



, PID (LOOP), PID
 1/loop 400 , 2.5ms ArduCopter 4.7 , PID
 4KHz, 2.5uS ,
 () ,

```

  //
  // CPU H , F4
  //

```

PID , (LOOP):



:

- :
 - 0: :1
 - 1: CPU (), CPU .
 - 2: , , CPU
 - 3: Enable fixed fast rate. This is useful for testing but not usually used.
- FSTRATE_DIV**: this defaults to 1 and represents the minimum fast rate gyro divisor. So a value of 2 will yield a rate loop of gyro rate / 2 (**INS_GYRO_RATE** / 2). This allows a fixed fast rate that is lower than the gyro rate. This parameter is can be modified in-flight.

The easiest way to try this feature is to set **FSTRATE_ENABLE** = 1 (Dynamic rate). If your flight controller is struggling it will reduce the attitude loop rate until normality is restored. **FSTRATE_ENABLE** = 2 (Fixed Rate) is not recommended until you have seen reasonable performance with dynamic rates.

One way to gain more CPU is to switch off additional IMUs using **INS_ENABLE_MASK** or reduce **INS_GYRO_RATE**. The main CPU load is from the INS and attitude control threads.

When this feature is enabled, several other settings are affected:

- **SERVO_DSHOT_RATE** - this represents a multiplier of the main loop rate to output to the motors. When the fast rate loop is enabled this is normally set to 1, however if the calculated rate will not exceed the gyro rate, higher values are allowed. For instance if **INS_GYRO_RATE** = 2(4KHz) and **FSTRATE_DIV** = 4 (1KHz) then values of **SERVO_DSHOT_RATE** up to 4(4x loop rate) are allowed.
- Fast attitude and PID logging enabled in **LOG_BITMASK** - setting these bits usually logs at the main loop rate, however if fast attitude is enabled these will be logged at the minimum of the fast attitude rate and 1kHz
- **SCHED_LOOP_RATE** - since all the heavy lifting of attitude control is being done in a separate thread, **SCHED_LOOP_RATE** can be run at normal values - for instance 400Hz or even less.

Tuning Setup

Its extremely important that the **Notch filtering** **** be setup as well as the **tuning-process-instructions** be followed before tuning with this feature enabled.

- **INS_GYRO_FILTER** - as high as you can get without cooking your motors. Often copters have resonance around 120Hz so it is hard to get higher than this without notching out frame resonance.
- each axis' `ATC_RAT_xxx_FLTD` should be **INS_GYRO_FILTER**/2 on roll and pitch and **INS_GYRO_FILTER**/4 on yaw. This is because D is more active, lets more noise through and is more likely to cook your motors. Setting it above $0.75 * \text{INS_GYRO_FILTER}$ is not recommended.
- each axis' `ATC_RAT_xxx_FLTT` should be at the highest rate you want the EKF or your fingers to control the copter. Values of 30Hz should be fine, but higher has diminishing returns but does not affect the tune.



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Admin 2026-10-09 14:41:54 UTC

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