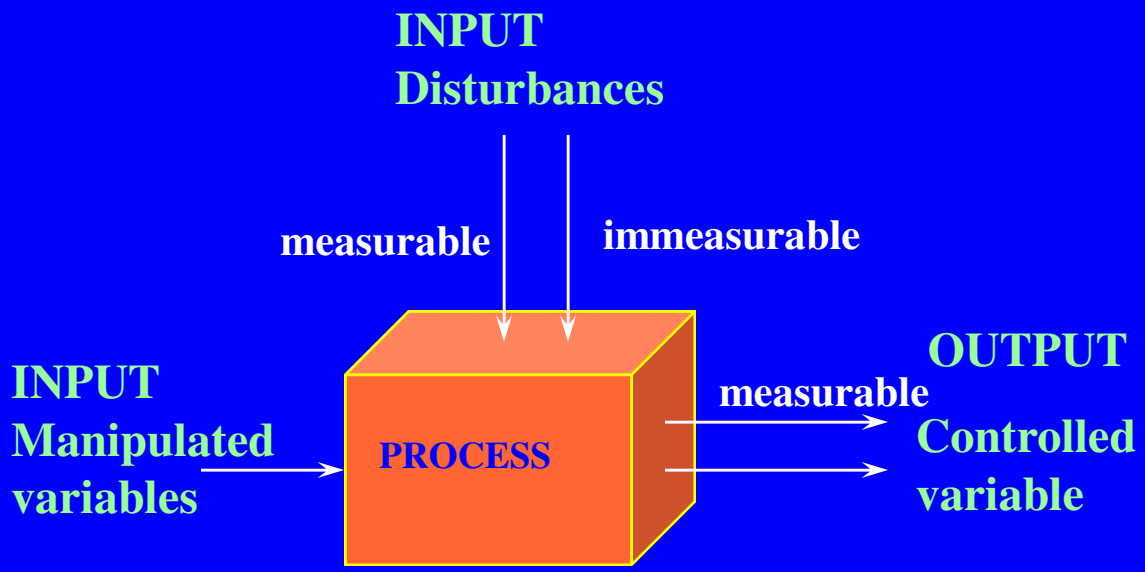
PROCESS VARIABLES

Process Variables

- Input variables
- Output variables
- Controlled variable
- Manipulated variable



Process Variables

- ***Input Variables*** (Giriş Degişkenleri)

  -affect the process independently,

  -change the conditions of the process

- ***Output Variables*** (Çıkış Degişkenleri)

  -gives information about the state of the process

- ***Controlled Variable*** (Kontrollu Değişken)

  The output variable which is requested to be kept constant at a set value (set point)

- ***Manipulated Variable*** (Ayar Değişkeni)

  The input variable which can be adjusted manually or automatically to keep the controlled variables value constant at a set value

Classification of the variables

- **Input variables**

1. Manipulated variable

   Variable which can be easily adjusted by a control mechanism or operator

2. Disturbance, load effect (bozan etken, yük etkisi, düzensizlik)

   Input variables which are effective on controlled variable but which cannot be easily manipulated

Output Varibles

1. Measurable variable or controlled variable

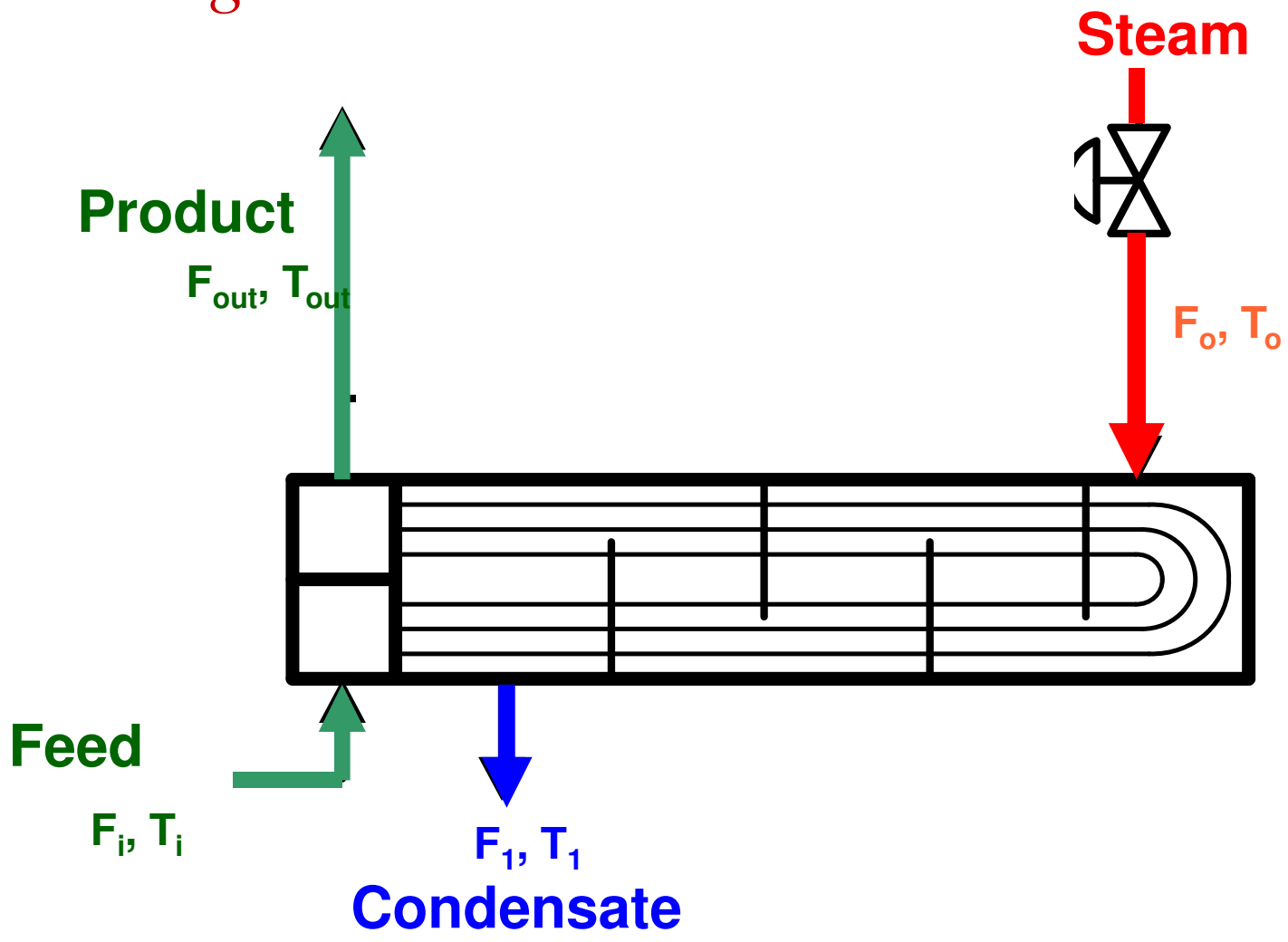
Its value can be easily determined by measurement methods

e.g. The temperature of the product in a pasteurizer

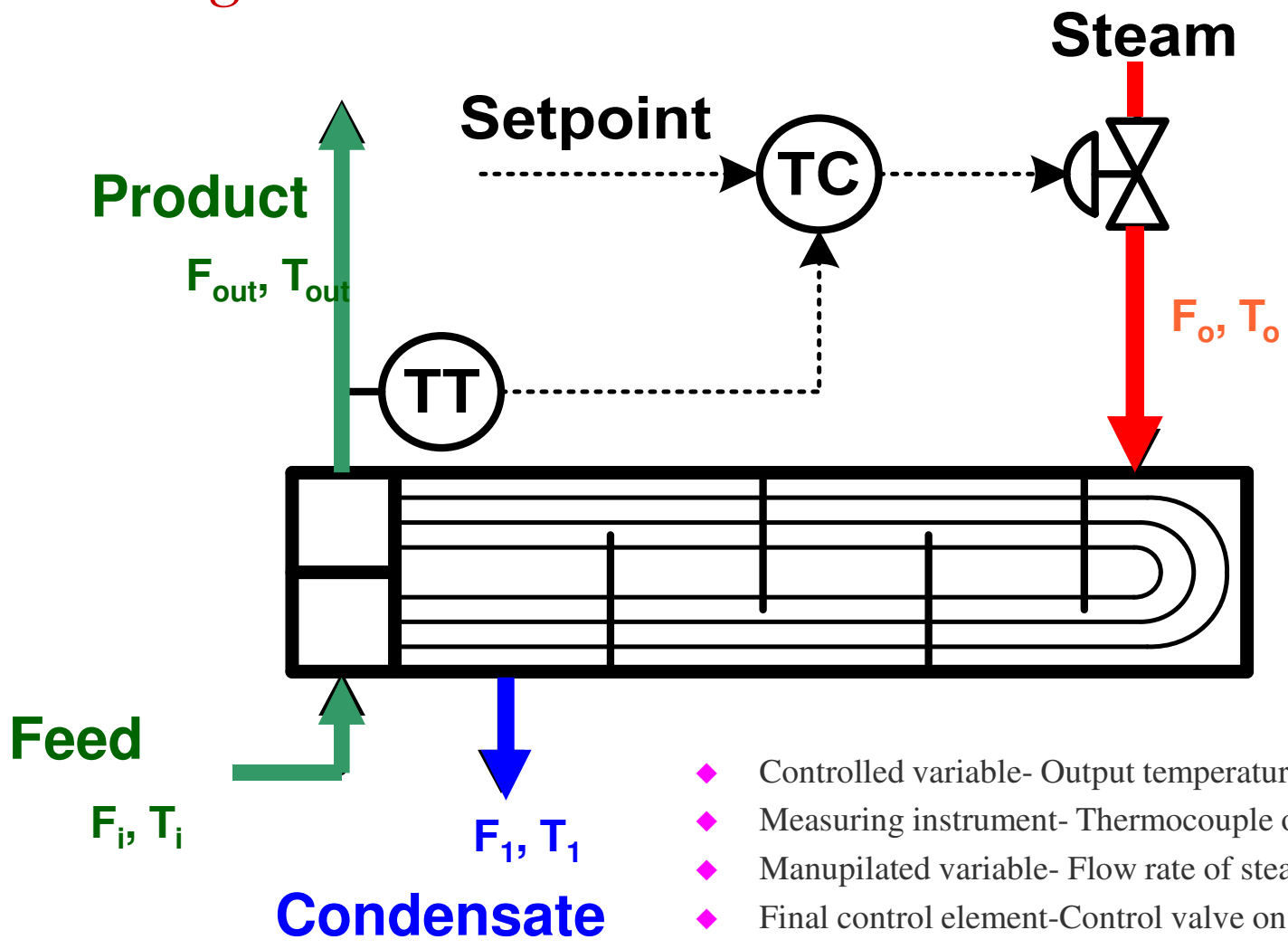
2. Immeasurable output variables

It cannot be measured directly

Example : *Temperature control for a heat exchanger*

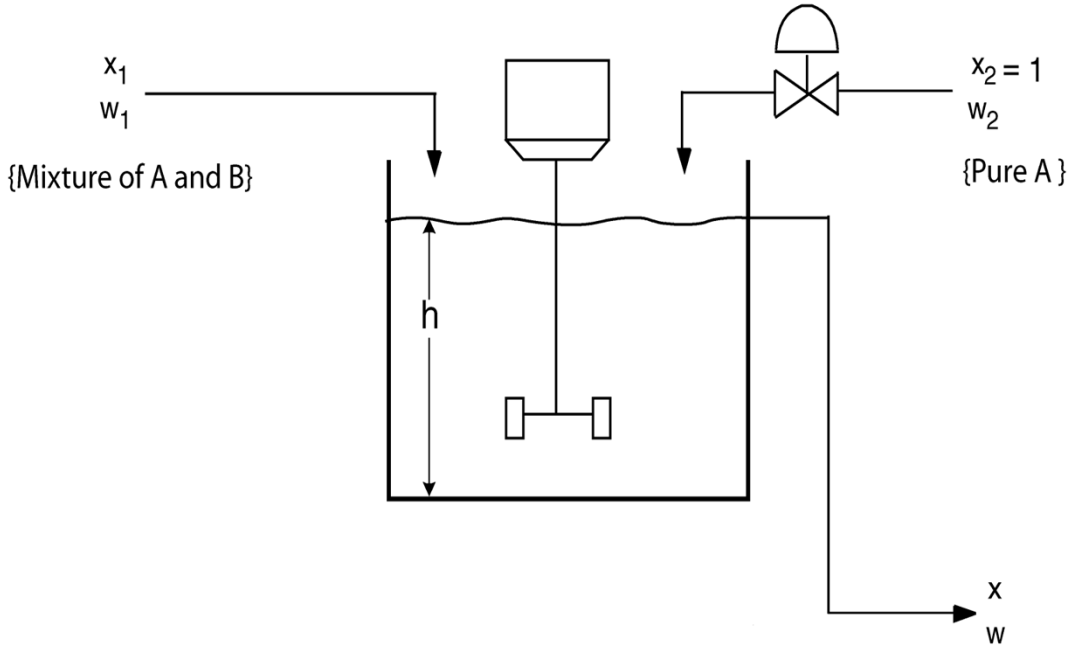


Example : *Temperature control for a heat exchanger*



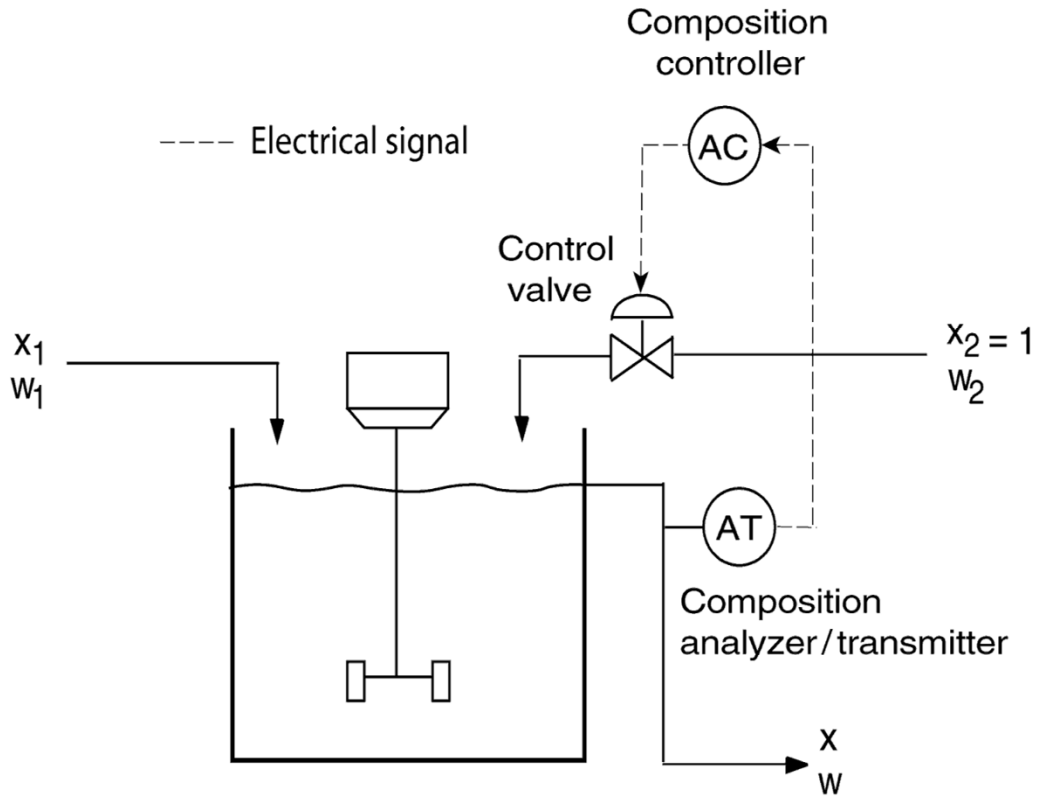
- Controlled variable- Output temperature of product stream
- Measuring instrument- Thermocouple on product stream
- Manupilated variable- Flow rate of steam
- Final control element-Control valve on steam stream
- Disturbance(Noise)- Variation of feed temperature

Example : Mixing Process



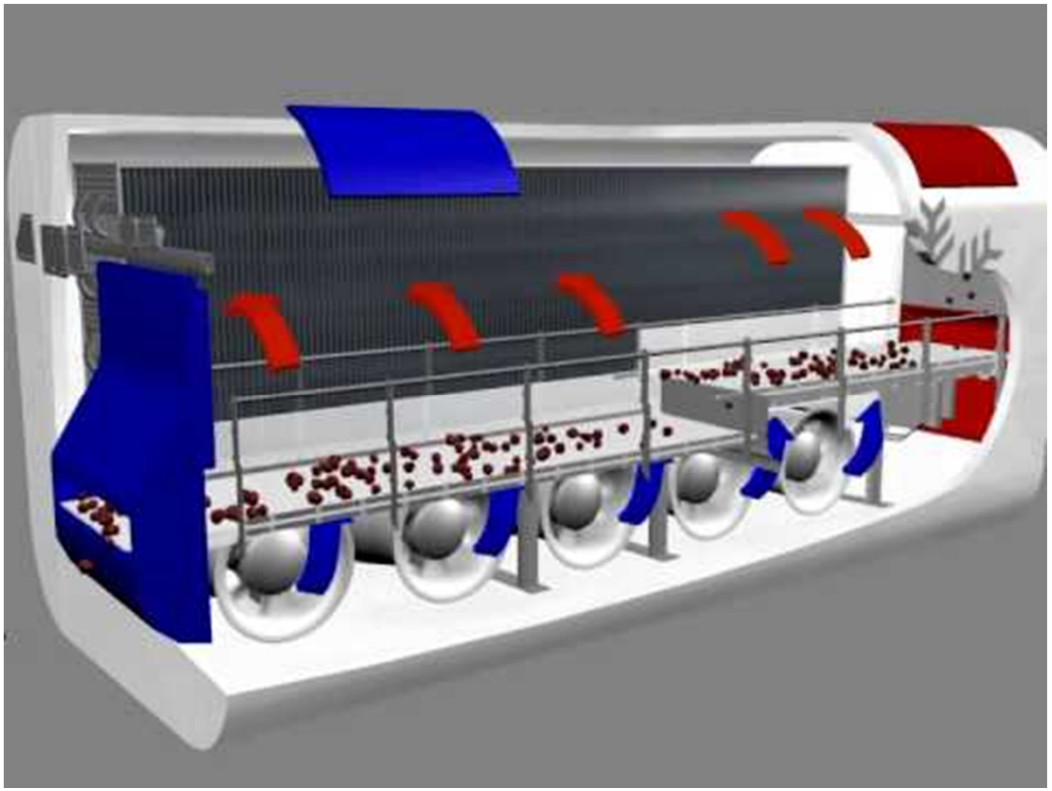
Notation:

- w_1, w_2 and w; mass flow rate
- x_1, x_2 ve x; mass fraction of component A



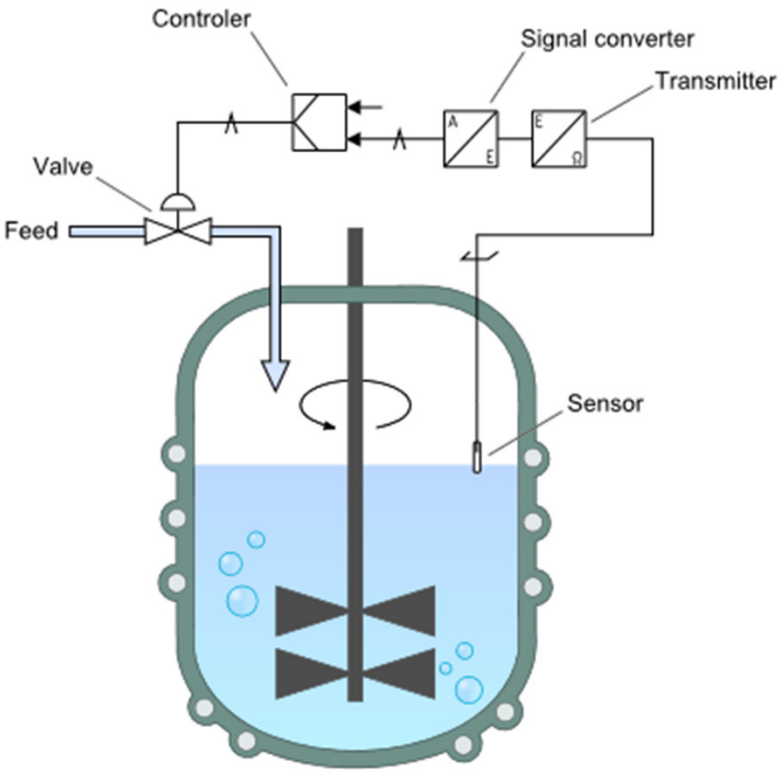
- **Controlled variable-** Product concentration
- **Measuring instrument-** Composition analyzer on product stream
- **Manipulated variable-** Flow rate of input stream 2
- **Final control element-** Control valve on input stream 2
- **Disturbance (Noise)-** variation of flow rate of input stream 1

Example: IQF system



- Controlled variable- Temperature in IQF
- Measuring instrument- Thermocouple in IQF
- Manipulated variable- Rate of air entering the system
- Final control element- Valve on air inlet stream
- Disturbance(Noise)- Input temperature of peas

HOMEWORK: Fermentor (pH control)



What are the input and output variables of fermentation process?

According to pH control, decide the following unknowns?

- Controlled variable- ?
- Measuring instrument- ?
- Manipulated variable- ?
- Final control element- ?
- Disturbance (Noise)- ?