# PID Regulator for the simple flight controller

## Structure of the PID components

One of the most important software parts of the flight controller are the PID modules. These modules are responsible for the orientation of the XCopter and guarantee a stable movement. There are three PID modules implemented in the flight controller. Each axis (roll, pitch and yaw) is controlled by one PID regulator. As described in section (ref “PID regulator”) every PID module gets two input parameters, on the one hand the set point parameter and on the other hand the real value. The outputs of the RCReceiver module are providing the set points, and the returned values of the SensorDataFilter are taken for the real values of the PIDs (ref “Structure of the PID components”).

PIDRoll

**set value**

RCReceiver

Figure 1: Structure of the PID components

**set value**

PIDPitch

**set value**

PIDYaw

**real value**

SensorDataFilter

### The PID modules provide a function which expects the parameters set point and real value and returns a float number which represents the control variable for the motors. In the function the proportional part, the integral part and the differential part are computed as described in section (ref “PID regulator”).

The constants Kp, Ki, Kd (in this function named RollKi, PitchKi, etc) regulate the behavior of the PID controllers. Incorrect values of the constants can lead to a crash of the XCopter. Therefore, the constants have to be set absolutely correct. This values (RollKp, RollKi, RollKd, PitchKp, PitchKi, PitchKd, YawKp, YawKi, YawKd) need to be determined experimentally using for example a specific tuning method like the “Ziegler-Nichols-Method” or using an online tutorial for tuning PIDs of a quadcopter (<http://www.technik-consulting.eu/Optimierung/Quadrocopter_PID-Regelung.html>). Additionally, a limitation of the maximum and minimum return value is implemented, so the value is also valid in case of a wrong computation. The maximum and minimum values can also be changed while experimenting with the constants of the PID regulators.