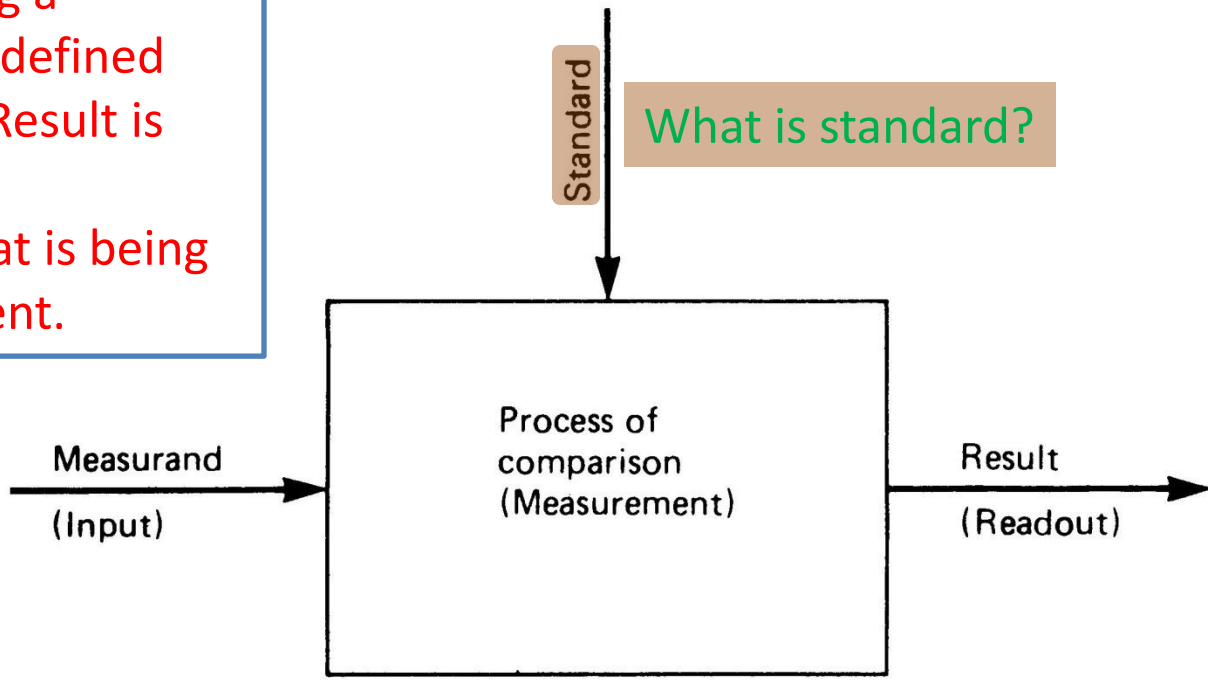
AE 242
Aerospace Measurements Laboratory

What is measurement?

The act of or process of measuring (English dictionary)

We are concerned about measuring engineering quantities: Temperature, Pressure, Flow, Speed, Acceleration, Angular rate, Linear displacement, Angular displacement etc.

Measurement is : Obtaining a comparison between a predefined standard and measurand. Result is the measured quantity.
Measurand - A quantity that is being determined by measurement.



What is Instrumentation?

Measurement system : Creating instruments for measurements

Measurement instruments interact with the physical quantity and develop output signal

Simple example : Measuring tape for distance measurement, vernier, dial gage etc.
Complex example : GPS for position

Absolute measurement
Relative measurement

Instrumentation needs information about the interaction with physical quantity e.g. temp & voltage, distance & resistance etc. Modern instruments use electronic devices, micro-controllers etc

Why Instrumentation?

1) Monitoring of processes and operation
2) Control of processes and operation
3) Experimental engineering analysis

1) <u>Monitoring of processes and operation</u>
Barometer, thermometer, anemometer etc in a weather bureau.
Electric meter, water meter at home.
Simply indicates the values

Why Instrumentation?

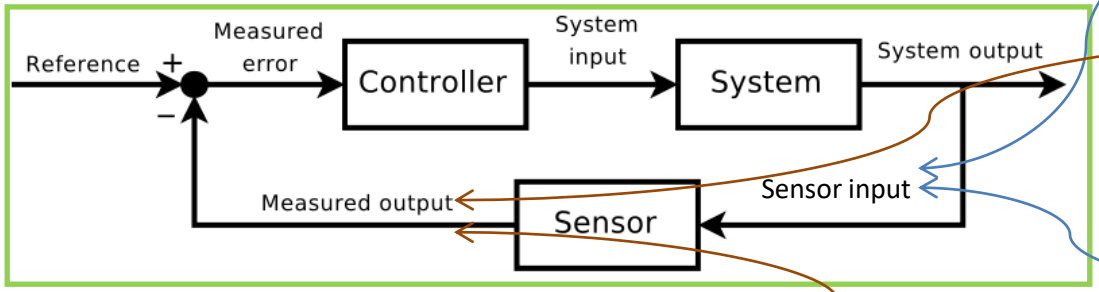
2) Control of processes and operation

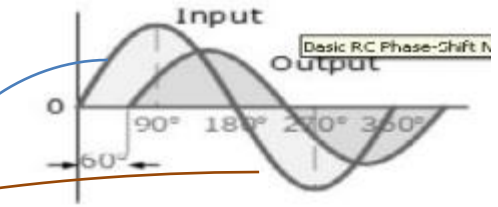
Measured quantity is used to control a process. Measured quantity is used as feed back.

Control of speed in a vehicle: Vehicle speed from odometer, human uses this measurement for control. Human in feed back loop.

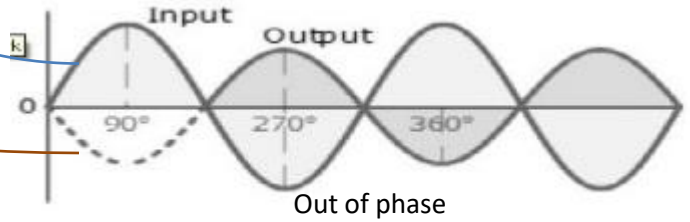
Automatic control : Control system uses the vehicle speed in the feed back system

Quality of the instrumentation (accuracy and reliability) is very important in controls.





In phase



Out of phase

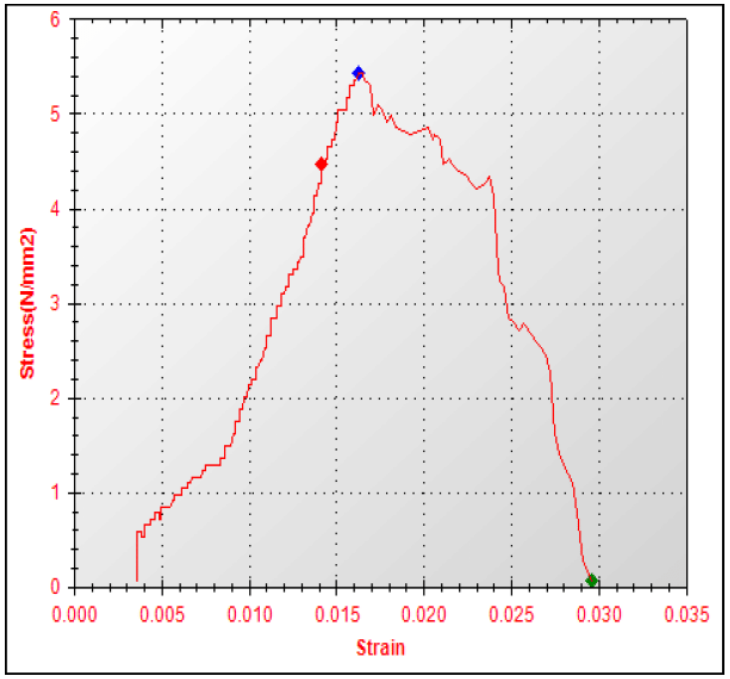
Why Instrumentation?

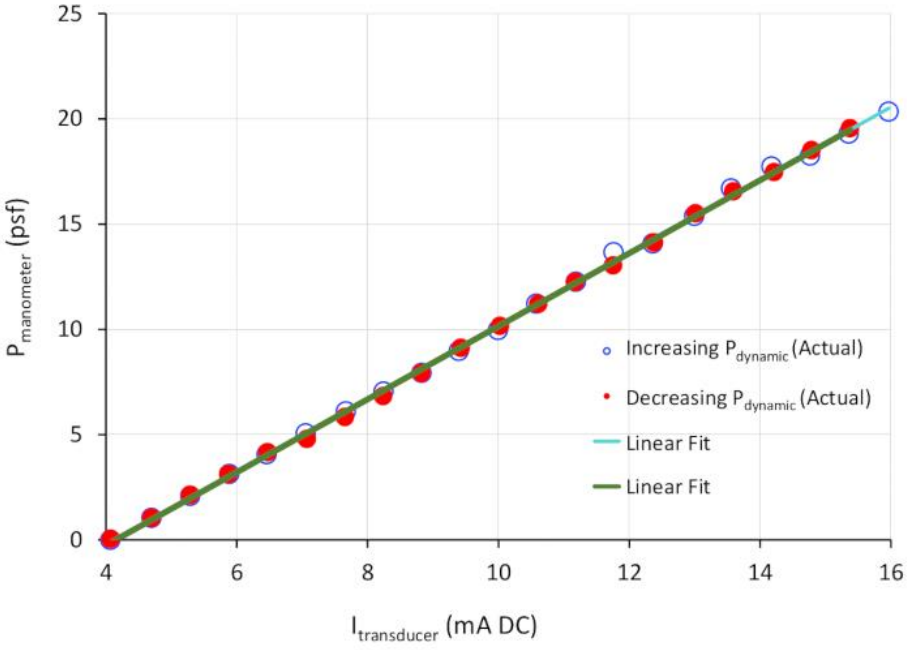
3) Experimental engineering analysis

Measured quantity/quantities are compared with theoretical results.

Theory and experiments compliments each other.

Many times theories are not available, experiments are conducted to get the insight





Why Instrumentation?

Measured quantity have different meaning for different applications.

Temperature, Barometer, anemometer etc. weather bureau

- For general public it is just a monitoring data
- For a fruit grower, water requirement, anti frost deployment etc
- For a weather analyst, data from large area may be used for prediction

Quality and quantity of measured quantity depends on the end use