

Safety Instructions

TM111, TM131, TS111, TS211

Thermometers and inserts

Ex ia IIC T6 Ga/Gb



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Safety instructions for electrical apparatus for explosion-hazardous areas →  3

TM111, TM131, TS111, TS211

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Supplementary Documentation

Explosion-protection brochure: CP00021Z

The Explosion-protection brochure is available: In the download area of the Endress+Hauser website: www.endress.com → Download → Advanced → Documentation code: CP00021Z

Manufacturer's certificates

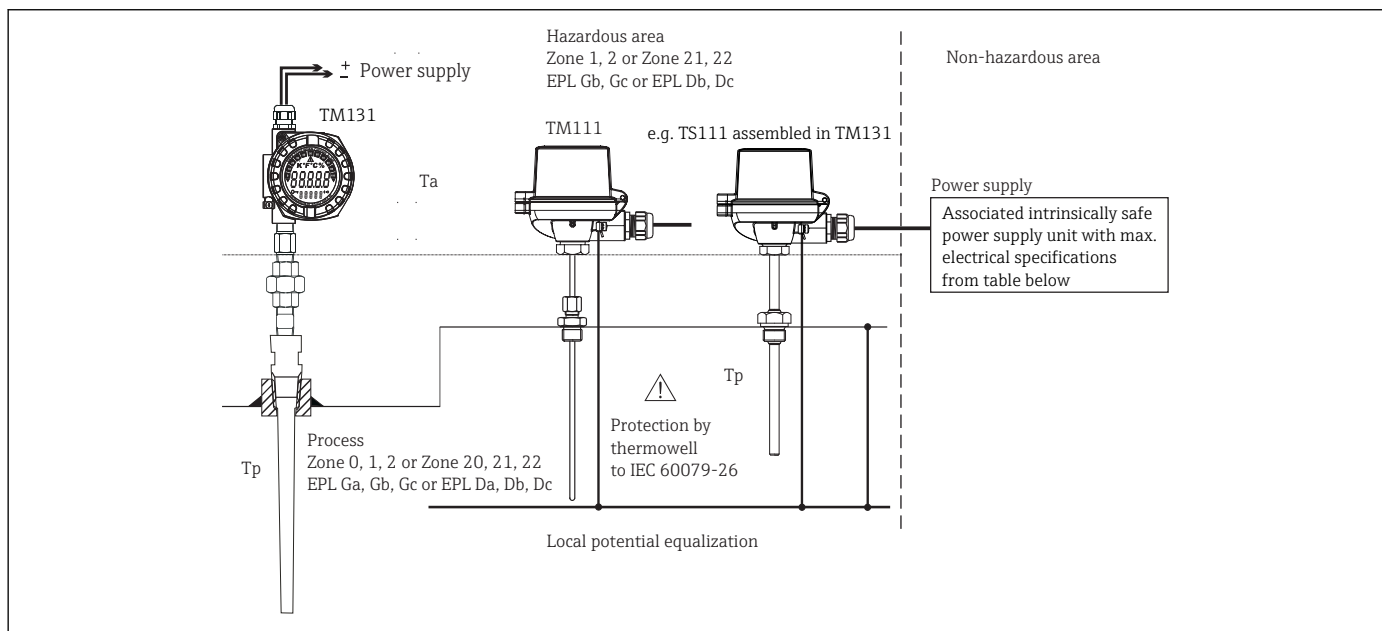
NEPSI Certificate of conformity

Certificate number: GYJ19.1377X

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

- GB3836.1:2010
- GB3836.20:2010
- GB3836.4:2010

Safety instructions



A0039244-EN

Safety Instructions: General

- Install the device according to the manufacturer's instructions and any other valid standards and regulations.
- 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.
- Staff must meet the following conditions for mounting, electrical installation, commissioning and maintenance of the device:
 - Be suitably qualified for their role and the tasks they perform
 - Be trained in explosion protection
 - Be familiar with national regulations
- This product should be used in explosive gas atmospheres together with approved associated apparatus, follow the instruction manual of this product and associated apparatus when connecting the wiring. Connect the wiring terminals correctly.

- Connecting cable between the temperature sensor and associated apparatus should be insulated screen cable; connect the cable screen functionally to earth ground.
- The user shall not change the configuration in order to maintain/ensure the explosion protection performance of the equipment. Any change may impair safety.
- For installation, use and maintenance of this product, the end user shall observe the instruction manual and the following standards:
 - GB 50257-2014 "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering".
 - GB 3836.13-2013 "Explosive atmospheres – Part 13: Equipment repair, overhaul and reclamation".
 - GB/T 3836.15-2017 "Explosive atmospheres – Part 15: Electrical installations design, selection and erection".
 - GB/T 3836.16-2017 "Explosive atmospheres – Part 16: Electrical installations inspection and maintenance".
 - GB/T 3836.18-2017 "Explosive atmospheres – Part 18: Intrinsically safe electrical systems".
 - GB 50257-2014 "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering".

Safety instructions: Installation in equipment of Group III

- Sensors for thermometers without thermowell (e.g. TX62, TR24, TX88) are to be mechanically protected by thermowell suitable for Group III in compliance with GB3836.4:2010 and GB3836.1:2010 and its ultimate application.
- Seal the cable entries tight with certified cable glands (min. IP6X) IP6X according to IEC 60529.
- The provided cable glands according to option code are suitable NEPSI 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 +5K 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 at least IP6X is maintained during operation).

Safety instructions: Intrinsic safety

- 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.
- 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 GB3836.20:2010.
- 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:
 - $-20\text{ °C} \leq T_a \leq +60\text{ °C}$
 - $-0.8\text{ bar} \leq p \leq 1.1\text{ bar}$
- 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: Special conditions

- The thermometer must be installed 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.
- Avoid electrostatic charging of the plastic surfaces of TA20B housing.
- Avoid electrostatic charging of the plastic housing (do not rub dry).
- The suffix "X" placed after the certificate number indicates that this product is subject to special conditions for safe use, that is:
 - From the safety point of view, the circuit of versions of the following temperature sensors and inserts shall be considered to connected to ground (for details, the instruction manual, provided with the equipment, shall be observed): Type TS111, TS11 with diameter 3 mm, single or dual Type TS111, TS211 with diameter 6 mm dual
 - The insert TS111, TS211 shall be provided with a mounting head comply with GB 3836.1-2010 and GB 3836.4-2010 including the cable entry device to ensure a degree of protection of at least IP20 according to GB/T 4208-2017 when in use.

Safety instructions: Partition wall

Install the thermometer in a partition wall which is in compliance with GB3836.20:2010 in reference to its ultimate application.

Electrical data and temperature tables

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

Transmitter	U _i	I _i	P _i	C _i	L _i
TMT71/TMT72	30 V	100 mA	800 mW	0	0
TMT82	30 V	130 mA	800 mW	0	0
TMT162 HART	30 V	300 mA	1 000 mW	0	0
TMT84, TMT85, TMT162 PA/FF	FISCO field device				
Terminal block	30 V	140 mA	1 000 mW	See tables below	
Flying leads	30 V	140 mA	1 000 mW	See tables below	

Sensor type	Insertion Length IL		Flying leads		Terminal block	
	C _i /m	L _i /m	C _i	L _i	C _i	L _i
Single	200 pF	1 μH	56.4 pF	282 nH	4.6 pF	23 nH
Dual	400 pF	2 μH	113 pF	564 nH	9.2 pF	46 nH

Calculation formula for options with flying leads only:

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


Calculation formula for options with terminal block only:

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

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	Maximum surface temperature housing
TS111 TM111 TM131 TS211	TMT84, TMT85, TMT 162 PA/FF	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, MT162 HART	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	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

Type	Assembled Transmitter	Insert diameter	Process temperature range	Temperature class/maximum surface temperature sensor
TS111 TM111 TM131 TS211	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
			-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 T85 °C...T450 °C are equal to the process temperature.

Type	Transmitter	Insert diameter	Temperature class	Process temperatur
TM131 TS211	TMT162	3 mm, 3 mm(dual) or 6 mm(dual)	T6	-50 °C ≤ Tp ≤ +64 °C
			T5	-50 °C ≤ Tp ≤ +79 °C
			T4	-50 °C ≤ Tp ≤ +114 °C
			T3	-50 °C ≤ Tp ≤ +179 °C
			T2	-50 °C ≤ Tp ≤ +279 °C
			T1	-50 °C ≤ Tp ≤ +424 °C
		6 mm	T6	-50 °C ≤ Tp ≤ +71 °C
			T5	-50 °C ≤ Tp ≤ +86 °C
	T4	-50 °C ≤ Tp ≤ +121 °C		
	T3	-50 °C ≤ Tp ≤ +186 °C		

Type	Transmitter	Insert diameter	Temperature class	Process temperatur
			T2	$-50\text{ °C} \leq T_p \leq +286\text{ °C}$
			T1	$-50\text{ °C} \leq T_p \leq +431\text{ °C}$


The dependency of the ambient and process temperatures upon the temperature class for sensors, type TS111 or TS211, without transmitter (terminal block or flying leads):

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 ≤ 1 000 mW	
3 mm, 3 mm dual or 6 mm dual	T1/T450 °C	320 °C	312 °C	280 °C	$-50\text{ °C} \leq T_a \leq +130\text{ °C}$
	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	$-50\text{ °C} \leq T_a \leq +116\text{ °C}$
	T5/T100 °C	-25 °C	-33 °C	-	$-50\text{ °C} \leq T_a \leq +81\text{ °C}$
	T6/T85 °C	-40 °C	-	-	$-50\text{ °C} \leq T_a \leq +66\text{ °C}$
6 mm	T1/T450 °C	381 °C	377 °C	361 °C	$-50\text{ °C} \leq T_a \leq +130\text{ °C}$
	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	$-50\text{ °C} \leq T_a \leq +123\text{ °C}$

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 ≤ 1 000 mW	
	T5/T100 °C	36 °C	32 °C	16 °C	-50 °C ≤ Ta ≤ +88 °C
	T6/T85 °C	21 °C	17 °C	1 °C	-50 °C ≤ Ta ≤ +73 °C

1) The ambient temperature at the terminal head may be directly influenced by the process temperature, but its restricted to the range -50 to +130 °C.

 For thermocouple inserts, the temperature class T6...T1 and the maximum surface temperature T85 °C...T450 °C are equal to the process temperature.

Determination of 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 or 6 mm dual	274K/W	$T_p < T_{class}^{1)} - Tol. - (R_{th} \times P_0^{3)})$
	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) P0 of intrinsic safe temperature input (e.g. measurement circuit TMT182, P0 = 6.6 mW)

Calculation example for T6 and 6 mm insert: $T_p < T_{class} - Tol. - (R_{th} \times P_0)$

$$T_p < 85 \text{ °C(K)} - 5\text{K} - (144\text{K/W} \times 6.6 \text{ mW})$$

$$T_p < 79.04 \text{ °C}$$



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