Thermoelectric temperature sensor to thermowell DIN without converter, with converter or Ex ia design type series 330 type 331

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
- 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-331000** 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 adapter with screw joint for the connection of the sensor into the thermowell selected by the customer. 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.

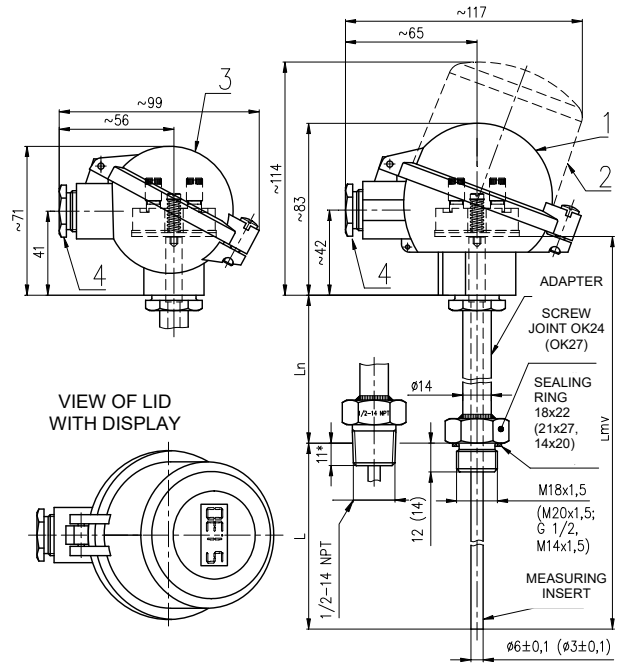
TECHNICAL DATA

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±15°C and max. 80% relative humidity, test voltage 500 V DC

Intrinsically safe pursuant to EN IEC 60079-0 and EN 60079-11:
Ⓔx II 1 G Ex ia IIC T5/T6 Ga
(Meaning of designation - see figure 4)
P_i = 500 mW T6 (-60°C≤ Ta ≤ 68°C)



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
11* Standard length of screwing in

Intrinsically safe circuit parameters:
only for thermocouple "K" and "J", with measuring insert Ø6
U_i = 60 V U_o = 100 mV
I_i = 100 mA I_o = 50 mA
P_i = 500 mW P_o = 25mW
C_i = 850 pF/m
L_i = 16 μH/m

WARNING

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

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

Power supply of converter:
DC 24 V from source SELV, e.g. INAP 16 and INAP 901
Other data of converter: refer to enclosed manual
Display: LED display to loop 4-20mA
other date refer to enclosed manual
Ingress protection pursuant to EN 60529: IP65

Operation position:
discretionary; the gland shall not be situated upwards
Type of operation: continuous
Sensor weight:
With ball head (Al alloy), adapter 150 mm and nominal length 200 mm approx. 0.6 kg

Dimensions of connection thread and measuring insert:

Connection thread	Screw joint	Thread length [mm]	Sealing ring	Measuring insert Ø [mm]
M14x1,5	OK17	12	14x20	3±0,1
M18x1,5	OK24		18x22	6±0,1
M20x1,5	OK27	14	21x27	

Measuring range:

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

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

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

Applied materials:

Stem tube of measuring insert	for thermocouple of type "J"	Steel 1.4541
	for thermocouple of type "K"	INCONEL 600
Adapter		Steel 1.4541
HEAD		Aluminium alloy painted with polyester paint
		plastic PPO (phenyl polyoxide)
Sealing of lid of head and gland		Oil-resistant rubber
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 EN 60721-3-3 and the following operation conditions.

Ambient temperature for sensor head and gland:

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

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

Relative ambient humidity:

- 10 to 100 % with condensation, with upper limit of water content 29 g H_2O/kg of dry air
- For design with converter pursuant to type of converter (refer to enclosed converter manual)
- For design with converter and display (refer to enclosed converter and display manual)

Atmospheric pressure: 70 to 106 kPa

Vibrations:

Sensor	with converter		without converter	
Nominal length L [mm]	110, 140, 170	200, 260	110, 140, 170	200, 260
Frequency range [Hz]	10 to 500			
Drift amplitude [mm]	0.2	0.15	0.5	0.2
Acceleration amplitude [ms^{-2}]	29.4	19.6	68.7	39.2

Maximum speed of flow of liquids:
pursuant to parameters of the thermowell used by the customer

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	non-resistant
Weak acids	resistant
Strong acids	non-resistant
Sea water	resistant
Trichloroethylene	partially resistant
Hot water	

METROLOGICAL DATA

Sensing probe: measuring thermocouple **J** (Fe-CuNi) or **K** (NiCr-NiAl) pursuant to EN 60584-1, Ø 6 or Ø 3 mm, tolerance class 2 or 1 pursuant to EN 60584-1, single with insulated measuring end or double with independent measuring end

Output signal of
analogue converter (linear with thermoelectric voltage):
4 to 20 mA
programmable 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 EN 60751 in whirling water for measuring insert Ø 6 mm (characteristic value):
Without thermowell (independent meas. insert)
$\tau_{0.5}$ 5.5 s
With thermowells pursuant to DIN 43772, shape 4 (L = 100, 140))
$\tau_{0.5}$ 85 s
$\tau_{0.9}$ 250 s
With thermowells pursuant to DIN 43772, shape 4 (L = 200, 260))
$\tau_{0.5}$ 53 s
$\tau_{0.9}$ 115 s

Temperature response time pursuant to EN 60751 in whirling water for measuring insert Ø 3 mm (characteristic value):
Without thermowell (independent meas. insert)
$\tau_{0.5}$ 2 s
$\tau_{0.9}$ 4 s

DESIGNATION:

Data on head label

- Trademark of the manufacturer
- Made in Czech Republic
- Type of thermoelectric sensor / tolerance class
- Measuring range or pre-set converter range
- Product ordering number
- Ingress protection
- Time code (Serial number for calibrated design, design with tolerance class 1, design with converter, Ex ia design)
- Output signal 4 to 20 mA (design with converter)
- Ambient temperature
- Mark of non-explosiveness (Ex ia design):
  Ex II 1 G Ex ia IIC T5/T6 Ga
  and number of the EU-Type Examination Certificate
- Mark CE 1026

Data on measuring insert label

- Trademark
- Type of sensor
- Time code (Serial number for calibrated design, design with tolerance class 1, design with converter, Ex ia design)

Data on converter label

- Trademark
- Type of sensor

- Pre-set temperature range
- Designation of non-explosiveness and EU-Type Examination Certificate number for design with converter Ex ia
- CE mark with identification number of the notified person (for design with converter Ex ia)

Data on display
- Trademark
- Designation of non-explosiveness and EU-Type Examination Certificate number (for design with converter EX ia)
- CE mark with identification number of the notified person (for design with converter)

DELIVERY
Unless agreed otherwise with the customer, each delivery includes
- Delivery note
- Sensor pursuant to the purchase order
- Sealing ring
  - o Cu 18x22x1.5 (ČSN 02 9310.2) for connecting thread M18x1.5,
  - o 21x27 TPD 62-014-91 for connecting thread M20x1.5 a G ½
  - o 14x20 TPD 62-0114-91 for connecting thread M14x1.5

  (for thread 1/2-14NPT, the sealing ring is not delivered)
- Suitable thermowells and nipples ordered separately pursuant to the catalogue of accessories, type 991
- 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
- Declaration of Conformity with purchase order 2.1 acc. to EN 10204
- 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)

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 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 to thermowell DIN
Without converter
331 410 131 K2/JI/Q42
Calibration points 600, 800 and 1000°C
Range -200 to 1150°C
6 pcs

Special requirement:

Thermoelectric temperature sensor to thermowell DIN
With converter
331 910 231 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:

1. Welding thermowell pursuant to DIN shape 4
   991 DIN 407244
   20 pcs
2. Direct nipple for welding thermowell shape 4
   991 NVD4 D24 51
   20 pcs

Special request:

Nipple
991 NVD4 D24 99
material 1.5415
6 pcs

TABLE 1 - DESIGN OF TEMPERATURE SENSORS TO THERMOWELL DIN TYPE 331

SPECIFICATIONS						ORDERING NUMBER										
						331	x	x	0	x	x	1	x	x	/xxxxxx	/xxx
Nominal length L [mm]	110	Length of adapter L_n [mm]	140	Length of measuring insert L_{mv} [mm]	275		1	1								
	140		150		315		2									
	170		140		335		3									
	200		150		375		4									
	260				435		5									
	410				585		6									
	Other (min. 75) *)						9									
Nominal length L [mm]	110	Length of adapter L_n [mm]	80	Length of measuring insert L_{mv} [mm]	215		1	2								
	140				245		2									
	170				275		3									
	200				305		4									
	260				365		5									
	410				515		6									
	Other (min. 75) *)						9									
Length of adapter	150 mm (140 mm)							1								
	80 mm	max. –200 to 250°C						2								
	Other *)**	(min. 80 mm)						9								
Thermowell material	without thermowell								0							
Connecting thread	M18 x 1.5	ø tube of measuring insert	6 ± 0,1							1						
	M20 x 1.5									2		1				
	G1/2									3						
	M14 x 1.5		3 ± 0,1							4		3				
	1/2-14NPT		6 ± 0,1							5		1				
Sensor head	Ball (Al alloy) (for converter Ex ia with both external and internal terminals)										3					
	Ball, plastic (cannot be used for converter Ex ia)										4					
	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)										5					
	Ball, small (Al alloy) (only for terminal board and converters APAQ-HCF, MINIPAQ-HLP)										6					
	Other *)										9					
Tube of measuring insert [mm]	Ø6 ± 0,1											1				
	Ø3 ± 0,1 (only with connecting thread M14 x 1,5)									4		3				
Thermocouple	K												K			
	J												J			
Accuracy class	1 *)													1		
	2													2		
Design of measuring ends of thermocouple pursuant to Figure 1	Single thermocouple, insulated end														/JI	
	Double thermocouple, independent end														/DU	
	Single thermocouple, insulated end	only for TC "K" a "J", with measuring insert ø 6, length of measuring insert L_{mv} 100 – 3025 [mm]										1			/JIX	
	Double thermocouple, independent end											1			/DUX	

TABLE 1 - DESIGN OF TEMPERATURE SENSORS TO THERMOWELL DIN TYPE 331 (continuation)

SPECIFICATIONS						ORDERING NUMBER									
						331	x	x	0	x	x	1	x	x	/xxxxxx	/xxx
	Converter type		Galvanic separation	Ex ia	NFC	Range [°C]										
Converter (design of thermocouple measuring ends: single thermocouple, isolated end)	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		●											/C202	
		IPAQ C330	●		●										/C330	
		IPAQ C330X	●	●	●										/C330X	
	Programmable with HART protocol linear output signal with temperature	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	●								5				/644HANA	
		644 HA I1	●	●											/644HAI1X	
	Other *)														/99	
	Without converter (for converter installation by the customer)														/00	
LED display to loop 4-20 mA	LED display LPI-01 (only with converter, with the exception of converter 644 HANA)										5					/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 140 mm (minimum 80 mm), the temperature range is decreased to -200 to 250 °C
***) Functional safety SIL2

TABLE 2 – ADDITIONAL REQUIREMENT FOR DESIGN OF TEMPERATURE SENSORS TO THERMOWELL, TYPE 331

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		/EU
Copy of EU-Type Examination Certificate acc to the 2014/34/EU (ATEX)		for Ex ia design		/Exi
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 DESIGNS AND ORDERING WELDING THERMOWELLS PURSUANT TO DIN, SHAPE 4 (4F) PURSUANT TO DIN 43772, TYPE 991

SPECIFICATIONS								ORDERING NUMBER							
								991	DIN	x	x	x	x	x	x
Cone welding thermowell	Shape 4	pursuant to DIN 43772	Without flange		PN 250					4	0				
	Shape 4F		With flange *) **)							4	F				
	Internal bore [mm]		ø 3,5									3			
			ø 7									7			
	Internal thread	M14x1,5	Internal Ø of thermowell	18	Internal bore [mm]	ø 3,5						3	1		
		M18×1.5		24		ø 7						7	2		
		M20×1.5		26									3		
		G 1/2											4		
		1/2 – 14 NPT											5		
	Nominal length of thermowell L [mm]	110	L1 [mm]	65	L2 [mm]	105								1	
		140		65		135								2	
		170		133		165								3	
		200		65		195								4	
		200		125		195								5	
		260		125		255								6	
		410		275		405								7	
		Other (max. 410) *)												9	
	Material of thermowell	1.7335 ***)			Maximum operation temperature [°C]	550									1
		1.7380 ***)				580									2
		1.4541 ****)				580									3
		1.4571 ****)				400									4
		1.5415 *) ***)				530									5
		1.4903 *) ****)				620									6
		A105, C22.8 or 1.0460 (P250GH) *) ***)				425									7
		1.4404 *) ****)				550									8
		Other *)													9

*) Upon a special requirement after an agreement with the manufacturer
**) Flange design (shape, PN, DN and material) pursuant to the requirement of the customer
***) Surface treatment of thermowells material: preservation with grease – oil
****) thermowells of these materials are suitable for contact with food

TABLE 4 – ACCESSORIES - OVERVIEW OF DESIGNS RECOMMENDED SCREW-IN THERMOWELLS SHAPE 6 PURSUANT TO DIN 43772, TYPE 991 (order separately)

SPECIFICATION							ORDERING NUMBER							
							991	DIN	6	x	x	x	x	x
Cone screw-in thermowell	thermowell pursuant to DIN 43772			PN 250					6					
	external thread			G1/2						1				
				G1						2				
				M27x2						3				
				G3/4						4				
				M20x1.5						6				
	internal bore [mm]			Ø 7							7			
	internal thread			M18x1.5								2		
				M20x1.5/								3		
				G 1/2/								4		
	Nominal length of thermowell L [mm]	110	L1 [mm]	105									1	
		140		135									2	
		170		165									3	
		200		195									4	
		260		255									6	
		410		405									7	
		other (maximum 1200) *)											9	
	Material of thermowell		1.4541 **)	maximum operation temperature [°C]	580									3
			1.4571 **)		400									4
			other *)											9

*) upon a special requirement after an agreement with the manufacturer
**) thermowells of these materials are suitable for contact with food

TABLE 5 – ACCESSORIES - OVERVIEW OF DESIGNS RECOMMENDED SCREW-IN THERMOWELLS SHAPE 7 PURSUANT TO DIN 43772, TYPE 991 (order separately)

SPECIFICATION							ORDERING NUMBER							
							991	DIN	K	x	x	x	x	x
Cone screw-in thermowell	Shape 7 pursuant to DIN 43772			PN 250					K					
	Internal bore [mm]			Ø 7						7				
	External fixing thread			½ - 14 NPT							5			
				¾ - 14 NPT							7			
				1- 11,5 NPT							8			
				other *)							9			
	Internal thread for sensor			M18 ×1.5								2		
				½ - 14 NPT								5		
				other *)								9		
	Nominal length of thermowell L [mm]	110	L1 [mm]	105									1	
		140		135									2	
		170		165									3	
		200		195									4	
		260 *)		255									6	
		410 *)		405									7	
		Other (maximum 1200) *)											9	
	Material of thermowell	1.7335 *) **)		maximum operation temperature [°C]		550								1
		1.7380 *) **)				580								2
		1.4541 ***)				580								3
		1.4571 ***)				400								4
		1.5415 *) **)				530								5
		1.4903 *) ***)				620								6
		A105, C22.8 or 1.0460 (P250GH) *) **)				425								7
		1.4404 *) ***)				550								8
		Other *)												9

*) upon a special requirement after an agreement with the manufacturer
**) surface treatment of thermowells: preservation with grease – oil
***) thermowells of these materials are suitable for contact with food

TABLE 6 – ACCESSORIES - OVERVIEW OF DESIGNS RECOMMENDED NIPPLES FOR WELDING THERMOWELLS, TYPE 991 (order separately)

SPECIFICATION						ORDERING NUMBER				
						991	xxx	x	xxx	xx
Nipple pursuant to DIN 43772 for welding thermowell shape 4 pursuant to DIN 43772	Direct nipple						NVD	4		
	Internal bore [mm]	Ø 24	PN	250					D24	
		Ø 26							D26	
	Material	15 128.5 **)	maximum operation temperature [°C]		550					51
		1.4541			550					72
		1.5415 *) **)			530					50
		1.4903 *)			620					71
		A105, C22.8 or 1.0460 (P250GH) *) **)			425					20
		1.4404 *)			550					73
		Other *)								99

*) upon a special requirement after an agreement with the manufacturer
**) surface treatment of nipples: preservation with grease – oil

TABLE 7 – ACCESSORIES - OVERVIEW OF DESIGNS RECOMMENDED NIPPLES FOR SCREW-IN THERMOWELLS, TYPE 991 (order separately)

SPECIFICATION								ORDERING NUMBER					
								991	xxx	x	xxx	xx	
Nipple for screw-in thermowells pursuant to DIN 43772 shape 6 a 7	Direct nipple								NVP				
	Oblique (chamfer 45°)								NVS				
	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				160				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	13	
											G12		
											M27		
											G34		
											N34		
		1.0577				400					G01	15	
		15 128.5				550					M27	51	
											G34		
											N34		
		1.4541		-		550						72	
		Other *)		pursuant to material		pursuant to material						99	

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

TABLE 8 –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
M14 x 1,5	14x20x2	copper thermally insulating insert	1 Pcs	991 TK 14
M18 x 1,5	18x22x1,5	copper		991 TK 18
M20 x 1,5	21×27x2	copper thermally insulating insert		991 TK 21
G1/2				
1/2-14NPT	-	-	-	-

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

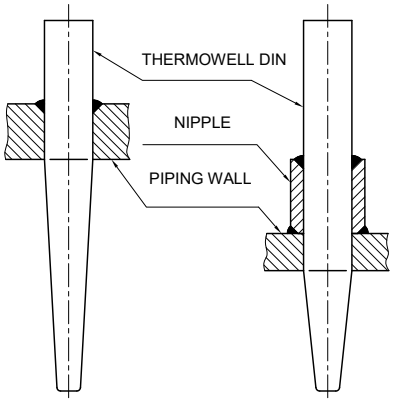
INSTALLATION AND CONNECTION

SENSOR INSTALLATION

Install the sensors by screwing into the relevant thermowell screwed into the nipple on the piping (technological equipment) or welded into the piping wall. Before the installation, put on the enclosed sealing ring in advance (for thread 1/2-14NPT, the sealing ring is not used). During the installation, torque of 70 Nm is recommended; for thread 1/2-14NPT it is 40 Nm.

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.

EXAMPLES OF INSTALLATION OF THERMOWELLS DIN



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 mm^2.

Sensors without converter connect with compensation or thermocouple wiring with cross section 0.5 to 1.5 mm^2.

Seal the cable gland adequately.

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 mm^2. 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 P_0 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.

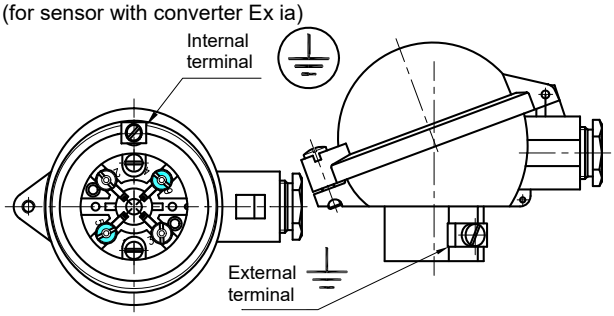
Maximum cross-section of wire for connection to external and internal terminals:

Internal terminal: stranded wire 1.5 mm^2, full wire 2.5 mm^2

External terminal: stranded wire 4.0 mm^2, full wire 6.0 mm^2

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

HEAD OF THE SENSOR WITH TERMINALS
(for sensor with converter Ex ia)



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 for thread M18 x 1,5, G1/2 a M20 x 1,5, approx. 50 Nm for thread M14 x 1,5 and approx.40 Nm for thread 1/2-14NPT. While releasing the screw joint of the sensor, the thermowell may never be released.

SPARE PARTS

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

SPECIFICATIONS		ORDERING NUMBER					
		MV330	/xxx/	x	x	x	/xxxx
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 thermo-couple or converter	Single thermocouple, insulated end						/JI
				1			/JIX *)
	Double thermocouple, independent end						/DU
				1			/DUX*)
Converter pursuant to tab. 1							/converter

*) *Ex ia design*(only with measuring insert ø 6, length of measuring insert L_{mv} 100 – 3025 [mm])

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.

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.

REPAIRS

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

DISABLING AND LIQUIDATION

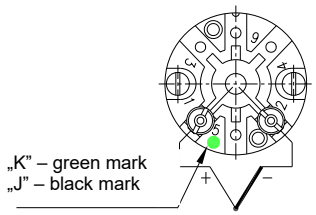
The product and its package do not include any parts that could impact the environment.
Products that are withdrawn from operation, including their packages (with the exception of products marked as electrical equipment for the purposes of return withdrawal and separate salvage of electrical waste), may be disposed of to sorted or unsorted waste pursuant to the type of waste.
The manufacturer realizes free return withdrawal of marked electrical equipment (from 13.8.2005) from the consumer and points out the danger connected with their illegal disposal. The package of the sensor can by 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)

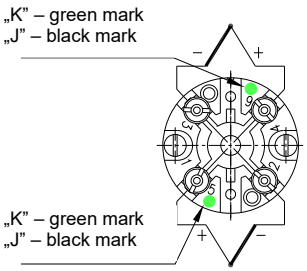
FIGURE 2 - SCHEME OF CONNECTION OF TEMPERATURE SENSORS

SCHEME OF CONNECTION WITHOUT CONVERTER

with single thermocouple



with double thermocouple



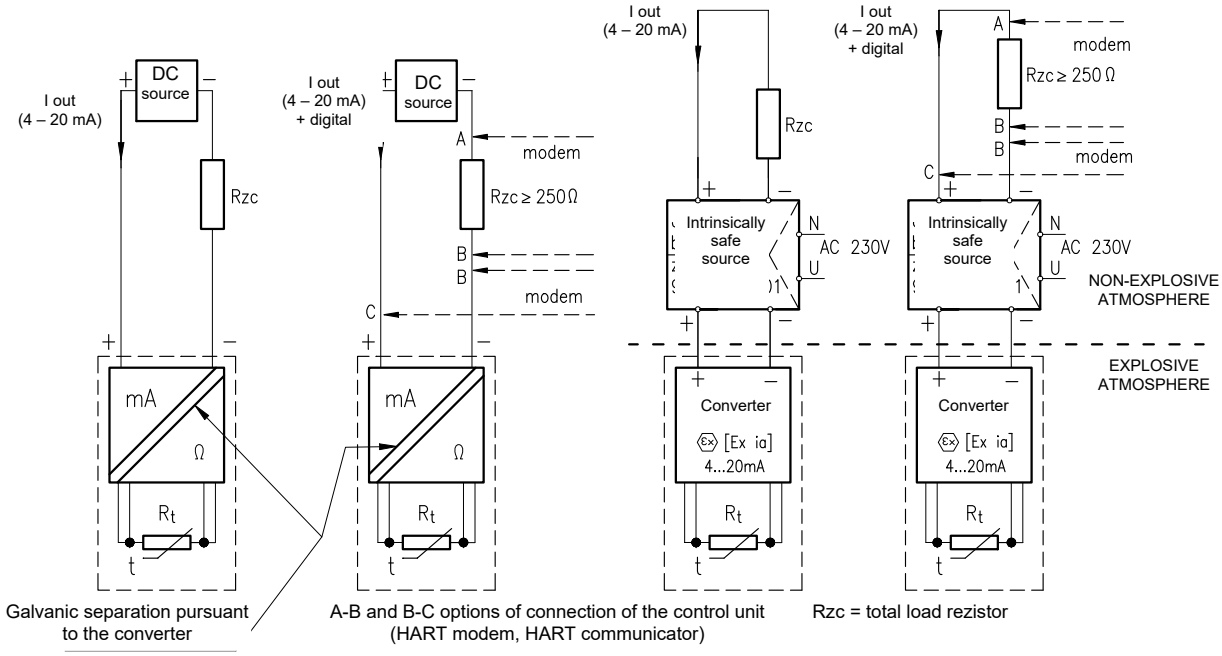
SCHEME OF CONNECTION WITH CONVERTER AND DISPLAY

with converter

with converter with HART protocol

with converter Ex ia

with converter Ex ia with HART protocol



Galvanic separation pursuant to the converter

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

Rzc = total load rezistor

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

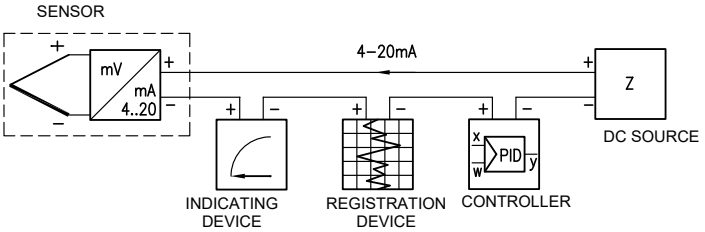
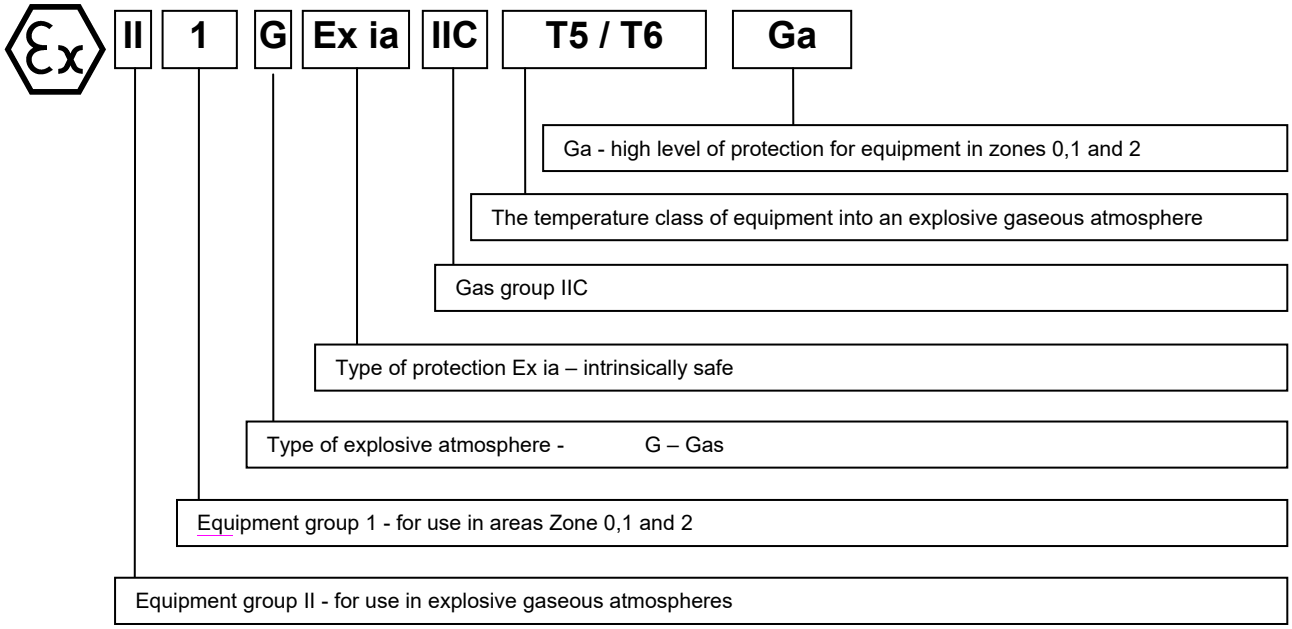


FIGURE 4 - INTRINSICALLY SAFE MARKING



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