

PTC-resistor temperature sensors , MINIKA®

to DIN 44 081 and DIN 44 082

General points

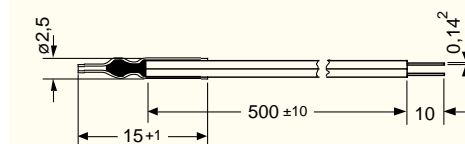
PTC-resistor temperature sensors (also called PTC-resistors or thermistors) are temperature dependent semiconductor resistors whose main function is to alter their electrical resistance drastically when their body temperature changes within the response range.

PTC-resistors are used principally to protect windings in electromotors or transformers against excess temperature. They also find application in machines, tooling machines especially machine bearings and controlling the temperature of power semiconductors.

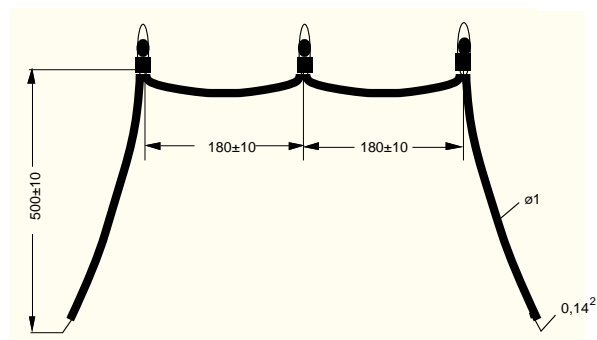
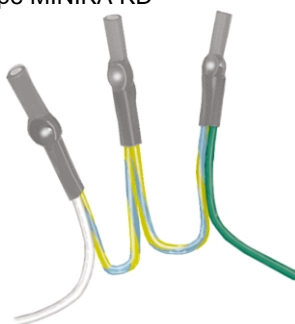
PTC-resistor temperature sensors are particularly suited to this purpose due to their precise response range combined with small dimensions and minimal thermal inertia at low cost. PTC-resistor sensors are available in 2 designs. In its standard design the sensor element has a diameter of approx. 4 mm. The MINIKA® model has a diameter of only 2.5 mm.

MINIKA®

type MINIKA K



type MINIKA KD



Markings

Temperature sensors are marked according to their nominal response temperature (NRT).

Marking achieved using corresponding colours for the leads. How colours are allocated can be seen from the table.

Leads

The sensor leads comprise a silvered Cu-strand with PTFE teflon insulation. Standard lengths run as follows:

Single PTC-resistor 500mm ± 10 mm
Triple PTC-resistor 500-180-180-500 ± 10 mm
The stand cross-section is 0.14 mm².
In addition to these, any special designs are available on request.

Resistors

The resistance of each individual sensor (according to standard) must, for temperatures related to the Nominal Response Temperature, have the following values:

- ≤ 250 Ohms at temperatures of -20°C to NRT -20 degrees. Measurement voltage up to max. 2.5 V
- ≤ 550 Ohms at a temperature of NRT -5 degrees. Measurement voltage max. 2.5 V
- ≥ 1330 Ohms at a temperature of NRT +5 degrees. Measurement voltage max. 2.5 V
- ≥ 4000 Ohms at a temperature of NRT +15 degrees. Measurement voltage max. 7.5 V

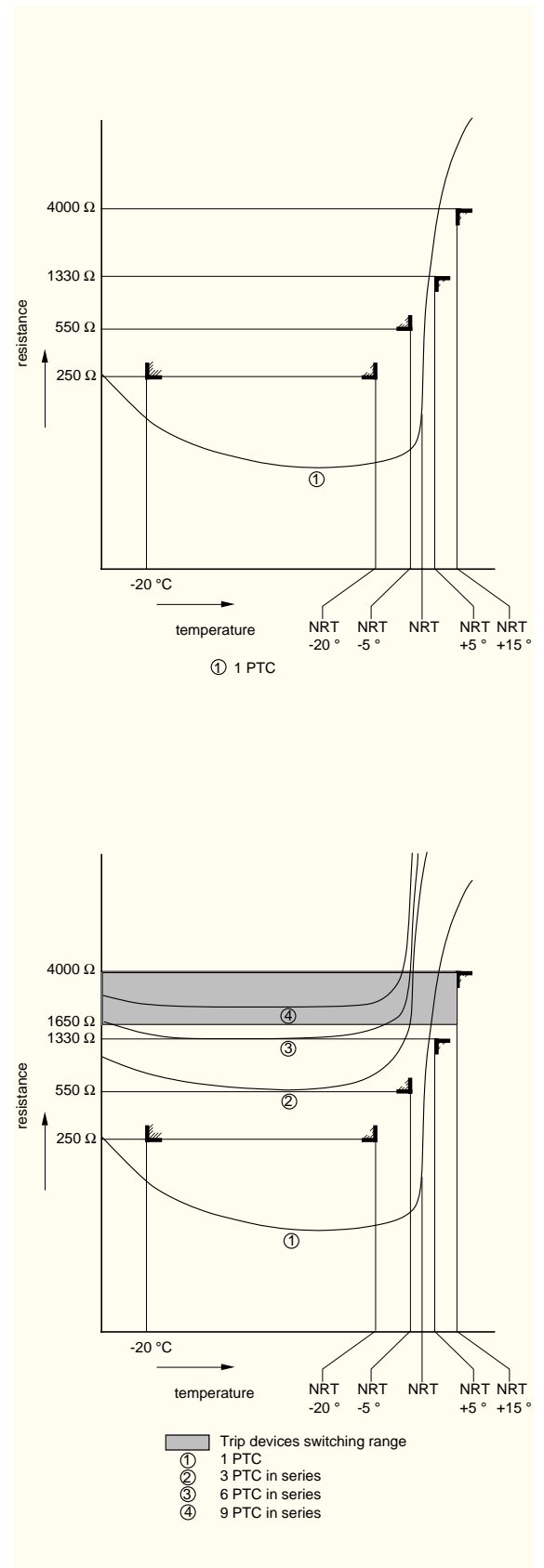
The exact values of the resistance values in the temperature ranges are not relevant. Flawless sensors should have a cold resistance of between 20 and at most 250 Ohms. Typical values (ambient temperature) lie between 50 - 150 Ohms.

The exact value of the cold resistance has no meaning for the functioning of the PTC, as long as it is within the specified limits.

In accordance with standards, trip devices switch between 1650 Ohms and 4000 Ohms.

If a varying number of temperature sensors connected in series to a trip device are subjected to uniform heat, this results in the following cut-off point:

- 1 PTC switches at latest at NRT +15 degrees, at earliest at NRT +5 degrees.
- 3 PTC (typical instance) switch at latest at NRT +5 degrees, at earliest at NRT -5 degrees.
- 6 PTC switch at latest at NRT, at earliest at NRT -20 degrees.
(Absolutely uniform heating of all sensors virtually never occurs in this instance).



Insulation classes

For built-in PTC-resistors, we recommend the following nominal cut-off temperature values for machines which are used to full capacity within permissible heating limits in keeping with their insulation class (VDE 0530).

These values can then be correspondingly reduced for machines at less than full capacity. In some instances it might prove necessary to work out nominal response temperature values which deviate somewhat from

the values recommended in the table, on the basis of trial and error. When it is intended as a preliminary warning, the value recommended as nominal response temperature is 20°C below the break temperature.

| Insulation material class | | | |
|---------------------------|-------|-------|-------|
| E | B | F | H |
| 110°C | 130°C | 150°C | 170°C |

Fitting PTC-resistor temperature sensors

PTC-resistors can only be fitted before a winding has been impregnated by the motor manufacturer. It is not possible to insert them at a later stage.

Each winding has a sensor of its own. This means fitting 3 in single-speed motors and 6 in pole changing motors, with these sensors arranged in series and taken to separate terminals in the terminal box.

Measuring circuit must be provided with a separate power supply. The use of motor supply lines or other main current lines is unacceptable. Shielded supply lines must be used in case inductive or capacitive interference is produced by nearby high-voltage lines.

The maximum line length for a cable diameter of 0.5 mm² is approx. 500 m. For greater diameter cable, correspondingly more (except MSM 220 F).

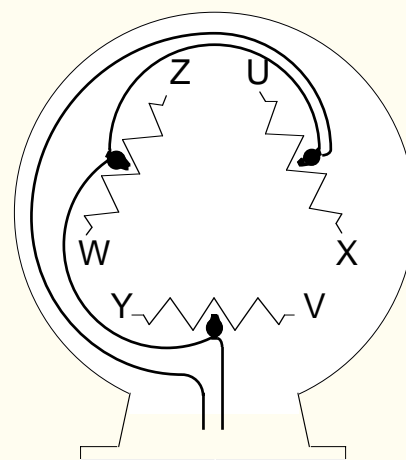
Fitting should, where possible, be carried out at the warmest winding head in the exhausted-air-side of the electrical machine. Care should be taken to ensure good heat contact between the sensors and the winding when being fitted. The more intimate the connection between a PTC-resistor and its winding, the better the winding temperature is registered, especially when temperatures rise sharply. For this reason, Temperature sensors should be implanted in the middle of the end winding-heads so as to be surrounded on all sides by the winding copper.

To fit the temperature sensors, the ready-shaped winding heads are spread apart in the centre using a piece of winding wood. The temperature sensors should be inserted parallel to the winding wires, care being taken that the winding wires are actually touching the temperature sensors. Cavities and air-occlusions impair heat contact and can be minimized by exerting pressure by hand to close the gap between winding wires and sensors. At the spot where the sensors are to be fitted, the winding wires on the end winding should be tightly bandaged. If the wire is more than 1 mm² thick, intervening spaces should be filled in with resin thickened with quartz powder.

If the motor manufacturer uses special saturants or impregnating resins whose chemical behaviour is anything but neutral, or if he uses some special working method, he will have to test the temperature sensors' resistivity himself in the operating conditions he will use.

To prevent peaks in interference voltage due to the formation of loops, we recommend that the connecting strand be fed back on the same side as the lead.

Assembly Tip: Do not shorten leads which are too long, roll them up and fasten them in position.



Testing fitted PTC-resistors

A maximum DC-voltage of 2.5 V can be passed through PTC-resistor temperature sensors when testing. Buzzers (voltage peaks) and similar testers should, therefore, not be used, but only meters or bridges.

For all measurement voltage values up to DC 2.5 V, resistance

values ranging from -20°C to NRT -20 degrees should not exceed 250 Ohms. Exact resistance values within this temperature range are unimportant. For flawless sensors, the lowest resistance value is generally above 20 Ohms.

When measurement values are being determined, care must be taken that the measurement results are not influenced by the selfwarming of the sensors. In the course of the manufacturing process, we test all sensors for NRT and disruptive strength.

Electrical data

Limit values

| | |
|---|------------------------------------|
| Max. perm. operational voltage | U _{max} . 30 V |
| Max. perm. PTC-resistor temp. | T _{max} . 200°C |
| Max. perm. top temperature | T _{max} . *210°C for 12 h |
| Test voltage (Strand against insulation) also for screwable sensors | 2.5 kV |

Characteristic values

| | |
|----------------------------------|--|
| Measuring voltage below NRT +5°C | max. DC 2.5 V |
| Leads | silvered copper strand with PTFE teflon insulation |
| Stripping of lead ends | approx. 10 mm, twisted |
| Dielectric strength of leads | AC 660 V _{eff} , permanent |
| Shrink-tube | Kynar, approx. 15 mm |
| Donut diameter | 3.5 mm (2.5 mm for MINIKA) |
| Thermal sensor time constant | approx. 2.5 - 3.5 sec (MINIKA < 2 sec) |
| PTB-approval Nr. | Trade No. 2.42-2550/75 |

Mechanical data

| | |
|--------------------------------|---|
| Lead length | Single PTC-resistor 500 mm ± 10 mm (standard) Double PTC-resistor 500-180-500 mm ± 10 mm (standard) Triple PTC-resistor 500-180-180-500 mm ± 10 mm (standard) Oil immersed single PTC-resistor 1200 mm ± 10 mm Other connection lengths are available on request. |
| Lead cross-section | 0.14 mm ² for single, double and triple PTC-resistors 0.75 mm ² for oil immersed single PTC-resistors |
| Standard identification colour | see table |
| Nominal response temperature | 60°C...180°C |

Special designs are available on request.

Order numbers for ZIEHL single PTC-resistor

Lead length: **500 ± 10 mm**
 Standard cross-section: **0.14 mm²**
 weight: **approx. 260 g / 100 pcs**

| Type | NRT°C | Standard ID colour (DIN 44 081) | Order number MINIKA® | Order number standard |
|-------|---------|---------------------------------|-------------------------|--------------------------|
| K 60 | 60 ± 5 | white - grey | K 401000 | |
| K 70 | 70 ± 5 | white - brown | K 401010 | |
| K 80 | 80 ± 5 | white-white | K 401005 | K 301005 |
| K 90 | 90 ± 5 | green -green | K 401015 | K 301015 |
| K 100 | 100 ± 5 | red - red | K 401025 | K 301025 |
| K 110 | 110 ± 5 | brown - brown | K 401035 | K 301035 |
| K 120 | 120 ± 5 | grey - grey | K 401045 | K 301045 |
| K 130 | 130 ± 5 | blue - blue | K 401055 | K 301055 |
| K 140 | 140 ± 5 | white - blue | K 401065 | K 301065 |
| K 150 | 150 ± 5 | black -black | K 401075 | K 301075 |
| K 160 | 160 ± 5 | blue - red | K 401085 | K 301085 |
| K 170 | 170 ± 5 | white - red | K 401095 | K 301095 |
| K 180 | 180 ± 5 | white - red | K 401090 | |

Order numbers for ZIEHL trible PTC-resistor

Lead length: **500-180-180-500 ± 10 mm**
 Standard cross-section: **0.14 mm²**
 weight: **approx. 360 g / 100pcs**

| Type | NRT°C | Standard ID colour (DIN 44 082) X = black for standard sensor yellow for MINIKA® | Order number MINIKA® | Order number standard |
|--------|---------|--|-------------------------|--------------------------|
| KD 60 | 60 ± 5 | white - x - x -grey | K 401300 | |
| KD 70 | 70 ± 5 | white - x - x - brown | K 401310 | |
| KD 80 | 80 ± 5 | white - x - x - white | K 401305 | K 301305 |
| KD 90 | 90 ± 5 | green - x - x - green | K 401315 | K 301315 |
| KD 100 | 100 ± 5 | red - x - x - red | K 401325 | K 301325 |
| KD 110 | 110 ± 5 | brown - x - x - brown | K 401335 | K 301335 |
| KD 120 | 120 ± 5 | grey - x - x - grey | K 401345 | K 301345 |
| KD 130 | 130 ± 5 | blue - x - x - blue | K 401355 | K 301355 |
| KD 140 | 140 ± 5 | white - x - x - blue | K 401365 | K 301365 |
| KD 150 | 150 ± 5 | black - x - x - black | K 401375 | K 301375 |
| KD 160 | 160 ± 5 | blue - x - x -red | K 401385 | K 301385 |
| KD 170 | 170 ± 5 | white - x - x - green | K 401395 | K 301395 |
| KD 180 | 180 ± 5 | white - x - x - red | K 401390 | |

Order numbers for ZIEHL screw-in sensors

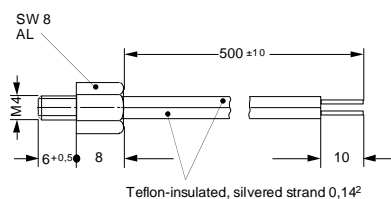
screw-in sensor M4 winding

Lead length:
Standard cross-section:
weight:

500 ± 10 mm
 0.14 mm^2
approx. 5 g



Type KS



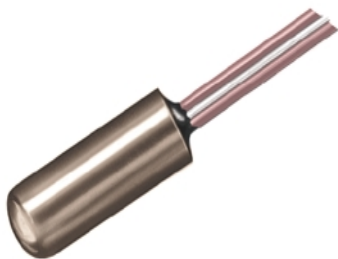
| Type | NRT°C | Standard ID colour (DIN 44 081) | Order number |
|--------|-------------|------------------------------------|-----------------|
| KS 80 | 80 ± 5 | white - white | K 302005 |
| KS 90 | 90 ± 5 | green - green | K 302015 |
| KS 100 | 100 ± 5 | red - red | K 302025 |
| KS 110 | 110 ± 5 | brown - brown | K 302035 |
| KS 120 | 120 ± 5 | grey - grey | K 302045 |
| KS 130 | 130 ± 5 | blue - blue | K 302055 |
| KS 140 | 140 ± 5 | white - blue | K 302065 |
| KS 150 | 150 ± 5 | black - black | K 302075 |
| KS 160 | 160 ± 5 | blue - red | K 302085 |
| KS 170 | 170 ± 5 | white - green | K 302095 |
| KS 180 | 180 ± 5 | white - red | K 302090 |

Order numbers for ZIEHL immersed oil sensors

Immersed oil sensor

Lead length:
Standard cross-section:
weight:

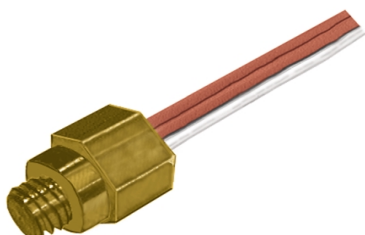
1200 ± 10 mm
 0.75 mm^2
approx. 41 g



| Type | NRT°C | ID colour | Order number |
|-------|------------|-------------------|-----------------|
| KU 70 | 70 ± 5 | teflon colourless | K 304000 |

Special sensor 5 kV tested

Other dimensions and temperatures on request.
When ordering, please state description, order number and length.



We also manufacture for you the temperature sensors in any other packaging. Thus we are able to deliver e.g. the MINIKA® also as couple sensor with other cable lengths, types and outside AMP-plug sockets or also in special electric strength up to 5 kV.

Please ask for your special design!