



# SNS COLLEGE OF TECHNOLOGY

Coimbatore-35

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*DEPARTMENT OF MECHATRONICS*

## 19MCB303 – SENSORS AND SIGNAL PROCESSING

### UNIT 2 – ELECTROMECHANICAL SENSOR

#### Thermocouple

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# UNIT-2

## ELECTRO MECHANICAL SENSOR

### SENSORS

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graph TD; SENSORS --> Resistance; SENSORS --> Inductance; SENSORS --> Conductance;
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#### Resistance

- Transducer
- Potentiometer
- Thermistor
- Thermocouple
- Strain gauge

#### Inductance

- Transducer
- LVDT
- RVDT

#### Conductance

- Transducer
- Ultra sonic transducer

# UNIT-2

## Transducer

- A resistive transducer is an electronic device that is capable of measuring various physical quantities like temperature, pressure, vibration, force, etc.
- These physical quantities are extremely difficult to measure as they can change easily.
- The measurement of the physical quantity is quite difficult. The resistive transducer converts the physical quantities into variable resistance which is easily measured by the meters.
- The process of variation is widely used in the industrial applications.

# UNIT-2

## Transducer

- The resistive transducer can work both as the primary as well as the secondary transducer.
- The primary transducer changes the physical quantities into a mechanical signal, and secondary transducer directly transforms it into an electrical signal

### **Advantages**

- The resistive transducer gives the fast response.
- It is available in various sizes and having a high range of resistance.

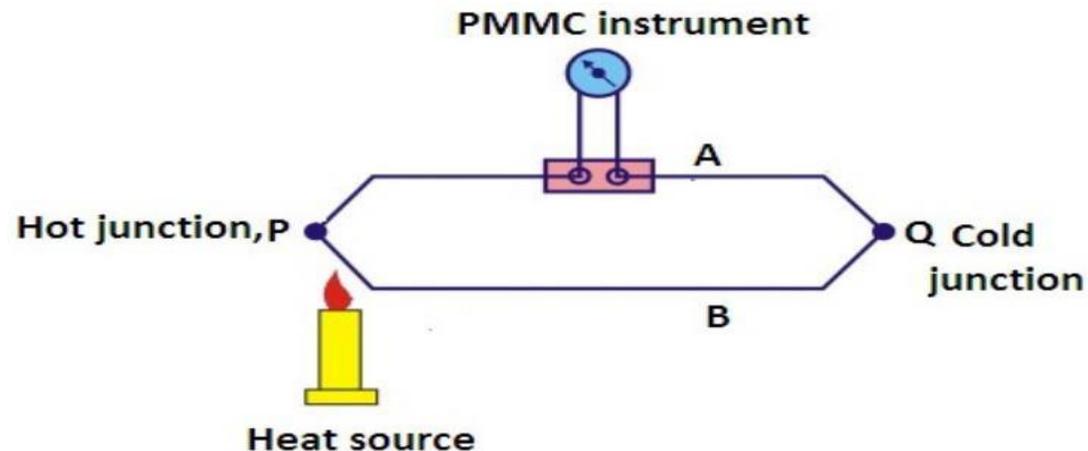
# THERMOCOUPLE

- Thermocouples are the temperature sensors which are extensively used for the measurement of the temperature variations.
- As they convert a non-electrical quantity (temperature) into voltage (electrical quantity) so they are transducers also.
- Since they do not require any external power source to operate, so they are active transducers.

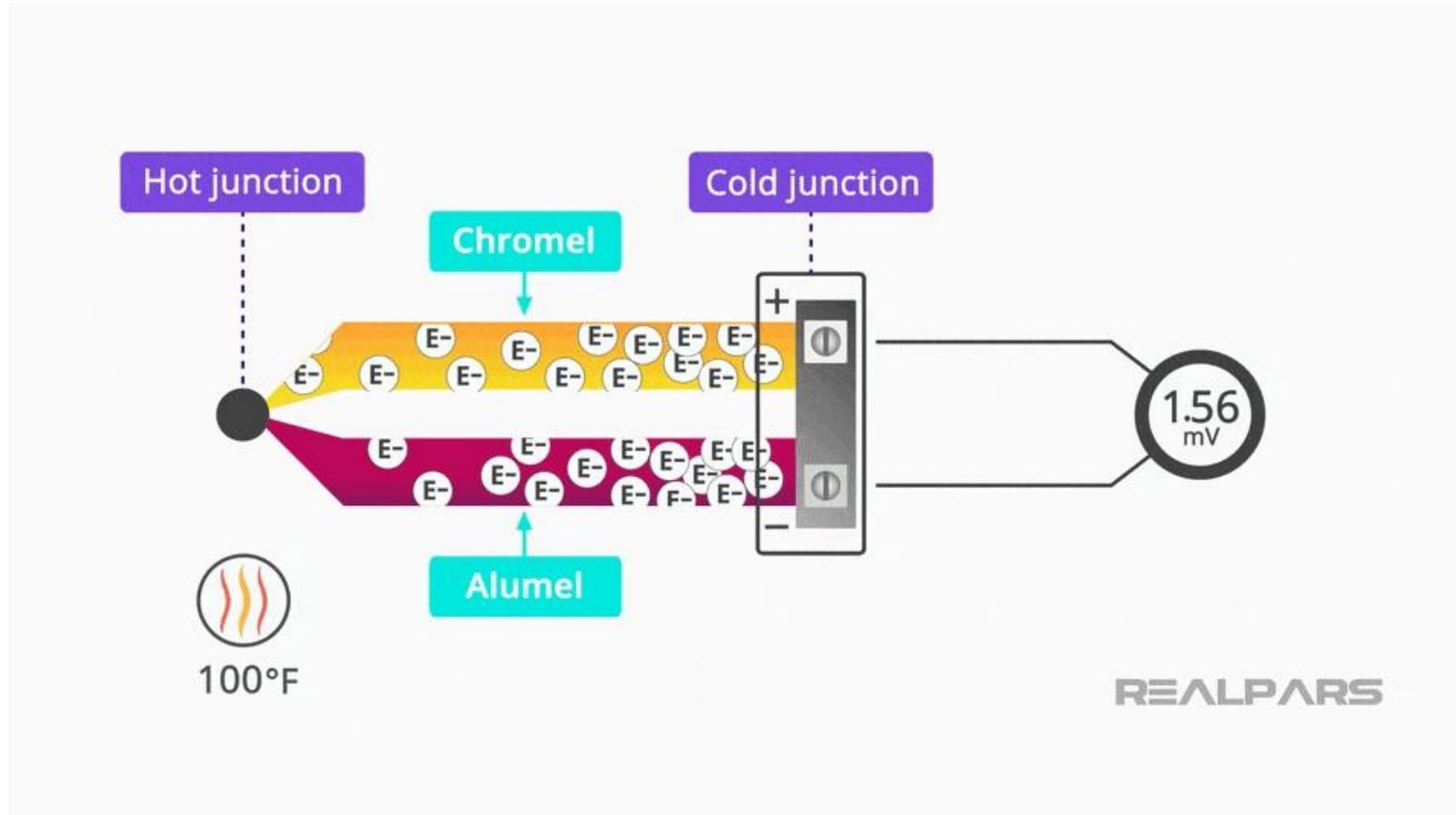


# Thermocouple Working Principle:

- The thermocouple working principle is based on the Seebeck Effect.
- This effect states that when a closed circuit is formed by jointing two dissimilar metals at two junctions, and junctions are maintained at different temperatures then an electromotive force (e.m.f.) is induced in this closed circuit.



# WORKING:



# TYPES OF THERMOCOUPLES:

- The metal alloys chosen as thermocouple positive and negative leg wires define the type of thermocouple.
- Selection of the proper thermocouple type for a particular application is determined by temperature expectations and by the environment in which the sensor will be placed.

Thermocouple Types			
Type	Conductor Combination	Temperature Range	
		°F	°C
B	Platinum 30% Rhodium / Platinum 6% Rhodium	2500 to 3100	1370 to 1700
E	Nickel-chromium / Constantan	32 to 1600	0 to 870
J	Iron / Constantan	32 to 1400	0 to 760
K	Nickel-chromium / Nickel-aluminium	32 to 2300	0 to 1260
N	Nicrosil / Nisil	32 to 2300	0 to 1260
R	Platinum 13% Rhodium / Platinum	1600 to 2640	870 to 1450
S	Platinum 10% Rhodium / Platinum	1800 to 2640	980 to 1450
T	Copper / Constantan	-75 to +700	-59 to +370

## Advantages:

- The thermocouple is less expensive.
- It has wide temperature ranges.
- The temperature range is 270 to 2700 degree Celsius.
- It has good accuracy.
- It has high speed of response.

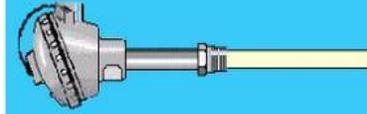
## Disadvantages:

- As output voltage is very small, it needs amplification.
- The cold junction and lead compensation is essential.
- It shows non linearity.
- They have very low accuracy. So they cannot be used for very high precision measurement.

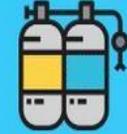
# APPLICATIONS:

- Temperature sensors in thermostats in offices, homes, offices & businesses.
- In industries for monitoring temperatures of metals in iron, aluminum, and metal.
- In the food industry for cryogenic and Low-temperature applications. Thermocouples are used as heat pumps for performing thermoelectric cooling.
- These are used to test temperature in chemical plants, petroleum plants.
- In gas machines for detecting the pilot flame.

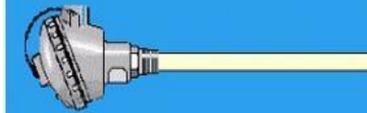
## TYPE: J



Recommended in vacuum, inert, and reducing atmospheres, as well as hot processes including plastics and resin manufacture.



## TYPE: K



Used for environments such as water, mild chemical solutions, gases, and dry area. Found in engines, oil heaters, and boilers, hospitals and the food industry.



## TYPE: N



Used in vacuum or controlled atmospheres, ovens, furnaces and kilns. Also, gas turbine and engine exhausts and iron, aluminium and smelting industry.



## TYPE: R & S



Used in Heat treating and control sensors, semi-conductor industry, glass manufacturing, ferrous and non-ferrous metals.





*Thank You*