DLG template for OpenTX

Version 1.2

Setup Guide

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1 CONTENTS

2 INTRODUCTION

2.1 DESCRIPTION

DLG is a richly featured template for discus launch gliders with four servos. It includes a Zoom mode, and a launch height callout. A special CAL mode is provided, for precise adjustment of control surfaces.

Specification:

APPLICATION
- For DLG gliders with four servos/flapperons
- Any stick mode

LAUNCH HEIGHT CALLOUT
- Optional launch height callout (using ALT telemetry)

6 FLIGHT MODES
- Launch followed by Zoom
- Thermal, Cruise, Speed
- Landing
- Voice confirmation

IN-FLIGHT ADJUSTERS
- Adjuster for aileron diff
- Adjuster for brake compensation
- Adjuster for camber compensation

CAMBER CONTROL
- Choice of preset, switched, or variable.

CONTROL SURFACE CALIBRATION
- integrated 'CAL' mode
- 5-point balancing curve for flapperons

MISC
- Reassignable controls and switches
- Integrated flight timer
- Aileron to rudder mix
- Channels 5,6,7 free for other functions

If you already have a DLG, you can reassign the channels to match the model using the author's ChannelChanger script.

Okay, so let's begin your journey to a great DLG setup! But first, here are the golden rules for success:

READ THROUGH THESE INSTRUCTIONS ONCE BEFORE STARTING!

and

FOLLOW THE INSTRUCTIONS IN SEQUENCE!

2.2 PACKAGE CONTENTS

What's included in the ZIP file:

Filename	Description
DLG_12_SetupGuide.pdf	This document
DLG_12_SettingsRef.xls	Settings reference
DLG _12*.otx	Model settings
dl1***.wav	Sound files

2.3 REQUIREMENTS

The following are required:

- Any OpenTX transmitter with OpenTX 2.2.1 or later
- A momentary switch on the correct side, for launching
- OpenTx Companion software + USB cable.

3 OVERVIEW

3.1 STICK MODE AND CONTROL ASSIGNMENTS

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

The default control assignments are as follows:

Function	Control
Flight mode selection	SA (3-pos) To change, see section 7.1
Launch/Zoom switch	SH (momentary). To change, see section 7.2
Landing mode / brakes	Throttle stick
Compensation adjust	Throttle trim
Aileron diff adjust	Rudder trim

3.2 FLIGHT MODES

There are 6 flight modes: Launch, Zoom, Landing, Thermal, Cruise and Speed.
Launch and Zoom have priority over all other modes.
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 elevator to exit*	High
Landing	FM4	Throttle stick ↓ (activates brakes)	Mid
Thermal	FM5	SA ↓	Low
Cruise	FM0	SA —	Low
Speed	FM6	SA ↑	Low

3.3 FLIGHT SEQUENCE

The flight sequence is as follows:

1. Spin 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 fm switch (SA) and the brake stick.

3.4 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	Camber comp	Snapflap
Launch	Y(RudTrm)	Y			Y	Y		Y
Zoom	Y(RudTrm)	Y				Y		Y
Landing	Y(RudTrm)	Y	Y	Y(Thr trm)				Y
Thermal	Y(RudTrm)	Y				Y	Y(Thr trm)*	Y
Speed	Y(RudTrm)	Y				Y		Y
Cruise	Y(RudTrm)	Y				Y		Y

* if variable camber is enabled

3.5 SERVO ASSIGNMENTS

Channel	Function
1	Rudder
2	Elevator
3	Left Aileron
4	Right Aileron
5	Free
6	Free

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

3.6 FLIGHT TIMER

Timer1 is the flight timer.

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

3.7 CAL MODE

CAL mode (FM1) is a special flight mode for calibrating the outputs. When CAL is active, mixers and trims are disabled. There are two submodes (see below).

To activate CAL mode:

1. Apply full left aileron and full up elevator, and hold.
2. Pull and release SH
3. Release sticks.
4. Check that CAL mode is activated.
5. Choose the submode
    - Mode 1 (SA—): for calibrating servo end points, and balancing the flapperons. **In this mode, the flapperons move in 25% increments.** It's not a faulty gimbal, it's to aid calibration 😊
    - Mode 2 (SA↓): for calibrating flapperon neutral

To exit CAL mode, pull SH.

3.8 BASIC OPERATION

Trims

- Aileron trim is shared across all flight modes.
- Elevator trim is independent for each flight mode.
- Rudder and throttle trims are repurposed for other functions (see below).

Rudder offset

- Rudder offset for launching is adjusted is via a GVAR.

Aileron differential

- Aileron diff is adjustable independently for each flight mode. Adjustment is via the rudder trim lever.

Camber control

- Camber (or reflex) presets are configured individually for Launch, Zoom, Cruise, Thermal and Speed modes.
- In Thermal mode, instead of a preset, you can optionally assign a slider or 3-pos switch – see section 7.4. Camber compensation allows you to counteract pitch changes.

Brake compensation (brake to elevator)

- Brake compensation cancels pitch changes due to deployment of brakes.
- The amount of compensation can be adjusted during flight, via the throttle trim.
- Non-linear compensation may be employed by editing a curve

Aileron to rudder mix

- Aileron to rudder mix can be applied individually for each flight mode.

Snapflap

- Snapflap (elevator to flapperon mixing) can be set independently for each flight mode.

4 PREPARING THE TRANSMITTER

4.1 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*.

Transfer template to transmitter

1. Start the Companion software, using the correct profile for your transmitter
2. Open supplied file *DLG_12.otx*.
3. If using a transmitter other than the X9D, you may receive warnings that the **SA** and/or **SH** are not available. Make a note of the warnings, and reassign switches if necessary (section 7).
4. From the File menu, choose *Read Models and Settings From Radio*. The model list from the radio is displayed in a second window.
5. Drag the *DLG_12* model into an empty slot in the model list.
6. Close the *DLG_12.otx* window.
7. From the File menu, choose *Write Models and Settings To Radio*.
8. Close OpenTx Companion

4.2 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.

4.3 TELEMETRY

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

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

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

4.4 FAMILIARISATION

Using the transmitter on its own, practise the following:

- Activate Launch, Zoom, Thermal, Cruise, Speed and Landing modes (see Section 3.2). *TIP: start with the throttle stick pushed fully forward.*
- Activate CAL mode and sub-modes (see Section 3.7)
- Start/stop/reset integrated flight timer (see Section 3.6)
- Verify that the sounds are working correctly. If not, check that the sound files are in the correct location.

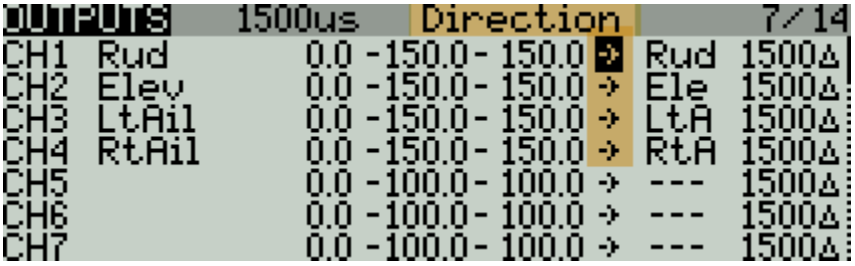
5 CALIBRATING THE OUTPUTS (SERVOS)

In this section you will set the operating range of the servos. For this and the following steps, you'll need the actual model.

5.1 SET SERVO ROTATION

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

1. Switch on the transmitter (do not power up the receiver yet)
2. Enter Cruise mode.
3. Power up the receiver
4. Open the **OUTPUTS** menu
5. Using the aileron, elevator and rudder sticks, check the direction of each output.
   Note: The throttle stick will not function yet.
6. Alter the direction of any outputs as necessary



5.2 ADJUST SERVO END POINTS AND CENTRES

In this section, you will set the operating limits and centres of the servos. At the same time, you will compensate for linkage differences between the left and right sides of the model. *All adjustments are made in CAL mode!*

- Set the servo limits to the ***maximum possible***, as limited by the linkages and hinges. At the end of each step, you may need to reduce one or other end point in order to maintain left/right and up/down symmetry – this is described in each step.
- Adjustments are made using curves. ***Do not alter min, max or Subtrim!***

Channel	Calibration procedure
CH 2 – Ele	Calibrate elevator. **IMPORTANT: in CAL mode, the *elevator* moves in the opposite direction to normal. This aids the calibration procedure. Once out of CAL mode, the elevator will return to normal.** 1. Enter CAL mode 2. Switch SA to middle position 3. In the **OUTPUTS** menu, highlight the Ele channel (default CH2) 4. Skip to 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 1 – Rudder	Calibrate the rudder 1. Enter CAL mode 2. Switch SA to middle position 3. In the **OUTPUTS** menu, highlight the rudder channel (default CH1) 4. Skip to 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 3 – Lt Ail	Start with the left aileron (it will be used as the reference when calibrating the right aileron). 1. Enter CAL mode 2. Switch SA to middle position 3. In the **OUTPUTS** menu, highlight left aileron channel (default CH3) 4. Skip to 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.* 8. 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. Enter CAL mode 2. **SA** to middle position 3. In the **OUTPUTS** menu, highlight the right aileron channel (default CH4) 4. Skip to curve field **RtA**, press {long enter} to open curve editor Adjust points 1 – 5 to exactly match the left flap: 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	Finally, adjust the aileron offset: 1. Enter CAL mode, **with SA *down*.** 2. Open the **GLOBALVARS** menu. 3. Go to AOf:FM0 4. Adjust offset so that ailerons follow the airfoil profile Check that the ailerons are in line with each other. If not, then redo the calibration of the right aileron (see previous step), paying particular attention to the two 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.

WELL DONE! CALIBRATION IS COMPLETE - BACKUP YOUR WORK NOW.

6 CONFIGURING TRAVEL AND MIXERS

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

> *Note:* Transmitters with small mono screens (TX12, X-Lite, X9 Lite etc.) do not have a GLOBALVARS menu. Instead, GVARs are accessed through the **FLIGHT MODES** menu.

6.1 AILERON, ELEVATOR AND RUDDER TRAVEL (INPUTS)

Following calibration, the travel may be excessive. In this section, you'll finalise the travel.

1. Enter 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. Skip to the weight field
6. Adjust weight for required travel.
7. If Expo is required, skip to Curve field, choose 'Expo' as the curve type. Set required value.

WHEN ADJUSTING AILERONS, CONSIDER UPWARD TRAVEL ONLY! DOWNWARD TRAVEL DEPENDS ON DIFFERENTIAL (SEE BELOW). DO NOT SPECIFY DIFF IN THE INPUTS MENU.

6.2 ADJUSTING AILERON DIFF

Aileron differential reduces the downward travel of the ailerons in response to roll commands. Diff is adjusted using the rudder trim. The range is 70% to 0% as the trim is moved from left to right (think of the rudder trim as a roll rate control). Diff settings are stored independently for each flight mode - *make sure to set diff for all flight modes!*

6.3 RUDDER LAUNCH OFFSET (GVARS:RUD→FM2)

A small rudder offset can reduce rotation of the model after launch. The launch offset is set as follows:

1. Open the **GLOBALVARS** menu
2. Go to Rud→FM2
3. Pull on the Launch momentary switch, and hold
4. Adjust the GV for required offset

6.4 BRAKE TRAVEL (GVARS:CAM→FM4)

Sets the downward aileron travel due to brakes.

1. Open **GLOBALVARS** menu
2. Enable Landing mode
3. Go to Cam→FM4
4. Move throttle stick back (full brake)
5. Adjust GV for required down movement

6.5 CAMBER/REFLEX (GVARS:CAM)

Camber and reflex are independently adjustable in Launch, Zoom, Thermal, Cruise and Speed modes:

1. Open **GLOBALVARS** menu
2. Go to the Cam row
3. Activate the flight mode to be adjusted
4. Adjust value in highlighted column

Typically settings are zero camber for Cruise and Launch, positive camber for Thermal, and negative camber ('reflex') for Speed and Zoom. However these may differ according to the model.

6.6 BRAKE-TO-ELE COMPENSATION (GVARS:CMP→FM4)

Brake compensation is used to counteract pitch changes as brake is applied. It's adjusted during flight using the throttle trim - this works like a regular elevator trim, so trim centre = zero compensation, forward to pitch down, back to pitch up.

Adjusting compensation

To adjust the compensation while flying the model:

1. Deploy full brake
2. Adjust *throttle trim* for level flight. *Remember not to use the elevator trim!*

How to increase max compensation

The default maximum compensation is +/-60%. If this is insufficient, you can adjust it as follows:

1. Open **GLOBALVARS** menu, highlight Cmp→FM4
2. Increase the GV

Adjusting the compensation curve.

After initial flight tests, you can fine-tune the compensation curve 'BrC'. The point (-100,-100) corresponds to full brakes. The point (100,100) corresponds to zero brake. Do not adjust these end points, alter the intermediate points only. The default curve is a good starting point.

6.7 AIL→RUDDER (GVARS:A2R)

This mix can help turn response. Adjust per flight mode as follows:

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

6.8 ELEVATOR-TO-FLAPPERON ('SNAPFLAP') GVARS:SNP

Snapflap is an optional mix. Adjust per flight mode as follows:

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

7 CUSTOMISATIONS

This section describes how to customise your setup. Customisations will not affect mixer adjustments, so you can customise at any time without breaking the setup.

7.1 CHANGING THE FLIGHT MODE SWITCH

The default flight mode switch is SA, however it can be changed as follows:

Function	Menu point	Assign to	Default
Flight mode switch	Mixers→CH24:FMPos→Source	Any 3-pos switch	SA

To reverse the switch, change the sign of *weight*.

7.2 CHANGING THE MOMENTARY (LAUNCH) SWITCH

The momentary switch is used to select Launch mode, and for selecting the CAL sub-modes. The default setting is **SH,** available on most transmitters. You can specify a different switch as follows:

Function	Menu point	Assign to	Default
Momentary switch	Logical switches→L1	Any momentary switch	SH↓

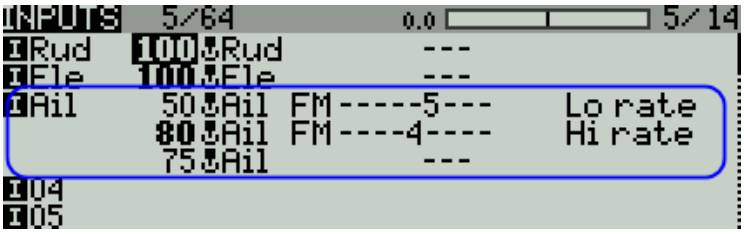
7.3 ADDING DUAL OR TRIPLE RATES

Multiple rates are implemented by adding extra Input lines. To add a new rate:

1. Go the **INPUTS** menu.
2. Highlight the last line in the Ail, Ele or Rud group.
3. Press {long Enter}, 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 the applicable flight modes (0: Cruise, 2: Launch, 3: Zoom, 4: Landing, 5: Thermal, 6: Speed).

Alternatively you can specify a two- or three-position switch to select rates directly rather than by flight mode.

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%.



Note that the last (or only) line in each group is configured as the default, with all flight modes checked, and switch = '---'. This convention should always be observed for safety (see below for explanation).

Background: How OpenTx handles inputs: With each Rud/Ail/Ele group, OpenTX starts at the top line. If the flight modes and switch are not both active, OpenTx advances to the next line and repeats the test. The cycle is repeated until a match is found or the end of the group is reached.
If a match is found, the corresponding rate and expo are applied. **However, if no match is found, the control will be inoperative**. To guard against this possibility, the last line should be a 'catch all' with **all flightmodes checked and no switch**. This will guarantee a match, even if there is no match in the previous lines, perhaps due to a mistake by the user.

7.4 REVERSING THE THROTTLE/BRAKE STICK

By default, zero brake is with the stick at the top. To reverse the stick action (so zero brake is with stick at bottom):

1. Open the **MIXER** menu
2. Go to CH23:RawBr
3. Go to the Curve field, and change the curve from CV9 to !CV9

7.5 SETTING VARIABLE CAMBER (THERMAL MODE)

In Thermal mode, camber can be either *preset* or *variable*. The setting is determined by logical switch L5.

Function	Menu point	Value	Default
Camber preset/variable	LOGICAL SWITCHES→L5	99 = preset, 100 = variable	preset

To adjust preset, see section 6.5.

THE FOLLOWING APPLIES TO VARIABLE CAMBER ONLY:

Changing the camber control

The default control is LS. It can be changed to any spare control:

Function	Menu point	Value	Default
Camber control (switch, slider)	MIXERS→CH18:VcmCtl→Source	Switch, slider or knob	LS

Setting camber limits / reversing the camber control

The camber limits are defined in the 2-point curve CV11:VCR. The limits are independently adjustable. A positive point value means 'above neutral' (reflex); a negative value means 'below neutral' (camber).
Adjust the curve points only. Don't alter mixer weights as compensation will not work properly.

Function	Menu point	Value	Default
Camber limits	CURVES→CV11:VCR→Pt1, Pt2	>0 = above neutral <0 = below neutral	Small range below neutral

Elevator compensation

Elevator compensation is used to counteract trim changes as camber is deployed. Compensation is zero with the flapperons at the upper limit, reaching a maximum at their lower limit.

Compensation is adjusted throttle trim. It works like a regular trim – forward to pitch down, back to pitch up. The default range of adjustment should be fine for most applications but can be altered as follows:

Function	Menu point	Value	Notes
Max compensation	GVARS→Cmp→FM5	Any value >= 0	Default = 25%. Set to zero to disable compensation.

Adjusting pitch trim

The procedure for adjusting pitch trim including compensation is as follows:

1. Apply *minimum* camber, adjust *elevator* trim. (This is the 'base' trim.)
2. Apply *max camber*, adjust compensation using *throttle* trim. The compensation is added to the base trim.

7.6 LAUNCH HEIGHT ANNOUNCEMENT

If you have ALT telemetry, you can enable the announcement of launch height. That height is the difference between height at launch, and the maximum height achieved till 3 seconds after exiting Zoom mode.

Function	Menu point	Note
Callout enable/disable	SPECIAL FUNCTIONS→SF12	*Disabled:* !L24, '---' (default) *Enabled:* !L24, **ALT+** *(make sure to 'discover sensors' first, otherwise the ALT+ option will not be shown)*
Callout Zoom delay	L24→Duration	Default=3secs

To minimise the effect of sensor drift, telemetry values are reset on launch (SPECIAL FUNCTIONS→SF13).

7.7 DIFFERENTIAL ADJUSTMENT RANGE

Diff is adjusted via the rudder trim. The range of adjustment is 0% to 70%. The range can be adjusted by editing the end points of curve CV10:Dif. Negative diff is permitted.

7.8 ADJUSTING BRAKE STICK DEADBAND

The brake stick response incorporates some deadband at the idle end. It can be adjusted as follows:

Function	Menu point	Value	Default
Brake stick deadband	CURVES→CV9:Thr	Set point 2 for required deadband	85

7.9 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:

- Setup your model as described in this manual
- Backup your work
- Apply your modifications incrementally, testing and backing up as you go along.

8 DISCLAIMER

Although this setup is 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 have any queries or suggestions, or if you find any errors in the documentation, or just want to say hello, then please contact me at http://rc-soar.com/email.htm.

Safe flying!

Mike Shellim