

Precision Temperature Transmitter

Measurement of Temperature and Temperature Difference with Pt100 Sensors



- High accuracy: typical error < 0,03 °C
- At difference measurement the output is independent of the absolute temperature
- Minimum span 5 °C
- Output either voltage (e. g. 0-10 V) or load independent current (e.g. 4-20 mA)
- Calibration protocol with each transmitter

The transmitter DA 576 is intended for temperature measurements with Pt100 sensors, when the highest accuracy and stability is needed. Examples of applications for the DA 576 transmitter are:

- Power/energy measurement in hot water systems
- Heat pumps
- Cooling efficiency in coolers
- Monitoring of risk for freezing/icing in water inlets (turbine application)
- Batch-boiler temperature at paper pulp production

1. Function

The input of DA 576 can only handle Pt100 sensors. At absolute temperature measurement as well as at difference measurement the output signal is linearized. In the case of difference measurement this means that the output gives the correct difference value independent of the temperature level at which the difference is measured. The DA 576 has no galvanic isolation between input and output signal. There is no electrical potential between input and output, which means that grounding of the output will not cause any measurement error with the normal isolation levels of industrial Pt100 RTD's up to about 300 °C. Thanks to a very special input circuitry the influence of the sensor lead resistance has been reduced to a practically negligible level (about 0.01 °C). The EMC immunity is also very high allowing long sensor cables to be used.

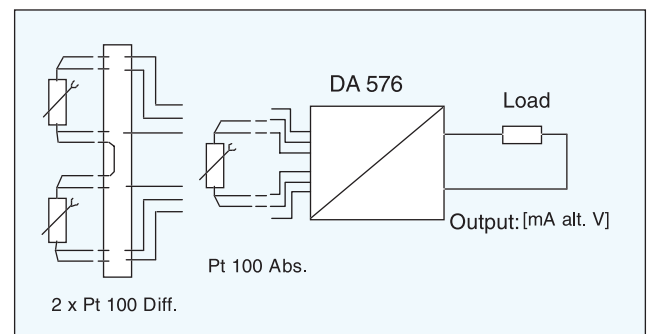


Fig. 1.1.

2. Input

General input data

| Specification | Pt100, 4-w, Abs.Temp (T1) | 2 x Pt100, Diff. Temp.(T1-T2) |
|----------------------------|---------------------------|---|
| Range | T1:-10 +200 °C | T1: -10 ... +200 °C T2: -10 ... +150 °C (T1-T2): -50 ... +50 °C |
| Min.span | T1: 5 °C | (T1-T2): 5 °C |
| Zero point range | T1: -10 +50 °C | (T1-T2): -10 ... +20 °C |
| Max sensor lead resistance | 10 Ω per lead | 10 Ω per lead |
| Sensor current | 3 mA (all ranges) | 3 mA (all ranges) |

3. Output

General output data

| Specification | Standard | Option |
|-------------------------|--|---|
| Output mA | 4-20 or 0-20 mA (DA 576-I) | Reversed output or other, smaller range, min 5 mA |
| Output V | 0-10 V (DA 576-U) | 2-10 V, 0-5 V, 1-5 V, Reversed output. |
| Max load | 600 Ω at mA output 2 mA at V output | |
| Current/Voltage limit | About 25 mA or 12.5 V | |
| Response time, t_{50} | About 50 ms | |

4. Power Supply

Standard: 230 V AC, 45 - 75 Hz, 4 VA. Other AC supply on request

Permissible variation: -15...+10 % .

Option: 19 - 60 V DC

5. Environment, Size and Weight

| | |
|------------------------------------|-------------|
| Ambient operating temperature [°C] | 0 ... +60 |
| Ambient storage temperature [°C] | -25 ... +70 |
| Protection class | IP 20 |
| Weight (Shipping) [kg] | ca 0,5 |

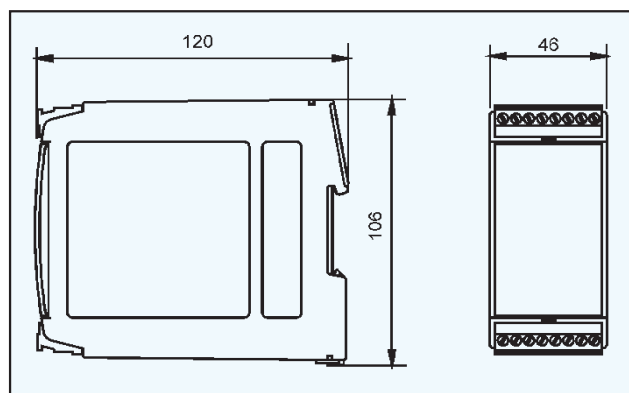


Fig. 5.1. DA 576 Dimensions (mm).

6. Inaccuracy of DA 576

DA 576-U: Voltage output
DA 576-I: Current output

Inaccuracy and error influences (‰ refers to the span of the measuring range)

| | DA 576-U | | DA 576-I | |
|--|---------------|-----------|---------------|-----------|
| | Typical error | Max.error | Typical error | Max.error |
| Pt100, 4-w, Absolute temperature | | | | |
| Calibration: zero-/endpoint incl. nonlinearity [°C] | 0,01 | 0,02 | 0,015 | 0,025 |
| Temp. drift zero point [°C / °C] | 0,0005 | 0,001 | 0,001 | 0,0015 |
| Temp. drift span ¹⁾ [‰ / °C] | 0,02 | 0,03 | 0,03 | 0,05 |
| Long term stab. zero point [°C] | 0,01 | 0,02 | 0,015 | 0,025 |
| Long term stab. span ¹⁾ [‰] | 0,15 | 0,2 | 0,25 | 0,4 |
| Pt100, 4-w, Differential temperature | | | | |
| Calibration: zero-/endpoint incl. nonlinearity [°C] | 0,015 | 0,04 | 0,025 | 0,05 |
| Temp. drift zero point [°C / °C] | 0,0003 | 0,0005 | 0,0005 | 0,001 |
| Temp. drift span ¹⁾ [‰ / °C] | 0,02 | 0,03 | 0,03 | 0,05 |
| Long term stab. zero point [°C] | 0,01 | 0,02 | 0,015 | 0,025 |
| Long term stab. span ¹⁾ [‰] | 0,1 | 0,2 | 0,25 | 0,4 |
| Pt100, common for Absolute and Differential temperature | | | | |
| Sensor wire resistance effect on zero-/endpoint [°C per Ω] | 0,002 | 0,003 | 0,003 | 0,005 |
| Repeatability error [‰] | 0,1 | 0,1 | 0,1 | 0,1 |
| Influence of variation of supply voltage and output load (within permissible limits) ²⁾ [‰] | < 0,05 | < 0,05 | < 0,05 | < 0,05 |

¹⁾ If the calculated effect would become less than 0,01 °C; still use the value 0,01 °C

²⁾ DA 576-U: Min. load 5 kΩ
DA 576-I: Max. load 600 Ω

7. Standards

| EMC-data | | | |
|---------------------------------|---|--------------------------------------|-------------------------|
| EMC-Category | Basic standard | Severity | Functional Requirements |
| ESD (electrostatic discharge) | IEC 1000-4-2 | 8 kV air 6 kV contact | Criterion A |
| Radiated, electromagnetic field | IEC 1000-4-3 | 80 % AM 1 kHz, 10 V/m 80-1000 MHz | Criterion A |
| Bursts | IEC 1000-4-4 | Level 3 (2 kV) | Criterion A |
| Surge | IEC 1000-4-5 | Level 3 (2 kV) | Criterion A |
| Injected RF-interference | IEC 1000-4-6 | 80 % AM 1 kHz, 10 V 0,15-80 MHz | Criterion A |
| Magnetic field | IEC 1000-4-10 | Level 4 (1000 A/m) | Criterion A |
| 1 MHz osc | IEC 1000-4-12 | Level 3 (1 kV) | Criterion A |
| LVD-Qualifications | IEC 1010-1, Installation category III, max. 250 V | | |

8. Connections

Sensor wire connection: The Pt100 sensor (or both sensors at diff.) must always be connected with four wires. The wire resistance (in either wire) may be 4Ω with error effect less than $0.01 \text{ }^\circ\text{C}$. This corresponds to a Cu-wire with area 1 mm^2 and length 250 m. Thus the DA 576 unit can normally be centrally located or any other place with nonstressing envi-

ronment, e.g. small variation in ambient temperature, and convenient access.

Shielded input and output cables should be used outside the cubicle in which DA 576 is mounted. The way to ground the shields is shown in fig. 9.3 below.

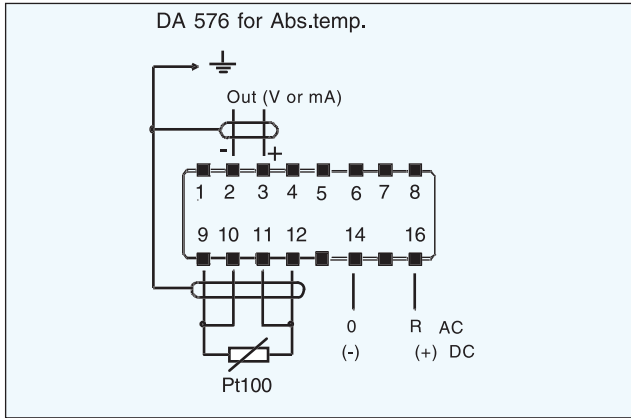


Fig 9.1 Wiring diagram for absolute temperature

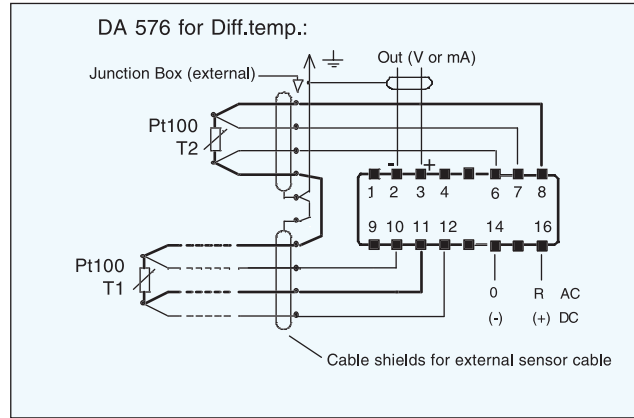


Fig 9.2 Wiring diagram for differential temperature

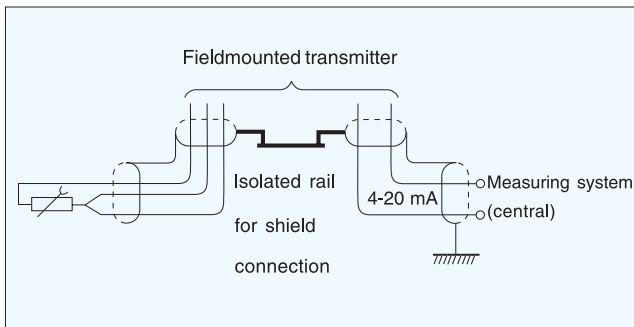


Fig. 9.3 Recommended shield grounding

Cables and terminals

| | |
|-------------------|------------------------------------|
| Cable type | Multistranded |
| Max cable area | $2,5 \text{ mm}^2$ |
| Terminal material | Tin and nickel plated copper alloy |

10. Order Specification

Selections

Precision Transmitter DA 576-U, alternatively DA 576-I

| | |
|--------------|--|
| Input | Pt100, 4-w., Abs. alternatively 2 x Pt100 4-w, Diff. |
| Range | [a] |
| Output | [b] |
| Power supply | [c] |

- [a] Input range within the limits given in section 2
 [b] 0-10 V, 2-10 V, 0-5 V, 1-5 V for DA 576-U
 0-20 mA or 4-20 mA for DA 576-I
 [c] 230 V AC is standard, other AC-voltages on special request
 DC-supply voltage 19-60 VDC

Order example

Precision Transmitter DA 576-I

| | |
|--------------|-----------------------|
| Input | Pt100, 4-w. Abs. |
| Range | 0-40 $^\circ\text{C}$ |
| Output | 4-20 mA |
| Power supply | 230 VAC |