

## TW50..59 || Flange Resistance Thermometer

### Application

Resistance thermometers are suited for direct temperature measurement of gaseous and liquid media.

The applications for the measuring inserts are not limited to the specified resistance thermometers. They are adapted to the given request with regard to temperature, length, bending property, vibration resistance and accuracy. In addition to our standard models we provide a lot of special types for special applications.

### Construction and Operation

All flange resistance thermometers presented in this data sheet are built acc. to DIN 43765 and some are further developments.

Standard features

- Protective tube acc. to DIN 43772
- Connection head acc. to DIN EN 50446
- exchangeable measuring inset acc. to DIN 43762

### Specifications

The accuracy classes acc. to DIN EN 60751 are distinguished as follows:

- class B (1/3; 1/10 DIN possible)
- class A (1/2 DIN possible)

All measuring inlets contain a standard measuring resistance acc. to DIN EN 60751 class B.

Please see the end of this data sheet for basic values and deviations of limit values.

The protective tube is designed as flange-type for this type series.

It protects the measuring insert and consequently the measuring resistance against pressure, flow and possible damages. It remains installed and assures the continuation of process during an exchange of the measuring insert.

The construction of the protective tube depends on the pressure and temperature of the medium on site. See the load diagrams for the necessary specifications.



### Main Features

- high accuracy
- easy to exchange
- easy data processing
- economic measuring principle
- application possible even for great distance measurement
- easy installation of double Pt 100

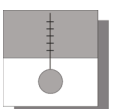
### Typical Applications

- boiler and furnace construction
- heating, ventilation and air technology

The connection head consists mainly of light metal acc. to DIN EN 50446 type B. Other connection heads are indicated at the end of this data sheet.

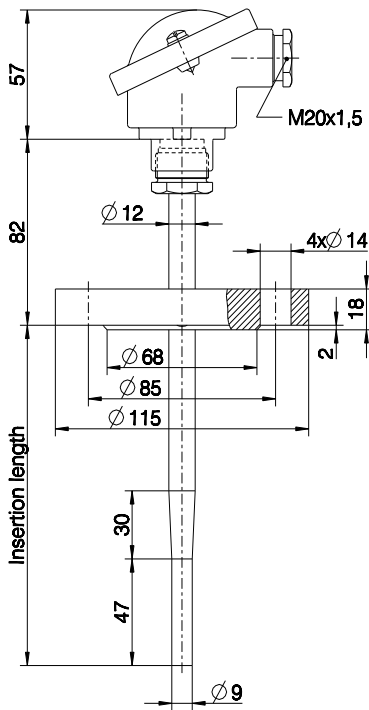
The resistance thermometers are also available with integrated 2-wire transmitter.

See the data sheets TE41 and TE42 for details!



## Flange Resistance Thermometer TW50

Type F DIN 43771, for temperature measurement during high pressure and flow



|                      |  |
|----------------------|--|
| Measuring element    | Measuring insert acc. to DIN 43762<br>Inset tube of stainless steel 1.4571<br>Measuring resistance 1 or 2 Pt100 acc. to DIN EN 60751 |
| Protective tube      | like DIN 43772 type 3F<br>ø 12 mm; 2,751 mm wall thickness; material: 1.4571;<br>measuring point reduced to ø 9 mm                   |
| Neck pipe            | ø 12 mm; length: 82 mm lang; material: 1.4571  |
| Mounting             | flange DN25 PN40 acc. to DIN EN 1092-1   |
| Connection           | Standard connection head type B of light metal acc. to<br>DIN EN 50446   |
| max. measuring temp. | 400°C  |

### Ordering Code

Flange Resistance  
Thermometer

TW50

|  |  |  |   |   |  |  |
|--|--|--|---|---|--|--|
|  |  |  | 0 | 0 |  |  |
|--|--|--|---|---|--|--|

#### Standard Type

|  |     |
|--|-----|
| Inset tube with 1x Pt100, 2-wire ..... | > A |
| Inset tube with 1x Pt100, 3-wire ..... | > B |
| Inset tube with 1x Pt100, 4-wire ..... | > C |
| Inset tube with 2x Pt100, 2-wire ..... | > D |
| Inset tube with 2x Pt100, 3-wire ..... | > E |

#### Connection Head

|                         |     |
|-------------------------|-----|
| Type B (standard) ..... | > 1 |
| Type BBK .....          | > 2 |
| Type S79 .....          | > 3 |
| Type BUSH .....         | > 4 |
| Type BUS .....          | > 5 |

#### Fitting Length

|                                |     |
|--------------------------------|-----|
| 225 mm .....                   | > 3 |
| 285 mm .....                   | > 5 |
| 345 mm .....                   | > 7 |
| Other lengths on request ..... | > 9 |

#### Output

|  |     |
|--|-----|
| Resistance on terminal strip .....   | > K |
| 2-wire transmitter output signal 4..20 mA<br>(only for inset tube with 1x Pt100) ..... | > L |

#### Measuring Range Transmitter (°C)

|                                   |     |   |
|-----------------------------------|-----|---|
| Without transmitter .....         | > 0 | 0 |
| -50 .. 0 .....                    | > 1 | 0 |
| -50 .. +50 .....                  | > 2 | 0 |
| 0 .. 50 .....                     | > 3 | 0 |
| 0 .. 100 .....                    | > 4 | 0 |
| 0 .. 150 .....                    | > 5 | 0 |
| 0 .. 200 .....                    | > 6 | 0 |
| 0 .. 300 .....                    | > 7 | 0 |
| 0 .. 400 .....                    | > 8 | 0 |
| Other measuring ranges on request |     |   |

#### Mechanical and thermal load of protective tube

#### Type 3F, DIN 43772

Diagram 1

Material 1.4571  
(X6CrNiMoTi17122)

Allowable flow rate:

for air 25 m/s  
for water 5 m/s

max. pressure 40 bar

## Flange Resistance Thermometer TW55

for temperature measurement during high pressure and flow

|                      |  |
|----------------------|--|
| Measuring element    | Measuring insert acc. to DIN 43762<br>Inset tube of stainless steel 1.4571<br>Measuring resistance 1 or 2 Pt100 acc. to DIN EN 60751 |
| Protective tube      | acc. to DIN 43772, type 2F;<br>ø 11 mm; 2 mm wall thickness; material: 1.4571  |
| Neck pipe            | ø 11 mm; length: 145 mm; material: 1.4571  |
| Mounting             | Flange DN25 PN40 acc. to DIN EN 1092-1   |
| Connection           | Standard connection head type B of light metal acc. to<br>DIN EN 50446   |
| max. measuring temp. | 400°C  |

### Ordering Code

|                                  |      |  |  |  |   |   |  |  |
|----------------------------------|------|--|--|--|---|---|--|--|
| Flange Resistance<br>Thermometer | TW55 |  |  |  | 0 | 0 |  |  |
|                                  |      |  |  |  |   |   |  |  |

#### Standard Type

|                                       |   |   |   |
|---------------------------------------|---|---|---|
| Inset tube with 1x Pt100, 2-wire..... | > | A | ↑ |
| Inset tube with 1x Pt100, 3-wire..... | > | B | ↑ |
| Inset tube with 1x Pt100, 4-wire..... | > | C | ↑ |
| Inset tube with 2x Pt100, 2-wire..... | > | D | ↑ |
| Inset tube with 2x Pt100, 3-wire..... | > | E | ↑ |

#### Connection Head

|                         |   |   |   |
|-------------------------|---|---|---|
| Type B (standard) ..... | > | 1 | ↑ |
| Type BBK .....          | > | 2 | ↑ |
| Type S79 .....          | > | 3 | ↑ |
| Type BUSH .....         | > | 4 | ↑ |
| Type BUS .....          | > | 5 | ↑ |

#### Fitting Length

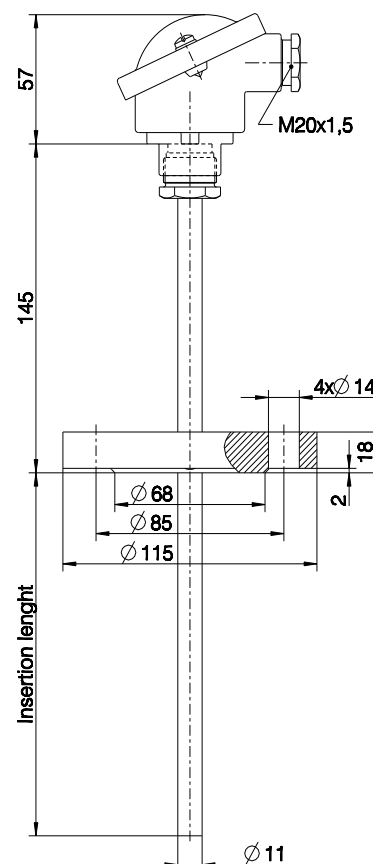
|                                |   |   |   |
|--------------------------------|---|---|---|
| 160 mm .....                   | > | 2 | ↑ |
| 250 mm .....                   | > | 5 | ↑ |
| 400 mm .....                   | > | 8 | ↑ |
| other lengths on request ..... | > | 9 | ↑ |

#### Output

|  |   |   |   |
|--|---|---|---|
| Resistance on terminal strip .....   | > | K | ↑ |
| 2-wire transmitter output signal 4..20 mA<br>(only for inset tube with 1x Pt100) ..... | > | L | ↑ |

#### Measuring Range Transmitter (°C)

|                                   |   |   |   |
|-----------------------------------|---|---|---|
| Without transmitter .....         | > | 0 | 0 |
| -50 .. 0 .....                    | > | 1 | 0 |
| -50 .. +50 .....                  | > | 2 | 0 |
| 0 .. 50 .....                     | > | 3 | 0 |
| 0 .. 100 .....                    | > | 4 | 0 |
| 0 .. 150 .....                    | > | 5 | 0 |
| 0 .. 200 .....                    | > | 6 | 0 |
| 0 .. 300 .....                    | > | 7 | 0 |
| 0 .. 400 .....                    | > | 8 | 0 |
| Other measuring ranges on request |   |   |   |



#### Mechanical and thermal load of protective tube

Diagram 6

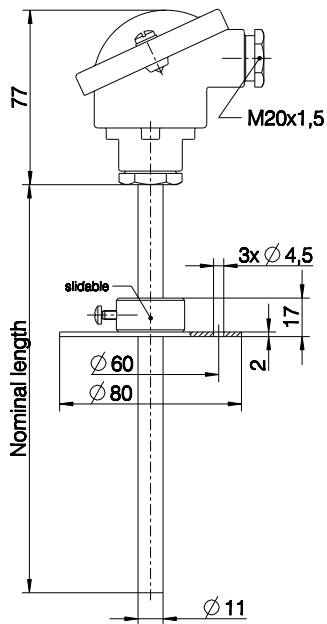
Material 1.4571  
(X6CrNiMoTi17122)

Allowable flow rate:  
for air 40 m/s  
for water 5 m/s

max. pressure 40 bar

## Flange Resistance Thermometer TW56

for temperature measurement during moderate flow and at zero pressure



|                      |  |
|----------------------|--|
| Measuring element    | Measuring insert acc. to DIN 43762<br>Inset tube of stainless steel 1.4571<br>Measuring resistance 1 or 2 Pt100 acc. to DIN EN 60751 |
| Protective tube      | Ø 11 mm; 1 mm wall thickness; material: 1.4571<br>mechanical load for temperature measurement at zero pressure                       |
| Neck pipe            | variable because of movable metal flange   |
| Mounting             | movable metal flange acc. to dimensional drawing   |
| Connection           | Standard connection head type B of light metal acc. to DIN EN 50446  |
| max. measuring temp. | 400°C  |

### Ordering Code

**Flange Resistance Thermometer**

**TW56**

|  |  |  |   |  |   |  |
|--|--|--|---|--|---|--|
|  |  |  | 0 |  | 0 |  |
|--|--|--|---|--|---|--|

#### Standard Type

|  |   |   |   |
|--|---|---|---|
| Inset tube with 1x Pt100, 2-wire ..... | > | A | ↑ |
| Inset tube with 1x Pt100, 3-wire ..... | > | B | ↑ |
| Inset tube with 1x Pt100, 4-wire ..... | > | C | ↑ |
| Inset tube with 2x Pt100, 2-wire ..... | > | D | ↑ |
| Inset tube with 2x Pt100, 3-wire ..... | > | E | ↑ |

#### Connection Head

|                         |   |   |   |
|-------------------------|---|---|---|
| Type B (standard) ..... | > | 1 | ↑ |
| Type BBK .....          | > | 2 | ↑ |
| Type S79 .....          | > | 3 | ↑ |
| Type BUSH .....         | > | 4 | ↑ |
| Type BUS .....          | > | 5 | ↑ |

#### Fitting Length

|                               |   |   |   |
|-------------------------------|---|---|---|
| 200 mm .....                  | > | 3 | ↑ |
| 300 mm .....                  | > | 7 | ↑ |
| 400 mm .....                  | > | 8 | ↑ |
| othe lengths on request ..... | > | 9 | ↑ |

#### Output

|  |   |   |   |
|--|---|---|---|
| Resistance on terminal strip .....   | > | K | ↑ |
| 2-wire transmitter output signal 4..20 mA<br>(only for inset tube with 1x Pt100) ..... | > | L | ↑ |

#### Measuring Range Transmitter (°C)

|                           |   |   |   |
|---------------------------|---|---|---|
| Without transmitter ..... | > | 0 | 0 |
| -50 .. 0 .....            | > | 1 | 0 |
| -50 .. +50 .....          | > | 2 | 0 |
| 0 .. 50 .....             | > | 3 | 0 |
| 0 .. 100 .....            | > | 4 | 0 |
| 0 .. 150 .....            | > | 5 | 0 |
| 0 .. 200 .....            | > | 6 | 0 |
| 0 .. 300 .....            | > | 7 | 0 |
| 0 .. 400 .....            | > | 8 | 0 |

Other measuring ranges on request

## Basic Values and Limit Value Deviation for Pt100 Resistance Thermometers

### Calculation equations for the basic values

The following calculation equations apply to the basic value calculation of Pt100 resistance thermometers acc. to DIN EN 60751. In this equation resistance = R in ohm at temperature t and temperature = t in °C.

For Pt100 in temperature ranges of 0 to 850°C:

$$R_t = 100 (1 + 3.90802 \cdot 10^{-3} \cdot t - 0.5802 \cdot 10^{-6} \cdot t^2)$$

For Pt100 in temperature ranges of -200 to 0°C:

$$R_t = 100 (1 + 3.90802 \cdot 10^{-3} \cdot t - 0.5802 \cdot 10^{-6} \cdot t^2 + 0.42735 \cdot 10^{-9} \cdot t^3 - 4.2735 \cdot 10^{-12} \cdot t^4)$$

As simplification we provide the values for the range of -200 to +850°C in the following table.

### Basic Values (Ohm) for Pt100 Resistance Thermometers acc. to DIN EN 60751

| Temp. °C | 0      | -10    | -20    | -30    | -40    | -50    | -60    | -70    | -80    | -90    | -100   |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| -200     | 18.49  |        |        |        |        |        |        |        |        |        |        |
| -100     | 60.25  | 56.19  | 52.11  | 48.00  | 43.87  | 39.71  | 35.53  | 31.32  | 27.08  | 22.80  | 18.49  |
| 0        | 100.00 | 96.09  | 92.16  | 88.22  | 84.27  | 80.31  | 76.33  | 72.33  | 68.33  | 64.30  | 60.25  |
| Temp. °C | 0      | 10     | 20     | 30     | 40     | 50     | 60     | 70     | 80     | 90     | 100    |
| 0        | 100.00 | 103.90 | 107.79 | 111.67 | 115.54 | 119.40 | 123.24 | 127.07 | 130.89 | 134.70 | 138.50 |
| 100      | 138.50 | 142.29 | 146.06 | 149.82 | 153.58 | 157.31 | 161.04 | 164.76 | 168.46 | 172.16 | 175.84 |
| 200      | 175.84 | 179.51 | 183.17 | 186.82 | 190.45 | 194.07 | 197.69 | 201.29 | 204.88 | 208.45 | 212.02 |
| 300      | 212.02 | 215.57 | 219.12 | 222.65 | 226.17 | 229.67 | 233.17 | 236.65 | 240.13 | 243.59 | 247.04 |
| 400      | 247.04 | 250.48 | 253.90 | 257.32 | 260.72 | 264.11 | 267.49 | 270.86 | 274.22 | 277.56 | 280.90 |
| 500      | 280.90 | 284.22 | 287.53 | 290.83 | 294.11 | 297.39 | 300.65 | 303.91 | 307.15 | 310.38 | 313.59 |
| 600      | 313.59 | 316.80 | 319.99 | 323.18 | 326.35 | 329.51 | 332.66 | 335.79 | 338.92 | 342.03 | 345.13 |
| 700      | 345.13 | 348.22 | 351.30 | 354.37 | 357.42 | 360.47 | 363.50 | 366.52 | 369.53 | 372.52 | 375.51 |
| 800      | 375.51 | 378.48 | 381.45 | 384.40 | 387.34 | 390.26 |        |        |        |        |        |

### Limit Value Deviations for Pt100 Resistance Thermometers acc. to DIN EN 60751

| Temp.<br>[°C] | KI. B DIN |      | KI. B1/2 DIN |      | KI. B1/3 DIN |      | KI. B1/10 DIN |      | KI. A DIN |      | KI. A1/2 DIN |      |
|---------------|-----------|------|--------------|------|--------------|------|---------------|------|-----------|------|--------------|------|
|               | [°C]      | Ω    | [°C]         | Ω    | [°C]         | Ω    | [°C]          | Ω    | [°C]      | Ω    | [°C]         | Ω    |
| -200          | 1.30      | 0.56 | 1.15         | 0.50 | 1.10         | 0.48 | 1.03          | 0.45 | 0.55      | 0.24 | 0.48         | 0.21 |
| -100          | 0.80      | 0.32 | 0.65         | 0.26 | 0.60         | 0.24 | 0.53          | 0.21 | 0.35      | 0.14 | 0.28         | 0.11 |
| -50           | 0.55      | 0.21 | 0.40         | 0.15 | 0.35         | 0.13 | 0.28          | 0.10 | 0.25      | 0.10 | 0.18         | 0.07 |
| 0             | 0.30      | 0.12 | 0.15         | 0.06 | 0.10         | 0.04 | 0.03          | 0.01 | 0.15      | 0.06 | 0.08         | 0.03 |
| 50            | 0.55      | 0.21 | 0.40         | 0.15 | 0.35         | 0.13 | 0.28          | 0.10 | 0.25      | 0.10 | 0.18         | 0.07 |
| 100           | 0.80      | 0.30 | 0.65         | 0.24 | 0.60         | 0.22 | 0.53          | 0.19 | 0.35      | 0.13 | 0.28         | 0.10 |
| 150           | 1.05      | 0.39 | 0.90         | 0.33 | 0.85         | 0.31 | 0.78          | 0.28 | 0.45      | 0.17 | 0.38         | 0.14 |
| 200           | 1.30      | 0.48 | 1.15         | 0.42 | 1.10         | 0.40 | 1.03          | 0.37 | 0.55      | 0.20 | 0.48         | 0.17 |
| 300           | 1.80      | 0.64 | 1.65         | 0.58 | 1.60         | 0.56 | 1.53          | 0.53 | 0.75      | 0.27 | 0.68         | 0.24 |
| 400           | 2.30      | 0.79 | 2.15         | 0.73 | 2.10         | 0.71 | 2.03          | 0.68 | 0.95      | 0.33 | 0.88         | 0.30 |
| 600           | 3.30      | 1.06 | 3.15         | 1.00 | 3.10         | 0.98 | 3.03          | 0.95 | 1.35      | 0.43 | 1.28         | 0.40 |
| 800           | 4.30      | 1.28 | -            | -    | -            | -    | -             | -    | -         | -    | -            | -    |

The given limit value deviations for pt100 resistance thermometers are defined by the following calculation equations:

Limit value deviations in °C

= ± (0.30 + 0.005 \* t) for class B DIN

= ± (0.15 + 0.005 \* t) for class B1/2 DIN

= ± (0.10 + 0.005 \* t) for class B1/3 DIN

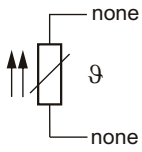
= ± (0.03 + 0.005 \* t) for class B1/10 DIN

= ± (0.15 + 0.002 \* t) for class A DIN

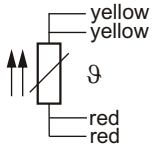
= ± (0.08 + 0.002 \* t) for class A1/2 DIN

## Connection Diagrams

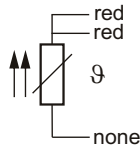
**Single Pt100  
2-wire circuit**



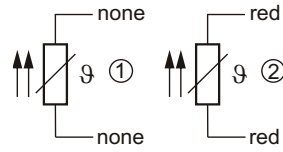
**Single Pt100  
4-wire circuit**



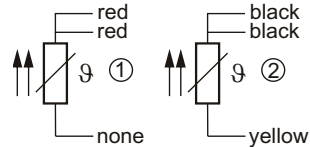
**Single Pt100  
3-wire circuit**



**Double Pt100  
2-wire circuit**



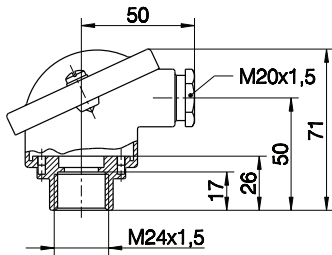
**Double Pt100  
3-wire circuit**



## Standard Connecting Heads (Connecting dimensions acc. to DIN EN 50446)

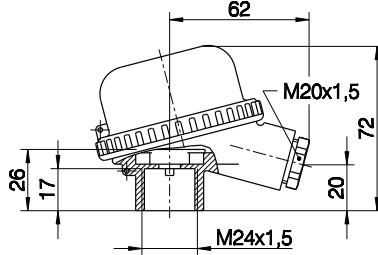
**Type B DIN EN 50446**

Material: diecast light metal  
Protection class: IP54



**Type BBK**

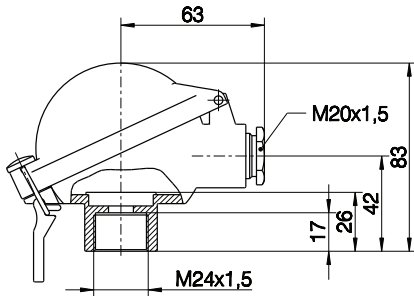
Material: Polyamide (max. 120°C=)  
Protection class: IP54



## Other Possible Connecting Heads (Connecting dimensions acc. to DIN EN 50446)

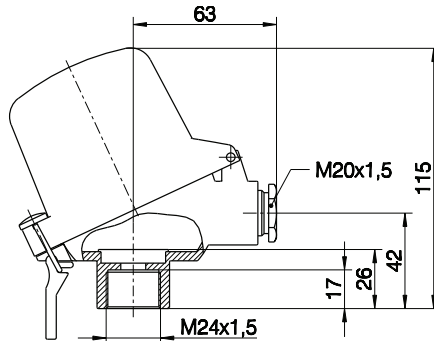
**Type BUS**

Material: diecast light metal  
Protection class: IP65



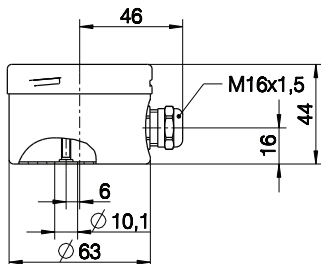
**Type BUSH**

Material: diecast light metal  
Protection class: IP65



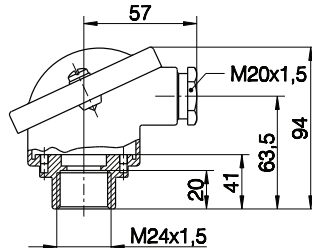
**Type S79**

Material: stainless steel 1.4301  
Protection class: IP65



**Type A DIN EN 50446**

Material: diecast light metal  
Protection class: IP54



**Type F**

Material: cast light metal  
Protection class: IP54

