DLG

OpenTX template for four-servo DLG's

Version 2.1

Setup Guide

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Thermal 1
Thermal 2

Speed
Cruise
(Thermal)

Landing

Camber

Ele trim
Brake comp

Aileron diff

Aileron trim

Launch
Zoom

CONTENTS

1 INTRODUCTION

1.1 DESCRIPTION

DLG is a full feature template for four-servo DLGs. Yet it is quick to set up, and fully customisable. Full documentation is provided. Version 2 features several improvements for even quicker setup, easier trimming and direct adjustment of camber.

Specification:

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
- Thermal1, Thernal2, Cruise, Speed
- Landing
- Voice confirmation

IN-FLIGHT ADJUSTERS
- Adjuster for aileron diff (per FM)
- Adjuster for camber (per FM)
- Adjuster for brake compensation

SNAPFLAP
- Snapflap, preset per flight mode.

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

CROW BRAKE FEATURES
- compensation adjustment using regular elevator trim
- super diff for better roll response under braking

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

Now begin your journey to a great DLG setup! But first, here are the golden rules for success:

> ### - READ THROUGH THESE INSTRUCTIONS ONCE BEFORE STARTING!
> ### - FOLLOW THE INSTRUCTIONS IN SEQUENCE!

1.2 PACKAGE CONTENTS

What's included in the ZIP file:

Filename	Description
DLG_21_SetupGuide.pdf	This document
DLG_21_SettingsRef.xls	Settings reference
DLG_21*.otx	Model settings
Dl1***.wav	Sound files
DLG_21_Zorro-addendum.pdf	Addendum with mods for RM Zorro

1.3 REQUIREMENTS

The following are required:

- Any OpenTX transmitter with OpenTX 2.2.2 or later
- A momentary switch on the correct side, for launching
- OpenTx Companion software + USB cable.

2 OVERVIEW

2.1 STICK MODE AND SWITCH ASSIGNMENTS

Any stick mode may be used. The stick mode is set in the **RADIO SETUP → MODE** menu.

The default switch assignments are designed for the Taranis X9D. *If using a different radio, check that the switches are of the correct type, and re-assign if necessary.*

Function	Switch type	Default	How to re-assign
Main flight mode switch	3-pos	SA	see section 7.1
Launch, CAL modes	Momentary	SH	see section 7.4
CAL submode	2- or 3-pos	SA	see section 7.5
Thermal1, Thermal2 modes	2- or 3-pos	SF	see section 7.2
Brakes/landing mode		Throttle stick	
Aileron diff adjustment		Rudder trim	
Camber adjustment		Throttle trim	

2.2 FLIGHT MODES

There are 7 flight modes: Launch, Zoom, Landing, Thermal1, Thermal2, Cruise and Speed.
Launch and Zoom have highest priority. Landing has priority over Thermal, Cruise and Speed.

Flight Mode	ID	Activation switches (defaults shown)	Priority
Launch	FM2	SH↓ (momentary switch)	High
Zoom	FM3	Follows Launch mode. Down eleva to exit	High
Landing	FM4	Throttle stick ↓ (activates brakes)	Mid
Cruise	FM0	SA —	Low
Speed	FM5	SA ↑	Low
Thermal 1	FM6	SA ↓ and SF↑	Low
Thermal 2	FM7	SA ↓ and SF↓	Low

2.3 SERVO ASSIGNMENTS

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

The left and right channels are not interchangeable – *please ensure they are connected correctly!*
Channel assignments can be changed using the author's ChannelChanger script.

2.4 MIXER TABLE

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	✓ (RudTrm)	✓			✓	✓(Thr trim)	✓
Zoom	✓ (RudTrm)	✓				✓(Thr trim)	✓
Landing	✓ (RudTrm)	✓	✓	✓ (Ele trim)		✓(Thr trim)	✓
Thermal1/2	✓ (RudTrm)	✓				✓(Thr trim)	✓
Speed	✓ (RudTrm)	✓				✓(Thr trim)	✓
Cruise	✓ (RudTrm)	✓				✓(Thr trim)	✓

2.5 FLIGHT TIMER

Timer1 is the flight timer.

- *To reset and start*: release Launch switch
- *To stop*: pull and hold Launch switch

2.6 CAL MODE

CAL mode is a special flight mode for calibrating the outputs. When CAL is activated, trims are ignored and stick values are passed directly to the outputs. This allows end points and centres to be visualised. To activate CAL mode:

1. Apply full left aileron and full up elevator, and hold.
2. Pull and release SH
3. Release sticks.
4. Listen for voice confirmation.
5. Select the appropriate submode ('calibration' or 'calibrate flap neutral').

Sub mode	Switch	Description
Calibration	SA— *or* SA↑	for calibrating end points and centres. ***The flapperons move in 25% increments.***
Calibrate flap neutral	SA↓	for calibrating the flapperon neutral offset

To exit CAL mode, pull SH.

Note for v2.1: when entering CAL mode, Launch mode is activated briefly – this is expected behaviour.

2.7 BASIC OPERATION

Trims
- Aileron trim is shared across all flight modes.
- Elevator trim is independent in each flight mode (but see section 6.1 for Landing mode).
- Rudder trim is repurposed to adjust differential.
- Throttle trim adjusts camber per flight mode.

Launch offsets
- The rudder offset is adjusted via a GVAR.
- The elevator offset is adjusted using the regular elevator trim

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

Camber control
- Camber/reflex is adjustable using the throttle trim in all flight modes.

Brake compensation (brake=>elevator)
- Counteracts pitching due to deployment of brakes.
- The compensation at full brake can be adjusted in flight, via the elevator trim.
- The compensation with partial brake can be tuned by editing the compensation curve.

Aileron=>rudder mix
- Aileron=>rudder mix can be set per flight mode.

Snapflap
- Snapflap (elevator=> ail) can be preset per flight mode.

2.8 THE FLIGHT SEQUENCE

The flight sequence is as follows:

1. Rotate the model whilst pulling the launch switch. Model is 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, **push forward on the elevator stick**. Model exits Zoom mode.
4. Once out of Zoom mode, the flight mode is determined by flight mode switch (default SA) and throttle stick.

3 PREPARING THE TRANSMITTER

3.1 TRANSFER TEMPLATE TO TRANSMITTER

Start by transferring the template to your transmitter. The model is not needed for this step.

Establish a USB connection
1. Enter Bootloader mode (the exact method will depend on your transmitter).
2. Connect to PC via USB. The tx's SD card should appear as an external drive.

Copy sound files
1. Copy the supplied sound files to the */SOUNDS/{language}* folder on the SD card. For example, the English folder is */SOUNDS/en*. ***Note*: version 2 has some new sound files, do not skip this step!**

Transfer template to transmitter
1. Start the Companion software, using the correct profile for your transmitter
2. Open supplied file *DLG_21.otx*.
3. If using a transmitter other than the X9D, you may receive warnings that certain switches are not available. Make a note of the warnings, and reassign switches if necessary (see section 2.1).
4. From the File menu, choose *Read Models and Settings From Radio*. The models from the radio are displayed in a second window.
5. Drag the *DLG_21* model into an empty slot in the model list.
6. Close the *DLG_21.otx* window.
7. From the File menu, choose *Write Models and Settings To Radio*.
8. Close OpenTx Companion

3.2 HARDWARE CALIBRATION

The transmitter hardware (sticks, sliders etc.) must be properly calibrated, so do so now if you haven't already calibrated or are not sure. To do a hardware calibration:

1. Open the **RADIO SETUP** menu and page to *Hardware -> Calibration* (Horus) or *Calibration* (Taranis)
2. Calibrate all sticks, knobs and sliders.

3.3 TELEMETRY

Check that your transmitter is receiving telemetry (if supported by the protocol and module). If you encounter problems, try rediscovering your sensors as follows:

1. Open the **TELEMETRY** menu
2. Choose 'Delete all sensors' then 'Discover sensors'

RSSI low/critical warning thresholds are set to 45/42. If using the FrSky ACCESS protocol, change to 35/32 (FrSky recommendation).

3.4 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.
- 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 correctly. If not, check that the sound files are in the correct location.

4 CALIBRATING THE OUTPUTS (SERVOS)

In this section you will set the rotation and operating range of the servos.

4.1 SET SERVO ROTATION

First, set the rotation of each servo:

1. Switch on the transmitter (do not power up the receiver yet)
2. Move the elevator stick, and check for correct direction of elevator surfaces. If necessary, reverse the direction of the output (see below).
3. Repeat for the rudder and ailerons. ***Note:*** **the throttle (brake) stick will have no effect yet.**

To change the direction of an output:

1. Go to the Direction field
2. Press {enter}, and immediately {exit}

4.2 ADJUST SERVO END POINTS AND CENTRES

The next task is to set the operating limits of the servos. At the same time, you will compensate for linkage differences between the left and right sides of the model. **All the adjustments are made in CAL mode.**

When making the adjustments:

- Set the servo end points to the *maximum* as limited by the linkages and hinges. You may need to refine the adjustments to achieve symmetry – this is described in each step.
- Adjustments are made using curves. ***Do not alter min, max or subtrim!***

Notes for radios with lo-res mono screens (X-Lite, TX12, Zorro etc.)

To edit a curve on these radios and also on radios running EdgeTX, you must close the OUTPUTS menu, then open the CURVES menu ().

These radios also lack a dedicated GLOBALVARS menu. Instead, GVARs are accessed through the FLIGHT MODES menu.

Channel	Calibration procedure
CH 1 – Rudder	CALibrate the rudder 1. Activate CAL mode 2. Open the **OUTPUTS** menu 3. Highlight the rudder channel (default CH1) 4. Go to the curve field 'Rud', press {long enter } to open curve editor 5. With stick in centre, adjust point 2 so rudder is central 6. Move Rudder stick right (→), then set point 3 for max right movement 7. Move Rudder stick left (←), then set point 1 for max left movement 8. Check equal travel left/right, reduce one or other side if necessary.
CH 2 – Elevator	CALibrate elevator. **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 Ele channel (default CH2) 4. Go to the curve field 'Ele', press {long enter } to open curve editor 5. With Ele stick at centre, adjust point 2 so elevator is central 6. Move Ele stick forward (↑), then adjust point 3 for *upper* limit 7. Move Ele stick back (↓), then adjust point 1 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. Go to **OUTPUTS** menu 3. Highlight left aileron channel (default CH3) 4. Go to the curve field **LtA**, and press {long enter} to open curve editor 5. Throttle stick fully back (↓), adjust point 1 for *lower* end point. 6. Throttle stick fully forward (↑), adjust point 3 for *upper* end point. 7. Adjust point 2 so it lies on the ***straight line*** between points 1 and 3. Do not worry that the point 2 does not correspond to the airfoil centre line – that will be fixed later. Move throttle stick from one end to the other, observing step intervals. If they are grossly unequal, adjust point 2 to for better linearity.
☐ CH 4 – Rt Ail	Next, CALibrate the right aileron so it precisely matches the left aileron: 1. Activate CAL mode, select 'Calibration' submode 2. Return to **OUTPUTS** menu 3. Highlight the right aileron channel (default CH4) 4. Go to the curve field **RtA**, press {long enter} to open curve editor Adjust points 1 – 5 to exactly match the let aileron: 5. Stick fully back, adjust point 1 6. Stick ½-back, adjust point 2 7. Stick to centre, adjust point 3 8. Stick to ½-forward, adjust point 4 9. Stick fully forward, adjust point 5 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.

Channel	Calibration procedure
Aileron offset	Next, CALibrate the aileron offset: 1. Activate CAL mode 2. Select 'calibrate flap neutral' submode. 3. Page to **GLOBALVARS** menu. 4. Go to cell GV5:Fof→FM0 (Note **FM0**, not FM1) 5. Adjust offset so that ailerons follow the neutral profile If ailerons are not in line, redo the calibration of the left aileron (see above), paying attention to the points either side of the neutral position.

Check operation:
1. Exit CAL mode
2. Move the sticks, checking that aileron, elevator and rudder control surfaces move in the correct sense. **Note that the throttle stick (for brakes) will not function yet** (it will be configured in the next section).
3. The travel will be excessive – don't worry, it'll be dialled down in the next section.

5   CONFIGURING TRAVEL AND MIXERS

In the final section, you'll set the control travel ('rates') and mixers. Watch your model come to life!

5.1   AILERON, ELEVATOR AND RUDDER TRAVEL (INPUTS MENU)

In this section, you'll reduce the rates of the main flight controls, to achieve the required travel.

1. Activate Cruise mode
2. Open the **INPUTS** menu
3. Scroll down to [I]Ail, [I]Ele or [I]Rud as required
4. Press {LONG ENTER} and choose Edit
5. Go to the weight field
6. Adjust weight for required travel.
7. To add expo, go to the Curve field, and change the curve type from 'Diff' to 'Expo'. Set required value.

When adjusting aileron travel, *consider upward travel only* (downward travel will be adjusted when setting diff, in the following section.)

5.2   AILERON DIFF (RUDDER TRIM)

Aileron differential alters the downward travel of the ailerons in response to roll commands.

Diff is adjusted using the rudder trim. As the trim is moved from left to right, the amount of Diff *decreases* thus *increasing* the roll rate – think of the trim as a roll rate adjuster.

The range of diff adjustment can be changed (see section 7.9).

New in v2.1: The default minimum diff has been changed to -30%, allowing down-travel to exceed up-travel as is required for some DLG setups.

Diff settings are stored independently for each flight mode - make sure to set diff correctly for each flight mode.

5.3   RUDDER LAUNCH OFFSET (GV: RUD)

Counteracts rotation of the model following launch. Adjust as follows:

1. Open the **GLOBALVARS** menu
2. Go to row 'Rud', column FM2:Launch
3. Pull on the Launch switch, and hold.
4. Adjust the GV for required offset
5. Release the Launch switch
6. Push forward on elevator stick to exit Zoom mode.

5.4   ELEVATOR LAUNCH OFFSET

There is no dedicated elevator offset adjustment. Instead, activate launch mode and adjust the elevator trim.

5.5   BRAKE TRAVEL (GV: BRK→FM4)

Set the brake=>aileron travel as follows:

1. Open **GLOBALVARS** menu
2. Enable Landing mode
3. Move throttle stick back (full brake)
4. Go to row 'Brk', column FM4:Landing
5. Adjust for required down movement

5.6   SUPERDIFF (GV:SDF→FM4)

Superdiff is an optional adjustment which may improve roll response under braking. As the brakes are applied, the travel of the rising aileron (in response to a roll command) is gradually increased by the amount that you specify. Try a small amount first, as too much can adversely affect handling.

To set the amount of Superdiff:

1. Open the GVARS and scroll to line GV6:SDf.
2. Go to the FM4 column (for Landing mode).
3. Enter Landing mode and apply full brakes and full aileron
4. Adjust GV as required

5.7   CAMBER/REFLEX PRESETS (THROTTLE TRIM)

Camber and reflex are adjustable independently in all flight modes.
The amount of camber is adjusted using the throttle trim:

- Trim centre = zero camber
- Trim forward = reflex
- Trim back = +ve camber

New in v2.1 In Landing mode, adjusts the 'starting' camber.

5.8   SNAPFLAP (GV:SNF)

Snapflap (Ele=> aileron) is adjustable per flight mode. Adjust as follows:

1. Open **GLOBALVARS** menu, go to row 'SnF'
2. Activate flight mode to be adjusted - the column is highlighted
3. Adjust value in highlighted column

5.9 AIL=>RUDDER (GV:A2R)

This mix can help the model enter the turn. Adjust per flight mode as follows:

1. Open **GLOBALVARS** menu, go to row 'A2R'
2. Activate flight mode to be adjusted - the column is highlighted
3. Adjust value in highlighted column

6 FLYING NOTES

6.1 ADJUSTING PITCH TRIM IN LANDING MODE

Version 2 features Supertrim. This is a simple way of adjusting pitch trim in Landing mode, using the same trim lever for both the base trim and the compensation. The adjustment procedure is as follows:

1. Enter Cruise mode and adjust base trim as normal, using the elevator trim.
2. Now enter Landing mode, and apply 75% - 100% brakes. *Still using the elevator trim*, adjust the compensation as follows:
   - Trim fully back = zero compensation
   - Trim fully forward = 80% down elevator

Technical note: In Landing mode, (a) The base trim is shared from Cruise mode and (b) the function of the elevator trim lever changes so that it becomes an adjuster for the compensation mix.

Adjusting the compensation curve.

Once the compensation is adjusted, the response with partial brake can be tuned by editing curve CV7:BrC. *Alter points 2 – 4 only.* The default curve is a typical 'S' shape.

7 CUSTOMISING YOUR SETUP

This section describes how to customise your setup. You can customise at any time without breaking the setup.

7.1 CHANGING THE MAIN FLIGHT MODE SWITCH

Main flight mode switch

The main flight mode switch is defined in logical switches L2 and L3:

Function	Menu point	Assign to	Default
Speed mode	**LOGICALSWITCHES**→L2→V1	3-pos switch	SA↑
Thermal mode	**LOGICALSWITCHES**→L3→V1		SA↓

The same 3-position switch must be used for both flight modes.
Cruise mode is automatically assigned to the remaining position.

7.2 CONFIGURING THERMAL 1/THERMAL 2 MODE SWITCH

By default, two alternative thermal modes are available Thermal_1 and Thermal_2. The selection switch can be 2- or 3-position, and is defined in logical switch L28:

Function	Menu point	Assign to	Default
Thermal_2 select	**LOGICALSWITCHES**→L28→V2	2- or 3-pos switch	SF↓

The remaining switch position(s) are assigned to Thermal 1.

7.3 HIDING THERMAL 2

If you prefer, you can hide thermal_2. In that case, only thermal_1 is available; the selector switch (default SF) can then be re-used for another function.

Function	Menu point	Value	Default
Thermal_2 enable	LOGICALSWITCHES→L4→V2	99 = disabled 100=enabled	Enabled

If hiding Thermal_2 mode, you may wish to change the sound file for Thermal_1 to say just 'thermal' or 'slow'. Suitable WAV files are provided in the package, assign in the SPECIAL FUNCTIONS menu=>SF9.

7.4 CHANGING THE LAUNCH AND CAL SWITCH

Launch and CAL modes share the same momentary switch, default **SH**. On some radios, SH is a regular 2- or 3-pos switch, and it will be necessary to reassign to the momentary. To do this, edit logical switch L1:

Function	Menu point	Assign to	Default
Launch/CAL switch	LOGICALSWITCHES→L1→V1	Any momentary switch	SH↓

SAFETY: The switch must be a momentary type, do not use a regular switch!

7.5 CHANGING THE CAL SUBMODE SWITCH

The CAL submode switch selects between 'normal' and 'aileron neutral' calibration modes. It must be a regular 2- or 3-position switch. The default is SA, however on some radios SA is a momentary switch. To reassign the CAL submode switch, edit logical switch L5:

Function	Menu point	Assign to	Default
CAL Submode switch	LOGICALSWITCHES→L5→V1	Any 2- or 3-pos switch	SA↓

7.6 ADDING RATES

Rates are managed in the **INPUTS** menu. To add a new rate:

1. Go the **INPUTS** menu.
2. Highlight the last line in the target group (Ail, Ele or Rud).
3. Press {long Enter} and choose 'Insert Before'
4. Create a new input line.
5. Set source = Ail/Ele/Rud as appropriate
6. Set weight to the new rate.
7. Set expo as required
8. Tick applicable flight modes (0: Cruise, 2: Launch, 3: Zoom, 4: Landing, 5: Speed, 6: Thermal2, 7: Thermal1). (Alternatively, you can select via a switch instead of via flight modes.)

Here is an example showing triple aileron rates linked to flight modes. Rate = 50% for FM5, and 80% for FM4. For all other flight modes, rate = 75%.

The last (or only) line in each group must have all flight modes checked, and switch = '---'. This provides a safe fallback in case none of the previous lines is selected due to a data entry error. For a deeper explanation see 'more about inputs'.

7.7 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 CH23:RawBr

Go to the Curve field, and change the curve from CV9:Thr to CV9:!Thr (note leading '!').

7.8 Launch height announcement

If you have ALT telemetry, you can enable the announcement of launch height. This is the difference between the height at launch, and the maximum height achieved until 3 seconds after exiting Zoom mode. Configure as follows:

Function	Menu point	Note
Callout enable/disable	SPECIAL FUNCTIONs→SF14	*Disabled:* L26, '---' (default) *Enabled:* L26, **'ALT+'** *(make sure to discover sensors first, otherwise ALT+ will not be available)*
Callout Zoom delay	LOGICAL SWITCHES→L25→Duration	Default=3secs

7.9 Setting diff adjustment range

Aileron diff is adjusted via the rudder trim. The default range is −30% to +70%. The range can be adjusted by editing the end points of curve CV10:Dif.

7.10 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→CV9:Thr	Set point 2 for required deadband	85

7.11 Zoom Safe Exit (ZSE)

Zoom mode is exited by pushing forward on the elevator stick. With the default configuration, the pilot must ensure that the brake stick is in the 'off' position when exiting Zoom mode, otherwise the brakes will deploy suddenly.

Zoom Safe Exit (ZSE) is an optional interlock which prevents this. When ZSE is enabled, the brake stick must be in the 'off' position in order to exit Zoom mode. If the brake stick is not in the off position, then pushing forward on the elevator stick will not exit Zoom mode.

ZSE is disabled by default. It's enabled by editing logical switch L13.

Function	Menu point	Logical switch	Default
Zoom Safe Exit	LOGICAL SWITCHES →L13	*Disabled:* a>x, Ele, 25, **---** *Enabled:* a>x, Ele, 25, **!L12**	Disabled

Note: The '!' in front of L12 signifies 'inverse'. On some radios, the inverses are included in the logical switch pick list. On other radios like the Radiomaster Zorro, there is a separate 'invert' option.

7.12 Making your own modifications

If you wish to make your own modifications, please study the Excel documentation carefully 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 work
- 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 OpenTx.

Remember to 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 at http://rc-soar.com/email.htm. For technical queries, please provide the following information:

- Transmitter manufacturer and model
- Operating system (Open/EdgeTX)
- Operating system version
- DLG template version

Safe flying!

- Mike Shellim