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Instrumentation system

The block diagram shown below is of basic instrumentation system. It consist of primary sensing element, variable manipulation element, data transmission element and data presentation element.

Primary sensing element

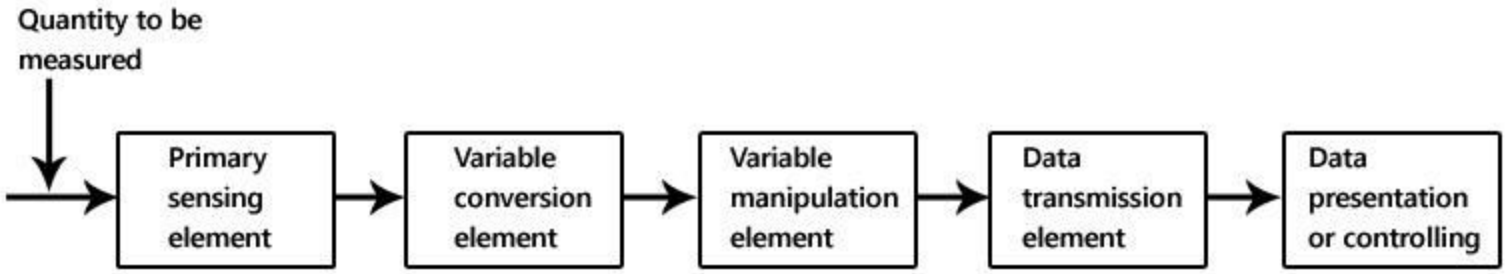
The primary sensing element is also known as sensor. Basically transducers are used as a primary sensing element. Here, the physical quantity (such as temperature, pressure etc.) are sensed and then converted into analogues signal.

Variable conversion element

It converts the output of primary sensing element into suitable form without changing information. Basically these are secondary transducers.

Variable manipulation element

The output of transducer may be electrical signal i.e. voltage, current or other electrical parameter. Here, manipulation means change in numerical value of signal. This element is used to convert the signal into suitable range.



Block diagram of instrumentation system

Data transmission element

Sometimes it is not possible to give direct read out of the quality at a particular place (Example – Measurement of temperature in the furnace). In such a case, the data should transfer from one place to another place through channel which is known as data transmission element. Typically transmission path are pneumatic pipe, electrical cable and radio links. When radio link is used, the electronic instrumentation system is called as telemetry system.

Data presentation or controlling element

Finally the output is recorded or given to the controller to perform action. It performs different functions like indicating, recording or controlling.

What is Temperature?

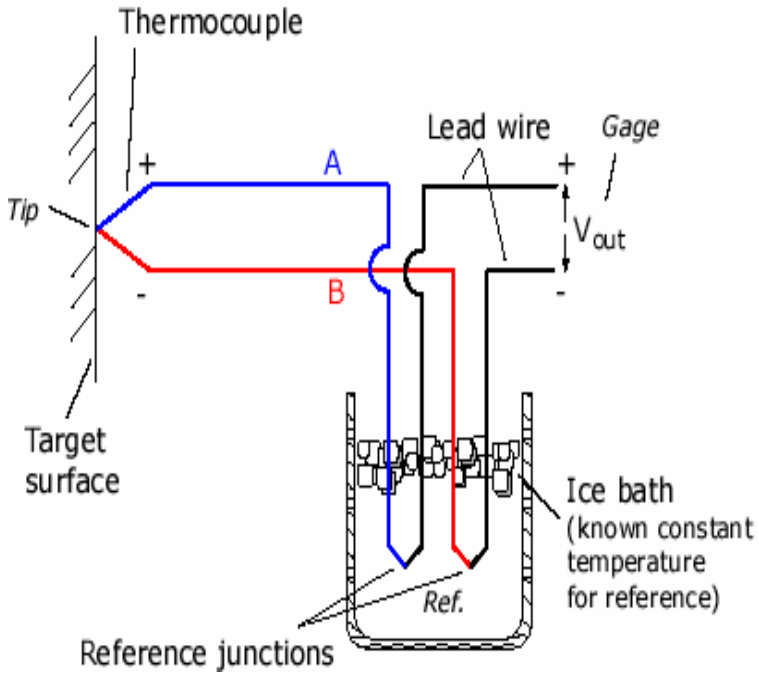
Temperature is a measure of degree of hotness or coldness of an object. The two most common temperature scales are Fahrenheit (°F) and Celsius (°C). SI unit of temperature is Kelvin(K).
Temperature is most commonly measured by Resistance Temperature Devices (RTD) and Thermocouples, and to a lesser degree Infrared (IR).

Thermocouples

Thermocouples are fabricated from two electrical conductors made of two different metal alloys. At one end of the cable the two conductors are electrically shorted together by crimping, welding, etc. This end of the thermocouple, the hot or sensing junction, is thermally attached to the object to be measured. The other end, the cold or reference junction is connected to a measurement system.
Thermocouples generate an open-circuit voltage, called the Seebeck voltage that is proportional to the temperature difference between the sensing (hot) and reference (cold) junctions:

$$V_S = V\,(T_{Hot} - T_{Ref})$$

Where : VS = Seebeck Voltage
V = Proportionality Constant
T_{Hot} = Temperature of the Sensing Junction
T_{Ref} = Temperature of the Reference Junction



Advantage of Thermocouples

- These are cheaper than resistance thermometer.
- Thermocouples follow the temperature changes with a small time lag in such are suitable for recording completely rapid change in temperature.
- These are very convenient for measuring the temperature at one particular point in a piece of apparatus.
- Thermocouples are used for temperature up to 1400^0 C