Safety Instructions
TR1x, TR4x, TR88, TSC310, TST310, TR6x, TC1x, TC6x, TC88, TPC100, TPR100, TM411, TM412, TR24

Thermometers and inserts

Ex iaIIIC T1-T6 Ga, Ex iaD 20 T85-T450
TR1x, TR4x, TR88, TSC310, TST310, TR6x, TC1x, TC6x, TC88, TPC100, TPR100, TM411, TM412, TR24

Thermometers and inserts
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 → Download → Advanced → Documentation code: CP00021Z

Manufacturer’s certificates

NEPSI Certificate of conformity

Certificate number: GYJ20.1295X, GYJ18.1371X

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

- GB3836.1-2010
- GB3836.4-2010
- GB3836.20-2010
- GB12476.1-2013
- GB12476.4-2010

Safety instructions

Hazardous area
Zone 0, 1, 2 or Zone 20, 21, 22

Non-hazardous area

Power supply
Associated intrinsically safe power supply unit with max. electrical specifications from table below

Local potential equalization

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.
- 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 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 12476.2-2010 'Electrical apparatus for use in the presence of combustible dust-Part 2:
Selection and installation’. (Only if installed in dust hazardous areas)
  • GB 50257-2014 “Code for construction and acceptance of electric device for explosion
atmospheres and fire hazard electrical equipment installation engineering”
  • GB 15577-2018 “Safety regulations for dust explosion prevention and protection”. (Only if
installed in dust hazardous areas).

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:
  - $-20 ^\circ C \leq T_a \leq +60 ^\circ C$
  - $-0.8 \text{ bar} \leq p \leq 1.1 \text{ bar}$
- 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).
- 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:
    - The insert TPR100 and TPC100 should be provided with a mounting head including the cable entry device to ensure a degree of protection of at least IP20 when in use.
    - For EPL Ga applications, electrostatic changes on the cable of product TST310 and TSC310 shall be avoided.
    - For EPL Ga applications, at the metallic parts of the products made of light metal there is a danger of ignition by impact or friction.

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.
Temperature tables

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

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>$U_i$</th>
<th>$I_i$</th>
<th>$P_i$</th>
<th>$C_i$</th>
<th>$L_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMT181</td>
<td>30 V</td>
<td>100 mA</td>
<td>760 mW</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TMT182</td>
<td></td>
<td></td>
<td>750 mW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TMT82</td>
<td></td>
<td>130 mA</td>
<td>800 mW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TMT84, TMT85</td>
<td>17.5 V</td>
<td>500 mA</td>
<td>5.5 W</td>
<td>5 nF</td>
<td>-</td>
</tr>
<tr>
<td>without</td>
<td>30 V</td>
<td>140 mA</td>
<td>1000 mW</td>
<td>1 nF</td>
<td>1 mH</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Assembled Transmitter</th>
<th>Temperature class</th>
<th>Ambient temperature range housing</th>
<th>Maximum surface temperature housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMT181 TMT182 TMT84/TMT85</td>
<td>T6</td>
<td>$-40 \degree C \leq T_a \leq +55 \degree C$</td>
<td>$T_{85} \degree C$</td>
</tr>
<tr>
<td></td>
<td>T5</td>
<td>$-40 \degree C \leq T_a \leq +70 \degree C$</td>
<td>$T_{100} \degree C$</td>
</tr>
<tr>
<td></td>
<td>T4</td>
<td>$-40 \degree C \leq T_a \leq +85 \degree C$</td>
<td>$T_{135} \degree C$</td>
</tr>
<tr>
<td>TMT82</td>
<td>T6</td>
<td>$-40 \degree C \leq T_a \leq +58 \degree C$</td>
<td>$T_{85} \degree C$</td>
</tr>
<tr>
<td></td>
<td>T5</td>
<td>$-40 \degree C \leq T_a \leq +75 \degree C$</td>
<td>$T_{100} \degree C$</td>
</tr>
<tr>
<td></td>
<td>T4</td>
<td>$-40 \degree C \leq T_a \leq +85 \degree C$</td>
<td>$T_{135} \degree C$</td>
</tr>
<tr>
<td>TMT8x with display</td>
<td>T6</td>
<td>$-40 \degree C \leq T_a \leq +55 \degree C$</td>
<td>$T_{85} \degree C$</td>
</tr>
<tr>
<td></td>
<td>T5</td>
<td>$-40 \degree C \leq T_a \leq +70 \degree C$</td>
<td>$T_{100} \degree C$</td>
</tr>
<tr>
<td></td>
<td>T4</td>
<td>$-40 \degree C \leq T_a \leq +85 \degree C$</td>
<td>$T_{135} \degree C$</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Assembled Transmitter</th>
<th>Insert diameter</th>
<th>Process temperature range</th>
<th>Temperature class/maximum surface temperature sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMT18x TMT8x</td>
<td>3 mm, 3 mm dual or 6 mm dual</td>
<td>$-50 \degree C \leq T_p \leq +66 \degree C$</td>
<td>$T_6/T_85 \degree C$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-50 \degree C \leq T_p \leq +81 \degree C$</td>
<td>$T_5/T_{100} \degree C$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-50 \degree C \leq T_p \leq +116 \degree C$</td>
<td>$T_4/T_{135} \degree C$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-50 \degree C \leq T_p \leq +181 \degree C$</td>
<td>$T_3/T_{200} \degree C$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-50 \degree C \leq T_p \leq +276 \degree C$</td>
<td>$T_2/T_{300} \degree C$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-50 \degree C \leq T_p \leq +426 \degree C$</td>
<td>$T_1/T_{450} \degree C$</td>
</tr>
<tr>
<td></td>
<td>6 mm</td>
<td>$-50 \degree C \leq T_p \leq +73 \degree C$</td>
<td>$T_6/T_{85} \degree C$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-50 \degree C \leq T_p \leq +88 \degree C$</td>
<td>$T_5/T_{100} \degree C$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-50 \degree C \leq T_p \leq +123 \degree C$</td>
<td>$T_4/T_{135} \degree C$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-50 \degree C \leq T_p \leq +188 \degree C$</td>
<td>$T_3/T_{200} \degree C$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-50 \degree C \leq T_p \leq +283 \degree C$</td>
<td>$T_2/T_{300} \degree C$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-50 \degree C \leq T_p \leq +433 \degree C$</td>
<td>$T_1/T_{450} \degree C$</td>
</tr>
</tbody>
</table>

The dependency of the ambient and process temperatures upon the temperature class for assembly without transmitter (terminal block):
<table>
<thead>
<tr>
<th>Insert diameter</th>
<th>Temperature class/Maximum surface temperature</th>
<th>Tp (process) - maximum allowed process temperature (sensor)</th>
<th>Ta (ambient) - ambient temperature (housing) 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pi ≤ 50 mW</td>
<td>Pi ≤ 100 mW</td>
</tr>
<tr>
<td>6 mm</td>
<td>T3/T200 °C</td>
<td>181 °C</td>
<td>170 °C</td>
</tr>
<tr>
<td></td>
<td>T4/T135 °C</td>
<td>116 °C</td>
<td>105 °C</td>
</tr>
<tr>
<td></td>
<td>T5/T100 °C</td>
<td>81 °C</td>
<td>70 °C</td>
</tr>
<tr>
<td></td>
<td>T6/T85 °C</td>
<td>66 °C</td>
<td>55 °C</td>
</tr>
<tr>
<td>6 mm</td>
<td>T1/T450 °C</td>
<td>433 °C</td>
<td>428 °C</td>
</tr>
<tr>
<td></td>
<td>T2/T300 °C</td>
<td>283 °C</td>
<td>278 °C</td>
</tr>
<tr>
<td></td>
<td>T3/T200 °C</td>
<td>188 °C</td>
<td>183 °C</td>
</tr>
<tr>
<td></td>
<td>T4/T135 °C</td>
<td>123 °C</td>
<td>118 °C</td>
</tr>
<tr>
<td></td>
<td>T5/T100 °C</td>
<td>88 °C</td>
<td>83 °C</td>
</tr>
<tr>
<td></td>
<td>T6/T85 °C</td>
<td>73 °C</td>
<td>68 °C</td>
</tr>
</tbody>
</table>

1) When using TA20R or TA21E housing please observe the maximum allowed temperature per TI072t02.

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

<table>
<thead>
<tr>
<th>Insert diameter</th>
<th>Thermal resistance ($R_{th}$) for $\Pi \leq 50 \text{ mW}$</th>
<th>Formula for calculating process temperature ($T_p$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 mm, 3 mm dual or 6 mm dual</td>
<td>274K/W, 144K/W</td>
<td>$T_p &lt; T_{\text{class}} - \text{Tol.} - (R_{th} \times P_0)^3$</td>
</tr>
</tbody>
</table>

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 TMT182, $P_0 = 6.6 \text{ mW}$)

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

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

$T_p < 79.04 \text{ °C}$