Thermocouple Types and Specifications

T/C Type	ANSI Color Coding: Single Color	ANSI Color Coding: Overall Extension	ANSI Color Coding: Overall	Conductor Alloys	Temperature Range F (C) Thermocouple Grade Extension Grade	Tolerance (Standard) (Whichever is Greater)	Tolerance (Special) (Whichever is Greater)
E	Purple Red	Purple	Brown	**EP/EN** Chromel/Constantan	-328 to 1652 (-200 to 900) 32 to 392 (0 to 200)	±1.7 °C or ±0.5%	±1.0 °C or ±0.4%
J	White Red	Black	Brown	**JP/JN** Iron/Constantan	32 to 1382 (0 to 750) 32 to 392 (0 to 200)	±2.2 °C or ±0.75%	±1.1 °C or ±0.4%
K	Yellow Red	Yellow	Brown	**KP/KN** Chromel/Alumel	-328 to 2282 (-200 to 1250) 32 to 392 (0 to 200)	±2.2 °C or ±0.75%	±1.1 °C or ±0.4%
N	Orange Red	Orange	Brown	**NP/NN** Nicrosil/Nisil	-450 to 2372 (-270 to 1300) 32 to 392 (0 to 200)	±2.2° C or ±0.75% (2% below 0°C)	±1.1 °C or ±0.4%
T	Blue Red	Blue	Brown	**TP/TN** Copper/Constantan	-328 to 662 (-200 to 350) -76 to 212 (-60 to 100)	±1.0 ° C or ±0.75% (1.5% below 0°C)	±0.5 °C or ±0.4%
B	Grey Red	Grey	None	**BP/BN** Platinum 30% Rhodium /Platinum 6% Rhodium	32 to 3092 (0 to 1700) 32 to 212 (0 to 100)	±3.7°C or ±0.5% over 8000°C	NOT ESTABLISHED
C	White Red	White Red Trace	None	**CP/CN** Tungsten 5% Rhenium /Tungsten 26% Rhenium	32 to 4208 (0 to 2320) 32 to 1600 (0 to 870)	±4.5 °C to 425°C ±1% to 2320 °C	NOT ESTABLISHED
R/S	Black Red	Green	None	**RP/RN** Platinum **R** =13% Rhodium S=10% Rhodium/Pure Platinum	32 to 2642 (0 to 1450) 32 to 300 (0 to 150)	±1.5 °C or ±0.25%	±0.6 °C or ±0.1%

Resistance Temperature Detector (RTD) Types and Specifications*

Element Type	Temperature Range	Resistance (Ohms)	Class Tolerance**
Thin Film 1.2 x 1.6mm	-200 to +600°C	100/500/1000	B
Thin Film 1.2 x 1.6mm	-90 to +300°C	100/500/1000	A
Thin Film 1.2 x 1.6mm	-50 to +150°C	100/500/1000	⅓ DIN
Thin Film 2 x 2.3mm	-200 to +750°C	100/1000	B
Thin Film 2 x 2.3mm	-90 to +300°C	100/1000	A
Thin Film 2 x 2.3mm	-50 to +150°C	100/1000	⅓ DIN
Thin Film 1.6 x 5mm	-200 to +850°C	100/1000	B

RTD TOLERANCE CLASS DEFINITIONS

DIN Class A +/- (0.15 + 0.0020 * t)
DIN Class B +/- (0.30 + 0.0050 * t)
1/3 DIN +/- (0.10 + 0.0017 * t)
t = temperature in degrees C

** Higher accuracies available upon request

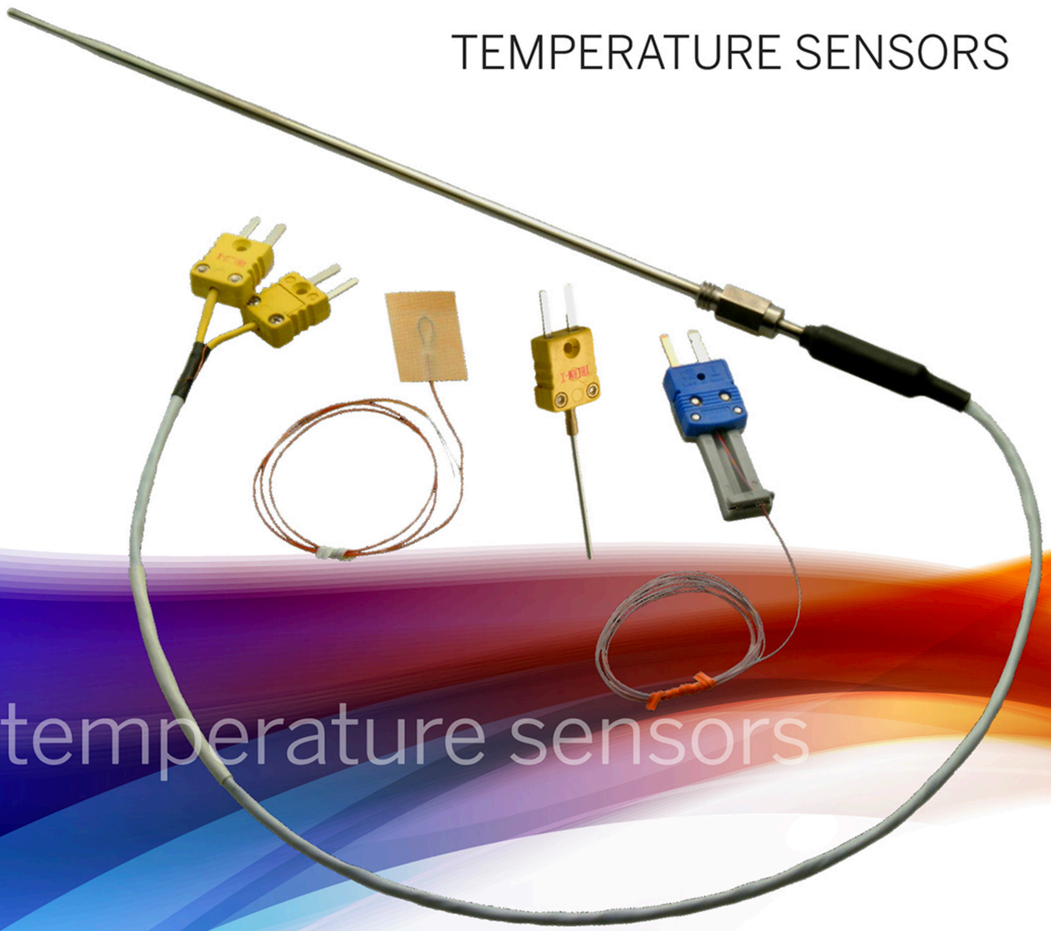
Thermistor Types and Specifications*

Ordering Part #	Power Resistance @ 25°C (Ohms)	Store and Working Temp for Best Stability (°C)	Interchangeability
44000 Series	100 - 1000K	-80 to +120 °C	±0.2 °C
44000 Series	2252 - 30K	-80 to +75 °C	±0.1 °C
55000 Series	2252 - 30K	-80 to +200 °C	±0.2 °C
55000 Series	2252 - 30K	-80 to +100 °C	±0.1 °C

* Typical types and specifications are shown. Additional products available. Contact us for more information.

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TEMPERATURE SENSORS



temperature sensors

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Benefits of Using Therm-x Sensor Solutions

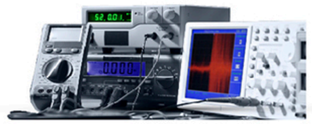
- Therm-x manufactures a variety of temperature sensors for critical process measurement, utilizing thermocouples, resistance emperature detectors (RTD), and thermistors.
- Choose to order an existing product, customize an existing product, or, with the help of our engineering team, custom design and manufacture a new product.
- We have unbeatable customer and engineering support to help you decide which sensor solution is best for your application.
- We offer competitive prices and lead times on build to print (BTP) and OEM sensors.

Customization Capabilities

Therm-x is a vertically-integrated manufacturing company with machining, furnace brazing, welding, assembly, integrated systems, clean room packaging, calibration, testing, etc. As a result, we can design and produce products to satisfy a broad range of applications.

Standards, Certifications, and Calibration Services

- Thermocouple products are designed and built to American Society for Testing and Materials (ASTM) tolerances, and conform to International Temperature Scale of 1990 (ITS-90).
- Thermocouple wire conforms to ASTM E230 specifications.
- RTD products are designed and built to DIN EN 60751 specifications.
- Sensor calibration services adhere to ASTM guidelines, and produce National Institute of Standards and Technology (NIST) traceable calibrations.



Applications and Market Segments

- Semiconductor Processing Equipment
- Automotive Engineering
- Industrial Process Applications/Refineries
- Food/Beverage Process Equipment
- Chemical Conditioning/Monitoring
- Medical Equipment
- Alternative Energy Industries
- Ovens/Furnaces/Kilns
- Life Sciences and Pharmaceutical Development
- Packaging/Adhesion Markets
- R&D Laboratory Requirements

Original Equipment Manufacturer (OEM) Products

Therm-x temperature sensors are packaged to meet the requirements of your application. Thermocouples, RTD, and thermistors have different characteristics, and we can assist you to select the appropriate type for your application. We also design and manufacture control systems for your temperature and process control needs.

Sensor Types Available

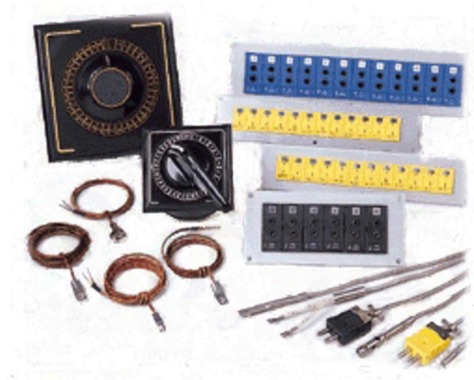
Thermocouples

Mineral Insulated (MI) Thermocouples consist of matched thermocouple wires surrounded by insulating material (typically magnesium oxide) compacted by sheath-drawing processes. The result is a rugged and reliable construction suitable for a diverse range of applications, including semiconductor wafer processing, heat treating, medical integration, nuclear reactors, refineries, vacuum furnaces, laboratory and research, etc. Advantages of MI thermocouples are:

- Usable under severe conditions
- Capable of withstanding temperatures up to metal melting point
- Capable of withstanding corrosive conditions limited only by the choice of sheath material
- Can be formed to a minimum radius of twice the sheath diameter without loss of integrity
- Can be welded, brazed, or soldered to other metals using proper techniques
- Available in a wide range of diameters from .010" to .500"
- Can withstand external pressures up to 50,000 PSI

Hardware, Wire, and Accessories for Temperature Sensors

- Thermocouple Wire with Multiple Insulation Types
- Thermowells
- Thermocouple Miniature and Standard Connectors
- Panel Jacks
- Lugs for Thermocouples
- Compression Fittings
- Protection Heads and Blocks
- Ceramic Insulators
- Alumina and Mullite Protection Tubes
- Instrumentation

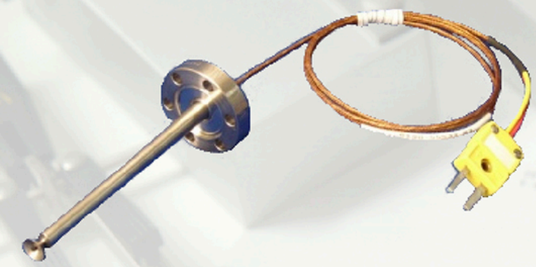


Sensor Engineering Solutions

Therm-x has the engineering capability of working with you and your team to custom design a sensor that is optimal for your application. As we begin to develop your sensor, you will be assigned your own technical team and program manager to guide you through and manage the entire project from start to finish. While there are no limitations on the types of industries we work with, below are a few industrial examples where our sensor engineering expertise played a critical role.

In addition to an array of sensors, our Integrated Systems group offers custom control solutions. With our strong skill set in thermal applications, we can deliver a cost-effective, functional, and agency-approved integrated control system for your sensor application. When inquiring about our sensors, please feel free to request additional information about a potential integrated solution for your application.

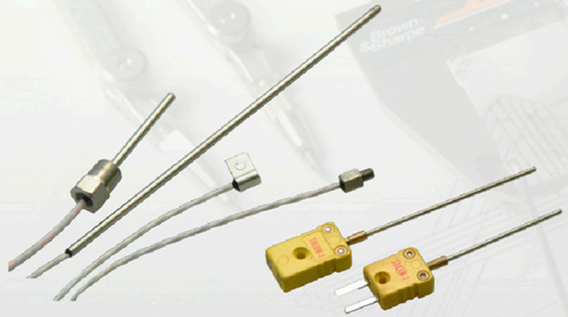
Semiconductor Processing Equipment



Exhaust Abatement Equipment



Life Sciences and Laboratory Applications



General Industrial Process Equipment

