

Safety Instructions

iTHERM TM411, TM412

Modular RTD assemblies for hygienic applications

ATEX, IECEx: Ex ia IIIC Txxx °C Da/Db or Ex ia IIC
T6 Ga/Gb

Safety instructions for electrical apparatus in
explosion-hazardous areas



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About this document



This document has been translated into several languages. Legally determined is solely the English source text.

The document translated into EU languages is available:

- In the download area of the Endress+Hauser website:
www.endress.com -> Downloads -> Manuals and Datasheets -> Type: Ex Safety Instruction (XA) -> Text Search: ...
- In the Device Viewer: www.endress.com -> Product tools -> Access device specific information -> Check device features



If not yet available, the document can be ordered.

Associated documentation

This document is an integral part of the following Operating Instructions:

- Operating Instructions: BA02023T
- Technical Information:
 - TM411: TI01038T
 - TM412: TI01057T

Supplementary documentation

Explosion-protection brochure: CP00021Z/11

The Explosion-protection brochure is available:

- In the download area of the Endress+Hauser website:
www.endress.com -> Downloads -> Brochures and Catalogs -> Text Search: CP00021Z
- On the CD for devices with CD-based documentation

**Manufacturer's
certificates****IECEX certificate**

Certificate number: IECEX DEK 12.0049X

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

- IEC 60079-0 : 2017
- IEC 60079-11 : 2011
- IEC 60079-26 : 2014

ATEX certificate

Certificate number: DEKRA 12ATEX0161 X

EU Declaration of Conformity

Declaration number: EC_00177

UKCA certificate

Certificate number: CML 21UKEX21239X

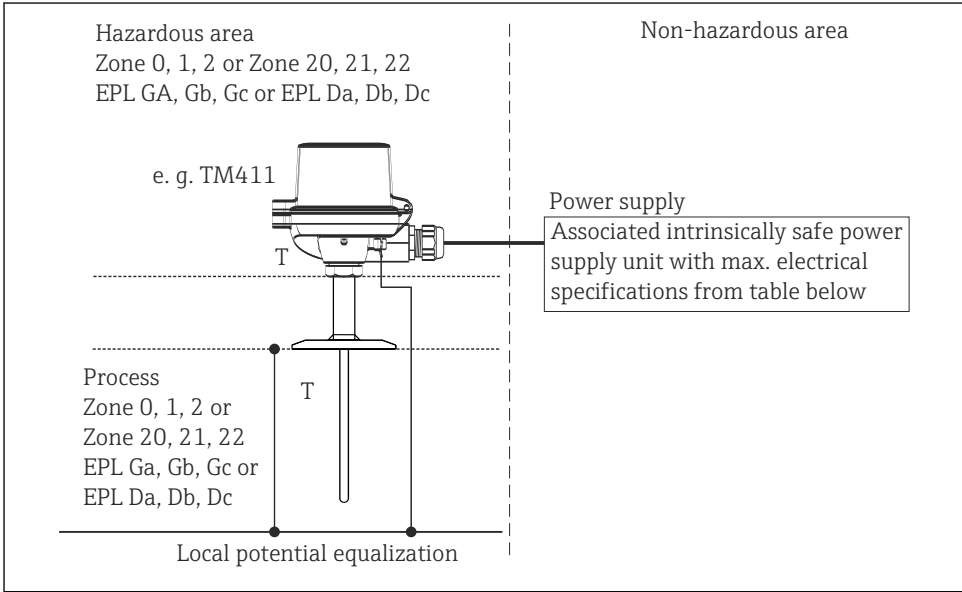
UKCA Declaration of Conformity

Declaration number: UK_00428

**Manufacturer
address**

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

Safety instructions



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. TK40) 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 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 TM411 in conjunction with compression fitting and a diameter smaller than 6mm 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 entries to option code glands are suitable ATEX/IECEX Ex certified cable 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 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 mm 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.
- For inserts with 3 mm diameter or grounded inserts, e.g. type TS111 must be connected to the local potential equalization.
- For inserts with 3 mm diameter or grounded inserts, e.g. type TS111 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:
 - $-40\text{ °C} \leq T_a \leq +130\text{ °C}$ (see table Ta housing)
 - $-0.8\text{ bar} \leq p \leq 1.1\text{ bar}$
- 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:
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.

**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.

Temperature tables

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

Transmitter	Ui	Ii	Pi	Ci	Li
iTEMP TMT82	30 V	130 mA	800 mW	0	0
iTEMP TMT71/ TMT72	30 V	100 mA	800 mW	0	0
iTEMP TMT162 HART	30 V	300 mA	1 000 mW	5 nF	0
iTEMP TMT84, TMT85	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	

TS111:

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	9,20W-12	4,60E-08

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:

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

Category	Type of protection (ATEX, IECEx)	Type
II 1D II 2D	Ex ia IIIc T ₂₀₀ 85 °C...T ₂₀₀ 450 °C Da/ Ex ia IIIc T85 °C...T450 °C Db	iTHERM TM411, TM412
II 1G	Ex ia IIC T6...T1 Ga	
II 1/2G	Ex ia IIC T6...T1 Ga/Gb	

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

Type	Assembled head transmitter	Temperature class	Ambient temperature (housing) Ta ¹⁾	Temperature code
iTHERM TM411, TM412	iTEMP TMT84, TMT85	T6	-40 °C ≤ Ta ≤ +55 °C	85 °C
		T5	-40 °C ≤ Ta ≤ +70 °C	100 °C
		T4	-40 °C ≤ Ta ≤ +85 °C	135 °C
	iTEMP TMT71, TMT72	T6	-50 °C ≤ Ta ≤ +55 °C	85 °C
		T5	-50 °C ≤ Ta ≤ +70 °C	100 °C
		T4	-50 °C ≤ Ta ≤ +85 °C	135 °C
	iTEMP TMT82 ²⁾	T6	-50 °C ≤ Ta ≤ +58 °C	85 °C
		T5	-50 °C ≤ Ta ≤ +75 °C	100 °C
		T4	-50 °C ≤ Ta ≤ +85 °C	135 °C
	iTEMP TMT8x, iTEMP TMT7x with display	T6	-40 °C ≤ Ta ≤ +55 °C	85 °C
		T5	-40 °C ≤ Ta ≤ +70 °C	100 °C
		T4	-40 °C ≤ Ta ≤ +85 °C	135 °C
	iTEMP TMT162 HART	T6	-40 °C ≤ Ta ≤ +55 °C	85 °C
		T5	-40 °C ≤ Ta ≤ +70 °C	100 °C
		T4	-40 °C ≤ Ta ≤ +85 °C	110 °C

- 1) For thermometers with two mounted head transmitters the allowed ambient temperature is up to 12K lower than each head transmitter's 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
iTHERM TM411 TM412	iTEMP TMT8x iTEMP TMT7x iTEMP TMT162 HART	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
			$-50\text{ °C} \leq T_p \leq +283\text{ °C}$	T2/T300 °C
			$-50\text{ °C} \leq T_p \leq +433\text{ °C}$	T1/T450 °C



For thermocouple inserts, the temperature class T6...T1 and the maximum surface temperature $T_{200}85\text{ °C}...T_{200}450\text{ °C}$ 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	$-40\text{ °C} \leq T_a \leq +130\text{ °C}$
	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	$-40\text{ °C} \leq T_a \leq +116\text{ °C}$
	T5/T100 °C	-25 °C	-33 °C	-	$-40\text{ °C} \leq T_a \leq +81\text{ °C}$

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 ≤ 1000 mW	
	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° C ... +130°C, besides for types TA30A, TA30D and TA30H with a restricted range -50°C ... +130°C.



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

Determination of process temperature for $P_i \leq 50\text{ mW}$:

Insert diameter	Thermal resistance (Rth) for $P_i \leq 50\text{ mW}$	Formula for calculating process temperature (Tp)
3 mm, 3 mm dual or 6 mm dual	274K/W	$T_p < T_{\text{class}}^{1)} - \text{Tol.}^{2)} - (\text{Rth} \times P_o^{3)})$
6 mm	144K/W	

- 1) Inserting of temperature class, e.g. 85 °C(K) for T6
 2) Inserting of Tolerances to EN/IEC 60079-0 chapter 26.5.1.3: 5 K for T6, T5, T4 and T3 10 K for T2 and T1
 3) P_o of intrinsic safe temperature input (e.g. measurement circuit TMT72, $P_o = 5.2\text{ mW}$)

Calculation example for T6 and 6 mm insert:

$$T_p < T_{\text{class}} - \text{Tol.} - (\text{Rth} \times P_o)$$

$$T_p < 85\text{ °C(K)} - 5\text{K} - (144\text{K/W} \times 5.2\text{ mW})$$

$$T_p < 79.25\text{ °C}$$



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