Resistance thermometer for flue gas temperature measurements
With thermowell model TW81
Model TR81

Applications
- Blast furnaces, hot blast stoves
- Annealing and heat treatment processes
- Waste and hazardous waste incineration
- Large heating systems, heat generation

Special features
- Application ranges up to +600 °C [+1,112 °F]
- Thermowell from heat-resistant steel
- Measuring insert replaceable
- Gas-tight process connection (option)

Description
These straight resistance thermometers consist of a form B connection head, a measuring insert in accordance with DIN 43735 and a model TW81 thermowell. In addition to DIN form A or C thermowells, customer-specific versions are possible.
Possible process connections are stop flange or threaded bushing - the latter can realise a gas-tight connection.

These thermometers are suitable for gaseous media in the low pressure range (up to approx. 1 bar). Different thermowell materials, with or without enamelling, ensure matching to the respective thermal load.

Measuring insert is replaceable. This enables inspection, measuring equipment monitoring or, when servicing is necessary, replacement while the plant is running. The choice of standard lengths assists with short delivery times and the possibility of stocking spare parts.

Thermowell material, connection head and sensor can each be selected to suit the respective application.

Optionally, a transmitter can be built in. Among the advantages of a built-in transmitter is an increased reliability of the signal transmission.
Explosion protection (option)

The permissible power, $P_{\text{max}}$, as well as the permissible ambient temperature, for the respective category can be seen on the EC-type examination certificate and the certificate for hazardous areas or the operating instructions.

Attention:
Only with the correspondingly suitable protective components is operation in dust Ex hazardous areas permissible.

Built-in transmitters have their own EC-type examination certificate. The permissible ambient temperature ranges of the built-in transmitters can be taken from the corresponding transmitter approval.

Approvals (explosion protection, further approvals)

<table>
<thead>
<tr>
<th>Logo</th>
<th>Description</th>
<th>Country</th>
</tr>
</thead>
</table>
| EU declaration of conformity | ■ EMC directive ¹)  
EN 61326 emission (group 1, class B) and immunity (industrial application)  
■ RoHS directive  
■ ATEX directive (option)  
Hazardous areas  
- Ex i  
Zone 0 gas  
Zone 1 mounting to zone 0 gas  
Zone 1 gas  
Zone 20 dust  
Zone 21 mounting to zone 20 dust  
Zone 21 dust | European Union |
| Ex | [II 1G Ex ia IIC T1 ... T6 Ga]  
[II 1/2G Ex ia IIC T1 ... T6 Ga/Gb]  
[II 2G Ex ia IIC T1 ... T6 Gb]  
[II 1D Ex ia III C T125 ... T65 °C Da]  
[II 1/2D Ex ia III C T125 ... T65 °C Da/Db]  
[II 2D Ex ia III C T125 ... T65 °C Db]  
[II 2G Ex eb IIC T1 ... T6 Gb]  
[II 3G Ex ec IIC T1 ... T6 Gc X]  
[II 2D Ex tb III C TX °C Db]  
[II 3D Ex tc III C TX °C Dc X]  
[II 3G Ex nA IIC T1 ... T6 Gc X]  
[II 3D Ex tc III C TX °C Dc X] | |
| IECEx (option) - in conjunction with ATEX | Hazardous areas  
- Ex i  
Zone 0 gas  
Zone 1 mounting to zone 0 gas  
Zone 1 gas  
Zone 20 dust  
Zone 21 mounting to zone 20 dust  
Zone 21 dust  | International |
| | [Ex ia IIC T1 ... T6 Ga]  
[Ex ia IIC T1 ... T6 Gb]  
[Ex ia IIC T125 ... T65 °C Da]  
[Ex ia IIC T125 ... T65 °C Da/Db]  
[Ex ia IIC T125 ... T65 °C Db] | |
| EAC (option) | Hazardous areas  
- Ex i  
Zone 0 gas  
Zone 1 gas  
Zone 20 dust  
Zone 21 dust  | Eurasian Economic Community |
| | [0 Ex ia IIC T6 ... T1 Ga X]  
[1 Ex ia IIC T6 ... T1 Gb X]  
[Ex ia III C T80 ... T440 °C Da X]  
[Ex ia III C T80 ... T440 °C Db X]  
[Ex nA IIC T6 ... T1 Gc X] | |
| INMETRO (option) | Hazardous areas  
- Ex i  
Zone 0 gas  
Zone 1 mounting to zone 0 gas  
Zone 1 gas  
Zone 20 dust  
Zone 21 mounting to zone 20 dust  
Zone 21 dust  | Brazil |
| | [Ex ia IIC T3 ... T6 Ga]  
[Ex ia IIC T3 ... T6 Gb]  
[Ex ia IIC T3 ... T6 Gb]  
[Ex ia IIC T125 ... T65 °C Da]  
[Ex ia IIC T125 ... T65 °C Da/Db]  
[Ex ia IIC T125 ... T65 °C Db] | |

¹) Only for built-in transmitter
<table>
<thead>
<tr>
<th>Logo</th>
<th>Description</th>
<th>Country</th>
</tr>
</thead>
</table>
| ![Logo](image) | NEPSI (option)  
**Hazardous areas**  
- Ex i Zone 0 gas  
Zone 1 mounting to zone 0 gas  
Zone 1 gas  
- Ex ia IIC T1 – T6 Ga  
- Ex ia IIC T1 – T6 Ga/Gb  
- Ex ia IIC T1 – T6 Gb | China |
| ![Logo](image) | KCs - KOSHA (option)  
**Hazardous areas**  
- Ex i Zone 0 gas  
Zone 1 gas  
- Ex ia IIC T4 ... T6 | South Korea |
| ![Logo](image) | PESO (option)  
**Hazardous areas**  
- Ex i Zone 0 gas  
Zone 1 mounting to zone 0 gas  
Zone 1 gas  
- Ex ia IIC T1 ... T6 Ga  
- Ex ia IIC T1 ... T6 Ga/Gb  
- Ex ia IIC T1 ... T6 Gb | India |
| ![Logo](image) | DNOP - MakNII (option)  
**Hazardous areas**  
- Ex i Zone 0 gas  
Zone 1 mounting to zone 0 gas  
Zone 1 gas  
Zone 20 dust  
Zone 21 mounting to zone 20 dust  
Zone 21 dust  
- Il 1G Ex ia IIC T3 ... T6 Ga  
- Il 1/2G Ex ia IIC T3 ... T6 Ga/Gb  
- Il 1D Ex ia IIIc T125 ... T65 °C Da  
- Il 1/2D Ex ia IIIc T125 ... T65 °C Da/Db  
- Il 2D Ex ia IIIc T125 ... T65 °C Db | Ukraine |
| ![Logo](image) | GOST (option)  
Metrology, measurement technology | Russia |
| ![Logo](image) | KazInMetr (option)  
Metrology, measurement technology | Kazakhstan |
| ![Logo](image) | MTSCHS (option)  
Permission for commissioning | Kazakhstan |
| ![Logo](image) | BelGIM (option)  
Metrology, measurement technology | Belarus |
| ![Logo](image) | UkrSEPPO (option)  
Metrology, measurement technology | Ukraine |
| ![Logo](image) | Uzstandard (option)  
Metrology, measurement technology | Uzbekistan |

**Manufacturer's information and certificates**

<table>
<thead>
<tr>
<th>Logo</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Logo](image) | SIL 2  
Functional safety  
(only in conjunction with model T32 temperature transmitter) |
| ![Logo](image) | NAMUR NE24  
Hazardous areas (Ex i) |

Instruments marked with “ia” may also be used in areas only requiring instruments marked with “ib” or “ic”. If an instrument with “ia” marking has been used in an area with requirements in accordance with “ib” or “ic”, it cannot be operated in areas with requirements in accordance with “ia” afterwards.

Approvals and certificates, see website
Sensor

Measuring element
Pt100 (measuring current: 0.1 ... 1.0 mA) ¹)

<table>
<thead>
<tr>
<th>Connection method</th>
<th>1 x 2-wire</th>
<th>1 x 3-wire</th>
<th>1 x 4-wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single elements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dual elements</td>
<td>2 x 2-wire</td>
<td>2 x 3-wire</td>
<td>2 x 4-wire</td>
</tr>
</tbody>
</table>

| Accuracy class / Range of use of the sensor per EN 60751 |
|---------------|----------------|-----------------|
| Class          | Sensor construction | Wire-wound | Thin-film |
| Class B        | -196 ... +600 °C    | -50 ... +500 °C |
| Class A ³)     | -100 ... +450 °C    | -30 ... +300 °C |
| Class AA ³)    | -50 ... +250 °C     | 0 ... 150 °C   |

¹) For detailed specifications for Pt100 sensors, see Technical information IN 00.17 at www.wika.com.
²) Not with 3 mm diameter
³) Not with 2-wire connection method

The table shows the temperature ranges listed in the respective standards, in which the tolerance values (class accuracies) are valid.

Electrical connection (colour code per IEC/EN 60751)

For the electrical connections of built-in temperature transmitters see the corresponding data sheets or operating instructions.
**Measuring insert**

The measuring insert is made of a vibration-resistant, sheathed measuring cable (MI cable).

Using two screws and springs, the measuring insert can be mounted into a connection head (form B), replaceable and mounted spring-loaded.

When fitting the measuring insert into a thermowell, it is very important to determine the correct insertion length (= thermowell length for bottom thicknesses of ≤ 5.5 mm). In order to ensure that the measuring insert is firmly pressed down onto the bottom of the thermowell, the insert must be spring-loaded (spring travel: max. 10 mm).

The standard material used for the measuring insert sheath is stainless steel. Other materials on request.

**Components model TR81 (with thermowell model TW81)**

![Diagram of components model TR81](image)

Legend:

1. Connection head
2. Thermowell (TW81)
3. Measuring insert
4. Transmitter (option)
5. Process connection, adjustable (Fig. stop flange)
6. Mounting screw
7. M24 x 1.5 thread

A (NL) Nominal length
Ø F Thermowell diameter
N approx. 10 mm
Connection head

<table>
<thead>
<tr>
<th>Model</th>
<th>Material</th>
<th>Cable entry thread size</th>
<th>Ingress protection 1)</th>
<th>Cap</th>
<th>Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>Aluminium</td>
<td>M20 x 1.5</td>
<td>IP53, IP65</td>
<td>Cap with 2 screws</td>
<td>Blue, lacquered 2)</td>
</tr>
<tr>
<td>BSZ</td>
<td>Aluminium</td>
<td>M20 x 1.5</td>
<td>IP53, IP65</td>
<td>Hinged cover with cylinder head screw</td>
<td>Blue, lacquered 2)</td>
</tr>
<tr>
<td>BSZ-H</td>
<td>Aluminium</td>
<td>M20 x 1.5</td>
<td>IP53, IP65</td>
<td>Hinged cover with cylinder head screw</td>
<td>Blue, lacquered 2)</td>
</tr>
</tbody>
</table>

1) IP53: Lateral mounting screws
   IP65: M24 x 1.5 thread
2) RAL 5022

Transmitter (option)

The transmitter can be mounted directly into the thermometer. Attention must be paid to the permissible ambient temperature of the transmitter in accordance with the data sheet. We recommend installing the transmitter in the cover of a model BSZ-H connection head. Here, the sensor is connected indirectly to the transmitter by means of connection lead between terminal block and transmitter.

- Mounted within the cover of the connection head
- Mounting is not recommended, on thermal grounds

<table>
<thead>
<tr>
<th>Connection head</th>
<th>Transmitter model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T15</td>
</tr>
<tr>
<td>BS</td>
<td>-</td>
</tr>
<tr>
<td>BSZ</td>
<td>-</td>
</tr>
<tr>
<td>BSZ-H</td>
<td>●</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Data sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>T15</td>
<td>Digital transmitter, PC configurable</td>
<td>TE 15.01</td>
</tr>
<tr>
<td>T32</td>
<td>Digital transmitter, HART® protocol</td>
<td>TE 32.04</td>
</tr>
<tr>
<td>T53</td>
<td>Digital transmitter, FOUNDATION™ Fieldbus and PROFIBUS® PA</td>
<td>TE 53.01</td>
</tr>
<tr>
<td>T91.10</td>
<td>Analogue transmitter, fixed measuring range</td>
<td>TE 91.01</td>
</tr>
</tbody>
</table>
Thermowell model TW81

**Metal thermowell**
The thermowell is manufactured from tube. The bottom of the thermowell is flat or dished, always dished with enamelled metal thermowell. The thermowell is pressed into the connection head and clamped.

In addition, we offer the possibility of a head screwed onto the thermowell. This enables IP65 protection to be achieved. An adjustable process connection is clamped onto the thermowell, thus allowing a variable insertion length.

Standard nominal lengths per DIN EN 50446 are preferable.

**Standard nominal lengths**
A = 500, 710, 1,000, 1,400, 2,000 mm
Others on request

**Thermowell materials**

- **Carbon steel 1.0305**
  up to 550 °C (air), low resistance to sulphurous gases, medium resistance to nitrogen-containing gases
- **Carbon steel 1.0305, enamelled**
  up to 550 °C, can be pressurised up to max. 1 bar, for the low pressure range in furnaces and flue gas ducts
- **Stainless steel 1.4571**
  up to 700 °C ¹) (air), good resistance to aggressive media
- **Stainless steel 1.4841**
  up to 1,150 °C ¹) (air), low resistance to sulphurous gases; high resistance to nitrogen-containing gases with low oxygen content; high creep strength
- **Stainless steel 1.4762**
  up to 1,200 °C ¹) (air), high resistance to sulphurous gases; low resistance to nitrogen-containing gases

Other materials on request

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¹) Please note that the maximum operating temperature is limited by the maximum range of application of the sensor (Pt100: +600 °C).
Remarks on the selection and operation of metal thermowells

The following table does not claim to be complete. All information is non-binding and does not represent guaranteed characteristics. They should be fully tested by the customer using the conditions of the respective application.

Please note:
The maximum operating temperature is limited by the maximum range of application of the sensor.

Resistance when in contact with gases

<table>
<thead>
<tr>
<th>Material No.</th>
<th>AISI No.</th>
<th>Applicable in air up to °C</th>
<th>Resistance against Sulphurous gases</th>
<th>Nitrogen-containing gases with low oxygen content</th>
<th>Carburisation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Oxidising</td>
<td>Reducing</td>
<td></td>
</tr>
<tr>
<td>1.0305</td>
<td>-</td>
<td>550</td>
<td>low</td>
<td>slight</td>
<td>medium</td>
</tr>
<tr>
<td>1.4571</td>
<td>316 Ti</td>
<td>800</td>
<td>slight</td>
<td>slight</td>
<td>medium</td>
</tr>
<tr>
<td>1.4762</td>
<td>-</td>
<td>1,200</td>
<td>very high</td>
<td>high</td>
<td>slight</td>
</tr>
<tr>
<td>1.4841</td>
<td>310 / 314</td>
<td>1,150</td>
<td>very slight</td>
<td>very slight</td>
<td>high</td>
</tr>
</tbody>
</table>

Operation in gases

<table>
<thead>
<tr>
<th>Material No.</th>
<th>Range of applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0305 (St35.8)</td>
<td>Tempering furnaces for heat treatment plants, galvanising and tinning plants, carbon-dust-air mixture pipelines in steam power stations</td>
</tr>
<tr>
<td>1.0305 enamelled (St35.8 enamelled)</td>
<td>Flue-gas desulphurisation plants, babbitt metal, lead and tin smelters</td>
</tr>
<tr>
<td>1.4762 X 10 CrAISI 25</td>
<td>Combustion exhaust gases, cement and ceramic furnaces, heat treatment plants, annealing furnaces</td>
</tr>
<tr>
<td>1.4749 X 18 CrNi 28</td>
<td>Flue gas ducts, annealing furnaces</td>
</tr>
<tr>
<td>1.4841 X 15 CrNiSi 25-21</td>
<td>Combustion chambers, industrial furnaces, petrochemical industry, hot blast stoves, cyanide baths</td>
</tr>
</tbody>
</table>
Process connection

Not gas-tight
A stop flange is sufficient; a mating flange is not needed. The stop flange is adjustable on the thermowell and is secured using a clamp. Therefore, the insertion length of the thermometer is variable and can be easily adjusted at the mounting point.

Gas-tight up to 1 bar
A threaded bushing or a combination of stop flange - mating flange is needed.

- Threaded bushing
  This is secured onto the metal thermowell using a clamp. Once loosened, adjustment along the thermowell is possible. The insertion length of the thermometer is variable and can be easily adjusted at the mounting point.

- Stop flange - mating flange
  Sealing is made via a stuffing box between mating flange and thermowell. It is secured using a clamp between the stop flange and thermowell.
  The insertion length of the thermometer is variable.

Enamelled thermowell
When using enamelled thermowells, a threaded bushing should be used to prevent the enamel layer from being damaged.

Selectable threaded bushings

<table>
<thead>
<tr>
<th>Thermowell</th>
<th>Dimensions in mm</th>
<th>Process connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Ø</td>
<td>Ø f/f₄</td>
<td>i min.</td>
</tr>
<tr>
<td>22</td>
<td>22.5</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>15.5</td>
<td>20</td>
</tr>
</tbody>
</table>

Other threads on request

Selectable stop flanges

<table>
<thead>
<tr>
<th>Thermowell</th>
<th>Dimensions in mm</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>External Ø</td>
<td>Ø f/f₄</td>
<td>C (hole)</td>
</tr>
<tr>
<td>22</td>
<td>22.5</td>
<td>70</td>
</tr>
<tr>
<td>15</td>
<td>15.5</td>
<td>55</td>
</tr>
</tbody>
</table>
### Selectable flange sizes

<table>
<thead>
<tr>
<th>Flange diameter</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ½ inch, 150 lbs, RF</td>
<td>Stainless steel 316</td>
</tr>
<tr>
<td>1 ½ inch, 300 lbs, RF</td>
<td>Stainless steel 316</td>
</tr>
<tr>
<td>2 inch, 150 lbs, RF</td>
<td>Stainless steel 316</td>
</tr>
<tr>
<td>2 inch, 300 lbs, RF</td>
<td>Stainless steel 316</td>
</tr>
<tr>
<td>3 inch, 150 lbs, RF</td>
<td>Stainless steel 316</td>
</tr>
<tr>
<td>3 inch, 300 lbs, RF</td>
<td>Stainless steel 316</td>
</tr>
<tr>
<td>4 inch, 150 lbs, RF</td>
<td>Stainless steel 316</td>
</tr>
<tr>
<td>4 inch, 300 lbs, RF</td>
<td>Stainless steel 316</td>
</tr>
</tbody>
</table>

Other flange sizes on request

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**Ordering information**

Model / Sensor / Connection head / Transmitter / Certificates / Options