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Safety Instructions
TR1x, Tx88, TSx310, Tx6x, TC1x, TPx100, TM411, TR24

Thermometers and inserts

Ex ia IIC T1...T6 Ga
Ex ia IIIC T_{200} 85 °C...T_{200} 450 °C Da

Endress+Hauser
People for Process Automation

TR1x, Tx88, TSx310, Tx6x, TC1x, TPx100, TM411, TR24

Thermometers and inserts

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Associated documentation

To commission the device, please observe the Operating Instructions pertaining to the device:
www.endress.com/<product code>, e.g. TM411

Supplementary documentation

Explosion protection brochure: CP00021Z

The explosion protection brochure is available on the Internet:
www.endress.com/Downloads

Certificates and declarations

NEPSI Certificate of conformity

Certificate number: GYJ23.1144X

Affixing the certificate number certifies conformity with the following standards (depending on the device version)

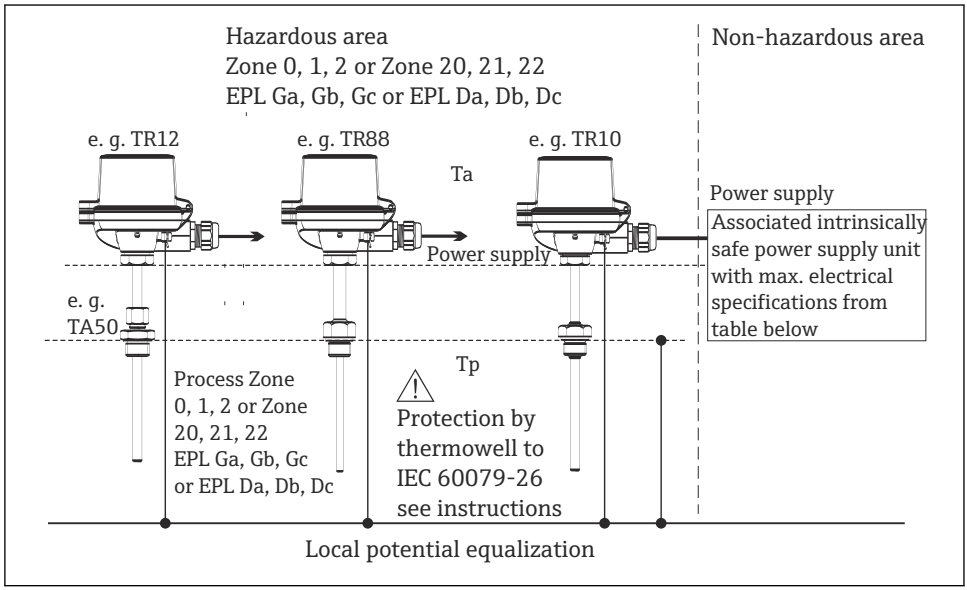
- GB/T 3836.1-2021
- GB/T 3836.4-2021

Please refer to NEPSI/CCC certificates for conditions of safe use.

Manufacturer address

Endress+Hauser Wetzer GmbH + Co. KG
Obere Wank 1
87484 Nesselwang, Germany

Safety instructions:



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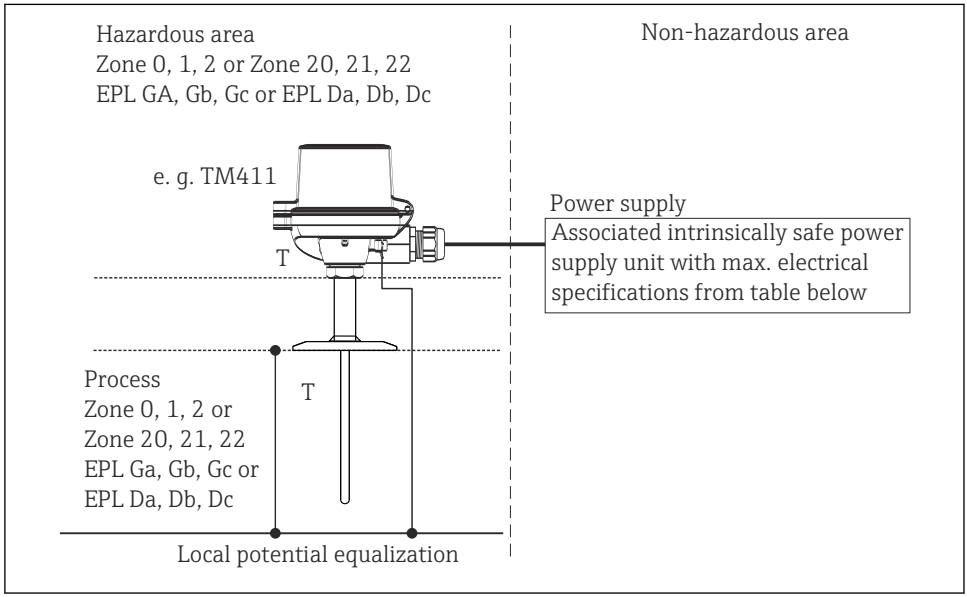

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Safety instructions: General

- Comply with the installation and safety instructions in the Operating Instructions.
- Install the device according to the manufacturer's instructions and any other valid standards and regulations (e.g. EN/IEC 60079-14).
- The housing of the thermometer must be connected to the local potential equalization or installed in a grounded metallic piping or tank respectively.
- It cannot be taken for granted that when using compression fittings (e.g. TA50, TA60, TA70) with non metallic olives that there is a secure grounding when installing in a metal system. This means that an additional safe connection to the local potential equalization needs to be used.
- For using of a plug-in connector (e.g. PA-connector by Weidmüller) is to be observed that the requirements for the respective category and the operating temperature are followed.

Safety instructions: Installation in equipment of Group III

- Sensors for thermometers without thermowell (e.g. TX62, TR24, TX88) are to be protected by thermowell providing a degree of protection of at least IP5X and in compliance with the enclosure requirements to EN/IEC 60079-0.
- Sensors of TX65 and TR24 with a diameter smaller than 6 mm or reduced tip shall be protected by a thermowell providing a degree of protection of at least IP5X and in compliance with the enclosure requirements to EN/IEC 60079-0.
- Seal the cable entries tight with certified cable glands (min. IP6X) IP6X according to EN/IEC 60529.
- The provided cable glands according to option code are suitable ATEX/IECEx Ex certified glands with a temperature range of −20 to +95 °C.
- For operating the thermometer at an ambient temperature under −20 °C, appropriate cables, cable entries and sealing facilities permitted for this application must be used.
- For ambient temperatures higher than +70 °C, use suitable heat-resisting cables or wires, cable entries and sealing facilities for Ta +5 K above surrounding.
- For using of a plug-in connector (e.g. PA-connector by Weidmüller) is to be observed that the requirements for the respective category and the operating temperature are followed.
- The thermometer must be installed and maintained so, that even in the event of rare incidents, an ignition source due to impact or friction between the housing and iron/steel is excluded.

⚠ WARNING

Explosive atmosphere

- In an explosive atmosphere, do not open the device when voltage is supplied (ensure that the IP6x housing protection is maintained during operation).

Safety instructions for intrinsic safety: Installation

- Comply with the installation and safety instructions in the Operating Instructions.
- Install the device according to the manufacturer's instructions and any other valid standards and regulations (e.g. EN/IEC 60079-14).
- Observe the safety instructions for the used transmitters.
- The display, type TID10, may only be installed in Zone 1 (EPL Gb) or Zone 2 (EPL Gc).
- The type of protection changes as follows when the devices are connected to certified intrinsically safe circuits of Category ib: Ex ib IIC.
- When connecting to an intrinsically safe ib circuit, do not operate the sensor at Zone 0 without any thermowell according to EN/IEC 60079-26.
- The inserts with dual circuits (3 and 6 mm diameter) and 3 mm diameter are not isolated to the metallic sheath in conformance with EN/IEC 60079-11 chapter 6.3.13.
- When connecting dual sensors make sure that the potential equalizations are at the same local potential equalization.
- Inserts with 3 mm diameter or grounded inserts, e.g. type TPC100 must be connected to the local potential equalization.
- For inserts with 3 mm diameter or grounded inserts, e.g. type TPC100 an intrinsically safe supply with galvanic isolation must be used.

Safety instructions: Zone 0

- Only operate devices in potentially explosive vapour/air mixtures under atmospheric conditions:
  - −40 °C ≤ Ta ≤ +130 °C (see table Ta housing)
  - −0.8 bar ≤ p ≤ 1.1 bar
- If no potentially explosive mixtures are present, or if additional protective measures have been taken, according to EN 1127-1, the transmitters may be operated under other atmospheric conditions in accordance with the manufacturer's specifications.
- Associated apparatus with galvanic isolation between the intrinsically safe and non-intrinsically safe circuits are preferred.

Safety instructions: Partition wall

Install the thermometer in a partition wall which is in compliance with EN/IEC 60079-26 in reference to its ultimate application.

Safety instructions: Specific conditions of use

- If the mounting head of the Temperature Sensor is made of aluminium and if it is mounted in an area where the use of apparatus of Equipment Protection Level Ga is required, the head must be installed such, that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.
- Avoid electrostatic charging of the plastic surfaces of TA20B housing.
- Avoid electrostatic charging of coated and plastic surfaces. Do not rub.
- For Temperature Sensors Type TST310-..., TSC310-..., if intended for use in explosive gas atmospheres where the use of apparatus of Equipment Protection Level Ga is required, electrostatic charges on the cable shall be avoided.

Safety instructions: Special conditions for safe use

The suffix "X" placed after the certificate number indicates that this product is subject to special conditions for safe use, that is:

- To avoid an ignition hazard due to impact or friction when the product is installed in zone 0 with aluminum housing.
- The ignition hazard caused by electrostatic charge accumulation on the cable is **to be avoided** when the thermometer type, TST310 and TSC310 is installed in zone 0.
- The relationship between temperature class/ maximum surface temperature, ambient temperature and process temperature is shown in tables below.

Temperature tables

The dependency of the ambient and process temperatures upon the temperature class for assembly with transmitters:

Type	Assembled Transmitter	Temperature class	Ambient temperature range housing Ta [1]	Maximum surface temperature housing
TRxx TCxx iTHERM TM411	TMT84/TMT85	T6	−40 °C ≤ Ta ≤ +55 °C	T85 °C
		T5	−40 °C ≤ Ta ≤ +70 °C	T100 °C
		T4	−40 °C ≤ Ta ≤ +85 °C	T135 °C
	TMT71, TMT72, TMT86 [2]	T6	−50 °C ≤ Ta ≤ +55 °C	T85 °C
		T5	−50 °C ≤ Ta ≤ +70 °C	T100 °C
		T4	−50 °C ≤ Ta ≤ +85 °C	T135 °C
	TMT82 [2]	T6	−50 °C ≤ Ta ≤ +58 °C	T85 °C
		T5	−50 °C ≤ Ta ≤ +75 °C	T100 °C
		T4	−50 °C ≤ Ta ≤ +85 °C	T135 °C
	TMT8x, TMT7x with display	T6	−40 °C ≤ Ta ≤ +55 °C	T85 °C
		T5	−40 °C ≤ Ta ≤ +70 °C	T100 °C
		T4	−40 °C ≤ Ta ≤ +85 °C	T135 °C

1) For thermometers with two mounted head transmitters the allowed ambient temperature is up to 12K lower than each head transmitters certified ambient temperature.
2) lower temperature of −52 °C is possible with marking Ex ia IIC Ga/Gb only

Type	Assembled Transmitter	Insert diameter	Process temperature range	Temperature class/maximum surface temperature sensor
TRxx TCxx iTHERM TM411	TMT8x TMT7x	3 mm, 3 mm dual or 6 mm dual	−50 °C ≤ Tp ≤ +66 °C	T6/T85 °C
			−50 °C ≤ Tp ≤ +81 °C	T5/T100 °C
			−50 °C ≤ Tp ≤ +116 °C	T4/T135 °C
			−50 °C ≤ Tp ≤ +181 °C	T3/T200 °C
			−50 °C ≤ Tp ≤ +276 °C	T2/T300 °C
			−50 °C ≤ Tp ≤ +426 °C	T1/T450 °C
		6 mm	−50 °C ≤ Tp ≤ +73 °C	T6/T85 °C
			−50 °C ≤ Tp ≤ +88 °C	T5/T100 °C
			−50 °C ≤ Tp ≤ +123 °C	T4/T135 °C
			−50 °C ≤ Tp ≤ +188 °C	T3/T200 °C

Type	Assembled Transmitter	Insert diameter	Process temperature range	Temperature class/maximum surface temperature sensor
			−50 °C ≤ Tp ≤ +283 °C	T2/T300 °C
			−50 °C ≤ Tp ≤ +433 °C	T1/T450 °C

For thermocouple inserts, the temperature class T6...T1 and the maximum surface temperature T_{200} 85 °C . . . T_{200} 450°C are equal to the process temperature.

The dependency of the ambient and process temperatures upon the temperature class for assembly without transmitter (terminal block):

Insert diameter	Temperature class/ Maximum surface temperature	Tp (process) - maximum allowed process temperature (sensor)				
		Pi ≤ 50 mW	Pi ≤ 100 mW	Pi ≤ 200 mW	Pi ≤ 500 mW	Pi ≤ 650 mW
3 mm, 3 mm dual or 6 mm dual	T1/T450 °C	426 °C	415 °C	396 °C	343 °C	333 °C
	T2/T300 °C	276 °C	265 °C	246 °C	193 °C	183 °C
	T3/T200 °C	181 °C	170 °C	151 °C	98 °C	88 °C
	T4/T135 °C	116 °C	105 °C	86 °C	33 °C	23 °C
	T5/T100 °C	81 °C	70 °C	51 °C	−2 °C	−12 °C
	T6/T85 °C	66 °C	55 °C	36 °C	−17 °C	−27 °C
6 mm	T1/T450 °C	433 °C	428 °C	420 °C	398 °C	388 °C
	T2/T300 °C	283 °C	278 °C	270 °C	248 °C	238 °C
	T3/T200 °C	188 °C	183 °C	175 °C	153 °C	143 °C
	T4/T135 °C	123 °C	118 °C	110 °C	88 °C	78 °C
	T5/T100 °C	88 °C	83 °C	75 °C	53 °C	43 °C
	T6/T85 °C	73 °C	68 °C	60 °C	38 °C	28 °C

Insert diameter	Temperature class/ Maximum surface temperature	Tp (process) - maximum allowed process temperature (sensor)			Ta (ambient) - ambient temperature (housing) [1]
		Pi ≤ 750 mW	Pi ≤ 800 mW	Pi ≤ 1000 mW	
3 mm, 3 mm dual or 6 mm dual	T1/T450 °C	320 °C	312 °C	280 °C	−40 °C ≤ Ta ≤ +130 °C
	T2/T300 °C	170 °C	162 °C	130 °C	
	T3/T200 °C	75 °C	62 °C	30 °C	
	T4/T135 °C	10 °C	2 °C	−30 °C	−40 °C ≤ Ta ≤ +116 °C

Insert diameter	Temperature class/ Maximum surface temperature	Tp (process) - maximum allowed process temperature (sensor)			Ta (ambient) - ambient temperature (housing) [1]
		Pi ≤ 750 mW	Pi ≤ 800 mW	Pi ≤ 1000 mW	
	T5/T100 °C	–25 °C	–33 °C	-	–40 °C ≤ Ta ≤ +81 °C
	T6/T85 °C	–40 °C	-	-	–40 °C ≤ Ta ≤ +66 °C
6 mm	T1/T450 °C	381 °C	377 °C	361 °C	–40 °C ≤ Ta ≤ +130 °C
	T2/T300 °C	231 °C	227 °C	211 °C	
	T3/T200 °C	136 °C	127 °C	111 °C	
	T4/T135 °C	71 °C	67 °C	51 °C	–40 °C ≤ Ta ≤ +123 °C
	T5/T100 °C	36 °C	32 °C	16 °C	–40 °C ≤ Ta ≤ +88 °C
	T6/T85 °C	21 °C	17 °C	1 °C	–40 °C ≤ Ta ≤ +73 °C

1) The ambient temperature at the terminal head may be directly influenced by the process temperature, but is restricted to the range –40 to +130 °C, besides for types TA30A, TA30D and TA30H with a restricted range –50 to +130 °C.

For thermocouple inserts, the temperature class T6...T1 and the maximum surface temperature T_{200} 85 °C . . . T_{200} 450°C are equal to the process temperature.

Determination of process temperature for Pi ≤ 50 mW:

Insert diameter	Thermal resistance (Rth) for Pi ≤ 50 mW	Formula for calculating process temperature (Tp)
3 mm, 3 mm dual or6 mm dual	274K/W	Tp < T_{class} [1]-Tol. [2]Tol.-(Rth x P_0 [3]
	144K/W	
6 mm		

1) Inserting of temperature class, e.g. 85 °C (K) for T6
2) Inserting of Tolerances to IEC60079-0 chapter 26.5.1.3: 5 K for T6, T5, T4 and T3 10 K for T2 and T1
3) P_0 of intrinsic safe temperature input (e.g. measurement circuit TMT72, P_0 = 5.2 mW)

Calculation example for T6 and 6 mm insert: Tp < T_{class} - Tol. - (Rth x P_0)

Tp < 85 °C(K) - 5K - (144K/W x 5.2 mW)

Tp < 79.25 °C

Electrical connection data

Associated intrinsically safe power supply unit with maximum electrical specifications below the characteristic values of the assembled transmitter:

Transmitter	Ui	Ii	Pi	Ci	Li
TMT82	30 V	130 mA	800 mW	0	0
TMT71/TMT72	30 V	100 mA	800 mW	0	0
TMT84, TMT85	FISCO field device				
TMT86	FISCO field device				
Terminal block	30 V	140 mA	1000 mW	See tables below	
Flying leads	30 V	140 mA	1000 mW	See tables below	

TS111/TPx100:

Sensor type	Insertion Length IL		Flying leads		Terminal block	
	C_i/F/m	L_i/H/m	C_i/F	L_i/H	C_i/F	L_i/H
Single	2,00E-10	1,00E-06	1,96E-11	9,80E-08	4,60E-12	2,30E-08
Dual	4,00E-10	2,00E-06	3,92E-11	1,96E-07	9,20E-12	4,60E-08

Calculation formula for options with flying leads and terminal block only:

$C_i = C_{i\ \text{Insertion length IL}} \times IL + C_{i\ \text{Flying leads}}$

$L_i = L_{i\ \text{Insertion length IL}} \times IL + L_{i\ \text{Flying leads}}$

$C_i = C_{i\ \text{Insertion length IL}} \times IL + C_{i\ \text{Terminal block}}$

$L_i = L_{i\ \text{Insertion length IL}} \times IL + L_{i\ \text{Terminal block}}$

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