



Thermoelectric temperature sensor with thermowell DIN without converter, with converter or Ex ia design type series 330 type 332

PRODUCT MANUAL

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

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 selected by the customer are suitable; the measurement may be realized up to the temperature and pressure determined by thermowell resistance and nominal pressure PN 160
- For explosive conditions in areas Zone 2, Zone 1 and Zone 0 pursuant to 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 thermoelectric sensor to unified output signal 4 to 20 mA or digital signal (converter with HART protocol)
- In design with display to display the value of the measured value immediately
- 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)

The sensors with converter and in 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-332000** is issued for them.

DESCRIPTION

The sensor consists of a replaceable measuring insert with flange and ceramic terminal board or installed two-wire converter (insulated or non-insulated, even in design Ex ia) and protective armature, consisting of the head and thermowell with adapter with screw joint. The head is provided with a lid and cable gland for the connection wiring.

The terminal board of the sensor (converter) is accessible after tilting away the lid of the head, which is connected with one screw. The sensor with converter in design Ex ia is provided on its head with both external and internal terminals 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 supplied from an external source. The installed converter is set-up to the required range at the sensor manufacturer.

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

TECHNICAL DATA

The sensor design corresponds to DIN 43772. 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 pollution grade 2 pursuant to EN 61010-1, the follow-up (evaluation) device shall comply with Article 6.3 thereof.

Electric strength pursuant to EN 61010-1, Article 6.8.3:

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

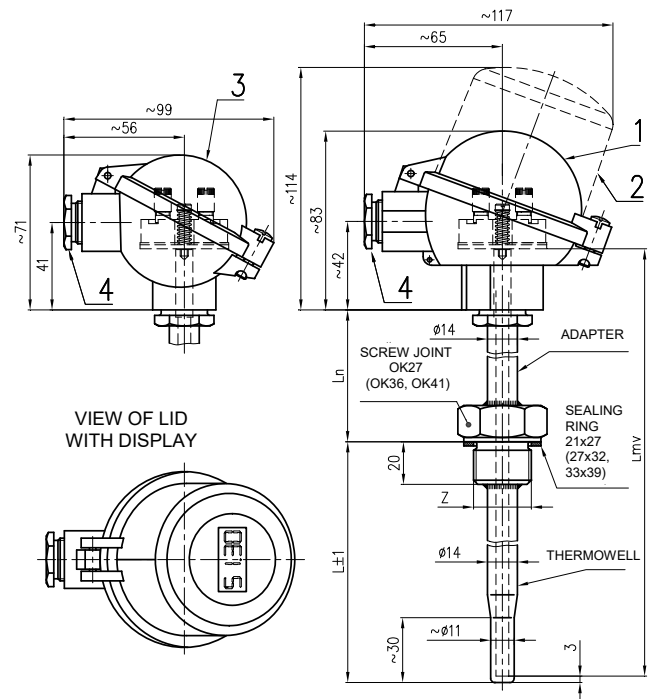
Electric insulation resistance pursuant to EN 61515, Article 5.3.2.4:

min. 1000 MΩ, at ambient temperature $20 \pm 15^\circ\text{C}$ and
max. 80% relative humidity, test voltage 500 V DC

Measuring range:

Min. adapter length L_n [mm]	Type of thermocouple	Measuring range [°C]
115	J	-200 to 800 *)
	K	-200 to 1150 *)
55	J, K	-200 to 250

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



- 1 - Ball head (Al alloy)
(for converter Ex ia with both external and internal terminals)
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 lid or with display
(for converter Ex ia with both external and internal terminals)
 - 3 - Small ball head (Al alloy)
(only for terminal board)
 - 4 - Cable gland M20x1.5
- L Nominal length
 L_n Length of adapter
 L_{mv} Length of measuring insert
Z connecting thread of sensors adapter
G $\frac{1}{2}$, M20x1,5 OK27
G $\frac{3}{4}$, M27x2, 3/4-14NPT OK36
G1 OK41

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

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

⊕ II 1 G Ex ia IIC T5/T6 Ga
(Meaning of designation - see figure 4)
 $P_i = 500 \text{ mW}$ T6 ($-60^\circ\text{C} \leq T_a \leq 68^\circ\text{C}$)

Intrinsically safe circuit parameters:

only for thermocouple "K" and "J", with measuring insert $\varnothing 6$

$U_i = 60 \text{ V}$ $U_o = 100 \text{ mV}$
 $I_i = 100 \text{ mA}$ $I_o = 50 \text{ mA}$
 $P_i = 500 \text{ mW}$ $P_o = 25 \text{ mW}$
 $C_i = 850 \text{ pF/m}$
 $L_i = 16 \text{ } \mu\text{H/m}$



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.

Intrinsically safe version with converter:
according to built-in converter

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

DELIVERY

Unless agreed otherwise with the customer, each delivery includes

- Delivery note
- Sensor pursuant to the purchase order
- Sealing ring
 - o 21x27 TPD 62-014-91 for connecting thread G $\frac{1}{2}$ and M20x1,5
 - o Cu 27x32x1.5 (ČSN 02 9310.2) for connecting thread M27x2 and G $\frac{3}{4}$
 - o Cu 33 x 39 x 2 (ČSN 02 9310.2) for connecting thread G1
- (for thread $\frac{3}{4}$ -14NPT, the sealing ring is not delivered)
- Optional accessories to the 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 manual
 - o Product quality and completeness certificate, which also serves as the warranty certificate
 - o EU Declaration of Conformity for Ex ia design

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 thermowell with the heat number
- Declaration of Conformity with purchase order 2.1 acc. to EN 10204
- Test report about the seismic and the vibration qualification
- EU Declaration of Conformity (for design with converter)
- Calibration sheet (for uncertified calibrated design)
- Copy of EU-Type Examination Certificate pursuant to the Directive No 2014/34/EU for Ex ia design

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 and display)

CALIBRATION

It is realized pursuant to TPM 3342-94 and in compliance with EN 60584-1, 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 12 pursuant to EN IEC 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.)

ORDERING TEMPERATURE SENSORS

The purchase order shall specify

- Name
- Product ordering number
- Ex ia design is ordered using codes JIX, or DUX according to table 1
- Additional requirements for sensor design pursuant to Table 2
- Request for other documentation pursuant to Table 2
- Measuring range
- If calibration is required and in what temperature points
- If the delivery of thermowell and nipple pursuant to the type 991 is required for the sensor as accessories
- If optional accessories to the sensor with programmable converter is required
- Request for other documentation according to Article DELIVERY
- 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.).

EXAMPLE OF PURCHASE ORDER**Standard design:**

Thermoelectric temperature sensor with thermowell DIN
Without converter
332 412 131 K2/JI/Q4
Calibration points 200, 400 and 600°C
Range -200 to 600°C
6 pcs

Special requirement:

Thermoelectric temperature sensor with thermowell DIN
With converter
332 912 231 J2/HCF
Nominal length L 380 mm
Range 0 to 300°C
6 pcs

ORDERING ACCESSORIES

The purchase order shall specify:

- Name
- Ordering number
- Number of pieces

EXAMPLE OF PURCHASE ORDER**Standard design:**

Nipple
991 NVP4 M27 72
6 pcs

Special request:

Nipple
991 NVP4 M27 99
material 1.5415
6 pcs

TABLE 1 - DESIGN OF TEMPERATURE SENSORS TO THERMOWELL DIN TYPE 332

SPECIFICATIONS						OBJEDNACÍ ČÍSLO																		
						332	x	x	x	x	x	x	x	x	x	/xxxxxxx	/xxx							
Nominal length L [mm]	130	Length of adapter L _n [mm]	115	Length of measuring insert L _{mv} [mm]	275	1																		
	160				2																			
	220				3																			
	280				4																			
	400				5																			
	Other (min. 130) *)				9																			
Nominal length L [mm]	130	Length of adapter L _n [mm]	55	Length of measuring insert L _{mv} [mm]	215	1																		
	160				2																			
	220				3																			
	280				4																			
	400				5																			
	Other (min. 130) *)				9																			
Length of adapter L _n [mm]	125 (115)					1																		
	55 maximal measuring range [°C] -70 to 250					2																		
	Other (min. 55) *) **)					9																		
Thermowell material	1.4571 ***) maximal measuring range [°C] -200 to 400																							
	1.4541 ***) maximal measuring range [°C] -200 to 600																							
	Other *)																							
Connecting thread	G1/2																							
	G1																							
	M27x2																							
	G3/4																							
	3/4-14 NPT																							
	M20x1,5																							
	Other *)																							
Sensor head	Ball (Al alloy) (for converter Ex ia with both external and internal terminals)																							
	Ball, plastic (cannot be used for converter Ex ia)																							
	Ball head with increased lid (Al alloy) without display for converter in lid or with display (for converter Ex ia with both external and internal terminals)																							
	Ball, small (Al alloy) (only for terminal board and converters APAQ-HCF, MINIPAQ-HLP)																							
	Other *)																							
Tube of measuring insert for sensor with thermowell (Ø6 ± 0,1 mm)																								
Thermocouple	K																							
	J																							
Accuracy class	1 *)																							
	2																							
Design of thermocouple measuring ends pursuant figure 1	Single thermocouple, insulated end																				/JI			
	Double thermocouple, independent end																				/DU			
	Single thermocouple, insulated end																				1			
	Double thermocouple, independent end																				1			
	only for TC "K" a "J", length of measuring insert L _{mv} 100 – 3025 [mm]																							

TABLE 1 - DESIGN OF TEMPERATURE SENSORS TO THERMOWELL DIN TYPE 332 (continuation)

SPECIFICATIONS						OBJEDNACÍ ČÍSLO														
						332	x	x	x	x	x	x	x	x	x	x	/xxxxxx	/xxx		
Converter (design of thermocouple measuring ends: single thermocouple, isolated end)	Converter type		Galvanic separation	Ex ia	NFC	Range [°C]														
	Analogue linear output signal with thermoelectric voltage	APAQ-HCF				Adjustable range													/HCF	
		APAQ-HCFX		•																/HCFX
	Programmable linear output signal with temperature	TH 200	•			Programmable range													/TH200	
		TH 200-ex	•	•																/TH200X
		IPAQ-H	•																	/IPAQH
		IPAQ-HX	•	•																/IPAQHx
		MINIPAQ-HLP																		/MINIPAQ
		IPAQ C202																		/C202
		IPAQ C202X		•																/C202X
	Programmable with HART protocol linear output signal with temperature	IPAQ C330	•		•														/C330	
		IPAQ C330X	•	•	•														/C330X	
		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	•	•															/248HAI1X			
644 HA NA	•																/644HANA			
644 HA I1	•	•															/644HAI1X			
Other *)																		/99		
Without converter (for converter installation by the customer)																		/00		
LED display to loop 4-20mA	LED display(only with converter, with the exception of converter 644 HA)																	/LD		
	LED display Ex ia *) (only with converter Ex ia except converter 644 HAI1X)																	/LDX		

Standard design

- *) Only as a special requirement after an agreement with the manufacturer
- **) In case of adapter length below 115 mm (minimum 55 mm), the temperature range is decreased to -200 to 250 °C
- ***) thermowells of these materials are suitable for contact with food
- ****) Functional safety SIL2

TABLE 2 – ADDITIONAL REQUIREMENT FOR DESIGN OF TEMPERATURE SENSORS, TYPE 332

SPECIFICATIONS			CODE	
CALIBRATION	NUMBER OF CALIBRATION POINTS	CALIBRATION RANGE		
Calibration by TPM 3342-94, define calibration points	3	0 to 800 °C	/Q4	
	3	0 to 1100 °C	/Q42	
	Other	0 to 1100 °C	/Q9	
REQUIREMENT FOR OTHER DOCUMENTATION			USE	
EU Declaration of Conformity			for design with converter	
Copy of EU-Type Examination Certificate acc to the 2014/34/EU (ATEX)			for Ex ia design	
Copy of the Inspection Certificate 3.1 acc to EN 10204 for material of 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 Q4, Q42 a Q9.

TABLE 3 –OVERVIEW OF SEALING RINGS TYPE 991 SUPPLIED TO TEMPERATURE SENSORS

EXTERNAL FIXING THREAD OF TEMPERATURE SENSORS	SEALING RING			
	DIMENSION [mm] Ød x ØD x t	MATERIAL	NUMBER	ORDERING NUMBER
M20x1,5	21×27x2	copper thermally insulating insert	1 Pcs	991 TK 21
G1/2				991 TK 27
M27x2	27×32x1,5	copper		991 TK 33
G3/4				
G1	33×39x2			
3/4-14 NPT	-	-	-	-

The sealing ring is supplied to each sensor by default, only for the sensor with internal thread 1/2-14NPT the sealing ring is not supplied. The sealing ring can also be ordered separately using ordering number

TABLE 4 – ACCESSORIES - OVERVIEW OF DESIGNS RECOMMENDED NIPPLES FOR WELDING THERMOWELLS, TYPE 991 (order separately)

SPECIFICATION					ORDERING NUMBER							
					991	xxx	x	xxx	xx			
Shape	Direct nipple											
	Oblique (chamfer 45°)											
Internal bore	M20×1,5	for embed sealing ring	PN	40			1	M20				
	G 1/2							G12				
	M20×1,5	without embed for sealing ring							2	M20		
	G 1/2								G12			
	M27×2									4	M27	
	G 3/4									G34		
	3/4 – 14 NPT										N34	
	G1										G01	
	Other *)										999	
	Material	1.0308 or 1.0122		surface treatment	preservation with grease – oil	maximum operation temperature [°C]	300 (only PN 40)					M20
1.0577									G12			
15 128.5									M27			
1.4541									G34			
Other *)									N34			
									G01	15		
					400				M27	51		
					550				G34			
					550				N34			
					550						72	
					pursuant to material						99	

*) upon a special requirement after an agreement with the manufacturer

INSTALLATION AND CONNECTION

SENSOR INSTALLATION

Install the sensors by screwing into the nipple on the piping (technological equipment). Before the installation, put on the enclosed sealing ring in advance (for thread 3/4-14NPT, the sealing ring is not used). During the installation torque of 150 Nm is recommended, for thread 3/4-14NPT torque of 70 Nm. Examples of the use of the nipples are shown in Figure 5. 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.

ELECTRICAL CONNECTION

The electrical connection may be only realized by qualified workers.

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 converter) 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.

Sensors without converter connect with compensation or thermocouple wiring with cross section 0.5 to 1.5 mm².

Seal the cable gland of the sensor properly.



WARNING

Do not use independent wires without jacket for electrical connection. To ensure the Ingress Protection grade in the gland, 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 min. 0.5 mm².

The HART communicator is connected to the supply loop of the sensor with converter pursuant to Figure 3.

To achieve reliable communication, the total load resistance of min. 250 Ω shall be in the circuit of the output loop.

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

In environment with explosive gaseous atmosphere a sensor without converter or sensor with Ex ia converter can be installed.

The installation of the sensor in the environment with explosive gaseous atmosphere shall comply with the requirements of 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 P₀ 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 LiR 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 EN 60079-11.



WARNING

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



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 the dangerous area

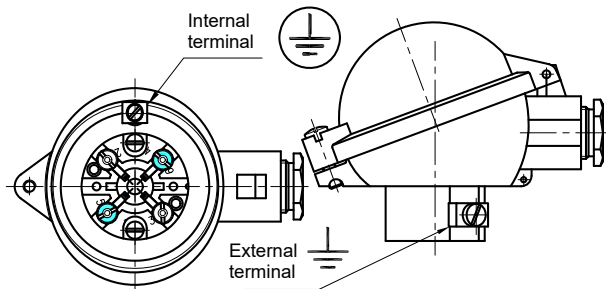
For the installations in dangerous areas, mutual interconnection is required (bringing to the same potential). To achieve it, terminals on the sensor head can be used.

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

(for sensor with converter Ex ia)



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.



WARNING

After finish installation of the sensor in the environment with explosive gaseous atmosphere the default device revision and installation must be performed in EN 60079-17.



OPERATION AND MAINTENANCE

The sensor does not require any operation and maintenance. For the sensor in the environment with explosive gaseous atmosphere maintenance and following regular periodic revisions or continuous supervision of professional personnel are carried out compliance with EN 60079-17.

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.

Unscrew the sensor from the thermowell; torque for releasing is approx. 70 Nm. While releasing the screw joint of the sensor, the thermowell may never be released.

REPAIRS

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

SPARE PARTS

Spare parts shall be delivered by the manufacturer.

EXAMPLE OF PURCHASE ORDER OF MEASURING INSERT

Thermoelectric measuring insert without converter
 330 /375/ 1K2/JI
 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.

Relevant measuring inserts can be ordered pursuant to the following table:

SPECIFICATIONS		ORDERING NUMBER					
		MV330	/xxx/	x	x	x	/xx xx
Length of measuring insert [mm]			Pursuant to tab. 1				
ø measuring insert [mm]	6 ± 0,1			1			
	3 ± 0,1			3			
Sensing probe	Thermocouple K				K		
	Thermocouple J				J		
Accuracy class	1					1	
	2					2	
Connection of the terminal board and design of measuring ends of thermocouple or converter	Single thermocouple, insulated end						/JI
	Double thermocouple, independent end						/JIX *)
Converter pursuant to tab. 1							converter

*) Ex ia design (length of measuring insert L_{mv} 100 – 3025 [mm])

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 manual
 - o Product quality and completeness certificate, which also serves as the warranty certificate
 - o EU Declaration of Conformity (for Ex ia design)

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

- Calibration sheet (for calibrated design)
- EU Declaration of Conformity (for design with converter)
- Copy of EU-Type Examination Certificate pursuant to the Directive No 2014/34/EU for Ex ia design

WARRANTY

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.

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 - DESIGN OF MEASURING ENDS OF JACKETED THERMOCOUPLES (SCHEMATIC ILLUSTRATION)

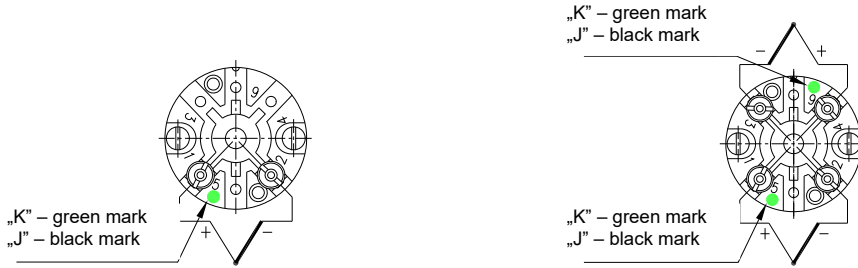


FIGURE 2 - SCHEME OF CONNECTION OF TEMPERATURE SENSORS

SCHEME OF CONNECTION WITHOUT CONVERTER

with single thermocouple

with double thermocouple



SCHEME OF CONNECTION WITH CONVERTER AND DISPLAY

with converter

with converter with HART protocol

with converter Ex ia

with converter Ex ia with HART protocol

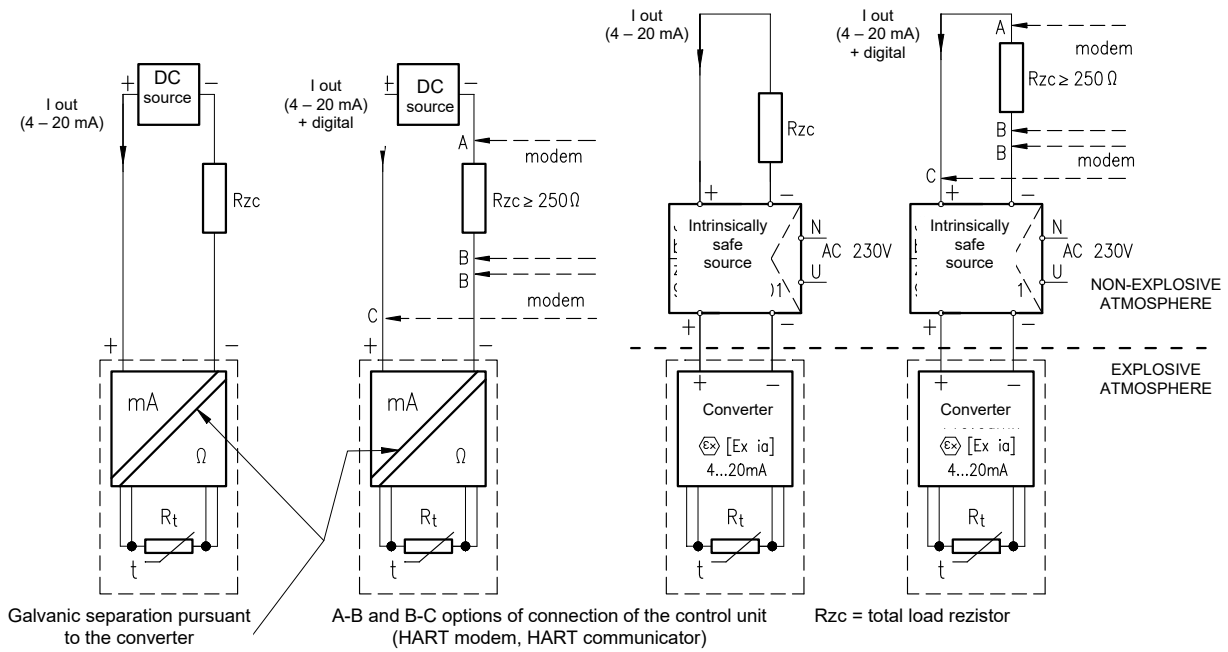


FIGURE 3 - EXAMPLE OF OPERATION CONNECTION OF TEMPERATURE SENSOR WITH CONVERTER IN LOOP 4 - 20 mA

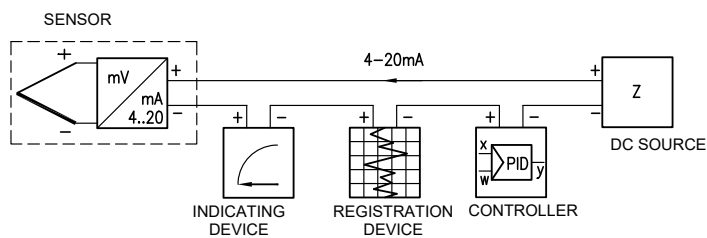


FIGURE 4 - INTRINSICALLY SAFE MARKING

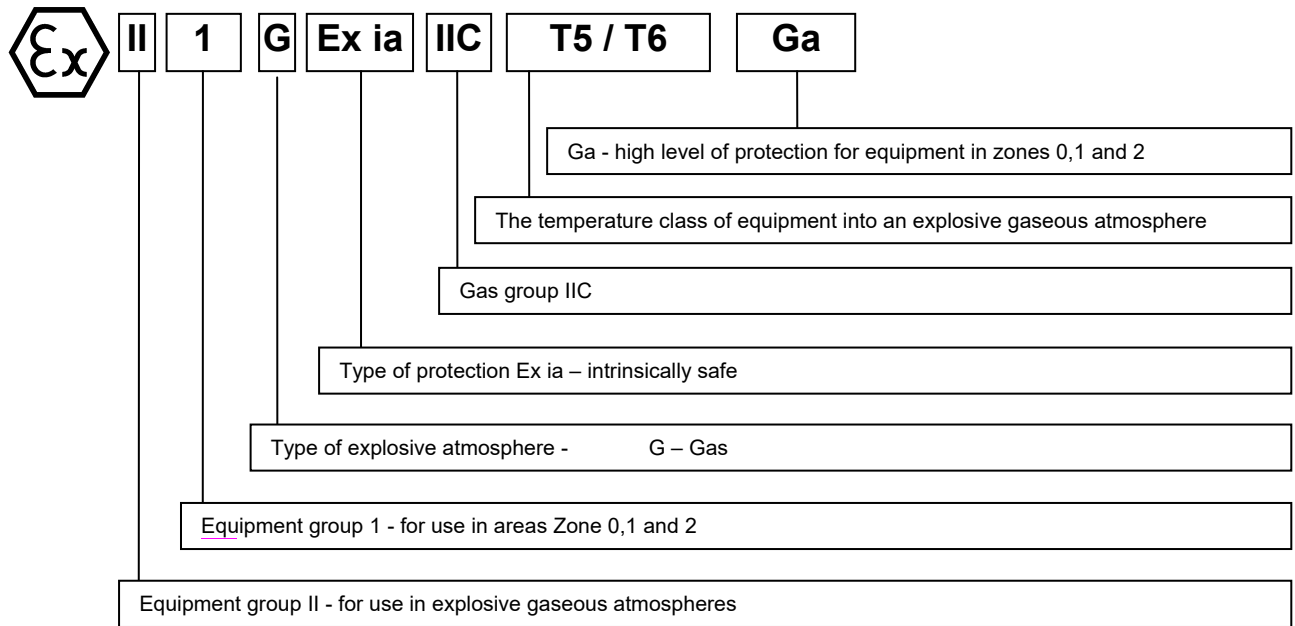
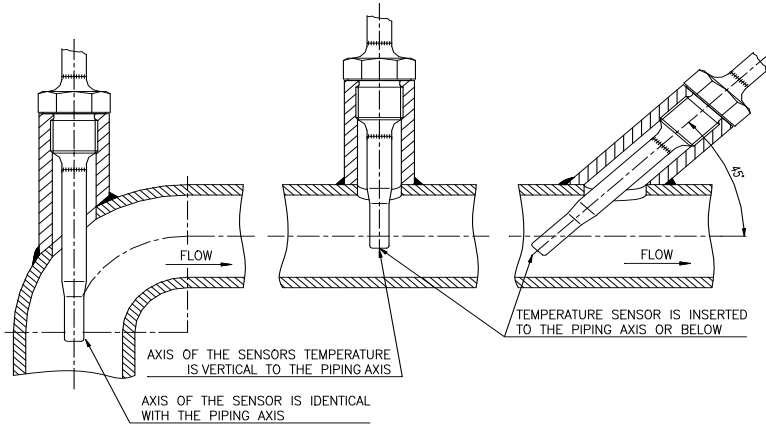


FIGURE 5 - EXAMPLES OF THE INSTALLATION OF DIRECT AND OBLIQUE NIPPLES



WARNING

- When using the sensor with an oblique nipple, locate the sensor with 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

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