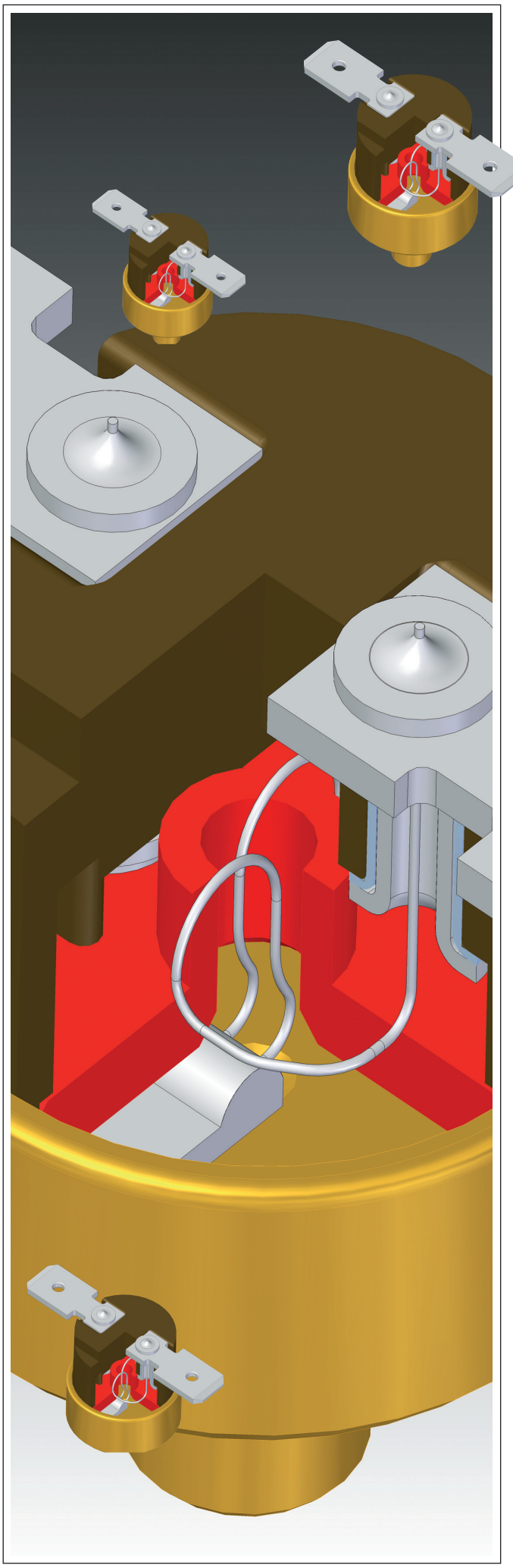
Thermal Sensors
Product Overview

eaw



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In 1926 AEG AG acquired the property in the Hoffmannstrasse in Berlin-Treptow. At this The Apparate-Werke company developed at this location Berlin-Treptow (AT) quickly became a remarkable one Manufacturer of switching devices, electrical measuring instruments and meters as well as relays, radios and Mercury vapor converters. The Apparate-Werke Berlin was already counted in 1928 around 4000 employees.

At the end of the Second World War, the company was converted into a Soviet stock corporation. changed. In 1948 the name was changed to Elektro-Apparate-Werke Berlin and the company developed into one of the largest companies in the world Electrical industry. In 1990 the previously popular converted its own company into a corporation and traded on the market as EAW Berlin GmbH.

Since EAW Relaistechnik GmbH was founded on February 27, 1993 we succeeded, proven To market series of devices and to innovate the field of relay technology and low voltage switching devices successfully into the market lead. The high quality standards of ours products, as well as our creativity motivated and professionally qualified employees is what will keep us in the coming years enable you to find convincing solutions for offer the domestic and foreign market to be able to.

In this, our 20th year, we are starting with one completely new range of temperature sensors NTC, PTC, PT's and sensor elements as a supplement to our tried and tested range of tempera- door switch with bimetal snap elements. With it We are now able to provide a complete Range for temperature detection, control, - offer monitoring and limitation can.

1.1. PTC – PTC thermistor

PTC sensors are made of materials that can conduct electricity better at low temperatures
than at high temperatures. They are therefore also colloquially referred to as PTC thermistor. Her
Electrical resistance increases as the temperature increases and is therefore positive
Temperature coefficients (Positive Temperature Coefficient).

1.1.1. Platinum sensors

For temperature measurements with high accuracy
Platinum resistors are mainly used,
whose resistance increases approximately linearly with temperature.

Platinum resistors for temperature measurement are
widely used industrially and in DIN EN 60751
for an operating temperature range of ÿ200°C to
850°C standardized. The practical area of application is
However, it is usually more limited and in the data sheet
specified. The platinum temperature sensors will
with the symbol Pt and its nominal resistance R0
at a temperature of 0 °C. Standardized
are the temperature sensors

- Pt100 R0 = 100ÿ
- Pt500 R0 = 500ÿ
- Pt1000 R0 = 1000ÿ

The use of Pt1000 sensors is permitted when switching on
connection of the sensor with long connecting cables
advantageous. With a higher nominal resistance the
distorting influence of the conductor resistance
the long connecting cables are less.

Construction

Platinum temperature sensors are available in two different
manufactured in different designs. The metal will
either applied as a film to a carrier material using screen printing
or wound as a wire onto a carrier element to form platinum resistors.

Platinum wire sensors

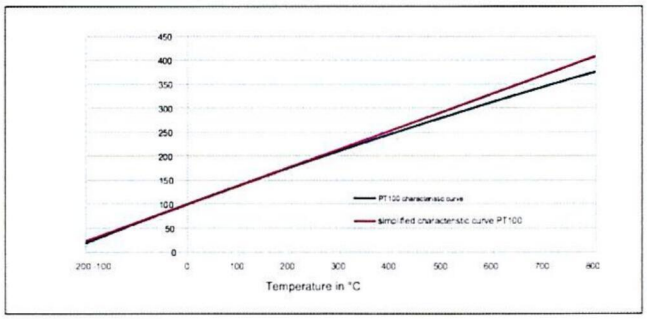
The temperature sensitive element is from
a platinum wire. The nominal resistance is adjusted by shortening
the platinum wire.

The wire is melted in many turns into a glass rod or into a ceramic mass
embedded and integrated into various housings for protection and
application adaptation.
Wound sensors are preferred for higher
temperatures produced.

Thin film sensors

The platinum appears as a thin layer in a meandering shape
a ceramic carrier applied. After receipt
the connection wires and the adjustment of the
Nominal resistance by laser trimming
Platinum layer with a coating for protection
chemical influences. Afterward
The embedding takes place to protect against mechanical
influences and to adapt the application
analogous to the platinum wire sensors in various
Housing requirements. Advantage of thin-film sensors
is in addition to their rational manufacturing and
Matching procedures that are very compressed
Design point-shaped temperature detection.

curve



Characteristic curve PT100 according to DIN EN 60751

Linearization / valuation

The dependence of the resistance R of a platinum
Temperature sensor with the nominal resistance R0 of
the Celsius temperature t is specified in DIN EN 60751
placed:

In the range 0 ... 850°C the following function applies
Temperature t:

$R = R0 (1 + a t + b t2)$

In the range -200 ... 0°C the following function applies
Temperature t:
R = R0 (1 + a t + b t2 + c (t ÿ 100°C) t3)

The following material-dependent constants apply to both functions:
a = 3.9083 10-3 / °C
b = ÿ5.775 10-7 / °C2
c = ÿ4.183 · 10-12 / °C4

To simplify things, the following linear approximation is often used in the temperature range ÿ20 ... +120 °C used:
R = R0 (1 + ÿ t)
ÿ = 3.85 10-3 / °C

This approximation meets the characteristic curve at 0°C and 100°C and includes a maximum deviation of 0.4°C in the specified temperature range.
Resistors and as such also the platinum temperature sensor are affected by the current supply the measuring current causes self-heating. The self-heating of the thin-film sensors is due to the smaller material cross-sections are more pronounced than the self-heating of the platinum wire sensors.
The resulting temperature measurement error is given by:

ÿT=P•S

with: P = I²R

S = self-heating coefficient in K/mW (sensor dependent, typically 0.3 K/mW)

1.1.2. KTY sensor

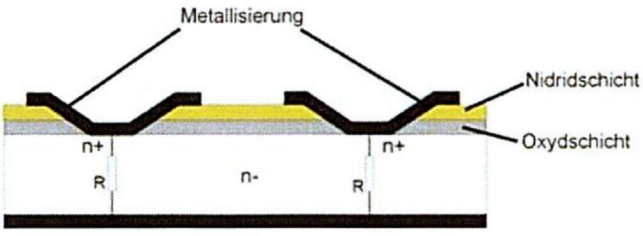
The KTY temperature sensors are compared to other temperature sensors proportionately cheap. However, their accuracy is limited due to the non-linear temperature resistance behavior restricted. For sufficient accuracy KTY temperature sensors must be calibrated.
As a rule, this happens through downstream Electronics. This allows comparative achieve mediocre linearities. Can be used KTY sensors are still only for a smaller one Temperature range than, for example, platinum sensors. Detectable with sufficient accuracy Temperature ranges are limited to a temperature range of approx. 200 Kelvin.
The biggest disadvantage of KTY sensors is their Sensitivity to electrostatic discharge (ESD). The sensors can be activated by external voltage impulses easily to be damaged.
In turn, the temperature coefficient is KTY sensors about twice as compared to PT100 so tall. This makes the usable signal that can be evaluated less susceptible to disturbances from the sensor environment.
KTY sensors are available for different nominal resistors. However, these do not apply as in Platinum sensors at 0°C but are for under-different nominal temperatures defined.

Examples of two basic types are:
- KTY 83- RN = 1000 ÿ at + 25°C
- KTY 84- RN = 1000 ÿ at +100°C

The basic types are both in terms of Level of tolerance of the nominal resistances as well further divided according to the position of the tolerance bands. offered.

Construction

KTY temperature sensors function as silicon propagation resistors. They consist of one typically 100µm thick silicon layer with two metallized poles. The temperature dependence of the resulting semiconductor junction is used.



KTY sensors are polarized components, which means... their use and connection are observed must become.

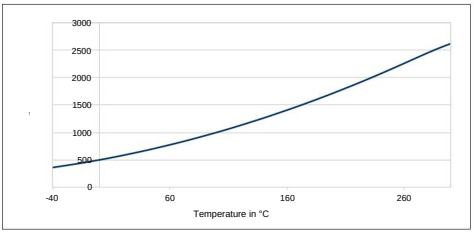
KTY sensors are available in a wide variety
Housing variants like

• TO92 – Plastic housing
• SOT23 – Plastic package for SMD mounting
• DO34, SOD-68 – diode package
• SOD-80 – SMD mount diode package

offered.

curve

The characteristics of the KTY sensors differ
type dependent. The specification of a generally valid
Characteristic curve for all types is therefore not possible.
However, each manufacturer either provides a calculation
basis or a temperature-resistance characteristic for the sensor
types offered
ready. The following is an example of the characteristic curve
of the KTY84/130 sensor in the temperature range -40
shown up to 300°C.



Characteristic curve KTY84/130 1

This connection between temperature and
Resistance is part of a parabola. If through the
The PTC thermistor has a constant current flowing
Change in voltage not proportional to change in temperature. The
curve becomes steeper in the positive temperature range and
steeper in the negative one
Temperature range getting flatter. The voltage
change with a temperature increase of 10°C
above 100°C, for example, is approximately double
as high as the change in voltage at one
Temperature increase of 10°C below 0°C.

1.2. NTC – thermistor

NTC resistors, also called “thermistors”,
consist of materials that work at high temperatures
conduct electrical current better than
low temperatures. Your electrical resistance
decreases as the temperature increases and therefore has a
negative temperature coefficient
(Negative Temperature Coefficient).

Construction

Semiconductor materials without contamination are hot-conducting.
cleaning, various metal oxides and various alloys. Processed into
thermal sensors
NTC resistors usually consist of with
Metal oxides of the transition metals mixed with binders, pressed
and sintered. Often will
Oxides of manganese, nickel, cobalt, iron, copper
or titanium is used. They are taken with them for isolation
covered with a non-conductive layer. So received
they have a typical pearl shape. To contact the
NTC resistors are wires made from a platinum plate.
yation or made of nickel/iron already during the
Pressing or sintering process inserted
then connect with the semiconductor material.

In addition to NTC beads, you can also find discs,
or cylindrical designs. The contact
is carried out by surface metallization of the semiconductors
termaterials. Depending on usage
The above-mentioned wires are mounted or the contacting
takes place directly using the metallized contact surfaces.

The usual operating temperature range of
Hot conductors are between ÿ80°C and +250°C.
It is therefore suitable for many automation projects
Can be used for a variety of measurement tasks.

Thermistors are often used as an alternative to PTCs as temperature
Temperature sensors used in the automotive sector.
Common use cases here are motor or
Fluid temperature sensor. Due to their high temperature
Temperature coefficients are some NTC's
optimized manufacturing processes are also increasing
in aerospace and measuring devices
used to correct the disadvantageous non-linearity on the software
side. They often come too
Temperature compensation of electronic circuits for use.

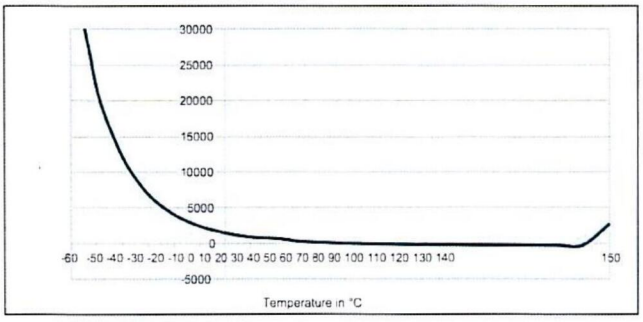
The nominal value of an NTC sensor gives, as in
The following is an example of its electrical resistance at 25°C:

- "NTC 10k" means a resistance of
  10 kÿ at 25°C
- "NTC 12k" means a resistance of
  12 kÿ at 25°C
- "NTC 1k8" means a resistance of
  1.8 kÿ at 25°C

Different types of sensors are also included
the same nominal value usually not without adjustment
interchangeable. In addition to the resistance value is for
the description of the resistance/temperature
the nonlinearity coefficient B also increases
take into account. He describes the curvature of the
Characteristic curve and applies to a specific one
Sensor type. Due to the underlying semiconductor effect, the
characteristic curve of the materials used is high, even with the
same sensor types
The extent depends on defects in the basic materials and
slightly swaying. The quality of the manufacturing
process has a major influence on the properties and long-term
stability.
Today, large-scale production is common
Tolerance values of ±1.0 K to ±0.2 K achieved.

curve

Thermistors have a flat, non-linear characteristic
or available with a very steep characteristic curve in a certain
temperature range. Hot conductors with flat characteristics are
used for measurement tasks
Use or the measuring range is reduced to a small one
the measuring range of interest is limited. Due to the variance of
the characteristics among the different
Different types of thermistor can be used at this point
only an example of a characteristic curve is shown.
The characteristic curve of a special sensor type is in
Inquire about individual cases



Linearization / valuation

Despite the nonlinear resistance/temperature
behavior of the thermistor materials, the characteristics can
line of NTC's using electronic circuits
or downstream software-based measured value processing.

Approximately:

$$R_T = R_N \cdot e^{B\left(\frac{1}{T}-\frac{1}{T_N}\right)} \quad \Leftrightarrow \quad T = \frac{B \cdot T_N}{B + \ln\left(\frac{R_T}{R_N}\right) \cdot T_N}$$

The parameter B is material-dependent
Constant whose value varies with temperature
changes. It will be in addition to the nominal resistance
Nominal temperature from the manufacturer in the data sheet
Sensor specified.
It should also be noted that all temperature information refers to
absolute zero
are. That means:
T = measuring temperature + 273.15K
TN = 25°C + 273.15K (25°C = temperature at
nominal resistance)
Another important parameter is the dissipati-
on constant of an NTC sensor. She will be in W/K
also stated by the manufacturer in the data sheet
and describes the self-heating of the sensor
through the sensor current required for the measurement. The
parameter indicates the performance
is required to compare the sensor by 1 K
to warm up to the ambient temperature. The power should be
dimensioned as low as possible
and/or the measured value calculation accordingly
correct.

Example: RN = 1 kOhm at 25°C,
B = 3480K

2.1. Temperature sensors in surface sensor design

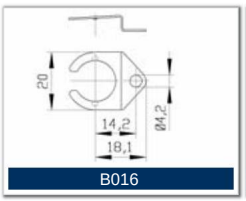
Operating temperature up to 200°C, IP40

Sensor head / assembly	Operating temperature T200	Operating temperature T400	Connection techniques
Aluminum, round*		X	Flat connector 2.8/4.8/6.3 (Turn to Customer request) screw connection conclusion M3 Weld connection (Turn to Customer request) Solder connection lines, according to customer request assembled
Aluminum, air flange		X	
Brass, round		X	
Brass, SW Tenon M 3x4 to M 10x18		X	
Stainless steel, round*			
Stainless steel, flange			

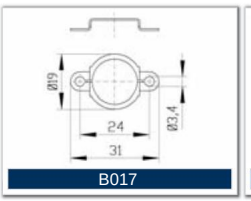
* Loose flange mounting available

Other designs according to customer documentation possible on request!

Loose flanges



B016



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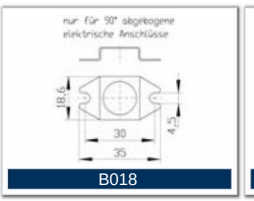
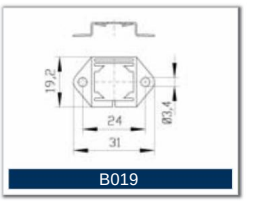


B018



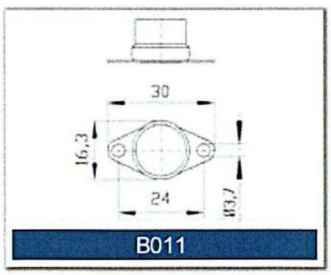
B019

IP44/IP54

Sensor head / assembly	Operating temperature T200	Operating temperature T300	Connection techniques
Aluminum, round			lines, according to customer request assembled
Aluminum, air flange		X	
Brass, round			
Brass, SW			
Stainless steel, round			
Stainless steel, flange			

Other designs according to customer documentation possible on request!

Flange dimensions



2.2. Screw-in resistance thermometer

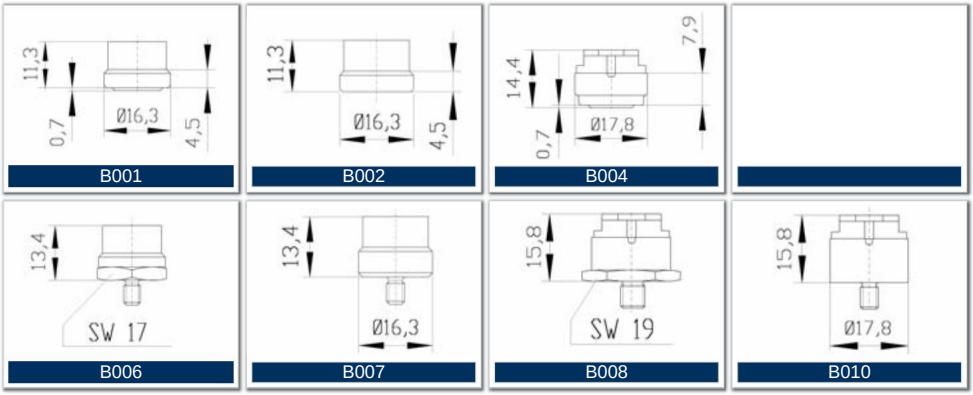
Operating temperature T200, IP44 / IP54

Housing	Plug connection 6.3	lines, according to Tailored to customer requirements
Brass, metric or Inch screw connection		
Brass, metric or customs screw connection, with cones		

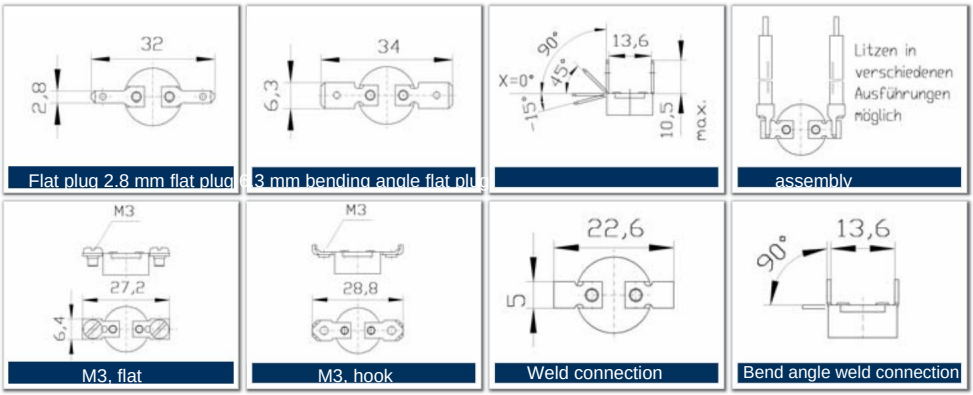
Other designs according to customer documentation possible on request!

2.3. Dimensional drawings

Area sensor

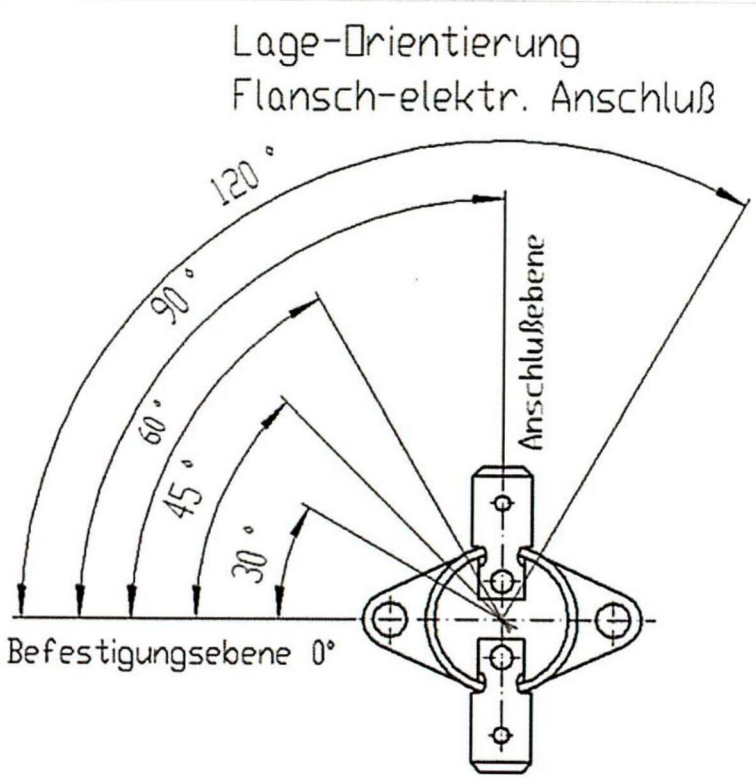


Connection techniques



Position orientation cap «–» connection technology

In addition to those shown
Designs can also
Special designs accordingly
Customer documentation
getting produced.



3.Technical data

Sensor Head Measurement Range	-70°C ... 400°C (depending on design and sensor)
Head/Housing Material	Aluminum / Brass / Stainless Steel
Thermal Contacting of Surface Sensors	flange
Thermal Contacting of Screw-in Resistance Thermometers	Brass screw-in housing with flange face or Tenon
Tenon length, tenon diameter	According to customer requirements (max. length Ø dependent)
Temperature Sensor	PTC/ NTC thermo elements
Tolerance class	in accordance with DIN EN 60751 (sensor-dependent)
Circuit type	2-wire (4-wire upon request)
Connection type	Plug-in, screw, weld, or solder connection
Ready-made clothing	Cables, Pre-assembled Sheathed Cables
Cable length	According to customer requirements
Line type	Silicone / PTFE / According to customer requirements
Core colors	according to DIN EN 60751/ according to customer requirements
Protection against contact (IP44)	Plastic Encapsulation
Dielectric strength	2,5 kV/ AC 50Hz/ 1min.
Labeling	Printing / Engraving / Label (depending on design)

TYPE CODE

T.S xxx xxxxx x x + (xxxxx)

Thermal sensor

Connections:

Screw connection up to	1.5mm²	0
Screw connection up to	2.5mm²	5
customer request		
Flat connector 6.3 x 0.8	horizontal	1
Flat connector 4.8 x 0.8	horizontal	2
Flat connector 2.8 x 0.8	horizontal	C
Flat plug 6.3 x 0.8 / 90°		3
Flat plug 4.8 x 0.8 / 90°		4
Flat plug 2.8 x 0.8 / 90°		D
Flat connector 6.3 x 0.8	bel. deviated F bel.	
Flat connector 4.8 x 0.8	deviated G bel.	
Flat connector 2.8 x 0.8	deviated H	
Solder connection	horizontal A	
Solder connection	90°	b
Cable according to customer requirements		K
Strands according to customer requirements		L
Flat connector xx 0.5 thick		S
Weld connection		T
Special connections		Q

Fastenings: without

flange	0
loose flange	1
loose flange on both sides, round	R
loose flange on one side	2
fixed flange, angle selectable fixed	3
flange 90°, pitch 24 fixed flange, pitch	9
24-30 screw fastening round M4 screw	8th
fastening round M5 screw fastening.	4
round, thread selectable, loose	5
flange, on both sides, pitch 30 air flange	7
	A
	C
Screw fastening SW 17 fixed flange , Pitch 34	D
	N
Special fastening	Z

crimp caps

closed crimp cap aluminum open crimp cap	0
aluminum closed crimp cap CrNi	1
closed crimp cap brass closed crimp	2
cap aluminum, flat	4
	A

PTC	
NTC	
PT100	
PT500	
PT1k	
KTY	

	D
	E
	F

	G
	K
	M
	N
	v
	W

Special versions

gold plated contacts
glued cap
Brass flat connector
protective cap
cast T120
potted T200

base

PPS
Al2O3 small
Al2O3 large

Sensor type

PTC
NTC
PT100
PT500
PT1000
KTY

AMBIENT TEMPERATURES:

For standard versions: - with silicone cables: - with stranded wires: short term 200°C up to 180°C max. 110ºC, 150ºC

Versions cast for epoxy resin:

- "V" :T 120°C | - "W" :T 200°C

For solutions for your development and

Manufacturing tasks

EAW Relaistechnik GmbH has been working for more than

50 years of success in the temperature switch and temperature

sensor market segment. From here

As a result, our employees have one

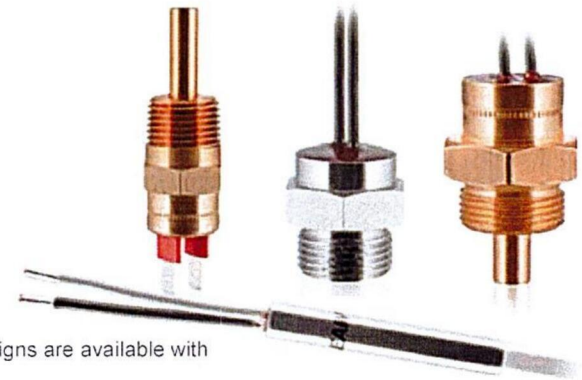
extensive experience. this is a

Guarantee that you are using temperature sensors

Always the optimal one from our diverse range

Find a quick solution to your temperature monitoring and control

problems.



All designs are available with

Sensor elements based on the functional principles

- Platinum resistance
- Resistor with negative temperature coefficients
- Resistor with positive temperature coefficients

Active sensors with standard current output

signal 4 to 20mA

For electrical connection or installation

We have an extensive range of temperature sensors in our

program. At

We also produce application-related products if required

Special solutions according to your documentation.

Sample deliveries

If you need samples, please use our inquiry form.

sheet for thermal sensors on our website

www.eaw-relaistechnik.de.

Technical parameters, test methods and

Conditions of use

The technical parameters contained in the data sheet

ter only apply in conjunction with the ones we have in place

Usual testing methods and equipment.

When using other methods, differences in the measurement

results are possible. The adaptation

of our thermal sensors and the proof of the

Suitability for the intended use depends on

to be carried out by the client.

A guarantee against mismatches will be provided

not adopted. Changes due to technical

We reserve the right to do so for the purpose of further progress.

Quality system

Quality management system

according to DIN ISO 9001:2008

Documented evidence

Certificate (see picture below)

Standard quality for

production-related piece testing

Voltage test

Characteristic curve test

CE and RoHS marking

The products of EAW Relaistechnik GmbH

bear the CE and RoHS markings on the

device, packaging or documentation.

Please contact us.

EAW develops, produces, and distributes proven and innovative relay technology—for the automotive industry, energy providers, railway systems, mining, household appliances, heating and air conditioning technology, and much more.

We deliver long-established standards and develop specialized solutions for—and in collaboration with—our customers. Of high quality, Made in Germany.

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