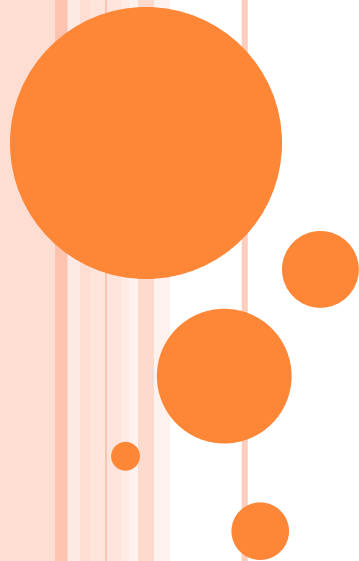


INTRODUCTION TO MEASUREMENT

Dr. V. Karteek

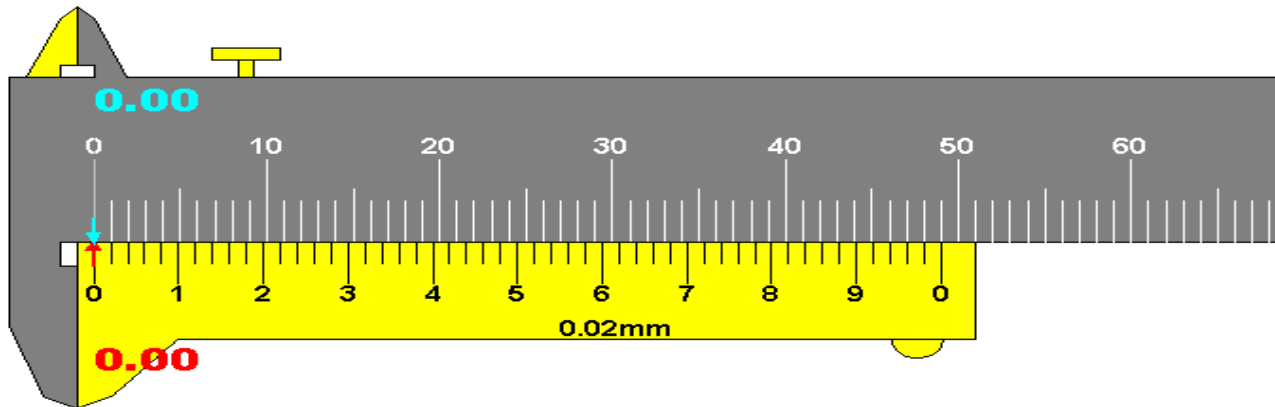
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DEFINITION

- Measurement is a process of detecting an unknown physical quantity by using standard quantity.
- A way of giving an activity a precise dimension, generally by comparison to some standard; usually done in a quantifiable or numerical manner.



APPLICATIONS

- ***Monitoring of processes and operations***
example: thermometers, barometers, oximeter etc.

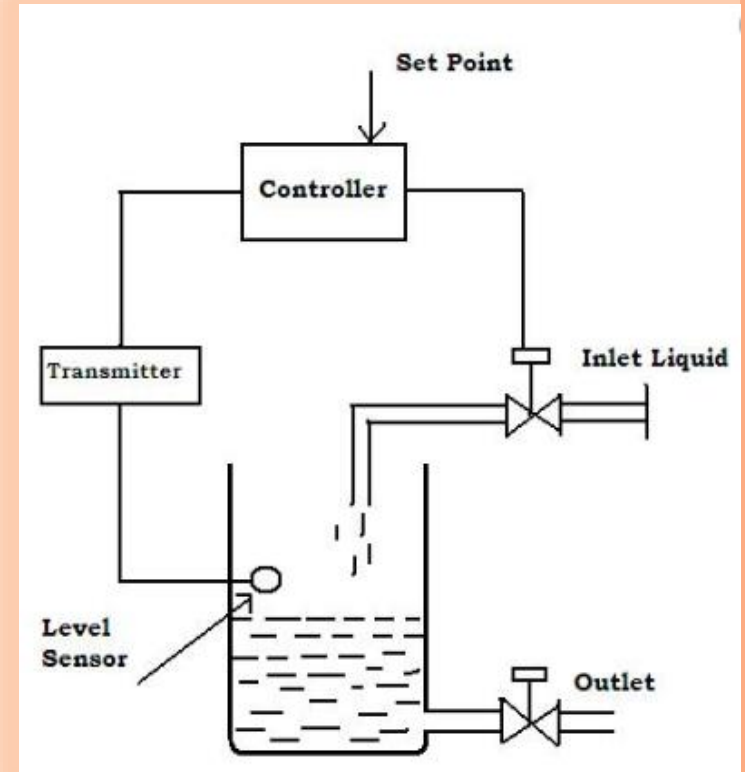
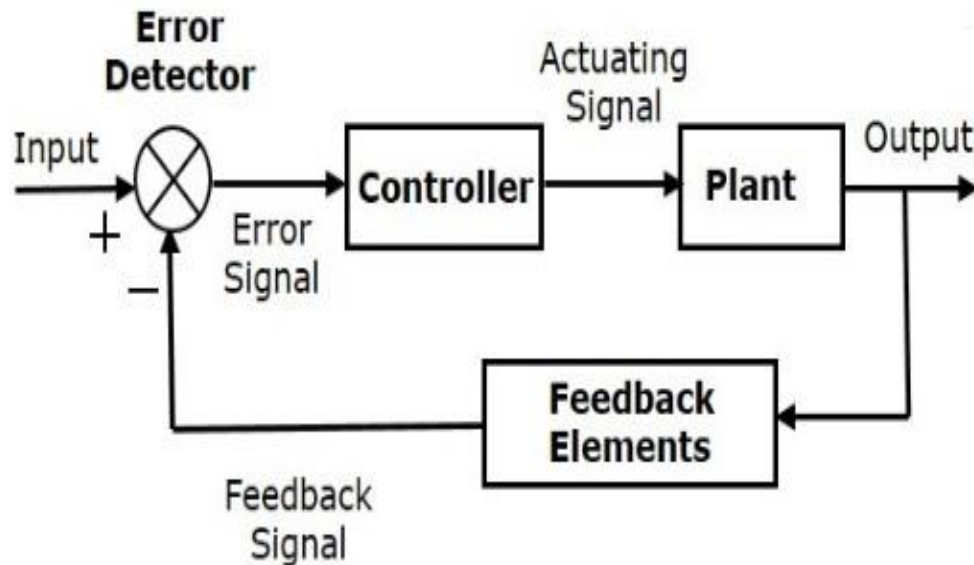
These instruments simply indicate the condition of the environment and their readings do not serve any control functions.



APPLICATIONS

➤ *Control of processes and operations*

If you can measure then you can control. All control systems must incorporate at least one measuring instrument.



APPLICATIONS

➤ *Experimental Engineering Analysis*

- To test the validity of theoretical calculations (Exa. In the laboratory we do experiments related Thevenin or Norton theorems and verify the theoretical results with the experimental results)
- To determine system parameters, variables and performance indices



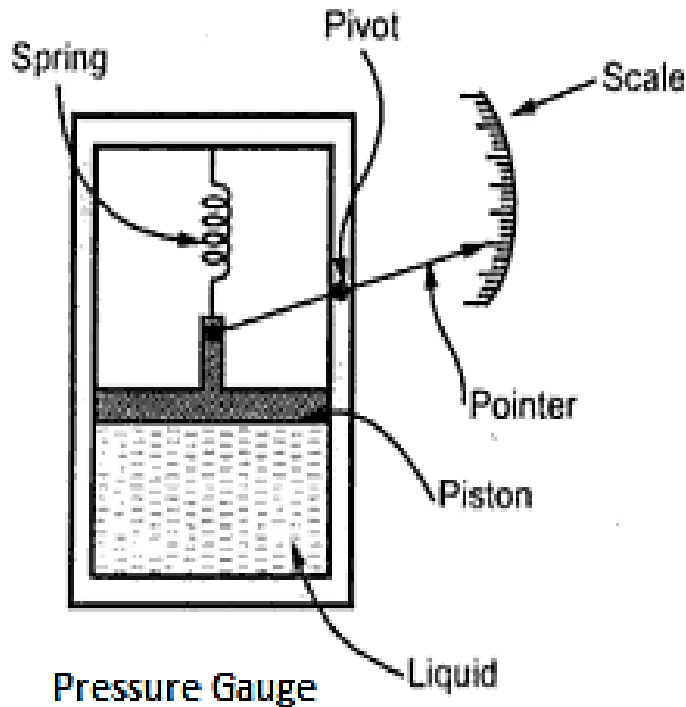
INSTRUMENT CLASSIFICATION

- *Passive and Active Instruments*
- *Null and Deflection Type Instruments*
- *Analog and Digital Instruments*
- *Absolute and Secondary Instruments*



PASSIVE INSTRUMENTS

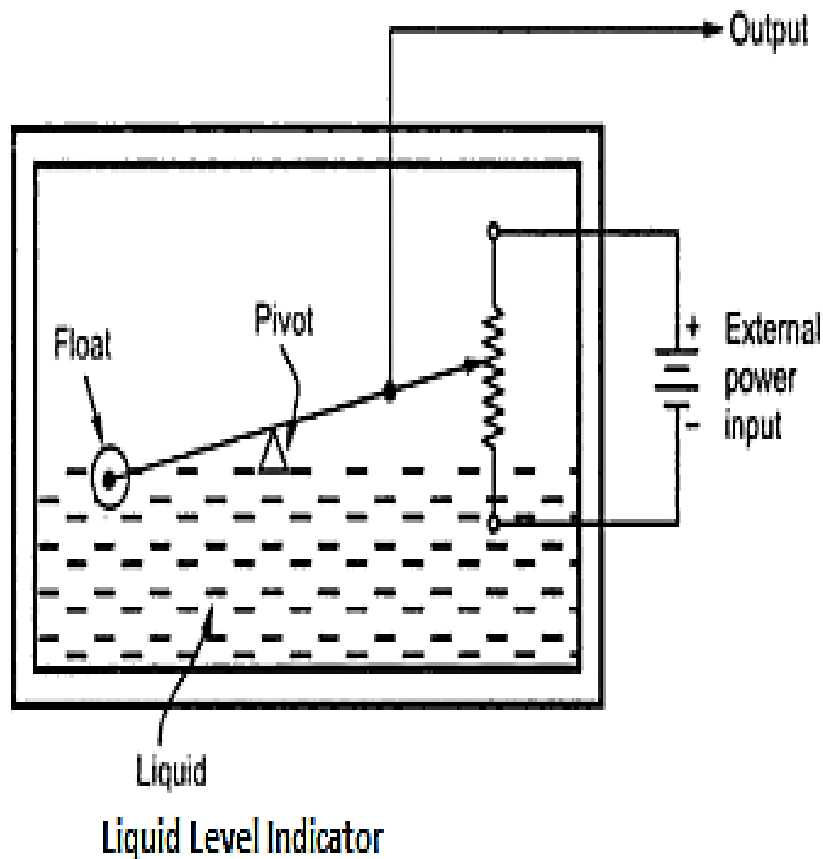
- The instruments in which the output is produced entirely by the quantity being measured are called passive instruments.



As the liquid pressure changes, the piston moves to which the pointer is connected. Thus the liquid pressure due to which piston and hence pointer moves is solely responsible for measurement. No other input energy source other than liquid pressure is used in this measurement.



ACTIVE INSTRUMENTS



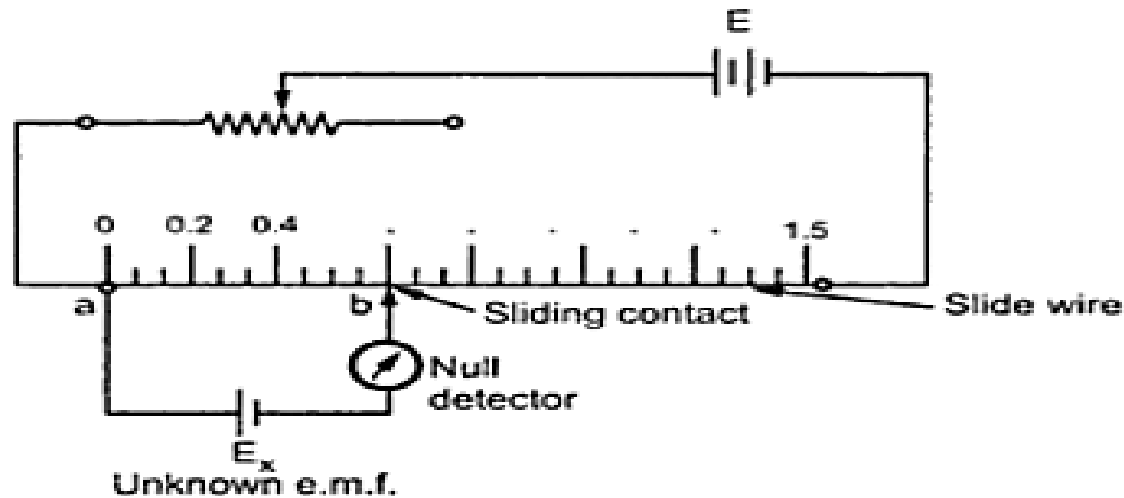
The instruments in which the quantity to be measured just activates the magnitude of some external power input source which internally produces the measurement are called active instruments.

The potentiometer and the external power input is used to sense the position of float which is proportional to the level of liquid in a tank.



NULL TYPE INSTRUMENTS

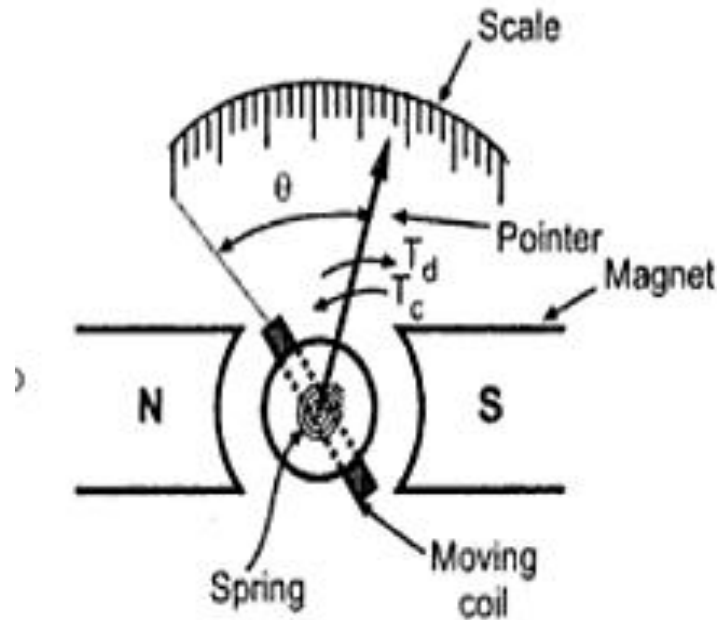
The instruments in which a zero or null indication leads to the determination of the magnitude of the measured quantity are called null type instruments.



D.C. Potentiometer

The slide wire is calibrated in terms of emf with the help of standard emf source. The deflection of the galvanometer is proportional to the difference between the emfs E_{ab} and unknown emf E_x . When the two emfs are equal the galvanometer shows null deflection. This value is directly indicated on slide wire.

DEFLECTION TYPE INSTRUMENTS



The instruments in which the quantity to be measured produces some effect due to which the pointer deflects are called deflection type instruments. The pointer deflection is proportional to the quantity to be measured.



ANALOG AND DIGITAL INSTRUMENTS

In the analog method, measurement is done continuously, and the size of the signal is analogous to the measured value.

The measured value is indicated on a pointer instrument that has got a scale (e.g. voltage, resistance).

Another example of analog measurement is the measurement of the temperature by using a mercury thermometer as mentioned above.



CONTINUED

- In the digital method, the measured value is converted to binary format and shown in numerical form. The measurement of the speed by counting the number of revolutions within a defined period of time is a digital measuring procedure, too.



ABSOLUTE AND SECONDARY INSTRUMENTS

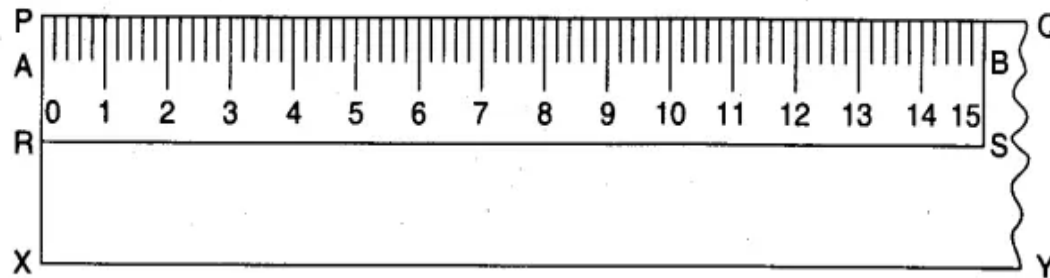
- The instrument which gives the magnitude of the quantity to be measured in terms of physical constants of the instrument is called an absolute instrument. Exa. Tangent Galvanometer
- The instrument in which the reading shown by the instrument gives directly the measurement of the quantity to be measured is called a secondary instrument. These are calibrated by comparison with absolute instruments. Exa. Ammeter, Voltmeter



TYPES OF MEASUREMENTS

Direct- In these methods the unknown quantity is directly compared against a standard.

Example: length measurement using a scale.



Scale of least count 0.2 cm.

Indirect- Where direct measurement is not possible, the indirect measurement method is used. The value under measurement is obtained by measuring other quantities, whereby the relation between the physical quantities must be known.

(Example: the determination of speed by using the formula “speed = distance/time”).

THANK YOU

