



# Resistance temperature sensor without protective armature (jacketed)(Ex ia) type 212

## PRODUCT MANUAL

FOR DESIGN WITH CONVERTER A MANUAL IS ENCLOSED TO THE RELEVANT CONVERTER

### APPLICATION

- For such temperature measurement, where the following is required
  - o Short time of temperature response (fast response of the sensor to a change of the measured temperature)
  - o Small dimensions and flexibility of the sensor (possibility of shaping the stem of the sensor)
  - o High mechanical resistance to shocks and vibrations
  - o Resistance to fast changes of temperature
  - o High insulation resistance at normal ambient temperature also in high temperatures
  - o Good general resistance to corrosion, resistance to corrosion under voltage
  - o High accuracy of measurement
  - o Good resistance to inter-crystalline corrosion also after welding, good resistance to heavy oil products, steam and exhaust gases, good resistance to oxidation
  - o Maximum temperature of application up to 600°C
- for potentially explosive atmosphere in the areas of Zone 2, Zone 1 and Zone 0 pursuant to EN 60079-10 1 during the application of the converter Ex ia or in connection to the Ex ia circuit
- In design with converter for the transfer of the signal of the resistance sensor to a unified output signal 4 to 20 mA or signal digital (converter with HART protocol)
- For the environment, where mechanical resistance is required pursuant to EN 60068-2-6 (class AH2) and seismic capability of the electrical equipment of the safety system of the nuclear power stations pursuant to IEC 980 (MVZ level SL-2)
- special design for cryogenic environment with medium temperature up to -196 °C

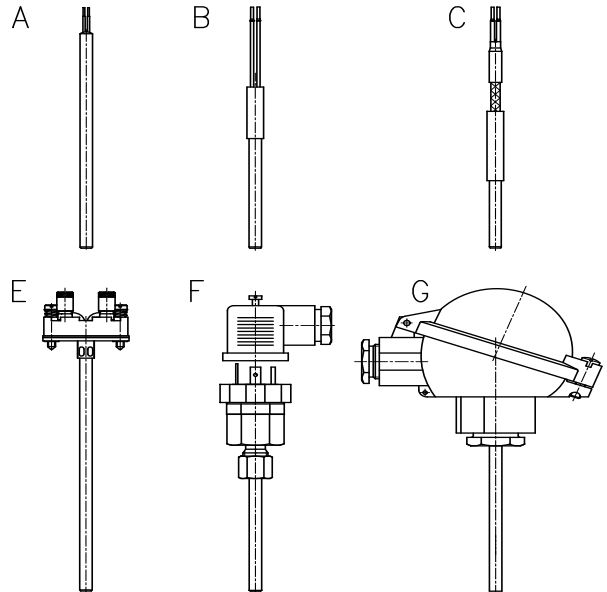
The areas of application can be e.g. nuclear energy, steam boilers, pressurized water reactors, aircraft engines, processing plastic materials, paper industry and food industry. The sensors with converter or Ex ia design are rated products pursuant to the Directive 2014/30/EU of the European Parliament and the Council and EU Declaration of Conformity **EU - 212000** is issued for them.

### DESCRIPTION

Jacketed resistance sensors are manufactured with a stem of the measuring insert with an outer diameter of 3 to 6 mm. Nominal length of the sensor can be pursuant to the requirement of the customer from 100 mm to several meters, after an agreement also several dozen meters. The stem tube of the sensor is made of stainless steel 1.4541 and copper wires are placed in it in compacted mineral insulation from MgO. The measuring resistor is located in a case welded on the end of the stem of the sensor.

Pursuant to the end of the stem of the sensor with measuring resistor, the jacketed resistance sensors are made in several different designs.

- A with free glands
  - B with reducer and free glands
  - C with reducer and cable glands, which can be
    - o with insulation from glass fibres and external braiding with a stainless wire to increase mechanical resistance
    - o with internal and external Teflon (fluoroplastic FEP) insulation
    - o with internal Teflon and external silicon insulation
  - E with flange and ceramic terminal board or with converter
  - F with connector pursuant to EN 175301-803
  - G with head with terminal board or two-wire converter (analogue or digital, insulated or non-insulated, in design Ex ia or with digital communication)
- The head is provided with a lid and cable gland for the connecting wiring. The sensor with converter in Ex ia design has external and internal terminals on the head for



the connection of grounding wire or wire for mutual interconnection. The converter is installed either directly on the flange of the measuring insert or in the lid of the head. The sensor with converter is supplied from an external source. The installed converter is set-up at the manufacturer of the sensor to the required range.

To measure temperature, a defined change of sensor resistance in dependence on the change of temperature of the measured environment is used.

### TECHNICAL DATA

The sensor is designed pursuant to EN 61140 as an electrical equipment of protection class III for the application in networks with the category of overvoltage in the installation II and the pollution grade 2 pursuant to EN 61010-1. The follow-up (evaluation) device shall comply with Article 6.3 of the said standard.

**Measuring range:** -196 to 600°C \*) \*\*)

\*) Class A is only guaranteed in the range from -50 to 300 °C

\*\*) Special design for cryogenic environments in range -196 to 100°C

The measuring range of the sensor with converter is established by the range of the selected converter.

**Electric strength** pursuant to EN 61010-1 Article 6.8.4:

500 V eff for measuring insert Ø 6 mm

100 V eff for measuring insert Ø 3 mm

(only the sensor without the converter or design with insulated converter)

**Electrical insulation resistance** pursuant to EN 60751:

min. 100 MΩ, at 15 to 35°C, max. 80 % relative humidity

**Intrinsically safe** pursuant to EN IEC 60079-0 and EN 60079-11:

Ex II 1 G Ex ia IIC T5/T6 Ga

(Meaning of designation - see figure 4)

P<sub>i</sub> = 192 mW T6 (-60°C ≤ Ta ≤ 60°C)

P<sub>i</sub> = 290 mW T6 (-60°C ≤ Ta ≤ 55°C)

T5 (-60°C ≤ Ta ≤ 65°C)

**Intrinsically safe circuit parameters:**

only for Pt 100, with measuring insert Ø6

Input

U<sub>i</sub> = 60 V

I<sub>i</sub> = 100 mA

P<sub>i</sub> = 192 mW / 290 mW

C<sub>i</sub> = 780 pF/m

L<sub>i</sub> = 0,6 μH/m



**WARNING**



The device must be installed in a housing that meets the degree of protection against intrusion of at least IP 20. The casing of the measuring insert is not separated from the inner intrinsically safe circuit according to the standard EN 60079-11. This information must be taken into account during installation.

**Power supply of the converter:**

DC 24 V from the source SELV, e.g. INAP 16 and INAP 901

**Other data of the converter:** refer to the enclosed manual

**Ingress Protection** pursuant to EN 60529:

- IP 65 for design F and G
- IP 60 for design B and C
- IP 00 for design A and E

**Operation position:**

discretionary; in case of the design with head the outlet shall not be situated upwards

**Type of operation:** continuous

**Weight of sensor:** depending on design and length

**Applied materials:**

Jacket of the stem 1.4541

Insulation of cable gland (Cu cores)

- External and internal insulation from glass fibres and external jacket with stainless wire (4 x 0.5 mm<sup>2</sup>)
- External and internal insulation of Teflon, shielding brought out with Cu wires (4 x 0.22 mm<sup>2</sup>)
- Internal insulation of Teflon, external silicone insulation, shielding brought out with Cu wires (4 x 0.22 mm<sup>2</sup> or 6 x 0.15 mm<sup>2</sup>)

Reducer	aluminium
Connector	polyamide
Head	aluminium alloy painted with a polyester colour or plastic PPO (phenyl polyoxide)
Sealing of lid of head and gland	oil-resistant rubber
Sealing under sealing screw joint	silicone rubber
Internal wiring	Cu
Head clamps of the terminal board	brass with Ni surface

**OPERATION CONDITIONS**

The environment is defined by the group of parameters and their severity grades IE 36 pursuant to EN 60721-3-3 and the following operation conditions.

**Maximum temperature in the place of the reducer and sealed free outlets:** 180°C

**Permitted surface temperature of the connector:** 40 to 90°C

**Ambient temperature for terminal board, head and gland of the sensor:**

- for design without the converter -50°C to 120°C
- for design with converter pursuant to type of the converter (refer to the enclosed manual for the converter)
- for design with converter and display pursuant to type of the converter and display (refer to the enclosed manual for the converter and display)

**Relative ambient humidity:**

- 10 to 95 % without condensation, with upper limit of water content of 29 g H<sub>2</sub>O/kg of dry air
- for design with converter pursuant to type of the converter (refer to the enclosed manual for the converter)
- for design with converter and display pursuant to type of the converter and display (refer to the enclosed manual for the converter and display)

**Intrinsically safe measuring inserts can be used in intrinsically safe circuits of group II electrical equipment.**

**Atmospheric pressure:** 70 to 106 kPa

**Resistance of material of the head PPO (phenyl polyoxide):**

Kerosene	partially resistant
Diesel oil	resistant
Benzene	partially resistant
Animal and vegetable oil	resistant
Weak hydroxydes	
Strong hydroxydes	
Weak acids	
Strong acids	
Sea water	partially resistant
Trichloroethylene	

**Resistance of material of the lid sealing and outlet sealing of the head (oil resistant rubber):**

Spirit	resistant
Ether	
Benzole	
Petrol	
Ester	
Animal and vegetable oil	
Mineral oil	
Diesel oil	
Weak alkali hydroxydes	
Strong alkali hydroxydes	
Weak acids	resistant
Strong acids	non-resistant
Sea water	resistant
Trichloroethylene	partially resistant
Hot water	

**METROLOGICAL DATA**

**Sensor:** measuring resistor Pt 100 in connection pursuant to the scheme and table of designs,  $\alpha = 0.00385 [K^{-1}]$ , tolerance class A or B pursuant to ČSN IEC 751

**Resistance of internal wiring at 20 °C:**

0,05 Ω/m for measuring insert Ø 6 mm  
0,20 Ω/m for measuring insert Ø 3 mm

**Resistance of internal wiring of cable outlet (two cores) at 20 °C:**

core cross section	0.22 mm <sup>2</sup>	0.175 Ω/m
core cross section	0.56 mm <sup>2</sup>	0.066 Ω/m
core cross section	0.15 mm <sup>2</sup>	0.274 Ω/m
core cross section	0.50 mm <sup>2</sup>	0.082 Ω/m

**Maximum current load of measuring resistor:** 3 mA

**Recommended measuring current:** 1 mA

**Output signal of the converter (linear with measured temperature):**  
4 to 20 mA (+ digital for HART protocol)

**Calibration depth of immersion of the measuring insert of the sensor**

for temperature points within the range of  
-70 to 250°C: min. 160 mm  
for temperature points over 250°C: min. 260 mm

The distance of the end of the measuring insert from the level of the medium in the calibration bath shall be at least 40 mm at temperatures to 250°C and min. 70 mm at temperatures over 250°C.

**Time of temperature response** pursuant to EN 60751 in whirling water:

for measuring insert Ø 6 mm (characteristic value):	$\tau_{0.5}$	5,5 s
for measuring insert Ø 3 mm (characteristic value):	$\tau_{0.5}$	1,6 s
	$\tau_{0.9}$	3,7 s

**DESIGNATION**

**DESIGN A**

- Type of designation pursuant to the agreement with the customer with the manufacturer

**DESIGN B**

**Data on self-sealing label on the outlet insulation:**

- Trademark of the manufacturer
- Made in Czech Republic
- Type of resistance sensor, nominal value R<sub>0</sub> / tolerance class / configuration of wires of internal wiring
- Measuring range
- Product ordering number
- Ingress Protection
- Time code (serial for calibrated design and design with tolerance class A)

**DESIGN C**

**Data on shrinking hose on the cable:**

- Trademark of the manufacturer
- Made in Czech Republic
- Type of resistance sensor, nominal value R<sub>0</sub> / tolerance class / configuration of wires of internal wiring
- Measuring range
- Product ordering number
- Ingress Protection
- Time code (serial number for calibrated design and design with tolerance class A)

**DESIGN E****Data on self-sealing label under the flange:**

- Trademark of the manufacturer
  - Made in Czech Republic
  - Type of resistance sensor, nominal value  $R_0$  / tolerance class / configuration of wires of internal wiring \*)
  - Maximum measuring range
  - Product ordering number
  - Time code (serial number for calibrated design, design with tolerance class A, for design with converter and for Ex ia design)
  - Value of resistance of internal wiring (for design without the converter)
  - CE mark (for design with converter)
  - Mark of non-explosiveness:
    - ⊕ II 1 G Ex ia IIC T5/T6 Ga (Ex ia design)
    - and number of the EU-Type Examination Certificate
    - Mark CE 1026 (for Ex ia design)
- \*) For the converter, the configuration of wires of internal wiring is not specified

**Data on the label of the converter:**

- Trademark of the manufacturer
- Type of sensor
- Adjusted temperature range
- Designation of non-explosiveness and EU-Type Examination Certificate number (for design with converter Ex i)
- CE mark (for design with converter Ex ia with identification number of the notified person)

**DESIGN F****Data marked on screw union:**

- Trademark of the manufacturer
- Made in Czech Republic
- Type of resistance sensor, nominal value  $R_0$  / tolerance class / configuration of wires of internal wiring
- Measuring range
- Product ordering number
- Ingress Protection
- Time code (serial number for calibrated design, and design with tolerance class A)
- Material of screw joint

**DESIGN G****Data on self-sealing label on the head:**

- Trademark of the manufacturer
  - Made in Czech Republic
  - Type of resistance sensor, nominal value  $R_0$  / tolerance class / configuration of wires of internal wiring \*)
  - Measuring range or adjusted range of the converter
  - Product ordering number
  - Ingress Protection
  - Time code (serial number for calibrated design, design with tolerance class A, for design with converter and for Ex ia design)
  - Output signal 4 to 20 mA (design with converter)
  - Ambient temperature (for design with converter Ex ia)
  - Mark of non-explosiveness and EU Type examination certificate (for design with converter Ex ia)
  - Mark of non-explosiveness:
    - ⊕ II 1 G Ex ia IIC T5/T6 Ga (Ex ia design)
    - and number of the EU-Type Examination Certificate
    - Mark CE 1026 (for Ex ia design)
- \*) For the converter, the configuration of wires of internal wiring is not specified

**Data on the label of the measuring insert (nor for head MA):**

- Trademark of the manufacturer
  - Made in Czech Republic
  - Type of resistance sensor, nominal value  $R_0$  / tolerance class / configuration of wires of internal wiring \*)
  - Measuring range or adjusted range of the converter
  - Designation of type
  - Time code (serial number for calibrated design, design with tolerance class A, for design with converter and for Ex ia design)
  - Value of resistance of internal wiring (for design without the converter)
- \*) For the converter, the configuration of wires of internal wiring is not specified

**Data on the label of the converter:**

- Trademark of the manufacturer
- Type of sensor
- Adjusted temperature range
- Mark of non-explosiveness and EU Type examination certificate (for design with converter Ex ia)
- CE mark (CE with identification number of notified person for design with converter Ex ia)

**Data on the display**

- Trademark of the manufacturer
- Mark of non-explosiveness and EU Type examination certificate (for design with converter Ex ia)
- CE mark (CE with identification number of notified person for design with converter Ex ia)

**DELIVERY**

Jacketed temperature sensors are delivered in direct conditions or coiled up.

In direct conditions, the sensors are delivered with length  $L \leq 2000$  mm. As a default, the sensors of bigger lengths are delivered coiled up to  $\varnothing$  approx. 350 to 450 [mm], in direct conditions only a prior agreement with the manufacturer.

Unless agreed otherwise with the customer, each delivery includes

- Delivery note
- Sensor pursuant to the purchase order
- Suitable screw joint ordered independently from the catalogue of accessories of type 991
- Optional accessories to the sensor with programmable converter
  - o Configuration (parameterization) program pursuant to the required converter
  - o Communication modem (for serial port RS 232C) pursuant to the required converter
- Accompanying technical documentation in Czech
  - o Product quality and completeness certificate, which also serves as the warranty certificate
  - o Calibration sheet (for calibrated design)
  - o EU Declaration of Conformity for Ex ia design
  - o Product manual

If it is established in the purchase contract or agreed otherwise, the following documentation can be also delivered with the product

- EU Declaration of Conformity for design with converter
- Copy of the Inspection Certificate 3.1 for the material of the jacket with the heat number
- Declaration of Conformity with purchase order 2.1 acc. to EN 10204
- Declaration of Conformity of the supplier pursuant to EN ISO/IEC 17050-1
- Test report about the seismic and the vibration qualification
- Calibration sheet (for uncertified calibrated design)
- EU Declaration of Conformity (for design with converter)
- Copy of EU-Type Examination Certificate pursuant to the 2014/34/EU (ATEX). for Ex ia design

**TABLE 1 – TOLERANCE OF LENGTH OF THE MEASURING INSERT**

Length L [mm]	Tolerance
0 to 1000	±1 mm
1001 to 2500	±2 mm
2501 to 5000	±10 mm
5000 to 10000	±0.5% of length
10001 to 25000	± 1% of length

**CERTIFICATION**

- Non-explosiveness Ex ia, EU-Type Examination Certificate pursuant to the Directive 2014/34/EU FTZÚ 21 ATEX 0007X
- Non-explosiveness Ex ia, EU-Type Examination Certificate pursuant to the 2014/34/EU, (pursuant to the type of the converter)

**RELIABILITY**

Indicators of reliability in operation conditions and conditions of the environment specified herein

- Mean time of operation between failures 96 000 hours (inf. value)
- Expected service life 10 years

**CALIBRATION**

It is realized pursuant to TPM 3342-94 and in compliance with EN 60751 usually in three temperature points spread evenly within the operation range of the sensor or in the points according to the requirement of the customer. Calibration sheets with measured data are issued for calibrated sensors.

**PACKING**

Both sensors and accessories are delivered in a packing ensuring resistance to the impact of thermal effects and mechanical effects pursuant to controlled packing regulations.

**TRANSPORT**

The sensors may be transported on conditions corresponding to the set of combinations of classes IE 21 pursuant to EN IEC 60721-3-2 (i.e. by airplanes and trucks, in premises that are ventilated and protected against atmospheric conditions).

**STORAGE**

The sensors may be stored on conditions corresponding to the set of combinations of classes IE 11/1K3 pursuant to EN IEC 60721-3-1 (i.e. in places with temperature from -5 to 45 °C and humidity from 5 to 95%, without a special threat of an attack with biological agents, with vibrations of small significance and not situated close to sources of dust and sand).

**ORDERING TEMPERATURE SENSORS**

The purchase order shall specify

- Name
- Product ordering number
- Ex ia design is ordered using codes J4X, D2X or D3X according to table 2
- If calibration is required and in what temperature points
- If the delivery of the screw joint pursuant to type 991 is required for the sensor as accessories
- If optional accessories to the sensor are required with a programmable converter
- Requirement for other documentation pursuant to the article DELIVERY
- Additional information about the design of the sensor (maximum operation temperature and characteristics of the measured medium)
- Dimensional drawing (sketch) for atypical design
- Number of pieces

Behind the ordering number specified pursuant to the table 1, the customer shall identify the required range of measured temperature (i.e. lower and upper temperature limits in °C) and, as the case may be, other non-standard required parameters for converter configuration (e.g. indication of sensor tripping, dampening, required designation - tagging etc.).

**EXAMPLE OF PURCHASE ORDER****Standard design:**

- 1 - Resistance temperature sensor without protective armature with free outlets  
212A601BJ4100/100/30  
50 pcs
- 2 - Resistance temperature sensor without protective armature with reducer and free outlets  
212B601BJ4100/100/150  
30 pcs
- 3 - Resistance temperature sensor without protective armature with reducer and cable outlet  
212C601BD21S0/100/3500  
15 pcs
- 4 - Resistance temperature sensor without protective armature with flange and terminal board or with converter  
212E601BD3100/100  
15 pcs
- 5 - Resistance temperature sensor without protective armature with connector  
212F601BJ310A/100  
20 pcs
- 6 - Resistance temperature sensor without protective armature with head  
212G601BJP103/100/07  
10 pcs

**Special request:**

Resistance temperature sensor without protective armature 212  
pursuant to drawing  
6 pcs

**ORDERING ACCESSORIES**

The purchase order shall specify:

- Name
- Product ordering number
- Number of pieces

**EXAMPLE OF PURCHASE ORDER:**

- 1 - Screw union with collet  
991 SR 60 K M18  
20 pcs
- 2 - Screw union with threaded rings  
991 SR 60 Z N14  
20 pcs

TABLE 2 - DESIGN AND ORDERING OF THE TEMPERATURE SENSOR, TYPE 212

SPECIFICATIONS			ORDERING NUMBER																
			212	x	xx	x	x	xx	x	x	x	/xxx	/xxx	/xx	/xx				
Design	pursuant to the figure	with free outlets of branches	A																
		1 with reducer and free outlets	B																
		with reducer and cable outlet	C																
		2 with flange and terminal board or with converter	E																
		4 with connector (only J3)	F																
		3 with head	G																
other - pursuant to drawing of the customer *)		Z																	
Diameter of steam of the measuring insert	Ø3 L ≤ 3000 mm, L > 3000 mm *)			30															
	Ø6 mm			60															
	Ø6 mm + limiting bush Ø8		E	80															
Measuring resistor		Pt 100				1													
Tolerance class	A - measuring range max. -70 to 300°C (not for D2)								A										
	B								B										
Connection	with connector	single three-wire (can't be with the measuring insert)	F						J3										
		single four-wire							J4										
	another design	single four-wire with measuring insert ø 6, length of measuring insert L <sub>mv</sub> 100 – 3025 [mm]	E							J4X									
		double two-wire							B	D2									
		double three-wire								D3									
		double two-wire								B	D2X								
		double three-wire								B	D3X								
	with converter	single two, three or four-wire, pursuant to the converter	E							JP									
		G																	
Material of jacket of the measuring insert		1.4541								1									
Material of insulation of the cable outlet	without cable outlet											0							
	glass fibre with metal braiding											G							
	external and internal Teflon		C									T							
	external silicone, internal Teflon											S							
Sensor head (connector)	without head												0						
	ball (alloy Al) (for converter Ex ia with external and internal terminals)													3					
	plastic ball (it cannot be used for converter Ex ia)														4				
	ball with increased lid (alloy Al) without display for converter in lid or with display (for converter Ex ia with external and internal terminals)															5			
	ball small (alloy Al) (only for terminal boards and converters INPAL 420. APAQ-HRF, TH 100. MINIPAQ-HLP)		G														6		
	small, type MA (only for terminal boards, design J4, D2)									J4							7		
	connector pursuant to EN 175301-803-																	A	
	another *)		F															C	
Nominal length L [mm]																	/xxx		
Length of free outlets or length of cable outlet L <sub>1</sub> [mm]																		/xxx	

TABLE 2 - DESIGN AND ORDERING OF THE TEMPERATURE SENSOR, TYPE 212 (continuation)

SPECIFICATIONS					ORDERING NUMBER														
					212	x	xx	x	x	xx	x	x	x	/xxx	/xxx	/xx	/xx		
Type of converter		Galvanic separation	Ex ia	NFC	Range [°C]														
Converter (connection for converter: single, double, three or four-wire, pursuant to the converter)	Analogue	INPAL 420			-50 to 50										/07				
					-30 to 70										/55				
					0 to 50											/15			
					0 to 100											/18			
					0 to 150											/19			
					0 to 200											/20			
					0 to 250											/21			
					0 to 400											/23			
	Programmable	TH 100				Programmable range	1	JP								/TH100			
		TH 100-ex		•					/TH100X										
		TH 200	•						/TH200										
		TH 200-ex	•	•					/TH200X										
		IPAQ-H	•						/IPAQH										
		IPAQ-HX	•	•					/IPAQHX										
		MINIPAQ-HLP							/MINIPAQ										
		APAQ C130			•				/C130										
		IPAQ C202							/C202										
		IPAQ C202X		•					/C202										
		IPAQ C330	•						/C330										
		IPAQ C330X	•	•					/C330X										
	HART protocol	IPAQ C520	•						/C520										
		IPAQ C520S ***)	•						/C520S										
		IPAQ C520X	•	•					/C520X										
		IPAQ C520XS ***)	•	•					/C520XS										
		IPAQ C530	•		•				/C530										
		IPAQ C530X	•	•	•				/C530X										
		TH 300	•						/TH300										
		TH 300-ex	•	•					/TH300X										
		MESO-H	•						/MESOH										
		MESO-HX	•	•					/MESOHX										
	248 HA NA	•			/248HANA														
	248 HA I1	•	•		/248HA11X														
	644 HA NA **)	•			/644HANA														
644 HA I1 **)	•	•		/644HA11X															
Other *)					/99														
Without converter (for installation of the converter by customer)																	/00		
LED display (to loop 4-20mA)	LED display LPI-01 (only with converter, except for converter 644 HANA)																	/LD	
	LED display Ex ia *) (only with converter Ex ia, except for converter 644 HA11X)															5		/LDX	
Special design for negative temperatures -196°C *)																		/CT	
Holder of head (only for design with head)																			/DR

Standard design

- \*) Only as a special request after an agreement with the manufacturer
- \*\*\*) Only without head (design E) or with head with increased lid
- \*\*) Functional safety SIL2

TABLE 3 – ADDITIONAL REQUIREMENT FOR DESIGN OF TEMPERATURE SENSORS, TYPE 212

SPECIFICATIONS			CODE
CALIBRATION	NUMBER OF CALIBRATION POINTS	CALIBRATION RANGE	
Calibration by TPM 3342-94, define calibration points	3	0 to 420 °C	/Q1
	3	0 to 600 °C	/Q2
	3	-196 to 100 °C	/Q3
	3	-50 to 600 °C	/Q22
	Other	-50 to 600 °C	/Q9
REQUIREMENT FOR OTHER DOCUMENTATION		USE	
EU Declaration of Conformity		for design with converter	/EU
Copy of EU-Type Examination Certificate acc to the 2014/34/EU (ATEX)		for Ex ia design	/Exi
Copy of the Inspection Certificate 3.1 acc to EN 10204 for material of protective tube with the heat number			/3.1
Declaration of Conformity with purchase order 2.1 pursuant to EN 10204			/2.1

Specify the code behind ordering number. Define calibration points for codes Q1, Q2, Q3, Q22 and Q9.



**TABLE 4 – OVERVIEW OF DESIGNS AND ORDERING OF SCREW UNION, TYPE 991**  
(to be ordered separately)

SPECIFICATION		ORDERING NUMBER						
		991	SR	xx	x	xxx	/xxx	/xx
Screw union for temperature sensor without protective tube			SR					
Stem tube of the measuring insert Ø [mm]	3			30				
	4,5 (not for screw union with threaded rings)			45				
	6			60				
Screw union	with collet				K			
	with threaded rings **)				Z			
Fixing thread Z	M 8x1 (not for tube of the measuring insert Ø 6)					M08		
	M 12x1,5					M12		
	M 18x1,5					M18		
	M 20x1,5					M20		
	G 1/4					G14		
	G 1/2					G12		
	G 3/8					G38		
	G 3/4					G34		
	1/4-18 NPT					N14		
	1/2-14 NPT					N12		
Thread of the protective hose Z2 *)							/xxx	

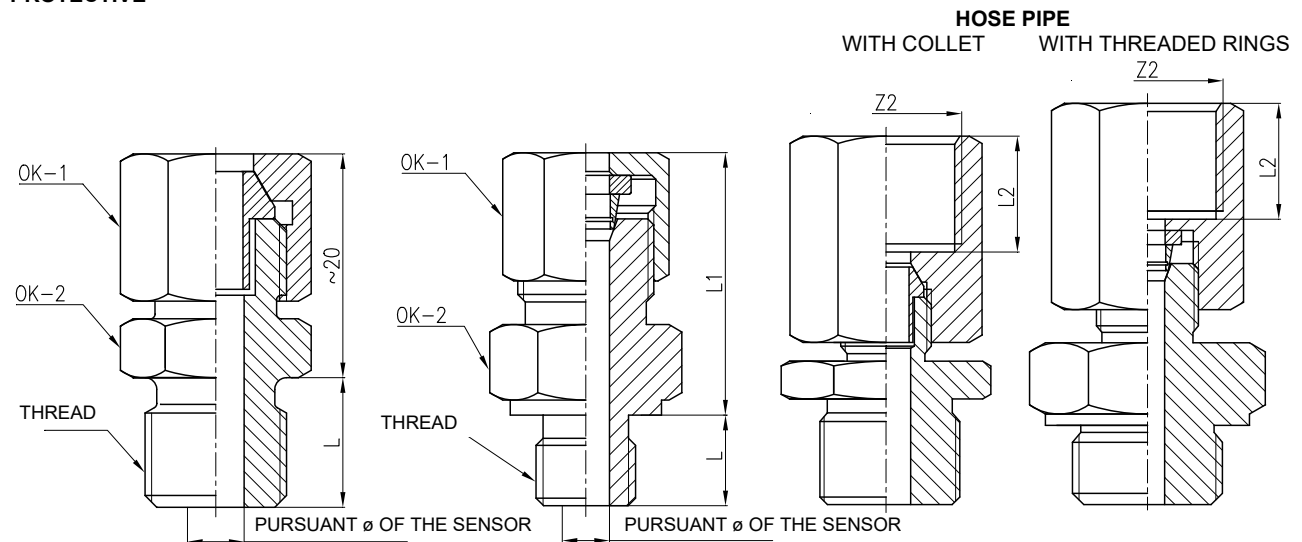
\*) Only as special requirement, Thread of the protective hose must be adduce in the order

\*\*)) For each screw union with threaded rings is delivered corresponding sealing ring

**SCREW UNION WITH COLLET PROTECTIVE**

**SCREW UNION WITH THREADED RINGS**

**SCREW UNION FOR CONNECTION**

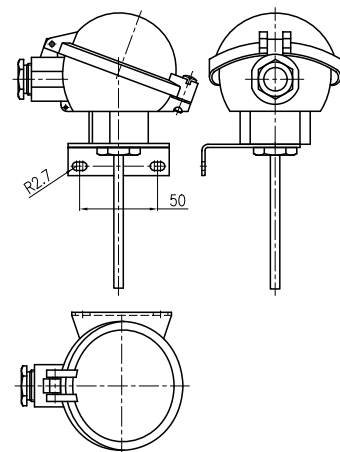


Dimensions of screw union are in the product manual - Accessories to temperature sensors - Screw union, type 991

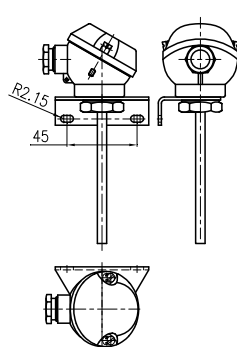
**INSTALLATION AND CONNECTION**

**SENSOR WITH HEAD WITH HOLDER FOR CONNECTION ON THE WALL**

Sensor with head B



Sensor with head MA



**INSTALLATION OF THE SENSOR**

The sensors are installed pursuant to specific conditions for a particular application, e.g. to a collet, by means of clamps and tightening stripes, placement into the bores or thermowells etc.

Jacketed sensors can be bent with a radius equalling to a five-fold of the external diameter of the jacket, i.e. 30 mm. It is not recommended to bend the stem at the length of 100 mm from the measuring end (welded case). The operation position of the sensors is discretionary.

Jacketed sensors with free outlets and cable gland can be installed directly as a part of various evaluation devices.

The sensors with head can be attached on the wall by means of the holder from the corrosion resistant steel and two screws. The gland of the head can be turned in the holder to a discretionary position after releasing the sealing screw joint.

**ELECTRICAL CONNECTION**

Electrical connection may only be realized by qualified workers.

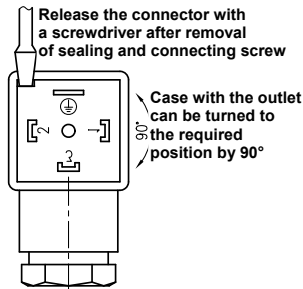
**DESIGN F**

The terminal board is accessible after releasing the central screw of the connector, its removal and removal of the body of the terminal board with the use of a screw driver (cut-out in the body of the terminal board) pursuant to the drawing. Connect the evaluation devices to the sensor cable with double insulation (internal wires with Cu core with cross section from 0.5 to 1.5 mm<sup>2</sup> for connector A and from 0.5 to 0.75 mm<sup>2</sup> for connector C). Temperature resistance of the insulation of the used cable shall be in compliance with the permitted temperature of the connector. Fix the cable in the gland against releasing. The gland is suitable for the connecting

cable with an outer diameter from 5 to 9 mm for connector A and from 4.5 to 6 mm for connector C.

In the environment with interfering signals, use shielded cables in the power supply voltage. If it is not possible to avoid influencing the measurement, ground the wiring.

The sensor from the terminal board of the connector can be connected in two-wire or three-wire way pursuant to strictness of the requirement for the elimination of resistance of internal wiring or resistance of the used cable. The cable pass-through piece (outlet) on the connector has four possibilities of positioning of the direction of the cable output (by 90°).



### ! WARNING

**As a default, the grounding terminal in the connector is not connected with the metal structure of the sensor.**

### DESIGN G

The terminal board of the sensor (of the converter) is accessible after tilting the lid of the head away, which is connected with one or two screws.

Connect the evaluation devices to the sensor with a non-armoured cable with double insulation with an external diameter from 5 to 8 mm, for head MA from 4.5 to 7 mm (internal wires with Cu core with cross-section 0.5 to 1.5 mm<sup>2</sup>). The cable outlet of the sensor shall be sealed properly.

### ! WARNING

**Do not use independent wires without a jacket for electrical connection. To ensure the Ingress Protection grade in the outlet, the connecting cable shall have a circular cross section. Temperature resistance of the cable shall comply with the ambient temperature!**

The cable insulation shall have chemical and mechanical resistance in compliance with the conditions, in which the cable will be installed. It is recommended supporting the cable along its length between the sensor and the follow-up device. In the environment with interfering signals, use shielded cable in the power supply circuit. Shielding may be only grounded (earthed) in one point. The cable should not be placed together with power cables.

In case of the sensor with HART protocol converter, the maximum length of wiring is defined by the arrangement of wires of the connecting cable. The total length of wiring may be up to 1500 m. It requires a twisted two-wire with shared shielding with the cross section of the core min. 0.5 mm<sup>2</sup>. HART communicator is connected to the supply loop of the converter pursuant to Figure 3. To achieve reliable communication, total load resistor of min. 250 Ω shall be in the circuit of the output loop.

### INSTALLATION OF THE SENSOR WITH CONVERTER Ex ia IN CONDITIONS WITH EXPLOSIVE GASEOUS ATMOSPHERE

The installation of the sensor in the conditions with explosive gaseous atmosphere shall be in compliance with the requirement EN 60079-14

**The sensor without converter** (with ball head from alloy Al with external and internal terminals – only on ZP (special requirement) after an agreement with the manufacturer) can be used as a simple device pursuant to EN 60079-11 Article 5.7 in an intrinsically safe circuit Ex ia pursuant to EN 60079-25. For a simple device, the maximum temperature can be determined from the value of the P<sub>0</sub> of the connecting device and the temperature class is determined.

**The sensor with converter Ex ia** may be used in case of compliance with the parameters Ex ia of the converter according to the enclosed converter manual.

Only insulated cables must be used in intrinsically safe circuits which is able to withstand the electrical strength test with a voltage equal to twice the voltage in the intrinsically safe circuit, or 500 V eff (DC 750 V), taking greater of the values.

In case of installation of intrinsically safe circuits, including cables, the maximum permitted inductance, capacity or ratio L/R and surface temperature may not be exceeded. Permitted values can be found out in the documentation of the follow-up equipment or label with the designation. Locate the follow-up equipment outside of the dangerous area. To ensure safety, an intrinsic safe source shall be always used pursuant to the converter manual. If the LED display is required, it shall be in design Ex ia.

### ! WARNING

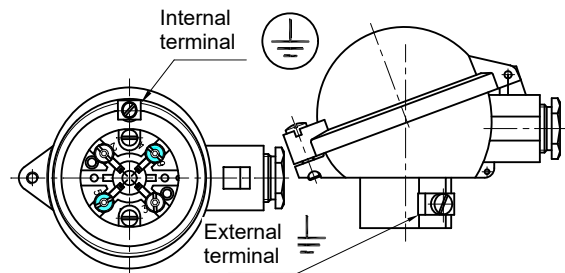
**Programmable converter may not be connected to the computer or HART communicator if the converter is located in the conditions with a danger of explosion.**

For installations in dangerous areas, mutual interconnection is required (bringing to the same potential). To achieve it, terminals on the sensor head can be used.

The sensor need not be connected to the system of mutual connection independently if it is installed firmly and has metal interconnection with the structural parts or the piping, which is connected to the system of mutual connection.

### HEAD OF THE SENSOR WITH TERMINALS

for the sensor with converter Ex ia



### Maximum cross section of the wire for connection to external and internal terminals:

Internal terminal: stranded wire 1.5 mm<sup>2</sup>, full wire 2.5 mm<sup>2</sup>

External terminal: stranded wire 4.0 mm<sup>2</sup>, full wire 6.0 mm<sup>2</sup>

If stranded wires are used for the interconnection, they shall be protected against fraying with pressing hollow.

### COMMISSIONING

After the sensor installation and connection of the follow-up (evaluation) device to the supply voltage (and the settlement period of the converter), the equipment is prepared for operation.

### ! WARNING

**After the end of installation of the sensor with converter Ex ia in conditions with explosive gaseous atmosphere, the initial revision of the equipment and installation shall be realized pursuant to EN 60079-17.**



### OPERATION AND MAINTENANCE

The sensor does not require any operation and maintenance. In case of the sensor with converter Ex ia, maintenance and follow-up regular periodical revisions or permanent supervision of the expert staff shall be realized pursuant to EN 60079-17.

### WARRANTY

The warranty period is 24 months from the receiving of the product by the customer, unless established otherwise in the contract.

The rejection of defects shall be enforced in writing at the manufacturer within the warranty period. The rejecting side shall identify the product name, ordering and manufacturing numbers, date of issue and number of the delivery note, clear description of the occurring defect and the subject of the claim. If the rejecting side is invited to send the device for repair, it shall do so in the original package of the manufacturer and/or in another package ensuring safe transport.

The warranty shall not apply to defects caused by unauthorized intervention into the device, its forced mechanical damage or failure to comply with operation conditions of the product and the product manual.



**SPARE PARTS**

The design of the sensors does not require any delivery of spare parts.

**REPAIRS**

The sensors shall be repaired by the manufacturer. They shall be sent for repair in the original or equal package without accessories.

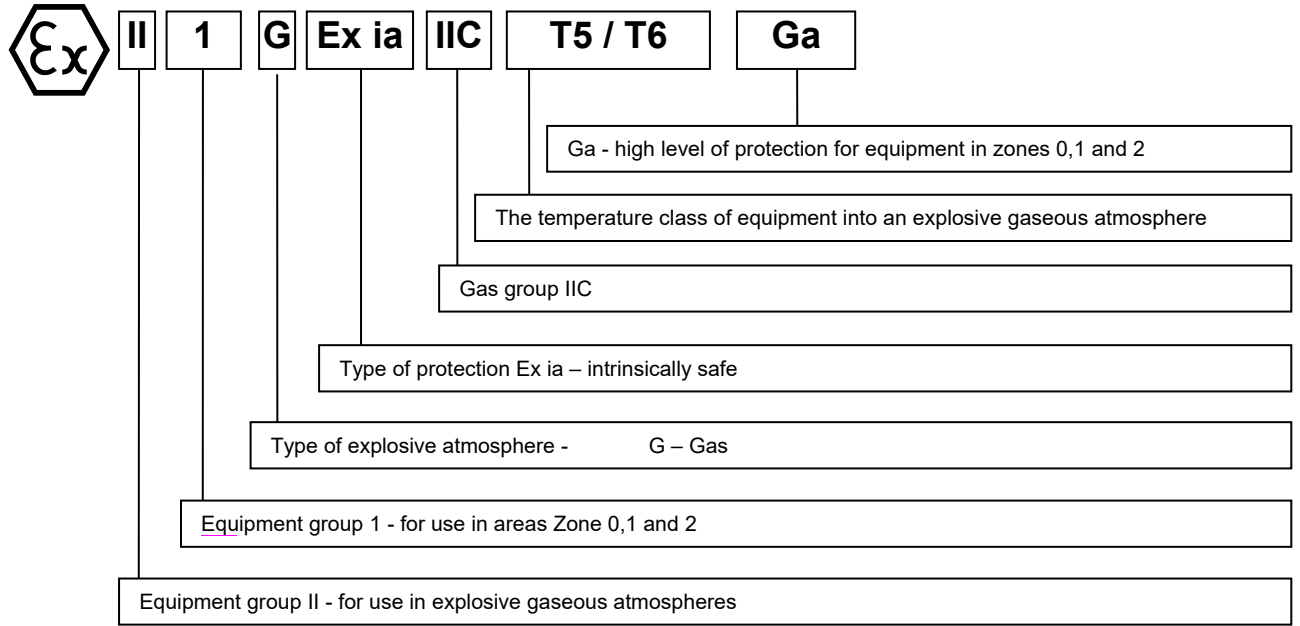
**DISABLING AND LIQUIDATION**

The product and its package do not include any parts that could impact the environment.

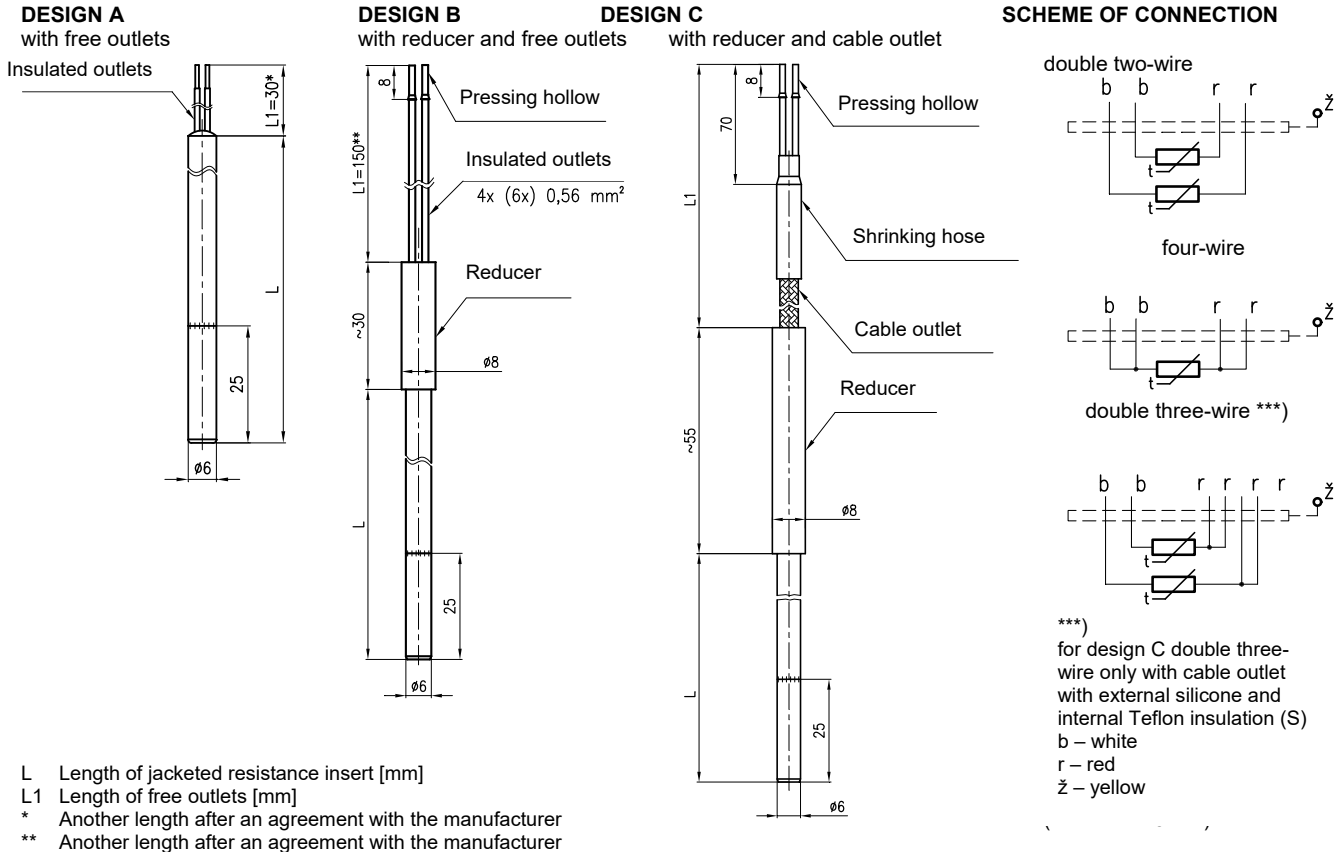
Products that are withdrawn from operation, including their packages (with the exception of products marked as electrical equipment for the purposes of return withdrawal and separate salvage of electrical waste), may be disposed of to sorted or unsorted waste pursuant to the type of waste.

The manufacturer realizes free return withdrawal of marked electrical equipment (from 13.8.2005) from the consumer and points out the danger connected with their illegal disposal. The package of the sensor can be recycled completely. Metal parts of the products are recycled, non-recyclable plastic materials and electrical waste shall be disposed of in accordance with applicable legislation.

**FIGURE 1 - INTRINSICALLY SAFE MARKING**

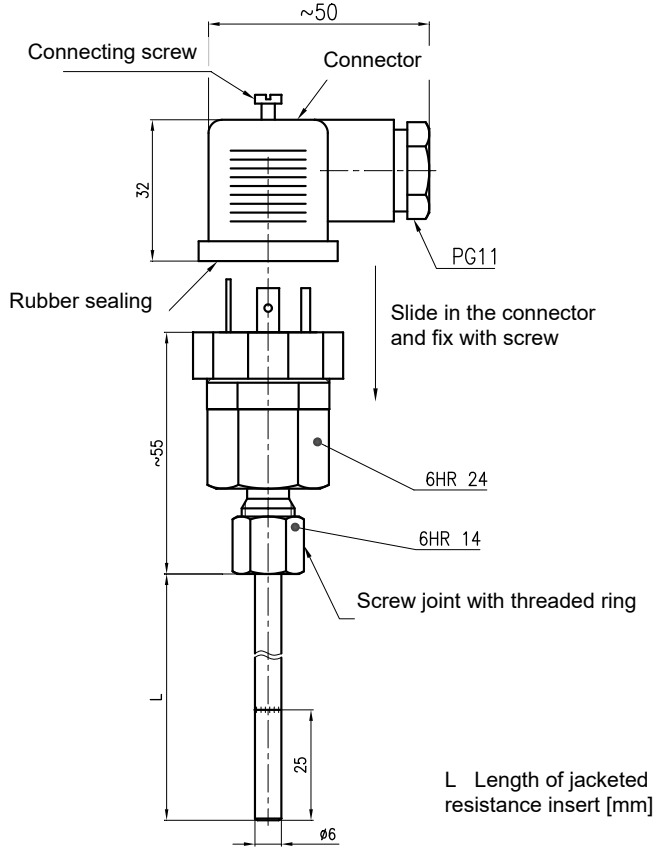


**FIGURE 2 - DIMENSIONAL DRAWING**

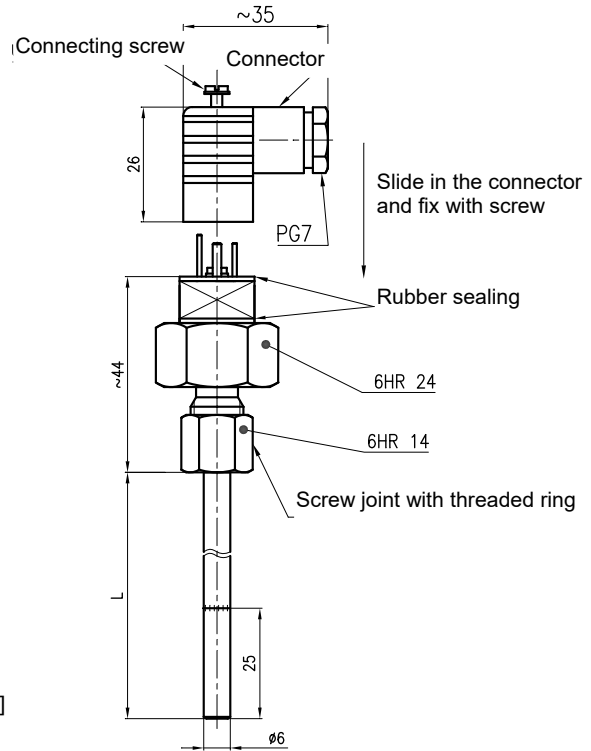


**FIGURE 3 DIMENSIONAL DRAWING  
DESIGN F**

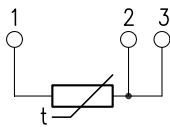
with connector pursuant to EN 175301-803, design A



with connector pursuant to EN 175301-803, design C

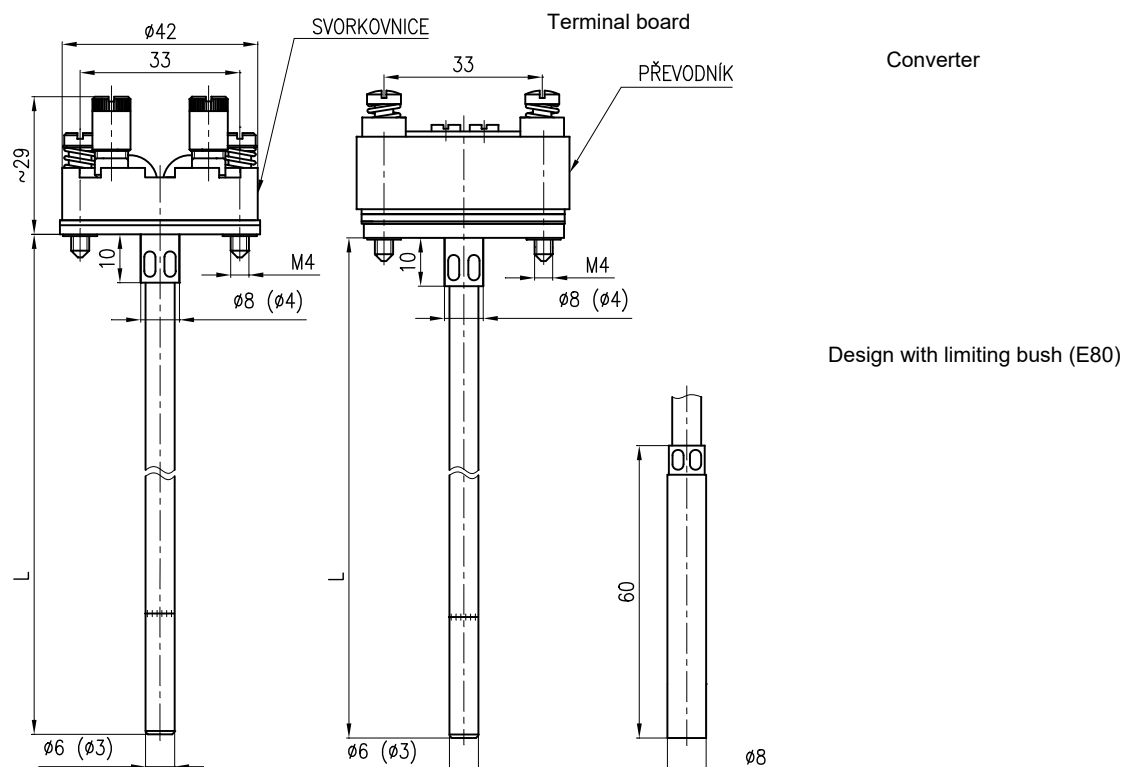


**SCHEME OF CONNECTION**



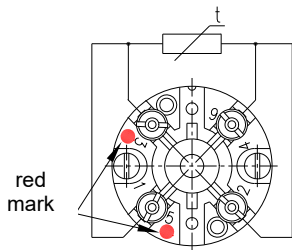
**FIGURE 4 DIMENSIONAL DRAWING  
DESIGN E**

WITH FLANGE AND CERAMIC TERMINAL BOARD OR WITH CONVERTER TO HEAD OF TYPE B PURSUANT TO DIN 43 729

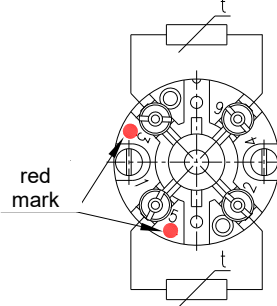


**CONNECTION SCHEME OF THE TERMINAL BOARD**

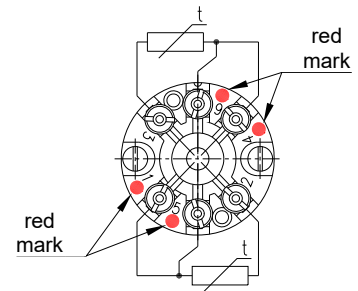
**J4** with single measuring resistor in four-wire connection (Pt 100/ I4)



**D2** with double measuring resistor in two-wire connection (2 × Pt 100/B/2)



**D3** with double measuring resistor in three-wire connection (2 × Pt 100/ I3)



L Length of jacketed resistance insert [mm]  
 screw terminals for wires with cross section 0.2 to 1.5 mm<sup>2</sup>



**WARNING**

The sensor 212E may not be used as replacement measuring insert to temperature sensors Ex d.

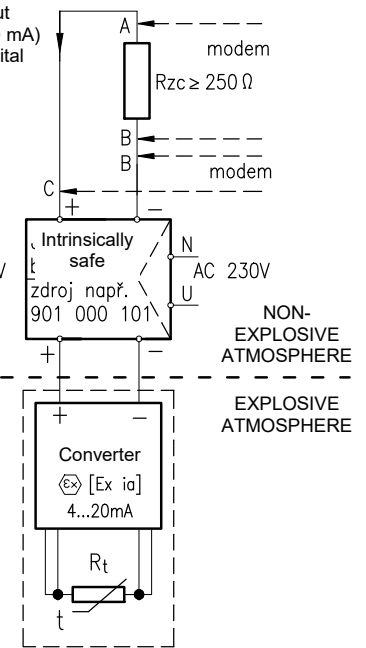
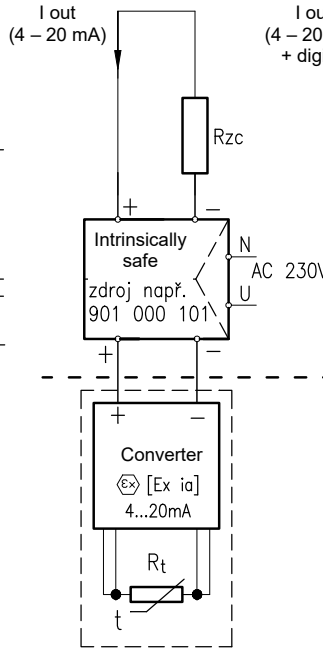
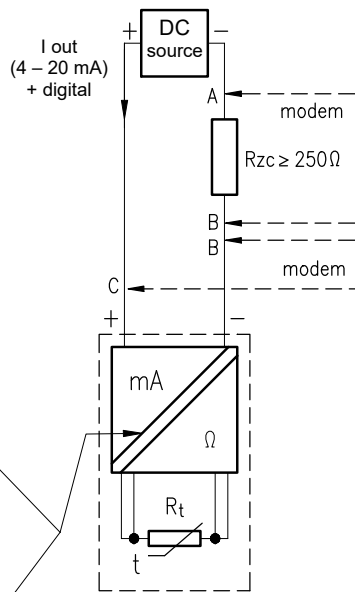
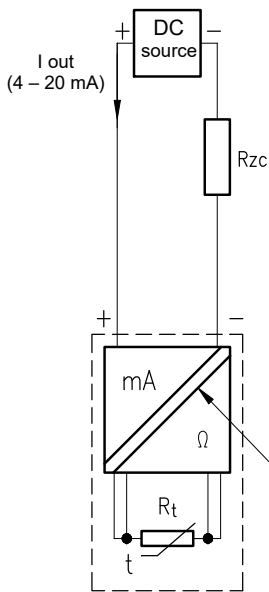
**SCHEME OF CONNECTION WITH CONVERTER**

with converter

with converter with HART protocol

with converter Ex ia

with converter Ex ia with HART protocol



Galvanic separation pursuant to the converter

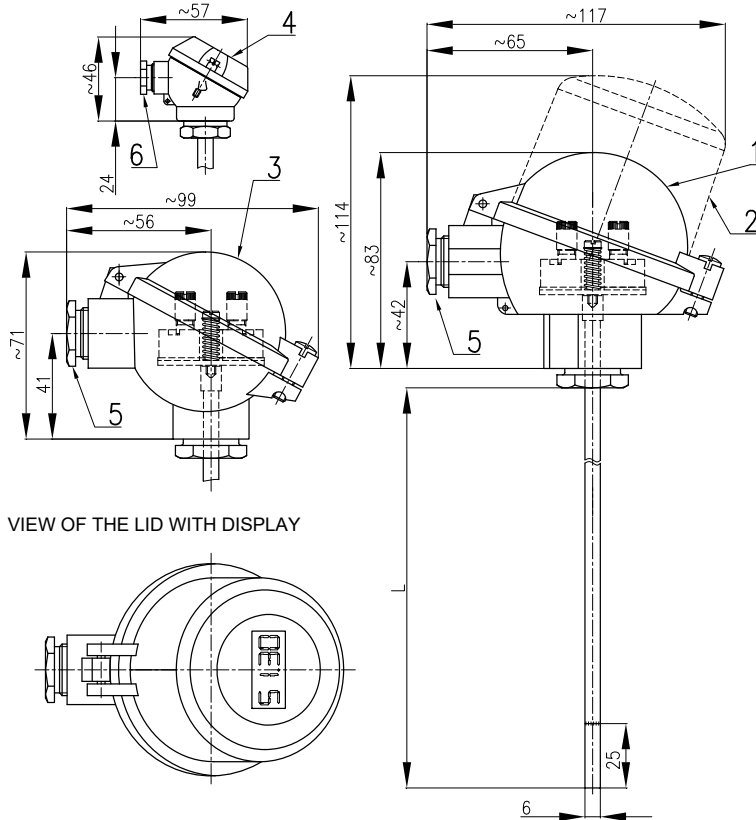
A-B and B-C options of connection of the control unit (HART modem, HART communicator)

Rzc = total load resistor

NON-EXPLOSIVE ATMOSPHERE  
 EXPLOSIVE ATMOSPHERE

**FIGURE 5 DIMENSIONAL DRAWING**

**DESIGN G** with head of type B pursuant to DIN 43 729 and type MA

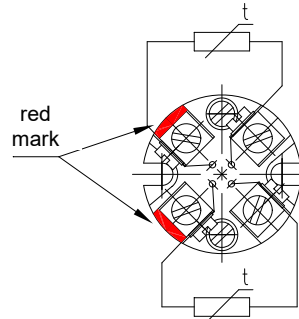
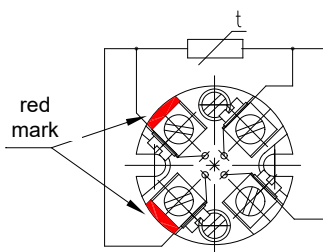


- 1 Ball head (alloy Al)  
(for converter Ex i with external and internal terminals) or plastic ball head  
(it cannot be used for converter Ex i)
- 2 Ball head with increased lid (alloy Al)  
without display for converter in lid or  
with display  
(for converter Ex i with external and internal terminals)
- 3 Small ball head (alloy Al)  
(only for terminal board or converter  
INPAL 420. APAQ-HRF, TH 100. MINIPAQ-HLP)
- 4 Head MA (alloy Al)
- 5 Cable outlet M20x1.5
- 6 Cable terminals M16x1.5
  
- L Length of jacketed resistance insert

**CONNECTION SCHEME OF THE TERMINAL BOARD** in head of type MA

**J4** with single measuring resistor  
in four-wire connection  
(Pt 100/ /4)

**D2** with double measuring resistor  
in two-wire connection  
(2 × Pt 100/B/2)

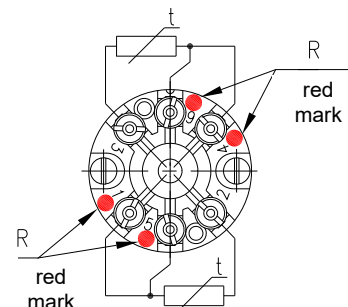
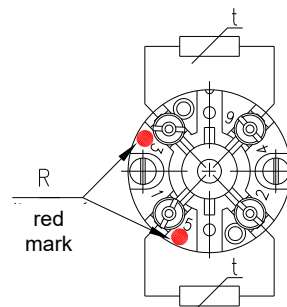
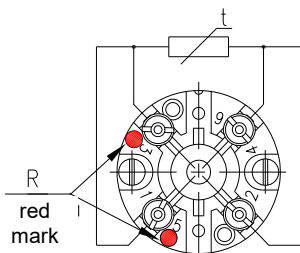


**CONNECTION SCHEME OF THE TERMINAL BOARD** in head of type B pursuant to DIN 43 729

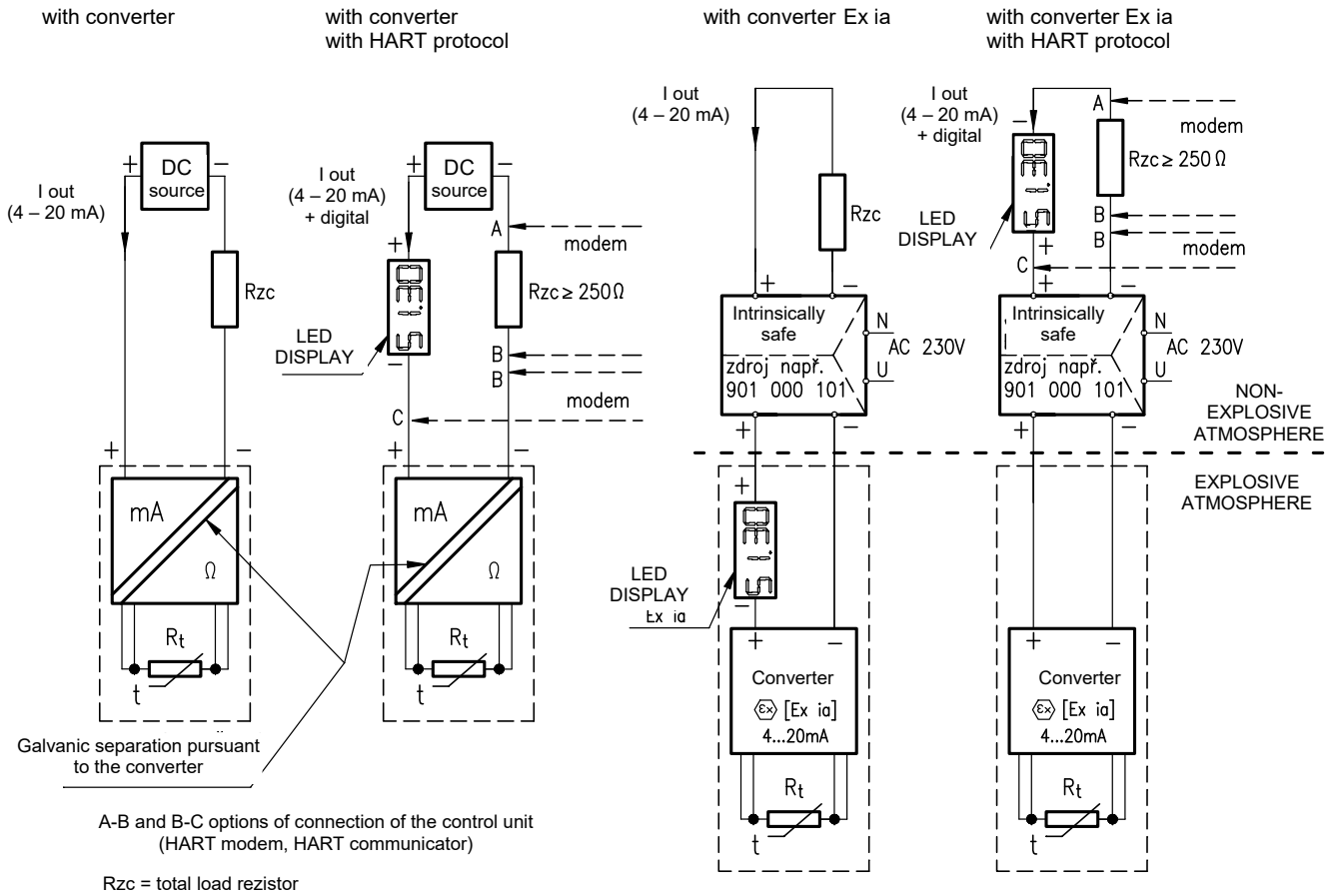
**J4** with single measuring resistor  
in four-wire connection  
(e.g. Pt/ /4)

**D2** with double measuring resistor  
in two-wire connection  
(e.g. 2 × Pt/B/2)

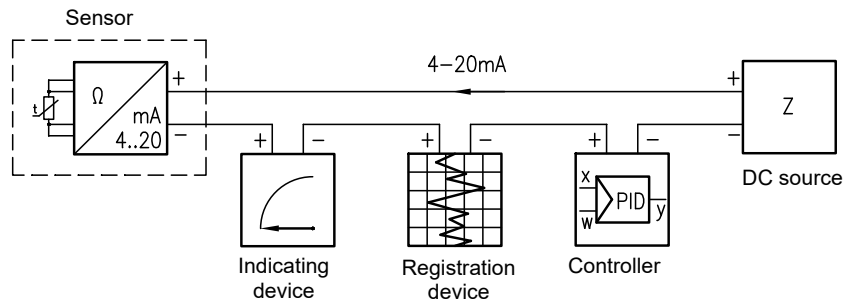
**D3** with double measuring resistor  
in three-wire connection  
(e.g. 2 × Pt/ /3)



**SCHEME OF CONNECTION WITH CONVERTER AND DISPLAY**



**FIGURE 6 – EXAMPLE OF OPERATION CONNECTION OF THE TEMPERATURE SENSOR WITH CONVERTER IN LOOP 4 - 20 mA**



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NOVÁ PAKA



ZPA Nová Paka, a.s.  
Pražská 470  
509 01 Nová Paka

tel.: spojovatel: 493 761 111  
e-mail: obchod@zpanp.cz  
www.zpanp.cz

bankovní spojení: ČSOB HK  
číslo účtu: 271 992 523/300

IČO: 46 50 48 26  
DIČ: CZ46504826