# Robust analogue temperature transmitter

## Safety warnings

**General:** When mounting, initiating and operating this transmitter the safety precautions have to be observed as well as the regulations. Only staff with a corresponding qualification should work with the transmitter. A non-observance of the safety regulations may cause serious injuries and/or damages. Check before initial operation the suitability of the transmitter for this area of application. The technical data of this manual and the data sheet have to be followed. Use only configured transmitters.

## Characteristics

Input: RTD Pt100 (2-, 3-wire) / thermocouple type T, J, K, S
Output: current loop 4...20 mA
Measuring deviation: ±0,5% of measuring span
Linearity error: ±0,1% of measuring span
Supply: 10...30 V (out of current loop)
Measuring ranges: selectable with solder bridges
Adjustment: with potentiometer
Mounting: eg B head / top hat rail with adaptor

## Configuration (before mounting)

### Transmitters with standard measuring ranges

Transmitters with standard measuring ranges are configurable by means of solder bridges. Access to the solder bridges is gained after removing the bottom of the casing. Mounted transmitters have to be dismantled first before they can be configured.

! To work properly, the transmitter has to be configured. Make sure that the transmitter is configured before mounting. Configuration can be carried out as discribed on page 3 (adjustment).

As an option standard measuring ranges can be configured at the factory and in this case the appropriate measuring range is printed on the rating plate. Transmitters with standard measuring range configured at the factory can be immediately fitted at the measuring point and put into operation.

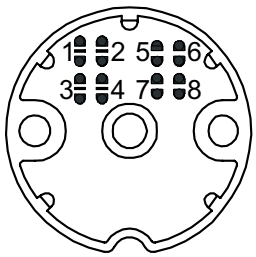
### Transmittes with special measuring ranges

Transmitters with special measuring ranges cannot be reconfigured. Special measuring ranges can be recognised by a 0 as last digit in the model designation: (TRxxxxxx-xx0). Special measuring ranges are configured at the factory and can be immediately fitted at the measuring point and put into operation.

### Working sequence

1. Remove case bottom
2. Set the solder bridges for the desired measuring range in accordance with the tables. The measuring ranges to be selected depend on the model of the transmitter.
3. Snapfit the bottom to the case again
4. Adjust zero point and span by means of potentiometer as discribed on page 3.
5. Note the measuring range on the rating plate (eg with waterproof fibretip pen).

### Position of solder bridges with Pt100



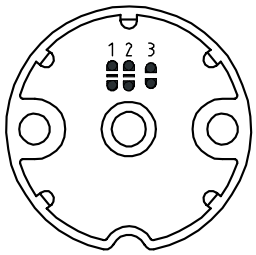

| Pt100 measuring ranges large | |
|---|---|
| measuring range | bridge |
| -50 ... +200 °C | 1●●2 5●●6<br>3●04 7●●8 |
| 0 ... 200 °C | 1●●2 5●06<br>3●●4 70●8 |
| 0 ... 250 °C | 1●●2 5●06<br>3●04 7●●8 |
| 0 ... 300 °C | 1●●2 5●06<br>3004 7008 |
| 0 ... 350 °C | 1●02 5●06<br>3004 7008 |
| 0 ... 400 °C | 1002 5●06<br>3004 7●08 |

| Pt100 measuring ranges small | |
|---|---|
| measuring range | bridge |
| -50 ... +50 °C | 1●●2 50●6<br>3●04 7008 |
| 0 ... 50 °C | 1●●2 5006<br>3●●4 70●8 |
| 0 ... 100 °C | 1●●2 5006<br>3●04 7008 |
| 0 ... 120 °C | 1●●2 5006<br>3004 7008 |
| 0 ... 150 °C | 1●02 5006<br>3004 7●●8 |
| 0 ... 200 °C | 1002 5006<br>3004 7●08 |


MANUAL

## Configuration (continued)

**Postion of solder bridges with thermocouple**




| thermoelement type T | |
|---|---|
| measuring range | bridge |
| -100 ... +200 °C | 1● 0 0 3 |
| -100 ... +300 °C | 1 0 0 0 3 |
| 0 ... 400 °C | 1 0 0 ● 3 |

| thermocouple type K | |
|---|---|
| measuring range | bridge |
| 0 ... 300 °C | 1● ● 0 3 |
| 0 ... 600 °C | 1● 0 0 3 |
| 0 ... 1200 °C | 1 0 0 0 3 |

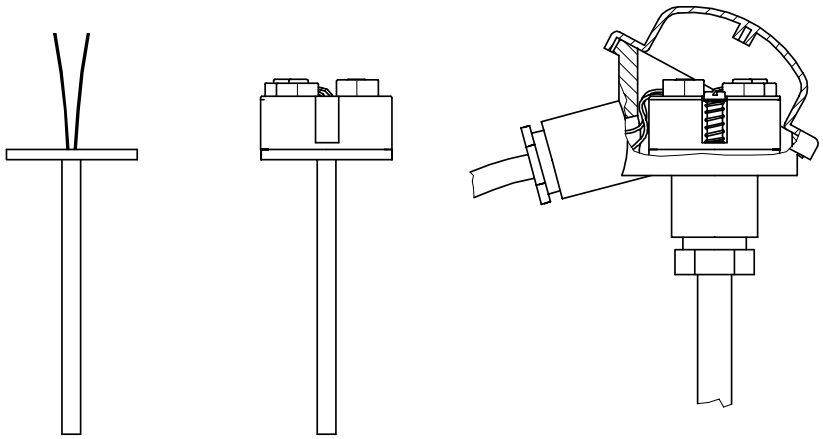
| thermocouple type J | |
|---|---|
| measuring range | bridge |
| 0 ... 350 °C | 1● ● 0 3 |
| 0 ... 550 °C | 1● 0 0 3 |
| 0 ... 700 °C | 1 0 0 0 3 |

| thermocouple type S | |
|---|---|
| measuring range | bridge |
| 0 ... 400 °C | 1 0 0 0 3 |

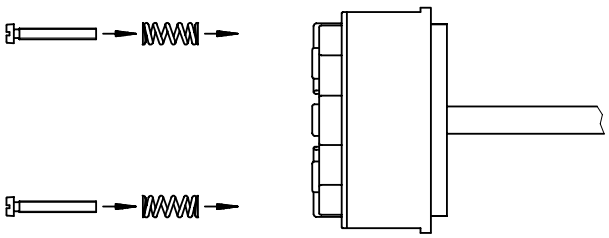
## Mounting

The transmitter for head mounting are desined to be mounted on a measuring insert in a DIN connecting head with form B. The connecting wires of the measuring insert must be approx. 50 mm long and insulated.

Mounting example



Insert the measuring insert with the mounted transmitter in the protective sheath and affix in the connecting head using screws in pressure springs.



## Electrical connections

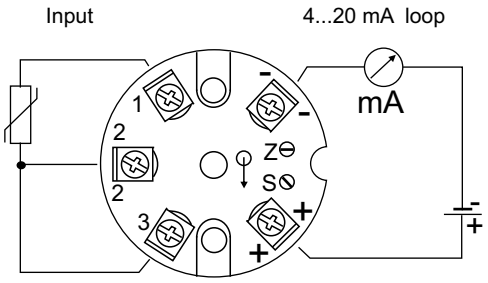
! In the case of these transmitters described here there is an internal galvanic connection between the sensor input and analogue output. No external conducting is to be made (eg by earthing) between the connected temperature sensor and analogue output. In case of flexible leads the use of crimped connector sleeves is recommended.

To connect a Pt100 sensor in a 2-wire connecting circuit:
Set a jumper between the input terminals 2 and 3 (see also top of page 3)

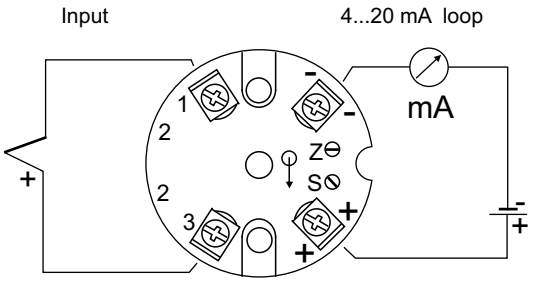
To connect a thermocouple:
Make sure that the thermocouple is connected up with the correct polarity. In case that the cable between the thermocouple and the transmitter must be extended use only thermal or compensating cable corresponding to the connected thermocouple type.

## Electrical connections (continued)

Sensor imput Pt100 / Pt1000




Sensor input thermocouple




The electrical connection is made through the ⊕ and ⊖ terminals. .

- Maximum permissible terminal voltage: 30 V

-Maximum permissible load $R_A$ (dependent upon the loop power supply voltage $U_B$

1000 ohms at 30 V power supply $U_B$

700 ohms at 24 V power supply $U_B$

$R_A \leq (U_B - 10\ V) / 0{,}02\ A$ with $R_A$ in ohms and $U_B$ in V

## Maintenance

The temperature transmitters described here are maintenance-free. The electronics incorporate no components which could be repaired or replaced. Depending on operating conditions, it may be advisable to check the adjustment yearly (adjustment see next section).

## Adjustment of transmitter

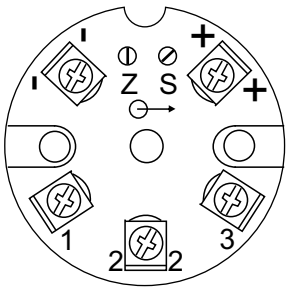
The adjustment of the zero point and the span is carried out with potentiometers. In order to adjust the transmitter output to optimal values please adjust to the desired value by turning the potentiometer in one direction only.

**Example**

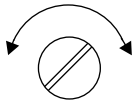
Adjust the potentiometer in a clockwise direction:

The potentiometer has to be turned clockwise (the output current gets higher) until the signal shows the desired value.

If the potentiometer is turned too much (the output current is too high), the potetiometer must be turned back again until a value below below the desired value is reached (output current is too low). Adjust the potentiometer in a clockwise direction again until the desired value is reached. Repeat steps as necessary.




Potentiometer



Z for zero point
S for span

**Preparation**

- Connect a suitable simulation source to the input of the transmitter (Pt100 or thermocouple simulator)

  When simulating a Pt100 connect the simulator in a 3-wire connecting circuit. It is recommended to use passive resistances. Electronical simulation sources can cause incorrect measuring values.
  When simulating a thermocouple the actual terminal temperarure of the transmitter must be pre-set on the simulator (Cold Junction Compensation).
- Connect a mA meter in 4...20 mA-loop according drawing (top of this page) to measure the output signal (with Ri ≤ maximum permissible load).
- Connect a suitable power supply to the transmitter.

**Adjustment**

Carry out steps **A** to **F** in the given order.

**A:** Set the lower value of the measurement range with the simulator, eg. -30 °C for measuring range -30...+50 °C.

**B:** Turn the zero potentiometer **Z**, until the output signal shows the desired value.

**C:** Set the end value of the measurement range with the simulator, eg +50 °C for measurement range -30...+50 °C.

## Adjustment (continued)

**D:** Turn the span potentiometer **S**, until the output signal shows the desired value.

Particularly in case of transmitters with input for thermocouple:
The heat development in the transmitter must be kept low during adjustment procedure by means of a constant voltage source. Otherwise the temperature of the Cold Junction Compansation will not be constant which, in turn, will lead to faulty adjustment. The heat development in the transmitter can be reduced by using a smaller supply voltage.

High output currents (eg 20 mA) should therefore not exist longer than 1 minute (in total) when doing adjustment. If adjustment has to be repeated then allow the transmitter to cool down for approx. 20 minutes (disconnect the transmitter from the power supply).

**E:** Repeat step **A** and check output signal of zero span.

**F:** Repeat step **C** and check output signal of span.

### Closing steps

- Disconnect the simulator, the mA meter and the power supply.

## Technical data

### Input

Ranges selectable: with solder bridges

Resistance thermometer (DIN EN 60751)
TR1...: RTD Pt100 (2- / 3-wire) -50...+200 °C
Ranges: -50...+50 / 0...50 / ...100 / ...120 / ...150 / ...200 °C
TR2...: RTD Pt100 (2- / 3-wire) -50...+400°C
Ranges: -50...+200 / 0...200 / ...250 / ...300 / ...350 / ...400 °C

Thermocouple (DIN EN 60584)
TR3...: type T (-100...+400°C)
Ranges: -100...+200 / ...+300 / 0...400 °C
TR4...: type J (0...700°C) Ranges: 0...350 / ...550 / ...700°C
TR5...: type K (0...1200°C) Ranges: 0...300 / ...600 / ...1200°C
TR6...: type S (0...1500°C)
Other ranges TR1... - TR6...: on request (not cofigurable)

Adjustment range:
Zero potentiometer: TR1...: approx. ±10°C / TR2...: ±25°C
TR3... - TR6...: approx. ±40°C
Span potentiometer: approx. 10%
Sensor current: approx. 0,8 mA
Cold junction compensation for TR3... - TR6...
Maximum lead resistance:
TR1... / TR2...: 30 ohms each lead, 3-lead symmetric
TR3... - TR6...: 500 ohms total resistance

Effect connection leads: ±0,2K / 10 ohms
For TR1... / TR2...: with 3-wire lead connection only, for 2-wire lead connection lead resistance counts fully towards error.

### Output:

Analogue: 4...20 mA (2-wire design)
Measuring deviation: ±0,5%
For TR1... - TR6...: with factory configured measuring range
Values are valid at 23 °C ±5 K (according DIN EN 60770)
Linearization: temperature according DIN EN 60751
TC: proportinal to voltage
Linearity error: ±0,1% (RTD)
TR1... - TR6...: ±0,15% for range 0...50 / ...300 / .. 350 °C
Amplification error: ±0,1% (TC)
Temperature coefficient zero:
TR1..., TR2...: ±0,1% / 10K, ±0,2K /10K
TR3... - TR6...: ±0,1% / 10K, ±25µV / 10K
Greater value is valid.
Temperature coefficient gain: ±0,2% / 10K

### Output (continued)

Error effect of cold junction compensation:
TR3... - TR6...: at Ta -20...+60°C: ±1.0K
at Ta -40...+85°C: ±2,0K
Rising time t90: <1ms
Switch-on delay: <10ms (electric)
Signalling with sensor burnout
TR1... / TR2...: down scale <3 mA
up scale, in case only lead no.1 open
TR3... - TR6...: up scale, >23,5 mA

Signalling with sensor short circuit
TR1... / TR2...: down scale, <3 mA
Temperature value in case of short circuit between leads no.2 and no.3 (operation of Pt100 in 2-lead connection)
Load: TR1... - TR6...: Ra <(UB-10 V) / 0,02 A
Load effect: ±0,05% / 100 ohms
Power supply effect: ±0,025% / V

### Ambient conditions

Operating temperature: -40...+85°C
Storage temperature: -40...+85°C
Climate class: Cx (-40...+85°C, 5% up to 95% relative humidity) DIN EN 60654-1
Humidity maximum: 95% rF noncondensing
Vibration: 10...2000 Hz 5g DIN IEC 68-2-6
Shock: DIN IEC 68-2-27
EMV: according DIN EN 61326-1

### Supply

Voltage: 10...30 VDC out of current loop 4...20 mA
Reverse polarity: existing

### Mechanics

Enclosure: for head mounting
Material: polyamide, glass fibre reinforced
Protection: enclosure IP40 (IEC 529 / EN 60 529)
terminals IP00 (IEC 529 / EN 60 529)
Cross section of terminals: 0,14...1,5 mm²
Weight: approx. 30 g
Dimensions: Ø43 x 20/21 mm