



This manual covers mounting and operation of APZ pressure transmitters (hereinafter referred to as "transmitter" or "device"); it contains technical data, connection instructions and other information necessary for proper operation and maintenance.

See datasheets at <http://piezus.ru> for complete specifications.

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### 1 Design and operation

1.1 PIEZUS transmitters are contact pressure transmitters continuously converting pressure into a normalized unified analog or digital (HART, Modbus RTU) output signal.

1.2 Transmitters outputting 4...20 mA/2-wire signal can cover 2 or 3 ranges (specified when ordering). Switching ranges and calibrating zero requires ZCON 100 configurator, sold separately.

1.3 Applications: control, automated regulation and metering systems in industrial environments and public utilities.

**Note:** Maritime versions of pressure transmitters (which have "k" as the first symbol of their code) comply with Part XV of Rules for the Classification and Construction of Sea-Going Ships and Section 12, Part IV of the Rules for Technical Supervision During Construction of Ships and Manufacture of Materials and Products for Ships. Avoid mounting such transmitters on open decks; they are designed to work in switchboards, casings or reservoirs.

### 2 Technical specifications

#### 2.1 Basic specifications

2.1.1 See transmitter's passport and label (sticker) for span and accuracy info.

2.1.2 See Tables 1 and 2 for output signal options (factory set to order).

Table 1 - Analog output signals

Ordering code	Output signal	Power supply (U <sub>power</sub> )	Load impedance	Power consumption
<b>A</b>	4...20 mA / 2 wire	12...36 V	≤ 1000 Ohm	<26 mA
<b>V</b>	4...20 mA / 3 wire	12...36 V	≤ 500 Ohm	
<b>C</b>	0...20 mA / 3 wire	12...36 V	≤ 500 Ohm	
<b>D</b>	0...10 V / 3 wire	12...36 V	> 10 kOhm	<7 mA
<b>E</b>	0...5 V / 3 wire	12...36 V	> 5 kOhm	
<b>R*</b>	0.5...4.5 V / 3 wire	5 V / 6...15 V	> 5 kOhm	<2 mA
<b>Q*</b>	4...20 mA / 2 wire	12...28 V	≤ 1000 Ohm	<26 mA

\* Intrinsically safe design (Ex version)

Table 2 - Digital output signals (models 3230, 3240, 3420, 3421)

Ordering code	Output signal	Power supply (U <sub>power</sub> )	Load impedance	Power consumption
<b>M</b>	RS-485/Modbus RTU	12...36 V	-	<7 mA
<b>H</b>	4...20 mA / HART	12...36 V	≥ 250 Ohm	<26 mA

2.1.3 RS-485 digital interface parameters: bitrate - 4800, 9600, 19200, 38400 bps; Modbus RTU protocol (8 data bits + 1 stop bit); Factory settings (unless otherwise specified by the customer): address: 1; bitrate: 9600 bod; data: 8 bit; parity check: parity check bit.

2.1.4 Consumed power, max:  
all except APZ 1120 / 1120a - 1 W; APZ 1120 / 1120a - 0.04 W.

#### 2.2. Operating conditions:

- intrinsically safe design (Ex versions): hazardous environments (see explosion protection markings);
- atmospheric pressure from 84 to 106.7 kPa (group R1 under GOST R 52931);
- ambient air temperature from -50 to +85 °C;
- permissible media temperatures (depends on pressure port and seal materials):
  - 2410 (a), 2412, 3410 - from -25 to +135 °C;

- sensor exposure (liquids, gases and vapors):

- non-corrosive media contacting stainless steel diaphragm and seal - models 1120, 1120a, 2410, 2412, 2422, 3420, 3420 (a, m, s), 3421;
- non-corrosive media contacting stainless steel or silicon diaphragm and seal - model 3230;
- aggressive media (specify when ordering) - models 3240, 3410.

Mechanical attack resistance when in use - GOST R 52931, all except

#### 2.3 Operating 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 installing the transmitter;
- install DZ 10 pressure snubber if the system can produce hydraulic shocks;
- use impulse tubing (pre-filled with water) when measuring vapour pressure.

### 3 Safety precautions

3.1 Pressurized medium is a source of danger. Always close the valve up the line when mounting or disconnecting pressure transmitters.

3.2 Circuits of the device carry no dangerous voltage (class III under GOST 12.2.007.0).

3.3 Always cut off power when connecting sensor circuits.

### 4 Mounting instructions

4.1 Mount the transmitter with maintenance convenience (incl. mounting, dismantling) in mind.

**Note:** it is advisable to specify the transmitter's working position when ordering low pressure transmitters (range below 40 kPa).

4.2 If the medium is gaseous, position the transmitter so that the connecting line slopes one way (≥1:10) up from the pressure tap; if the medium is liquid, the line should slope down to the transmitter. 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.

4.3 Screw the transmitter into a prepared hole (must be of the required size) to expose the diaphragm to the medium. Use the seals supplied or those resistant to the medium.

4.4 Use an S27 wrench to lock the transmitter in place ( S24 for models 2410 (a), 2412, 2422 (a)).



**DO NOT USE** any thread seals (fiber, Teflon tape) other than supplied.

**DO NOT SCREW** pressure transmitters into enclosed volumes filled with liquid.

Never hold onto the transmitter's body when screwing it in! Use the hexagon or the knurled ring found on the body for that purpose.

4.5 Connect sensor circuits via connectors as shown in Figures 1-3 or via the cable built into the transmitter as described by Tables 3 and 4.

Observe polarity when connecting the circuits; transmitters come with reverse polarity protection.

**Note: see PIEZUS Explosion Protection Guidelines for additional components connection diagrams for intrinsically safe versions.**

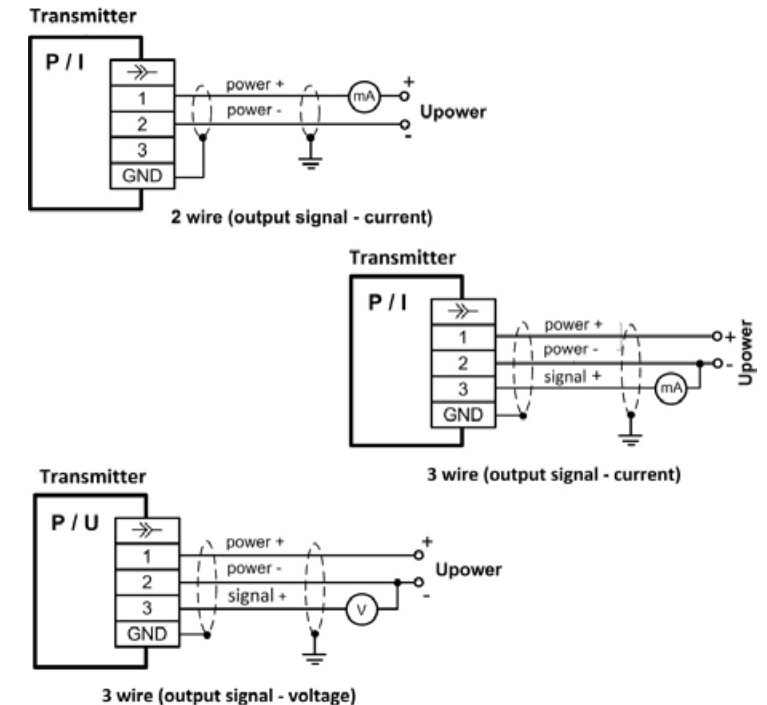


Figure 1 - DIN 43650A outputs connection diagram; examples

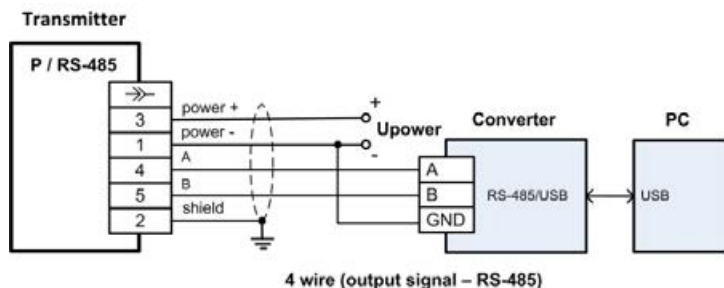


Figure 2 – Digital output connection diagram, RS-485, Binder

**ATTENTION!** Connect adapter's/controller's GND to the transmitter's minus terminal (terminal 1).

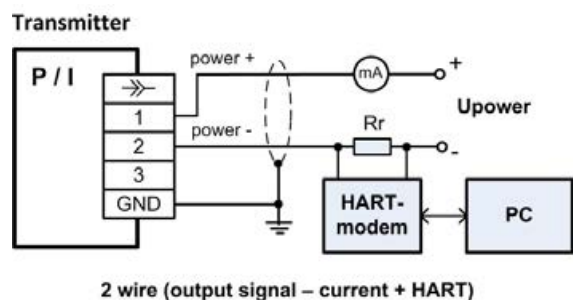


Figure 1 - HART digital output connection diagram, DIN 43650A

Table 3 - Analog signals

Transmitter circuits	Connector pins					Wires colors (cable gland)
	DIN 43650A	Binder 713	Binder 723	Buccaneer	Packard	
<b>2 wire:</b>						
Power +	1	1	3	1	2	white
Power -	2	2	4	2	1	brown
shield	GND	4	5	4	-	yellow-green
<b>3 wire:</b>						
Power +	1	1	3	1	-	white
Power -	2	2	4	2	-	brown
signal +	3	3	1	3	-	green
shield	GND	4	5	4	-	yellow-green

Table 4 - RS-485 interface (4 wire line)

Transmitter circuits	Connector pins		Wires colors (cable gland)
	Binder 713	Binder 723	
Power +	3	3	white
Power -	1	1	brown
A	4	4	yellow
V	5	5	green
shield	2	2	yellow-green

**ATTENTION!** The potential difference seen when mounting transmitters to vessels with cathodic corrosion protection can be significant, which translates into possible currents running through the signal cable when its shield is bi-grounded. As a preventive measure in such setups, you can skip connecting shield to the transmitter's ground terminal.



**DO NOT USE any non-standard seals when sealing the cable. Use round cable of appropriate diameter.**

### 5 Operation and maintenance

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.



#### DO NOT:

- allow voltage exceeding maximum specified for the transmitter;
- use any objects to touch or otherwise apply mechanical force to the diaphragm;
- use transmitters bearing visible signs of mechanical damage;
- use transmitters in inappropriate climatic conditions;
- allow medium temperatures above or below the limits specified for the transmitter; temperature above the limit may lead to medium seeping into the transmitter, temperature below the limit may render the transmitter inoperative.

Routine checkups of the device in use follow data specified in its passport.

After switching the working range of a multirange transmitter, always put a sticker announcing the new range on top of the sticker with the previous range. Degrease the surface before putting the sticker. Stickers are supplied with the ZCON 100 configurator.

Always register range switches in the transmitter's passport.

See the device's passport for its calibration interval and manufacturer's warranty.

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

All and any repairs are done by the manufacturer exclusively.

### 6 Transportation and storage

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

6.2 Protect devices from impacts and vibrations while in transit; permissible temperature for transportation in shipping containers ranges from -50 to +85 °C.

6.3 Store devices in shipping containers in a heated (+5 to 40 °C) ventilated space.

### 7 Package contents

See Table 5 for package contents details.

Table 5 - Package contents

Name	Qty
APZ pressure transmitter	1 pc
Passport	1 copy
User manual (this paper)	1 copy*
Calibration leaflet	1 copy**
PIEZUS Explosion Protection Guidelines (Ex versions only)	1 copy*
Optional accessories	1 set**

\* 1 copy per 10 transmitters for batch supplies to the same address.  
Papers can be downloaded from the manufacturer's website.  
\*\* Supplied by special order.

### 8 Resource and service life

8.1 Operating mode - 24/7.

8.2 Mean time between failures, min – 100,000 h.

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

### 9 Disposal

9.1 Transmitter contains no precious metals.

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

### Supplement - Appearance of pressure transmitters



**Note:** appearance may vary depending on the transmitter's configuration. Housing of Ex version (4...20 mA output signal) is 26 mm longer

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**APZ PRESSURE TRANSMITTERS**  
**(1110, 1120, 3020, 3230, 3410, 3420, 3421)**  
**ALZ LEVEL TRANSMITTERS**  
**(3720, 3721, 3820, 3821)**



**Explosion Protection Guidelines**  
**Version 01**



This instruction sheet applies to explosion-proof (Ex) versions of pressure transmitters. It contains technical information necessary for their correct mounting and operation in hazardous areas.

This instruction sheet is a supplement to the relevant Operation Manual; it offers typical connection diagrams for transmitters and their explosion protection components.

Explosion-proof versions have intrinsically safe circuits, level "ia", which allows bearing markings 0Ex ia IIC T4 Ga and 0Ex ia IIC T4 Ga X. X after Ex marking means there are special requirements to connection of pressure transmitters: integral communication cable must run outside of the hazardous area or in a box meeting the requirements of TP 012/2011.



**Please pay special attention to paragraphs accompanied by this mark.**

**1 General Information**

1.1 Only specialists trained in handling explosion-proof equipment can mount the transmitters; before mounting, they must read this instruction sheet and Operation Manual.

1.2 Following documents regulate mounting of explosion-proof transmitters:

- 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 60079-0-2011 Explosive atmospheres. Part 0. Equipment. General Requirements;
- GOST R IEC 60079-11-2010 Explosive atmospheres. Part 11. Intrinsically safe electrical circuit "i";
- GOST IEC 60079-14-2013 Explosive atmospheres. Part 14. Design, Selection and Installation of Electrical Units;
- VSN332-74 Installation of Electrical Equipment, Power and Lighting Lines in Explosion Hazard Zones: Instructions.

**2 Safety Precautions**

2.1 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.

Unplug the transmitter only after medium pressure equalizes with atmospheric pressure.

2.2 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.

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

2.4 Always cut off power when connecting circuits.



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

**3 Mounting**

3.1 Ex versions of transmitters can be used in explosion hazard zones IIA, IIB, IIC, temperature classes T1 ... T4, as prescribed by regulations setting framework for application of electrical equipment in explosion hazard conditions.

3.2 Always check the exterior of the transmitter 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.

3.3 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.

3.4 See the Manual for additional recommendations pertaining to mounting.

**4 Power Connection**

**4.1 General**

4.1.1 Depending on the version, transmitters can have two- or three-wire connection circuits. Ordering code contains information about the transmitter's communication link type, which must be taken into account when connecting the transmitter.

4.1.2 To ensure compliance with explosion safety rules applicable to transmitters in specific locations:

- connect circuits as described in Supplement A;
- use additional equipment compliant with the requirements provided in clause 4.2;
- disconnect transmitter from power source when connecting communication cable.

4.1.3 We recommend using a circular cross-section wire (see transmitter's Specifications for its diameter) to ensure a reliable seal of the cable gland. Sealing cable gland with standard rings and gaskets is MANDATORY.

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

4.1.5 Ensure compliance with requirements provided below when mounting transmitters in explosion hazard zones.

**NOTE: You may use a DC power source (see Manual for voltage) for an intrinsically safe transmitter mounted outside of explosion hazard zones; in such a setup, the transmitter is no longer explosion-proof.**

**4.2. ia Explosion Protection**

4.2.1 ia versions of transmitters are designed following guidelines provided in GOST 22782.5 and have their current and voltage limited to intrinsically safe values.

Transmitters 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.

4.2.2 Electrical parameters of pressure transmitters (input, intrinsically safe):

**- current signal 4...20 mA (2 wire):**

$U_i \leq 28 \text{ V}$ ,  $I_i \leq 93 \text{ mA}$ ,  $P_i \leq 0.66 \text{ W}$ ;  $C_i \leq 0,015 \text{ }\mu\text{F}$ ,  $L_i \leq 10 \text{ }\mu\text{H}$ ;

**- voltage signal 0.5...4.5 V (3 wire):**

$U_i \leq 6 \text{ V}$ ,  $I_i \leq 60 \text{ mA}$ ,  $P_i \leq 0.1 \text{ W}$ ;  $C_i \leq 0.5 \text{ }\mu\text{F}$ ,  $L_i \leq 10 \text{ }\mu\text{H}$ .

**Note - Ex pressure transmitters bear the following data:**

- explosion protection type;
- electrical parameters of explosion protection;
- number of the certificate of conformity.

**5 Explosion protection in operation**

5.1 Using Ex versions of pressure transmitters, you need to follow guidelines provided in this sheet, relevant Manual, chapter 3.4 of the Electrical Equipment Operation Rules, chapter 7.3 of the Electrical Installations Code, as well as other regulations covering operation of electrical equipment in hazardous areas.

5.2 The devices need maintenance; the routine includes external inspection that aims at checking:

- reliability of transmitter's connection to the medium line, its seals;
- its mechanical integrity, contamination with dust and dirt;
- integrity of the communication cable and its insulation.



**Use of malfunctioning or damaged transmitters is strictly prohibited.**

5.3 Maximum period between maintenance checkups is one year; depending on the operating conditions, you may need to perform them more often.

5.4 Maximum medium pressure (in line, etc) should not exceed the transmitter's URL (upper range limit).

5.5. Never adjust ZERO and RANGE if the atmosphere around the transmitter is explosive.

**Supplement A**

**Analog Output Connection**

See figures A.1 and A.2 for typical transmitter circuits connection diagrams (Ex version).

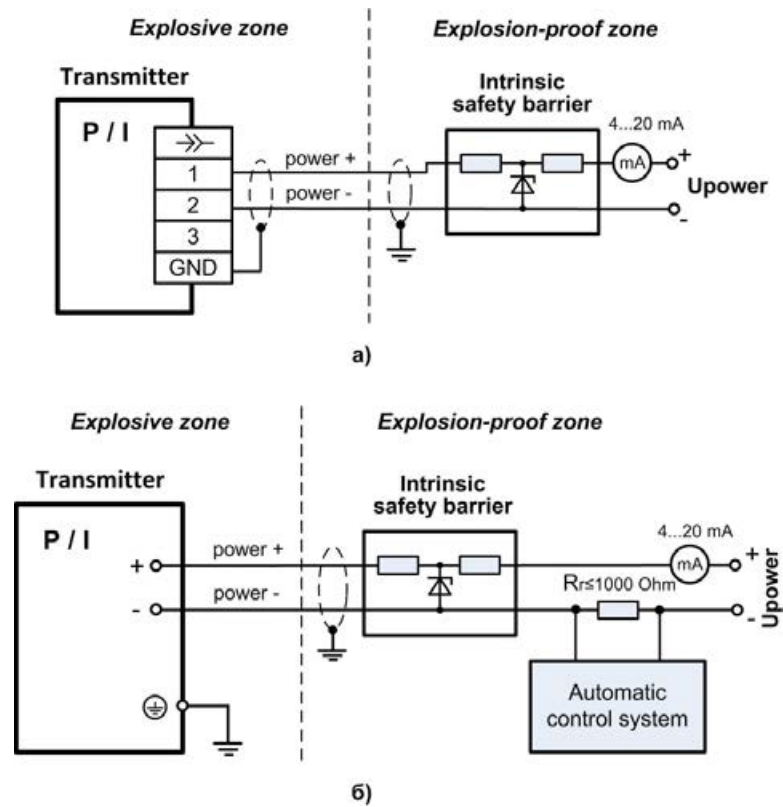


Figure A.1. Variant of analog output connection diagram, current signal: a) DIN 43650A connector; b) cable gland

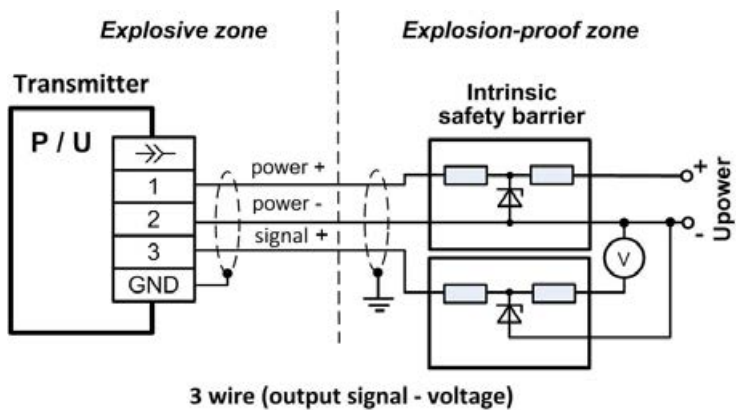


Figure A.2. Variant of analog output connection diagram, voltage signal, DIN 43650A connector