Measurement Systems

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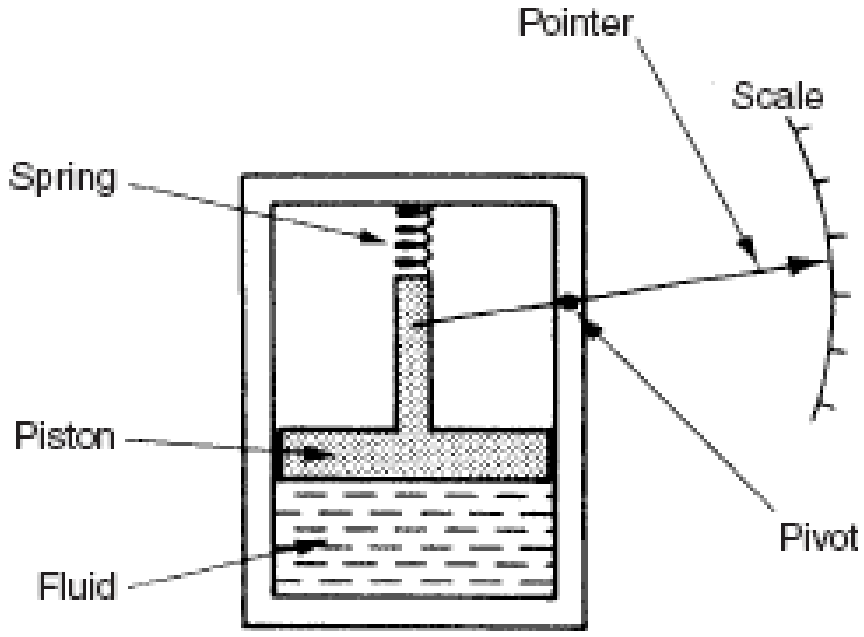
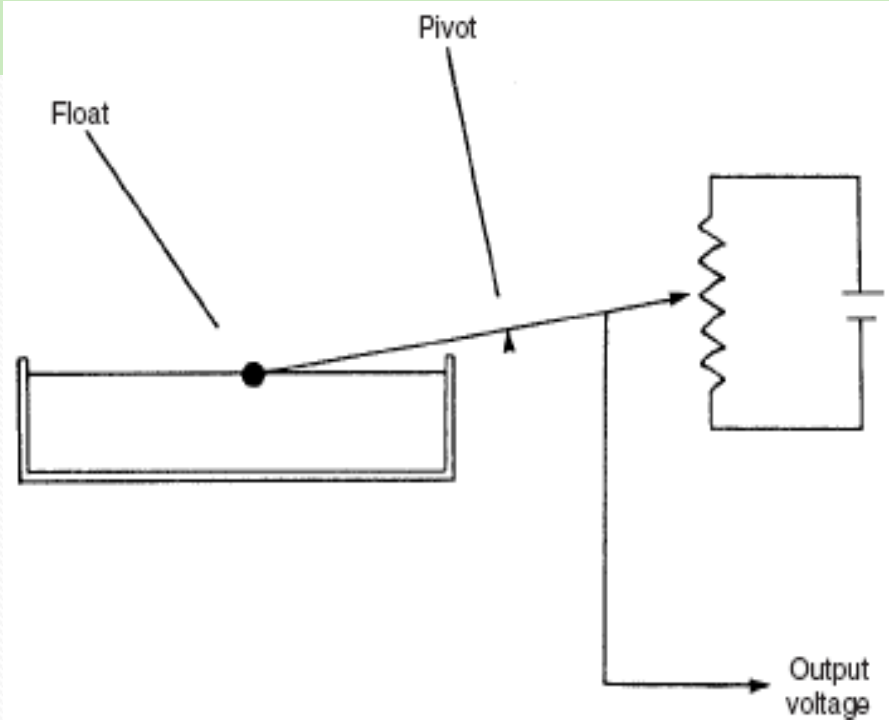
Text: Measurement Systems, Application and Design by Ernest O. Doebelin.

Instrument classification and characteristics

1- Active/Passive

Passive Instrument: The energy required for moving the pointer is delivered from the measured quantity.



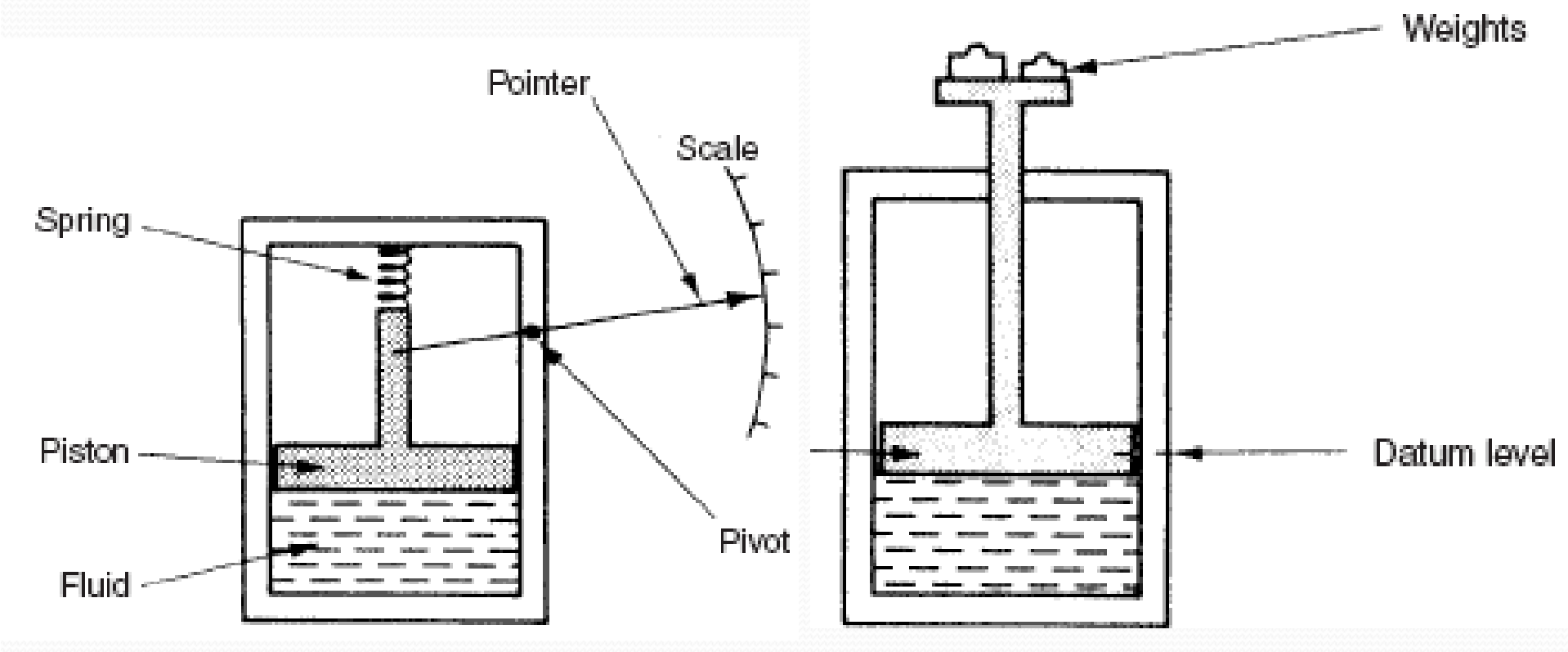


Active instrument: The energy required for moving the pointer is received from an external power source.

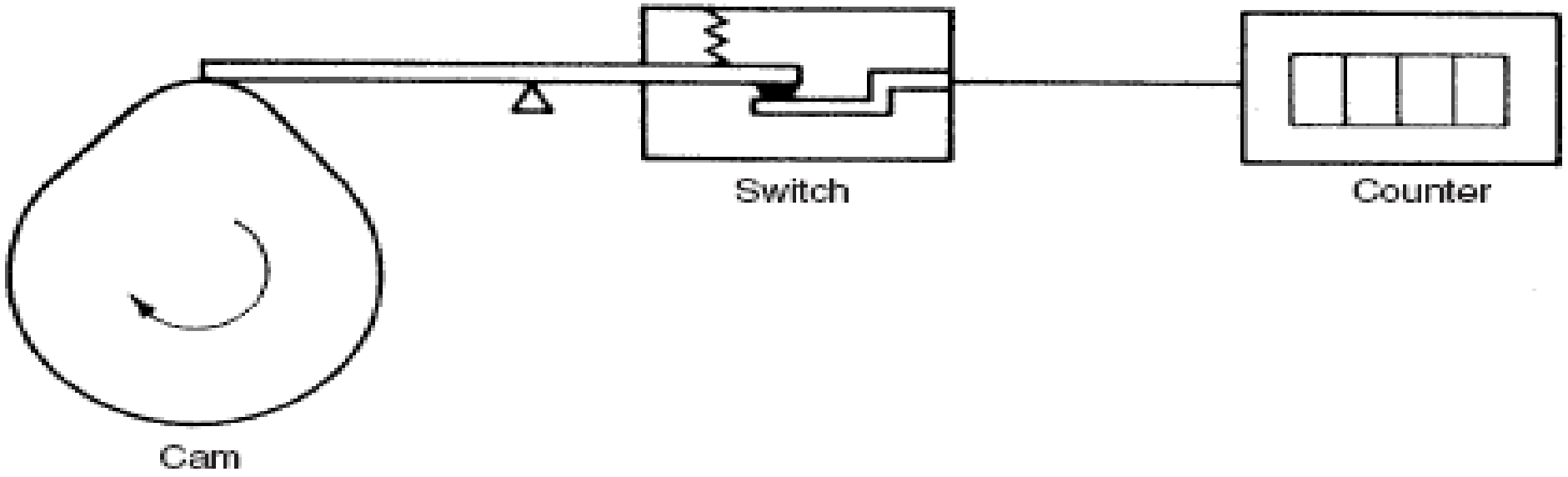
2- Null/Deflection Instruments:

Deflection type: In this type the value of the quantity being measured is displayed in terms of the amount of movement of the pointer.

Null type: It maintain the deflection at zero position by the application of a suitable effect opposing to that caused by the measured quantity.



3- Analog/ Digital Instruments: The analog instrument gives an output which varies continuously as the measured quantity changed. The digital instrument has an output which varies in discrete steps and so can only have a finite number of values.



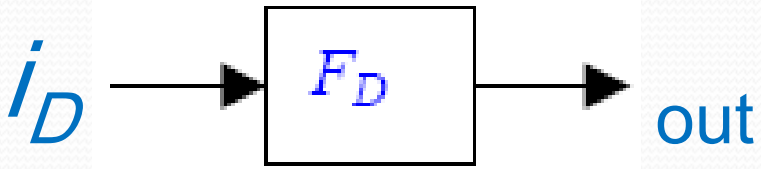
4-Monitoring/Control Instruments:

- Control instruments are suitable for including in an automatic control system, while monitoring instruments gives only an audio or visual indication of the physical variable being measured.

Input-Output Configuration of Measuring Instruments:

(Generalized model of a System Element)

1- Desired Inputs: Represent the quantities to be measured by an instrument. The relation of input-output is denoted by



Where,

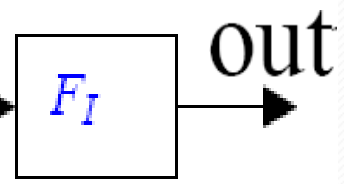
F_D is a mathematical operation necessary to obtain the output from the input.

$F_D = k$ which gives the proportionality between the static input and static output for a linear instrument.

F_D= algebraic function for static input –output proportionality in nonlinear instruments.

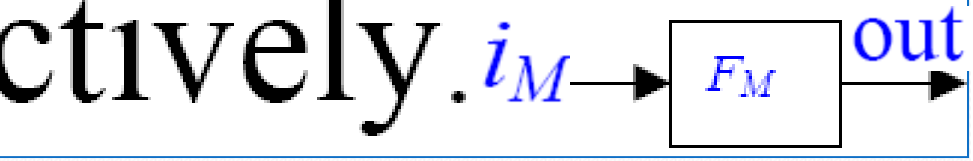
F_D= Differential equation for relating dynamic inputs and outputs.

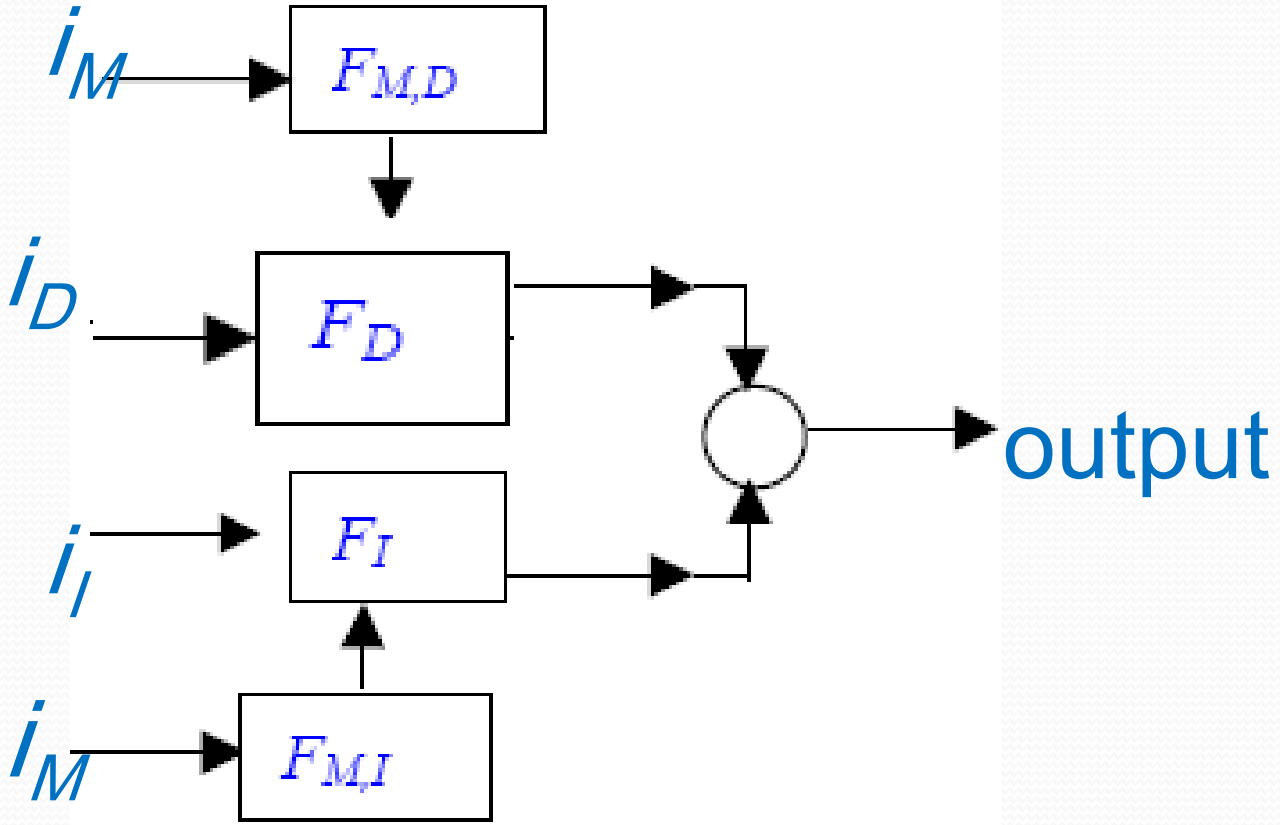
2- Interfering Inputs: Are the quantities that the instrument is unintentionally to measure it. And is denoted by i_I



3- Modifying Inputs: Are the quantities that cause a change in input- output relations of

the desired and interfering inputs and denoted by F_{MD} and F_{MI} respectively.





- Thank You For Listening