

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

When installing the pressure transmitter with the housing (4) vertically downwards (the fitting (17) is above the housing), it is necessary to prevent the accumulation of an aggressive medium (moisture) on the fitting (17) in order to avoid blocking the breathing hole and failure of the device.

NOTE: We recommend mounting the device vertically or horizontally.

5.1.6 The display is rotatable with the 90° increment. To rotate the display remove the cover first. To adjust the display's position along its vertical axis, loosen the locking screw at the base of its housing.

5.1.7 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.

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

5.1.9 The most usual 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).

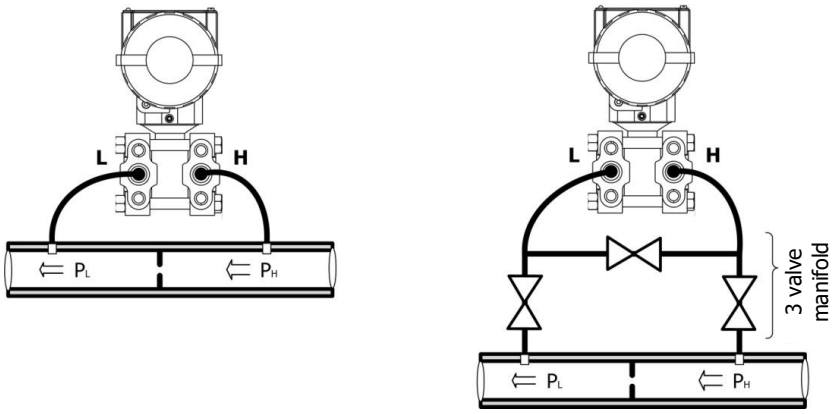
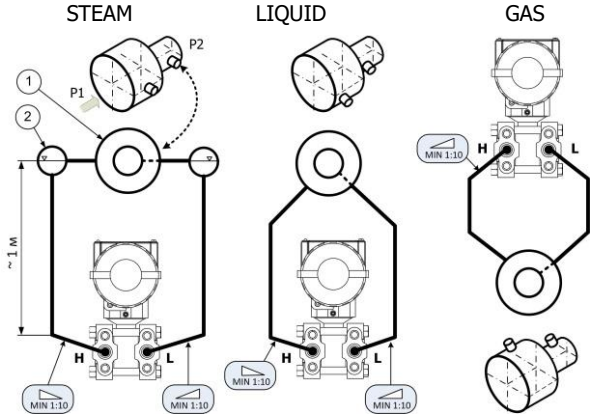


Figure 5.1. Mounting transmitter to measure pressure of liquid medium (examples).

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



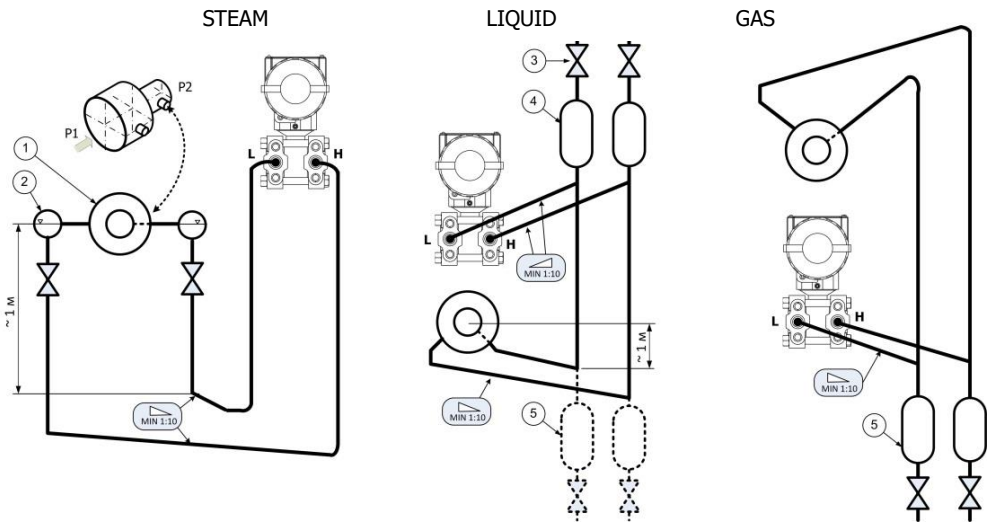
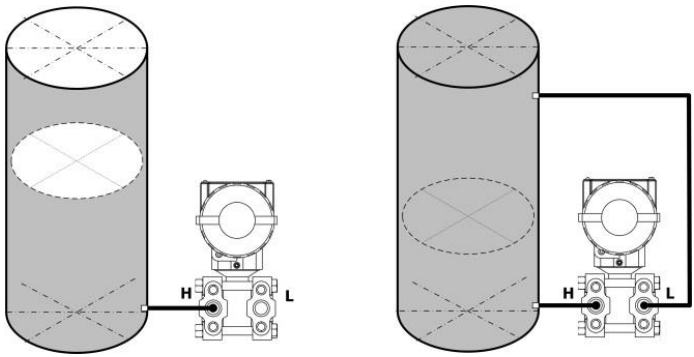


Figure 5.2. Examples of connecting tubes to measure pressure of steam, gas or liquid. 1 - pressure take-off; 2 - condensing chamber; 3 - valve; 4 - gas collector; 5 - condensate settling chamber



A) open container B) closed container

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

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

5.1.10 Connect the device to a DC power source; max permissible voltage pulsation amplitude is 0.5%.

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

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

NOTE: transmitters come with reverse polarity protection.

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

5.1.14 Stable communication via HART protocol requires a shielded twisted pair or a special cable with minimal cross-section 0.2 mm^2 and max length 1500 m).

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

5.1.16 Always ground the device's housing.

5.1.17 Use a circular cross-section wire which fits the cable gland 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.

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

5.1.19 See Figure 5.4 for cable positioning recommendation.

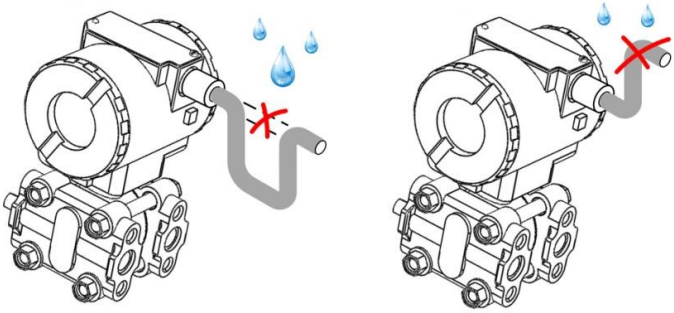


Figure 5.4 - Cable entry

5.1.20 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 hazardous 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 hazardous zones.

5.2.2 Please observe the following documents when mounting the device:

- Electrical Installations Code, Chapter 7.3 "Electrical Installations in Hazardous Zones";

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

- GOST R IEC 60079-0;

- GOST R IEC 60079-11;

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

6 Setup

6.1 Factory settings

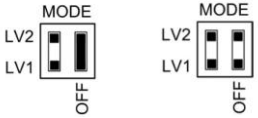
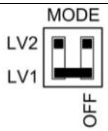
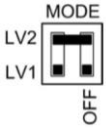
Factory settings follow the ordering code submitted by the customer. You can find values of the most important settings in the device's passport. Values of other settings are as follows.

- output signal is linear to input pressure;
- pressure snubbing time - 0 s;
- displays: 1st display shows pressure in selected units of measurement; 2nd display gives the same information;
- 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 fit the operating conditions. Appendix C contains connection diagrams; follow them to connect the device and adjust settings. See table 6.1 for jumpers positions (Figure C.1, Appendix C) allowing adjustment of operation parameters.

Table 6.1 – Jumpers positions

Contact status	Settings mode
	HART only reading. HART configuration disabled. Manual configuration disabled.
	HART reading and all HART parameters configuration enabled. Manual configuration of URL and LRL with reference pressure feed.
	HART configuration enabled. Manual configuration of all parameters via the menu.

The jumpers for setting the transmitter operating modes are located under the cover to the right of the display, and the backlight on/off switch is to the left of the display, Table 6.2.

Table 6.2 – Jumpers positions for display backlight control

Contact status	Settings mode
	Display backlight is off (min device power supply is 9 V)
	Display backlight is on (min device power supply is 13.5 V)

6.2 Zero and scale adjustment of device without display

This procedure allows matching the device readings with the accurate pressure applied.
First, supply reference pressure equal to URL or LRL to the transmitter and wait for its settling.

NOTE: put the jumper between pins LV1 (Table 6.1) before the procedure.

Next:

- remove the top cover and insert magnetic tool into hole Z or S (Figure 6.1);

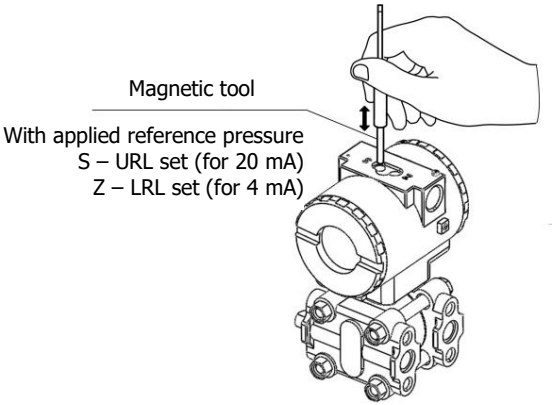


Figure 6.1. Location of Z (zero) and S (span) controls, local configuration

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

NOTE: The version with buttons on the top of the transmitter is optional. The remains the same in this case.

6.3 Local configuration of device with display

NOTE: Put the jumper between pins LV2 (Table 6.1) before the procedure.

Next:

- remove the top cover and insert magnetic tool into hole S (Figure 6.2); the device switches to the operation parameters setup mode, display shows one of the menu items;

- insert the magnetic tool into hole Z to browse the menu, find the menu item you need (see Appendix D for adjustable parameters list) by inserting magnetic tool time after time;

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

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

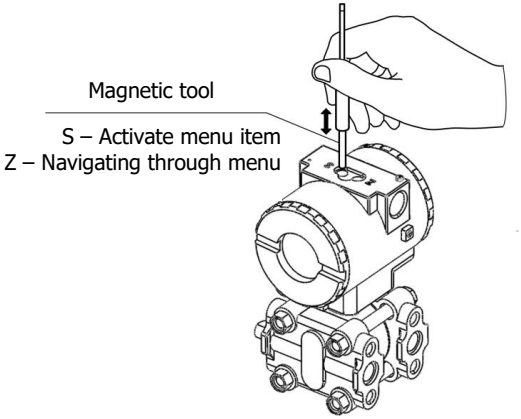


Figure 6.3. Local configuration process

To configure or adjust the parameters, proceed as follows.

URL and LRL values setup:

- shut off pressure at the device's pressure port;

- 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 tool is inserted into hole S. If it points up, the values will increase, if it points down, the values will decrease.

Configuration. Setting URL/LRL with reference pressure applied:

- apply pressure equal to URL or LRL to the transmitter's pressure port and wait for its settling;

- 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 fluctuates or jumps a lot.

Configuration. Units of measurement:

- select **rAnG UNIT** item in the **tOP RANGE** menu;

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

Adjustment of parameters

Find the item in the **tOP TRIM** menu (**ZTRIM/LTRIM/UTRIM**) and select it to adjust parameters of the device when the input pressure corresponds.

6.4 Setup using HART communicator

Portable HART communicator allows adjusting parameters of the device. See figures C.5-C.8 (Appendix 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.

It is recommended to use universal HART-communicators, e.g., HART 375 Communicator BR.

See Appendix E for features of HART 375 Communicator.

6.5 Setup using PC and HART modem

PC connected via HART-modem can adjust the device's operating parameters remotely.

See figure C.3 (Appendix C) for connection diagrams.

It is recommended to use 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 Calibration of the device in operation 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 apply mechanical force to the diaphragm;**
3. **use transmitters with visible signs of mechanical damage;**
4. **use transmitters in inappropriate climatic conditions;**
5. **use transmitters with medium temperatures above or below the limits specified for the device.**

7.4 All 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 4 when doing maintenance.

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

- the housing possible damage, corrosion, dents and visible mechanical damage;

- reliability of screw connections and mounting;

- tightness in the pressure supply lines;

- 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 OK, the output current is set to match the measured pressure. The integrated controller detects malfunctions (related to data or emergency errors). If a malfunction is detected (at startup or during operation), the device outputs a constant current as provided in Table 8.1 and system messages (see Table 3.1).

8.6 There may occur malfunctions requiring immediate response 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.

Table 8.1 - Troubleshooting

Problem	Solution
1. No output signal	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 it is stable, 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 if the HART modem working
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 pressure changes	Check for clogging in the tubes going to the sensor; restore them to the working order if necessary
	Check if the pressure is within the span; readjust span or replace with a model covering the span needed if necessary
5. Output signal is 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 (via 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. The metal plate shows the following information:

- name of the manufacturer;
- model and 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);

For Ex versions:

- 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.

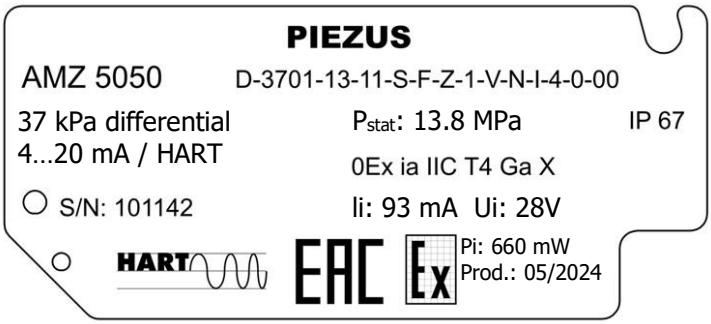


Figure 9.1. Main technical specifications on the plate

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 cardboard box. 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
Product passport	1 copy
Operation manual	1 copy*
Local setup tool (magnetic tool)	1 pc**
Mounting bracket (ordering code: 1 - straight, 2 - angled)	1 pc**
Fasteners	1 set**
Cable gland according to the order	1 set

* 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.com.
** 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 is from -40 to +85 °C.

11.3 Store devices in shipping containers in a heated (from +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 only if 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.com

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.

APPENDIX A. Ordering Information.

AMZ 5050 ordering code

AMZ 5050	-X	-XXXX	-XX	-XX	-X	-X	-X	-X	-X	-X	-X	-X	-X	-X	-XX
PRESSURE TYPE															
differential	**D**														
absolute	**A**														
gauge	**G**														
UPPER RANGE LIMIT															
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**												
25 MPa (URL from 37 kPa to 7 MPa)			**25**												
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**							
yes								**1**							
yes / with buttons								**2**							
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															
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**			

VALVE MANIFOLD*			
no	**0**		
included	**1**		
installed**	**2**		
MOUNTING KIT			
no fasteners		**0**	
straight bracket		**1**	
angled bracket		**2**	
VERSION			
standard			**00**
special			**99**

* The valve block configuration is issued as a separate order line according to the technical specification for the valve block.
** The transmitter is supplied assembled with the valve block. After installation, a leak test is performed.

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

APPENDIX A - Continued
AMZ 5450 ordering code

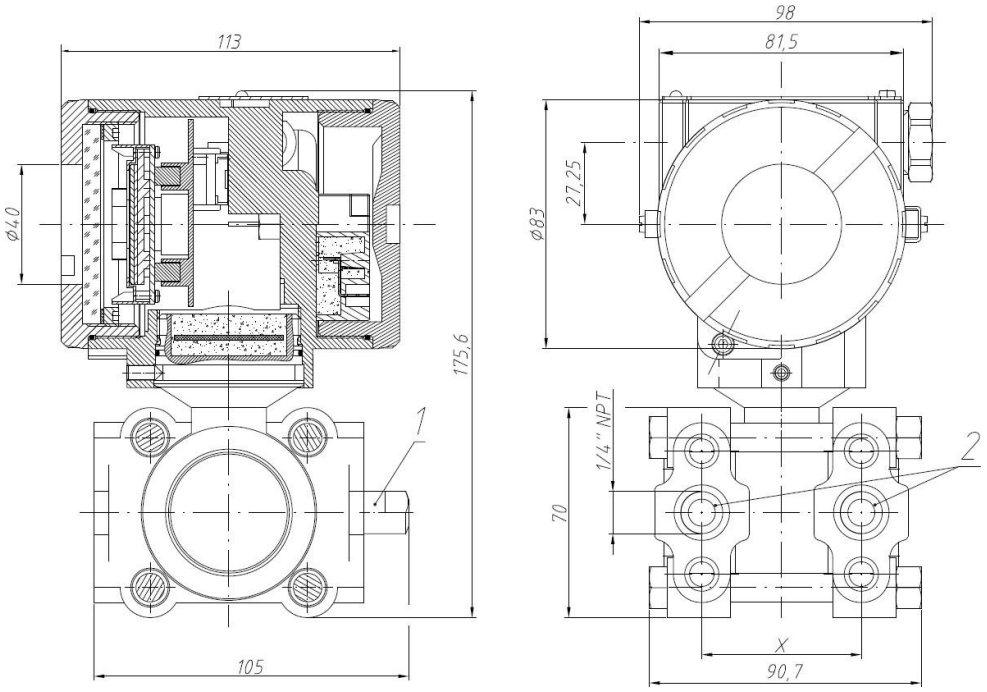
AMZ 5450	-X	-XXXX	-XX	-X	-X	-X	-X	-X	-X	-X	-X	-X	-XX
PRESSURE TYPE													
absolute	**A**												
gauge	**G**												
UPPER RANGE LIMIT													
Gauge / Absolute													
1.5 kPa / –		**1500**											
7.5 kPa / –		**7500**											
37 kPa / 37 kPa		**3701**											
187 kPa / 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													
316 L stainless 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 from 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**						
yes with buttons							**2**						
ELECTRICAL CONNECTION													
cable gland 1/2"- 14 NPT								**N**					
cable gland M20x1.5								**M**					
OUTPUT SIGNAL													
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**			
VALVE MANIFOLD*													

no	**0**		
included	**1**		
installed**	**2**		
MOUNTING KIT			
no fasteners		**0**	
pipe bracket		**1**	
VERSION			
standard			**00**
special			**99**

* The valve block configuration is issued as a separate order line according to the technical specification for the valve block.
** The transmitter is supplied assembled with the valve block. After installation, a leak test is performed.

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

APPENDIX 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 - 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.

APPENDIX B - Continued

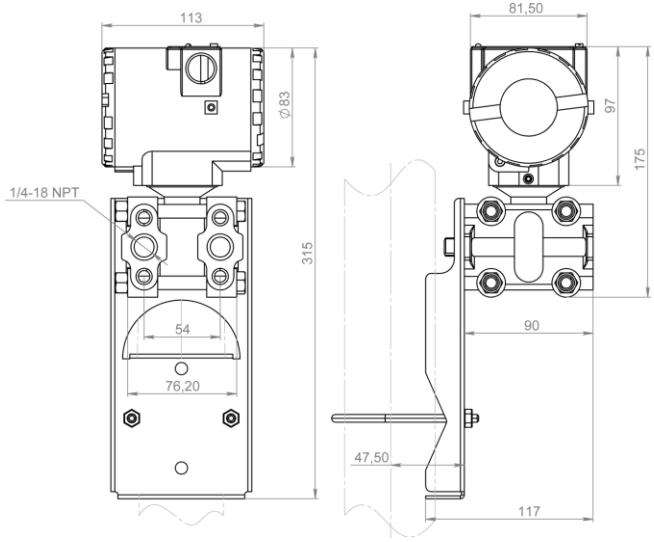


Figure B.2 - Mounting AMZ 5050 to a 2" pipe, straight bracket

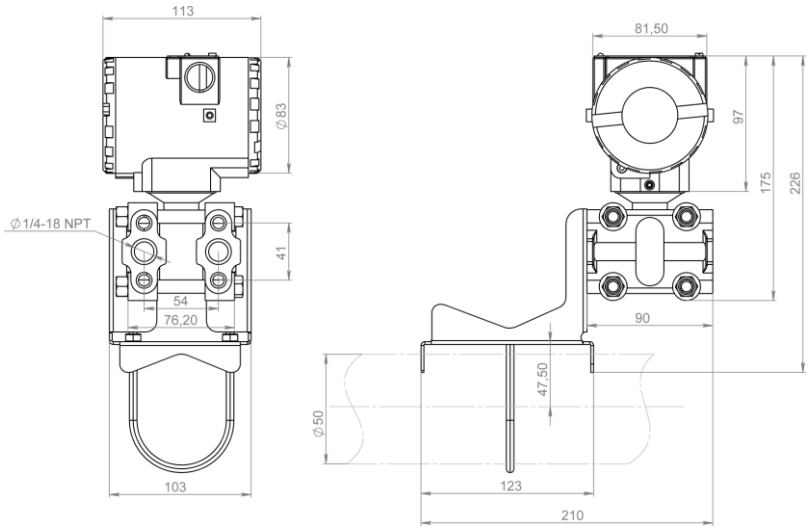


Figure B.3 - Mounting AMZ 5050 to a 2" pipe, angle bracket

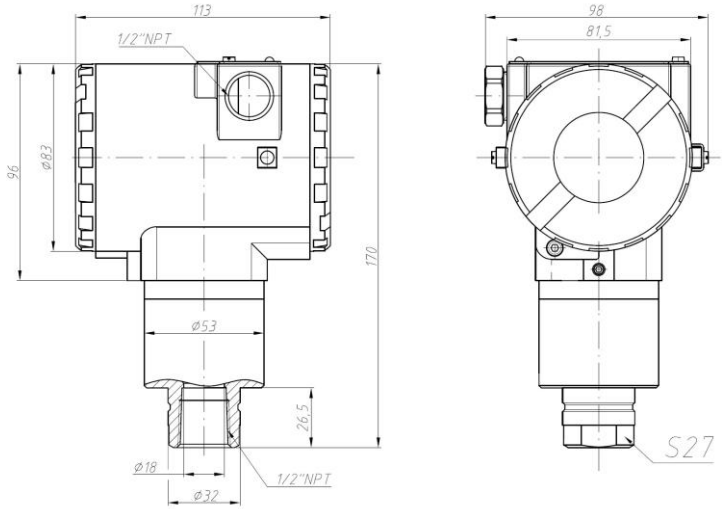


Figure B.4 - AMZ 5450 housing dimensions

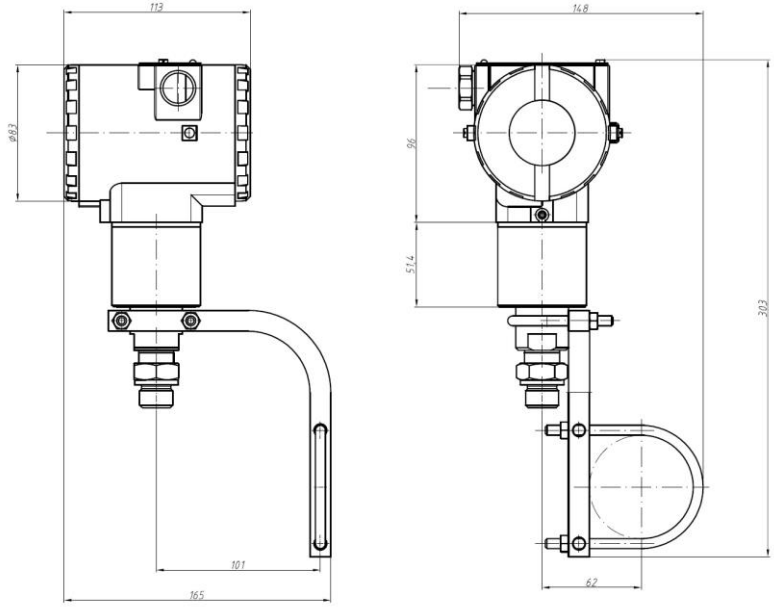


Figure B.5 - Mounting AMZ 5450 to a 2" pipe, angle bracket

APPENDIX C. Connection diagrams.

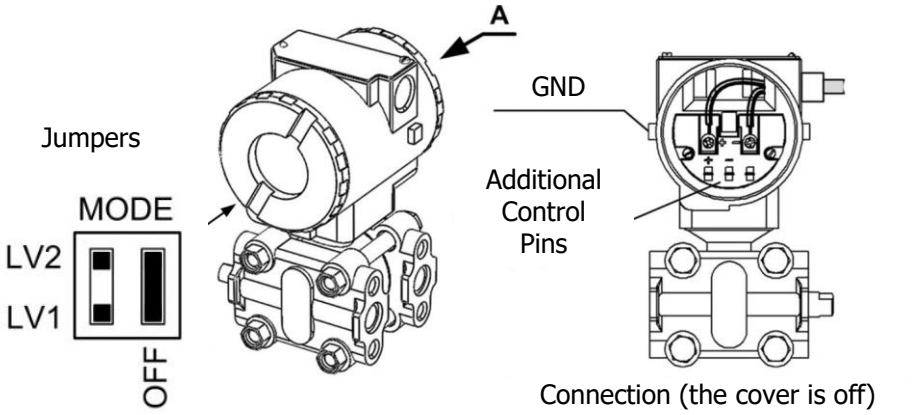


Figure C.1 - Terminal board contacts and jumpers mode (covered)

Explosion-proof zone

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

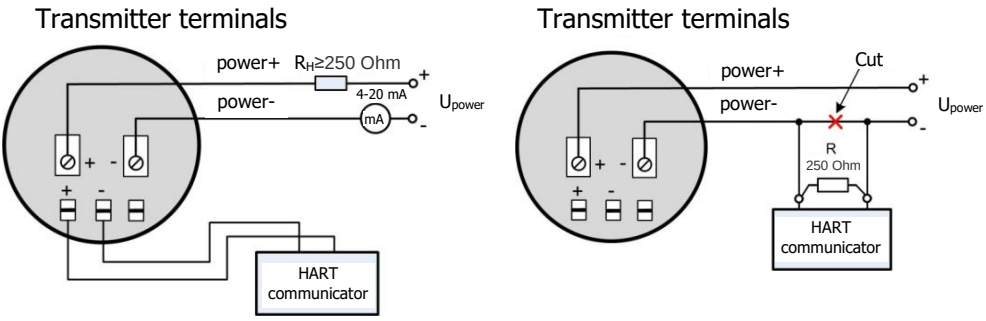
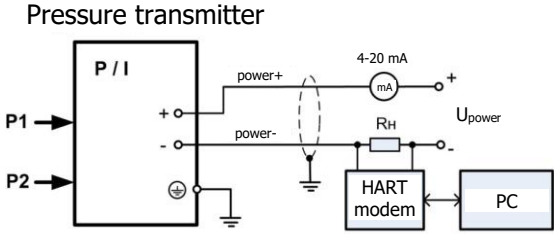


Figure C.2 - HART communicator connection diagrams

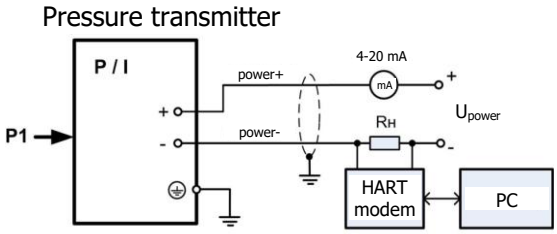
APPENDIX C - Continued

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



2-wire (current and HART output)

a) AMZ 5050



2-wire (current and HART output)

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 Appendix 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 showing connection of a cluster of devices to a single power circuit.

APPENDIX C - Continued

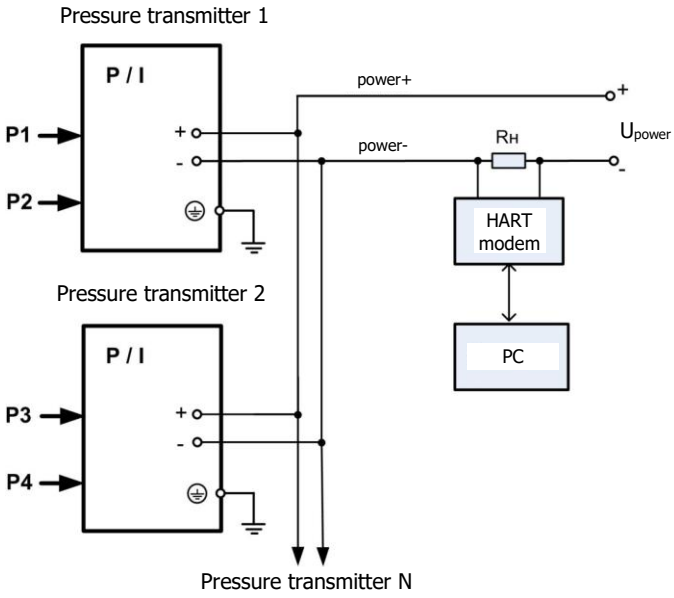


Figure C.4 - Connection of several AMZ 5050/AMZ 5450 transmitters to a singe power circuit (P1-P4 - medium pressure, $R_H \geq 250$ Ohm)

HART communicator connection

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

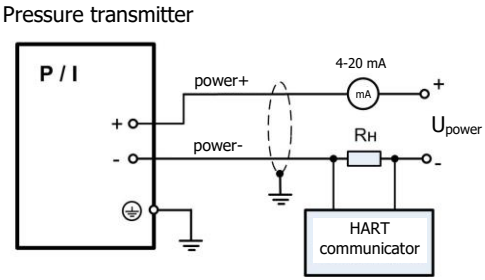


Figure C.5 - HART communicator connection to AMZ 5050/5450

APPENDIX C - Continued

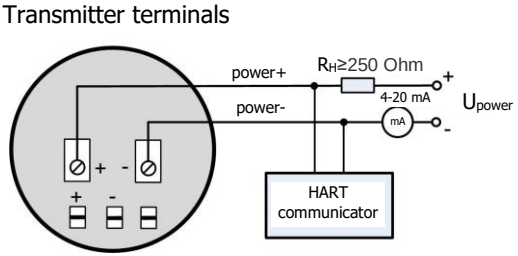


Figure C.6 - HART communicator connection directly to communication terminals

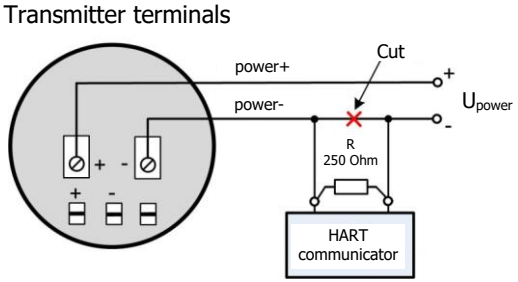


Figure C.7 - HART communicator connection to the additional control contacts on the housing

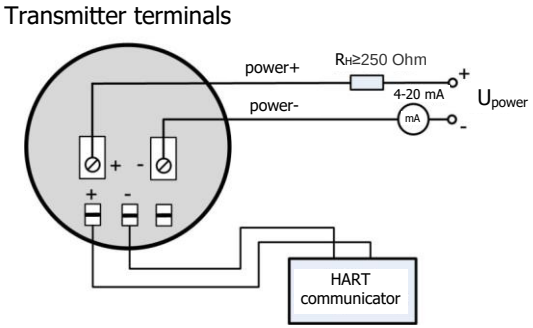


Figure C.8 - HART communicator connection with a temporal load resistor (250 Ohm) at the input

APPENDIX 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 (R_H) for the 4…20 mA output signal should be from 250 to 1650 Ohm (Figure C.9).

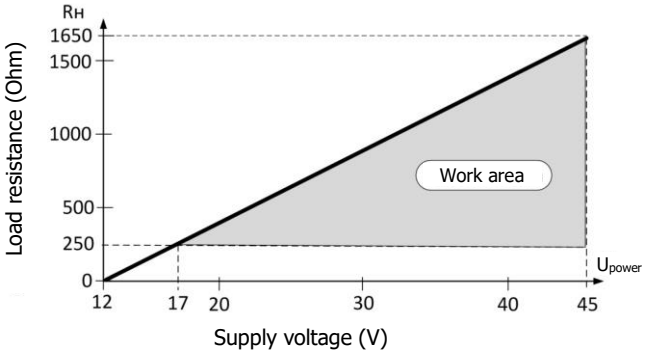


Figure C.9 - Load resistance (R_H) selection depending on supply voltage

Output signal function

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

$$Iout\ [mA] = 4[mA] + 16[mA] \times \frac{P - Plrl}{Purl - Purl}$$

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

P_{lrl} – lower range limit pressure;

P_{url} – upper range limit pressure;

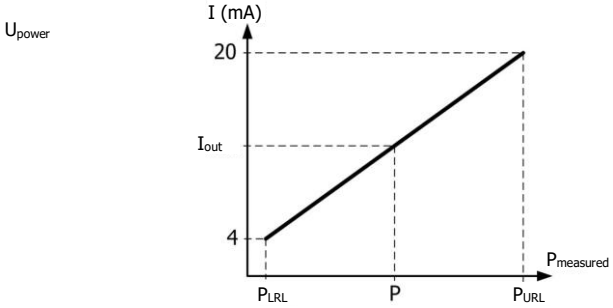


Figure C.10 - Output signal (current) alteration depending on the input pressure (P)

APPENDIX D. 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. 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. 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".

APPENDIX 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 mA). The arrow indicates the direction in which the values changes 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)
inH_2O	inch of water column (at 20 °C)
inHg	inch of mercury column (at 0 °C)
ftH_2O	ft of water column (at 20 °C)
mmH_2O	mm of water column (at 20 °C)
mmHg	mm of mercury column (at 0 °C)
PSI	pound per square inch
bar	bar
mbar	mbar
g/cm^2	g/cm^2
kg/cm^2	kg/cm^2
Pa	Pa, pascal
kPa	kPa, kilopascal
atm	atmosphere
ESC	Quit the menu (press button "S")

APPENDIX E. 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 used in hazardous zones. See Supplement C for typical wiring diagrams (any connection polarity).

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

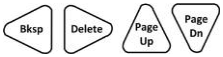
Figure E.1 - Model 375 communicator controls descriptions

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.

APPENDIX 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
	Alphanumerc keys	Enter data (numbers, letters and characters, press repeatedly to get the required letter or number) or run functions indicated on the keys

Functionality

HART communicator allows configuring the following parameters:

– LRL;

– URL;

– pressure snubbing time;

– units of measurement.

APPENDIX F. Explosion protection parameters.

General info

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

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

- Ex i, current and voltage in circuits limited to intrinsically safe values as prescribed by GOST R 51330.11 (subgroup IIC, explosive mixtures GOST R 51330.11); 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 with the explosion protection level 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 U_0 ≤28 V, maximum output current - I_0 ≤93 mA.

See figure F.1 for Ex version connection diagram.

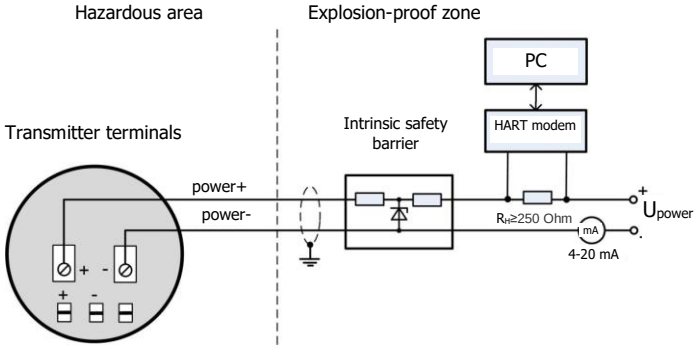
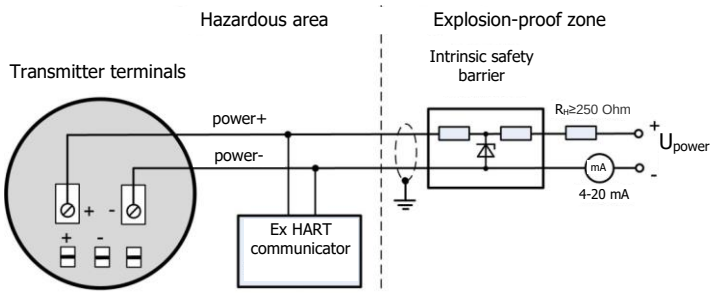


Figure F.1 - Connection of a HART modem to an Ex version of AMZ 5050/5450 (R_H- load resistance)

a)



b)

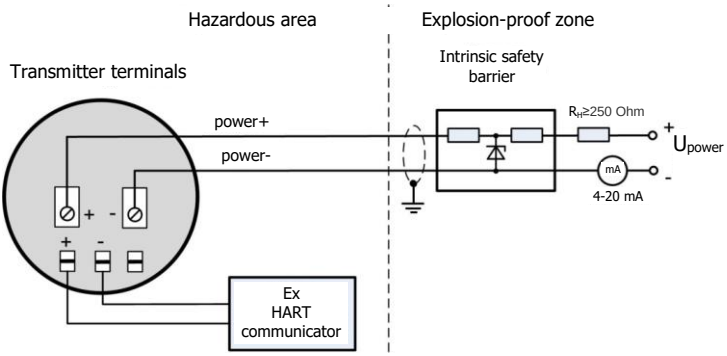


Figure F.2 - HART communicator connection to AMZ 5050/5450:
a) directly to the communication terminals;
b) to additional control terminals of the housing

Notes

Version 05

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