BENHA UNIVERSITY
FACULTY OF ENGINEERING (SHOUBRA)
ELECTRONICS AND COMMUNICATIONS ENGINEERING

ECE 444
Industrial Electronics

(2022 - 2023) 1st term

Lecture 1: Course Introduction.

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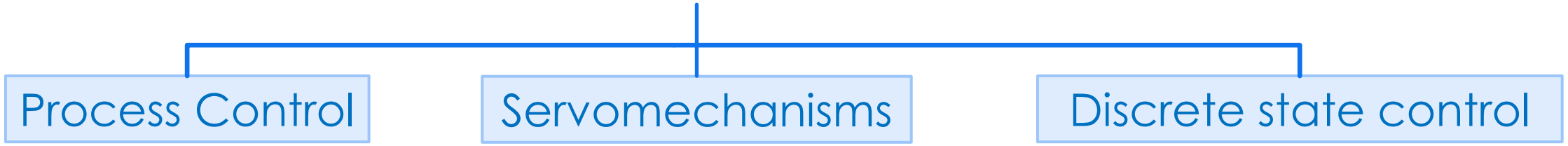
Outlines

- Principles and Definitions.
- Process-Control System
- Human-Aided Control and Automatic Control.
- Servomechanisms.
- Discrete-State Control Systems.
- Process-Control Block Diagram.

Introduction:

- **Control:** Methods to force parameters in the environment to have specific values.
- **Control System:** All the elements necessarily to accomplish the control objective.



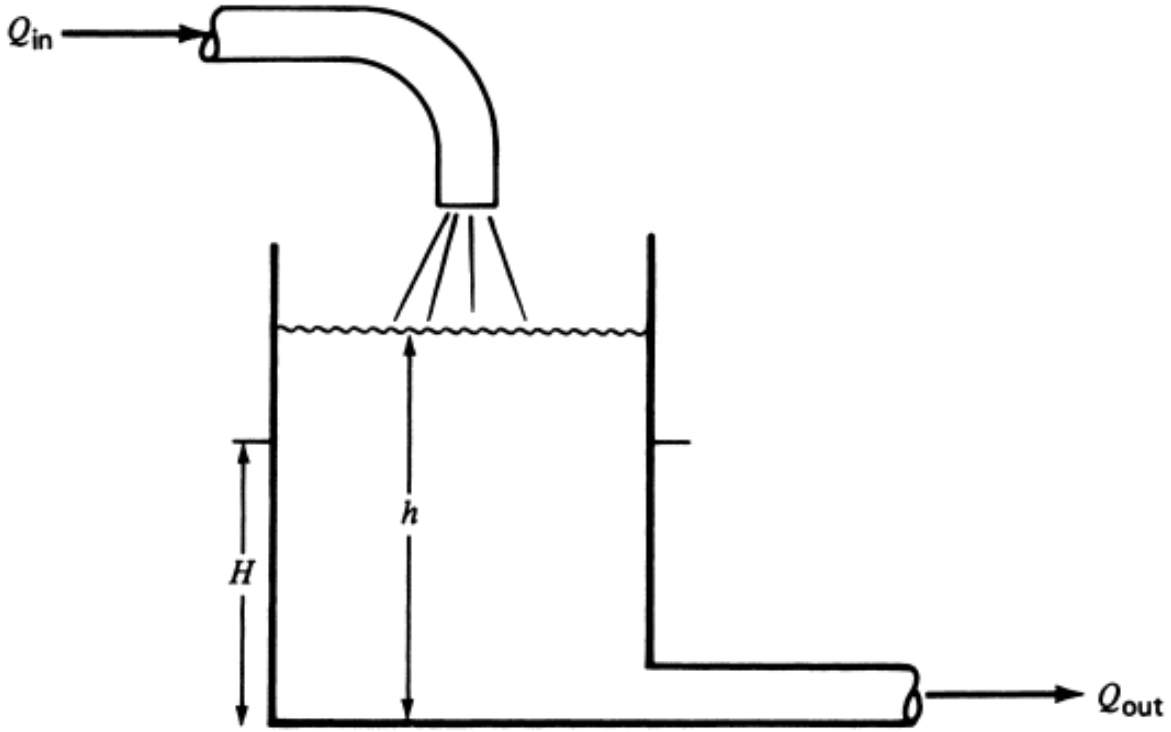
- **Process Control:** The elements & methods of control system used in industry process.
- **Control system requirements:**
  - Sensor to measure the controlled variable
  - Actuator to change the controlling variable or manipulated variable

Process-Control Systems:

- In process control, the basic objective is to regulate the value of some quantity.

- To regulate means to maintain that quantity at some desired value regardless of external influences.

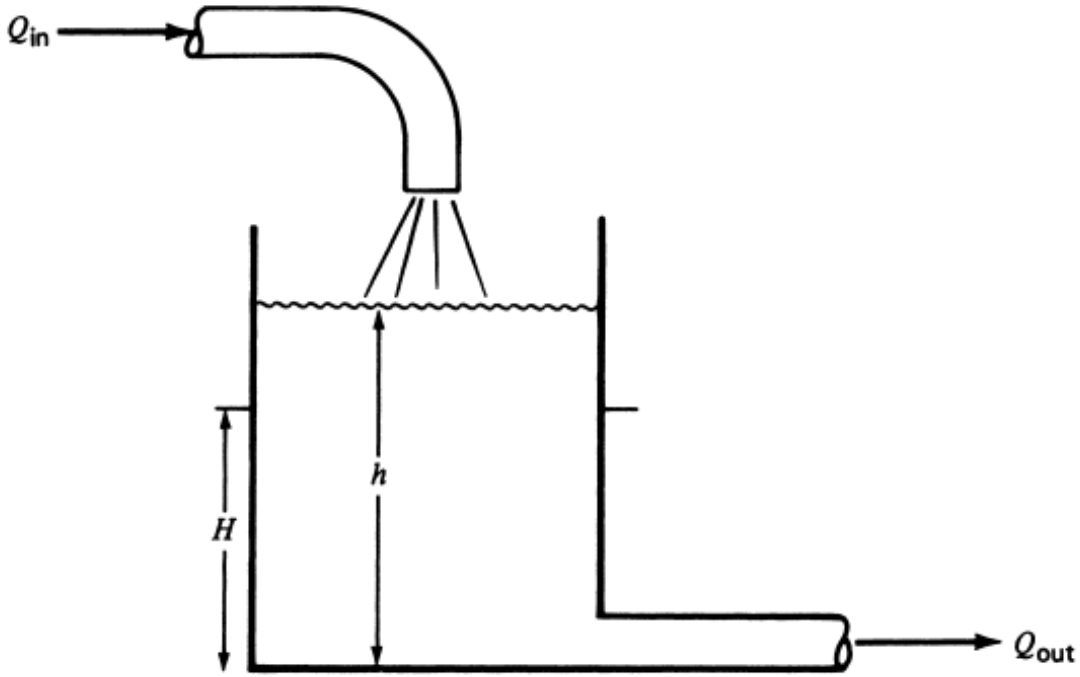
- The desired value is called the reference value or setpoint (H).
- Controlled variable (h).
- Controlling variable(Qin or Qout).



Process-Control Systems:

The Process description:

- Liquid is flowing into a tank at some rate Qin.
- The liquid in the tank has some height or level h.
- Liquid is flowing out of the tank at rate Qout.



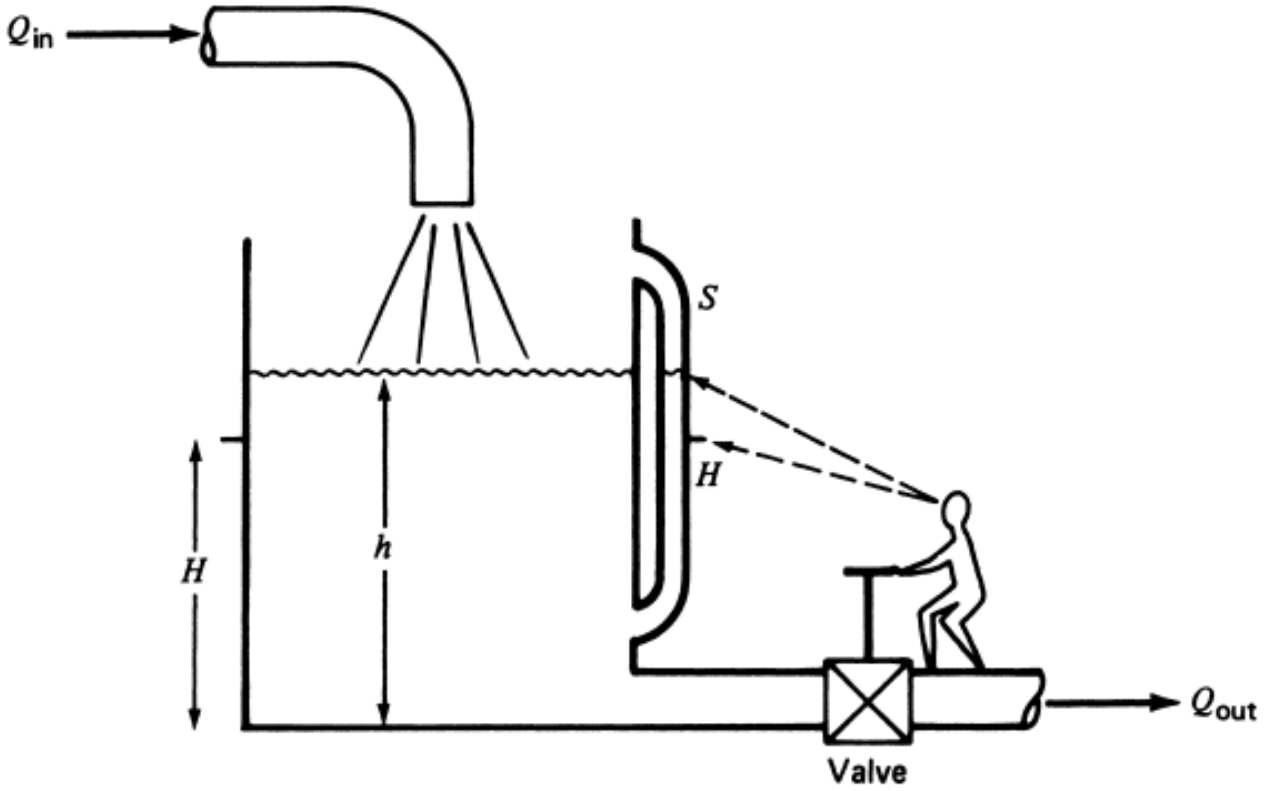
Self-regulation

- is a process property means that for some input flow rate, the liquid height will rise until it reaches a height for which the output flow rate matches the input flow rate.
- It does not provide regulation of a variable to any particular reference value.
- If Qin> Qout level rise, Qin< Qout level drop, Qin= Qout level fixed.

Human-Aided Control:

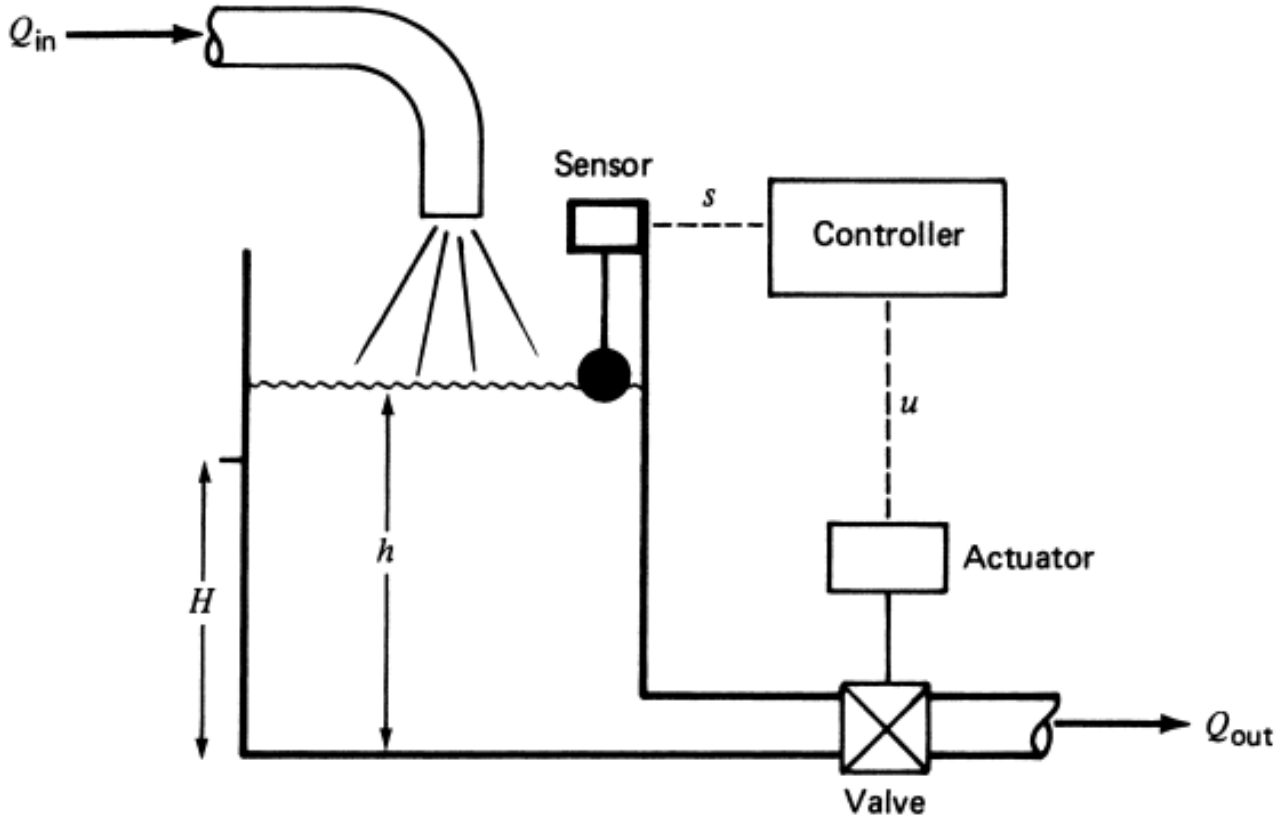
A human is playing the role of sensor and actuator

- Sensor : using sight tube
- Actuator : using a valve
- Controlled Variable : h
- Set point : H
- Controlling Variable : Qout



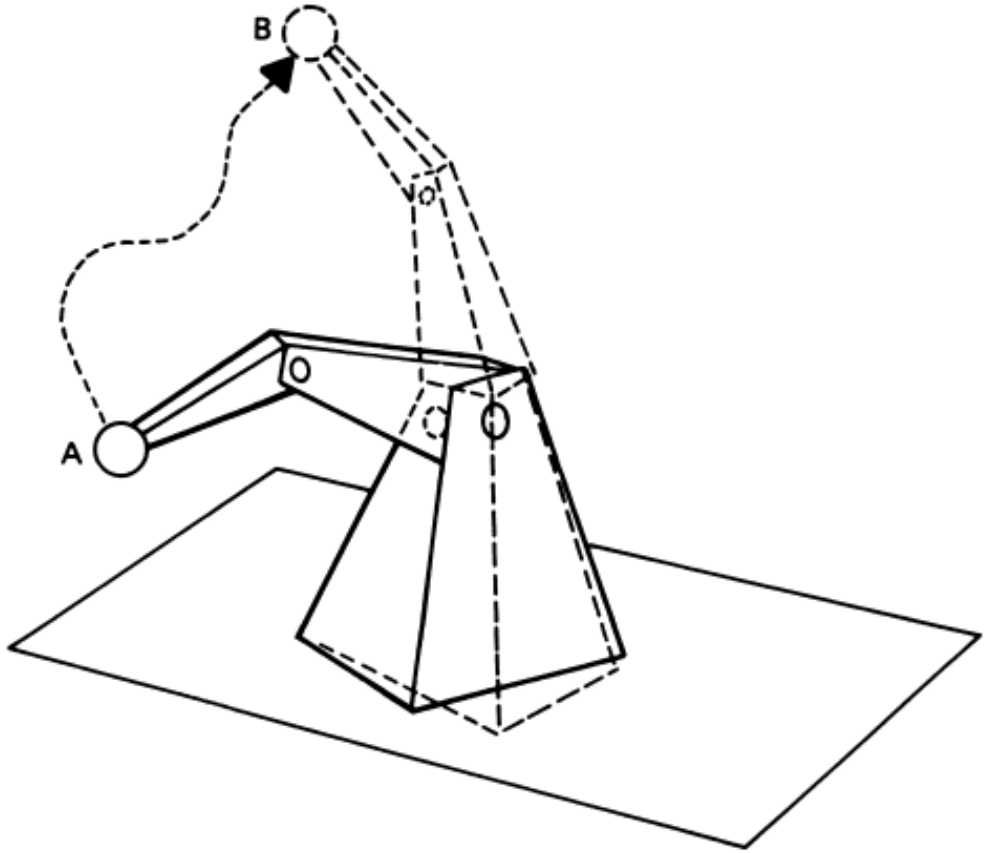
Automatic Control:

- A sensor measures the value of the level and converts it into a proportional signal (s).
- A controller evaluates the measurement and provides an output signal (u) to change the valve setting via an actuator connected to the valve by a mechanical linkage.



Servomechanisms:

- Another commonly used type of control system.
- The objective is to force some parameter to vary in a specific manner.
- This may be called a tracking control system. Instead of regulating a variable value to a setpoint, the servomechanism forces the controlled variable value to follow variation of the reference value.



Note

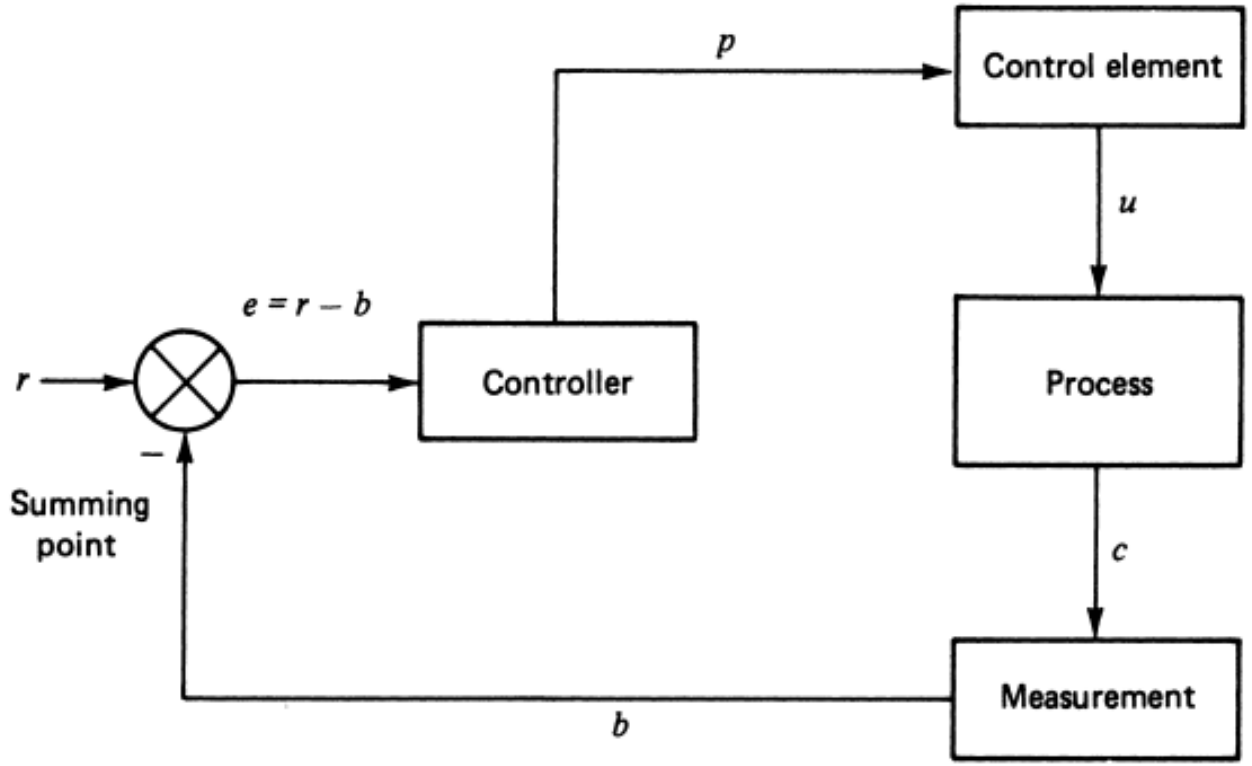
The strategy for servomechanisms is similar to that for process-control systems, but the dynamic differences between regulation and tracking result in differences in design and operation of the control system.

Discrete-State Control Systems:

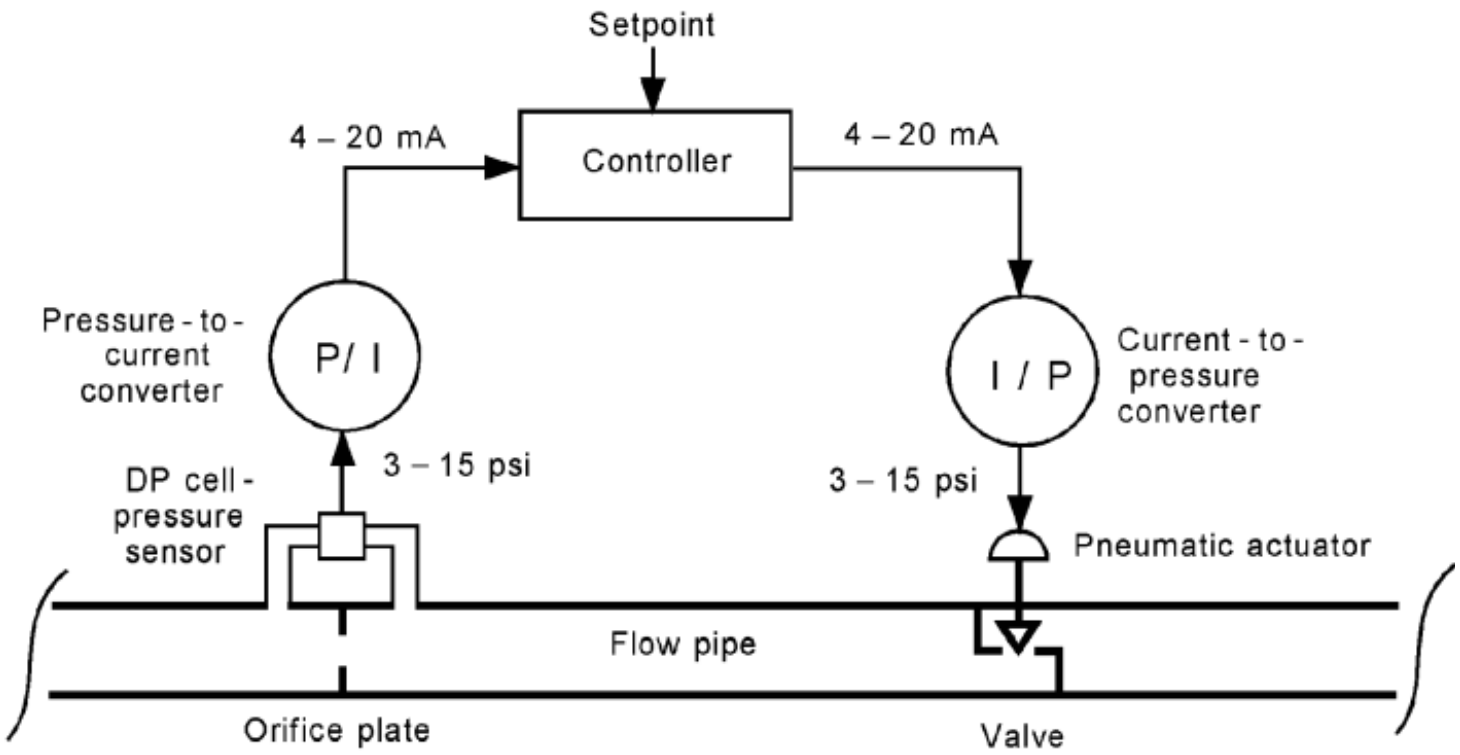
- Another type of control systems that is concerned with controlling a sequence of events rather than regulation or variation of individual variables.
- The starting and stopping of events is a discrete-based system because the event is either true or false.
- These discrete-state control systems are often implemented using specialized computer based equipment called programmable logic controllers (PLCs).

PROCESS-CONTROL BLOCK DIAGRAM:

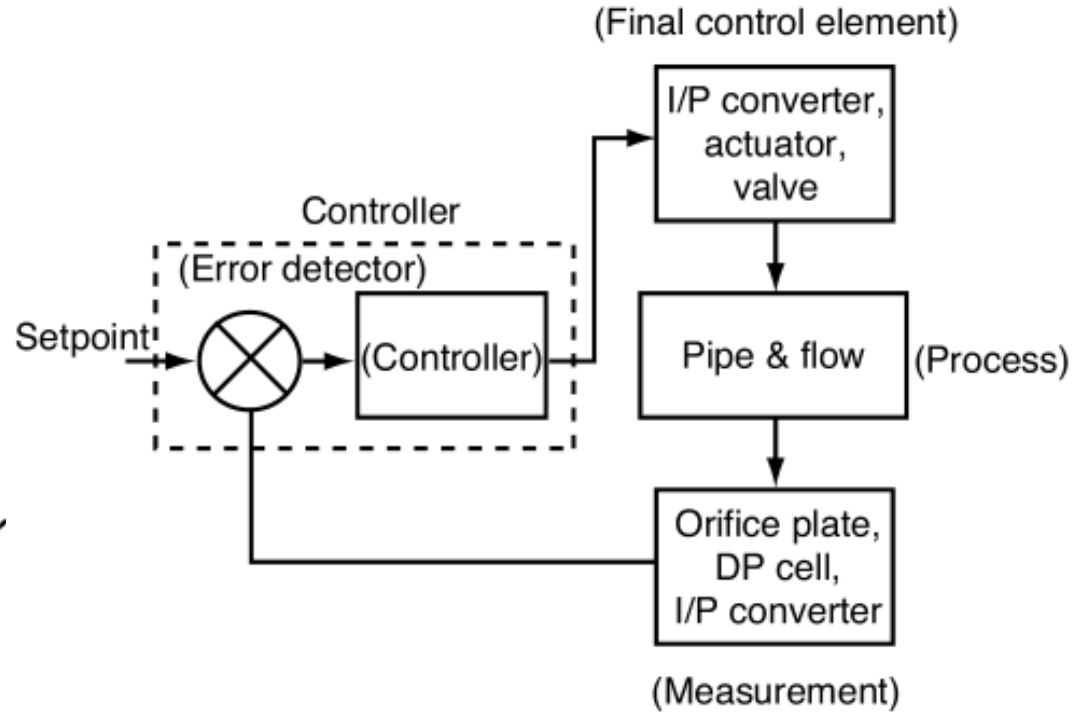
- Process (also called Plant) may has either a single variable or multi variables to be controlled.
- Measurement of the controlled variable using a Sensor (also called Transducer).
- Error Detector (is often a physical part of the controller device).
- Controller examine the error & determine what action if any should be taken.
- Final control element: The device that exerts a direct influence on the process.



PROCESS-CONTROL BLOCK DIAGRAM:



(a) Physical diagram of a process-control loop



(b) Block diagram of the process-control loop

END OF LECTURE

BEST WISHES