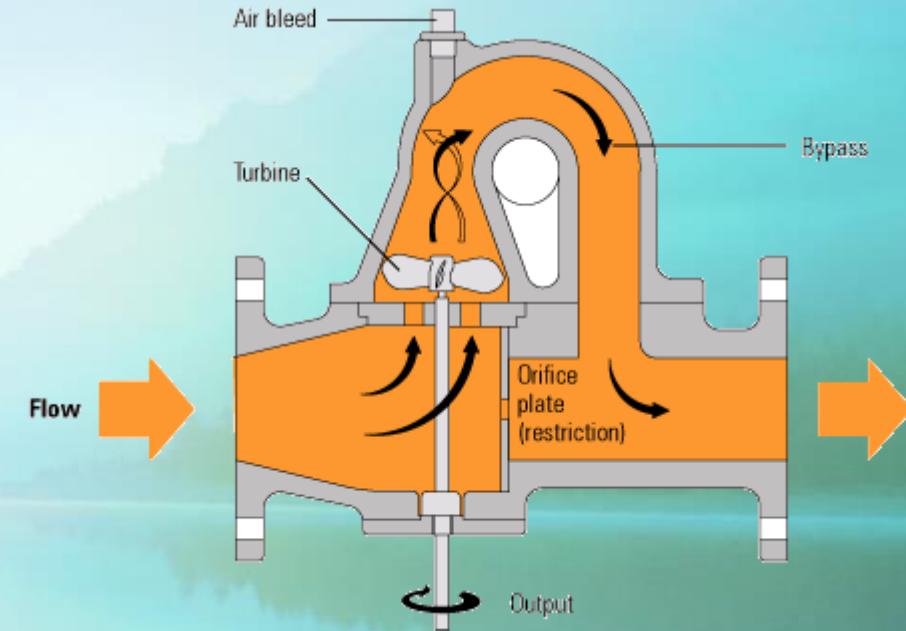


BY OMID PAKBIN

Pressure & Flow Sensor



Bilegsaikan Ganbold – Awaisu Mubinun - Stéphane Lejeune / September 2017



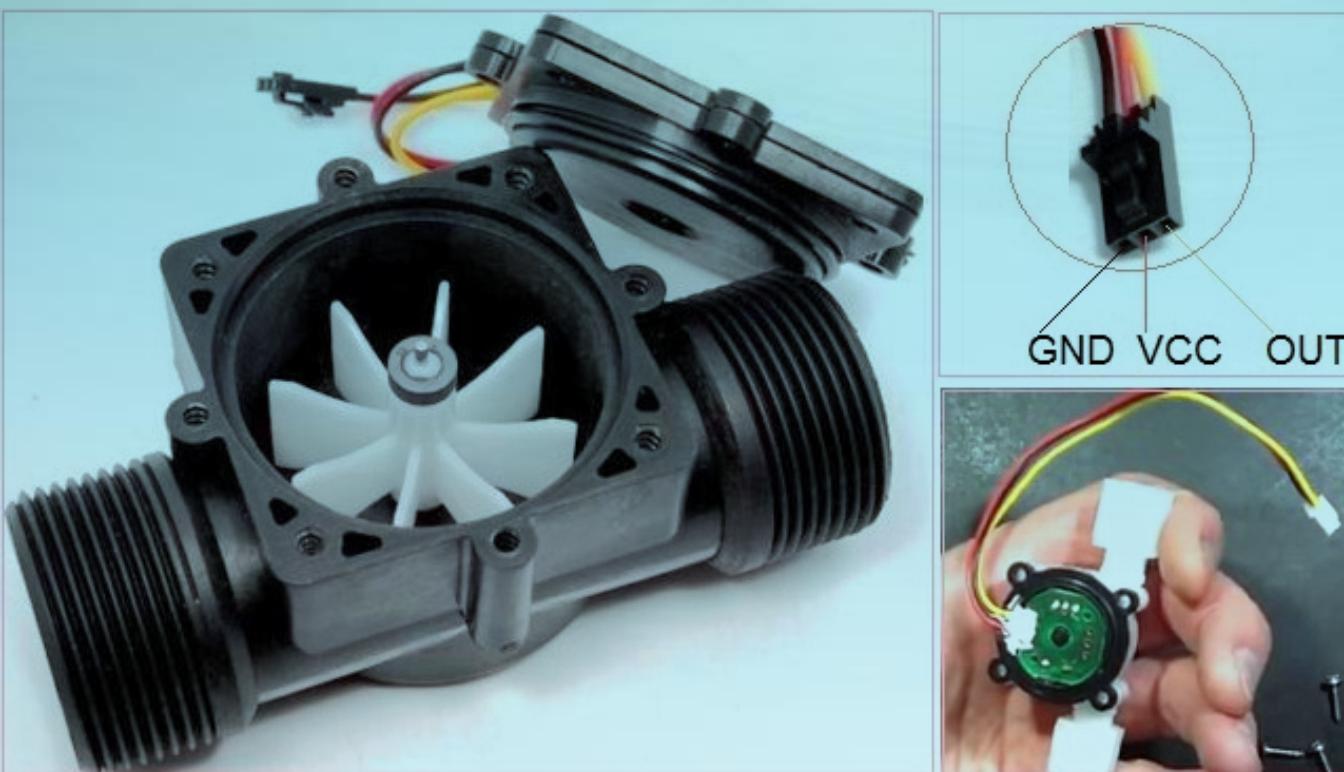
Flow Sensor - Index

- A. What is a flow sensor ?
- C. Units of measurement.
- B. Differents Flow measurement.
 - . Mechanical flow meters,
 - . Pressure-based meters,
 - . Optical flow meters,
 - . Open-channel flow measurement,
 - . Thermal mass flow meters,
 - . Vortex flow meters,
 - . Sonar flow measurement,
 - . Electromagnetic, ultrasonic and Coriolis flow meters,
 - . Laser Doppler flow measurement,
- D. How to Calibrate of a flow sensor !



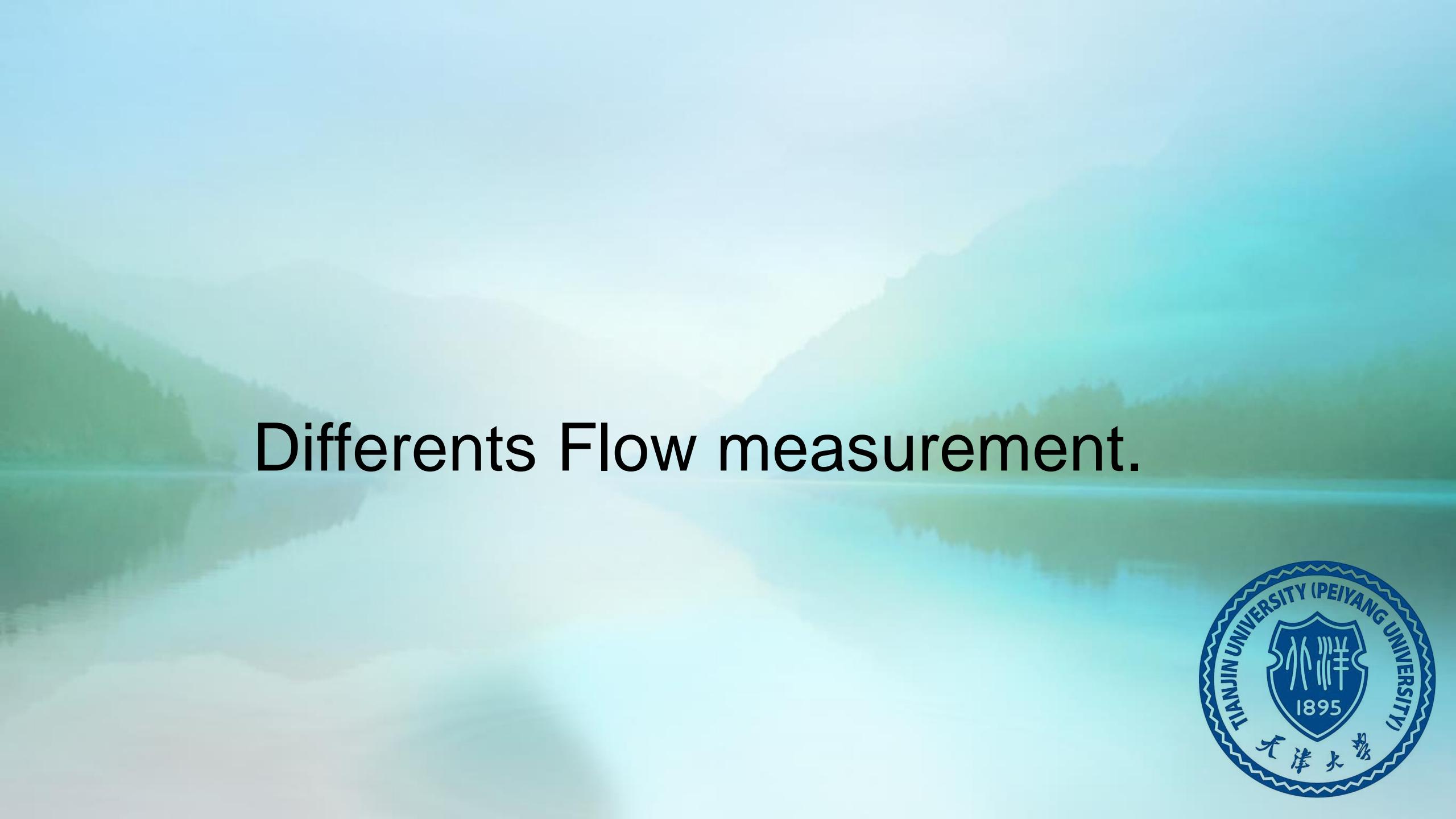
What is a flow sensor ?

Flow Sensor represent lot of different tools for getting different type of flow measurement.



Elecsensor - Units of measurement



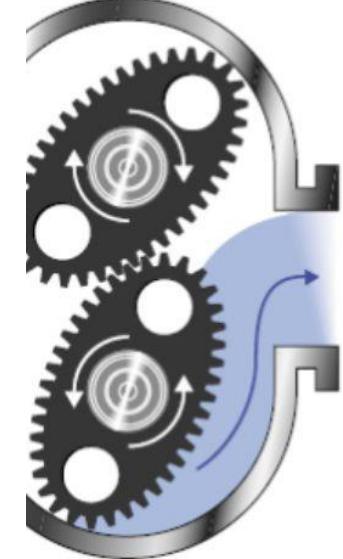
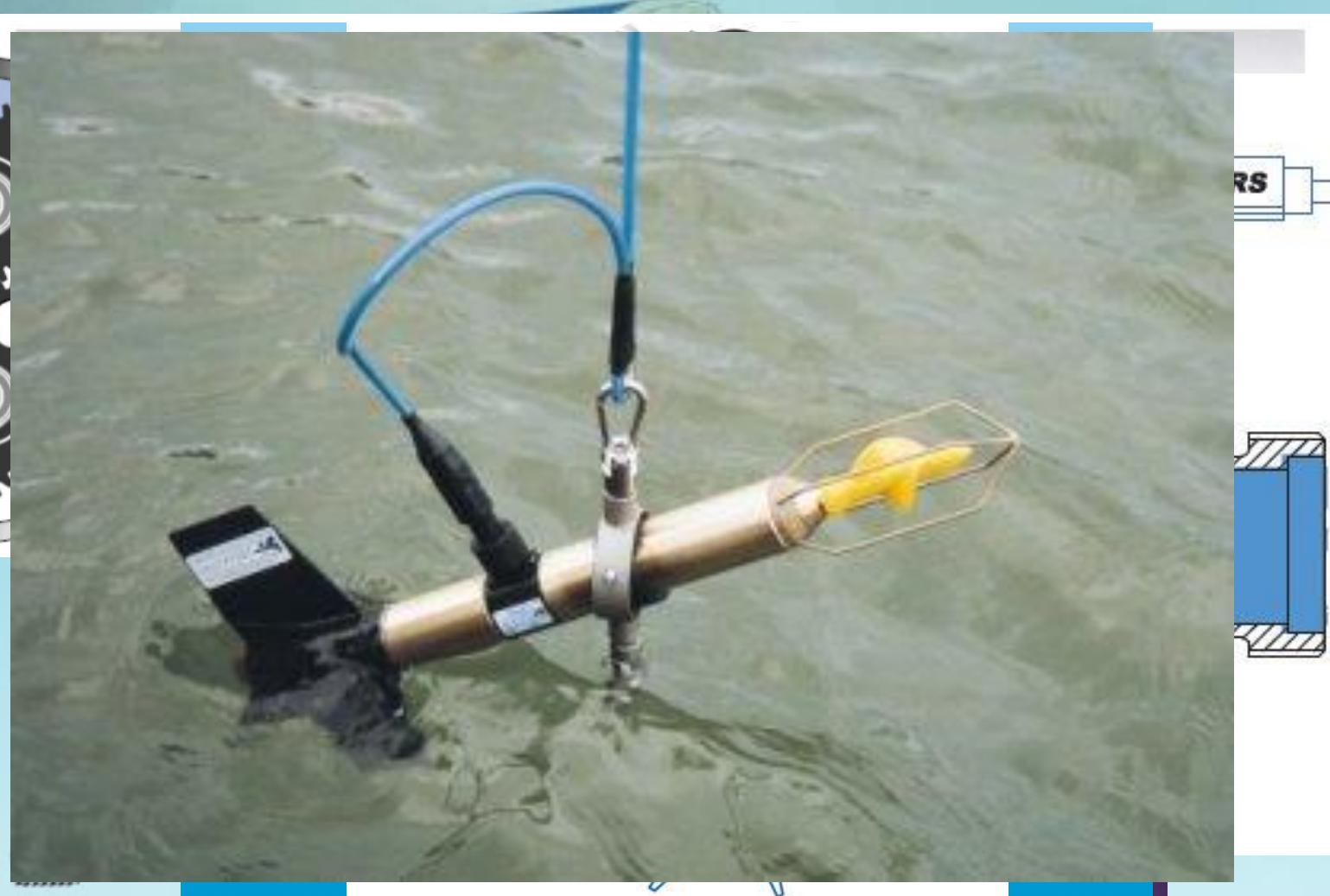


Differents Flow measurement.



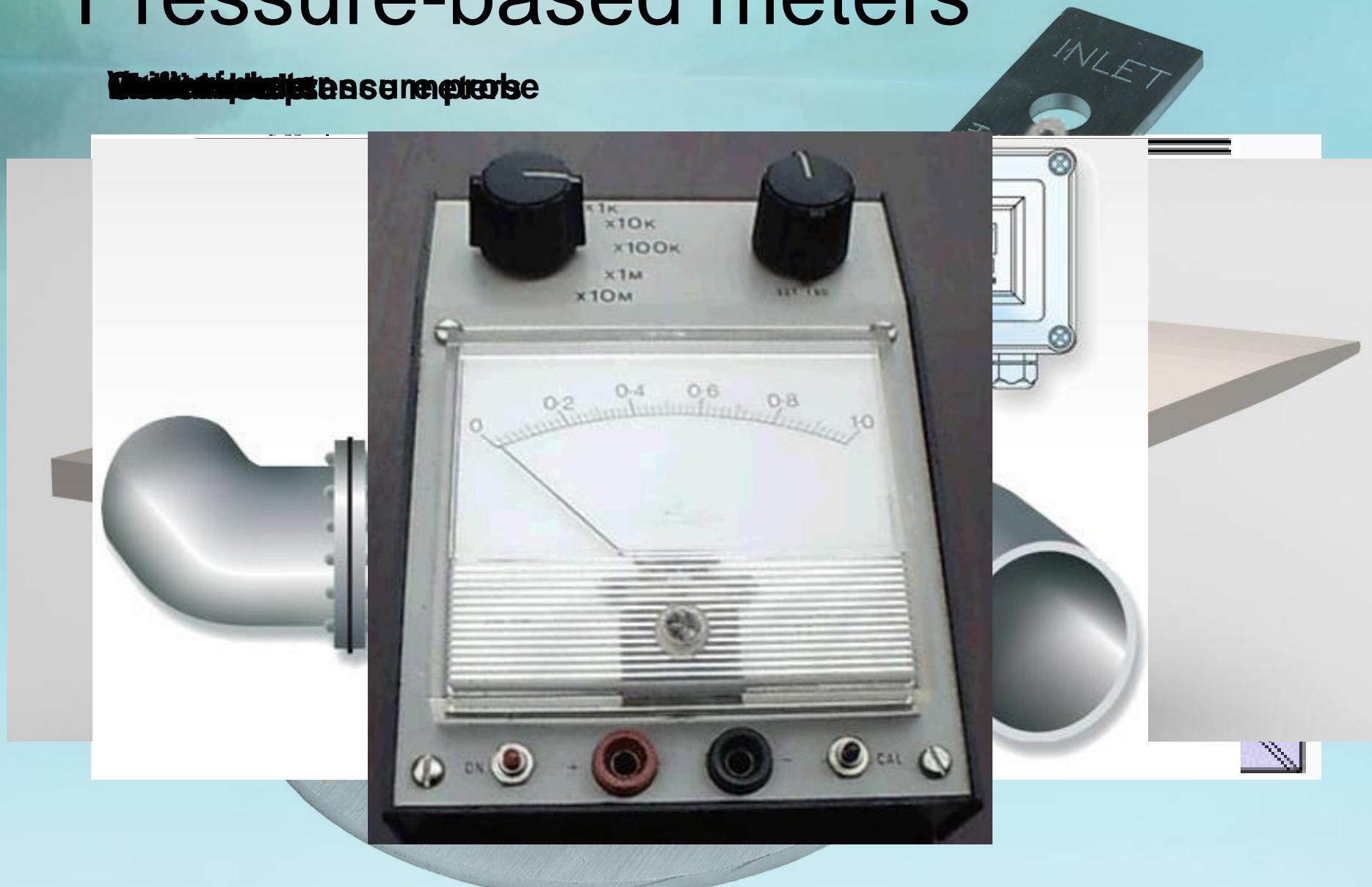
Mechanical flow meters

mechanical piston

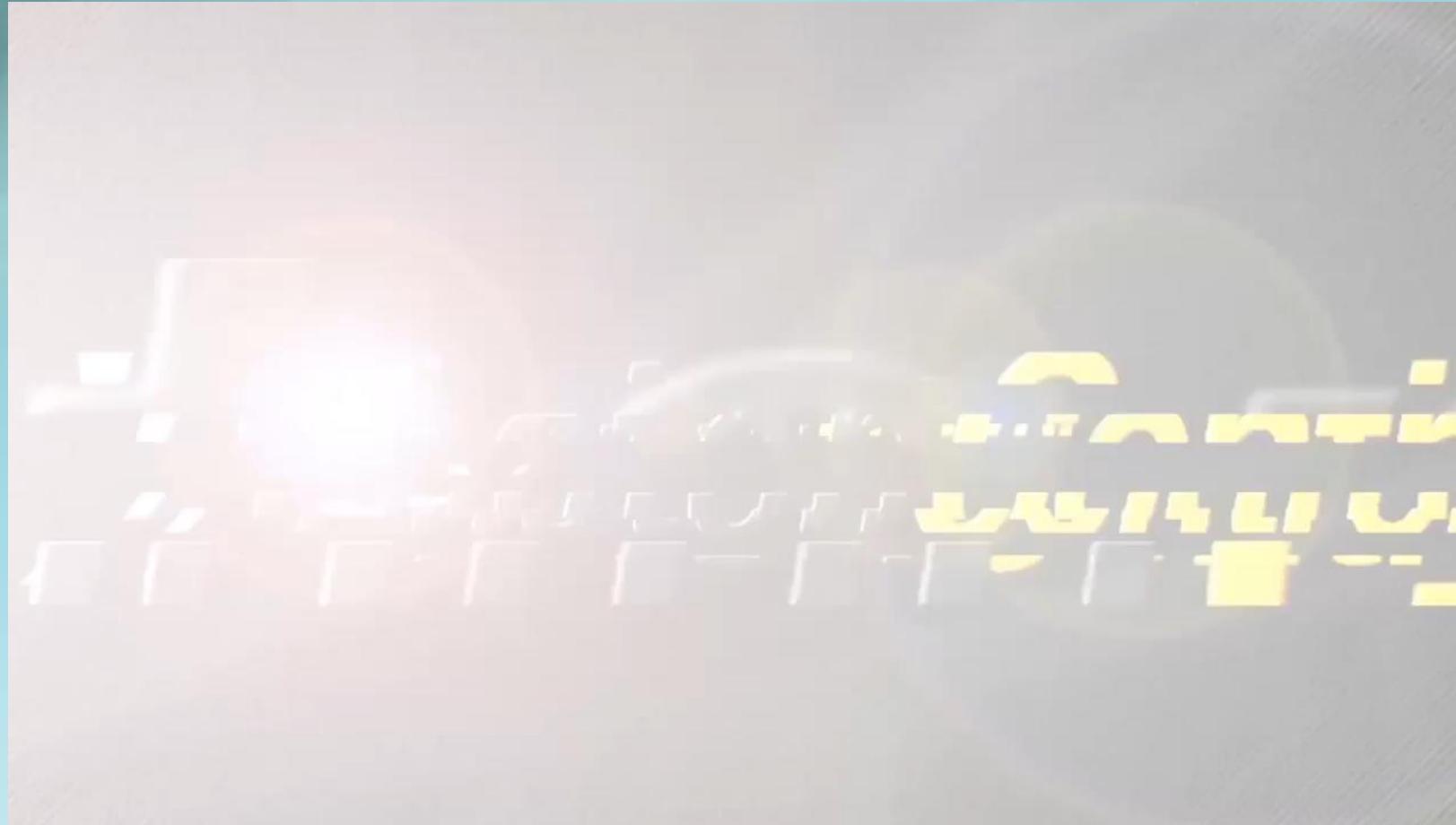


Pressure-based meters

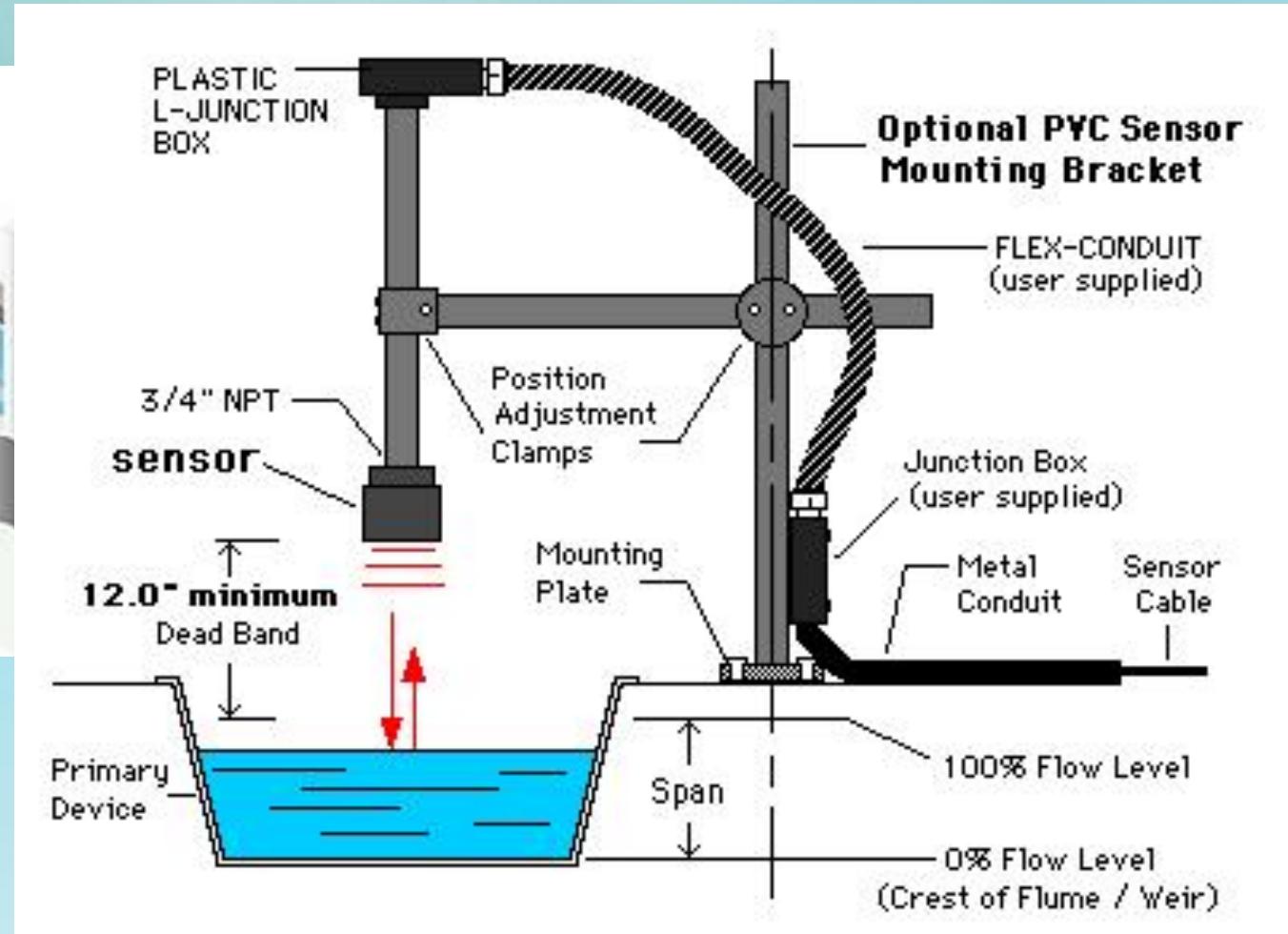
Manometer
Differential pressure meter



Optical flow meters



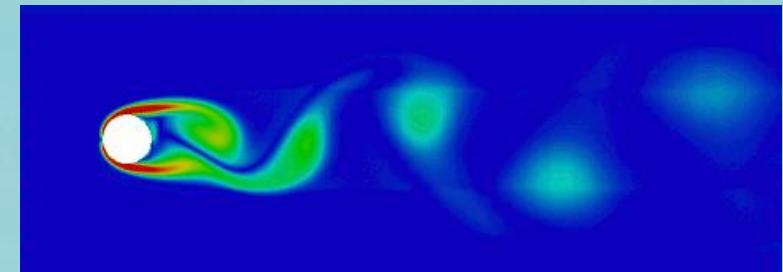
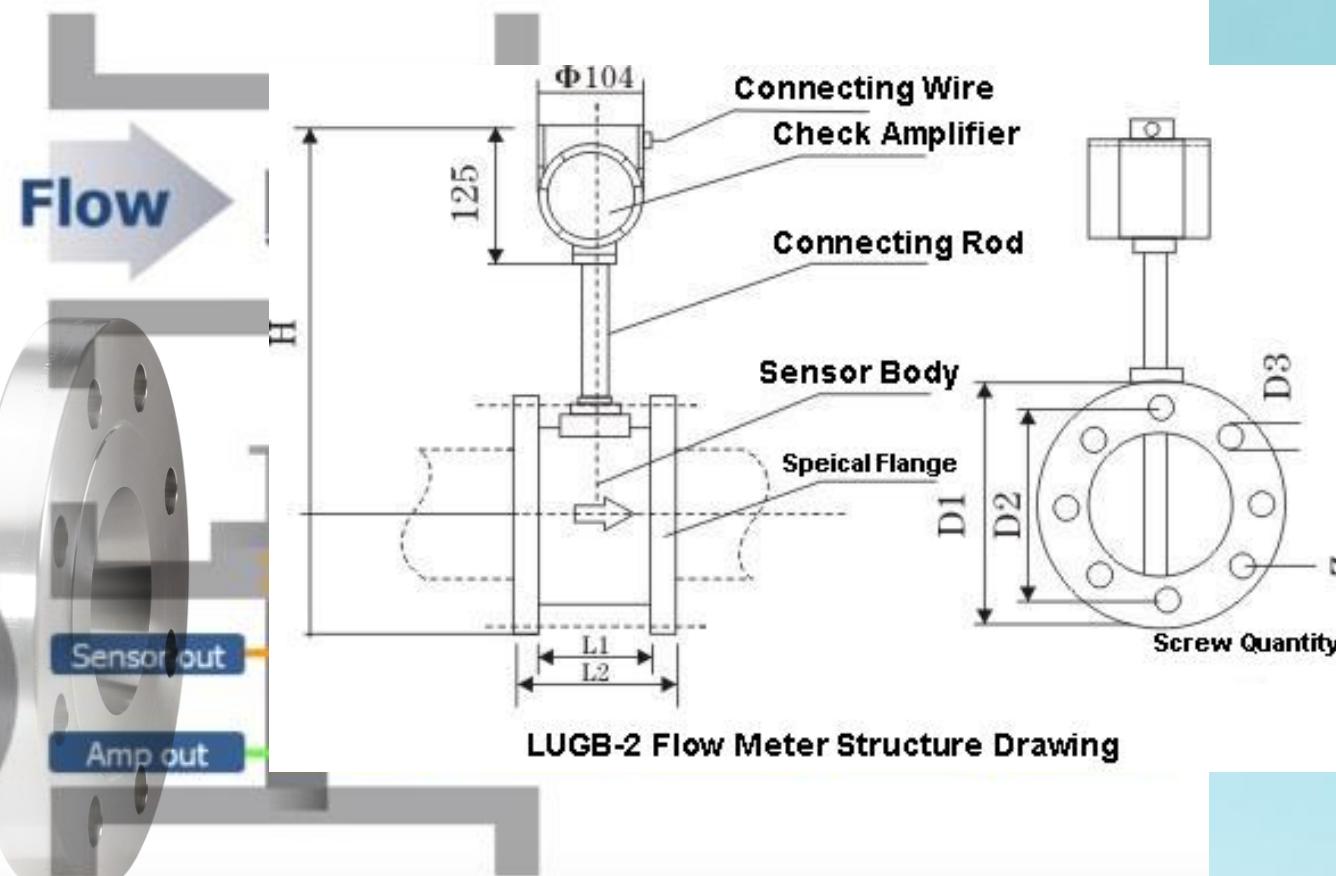
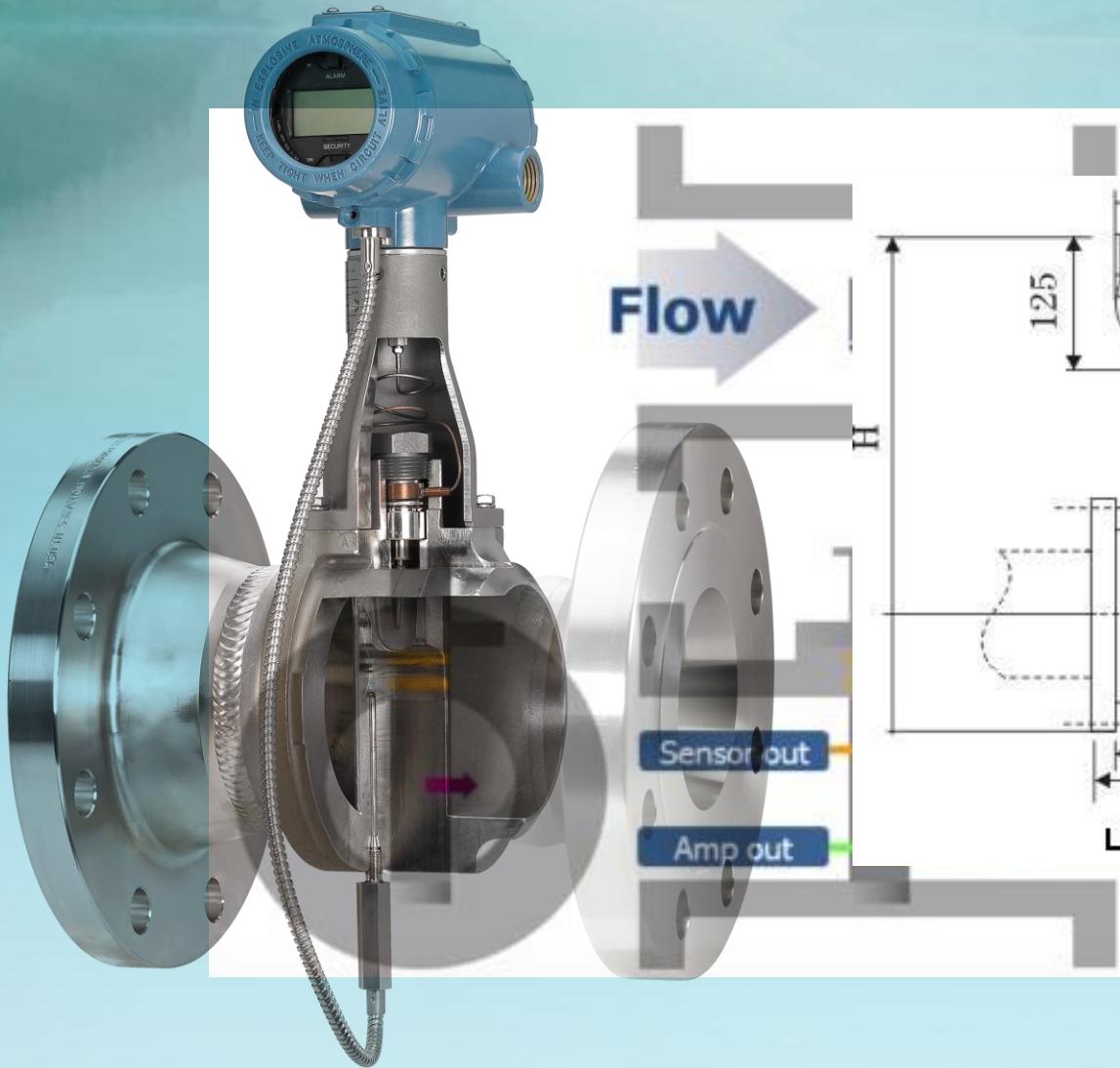
Open-channel flow measurement



Thermal mass flow meters



Vortex flow meters

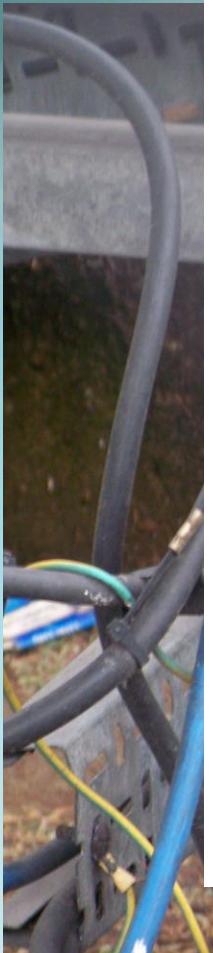


Sonar flow measurement



Electromagnetic, ultrasonic and Coriolis flow meters

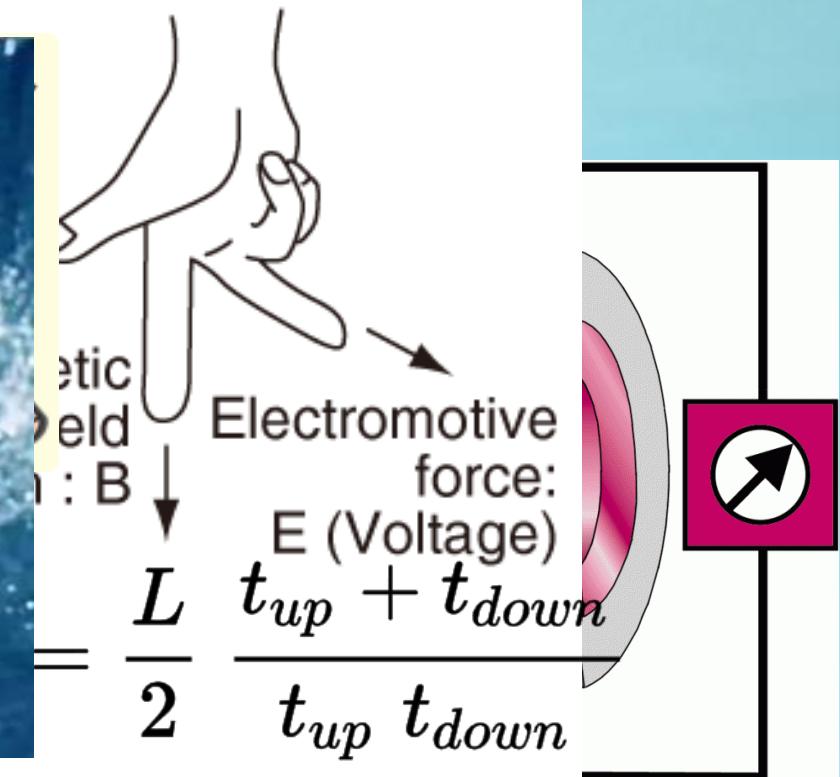
Magneto hydrodynamics (Doppler, transit time)



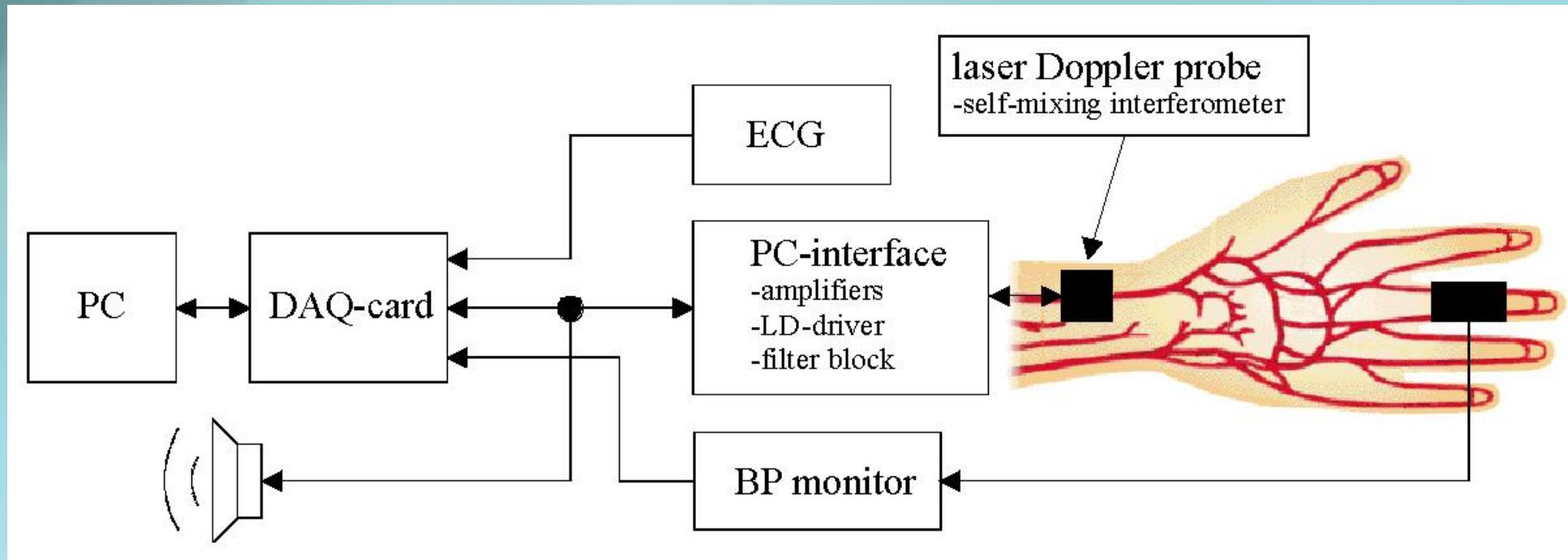
Exciting
Electromagnetic
flow meter detector

$$v = \frac{L}{2 \sin(\alpha)}$$

Pipe inner diameter: D



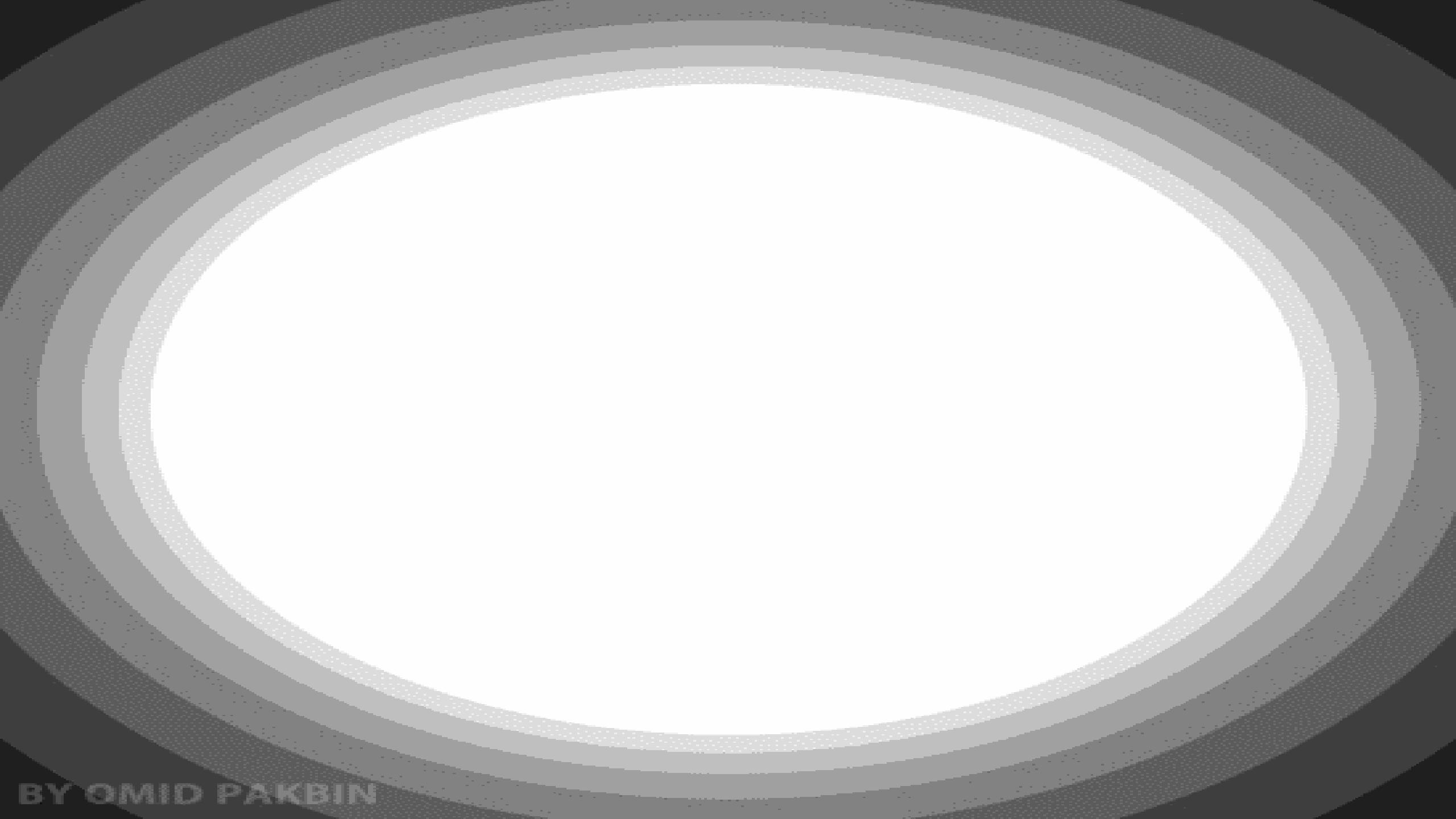
Laser Doppler flow measurement



Transit time method

How to Calibrate of a flow sensor.





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Calibration of a flow sensor

- What's calibration?

calibration simply means comparing an instrument or measuring device to a standard without making an adjustment to make the instrument read correctly.

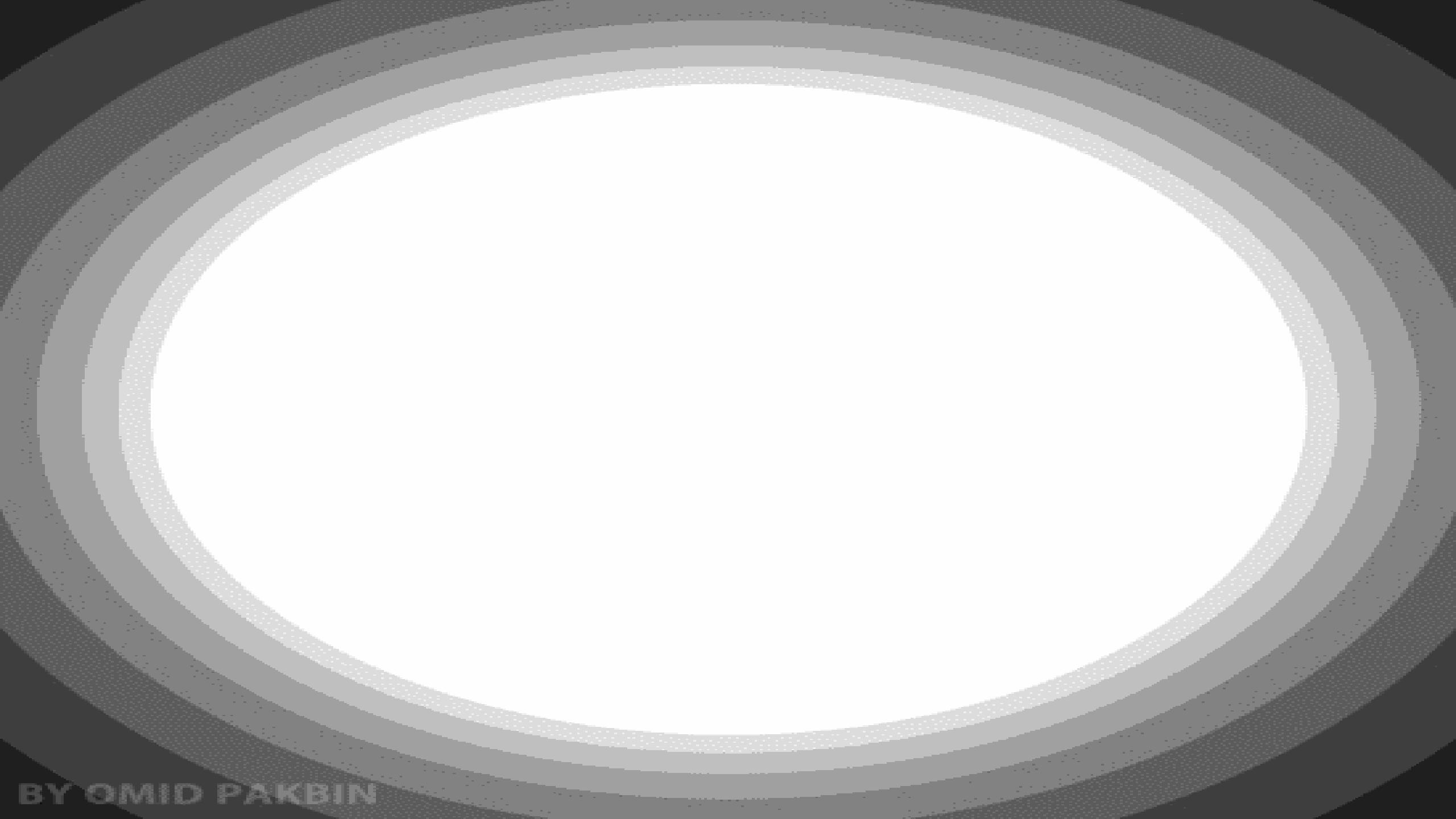
- Method of calibrating flow meters

- Standing start and finish method
- Master meter

- Standing start and finish method
 - This method is generally preferred for flow meters that are used for measuring the quantity of liquids.
 - The required flow rate is established into the tank. The flow is then stopped using a fast-acting valve, the container drained, and the drain valve closed. The flow is restarted, the container filled, and the flow stopped. The weight of liquid is noted along with the time taken to fill the tank. The reading from the flow meter is also noted. Temperature and pressure of the liquid at the flow meter are also noted during the fill.

- Master meter

A master meter is a calibrated flow meter that is used as a calibration standard, the master meter is placed in series with the flow meter under test and the results are compared at different flow rates. For a master meter to serve as a calibration standard, its calibration must be traceable back to some national or international standard.



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PRESSURE & FLOW SENSOR



Ganbold Biligsaikhan Stephane Ijn Mubeen
Uwais

WHAT IS PRESSURE?

Pressure is the amount of force applied perpendicular to the surface of an object per unit area.

The symbol for it is p or P .^[1] The IUPAC recommendation for pressure is a lower-case p .^[2] However, upper-case P is widely used.

The usage of P vs p depends upon the field in which one is working, on the nearby presence of other symbols for quantities such as power and momentum, and on writing style.

PRESSURE SENSOR



UPX6-a



UPX6-b



UPX19



UPX7



UPX30



UPX22

WHAT IS PRESSURE SENSOR?

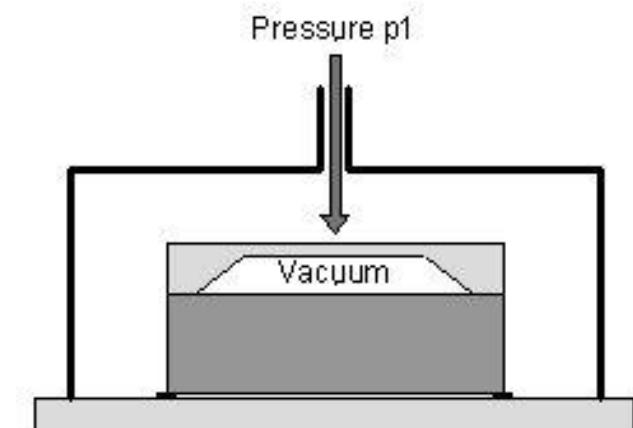
A pressure sensor is a device for pressure measurement of gases or liquids. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer; it generates a signal as a function of the pressure imposed. For the purposes of this article, such a signal is electrical.

TYPES OF PRESSURE MEASUREMENTS

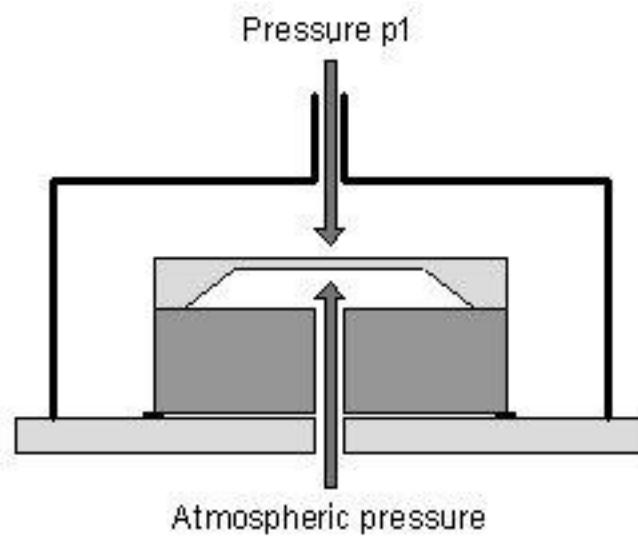
- ▷ Absolute pressure sensor
- ▷ Gauge pressure sensor
- ▷ Vacuum pressure sensor
- ▷ Differential pressure sensor
- ▷ Sealed pressure sensor

Absolute pressure sensor

Absolute pressure is referred to the vacuum of free space (zero pressure). In practice absolute piezoresistive pressure sensors measure the pressure relative to a high vacuum reference sealed behind its sensing diaphragm. The vacuum has to be negligible compared to the pressure to be measured. First Sensor's absolute pressure sensors offer ranges from 1 bar or even 700 mbar as well as barometric pressure ranges.



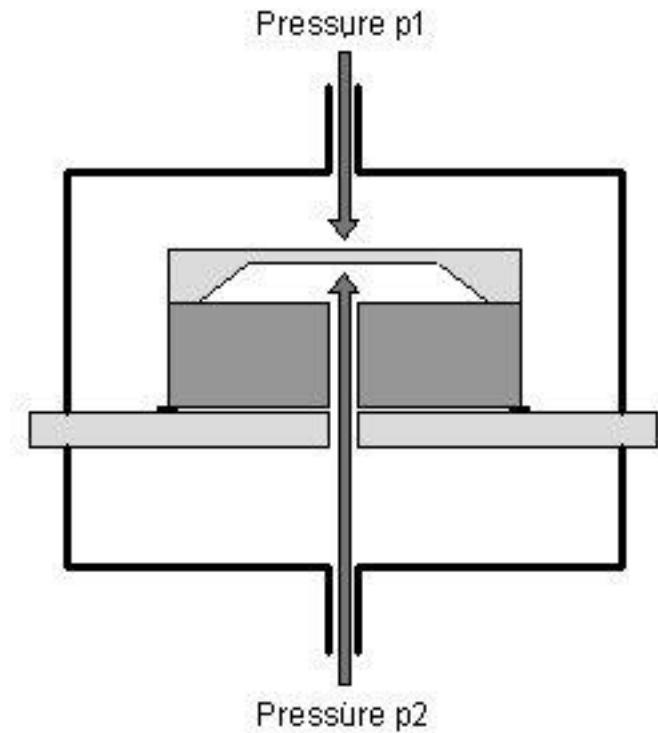
Gauge pressure sensor



Gage pressure is measured relative to the ambient atmospheric pressure. The average atmospheric pressure at sea level is 1013.25 mbar. Changes of the atmospheric pressure due to weather conditions or altitude directly influence the output of a gage pressure sensor.

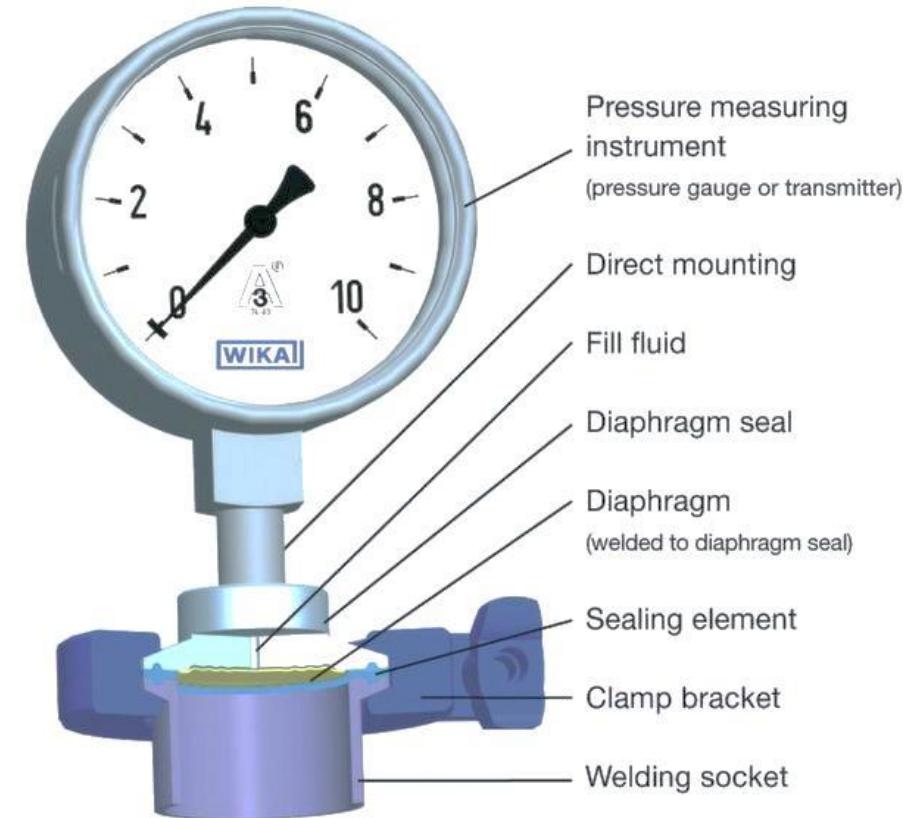
Differential pressure sensor

Differential pressure is the difference between any two process pressures p_1 and p_2 . Therefore, differential pressure sensors must offer two separate pressure ports with tube or threaded connections. First Sensor's amplified pressure sensors are able to measure positive and negative pressure differences, i.e. $p_1 > p_2$ and $p_1 < p_2$.



Sealed pressure sensor

This sensor is similar to a gauge pressure sensor except that it measures pressure relative to some fixed pressure rather than the ambient atmospheric pressure (which varies according to the location and the weather).



Ratiometric correction of transducer output

Piezoresistive transducers configured as Wheatstone bridges often exhibit radiometric behavior with respect not only to the measured pressure, but also the transducer supply voltage.

V_{out} is the output voltage of the transducer.

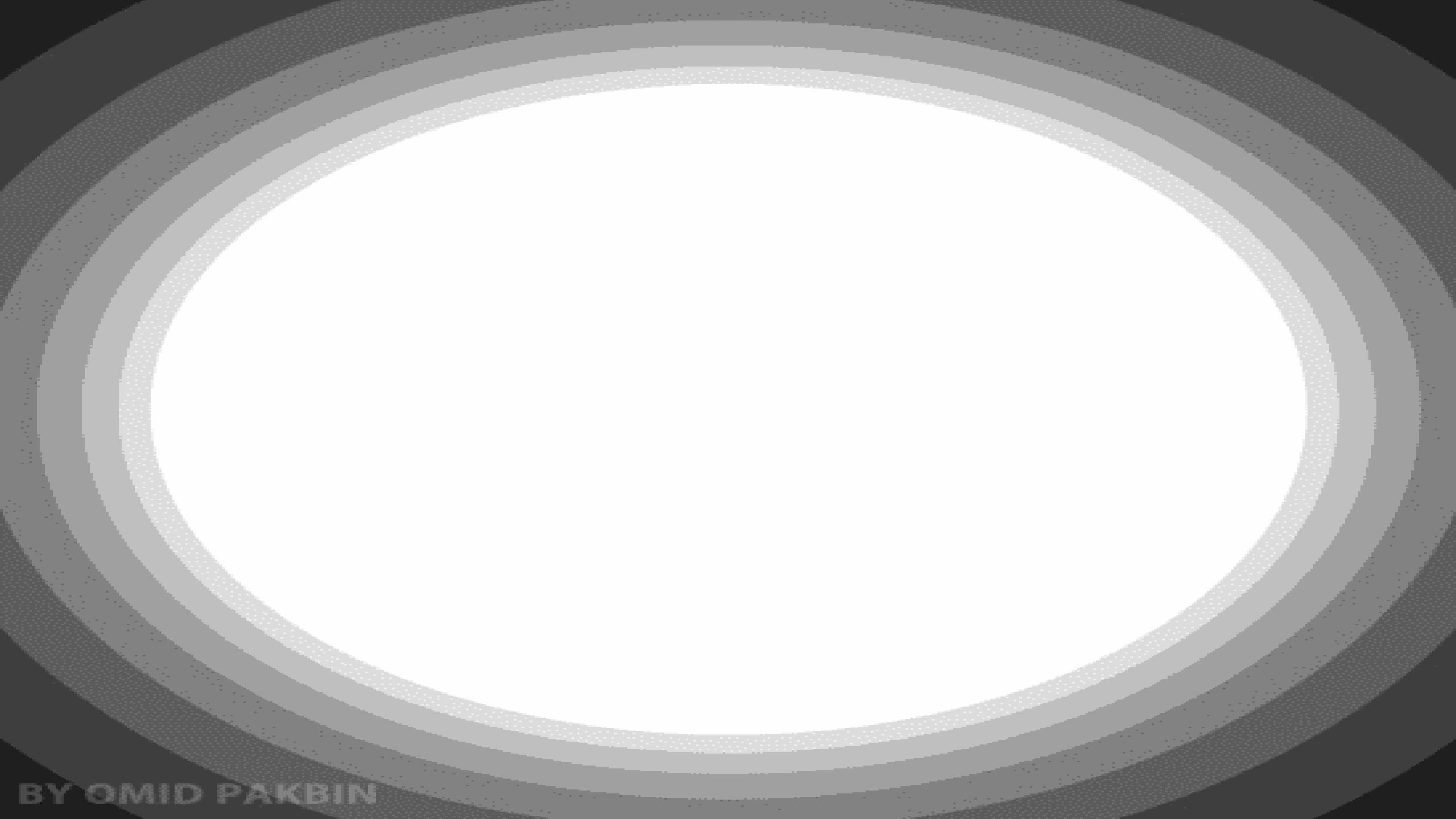
P is the actual measured pressure.

K is the nominal transducer scale factor (given an ideal transducer supply voltage) in units of voltage per pressure.

Vs_{actual} is the actual transducer supply voltage.

Vs_{ideal} is the ideal transducer supply voltage.

$$V_{\text{out}} = \frac{P \times K \times Vs_{\text{actual}}}{Vs_{\text{ideal}}}$$



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CONCLUSION

- Where flow sensor are use
- Where pressure sensor are use
- Difference between mass flow and volumetric flow
- Some important things to know before choosing a flow meter
- Calibration of a flow sensor

Where flow sensor are use

- There are many types of flow sensors used for different purpose
 - Turbine flow sensor application
 - Oil and gas
 - Water and waste water
 - Chemical
 - RTD sensors application
 - air condition and refrigerator
 - plastic processing
 - exhausted gas temperature
 - Water flow sensors application
 - water management
 - mining
 - agriculture

Where pressure sensor are use

- There are many uses of pressure sensor below are of the some uses
 - Weather prediction
 - In industry
 - Hospital
 - Ventilators
 - aerospace

Difference between mass flow and volumetric flow

- Mass flow rate: is the amount of mass moving through an instrument over a time and the unit of measure is mass per unit time, consider the equation below

$$W = \rho \times Q$$

assuming $Q = 1\text{m}^3/\text{s}$ and $\rho = 1\text{kg/m}^3$

- Volume flow: is the measure of substances moving through an instrument over a time, the unit of measure for volumetric flow rate is m^3/s , consider the equation below.

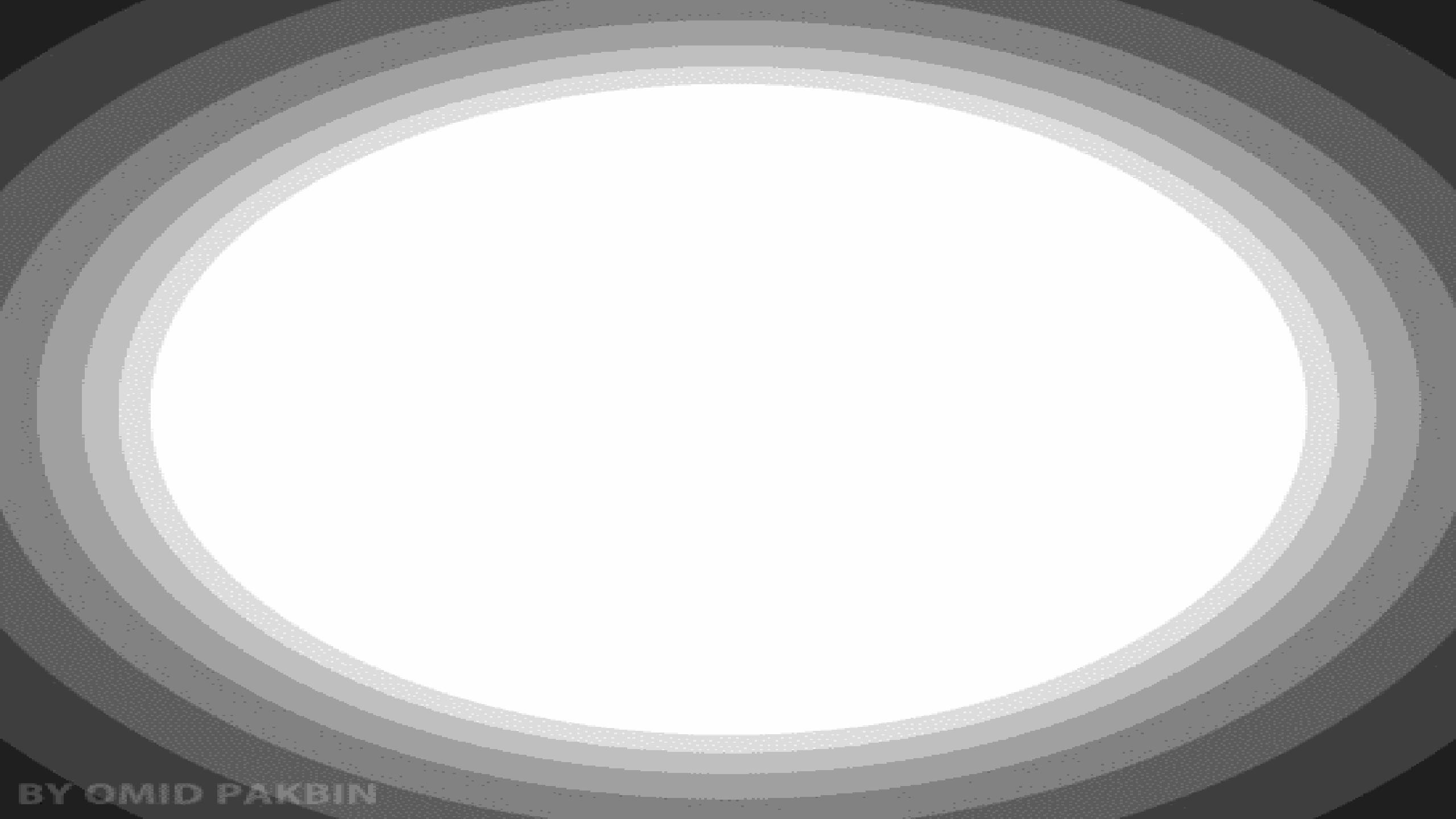
$$Q = A \times v$$

assuming fluid is travelling at an average velocity of 1m/s through a pipe with 1m^2 cross-sectional area.

Some important things to know before choosing a flow meter

- Know what fluid is to be measured
- Know the viscosity of the liquid
- Know the minimum and maximum flow rate
- Know the minimum and maximum process pressure
- Know if the fluid is chemically compatible with the flow meter wetted part

therefore its advisable when selecting any particular sensor for flow measurement to consult with the manufacturers specification.



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Merci! ~~~ Баярлалаа! ~~~ Nagode!

