Temperature Transmitter
head mounted TR11, TR01-EX
analog, high accuracy,
Pt 100 (2-, 3-, 4-wire circuit)
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head mounted TR11, TR01-EX

Analog, high accuracy
Pt 100 (2-, 3-, 4-wire circuit)

Operating Instructions
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1 General safety instructions

The device:
- Is built and tested in accordance with IEC 1010-1 (equivalent to EN 61 010-1 and DIN VDE 0411 Part 1 “Safety regulations for electrical measuring, control, regulation and laboratory equipment”)
- Is CE certified
- Left the factory in perfect order as regards safety.

In order to maintain this condition, when handling the device (transport, storage, installation, commissioning, operation, servicing, decommissioning), you must observe
- the content of this operating manual
- type plates, labels and safety instructions attached to it otherwise
- injury may result
- the device and other equipment may be damaged.

The ordinances, norms and guidelines named in this operating manual apply in the Federal Republic of Germany. When using the device in other countries, observe the appropriate national regulations.

If the information in this manual is insufficient, you can contact the manufacturer at any time at the address stated on the back of the manual.

Safety instructions for all models

Live circuits which are dangerous to touch can only be safely disconnected if the connected devices meet the requirements of VDE 0106 T.101 (basic requirements for safe disconnection). In order to ensure safe disconnection, lay the feed wires separately from circuits which are dangerous to touch or provide them with additional insulation.

Before switching on the device, make sure that the ambient conditions stated in the technical data are complied with and that the power supply voltage matches that of the transmitter.

If you believe that safe operation is no longer possible, shut down the device and secure it from being switched on inadvertently.

Additional safety instructions for TR 01-Ex

During all work on TR 01-EX the EEC Certificate of Conformity PTB 01 ATEX 2134 X must be observed.

The temperature transmitter TR 01-EX may be directly mounted in Zone 0.

The TR01-EX transmitter must be mounted in such a way that a housing protection degree of at least IP 20 is achieved also for the point of connection, as required by the IEC publication No. 529(144).

If, for functional reasons, the intrinsically safe circuit must be grounded due to equipotential bonding, the grounding should be effected at a single point.

If an apparatus with an intrinsically safe circuit is connected to the transmitter, proof of the intrinsic safety of the connection must be provided in accordance with DIN VDE 0165/08.98 (=EN 60079-14/1997 as well as IEC 60079-14/1996).

Operations on an explosions-protected apparatus may be carried out by any expert and/or in any workshop, but the apparatus has to be tested and certified by an expert before recommissioning.

Before commencing work, please ensure that the safety measures regarding explosion protection have been taken!

Due to the high surface resistance of R > 10⁹ Ohms, the TR01-EX temperature transmitter must be operated and maintained in such way that no harmful electrical discharges can occur.

Declaration of conformity

The protection requirements of the European Guidelines 94/9/EG are met.

The protection requirements of the European Guidelines 89/336/EWG with its amendments are fulfilled because of adherence to the following norms:
- Emitted interference: EN 50 081-1:1992
- Interference immunity: EN 50 082-2:1995
- Test standards: EN 61 000-4 Teil 2, 3, 4, 5 und 6.

For details of the EMC test report see Technical Data.

Necessary documentation
TR01-EX, TR 11 Data Sheet 10/11-8.11 EN
2 Technical data

2.1 Type overview

<table>
<thead>
<tr>
<th>Type</th>
<th>Output signal</th>
<th>Explosion protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitters for resistance thermometers</td>
<td>4...20 mA</td>
<td>–</td>
</tr>
<tr>
<td>TR11</td>
<td>4...20 mA</td>
<td>PTB 01 ATEX 2134 X</td>
</tr>
<tr>
<td>TR01-EX</td>
<td></td>
<td>Ex II G Ex ia IIC T6</td>
</tr>
</tbody>
</table>

2.2 Technical data

<table>
<thead>
<tr>
<th>Types</th>
<th>TR11, TR01-EX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Pt 100 in 2-, 3- or 4-wire circuit</td>
</tr>
<tr>
<td>Circuit type</td>
<td>See ordering information</td>
</tr>
<tr>
<td>Measuring range type</td>
<td>Min. span 20 K (e. g. 80...200 °C)</td>
</tr>
<tr>
<td>Standard</td>
<td>Min. span 5 K (e. g. 8...13 °C)</td>
</tr>
<tr>
<td>Special</td>
<td>Special</td>
</tr>
<tr>
<td>Measuring current</td>
<td>≤ 1 mA</td>
</tr>
<tr>
<td>Output</td>
<td>4...20 mA</td>
</tr>
<tr>
<td>Output current</td>
<td>temperature-linear</td>
</tr>
<tr>
<td>Current limitation</td>
<td>≤ 40 mA</td>
</tr>
<tr>
<td>Input voltage Us</td>
<td>12...28 V DC</td>
</tr>
<tr>
<td>Max. load</td>
<td>( R_{\text{lim}(\mu)} = \frac{U_{\text{us}}(V) - 12V}{0.024} )</td>
</tr>
<tr>
<td>Rise time ( \tau_{90} )</td>
<td>&lt; 1 ms</td>
</tr>
<tr>
<td>Switch-on delay</td>
<td>&lt; 2 ms</td>
</tr>
</tbody>
</table>

Error limit, drift values

(in percent, relative to span)

Balancing uncertainty

- if lower-range limit = 0 °C:
  - ≤ 0.1 % or 0.1 K, greater value applies
- if lower-range limit ≠ 0 °C:
  - ≤ 0.15 % or 0.15 K, greater value applies

Linearity deviation

≤ 0.1 %

Effect of ambient temperature

(relative to 20 °C)

- Lower-range value:
  - ≤ 0.1 °C/10 K
- Span:
  - ≤ 0.1 °C/10 K

Change in supply voltage

No influence

(in the range 12...28 V DC)

Electromagnetic compatibility (EMC)

meets NAMUR recommendations

on immunity to interface (as of 02.88)

IEC 801-3

Vibrations

No influence (tested to 40g)

Error signalling

Sensor break

> 22 mA

Sensor short-circuit

< 3 mA

Sensor line break

< 3 or > 22 mA

Depending on the type of line combination

Incorrect supply voltage polarity

0 mA
### Technical data

#### Types

<table>
<thead>
<tr>
<th>Environment conditions</th>
<th>TR11, TR01-EX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amb. temperatures a)</td>
<td>-25..+90 °C</td>
</tr>
</tbody>
</table>
| in non-hazardous areas | -50..+25 °C or 90..110 °C  
| Nominal range of use   |               |
| Overload temperatures  |               |
| (approx. twofold drift values) |           |
| b) in hazardous areas  | T6  T5  T1-T4  |
| Category II 1 G (Zone 0) | -20...+40 °C  |
| Category II 2 G (Zone 1) | -40...+50 °C  |
| Transport. and storage temperature range | -50...+120 °C  |
| Relative humidity      | 0...100 %     |

#### Screws terminals

M 3.5

#### Weight (module)

110 g

#### Explosion protection

Type TR 01-EX  
PTB 01 ATEX 2134 X

Type of protection

Intrinsic safety II 1 G EEx ia IIC T6

Mounting of transmitter

Zone 0
Zone 1
Zone 2

Supply current circuit (terminals +, –)

EEx ia IIC T6 or EEx ib IIC  
only for connection to certificated intrinsically safe current circuits with a max. Uᵢ = 28 V, Iᵢ = 130 mA, Pᵢ = 800 mW, effective inner inductance and capacitance negligible

Type of protection for the signal circuit depends on the type of protection the supply current has.

Measuring current circuit

EEx ia or ib IIC/IIIB  
The maximum values are given in Tab. 1. These are dependent on the maximum voltage of the voltage supply circuit Uᵢ,

<table>
<thead>
<tr>
<th>Uᵢ</th>
<th>Uₒ</th>
<th>I₀</th>
<th>Pᵢ</th>
<th>Iₘᵢₙ</th>
<th>C₀</th>
<th>L₀</th>
<th>Cₒ</th>
<th>Lₒ</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 V</td>
<td>28 V</td>
<td>52 mA</td>
<td>555 mW</td>
<td>93,2 mA</td>
<td>38 nF</td>
<td>0,5 mH</td>
<td>260 nF</td>
<td>2 mH</td>
</tr>
<tr>
<td>24 V</td>
<td>24 V</td>
<td>52 mA</td>
<td>467 mW</td>
<td>80 mA</td>
<td>61 nF</td>
<td>0,5 mH</td>
<td>420 nF</td>
<td>10 mH</td>
</tr>
<tr>
<td>18 V</td>
<td>18 V</td>
<td>52 mA</td>
<td>207 mW</td>
<td>60 mA</td>
<td>190 nF</td>
<td>2 mH</td>
<td>10,7 μF</td>
<td>10 mH</td>
</tr>
</tbody>
</table>

#### Tab. 1

Characteristics: linear

I₀  Load current for connected intrinsically safe transducers (static)

Iₘᵢₙ  Dynamic short-circuit current of the signal circuit

The signal circuit and the power circuit are electrically connected to each other.
3 Connection diagrams

**Construction: Module**
2- or 3-wire circuit

2- or 4-wire circuit

**Construction: field housing**

**Construction: serial field housing**
Dimensional drawings (all dimensions in mm)

4 Dimensional drawings (all dimensions in mm)

- **Module (with soldered connection)**
- **Connection head (type BUZH)**
- **Polyester field housing**
- **Serial rail housing**
- **Aluminium field housing**
- **Polycarbonat field housing**
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 2134 X

(4) Equipment: Temperature measuring transducer, type TR 01-Ex

(5) Manufacturer: ABB Automation Products GmbH

(6) Address: Borsigstraße 2, 63755 Alzenau, Germany

(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 02-21330.

(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 with 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 Ex ia IIC T6

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, February 28, 2002

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.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

(13) S C H E D U L E

(14) EC-TYPE-EXAMINATION CERTIFICATE PTB 01 ATEX 2134 X

(15) Description of equipment

The temperature measuring transducer, type TR 01-Ex, is used in conjunction with measuring sensors for the detection, amplification and transmission of measured values in intrinsically safe circuits. Sensors that may be connected to the input may be resistance thermometers, thermocouples or other sensing elements with defined quantities of resistance and d.c. voltage.

For the relationship between permissible ambient temperature range and temperature class as well as equipment category, reference is made to the following table.

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>T6</th>
<th>T5</th>
<th>T4, T3, T2, T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category II 1 G</td>
<td>-20 °C...+40 °C</td>
<td>-20 °C...+55 °C</td>
<td>-20 °C...+60 °C</td>
</tr>
<tr>
<td>Category II 2 G</td>
<td>-40 °C...+50 °C</td>
<td>-40 °C...+70 °C</td>
<td>-40 °C...+90 °C</td>
</tr>
</tbody>
</table>

Electrical data

Supply circuit .................................. type of protection Intrinsic Safety EEx ia IIC or EEx ib IIC
(Terminals "+" and "-"

for connection to certified intrinsically safe circuits,

Maximum input values:

\[ U_i = 28 \text{ V} \]
\[ I_i = 130 \text{ mA} \]
\[ P_i = 800 \text{ mW} \]

\[ C_i \approx 0 \]
\[ L_i \approx 0 \]

Measuring circuit .................................. type of protection Intrinsic Safety EEx ia IIC/IIB
(solder terminations 1, 2, 3 & 4) or EEx ib IIC/IIB

The maximum values, which are determined by the maximum voltage of the supply circuit \( U_i \), are listed in the table below.
<table>
<thead>
<tr>
<th>Uo</th>
<th>Ua</th>
<th>Io</th>
<th>Po</th>
<th>Iothing</th>
<th>Co</th>
<th>Lo</th>
<th>Co</th>
<th>Lo</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 V</td>
<td>28 V</td>
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<td>10.7 μF</td>
<td>10 mH</td>
</tr>
</tbody>
</table>

(the tabulated \( L_0 \) and \( C_0 \) are based on the respective \( I_{\text{syn}} \))

Linear characteristic

\( I_0 \)  load current for connected intrinsically safe measuring sensors (static)

\( I_{\text{syn}} \)  dynamic short-circuit current of the measuring circuit

The measuring circuit and the supply circuit are electrically interconnected.

(16) Test report PTB Ex 02-21330

(17) Special conditions for safe use

1. The measuring transducer, type TR 01-Ex, shall be installed in such a way that also for the connection facilities a degree of protection of at least IP 20 according to IEC publication 60529:1989 is met.

2. Inadmissible electrostatic charge of the plastic housing of the measuring transducer TR 01-Ex shall be avoided. A warning note on the equipment shall point to this danger.

(18) Essential health and safety requirements

Covered by standards.

Zertifizierungsstelle Explosionsschutz

By order:

Dr.-Ing. U. Johannsmeier
Regierungsdirektor

Braunschweig, February 28, 2002

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