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"Bixler" 6 Servo Taranis Configuration

This guide and the associated downloads are provided with absolutely no warranty what so ever. You need to check that it all works for yourself and your situation.

Revision	Author	Notes
07.06.14	Sean Cull	Draft for comments

1. Introduction

This guide shows how you can set up a 6 servo model such as a Bixler with the FRSky Taranis with version 1[1] of OpenTx.

The features include Flaps, Opposing Aileron / Flaps as Spoilers (Crow), Trainer Mode with and without student throttle, High, Medium and Low Rates with Expo and a motor safety switch.

This manual is as much for me as it is for you. I am a relative novice in R/C having picked up the hobby again after a gap of 25 years. Please let me know if there are better ways of doing things – seriously ! My email is sean@seancull.co.uk
Note that there are some links in the Appendix about getting started with the Taranis if you are new to it.

You will find it much easier to use the Companion 9X to program the Taranis rather than using the Taranis screen. You can also use it to upload my configuration file /Eprom

You can download the associated Eprom and the latest copy of this guide at http://www.seancull.co.uk/taranis.

2. What I wanted to achieve

I am an Engineer. I love messing about with things to see what happens to them. I am also a dad and enjoy teaching my kids to fly R/C. My son has a 6 servo Bixler and I love just messing about with it.

I wanted :

⇨ A Motor Safety Switch

⇨ A trainer function so that I could connect the Taranis to another buddy box via a buddy / trainer lead. I wanted to have two modes – a partial mode where I retained throttle control and a full mode where I could pass across all 4

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[1] Version 2.0 has just been released so check http://www.seancull.co.uk/taranis for a new version soon.

primary functions.

⇨ High, Medium and Low Rates with Expo

⇨ Rudder and Aileron mixing to smooth out turns

⇨ Flaps with elevator compensation

⇨ Spoilers / Air Brakes / Opposing Ailerons and Flaps or Crow as the glider folks call it. Also requiring elevator compensation

⇨ Reflex – positioning the flaps in a slightly up position – supposedly makes for more speed – I just like experimenting

⇨ A basic "panic mode" that removes all mixes

⇨ Dangerous functions such as flaps or spoilers should have repeating warnings to remind you they are active.

⇨ Occasional functions should have a once off voice alert to remind you what they are – e.g. the partial trainer mode selection.

3. Channels

These are the channels outputs as they appear on the receiver

Channel	Function	Inputs
1	Throttle	
2	Aileron – Left	Aileron Stick Virtual Spoiler Channel
3	Elevator	Elevator Stick Virtual Spoiler Channel for Compensation
4	Rudder	Rudder Stick Aileron Channel for mixing
5	Aileron – Right	Aileron Stick Virtual Spoiler Channel
6	Flap Left	Virtual Flap Channel Virtual Spoiler Channel
7	Flap Right	Virtual Flap Channel Virtual Spoiler Channel
8		
9		
10		
11	Virtual Flaps Channel	Rotary Switch S1

12	Virtual Spoiler Channel	Switch SA
		Right Slider (RS)
		Switch SB

4. Controls Overview

This guide is for a Mode 2 (throttle left) configuration

4.1. Throttle Safety Switch SE
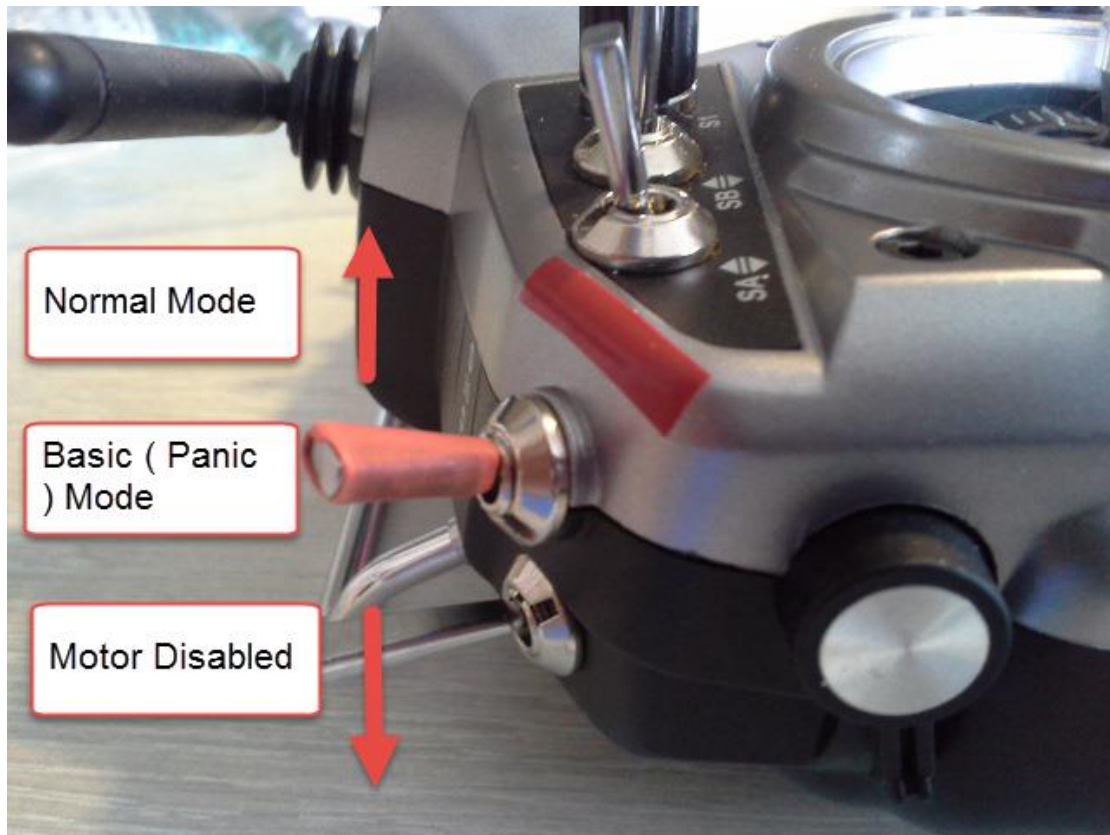
I firmly believe that every electric model should have a Throttle Safety Switch. Electric motors are more dangerous than nitro engines in many respects. This is especially important if kids are retrieving the plan after landing.

I have some red shrink wrap in the "SE" switch and some red tape on the tx body indicating that when the switch is up the motor is armed.

There is a verbal warning as you engage and disable this feature.

Switch SE Position

SE ↑	Motor Safety Engaged – no power
SE -	Basic (Panic) Mode – see later
SE ↓	Motor Armed

Moving the switch also causes a voice message via Custom Functions

4.2. Basic (Panic) Mode SE

I sometimes find that I can get confused when I am messing about with the model and different modes so I always have a basic mode with no mixes that I can drop into if I am flustered. Hitting this switch guarantees that there is nothing clever happening to the model. As an example if the model is behaving strangely and you are not sure if you have left the flaps on.

Switch SE ↑ is Throttle Safety On
Switch SE - is Baisc (Panic) Mode
Switch SE ↓ is Normal Mode

Switch SE Position	
SE ↑	Motor Safety Engaged – no power
SE -	Basic (Panic) Mode – see later
SE ↓	Motor Armed

A custom function activates a voice message basic mode

4.3. Flaps Switch SA

Switch SA controls the flaps. It has 3 positions, up, half flaps and full flaps.

Switch SA Position	
SA ↑	Flaps up
SA -	Half Flaps
SA ↓	Full Flaps

The configuration of the Flaps is discussed later in more detail later.

4.4. Spoiler / Crow Switch SB

Spoilers or Crow is the opposed raising of the ailerons while dropping the flaps to create a speed brake effect. See this article for more explanation - http://www.rc-airplane-world.com/rc-glider-wing-setups.html

Image from http://www.rc-airplane-world.com/rc-glider-wing-setups.html

Switch SB controls the Spoilers. The spoilers drop the flaps and raise the ailerons in an opposing fashion to create drag. This is commonly known as "crow". The switch has 3 positions, up, half spoilers and full spoilers.
Elevator Compensation is via the throttle trim.

Switch SB Position	
SB ↑	No Spoilers
SB -	Half Spoilers
SB ↓	Full Spoilers

The configuration of the Spoilers is discussed later in more detail later.

4.5. Spoiler Slider RS

The spoilers can also be deployed via the Right Hand Slider (RS).

Switch RS Position	
RS ↑	No Spoilers
RS intermediate	Proportional Spoilers
RS ↓	Full Spoilers

The configuration of the Spoilers is discussed later in more detail later.

4.6. Flaps / Reflex Knob S1

Reflex is raising the flaps (and ailerons ?) into a slightly raised position to modify the camber of the wing. It is used in R/C gliders to improve speed.

In order to experiment with this I have added control of the flaps in a both up and down direction onto know S1. In its mid position the flaps are neutral. To the left the flaps go up and to the right they go down.

Switch S1 Position	
Anti- Clockwise	Proportional Reflex (Raised flaps)
Mid Point	No flaps
Clockwise	Proportional Flaps

4.7. Trainer mode SG + SH

Note that there are separate configuration steps to enable the use of a trainer / buddy lead. These can be found in the main transmitter set-up manual. I will write a guide for this at some point as there is not a lot published on it.

Once the above is configured switch SG can be used to set the trainer mode and then holding switch SH passes control to the buddy box.

In Full Trainer Mode Throttle, Ailerons, Rudder and Elevator are passed over.

In Partial Trainer Mode the instructor retains control of the throttle

Switch SG Position	
SG ↑	
SG - + SH held	Partial Trainer Mode (Instructor has throttle)
SG ↓ + SH held	Full Trainer Mode

4.8. Throttle Stick

The Throttle Stick is used for the throttle (not spoilers)

4.9. Throttle Trim

The Throttle trim is used to adjust the spoiler and flaps elevator compensation

4.10. Rudder Stick

The rudder stick is just used for the rudder

4.11. Aileron Stick

The aileron stick is used for the ailerons and also feeds into the rudder channel to add some rudder to the aileron turns.

4.12. Elevator Stick

The elevator stick is used for the elevators. The elevators also receive inputs for flap and spoiler compensation settings.

5. Flap / Reflex Configuration

The Bixler has a servo for each flap. This configuration uses a single virtual channel (11) to drive the flaps. Virtual Channel 11 is subsequently mixed into real channels 6 and 7 to make the flaps move.

Using a virtual channel makes it simpler to understand the flap logic and to make adjustments.

For example the speed of the flaps or the position of "half flaps" can all be controlled in one place ie. Channel 11.

Also as Channel 11 represents the flap movement it can be used to dial in elevator compensation by mixing it into the elevator channel.

Reflex is where the flaps are moved upwards above the wing to change its profile.

Image from http://www.rc-airplane-world.com/rc-glider-wing-setups.html

See Channel 11 for more detail.

6. Spoiler Configuration

When the Spoilers are deployed the ailerons and flaps are moved in opposing fashion. i.e. the ailerons are raised and the flaps are dropped. This is often known as crow in r/c gliding.

Using a virtual channel (12) simplifies how the spoilers are configured in a similar fashion to the flaps above.

See Channel 12 for more detail.

7. Flap and Spoiler Elevator Compensation

Applying flaps or spoilers causes the model trim to change. This can be minimised by adding some automated elevator compensation which is proportional to the amount of flap or spoilers applied.

This is configured by mixing in a percentage of the virtual flap channel (12) and spoiler channel (12) .

So if the percentage was 100% then applying 100% flap would apply 100% elevator. If the percentage was 0% then no compensation would be applied.

If the percentage is negative then movement is in the opposite direction.

The actual percentage is bound to the value of global variables GV1 and GV2. These are initially zero but as you apply the throttle trim in flap or spoiler mode (but not both) the values of GV1 and GV2 are adjusted up or down including negative values.

So if I deploy the flaps fully and apply 2 click of down trim on the throttle trim switch then in my case 8% of down elevator will be applied. If I move to half flap then 4% of elevator will be applied. When I lift the flaps zero elevator compensation will be applied.

The nice thing about using a trim switch is that the value of GV1 and GV2 will be remembered between flights as the Taranis will remember the last used trim settings.

The mapping of the throttle trim to GV1 and GV2 is via Custom Functions 19 and 4 respectively.

In order to use the same throttle trim for both flap and spoiler compensation Custom Switches 6 and 7 are used together to ensure that the flap compensation can only be adjusted when only the flaps are deployed and the spoiler compensation only when just the spoilers are deployed.

If both spoilers and flaps are deployed both sets of compensation will be active but neither can be adjusted.

8. Curves

Curves allow the signals from the sticks and switches to be manipulated. For example curve 1 below introduces a dead spot where the rotary slider has no affect close to the mid point.

8.1. Curve 1 – Flaps / Reflex rotary switch

This curve is used for rotary switch S1 to control the flaps. It has a deliberate flat spot so that any minor calibration errors on the switch do not cause the verbal warning to sound.
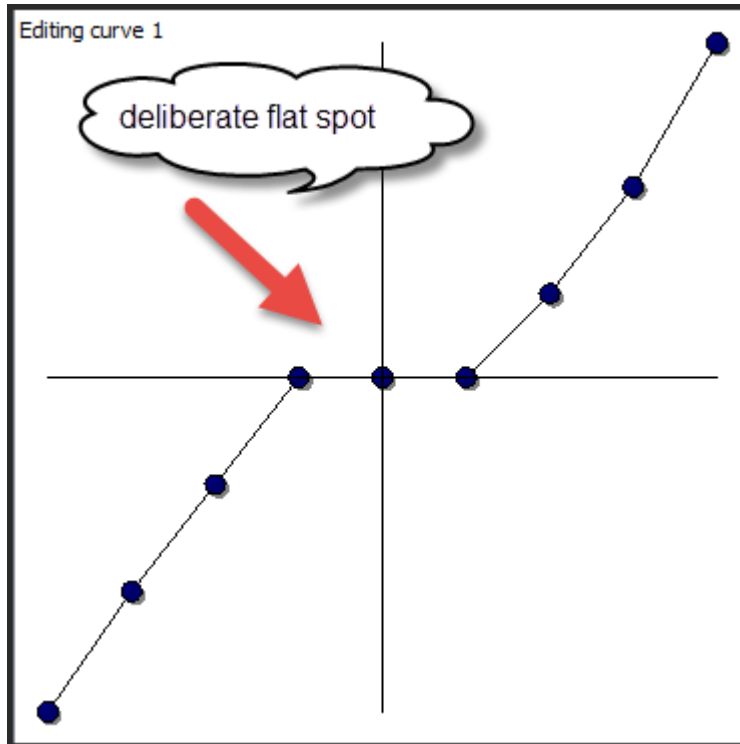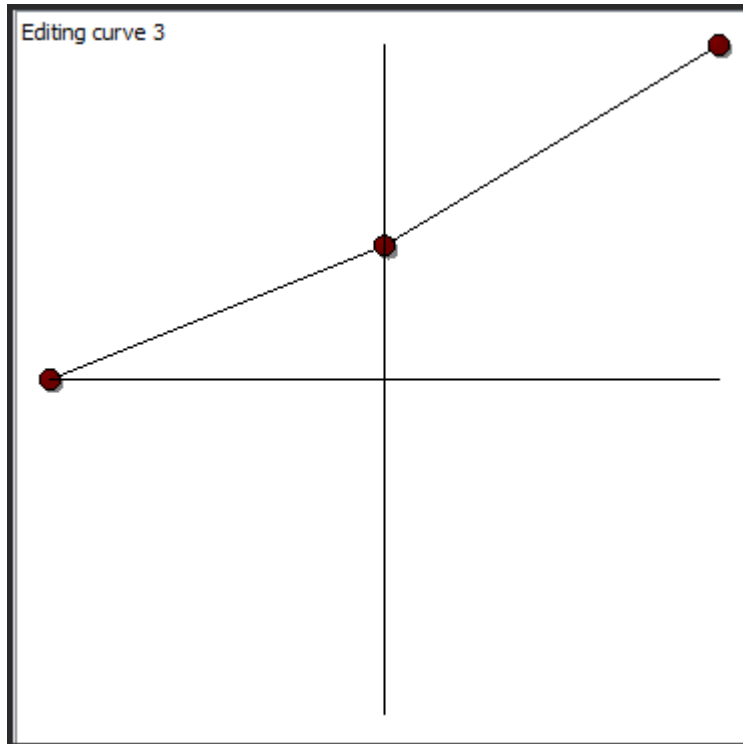
8.2. Curve 2 – Spoilers on Right Hand Slider

This curve causes the spoiler channel to activate the flaps and ailerons in an opposing fashion as the right hand slider is rotated. It looks the wrong way around but it works fine.

Editing curve 2
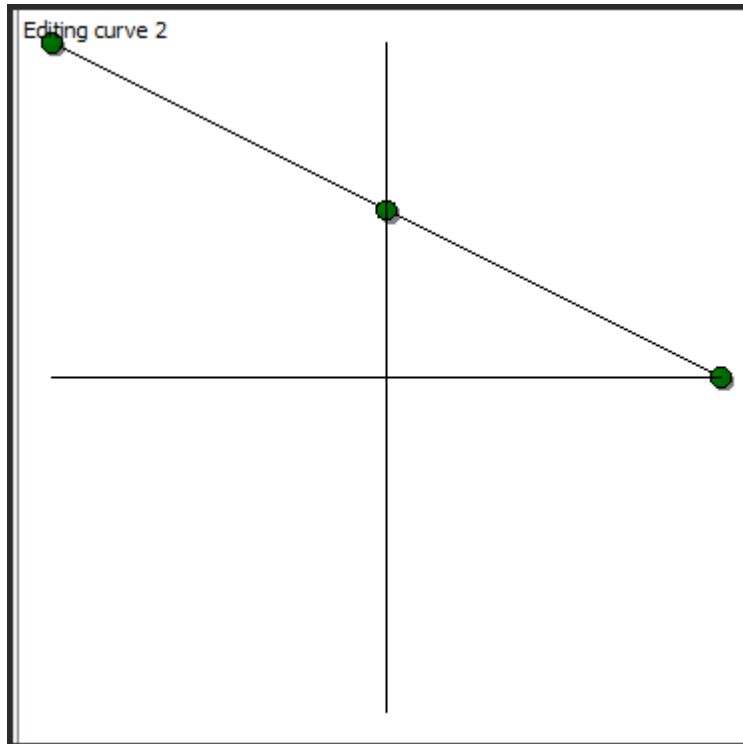
8.3. Curve 3 – Flaps on Switch SA

This curve is used to activate the flaps on the 3 position switche.
The choice of midpoint is a personal preference based on the configuration of your servos.

Editing curve 3

8.4. Curve 4 – Spoilers on Switch SB

This curve is used to activate the spoilers on the 3 position switch.
The choice of midpoint is a personal preference based on the configuration of your servos.

Separating Spoilers and Flaps onto 2 curves allows better flexibility.

Editing curve 4
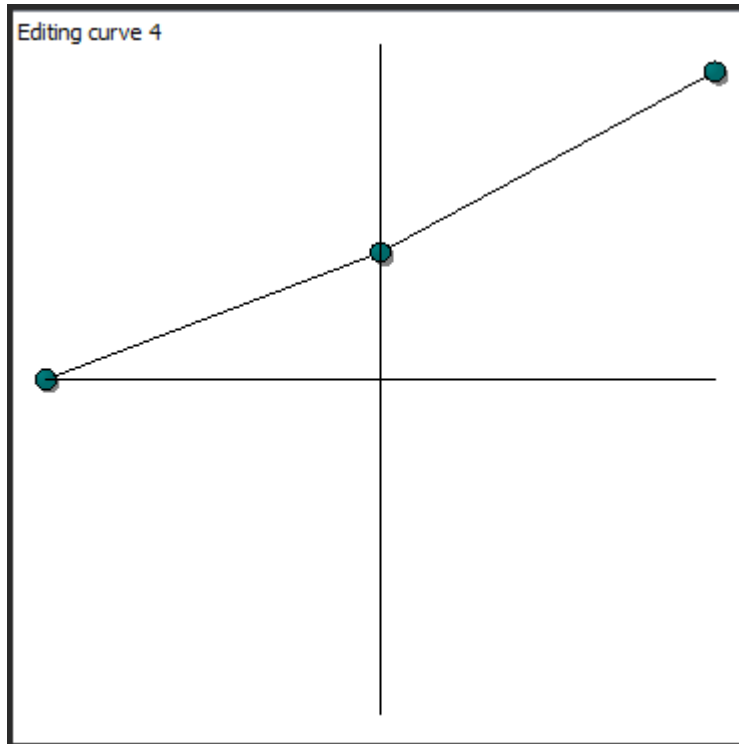
9. Custom Switches

Custom Switches are virtual switches which can be programmed based on multiple inputs.

Custom Switch	Function	Inputs
CS1	Flaps Down	Virtual Flap channel (11) > 10 %
CS2	Reflex	Virtual Flap channel (11) < -10 %
CS3	Spoilers Deployed	Virtual Spoiler Channel (12) > 10 %
CS4	Full Trainer Mode in use	SG ↓ + SH held
CS5	Partial Trainer Mode in use	SG - + SH held
CS6	Only Flaps no Spoilers Interlock for adding trim	CS1 AND !CS3
CS7	Only Spoilers no Flaps Interlock for adding trim	!CS1 AND CS3

10. Custom Functions

Custom Function	Input	Output / Action
CF1	CS1 (Flaps Down)	Voice : Flaps Down
CF2	CS2 (Flex Active)	Voice : Flex Active
CF3	CS4	Full Trainer Mode
CF4	CS7 (Spoilers only)	Adjust GV1 via T Trim
CF5	CS3 (Spoilers Active)	Voice : Spoilers Active
CF6	SE ↑	Throttle Safety Switch
CF7	SE ↑	Voice : Engine Disabled
CF8	SD ↑	Voice : High Rates
CF9	SD -	Voice : Medium Rates
CF10	SD ↓	Voice : Low Rates
CF11	SE ↓	Voice ; Engine On
CF12	CS5	Trainer Rudder Active
CF13	CS5	Trainer Elevator Active
CF14	CS5	Trainer Aileron Active
CF15	SG ↓	Voice : Full Trainer Mode
CF16	SG -	Voice : Part Trainer Mode
CF17	SE -	Voice : Basic (Panic) Mode
CF18	SE ↓	Voice : Normal Mode
CF19	CS6 (Flaps Only)	Adjust GV2 via T Trim

11. Mixes

11.1. Channel 1 – Throttle

Simple mix but with trim disabled as the trim is used for Spoiler and Flaps compensation.

11.2. Channel 2 – Aileron Left

The left aileron has two inputs.

⇨ Aileron Stick – simple 100% mix
⇨ Virtual Spoiler Channel – negative 75% mix from Channel 12

11.3. Channel 3 Elevator

The Elevator has 3 inputs

⇨ Elevator Stick – simple 100% mix

⇨ Spoiler Elevator Compensation – The rate of compensation is linked directly to the spoiler channel BUT the weight of compensation is controlled by the global variable GV1 which is in turn adjusted by the throttle trim when the Spoilers _alone_ are active. Custom Switch 7 determines if this is the case

So if GV1 is 100% the compensation is huge and if it is 0% it is nothing. Note that you can see the current GV values on one of the screens on the Tx.

⇨ Flap Elevator Compensation – The rate of compensation is linked directly to the flap channel BUT the weight of compensation is controlled by the global variable GV2 which is in turn adjusted by the throttle trim when the Flaps _alone_ are active. Custom Switch 7 determines if this is the case

So if GV1 is 100% the compensation is huge and if it is 0% it is nothing. Note that you can see the current GV values on one of the screens on the Tx.

11.4. Channel 4 – Rudder

The rudder has 2 inputs :

⇨ Simple mix for rudder stick

⇨ Aileron Stick mixed at @ 30%
This adds rudder to aileron turns to smooth them out.

11.5. Channel 5 – Aileron Right

⇨ As per Aileron Left but with a negative weight

11.6. Channel 6 – Flaps Left

The flaps have 2 inputs :

⇨ Virtual Flap Channel 11

⇨ Virtual Spoilers Channel 12

11.7.   Channel 6 – Flaps Right

As per Flaps Left but negative weight

11.8.   Channel 11 – Virtual Flaps Channel

This channel has 2 inputs, a rotary switch and a 3 position switch.
These are independent and are additive.

Note that elevator compensation is adjusted via the throttle trim but only when the flaps are in use without the spoiler in use
The rotary switch curve (1) has a deliberate dead spot in the middle

⇨ Rotary Switch S1 via Curve 1

⇨ 3 Position Switch SA via Curve 3

This mix includes a 1 second delay for deploying flaps but zero delay for lifting them. The idea being that you can lift the lowered flaps quickly just before you land to prevent damage.

11.9.   Channel 12 – Virtual Spoiler Channel

This channel has 2 inputs, a rotary switch and a 3 position switch.
These are independent and are additive.

Note that elevator compensation is adjusted via the throttle trim but only when the spoilers are in use without the flaps in use.

⇨ Rotary Switch S1 via Curve 2

⇨ 3 Position Switch SA via Curve 4

This mix includes a 1 second delay for deploying spoilers but zero delay for lifting them. The idea being that you can lift the lowered spoilers quickly just before you land to prevent damage.

11.10.   Channel 15 – Read Only Display Global Variable 1 (GV1)

Displays the value of GV1 for troubleshooting[2]

Channel 16 – Read Only Display Global Variable 1 (GV1)

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[2] Note the simulator does not work properly with GVs

11.11. Displays the value of GV2 for troubleshooting

12. Sticks (Rates and Expo)

The sticks menu is used to modify the characteristics of the sticks.

This is used to provide the "Dual Rates" functionality – in this case, Hight, Medium and Low Rates.
The rates modify the total movement of the control surfaces and the "Expo".
Expo or Exponential is the ability to make the sticks less sensitive in the middle but still give full throws at the end of the stick travel.

Scott Pages's tutorial - https://www.youtube.com/watch?v=iqMzZ-XBgTM

12.1. Rudder

There are 3 lines, one for each set of rates

Switch	Rate	Weight	Expo
SD ↑	High	100%	40%
SD -	Medium	75%	40%
SD ↓	Low	50%	40%

12.2. Elevator

Switch	Rate	Weight	Expo
SD ↑	High	100%	40%
SD -	Medium	75%	40%
SD ↓	Low	50%	40%

12.3. Throttle

No adjustments

12.4. Aileron

Switch	Rate	Weight	Expo
SD ↑	High	100%	40%
SD -	Medium	75%	40%

| SD ↓ | Low | 50% | 40% |

13. Voices

The zip file for the download includes some custom wav files. These need to be added to the folder shown below (this example is for English)

aspoilact.wav
abasic.wav
afulltrain.wav
anormal.wav
aparttrain.wav
arates_h.wav
arates_l.wav
arates_m.wav
areflex.wav
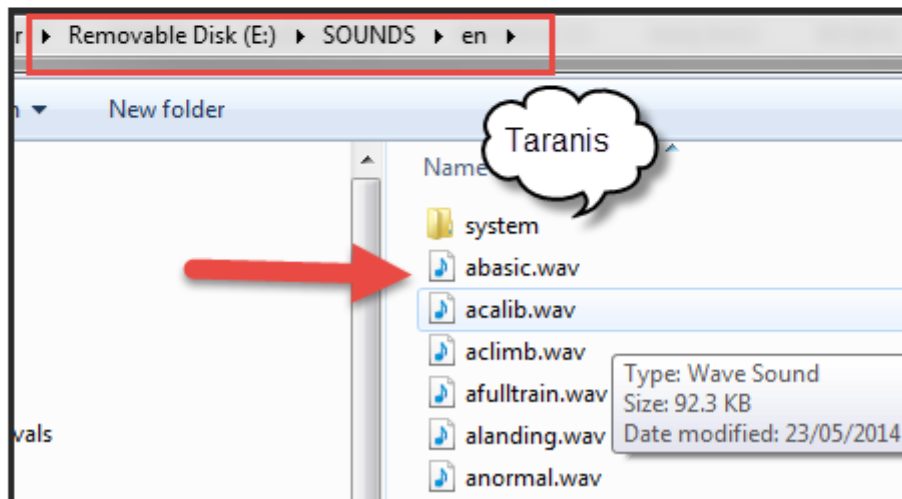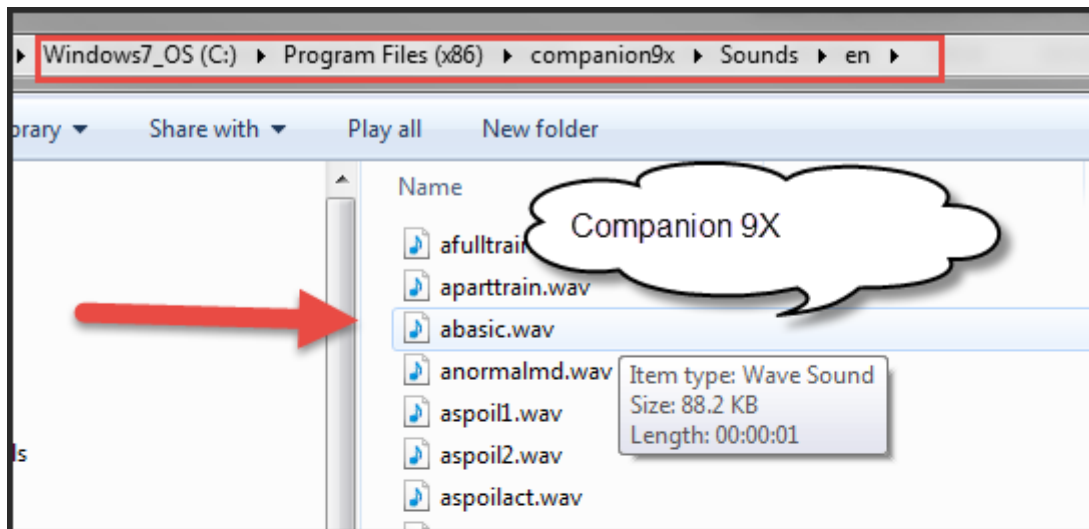
The wav files were created by :

⇨ Creating and mp3 here => http://www.fromtexttospeech.com/

⇨ Converting it to wav (32000 Hz) using Audacity - http://audacity.sourceforge.net/

14. Appendix – Setting up your model

⇨ Ensure your transmitter sticks and rotary

⇨ Plug in the servos to the correct channels

⇨ Mechanically centre the control surgaces as best you can. Try to avoid over reliance on the subtrim feature to centre everything

⇨ Enable Basic (Panic) mode

⇨ Limit all the servo throws using the limits settings on the Taranis Servos screen as required so that the servos are not over strained at the stops.

⇨ Correct the rudder and elevator direction on the servos screen if required.

⇨ Ensure that the ailerons are moving in the correct direction. Adjust by reversing the servo on the servos screen as required.

⇨ Ensure that the ailerons are moving in a similar fashion to each other. I temporarily reverse the direction of 1 so that they move up and down together so that I can check it easier.

⇨ Ensure that the flaps are moving in the correct direction. If they are not then adjust the direction of the servos in the servo menu on the Taranis. Remember that the servos are also intended to move the flaps upwards in Reflex mode using rotary switch S1.

⇨ The position of the half flap and full flaps can be set by adjusting the two right hand points on curve 3.

⇨ Ensure that the Spoiler function moves the flaps and ailerons in opposite directions. Adjust the weight of the spoiler mixes on channels 2,5,6 and 7 accordingly – moving the weight from 100 to -100 reverses the action.

You can also modify the proportion of flap to aileron by using these weights settings.

15. Appendix – Resources for getting started with Taranis

15.1. OpenTx

The best thing about the Taranis is not the hardware but the software. The software is created by a volunteer group under the umbrella of OpenTX.

OpenTX - http://www.open-tx.org/

If you are interested in the actual code you can see is ALL here ->
https://github.com/opentx/opentx/tree/master and the list of open bugs here =>
https://github.com/opentx/opentx/issues?state=open

15.2. Using your Taranis

Scott Page – Aloft Hobbies

Scott has done a fantastic series of videos on the Taranis
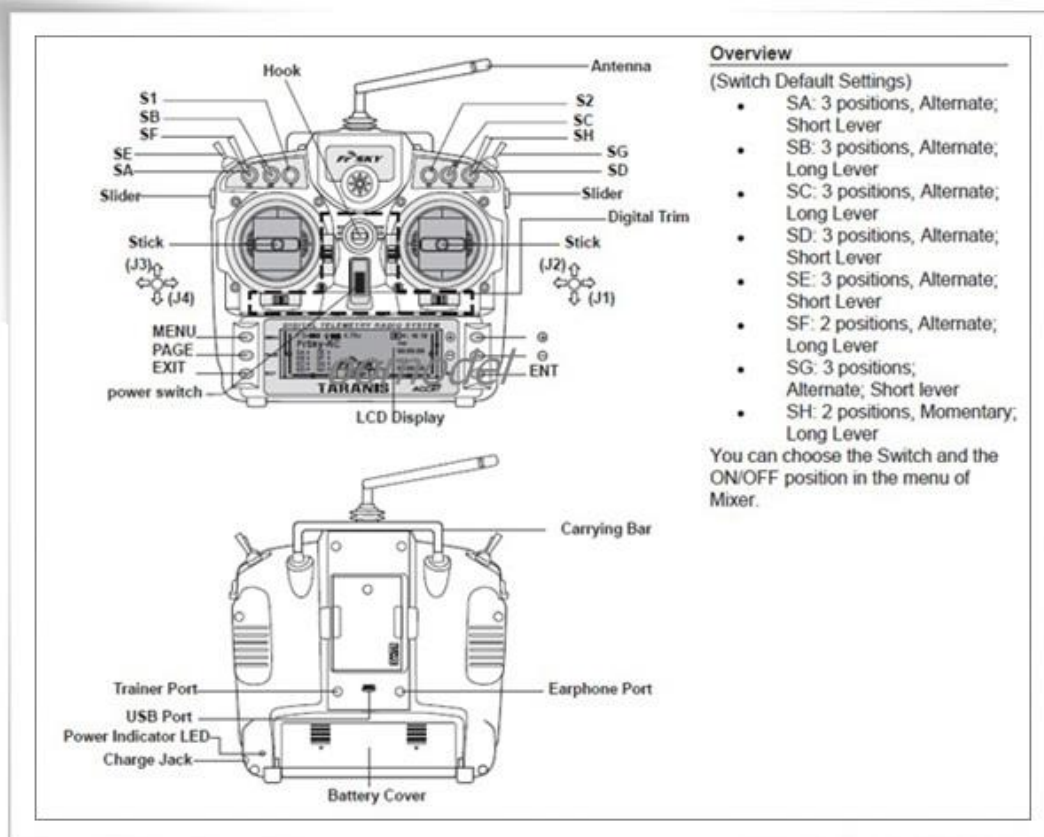https://www.youtube.com/channel/UC-A2sf9a_BDbKs81HuU7p4w

Richard Mrázek
https://www.youtube.com/watch?v=8aneWbODMkw

Mike Shellim inspired me to write this guide after I saw his f3f configuration
document

http://rc-soar.com/opentx/setups/f3f/index.htm

15.3. General Taranis discussions

OpenRC forums - http://openrcforums.com/forum/

16. Appendix Switch Diagram

Overview

(Switch Default Settings)

- SA: 3 positions, Alternate; Short Lever
- SB: 3 positions, Alternate; Long Lever
- SC: 3 positions, Alternate; Long Lever
- SD: 3 positions, Alternate; Short Lever
- SE: 3 positions, Alternate; Short Lever
- SF: 2 positions, Alternate; Long Lever
- SG: 3 positions; Alternate; Short lever
- SH: 2 positions, Momentary; Long Lever

You can choose the Switch and the ON/OFF position in the menu of Mixer.

17. Appendix – Table of Contents