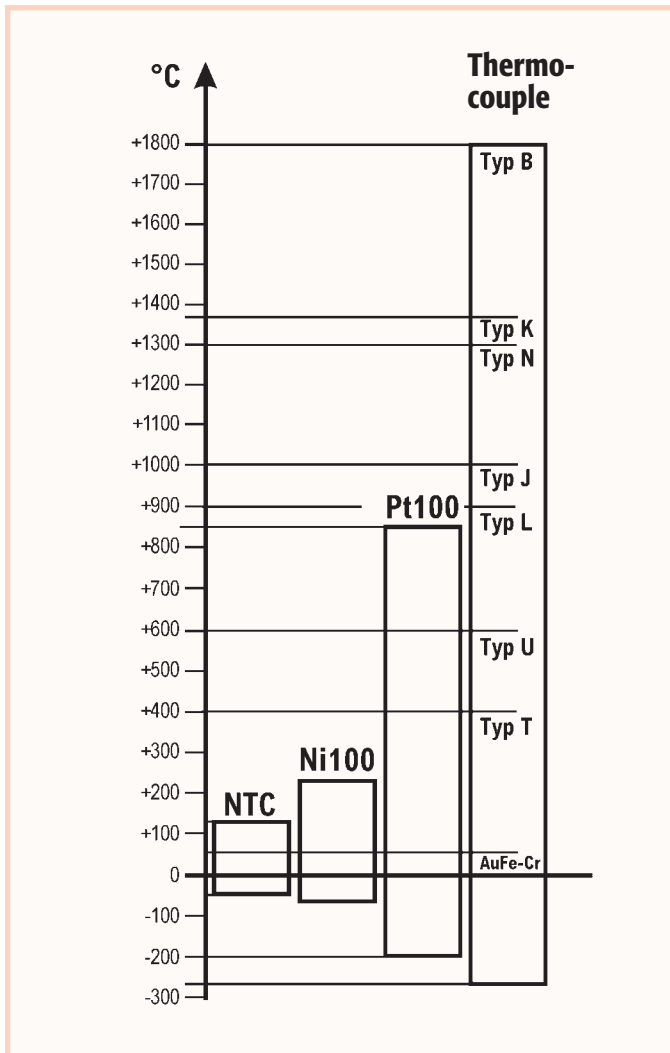


TEMPERATURE

The Right Temperature Sensor For Any Measuring Task



Selecting the right type of temperature sensor depends on your measuring task. For example, thermocouples, resistor-based sensors (Pt100 and Ntc) and pyrometers (infrared sensors) are available.

Rule of Thumb:

- ▶ Thermocouples are very fast and provide a large measuring range.
- ▶ Resistor-based sensors are more accurate but slower.
- ▶ Ntc sensors are very fast, accurate, but they have a limited measuring range.
- ▶ Infrared sensors do not contact the device under test and they have very small time constants, but they depend on the emission grade.
- ▶ The larger the measuring range, the more universal the possible range of applications.

Selection Criteria:

Select the temperature sensor that suits your measuring task according to the criteria below:

- ▶ Meas. range
- ▶ Accuracy
- ▶ Response time
- ▶ Stability
- ▶ Type of construction

Note:
Non-contact temperature measurement with AMiR infrared devices can be found in section 18

01/2007 We reserve the right to make technical changes.

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Thermocouples

Thermocouples consist of two spot-welded wires of different metals or alloys. The thermoelectric effect at the contact surface is used to measure temperatures. A relatively small thermoelectric voltage is caused, which depends on the temperature difference between the measuring point and the connecting terminals.

Accuracy, Operating Temperatures:

The basic values for the thermoelectric voltages and for the permissible tolerances of thermocouples are specified in standard DIN/IEC 584. Our thermocouple sensors are available in two tolerance classes as per DIN/IEC 584-2. For type K the following limit values apply (highest value in each case) :

Class 1 : $\pm 1.5 \text{ }^\circ\text{C}$ or $\pm 0.004 \times |t|$ (-40 to +1000 $^\circ\text{C}$)

Class 2 : $\pm 2.5 \text{ }^\circ\text{C}$ or $\pm 0.0075 \times |t|$ (-40 to +1200 $^\circ\text{C}$)

Our thermocouple sensors generally comply with Class 2 as per DIN/IEC 584-2. The specified T_{\max} values refer to the tip of the sensor. The specified T_{90} times refer to measuring operations in a moving liquid. The sensor handles and cables are usually resistant to temperatures up to +80 $^\circ\text{C}$. Heat-resistant silicon or Teflon cables are also available on request.

Various types of thermocouples are available; these can be distinguished in terms of their temperature range, sensitivity, and in particular their compatibility with the test substance. The most popular thermocouple is the NiCr-Ni (type K).

As sensor connecting cables and extension cables we use compensation lines. The compensation lines generally comply with Class 2 as per DIN 43722. For type K the operating temperature range of the compensation line is 0 to +150 $^\circ\text{C}$.

Resistor-Based Sensors (Pt100 Sensors)

When measuring the temperature the increase in resistance at increasing temperatures is utilised at the Pt100 sensors. The measuring resistor is fed with a constant current and the voltage drop at the resistor is measured as a function of the temperature. Due to the small resistance variation (0.3 to 0.4 $\Omega/^\circ\text{C}$) the 4-conductor circuit should always be used to exclude any influences from the lead wires.

Accuracy, Operating Temperatures:

Pt100 sensors are, as standard, used with Class B (DIN/IEC 751) measuring resistors (surcharge for 1/2 DIN Class B or 1/5 DIN Class B accuracy). The specified T_{\max} values relate to the tip of the sensor. The specified T_{90} times are related to measurements in a moving liquid. The sensor handles and cables are usually resistant to temperatures up to +80 $^\circ\text{C}$. Heat-resistant silicon or teflon cables are available on request.

Measuring ranges, resolution

PT100 probes FP Axx are by default assigned measuring range PT100-1 (resolution 0.1 K). Measuring range PT100-2 (resolution 0.01K) can be programmed as alternative on the 1st channel or in addition on the 2nd channel.

New : Measuring range PT100-3 (resolution 0.001K) in range 0 to 65 $^\circ\text{C}$ (for V6 devices, with effect from 2690-8, 2890-9, 85/8690-9, 5690-1/2)

Thermistors (NTC Sensors)

NTC sensors (thermistors) have a significantly higher resistance than Pt100 sensors. When measuring temperatures their negative temperature coefficient is utilised, i.e. the resistance is decreasing with increasing temperatures.

Accuracy, Operating Temperatures:

The accuracy data of the normalised NTC sensors are based on manufacturer specifications. The specified T_{\max} values relate to the tip of the sensor. The specified T_{90} times are related to measurements in a moving liquid. The sensor handles and cables are resistant to temperatures up to 90 $^\circ\text{C}$.

Measurement Accuracies of Resistor-Based Temperature Sensors

Designation	Range	Maximum Deviation		
NTC element (10K at 25 $^\circ\text{C}$) with 1.5m sensor cable	-20 to 0 $^\circ\text{C}$	$\pm 0.4 \text{ K}$		
	0 to 70 $^\circ\text{C}$	$\pm 0.1 \text{ K}$		
	70 to 125 $^\circ\text{C}$	$\pm 0.6 \text{ K}$		
Test resistances Pt 100 Ω	at -200 $^\circ\text{C}$	Class B	1/2 DIN Class B	1/5 DIN Class B (0 $^\circ\text{C}$)
	at -100 $^\circ\text{C}$	$\pm 1.3 \text{ K}$		
	at 0 $^\circ\text{C}$	$\pm 0.8 \text{ K}$		
	at 0 $^\circ\text{C}$	$\pm 0.3 \text{ K}$	$\pm 0.15 \text{ K}$	0.06 K
	at +100 $^\circ\text{C}$	$\pm 0.8 \text{ K}$	$\pm 0.4 \text{ K}$	
	at +200 $^\circ\text{C}$	$\pm 1.3 \text{ K}$		
	at +300 $^\circ\text{C}$	$\pm 1.8 \text{ K}$	$\pm 0.9 \text{ K}$	
at +400 $^\circ\text{C}$	$\pm 2.3 \text{ K}$			
higher accuracies for an additional charges		Order No. OPG2	Order No. OPG5	

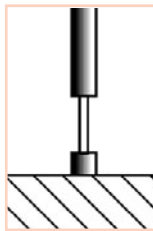
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Types and Fields of Application

The types of construction of temperature sensors are as many and diverse as the measuring tasks.

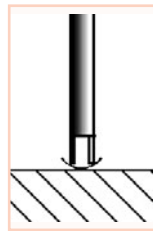
T_{max} is the maximum operating temperature of the probe tip. T_{90} is the time required by the sensor to reach 90% of the step response after a jump of temperature. The specified T_{90} times are related to measurements in a moving liquid.

The temperature sensors listed are also available, on request, with other lengths and diameters.



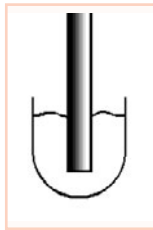
Surface sensors with flat measuring tip

For measurements on good heat conductors, on even and plain surfaces.



Surface sensor with spring-type thermocouple band

For quick measurements, also on non-plain surfaces.



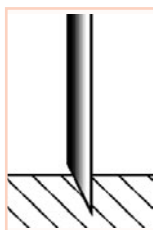
Immersion probes

For measurements in liquids, as well as powdery substances, air and gases.



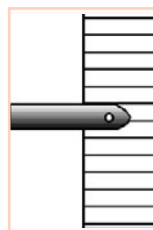
Sensors with heat-resistant measuring tip

For measurements at extremely high temperatures.



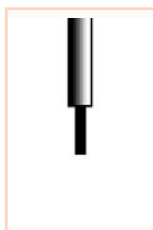
Sensor with penetrating tip

For measurements in plastic and pasty substances.



Sword probe

For measurements in paper, cardboard and textile stacks.



Transducer with free sensor

For measurements in air and gases.



If you do not find a suitable sensor in this catalogue, we can manufacture it according to your specifications (technical drawing or detailed specification) and supply you with a customised sensor!

Temperature Measurement à la ALMEMO®

All ALMEMO® sensors can be adjusted, i.e. the correction values of the sensor can be stored in the connector. This considerably increases the accuracy of measurement.

As a result of the DKD and factory-set calibrations performed by us, the corrective factors are automatically determined, stored in the connector plug and permanently locked. Maximum accuracy can then be achieved.

Ordering Information

ALMEMO® sensors are available in different designs. The type designation can be identified by:

- "P" = temperature sensor with Pt100W test resistance
- "N" = temperature sensor with NTC element
- "T" = temperature sensor with NiCr-Ni element

All temperature sensors with an ALMEMO® flat connector can be identified by the "A" in the order no. Naturally, they are also available for the measuring instruments of our THERM series. In this case they will have a circular connector. When ordering please replace the letter "A" by the number "9".

Example: FT**A**1201 (with ALMEMO® connector) >> FT**9**1201 (with circular connector for THERM devices)

Describe your measuring task to us!

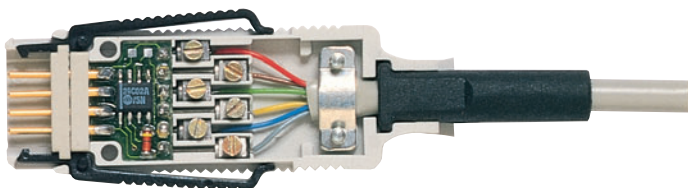
We can provide you with comprehensive advice and find the most cost-effective solution for you.

Please do not hesitate to ask!

Use Your Existing Sensor Technology!

The patented idea of the intelligent connector makes the ALMEMO® system an extraordinarily flexible measuring system. Instead of our pre-configured ALMEMO® sensors you can also use your own, existing sensors.

- ▶ We can supply you with pre-programmed ALMEMO® connectors that contain the corresponding sensor parameters and matching measuring ranges. They have six screw terminals and can be easily connected.
- ▶ You can correct the errors of the sensors, which means that even simple sensors become precision transducers
- ▶ Listing all the combinations and application options would be beyond the scope of this catalogue. Special programming, range extensions and linearisations for other sensor technology are always available for ALMEMO® devices.
- ▶ The pricing for this results from the efforts and the number of devices required.



**ALMEMO® sensor connector
with 6 terminal screws and
EEPROM in original size**