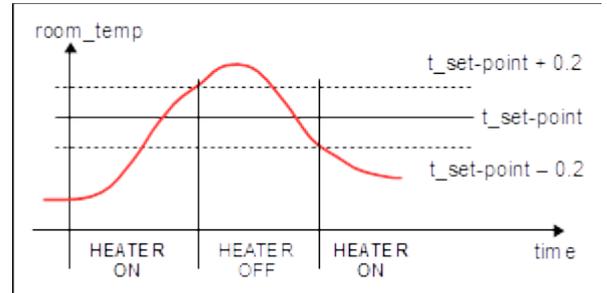


# C4μC - Examination

## Design a digital thermostat for an home heating system:

- The digital thermostat, other than buttons and display on the interface, has:
  - an analog input from the temperature sensor (**ROOM\_T**) which is in range [0, 5V] for [-10°, 41.15°]
  - an output to activate heating system (**HEATER**), HI = active
- ON/OFF (signal **OO**) button is used to activate-deactivate the thermostat mode (**TH**), in which the system continuously tries to keep the temperature near set-point (see below how).
- The "T" button (signal **TM**) is used to activate-deactivate temporarily (**TEMP\_x**) the system for 1 hour in 2 modes, depending on the state within it is pressed:
  - from **OFF** state, the thermostat will be working trying to keep the temperature near set-point for only 1 hour (it will be **TEMP\_TH** mode), after that will be back in **OFF** state.
  - from thermostat mode (**TH**), the system will force the heater to be on, regardless the room temperature (it will be the **FORCE\_HEAT** mode)
- The "P" button (**PAUSE**) is used to exclude the thermostat for 2 hours, for example during cleaning (**CLEAN**) with open windows it makes no sense to heat the building; it works only from thermostat mode (**TH**).
- Arrow up (**UP**) and arrow down (**DOWN**) buttons are used to regulate temperature set-point, incrementing and decrementing by 0.1°; the setpoint is always updated, regardless the state/mode.
- The heater, when trying to control the temperature, has to be activated/deactivated applying a hysteresis of +/-0.2° on set-point temperature to avoid oscillations due to sensor noise
- DO NOT NEED TO TAKE CARE OF THE DISPLAY, just consider to store set-point temperature and room temperature in appropriate variables



## Exercise tasks:

- Define inputs and outputs for the reference μC 328p, filling the table with Signals, IN/OUT and type, PIN assignments, notes (so 4! columns) [up to 2pts]
- Draw the state-chart for the system, [up to 3pts]
- Add every reasonable transaction, that has not been explicated in requirements, to solve undeclared cases. (should be comprehensible from state chart and code) [up to 1pts]
- Write down the code for the init function (e.g. *setup()*), the main function (or *loop()*) and other functions, if any, declaring all the needed variables [up to 6pts]

## General note:

- Write any comment to justify a choice when the system requirements leave a degree of uncertainty

**Mandatory!:** use a correct indentation and parentheses, otherwise penalty [up to -2pts]