

F3J / TD Setup for Taranis

Version: 1.00

***Mike Shellim
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1 Introduction

This is the second in a series of competition-level sailplane setups for the FrSky Taranis. The setup is designed for full-house thermal soaring gliders.

Key features

- For F3J/TD thermal soarers with 6 servos
- V- and X-tail versions provided
- Flight modes: Launch, T1(thermal), T2(cruise), T3(speed), and Landing

In-flight adjustments (for trimming and camber control)

- adjuster for launch preset
- adjuster for thermal camber
- adjuster for aileron diff
- adjuster for spoiler compensation
- adjuster for snapflap volume

Advanced mixing

- Aileron differential suppression
- Snapflap and reflex option in speed mode
- Spoiler compensation with multi-point curve
- Coupled ailerons and rudder ('combi')
- Mixers linked to flight modes

Other

- Full travel on flap servos (even if travel is asymmetric)
- Balancing curve for flaps ensures accurate tracking
- 'Calibration' mode for adjusting servo centres and limits
- Compatible with all versions of OpenTx

2 Pre-requisites

A good working knowledge of OpenTx is needed, including menu navigation and data entry. You'll also need to know how to transfer model setups to your transmitter using Companion9X. Please also read through this manual carefully before commencing.

3 Files provided

| Filename | Description |
|--------------------------|-------------------------------|
| f3j_100_instructions.pdf | this document |
| f3j_100_reference.xls | settings reference |
| f3j_100_setup.eepe | EEPROM image for Companion 9X |
| f3j_land.wav | Sound files for flight modes |
| f3j_laun.wav | |
| f3j_t1.wav | |
| f3j_t2.wav | |
| f3j_t3.wav | |
| F3j_cal.wav | |

4 Flight modes and mixers

There are five flight modes, selected via SA, SE, and throttle stick. In the event of a clash, Launch mode takes precedence, then Landing, then T1, T2 & T3.

| Flight Mode | OpenTx ID | Activated by | | Priority | Mixers active |
|-------------|-----------|---------------------|------|----------|------------------|
| LAUNCH | FM2 | SE ↑ or - | | High | camber |
| LANDING | FM3 | Throttle stick back | | Mid | crow |
| T1-Thermal | FM4 | SE ↓ | SB ↓ | Low | camber |
| T2-Normal | FM0 | | SB - | Low | - |
| T3-Speed | FM5 | | SB ↑ | Low | camber, snapflap |

5 Control assignments

Sticks are assigned according to stick mode (1 or 2). Secondary controls are assigned as follows:

| Control | Function | Flight mode |
|------------------|--|----------------------|
| Rudder trim | Aileron diff adjust (per flight mode) | <i>all</i> |
| Throttle trim | Spoiler compensation adjust Snapflap volume | LANDING T3(speed) |
| LS (left slider) | Thermal camber adjust | T1(thermal) |
| S2 (right knob) | Launch preset adjust | LAUNCH |
| Switch SF | Backlight | - |

6 Channel assignments

| Channel # | Vtail | Xtail |
|-----------|-------------|---------------|
| 1 | | Right aileron |
| 2 | | Left aileron |
| 3 | | Right flap |
| 4 | | Left flap |
| 5 | Right Vtail | Elevator |
| 6 | Left Vtail | Rudder |
| 7 | | [free] |
| 8 | | [free] |
| 9 | | [free] |

7 ‘Calibration’ mode

A special ‘CAL’ flight mode aids setting up servo limits and centres. When CAL mode is activated, the raw stick signal is passed directly to each servo, allowing the servo centres and limits to be visualised. To enable CAL:

1. Apply full left aileron and full up elevator, and hold
2. Pull SH
3. Release SH
4. Release stick(s)

The tx emits a beep every 5 seconds while CAL is enabled.
To exit CAL mode, pull SH.

8 Using Companion 9X

If you wish to try out the setup in Companion9X, then the following is recommended:

- For ease of navigation, check “Show channel names in mixers” in the main editing screen of C9X.
- The servo end points are conservatively set. If familiarising in C9X, go to the LIMITS menu and set *MAX* = 100 and *MIN* = -100 on all servo channels.

9 Overview of controls, mixes and adjustments

Before we go into the detail, here’s a quick run through of the main adjustments.

Control movements

- Travel and expo for Aileron, Elevator, and Rudder can be set per flight mode.

Trims

- The aileron trim can be set from any flight mode, and propagates to all other flight modes.
- The elevator trim is stored per flight mode.
- The rudder and throttle trims are reassigned to other functions (see below)

Camber presets

- Camber presets can be defined for Launch, T1-thermal and T3-speed flight modes.
- The Launch preset can be adjusted using knob S2. Adjustment range +/- 50%.
- The T1(thermal) preset can be adjusted via the left slider LS. Adjustment range +/- 50%.
- The T3(speed) preset is fixed. It will normally be set for reflex.

Spoiler compensation (spoiler to elevator mix)

- Spoiler compensation is used to trim out pitch changes when deploying spoiler.
- The amount of spoiler compensation can be adjusted during flight, via the Throttle trim.
- Non-linear compensation can be defined by editing a curve.

Differential

- Diff is applied to both ailerons and flaps.
- As is convention, 0% diff means equal up/down movement, 100% diff means zero down-movement.
- Diff is adjustable in-flight, using the rudder trim lever. The range of adjustment is 80% (trim fully left) to 0% (trim fully right). Think of the rudder trim as controlling roll rate.
- Diff settings are stored per flight mode.
- Aileron diff is automatically suppressed as spoiler is deployed. Flap diff is not affected by spoiler.

Combi Rudder

- Combi rudder (also known as coupled ailerons and rudder or “CAR”), introduces a yaw component into roll inputs.
- Combi is stored per flight mode.

Snapflap

- Snapflap (i.e. elevator to flap mixing) can optionally be set for T3(speed) mode.
- Snapflap may be adjusted in flight using the throttle trim lever.

Time delays

- For smooth transitions, a 0.4 sec fade-out period is set for Launch mode, and 0.5 sec fade-in/out for Landing mode (the fades can of course be changed).

Other mixers

The remaining mixers are described later in the setup instructions (§10.7).

10 Setting up the radio

Adjustments should be made in sequence, and tick boxes are provided for recording your progress.

10.1 Before you start

- ☐ Copy your choice of X- or V-tail model from the .EEPE file to your EEPROM, using Companion 9X.
- ☐ Copy the sound files to the /SOUNDS/{language} folder on the microSD card.
- ☐ IMPORTANT: do a hardware stick calibration on the tx (MENU long press, press PAGE x 7).
- ☐ Using the tx only, familiarise yourself with the flight modes. The name of the active flight mode is displayed on the main info screen.
- ☐ Check that you're getting voice confirmation on change of flight mode. If not, then check that the sound files were installed correctly (above).

10.2 Calibrate flap servos and set up spoiler

Let's start with the trickiest task - setting the direction, centre and end points of the flap servos. We'll use the special CAL flight mode for this. If you follow the steps to the letter you'll be rewarded with a linear, properly balanced setup which will make you the envy of your Futaba and JR toting friends!

10.2.1 Calibrate flap servos (CHs 3,4)

- ☐ Switch on the transmitter (don't switch on the receiver yet)
- ☐ Enable CAL flight mode (the transmitter should chirp every five seconds)
- ☐ Move throttle stick to centre
- ☐ Switch on the receiver. The flaps will settle between neutral and 30 degrees down
- ☐ Enter the *SERVOS* menu
- ☐ Check direction of the flap servos: Gradually move the throttle stick **forwards**. Both flaps should move **UP – yes, this is the reverse of the way spoiler will eventually work!!** If necessary reverse servo direction in *SERVOS* → *DIRECTION*. Ignore any 'invert throttle' warning.
- ☐ Set the end points for the flap servos. These are 'never exceed' positions, i.e. *the furthest the servos can travel before damaging the linkages*. Don't be too conservative with these adjustments, otherwise you'll restrict yourself later. These are the steps for each servo:
 - ☐ Move the throttle stick fully **forward**. The flaps will move **up**. Adjust *MAX* until the linkage starts to bind, then back off a little.
 - ☐ Move the throttle stick fully **back**. The flaps will move **down**. Adjust *MIN* until the linkage starts to bind, then back off a little.
- ☐ Readjust *MAX* and *MIN* so the **end points of the flaps match precisely**. In practice, you'll probably want to do this step concurrently with the previous step.
- ☐ Move the throttle stick forwards and back. You may notice that the movement of the flap is non-linear and probably don't track too well. We'll fix this in the next step.

- ☐ Adjust the servo centres. The goal of this step is to make the flaps move linearly with respect to the throttle stick, and to improve tracking. The adjustments in this step are done without visualising. For each flap servo, set *SUBTRIM* to the average of *MIN* and *MAX*. So, for example, if a servo has *MIN* = -80 and *MAX* = +20, then $SUBTRIM = (-80 + 20)/2 = -60/2 = -30$.
- ☐ Check that the flaps are now moving reasonably linearly with respect to the throttle stick.
- ☐ Now finalise the servo centres. Move the throttle stick to the centre (16 clicks from top or bottom). The flaps will probably not be quite in line (unless you're lucky!). No worries, just make a mental note of the *average* position. Now re-adjust *SUBTRIM* for each servo, so the flaps line up precisely at this position. (The flaps will not be in line with the trailing edge - we'll correct that later.)
- ☐ At this point, the flaps should match up perfectly with the throttle stick in 3 positions: fully forward, centre, and fully back. Check now.
- ☐ Move the throttle stick so the flaps are in line with the trailing edge. They will hopefully match up precisely. If not, you can adjust the balancing curve for the right flap (curve "RtFlpBal"). To do this, move throttle stick fully forward, then move back 8 clicks (25%). Now open the curves menu and adjust point 4 of the RtFlpBal curve. Only a small deviation should be needed.
- ☐ Double-check the tracking by moving the throttle stick back and forth once more.
- ☐ Exit CAL mode.

Not so bad, was it?!!

10.2.2 Set spoiler neutral and travel

Now that you've got your flap surfaces tracking nicely, setting up Spoiler is going to be a piece of cake!

- ☐ Enable T2 mode (throttle fully forward , switch SE in middle, switch SA in middle,).
- ☐ Enter the *MIXERS* menu. Scroll down to CH11 (FlapCm). Highlight the 'Splr' input, and open the mixer editing screen.
- ☐ While still in T2 mode, adjust *offset* so that the flaps go to the neutral position i.e. in line with the wing profile.
- ☐ Pull full back on the throttle stick to engage Landing mode and deploy full spoiler. Adjust *wt* for desired flap travel (don't worry about over-driving the servos - you've already calibrated the servos so they'll stop dead before doing any damage).
- ☐ Push forward on the throttle stick again. Adjust *offset* so that the flaps are in the neutral position.
- ☐ Keep adjusting *weight* and *offset*, alternating between T2 and Landing mode, until you have the movement required **and** the flaps go to neutral correctly with spoiler off.
- ☐ Exit the mixer editing menu.
- ☐ Check the transition between Landing and T2 modes. If the flaps jump suddenly as the transition point is reached, then the sticks almost certainly require calibration (§10.1). Carry out a stick calibration if necessary and start again.

10.3 Calibrate aileron servos (CHs 1, 2)

Relax - calibrating the aileron servos is going to be easy! Just one thing to note: during calibration, **both ailerons will move in the same direction** - this may look strange, but it will allow you to match up the ailerons very easily, by sighting down the fuselage.

- ☐ Enable CAL flight mode. The transmitter starts to chirp.
- ☐ Go to the *SERVOS* menu
- ☐ As you move the aileron stick to the right **both ailerons should move up together**. If necessary reverse the direction of the servo(s) in *DIRECTION* field.
- ☐ Adjust *SUBTRIM* for each servo, so ailerons line up with the trailing edge of the wing.
- ☐ Set the end points of the aileron servos. These will correspond to the 'never exceed' positions of the control surfaces, i.e. the furthest the ailerons can travel before damaging the linkages. Don't be too conservative with these adjustments; otherwise you'll restrict yourself later. For each servo:
 - ☐ Move the aileron stick fully to the **right**. The aileron moves **up**. Increase *MAX* until the linkage just start to bind, then back off slightly.
 - ☐ Move the aileron stick fully to the **left**. The aileron moves down. Decrease *MIN* until the linkage just start to bind, then back off slightly.
 - ☐ Re-adjust *MIN* and *MAX*, so that up- and down-travel are the same for both surfaces.
- ☐ Finally, equalise the travel on both ailerons, while still maintaining the equal up/down travel. Again, this may require backing off some adjustments.
- ☐ Check, and check again: remember, **equal up/down, and both sides match!!**

Exception: On some F3X models, the downward movement of the ailerons may be limited because of the hinge geometry. In such cases, it will not be possible to match the up/down movement without unnecessarily restricting upward movement. To get round this, **specify diff=+50 in the CAL mixer lines for each aileron**, then **adjust the down-movement to be 50% the up-movement**. The menu points for setting the calibration diff are as follows.

MIXER→CH01 (LtAil) →CAL→diff = 50

MIXER→CH02 (RtAil) →CAL→diff = 50

The diff you set here is **only to permit correct calibration**. Final diff will be set up using a separate procedure.

- ☐ Exit CAL mode.
- ☐ Enable T2 mode and check the ailerons move correctly. Don't worry that the aileron travel may be too much, you'll adjust that in §10.7.
- ☐ The downgoing aileron movement will be affected by the diff setting. If you like, you can quickly adjust this using the rudder trim (settings are per flight mode).

10.4 V-TAIL only -- Calibrate V-tail servos (CHs 5,6)

- ☐ Enable CAL mode. The transmitter starts to chirp.
- ☐ Calibrate the V-tail servos, following the same steps for the aileron servos (step 2 above), but with the following difference: Pushing **up** on the elevator stick, should result in **both surfaces moving UP** (yes, this is the opposite of normal operation!!). If either tail surface moves *down*, reverse its direction by setting *DIRECTION* to 'INV'.
- ☐ Exit CAL mode
- ☐ Check for correct operation of V-tail

10.5 X-tail only -- Calibrate Rudder (CH 5)

- ☐ Enable CAL mode. The transmitter starts to chirp.
- ☐ Go to the *SERVOS* menu
- ☐ Check the direction of the servo. As you move the rudder stick to the **right** the rudder should move to the **right**. If it moves to the *left*, reverse the direction of the servo by setting *DIRECTION* to 'INV'.
- ☐ Adjust *SUBTRIM* so that rudder centres correctly.
- ☐ Set the servo end points. These will correspond to the 'never exceed' positions of the rudder, i.e. the furthest the rudder can travel before damaging the linkage. These are the steps:
 - ☐ Move the rudder stick fully to the right, and increase *MAX* until the linkage just start to bind, and then back off slightly.
 - ☐ Move the rudder stick fully to the left, and adjust *MIN* so linkage just starts to bind. Back off slightly.
- ☐ Finally, equalise rudder movement left and right. You may need to back off either *MIN* or *MAX*.
- ☐ Exit CAL mode.
- ☐ Check for correct operation of the rudder

10.6 X-tail only -- Calibrate Elevator (CH 6)

- ☐ Enable CAL mode. The transmitter starts to chirp.
- ☐ Calibrate the Elevator servo, following the same steps as above for the rudder servo (step 3A), but with the following difference: **Pushing up on the elevator stick should result in the elevator servo moving UP** (yes, this is the opposite of normal operation!). If the elevator moves *down*, reverse its servo by setting *DIRECTION* to 'INV'.
- ☐ Exit CAL mode
- ☐ Check for correct operation of elevator

10.7 Adjust control travel and mixing... watch your model come to life!

| Control / mix | Adjustment point | Adjustment procedure |
|---|---|--|
| Travel and Expo for primary controls | | |
| <input type="checkbox"/> Aileron | STICK→Ail | Adjust ail travel and expo. Copy additional lines for specific flight modes if required. Each line should have the relevant flight mode(s) ticked. For the last line, tick all 8 flight modes (to catch any modes which may have been missed). |
| <input type="checkbox"/> Elevator | STICK→Ele | <i>As above</i> |
| <input type="checkbox"/> Rudder | STICK→Rud | <i>As above</i> |
| Mixes to WING SERVOS | | |
| <input type="checkbox"/> Aileron→flap | GLOBALVARS→GV5("Ail2FL") | <ol style="list-style-type: none"> 1. Open GlobalVars menu, highlight GV5("Ail2FL"). 2. Adjust aileron to flap mix as follows: <ul style="list-style-type: none"> -Enable LAUNCH mode, adjust GV5/FM2 -Enable T1 mode, adjust GV5/FM4 -Enable T2 mode, adjust GV5/FM0 -Enable T3 mode, adjust GV5/FM5 -Enable LANDING mode, adjust GV5/FM3 <p>Note: movement of downgoing flap will be affected by aileron diff setting.</p> |
| <input type="checkbox"/> Flap camber preset | GLOBALVARS→GV3("FlapCm") | <ol style="list-style-type: none"> 1. Ensure that both LS and S2 are in their centre positions. 2. Open GlobalVars menu, scroll down to GV3("FlapCm") <ul style="list-style-type: none"> -Enable LAUNCH mode, adjust GV3/FM2 -Enable T1-Thermal mode, adjust GV3/FM4 -Enable T3-Speed mode, adjust GV3/FM5 (you may wish to set some reflex for T3). |
| <input type="checkbox"/> Aileron camber preset | GLOBALVARS→GV4("AilCm") | As above, but adjust GV4("AilCm") instead of GV3. |
| <input type="checkbox"/> Snapflap | CH11 (FlapCm)→Snap CH10 (AilCm)→Snap | <p>Snapflap is active in T3-Speed mode, and adjustable via the throttle trim. Snapflap is set individually for flaps and ailerons.</p> <ol style="list-style-type: none"> 1. Select CH11->Snap mix and open editing menu 2. Enable T3 mode 3. Move throttle trim fully back (max snapflap). 4. Hold full up elevator 5. Adjust wt in mix for desired <i>maximum possible</i> snapflap 6. Close mixer editor 7. Repeat 1-6 for CH10->Snap mix. <p>Using throttle trim, adjust snapflap for initial flight setting.</p> |
| <input type="checkbox"/> Spoiler→Aileron | CH10 (AilCm) →SpoilO | <p>Sets the upward aileron movement due to spoiler.</p> <ol style="list-style-type: none"> 1. Enable LANDING mode 2. Move throttle stick back (full spoiler) 3. Adjust wt for required up-aileron movement |
| Mixes to ELEVATOR | | |
| <input type="checkbox"/> Spoiler→Ele compensation | Vtail: CH13(VeeCm)→Spcomp Xtail: CH05(Elev)→Spcomp | <p>Spoiler compensation is adjustable using the throttle trim. To set range of adjustment,</p> <ol style="list-style-type: none"> 1. Select mixer (see left), and open mixer editing menu 2. Enable LANDING mode. 3. Move throttle stick fully back (max spoiler) 4. Move throttle <i>trim</i> fully <i>forward</i> (max comp) 5. set wt for max compensation 6. Using throttle trim, adjust comp for initial flight setting <p>Note: For non-linear response, adjust curve 'SpoilerComp'.</p> |
| Mixes to RUDDER | | |
| <input type="checkbox"/> Combi rudder | CH18 (Combi) | <p>From the MIXERS menu, scroll down to CH18(Combi) mix. Set wt > 0 for these lines as required:</p> <ul style="list-style-type: none"> - LAUNCH: CombiLau - T1: CombiT1 - T2: CombiT2 - T3: CombiT3 - LANDING: CombiLan |

| Front-panel adjustments | | |
|---|----------------------------|---|
| <input type="checkbox"/> Aileron Diff | Rudder trim | Adjust ail diff for each flight mode. Default diff range is 0 - 80% (defined in CH15), trim centre corresponds to 40%. |
| <input type="checkbox"/> Spoiler→Ele compensation | Throttle trim | Adjusts spoiler compensation (LANDING mode only) |
| <input type="checkbox"/> Snapflap volume (T3) | Throttle trim | Adjust snapflap volume (T3 mode only) |
| <input type="checkbox"/> Launch camber | S2 | S2 provides +/- 50% adjustment of Launch preset |
| <input type="checkbox"/> Thermal (T1) camber | LS | LS provides +/- 50% adjustment of T1 preset |
| <input type="checkbox"/> Aileron, Elevator trim | Aileron and elevator trims | Trims are stored per flight mode |

11 Spoiler tweaks

Adjusting the deadband

Curve 4 “Thr2Sp” can be used to adjust the deadband at the top of the spoiler stick travel. The X-value of the middle point defines the transition point. Default is 85%, max recommended value is 95%.

Reversing spoiler direction

To reverse the direction of the spoiler, enable the “Throttle Reverse” option in the Model Setup menu.

12 OpenTx v. 2 tips

OpenTx v. 2 offers ‘pot position memory’, where the pot positions are remembered between sessions. In the Model Setup menu, enable pot position checks for S2 and LS. Specify “AUTO” option.

13 Pre-flight

Before flying with this setup for the first time, remember to:

- set the battery alarm threshold to suit your battery chemistry, for both the tx and rx.
- set the failsafe
- check for correct operation under all flight modes

14 Re-calibrating servos

Control surface neutrals may wander over time. Typical causes are temperature drift, damage to linkages etc. From time to time, enter ‘CAL’ mode and do a quick visual check of centres and tracking.

If the flaps don’t go to neutral correctly, check the servo calibration, then adjust the flap offset according to 10.2.2

15 Modifying the setup

If you wish to modify the setup, then please look carefully Excel file which contains the mixer schema and detailed notes. Plan and test your changes carefully. The recommended workflow is:

1. Set up your model according to these instructions
2. Backup your EEPROM
3. Apply your modifications, backing up with each step.

If you make a mistake with your modified setup, you can restore the EEPROM from a suitable point.

16 Disclaimer

Pretty obvious really, but worth repeating: you as pilot are responsible for the safety of your model. Make sure that the controls respond correctly under all conditions. I can't be held responsible for any bugs in the setup or documentation, so remember to test your setup thoroughly before flying!

17 Feedback

Do let me know how you get on with this setup - I'd love to hear of your experiences and any suggestions, whether to do with functionality or documentation. You can reach me at mike@rc-soar.com

Fly safely! – Mike Shellim