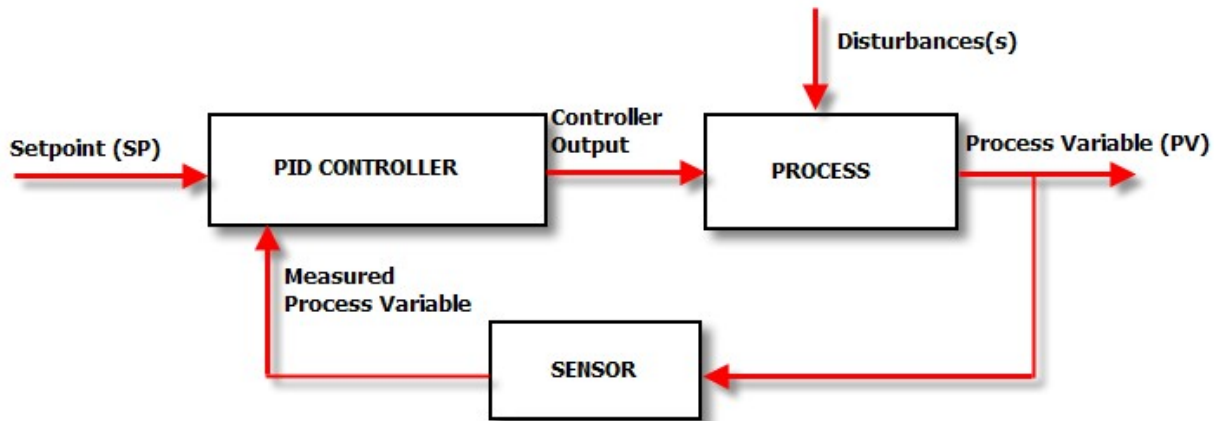# PID-controller



## Functionality:

PID controllers automatically influence the physical parameters in usually a technical process in such a way that a predetermined value is maintained as well as possible even when interfering flows occur.

For this purpose, controllers within a control circuit continuously compare the signal of the "reference variable (set-point)" with the measured and returned "feedback variable (actual value)" and determine a "control variable" from the difference between the two variables of the control deviation.

The control path is influenced in such a way that the control deviation becomes a minimum in the steady state. Because the individual control circuits have a time response, the controller must amplify the value of the control deviation and at the same time compensate the time behavior of the line in such a way that the control variable is able to reach the set point value in a desired manner from aperiodic to damped oscillation.

Incorrectly set controllers make the control loop too slow, lead to a large control deviation or to undamped vibrations of the control variable and therefore possibly to the destruction of the control path.

This control function component can be used as a P-controller, I-controller, PI-controller, PD controller and PID-controller.
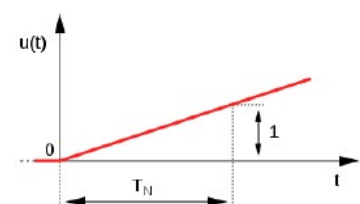
## P-controller:

Jump response P-amount with Kp

The P-controller only consists of a pro-portional amount of the amplification Kp. With its output signal u it is propor-tional to the input signal e.
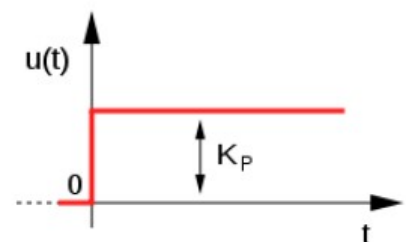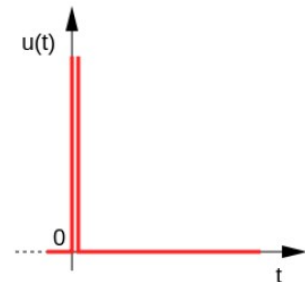


## I-controller:
Jump response I-amount

An I-controller (integrated controller, I-lied) affects the control variable through temporal integration of the control devi-ation e(t) with the weighting according to the reset time T_N.

**D-Unit:**
Jump response of the ideal D-unit
The D-unit is a differentiator, which is used as a controller only in conjunction with controllers with P- and / or I-behavior. It does not react to the height of the control deviation e (t) but only to its rate of change.

**Empirical dimensioning:**
In practice, control loops are often im-plemented without using a model by simply trying out controller settings. The controller parameters are simply prese-lected and varied according to practical experience. Therefore, this method is also only suitable for dimensioning sim-ple systems.

**The procedure is as follows:**
One starts with a noncritical setting by choosing the P-part small and setting I and D to 0. Now slowly increase the P-part so long until the damping becomes bad. If an oscillation inclination occurs, the gain P is decreased by a little bit. Subsequently, the integral part and the differential part are also added, and they are also slowly increased until the result is quite acceptable. If the regula-tion becomes more stable, you can again increase P or I and test until eve-rything fits.
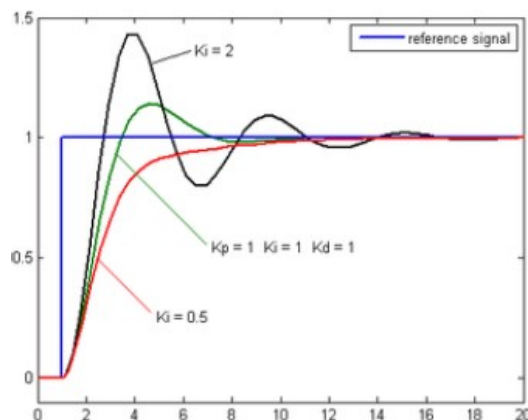
**Set Up an PID-controller in SmartDog**

Go to „Controls" in the device configuration . Create a new control function with the green plus.

Press the button „Output"

Create the „PID-Regulation" function component.

At name enter e.g.: „Controller 1".

At „Actual Value" select your e.g.: PT1000 temperature sensors that is responsible for the actual value.
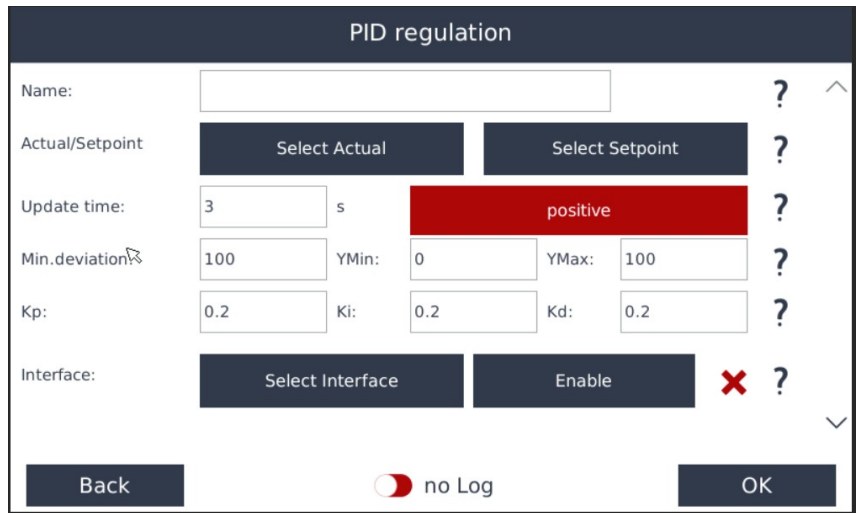
At „Enable" (set point) you se-lect e.g.. Fix Value and a temperature of e.g.: 65°C.

**Here you also have the pos-sibility to select a not fixed set point that e.g.: is affect-ed by the outdoor tempera-ture.** At „Update time" select the speed of how often this con-trol is refreshed e.g.: 1 s.

At „positive" select the control direction. **This function is set to "neg-ative" at e.g.: export con-trols.**

At „Min. deviation" you enter the smallest deviation step e.g.: 5.

At „Ymin" you can set the start value. It usually starts with 0. But it can also be higher e.g.: 20.



At „Ymax" you can set the end value. This value is usually at 100. But it can also be lower.

At „Kp" you can enter the pro-portional amount. See P-Controller.

At „Ki" you enter the integral amount. See I-controller.

At „Kd" you enter the differen-tial amount. See D-unit.

At „Interface" you go to „Select Interface" and select the „Physical output" or an „inter-nal Memory".

At "Select Enabled" you can turn the control on and off with another component.

Confirm with „OK".

Press on „Save".