

TRIMMING GUIDE PART 1 - GENERAL INFO & CHECKS IN THE WORKSHOP!

GENERAL INFORMATION:

This guide is a consolidation of knowledge learned, my own thoughts & experience of trimming a wide variety of aerobatic models. Other ideas & guides are widely available on the web, so just use whichever trimming guide gives you the best results.

This guide is ideal for both new models & also for those existing models that do not seem to be flying as well as they should!

The guide is primarily aimed at trimming aerobatic models, but many sections are applicable to trimming ANY type of model (from basic checks in the workshop, to balance, thrust lines, aileron differential, throttle mixes etc.). There is quite a lot of information here, but it falls naturally in sections, so just take it one section, or page, at a time!

The guide works best if your aircraft has been built reasonably accurately; the thrust lines & the C of G are (initially) as quoted in the manual

- *You can still successfully trim a crooked model, but you will probably need to use significantly more & larger radio mixes to achieve the desired result!*

TO BEGIN - SOME VERY IMPORTANT CHECKS IN THE WORKSHOP

MODEL BALANCE

1) Check the Centre of Gravity (CofG). Remember that the CofG on all aircraft is a RANGE & not a position. So, whilst should fly with the CofG as per the instructions, it is only during flight tests that the ideal position for any model/pilot combination will be established. For example, in general I like my models to be fairly neutrally balanced but just a TAD nose heavy, where the nose of the model will JUST fall gently when the model is tested using the 45° full power climb & rolled to inverted method (see flight tests).

2) Check the model's lateral balance. This check is a precursor to the lateral balance flight checks, it does NOT replace them. You may be surprised how many kits (especially with foam wings or foam cores) require quite substantial tip weights.

The check may not be so applicable to a model of a Blohm & Voss BV 141 though!



10g on Sebart Miss Wind



10g on Freewing Venom EDF

Note: Self-adhesive wheel balance weights are ideal for this. They are easy to cut/adjust, stick very well - & are cheap to buy.

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FLYING CONTROLS

- 3) Check there is **NO** play or slop, in any control linkages, hinges, horns, servo mounts etc.
- 4) Check ALL transmitter settings to ensure there are no 'odd ball' inputs – previously set servo end points, sub-trims, program mixes etc.
- 5) If you have any trims set on the transmitter sliders, adjust the control linkages so that you can reset the trim sliders back to zero. This ensures that, at least to start with, the servo travels should be equal in both directions.
- 6) Where possible, ensure that the servos are using their full $45^{\circ}\pm$ travel in both directions i.e. using the maximum 100% on high rates. If not, adjust the horns, servo arms or clevises to achieve this (sometimes this is not possible due to the position of the servo's &/or horns).
- 7) Now, check that all the control surfaces move equally in both directions. If not, adjust the end points/maximum travel, so that the controls are balanced. If you have individual servos per aileron, they **MUST** both/all have equal movements! Many servos are slightly 'off' & will need small adjustments to achieve this.

Note: For aerobatics, some people prefer the elevator to have slightly more down movement than up or use slightly different expo settings - but start off with them balanced.

A lightweight Control Surface Throw Gauge Goniometer is a useful tool here, it is easy to use & is generally more accurate than trying to measure the travel with a ruler.



DUAL RATES AND EXPO

8) Set up some Dual rates (& then Expo). Models can be a bit of a handful on early flights, so being able to quickly set lower rates, especially for Aileron & Elevator via an easy to reach switch (either one for both controls, or one for each) can make a difficult maiden flight into a very much more relaxing one!

A 'Low rate' with around 50% of the recommended travel is a good starting point.

9) Expo settings are of course very much set to personal taste. However, a good starting point for aerobatics is 35-40% on the aileron & elevator control surfaces, which gives a roughly **linear control reaction**. I tend to start with much less rudder Expo, which generally ends up with more balanced controls, so look to begin with around 15%.

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These Expo setting for aileron & elevator is so that with half stick displacement, you get about 50% of the model's **reaction** compared to full stick deflection (it is not 50% of control travel) - for models with normal control deflections, hence it being 'linear'. So, if you have the aircraft rolling at 360°/second (about right for precision aerobatics) with full stick deflection, moving the stick halfway should give a roll rate of 180°/second.

SUPPLEMENTAL MIXING (Only if available on the Tx)

10) This part is not essential for early trimming flights. However, whilst most radios come with some pre-set control mixes, for example Rudder » Aileron & Rudder » Elevator, you **MAY** need the mixes shown below - so now could be a good time to set them up ready to use.

- a) Throttle to Elevator
- b) Throttle to Rudder
- c) Throttle to Aileron

***Note 1:** These mixes are generally required because thrust lines are normally set at high(ish) power. Reducing power may result for example, in the model yawing as it approaches the stall/spin, perhaps it will consistently try & drop one wing on entering a spin too & if so, it is also likely to try & drop that wing as it approaches landing speed! Vertical downlines at the opposite end of the power spectrum to vertical climbs, unsurprisingly give different aircraft reactions due to the lower torque values.*

***Note 2:** If you have more than one aileron servo, you will probably need to set up the throttle/aileron mix of each servo fitted.*

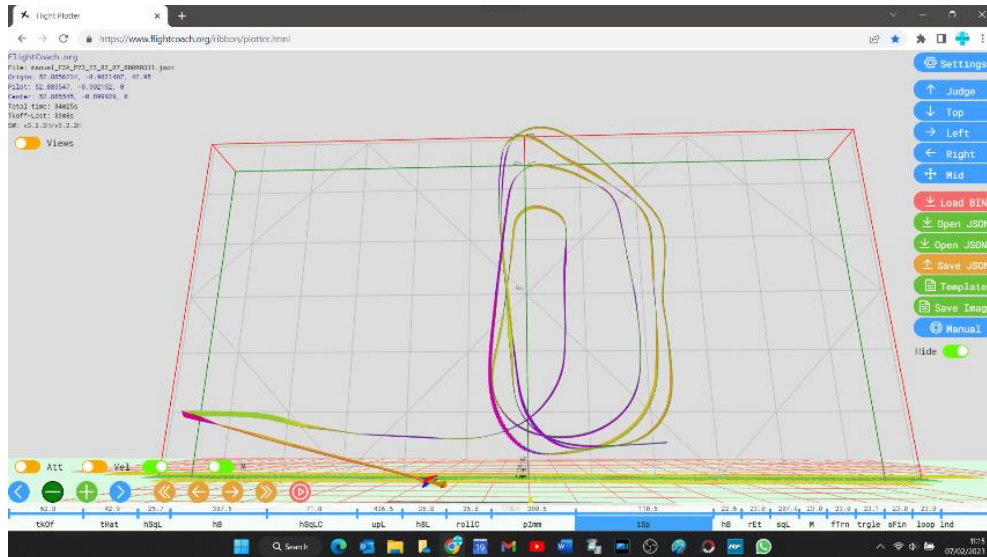
NEXT – SOME PLANNING FOR THOSE TRIMMING FLIGHTS

Trimming flights should be done in the order shown in the table in **Part 2** of this guide, that way the changes you make as you progress through the table will have the least impact on any previous adjustments. They are not in order of priority!

Trimming flights are best be carried out in reasonably calm/stable weather conditions. Make multiple checks before deciding on an adjustment & make the checks long enough to really see what is happening to the model.

Trimming requires a bit of dedication, patience... & airspace! For example, when checking vertical lines, my model may climb/descend through 1000'! (As shown on the data logger, where the red 'top of box' is at 994') & horizontal checks are even longer, typically 500 yds.

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Some of the check techniques do require a little bit of practice to ensure that you can get the maximum feedback & then make the correct trimming adjustment. Always ensure you are not moving any controls by mistake when doing the checks too!

Some of the checks listed in the trimming table (Part 2) have more than one check method. Generally, the first check shown is the easiest to fly or to observe, but it is not necessarily the most accurate. For best results, fly all of the checks listed.

In general, only make one trimming adjustment at a time and check the result thoroughly before making further adjustments or proceeding to the next step. This is especially important when making small 'final' adjustments.

NEVER accept 'near enough is good enough', for example the Throttle » Aileron mix on my Miss Wind biplane gives just ½ a degree of right aileron input - but that is just perfect for nice straight downlines...

Remember that if you change something like the propeller size/pitch, or even a throttle curve, you will probably need to do at least some retrimming for the new setup.

Of course, if you suddenly find you must strangely change a transmitter trim setting - it may indicate a new or developing problem with a control linkage, hinge, or a servo mounting etc.

Trimming should be checked at regular intervals, to keep your model in good flying order, especially if the model has been dormant for some time. There is no need to complete the entire trimming guide, but a few checks in the workshop followed a few long up & downlines for example, will usually give a good indication of how the model is performing.

Please now continue to Part 2!