



METHODS & TYPES OF MEASUREMENTS, CLASSIFICATION OF INSTRUMENTS



CONTENTS



**Review answers for
worksheet-1**

**Methods of
Measurements**

**Types of Measurement
Techniques**

**Classroom Game –
Password**

**Classification of
Measuring Instruments**

Summary

Worksheet-2



MEASUREMENT



- Measurement is an act or the result of quantitative comparison between an unknown magnitude and the predefined standard.
- Since two quantities are compared, the result is expressed in numerical values.





TWO REQUIREMENTS FOR MEASUREMENT



1. The standard used for comparison must be accurately known and commonly accepted.
2. The procedure and equipment used for obtaining this comparison must be provable.



1. Direct Comparison Method

- Unknown quantity (**measurand**) is directly compared against a standard.
- Result expressed as a numerical value and a unit. (Ex: Mass and Time)
- **Involve human factors** – inaccurate and less sensitive
- Not always possible, feasible and practicable



2. Indirect Comparison Method

- Unknown quantity is compared with the standard through the use of a calibrated system.
- Mostly used in industries.



TYPES OF MEASUREMENTS



1. Primary Measurements

- Unknown quantity (measurand) is determined by comparing it directly with reference standards.

Example:

- Measuring length with a scale
- Judging weight of unknown mass
- Matching of two colours
- Matching of light intensities



TYPES OF MEASUREMENTS



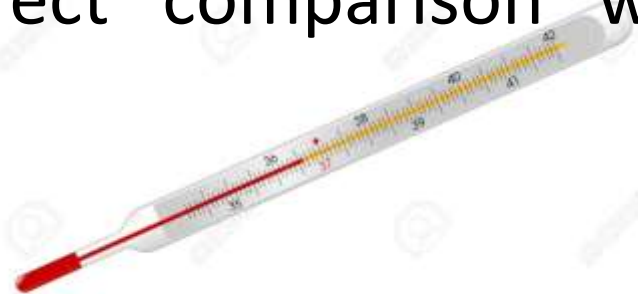
2. Secondary Measurements

- Involves one conversion since the Measured quantity is not observable (Ex: Temperature of fluid).
- Necessary to make indirect comparison with calibrated system.

Example:

- Mercury Thermometer

(Py. Signal – Temperature is transmitted to transducer – mercury, Sy. Signal – length is read by observer)



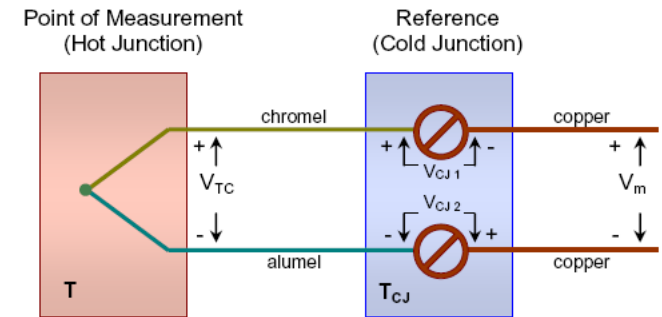
3. Tertiary Measurements

- Involves two conversions.

Temperature is converted into Voltage



Voltage is converted into Length



$$V_m = V_{TC} - (V_{CJ1} + V_{CJ2}) = V_{TC} - V_{CJ}$$

© www.mosaio-industries.com/embedded-systems

Example:

- Measurement of temperature by thermocouple.



CLASS ROOM GAME

PASSWORD

1. Mechanical Instruments

- First instruments in nature
- Reliable for static and stable operation
- Rigid, heavy and bulk moving parts, large mass – Poor dynamic response
- Source of noise



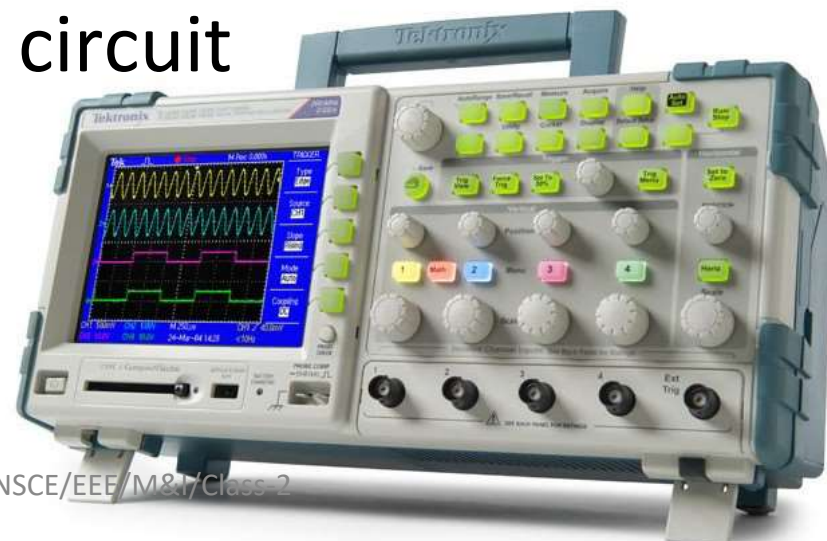
2. Electrical Instruments

- Depend on mechanical instruments
- More rapid than mechanical instruments



3. Electronic Instruments

- Dynamic response in the order of nanoseconds
- Example : CRO, DSO
- More reliable, Light Weight, Compact, Fast response, Low power consumption
- High cost, Complex circuit





1. Absolute Instruments

- It measures the quantity in terms of physical constants of the instruments.
- Time consuming – Take lot of time to compute the magnitude of measurement.

Example:

- Tangent Galvanometer
- Rayleigh's current balance

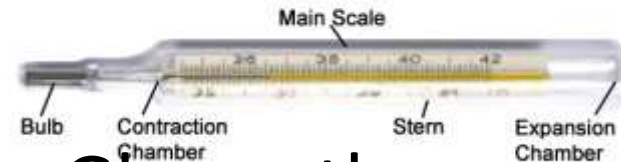


2. Secondary Instruments

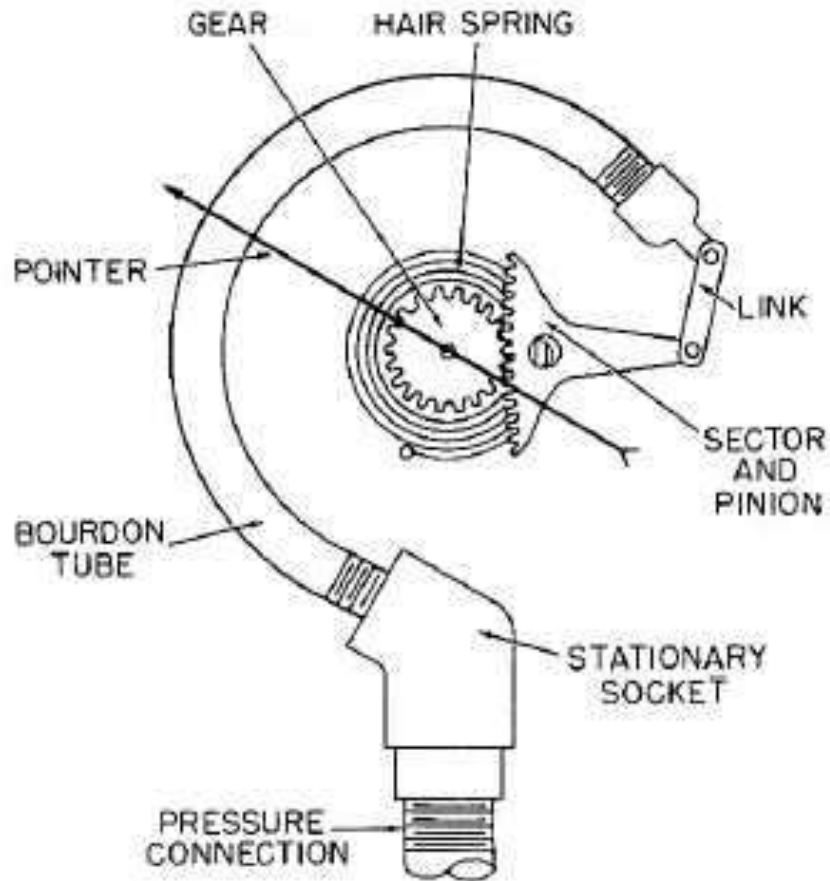
- Measurand can be measured by observing output indicated by the instrument.

Example:

- Voltmeter, Ammeter, Glass thermometer, Pressure gauge



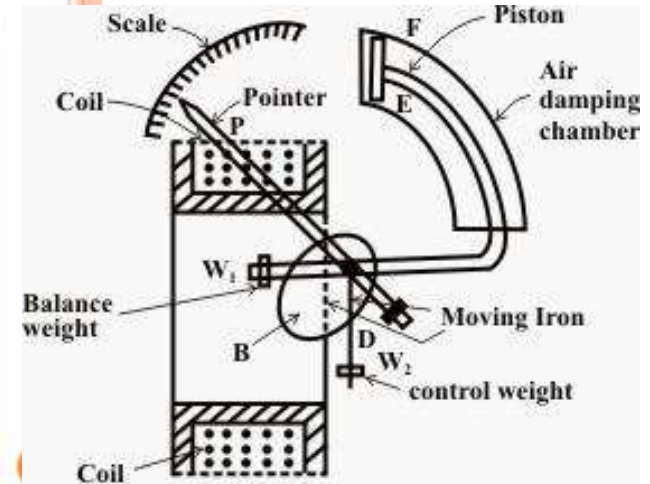
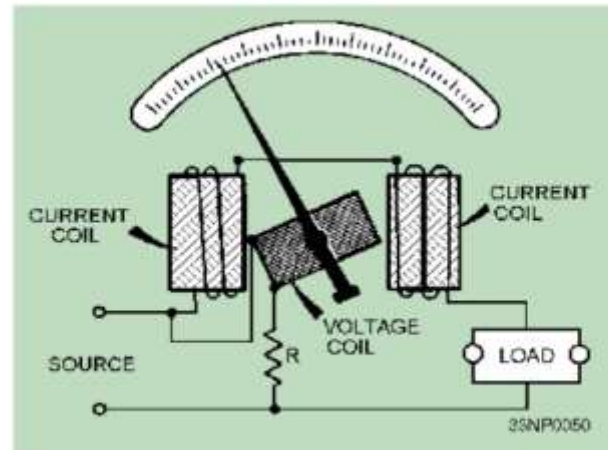
BOURDAN GAUGE



1. Indicating Instruments

- Indicate the magnitude of quantity being measured with the help of dial, pointer and calibrated scale.

Example:





FUNCTIONAL CLASSIFICATION OF INSTRUMENTS

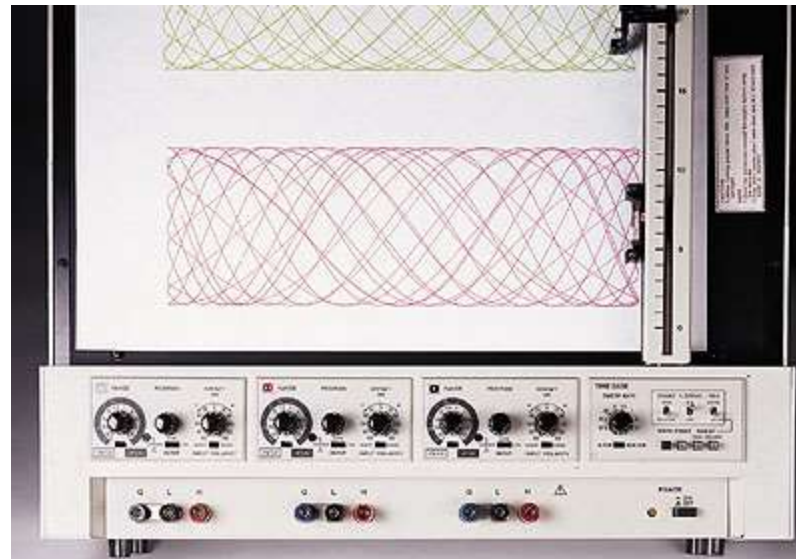


2. Recording Instruments

- Gives a continuous record of quantity being measured over a specified period
- Moving part connected to pen, records the variation in the measurand on a paper.

Example:

- X-Y recorder





FUNCTIONAL CLASSIFICATION OF INSTRUMENTS



3. Controlling Instruments

- Information is used by the instruments to control the original measured quantity.

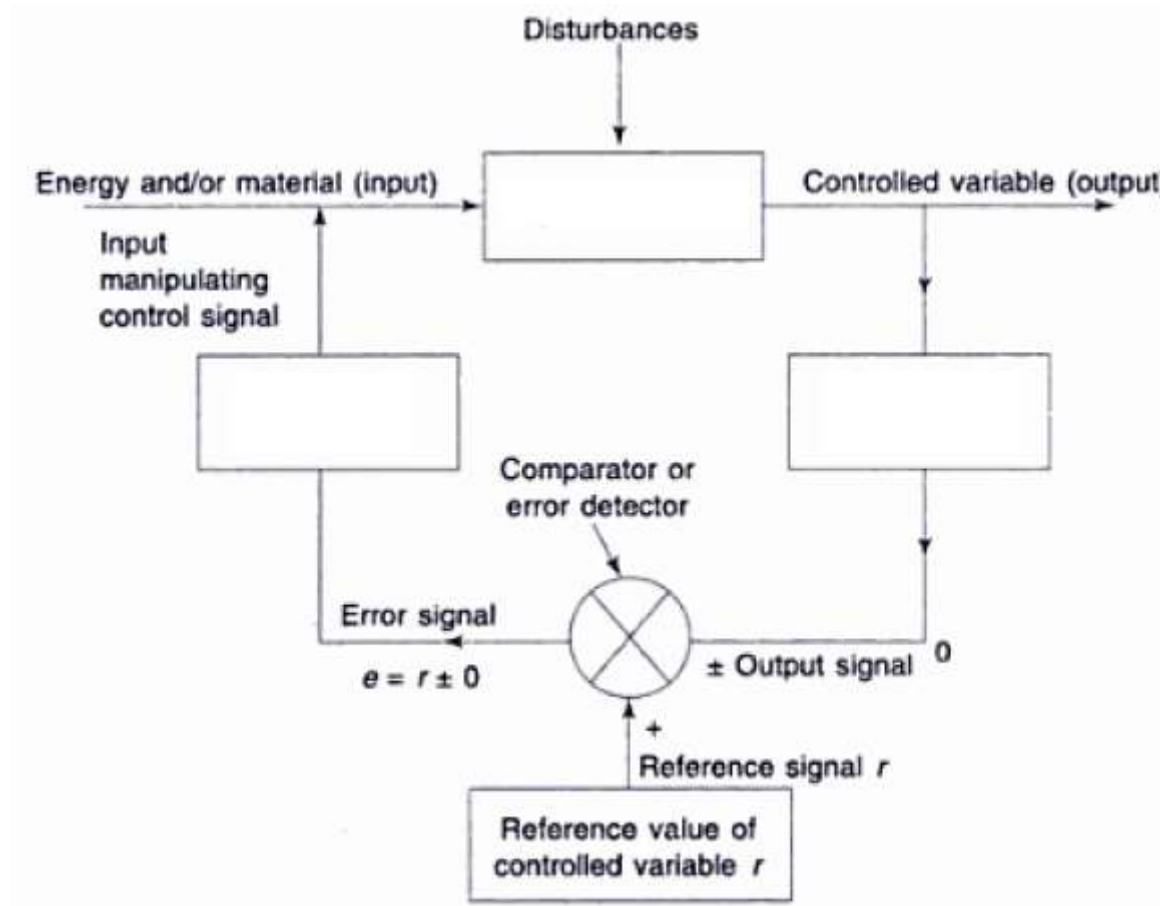
Example:

- Thermostats for temperature control
- Floats for liquid level control



Work sheet

1. Fill the block





Work sheet

1. Direct comparison method is not always possible and feasible, because, it involves human error B. is an old method C. requires more time

2. Measuring the length of a line with a scale is
Secondary measurement B. Primary measurement C. Tertiary measurement

3. Example of absolute instruments are _____

4. X-Y recorder is an example of _____ instrument

5. Measurement of temperature by thermocouple is an example of _____ measurements

6. Mechanical instruments are
Noiseless B. Stable C. Compact D. Very fast response



THANK YOU