

Operating instructions

for the
Ex APPLICATION

TFE Temperature Probe

Manufactured by

Albert Balzer AG Rotax CH 4143 Dornach

The electrical appliance for areas with a high-risk of explosion

Ex ia IIC T1 ... T6

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1 General description

TFE temperature probes and measuring devices are for determining the temperature of a medium as per Directives 2014/34/EU. They consist of sheathed resistance thermometers or thermoelectric couples as per the type coding and if necessary the sheathed measuring element is enclosed within a protective pipe.

The TFE temperature probes are specified for connecting to a category "ia" intrinsically safe electrical circuit. Subject to taking into account EN 60079-26, TFE temperature probes can be used for category G1 (Zone 0). When being used as a partition device, the connecting flange must conform to the IP67 standard.

Marking

Rotax /Type* C € 1258  II 1 G Ex ia IIC T1 ... T6 / PTB 01 ATEX 2206 X connected loads**

* see type coding

** The connected loads are displayed as per the corresponding specifications ("Maximum electrical values see above").

In the event that there is too little space, "Connected loads see certification" will be displayed.

Designation as per Directives 2014/34/EU:

 II 1 G

TFE Model Code

TFE a b c d No. i

a = Process connection as per parts list / delivery note

b = Protective tube – material as per parts list / delivery note

c = Measuring element – type as per parts list / delivery note

d = Housing type as per parts list / delivery note (incl. type of connection)

No= Serial number as per following code:

Capital letter A means the year 2001, B means 2002, etc. up to T for 2020 and then starting again with A for 2021. There are consecutively running serial numbers for each year.

i = Intrinsically safe

Remarks: A designation with a consecutive identification number as a model code is only accepted provided the delivery documents display the required model code. These consecutive identification numbers are also kept on file by the manufacturer.

2. Use in line with regulations

Category:  II 1 G
Zones: May be used subject to observing the applicable regulations for the operation of electrical appliances within:
a) Zones 1 and 2 and
b) Subject to observing point 3 in Zone 0
Group: IIC

2a Thermal design

Ambient temperature

The ambient temperature is limited by the design of the connections and the joint sealing compound that is utilised.

The maximum ambient temperature is 80 °C for the low-temperature version and 210°C for the high-temperature version.

The high-temperature version is for use when the temperature probe is to measure materials at temperatures of ≥ 150 °C.

When using measuring transducers attention should be paid to their working temperature

Maximum temperatures of media in °C at ratings in Watts

For probe types 3 & 6 (3 or 6 mm in diameter) and 2 x 6 (6 mm diameter, 2 resistors)

W = resistance, 100 Ohms Th = Thermo elements

| Output | | 0.1 W | 0.25 W | 0.5 W | 0.75 W |
|-------------------|-------|---------------------------|---------------------------|---------------------------|---------------------------|
| Temperature class | | Probe type 3 / 6 / 2x6 |
| T1 | W G2 | 429 / 438 / 430 | 407 / 409 / 410 | 374 / 413 / 381 | 346 / 399 / 354 |
| | G1 | 339 / 348 / 340 | 317 / 339 / 320 | 284 / 323 / 291 | 256 / 309 / 264 |
| | Th G2 | 443,4 / 444 / - | 442 / 443 / - | 438 / 441 / - | 435 / 437 / - |
| | G1 | 353,5 / 354 / - | 352 / 353 / - | 384 / 351 / - | 345 / 347 / - |
| T2 | W G2 | 279 / 288 / 280 | 257 / 279 / 260 | 224 / 263 / 231 | 196 / 249 / 204 |
| | G1 | 219 / 228 / 220 | 197 / 219 / 200 | 164 / 203 / 171 | 136 / 189 / 144 |
| | Th G2 | 293,5 / 294 / - | 292 / 293 / - | 288 / 291 / - | 185 / 287 / - |
| | G1 | 233,5 / 234 / - | 232 / 233 / - | 228 / 231 / - | 225 / 227 / - |
| T3 | W G2 | 179 / 188 / 180 | 157 / 179 / 160 | 124 / 163 / 131 | 96 / 149 / 104 |
| | G1 | 139 / 148 / 140 | 117 / 139 / 120 | 84 / 123 / 91 | 56 / 109 / 64 |
| | Th G2 | 193,5 / 194 / - | 192 / 193 / - | 188 / 191 / - | 185 / 187 / - |
| | G1 | 153,5 / 154 / - | 152 / 153 / - | 148 / 151 / - | 145 / 147 / - |
| T4 | W G2 | 114 / 123 / 120 | 92 / 114 / 95 | 59 / 98 / 66 | 31 / 84 / 39 |
| | G1 | 87 / 96 / 88 | 65 / 87 / 68 | 32 / 71 / 39 | - / 57 / - |
| | Th G2 | 128,5 / 129 / - | 127 / 128 / - | 123 / 126 / - | 120 / 122 / - |
| | G1 | 101,5 / 102 / - | 100 / 101 / - | 96 / 99 / - | 93 / 95 / - |
| T5 | W G2 | 79 / 88 / 80 | 57 / 79 / 60 | 24 / 63 / - | - / 49 / - |
| | G1 | 59 / 68 / 60 | 37 / 59 / 40 | - / 43 / - | - / 29 / - |
| | Th G2 | 93,5 / 94 / - | 92 / 93 / - | 88 / 91 / - | 85 / 87 / - |
| | G1 | 73,5 / 74 / - | 72 / 73 / - | 68 / 71 / - | 65 / 67 / - |
| T6 | W G2 | 64 / 73 / 65 | 42 / 64 / 45 | - / 48 / - | - / 34 / - |
| | G1 | 47 / 56 / 48 | 25 / 47 / 28 | - / 31 / - | - / - / - |
| | Th G2 | 78,5 / 79 / - | 77 / 78 / - | 73 / 76 / - | 70 / 72 / - |
| | G1 | 61,5 / 62 / - | 60 / 61 / - | 56 / 59 / - | 53 / 55 / - |

2.b Electrical maximum rating:

$U_i = 30$ V DC, $I_i = 100$ mA, $P_i = 0.1 - 0.75$ W

(according to the temperature class)

$L_i = 0.015$ mH/m $C_i = 280$ pF/m (input lead)

2.c Electrical maximum rating: $U_o < 0.1$ V DC, $I_o =$

24 mA, $P_o < 1$ W

$L_o = 60$ mH, $C_o = 0.1$ mF (external figures)

When connecting to active, intrinsically safe equipment the rules for the interconnection of intrinsically safe electrical circuits are to be considered.

Interpolation: In order to calculate the accompanying permitted temperatures of the medium T_x (in °C) at a known output P_{sp} (in W) of an existing feeding device, you should use the following formula:

$T_x = T1 - (T1 - T2) \times (P1 - P_{sp}) / (P1 - P2)$. With this, the indices 1 or 2 are the figures for the respective types of probes from the output columns and the temperature lines of the above table.

E.g. for $P_{sp} = 0.15$ W, $P1 = 0.1$ W and $P2 = 0.25$ W. For a PT 100 \varnothing 6 mm- probe in Zone 1, the respective temperature figures as per Table are $T1 = 438$ °C, $T2 = 409$ °C. T_x is calculated with this as $T_x = 428$ °C.

If the permitted temperature of the medium is given as T_z and you are seeking the maximum output of a feeding device, the you should proceed in a similar manner as per the formula

$$P_x = P1 - (P1 - P2) \times (T1 - T_z) / (T1 - T2).$$

For outputs $0.01 < P_{sp} > 0.1$ W the figures for $P1 = 0.1$ W and $P2 = 0.25$ W can be used for extrapolation.

3. Installation

When carrying out the installation, the general requirements for the development, selection and erection of electrical installations in areas with explosive gas atmospheres are to be observed (e.g. EN 60079-14).

When being used as Category 1 equipment, the equipment is to be connected electrostatically ($R < 1 \text{ MOhm}$) to the local equipotential bonding.

When being used as Category 1 equipment, the TFE type temperature probes in the versions in which aluminium is used are to be erected in such a way that

Measuring temperature in Zone 0

Protective tubes must be used for measuring temperatures in Zone 0, unless these are included in the supplied specification. The protective tubes must be made of stainless steel (e.g. as per DIB 17440) or of corrosion-resistant nickel alloys (e.g. as per DIN 17442).

Minimum wall thickness: 1 mm

4. a Assembly

- Possible increases in temperature due to heating feed pipes or heat accumulation are to be avoided.
- Only separately certified wiring screws of a suitable safety type are to be used. The instructions on the fixing of wiring screws are to be observed.
- Ensure you use suitable sealing materials
- Ensure you use flanges with the correct screws and safety washers and seals. Be sure also to observe the permitted torque levels.
- When being used as a partition device, the connecting flange must conform to the IP67 standard.
- If the need arises, use the equipotential bonding conductor in the event that a safe contact via metal flange screws or connecting threads is not guaranteed.

When being used as Category 1 equipment, the equipment is to be connected electrostatically ($R < 1 \text{ MOhm}$) to the local equipotential bonding.

- Lay cables/wiring in a safe manner as required (protect them from tension / twisting / mechanical damage)
- Observe the rules for making connections for 2 / 3 / 4 – phase systems for resistance thermometers or when making connections of the thermo-elements.
- Only use prototype-tested measuring elements. When doing this, observe the corresponding installation

any production of sparks caused by impact and frictional processes between aluminium and steel is to be prevented (except for: stainless steel, if the existence of rust particles can be eliminated).

When being used as a partitioning device, the connecting flange must meet the IP67 standard.

Adequate excess loads are to be taken into account in the lay-out design commensurate with the operational demands (temperature, pressure, bending/ oscillations due to flow rates and corrosion).

The testing of the protective tubes must be conducted at 1.5 times the nominal pressure.

guidelines.

The safety devices (e.g. connection head) for the electrical connection must meet the IP 54 standard as a minimum.

Instructions on Zone 0: Suitable protective tubes and suitable seals must be utilised (see 3) in the event that they are not part of the delivered specification.

The accuracy according to the tolerance classes can only be met if the installation conditions according to DIN EN 60751 are respected.

4b. Disassembly

Remove the cover only when the appliance is de-energised.

Observe the operationally-agreed maintenance schedules in line with the operating situation.

5. Initial start-up procedure

Prior to the initial start-up, the correct assembly and sealing of the mechanical and of the electrical components is to be checked as per the installation instructions for the Zone in question.

6 Maintenance / trouble-shooting

TFE temperature probes are to be made part of the normal maintenance schedule for electrical equipment. When this work is being carried out, a careful check should be made for any damage to the housing, wiring, wiring screw connections and - if need be - the equipotential bonding conductor.

In the event of any defects, the equipment should be immediately taken out of service.

Repairs to damaged or worn-out components may only be carried out by the manufacturer.

Protective tubes or bushings that serve as disconnect elements to the Zone 0 are to be incorporated into the recurrent tests of the complete system.

| Explanations of the type coding | | | | | | | |
|---|-------------------------------|----|-------------------------------|----|------------------------------|----|--------------------------|
| Process connection (MC = Model Code, key-position a) | | | | | | | |
| MC | Description | MC | Description | MC | Description | MC | Description |
| O | Without | A | Flange | B | Screwed plug | | |
| C | Clamping screw | D | Bayonet | | | | |
| Process connection (MC = Model Code, key-position b) (Sheath material: 1.4571) | | | | | | | |
| MC | Protective tube material | MC | Protective tube material | MC | Protective tube material | MC | Protective tube material |
| A | 1.4435 | B | 1.4404 | C | 1.4401 | D | 1.4571 |
| E | 1.4539 | F | 1.4541 | G | 1.4301 | H | 1.4762 |
| I | 1.4841 | J | 2.4816 | K | 1.1003 | L | ST 37 |
| M | St37K | N | Alloy C4 | O | 2.4856 | P | 1.4305 |
| Q = | 1.7335 | R | 1.5415 | S | 1.4713 | T | 2.4617 |
| U | Tantalum | V | 2.4602 | W | 1.4749 | X | 2.4819 |
| Measuring elements (MC = Model Code, key-position c) | | | | | | | |
| MC | Description | MC | Description | MC | Description | MC | Description |
| A | PT 100 Resistance | B | Metallic-film resistor | C | Thermo-element Fe-CuNi Typ K | | |
| D | Thermo-element Fe-CuNi, Typ J | E | Thermo-element PtRh-Pt, Typ S | | | | |
| Head type (MC = Model Code, key-position d) | | | | | | | |
| MC | Description | MC | Description | MC | Description | MC | Description |
| A | BUKH, polyamide | B | B, aluminium | C | BBK, plastic | | |
| D | BUZ, aluminium | E | BUZH, aluminium | F | BUS, aluminium | | |
| G | BUSH, aluminium | H | A, aluminium | I | AUZ, aluminium | | |
| J | AUZH, aluminium | K | AUS, aluminium | L | AUSH, aluminium | | |
| M | B, rustproof | N | Aluminium, die-cast case | O | without head | | |

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin



(1) EC-TYPE-EXAMINATION CERTIFICATE (Translation)

- (2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**
- (3) EC-type-examination Certificate Number:



PTB 01 ATEX 2206 X

- (4) Equipment: Temperature sensors, types TFE
- (5) Manufacturer: Albert Balzer AG Rotax
- (6) Address: 4143 Dornach, Switzerland
- (7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.
- (8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.
- The examination and test results are recorded in the confidential report PTB Ex 01-21121.
- (9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 50014:1997 + A1 + A2 EN 50020:1994 EN 50284:1999
- (10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.
- (11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.
- (12) The marking of the equipment shall include the following:

II 1 G EEx ia IIC T1 ... T6

Zertifizierungsstelle Explosionsschutz
By order:

Braunschweig, January 30, 2002

(signature)

In the absence of Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

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EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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(13) **SCHEDULE**

(14) **EC-TYPE-EXAMINATION CERTIFICATE PTB 01 ATEX 2206 X**

(15) Description of equipment

The temperature sensors, types TFE are used for the determination of a medium temperature. Resistance thermometers or thermo-couples are employed as measuring elements. The temperature sensors are applied as category-1 or category-2 equipment.

For relationship between maximum permissible medium temperature, temperature class, sensor type and supplied power for application as category-1 or category-2 equipment, reference is made to the table given in the operating instructions.

Electrical data

Resistance thermometer

Sensor circuit type of protection Intrinsic Safety EEx ia IIC
only for connection to a certified intrinsically safe circuit

Maximum values:

$$U_i = 30 \text{ V DC}$$

$$I_i = 100 \text{ mA}$$

$$P_i = 0.1 \dots 0.75 \text{ W according to table (cf. operating instructions)}$$

Reactances per unit length of the incoming line:

$$L_i = 15 \text{ } \mu\text{H/m}$$

$$C_i = 280 \text{ pF/m}$$

Thermo-couple

Sensor circuit type of protection Intrinsic Safety EEx ia IIC

Maximum values:

$$U_o = 0.1 \text{ V DC}$$

$$I_o = 24 \text{ mA}$$

L_i negligibly low

C_i negligibly low

When the thermo-couple is connected to an active intrinsically safe circuit, the rules for the interconnection of intrinsically safe circuits are to be considered:

$$P_i = 1 \text{ W}$$

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Physikalisch-Technische Bundesanstalt



Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 01 ATEX 2206 X

(16) Test report PTB Ex 01-21121

(17) Special conditions for safe use

1. For the application as category-1 equipment the temperature sensors, types TFE of such designs for which the material aluminium is used, shall be installed as such that the generation of sparks due to impact or friction between aluminium and steel (with the exception of stainless steel if the existence of rust particles can be excluded) is not possible.
2. For the application as category-1 or -1/2 equipment the temperature sensors, types TFE shall be connected electrostatically (contact resistance $\leq 1M\Omega$) to the equipotential bonding system (e.g. using the ground terminal clamp).
3. For relationship between maximum permissible medium temperature, temperature class, sensor type and supplied power for application as category-1 or category-2 equipment, reference is made to the table given in the operating instructions.

(18) Essential health and safety requirements

met by compliance with the standards mentioned above

Zertifizierungsstelle Explosionsschutz

Braunschweig, January 30, 2002

By order:

(signature)

In the absence of Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

3 pages, correct and complete as regards content.

By order:

Dr.-Ing. U. Gerlach Braunschweig, August 03, 2006
Oberregierungsrat



sheet 3/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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