MECHATRONICS

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Lectures: **Thursday 14-16, Friday 9-11**

MATERIAL

- **Lecture slides + notes**

- **Web site** **http://mclab.unipv.it/eleind/Mechatronics/**

COURSE TOPICS

Aim of the course
To study a microprocessor based system to acquire, measure and elaborate environmental physical magnitudes (temperature, force, acceleration, etc.).

Transducers
Linear and angular position transducers, velocity, acceleration, pressure, temperature, flux, level, acidity.

Conditioning networks
Current-voltage and current voltage converters, charge to voltage, frequency to voltage. Bridge circuits. Operational amplifiers: diodes and AC-DC converters single and double wave. Synchronous and Bridge of diodes Rectifiers. Instrumentation amplifier.

Actuators
SCR, Triac and Unijunction transistors. Direct current motors. Stepper motors.

Control Algorithms
P, PI e PID. Cascade control and feed-forward. Numerical controllers and their implementation. Smith Predictor. Pure delay compensation.
Examples of acquisition and control chains in automation typical applications.

Requirements
Electronics, Physics, Control theory and Informatics fundamentals

EXAM RULES

***Exams*:**

Examination tests include a written text with questions on the theory and exercises

Exercises concern real situations into which it is necessary

- To choose the most suitable transducer for the measurement that we want to perform
- To interface the transducer with the microprocessor to read the measurement
- To connect the microprocessor to an actuator to intervene on the controlled process
- To identify the transfer function of the process in the Laplace transform dominion
- To apply a suitable control algorithm that makes the process stable

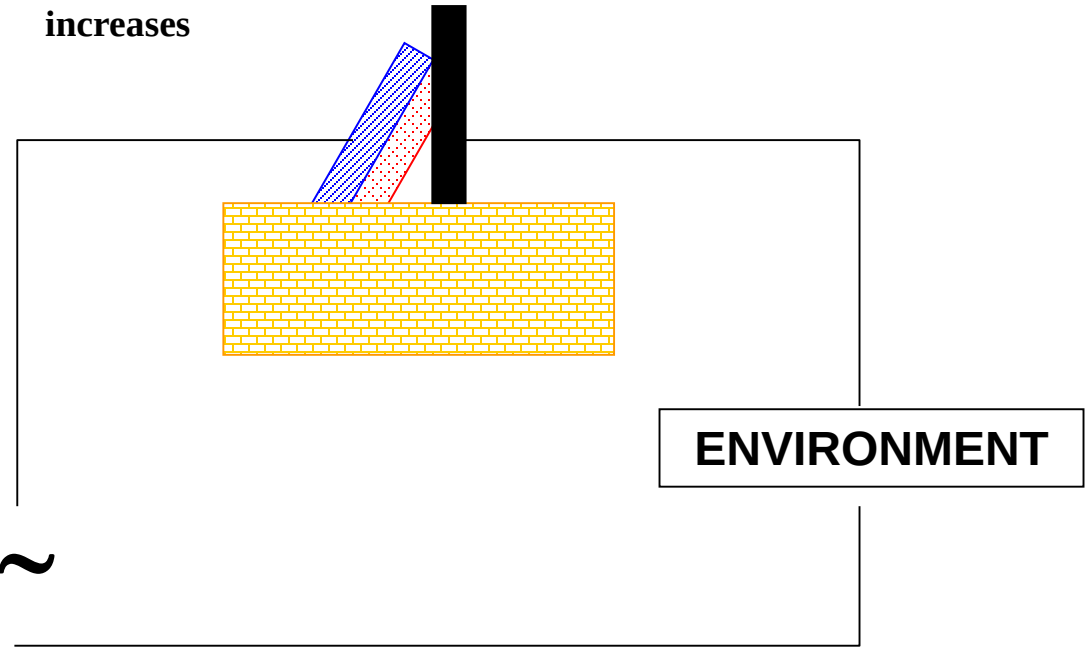
The exam is passed if the score obtained is >= than 18/30.

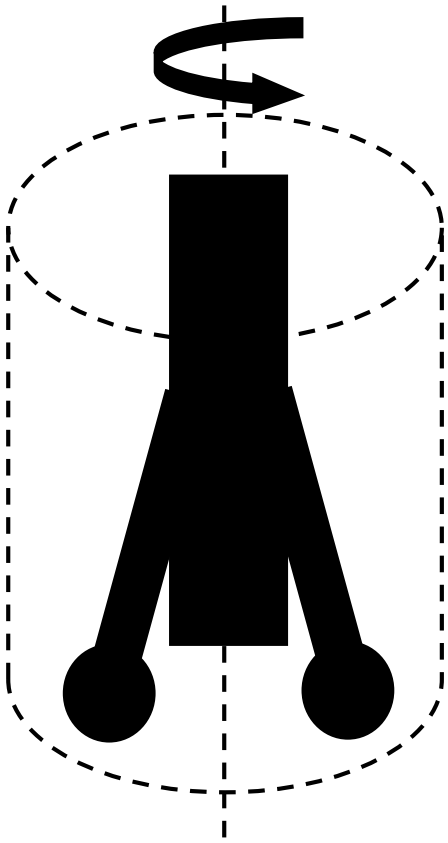
No oral examination (colloqium) is comprised

INDUSTRIAL PROCESS CONTROL

Industrial process: to keep the temperature of an environment on a certain set point, to control the level of the water in a tub, to fix the acidity of a biological food product.

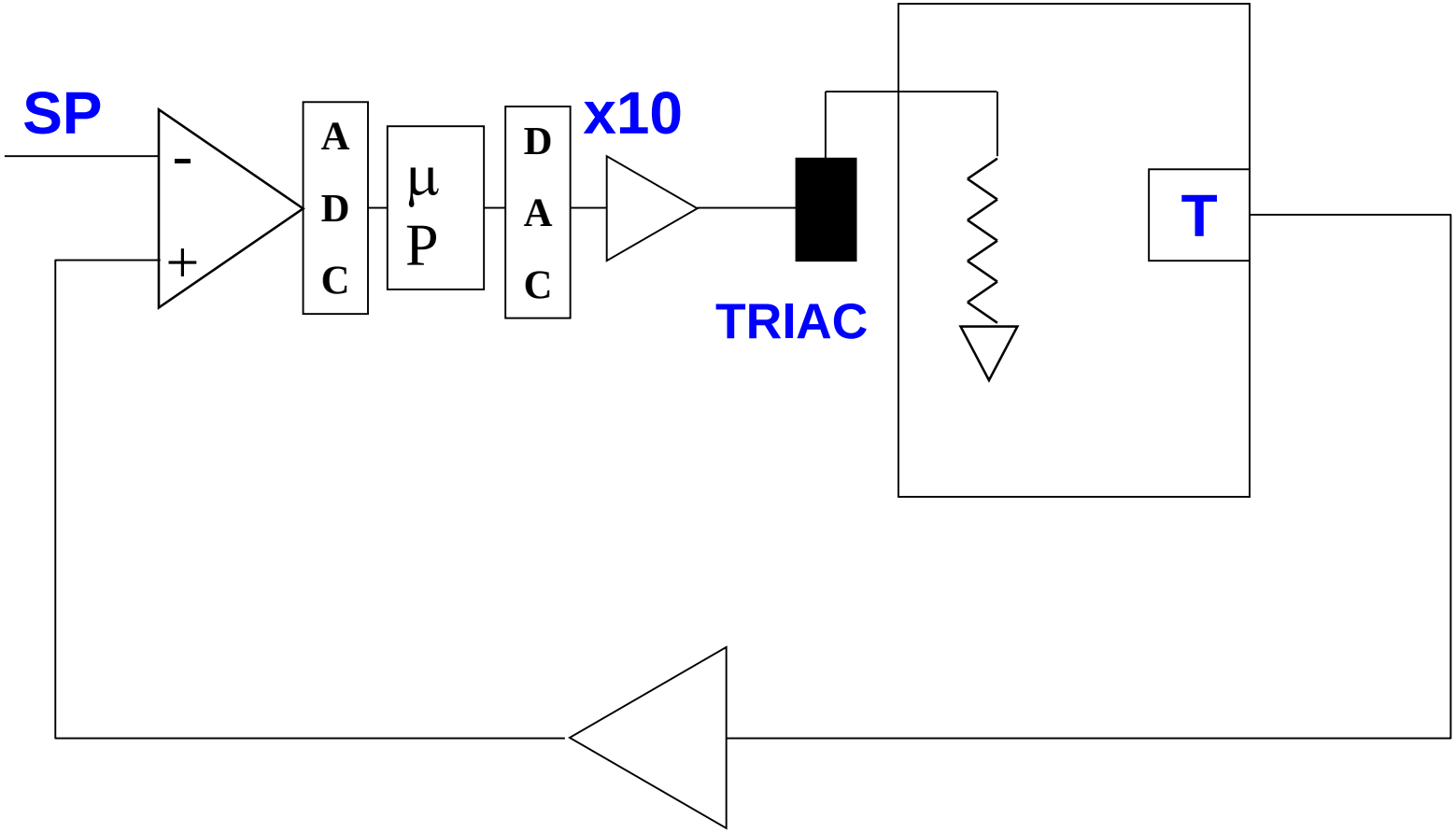
Metallic contacts separated by an element with different dilation so as to isolate them when temperature increases





Watt regulator

Example: the control of the oven temperature



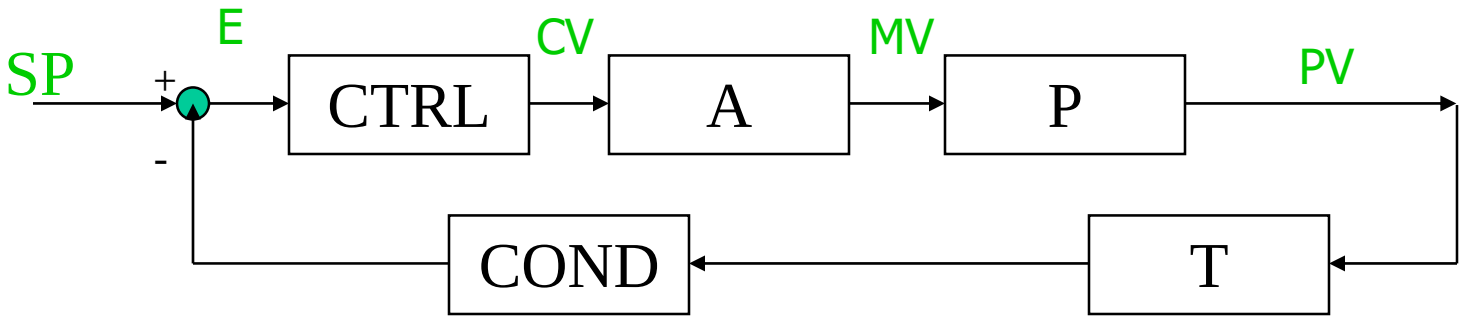
Controller of proportional type (x10) so as to regulate the power to be provided to the warming resistance to bring the environment to a fixed temperature T desired.

INDUSTRIAL PROCESS CONTROL

Electronic control ⇒ accuracy and precision

Problems:

- **convert a physical signal into an electronic one (transducer)**
- **to keep the signal amplitude in standard level (0-5 V)**
- **electronic signal to physical conversion (actuator)**
- **acquired information processing (μP)**
- **transfer function of the analyzed process (transfer function)**
- **control algorithm**



COURSE SECTIONS

TRANSDUCERS

CONDITIONING NETWORKS (Electronics)

ACTUATORS

CONTROL ALGHORITMS

EXAMPLES OF PROCESS CONTROL