DLG for Ethos

Template for 4-servo DLG's
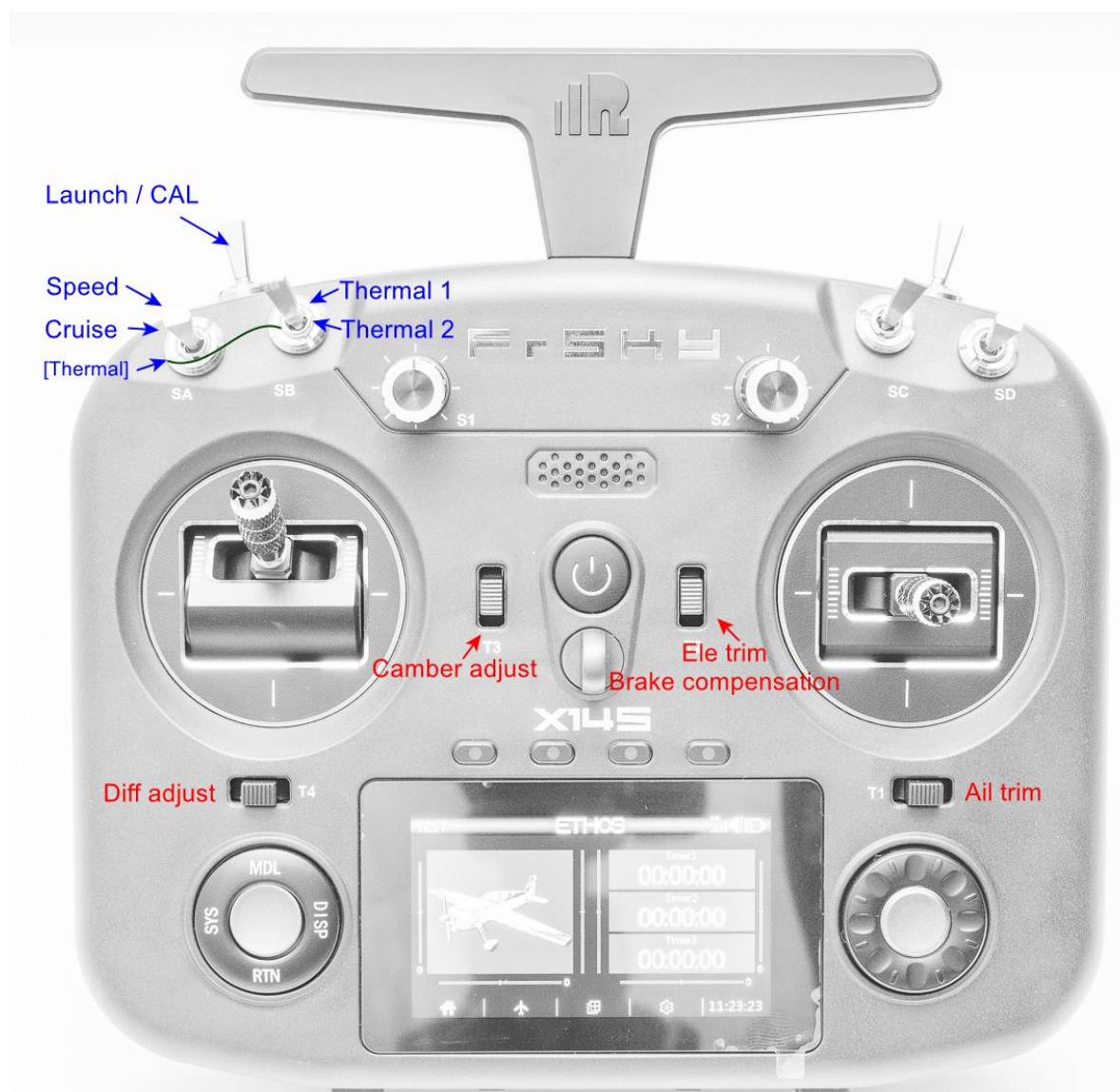
Version 2.2

for Ethos 1.5.19 and above

Setup Guide

Mike Shellim
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CONTENTS

1 INTRODUCTION

1.1 DESCRIPTION

DLG is a full feature template for 4-servo DLGs (two wing servos). It is quick to set up, and customisable. Full documentation is provided.

APPLICATION
- For DLG gliders with two wing servos
- Any stick mode
- Freely assignable switches

LAUNCH HEIGHT CALLOUT
- Optional launch height callout using ALT telemetry

7 FLIGHT MODES
- Launch followed by Zoom
- Cruise, Thermal1, Thernal2, Speed
- Landing (auto activated)

LANDING BRAKES
- brake-aware adaptive trim
- automatic suppression when exiting Zoom
- negative diff option for increased roll response

IN-FLIGHT ADJUSTERS
- Adjuster for aileron diff, per FM
- Adjuster for camber, per FM

SNAPFLAP
- Individually configurable up/down travel, per FM
- Adjustable deadband

CONTROL SURFACE CALIBRATION
- 'CAL' mode for quick calibration
- 5-point balancing curve for flaps

MISC
- Flight timer
- Voice files
- Aileron to rudder mix
- Channels 7,8,9 free for other functions

I hope you enjoy your journey to a great DLG setup! But first, please follow the golden rules for success:

> *- PLEASE READ THROUGH THESE INSTRUCTIONS ONCE BEFORE STARTING*
> *- VISIT THE SUPPORT PAGE FOR LATEST ALERTS*
> *- FOLLOW THE INSTRUCTIONS IN SEQUENCE*

1.2 PACKAGE CONTENTS

What's included in the ZIP file:

Filename	Description
dlg22*x.bin	Model file
dl1***.wav	Audio files
dlg_ethos_22_SetupGuide.pdf	Setup guide (this document)
dlg_ethos_22*_SettingsRef	Settings reference

1.3 MINIMUM REQUIREMENTS

- FrSky Transmitter running Ethos 1.5.19 or above
- Momentary switch for launching
- 3-position switch for flight modes
- Additional 2- or 3-position switch for thermal 1 / 2 selection

2 OVERVIEW

2.1 STICK MODE AND SWITCH ASSIGNMENTS

Any supported stick mode may be used (set in the SYSTEM→STICKS menu)

Switch assignments are flexible and set via the VARS menu – see section 3.2

Switch/control	Switch type	Function
SW_Launch	Momentary	Launch mode
SW_Flightmodes	3-position	Thermal/Cruise/Speed selector
SW_Thermal1-2	2- or 3-pos	Thermal1/Thermal2 selector
Throttle stick	—	Brakes
Rudder trim	—	Aileron diff adjustment
Throttle trim	—	Camber/reflex

2.2 FLIGHT MODES

There are 7 flight modes: Launch, Zoom, Cruise, Thermal1, Thermal2, Speed, and Landing.

Launch and Zoom have highest priority. Landing has priority over Thermal, Cruise and Speed.

Flight Mode	ID	Activation switches	Priority
Launch	FM2	SW_Launch	High
Zoom	FM3	Follows Launch mode. Up/down elevator to exit	High
Landing	FM4	Throttle stick ↓ (activates brakes)	Mid
Cruise	FM0	SW_Flightmodes —	Low
Speed	FM5	SW_Flightmodes ↑	Low
Thermal 1	FM6	SW_Flightmodes ↓ and SW_Thermal1-2↑	Low
Thermal 2	FM7	SW_Flightmodes ↓ and SW_Thermal1-2↓	Low

2.3 SERVO ASSIGNMENTS

Channel	Function
1	Rudder
2	Elevator
3	Left aileron
4	Right aileron

Left and right are from the point of view of an observer looking forwards from the tail.

The left and right channels are not interchangeable – *please ensure they are connected correctly!*

2.4 MIXERS

The table below shows the mixers in each flight mode. Mix adjusters are in brackets.

Flight mode	Diff	Ail=>Rud	Brakes	Brake Comp	Rudder offset	Camber/ Reflex	Snapflap
Launch	✓ (Rud trim)	✓			✓	✓ (Throttle trim)	✓
Zoom	✓ (Rud trim)	✓				✓ (Throttle trim)	✓
Landing	✓ (Rud trim)	✓	✓	✓ (Ele trim)		✓ (Throttle trim)	✓
Thermal1/2	✓ (Rud trim)	✓				✓ (Throttle trim)	✓
Speed	✓ (Rud trim)	✓				✓ (Throttle trim)	✓
Cruise	✓ (Rud trim)	✓				✓ (Throttle trim)	✓

2.5 FLIGHT TIMER

The flight timer is Timer1

- *To reset and start*: release **SW_Launch** switch
- *To stop*: press and hold **SW_Launch** switch

2.6 CAL MODE

CAL is a special flight mode for calibrating the control surfaces. All mixers and trims are disabled, and stick values are passed directly to the servo channels. This allows servo centres and end points to be visualised.

To activate CAL mode:

1. Apply full left aileron and full up elevator, and hold.
2. Pull and release momentary switch **SW_Launch**
3. Release the sticks
4. Select the appropriate submode ('calibration' or 'calibrate flap neutral') using switch **SW_FlightModes**

Sub mode	Switch	Description
'Calibration'	**SW_Flightmodes** —	for calibrating end points of all surfaces, and for equalising tracking of ailerons. ***The ailerons move in 25% steps, to facilitate tracking adjustment.***
'Calibrate flap neutral'	**SW_Flightmodes** ↓ *or* ↑	for calibrating the aileron neutral offset

To cancel CAL mode, pull **SW_Launch** switch.

Note*: in CAL mode, the aileron stick is disabled*!

2.7 BASIC OPERATION

Trims
- Aileron trim is shared across all flight modes.
- Elevator trim is independent per flight mode.
- Rudder trim is repurposed to adjust differential, per flight mode.
- Throttle trim adjusts camber/reflex

Rudder offset
- The rudder launch offset is preset

Aileron differential
- Aileron diff is adjustable using the rudder trim, per flight mode

Camber presets
- Camber/reflex is adjusted via the throttle trim, per flight mode

Brake compensation (brake=>elevator mix)
- Brake compensation is adjusted in flight via the elevator trim (brake-aware adaptive trim)

Aileron=>rudder mix
- Aileron=>rudder mix is preset, per flight mode.

Snapflap
- Snapflap (elevator=> ail) is preset, per flight mode.

2.8 THE FLIGHT SEQUENCE

Nothing special here, the flight sequence is standard for DLGs:

1. Activate momentary switch **SW_Launch**, and launch the model. Model is now in Launch mode.
2. As the model leaves the hand, release the launch switch. Model enters Zoom mode.
3. Near the top of the climb, **move the elevator stick forward or back**. The model exits Zoom mode.
4. Once out of Zoom mode, the flight mode is determined by the main flight mode switch and the throttle stick.

2.9 Zoom Safe Exit

Zoom Safe Exit prevents the brakes from deploying suddenly on exit from Zoom mode. If the brake stick is not in the 'off' position a warning sounds, the brakes remain retracted and the next lower priority flight mode is activated (Cruise, Thermal1, Thermal2, or Speed).

To re-enable brakes, move the brake stick to the off position.

3 PREPARING THE TRANSMITTER

3.1 Transfer template to transmitter

Start by transferring the template to your transmitter:

Establish a USB connection
1. Enter Bootloader mode.
2. Connect to PC via USB. The tx's SD card and/or internal memory should appear as a new drive.

Copy files
Note: '*' refers to the template's minor version number.
1. Unzip file *dlg-ethos-22*.zip* into a directory on your local drive
2. Select all the .wav files in the zip file, and copy to the folder designated for **voice1**. To determine the voice1 folder, open the SYSTEM>GENERAL menu on your transmitter, and scroll to the 'Audio' section.
   Example: if voice1='gb', copy .wav files to folder \audio\en**gb**. *Do **not** copy to the 'system' sub-folder!*
3. Copy the file *dlg22*x.bin* to the \models folder in the tx.
4. Terminate the USB connection and restart the transmitter.
5. Open the MODEL>SELECT menu and activate model 'DLG v22*X'. If the model is not visible, check that the Ethos version satisfies the minimum requirements for this template.
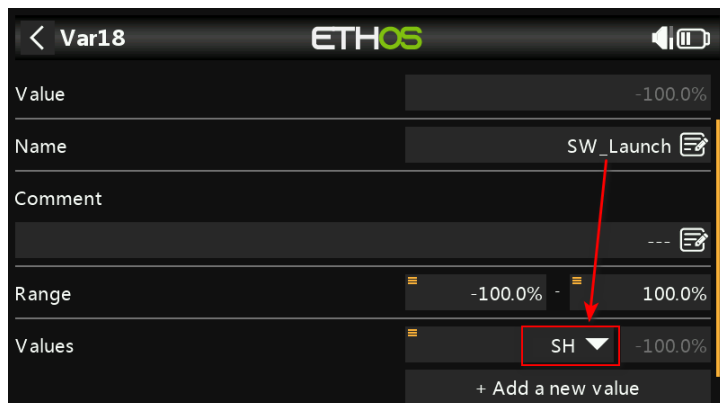
3.2 Assign switches *(NEW IN V2.2)*

Before proceeding, set the flight mode switches according to your transmitter layout, and your preferences.

The switches are defined in three VARs (see table below). Open each VAR and set the *Values* field to the desired switch. *Tip:* move the switch while editing the *Values* field - the entry will update automatically.

VAR name	Function	VAR>*Values* field
SW_Launch	Launch mode	Momentary switch ***ONLY (safety)**!*
SW_Flightmodes	Cruise/Thermal/Speed mode	3-pos switch
SW_Thermal1-2	Thermal1/Thermal2 mode	2-pos (preferred) or 3-pos switch

To reverse a switch, click on the adjacent hamburger icon, choose Options, and select Negative.

Example below shows Launch switch (**SW_Launch**) assigned to physical switch SH.

3.3 FAMILIARISATION

Using the transmitter on its own, practise the following:

- Activate Launch, Zoom, Thermal1, Thermal2, Cruise, Speed and Landing modes (see Section 2.2).
  TIP: start with the throttle stick pushed fully forward (brakes off position).
- Activate CAL mode and sub-modes (see Section 2.6)
- Start/stop/reset the flight timer (see Section 2.5)
- Verify that the sounds are working. If not, check that the sound files are in the correct location.

3.4 TELEMETRY

With the receiver bound and powered, check that your transmitter is receiving telemetry. If problems are encountered, try rediscovering your sensors.
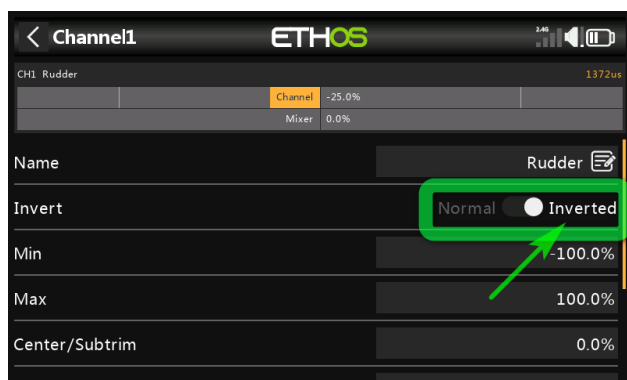
4 CALIBRATING THE OUTPUTS

In this section you will set the operating range of the servos, and equalise the aileron movement.

4.1 SET SERVO ROTATION

First, check and adjust the direction of each servo. The model is required from now on.

1. Switch on the transmitter and receiver
2. Move the aileron, elevator and rudder sticks (note: *the throttle stick will have no effect).*
3. If a control surface moves in the wrong direction, open the Outputs menu and invert the channel:

4.2 ADJUST SERVO END POINTS AND CENTRES

The next task is to set the operating limits of the servos, and to precisely match the ailerons. **All adjustments are made in CAL mode.**

Note:

- The servo limits should be set the maximum possible, limited by linkage geometry.
- Adjustments are made using curves only - leave *Min*, *Max* and *Subtrim* at their default values.
- With Ethos (unlike the OpenTX version), you will need to experiment to see which of two points to adjust. The alternative points are shown in brackets (). Try the first point, if nothing happens use the alternative.
- The aileron stick has no effect in CAL mode.

Calibration instructions for each surface are shown in the table below. Please follow in order.

Channel	Calibration procedure
CH 1 – Rudder	Calibrate the rudder channel 1. Activate CAL mode 2. Open the **OUTPUTS** menu 3. Highlight the rudder channel (default CH1) 4. Scroll down to *Curve* field, choose *Edit* 5. With Rudder stick in centre, adjust point 2 so rudder is centred 6. Move stick right (→), then set point 3 (or 1) for max possible right movement 7. Move stick left (←), then set point 1 (or 3) for max left movement 8. Check equal travel left/right, reduce one or other side as necessary.
CH 2 – Elevator	Calibrate the elevator channel. **!!! IMPORTANT: in CAL mode, the elevator moves in the opposite direction to normal !!!** 1. Activate CAL mode 2. Open the **OUTPUTS** menu 3. Highlight the elevator channel (default CH2) 4. Scroll down to *Curve* field, choose *Edit* 5. With Ele stick at centre, adjust point 2 so elevator is central 6. Move stick forward (↑), then adjust point 3 (or 1) for *upper* limit 7. Move stick back (↓), then adjust point 1 (or 3) for *lower* limit 8. Check elevator travel is equal up & down, reduce one or other side as necessary.
☐ CH 3 – Lt Ail	Calibrate the left aileron: 1. Activate CAL mode, select 'Calibration' submode 2. Open the **OUTPUTS** menu 3. Highlight left aileron channel (default CH3) 4. Scroll down to the Curve field, choose Edit 5. Throttle stick fully back (↓), adjust point 1 (or 2) for *lower* end point. 6. Throttle stick fully forward (↑), adjust point 2 (or 1) for *upper* end point.
☐ CH 4 – Rt Ail	Next, calibrate the right aileron so it precisely matches the left aileron: 1. Activate CAL mode, select Calibration submode (switch SA—) 2. Open the **OUTPUTS** menu 3. Highlight the right aileron channel (default CH4) 4. Scroll down to the *Curve* field, and press *Edit* Adjust points 1 – 5 to exactly match the let aileron: 5. Stick fully back, adjust point 1 (or 5) 6. Stick ½-back, adjust point 2 (or 4) 7. Stick to centre, adjust point 3 (or 3) 8. Stick to ½-forward, adjust point 4 (or 2) 9. Stick fully forward, adjust point 5 (or 1) To match the end points on left and right sides, it may be necessary to reduce one or other end points for the left aileron.
Aileron offset	Next, calibrate the aileron offset: 1. Activate CAL mode 2. Select submode 'calibrate aileron neutral' (switch SA↓) 3. Page to **VARS** menu. 4. Scroll to **V_AilNeutral**, and open the Vars editor 5. Adjust the number in the *values* field, until the ailerons follow the airfoil profile. If the ailerons are not precisely aligned with each other, redo the calibration of the left aileron (see above), paying attention to the points either side of the neutral position.

Now check for correct operation:

1. Exit CAL mode
2. Check that aileron, elevator and rudder control surfaces move in the correct sense. Don't worry if there's too much movement– it'll be reduced in the next section.
   Note that the throttle stick/brakes will not function yet – these are configured in the next section.

5 CONFIGURING TRAVEL AND MIXERS

In the final section, you'll set the control travel and mixers. All adjustments are made in the **VARs** menu, *Values* field.
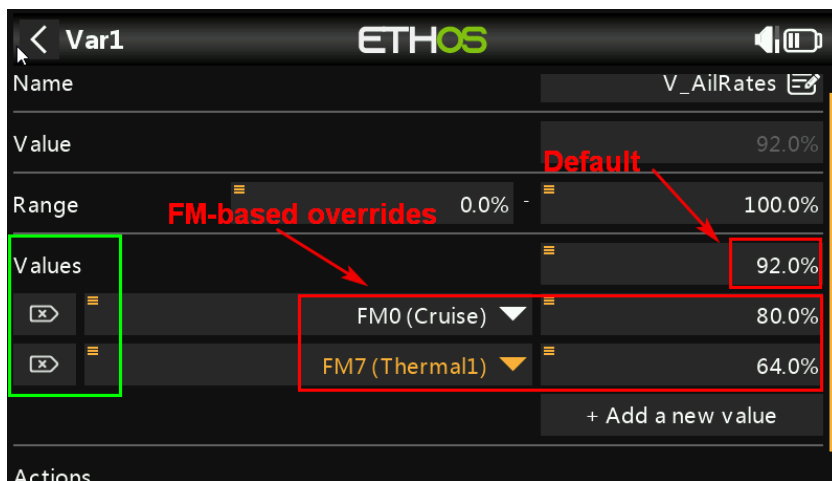
5.1 RATES (TRAVEL)

Control travel is set in the following VARs:

- **V_AilRates** – for aileron rate. Upward movement only (down movement is adjusted via Diff).
- **V_EleRates** – for elevator rate
- **V_RudRates** - for rudder rate

The first value is the default. Extra lines may be added for FM-specific rates. To add a line, click on the 'add' icon, and choose category 'Flight modes'. Then select the flight mode.

SAFETY: *always ensure that the default rate provides sufficient control. **Never set it to zero!***

5.2 EXPO

Expo is adjusted in the following VAR mixes:

- **V_AilExpo** – for aileron expo
- **V_EleExpo** – for elevator expo
- **V_RudExpo** – for rudder expo

Add FM-specific expo the same way as for Rates above.

5.3 AILERON DIFF

Aileron differential ('diff') determines the downward travel of each aileron. The more diff, the *less* down travel. Diff is adjustable in flight using the rudder trim.

- **Rudder trim** full left: down-travel = 30%
- **Rudder trim** centre: down-travel = 80%
- **Rudder trim** full right: down travel = 130% (more down than up!)

Adjustment is per flight mode, ***remember to set diff individually for each flight mode*!**

5.4 RUDDER LAUNCH OFFSET

Counteracts rotation of the model following launch. Adjust in VAR **V_RudOffset**

5.5 ELEVATOR LAUNCH OFFSET

There's no special setting for this – just activate Launch mode and adjust the elevator trim.

5.6 BRAKE TRAVEL

The aileron travel due to brakes is adjusted in VAR **V_BrakeTravel**. Ensure that brakes are fully deployed while adjusting (enter Landing mode, and pull the throttle lever to the down position).

The camber on entry into Landing mode (with minimal brake applied) may be adjusted using the **Throttle trim**.

5.7 BRAKE AWARE TRIM

In Landing mode, as you apply brakes, the amount of trim varies according to a 5-point 'compensation' curve. v2.1 introduces a simple method of adjusting the curve. Instead of manually editing each point, *simply use the **elevator trim*** as needed. The system automatically alters the shape of the curve appropriately. This makes it easy to trim out the curve in flight!

The procedure is transparent, it's not necessary (or recommended!) to look at the screen.

To familiarise, open the Curves menu and highlight the "BrakeComp" curve. Apply say 50% brake. Now, move the elevator trim forward and back and observe how the curve changes. Note that the last point on the curve (immediately after transitioning into Landing mode) is fixed and does not respond to the trim; this is by design.

With the model switched on, use the trim to configure the initial curve. Refine during test flights (see section 6.1).

> *Technical note:* at transition into Landing mode, the elevator trim value is inherited from Cruise mode. This constitutes the 'base' trim. As more brake is applied, the (variable) compensation is added to the base trim to give the final elevator offset.

5.8 NEGATIVE DIFF

Negative diff is an optional mix. You may find it improves aileron response under braking. As brakes are applied, the travel of the *upgoing* aileron is increased by an amount set in **V_NegDiffLand**. When adjusting, apply full brakes and full aileron. *Start with a small amount since excessive amounts can adversely affect handling.*

5.9 CAMBER/REFLEX (NEW IN 2.1)

Camber and reflex are adjustable using the **throttle trim**, per flight mode.

- **Throttle trim** centre => zero camber
- **Throttle trim** back => positive camber (flaps down)
- **Throttle trim** forward => negative camber (flaps up/reflex).

The limit of adjustment is set in **V_MaxCamber** – the default is +/- 35% of flap travel and should not need altering.

5.10 SNAPFLAP (NEW IN V2.2)

Snapflap is another name for an elevator-to-camber mix. Snapflap is configured in the VARs menu:

- **V_SnapDeadband**: centre deadband. Default is 5% of elevator stick travel.
- **V_SnapDown**: downward aileron movement due to up-elevator. Adjustable per FM.
- **V_SnapUp**: upward aileron movement due to down-elevator. Adjustable per FM.

With **V_SnapUp and V_SnapDown** , the first value is the default and should be zero. FM-specific values can be added for Cruise, Speed, Thermal1 and Thermal2. The screenshot below shows an example configuration of **V_SnapDown**:

Name	V_SnapDown ✎
Comment	--- ✎
Range	0% - 100.0%
Values	*Overrides per flight mode* · *Default, set to zero* → 0.0%
⊠	FM0 (Cruise) ▼ · 10.0%
⊠	FM5 (Speed) ▼ · 5.0%
⊠	FM6 (Thermal2) ▼ · 2.5%
⊠	FM7 (Thermal1) ▼ · 3.0%

5.11 AILERON=>RUDDER

This mix can help with entry into turns, and is especially useful in Landing mode. Adjust in **V_AilToRud**. Adjust in the same way as for Snapflap (section 5.10).

6 FLIGHT TESTING TIPS

6.1 ADJUSTING PITCH TRIM WITH BRAKES

The brake-aware trim system makes it easy to optimise the pitch trim at any brake setting.

Here's the procedure:

1. First, adjust the trim in Cruise mode.
2. Next, apply varying amounts of brake, and nudge the elevator trim as necessary. (Behind the scenes, the elevator trim is adjusting the brake compensation curve 'BrakeComp' - see section 5.7)

7 CUSTOMISING YOUR SETUP

This section describes how to customise your setup. You can customise at any time.

7.1 CONFIGURING THE LOW BATTERY ALARM

The low battery alert is disabled by default. When enabled, it sounds a "receiver battery low" alert every 7 seconds, while the voltage remains below a configurable threshold.

To configure and activate the low battery alarm:

1. Go to the LOGICAL SWITCHES menu, open LSW27: RXBAT_LOW.
2. Set the source to 'LiPo' or 'RxBat' as required (you may need to discover sensors)
3. Set *Value(X)* to the low voltage threshold.
4. Go to the SPECIAL FUNCTIONS: Play Track:'dl1rxbatlow'.
5. Set *State* to 'enabled' and set the repeat interval (default 7 seconds).

7.2 DISABLING THERMAL 2

If you prefer, you can disable thermal_2. Then only thermal_1 is available.

Function	Menu point	Value	Default
Thermal 2 enable	**VARS**→V_Therm2Enable→*values*	0 = disabled 1 = enabled	Enabled

If Thermal_2 is disabled:

- The physical switch **SW_Thermal1-2** is no longer needed and can be reassigned for other purposes.

- You may wish to change the sound file for Thermal_1 to say just 'thermal' or 'slow' - alternative WAV files are provided in the package. Go to **SPECIAL FUNCTIONS**:PlayTrack:'dl1th1' and replace with your choice.

7.3 REVERSING THE BRAKE STICK

By default, zero brake is with the throttle stick forward. To reverse the stick:

1. Open the **MIXER** menu
2. Go to mixer ThrWDeadband
3. In the source field, long press and check the *Negative* option.

Zero brake now corresponds to the bottom of stick travel.

7.4 LAUNCH HEIGHT ANNOUNCEMENT

If you have altitude telemetry, the system can announce the launch height. This is the difference between the height at launch, and the maximum height achieved until 3 seconds after exiting Zoom mode.

To enable this feature, edit the special function as described below. Note that the special function already exists in the template, it just needs to be enabled. The callout delay can also be changed.

Function	Menu point	Note
Callout enable	**SPECIAL FUNCTION**→ PlayAudio ActiveCondition = ALT_CALL	To activate callout, set *State* to 'enable'
Callout delay	**LOGICAL SWITCHES**→EXIT_ZOOM_DELAY→*During*	Callout delay, default=3secs

7.5 SETTING DIFF ADJUSTMENT RANGE

The default range of diff adjustment is −30% to +70%. It can be changed by editing the end points of curve 'DiffRng'.

7.6 ADJUSTING BRAKE STICK DEADBAND

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

Function	Menu point	Value	Default
Brake stick deadband	**CURVES**→ThrDb	Set point 2→X for required deadband	85

7.7 MAKING YOUR OWN MODIFICATIONS

If you want to make your own modifications, please study the Excel documentation and make sure you understand the implications of any changes. Recommended workflow as follows:

- Set up your model as described in this guide.
- Backup your setup (make a clone)
- Apply your modifications incrementally, testing and backing up as you go along.

8 DISCLAIMER

Although this setup is well tested, it's up to the pilot to make sure that the controls respond correctly under all conditions. The author will not be responsible for the consequences of any bugs in the setup or documentation or as the result of changes in Ethos.

Test your setup thoroughly before the first flight and after any modifications!

If in doubt, don't fly!!

If you find any errors in this document, or have any queries, you can contact me via http://rc-soar.com/email.htm. For technical queries, please provide the following information:

- Transmitter type
- Ethos version
- DLG template version

Safe flying!

- Mike Shellim