

<b>Heraeus Sensor Technology – Your Development Partner</b>	<b>5</b>
<b>Platinum Thin-Film Sensors in Operation</b>	<b>6</b>
<b>Color Coding</b>	<b>11</b>
<b>Temperature Sensor Elements</b>	<b>12</b>
<b>Platinum thin-film sensor Type C (Cryo)</b>	<b>13</b>
<b>Platinum thin-film sensor Type L (Low)</b>	<b>14</b>
<b>Platinum thin-film sensor Type M (Medium)</b>	<b>16</b>
<b>Platinum thin-film sensor Type M-DBW</b>	<b>19</b>
<b>Platinum thin-film sensor Type MH (Medium High)</b>	<b>20</b>
<b>Platinum thin-film sensor Type H (High)</b>	<b>22</b>
<b>Sensor Components</b>	<b>25</b>
<b>Platinum temperature sensor in thin-film technology SMD</b>	<b>26</b>
<b>Platinum temperature sensor in thin-film technology T092</b>	<b>28</b>
<b>Sensor Solutions</b>	<b>30</b>
<b>Primary housed platinum sensor in thin-film technology LG</b>	<b>31</b>
<b>Platinum temperature sensor in thin-film technology PCB</b>	<b>32</b>
<b>Platinum temperature sensor in thin-film technology MR 828 and 845</b>	<b>33</b>
<b>Sensor Modules</b>	<b>34</b>



## Heraeus Sensor Technology – Your Development Partner



The core capabilities at Heraeus Sensor Technology are in development, production and in the international marketing of primarily customised components in platinum thin-film technology. This includes annually many millions of Pt sensors for temperature and flow measurement as well as multi-sensor platforms. The latter are used by other manufacturers as a basis for gas and humidity measurement, but also for analytical techniques in aqueous media, for example for medical technology and biotechnology.

Our company philosophy includes contributing to the optimisation of custom-specific designs with our own expertise. Communication takes place without reservation with specialists at all levels of the added value chain. The tasks of the employees at the company include analysing every enquiry for feasibility and testing product ideas. Meetings for orientation are followed by initial estimates, realisation tests and finally the common specification of the most important product features. At the end of the development phase there are the product qualifications usual for this field of technology and in parallel the optimisation of the process parameters for reliable and efficient large-scale production.

However with Heraeus Sensor Technology this does not mark the conclusion of the project. Even once large-scale production has started, products and processes are continually adapted together with the customer to reflect the state of development. The growth of experience, the continual generation of knowledge, forms part of the expressed company objectives. In this regard it does not just involve new developments in the form of products.

All the manufacturing processes at Heraeus Sensor Technology are specifically developed so far that they run with stability, quickly, cost-effectively and orientated to the customer. A finely structured monitoring system with clearly defined parameters renders the quality of all procedures transparent and forms the basis of continual improvement.

Customers of Heraeus Sensor Technology are mainly subcontractors or system suppliers for manufacturers who produce their end products in large quantities, including in the following branches: white goods (household appliances), electronics, process technology, automotive industry, heating/ventilation/air conditioning and products for the life science sectors of pharmaceuticals and medical technology.

# Platinum Thin-Film Sensors in Operation

The electrical resistance of a platinum measuring element changes exactly defined by the temperature so that this relationship can be utilized for thermometry. The relationship is listed in the first table of basic values for Pt 100 (TC = 3850 ppm/K) and in the second table of basic values for Pt 200 (TC = 3770 ppm/K).

Described in more detail below are a few of the parameters influenced by platinum thin-film sensors during their operating time.

## Measured currents and self-heating

The supply current heats the platinum thin-film sensor. The resulting temperature measuring error is given by:  
 $\Delta T = P \cdot S$

with P, the power loss =  $I^2 R$  and S, the self-heating coefficient in K/mW.

The self-heating coefficients are specified in the data sheets for the individual products. Self-heating is dependent on thermal contact between the platinum thin-film sensor and the surrounding medium. If the heat transfer to the environment is efficient, higher measured currents can be used.

Platinum thin-film sensors set no lower limits for measured currents. They depend to a great extent on the application. We recommend:

- 100  $\Omega$ : max. 3 mA
- 500  $\Omega$ : max. 1 mA
- 1000  $\Omega$ : max. 1 mA
- 2000  $\Omega$ : max. 0.25 mA
- 10000  $\Omega$ : max. 0.1 mA

Basic values for 100 $\Omega$ platinum temperature sensors as per DIN EN 60751 (TS90) TC = 3850 ppm/K											
$^{\circ}\text{C}$	$\Omega$	$\Omega/^{\circ}\text{C}$	$^{\circ}\text{C}$	$\Omega$	$\Omega/^{\circ}\text{C}$	$^{\circ}\text{C}$	$\Omega$	$\Omega/^{\circ}\text{C}$	$^{\circ}\text{C}$	$\Omega$	$\Omega/^{\circ}\text{C}$
-200	18.52	0.432	70	127.08	0.383	340	226.21	0.352	610	316.92	0.320
-190	22.83	0.429	80	130.90	0.382	350	229.72	0.350	620	320.12	0.319
-180	27.10	0.425	90	134.71	0.380	360	233.21	0.349	630	323.30	0.318
-170	31.34	0.422	100	138.51	0.379	370	236.70	0.348	640	326.48	0.317
-160	35.34	0.419	110	142.29	0.378	380	240.18	0.347	650	329.64	0.316
-150	39.72	0.417	120	146.07	0.377	390	243.64	0.346	660	332.79	0.315
-140	43.88	0.414	130	149.83	0.376	400	247.09	0.345	670	335.93	0.313
-130	48.00	0.412	140	153.58	0.375	410	250.53	0.343	680	339.06	0.312
-120	52.11	0.409	150	157.33	0.374	420	253.96	0.342	690	342.18	0.311
-110	56.19	0.407	160	161.05	0.372	430	257.38	0.341	700	345.28	0.310
-100	60.26	0.405	170	164.77	0.371	440	260.78	0.340	710	348.38	0.309
-90	64.30	0.403	180	168.48	0.370	450	264.18	0.339	720	351.46	0.308
-80	68.33	0.402	190	172.17	0.369	460	267.56	0.338	730	354.53	0.307
-70	72.33	0.400	200	175.86	0.368	470	270.93	0.337	740	357.59	0.305
-60	76.33	0.399	210	179.53	0.367	480	274.29	0.335	750	360.64	0.304
-50	80.31	0.397	220	183.19	0.365	490	277.64	0.334	760	363.67	0.303
-40	84.27	0.396	230	186.84	0.364	500	280.98	0.333	770	366.70	0.302
-30	88.22	0.394	240	190.47	0.363	510	284.30	0.332	780	369.71	0.301
-20	92.16	0.393	250	194.10	0.362	520	287.62	0.331	790	372.71	0.300
-10	96.09	0.392	260	197.71	0.361	530	290.92	0.330	800	375.70	0.298
0	100.00	0.391	270	201.31	0.360	540	294.21	0.328	810	378.68	0.297
10	103.90	0.390	280	204.90	0.358	550	297.49	0.327	820	381.65	0.296
20	107.79	0.389	290	208.48	0.357	560	300.75	0.326	830	384.60	0.295
30	111.67	0.387	300	212.05	0.356	570	304.01	0.325	840	387.55	0.294
40	115.54	0.386	310	215.61	0.355	580	307.25	0.324	850	390.48	0.293
50	119.40	0.385	320	219.15	0.354	590	310.49	0.323			
60	123.24	0.384	330	222.68	0.353	600	313.71	0.322			

Basic values for 200 $\Omega$ Pt temperature sensors with special automotive TC = 3770 ppm/K									
$^{\circ}\text{C}$	$\Omega$	$^{\circ}\text{C}$	$\Omega$	$^{\circ}\text{C}$	$\Omega$	$^{\circ}\text{C}$	$\Omega$	$^{\circ}\text{C}$	$\Omega/^{\circ}\text{C}$
-40	169.18	170	326.79	380	474.07	590	611.04	800	737.68
-30	176.92	180	334.04	390	480.83	600	617.30	810	743.45
-20	184.64	190	341.26	400	487.56	610	623.54	820	749.20
-10	192.33	200	348.46	410	494.27	620	629.76	830	754.93
0	200.00	210	355.64	420	500.96	630	635.95	840	760.63
10	207.65	220	362.79	430	507.62	640	642.12	850	766.31
20	215.27	230	369.92	440	514.26	650	648.27	860	771.97
30	222.87	240	377.03	450	520.87	660	654.40	870	777.60
40	230.44	250	384.11	460	527.46	670	660.50	880	783.21
50	237.99	260	391.17	470	534.03	680	666.58	890	788.80
60	245.52	270	398.21	480	540.58	690	672.63	900	794.36
70	253.03	280	405.22	490	547.10	700	678.66	910	799.90
80	260.51	290	412.21	500	553.60	710	684.67	920	805.42
90	267.97	300	419.18	510	560.08	720	690.65	930	810.91
100	275.40	310	426.12	520	566.53	730	696.61	940	816.38
110	282.81	320	433.04	530	572.96	740	702.55	950	821.82
120	290.20	330	439.94	540	579.36	750	708.46	960	827.24
130	297.56	340	446.81	550	585.74	760	714.35	970	832.64
140	304.90	350	453.66	560	592.10	770	720.22	980	838.02
150	312.22	360	460.49	570	598.44	780	726.06	990	843.37
160	319.52	370	467.29	580	604.75	790	731.88	1000	848.70

## Thermal response times

The thermal response time is the time required by a platinum thin-film sensor to react to a step temperature change with a change in resistance, which corresponds to a certain percentage of the temperature change. DIN EN 60751 recommends the use of times for a 50% and 90% change,  $t_{0.5}$  and  $t_{0.9}$  are indicated in the data sheets for water and air flows of 0.4 or 2.0 m/s. Conversion to other media and speeds can be carried out with the aid of the VDI/VDE 3522 manual.

## Thermo-electric effect

Platinum thin-film sensors generate practically no electro-motive power.

## Vibration and impact

Platinum thin-film sensors are solid components and as such extremely resistant to vibration and impact. The qualifying factor is normally the mounting method. Testing well mounted platinum thin-film sensors revealed:

Vibration resistance: 40 g over a range of 10 Hz up to 2 kHz  
 Shock resistance: 100 g, 8 ms half sine

## General electrical parameters of the elementary sensors

Inductivity: <1  $\mu\text{H}$   
 Capacity: 1 to 6 pF  
 Insulation: >10 M $\Omega$  at 20 $^{\circ}\text{C}$   
 >1 M $\Omega$  at 500 $^{\circ}\text{C}$   
 High-voltage strength:  
 >1000 V at 20 $^{\circ}\text{C}$   
 > 25 V at 500 $^{\circ}\text{C}$

## Mechanical load capability

Platinum thin-film sensors are sensitive to mechanical loads that may, under extreme conditions, lead to a rupture or chipping of the glass cover or the ceramic substrate. Improper handling or unsuitable mounting processes may lead to permanent changes in the measuring signals.

During manufacture, the connection wires are subjected to pulling and tear resistance tests in accordance with MIL 833 and IEC 40046. In the case of nickel/platinum coated wires, the products are approved when  $F_{axial} > 8$  N (without glass ceramic connection sealing).

#### Repeatability

Platinum thin-film sensors manufactured by Heraeus Sensor Technology are characterized by a high degree of repeatability of the signal.

#### Accuracy tolerance classification

Heraeus Sensor Technology supplies platinum thin-film sensors in accordance with DIN EN 60751 in the accuracy tolerance classifications B and in addition A and 1/3 DIN (see table of limit variations for 100  $\Omega$  platinum sensors).

Proportionally limited tolerances are calculated as

$$\Delta T = \pm 1/a (0.3^\circ\text{C} + 0.005 \text{ tI}) \text{ with } a = 1, 2 \text{ or } 3$$

Platinum thin-film sensors can also be selected in tolerance groups with a maximum  $\Delta T = 0.1$  K over a range of 0°C to 100°C. For applications with high price sensitivity, other accuracy tolerances are also available.

Limit variations for 100  $\Omega$  platinum sensors

Temp °C	Limit variations			
	Class A		Class B	
	°C	Ohm	°C	Ohm
-200	±0.55	±0.24	±1.3	±0.56
-100	±0.35	±0.14	±0.8	±0.32
0	±0.15	±0.06	±0.3	±0.12
100	±0.35	±0.13	±0.8	±0.30
200	±0.55	±0.20	±1.3	±0.48
300	±0.75	±0.27	±1.8	±0.64
400	±0.95	±0.33	±2.3	±0.79
500	±1.15	±0.38	±2.8	±0.93
600	±1.35	±0.43	±3.3	±1.06
650	±1.45	±0.46	±3.6	±1.13
700	-	-	±3.8	±1.17
800	-	-	±4.3	±1.28
850	-	-	±4.6	±1.34

#### Long-term stability

The ageing effects on thin-film sensors as a result of long-term operation or temperature shock may have a negative influence on the precision and reproducibility of the sensor signal. Long-term stability is therefore of the greatest importance.

Due to the chemical stability and homogeneity of the platinum used, platinum thin-film sensors are the most stable thin-film sensors. Depending on the operating conditions, the resistance changes after 5 years of operation at 200°C are typically less than 0.04 %. The standard test conditions include 250 h, 500 h and 1000 h. However, shock tests and long-term tests can be adjusted to the customer's requirements.

#### Climate and humidity

A double glass layer and a glass of ceramic fixing drops protect the sensor element reliably from environmental influences. Measurements as per IEC 71 show that climatic and humidity variations do not have an impact on the measuring accuracy of sensor elements.

#### Circuit design

Platinum thin-film sensors are often fed with a continuous current, as standard in 2-lead circuitry. For energy-saving reasons (accumulator or battery operation), a switched measured current can also be used. The voltage output signal is a function of the  $R_t$  resistance. Because of the simple quadratic function of the platinum thin-film sensor characteristic curve as well as the possibility of a simple linear approximation, the linearization of the measuring symbols poses no problem.

#### Connection

Standard 2-lead circuits may result in a loss of precision. Therefore, 3 or 4-lead circuits are recommended:

- for longer cables, where the resistance and the temperature-dependent resistance of the cable may achieve significant values
- for platinum thin-film sensors with narrower tolerances
- if significant electromagnetic interference exist

#### Storage

Platinum thin-film sensors should not be subjected to caustic and corrosive media and atmospheres. The specific storage information for each type is to be followed.

#### Cleaning

Platinum thin-film sensors are cleaned before packing and further cleaning is normally not required. Should cleaning be required after mounting, most conventional industrial processes can be used, including immersion in a liquid or bath. We recommend that residue-free cleaning agents be used.

#### Handling

Platinum thin-film sensors are precision components, and should therefore be carefully handled during mounting. Metal holders, clamps or other rough gripping devices may not be used. Plastic tweezers are recommended for working with elementary sensors. The supply leads may not be bent near the body of the platinum thin-film sensor. Frequent repositioning of the supply leads should be avoided.

#### Connection technology

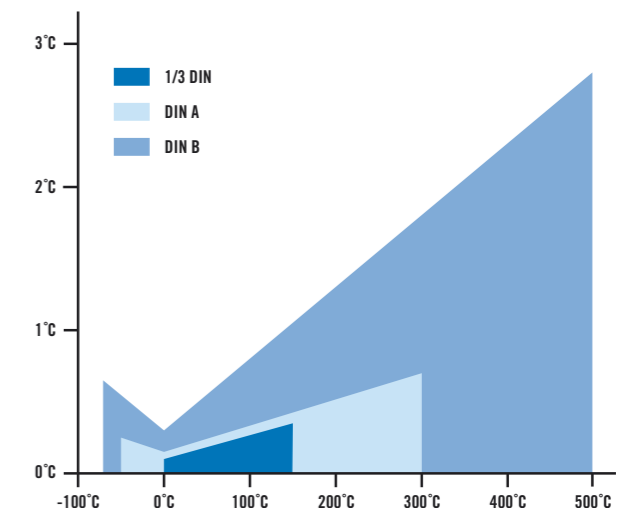
The best results are achieved with welding processes (resistance welding, laser welding etc.) or soldering (soft, hard solder). When using hard solder, it should be ensured that the platinum thin-film sensor body is not heated above its maximum nominal temperature. In general, the soldering times for hard solder should be less than three seconds. Shrinkage and ultrasonic sealing is also possible.

- When shrinkage is being carried out, it must be ensured that any electrical resistance is avoided at the connecting point.
- With ultrasonic sealing, the leads are to be bent out of the level of the platinum thin-film sensor, in order to exclude interior damage.
- For the SMD and TO92 series, we recommend automatic further processing with wave or reflow soldering processes.

#### Adhesion and embedding

When adhering, embedding, powdering or coating platinum thin-film sensors, it is important that the coefficients of thermal expansion of the different materials used agree, in order to avoid mechanical tensions that may affect the sensor signal.

The embedding materials should be chemically neutral and remain elastic after drying. The position of a connected platinum thin-film sensor should under no circumstances be subsequently corrected by sliding its body. Heraeus Sensor Technology's MR series is already recast in a ceramic casing. The TO92 serie is cast in plastic.



Tolerances of basic values for platinum temperature sensors are specified in DIN EN 60751. The following applies Class B:  $\Delta T = \pm (0.3^\circ\text{C} + 0.005 \text{ tI})$ ; Class A:  $\Delta T = \pm (0.15^\circ\text{C} + 0.002 \text{ tI})$  and according to our own definition: Class 1/3 DIN:  $\Delta T = \pm 1/3 (0.3^\circ\text{C} + 0.005 \text{ tI})$ , Class 2 B:  $\Delta T = \pm 2 (0.3^\circ\text{C} + 0.005 \text{ tI})$

# Color Coding

To meet the request of many customers and to enable an easier identification of the various sensor families, Heraeus Sensor Technology has introduced a clear color coding system. This ensures that the temperature application range and the resistance value of a sensor can be seen at a glance.

What is the benefit to you:

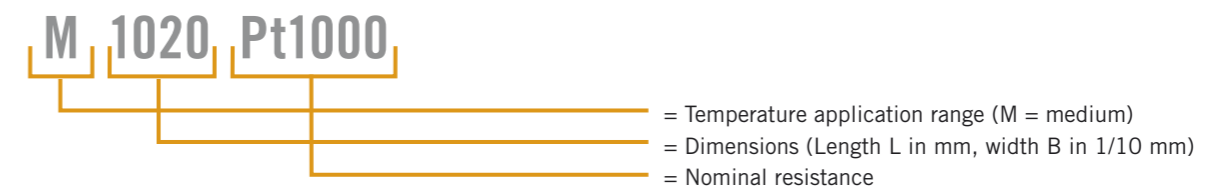
- avoiding mistakes in your production resulting in a higher quality level
- simplified logistics by easy classification

The table below indicates the meaning of the colors of fixing material and meander cover:

The color coding system			
Area	Temperature range °C	Color	Name
Fixing	C (above -200°C)	light blue	Cryo temperature
	L (up to 400°C)	light blue	Low temperature
	M (up to 600°C)	blue	Medium temperature
	H (above 600°C)	white	High temperature
Resistance value Ω			
Meander cover	Pt 100	transparent	
	Pt 500	pink	
	Pt 1000	blue	
	Pt 10000	white	

### Example

Sensor designation:



Concerning all products: We reserve the right to make alterations in illustrations and technical data printed. All technical data serves as a guideline and does not guarantee particular properties to any products.



# Temperature Sensor Elements



Sensor element from -196 °C to +1000 °C

Every year many millions of temperature sensors, produced in platinum thin-film technology, leave Heraeus Sensor Technology's factory. Depending on the field of application four main groups are available; for cryogenic (from -196 °C), low (up to +400 °C), medium (up to +600 °C) and high (up to +1000 °C) measurement temperatures. Versions with resistance values of 100, 200, 500, 1,000 and 10,000 ohm are available.

The chemical stability of initial materials, their tested purity and homogeneity, provide an important foundation for the well-known long-term stability and the reproducibility of the measurements over thousands of measurement cycles. Special glazes from Heraeus Sensor Technology almost completely eliminate effects due to moisture, climatic or other ambient influences.

The product group of wire-lead temperature sensor elements also includes particularly narrow types of sensor for mounting in protective tubes with a small internal diameter. This also applies to sensors with connection leads for substitution of conventional, wound Pt temperature probes by current versions of the HD and HA series in thin-film technology. The wide knowledge base of Heraeus Sensor Technology is available any time to the company's customers in the development of customer-specific special versions.



# Platinum thin-film sensor Type C (Cryo)

Temperature range -196 °C to +150 °C

### Applications

Cryo (aerospace, chemical and power generation plants and analytical equipment)

### Specification

DIN EN 60751

### Tolerance class

Class B

### Nominal resistances

100 Ω and 1000 Ω at 0 °C

### Temperature coefficient

3850 ppm/K

### Soldering connection

AuPd leads, AgPd leads

### Long-term stability

Max. R<sub>0</sub>-drift 0.03 % after 1000 h at 500 °C

### Vibration resistance

At least 40 g acceleration at 10 to 2000 Hz, depending on mounting method

### Shock resistance

At least 100 g acceleration with 8 ms half sine wave, depending on mounting method

### Measuring current

at 100 Ω: 0.3 to 1.0 mA  
at 1000 Ω: 0.1 to 0.3 mA

### Environmental conditions

Use unprotected only in dry environments

### Insulation resistance

> 10 MΩ at 20 °C;  
> 1 MΩ at 500 °C

### Packaging

Shipment < 500 pcs. in plastic box  
> 500 pcs. loose in a bag

### Status

04/2006

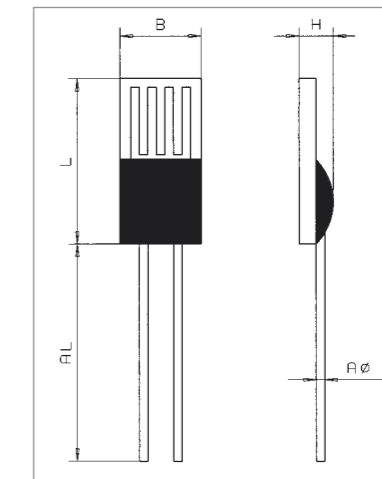
### Supply range

The standard types are listed in the catalog with their various features. These are the most frequently used versions, and can be obtained at short notice and at reasonable prices.

For special applications, non-standard versions are available. The following alternatives are possible:

- Different dimensions
- Different nominal resistances
- Different temperature coefficients
- Different lengths of leads
- Different tolerances
- Different packaging

Please contact us.



Tolerance class B from -196 °C to +150 °C

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic box/ Plastic bag	Leads	L	B	H	AL	AØ	Ice water 0 °C in K/mW	Water: v=0,4m/s		Air: v=2m/s	
											t <sub>0,5</sub>	t <sub>0,9</sub>	t <sub>0,5</sub>	t <sub>0,9</sub>
C	420	Pt 1000	32207502	AgPd	3.9	1.9	1.0	15	0.25	0.3	0.08	0.25	3.50	15
C	220	Pt 100	32207399	AgPd	2.3	1.9	1.0	10	0.25	0.4	0.06	0.20	3.00	13

### Tolerances:

L: ± 0.15 • B: ± 0.15 • H: + 0.3 / - 0.2 • AL: ± 1.0 • AØ: ± 0.02

# Platinum thin-film sensor Type L (Low)

## Temperature range -50°C to +400°C

### Applications

HVAC, process industry and all applications, where soft solderability is required

### Specification

DIN EN 60751

### Tolerance classes

Class B, class A, class 1/3 DIN

### Nominal resistances

100 Ω, 500 Ω and 1000 Ω at 0°C

### Temperature coefficient

3850 ppm/K

### Soldering connection

AgPd leads

### Long-term stability

Max.  $R_0$ -drift 0.04 % after 1000 h at 400°C

### Vibration resistance

At least 40 g acceleration at 10 to 2000 Hz, depending on mounting method

### Shock resistance

At least 100 g acceleration with 8 ms half sine wave, depending on mounting method

### Insulation resistance

> 10 MΩ at 20°C;  
> 1 MΩ at 400°C

### Measuring current

at 100 Ω: 0.3 to 1.0 mA  
at 500 Ω: 0.1 to 0.7 mA  
at 1000 Ω: 0.1 to 0.3 mA

### Environmental conditions

Use unprotected only in dry environments

### Packaging

Plastic box, plastic bag

### Status

04/2006

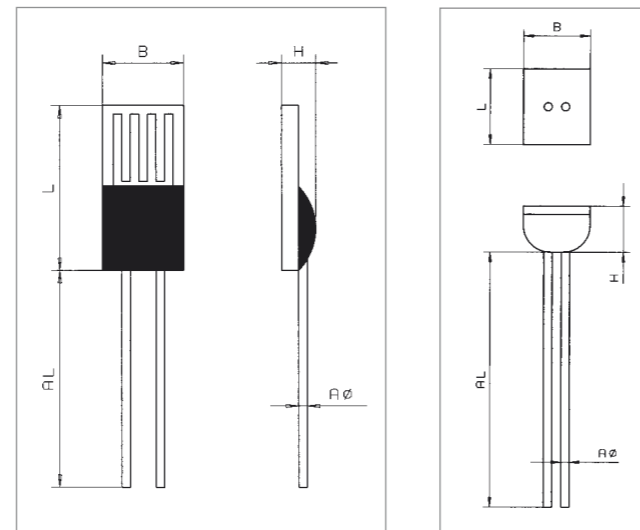
### Supply range

The standard types are listed in the catalog with their various features. These are the most frequently used versions, and can be obtained at short notice and at reasonable prices.

For special applications, non-standard versions are available. The following alternatives are possible:

- Different dimensions
- Different nominal resistances
- Different temperature coefficients
- Different lengths of leads
- Different tolerances
- Different packages

Please contact us.



## Type L (Low)

### Tolerance class B from -50°C to +400°C

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic box	Plastic bag	L	B	H	AL	AØ	Ice water 0°C in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>
L	1020	Pt 100	32207359	32207708	9.5	1.9	1.0	10	0.25	0.2	0.12	0.30	6.0	20
L	1020	Pt 500	32207449		9.5	1.9	1.0	10	0.25	0.2	0.12	0.30	6.0	20
L	1020	Pt 1000	32207479	32207710	9.5	1.9	1.0	10	0.25	0.2	0.12	0.30	6.0	20
L	420	Pt 100	32207409	32207702	3.9	1.9	1.0	10	0.25	0.3	0.08	0.25	3.5	15
L	420	Pt 500	32207469	32207703	3.9	1.9	1.0	10	0.25	0.3	0.08	0.25	3.5	15
L	420	Pt 1000	32207509	32207704	3.9	1.9	1.0	10	0.25	0.3	0.08	0.25	3.5	15
L	416	Pt 100		32207440	3.9	1.5	1.0	10	0.25	0.4	0.07	0.25	3.2	14
L	220	Pt 100		32207400	2.3	1.9	1.0	10	0.25	0.4	0.06	0.20	3.0	13
L	220 P	Pt 100	32207302	32207608	2.3	1.9	0.9	10	0.25	0.4	0.20	0.30	3.0	9

### Tolerance class A from -50°C to +300°C

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic box	Plastic bag	L	B	H	AL	AØ	Ice water 0°C in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>
L	1020	Pt 100		32207579	9.5	1.9	1.0	10	0.25	0.2	0.12	0.30	6.0	20
L	1020	Pt 1000		32207581	9.5	1.9	1.0	10	0.25	0.2	0.12	0.30	6.0	20
L	420	Pt 1000		32207582	3.9	1.9	1.0	10	0.25	0.3	0.08	0.25	3.5	15
L	416	Pt 100		32207583	3.9	1.5	1.0	10	0.25	0.4	0.07	0.25	3.2	14
L	220	Pt 100		32207584	2.3	1.9	1.0	10	0.25	0.4	0.06	0.20	3.0	13

### Tolerance class 1/3 DIN from 0°C to +150°C

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic box	Plastic bag	L	B	H	AL	AØ	Ice water 0°C in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>
L	1020	Pt 100		32207585	9.5	1.9	1.0	10	0.25	0.2	0.12	0.30	6.0	20
L	1020	Pt 1000		32207586	9.5	1.9	1.0	10	0.25	0.2	0.12	0.30	6.0	20
L	420	Pt 1000		32207587	3.9	1.9	1.0	10	0.25	0.3	0.08	0.25	3.5	15
L	416	Pt 100	32207439		3.9	1.5	1.0	10	0.25	0.4	0.07	0.25	3.2	14
L	220	Pt 100		32207588	2.3	1.9	1.0	10	0.25	0.4	0.06	0.20	3.0	13

### Tolerances:

L: ± 0.15 • B: ± 0.15 • H: + 0.3 / - 0.2 • AL: ± 1.0 • AØ: ± 0.02

# Platinum thin-film sensor Type M (Medium)

Temperature range  $-70^{\circ}\text{C}$  to  $+500^{\circ}\text{C}$ ,  
for a short time to  $+550^{\circ}\text{C}$

### Applications

Automotive, white goods, HVAC, energy management, medical and industrial equipment

### Specification

DIN EN 60751

### Tolerance classes

Class B, class A, class 1/3 DIN, class 2B

### Nominal resistances

100  $\Omega$ , 500  $\Omega$ , 1000  $\Omega$ , 2000  $\Omega$  and 10000  $\Omega$  at  $0^{\circ}\text{C}$

### Temperature coefficient

3850 ppm/K

### Soldering connection

Pt clad Ni wire

### Long-term stability

Max.  $R_0$ -drift 0.04 % after 1000 h at  $500^{\circ}\text{C}$

### Vibration resistance

At least 40 g acceleration at 10 to 2000 Hz, depending on mounting method

### Shock resistance

At least 100 g acceleration with 8 ms half sine wave, depending on mounting method

### Insulation resistance

> 10 M $\Omega$  at  $20^{\circ}\text{C}$ ;  
> 1 M $\Omega$  at  $500^{\circ}\text{C}$

### Measuring current

at 100  $\Omega$ : 0.3 to 1.0 mA  
at 500  $\Omega$ : 0.1 to 0.7 mA  
at 1000  $\Omega$ : 0.1 to 0.3 mA  
at 2000  $\Omega$ : 0.1 to 0.3 mA

### Environmental conditions

Use unprotected only in dry environments

### Packaging

Blister reel, plastic bag

### Status

04/2006

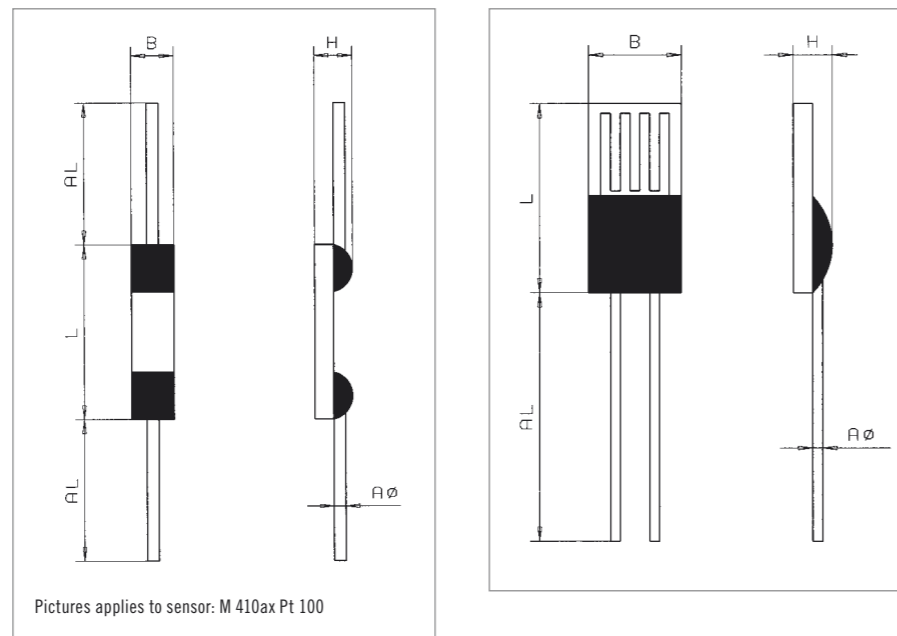
### Supply range

The standard types are listed in the catalog with their various features. These are the most frequently used versions, and can be obtained at short notice and at reasonable prices.

For special applications, non-standard versions are available. The following alternatives are possible:

- Different dimensions
- Different nominal resistances
- Different temperature coefficients
- Different lengths of leads
- Different tolerances
- Different packages

Please contact us.



The measuring point for the basic value is situated at 8 mm from the end of the sensor body.

# Type M (Medium)

## Tolerance class B from $-70^{\circ}\text{C}$ to $+500^{\circ}\text{C}$

Type	Name		Order number		Dimensions in mm					Self-heating Ice water $0^{\circ}\text{C}$ in K/mW	Response time in seconds			
	Design	Nominal resistance	Blister reel	Plastic bag	L	B	H	AL	A $\phi$		Water: v=0.4m/s		Air: v=2m/s	
										t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>	
M	1020	Pt 100	32208280	32208180	9.5	1.9	0.9	10	0.2	0.2	0.10	0.30	4.0	12
M	1020	Pt 500	32208285	32208201	9.5	1.9	0.9	10	0.2	0.2	0.10	0.30	4.0	12
M	1020	Pt 1000	32208286	32208191	9.5	1.9	0.9	10	0.2	0.2	0.10	0.30	4.0	12
M	622	Pt 1000		32208181	5.9	2.1	0.9	10	0.2	0.3	0.08	0.25	3.7	11.5
M	622	Pt 2000		32208541	5.9	2.1	0.9	10	0.2	0.3	0.08	0.25	3.7	11.5
M	622	Pt 10000		32208711	5.9	2.1	0.9	10	0.2	0.3	0.08	0.25	3.7	11.5
M	422	Pt 100	32208520	32208392	3.9	2.1	0.9	10	0.2	0.3	0.07	0.20	3.2	11
M	422	Pt 500	32208523	32208414	3.9	2.1	0.9	10	0.2	0.3	0.07	0.20	3.2	11
M	422	Pt 1000	32208526	32208499	3.9	2.1	0.9	10	0.2	0.3	0.07	0.20	3.2	11
M	416	Pt 100	32208278	32208213	3.9	1.5	0.9	10	0.2	0.4	0.06	0.18	3.1	10.5
M	410ax	Pt 100	32208209		3.7	0.9	0.9	10/15	0.2	0.4	0.06	0.17	3.0	10
M	310	Pt 100	32208721		3.0	1.0	0.9	10	0.15	0.3	0.04	0.12	2.5	8
M	310	Pt 1000	32208723		3.0	1.0	0.9	10	0.15	0.3	0.04	0.12	2.5	8
M	222	Pt 100	32208718	32208548	2.3	2.1	0.9	10	0.2	0.4	0.05	0.15	3.0	10
M	222	Pt 500		32208706	2.3	2.1	0.9	10	0.2	0.4	0.05	0.15	3.0	10
M	222	Pt 1000		32208571	2.3	2.1	0.9	10	0.2	0.4	0.05	0.15	3.0	10
M	220	Pt 100	32208440	32208714	2.3	1.9	0.9	10	0.2	0.4	0.05	0.15	3.0	10
M	213	Pt 100		32207340	1.7	1.25	0.9	10	0.2	0.6	0.04	0.12	2.2	7
M	213	Pt 1000		32207320	1.8	1.25	0.9	10	0.2	0.6	0.04	0.12	2.2	7

## Tolerance class A from $-50^{\circ}\text{C}$ to $+300^{\circ}\text{C}$

Type	Name		Order number		Dimensions in mm					Self-heating Ice water $0^{\circ}\text{C}$ in K/mW	Response time in seconds			
	Design	Nominal resistance	Blister reel	Plastic bag	L	B	H	AL	A $\phi$		Water: v=0.4m/s		Air: v=2m/s	
										t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>	
M	1020	Pt 100	32208429	32208734	9.5	1.9	0.9	10	0.2	0.2	0.10	0.30	4.0	12
M	1020	Pt 1000	32208439		9.5	1.9	0.9	10	0.2	0.2	0.10	0.30	4.0	12
M	422	Pt 100	32208521	32208498	3.9	2.1	0.9	10	0.2	0.3	0.07	0.20	3.2	11
M	422	Pt 500	32208524	32208501	3.9	2.1	0.9	10	0.2	0.3	0.07	0.20	3.2	11
M	422	Pt 1000	32208527	32208503	3.9	2.1	0.9	10	0.2	0.3	0.07	0.20	3.2	11
M	416	Pt 100	32208279	32208216	3.9	1.5	0.9	10	0.2	0.4	0.06	0.18	3.1	10.5
M	222	Pt 100	32208719	32208550	2.3	2.1	0.9	10	0.2	0.4	0.05	0.15	3.0	10
M	222	Pt 1000		32208572	2.3	2.1	0.9	10	0.2	0.4	0.05	0.15	3.0	10
M	220	Pt 100	32208465	32208715	2.3	1.9	0.9	10	0.2	0.4	0.05	0.15	3.0	10
M	213	Pt 100		32207591	1.7	1.25	0.9	10	0.2	0.6	0.04	0.12	2.2	7



## Type M (Medium)

Tolerance class 1/3 DIN from 0°C to +150°C														
Name			Order number		Dimensions in mm					Self-heating	Response time in seconds			
Type	Design	Nominal resistance	Blister reel	Plastic bag	L	B	H	AL	AØ	Ice water 0°C in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>
M	1020	Pt 100	32208428		9.5	1.9	0.9	10	0.2	0.2	0.10	0.30	4.0	12
M	1020	Pt 1000	32208483		9.5	1.9	0.9	10	0.2	0.2	0.10	0.30	4.0	12
M	422	Pt 100	32208522	32208500	3.9	2.1	0.9	10	0.2	0.3	0.07	0.20	3.2	11
M	422	Pt 500	32208525	32208502	3.9	2.1	0.9	10	0.2	0.3	0.07	0.20	3.2	11
M	422	Pt 1000		32208537	3.9	2.1	0.9	10	0.2	0.3	0.07	0.20	3.2	11
M	416	Pt 100	32208701	32208217	3.9	1.5	0.9	10	0.2	0.4	0.06	0.18	3.1	10.5
M	222	Pt 100		32208551	2.3	2.1	0.9	10	0.2	0.4	0.05	0.15	3.0	10
M	222	Pt 1000		32208707	2.3	2.1	0.9	10	0.2	0.4	0.05	0.15	3.0	10
M	220	Pt 100	32208466		2.3	1.9	0.9	10	0.2	0.4	0.05	0.15	3.0	10
M	213	Pt 100		32207571	1.7	1.25	0.9	10	0.2	0.6	0.04	0.12	2.2	7

### Tolerances:

L: ± 0.15 • B: ± 0.15 (bei X 22: B: ± 0.2) • H: + 0.3 / - 0.2 • AL: ± 1.0 • AØ: ± 0.02

## Platinum thin-film sensor Type M-DBW

Temperature range -70°C to +500°C,  
for a short time to +550°C

### Applications

Applications with high consumer volumes, typically in the automotive, white goods, ventilation, heating and energy generation sectors as well as in medical and industrial equipment. The advantage of the DBW technology is the cost effective leads

### Specification

DIN EN 60751

### Tolerance classes

Class B and class 2B

### Nominal resistances

100 Ω, 1000 Ω at 0°C

### Temperature coefficient

3850 ppm/K

### Soldering connection

Ni leads

### Vibration resistance

At least 40 g acceleration at 10 to 2000 Hz, depending on mounting method

### Shock resistance

At least 100 g acceleration with 8 ms half sine wave, depending on mounting method

### Insulation resistance

> 10 MΩ at 20°C;  
> 1 MΩ at 500°C

### Measuring current

at 100 Ω: 0.3 to 1.0 mA  
at 1000 Ω: 0.1 to 0.3 mA

### Environmental conditions

Unhoused for dry environments only, with operating temperatures > 450°C in housings with ventilation

### Fixing

White fixing (exception from color coding)

### Packaging

Plastic tube

### Status

04/2006

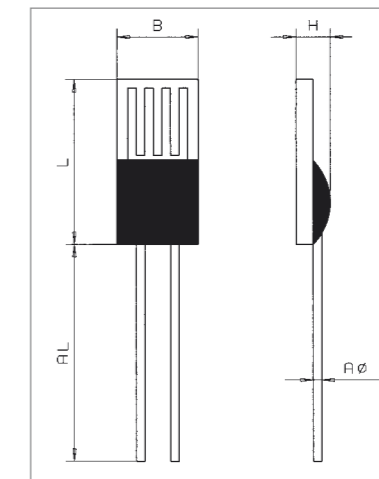
### Supply range

The standard types are listed in the catalog with their various features. These are the most frequently used versions, and can be obtained at short notice and at reasonable prices.

For special applications, non-standard versions are available. The following alternatives are possible:

- Different dimensions
- Different nominal resistances
- Different temperature coefficients
- Different lengths of leads
- Different tolerances
- Different packages

Please contact us.



### Tolerance class 2B from -70°C to +500°C

Name			Order number	Dimensions in mm					Self-heating	Response time in seconds			
Type	Design	Nominal resistance	Plastic tube	L	B	H	AL	AØ	Ice water 0°C in K/mW	Water: v=0,4m/s		Air: v=2m/s	
										t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>
M-DBW	420	Pt 100	32207620	3.9	1.9	0.9	150	0.25	0.3	0.07	0.20	3.2	11.0

### Tolerances:

L: ± 0.15 • B: ± 0.15 • H: + 0.3 / - 0.2 • AL: ± 1.0 • AØ: ± 0.02

# Platinum thin-film sensor Type MH (Medium High)

Temperature range -70°C to +600°C

## Applications

Process industry, automotive, white goods, HVAC and energy management

## Specification

DIN EN 60751

## Tolerance classes

Class B, class A, class 1/3 DIN

## Nominal resistances

100 Ω, 500 Ω and 1000 Ω at 0°C

## Temperature coefficient

3850 ppm/K

## Soldering connection

AuPd leads

## Long-term stability

Max. R<sub>0</sub>-drift 0.04 % after 1000 h at 500°C

## Vibration resistance

At least 40 g acceleration at 10 to 2000 Hz, depending on mounting method

## Shock resistance

At least 100 g acceleration with 8 ms half sine wave, depending on mounting method

## Insulation resistance

> 10 MΩ at 20°C;  
> 1 MΩ at 500°C

## Measuring current

at 100 Ω: 0.3 to 1.0 mA  
at 500 Ω: 0.1 to 0.7 mA  
at 1000 Ω: 0.1 to 0.3 mA

## Environmental conditions

Use unprotected only in dry environments

## Fixing

White fixing (exception from color coding)

## Packaging

Plastic box, plastic bag

## Status

04/2006

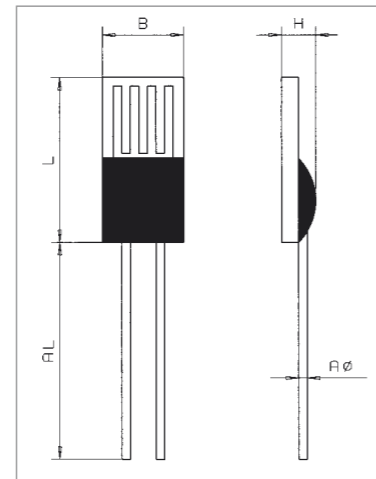
## Supply range

The standard types are listed in the catalog with their various features. These are the most frequently used versions, and can be obtained at short notice and at reasonable prices.

For special applications, non-standard versions are available. The following alternatives are possible:

- Different dimensions
- Different nominal resistances
- Different temperature coefficients
- Different lengths of leads
- Different tolerances
- Different packages

Please contact us.



# Type MH (Medium High)

## Tolerance class B from -70°C to +600°C

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic box	Plastic bag	L	B	H	AL	AØ	Ice water 0°C in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>
MH	1020	Pt 100	32207361		9.5	1.9	0.9	10	0.25	0.2	0.12	0.30	6.0	20
MH	1020	Pt 1000	32207481		9.5	1.9	0.9	10	0.25	0.2	0.12	0.30	6.0	20
MH	420	Pt 100	32207411		3.9	1.9	0.9	10	0.25	0.3	0.08	0.25	3.5	15
MH	416	Pt 100	32207460		3.9	1.5	0.9	10	0.25	0.4	0.07	0.25	3.2	14
MH	220	Pt 100		32207420	2.3	1.9	0.9	10	0.25	0.4	0.06	0.20	3.0	13

## Tolerance class A from -50°C to +300°C

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic box	Plastic bag	L	B	H	AL	AØ	Ice water 0°C in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>
MH	1020	Pt 100		32207572	9.5	1.9	0.9	10	0.25	0.2	0.12	0.30	6.0	20
MH	416	Pt 100		32207574	3.9	1.5	0.9	10	0.25	0.4	0.07	0.25	3.2	14
MH	220	Pt 100		32207577	2.3	1.9	0.9	10	0.25	0.4	0.06	0.20	3.0	13

## Tolerance class 1/3 DIN from 0°C to +150°C

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic box	Plastic bag	L	B	H	AL	AØ	Ice water 0°C in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>
MH	220	Pt 100		32207578	2.3	1.9	0.9	10	0.25	0.4	0.06	0.20	3.0	13

## Tolerances:

L: ± 0.15 • B: ± 0.15 • H: + 0.3 / - 0.2 • AL: ± 1.0 • AØ: ± 0.02

# Platinum thin-film sensor Type H (High)

Temperature range  $-70^{\circ}\text{C}$  to  $+750^{\circ}\text{C}$  (HL),  
 $-70^{\circ}\text{C}$  to  $+850^{\circ}\text{C}$  (HD),  $-70^{\circ}\text{C}$  to  $+1000^{\circ}\text{C}$  (HA),  
 $-70^{\circ}\text{C}$  to  $+850^{\circ}\text{C}$  (HDA)

## Applications

Applications with high consumer volumes, e.g. white goods, heating power and process technology

## Specification

DIN EN 60751 (HL, HD)

## Tolerance classes

Class B, class 2B, tolerance defined by HST

## Nominal resistances

100  $\Omega$ , 200  $\Omega$  and 1000  $\Omega$  at  $0^{\circ}\text{C}$

## Temperature coefficient

3850 ppm/K (HL, HD), 3770 ppm/K (HDA, HA)

## Soldering connection

PtNiCr, Au-Inc, Pt leads

## Long-term stability

HL: 1000 h at  $750^{\circ}\text{C}$  (energized) smaller than the allowed deviation according to DIN B

HD: 1000 h at  $850^{\circ}\text{C}$  (energized, open) smaller than the allowed deviation according to DIN B.  
 1000 h at  $650^{\circ}\text{C}$  (under current as clean MI-type) smaller than the allowed deviation according to DIN B

HDA: 1000 h at  $850^{\circ}\text{C}$  inside the HST tolerance

HA: 1000 h at  $1000^{\circ}\text{C}$  smaller than the tolerance defined by HST

## Vibration resistance

At least 40 g acceleration at 10 to 2000 Hz, depending on mounting method

## Shock resistance

At least 100 g acceleration with 8 ms half sine wave, depending on mounting method

## Environmental conditions

Unhoused for dry environments only, up to  $600^{\circ}\text{C}/650$  in housings also as clean MI-type possible, above  $600^{\circ}\text{C}/650$  no reducing atmosphere, free air admission necessary

## Insulation resistance

> 10 M $\Omega$  at  $20^{\circ}\text{C}$ ;  
 > 1 M $\Omega$  at  $650^{\circ}\text{C}$

## Measuring current

HL and HD at  $20^{\circ}\text{C}$ :  
 0.3 to 5 mA

HA and HDA at  $20^{\circ}\text{C}$ :  
 5 mA;  $1000^{\circ}\text{C}$  max.  
 2.7 mA

## Packaging

Plastic bag

## Status

04/2006

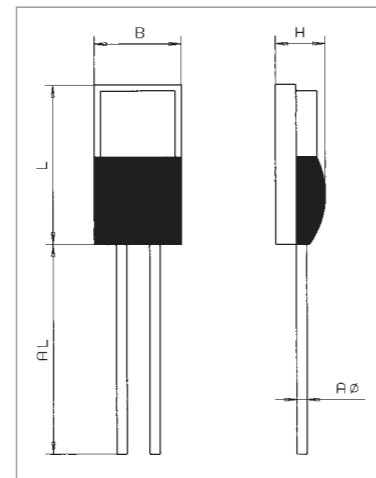
## Supply range

The standard types are listed in the catalog with their various features. These are the most frequently used versions, and can be obtained at short notice and at reasonable prices.

For special applications, non-standard versions are available. The following alternatives are possible:

- Different dimensions
- Different nominal resistances
- Different temperature coefficients
- Different lengths of leads
- Different tolerances
- Different packages

Please contact us.



# Type H (High)

## Tolerance class 2B from $-70^{\circ}\text{C}$ to $+750^{\circ}\text{C}$ , TC=3850 ppm/K

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic bag	Leads material	L	B	H	AL	AØ	Ice water $0^{\circ}\text{C}$ in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											$t_{0.5}$	$t_{0.9}$	$t_{0.5}$	$t_{0.9}$
HL	220	Pt 1000	32208239		2.3	1.9	0.9	8	0.2	0.2	$\leq 0.05$	$\leq 0.14$	$\leq 3$	$\leq 10$

L:  $\pm 0.15$  • B:  $\pm 0.15$  • H:  $+ 0.3 / - 0.2$  • AL:  $\pm 1.0$  • AØ:  $\pm 0.04$

## Tolerance class B from $-70^{\circ}\text{C}$ to $+650^{\circ}\text{C}$ ; TC = 3850 ppm/K and Tolerance class 2B to $+850^{\circ}\text{C}$ ; TC = 3850 ppm/K

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic bag	Leads material	L	B	H	AL	AØ	Ice water $0^{\circ}\text{C}$ in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											$t_{0.5}$	$t_{0.9}$	$t_{0.5}$	$t_{0.9}$
HD	421	Pt 100	32208228	Pt	4.0	2.0	1.1	6	0.25	0.2	0.05	0.17	3.3	13

L:  $+ 0.4 / - 0.2$  • B:  $\pm 0.2 / - 0.2$  • H:  $+ 0.3 / - 0.3$  • AL:  $\pm 1.0$  • AØ:  $\pm 0.04$

## HST tolerance from $-70^{\circ}\text{C}$ to $+850^{\circ}\text{C}$ ; TC = 3770 ppm/K

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic bag	Leads material	L	B	H	AL	AØ	Ice water $0^{\circ}\text{C}$ in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											$t_{0.5}$	$t_{0.9}$	$t_{0.5}$	$t_{0.9}$
HDA	420	Pt 200	32208771		3.9	1.9	0.9	4	0.25	0.2	$\leq 0.05$	$\leq 0.17$	$\leq 3$	$\leq 11$

L:  $\pm 0.15$  • B:  $1.9 \pm 0.2$  • H:  $1.0 \pm 0.3$  • AL:  $\pm 1.0$  • AØ:  $\pm 0.04$

## HST tolerance from $-70^{\circ}\text{C}$ to $+1000^{\circ}\text{C}$ ; TC = 3770 ppm/K

Name		Order number		Dimensions in mm					Self-heating	Response time in seconds				
Type	Design	Nominal resistance	Plastic bag	Leads material	L	B	H	AL	AØ	Ice water $0^{\circ}\text{C}$ in K/mW	Water: v=0.4m/s		Air: v=2m/s	
											$t_{0.5}$	$t_{0.9}$	$t_{0.5}$	$t_{0.9}$
HA	421	Pt 200	32208762	Pt	4.0	2.0	1.1	8	0.25	0.2	0.05	0.17	3.3	13

L:  $+ 0.4 / - 0.2$  • B:  $\pm 0.2 / - 0.2$  • H:  $+ 0.3 / - 0.3$  • AL:  $\pm 1.0$  • AØ:  $\pm 0.04$

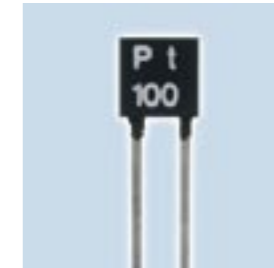
## Sensor Components

Heraeus Sensor Technology develops, produces and markets products whose function is based on structured thin films of platinum (Pt). With such an orientation the company is intentionally positioning itself at the start of the added value chain, i.e. the manufacture of components.

The customers of Heraeus Sensor Technology are generally manufacturers of equipment for process measurement technology, the life science sector, the complete bandwidth of heating/ventilation/air conditioning, or subcontractors for mass markets such as household appliances and motor vehicles, just to name a few as examples.

Since nothing can be better or more reliable than the sum of its parts, Heraeus Sensor Technology today leads the world market for long lasting Pt temperature sensors in thin-film technology for accurate and reproducible measurements. The reason here is not just the mastering of material properties and coating processes. Market leadership also implies a command of the production processes with dependable process management, well-conceived quality assurance and a high throughput.

Apart from some millions of temperature sensors, with its expertise in Pt thin-film technology, Heraeus Sensor Technology also manufactures gas-mass flow sensors for exhaust gas recirculation systems and platforms for the construction of multi-sensor systems. In this respect the company philosophy includes always developing new product variants together with customers and end users and mastering the associated tasks for widening the knowledge base.



Examples of sensor components:  
TO 92, SMD in the versions 0603,  
0805 and 1206



# Platinum temperature sensor in thin-film technology SMD

Temperature range -50°C to +130°C

**(V-Version: Possible working temperatures using volume expansion aligned conductor board material: 150 °C)**

### Applications

Designed for automatic assembly in large-scale applications

### Specification

DIN EN 60751

### Tolerance classes

Class B, class 2B

### Nominal resistances

100 Ω, 1000 Ω and 10000 Ω at 0°C

### Temperature coefficient

3850 ppm/K

### Leads

SMD-V: galvanic tin plated with Ni-barrier

### Insulation resistance

> 10 MΩ at 20°C

### Measuring current

at 100 Ω:  
0.3 to 1.0 mA

at 1000 Ω:

0.1 to 0.3 mA

at 10000 Ω:

0.1 to 0.25 mA

### Environmental conditions

Unhoused only in dry environment

### Packaging

Face-up in blister reel, up to 4000 pcs/reel; we deliver in common components packaging

### Processing

Face-up mounting: Reflow soldering or wave soldering, e.g. double wave soldering < 8 s / 235°

### Status

04/2006

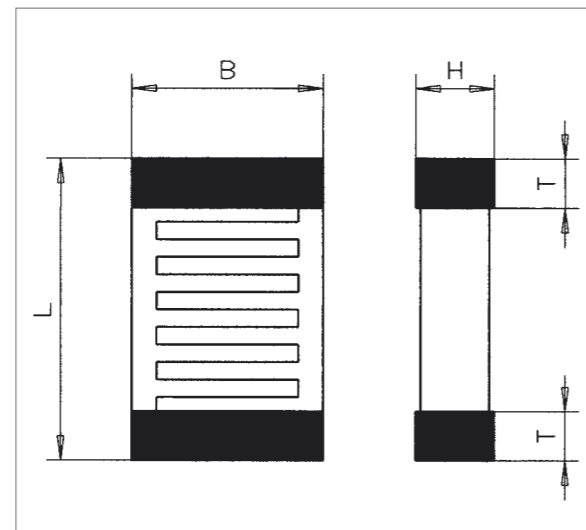
### Supply range

The standard types are listed in the catalog with their various features. These are the most frequently used versions, and can be obtained at short notice and at reasonable prices.

For special applications, non-standard versions are available. The following alternatives are possible:

- Different dimensions
- Different nominal resistances
- Different temperature coefficients
- Different tolerances

Please contact us.



## SMD

Tolerance class B from -50°C to +130°C;  $R_0: \pm 0.12\%$

Face up

Type	Name		Order number	Dimension in mm				Self-heating Ice water 0°C in K/mW	Response time in seconds			
	Design	Nominal resistance		Blister reel	L	B	H		T	Water: v=0.4m/s		Air: v=2m/s
								t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>	
SMD	1206 V	Pt 100	32207590	3.15	1.60	0.60	0.50	0.4	0.15	0.30	3.5	10
SMD	1206 V	Pt 1000	32207595	3.15	1.60	0.60	0.50	0.4	0.15	0.30	3.5	10
SMD	0805 V	Pt 100	32207605	2.30	1.40	0.60	0.35	0.8	0.10	0.25	2.5	8
SMD	0805 V	Pt 1000	32207615	2.30	1.40	0.60	0.35	0.8	0.10	0.25	2.5	8

Tolerance class 2B from -50°C to +130°C;  $R_0: \pm 0.24\%$

Face up

Type	Name		Order number	Dimension in mm				Self-heating Ice water 0°C in K/mW	Response time in seconds			
	Design	Nominal resistance		Blister reel	L	B	H		T	Water: v=0.4m/s		Air: v=2m/s
								t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>	
SMD	1206 V	Pt 100	32207589	3.15	1.60	0.60	0.50	0.4	0.15	0.30	3.5	10
SMD	1206 V	Pt 1000	32207594	3.15	1.60	0.60	0.50	0.4	0.15	0.30	3.5	10
SMD	0805 V	Pt 100	32207604	2.30	1.40	0.60	0.35	0.8	0.10	0.25	2.5	8
SMD	0805 V	Pt 1000	32207614	2.30	1.40	0.60	0.35	0.8	0.10	0.25	2.5	8
SMD	0805 V	Pt 10000	32208655	2.30	1.40	0.50	0.35	0.8	0.10	0.25	2.5	8
SMD	0603 V	Pt 1000	32207637	1.70	0.90	0.45	0.30	0.8	0.10	0.25	2.5	8

### Tolerances:

L: ± 0.2 • B: ± 0.2 • H: 0.1 • T: ± 0.2



# Platinum temperature sensor in thin-film technology T092

Temperature range -50°C to +150°C

## Applications

Automotive, appliances and industrial equipment

## Specification

DIN EN 60751

## Tolerance classes

Class B, class 2B

## Nominal resistances

100 Ω and 1000 Ω at 0°C

## Temperature coefficient

3850 ppm/K

## Soldering connection

Cu alloy with Sn/Pb coating

## Long-term stability

Max.  $R_0$ -drift 0.06 % after 1000 h at 150°C  
Max.  $R_0$ -drift 0.04 % after 1000 h at -55°C

## Flammability

UL 94-V0

## Resistance to soldering heat

Max. deviation 0.03 % after 10 s at 260 °C

## Specific volume resistance

20°C: 5 x 10<sup>16</sup> Ωcm,  
150°: 5 x 10<sup>13</sup> Ωcm

## Physical data of housing

Material: duroplastic  
coefficient of thermal expansion: 13 x 10<sup>-6</sup> 1/°C;  
thermal conductivity: 0.65 W/mK; moisture absorption: 0.5 % (P.C.T.: 121 °C, 24 h)

## Storage life

< 1 year (in dry environments)

## Status

04/2006

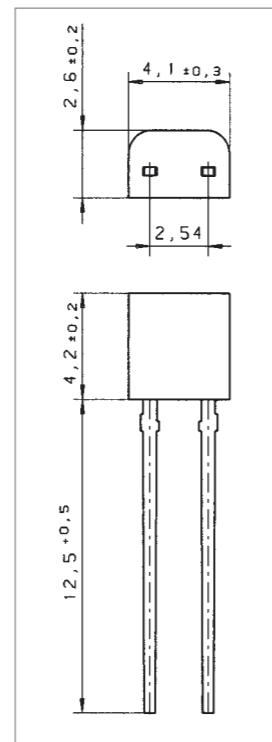
## Supply range

The standard types are listed in the catalog with their various features. These are the most frequently used versions, and can be obtained at short notice and at reasonable prices.

For special applications, non-standard versions are available. The following alternatives are possible:

- Different dimensions
- Different nominal resistances
- Different temperature coefficients
- Different tolerances
- Different lengths of leads

Please contact us.



# T092

## Tolerance class B from -50°C to +150°C, $R_0: \pm 0.12\%$

Type	Name		Order number	Self-heating Ice water 0°C in K/mW	Response time in seconds			
	Design	Nominal resistance			Water: v=0.4m/s		Air: v=2m/s	
					t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>
TO	92	Pt 100	32209210	0.4	0.7	2.0	8.0	26
TO	92	Pt 1000	32209220	0.2	0.7	2.0	8.0	26

## Tolerance class 2B from -50°C to +150°C, $R_0: \pm 0.24\%$

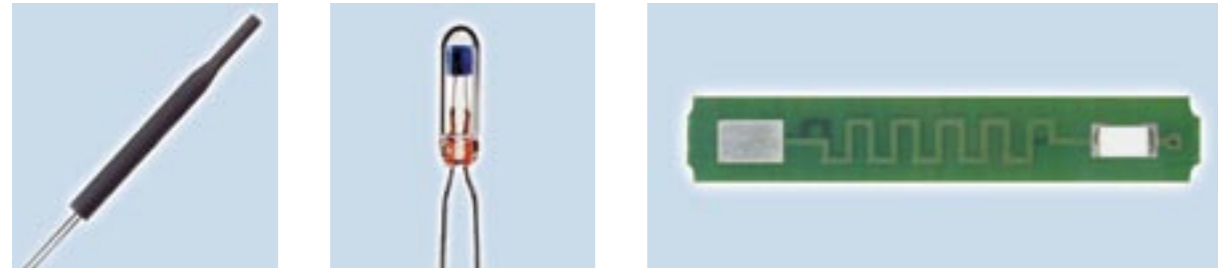
Type	Name		Order number	Self-heating Ice water 0°C in K/mW	Response time in seconds			
	Design	Nominal resistance			Water: v=0.4m/s		Air: v=2m/s	
					t <sub>0.5</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.9</sub>
TO	92	Pt 100	32209216	0.4	0.7	2.0	8.0	26
TO	92	Pt 1000	32209226	0.2	0.7	2.0	8.0	26

## T092

### Dimensions in mm

Dimension	min.	max.
A	2.4	2.8
b	0.35	0.48
b <sub>1</sub>	0.45	0.6
c	0.25	0.35
D	4.0	4.4
E	3.8	4.4
e	NOM.	1.27
Q	0.8	1.1
L	12.0	13.0
L <sub>1</sub>	1.0	1.3

## Sensor Solutions



Heraeus Sensor Technology always works closely with the company's customers. The extensive expertise from development through to the large-scale production of structured, thin platinum films already bears fruit for the customer during the product definition and also has an effect long after large-scale production has started.

This company philosophy is reflected in a range of products for completely tangible applications, which have been employed in large quantities for years. Through the principle of continuous improvement, the processes are further optimised in consultation with the customers even after the start of large-scale production, so that currently achievable levels of quality and costs become available.

Examples of this are temperature sensors for installation in ovens and hotplates, in engine-oil condition sensors subject to strong vibrations, in diesel exhaust treatment systems, in calorimetric measurement instruments or also in resistance thermometers for the process industry.

Apart from temperature sensors Heraeus Sensor Technology manufactures customer-specifically designed platforms with sensors, heating elements and other customised meander structures of thin platinum films which are employed by the users as the basis for the manufacture of their own gas sensors.



## Primary housed platinum sensor in thin-film technology LG Temperature range $-40^{\circ}\text{C}$ to $+180^{\circ}\text{C}$

### Specification

DIN EN 60751

### Tolerance class

Class B

### Nominal resistance

100  $\Omega$  and 1000  $\Omega$  at  $0^{\circ}\text{C}$

### Temperature coefficient

3850 ppm/K

### Leads

Cu, Ni-plated with gold layer,  $\varnothing$  0.4 mm

### Long-term stability

$\Delta R_0$  after 300 h at  $180^{\circ}\text{C}$ : < class B

### Environmental conditions

Version B unprotected only in dry environment  
Version C protected against humidity

### Insulation resistance

> 10 M $\Omega$  at  $20^{\circ}\text{C}$

### Measuring current

100  $\Omega$ :  
0.3 mA to 1.0 mA  
1000  $\Omega$ :  
0.1 mA to 0.3 mA (self-heating has to be considered)

### Self-heating

Version A:  
0.70 K/mW at  $0^{\circ}\text{C}$

Version B:  
0.20 K/mW at  $0^{\circ}\text{C}$

Version C:  
0.60 K/mW at  $0^{\circ}\text{C}$

### Response time

Version A:  
Water ( $v = 0.4$  m/s):  
 $t_{0.5} = 2.7$  s;  $t_{0.9} = 7.9$  s

Air ( $v = 2$  m/s):  
 $t_{0.5} = 8.7$  s;  $t_{0.9} = 22$  s

Version B:  
Water ( $v = 0.4$  m/s):  
 $t_{0.5} = 0.05$  s;  $t_{0.9} = 0.10$  s

Air ( $v = 2$  m/s):  
 $t_{0.5} = 2.6$  s;  $t_{0.9} = 9$  s

Version C:  
Water ( $v = 0.4$  m/s):  
 $t_{0.5} = 2.6$  s;  $t_{0.9} = 7.7$  s

Air ( $v = 2$  m/s):  
 $t_{0.5} = 8.1$  s;  $t_{0.9} = 21$  s

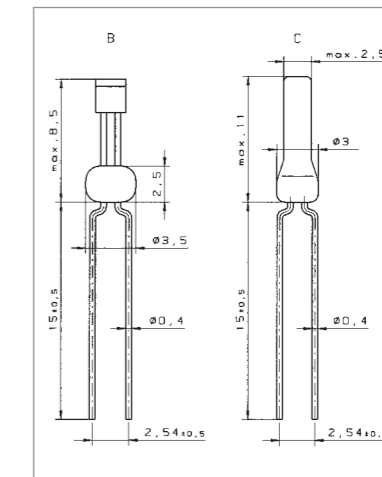
### Status

04/2006

### Note

Other tolerances, values of resistance and wire lengths are available on request. For automatic production we can supply on tape.

The new LG sensor is based on a platinum sensor in thin-film technology with laser welded extended leads and glass covering. It is sealed against humidity and can be handled very easily from batch size 1 to full automation. Using this design and the well-known qualities of platinum sensors it is a very good alternative to the glass wire-wound versions. Platinum thin-film sensors are known for good accuracy, an almost linear characteristic, long-term stability, low drift and good reproducibility.



	Nominal resistance	Tolerance	Order number
	$R_0$		
B	100 Ohm at $0^{\circ}\text{C}$	DIN EN 60751, class B	32 208 666
	1000 Ohm at $0^{\circ}\text{C}$	DIN EN 60751, class B	32 208 667
C	100 Ohm at $0^{\circ}\text{C}$	DIN EN 60751, class B	32 208 662
	1000 Ohm at $0^{\circ}\text{C}$	DIN EN 60751, class B	32 208 663

# Platinum temperature sensor in thin-film technology PCB

Temperature range 0°C to +150°C

**Specification**  
DIN EN 60751

**Tolerance class**  
Class B

**Nominal resistance**  
100 Ω, 500 Ω, 1000 Ω  
and 10000 Ω at 0°C

**Temperature coefficient**  
3850 ppm/K

**Long-term stability**  
< 0.1 K after 1000 h at  
150°C (energized with:  
Pt 100: 1.0 mA; Pt 500:  
0.7 mA; Pt 1000: 0.3 mA)

**Measuring current**  
100 Ω: 0.3 to 1.0 mA  
500 Ω: 0.1 to 0.7 mA  
1000 Ω: 0.1 to 0.3 mA  
10000 Ω: 0.1 to 0.25 mA

**Track resistance**  
Meander: 0.06 Ω

**Thermal fatigue resistance**  
≤ 0.1 K after 1000  
changes 0°C / 150°C in air

**Contact**  
Cu connection pad with  
chem. Sn surface

**Soldering**  
Chip is soldered lead-free  
Connection pads are ready  
for lead-free soldering

**Self-heating**  
0.15 K/mW in ice water

**Response time**  
with SMD 1206  
Water (v = 0.4 m/s):  
t<sub>0.5</sub> = 0.1 s; t<sub>0.9</sub> = 0.2 s

Air (v=2 m/s):  
t<sub>0.5</sub> = 2.5 s; t<sub>0.9</sub> = 8 s  
with SMD 0805

Water (v = 0.4 m/s):  
t<sub>0.5</sub> = 0.05 s; t<sub>0.9</sub> = 0.1 s

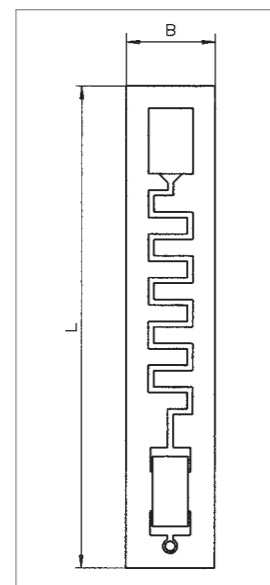
Air (v=2 m/s):  
t<sub>0.5</sub> = 1.5 s; t<sub>0.9</sub> = 5 s

**Environmental conditions**  
Use unprotected only in  
dry environments

**Packaging**  
Supplied in plastic con-  
tainer

**Storage life**  
12 months

**Status**  
04/2006



**Note**  
Other tolerances and values of resistance are available on request.

This platinum temperature sensor on a printed circuit board has been specially designed for use in calorimetry. When designing these sensors, the stringent requirements of this sector with regard to precision, long-term stability, cost minimisation as well as the option for fully automatic further processing were of prime concern. The temperature sensor in an SMD model forms the measurement active element on a PCB. The chip is connected with the terminal faces via meandering circuit board conductors in order to reduce heat dissipation and to prevent corruption of the measurement results. Prepared as a cable probe, it is suitable for a wide range of applications within a temperature range of 0°C to 150°C.

Nominal resistance	Dimensions		FC-type	Order number
	L [mm]	B [mm]		
R <sub>0</sub>				
100	22	2.5	0805	30 201 075
100	22	4.0	0805	30 201 071
500	22	2.5	0805	30 201 073
500	22	4.0	0805	30 201 069
1000	22	2.5	0805	30 201 063
1000	22	4.0	0805	30 201 067

# Platinum temperature sensor in thin-film technology MR 828 and 845

Temperature range -70°C to +500°C (continuous operation)

**Specification**  
DIN EN 60751

**Tolerance class**  
Class B

**Nominal resistance**  
100 Ω, 500 Ω and  
1000 Ω at 0°C

**Temperature coefficient**  
3850 ppm/K

**Leads**  
Pt clad Ni wire

**Long-term stability**  
Max. R<sub>0</sub>-drift 0.1% after  
1000 h at 500°C

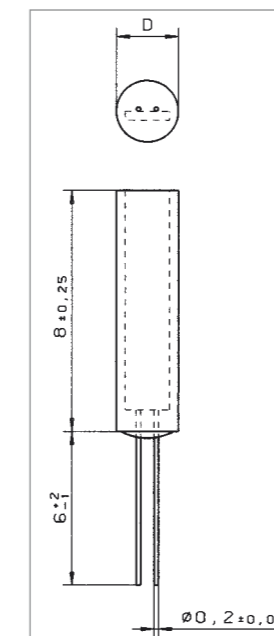
**Vibration resistance**  
According to DIN EN  
60751

**Insulation resistance**  
> 10 MΩ at 20 °C;  
> 1 MΩ at 500 °C

**Measuring current**  
100 Ω: 0.3 to 1.0 mA  
500 Ω: 0.1 to 0.7 mA  
1000 Ω: 0.1 to 0.3 mA  
(self-heating has to be  
considered)

**Response time**  
Water Current  
(v = 0.4 m/s)  
MR 828: t<sub>0.5</sub> = 0.9 s;  
t<sub>0.9</sub> = 2.7 s  
MR 845: t<sub>0.5</sub> = 1.5 s;  
t<sub>0.9</sub> = 4.6 s

Air (v=2 m/s)  
MR 828: t<sub>0.5</sub> = 12.3 s;  
t<sub>0.9</sub> = 39.5 s  
MR 845: t<sub>0.5</sub> = 24.8 s;  
t<sub>0.9</sub> = 78.8 s



The measuring point for the basic value is situated at 2 mm from the end of the leads.

**Self-heating**  
MR 828 (Pt 100/500/1000): 0.05 K/mW at 0°C  
MR 828 (2 Pt 100/1000): 0.16 K/mW at 0°C  
MR 845 (Pt 100/500/1000): 0.04 K/mW at 0°C  
MR 845 (2 Pt 100/1000): 0.08 K/mW at 0°C

**Environmental conditions**  
Unhoused for dry environments only

**Packaging**  
Blister reel (MR 828)  
Plastic container (MR 845)

**Status**  
04/2006

**Note**  
Other tolerances, values of resistance and wire lengths are available on request

MR series elements are designed for applications where high vibration resistance as well as high temperature stability are vital. Typical industrial applications include analytical and medical equipment, chemical plants and mechanical equipment. Small tolerances on diameter allow problem-free installation in protective tubes.

MR 828			
Type	Diameter D	Order number	
	(in mm ±0.3 mm)		
1 Pt 100 MR 828	2.8	32 209 340	
1 Pt 500 MR 828	2.8	32 209 341	
1 Pt 1000 MR 828	2.8	32 209 342	
2 Pt 100 MR 828	2.8	32 209 343	

MR 845			
Type	Diameter D	Order number	
	(in mm ±0.3 mm)		
1 Pt 100 MR 845	4.5	32 209 346	
1 Pt 500 MR 845	4.5	32 209 347	
1 Pt 1000 MR 845	4.5	32 209 348	
2 Pt 100 MR 845	4.5	32 209 349	
2 Pt 1000 MR 845	4.5	32 209 351	

# Sensor Modules



The core capability at Heraeus Sensor Technology is the manufacture of structured, thin platinum films. The product spectrum however extends well beyond the manufacture of classical Pt temperature sensors.

Sensor modules are multi-functionally constructed foundation modules based on platinum thin-film technology. They consist, for example, of sensor/heater combinations and application-specific structured electrodes. Sensitive layers can be applied to the electrodes by the customer. Through the application of metal oxides, for example, multi-sensor platforms become gas sensors with which concentrations of oxygen, carbon monoxide, nitrogen or methane can be detected down to the ppm range. Apart from the typical applications in gas and humidity measurement, analytical techniques in aqueous media, for example for medical technology or biotechnology, are conceivable.

Heraeus Sensor Technology produces multi-sensor platforms with customer-specifically designed Pt structures for sensors, heaters or electrodes in mono- or multi-layer versions. Within the scope of common product developments, the company is pleased to make its own expertise regarding coating, structuring and large-scale production available to its customers.

