



# PRODUCT MANUAL

## Resistance temperature sensor with thermowell ČSN without converter or with converter type series 240 type 242

FOR DESIGNS WITH CONVERTER, A MANUAL IS ENCLOSED TO THE RELEVANT CONVERTER  
FOR DESIGN WITH CONVERTER AND DISPLAY, MANUALS TO THE RELEVANT CONVERTER AND DISPLAY ARE ENCLOSED

### APPLICATION

- For exact remote measurement of temperature of steady and running liquids (gases and fluids), for which the properties of the thermowell of the sensor are suitable; possible up to the temperature determined by resistance of the thermowell (max. 600 °C) and nominal pressure PN 160
- For the environment with a threat of explosion in the premises of Zone 2, Zone 1 and Zone 0 according to ČSN EN 60079-10-1 in the application of the converter Ex ia or in case of the connection to Ex ia circuit according to ČSN EN 60079-25 ed. 2;
- As selected equipment of safety class 2 and 3 in the sense of the Decree No. 132/2008 Coll. on quality system when realizing and ensuring the activities related to the use of nuclear energy and radiation activities and on ensuring quality of selected equipment with respect to their classification in safety classes;
- As selected equipment of safety class 2, 3 and 4 in the sense of Directives of the Nuclear Regulatory Authority of the Slovak Republic No. 430/2011 Coll. on requirements for nuclear safety and No. 431/2011 Coll. on quality management system;
- In a complete set with control or diagnostic systems for process monitoring;
- In the design with converter for transformation of signal of the resistance probe to unified output signal 4 to 20 mA or digital signal (converter with HART protocol)
- In the design with a display for instantaneous indication of the value of the measured quantity
- For the environment, where mechanical resistance is required according to ČSN EN 60068-2-6 ed. 2 (class AH2 according to ČSN 33 2000-5-51 ed. 3) and seismic capability of the electrical equipment of the safety system of nuclear power stations according to ČSN IEC 980 (MVZ level SL-2), which is in compliance with the qualification requirements of the nuclear power plant Mochovce (MO34), the nuclear power plant Dukovany and the nuclear power plant Temelín, refer to the declaration of the manufacturer ZPA Nová Paka No. remec005-11

The sensors with converter are rated products in the sense of the Act No. 22/1997 Coll. and the EC Declaration of conformity **EC-232000** is issued for them.

### The application in the design certified as rated measuring gauge pursuant to Act No. 505/1990 Coll., on metrology:

- In the paired design and unpaired design as rated measuring gauge **TCM 321/09 - 4683** with the application as a part of rated gauges pursuant to the Decree of the Ministry of Industry and Trade No. 345/2002 Coll., for members of gauges and measuring sets of the flow-through quantity of liquids (gases, steam, condensate ...), for members of heat and cold meters and members of the gas quantity re-calculators, with the exception of the measurement being within the competence of the directive of the unified approach MID implemented in the Czech Republic by the Decree of the Government No. 464/2005 Coll.

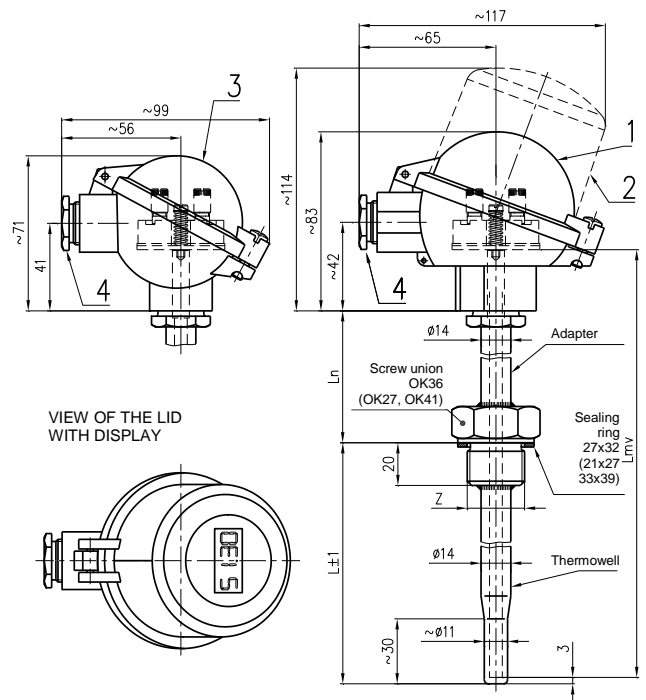
### The application in case of marketing pursuant to the Decree of the Government No.464/2005 Coll. (MID) as independent subsystem of a heat meter:

- In the paired design for the measurement of heat in the sense of the Decree of the Government No.464/2005 Coll., Annex MI-004 and in compliance with the standard ČSN EN 1434 (with the exception of ČSN EN 1432-2 Article 3.2 – dimensions of the sensor and thermowell), for members of gauges and measuring sets of flow and heat transferred by water

The sensors are rated products in the sense of the Act No. 22/1997 Coll. and the EC Declaration of conformity is **EC-MID-231-CZ** is issued for them.

**The application of the sensors in the sense of the Decree of the Government No.464/2005 Coll. (MID) as parts of the measuring sets of the customer, for which compliance of the sets as a whole must be evaluated when marketing it with all prerequisites according to the said Decree of the Government:**

- The sensor in the design without converter in the connection 1xPt100/..14 may be used by the customer on the basis of the test certificate (Evaluation certificate) to its measuring sets in the sense of the Decree of the Government No.464/2005 Coll.
  - o Annex MI-002 (gas meters and gas quantity re-calculators) in compliance with the standard ČSN EN 12405-1 + A2
  - o Annex MI-005 (measuring systems for the measurement of quantity of other liquids than water) in compliance with the standard OIML R117-1:2007



- 1 - ball head (Al alloy)  
(for converter Ex ia with external terminal and internal terminal)  
or plastic ball head  
(it cannot be used for converter Ex ia)
  - 2 - ball head with increased lid (Al alloy)  
without display for converter in the lid or with a display  
(for converter Ex ia with external terminal and internal terminal)
  - 3 - small ball head (Al alloy)  
(only for terminal board or converters INPAL 420, APAQ-HRF, TH 100, MINIPAQ-HLP)
  - 4 - cable outlet M20x1.5
- L* nominal length  
*L<sub>n</sub>* length of adapter  
*L<sub>mv</sub>* length of the measuring insert  
*Z* connecting thread of adapter of the sensor
- |                        |      |
|------------------------|------|
| G½, M20x1.5            | OK27 |
| G3/4, M27x2, 3/4-14NPT | OK36 |
| G1                     | OK41 |

## DESCRIPTION

The sensor consists of a replaceable measuring insert with a flange and ceramic terminal board or installed two-wire converter (insulated or non-insulated, even in the design Ex ia) and protective armatures, consisting of a head and thermowell with adapter and connecting screw-union. The head is provided with a lid and cable outlet for the connecting wiring. The terminal board of the sensor (converter) is accessible after tilting the lid of the head away, which is connected with one screw. The sensor with converter in Ex ia design is provided, on the head, with an external terminal and an internal terminal for the connection of the 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 powered from an external source. The installed converter is set-up at the manufacturer of the sensor for the required range. For the temperature measurement, a defined change of resistance of the probe in dependence on a change of the temperature of the measured environment is used.

## TECHNICAL DATA

Dimensions of the sensor are based on the original ČSN 25 8301. The sensor is realized pursuant to ČSN EN 61140 ed.2 as electrical equipment of protection class III for the application in networks with the category of overvoltage in the installation II and pollution grade 2 according to ČSN EN 61010-1 ed.2, the follow-up (evaluation) device must correspond to Article 6.3 of the said standard.

### Measuring range:

Sensor	Min. length of adapter L <sub>n</sub> [mm]	Tolerance class of probe Pt 100	Measuring range [°C]
Non-certified	150	A, B	-70 to 600 *)**)
	80	A, B	-70 to 250
Certified non-paired	80	A, B	-50 to 50
			-50 to 100
			0 to 200
	150	B	0 to 600 ***)
80	A, B	A	0 to 300
		A, B	0 to 250
Certified paired	80	A, B	0 to 180
			-50 to 200

\*) The upper limit of the range of measurement is limited by resistance of the material of the used thermowell.

\*\*) Class A is guaranteed only within the range to 300 °C.

\*\*\*) With converter IPAQH and IPAQHx only 0 to 400 °C

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

**Electric strength** according to ČSN EN 61010-1 ed. 2, Article 6.8.3:

500 V eff (only the measuring insert without converter or design with insulated converter)

**Electric insulation resistance** according to ČSN EN 60751: min. 100 MΩ, at 15 to 35°C, max. 80 % rel. humidity

### 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

**Display:** LED display to loop 4-20mA

other data refer to the enclosed manual

**Ingress Protection** according to ČSN EN 60529: IP65

**Nominal pressure of the thermowell** according to ČSN 13 0010: PN 160

### Operation position:

discretionary; the outlet shall not be situated upwards

**Type of operation:** continuous

### Sensor weight:

with ball head (Al alloy), adapter 150 mm and nominal length 250 mm approx. 1.06 kg

### Used materials:

Thermowell	steel 1.4541
	steel 1.4571
Stem tube of the measuring insert	steel 1.4541
Adapter	steel 1.4541
Head	aluminium alloy painted with polyester paint
	plastic PPO (phenyl polyoxide)
Sealing of the lid of the head and outlet	oil-resistant rubber
Internal wiring	Cu
Head terminals of the terminal board	nickel brass
Connecting elements of the sensor	corrosion-resistant steel

## OPERATING CONDITIONS

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

### Ambient temperature for head and outlet of the sensor:

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

### Vibrations:

Nominal length [mm]	100	160	250	400	630
Frequency range [Hz]	10 to 500				
Drift amplitude [mm]	0.2	0.2	0.15	0.15	0.15
Acceleration amplitude [ms <sup>-2</sup> ]	29.4	29.4	19.6	19.6	19.6

### Relative ambient humidity:

- For design without converter 10 to 100 % with condensation, with upper limit of water content 29 g H<sub>2</sub>O/kg of dry air
- For design with converter according to the type of the converter (refer to the enclosed converter manual)
- For design with converter and display according to the type of the converter and display (refer to the enclosed manuals to the converter and the display)

**Atmospheric pressure:** 70 to 106 kPa

### Maximum speed of flow of liquids:

Maximum speed of flow [m/s]	Nominal length [mm]				
	100	160	250	400	630
Water steam and air	50	25	8	2.5	1
Water	5	3	3	1.5	0.2

### Resistance of material of the head - PPO (phenyl polyoxide):

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

**Resistance of material of sealing of the lid (oil-resistant rubber):**

Alcohol	resistant	
Ether		
Benzol		
Petrol		
Ester		
Animal and vegetable oil		
Mineral oil		
Diesel		
Weak alkaline hydroxides		non-resistant
Strong alkaline hydroxides		
Weak acids	resistant	
Strong acids	non-resistant	
Sea water	resistant	
Trichloroethylene	partially resistant	
Hot water		

**METROLOGICAL DATA**

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

**Tolerance class of accuracy (compliance) of the pair according to TPM 3721-93**

For maximum difference of the output signal of both temperature sensors included into the pair and located in the trial medium at equal temperature:

class 5 max. difference 0.1°C

**Range of temperature difference of the pair according to**

ČSN EN 1434: 3 to 180 K

**Resistance of internal wiring of two wires (loop) at 20 °C:**

0.1Ω/m (inf. value)

The calculated value of resistance of the internal wiring of two wires (loop) is identified, in case of the design without converter, on the label of the measuring insert.

**Maximum current load of the 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 -70 to 250°C:  
200 mm (min. 160 mm)

For temperature points over 250°C:  
300 mm (min. 260 mm)

Distance of the flange of the measuring insert from the level of the medium in the calibration bath must be at least 40 mm at temperatures up to 250°C and min. 70 mm at temperatures over 250°C.

**Temperature response time** according to ČSN EN 60751 in whirling water (characteristic value):

$\tau_{0.5}$  29 s  
 $\tau_{0.9}$  95 s

**DESIGNATION****Data on the label head**

- Trade mark of the manufacturer
- Made in Czech Republic
- Type of the resistance probe, nominal value  $R_0$  / tolerance class / configuration of wires of internal wiring \*)
- Measuring range or set-up range of the converter
- Product ordering number
- Ingress Protection
- Time code  
(manufacturing number for orders according to the Decree 132/2008 Coll., for calibrated design, design with tolerance class A, design with converter and certified design, for certified paired design manufacturing number /1 and /2)
- Ambient temperature
- Other data for design with converter
  - o Output signal 4 to 20 mA
  - o CE mark
  - o Designation of non-explosiveness and No. of EC Type Examination Certificate for the converter Ex ia
- Other data for certified design (/P1 to /P5)

- o Type approval mark TCM 321/09 – 4683
- o Designation of accuracy class
- Other data for design with demonstration of metrological compliance (/M1)
  - o CE mark + additional metrological designation
  - o No. of EC Type Examination Certificate TCM 321/12 - 4906
  - o Temperature difference range
  - o Unambiguous differentiation of the sensors for inlet and for return piping
- Other data for design /M1, /M2, /M3 and /M4
  - o Test certificate No. ZR 141/10-0068

\*) In case of the converter, the configuration of wires of the internal wiring is not specified

**Data on the label of the measuring insert**

- Trade mark
  - Type of sensor, nominal value  $R_0$  / tolerance class / configuration of wires of the internal wiring \*)
  - Time code  
(manufacturing number for orders according to the Decree 132/2008 Coll., for calibrated design, design with tolerance class A, design with converter and certified design, for certified paired design manufacturing number /1 and /2)
  - Value of resistance of the internal wiring (for design without converter)
- \*) In case of the converter, the configuration of wires of the internal wiring is not specified

**Data on the label of the converter**

- Trade mark of the manufacturer
- Type of sensor
- Set-up temperature range
- Designation of non-explosiveness and No. of EC Type Examination Certificate for the converter Ex ia
- CE mark (for the converter Ex ia with the identification number of the notified person)

**Data on the display**

- Trade mark of the manufacturer
- Designation of non-explosiveness and No. of EC Type Examination Certificate for display Ex ia
- CE mark (for display Ex ia with the identification number of the notified person)

**DELIVERY**

The paired sensors are delivered in a shared packaging. Unless agreed otherwise with the customer, each delivery includes:

- Delivery note
  - Sensor pursuant to the purchase order
  - Sealing ring
    - o 21x27x2 TPD 62-014-91 for thread G $\frac{1}{2}$  and M20x1.5
    - o Cu 27 x 32 x 1.5 (ČSN 02 9310.2) for thread M27 x 2 and G $\frac{3}{4}$
    - o Cu 33 x 39 x 2 (ČSN 02 9310.2) for thread G1 (for thread 3/4-14NPT the sealing ring is not delivered)
  - Suitable weld-on pieces ordered separately according to the catalogue of accessories of type 991
  - Optional accessories to the sensor with a programmable converter
    - o Configuration (parameterization) program according to the required converter
    - o Communication modem (for serial port RS 232C) according to the required converter
  - Accompanying technical documentation in Czech
    - o Product quality and completeness certificate, which also serves as the warranty certificate
    - o EC Declaration of Conformity
      - For design with converter Ex ia
      - For design with demonstration of metrological compliance
    - o Calibration sheet (for non-certified calibrated design)
    - o Declaration of Conformity of the supplier according to ČSN EN ISO/IEC 17050-1 (for orders according to the Decree 132/2008 Coll.)
    - o Product manual
- If it is established in the purchase contract or agreed otherwise, the following documentation can be also delivered with the product
- EC Declaration of Conformity (for design with converter)

- Copy of the Inspection Certificate 3.1 for the stem tube and thermowell material with the casting number
- Declaration of Conformity with the purchase order 2.1 according to ČSN EN 10204
- Copy of the EC Type Examination Certificate according to 94/9/EC (ATEX 95) for the converter and display Ex ia
- For certified design pursuant to the Act No.505/1990 Coll.
  - o Copy of the Gauge Type Approval Certificate
  - o Confirmation about verification of the rated meter
- Copy of the EC Type Examination Certificate for design with demonstration of metrological compliance
- Copy of the test certificate (Evaluation certificate) for design /M1, /M2, /M3 and /M4
- Declaration of the manufacturer ZPA Nová Paka No. remec005-11 about seismic qualification of the instrumental equipment for the conditions of operation in the nuclear power plant Temelín, nuclear power plant Dukovany and nuclear power plant Mochovce, block 3 and 4;
- Declaration of conformity of the supplier according to ČSN EN ISO/IEC 17050-1
- Copy of the metrological certificate for the territory of Byelorussia

### CERTIFICATION

- Non-explosiveness Ex ia, EC Type Examination Certificate pursuant to 94/9/ES (ATEX 95), (depending on the type of the converter and display)
- Gauge type approval pursuant to the Act No. 505/1990 Coll., certificate ČMI No. 0111-CS-C020-09 revision 2, Type approval mark **TCM 321/09 – 4683**
- Demonstration of metrological compliance pursuant to the Decree of the Government No.464/2005 Coll. (MID), procedure of compliance assessment B+D with the standard ČSN EN 1434 (with the exception of ČSN EN 1432-2 Article 3.2 – dimensions of the sensor and

thermowell), certificate ČMI No. 0115-CS-C003-12, Type approval mark **TCM 321/12 – 4906**

- Test certificate (Evaluation certificate) No. ZR 141/10-0068
- Metrological certificate for the territory of Byelorussia

### PACKING

Both the 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 ČSN EN 60721-3-2 (i.e. by plains and trucks, in premises that are ventilated and protected against climatic effects).

### STORAGE

The products may be stored on conditions corresponding to the set of combinations of classes IE 12 pursuant to ČSN EN 60721-3-1, but with ambient temperature from -20 to 70 °C (i.e. in places, where temperature and humidity are not regulated, with a threat of occurrence of condensation, dripping water and formation of ice, 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).

### RELIABILITY

Reliability indicators in operating conditions and conditions of the environment identified herein

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

**TABLE 1 - DESIGN OF TEMPERATURE SENSORS WITH THERMOWELL, ČSN TYPE 242**

SPECIFICATION						ORDERING NUMBER																
						242	x	x	x	x	x	x	x	x	x	/xxxxxx	/xxx					
Nominal length L [mm]	100	Length of adapter L <sub>n</sub> [mm]	150	Length of the measuring insert L <sub>mv</sub> [mm]	280	1	1															
	160				2																	
	250				3																	
	400				4																	
	630				5																	
	Other (min. 75) *)				9																	
Nominal length L [mm]	100	Length of adapter L <sub>n</sub> [mm]	80	Length of the measuring insert L <sub>mv</sub> [mm]	210	1	2															
	160				2																	
	250				3																	
	400				4																	
	630				5																	
	Other (min. 75) *)				9																	
Length of adapter L <sub>n</sub> [mm]	150					1																
	80	Maximum measuring range [°C] -70 to 250				2																
	Other (min. 80) *) **)					9																
Material of thermowell	1.4571 ***)	Maximum measuring range [°C]	-70 to 400			1																
	1.4541 ***)		-70 to 600			2																
	Other *)					9																
Connecting thread	G1/2								1													
	G1								2													
	M27x2								3													
	G3/4								4													
	3/4-14 NPT								5													
	M20x1.5								6													
	Other *)								9													
Head of the sensor	Ball (Al alloy) (for converter Ex ia with external terminal and internal terminal)																					
	Ball, plastic (it cannot be used for converter Ex ia)																					
	Ball head with increased lid (Al alloy) without display for converter in the lid or with a display (for converter Ex ia with external terminal and internal terminal)																					
	Ball, small (Al alloy) (only for terminal boards and converters INPAL 420, APAQ-HRF, TH 100, MINIPAQ-HLP)																					
	Other *)																					
Stem tube of the measuring insert for the sensor with thermowell																						
Measuring resistor (probe)	Pt100																					
Tolerance class	A guaranteed only within the range to 300 °C																	A				
	B																	B				
Connection of the terminal board	Simple - four-wire (1xPt100/ /4)																	/J4				
	Double – two-wire (2xPt100/B/2)																	B /D2				
	Double – three-wire (2xPt100/ /3)																	/D3				
	Simple – with auxiliary loop (1xPt100/ /4C)																	/J2S				
Converter (connection for the converter: single two-, three- or four-wire pursuant to the converter)	Converter type		Galvanic separation	Ex ia	Range [°C]																	
	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		
		APAQ-HRF			Adjustable range													/HRF				
		APAQ-HRFX		•														/HRFX				
	Programmable	TH 100			•	Programmable range													/TH100			
		TH 100-ex		•															/TH100X			
		TH 200		•															/TH200			
		TH 200-ex		•	•														/TH200X			
		IPAQ-H		•															/IPAQH			
		IPAQ-HX		•	•														/IPAQHX			
	HART protocol	MINIPAQ-HLP																	/MINIPAQ			
		TH 300		•															/TH300			
		TH 300-ex		•	•														/TH300X			
		MESO-H		•															/MESOH			
		MESO-HX		•	•														/MESOHX			
248 HA NA			•															/248HANA				
248 HA I1		•	•														/248HA1X					
644 HA NA		•															/644HANA					
644 HA I1		•	•														/644HA1X					
Other *)																		/99				
Without converter (for installation of the converter by the customer)																		/00				
LED display to loop 4-20mA	LED display LPI-01 (only with converter, with the exception of 644 HANA)																	/LD				
	LED display Ex ia *) (only with converter Ex ia, with the exception of 644 HAI1X)																	/LDX				

**Standard design**

\*) Only as a special requirement after an agreement with the manufacturer  
 \*\*) In case of an adapter shorter than 150 mm (minimum 80 mm), the measuring range is decreased to -70 to 250 °C  
 \*\*\*) Thermowells from these materials are suitable for contact with foodstuffs according to the Decree of the Ministry of Health on hygienic requirements for products intended for contact with foodstuffs and meals 38/2001 Coll., Annex No.8



**TABLE 2 – ADDITIONAL REQUIREMENTS FOR DESIGN OF TEMPERATURE SENSORS WITH THERMOWELL, ČSN TYPE 242**

SPECIFICATION				CODE	
VERIFICATION AND DEMONSTRATION OF METROLOGICAL COMPLIANCE	DESIGN OF THE SENSOR	MEASURING RANGE [°C]		APPLICATION	
Verification pursuant to the Act 505/1990 Coll. for applications that do not fall under the impact of the Directive of unified access MID, pursuant to the Decree of the Government No. 464/2005 Coll.	Sensors non-paired, without converter in connection 1xPt100/..4 or with converter IPAQH and IPAQHX	-50 to 50		application for heavy industry	/P1
		-50 to 100			/P2
		0 to 200			/P3
		0 to 250	for the sensors with length of adapter shorter than 150 mm (min. 80 mm)		/P4
		0 to 300	for the sensors with measuring resistance in tolerance class A		
		0 to 400	for the sensors with length of adapter 150 mm and longer, with measuring resistance in tolerance class B		
		0 to 600	with converter IPAQH and IPAQHX without converter		
Sensors paired, without converter in the connection 1xPt100/..4 compliance class 5	0 to 180		/P5		
	-50 to 200		/P6		
Demonstration of metrological compliance pursuant to the Decree of the Government No.464/2005 Coll. (MID)	Sensors paired, without converter in the connection 1xPt100/..4 range of temperature differences 3 to 180 K min. immersion 160 mm	0 to 180		application for residential and commercial premises and for light industry	/M5
<b>CALIBRATION</b> for the application according to MID	<b>DESIGN OF SENSOR</b>	<b>MEASURING RANGE [°C]</b>		<b>APPLICATION</b>	
Calibration according to TPM 3342-94 in three temperature points evenly distributed within the measuring range of the sensor for application as a part of measuring sets of the customer pursuant to the Decree of the Government No. 464/2005 Coll.,(MID), Annex MI-002 and MI-005	Sensors non-paired, without converter in the connection 1xPt100/..4	-50 to 50		application for residential and commercial premises and for light industry	/M1
		-50 to 100			/M2
		0 to 200			/M3
		0 to 250	for the sensors with length of adapter shorter than 150 mm (min. 80 mm)		/M4
		0 to 300	for the sensors with measuring resistance in tolerance class A		
		0 to 400	for the sensors with length of adapter 150 mm and longer, with measuring resistance in tolerance class B		
<b>CALIBRATION</b>	<b>NUMBER OF CALIBRATION POINTS</b>	<b>CALIBRATION ZONE</b>			
Calibration pursuant to TPM 3342-94, calibration points shall be defined	3	0 to 420 °C		/Q1	
	3	0 to 600 °C		/Q2	
	3	-50 to 600 °C		/Q22	
	other	-50 to 600 °C		/Q9	
<b>REQUIREMENT FOR ADDITIONAL DOCUMENTATION</b>		<b>APPLICATION</b>			
Confirmation about verification of the rated meter - is issued for each individual sensor or pair		/P1 to P5			/PO
Copy of the Gauge Type Approval Certificate in ČMI No. 0111-CS-C020-09		/P1 to P5			/SM
Copy of the EC Type Examination Certificate - assessment pursuant to the Decree of the Government No. 464/2005 Coll.(MID)		M5			/MID
Copy of the test certificate (Evaluation certificate) No. ZR 141/10-0068		M1, M2, M3 a M4			/EC
Copy of metrological certificate for the territory of Byelorussia		not for P1 to P5 and M1 to M5			/RB
EC Declaration of Conformity		for design with converter			/ES
Copy of EC Type Examination Certificate according to 94/9/ES (ATEX 95)		for converter and display Ex ia			/Exi
Copy of the Inspection Certificate 3.1 according to ČSN EN 10204 for the material of the protective tube with the casting number					/3.1
Declaration of Conformity with the purchase order 2.1 according to ČSN EN 10204					/2.1

Identify the codes behind the product ordering number. In case of the codes for the calibration Q1, Q2, Q22 and Q9, specify the calibration points.

It is not possible to combine codes for design P1 to P5 and M1 to M5 with codes for the calibration Q1, Q2, Q22 and Q9.

In case of certified sensors with converter IPAQH and IPAQHX, choose between the codes P1 to P4 so as the required range of the converter is within the limits of the measuring ranges of the codes P1 to P4.

**ORDERING TEMPERATURE SENSORS**

The purchase order shall specify

- Name
- Product ordering number
- Additional requirements for design of the sensor according to table 2
- Requirement for additional documentation according to table 2
- Measuring range
- If the delivery of the weld-on piece pursuant to type 991 is required as accessories to the sensor
- If optional accessories to the sensor with a programmable converter required
- If the product is ordered as selected equipment of safety class 2 and 3 pursuant to the Decree No. 132/2008 Coll.
- Other (special) requirements
- Number of pieces (pairs)

Behind the required range of the measured temperature (i.e. lower and upper limits of temperature in °C), the customer shall specify other non-standard required parameters for the configuration of the converter (e.g. indication of breaking of the sensing probe, damping, required designation - tagging etc.).

**EXAMPLE OF PURCHASE ORDER**

**Standard design:**

Resistance temperature sensor with thermowell ČSN without converter  
 242 412 331 1B/J4/Q1  
 calibration points 100, 250 and 400°C  
 range -70 to 600°C  
 6 pcs

**Special requirement:**

Resistance temperature sensor with thermowell ČSN with converter  
 242 912 231 1B/18/2.1  
 nominal length L 380 mm, range 0 to 100°C  
 6 pcs

**EXAMPLE OF PURCHASE ORDER**

**Standard design:**

Weld-on piece, direct  
 NVP4 M27 72  
 6 pcs

**Special requirement:**

Weld-on piece, direct  
 NVP4 M27 99  
 material 1.5415  
 6 pcs

**ORDERING ACCESSORIES**

The purchase order shall specify

- Name
- Product ordering number
- Number of pieces

**TABLE 3 - ACCESSORIES - OVERVIEW OF DESIGNS OF RECOMMENDED WELD-ON PIECES – TYPE 991** (to be ordered separately)

SPECIFICATION				ORDERING NUMBER				
				991	xxx	x	xxx	xx
Shape	Direct							
	Angular (angle 45°)							
Internal thread	M20×1.5	PN	40			1	M20	
	G 1/2						G12	
	M20×1.5					2	M20	
	G 1/2						G12	
	M27×2	PN	160			4	M27	
	G 3/4						G34	
	3/4 – 14 NPT						N34	
	M33×2	PN	250			5	M33	
	G1						G01	
		Other *)						
Material	1.0308 or 1.0122 **)	Maximum operating temperature [°C]	300 (only PN 40)				M20	
							G12	
							M27	
							G34	
							N34	
	1.0577 **)	400				M33		
						G01		
	15 128.5 **)	550				M27		
						G34		
						N34		
	1.4541	550					72	
	Other *)						99	

\*) Only as special requirement after an agreement with the manufacturer

\*\*\*) Surface treatment of weld-on pieces: preservation with grease - oil

TABLE 4 - OVERVIEW OF SEALING RINGS OF TYPE 991 DELIVERED TO THE TEMPERATURE SENSORS

CONNECTING THREAD OF TEMPERATURE SENSOR	SEALING RING			
	DIMENSION [mm] $\varnothing d \times \varnothing D \times t$	MATERIAL	NUMBER	ORDERING NUMBER
M20x1.5	21×27x2	copper 42 3005.11 thermally insulating insert	1 pc	991 TK 21
G1/2				
M27x2	27×32x1.5	copper 42 3001.11		991 TK 27
G3/4				
G1	33×39x2	-	-	
3/4-14 NPT	-	-	-	-

As a default, the sealing ring is delivered to each sensor. With their ordering number, the sealing rings can be ordered separately.

## CALIBRATION

It is realized pursuant to TPM 3342-94 and in compliance with ČSN EN 60751, usually in three temperature points evenly distributed within the operation range of the sensor or in the points according to the requirement of the customer. In case of calibrated sensors, a Calibration sheet with the measured data is issued.

## VERIFICATION ACCORDING TO THE ACT 505/1990 Coll.

The paired sensors are verified pursuant to TPM 3722-93, the unpaired sensors pursuant to TPM 3342-94 and the sensors for gas quantity converters pursuant to TPM 6891-95. The error may not exceed the permitted tolerance pursuant to ČSN EN 60751. In case of the application of the sensor with converter, the verification is realized for the whole unit.

At request of the customer, a Confirmation about verification of the rated meter can be issued later on for a certified sensor.

The purchase order shall specify:

- Product ordering number \*)
- Manufacturing number \*) or manufacturing number/ applicability to the pair \*)
- \*) Data are identified on the device label

The manufacturer performs the follow-up verification pursuant to the Act 505/1990 Coll. on metrology, as amended. The follow-up verification is ordered with the AMS department of ZPA N. Paka a.s. (ams@zpanp.cz).

For a follow-up verification, always send the whole pair bundled together.

## TYPE OF LOCATION OF THE MARK OF THE INSTALLATION AND SERVICE ORGANIZATION AND OFFICIAL MARK OF THE VERIFICATION

The certified sensors are provided with a self-sealing label with the official mark of the verification. The label is sealed on the terminal board or on the converter and on the head of the sensor.

After the installation in the place of application, the sensors will be secured with the installation seal or, as the case may be, with a label preventing from authorized handling.

## ASSESSMENT OF COMPLIANCE ACCORDING TO THE DECREE OF THE GOVERNMENT 464/2005 Coll.

The paired sensors are certified pursuant to ČSN EN 1434-5.

The sensors are rated products pursuant to the Act No.22/1997 Coll. and the EC Declaration of Conformity is issued for them.

The manufacturer performs the follow-up verification pursuant to ČSN EN 1434-5. The follow-up verification is ordered with the department AMS of ZPA N. Paka a.s. (ams@zpanp.cz).

For a follow-up verification, always send the whole pair bundled together.

## TYPE OF LOCATION OF THE MARK OF THE INSTALLATION AND SERVICE ORGANIZATION AND THE SECURING MARK

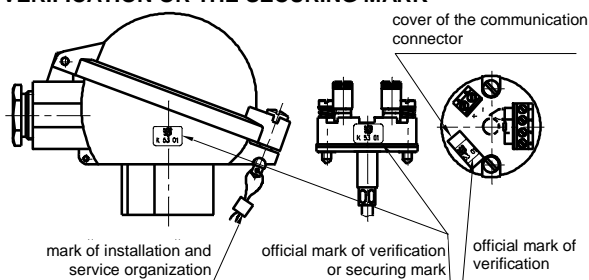
The certified sensors are provided with a self-sealing label with the securing mark. The label is sealed on the terminal board and on the head of the sensor.

After the installation in the place of the application, the sensors shall be secured with the installation seal or, as the case may be, with a label preventing from the unauthorized handling.

After the follow-up verification, the sensors shall be provided with a self-sealing label with the official mark. The label shall

be sealed on the terminal board and on the head of the sensor in the place of the original of the securing mark.

## LOCATION OF THE MARK OF THE INSTALLATION AND SERVICE ORGANIZATION, OFFICIAL MARK OF VERIFICATION OR THE SECURING MARK



## INSTALLATION AND CONNECTION INSTALLATION OF THE SENSOR

Connect the sensors by screwing into the weld-on piece on the piping (technological equipment). Before the connection, put on the enclosed sealing ring in advance (for thread 3/4-14NPT, the sealing ring is not used). During the installation, torque of 70 Nm is recommended for threads M20 x 1.5, G1/2 and 3/4-14NPT, and torque 150 Nm for threads M27 x 2 and G3/4.

A proposal of securing the thermowell of the temperature sensors Ex d for nominal lengths exceeding 630 m is in the figure 1, examples of installation of direct and angular weld-on pieces are in figure 2.

With respect to the preservation of metrological properties and the longest possible service life, it is not recommended to install the sensors in the places with a high turbulence of the medium caused e.g. by a fast transition from a small diameter of the piping to a bigger one (in case of a failure to comply with the required shape and dimensions of the diffuser behind the flow meter), etc. The recommended distance of the temperature sensor from the installation flange of the flow meter is min. 1 m.

## ELECTRICAL CONNECTION

The electrical connection may be only realized by qualified workers pursuant to Section 5 the Decree 50/1978 Coll.

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

Connect the evaluation device to the sensor with a non-armoured cable with a double insulation with the outer diameter 5 to 8 mm with a Cu core with the cross-section 0.5 to 1.5 mm<sup>2</sup> (in intrinsically safe circuits the resistance of insulation between wires, wires and shielding and shielding against ground at least AC 500V or DC 750 V). Seal the cable outlet of the sensor adequately.



**WARNING**

**Do not use separate wires without jacket for the electrical connection. To secure the Ingress Protection grade in the outlet, the connecting cable shall have a round cross-section. Temperature resistance of the cable shall be in compliance with the ambient temperature!**

The cable insulation shall have chemical and mechanical resistances 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 a shielded cable in the power supply circuit. Ground (earthen) the shielding only in one point. The cable should not be placed together with power cables.

In case of the sensor with converter HART protocol, the maximum length of wiring is established 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 shielded together with the cross-section of the core min. 0.5 mm<sup>2</sup>. The HART communicator shall be connected to the power supply loop of the sensor with the converter according to Figure 3. To ensure reliable communication, the total load resistance of min. 250 Ω shall be present in the circuit of the output loop.

**INSTALLATION OF THE SENSOR IN THE ENVIRONMENT WITH EXPLOSIVE GASEOUS ATMOSPHERE**

In the environment with explosive gaseous atmosphere it is permitted to install either the sensor without converter or the sensor with converter Ex ia.

The installation of the sensor in the environment with explosive gaseous atmosphere must be in compliance with the requirements of ČSN EN 60079-14 ed. 4.

**The sensor without converter** (with ball head from Al alloy with internal terminal and external terminal – only as a special request after an agreement with the manufacturer) may be used as simple equipment according to ČSN EN 60079-11 ed. 2, Article 5.7 in intrinsically safe circuit Ex ia according to ČSN EN 60079-25 ed. 2. For simple equipment, the maximum temperature may be established from the value P<sub>0</sub> of the follow-up equipment; therewith the temperature class is identified.

**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.

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. An intrinsically safe source must be always used that is approved for power supply of intrinsically safe equipment in the sense of ČSN EN 60079-11 ed. 2, e.g. INAP 901 ordering No. 901 000 101. If a LED display is required, it must be in the design Ex ia.

**WARNING**

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



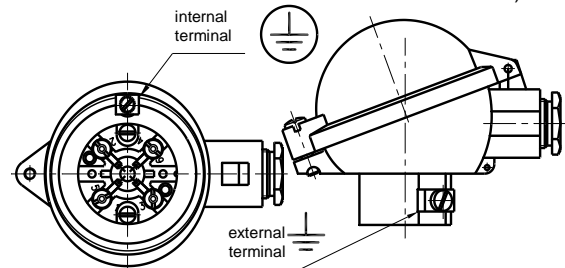
Shielding of the cable of the intrinsically safe circuit must be grounded in the same place as the intrinsically safe circuit; the connection must be outside of the dangerous area.

If the intrinsically safe circuit is insulated from ground, the shielding must be connected in one place to the system of protective interconnection. For that purpose, it is possible to use the terminals on the head of the sensor.

The sensor need not be connected independently to the system of interconnection if it is attached firmly and has metal interconnection with the structural parts or the piping that is connected to the system of interconnection.

**HEAD OF THE SENSOR WITH TERMINAL MI**

(for the sensor without converter or with converter Ex ia)

**Maximum cross-section of the wire for the connection to the external terminal and the internal terminal:**

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 a pressing hollow.

**INSTALLATION OF THE RATED GAUGE AND THE TEMPERATURE SENSORS WITH DEMONSTRATION OF COMPLIANCE PURSUANT TO THE DECREE OF THE GOVERNMENT 464/2005 Coll.**

Installation, commissioning and service maintenance of rated gauges pursuant to the Act 505/1990 Coll., on metrology, may be only performed by a person that is a bearer of a valid authorization for the installation and maintenance of the rated gauges issued e.g. in ZPA Nová Paka a.s.

Installation, commissioning, monitoring of activity and maintenance of the sensors with demonstration of compliance shall be realized in compliance with the standard ČSN EN 1434-6.

The certified sensors shall be provided, after the installation in the place of the application, by an authorized worker of the installation and service organization with the installation seal with the mark of the installation and service organization preventing from an unauthorized handling.

**WARNING for paired sensors**

- **Before the installation, check applicability to the pair according to the manufacturing number (the manufacturing numbers of one pair are equal, designation of individual sensors - manufacturing number/1 and manufacturing number/2) and time of the official verification**
- **For both sensors in the pair, use the same accessories (thermowells, weld-on pieces)**
- **Installation of both sensors shall be realized in the same way**
- **Location of both sensors shall be realized in the same way**
- **In case of a failure, replace the whole pair**

**COMMISSIONING**

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

**WARNING**

**After the end of the installation of the sensor in the environment with explosive gaseous atmosphere, an initial revision of the equipment and the installation shall be realized according to ČSN EN 60079-17 ed. 4.**



**OPERATION AND MAINTENANCE**

The sensor does not require any operation and maintenance. In case of the sensor **in the environment with explosive gaseous atmosphere**, maintenance and follow-up regular periodical revisions or permanent supervision of expert staff shall be realized according to ČSN EN 60079-17 ed. 4.

**OPERATION AND MAINTENANCE OF RATED GAUGES AND TEMPERATURE SENSORS WITH DEMONSTRATION OF COMPLIANCE PURSUANT TO THE DECREE OF THE GOVERNMENT 464/2005 Coll.**

In case of rated gauges and sensors with demonstration of compliance, it is necessary to comply with the prescribed period for the follow-up verification within the intervals established by the Regulation of the Ministry of Industry and Trade No. 345/2002 Coll., as amended.

The replacement and connection of the certified sensors shall be realized by the authorized worker of the installation or service organization, who shall seal the sensors with the mark of the service and installation organization again.

The renewal of the official mark or replacement of the securing mark with the official mark during the follow-up verification may only be realized by a worker of AMS or ČMI.

If the official mark or the securing mark was invalidated or removed, validity of verification of the gauge shall be terminated.

**UNINSTALLATION OF THE SENSOR**

Disconnect the sensor from the power supply source.

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

The measuring insert of the sensor is replaceable and it is dismantled from the head after the disconnection of the cable by releasing two screws.

If the sensor is connected to the system of interconnection, it is necessary before the complete uninstallation of the sensor to release the wire for mutual interconnection from the terminal on the head of the sensor.

Unscrew the sensor from the thermowell; torque for releasing is approx. 70 Nm for threads M20 x 1.5, G1/2 and 3/4-14NPT, and approx. 150 Nm for threads M27 x 2 and G3/4. When releasing the screw-joint of the sensor, the thermowell may not be released in any way.

**SPARE PARTS**

Spare parts shall be delivered by the manufacturer.

The relevant measuring inserts can be ordered according to the following table:

SPECIFICATION		ORDERING NUMBER					
		MV240	/xxx/	x	x	x	/xxx
Length of the measuring insert [mm]			according to table 1	1			
Probe	Pt100				1		
Tolerance class	A					A	
	B					B	
Connection of terminal board or the converter	Pt100/ /4						/J4
	2xPt100/B/2						/D2
	2xPt100//3						/D3
	Pt100/ /4C						/J2S
	Converter according to tab. 1						/converter

**EXAMPLE OF PURCHASE ORDER OF THE MEASURING INSERT**

Resistance measuring insert without converter  
 MV240 /430/ 11B/J4  
 6 pcs

To order the certified measuring inserts, specify the code according to Table 2 – Additional requirements – behind the ordering number.

The measuring inserts are marked according to Article DESIGNATION. Designation is completed with the ordering number.

Each delivery includes

- Delivery note
- Measuring insert pursuant to the purchase order
- Optional accessories to the measuring insert with a programmable converter
  - o Configuration program according to the required converter
  - o Communication modem (for serial port RS 232C) according to the required converter
- Accompanying technical documentation in Czech
  - o Product quality and completeness certificate, which also serves as the warranty certificate
  - o EC Declaration of Conformity (for design with converter Ex ia)
  - o Calibration sheet (for calibrated design)
  - o Declaration of Conformity of the supplier according to ČSN EN ISO/IEC 17050-1 (for orders according to the Decree 132/2008 Coll.)
  - o Product manual

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

- EC Declaration of Conformity (for design with converter)
- Copy of EC Type Examination Certificate according to the Decree of the Government 23/2003 Coll. (ATEX) for design with converter Ex ia

**WARRANTY**

Pursuant to Section 2113 Civil Code (Act No. 89/2012 Coll.), the manufacturer warrants for technical and operation parameters of the product specified in the manual. The warranty period is 24 months from the receiving of the product by the customer, unless established otherwise in the purchase contract or another document.

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.

**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**

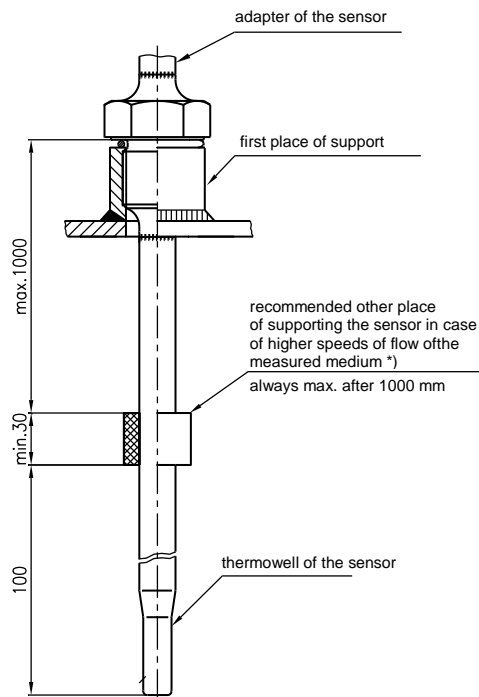
They shall be realized in compliance with the Waste Act No. 106/2005 Coll.

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.

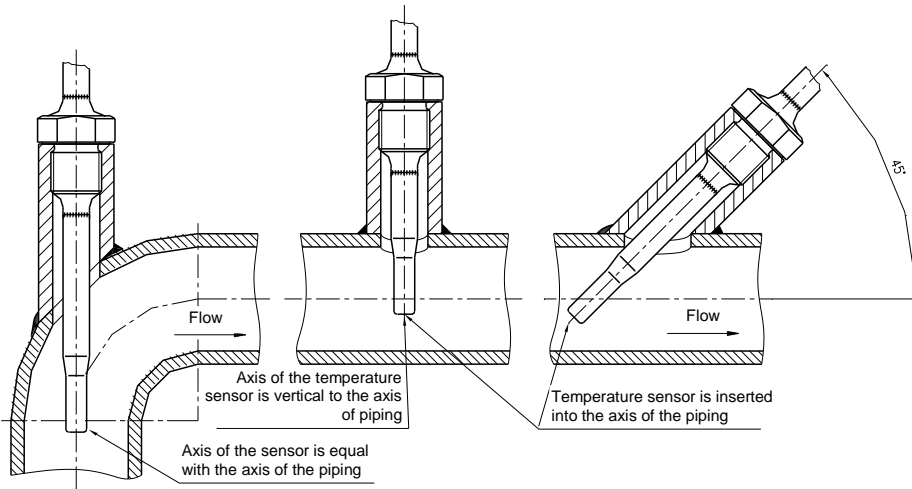
The manufacturer realizes free return withdrawal of marked electrical equipment (from 13.8.2005) from the consumer and points out the danger connected with their illegal disposal. The package of the sensor can be recycled completely. Metal parts of the products are recycled, non-recyclable plastic materials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

**FIGURE 1 – PROPOSAL OF SECURING THE THERMOWELL OF THE TEMPERATURE SENSOR** (for nominal length exceeding 630 mm)



\*) In case of the flow of the measured medium, the thermowells are stressed by dynamic effects by the flowing medium and this stress depends on the speed of flow, physical properties of the measured medium and immersion length of the thermowell. When the occurrence of such dynamic effects is expected, we recommend realizing another support of the sensor thermowell according to the above mentioned proposal.

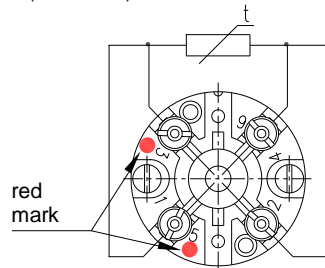
**FIGURE 2 - EXAMPLES OF INSTALLATION OF DIRECT AND ANGULAR WELD-ON PIECES ACCORDING TO ČSN EN 1434-2**



- ! WARNING**
- When using the sensor with an angular weld-on piece, locate the sensor with the thermowell at an angle against the direction of flow.
  - The sensor may not touch the opposite side of the piping.
  - It is also advantageous to use the temperature sensors in the piping elbow. In such a case, locate the sensor with the thermowell against the direction of flow so that the measured medium flows around evenly

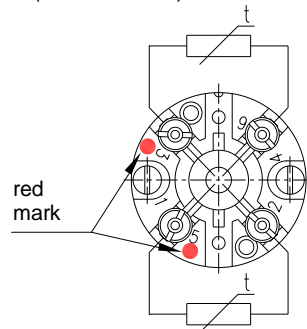
**FIGURE 3 – SCHEME OF CONNECTION OF TEMPERATURE SENSORS**  
without converter                      with converter                      with converter  
with HART protocol

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



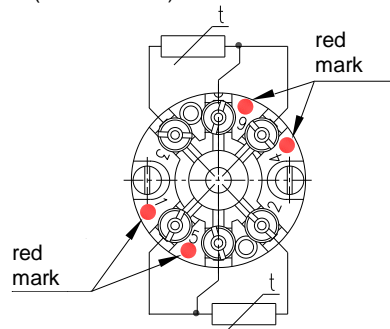
Red mark

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

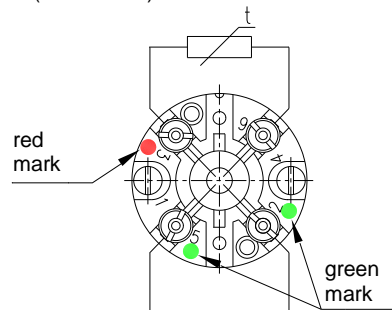


Red mark

**D3** - With double measuring in three-wire connection (2 × Pt 100/ /3)



**J2S** – with simple measuring resistance in connection with auxiliary loop (Pt 100/ /4C)



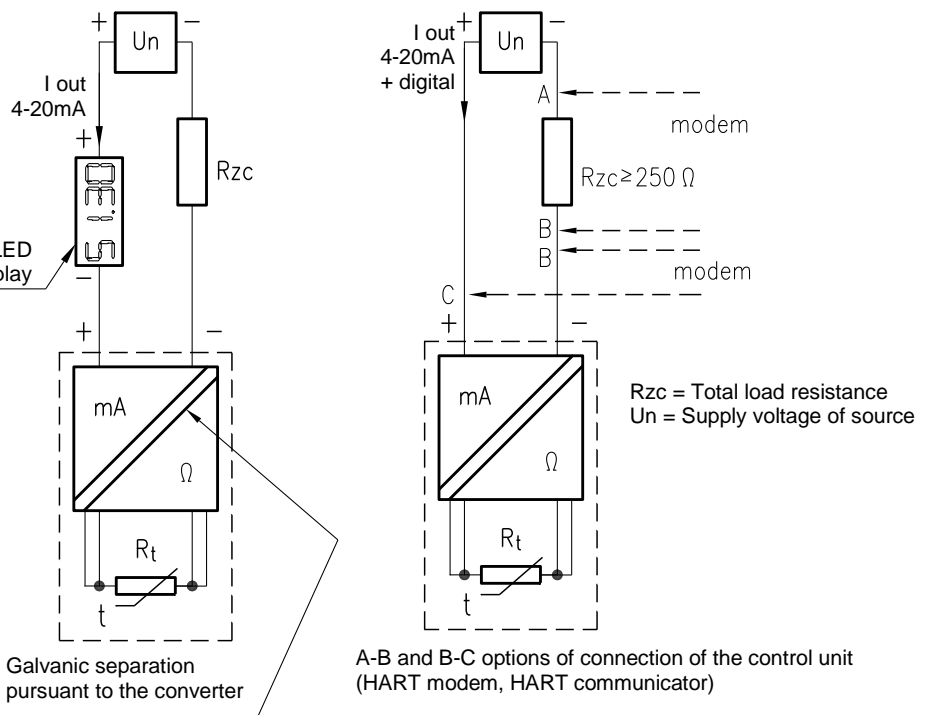
NOVÁ PAKA

ZPA Nová Paka, a. s.  
Pražská 470  
509 39 Nová Paka

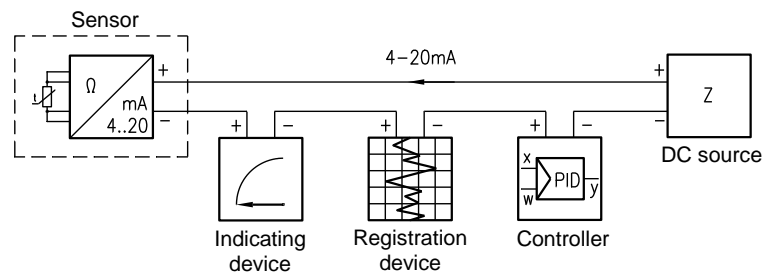
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IČO: 46 50 48 26  
DIČ: CZ46504826



**FIGURE 4- EXAMPLE OF OPERATION CONNECTION OF TEMPERATURE SENSOR WITH CONVERTER IN LOOP 4 - 20 MA**



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