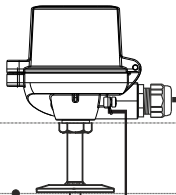


Hazardous (Classified) Location
 Class I / Division 1 / Groups ABCD
 Class I / Zone 0 / Ex ia IIC / AEx ia IIC
 Class II / Division 1 / Groups EFG
 Class III / Division 1 / Hazardous Locations

e.g. TM411

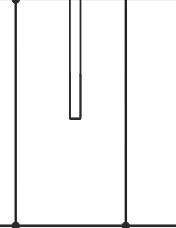
T_a



Nonhazardous Locations

CSA Approved Associated Apparatus
 or supply with suitable barrier

T_p



Nonhazardous Locations

Nonhazardous Locations

Power supply

Local potential equalisation

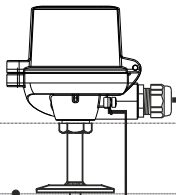
see also installation notes
 for using power supply

Local potential equalisation

Hazardous (Classified) Location
 Class I / Division 2 / Groups ABCD
 Class II / Division 1 / Groups EFG
 Class III / Division 1 / Hazardous Locations

e.g. TM411

T_a



Nonhazardous Locations

Nonhazardous Locations

Power supply

Local potential equalisation

Installation Notes TM411, TM412

- CSA approved apparatus must be installed in accordance with manufacturer's instructions.
- Install per Canadian Electrical Code (CEC) Part I or National Electrical Code (NEC) (ANSI/NFPA70) and ISA RP 12.06.01, as applicable for the country in use.
- The sensor is to be installed in a suitable enclosure accepted by local authority having jurisdiction.
- Install per temperature transmitter's control drawing when supplied with transmitter.



DUST IGNITION PROOF

**Class II / Div. 1 / Groups EFG
 Class III**

- A dust tight seal must be used for conduit entry when the temperature assembly is used in a Class II or Class III location.

INTRINSICALLY SAFE

Class I / Div. 1 / Groups ABCD

Ex ia IIC/AEx ia IIC

- CSA approved associated apparatus or barrier is required.
- Warning: Substitution of components may impair intrinsic safety.
 Avertissement : La substitution de composants peut compromettre la sécurité intrinsèque.

NONINCENDIVE

Class I / Div. 2 / Groups ABCD

- CSA approved associated apparatus or barrier is required.
- Warning: Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Warning: Substitution of components may impair suitability for Class I, Division 2.
 Avertissement: La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Class I, Division 2.
- Nonincendive field wiring installation:
 The Nonincendive Field Wiring Circuit Concept allows interconnection of Nonincendive Field Wiring Apparatus with Associated Nonincendive Field Wiring Apparatus or Associated Intrinsically Safe Apparatus or Associated Apparatus not specifically examined in combination as a system using any of the wiring methods permitted for unclassified locations, when $V_{oc} \leq V_{max}$, $C_a \geq C_i + C_{cable}$, $L_a \geq L_i + L_{cable}$.
 For transmitter's or sensor's Nonincendive Field Wiring parameters see parameters below.
 For these current controlled circuits, the parameter I_{max} is not required and need not to be aligned with parameter I_{sc} and I_t of the Associated Nonincendive Field Wiring Apparatus or Associated Apparatus.
 (* The head transmitter TMT180 is only suitable for Class I, Division 2.

Associated intrinsically safe power supply unit with max. electrical specifications below the characteristic values for Entity or NIFW of the assembled transmitter:

Transmitter	U _i /V _{max}	I _i /I _{max}	P _i	C _i	L _i
TMT180*	30 V	100 mA		144nF	0
TMT181	30 V	100 mA	750 mW	0	0
TMT182	30 V	100 mA	750 mW	0	0
TMT82	30 V	130 mA	800 mW	0	0
TMT84, TMT85	24 V	250 mA	1200 mW	5 nF	10 µH
TMT71/TMT72	30 V	100 mA	800 mW	0	0
TMT162 HART	30 V	300 mA	1000 mW	5.3 nF	0
TMT162 PA/FF	24 V	250 mA	1200 mW	5 nF	10 µH
Terminal block	30 V	140 mA	1000 mW	See tables next page	
Flying leads	30 V	140 mA	1000 mW	See tables next page	

Approved Pfanzelt	Date (yyyy-mm-dd) 2014-02-25	Drawing No. 10000005723	Dwg.rev. A	Revision no. W18N20	Revision date (yyyy-mm-dd) 2019-09-06	Name MP	Material 71457118	Endress+Hauser
Volume (mm³) Designed Pfanzelt	Date (yyyy-mm-dd) 2014-02-21	Unit iTHERM TM411, TM412	Scale 1:1	Title CONTROL DRAWING CSA		Series		
Refer to protection notice ISO 16016	Edge of working parts ISO 13715	Geometrical tolerancing ISO 2768-mH-E	Part No. -	Format A4	XA01149T/09/EN/02.19		Objekt version 1 of 3	
								Endress + Hauser Wetzer GmbH+Co. KG Nesselwang / Germany

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 μF	56.4 pF	282 nH	4.6 pF	23 nF
Dual	400 pF	2 μF	113 pF	564 nH	9.2 pF	46 nF

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

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

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

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

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

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

Type	Assembled transmitter	Temperature class	Ambient temperature range housing Ta
TM411	TMT84, TMT85	T6	-40°C ≤ Ta ≤ +55°C
TM412	TMT162 PA/FF	T5	-40°C ≤ Ta ≤ +70°C
		T4	-40°C ≤ Ta ≤ +85°C
	TMT71, TMT72 TMT162 HART	T6	-50°C ≤ Ta ≤ +55°C
		T5	-50°C ≤ Ta ≤ +70°C
	TMT180**	T6	-40°C ≤ Ta ≤ +50°C
		T5	-40°C ≤ Ta ≤ +65°C
		T4	-40°C ≤ Ta ≤ +85°C
	TMT82	T6	-50°C ≤ Ta ≤ +58°C
		T5	-50°C ≤ Ta ≤ +75°C
		T4	-50°C ≤ Ta ≤ +85°C
	TMT181, TMT182	T6	-40°C ≤ Ta ≤ +55°C
		T5	-40°C ≤ Ta ≤ +70°C
		T4	-40°C ≤ Ta ≤ +85°C
	TMT8x, TMT7x with display	T6	-40°C ≤ Ta ≤ +55°C
		T5	-40°C ≤ Ta ≤ +70°C
		T4	-40°C ≤ Ta ≤ +85°C

** The head transmitter TMT180 is only suitable for Class I, Division 2.

Type	Assembled transmitter	Insert diameter	Temperature class	Process temperature range Tp
TM411	TMT18x	3mm,	T6	-50°C ≤ Tp ≤ +66°C (64°C)*
TM412	TMT8x TMT7x TMT162	3mm(dual), 6mm dual	T5	-50°C ≤ Tp ≤ +81°C (79°C)*
			T4	-50°C ≤ Tp ≤ +116°C (114°C)*
			T3	-50°C ≤ Tp ≤ +181°C (179°C)*
			T2	-50°C ≤ Tp ≤ +276°C (279°C)*
			T1	-50°C ≤ Tp ≤ +426°C (427°C)*
		6mm	T6	-50°C ≤ Tp ≤ +73°C (71°C)*
			T5	-50°C ≤ Tp ≤ +88°C (86°C)*
			T4	-50°C ≤ Tp ≤ +123°C (121°C)*
			T3	-50°C ≤ Tp ≤ +188°C (186°C)*
			T2	-50°C ≤ Tp ≤ +283°C (286°C)*
T1	-50°C ≤ Tp ≤ +433°C (431°C)*			

* Process temperature when sensor is supplied with TMT162

For thermocouple inserts, the temperature class T6...T1 are equal to the process temperature.

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

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


Insert diameter	Temperature class	Maximum allowed process temperature (sensor) Tp (process)			Ambient temperature (housing), Ta (ambient)**
		Pi ≤ 750 mW	Pi ≤ 800 mW	Pi ≤ 1000 mW	
3mm, 3mm (dual) or 6mm dual	T6	-40°C			-40°C ≤ Ta ≤ +66°C
	T5	-25°C	-33°C		-40°C ≤ Ta ≤ +81°C
	T4	10°C	2°C	-30°C	-40°C ≤ Ta ≤ +116°C
	T3	75°C	62°C	30°C	-40°C ≤ Ta ≤ +130°C
	T2	320°C	312°C	280°C	-40°C ≤ Ta ≤ +130°C
	T1	170°C	162°C	130°C	-40°C ≤ Ta ≤ +130°C
6mm	T6	21°C	17°C	1°C	-40°C ≤ Ta ≤ +73°C
	T5	36°C	32°C	16°C	-40°C ≤ Ta ≤ +88°C
	T4	71°C	67°C	51°C	-40°C ≤ Ta ≤ +123°C
	T3	136°C	127°C	111°C	-40°C ≤ Ta ≤ +130°C
	T2	231°C	227°C	211°C	-40°C ≤ Ta ≤ +130°C
	T1	381°C	377°C	361°C	-40°C ≤ Ta ≤ +130°C

For thermocouple inserts, the temperature class T6...T1 are equal to the process temperature.

** The ambient temperature at the terminal head may be directly influenced by the process temperature, but is also restricted to the allowed range of installed terminal head as follows:

Option Terminal head	Ta
A, C	-50°C... +130°C
E, G, K, L	-40°C... +130°C
D	-40°C... +100°C

For thermometers with two mounted head transmitters the allowed ambient temperature is 12K lower than each head transmitter's certified ambient temperature.

Approved	Pfanzelt	Date (yyyy-mm-dd)	2014-02-25	Drawing No.	10000005723	Dwg.rev.	A	Revision no.	W18N20	Revision date (yyyy-mm-dd)	2019-09-06	Name	MP	Material	71457118	Endress+Hauser 
Volume (mm³)	Designed	Date (yyyy-mm-dd)	2014-02-21	Unit	iTHERM TM411, TM412	Scale	1:1	Title	CONTROL DRAWING CSA	Series		Objekt version		Sheet	Endress + Hauser Wetzger GmbH+Co. KG Nesselwang / Germany	
Refer to protection notice ISO 16016	Edge of working parts ISO 13715	Geometrical tolerancing ISO 2768-mH-E	Part No.	-	Format	A4	XA01149T/09/EN/02.19		2 of 3							

The dependency of the ambient and process temperatures upon the maximum surface temperature for Class II and Class III

Type	Assembled transmitter	Ambient temperature range housing Ta	Maximum surface temperature
TM411 TM412	TMT84, TMT85	$-40^{\circ}\text{C} \leq \text{Ta} \leq +55^{\circ}\text{C}$	85°C
	TMT162 PA/FF	$-40^{\circ}\text{C} \leq \text{Ta} \leq +70^{\circ}\text{C}$	100°C
$-40^{\circ}\text{C} \leq \text{Ta} \leq +85^{\circ}\text{C}$		135°C	
TMT71, TMT72 TMT162 HART		$-50^{\circ}\text{C} \leq \text{Ta} \leq +55^{\circ}\text{C}$	85°C
		$-50^{\circ}\text{C} \leq \text{Ta} \leq +70^{\circ}\text{C}$	100°C
		$-50^{\circ}\text{C} \leq \text{Ta} \leq +85^{\circ}\text{C}$	135°C
		TMT82	$-50^{\circ}\text{C} \leq \text{Ta} \leq +58^{\circ}\text{C}$
		$-50^{\circ}\text{C} \leq \text{Ta} \leq +75^{\circ}\text{C}$	100°C
		$-50^{\circ}\text{C} \leq \text{Ta} \leq +85^{\circ}\text{C}$	135°C
		TMT181, TMT182	$-40^{\circ}\text{C} \leq \text{Ta} \leq +55^{\circ}\text{C}$
		$-40^{\circ}\text{C} \leq \text{Ta} \leq +70^{\circ}\text{C}$	100°C
		$-40^{\circ}\text{C} \leq \text{Ta} \leq +85^{\circ}\text{C}$	135°C
		TMT8x, TMT7x with display	$-40^{\circ}\text{C} \leq \text{Ta} \leq +55^{\circ}\text{C}$
		$-40^{\circ}\text{C} \leq \text{Ta} \leq +70^{\circ}\text{C}$	100°C
		$-40^{\circ}\text{C} \leq \text{Ta} \leq +85^{\circ}\text{C}$	135°C

Type	Assembled transmitter	Insert diameter	Process temperature range Tp	Maximum surface temperature
TM411	TMT18x	3mm,	$-50^{\circ}\text{C} \leq \text{Tp} \leq +66^{\circ}\text{C}$ (64°C)*	85°C
TM412	TMT8x	3mm(dual),	$-50^{\circ}\text{C} \leq \text{Tp} \leq +81^{\circ}\text{C}$ (79°C)*	100°C
	TMT7x	6mm dual	$-50^{\circ}\text{C} \leq \text{Tp} \leq +116^{\circ}\text{C}$ (114°C)*	135°C
	TMT162	6mm	$-50^{\circ}\text{C} \leq \text{Tp} \leq +146^{\circ}\text{C}$ (146°C)*	165°C
			$-50^{\circ}\text{C} \leq \text{Tp} \leq +73^{\circ}\text{C}$ (71°C)*	85°C
			$-50^{\circ}\text{C} \leq \text{Tp} \leq +88^{\circ}\text{C}$ (86°C)*	100°C
			$-50^{\circ}\text{C} \leq \text{Tp} \leq +123^{\circ}\text{C}$ (121°C)*	135°C
			$-50^{\circ}\text{C} \leq \text{Tp} \leq +153^{\circ}\text{C}$ (153°C)*	165°C

* Process temperature when sensor is supplied with TMT162

For thermocouple inserts, the maximum surface temperature is equal to the process temperature.

The dependency of the ambient and process temperatures upon maximum surface temperature for assembly without transmitter (terminal block) for Group II and Group III:


Insert diameter	Maximum allowed process temperature (sensor) Tp (process)					Maximum surface temperature
	Pi ≤ 50 mW	Pi ≤ 100 mW	Pi ≤ 200 mW	Pi ≤ 500 mW	Pi ≤ 650 mW	
3mm,	66°C	55°C	36°C	-17°C	-27°C	85°C
3mm (dual) or 6mm dual	81°C	70°C	51°C	-2°C	-12°C	100°C
	116°C	105°C	86°C	33°C	23°C	135°C
	146°C	133°C	105°C	23°C	-18°C	165°C
6mm	73°C	68°C	60°C	38°C	28°C	85°C
	88°C	83°C	75°C	53°C	43°C	100°C
	123°C	118°C	110°C	88°C	78°C	135°C
	153°C	146°C	131°C	88°C	66°C	165°C

Insert diameter	Maximum allowed process temperature (sensor) Tp (process)			Maximum surface temperature	Ambient temperature (housing), Ta (ambient)**
	Pi ≤ 750 mW	Pi ≤ 800 mW	Pi ≤ 1000 mW		
3mm,	-40°C			85°C	$-40^{\circ}\text{C} \leq \text{Ta} \leq +66^{\circ}\text{C}$
3mm (dual) or 6mm dual	-25°C	-33°C		100°C	$-40^{\circ}\text{C} \leq \text{Ta} \leq +81^{\circ}\text{C}$
	10°C	2°C	-30°C	135°C	$-40^{\circ}\text{C} \leq \text{Ta} \leq +116^{\circ}\text{C}$
	-46°C	-59°C	-114°C	165°C	$-40^{\circ}\text{C} \leq \text{Ta} \leq +130^{\circ}\text{C}$
6mm	21°C	17°C	1°C	85°C	$-40^{\circ}\text{C} \leq \text{Ta} \leq +73^{\circ}\text{C}$
	36°C	32°C	16°C	100°C	$-40^{\circ}\text{C} \leq \text{Ta} \leq +88^{\circ}\text{C}$
	71°C	67°C	51°C	135°C	$-40^{\circ}\text{C} \leq \text{Ta} \leq +123^{\circ}\text{C}$
	52°C	45°C	16°C	165°C	$-40^{\circ}\text{C} \leq \text{Ta} \leq +130^{\circ}\text{C}$

For thermocouple inserts, the maximum surface temperature is equal to the process temperature.

** The ambient temperature at the terminal head may be directly influenced by the process temperature, but is restricted to the range $-40^{\circ}\text{C} \dots +130^{\circ}\text{C}$, besides for types TA30A, TA30D and TA30H with a restricted range $-50^{\circ}\text{C} \dots +130^{\circ}\text{C}$.

For thermometers with two mounted head transmitters the allowed ambient temperature is 12K lower than each head transmitter's certified ambient temperature.

Approved	Pfanzelt	Date (yyyy-mm-dd)	2014-02-25	Drawing No.	10000005723	Dwg.rev.	A	Revision no.	W18N20	Revision date (yyyy-mm-dd)	2019-09-06	Name	MP	Material	71457118	Endress+Hauser 
Volume (mm³)	Designed	Pfanzelt	Date (yyyy-mm-dd)	2014-02-21	Unit	iTHERM TM411, TM412	Scale	1:1	Title		CONTROL DRAWING CSA		Series			
Refer to protection notice ISO 16016	Edge of working parts ISO 13715	Geometrical tolerancing ISO 2768-mH-E	Part No.	-	Format	A4	Format		XA01149T/09/EN/02.19		Objekt version	Sheet	3 of 3		Endress + Hauser Wetzler GmbH+Co. KG Nesselwang / Germany	