

# Strengths of Pt RTDs, key properties and their advantages in your applications.





# INTRODUCTION – OUR SPEAKERS



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**GLOBAL HEAD OF MARKETING**



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**APPLICATION ENGINEER**



**Strengths of Pt RTDs, key properties and their advantages in your application**



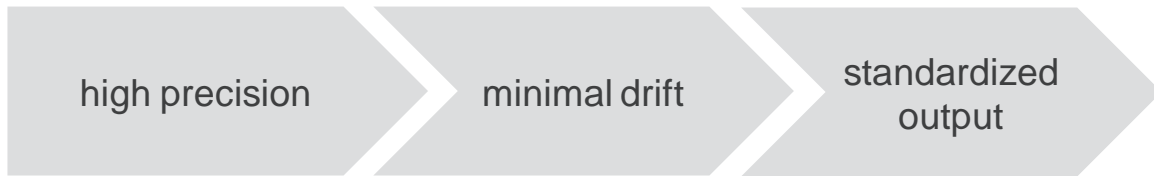
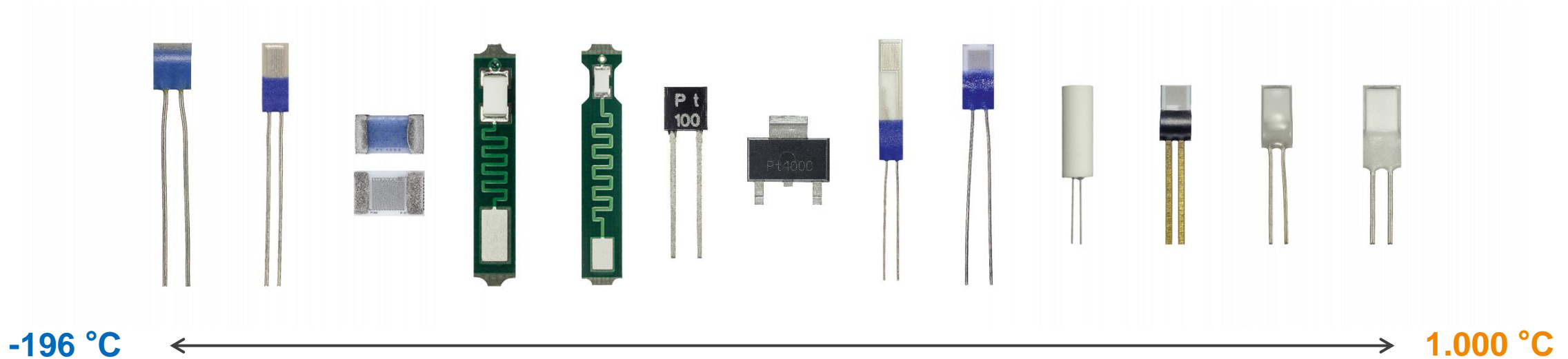


# STRENGTH OF Pt RTDS, KEY PROPERTIES, AND THEIR ADVANTAGES IN YOUR APPLICATION

- 1 | CHARACTERISTICS AND STRENGTHS OF Pt RTDs
- 2 | TYPICAL APPLICATIONS AND Pt ADVANTAGES
- 3 | NEXENSOS PRODUCTS AND KEY PROPERTIES
- 4 | SELECTION CRITERIA AND YOUR CUSTOMIZATION OPTIONS
- 5 | QUESTIONS AND ANSWERS



# WE EXPAND YOUR APPLICATION WINDOW TO OVER 1.000°C



broad range of standard products

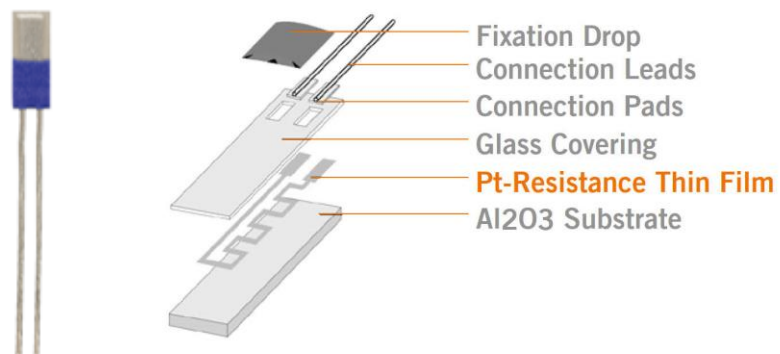
large volume availability

innovation power



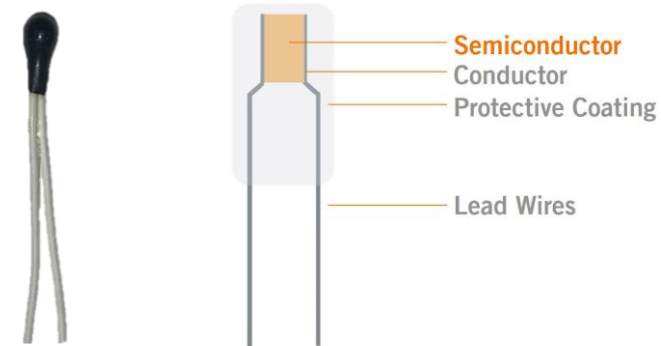
# CHARACTERISTICS AND STRENGTHS OF Pt RTDs

## PT RTD AND NTC COMPARISON



### Pt RTD – Platinum Resistance Temperature Detector

- Our sensors are based on thin film technology
- Typical configurations:  
Elements with lead wires, SMD types, SOT223, TO92



### NTC thermistor – Negative Temperature Coefficient

- Bulk resistor based on semi-conductive ceramics
- Typical configurations:  
Elements with lead wires, SMD types, diode package



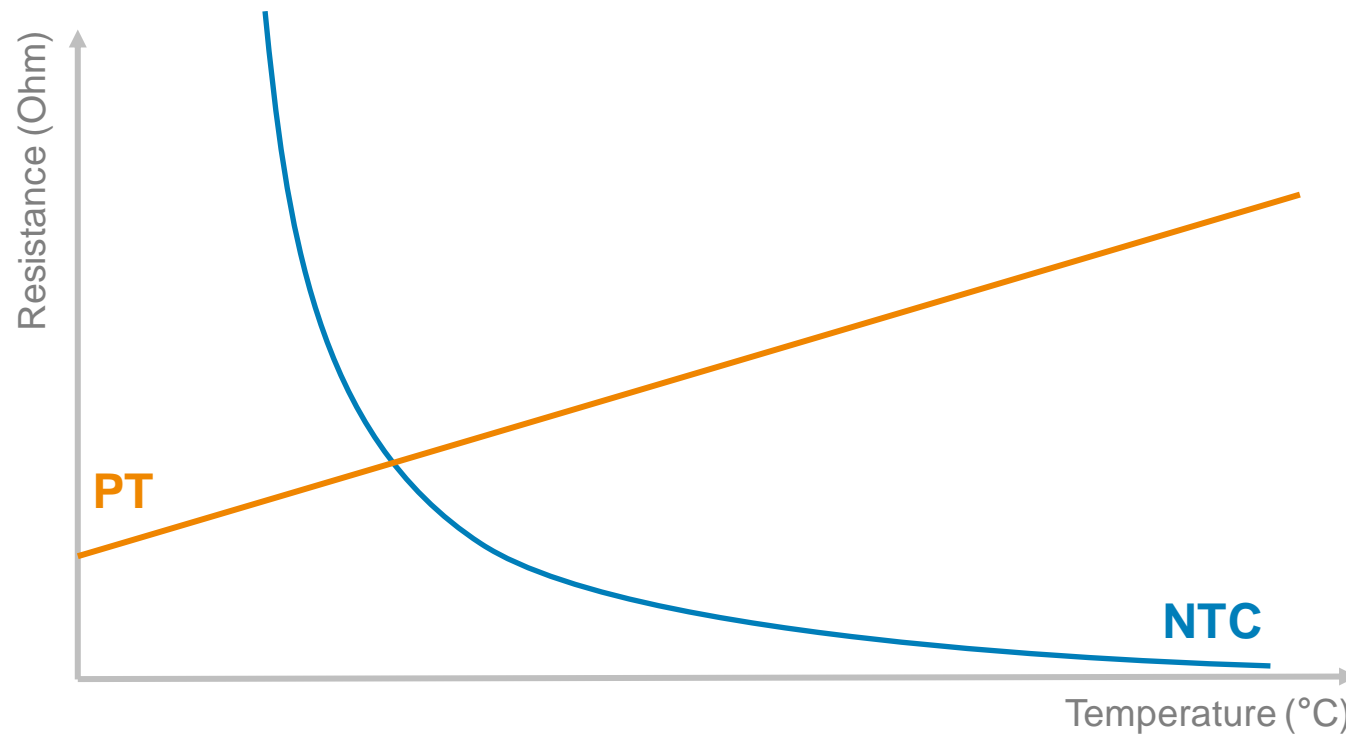


# CHARACTERISTICS AND STRENGTHS OF Pt RTDs

## PT RTD AND NTC COMPARISON

- PT**
- Typical resistance values: 100, 500, 1000 Ohm (@ 0 °C)
  - Linear characteristics (TCR 3850 ppm/K)
  - Positive Temperature Coefficient
  - Characteristics standardized to DIN EN 60751 (IEC 60751)

- NTC**
- Typical resistance values: 10 000 Ohm and higher (@ +25 °C)
  - Non-linear characteristics
  - Negative Temperature Coefficient





# CHARACTERISTICS AND STRENGTHS OF Pt RTDs

## PT RTD AND NTC COMPARISON

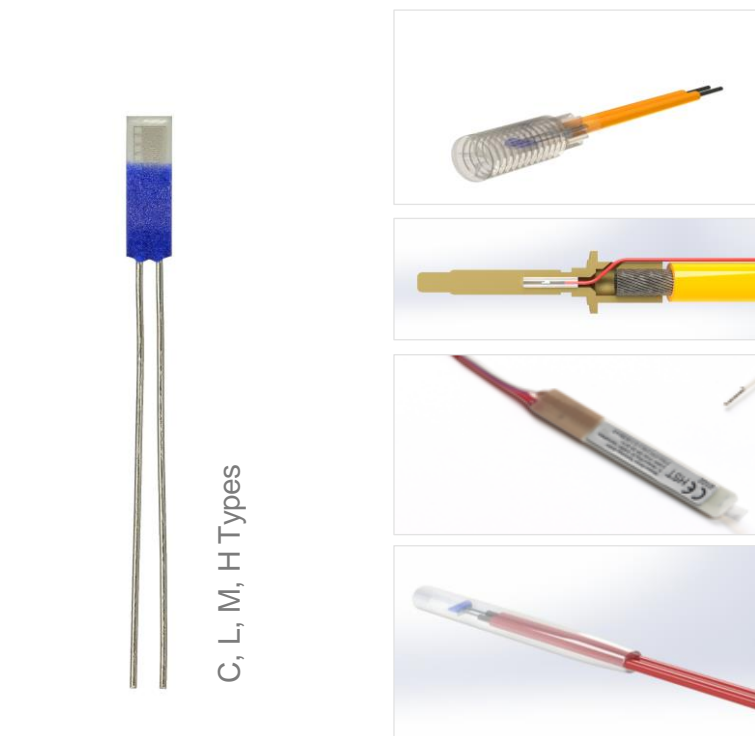
	Pt	NTC (typical)
Operating Temperature Range	<p>-196 °C to 1000 °C</p>	<p>-100 °C to 300 °C with special types up to 750 °C</p>
Resolution	<p>Consistent over the entire operating temperature range Differentiates with the sensor type (Pt 10000 also available) Lower resolution</p>	<p>Due to steeper curve higher resolution in a limited range Especially for lower temperatures</p>
Accuracy	<p>High accuracy over a wide temperature range Defined in DIN tolerance class F0.3, F0.15, F0.1</p>	<p>High accuracy over a relatively narrow temp. range No international standard</p>

# TYPICAL APPLICATIONS AND PT ADVANTAGES

## PT RTDs WITH LEAD WIRES

### Features

- Ideal for assembly in tubes and probes
- Good thermal contact with planar surfaces



C, L, M, H Types

### Applications

- Exhaust gas treatment in Diesel and Gasoline cars
- Petrochemistry, Oil & Gas, Energy & Power
- Process monitoring and automation
- Home appliance
- Pellet grills and pellet furnace
- e-mobility charger plug protection
- e-motor protection
- Medical cold chain data logger
- Medical devices and equipment
- Analytic equipment
- Heater unit control

### Strengths of Pt RTD

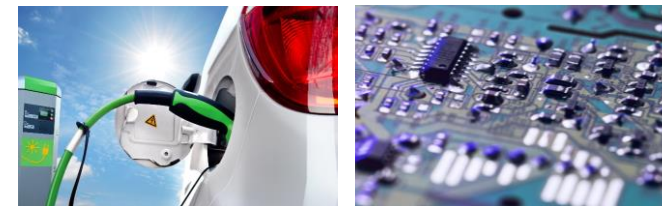
	wide T range	extreme high/low T capability	low signal drift	high accuracy	linear signal
Exhaust gas treatment in Diesel and Gasoline cars	●	●	●	○	○
Petrochemistry, Oil & Gas, Energy & Power	●	●	●	●	○
Process monitoring and automation	●	○	●	●	○
Home appliance	●	○		○	
Pellet grills and pellet furnace	●	●	○	○	
e-mobility charger plug protection	○		●	●	
e-motor protection	●	○	●	●	○
Medical cold chain data logger	●	○	●	●	
Medical devices and equipment			●	●	○
Analytic equipment	●	●	●	●	○
Heater unit control	●	●	●	●	

● important ○ helpful



# TYPICAL APPLICATIONS AND PT ADVANTAGES

## PT RTDs IN SMD FORMAT AND ON PCBs



### Features

- Support pick & place mounting
- Compact with small footprint
- Cost efficient



### Features

- SMD on PCB board (-40°C to +150°C)
- Reduce heat transfer from wires to the chip
- Simplifies assembly process for probes



### Applications

### Strengths of Pt RTD

	wide T range	extreme high/low T capability	low signal drift	high accuracy	linear signal
E-charger			●	●	○
Data logger and tracker	○	○	○	●	○
Medical devices and equipment			●	●	○
Electronic and power electronic board protection	○		●	●	○
T drift compensation in gas and other sensors	●		●	●	○
HVAC and smart home thermostats			●	○	○
HVAC probes for duct and immersion sensors	●		●	○	○
HVAC: heat and cold meters	●		●	●	○

● important ○ helpful

# HERAEUS NEXENSOS PRODUCTS AND KEY PROPERTIES

## M-TYPE DATA SHOWN



### Nominal Resistance

E.g. Pt100, Pt200, Pt500, Pt1000

### Temperature and Tolerance Range

E.g. F 0.3 (B) for temperature ranges from -50 °C to +500 °C

### Temperature Coefficient (TCR)

Standard TCR = 3850 ppm/K

**M222, Pt Temperature Sensor according to DIN EN 60751**  
Temperature range -70 °C to +500 °C, temporary up to +550 °C

- Excellent long term stability and low drift
- High accuracy and interchangeability
- High vibration and shock resistance
- Determined by welding, bending and crimping
- Ideal choice for your large volume applications

M-series Pt-RTDs are characterized by long-term stability and excellent precision over a wide temperature range. The M222 is a standard and combine performance and highest volume availability. This strengths make them a perfect choice for graphic arts, home appliances, HVAC industries, medical devices, industrial process monitoring and many more. In principle, the products can also be used in automotive applications. In this case Heraeus will check upon the request of the customer, whether additional requirements can be met (e.g. MSDS, PPAP).

Nominal Resistance (R <sub>0</sub> )	Tolerance Class	Order Number	Package
Pt100	F 0.3 / Class B	32208551	Plastic bag
	F 0.15 / Class A	32208550	Plastic bag
	F 0.3 / Class B	32208548 / 32208718	Plastic bag / Blister reel
Pt500	F 0.15 / Class A	32208712	Plastic bag
	F 0.3 / Class B	32208706	Plastic bag
Pt1000	F 0.3 / Class B	32208707	Plastic bag
	F 0.15 / Class A	32208702	Plastic bag
	F 0.3 / Class B	32208701 / 32208064	Plastic bag / Blister reel

The measuring point for the nominal resistance is 8 mm from the end of the sensor body.

**Temperature and Tolerance Range**  
Tolerance Class F 0.3 / Class B: 0 °C to +500 °C  
Tolerance Class F 0.15 / Class A: -50 °C to +300 °C  
Tolerance Class F 0.3 / Class B: -70 °C to +500 °C  
All continuous operation. Temporary use up to +550 °C possible.

**Temperature Coefficient**  
TCR = 3850 ppm/K

**Response Time**  
Water (v = 0.4m/s): 10.3 ± 0.25 s  
90.9 ± 0.15 s  
Air (v = 2m/s): 10.5 ± 3 s  
90.9 ± 30 s

**Measuring Current**  
Pt100 (D: 0.3 to 3 mA)  
Pt500 (D: 0.1 to 0.7 mA)  
Pt1000 (D: 0.1 to 0.3 mA)  
(Wiring has to be considered)

**Dimensions and Tolerances in mm**  
L: 2.8 ± 0.1  
W: 2.8 ± 0.1  
H: 0.8 ± 0.2  
L1: 10 ± 0.1  
L2: 0.8 ± 0.1  
W1: 0.4 ± 0.1

**Measuring Current and Self-Heating**  
Our recommendations to avoid self-heating effects

**Long-Term Stability**  
Typical R<sub>0</sub>-Drift is 0.04 % after 1000 hours at 500 °C

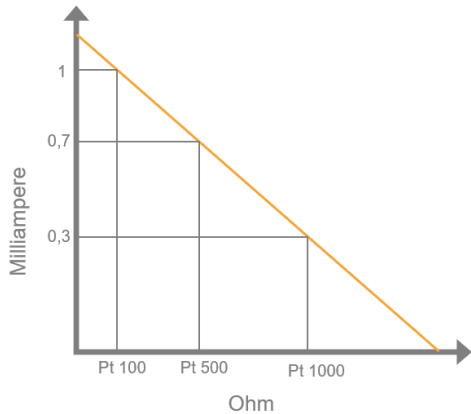
**Response Time**  
Measured in water current and air stream



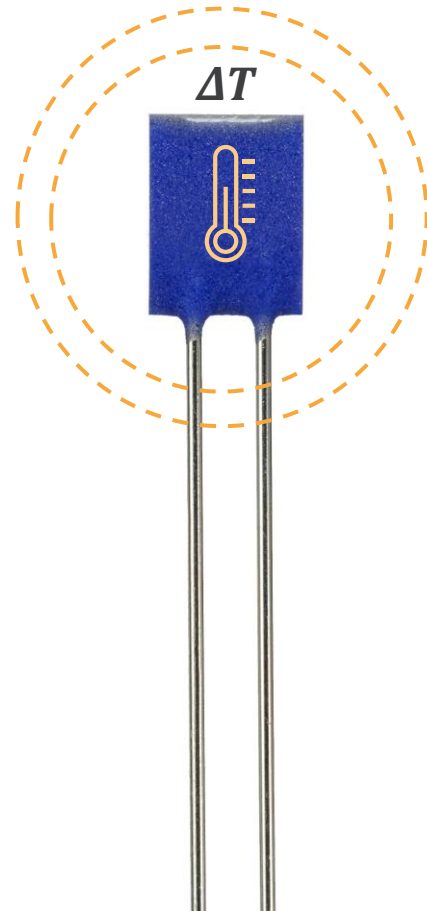
# NEXENSOS PRODUCTS AND KEY PROPERTIES

## SELF-HEATING: CONTROL MEASURING CURRENT AND INSTALLATION CONDITIONS

### I - Measuring Current



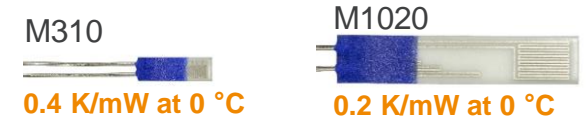
$$\Delta T = S \cdot I^2 \cdot R$$



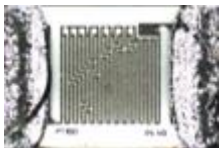
### Sensor Element

- Materials, Design
  - Dimensions
- The smaller the sensor for a given Ohm value, the higher the self-heating coefficient

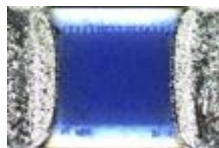
### S - Self-heating coefficient



### R - Resistance



Pt100



Pt1000

### Installation Conditions

- Housing and thermal contact to the surrounding medium impact the self-heating coefficient



# HERAEUS NEXENSOS PRODUCTS AND KEY PROPERTIES

## M-TYPE DATA SHOWN



### Nominal Resistance

E.g. Pt100, Pt200, Pt500, Pt1000

### Temperature and Tolerance Range

E.g. F 0.3 (B) for temperature ranges from -50 °C to +500 °C

### Temperature Coefficient (TCR)

Standard TCR = 3850 ppm/K

**M222, Pt Temperature Sensor according to DIN EN 60751**  
Temperature range -70 °C to +500 °C, temporary up to +550 °C

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Nominal Resistance (R0)	Tolerance Class	Order Number	Package
Pt100	F 0.1 / Class B	32208551	Plastic bag
	F 0.1 / Class A	32208550	Plastic bag
Pt500	F 0.15 / Class A	32208712	Plastic bag
	F 0.3 / Class B	32208706	Plastic bag
Pt1000	F 0.1 / Class B	32208707	Plastic bag
	F 0.15 / Class A	32208702	Plastic bag
	F 0.3 / Class B	32208701 / 31000064	Plastic bag / Blister reel

The measuring point for the nominal resistance is 8 mm from the end of the sensor body.

**Temperature and Tolerance Range**  
Tolerance Class F 0.1 / Class B: 0 °C to +500 °C  
Tolerance Class F 0.15 / Class A: -50 °C to +300 °C  
Tolerance Class F 0.3 / Class B: -70 °C to +500 °C  
All continuous operation. Temporary use up to +550 °C possible.

**Temperature Coefficient**  
TCR = 3850 ppm/K

**Response Time**  
Water (v = 0.4m/s): 10.3 ± 0.25 s  
90.9 ± 0.15 s  
Air (v = 2m/s): 10.5 ± 0.2 s  
90.9 ± 0.1 s

**Measuring Current**  
Pt100 (D: 0.3 to 0.7 mA)  
Pt500 (D: 0.1 to 0.7 mA)  
Pt1000 (D: 0.1 to 0.7 mA)  
\*Rating may be considered

**Dimensions and Tolerances in mm**  
L: 2.8 ± 0.1  
W: 2.0 ± 0.1  
H: 0.8 ± 0.2  
L1: 0.8 ± 0.1  
W1: 0.4 ± 0.1

### Measuring Current and Self-Heating

Our recommendations to avoid self-heating effects

### Long-Term Stability

Typical R<sub>0</sub>-Drift is 0.04 % after 1000 hours at 500 °C

### Response Time

Measured in water current and air stream

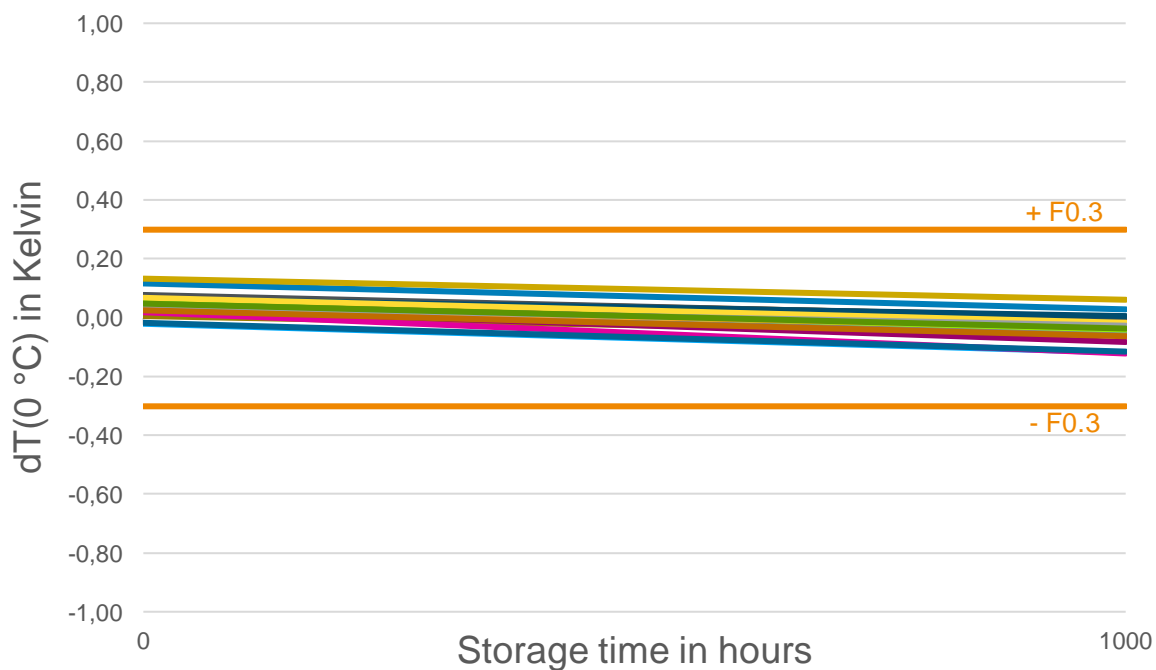


# HERAEUS NEXENSOS PRODUCTS AND KEY PROPERTIES

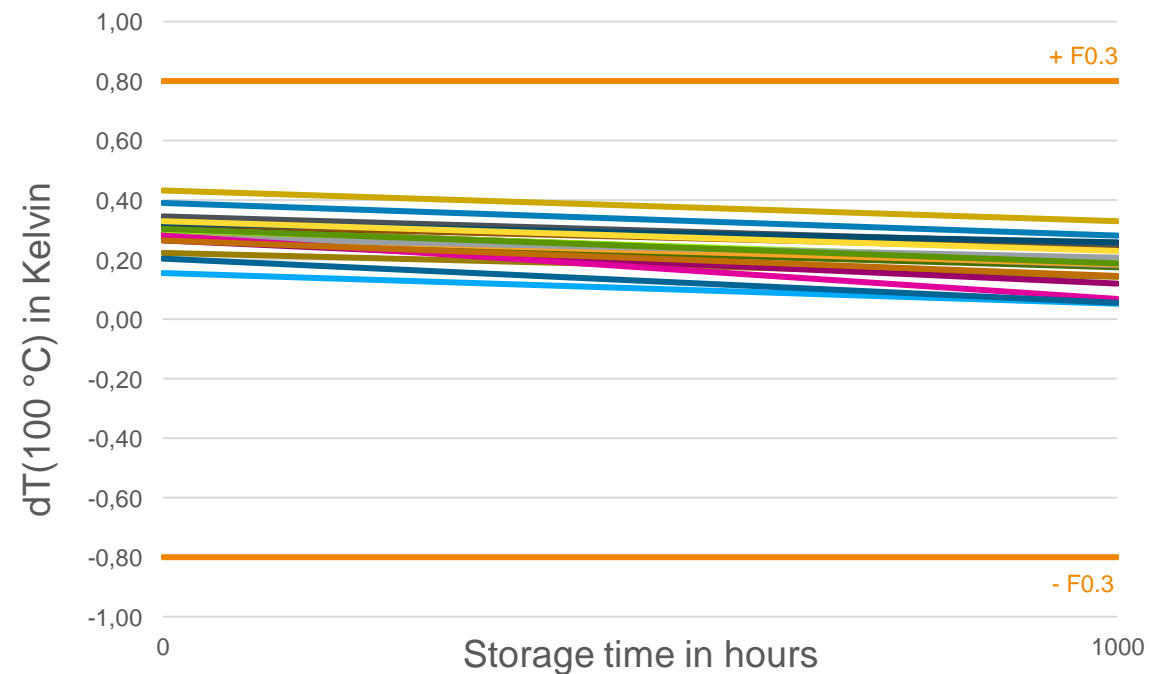
KEY PT-RTD FEATURE: VERY LOW SIGNAL DRIFT, HIGH LONG-TERM STABILITY



M222 Pt1000 B: Deviation dT from ideal value at T = 0 °C  
as a function of the storage time @ 500 °C



M222 Pt1000 B: Deviation dT from ideal value at T = 100 °C  
as a function of the storage time @ 500 °C





# HERAEUS NEXENSOS PRODUCTS AND KEY PROPERTIES

## M-TYPE DATA SHOWN



### Nominal Resistance

E.g. Pt100, Pt200, Pt500, Pt1000

### Temperature and Tolerance Range

E.g. F 0.3 (B) for temperature ranges from -50 °C to +500 °C

### Temperature Coefficient (TCR)

Standard TCR = 3850 ppm/K

**M222, Pt Temperature Sensor according to DIN EN 60751**  
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Nominal Resistance to E20	Tolerance Class	Order Number	Package
Pt100	F 0.3 / Class B	32208501	Plastic bag
	F 0.3 / Class A	32208500	Plastic bag
	F 0.3 / Class B	32208508 / 32208718	Plastic bag / Blister reel
Pt500	F 0.3 / Class A	32208712	Plastic bag
	F 0.3 / Class B	32208706	Plastic bag
Pt1000	F 0.3 / Class B	32208707	Plastic bag
	F 0.3 / Class A	32208702	Plastic bag
	F 0.3 / Class B	32208701 / 32208064	Plastic bag / Blister reel

The measuring point for the nominal resistance is 8 mm from the end of the sensor body.

**Temperature and Tolerance Range**  
Tolerance Class F 0.3 / Class B: 0 °C to +500 °C  
Tolerance Class F 0.3 / Class A: -50 °C to +500 °C  
Tolerance Class F 0.3 / Class B: -70 °C to +550 °C  
All continuous operation. Temporary use up to +550 °C possible.

**Temperature Coefficient**  
TCR = 3850 ppm/K

**Response Time**  
Water (v = 0.4m/s): 90.3 ± 0.25 s  
90.9 ± 0.15 s  
Air (v = 2m/s): 90.5 ± 0.1 s  
90.9 ± 0.1 s

**Measuring Current**  
Pt100: 0.3 to 0.7 mA  
Pt500: 0.3 to 0.7 mA  
Pt1000: 0.3 to 0.7 mA  
(Self-heating has to be considered)

**Dimensions and Tolerances in mm**  
L: 2.8 ± 0.1  
W: 2.8 ± 0.1  
H: 0.8 ± 0.2  
L1: 0.8 ± 0.1  
L2: 0.8 ± 0.1  
W1: 0.4 ± 0.1

### Measuring Current and Self-Heating

Our recommendations to avoid self-heating effects

### Long-Term Stability

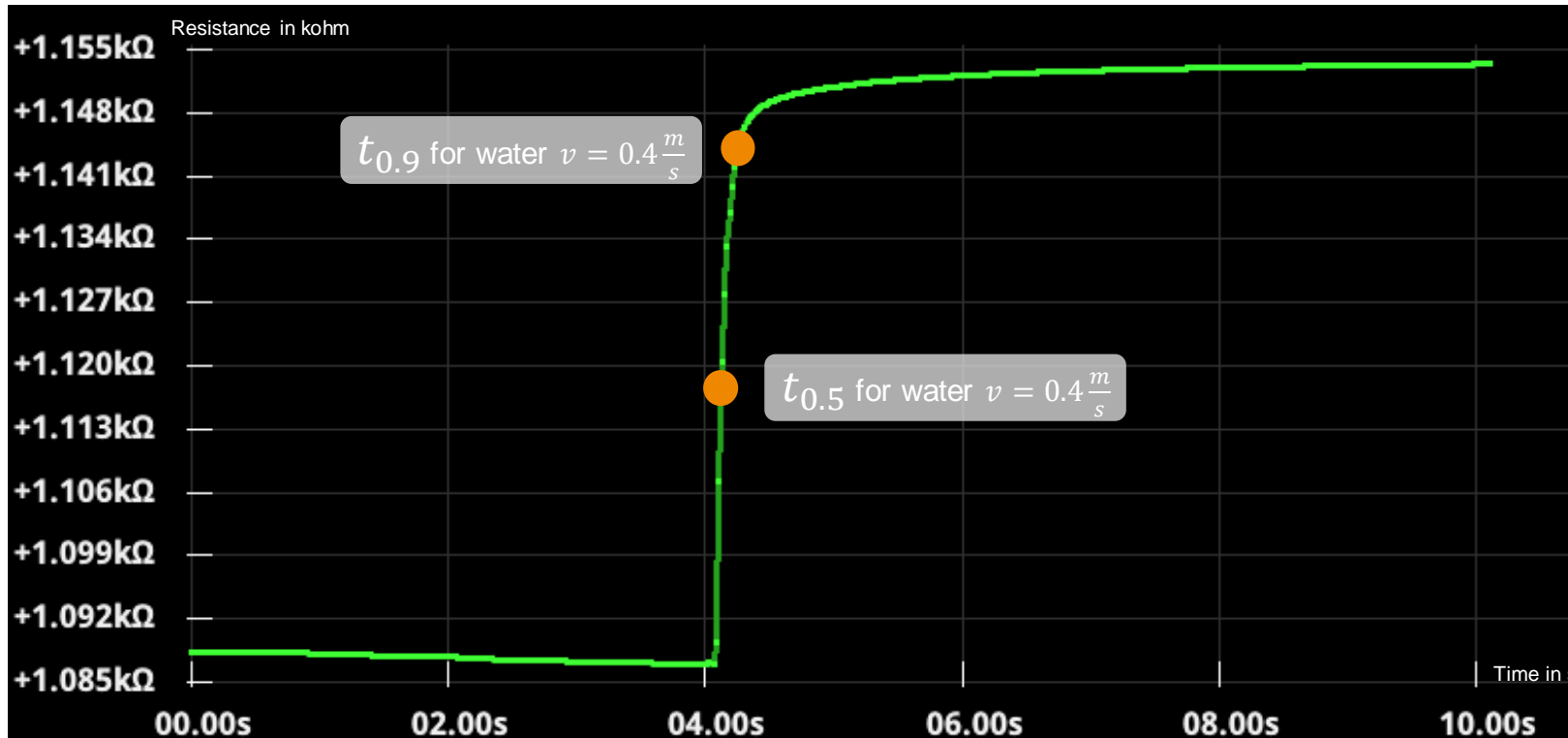
Typical R<sub>0</sub>-Drift is 0.04 % after 1000 hours at 500 °C

### Response Time

Measured in water current and air stream

# HERAEUS NEXENSOS PRODUCTS AND KEY PROPERTIES

## PT RTDs HAVE A VERY FAST RESPONSE TIME



Pt RTDs have a fast response time in a range of 0.1 - 0.3 sec.  
The sensor element is not the limiting factor, but the housing.

Have a closer look at our latest [webinar](#)



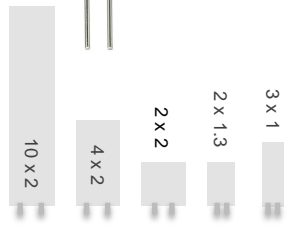
# SELECTION CRITERIA AND YOUR CUSTOMIZATION OPTIONS

## PRODUCT NAMING – EASY ORIENTATION

### Elements with lead wires



**M 220 PT1000 B**



**Size indication**  
220: 2 mm x 2 mm  
see details in datasheet

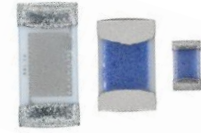
**Tolerance**

Standards	
B	F 0.3
A	F 0.15
1/3 DIN	F 0.1

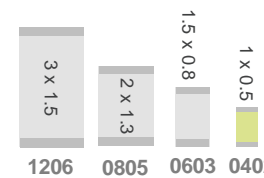
**Resistance**

Standards:  
100, 200, 500, 1000 Ohm

### Leadless Elements



**SMD 0805 PT1000 B**



**Standard SMD package**  
1206, 0805, 0603

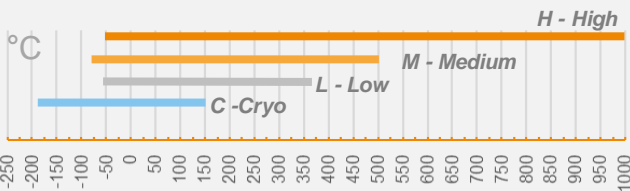
**Tolerance**

Standards	
2B	F 0.6
B	F 0.3

**Resistance**

Standards:  
100, 500, 1000 Ohm

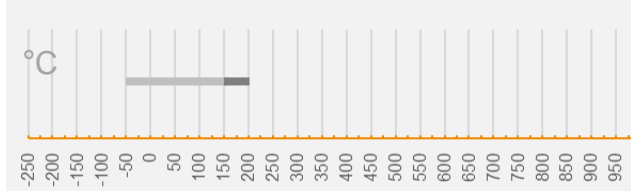
### Temperature operation range



### Connection methods

- welding
- brazing
- crimping
- soft soldering (L-types)

### Temperature operation range



### Connection methods

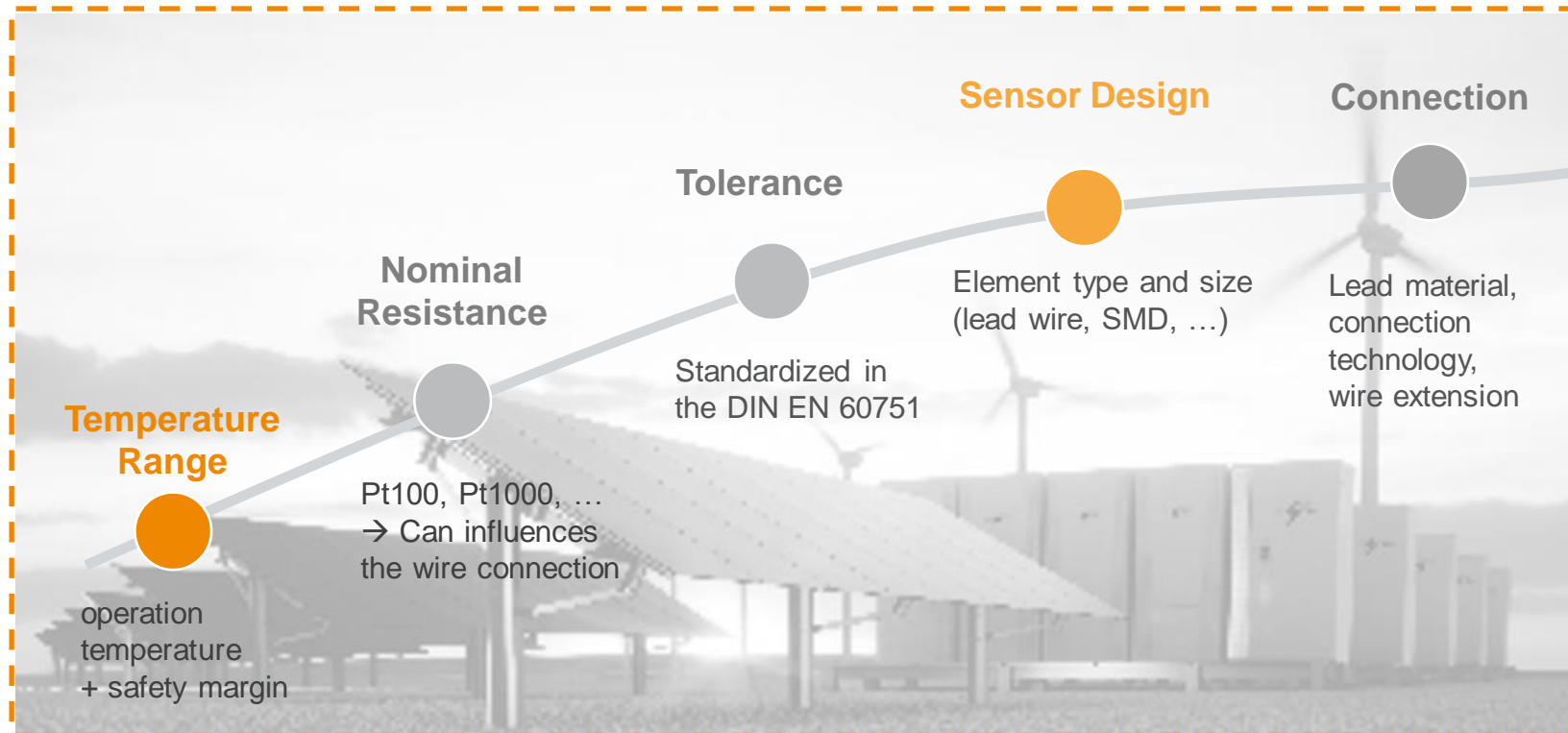
- soft soldering
- bonding/ gluing
- sintering + wire bonding



# SELECTION CRITERIA AND YOUR CUSTOMIZATION OPTIONS



Find the right Pt element for your application



Economies of Scale

Availability

- Economy of scale
- High volume availability



Product Selector **NEX**products

Order Number

Operating Temperature

Tolerance Class

Nominal Resistance R<sub>0</sub> [Ω]

PT1000

Your search returned 7 results.



Use our product selector **NEX**products to find the right product

# SELECTION CRITERIA AND YOUR CUSTOMIZATION OPTIONS



**Element size & Substrate thickness**

**Resistance**

Individual ohmic values possible

**Combination of PT loops: Sensor + Heater**

e.g. Pt element with two resistor loops: PT20 + PT1000

**Lead length:** 5 – 100 mm

**Lead material:** Ni, Pt plated Ni, AgPd, Pt

**Lead extensions**

Wires and stranded wires

For your high volume requests

For your mid volume requests

# SELECTION CRITERIA AND YOUR CUSTOMIZATION OPTIONS



## Semi-rigid encapsulated **EC3032**

- PT1000 B
- -50 °C to +200 °C (temporary up to 250 °C)
- IP68 protection
- Highly vibration resistant
- Response time  $t_{0.9} = 8.1 \text{ s}$  (0.3 m/s water flow)

# Thank you for your attention

