TEMPERATURE SENSORS

Identification and Selection

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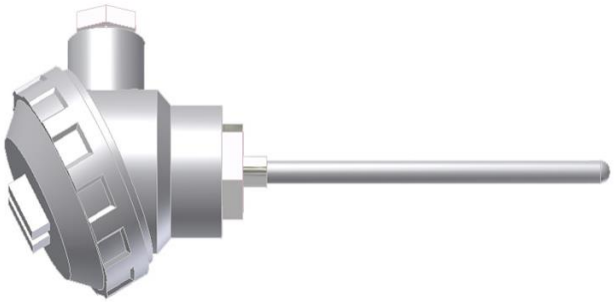
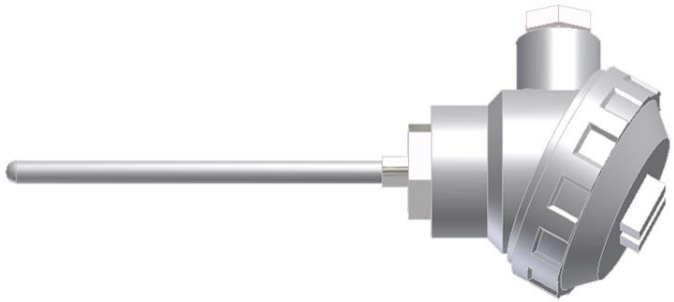
Main temperature sensors used in the industry

- RTD



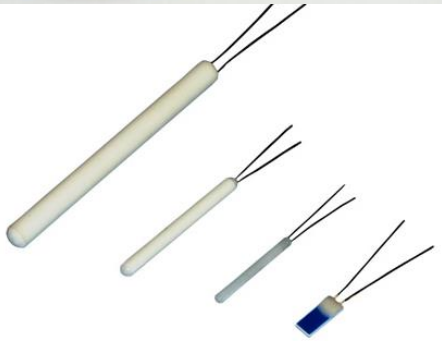
- Thermocouples



Which one to use?
RTD or Thermocouple (T/C)?

Factors:

- Temperature Range
- Response Time
- Size & Shape
- Overall accuracy requirements



RTD – What is it?

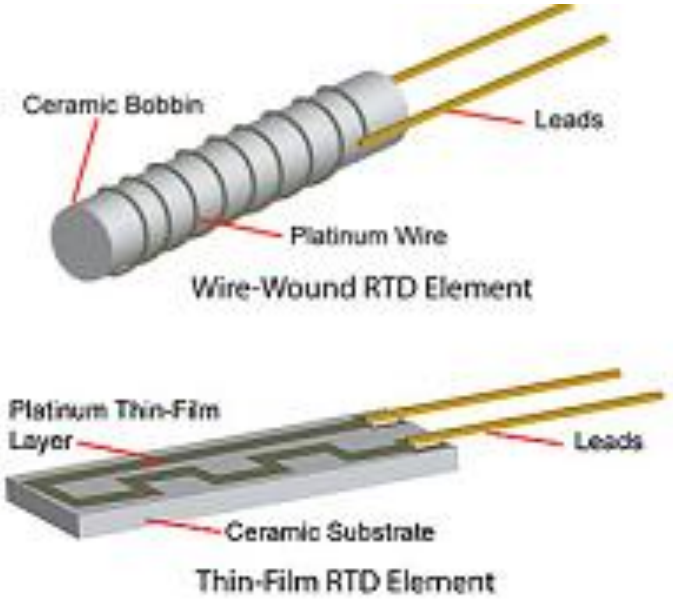
Resistance Temperature Detector (RTD)

Platinum wire of a known dimension encased in ceramic or glass. Reacts by change of resistance when exposed to temperature and is linear in its behaviour.

Types of RTD

Pt100 = 100ohms resistance at 0°C.
Pt1000 = 1000ohms resistance at 0°C.

Pt for Platinum.



RTD- Features

Advantages

- Simple construction
- Stable
- Repeatability
- Accurate to 0.1 of a degree
- Works well in the temperature range of -200°C to 400°C

Limitations

- Fragile
- Slower response time
- Needs to be in a protective sheath

Accuracy Classes

Class A & Band 5 held in stock

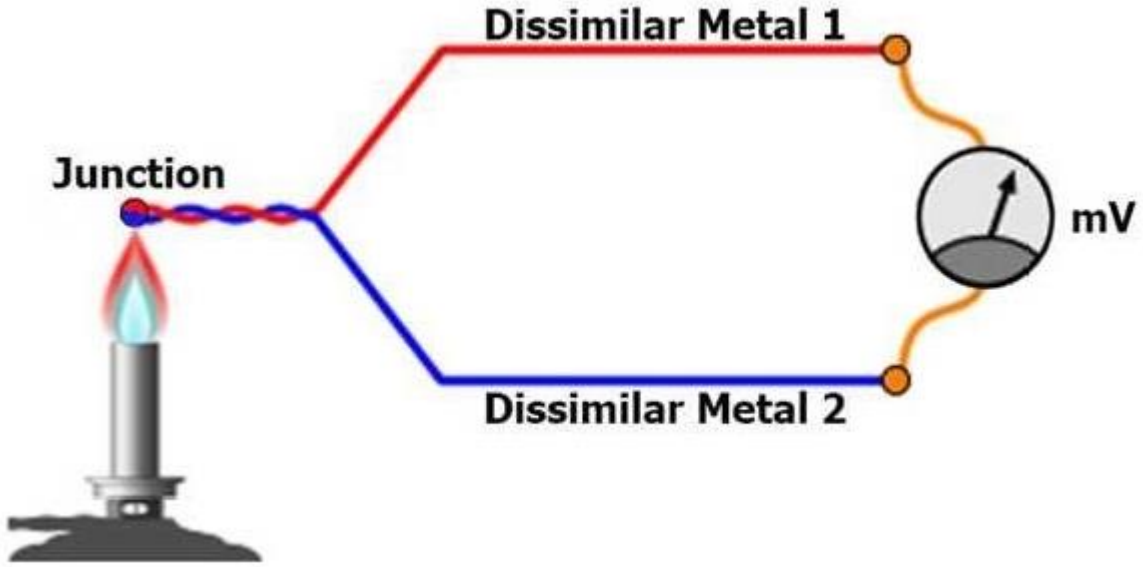
Class B is available but Class A is standard

RTD - Tolerance Table

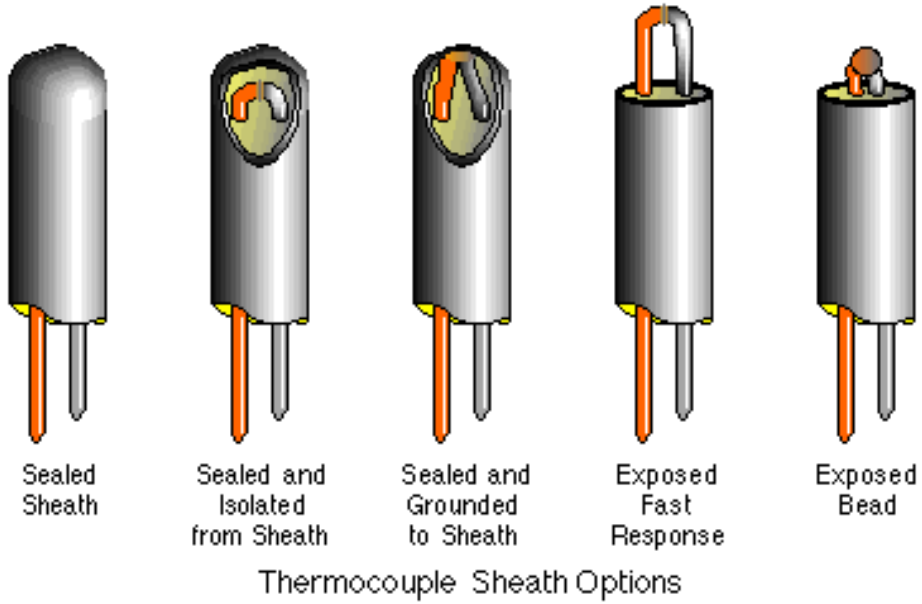
Equivalent Tolerances @ 0°C				
DIN/EC Class B	±.12%	0.12 Ohm	0.30 °C	0.54°F
SDI Band 1	±.10%	0.100 Ohm	0.26 °C	0.47°F
1/2 DIN/EC Class A	±.06%	0.06 Ohm	0.15 °C	0.23°F
SDI Band 2	±.05%	0.050 Ohm	0.13 °C	0.23°F
1/3 DIN/EC	±.04%	0.04 Ohm	0.10 °C	0.18°F
SDI Band 3	±.03%	0.030 Ohm	0.08 °C	0.14°F
1/5 DIN/EC	±.02%	0.024 Ohm	0.06 °C	0.11°F
SDI Band 4	±.02%	0.020 Ohm	0.05 °C	0.09°F
1/10 DIN/EC	±.01%	0.012 Ohm	0.03 °C	0.05°F
SDI Band 5	±.01%	0.010 Ohm	0.03 °C	0.05°F

Thermocouple – What is it?

Two different particular metals when junctioned together and exposed to heat generate a millivolt reading that is linear in behaviour in relation to the heat it is exposed to.



Sheath Options for Thermocouples



Thermocouple Sheath Options

Different options for tip as shown. Isolated or bonded junction inside the sheath or an exposed bead with no sheath are standard “in stock” items.

Thermocouple - Features

Advantages

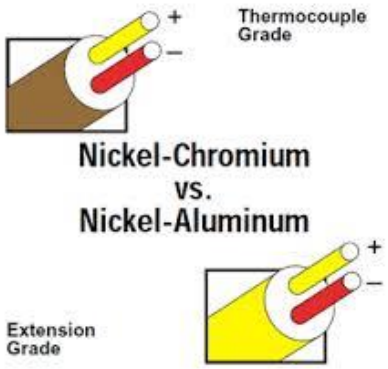
- Higher Temperature ranges
- Cheaper
- Durable
- Fast response time

Limitations

- Not as accurate
- Less stability in the reading
- Require different types for different temperature ranges

Grades

- Thermocouple Grade
- Extension Grade



Thermocouples Types

Common Types:
K, J, T

Less Common:
B, E, R, N, S

Rare:
C, D, U, G, L, M, V, P

Each Type is colour coded to a international standard so that you can tell them apart.

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Thermocouples Colour Codes

ANSI Code	ANSI MC 96.1 Color Coding		Alloy Combination		Maximum T/C Grand temp. range	EMF(mv)Over Max.temp.range	IEC 584-3 Color Coding	IEC Code
	Thermocouple	Extension	+ Lead	- Lead				
K			NICKEL-CHROMIUM Ni-Cr	NICKEL-ALUMINIUM Ni-Al	-270 to 1372°C -454 to 2501°F	-6.458 to 54.886		K
J			IRON Fe (magnetic)	CONSTANTAN COPPER-NICKEL Cu-Ni	-210 to 1200°C -346 to 2193°F	-8.095 to 69.553		J
T			COPPER Cu	CONSTANTAN COPPER-NICKEL Cu-Ni	-270 to 400°C -454 to 752°F	-6.258 to 20.872		T
E			NICKEL-CHROMIUM Ni-Cr	CONSTANTAN COPPER-NICKEL Cu-Ni	-270 to 1000°C -454 to 1832°F	-9.835 to 76.373		E
N			NICROSIL Ni-Cr-Si	NISIL Ni-Si-Mg	-270 to 1300°C -450 to 2372°F	-4.345 to 47.513		N
S	NONE ESTABLISHED		PLATINUM-10% RHODIUM Pt-10%Rh	PLATINUM Pt	-50 to 1768°C -58 to 3214°F	-0.236 to 18.693		S
R	NONE ESTABLISHED		PLATINUM-13% RHODIUM Pt-13%Rh	PLATINUM Pt	-50 to 1768°C -58 to 3214°F	-0.226 to 21.101		R
B	NONE ESTABLISHED		PLATINUM-30% RHODIUM Pt-30%Rh	PLATINUM-6% RHODIUM Pt-6%Rh	0 to 1820°C 32 to 3308°F	0 to 13.820		B

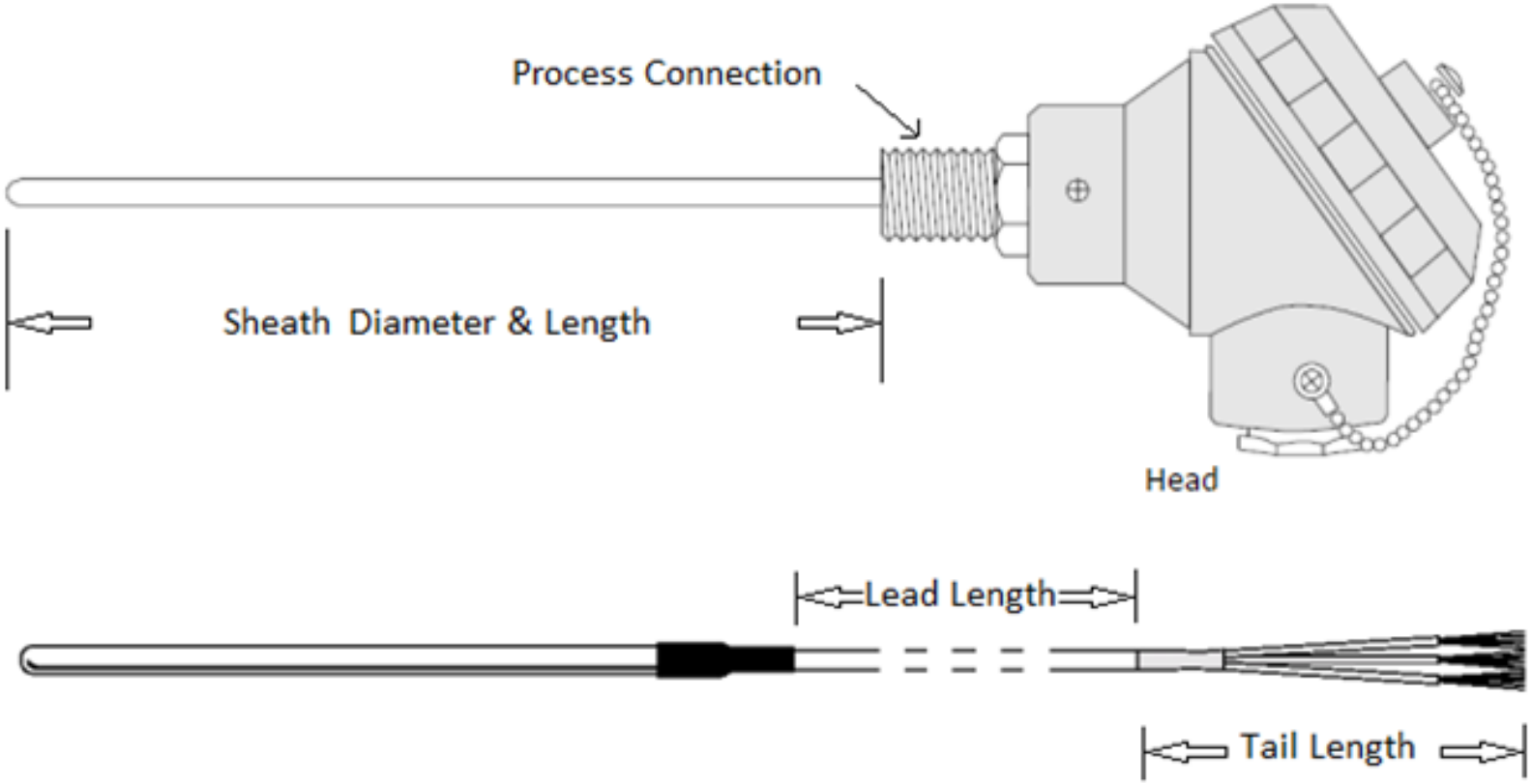
RTD's vs. Thermocouples

Resistance Temperature Detector (Rtd) vs. Thermocouples (General Principles)

Features	Rtd	Thermocouple
Accuracy	More Accurate	Less Accurate
Temperature Range	-200 to 600ºC	-200 to 2000ºC
Initial Cost	More Expensive	Less Expensive
Sensitivity	1" Typical (other lengths available)	Point Sensing Only
Response Time	1 to 7 seconds	less than 0.1 second
Robustness	Good	Good, Subject to drift
Reference Junction	Not Required	Required
Long Term Stability	Excellent	Good. Subject to drift
Output	Resistance 0.4 ohm/ohm/ºC Highly Linear	Voltage 10-40 microvolts/ºC, Approximately linear
Electrical Noise Resistance	Less susceptible	More susceptible

Source: Keystone Industries – May 2013

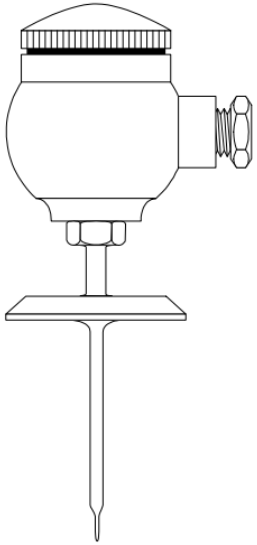
Parts of a Standard Probe

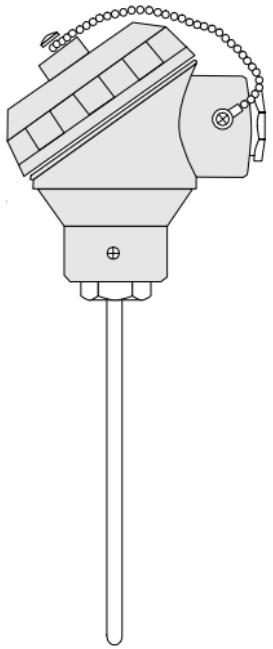


Probe Options

Tip options
Fast response
Standard Simplex
Duplex

Head options
Small or large aluminium
Polypropylene
Bakelite
Stainless steel
Process Connection options- ½ inch BSP





Probe Options (Cont.)

Transmitter options
Isolating (T/C)
Non Isolating

Terminal options
Fixed
Floating
Ceramic
Bake light

Plug options (T/C)
Miniature Plug
Miniature Jack
Standard & High Temp Plug
Standard & High Temp Jack
Standard Duplex

Accessories

Pockets

P1 pocket

P2 pocket

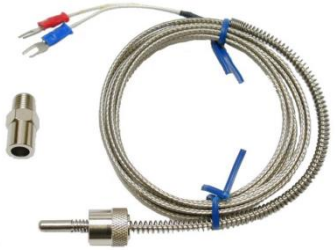
Flanges

Compression glands

Stock and Custom made Probes

MTC

RL-SIL



UT-K

HHT-01

WMR-AL

HHT-02

RHP/
MTHP

SR

& many more!

Intech Probe Catalogue

Download online: https://www.intech.co.nz/wp-content/uploads/2019/10/Probe-Catalogue-Web.pdf

THANK YOU!

Questions?

Contact us:

INTECH INSTRUMENTS LTD.
Christchurch: 03 343 0646
Auckland: 09 827 1930
sales@intech.co.nz
www.intech.co.nz