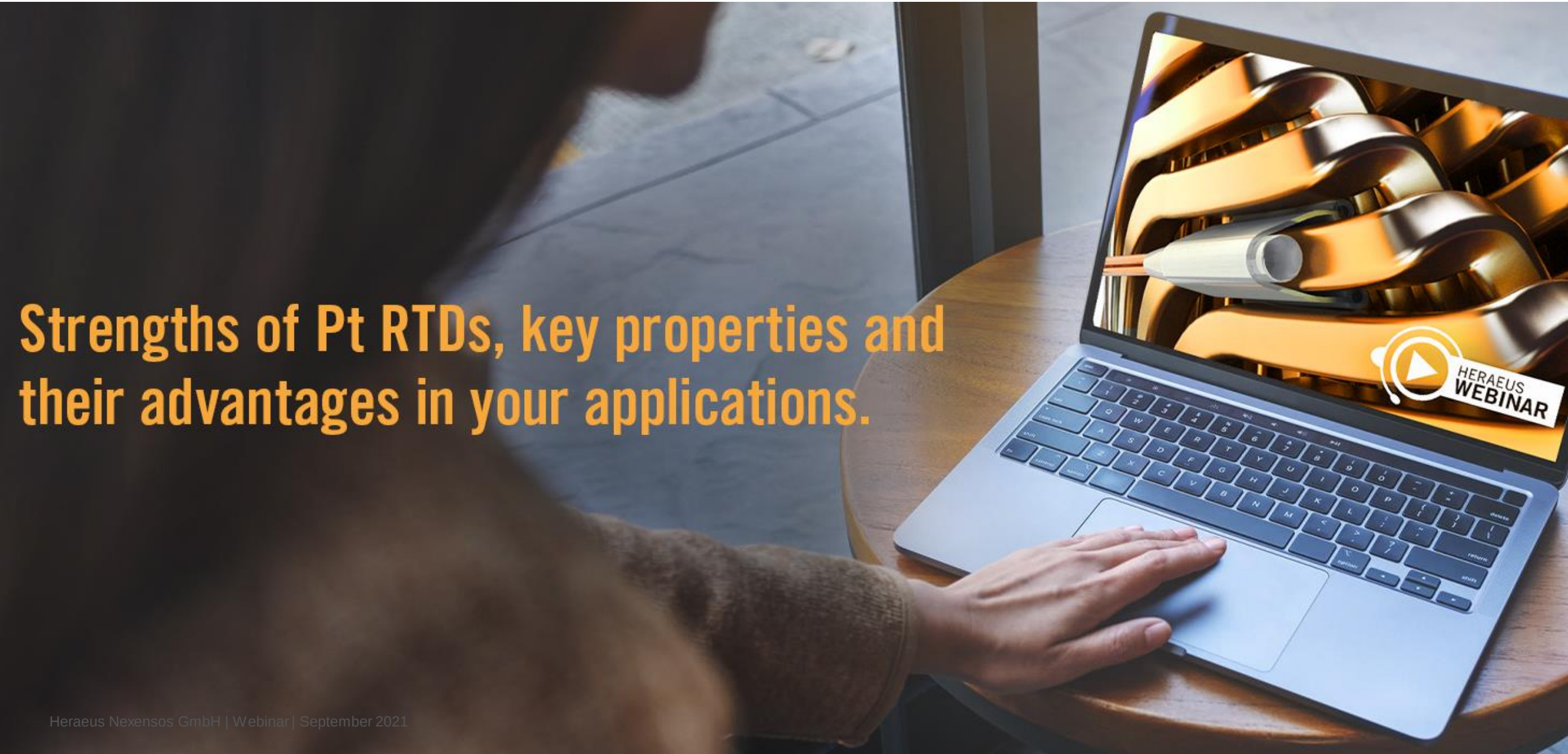
# Strengths of Pt RTDs, key properties and their advantages in your applications.



# INTRODUCTION – OUR SPEAKERS

**Dr. Andreas Schreiber**

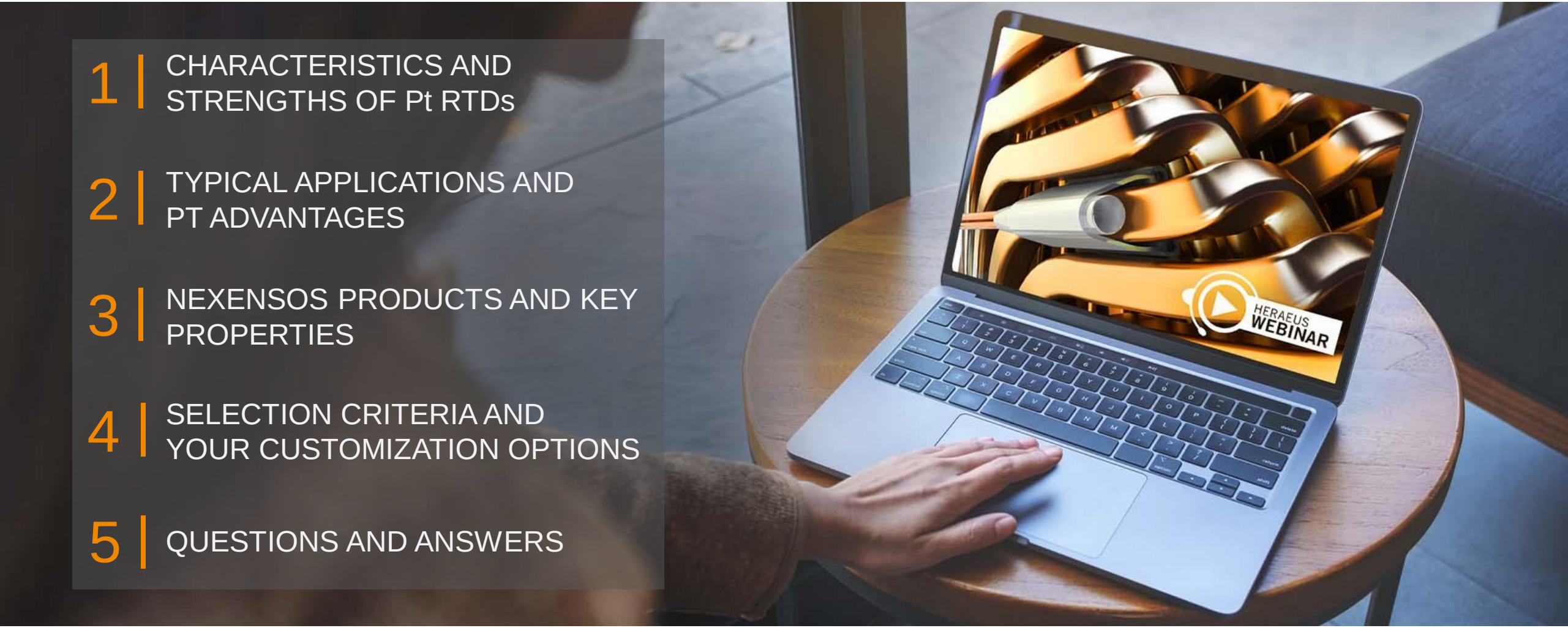
GLOBAL HEAD OF MARKETING

**Charlotte Clemen**

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

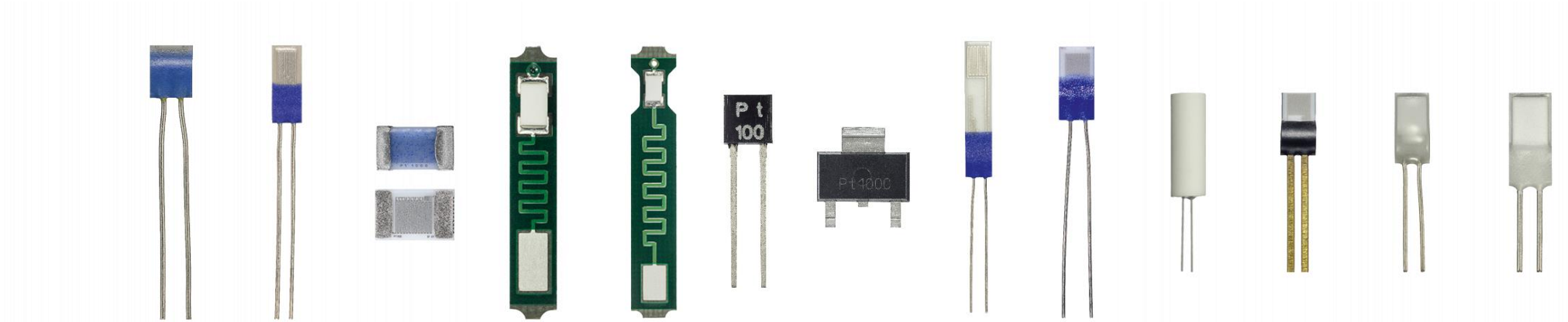
2 | TYPICAL APPLICATIONS AND PT ADVANTAGES

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

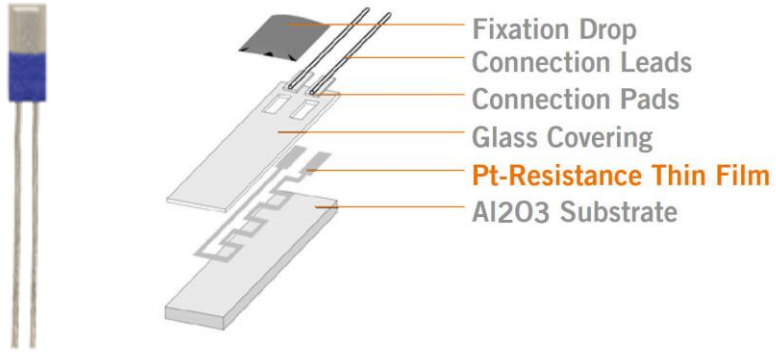



**-196 °C** ⟷ **1.000 °C**

- high precision
- minimal drift
- standardized output
- broad range of standard products
- large volume availability
- innovation power

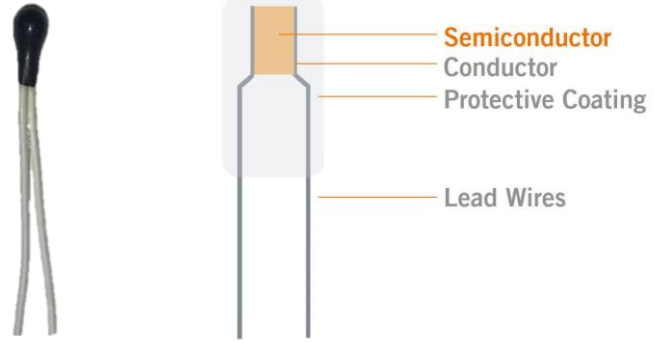
# CHARACTERISTICS AND STRENGTHS OF Pt RTDs

## 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

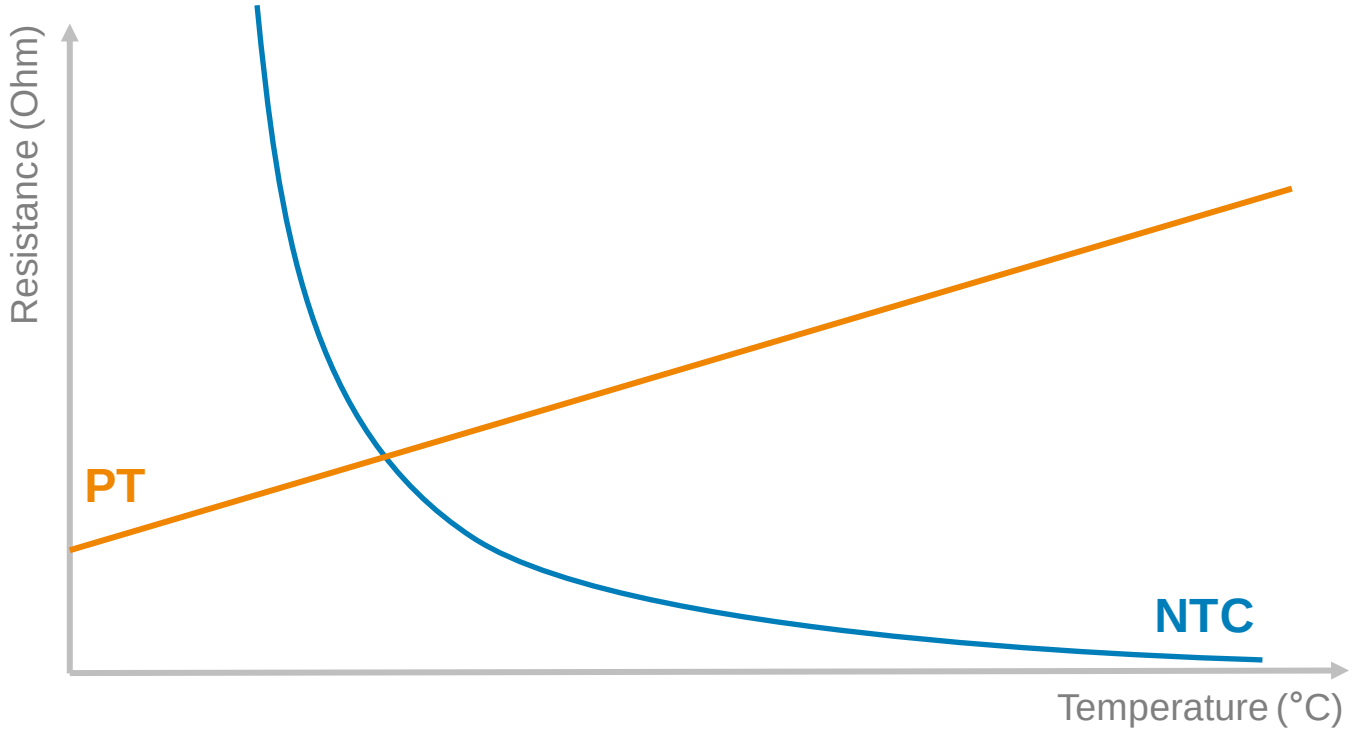
## PT RTD AND NTC COMPARISON

**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)

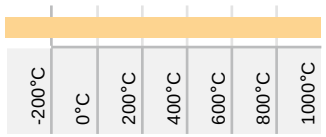
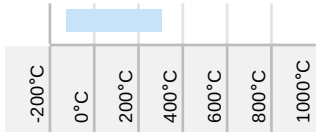
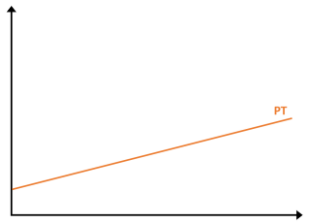
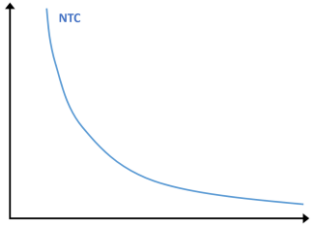
**NTC**

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

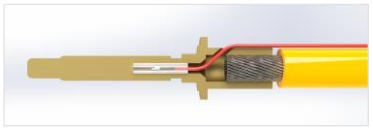
# TYPICAL APPLICATIONS AND PT ADVANTAGES

## PT RTDs WITH LEAD WIRES

### Features

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

C, L, M, H Types



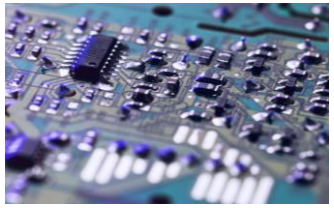
### Strengths of Pt RTD

| Applications | 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

1206 0805 0603

### Features

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

pads chip

### Strengths of Pt RTD

| Applications | 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

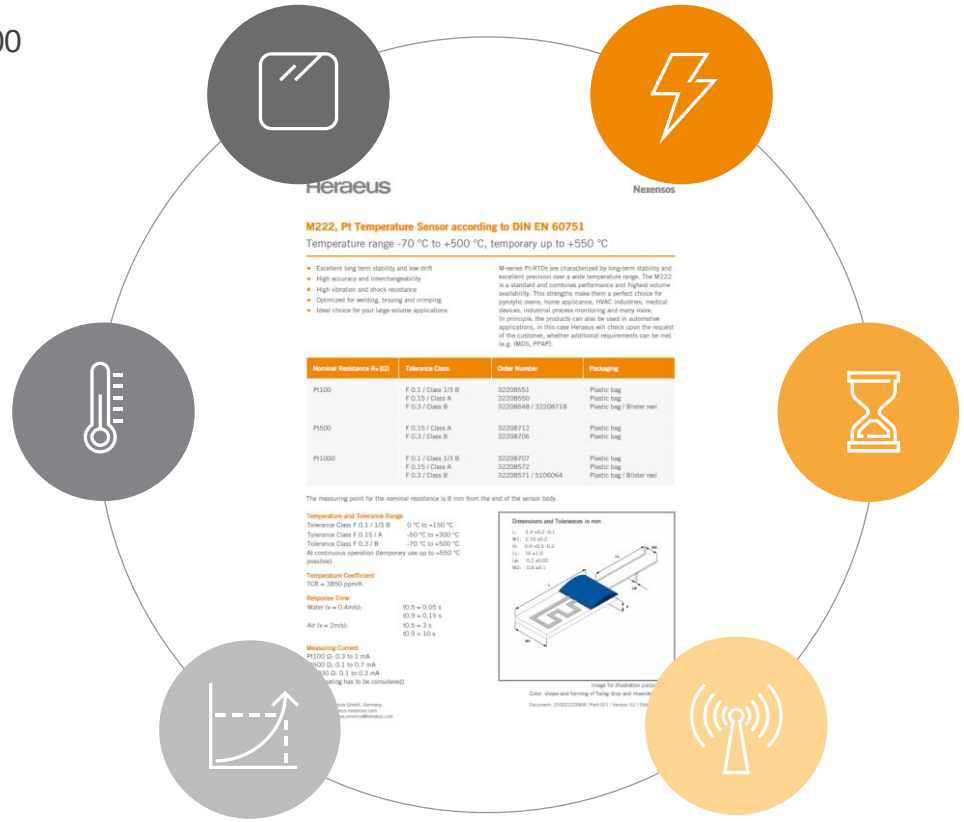
E.g. Pt100, Pt200, Pt500, Pt1000

### 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




### Measuring Current and Self-Heating

Our recommendations to avoid self-heating effects

### Long-Term Stability

Typical $R_0$-Drift is 0.04 % after 1000 hours at 500 °C

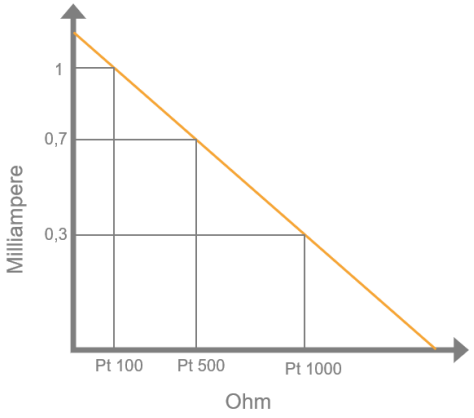
### Response Time

Measured in water current and air stream

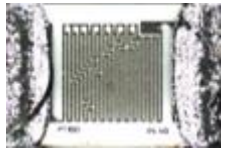
# NEXENSOS PRODUCTS AND KEY PROPERTIES

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

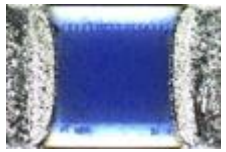
### $I$ - Measuring Current




### $R$ - Resistance

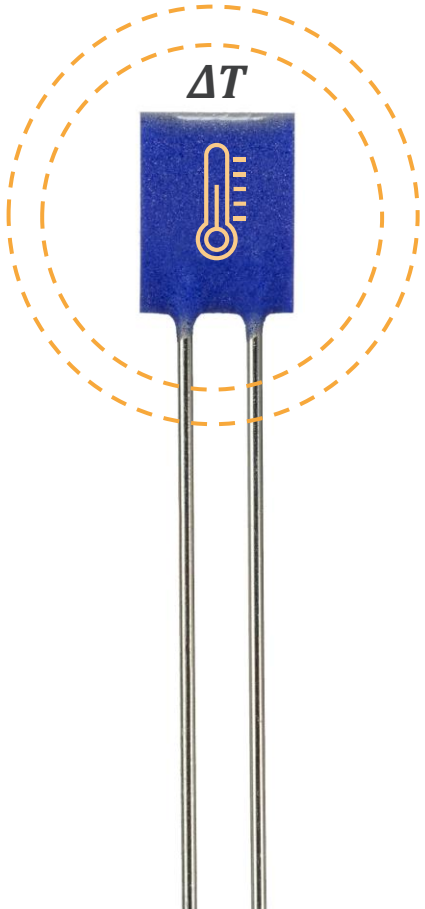


Pt100



Pt1000

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




### $S$ – Self-heating coefficient

### Sensor Element

- Materials, Design
- Dimensions

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

M310

0.4 K/mW at 0 °C

M1020

0.2 K/mW at 0 °C

### Installation Conditions

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

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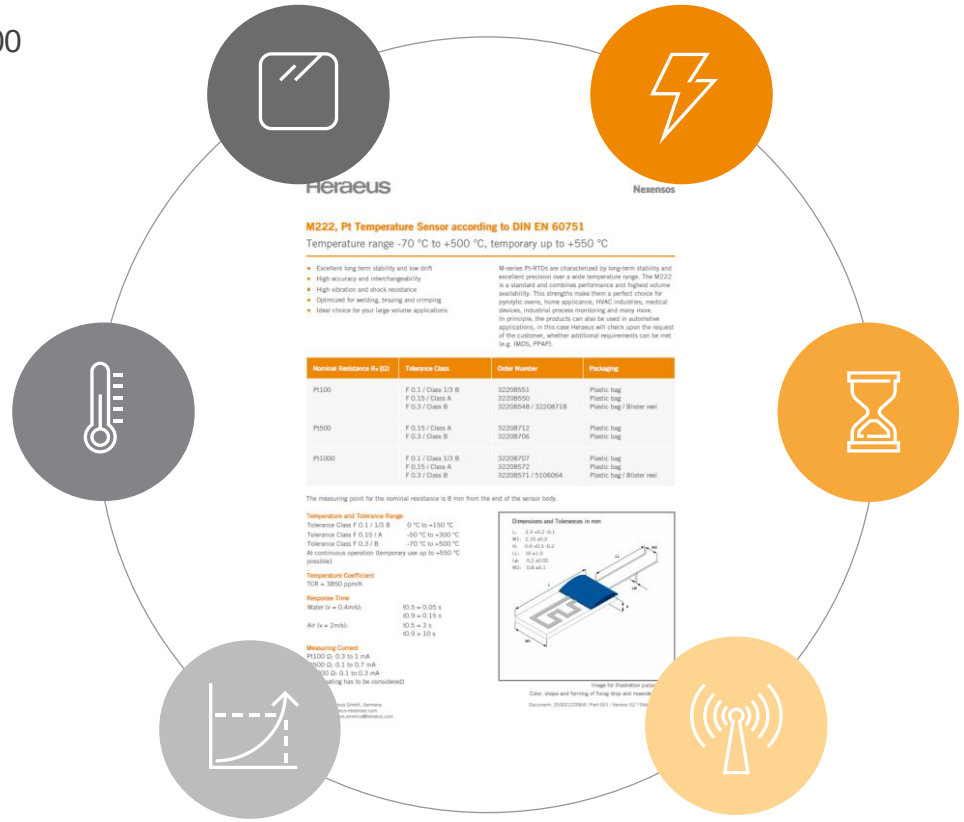


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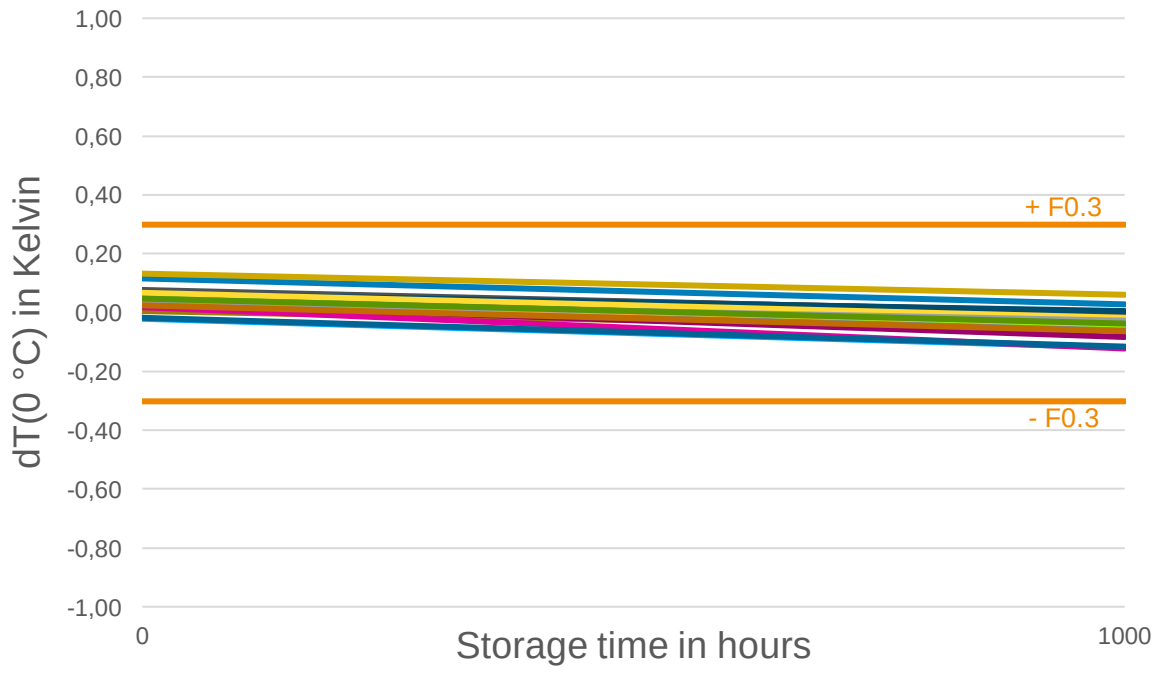
### Response Time

Measured in water current and air stream

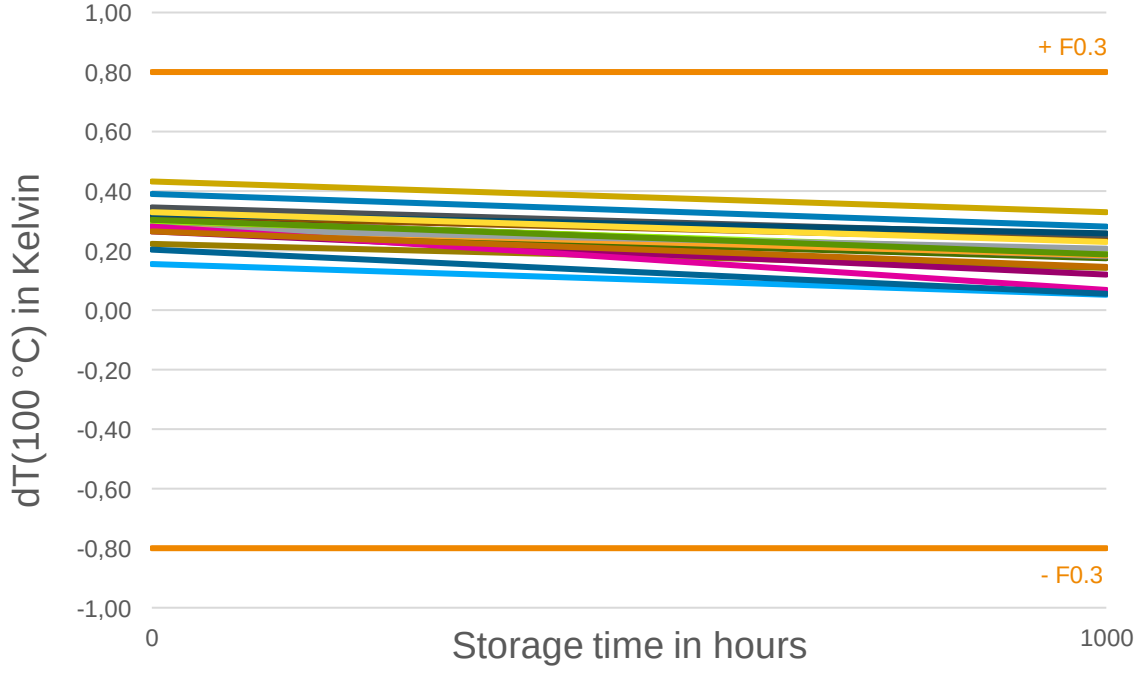
# HERAEUS NEXENSOS PRODUCTS AND KEY PROPERTIES

## 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

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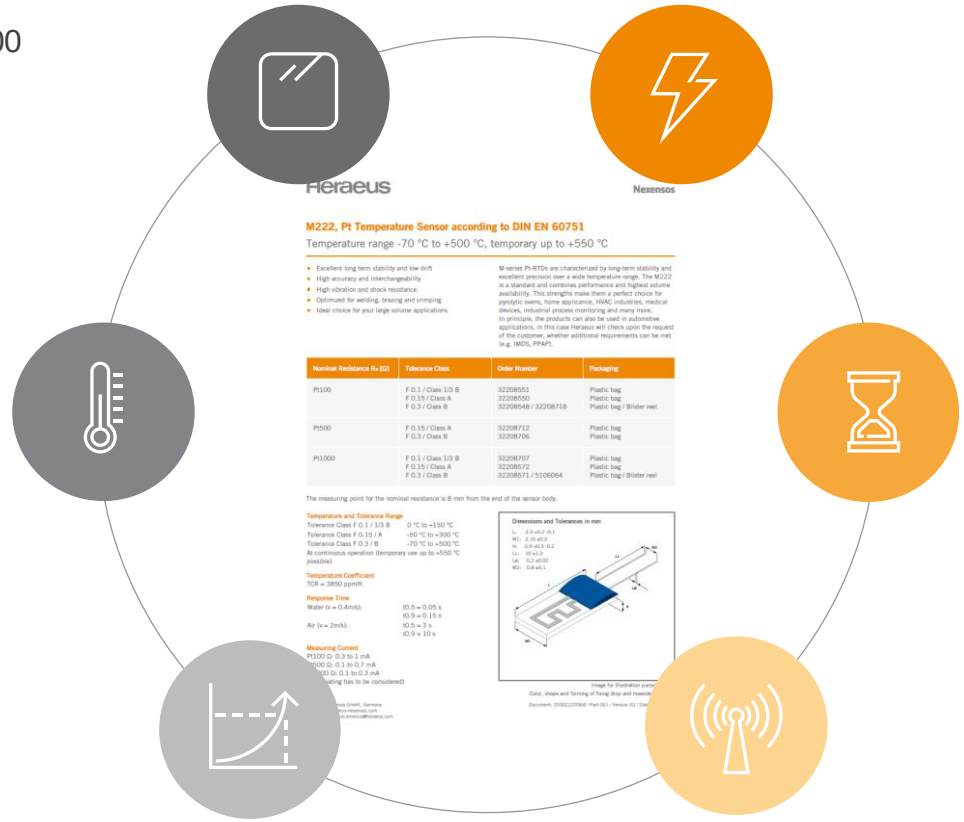


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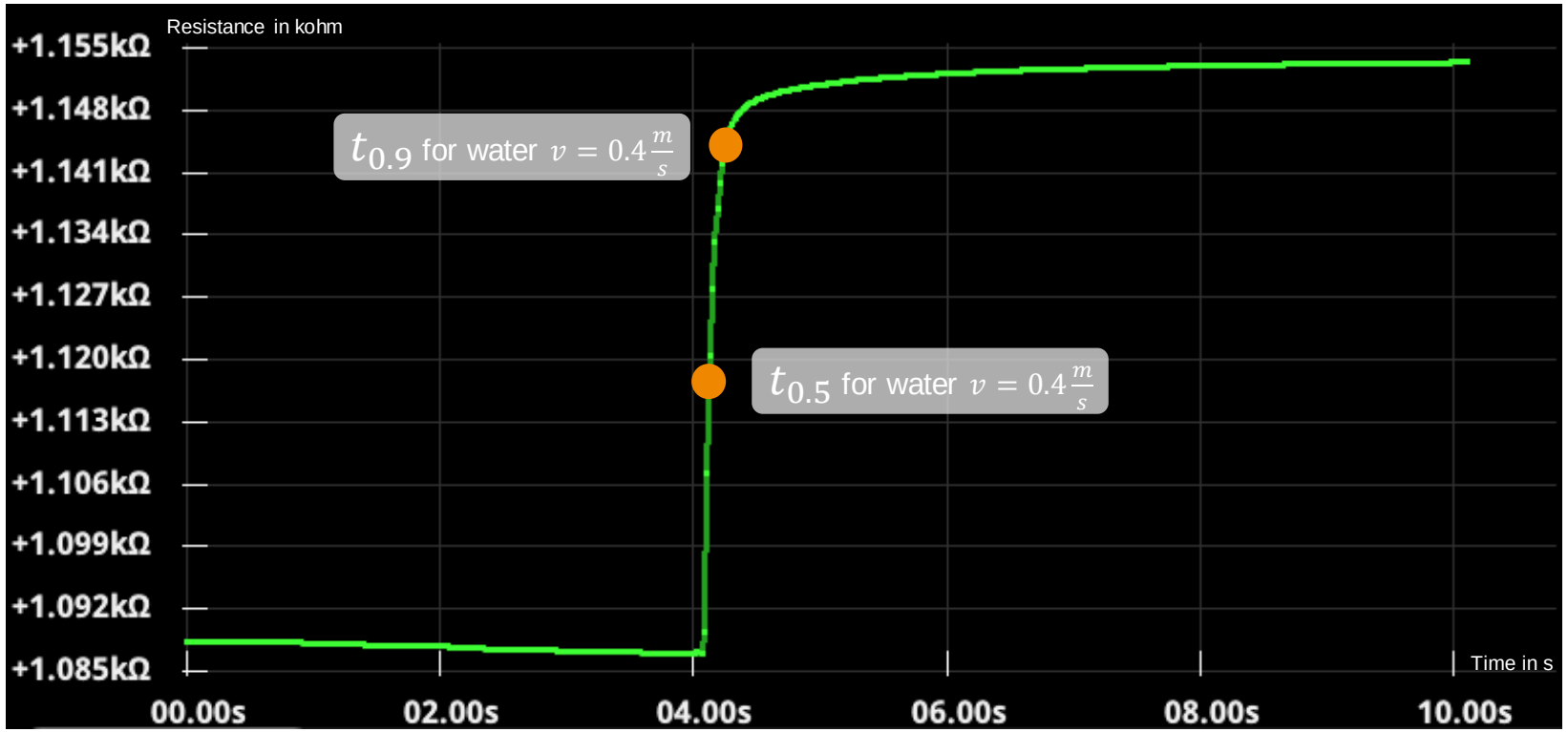
# HERAEUS NEXENSOS PRODUCTS AND KEY PROPERTIES

## PT RTDs HAVE A VERY FAST RESPONSE TIME




**Pt RTDs have a fast response time in a range of 0.1 - 0.3 sec.**

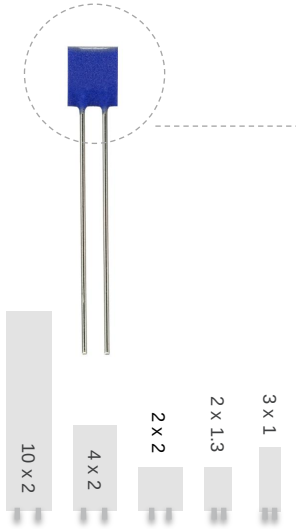
**The sensor element is not the limiting factor, but the housing.**

**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**

**Tolerance**
Standards

| | |
|---|---|
| B | F 0.3 |
| A | F 0.15 |
| 1/3 DIN | F 0.1 |

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

**Resistance**
Standards:
100, 200, 500, 1000 Ohm

### Leadless Elements


**SMD 0805 PT1000 B**

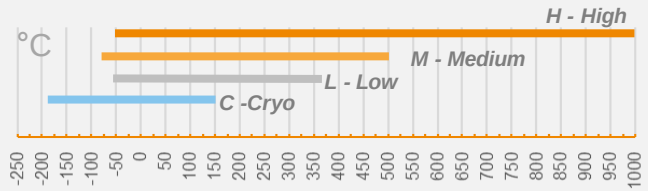
**Tolerance**
Standards

| | |
|---|---|
| 2B | F 0.6 |
| B | F 0.3 |

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

**Resistance**
Standards:
100, 500, 1000 Ohm

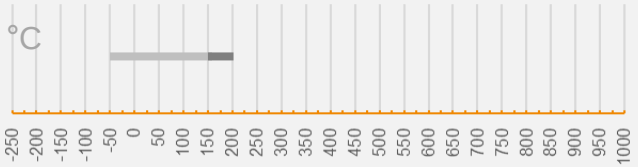
### Temperature operation range




### Connection methods

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

### Temperature operation range




### Connection methods

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

# SELECTION CRITERIA AND YOUR CUSTOMIZATION OPTIONS

HERAEUS WEBINAR

## Find the right Pt element for your application

**Temperature Range**
operation temperature + safety margin

**Nominal Resistance**
Pt100, Pt1000, …
→ Can influences the wire connection

**Tolerance**
Standardized in the DIN EN 60751

**Sensor Design**
Element type and size (lead wire, SMD, …)

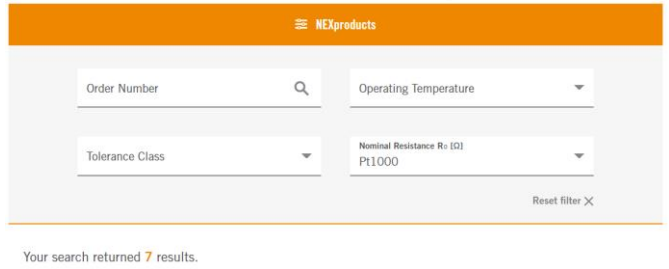
**Connection**
Lead material, connection technology, wire extension

**Availability**

**Economies of Scale**

- Economy of scale
- High volume availability

Product Selector NEXproducts




Website Use our product selector NEXproducts to find the right product

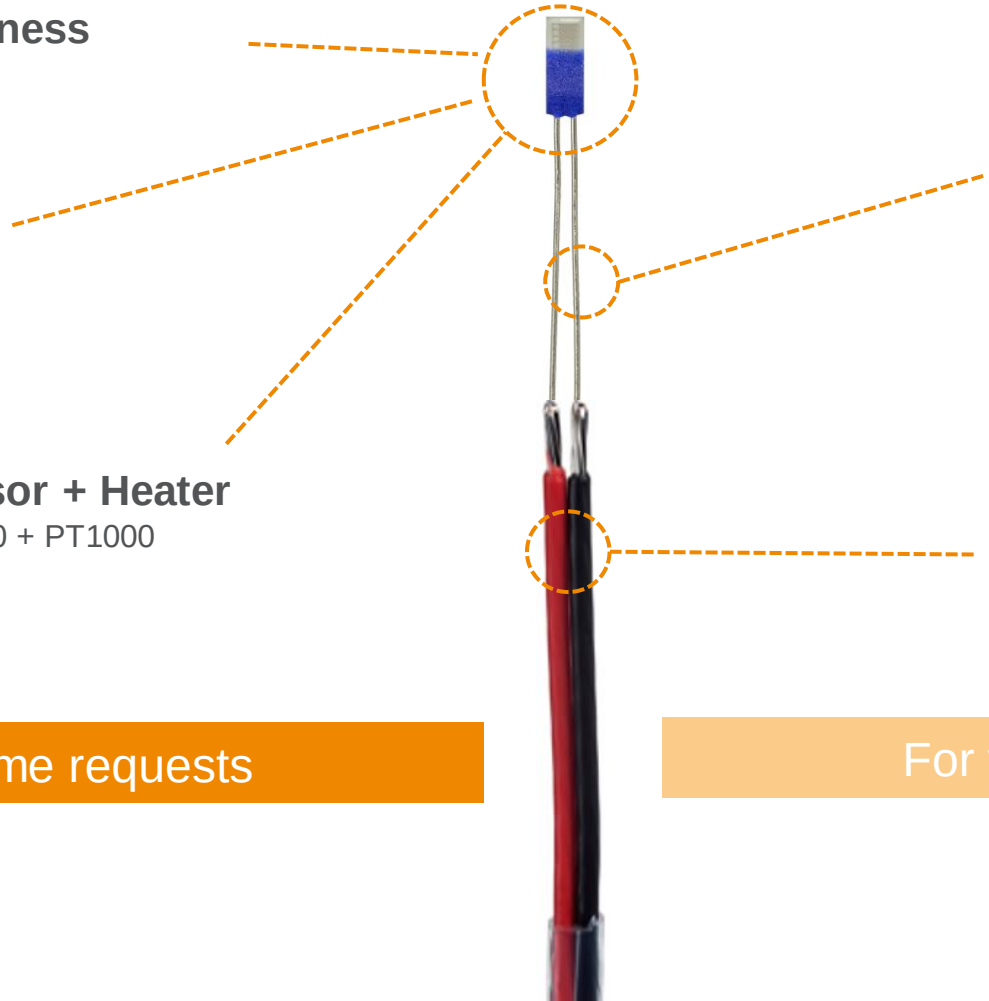
# SELECTION CRITERIA AND YOUR CUSTOMIZATION OPTIONS

HERAEUS WEBINAR

**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 s (0.3 m/s water flow)

# Thank you for your attention