

Wingy4S

for Taranis and Horus

Version 1.0

Setup Guide

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1 Introduction

Wingy4S is an OpenTX template for flying wings with 4 servos + (optional) rudder. Setup is quick for beginners yet the mixing is highly customisable for advanced users. An integrated CAL mode ensures perfect tracking of control surfaces.

Application

- 4-servo flying wings
- Optional rudder
- Any stick mode

Flight modes

- NORMAL, SLOW, SPEED and LANDING
- Voice confirmation on change of mode
- Flight mode switch layout is customisable

In-flight adjustments

- adjuster for aileron diff
- adjuster for crow compensation

Crow functions

- Choice of deployment mode (via switch or direct)
- Differential suppression
- Reverse diff
- Adjustable deadband
- 5-point compensation curve

Control surface calibration

- 'CAL' mode for adjusting servo centres and limits
- Balancing curve for flaps for accurate tracking
- Full rotation on flap servos

Before starting,

- Please **read through this document once**
- visit the [Support page](#) for any issues which may affect your setup.

1.1 Requirements

The following will be required to install Wingy 4S:

- A transmitter running OpenTX V2.2 or higher
- OpenTx Companion
- USB cable for transmitter <-> PC

Some familiarity with the OpenTx's menus and data entry will be useful.

1.2 Package contents

The contents of ZIP package are as follows:

Filename	Description
Wingy4S_v10_userguide.pdf	This document
Wingy4S_v10_reference.xls	Settings reference
Wingy4S_v10?.otx	Model file
*.wav	Sound files

1.3 Overview of features

Flight modes

- SLOW, NORMAL, SPEED and LANDING.

Roll (aileron stick)

- Rate can be global or per flight mode.
- Adjustable aileron/flap balance
- Aileron to rudder mixing, per flight mode

Pitch (elevator stick)

- Rate can be global or per flight mode.
- Adjustable aileron/flap balance

Pitch trim (elevator trim)

- Trim presets via SLOW/NORMAL/SPEED flight modes
- Adjustable aileron/flap balance

Crow

- Real time adjustment of crow compensation
- 5-point compensation curve

Roll enhancement

- Aileron diff suppression as crow deployed
- ‘Reverse diff’ mix further improves roll response with crow

Differential

- Real time adjustment of diff, per flight mode.

2 Assignments and flight modes

2.1 Stick and control assignments

Sticks are assigned according to stick mode (1 – 4) as set in **RADIO SETUP → STICK MODE**.
Controls are assigned as follows:

Stick	Control function
Aileron	Roll
Elevator	Pitch
Rudder	Yaw
Throttle	Crow

2.2 Channel assignments

Channel numbers are assigned as follows:

Ch	Target
1	Right aileron
2	Left aileron
3	Right flap
4	Left flap
5	Rudder (optional)

2.3 Flight modes

2.3.1 Main flight modes

Table below shows the four main flight modes, operating switch.

In the event of a clash, LANDING mode takes priority.

Flight Mode	Switch	Priority
LANDING (FM2)	SF↓	High priority
SPEED (FM3)	SA↑	Low priority
NORMAL (FM0)	SA---	Low priority
SLOW (FM6)	SA↓	Low priority

2.3.2 Calibration mode

CAL is a special flight mode for calibrating the servos. In CAL mode stick mixes and trims are bypassed.

To activate CAL mode:

1. Apply full left-aileron and full up-elevator
2. Press and release SH
3. Release stick(s). The transmitter cheeps at 3 second intervals

There are three submodes selected via SA:

- SA↑: cal with reduced ail throws
- SA-: cal end points
- SA↓: cal flap neutral

To exit CAL mode, pull SH.

3 Installation

Please follow the sequence as shown, use the tick boxes to record your progress.

- Establish communication with your PC:
 - Taranis: press inwards on horizontal trims and switch on. Connect Taranis to computer via USB cable.
 - Horus: switch on transmitter then connect to the computer via USB cable.
- Copy sound (.WAV) files to the **\SOUNDS\{language}** folder on the SD card. For example, for English, copy to folder "**\SOUNDS\en**" (this folder should already exist on the card).
- Using OpenTx Companion, transfer the template to your transmitter as follows:
 - Open the Wingy4S .otx file.
 - If you're using a transmitter other than the X9D, you may see a window with translation errors and warnings. Check the warnings (usually, no action is necessary).
 - From the File menu, choose 'Read Models and Settings from Radio'. Your models appear in a second window.
 - Drag the Wingy4S models into an empty slot in the model list.
 - Close the Wingy4S window.
 - Right-click the new model and choose "Use as Default"
 - Write the modified list to the tx ('Write Models and Settings to Radio').
 - Close OpenTx Companion
- IMPORTANT:** before going further **make sure your sticks are calibrated**. This can be done from the SYSTEM menu. Remember to calibrate the knobs and sliders. Failure to calibrate is one of the main causes of problems, for example jumping neutrals and inability to activate certain flight modes.

- Using the transmitter on its own, familiarise yourself with the flight modes. At the end of this step, you should know how to activate:
 - SLOW, NORMAL, SPEED and LANDING modes
 - CAL mode, including the three sub-modes
- Check that the flight mode sounds are working correctly. If not, check (a) sound files copied to correct folder (see above), and (b) check the WAV volume in the RADIO SETUP menu.

4 Calibrating the servos

The first task is to calibrate the servos, in other words set the direction of rotation, and the end points. The goals are:

- Maximise servo movement
- Linearise responses
- Equalise responses left/right

Correct calibration is essential for diff to work correctly, and for the flaps and ailerons to track precisely!!

4.1 Setting direction of rotation

In this step, you will set the direction of rotation of the servos:

- Switch on the transmitter (do not power up the receiver yet)
- Enter CAL mode
- Throttle stick to centre, Switch SA to **middle**
- Open the **OUTPUTS** menu
- Switch on the receiver
- While still in CAL mode, set the direction of control surfaces according to the table below. **Pay particular attention to the notes regarding aileron!**

Stick command	Control surface	Notes
<input type="checkbox"/> Aileron stick right →	RtAil goes up ↑ LtAil goes up↑	Ailerons move together in CAL mode!!
<input type="checkbox"/> Thr stick forward ↑	RtFlap goes up↑ LtFlap goes up↑	
<input type="checkbox"/> Rudder stick →	Rudder goes right→	

To reverse a control surface:

1. Highlight the *Direction* field, then
2. Press **[Enter]**, then immediately **[Exit]**

OUTPUTS	1455us	Direction	7 / 14
CH1	RtAil	0.0 -150.0 → 150.0	RtA 1500Δ
CH2	LtAil	0.0 -150.0 → 150.0	LtA 1500Δ
CH3	RtFlap	0.0 -150.0 → 150.0	RtF 1500Δ
CH4	LtFlap	0.0 -150.0 → 150.0	LtF 1500Δ
CH5	Rudder	0.0 -150.0 ← 150.0	Rud 1500Δ
CH6		0.0 -100.0 - 100.0	---
CH7		0.0 -100.0 - 100.0	---

- Exit CAL mode
- Enter NORMAL mode.
- Move the sticks, and check that the surfaces move in the correct direction. **Don't worry that some mixes don't work, or that the movements are incorrect!** These will be fixed later.

4.2 Calibrating servo centres and limits

In this section you'll adjust the servo absolute end points and centres. All adjustments are made using curves. **Do not alter min, max or subtrim.**

When setting end-points, consider all the inputs. For example, when setting the flap end points, allow sufficient travel for simultaneous crow and aileron inputs. Otherwise the flaps may stop before the commanded position is reached, resulting in deadband at the stick (this may however be unavoidable).

If you don't know the movements required for your model, then set servo end-points to maximum subject to restrictions below.

For users of Q X7, X-Lite and other radios with small displays.

- use the CURVES menu to edit curves.
- use the FLIGHT MODES menu to edit GVARs.

Channel	Calibration procedure
CH 4: LtFlap	<p>Start with left flap. You'll set end points only, ignoring flap neutral.</p> <ul style="list-style-type: none"><input type="checkbox"/> Set switch SA to middle position<input type="checkbox"/> Enter CAL mode<input type="checkbox"/> In the OUTPUT menu, highlight CH4:LtFlap<input type="checkbox"/> Skip to curve field LtF, and press [long ENTER] to open curve editor<ul style="list-style-type: none"><input type="checkbox"/> Throttle stick back (\downarrow), adjust point 1 for lower end point. Allow enough movement for both crow and aileron inputs.<input type="checkbox"/> Throttle stick forward (\uparrow), adjust point 3 for upper end point. Allow enough for any aileron-to-flap mixing.<input type="checkbox"/> Adjust point 2 so it's on the straight line thru points 1 and 3.<input type="checkbox"/> Move throttle stick from one end to the other, observing step intervals. If necessary fine tune point 2 to equalise intervals (i.e. optimise linearity).
CH 3: RtFlap	<p>Next, calibrate the right flap. You will adjust a 5-point curve to precisely match the left flap.</p> <ul style="list-style-type: none"><input type="checkbox"/> Enter CAL mode<input type="checkbox"/> Set switch SA to middle position<input type="checkbox"/> In the OUTPUT menu, highlight CH3:RtFlap<input type="checkbox"/> Skip to curve field RtF, press [long ENTER] to open curve editor<input type="checkbox"/> Adjust points 1 – 5 to exactly match the left flap:<ul style="list-style-type: none"><input type="checkbox"/> stick fully back, adjust point 1<input type="checkbox"/> stick ½-back, adjust point 2<input type="checkbox"/> stick to centre, adjust point 3<input type="checkbox"/> stick to ½-forward, adjust point 4<input type="checkbox"/> stick fully forward, adjust point 5 <p>To match the end points on left and right sides, it may be necessary to reduce one or other end points for the left flap.</p>
Flap neutral	<p>Next, set the flap neutral via an offset mix.</p> <ul style="list-style-type: none"><input type="checkbox"/> Enter CAL mode<input type="checkbox"/> Set switch SA to down position.<input type="checkbox"/> Open the GVARs menu.<input type="checkbox"/> Highlight row FNU, and go to the first column (contains a number)<input type="checkbox"/> Press {Enter}, and adjust for correct neutral. <p>If the flaps are not perfectly in line with each other, then redo calibration for CH3:RtFlap above, paying particular attention around the neutral position.</p>

Channel	Calibration procedure
CH 1:RtAil CH 2:LtAil	<p>Calibrate ailerons:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Enter CAL mode <input type="checkbox"/> Set switch SA to down position. The flaps will go to their calibrated neutrals. <input type="checkbox"/> In the OUTPUT menu, highlight CH1:RtAil <input type="checkbox"/> Skip to curve field RtA, then press [long ENTER] to open curve editor <ul style="list-style-type: none"> <input type="radio"/> Aileron stick to centre. Set Point 2 for correct centre <input type="radio"/> Move aileron stick right (\rightarrow). Set point 3 to desired upper limit. <input type="radio"/> Move aileron stick left (\leftarrow). Attempt to adjust point 1 so that down-travel = up-travel. If down-travel is too restricted to complete this step, then move SA to the up position – this reduces aileron movement by 50%, and sends the flaps to their calibrated neutrals. Now, re-adjust point 1 so that down-travel = the (reduced) up-travel. When you exit CAL mode, full rate will be restored; don't worry if down-travel is excessive – later adjustments to input and diff will reduce it. <input type="checkbox"/> Repeat for CH2:LtAil <input type="checkbox"/> Check: constant rate up/down for each aileron, and check left and right ailerons match. Readjust if necessary.
CH5:Rud	<p>Calibrate the rudder:</p> <ul style="list-style-type: none"> <input type="radio"/> Enter CAL mode <input type="radio"/> In the OUTPUT menu, highlight CH5:Rudder <input type="radio"/> Skip to curve field Rud, and press [long ENTER] to open curve editor <input type="radio"/> Rudder stick to centre, set point 2 for correct centre. <input type="radio"/> Move rudder stick right (\rightarrow). Set point 3 to desired right limit. <input type="radio"/> Move rudder stick left (\leftarrow). Set point 1 to desired left limit.

Well done, calibration is complete!!

- Exit CAL mode, enter Normal mode.
- Move the sticks, and check that surfaces move in the correct direction. ***Don't worry that some mixes don't work, or that the movements are incorrect! These will be fixed later.***
- Make a backup copy of your template now.

Keep your model in perfect trim! Perform a CAL check...

- after a hard landing
- after replacing a servo
- if you suspect drifting neutrals

5 Adjusting control travel and mixing

This is where your model comes to life!

Control / mix	Adjustment point	Description
<input type="checkbox"/> Aileron stick rate and expo	INPUTS→IAil GVARS→GV1:A2F	<p>Sets rate and expo of aileron stick</p> <p>First adjust for aileron (outer) surfaces. This is the master adjustment.</p> <ol style="list-style-type: none"> Activate NORMAL flight mode Open the INPUTS menu In IAil section, highlight 'catchall' line Press {long ENTER} and choose Edit to open the input editor Adjust <i>weight</i> for required upward travel of the ailerons. <i>Note:</i> down-travel is affected by diff setting, adjusted via rudder trim. Optionally, adjust <i>curve->expo</i> <p>By default, all flight modes will share these settings. To over-ride for individual flight modes, see section 6.1</p> <p><i>Note:</i> do not set <i>diff</i> here (affects stick diff, not servo diff).</p> <p>Now, set flap (inner) rate. This is relative to master adjustment above.</p> <ol style="list-style-type: none"> Activate NORMAL mode Open the GVARS menu Skip to row GV1:A2F, column FMO. Apply full aileron Adjust GV to achieve desired flap movement relative to the ailerons. <p>By default, all flight modes will use the FMO value. You can however override this for particular flight modes by entering a numeric value.</p>
<input type="checkbox"/> Elevator stick rate and expo	INPUTS→IEle GVARS→GV2:E2A	<p>Sets the rate and expo of elevator stick.</p> <p>First, adjust for flaps (inner surfaces). This is the master adjustment.</p> <ol style="list-style-type: none"> Activate NORMAL flight mode Open the INPUTS menu In IEle section, highlight 'catchall' line Press {long ENTER} and to open the input editor Adjust <i>weight</i> for required elevator movement. Optionally, adjust <i>curve->expo</i>. <p>By default, all flight modes will share these settings. To over-ride for individual flight modes, see section 6.1.</p> <p>Now, set aileron (outer surface) rate. This is relative to master adjustment above.</p> <ol style="list-style-type: none"> Activate NORMAL mode Set elevator trim to centre Open the GVARS menu Skip to row GV2:E2A, column FMO. Apply full up elevator Adjust GV to achieve desired aileron movement relative to the flaps. <p>By default, all flight modes will use the FMO value. You can however override this for particular flight modes by entering a numeric value.</p>
<input type="checkbox"/> Crow→Flap <input type="checkbox"/> Crow→Aileron	GVARS→GV4:FCm GVARS→GV3:ACm	<p>Sets the flap and aileron travel for crow brakes.</p> <p>To adjust flaps:</p> <ol style="list-style-type: none"> Activate LANDING mode. Move the throttle stick fully back/down, as if for full crow. Open the GVARS menu Skip to row GV4:FCm, then to highlighted column (FM2) Adjust GV for <i>downward</i> flap deflection <p>To adjust ailerons:</p> <ol style="list-style-type: none"> Go to row GV3:ACm and skip to highlighted column (FM2) Adjust for <i>upward</i> aileron deflection.

Control / mix	Adjustment point	Description
<input type="checkbox"/> Aileron→Rudder	GVARS→GV6:A2R	<p>Aileron to rudder mix, set per flight mode.</p> <ol style="list-style-type: none"> 1. Open GVARS menu, skip to row GV6:A2R 2. Activate flight mode to adjust. The column is highlighted. 3. Skip to highlighted column. 4. Adjust GV for required aileron to rudder mix (+ve value).
<input type="checkbox"/> Reverse diff	MIXER→CH5→Ail	<p>Sets the travel of the down-going aileron when both full crow and full aileron are applied. This can be used to improve roll response at full crow.</p> <p>To adjust:</p> <ol style="list-style-type: none"> 1. Activate LANDING mode. 2. Open the MIXER menu, 3. Skip to row CH21, and highlight the 'Ail' line (first line) 4. Press {long Enter}, and choose 'edit' to open the mix editor 5. Skip to the <i>weight</i> field. 6. Apply full crow and full aileron 7. Adjust weight so that the aileron is in the desired position (normally slightly below the neutral position.) <p>NOTE: this measure for improving roll response is in addition to aileron diff suppression, which is automatically applied.</p>
<input type="checkbox"/> Crow compensation	MIXER→CH17	<p>This mix compensates for pitch changes due to crow. It is adjustable via the throttle trim - forward for down, back for up. Centre position is zero compensation.</p> <p>Set the range of adjustment:</p> <ol style="list-style-type: none"> 1. Open MIXER menu, skip down to CH17, then to 'CompAdj' line 2. Press {long ENTER} and choose Edit to open the mix editor 3. Skip to the <i>weight</i> field 4. Apply full crow 5. Move the throttle trim fully forward (= full down trim) 6. Look at the wing surfaces, and adjust <i>weight</i> to set the maximum possible trim adjustment. 7. Move trim to centre (zero compensation) ready for flight tests. <p>How to adjust pitch trim during flight tests</p> <p>There are two adjustments, the base trim, using the elevator trim, and the compensation using the throttle trim. Here's the procedure:</p> <ol style="list-style-type: none"> 1. Enter Landing mode. 2. Apply minimum crow and adjust elevator trim for level flight. 3. Apply full crow and adjust throttle trim for level flight.

Congratulations, you've finished setting up your model! Please back up your template now.

6 Simple customisations

The next section describes optional customisations. Please backup your setup before starting.

6.1 Setting rates, expo per flight mode

By default, all flight modes share the same rate and expo. You can over-ride the default for specific flight modes by inserting extra lines in the INPUT menu. These extra lines **must come before the ‘catchall’ line**. Here’s the procedure:

1. Open the INPUTS menu.
2. Scroll down to the appropriate ‘catchall’ line.
3. Press {long Enter} and choose ‘Insert before’. Check that the new line was added before the catchall line.
4. Press {long Enter} and choose ‘Edit’ to open the input editor.
5. Leave the *input name* unchanged.
6. Enter a descriptive *line name* for example ‘hireate’
7. Enter *weight* and *expo*.
8. In the *flight modes* field, tick applicable flight mode(s), and untick the rest. Flight modes are as follows:
FM0 = Normal, FM2 = Landing, FM3 = Speed, FM6 = Slow

Example shows a 30% rate applied to FM3(Speed), 80% rate for FM2(Landing), and 70% for all other fm’s:

INPUTS	5/64	0.0	5/14
Rud	100	Rud	---
Ele	100	Ele	---
Ail	30	Ail FM ---3-----	Lo rate
	80	Ail FM --2-----	Hi rate
	70	Ail ---	CATCHALL
04			
05			

How OpenTx handles inputs: Starting with the first Input line in a group, OpenTx reads the flight mode and/or switch. If these correspond to the actual FM and switch states, OpenTx uses the rate and expo values specified in that line.

If there is no match, OpenTx advances to the next line and repeats the test. The cycle is repeated until either a match is found or the end of the input list is reached. **If no match is found in any line, the control will be inoperative!!** As a defence against this possibility, the last line **must have all flightmodes checked and switch set to ‘---’**. By convention, we call name this line ‘CATCHALL’. If both flightmode and switch are specified in the same line, both must match for the line to be active.

6.2 Reassigning flight mode switches

Flight modes switches are assigned in the LOGICAL SWITCH menu.

You can alter the assignments from the defaults, just make sure to use the appropriate switch type:

Switch function	LS	Default	Notes
CAL mode	L05	SH↓	Must be momentary switch (safety!)
SPEED mode	L06	SA↑	Main FM switch. The same 3P switch
NORMAL mode	L07	SA-	must be specified for all FMs, but each
SLOW mode	L08	SA↓	with a different position (↑↓-)
LANDING mode	L09	SF↓	2P or 3P switch.

6.3 Disabling flight modes

A flight mode may be disabled by setting its switch to '---' in the FLIGHT MODE menu. You may wish to do this, for example, if the model does not support crow brakes, or if you do not require SPEED or SLOW modes.

Note: It is not recommended to disable CAL mode.

FLIGHT MODES						
FM0	Normal	:0	:0	--	:0	0.0
FM1	CAL	L20	--	--	0.0	0.0
FM2	Landing	L14	:2	--	0.0	0.0
FM3	Speed	L06	:3	--	0.0	0.0
FM4	--	--	:4	--	0.0	0.0
FM5	--	--	:5	--	0.0	0.0
FM6	Slow	L08	:6	--	0.0	0.0

6.4 Configuring 'Autocrow'

Many pilots prefer to activate LANDING mode simply by pulling the throttle stick, without having to move a switch first. This is called 'Autocrow' and can be configured in the LOGICAL SWITCH menu. When Autocrow is enabled, the Landing mode switch (as specified in logical switch L09) is free for re-use.

Option	LS	Value	Description
AUTOCROW	L02	Disable: 99 Enable: 100	Enables or disables Autocrow

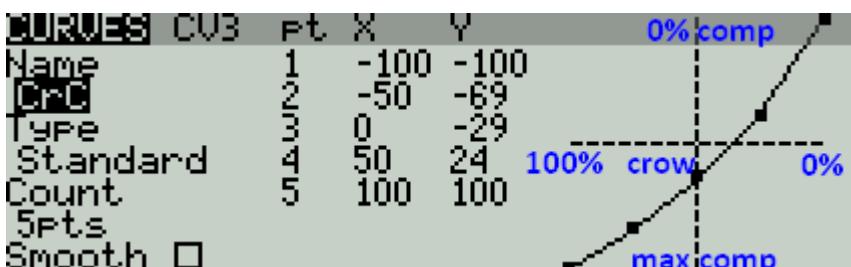
6.5 Adjusting crow deadband

The crow stick incorporates some deadband to prevent accidental deployment. The amount of deadband can be adjusted as follows:

1. Open the Curves editor for Curve 7 ('SDb')
2. Change pt2 -> X. Decrease X to increase the deadband. Recommended value is ~95.

6.6 Adjusting crow compensation curve

Crow compensation can be fine tuned by adjusting curve CV3:CrC. This should be done only after the full-crow compensation has been set using the throttle trim. Changes should be limited to points 2-4 (do not alter end points).



6.7 Reversing the crow stick

To reverse the crow stick:

1. Open the mixer editor for CH18 → CrowCt
2. Skip to the *curve* field
3. Change the curve from 'SDb' to '!SDb' (note leading exclamation mark).

6.8 Adjusting the range of aileron trim

To alter the range of adjustment of the aileron trim:

1. Open the MIXER menu
2. Skip to CH19:AilTrm, 'AilTrm' line
3. Press {long ENTER} to open mixer editor
4. Adjust *weight* for required range (default = 25%).

6.9 Adjusting the range of elevator trim

To alter the range of adjustment for the elevator trim:

1. Open the MIXER menu
2. Skip to CH17:PtchTr, 'BaseTrm' line
3. Press {long ENTER} to open mixer editor
4. Adjust *weight* for required range (default = 25%).

6.10 Setting a custom ele-trim→aileron mix (advanced!)

By default, any elevator trim changes affect both flaps and ailerons. This will be fine for most models. However it's possible to have independent mixing of trim to aileron. The procedure is as follows:

1. Open the MIXER menu
2. Skip to CH10:AilCm, 'PtchTr' line
3. Press {long ENTER} to open mixer editor
4. Change the *weight* field from '-GV2:E2A' to '-GV7:T2A'

To adjust the ele-trim→aileron mix, open the **GVARS** menu and edit first column in GV7:T2A. By default, all flight modes will share the FMO value, however you can override this for specific flight modes.

7 Other stuff

7.1 Field notes

The table below shows the adjustments you can make from the transmitter. Take a copy to the slope!

Adjustment	Adjuster	Flight modes	Notes
Aileron Diff	Rudder trim	[all]	Trim right = more roll response/less diff. Trim left = less roll/more diff. Range of adjustment = 0% - 70%. Trim centre = 35%. Stored independently for each flight mode.
Cow Compensator	Throttle trim	Landing	Trim centre = zero comp Trim forward = nose down Trim back = nose up

7.2 Fail safe

Remember to set the failsafe before the first flight.

7.3 Identifying errors

Companion offers a useful 'Compare files' tool for tracking down errors. If you suspect an error:

- 1 Start Companion
- 2 Open the original unedited file
- 3 Open your working EEPROM
- 4 Click on **FILE->COMPARE FILES** to open the Compare window, then drag the corresponding models into it.

Any errors should be easy to spot. It's not a bad idea to do a quick check before your first flight.

7.4 Safety/disclaimer

Pretty obvious really, but worth repeating: **it's up to the user to make sure that the controls respond correctly under all conditions.** The author will not be responsible for the consequence of any bugs in the setup or documentation.

Test your setup thoroughly
If in doubt, DO NOT FLY!!

7.5 Contact

If you find any errors in the documentation, please contact me via <http://rc-soar.com/email.htm> – you 'll be helping the author and your fellow users of this setup! Feedback and suggestions are also welcome and appreciated.

Happy flying!

Mike Shellim