

SKN3022

PROCESS INSTRUMENTATION

CHAPTER 1

INTRODUCTION

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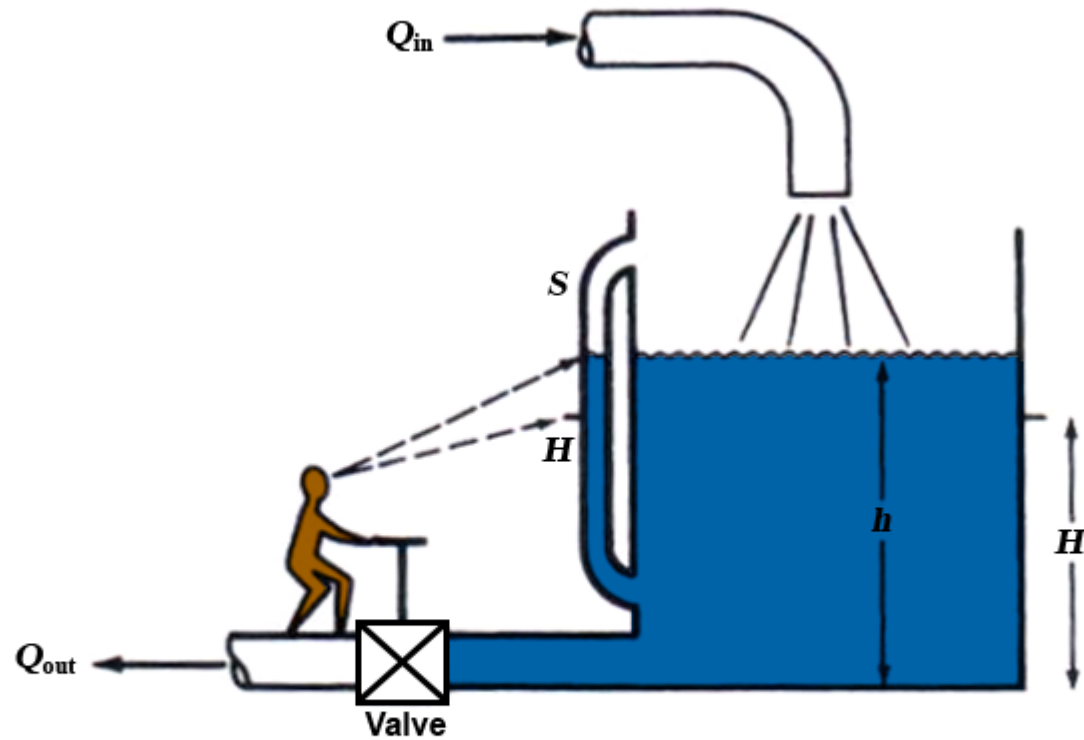


COURSE OUTLINE

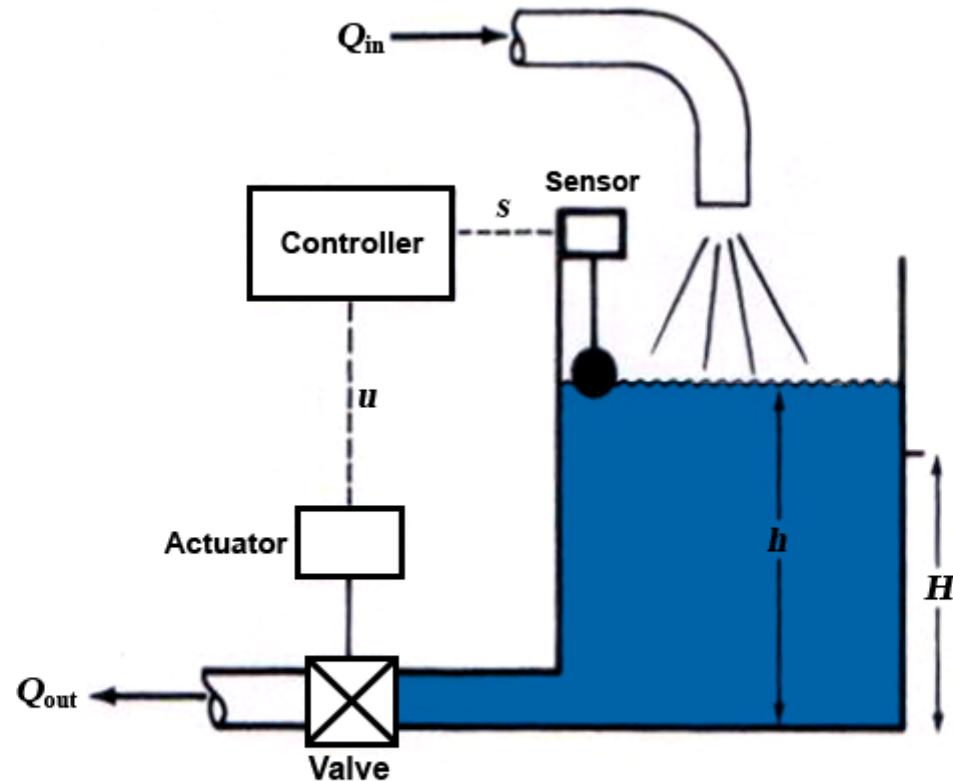
- **Introduction to instrumentation system**
- **Introduction to analog and digital instrumentation**
- **Characteristic of instrumentation**
- **Transducers/sensors**
- **Signal modifier**
- **Controller**
- **Final control element**

INSTRUMENTATION SYSTEM

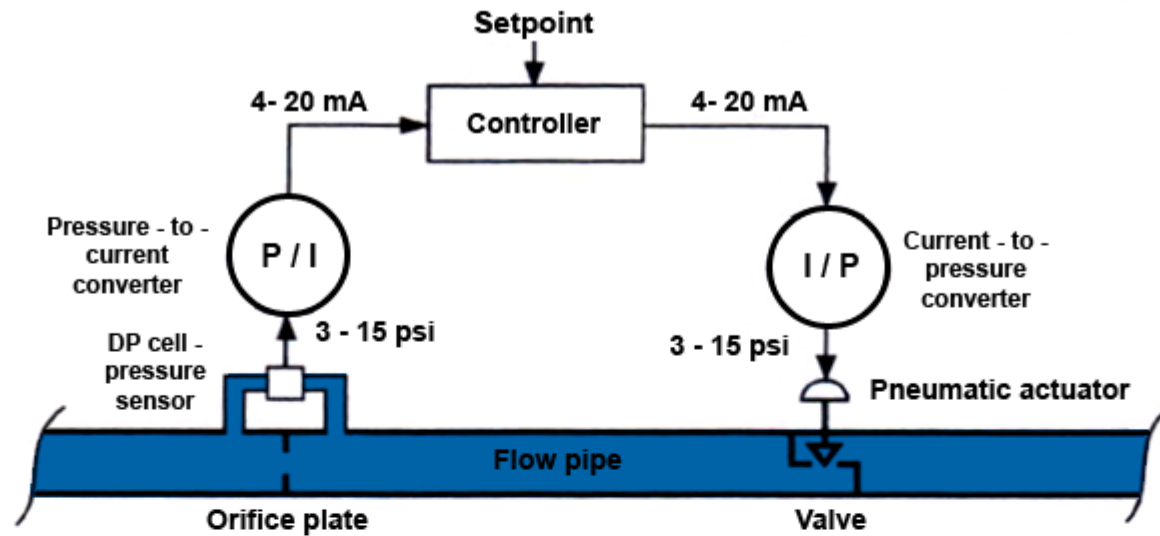
- **Defined as a peripheral which shows (in the contacts of measurement), send, record or control the signal of a process variable.**
 - **In a complex or simple form depending on the utilisation of the peripheral.**
 - **Does not require the operators' full attention.**
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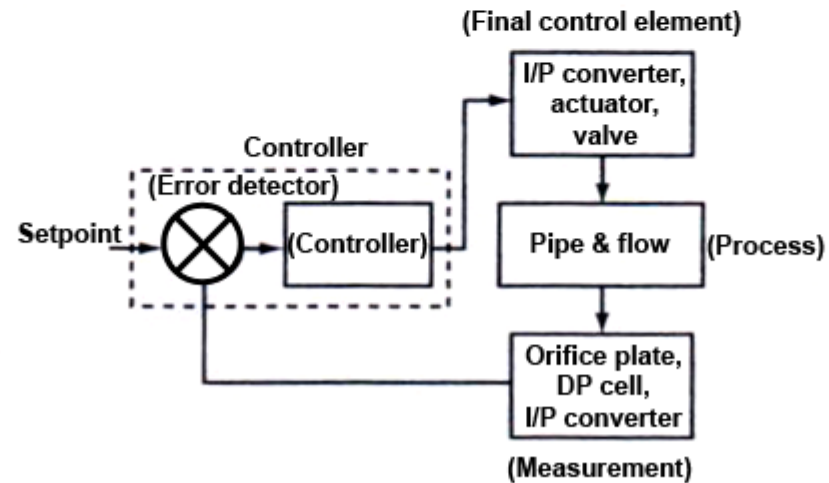
A human can regulate the level using a sight tube, S , to compare the level, h , to objective, H , and adjust a valve to change the level



An automatic level-control system replaces the human with a controller and uses a sensor to measure the level



(a) Physical diagram of a process-control loop



(b) Block diagram of the process-control loop

BASIC ELEMENTS OF INSTRUMENTATION

- **Transducer/ Sensor**
 - **Signal Modifier/ Signal Conditioning**
 - **Display Unit**
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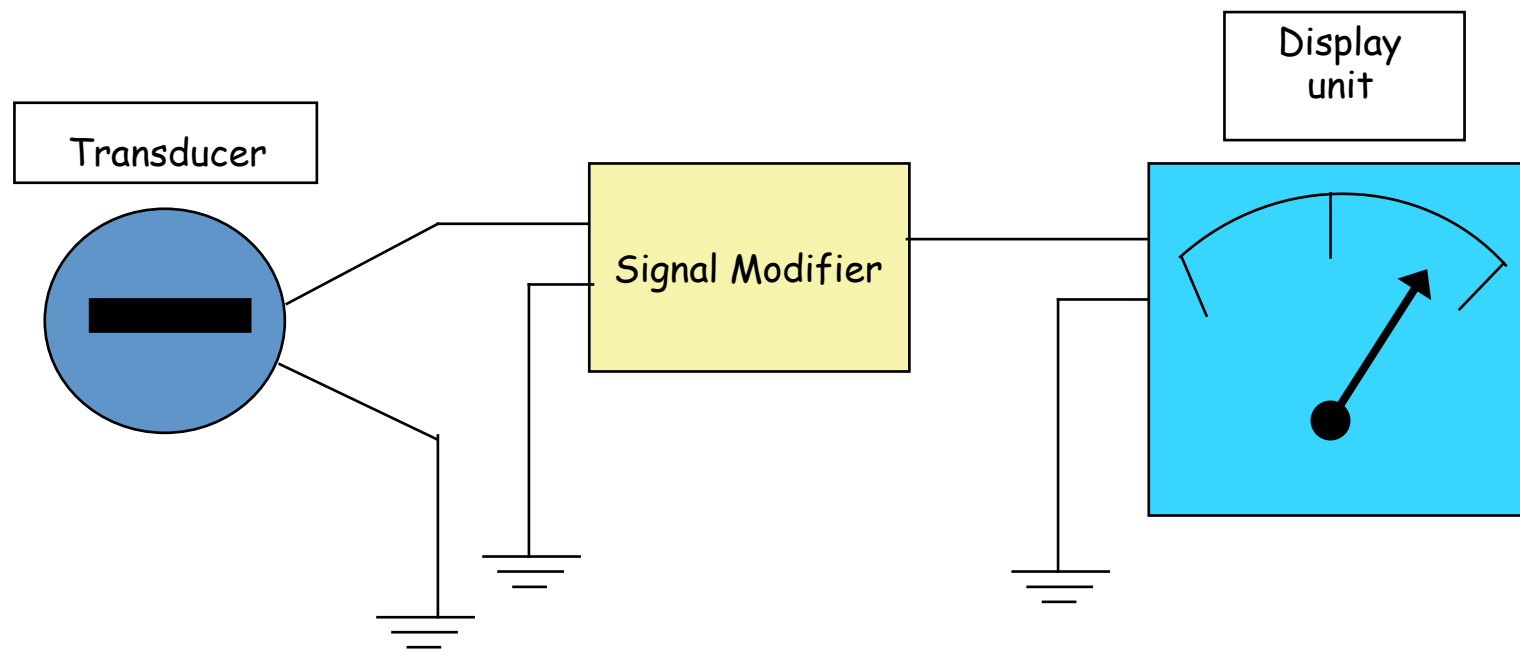


Figure 1 : Basic Elements of Instrumentation

TRANSDUCER

- **Primary sensor element.**
- **A transducer detects a physical input and converts into another form of physical output.**
- ***Example:***
 - **Only needed when measuring a non-electrical quantity (e.g. temperature, pressure, flow).**
 - **Its function is to convert a non electrical physical quantity to an electrical signal.**
 - **Not required if the quantity to be measured is in an electrical form.**

SIGNAL MODIFIER

- Functions as an element which enables an input signal to be displayed on a display meter.
- The form of an output signal from a transducer has to be converted so that it can be displayed or recorded properly.
- *Example:*
A signal usually has to be amplified/converted before being displayed.

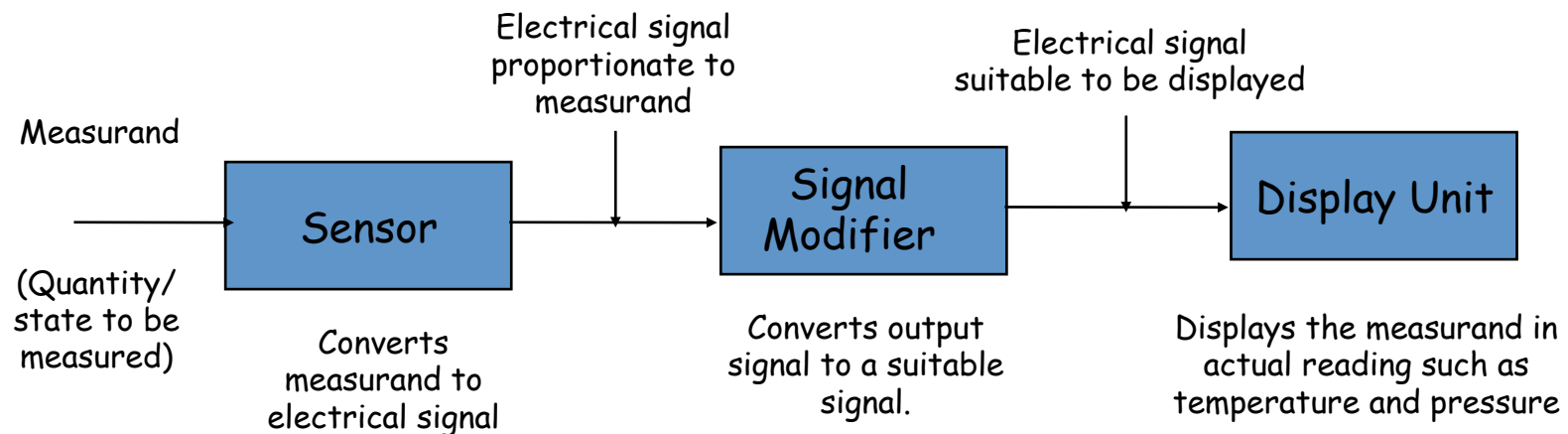
- **Signal modifiers consists of:**
 - 1. Amplifier** – To amplify the weak output signal of a transducer.
 - 2. Filter** – filters part of the unwanted signals.
 - 3. Analog-to-digital (ADC) / Digital-to-analog (DAC) converter** – converts analog signals to digital signals and vice versa.
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Display Unit/Meter

- Shows the condition (in the measurement sense) of a process.
- Consists of visual display type equipment such as graphic recorder, digital indicators and other type of display system.
- Commonly used equipment is a display meter (deflection-type meter) or digital meter.

MEASUREMENT SYSTEM

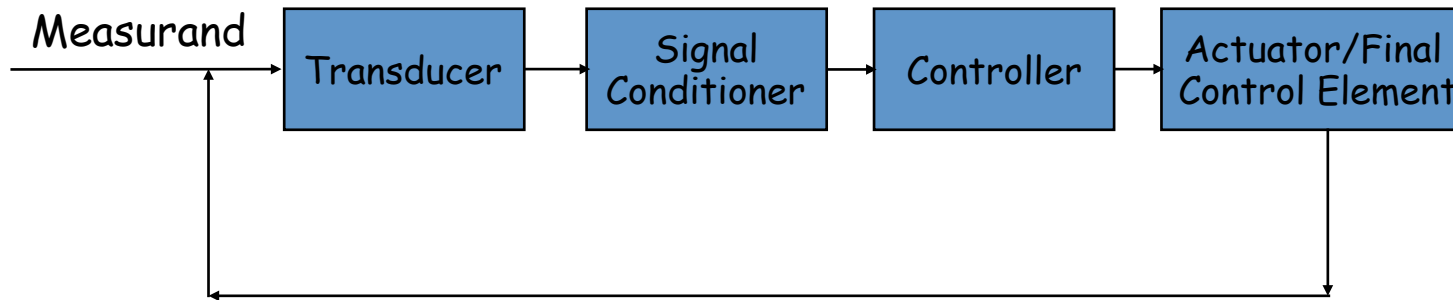
1. Basics of Measurement Systems



Operation:

Signal from a sensor is converted by a signal conversion circuit where the output signal from the signal modifier will be sent to a display unit (analog or digital meter).

2. Basics of Control System



Operation:

Output from a signal modifier for a control system to control peripherals like valves, motors and others.

INDUSTRIAL APPLICATIONS





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Typical Diaphragm Gas Meters

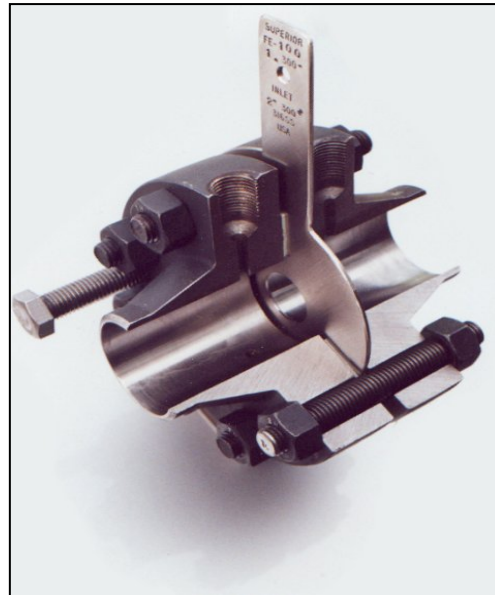


Restriction Orifice Plate



Orifice Carrier and Integral Plate
shown with optional isolation valves

Typical Orifice Meter



General Configuration of Typical Orifice Meter