TRIMMING GUIDE PART 2 – FLIGHT CHECKS

1 Basics set-up

Trim the model to fly hands off, perfectly straight and level at your intended cruising speed, typically at 1/2 - 2/3 throttle.
Then once again, adjust any linkages so that the transmitter trims can be set back to zero.

2 Balance

3a Centre of Gravity		
Fly Straight & Level, put the aircraft into a 45°dive at cruise power, then release the controls.	If the model pitches towards the canopy. If the model pitches towards the belly at all.	Model is nose heavy. Model is tail heavy.
AND/OR		
Fly straight and level, increase the throttle to full and pull to a 45° climb. Hold the 45° line, roll smoothly to inverted & release the controls.	If the model pitches quickly towards the canopy. If the model pitches towards the belly at all.	Model is nose heavy. Model is tail heavy.
AND / OR		
Pull the model into a tight VERTICALLY banked turn without rudder input (the model will descend during this check).	If the Nose drops If the Tail drops	Model is nose heavy. Model is tail heavy

Note 1: *There is no definitive right or wrong place for the CofG it is personal preference & most aircraft have a* ***CofG range****, rather than an exact position!*
Personally, I like to have the model gently falling towards the canopy when it is inverted, as I find this gives a good balance between stability & nice manoeuvring characteristics.

Note 2*: If the model mushes into a spin, rather than stopping cleanly & the nose dropping positively down due to the stall, the CofG is probably a bit too far forward.*

3b Lateral Balance		
Roll the model inverted at your chosen cruise speed.	Observe if any wing gradually drops.	Wing that drops, is the heavy wing. Add weight to other wing.
AND / OR		
Fly a vertical downline, for 3 or 4 seconds, then pull hard to the horizontal. (Make sure to pull the stick straight back without ANY lateral input).	Plane should exit wings level.	Wing that is low after the tight pull, is the heavy wing. Add weight to other wing.

Note 1*: For this check, you may need to TEMPORARILY adjust the rudder trim to ensure the wings are perfectly parallel to the ground before the tight pull (the vertical yaw correction will be covered later). It doesn't matter if it has rolled a little as the wing should remain parallel with the ground. – When this check is complete set the trim back to normal.*

Note 2: *Do not attempt to do this check using tight loops, as an incorrect thrust line (which is yet to be set) will give erroneous errors.*

3 Engine Thrust Line		
2a Downthrust		
Fly straight and level at your chosen cruise speed, then increase to full power.	Model climbs Model dives	Increase down thrust. Decrease down thrust.
AND / OR		
Fly level at full power, then pull to a vertical climb.	Model pitches towards canopy. Model pitches towards belly.	Increase down thrust. Decrease down thrust.
Note: *If you adjust the downthrust, you will need to recheck how the model performs during the CofG checks & may need to readjust this.*		
2b Side thrust		
Fly level at full power, then pull to a vertical climb.	Model pulls to the left. Model pulls to the right.	Increase engine right thrust. Decrease engine right thrust.
Top tip: *For average size rudders - Apply some rudder trim until the model tracks straight. Use a protractor to see how many degrees of rudder you required, divide this by 2 and that should be the correct degrees required to add/subtract to your side thrust.*		
4 'Virtual' Wing Incidence adjustment		
Fly flat (rudder) turns (don't use too much rudder initially) in both directions using cruise power. Try to use the same amount of rudder input for both directions.	Observe if aircraft pitches to canopy or to belly. The check is to see if it pitches in the <u>same</u> direction (up or down) with <u>both</u> left & right turns.	Nose pitches to canopy, adjust both ailerons down slightly. Nose pitches to belly, adjust both ailerons up slightly.
Note 1: *This check works best with models with mid mounted wings. Most Biplanes for example, tend to pitch quite rapidly nose down with rudder only turns due to the wing offset. So, miss this check out if it looks like significant changes would have to be made.* ***Note 2:*** *If you adjust the ailerons, you will need to recheck how the model performs during the CofG checks & downthrust check & you may need to readjust one or both.* ***Note 3:*** *An aft CofG can also cause the model to pitch to pitch towards the belly & a forward one can cause a pitch toward the canopy, so balance any virtual wing incidence adjustment with the CofG position.*		
5 Aileron Blowback		
Fly a vertical downline, complete a full deflection roll, pause, complete another full defection roll. **and / or** Fly a vertical upline, complete a full defection roll, fly a vertical downline, compete another full deflection roll.	In either check, both roll rates should be the same, if the second one is slower that the first you have aileron blowback.	Increase mechanical advantage, reduce throw, increase servo power, (if system can accept a higher voltage) or change to a more powerful servo, etc.

6 Aileron differential		
Fly a vertical upline directly into or down wind and away from you. Do a FULL deflection roll & check for any barrelling & heading changes.	If plane has barrelled or is seen yawing (the down going wing has more drag than the up going wing)	Increase aileron differential. Setting More deflection on up aileron than down aileron (Usually 1° more up than down throw to start with).
AND / OR.		
Fly towards you & push to a vertical downline. Do a one (or TWO) FULL deflection roll(s) & check for any barrelling & heading changes.	If plane has barrelled or yawed (the down going wing has more drag than the up going wing).	Increase aileron differential. Setting More deflection on up aileron than down aileron (Usually 1° more up than down throw to start with).
***Note: Do NOT** do this test in level flight as any elevator requirements to maintain altitude when inverted, will mask the result of the aileron differential test.* *If you have individual servos for aileron, this can be done on the transmitter, otherwise it will need to be done mechanically.*		
7 Throttle Mixing		
7a Throttle to Elevator Mixing		
Fly past you at high level & make a long vertical downline with the throttle at idle.	Observe if aircraft pitches to canopy or to belly.	Add throttle to elevator mix at low throttle to compensate for the pitch. Make sure it takes effect gradually, starting at around ½ - ¼ throttle.
7b Throttle to Rudder Mixing		
Fly directly away/towards you at high level & make a long vertical downline with the throttle at idle.	Observe if aircraft yaws left or right.	Add throttle to rudder mix at low throttle to compensate for the yaw. Make sure it takes effect gradually, starting at around ½ - ¼ throttle.
7c Throttle to Aileron Mixing		
Fly past you at high level & make a long vertical downline with the throttle at idle. & /or Fly along at medium height, throttle smoothly back to idle and watch for rolling.	Observe if aircraft rolls to left or right	Add throttle to aileron mix at low throttle to compensate for the rolling. Make sure it takes effect gradually, starting at around ½ - ¼ throttle.
***Note:** The above checks must be done in the order shown (elevator, then rudder then aileron), otherwise it is likely that some erroneous aileron corrections will be made.*		

8 Control Mixing

***** Be CAUTIOUS when setting these mixes*****
They can help the models flight characteristics. They can also be difficult to set correctly & even then, they can upset some other basic handling (which is why they are done last).

One benefit of these mixes is that they can help the model tracking in knife-edge flight. However, they can cause problems when flying stall turns & spins, etc. - where there is no aerodynamic coupling. So, after any adjustments yes check the knife-edge characteristic (preferably in a knife-edge loop!), but also check the stall & spin characteristics & aim for a nice handling balance during all manoeuvres.

Also, remember that you will fly knife-edge at different airspeeds (into & downwind for example) & as the required rudder input changes, so will the resultant mix reaction, this means that there is rarely a single best/only setting for knife-edge flight. - This is why it is best to check the knife-edge characteristics in a knife-edge loop. It is also why it is best to use constant rudder inputs to set up these mixes, rather than using knife-edge passes.

It is often better to just compensate for these couplings with the control sticks!

8a Rudder to Aileron Mixing

Fly flat (rudder) turns in both directions using cruise power. Try to use the same amount of rudder input for both directions.	Observe if aircraft is rolling left or right.	Add appropriate mix to compensate for the roll. - Left & Right rudder inputs normally need slightly different mixes!

8b Rudder to Elevator Mixing – this must be done AFTER Rudder to Aileron mixing

Fly flat (rudder) turns in both directions using cruise power. Try to use the same amount of rudder input for both directions.	Observe if aircraft pitches up or down & if this is in different directions with different rudder inputs, remember which way with which rudder input!	Add appropriate mix to compensate for the pitching. ***Note:*** *Left & right rudder inputs normally need different amounts of elevator mix!*

Note 1*: This is the same check profile as the Virtual Incidence Check but is used to fine tune any pitching tendencies & especially when different mixes are needed for left & right Rudder » Elevator inputs.*

9 Complete Handling Check

When you are happy with ALL the individual checks, carry out a series of flights with plenty of different manoeuvres to check that there is a nice balance of the model's handling characteristics throughout the flight.

The aim of course is always to get a model that is as easy to fly as possible, but don't worry if you have to accept some compromises – remember that even the best trimmed model will be affected by wind & turbulence!

Finally, always strive for the best you can achieve & in doing so, you will end up with a model both easier & hopefully MUCH more enjoyable to fly - in all weather conditions…