



**INTRODUCTION**

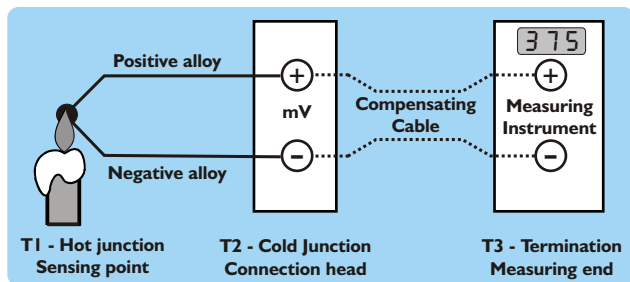
ESD offers a wide range of Thermocouples to suit various applications and environmental conditions. When faithful measurement over a wide range of temperature is a crucial factor ESD's Thermocouples are unequalled in performance. Stability over long periods of continued use makes them unmatched in reliability and durability. Matching alloy purity and high workmanship enables easy replacement and user obtains identical output. Thermocouples essentially consist of thermo-element, insulators, protecting sheath, terminals, connecting head and adjustable flange or some other mounting device. These are available in a variety of shapes, sizes and constructions to meet diverse application



requirements. The range includes Simplex and Duplex types. The thermocouples operate on the principle of seebeck effect. These sensors can be used either in direct immersion manner or with thermowells. Depending on the applications thermocouple elements are chosen.

**PRINCIPLE OF OPERATION**

Thermocouple is a device which converts thermal energy into electrical millivolts, proportional to the temperature difference between two junctions. These junctions are formed by pair of dissimilar alloys. One end of this pair is fused together to form a hot junction, which is placed at a measuring point. Other end cold junction is terminated at the connection head. Connection head is connected to the measuring instrument through compensating cable.



$mV$  Output at junction T2  $\propto$  (T1 - T2)  
For eg. if the hot junction is at 400 °C and cold junction is at 40 °C , then mV at T2 will be mV for 400°C minus mV for 40°C.  
Similarly if measuring instrument is at 25 °C, then mV at instrument input will be mV for 400°C minus mV for 25°C.

Automatic ambient temperature compensation circuit needs to be incorporated in the instruments which will add mV signal proportional to ambient temperature.

**SPECIFICATIONS**

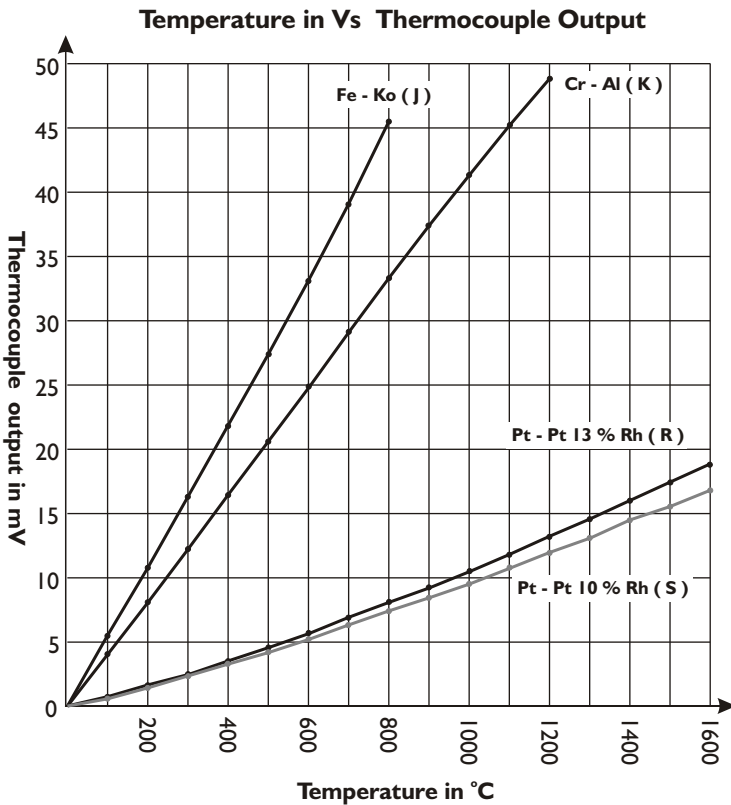
- Type : Fe Co / Cr Al / Pt Pt 13%Rh / Pt Pt 10% Rh
- ANSI Symbols : J / K / R / S
- Element : Simplex / Duplex
- Insulation : Ungrounded / Grounded / Exposed
- Connection head : Weatherproof / Flameproof / Without head
- Construction : Immersion Straight / Flameproof / Leaf  
Immersion Bare / Immersion L / Pierce  
Mineral Insulated / Pressurised / Bayonate
- Wire Gauge : 0.2 to 3.2 mm
- Sheath Diameter : 2 / 3 / 5/ 6 / 8 / 10 / 12 / 19 mm
- Sheath Length : 50 to 3000 mm
- Sheath Material : Brass / SS 316 / Ceramic / Copper / SS310  
Glass / SS 304 / Inconel
- Mounting : 1/4, 1/2, 3/4, 1 inch BSP or NPT male/female  
1/4, 1/2, 3/4, 1 inch BSP or NPT fixed threads  
Adjustable Flange
- Termination : 2 / 4 way ceramic block
- Lead wire : Type and length on demand
- Response Time : Depends on gauge, insulation and sheath material
- Output : mV as per chart proportional to the Difference in Junction temperature

Type	Material	Tmax. °C	Accuracy % of FS	Avg. mV/100 °C	Head Colour
J	Fe - Constantan	800	0.75	5.69	Black
K	Cromel - Alumel	1200	0.75	4.07	Red
R	Pt-Pt 13 % Rh	1600	0.25	1.18	Green
S	Pt-Pt 10 % Rh	1600	0.25	1.04	Green

## INSTALLATION AND PRECAUTIONS

Proper Installation Precautions will improve the performance, accuracy, stability and service of the sensor as well as measurement system. Some of them are listed below as "Use, Do's and Avoid"

- |              |  |
|--------------|--|
| <b>Use</b>   | <ul style="list-style-type: none"> <li>✓ Same type of compensating cable</li> <li>✓ Cable without joint from Junction head to Instrument</li> <li>✓ Appropriate Thermal conductive media between Thermowell &amp; sensor sheath</li> <li>✓ Proper sheathing material as per application and environment</li> </ul>   |
| <b>Do's</b>  | <ul style="list-style-type: none"> <li>✓ Sensor cables must be isolated from power cables</li> <li>✓ Insert minimum required sensitive length in the measurement object</li> <li>✓ Operating temperature should be 80 % of the maximum specified temperature</li> </ul>  |
| <b>Avoid</b> | <ul style="list-style-type: none"> <li>✓ Exposure of thermocouple head to temperatures greater than 90°C.</li> <li>✓ Too large sheath diameter as this may introduce time lag</li> <li>✓ Mechanical stresses and vibrations</li> <li>✓ Excessive relative humidity Magnetic field / inductive pickup or noise</li> <li>✓ Excessive Ambient temperature</li> <li>✓ Corrosive gases in surroundings</li> </ul> |



## ORDERING INFORMATION

TC	X1	X2	X3	X4	X5	X6	X7	X8	X9				
<b>Type</b>	1 - J 2 - K 3 - R 4 - S 5 - Other	<b>Head</b>	1 - Weather Proof 2 - Flame Proof 3 - Without Head 4 - Other	<b>Construction</b>	1 - Immersion Straight 2 - Immersion L 3 - Immersion Bare 4 - Mineral Insulated 5 - Bayonate 6 - Leaf 7 - Flameproof 8 - Pierce 9 - Pressurised	<b>Diameter</b>	1 - 2 (MI) 2 - 3 3 - 5 4 - 6 5 - 8 6 - 10 7 - 12 8 - 19 9 - Other	<b>Length</b>	1 - 50 2 - 75 3 - 100 4 - 150 5 - 200 6 - 250 7 - 300 8 - 450 9 - Other	<b>Material</b>	1 - Brass 2 - Copper 3 - SS304 4 - SS316 5 - SS310 6 - Inconel 7 - Ceramic 8 - Glass 9 - Other	<b>Mounting</b>	1 - 1/4" BSP(M/F) 2 - 1/2" BSP(M/F) 3 - 3/4" BSP(M/F) 4 - 1" BSP(M/F) 5 - 1/2" NPT(M/F) 6 - 3/4" NPT(M/F) 7 - Fix Threads 8 - Adj. Flange 9 - Other

- Elements**
- 1 - Simplex Ungrounded
  - 2 - Simplex Grounded
  - 3 - Simplex Exposed
  - 4 - Duplex Ungrounded
  - 5 - Duplex Grounded
  - 6 - Duplex Exposed

### Ordering Example TC 211137121

- Thermocouple  
2 - Cr - Al  
1 - simplex ungrounded  
1 - weather proof head  
1 - Immersion Straight  
3 - Sheath diameter 6 mm  
7 - sheath length 300 mm  
1 - sheath material SS 304  
2 - mounting 1/2" BSP M/F  
8 - without cable

### Lead Wire ( Original conductor without joint, please specify length in mtrs)

- |   |                                       |
|---|---------------------------------------|
| 1 - Fibreglass / Fibreglass               | 5 - Asbestos / Asbestos               |
| 2 - Fibreglass / Fibreglass metal braided | 6 - Asbestos / Asbestos metal braided |
| 3 - Teflon/Teflon                         | 7 - Not required                      |
| 4 - Teflon/Teflon metal braided           | 8 - Other                             |

For thermocouple with head, compensating cable is to be ordered separately. Refer catalogue on sensor accessories.

Attempt is made to make ordering information applicable to most of the requirements. Still this being application oriented product, detailed drawing will speed up the order processing. Response time of the thermocouple depends upon insulation, sheath material, element gauge.

Following points need to be considered while ordering the thermocouples

1. Application
2. Operating temperature and Maximum temperature
3. Media
4. Process Response
5. Insertion, insulating thickness and hangover length



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