YAGEO
NEXENSOS

BASIC TRAINING

YAGEO NEXENSOS PRODUCT INTRODUCTION

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AGENDA.

YAGEO NEXENSOS PRODUCT PORTFOLIO

COMPARISON: PT-RTD VERSUS NTC

APPLICATION EXAMPLES

PRODUCT NAMING

LIST OF TECHNICAL INFORMATION:
WEBINARS, SENSOR ACADEMY

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YAGEO NEXENSOS PRODUCTS

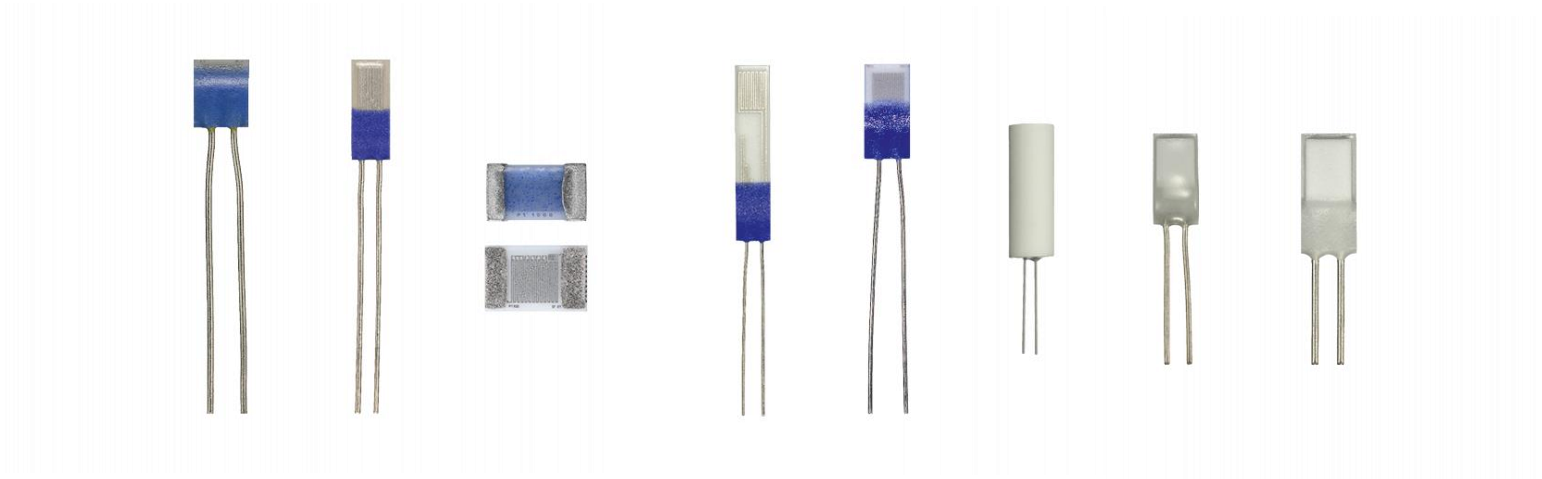
YAGEO NEXENSOS. EXPERT FOR MAXIMUM SENSING.

KEY FACTS

- **Worlds #1** in Pt thin film elements since more than 40 years
- ~500 employees
- Production sites in Kleinostheim, Germany and Johor, Malaysia
- ISO 9001, ISO 14001 and IATF certified
- Products: Pt-thin film resistors and assemblies

TEMPERATURE SENSOR ELEMENTS.

PLATINUM THIN FILM RESISTORS

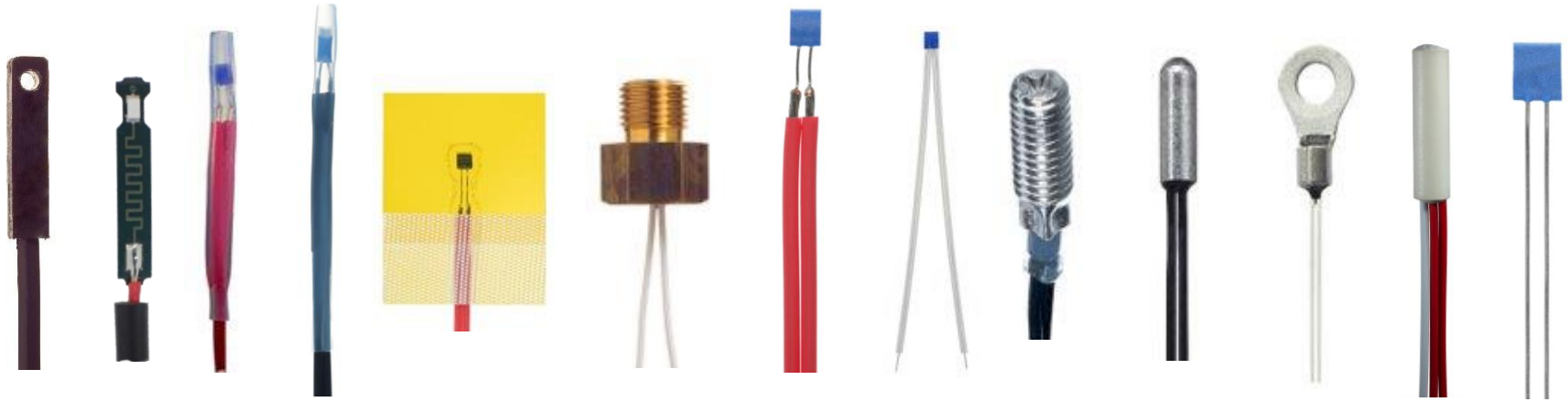


-200 °C ⟷ +1.000 °C

- HIGH PRECISION
- MINIMAL DRIFT
- STANDARDIZED OUTPUT (DIN EN60751)
- BROAD RANGE OF STANDARD PRODUCTS
- LARGE VOLUME AVAILABILITY

TEMPERATURE SENSOR ASSEMBLIES.

PT RESISTORS WITH ADDED VALUE: CABLE, HOUSING, CONNECTOR PLUG

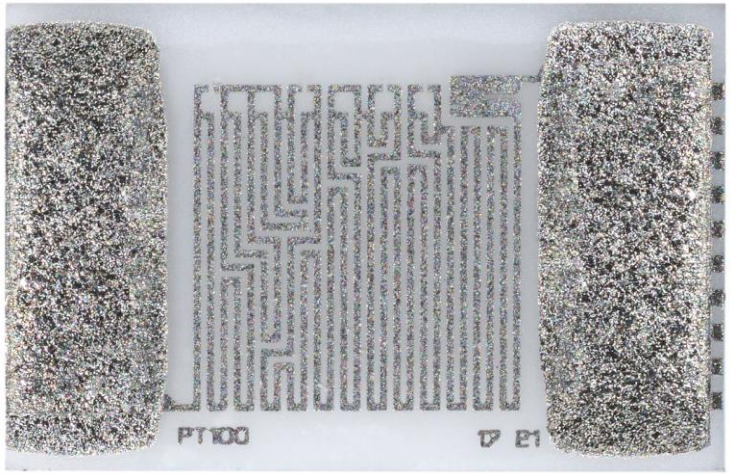


-70 °C ⟷ +500 °C

- IN HOUSE SUPPLY CHAIN FROM MATERIALS TO COMPLEX ASSEMBLIES
- CUSTOMIZATION ALONG ENTIRE VALUE CHAIN
- TAILORING TO SENSING APPLICATION

PRODUCT COMPARISON: PT RTD AND NTC

Nexensos Product

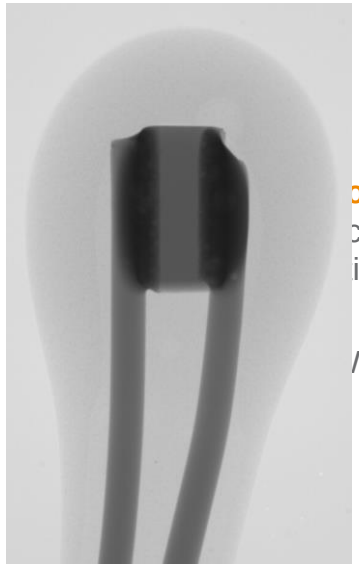


PTC – Positive Temperature Coefficient

Pt RTD – Platinum Resistance Temperature Detector

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

Competitive Technology



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/ires

NTC Thermistor – Negative Temperature Coefficient

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

PRODUCT COMPARISON: PT RTD AND NTC

PT

- Positive Temperature Coefficient
- Typical resistance values: 100, 500, 1000 Ohm (@ 0 °C)
- Linear characteristics (TCR 3850 ppm/K)
- Typical operating temperature range: -200 °C to +1000 °C

Nexensos product

NTC

- Negative Temperature Coefficient
- Typical resistance values: 2252 Ohm and higher (@ +25 °C)
- Non-linear characteristics
- Typical operating temperature range: -100 °C to +300 °C

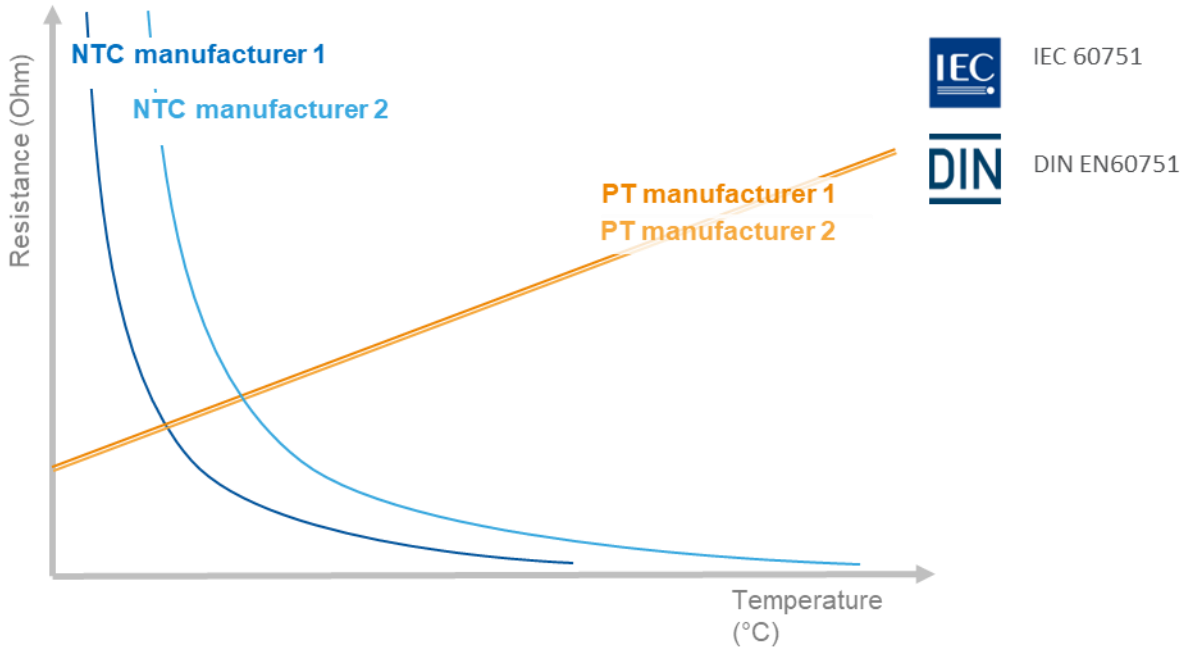
Competitive Technology

PT: Unique combination of product strengths

The corrosion-resistant, precious metal ‘platinum’ has a high long-term stability and Pt-RTDs feature a very **low signal drift** over time.

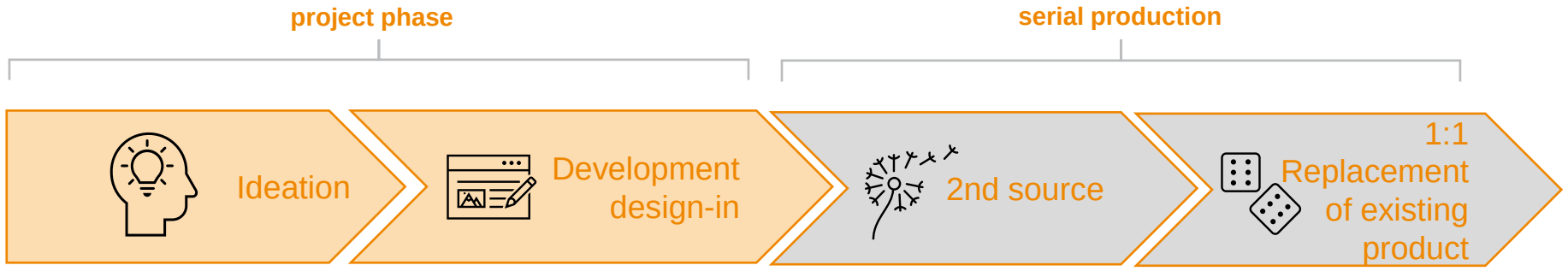
In addition, a Pt-RTD features:

- a high reproducibility
- a linear DIN/IEC normed signal
- good thermal shock resistance
- a high measurement accuracy



IS IT POSSIBLE TO REPLACE OTHER SENSING TECHNOLOGIES WITH PT-RTD?

PRESENCE DURING DESIGN-IN IS KEY



Possibility to replace competitive sensor technologies* with Pt-RTD	yes	yes	no	no

***Competitive Technologies**

NTC: bulk resistor (negative temp. characteristics)

KTY: silicon based sensor with positive temp. characteristics

TC: Thermocouple

IC: Semiconductor sensor, typically integrated

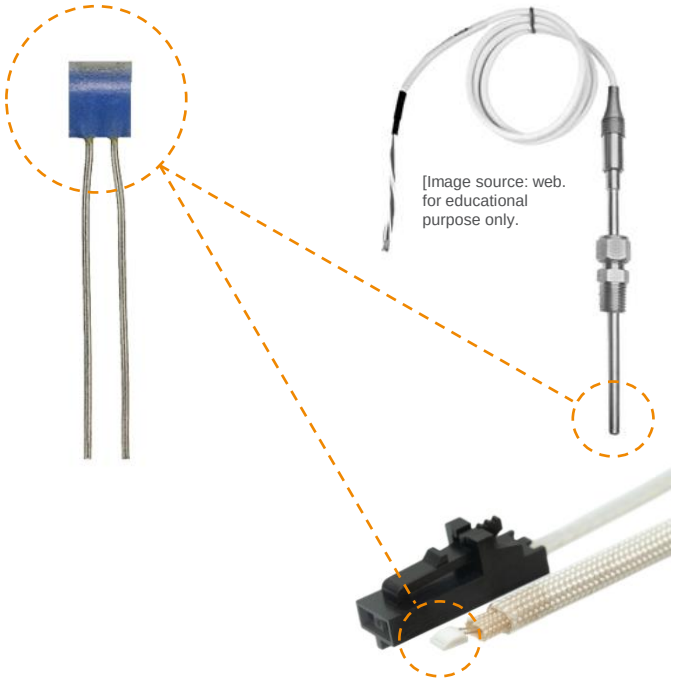
Other sensor technologies (temperature sensors) cannot be replaced with Pt-RTDs in running series business. This will require a design-change of the read-out electronics and software.

TYPICAL APPLICATIONS.
PT RTDs WITH LEAD WIRES.




FEATURES

- Ideal for assembly in tubes and probes
- Temperature detection with highest accuracy



STRENGTHS OF PT RTD

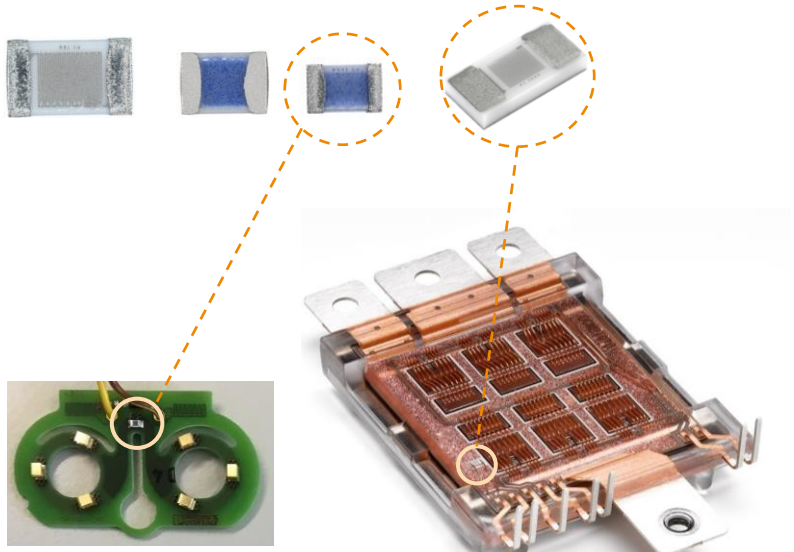
APPLICATION	wide T range	extreme high/low T capability	low signal drift	high accuracy	linear signal
Exhaust gas treatment in Diesel and Gasoline cars	●	●	●	○	○
Petrochemistry, Oil & Gas, Energy & Power	●	●	●	●	○
Industrial process monitoring and automation	●	○	●	●	○
Home appliance and professional appliance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

● important ○ helpful

TYPICAL APPLICATIONS.
PT RTDs IN SMD FORMAT.

FEATURES

- Automotive certification: AEC-Q200, PPAP
- Linear, normed signal support easy read-out
- High accuracy, long life, low signal drift



[Image source: Phoenix]

[Image source: Danfoss]

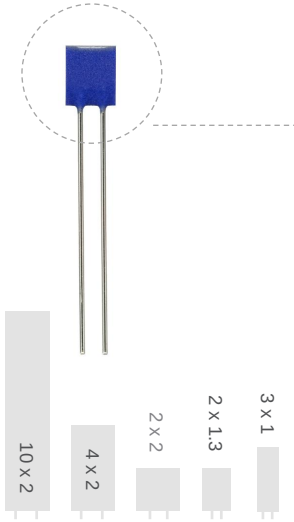
STRENGTHS OF PT RTD

APPLICATION	wide T range	extreme high/low T capability	low signal drift	high accuracy	linear signal
e-mobility: charging plugs and inlets protection			●	●	○
Data loggers	○	○	○	●	○
Medical equipment and devices			●	●	○
SiC power electronics	●		●	●	○
T drift compensation in gas and other sensors	●		●	●	○
HVAC: Thermostats			●	○	○
HVAC: Probes for duct and immersion sensors	●		●	○	○
HVAC: Heat and cold meters	●		●	●	○

● important ○ helpful

EASY ORIENTATION: PRODUCT NAMING.

Elements with lead wires



M 220 PT1000 B

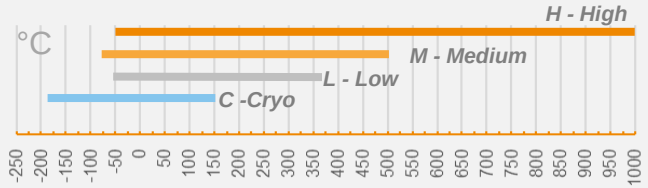
Tolerance
Standards

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

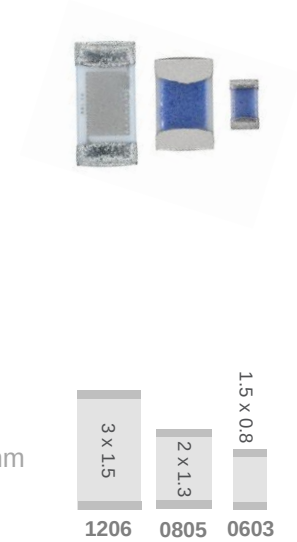
Temperature operation range



Connection methods

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

Leadless Elements



SMD 0805 PT1000 B

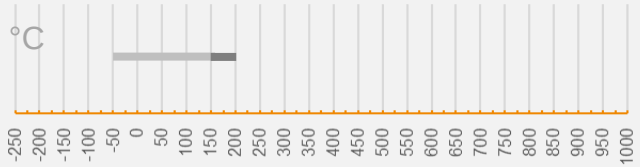
Tolerance
Standards

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

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

HOW TO FIND THE RIGHT SENSOR FOR YOUR APPLICATION

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

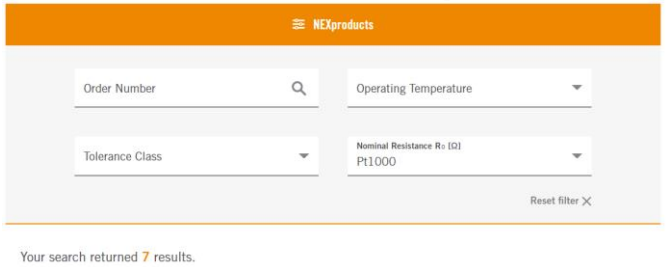
Sensor Design
Element type and size (lead wire, SMD, …)

Connection
Lead material, connection technology, wire extension

Availability
- Economy of scale
- High volume availability

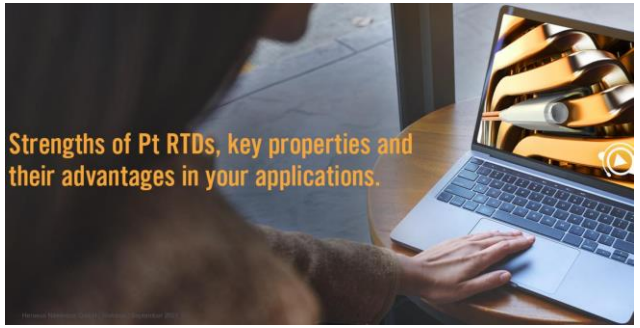
Economies of Scale

Product Selector NEXproducts



Website Use our product selector NEXproducts to find the right product

EASY ORIENTATION: WEBINARS.



Title	Content
The Power Of Temperature Sensors In E-Mobility Applications	Pt elements and application. Power electronics, e-motor protection, charging infrastructure
Installation Of Temperature Sensors and The Impact on Performance	Assembly of Pt elements into sensor assemblies and sensor probes. Performance, impact of housings, ….
Strengths of Pt RTDs, Key Properties And Their Advantages In Your Applications	Pt-RTD in comparison to NTC, advantages and application information. Product naming. Key properties.
Technical Training On Pt Sensors	Comparison of Pt-RTD, NTC, KTY sensors. Response characteristics, tolerances, accuracy and impacting factors
Pt RTD Or NTC Which Is The Best For Your Application?	Differences between Pt RTDs and NTCs. Advantages of Pt RTDs and applications examples
Pt RTD Sensor Assemblies: Forward Integration To Match Your Sensing Needs	Definition of sensor assemblies, technology & material toolbox. Design to application, performance & testing

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EASY ORIENTATION: SENSOR ACADEMY.

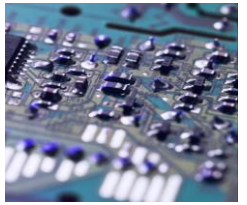
TECHNICAL EDUCATION FOR DESIGNERS AND ENGINEERS

Title	Content
Pt100 vs. Pt1000 vs. Pt10000	Difference between 100, 1000, 10000 Ohm RTD
Temperature Coefficient And Resistance	Temperature Coefficient (TCR)
Pt Sensor Design And Function	Pt sensor design, signal characteristics
Classification Of Pt Sensors And Active Principle Resistive	What is a sensor? Principle of Pt-RTD
Insulation Resistance	Resistance between the sensor element and the sensor housing
Measuring Current And Self Heating	Measuring current and impact on self heating
Temperature And Humidity Test	Temperature, humidity test
Wire Connections	2-, 3- and a 4 wire connection and when do I use which wiring type?
Long Term Stability	Tolerance and long term stability

HIGH RUNNER PRODUCTS.







Products	Series		Type	Typical Application
M222 PT100, PT1000	M-Series		Element	home appliance, HVAC, industrial process control, petro-chemistry, energy & power, e-cigarettes
M220 PT1000 (AEC-Q200)	M-Series		Element	e-mobility: e-motor control
HDA/HDZ PT200	H-Series		Element	automotive: exhaust gas treatment
SMD 0603 / 0805 PT1000	SMD Series		Element	e-mobility: Charger plugs HVAC: heat and cold meters
SMD-SC 1206 PT1000	SMD Series		Element	SiC power electronics
EC3032 PT1000	EC-Assemblies		Assembly	e-motor, e-charger, industrial applications

QUESTIONS?

THANK YOU!

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