

# Operating Instructions



## **Type TPR30**

Resistance thermometer

**tuhlen**  
CONTROL SYSTEMS

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## 1. General information

### 1. General information

The resistance thermometer described in the operating instructions has been designed and manufactured using state-of-the-art technology. All components are subject to stringent quality and environmental criteria during production.

These operating instructions contain important information on handling the instrument. Working safely requires that all safety instructions and work instructions are observed.

Observe the relevant local accident prevention regulations and general safety regulations for the instrument's range of use.

The operating instructions are part of the product and must be kept in the immediate vicinity of the instrument and readily accessible to skilled personnel at any time.

Skilled personnel must have carefully read and understood the operating instructions prior to beginning any work.

The manufacturer's liability is void in the case of any damage caused by using the product contrary to its intended use, non-compliance with these operating instructions, assignment of insufficiently qualified skilled personnel or unauthorised modifications to the instrument.

The general terms and conditions contained in the sales documentation shall apply.

Subject to technical modifications.

Further information:

- Internet address: [www.tuhlen.com](http://www.tuhlen.com)
- Relevant data sheet: DS-TPR30-Standard-EN.pdf
- Application consultant: [info@tuhlen.com](mailto:info@tuhlen.com)

# 1. General information

## Explanation of symbols



### **WARNING!**

... indicates a potentially dangerous situation that can result in serious injury or death, if not avoided.



### **CAUTION!**

... indicates a potentially dangerous situation that can result in light injuries or damage to equipment or the environment, if not avoided.



### **Information**

... points out useful tips, recommendations and information for efficient and trouble-free operation.



### **DANGER!**

... identifies hazards caused by electrical power. Should the safety instructions not be observed, there is a risk of serious or fatal injury.



### **WARNING!**

... indicates a potentially dangerous situation that can result in burns, caused by hot surfaces or liquids, if not avoided.

## Abbreviations

- |        |  |
|--------|--|
| 2-wire | The lead resistance is recorded as an error in the measurement.    |
| 3-wire | With a cable length of 30 m or longer, measuring errors can occur. |
| 4-wire | The lead resistance can be neglected.                              |

## 2. Safety

## 2. Safety



### **WARNING!**

Before installation, commissioning and operation, ensure that the appropriate resistance thermometer has been selected in terms of measuring range, design, specific measuring conditions and appropriate wetted parts' materials (corrosion).

Non-observance can result in serious injury and/or damage to the equipment.



Further important safety instructions can be found in the individual chapters of these operating instructions.

### **2.1 Intended use**

The resistance thermometer model TPR30 is used as general-purpose thermometer for the measurement of temperatures from  $-50 \dots +250 \text{ }^{\circ}\text{C}$  (without neck tube) and  $-200 \dots +600 \text{ }^{\circ}\text{C}$  (with neck tube) in liquid and gaseous media. It can be used for pressures up to 40 bar (special designs to 400 bar dependent on insertion length and diameter).

The instrument has been designed and built solely for the intended use described here, and may only be used accordingly.

The technical specifications contained in these operating instructions must be observed. Improper handling or operation of the instrument outside of its technical specifications requires the instrument to be taken out of service immediately and inspected by an authorised tuhlen service engineer.

If the instrument is transported from a cold into a warm environment, the formation of condensation may result in the instrument malfunctioning. Before putting it back into operation, wait for the instrument temperature and the room temperature to equalise.

The manufacturer shall not be liable for claims of any type based on operation contrary to the intended use.

## 2. Safety

### 2.2 Personnel qualification



#### **WARNING!**

#### **Risk of injury if qualification is insufficient!**

Improper handling can result in considerable injury and damage to equipment.

- The activities described in these operating instructions may only be carried out by skilled personnel who have the qualifications described below.
- Keep unqualified personnel away from hazardous areas.

### Skilled personnel

Skilled personnel are understood to be personnel who, based on their technical training, knowledge of measurement and control technology and on their experience and knowledge of country-specific regulations, current standards and directives, are capable of carrying out the work described and independently recognising potential hazards.

Special operating conditions require further appropriate knowledge, e.g. of aggressive media.

### 2.3 Special hazards



#### **WARNING!**

For hazardous media such as oxygen, acetylene, flammable or toxic gases or liquids, and refrigeration plants, compressors, etc., in addition to all standard regulations, the appropriate existing codes or regulations must also be followed.



#### **WARNING!**

Protection from electrostatic discharge (ESD) required. The proper use of grounded work surfaces and personal wrist straps is required when working with exposed circuitry (printed circuit boards), in order to prevent static discharge from damaging sensitive electronic components.

## 2. Safety



To ensure safe working on the instrument, the operating company must ensure

- that suitable first-aid equipment is available and aid is provided whenever required,
- that the operating personnel are regularly instructed in all topics regarding work safety, first aid and environmental protection, and know the operating instructions, in particular the section on safety instructions.



### **DANGER!**

Danger of death caused by electric current

Upon contact with live parts, there is a direct danger of death.

- The activities described in these operating instructions may only be carried out by skilled personnel who have the qualifications described below.
- Keep unqualified personnel away from hazardous areas.



### **WARNING!**

Residual media in dismantled instruments can result in a risk to personnel, the environment and equipment.

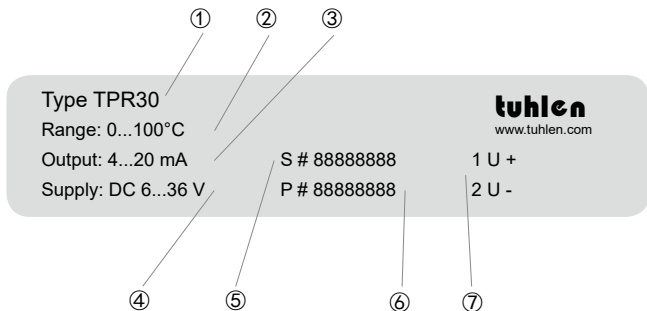
Take sufficient precautionary measures.

Do not use this instrument in safety or Emergency Stop devices. Incorrect use of the instrument can result in injury.

Should a failure occur, aggressive media with extremely high temperature and under high pressure or vacuum may be present at the instrument.

## 2. Safety

### 2.4 Labelling



- ① Type
- ② Measuring range
- ③ Output signal
- ④ Power supply
- ⑤ Serial number
- ⑥ Product number
- ⑦ Electrical connection



## 3. Specifications

### 3. Specifications

#### Output signal Pt100, model TPR30-R

##### Measuring element and measuring insert

The Pt100 measuring element is located in the thermometer's probe tip.

#### Output signal Pt100, model TPR30-R

<b>Temperature range</b> <ul style="list-style-type: none"><li>■ Class A</li><li>■ Class B</li></ul>	without neck tube -50...+250°C with neck tube -200...+600°C without neck tube -50...+250°C with neck tube -200...+600°C
<b>Measuring element</b>	Pt100 (measuring current: 0.1 ... 1.0 mA)
<b>Connection method</b>	■ 2-wire ■ 3-wire ■ 4-wire
<b>Sensor tolerance value per IEC 60751</b>	■ Class B ■ Class A
<b>Electrical connection</b>	■ M12 x 1 circular connector (4-pin) ■ DIN angular connector form A (for cable with Ø 6 ... 8 mm, cross section max. 1.5 mm <sup>2</sup> )

#### Output signal 4 ... 20 mA, model TPR30-A

##### Measuring element and measuring insert

The Pt100 measuring element is located in the thermometer's probe tip. The 4 ... 20 mA transmitter is mounted and potted within the tubular body of the thermometer.

#### Output signal 4 ... 20 mA, model TPR30-A

<b>Temperature range</b> <sup>1)</sup> <ul style="list-style-type: none"><li>■ Class A</li><li>■ Class B</li></ul>	without neck tube -50...+250°C with neck tube -200...+600°C without neck tube -50...+250°C with neck tube -200...+600°C
<b>Measuring element</b>	Pt100 (measuring current: 0.1 ... 1.0 mA)
<b>Sensor tolerance value per IEC 60751</b>	■ Class B ■ Class A
<b>Measuring span</b>	Minimum 20 K, maximum 800 K
<b>Basic configuration</b>	Measuring range 0 ... 150 °C, other measuring ranges are adjustable
<b>Analogue output</b>	4 ... 20 mA, 2-wire
<b>Measuring error per IEC 60770, 23 °C ±5 K</b>	1% (transmitter) <sup>2)</sup>
<b>Linearisation</b>	Linear with temperature per DIN EN 60751

### 3. Specifications

#### Output signal 4 ... 20 mA, model TPR30-A

<b>Linearisation error</b>	$\pm 0.1\%$ <sup>3)</sup>
<b>Switch-on delay, electrical</b>	< 10 ms
<b>Current signal for fault signal</b>	Configurable in accordance with NAMUR NE43 downscale $\leq 3.6$ mA    upscale $\geq 21.0$ mA
<b>Sensor short-circuit</b>	Not configurable, generally NAMUR downscale $\leq 3.6$ mA
<b>Load <math>R_A</math></b>	$RA \leq (UB - 6 \text{ V}) / 0.023 \text{ A}$ with $RA$ in $\Omega$ and $UB$ in V
<b>Effect of load</b>	$\pm 0.05\%$ / 100 $\Omega$
<b>Power supply <math>U_B</math></b>	DC 6 ... 36 V
<b>Power supply input</b>	Protected against reverse polarity
<b>Power supply effect</b>	$\pm 0.025\%$ / V
<b>Electromagnetic compatibility (EMC)</b>	EN61326 emission (Group 1, Class B) and immunity (industrial application) <sup>4)</sup> , and also per NAMUR NE21
<b>Temperature units</b>	Configurable °C, °F, K
<b>Configuration and calibration data</b>	Permanently stored in EEPROM
<b>Electrical connection</b>	<ul style="list-style-type: none"><li>■ M12 x 1 circular connector (4-pin)</li><li>■ DIN angular connector form A (for cable with <math>\varnothing 6 \dots 8</math> mm, cross section max. 1.5 mm<sup>2</sup>)</li></ul>

Readings in % refer to the measuring span

For a correct determination of the overall measuring error, both sensor and transmitter measuring deviations have to be considered.

1) The temperature transmitter should therefore be protected from temperatures over 85 °C (185 °F).

2) For measuring spans smaller than 50 K additional 0.1 K

3)  $\pm 0.2\%$  for measuring ranges with a lower limit less than 0 °C

4) Use resistance thermometers with shielded cable, and ground the shield on at least one end of the lead, if the cables are longer than 30 m or leave the building.

## 4. Design and function

### 4. Design and function

The resistance thermometer model TR30 consists of a thermowell with fixed process connection, the process connection are thread, flange, Tri-clamp etc.

It is designed to be resistant to shock and vibration and all electrical components are protected against splashed water. The vibration resistance of the standard version complies with DIN EN 60751 (up to 3 g); specific designs can withstand up to 10 g. The impact resistance for all versions meets the requirements of DIN EN 60751. The electrical connection is made via an angular DIN connector, Form A or M12 x 1 circular connector.

## 5. Transport, packaging and storage

### 5. Transport, packaging and storage

#### 5.1 Transport

Check the instrument for any damage that may have been caused during transportation. Obvious damage must be reported immediately.

#### 5.2 Packaging

Do not remove packaging until just before mounting.

Keep the packaging as it will provide optimum protection during transport (e.g. change in installation site, sending for repair).

#### 5.3 Storage

##### Permissible conditions at the place of storage:

- Storage temperature: 0 ... 70 °C
- Humidity: 35 ... 85 % relative humidity (no condensation)

##### Avoid exposure to the following factors:

- Direct sunlight or proximity to hot objects
- Mechanical vibration, mechanical shock (putting it down hard)
- Soot, vapour, dust and corrosive gases
- Potentially explosive environments, flammable atmospheres

Store the instrument in its original packaging in a location that fulfils the conditions listed above. If the original packaging is not available, pack and store the instrument as described below:

1. Wrap the instrument in an antistatic plastic film.
2. Place the instrument, along with shock-absorbent material, in the packaging.
3. If stored for a prolonged period of time (more than 30 days), place a bag containing a desiccant inside the packaging.



#### **WARNING!**

Before storing the instrument (following operation), remove any residual media. This is of particular importance if the medium is hazardous to health, e.g. caustic, toxic, carcinogenic, radioactive, etc.

## 6. Commissioning, operation

### 6. Commissioning, operation



#### WARNING!

Avoid putting mechanical stress on the electrical connections or on the enclosures. The maximum temperatures of  $-50 \dots +250$  °C (without neck tube) and  $-200 \dots +600$  °C (with neck tube) must not be exceeded. Connections must only be opened when the instrument is depressurised and has cooled down.

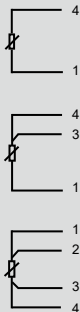
#### 6.1 Mounting

The insertion length, along with the flow velocity and viscosity of the process media, may reduce the max. loading on the thermowell.

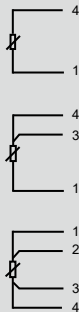
#### 6.2 Electrical connection

##### 6.2.1 Output signal Pt100, model TPR30-R

Angular connector DIN EN 175301-803, Form A



Circular connector M12 x 1 (4-pin)



## 6. Commissioning, operation

### 6.2.2 Output signal 4 ... 20 mA, model TPR30-A



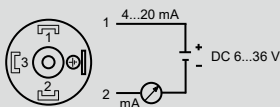
#### **DANGER!**

#### **Danger of death caused by electric current**

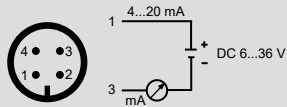
Upon contact with live parts, there is a direct danger of death.

- The instrument may only be installed and mounted by skilled personnel.
- Operation using a defective power supply unit (e.g. shortcircuit from the mains voltage to the output voltage) can result in life-threatening voltages at the instrument!
- Carry out mounting work only with power disconnected.

Angular connector DIN EN 175301-803, Form A



Circular connector M12 x 1 (4-pin)



#### **Version with angular connector (DIN EN 175301-803)**

For the cable leads we recommend the use of crimped ferrules.

To ensure IP65 ingress protection:

- Always use the silicon seals
- Tighten the locking screw
- Ensure the cables are inserted carefully



## 7. Maintenance and cleaning

### 7. Maintenance and cleaning

#### 7.1 Maintenance

The resistance thermometers described here require absolutely no maintenance and contain no components which could be repaired or replaced.

#### 7.2 Cleaning



#### **CAUTION!**

- Before cleaning the instrument disconnect the electrical connections.
- Clean the instrument with a moist cloth.
- Electrical connections must not come into contact with moisture.
- Wash or clean the dismantled instrument before returning it in order to protect personnel and the environment from exposure to residual media.
- Residual media in dismantled instruments can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.

## 8. Dismounting, return and disposal

### 8. Dismounting, return and disposal



#### **WARNING!**

Residual media in dismantled instruments can result in a risk to personnel, the environment and equipment.

Take sufficient precautionary measures.

#### 8.1 Dismounting



#### **WARNING!**

Risk of burns!

Let the instrument cool down sufficiently before dismantling!

During dismantling there is a risk of dangerously hot pressure media escaping.

Only disconnect the resistance thermometer once the system has been depressurised!

#### 8.2 Return



#### **WARNING!**

**Absolutely observe when shipping the instrument:**

All instruments delivered to tuhlen must be free from any kind of hazardous substances (acids, leachate, solutions, etc.).

When returning the instrument, use the original packaging or a suitable transport package.

#### **To avoid damage:**

1. Wrap the instrument in an antistatic plastic film.
2. Place the instrument, along with shock-absorbent material, in the packaging. Place shock-absorbent material evenly on all sides of the shipping box.
3. If possible, place a bag containing a desiccant inside the packaging.
4. Label the shipment as carriage of a highly sensitive measuring instrument.



## 8. Dismounting, return and disposal



Information on returns can be found under the heading “Service” on our local website.

### 8.3 Disposal

Incorrect disposal can put the environment at risk.

Dispose of instrument components and packaging materials in an environmentally compatible way and in accordance with the countryspecific waste disposal regulations.