I. ArduPilot Mega 2 Quadcopter Basic Stabilize Mode Flying & PIDs

A. Initial Flights: (Stabilize is the basic and startup mode and is necessary for arming).

1. Set the Quadcopter Flight Mode 3 way switch to "Stabilize" for the ArduPilot Mega 2 (APM2)
2. Place the Quad on a level spot facing away from you with at least 20 feet of flat clear space in every direction, turn on your transmitter and plug in your battery.
3. Stand at least 10 feet behind the Quad and arm the APM2 by holding the throttle all the way down and to the right for at least 4 seconds (red LED solid). (GPS lock is Not required).
4. Advance the throttle till the Quad lifts off. Hold altitude to 4 to 8 feet with the Throttle. Compensate for drift with the Pitch stick. Reduce throttle and land.
5. Repeat several times adding rotation correction with the Yaw stick and making short excursions.
6. Gain flight experience in "Stabilize" mode before using the more advanced modes.

B. PIDs: (Use no transmitter roll, pitch or yaw trim. In auto modes trim = moving set points)

1. PIDs are the control loop feedback parameters that permit the APM2 to use its various sensors to automatically compensate and adjust your Quads motors to provide the desired flight stability and for the appropriate execution of flight control commands.
2. PID = Proportional Integral Derivative. A PID has 3 variables which interact with the feedback loop to permit automatic error compensation. Wikipedia has an excellent description of the PID.
3. For the APM2 the PIDs are defined and explained at the Arducopter Wiki web site and the PID variables for each function are modifiable in the Mission Planner software.

C. How to Set the PID parameters: (Perform Initial PID tuning in Stabilize mode).

1. Disconnect the battery and connect a USB cable between your Quad and your computer, then start the Mission Planner and click the "Connect" button to upload parameters from the APM2.
2. Select the "Configuration" tab and select the "Arducopter PIDs" item in the left column.
3. Adjust the desired PID parameter (usually the "P" value) with the arrows or by typing it in.
4. When finished making adjustments to PID parameters, select the "Write Params" button to save your changes to the APM2. Select "Refresh Params" to verify changes were saved to the APM2.

D. Adjusting PIDs for Stabilize Mode: (Tune the flight characteristics of your Quad).

1. The Stabilize and Angular Rate Control PIDs tune Pitch and Roll for your Quad and are most important for control and stability. The "Pitch PID" values are slaved to "Roll PID" values.
    a. If your Quad twitches or oscillates quickly in Stabilize mode reduce the "Stabilize Angular Rate P" setting below the default "0.18" (Try "0.10"). (KK X525 = 0.08)
    b. If your Quad wobbles when descending quickly in Stabilize mode increase the "Stabilize Angular Rate P" setting above the default "0.18" (Try "0.20").
    c. If your Quad oscillates slowly in Stabilize mode reduce the "Stabilize Control P" setting below the default "4.5" (Try "4.0"). (KK X525 = 4.5)
    d. If your Quad responds sluggishly in Stabilize mode increase the "Stabilize Control P" setting above the default "4.5" (Try "5.0").
    e. Redo Stabilize PID – P settings until roll and pitch control and self leveling work smoothly.
2. Adjusting "Yaw Angular Rate PID" P value allows you to tune for a fast, stable yaw rotation rate.
    a. If your Quad responds slowly when you deflect the yaw stick, increase the "Yaw Angular Rate PIDs" P value above the default "0.13" (try "0.15"). (KK X525 = 0.15)
    b. If your Quad rotates too quickly when you deflect the yaw stick, decrease the "Yaw Angular Rate PIDs" P value below the default "0.13" (try "0.10").
    c. If your Quad is sluggish in rotating when you deflect the yaw stick, increase the "Yaw Stabilize PIDs" P value above the default "7.0" (try "8.0"). (KK X525 = 7.0)
    d. If your Quad wobbles slowly when you deflect the yaw stick, decrease the "Yaw Stabilize PIDs" P value below the default "7.0" (try "6.0").
    e. Redo the "Yaw rate PID - P" adjustment until Yaw control is smooth and stable.