

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

APPLICATION

- For remote measurement of temperature of gases, for which the properties of the material of the protective tube are suitable (e.g. in furnaces)
- For explosive conditions in areas Zone 2, Zone 1 and Zone 0 pursuant to ČSN EN 60079-10 in case of using the converter Ex ia or in case of connection to the Ex ia circuit
- In a set with control or diagnostic systems for process monitoring
- In design with converter to convert signal of the resistance sensor to unified output signal 4 to 20 mA or digital signal (converter with HART protocol)

The sensors with converter are rated products pursuant to the Act No. 22/1997 Coll. and Declaration of Conformity **EC-251000** is issued for them.

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 design Ex ia) and protective armature, consisting of a head and a protective tube. The head is provided with a lid and a cable outlet for the connecting wiring. The terminal board (of the converter) of the sensor is accessible after unscrewing the lid of the head, which is connected with one screw. On its head, the sensor with converter in design Ex ia is provided with an external terminal and an internal terminal for the connection of the grounding wire or the 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 pre-set to the required range at the sensor manufacturer.

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 dimensions are based on DIN 43772 and original ČSN 25 8301. The sensor is design ed pursuant to ČSN EN 61140 ed.2 as an electrical equipment of protection class III for the application in networks with category of overvoltage in installation II and pollution grade 2 pursuant to ČSN EN 61010-1; the follow-up (evaluation) device shall comply with Article 6.3 of the said standard.

Measuring range: -70 to 600 °C

The upper limit of the measurement range is limited by resistance of the material of the applied protective tube; however, it may not exceed 600°C.

Measuring range of the sensor with converter is given by the range of the selected converter.

Electric strength pursuant to ČSN EN 61010-1 Article 6.8.4: 500 V eff

(only measuring insert without converter or design with insulated converter)

Electric insulation resistance pursuant to ČSN IEC 751, Article 4.2.1:

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

Power supply of the converter:

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

Other data of the converter: refer to enclosed manual

Ingress protection pursuant to ČSN EN 60529: IP65

Operation position:

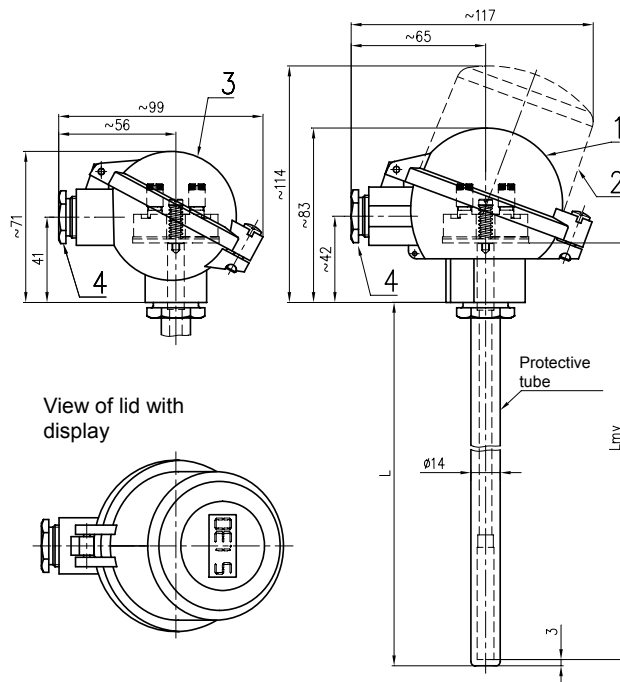
discretionary; the outlet shall not be situated upwards

Type of operation: continuous

Sensor weight:

With ball head (Al alloy)

Nominal length L	350 mm	approx. 0.96 kg
	500 mm	approx. 1.10 kg
	710 mm	approx. 1.28 kg
	800 mm	approx. 1.36 kg
	1000 mm	approx. 1.54 kg
	1400 mm	approx. 1.89 kg
	1600 mm	approx. 2.07 kg
	2000 mm	approx. 2.42 kg



- 1 - Ball head (Al alloy)
(for converter Ex i with both external and internal terminals)
or plastic ball head
(It cannot be used for converter Ex i)
 - 2 - Ball head with increased lid (Al alloy)
without display for converter in the lid or with display
(for converter Ex i with both external and internal terminals)
 - 3 - Small ball head (Al alloy)
(only for terminal board or converter INPAL 420)
 - 4 - Cable outlet M20x1.5
- L Nominal length
L_{mv} Length of measuring insert

Applied materials:

Protective tube	steel 1.4845 or 1.4541
Head	aluminium alloy painted with polyester paint or plastic PPO (phenyl polyoxide)
Sealing of lid of head	oil-resistant rubber
Internal wiring	Cu
Head terminals of terminal board	brass with Ni surface
Connecting items of sensor	stainless steel

OPERATION 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 sensor head and outlet:

- For design without converter -50 °C to 120 °C
- For design with converter pursuant to type of the converter (refer to enclosed converter manual)
- For design with converter and display -20 °C to 70 °C

Vibrations:

Nominal length L[mm]	350 to 1000	1400 to 2000
Frequency range [Hz]	10 to 55	
Drift amplitude [mm]	0.15	0.075
Acceleration amplitude [ms ⁻²]	19.6	9.8

Relative ambient humidity:

10 to 100 % with condensation, with upper limit of water content 29 g H₂O/kg of dry air

Atmospheric pressure: 70 to 106 kPa

Maximum speed of flow of gaseous medium: 2 m/s

Resistance of material of PPO (phenyl polyoxide) head:

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

Resistance of material of lid sealing (oil-sealing rubber):

Alcohol	resistant
Ether	
Benzol	
Petrol	
Ester	
Animal and vegetable oils	
Mineral oil	
Engine oil	
Weak alkali hydrohides	
Strong alkali hydroxides	
Weak acids	resistant
Strong acids	non-resistant
Sea water	resistant
Trichloroethylene	partially resistant
Hot water	

METROLOGICAL DATA

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

Internal wiring resistance at 20 °C: 0.1 /m

The calculated resistance value of internal wiring is specified on the label of the measuring insert for the design without converter.

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 from -70 to 250°C:
200 mm (min. 160 mm)

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

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

Temperature response time pursuant to ČSN IEC 751 in whirling water (characteristic value):

0.5	75 s
0.9	90 s

DESIGNATION:**Data on head label**

- Trademark of the manufacturer
- Made in Czech Republic
- Type of resistance sensor, nominal value R₀ / tolerance class / configuration of wires of internal wiring *)
- Measuring range or pre-set converter range
- Product ordering number
- Ingress protection

- Manufacturing number
- Output signal 4 to 20 mA (design with converter)
- Ambient temperature
- Designation of non-explosiveness and EC-Type Examination Certificate number (for design with converter Ex i)
- CE mark with identification number of the notified person (for design with converter Ex i)

*) Configuration of wires of internal wiring is not specified for the converter

Data on measuring insert label

- Trademark
- Type of sensor, nominal value R₀ / tolerance class / configuration of wires of internal wiring *)
- Manufacturing number
- Resistance value of internal wiring (for design without converter)

*) Configuration of wires of internal wiring is not specified for the converter

Data on converter label

- Type of sensor
- Pre-set temperature range

DELIVERY

Unless agreed otherwise with the customer, each delivery includes

- Delivery note
- Sensor pursuant to the purchase order
- Separately ordered accessories:
Connecting flange or weld-on piece with threaded ring
- Optional accessories to sensor with programmable converter
 - o Configuration (parameterization) programme 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 EC Declaration of Conformity for design with converter Ex i
 - o Calibration sheet (for uncertified calibrated 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

- Copy of the Inspection Certificate 3.1 for material of protective tube and stem tube with the casting number
- Copy of EC-Type Examination Certificate pursuant to the Decree of the Government 23/2003 Coll. for design with converter Ex i

CERTIFICATION

- Non-explosiveness Ex i, EC-Type Examination Certificate pursuant to the Decree of the Government 23/2003 Coll., (pursuant to the type of the converter)

ORDERING TEMPERATURE SENSORS

The purchase order shall specify

- Name
- Product ordering number
- Measuring range
- If calibration is required and in what temperature points
- If the connecting flange or weld-on piece with threaded ring is required
- If optional accessories to the sensor with programmable converter is required
- Other (special) requirements
- Number of pieces

Behind the ordering number specified pursuant to Table 1, the customer shall identify the required range of measured temperature (i.e. so-called 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.).

PURCHASE ORDER EXAMPLE**Standard design:**

Resistance temperature sensor with metal protective
tube without converter
251 401 032 1B/J4
Range -70 to 600°C
6 pcs

Special requirement:

Resistance temperature sensor with metal protective
tube with converter
251 901 032 1B/18
Nominal length L 380 mm
Range 0 to 100°C
6 pcs

ORDERING ACCESSORIES

The purchase order shall specify:

- Name
- Product ordering number
- Number of pieces

PURCHASE ORDER EXAMPLE

Connecting flange
991 UP 14
5 pcs

TABLE 1 - DESIGN OF TEMPERATURE SENSORS WITH METAL PROTECTIVE TUBE, TYPE 251

SPECIFICATIONS				ORDERING NUMBER													
				251	x	0	1	0	x	2	x	x	/xxxxxx	/xxx			
Nominal length L [mm]	350	Length of measuring insert L _{mv} [mm]	375	1													
	500		525	2													
	710		735	3													
	800		825	4													
	1000		1025	5	0		0										
	1400		1425	6													
	1600		1625	7													
	2000		2025	8													
	Other (max. 3000) *)			9													
Material of protective tube	1.4845	max. -70 to 600°C				1											
	1.4541	max. -70 to 600°C				2	0										
	other *)					9											
Sensor head	Ball (Al alloy) (for converter Ex i with both external and internal terminals)							3									
	Ball, plastic (it cannot be used for converter Ex i)							4									
	Ball head with increased lid (Al alloy) without display for converter in the lid or with display (for converter Ex i with both external and internal terminals)							5	2								
	Ball, small (Al alloy) (only for terminal board and converters INPAL 420, APAQ-HRF, TH 100, MINIPAQ-HLP)							6									
	Other *)							9									
Measuring resistor (sensing probe)	Pt100									1							
Tolerance class	A max. -70 to 300°C												A				
	B												B				
Connection terminal board	Single - four-wire (1xPt100/ /4)														/J4		
	Double- two-wire (2xPt100/B/2)													B	/D2		
	Double- three-wire (2xPt100/ /3)														/D3		
Converter type		Galvanic separation	Ex	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		
	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	•	•											/248HAI1X			
644 HA NA	•												/644HANA				
644 HA I1	•	•							5				/644HAI1X				
Other *)														/99			
Without converter (for converter installation by customer)														/00			
LED display to loop 4-20 mA (only with converter, with the exception of the converter 644 HA)																	
LED display										5					/LD		

Standard design

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

TABLE 2 - ACCESSORIES - to be ordered separately

SPECIFICATIONS		ORDERING NUMBER
Connecting flange		991 UP 14
Weld-on piece with threaded ring	Material: carbon steel	991 NVP6 D14 13
	Material: corrosion-resistant steel	991 NVP6 D14 72

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 ČSN EN 60721-3-2 (i.e. by airplanes and trucks, in premises that are ventilated and protected against atmospheric effects).

STORAGE

The sensors 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 between -20 and 70 °C (i.e. in places where temperature and humidity are not controlled, with a threat 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

Indicators of reliability in operation conditions and ambient conditions specified herein

- Medium time of operation between failures 96 000 hours (inf. value)

Expected service life 10 years

CALIBRATION

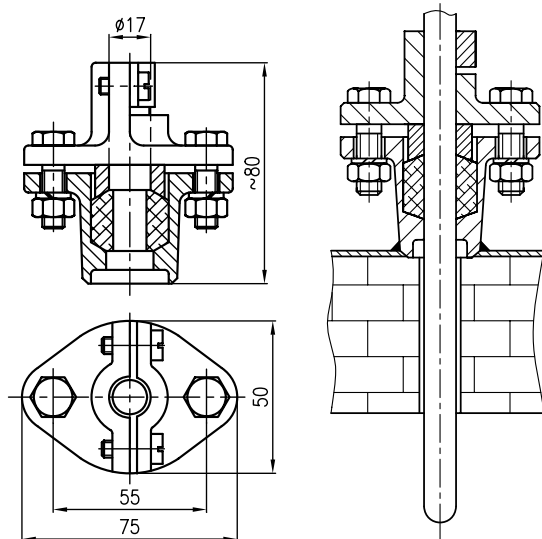
It is realized pursuant to TPM 3342-94 and in compliance with ČSN IEC 751, usually in three temperature points spread evenly within the operation range of the sensor or in the points according to the requirement of the customer. Calibration sheets with measured data are issued for calibrated sensors.

INSTALLATION AND CONNECTION**SENSOR INSTALLATION**

The sensor installation is realized by means of a connecting flange or by means of a weld-on piece with a threaded ring.

FLANGE INSTALLATION

Weld the bottom part of the flange into the wall of the technological equipment. In the connecting flange, you can move the sensor after releasing two screws M6x14, whereby you can achieve the required immersion of the sensor.

CONNECTING FLANGE (example of installation)

INSTALLATION OF THE WELD-ON PIECE WITH THREADED RING shall be realized pursuant to the instruction label as follows:

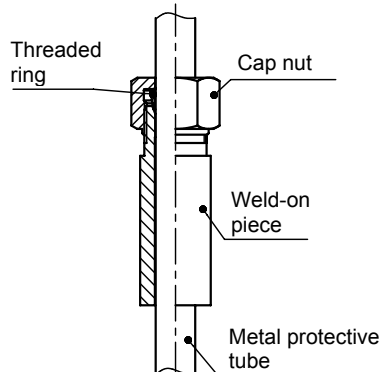
- 1) Uninstall the complete weld-on piece by unscrewing the cap nut

- 2) Weld the weld-on piece itself (after possible shortening) onto the wall of the piping or another technological equipment
- 3) On the metal protective tube of the rod temperature sensor, put the cap nut, thrust ring and threaded ring in the said order,
- 4) Slide the temperature sensor with put-on components pursuant to point 3 into the prepared weld-on piece and only tighten it adequately after the definitive selection of immersion (recommended torque is 60 to 70 Nm).

**WARNING**

Length of the immersion part of the sensor cannot be changed repeatedly; the sensor can only be uninstalled!

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

WELD-ON PIECE WITH THREADED RING**ELECTRICAL CONNECTION**

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

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

Connect the evaluation devices to the sensor with a non-armoured cable with double insulation with outer diameter 5 to 8 mm (internal wires with Cu core with cross section 0.5 to 1.5 mm²). Seal the cable outlet of the sensor adequately.

**WARNING**

Do not use independent wires without jacket for electrical connection. To ensure the Ingress Protection grade in the outlet, the connecting cable shall have circular cross-section. Temperature resistance of the cable shall comply 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 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 diameter of the cross section of the core min. 0.5 mm². The HART communicator is connected to the supply loop of the sensor with converter pursuant to Figure 1. To achieve reliable communication, the total load resistance of min. 250 shall be in the circuit of the output loop.

INSTALLATION OF THE SENSOR WITH CONVERTER Ex i IN ENVIRONMENT WITH EXPLOSIVE GASEOUS ATMOSPHERE

The installation of the sensor in the environment with explosive gaseous atmosphere shall comply with the requirements of CSN EN 60079-14 ed. 2.

WARNING 

Ex i parameters shall be complied with pursuant to the enclosed converter manual.

To ensure safety, an intrinsically safe source shall be always used pursuant to the converter manual, e.g. INAP 901 ordering number 901 000 101.

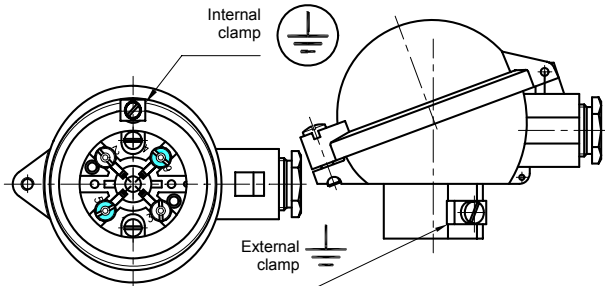
Surface temperature of the converter may not exceed the maximum surface temperature for that particular temperature class.

The programmable converter may not be connected to the PC or HART communicator if the converter is located in the explosive environment.

For the 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 interconnection separately if it is installed firmly and has metal interconnection with the structural parts or the piping, which is connected to the system of mutual interconnection.

HEAD OF THE SENSOR WITH TERMINALS



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

Internal terminal: stranded wire 1.5 mm², full wire 2.5 mm²
 External terminal: stranded wire 4.0 mm², full wire 6.0 mm²
 If stranded wires are used for the interconnection, they shall be protected against fraying with pressing hollow.

COMMISSIONING

After the installation of the sensor, including closing the fixed closure 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.

OPERATION AND MAINTENANCE

The sensor does not require any operation and maintenance.

SENSOR UNINSTALLATION

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

The measuring insert of the sensor is replaceable and is uninstalled from the head after disconnecting the cable by releasing two screws.

If the sensor is connected to the system of interconnection, the wire for mutual interconnection shall be released from the terminal on the head of the sensor before the complete uninstallation of the sensor.

After releasing the screws on the connecting flange (unscrewing the nut on the weld-on piece with threaded rings), remove the sensor.

SPARE PARTS

Spare parts shall be delivered by the manufacturer. Relevant measuring inserts can be ordered pursuant to the following table:

SPECIFICATIONS	ORDERING NUMBER					
	MV250	/x xx /	2	x	x	/xxxx
Length of measuring insert [mm]		pursuant to tab. 1	2			
Sensing probe	Pt100			1		
Tolerance class	A					A
	B					B
Connection terminal board or converter	Pt100/ /4					/J4
	2xPt100/B/2					/D2
	2xPt100/ /3					/D3
	Converter pursuant to tab. 1					/converter

PURCHASE ORDER EXAMPLE OF MEASURING INSERT

Resistance measuring insert without converter
 250 /735/ 21B/J4 - 6 pcs

WARRANTY

Pursuant to Section 429 of the Commercial Code and the provisions of Section 620 (2) of the Civil Code, 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 contract. 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 – SCHEME OF CONNECTION OF TEMPERATURE SENSORS

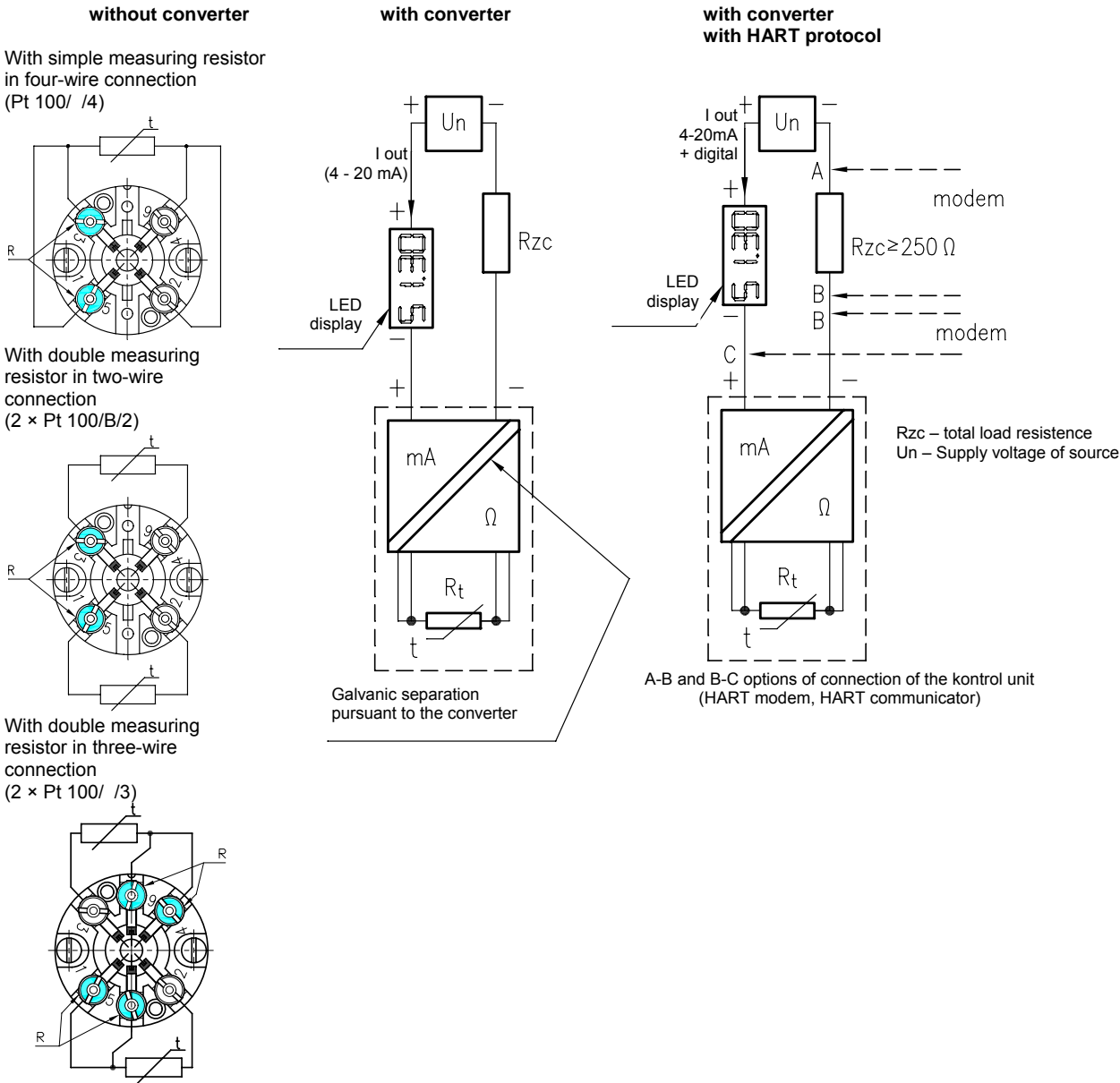
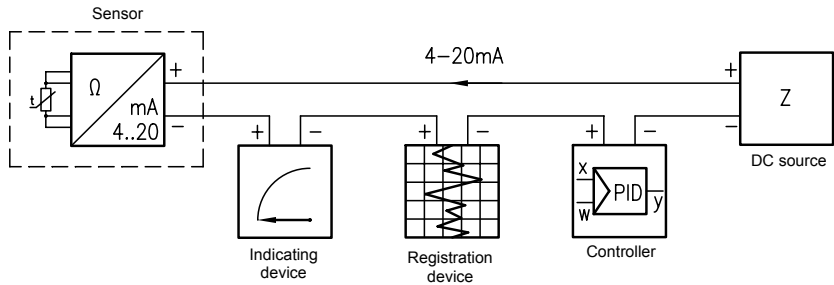


FIGURE 2- EXAMPLE OF OPERATION CONNECTION OF TEMPERATURE SENSOR WITH CONVERTER IN LOOP 4 - 20 mA



MMG Műszerszerviz Kft.
 1036 Budapest, Dereglye u. 1.,
 Tel/fax: 204-2252, Tel:203-7443
 Web: www.mmg.hu, E-mail: info@mmg.hu