F3J / TD Setup for Taranis
Version 2.0

Setup Guide

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1   Introduction

The FrSky Taranis is a great radio for complex RC sailplanes. However creating your perfect setup can be daunting if you don't have the necessary skills in OpenTx. *F3J Setup for Taranis* enables regular pilots to enjoy a full-feature setup targeted specifically at F3J/TD models - without the hassle of programming from scratch.

With the help of the accompanying Settings Reference, users with moderate OpenTx skills can modify the setup for their own requirements.

Key features
  - For F3J/TD thermal soarers with 6 servos
  - V- and X-tail versions provided
  - Flight modes:
     Launch
     Zoom *[new in 2.0]*
     T1(thermal)
     T2(cruise)
     T3(speed)
     Landing

In-flight adjustments
  - 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
  - Reverse diff *[new in 2.0]*
  - Snapflap and reflex option in speed mode
  - Spoiler compensation with multi-point curve
  - Combi (coupled ailerons and rudder)
  - Mixers linked to flight modes

Other
  - Full travel on flap servos
  - Balancing curve for flaps ensures accurate tracking
  - 'Calibration' mode for adjusting servo centres and limits

2   Requirements

The following are required:

- FrSky Taranis transmitter flashed with OpenTx 2.x (see web site for recommended versions)
- OpenTx Companion software + USB cable.
- A good familiarity with OpenTx's menu navigation and data entry.

Please read through this Guide carefully at least once, before commencing!

3   Files provided

Filename	Description
f3j_20_SetupGuide.pdf	this document
f3j_20_SettingsRef.xls	settings reference
f3j_20n.eepe	EEPROM image for Companion 9X
f3j_land.wav	Sound files for flight modes
f3j_laun.wav	
F3j_zoom.wav	
f3j_t1.wav	
f3j_t2.wav	
f3j_t3.wav	
F3j_cal.wav	

4   Flight modes and mixers

Six flight modes are provided. Two are for the launch phase (Launch, Zoom), three for normal flight (T1, T2, T3) and one for Landing. Launch and Zoom modes take precedence, then Landing, and finally T1, T2 & T3.

Flight Mode	OpenTx ID	Activation		Priority	Mixers active
LAUNCH	FM2	SE ↓		High	Camber
ZOOM	FM3	SE −		High	
LANDING	FM4	SE↑, *throttle back*		Mid	Crow
T1-Thermal	FM5	SA ↓	SE ↑, *throttle forward*	Low	Camber
T2-Cruise	FM0	SA -		Low	
T3-Speed	FM6	SA ↑		Low	Camber, Snapflap

A special flight mode 'CAL' (FM1) is also provided for calibrating the control surfaces (see below).

5   Control assignments

Sticks are assigned according to Stick Mode setting in the Model Setup menu.
Secondary controls are assigned as follows:

Control	Function	Flight mode
Rudder trim	Aileron diff adjust (per flight mode)	*all*
Throttle trim	Spoiler compensation adjust	LANDING
	Snapflap volume	T3(speed)
Left slider LS	Thermal camber adjust	T1(thermal)
Right pot S2 (X9D) or F2 (X9E)	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 sounds a beep at 5 second intervals. To exit CAL mode, pull briefly on SH.

8 Overview of controls, mixes and adjustments

Before you set up your transmitter, let's run through the main features and adjustments:

Control movements
- Travel and expo for Aileron, Elevator, and Rudder may be stored per flight mode.

Trims
- Aileron trim setting is global across all flight modes
- Elevator trim is stored per flight mode
- Rudder and throttle trims are repurposed for other functions (see below)

Camber presets
- Camber presets may be defined for Launch, T1-thermal and T3-speed flight modes.
- The Launch preset is adjusted in flight using knob S2 (F2 on X9E). Adjustment range +/- 50% of nominal.
- The T1(thermal) camber is adjusted via the left slider LS. Adjustment range +/- 50% of nominal.
- The T3(speed) preset is fixed. It will normally be set for reflex.
- By default T2(cruise) mode has zero camber.

Spoiler compensation (spoiler to elevator mix)
- Spoiler compensation is used to trim out pitch changes when deploying full 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.

Reverse Differential
- Reverse differential (new in v. 2.0) increases the movement of the down-going aileron when aileron is applied while spoiler is deployed. This improves roll response when deploying spoiler (crow).

Combi Rudder
- Combi rudder (also known as coupled ailerons and rudder or "CAR"), mixes aileron to rudder.
- 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.

9   Setting up the radio

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

9.1   Preparing the transmitter

The first task is to prepare your transmitter's EEPROM and file system.

☐ Connect the Taranis to the computer via a USB cable and establish a connection via the bootloader.

☐ Copy the sound files to the /SOUNDS/{language} folder on the Taranis' SD card.

☐ Using OpenTx Companion
- o Open your working EEPROM ("Read Models and Settings from Radio" menu)
- o Open f3j_200.eepe from the "File Open" menu
- o Drag the X- or V- model to an empty slot in your working EPRROM
- o Close f3j_200.eepe
- o Right click the new model in your working EEPROM, and choose "Use as Default"
- o Write your modified EEPROM back to the tx "Write Models and Settings to Radio".
- o Close OpenTx Companion

☐ **IMPORTANT**: do a hardware stick calibration on your tx **now** by pressing [MENU long], [PAGE] x 7.

☐ **X9E Users only**: Go to the MIXERS menu, and using the mixer editor:
- o Scroll to **CH10** and highlight mix 'CmbAdj' (2nd line). Open mix editor, and set *Source* = 'LS'.
- o Repeat above for CH11

☐ Check for voice alerts on change of flight mode. If none, then check sound files are installed correctly.

☐ Using just the transmitter, familiarise with the flight modes. Use the voice alerts to guide you. At the end of this step, you should be confident with selecting:
- o LAUNCH, ZOOM, T1, T2, T3 and LANDING flight modes
- o CAL mode

9.2   Calibrate flap servos

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!

Note for users of OpenTx version 2.1: the 'SERVOS' menu in OpenTx version 2.0 is renamed 'OUTPUTS' in 2.1

9.2.1   Set rotation of flap servos

The first task is to set the direction of rotation of the flap servos

☐ Switch on the transmitter (don't switch on the receiver just yet).

☐ Enable the CAL flight mode. The tx should chirp every five seconds.

☐ Move throttle stick to centre.

☐ Switch on the receiver. The flaps will probably settle at between neutral and 30 degrees down.

☐ Enter the Servos menu.

☐ Check direction of flap servos: As you move the throttle stick **forwards,** both flaps should move **up**.

☐ If either flap moves down, then reverse the servo by highlighting the *Direction* column and pressing the Enter key once. Be careful not to press it twice otherwise the setting will revert. Ignore any "INVERT THROTTLE" warning.

9.2.2 Left flap calibration

Now calibrate **left flap**. The goal of this step is to set the servo end points and centre.

☐ Highlight the **LtFlap** line

☐ Move the throttle stick fully **forward**. The left flap will move **up**.

☐ Adjust *Max* until the linkage just starts to bind, then back off a little.

☐ Move the throttle stick fully **back.** The left flap will move **down**.

☐ Adjust *Min* until the linkage just starts to bind, then back off a little.

☐ Move the throttle stick forwards and back. The movement of the left flap will probably be non-linear as the stick is moved. We'll fix that in the next two steps.

☐ Now set the *Subtrim*. This adjustment is done without visualising - simply set *Subtrim* midway between *Min* and *Max*, i.e. *Subtrim = (Min + Max)/2.*
Example: if *Min* = –80 and *Max*=20, then set *Subtrim* = (–80 + 20)/2 = –60/2 = **–30**

☐ Starting with the throttle stick in the centre, move to one end point. Repeat to the other end point. The flap travel should be approximately equal each side. If it's severely unequal, readjust *Subtrim* so that movement is approximately either side of stick centre.

9.2.3 Right flap calibration

Now calibrate the **right flap.** This time, you'll use a 5-point curve to match the response with the left flap.

☐ Check that you're still in CAL mode, re-enter CAL mode if not.

☐ In the Servos menu, highlight the **RtFlap** line.

☐ Leave *Min*, *Max* and *Subtrim* at the defaults values (-100, 0, +100)

☐ Skip to the curve field ('**CV3')** and Press *long Enter*. The curve dialog will open. Adjust points as follows:
- move throttle **back**, adjust point **1** to match left flap exactly:
- move throttle to **25%**, adjust point **2**
- move throttle to **centre**, adjust point **3**
- move throttle to **75%** pos, adjust points **4**.
- move throttle **forward**, adjust point **5**

NOTE: to get flaps to match at extremes (points **1** & **5**), it may be necessary to reduce one or other end points for the left flap (see §9.2.2).
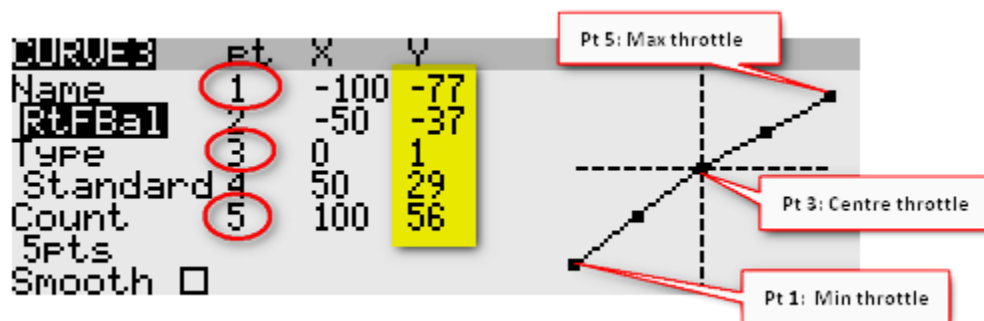
☐ The flaps should now match perfectly throughout the range of throttle stick travel. Check now. Don't worry that the flap neutral is floating - we'll fix that in the next section.

☐ Exit CAL mode.

9.3 Finalising the flaps

Time to (a) adjust the flap travel for spoiler and (b) adjust the flap neutral. For these tasks, we'll leave CAL mode and make some mixer adjustments.

☐ Select T2-CRUISE mode

☐ Ensure that the aileron trim is centred (trim positions are displayed on the main screen)

☐ Pull fully back on the spoiler stick. This activates LANDING mode.

☐ Enter the Mixer menu and scroll down to CH11 (FlapCm).

☐ Highlight the 'Splr' input, and open the mixer editor

☐ **Set the flap neutral**: Push the throttle stick **fully forward**. T2-CRUISE mode is automatically selected. (NOTE: there is a small amount of deadband at the top of stick travel. This is by design, and can be adjusted later.) Adjust the *offset* parameter so that the flaps go to the neutral position, i.e. in line with the wing profile.

☐ **Set the spoiler travel**: adjust the *wt* parameter. Start with say 80%. Don't worry about over-driving the servos - you've already calibrated the servos so they'll stop dead before doing any damage.

☐ Repeat the previous two steps, adjusting *wt* and *offset* repeatedly, until the movement is correct and the flaps go to neutral correctly. You may have to go through two or three iterations to reach the final setup.

☐ Exit the mixer editor.

☐ Move the throttle stick slowly around the transition point between T2-CRUISE and LANDING (indicated by the voice alert). The flaps should move smoothly across the transition. If the servos jump suddenly, then chances are that you did not calibrate your sticks, or did so incorrectly (§9.1). If necessary, calibrate your sticks again carefully, and the re-start the setup procedure.

9.4 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 will look strange, but 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 one or both servos by toggling the *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 the movement. For each servo:

   ☐ Move the aileron stick fully to the **right**. The aileron moves **up**. Increase *Max* until the linkage just starts to bind, then back off slightly.
   ☐ Move the aileron stick fully to the **left**. The aileron moves down. Decrease *Min* until the linkage just starts 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 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 for calibration*. Final diff will be set up using a separate procedure.

☐ Exit CAL mode.

☐ Enable T2-CRUISE mode and check the ailerons move correctly. Don't worry that the aileron travel is excessive, you'll adjust that in §9.8.

☐ The down-going 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).

9.5   *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, but with the following difference: Pushing **forwards** on the elevator stick should cause **both V surfaces to move *UP* (i.e. the opposite of normal operation!!)**. If necessary*,* reverse the direction of one/both servos by toggling their *Direction* field.

☐ Exit CAL mode

☐ Check for normal operation of V-tail. Don't worry if movements are excessive.

9.6 *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 toggling the *Direction* field.

☐ 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. Don't worry if movement is excessive.

9.7 *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 forward on the elevator stick should result in the elevator moving UP (i.e. the opposite of normal operation!)** If the elevator moves *down,* reverse the servo by toggling the *Direction* field.

☐ Exit CAL mode

☐ Check for correct operation of elevator. Don't worry if movement seems excessive.

9.8 Adjust control travel and mixing… watch your model come to life!

Control / mix	Adjustment point	Adjustment procedure
☐ Aileron travel	INPUTS→Ail	Set the travel and expo of the ailerons. How it works: each Input line defines a rate/expo for one or more flight modes. OpenTx skips through the lines and stops at the first line in which the current flight mode is ticked. NOTE: If no matching flight mode is found, the control will not operate at all. It's good practice therefore for the last line to be a 'catchall' with all 8 flight modes ticked in case a flight mode is missed in the lines above. *Key to flight mode numbers:* FM0:T2 FM1: *[CAL, no specific INPUTS line required]* FM2: LAUNCH FM3: ZOOM FM4:LANDING FM5:T1 FM6:T3 NOTE ensure *Diff* is set to zero in all lines (diff here affects stick diff, not servo diff).
☐ Elevator travel	INPUTS→Ele	*As above*
☐ Rudder travel	INPUTS→Rud	*As above*
☐ Aileron→flap	GLOBALVARS→GV5("Ail2FL")	Aileron to flap mixing is set per flight mode. 1. Open GlobalVars menu, highlight GV5("Ail2FL"). 2. Adjust aileron to flap mix as follows: -Enable LAUNCH mode, adjust GV5/FM2 -Enable ZOOM mode, adjust GV5/FM3 -Enable T1 mode, adjust GV5/FM5 -Enable T2 mode, adjust GV5/FM0 -Enable T3 mode, adjust GV5/FM6 -Enable LANDING mode, adjust GV5/FM4 Note: movement of down-going flap will be affected by diff setting (varied via rudder trim).
☐ Camber presets	GLOBALVARS→GV3("FlapCm") GLOBALVARS→GV4("AilCm")	Camber presets are set separately for ailerons and flaps. In T1 mode, overall camber can be tuned in flight via LS In Launch mode, overall camber can be tuned via S2 (or F2 if using X9E). In Speed mode, reflex camber can be hard programmed. Set up as follows: 1. Rotate LS and S2/F2 to their centre positions. 2. Open GlobalVars menu, scroll down to GV3("FlapCm") -Enable LAUNCH mode, adjust GV3/FM2 -Enable T1-Thermal mode, adjust GV3/FM5 -Enable T3-Speed mode, adjust GV3/FM6 (you may wish to set some reflex here). Now, repeat steps above, but using **GV4("AilCm")** instead of GV3.

☐ Snapflap	CH11 (FlapCm)→Snap CH10 (AilCm)→Snap	Snapflap is active in T3-Speed mode, and set individually for flaps and ailerons. Adjustable in flight using throttle trim. 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* for desired max limit of adjustment 6. Close mixer editor 7. Repeat 1-6 for CH10->Snap mix. Using throttle trim, adjust snapflap for initial flight setting.
☐ Spoiler→Aileron	CH10 (AilCm) →Spoilr	Sets the upward aileron movement due to spoiler. 1. Enable LANDING mode 2. Move throttle stick back (full spoiler) 3. Adjust *wt* for required up-aileron movement
☐ Spoiler→Ele compensation	GLOBALVARS→GV8("Comp")	Spoiler compensation is adjustable using the throttle trim. To max limit of adjustment, 1. Open GlobalVars menu, highlight GV8/FM4 2. Enable LANDING mode. 3. Move throttle stick fully back (max spoiler) 4. Move throttle *trim* fully *forward* (max comp) 5. Set limit of compensation by adjusting GV8 6. Using throttle trim, adjust comp for initial flight setting Note: For non-linear response, adjust curve 'SpComp'.
☐ Combi rudder	GLOBALVARS→GV7("Combi")	Combi can be set per flight mode. 1. Open GlobalVars menu, highlight GV7("Combi"). 2. Adjust aileron to flap mix as follows: -Enable LAUNCH mode, adjust GV7/FM2 -Enable ZOOM mode, adjust GV7/FM3 -Enable T1 mode, adjust GV7/FM5 -Enable T2 mode, adjust GV7/FM0 -Enable T3 mode, adjust GV7/FM6 -Enable LANDING mode, adjust GV7/FM4
☐ Reverse Differential	GLOBALVARS→GV6("RevDif")	Increases travel of down-going aileron when full spoiler is applied, in order to improve roll response. To set this up: 1. Open GlobalVars menu, highlight GV6/FM4 2. Enable Landing mode 3. Apply full spoiler and full aileron 4. Increase GV6 until the lower aileron is at the desired position. NOTE: this measure for improving roll response is in addition to aileron diff suppression, which is automatically applied.

9.9 In flight adjustments

A summary of the adjustments you can apply in flight:

Control / mix	Adjustment point	Adjustment procedure
☐ Aileron Diff	Rudder trim	Adjust ail diff for each flight mode. Default diff range is 0 - 80% (defined in curve 5 'DifRng').
☐ Spoiler→Ele compensation	Throttle trim	Adjusts spoiler compensation (LANDING mode only)
☐ Snapflap volume (T3)	Throttle trim	Adjust snapflap volume (T3 mode only)
☐ Launch camber	S2 (9XD), or F2 (X9E)	Provides +/- 50% adjustment of Launch preset
☐ Thermal (T1) camber	LS	Provides +/- 50% adjustment of T1 preset
☐ Aileron, Elevator trim	Aileron and elevator trims	Trims are stored per flight mode

10 Simple modifications

10.1 Adjusting throttle stick deadband
To adjust spoiler stick deadband edit Curve 4 "Thr2Sp". The X-value of the middle point defines the transition point. Max recommended value is 95%.

10.2 Reversing spoiler direction
To reverse the direction of the spoiler, enable the "Throttle Reverse" option in the Model Setup menu.

10.3 Disabling 'Zoom' flight mode
The 'Zoom' flight mode is new in version 2.0 and was introduced in response to requests from users. It's intended to be used for the second phase of the tow. For sport flying, you can disable ZOOM mode as follows:

1. Open the Flight Modes menu
2. Highlight the ZOOM flight mode line
3. Change the switch setting from 'SE–' to '---'

11 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

12 Re-calibrating servos

Control surface neutrals may wander over time due to 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 neutrals are incorrect, check the servo calibration then adjust the flap offset according to §9.3.

13 Modifying the setup

If you wish to modify the setup, please study the Settings Reference first. The recommended workflow is:

1. Set up your model according to these instructions
2. Backup your EEPROM
3. Apply your modifications, test and back up after each change.

14 Safety

Pretty obvious really, but worth repeating: you are responsible for the safety of your own model. I will not be held responsible for consequences arising from any errors in the setup or documentation. Make sure that the controls respond correctly under all conditions and...

... remember to test your setup thoroughly before flying!

Feedback and suggestions gratefully received. You can reach me at *mike@rc-soar.com*

Fly safely! – Mike Shellim