DLG template for OpenTX

Version 1.0

Setup Guide

Mike Shellim
3 March 2021
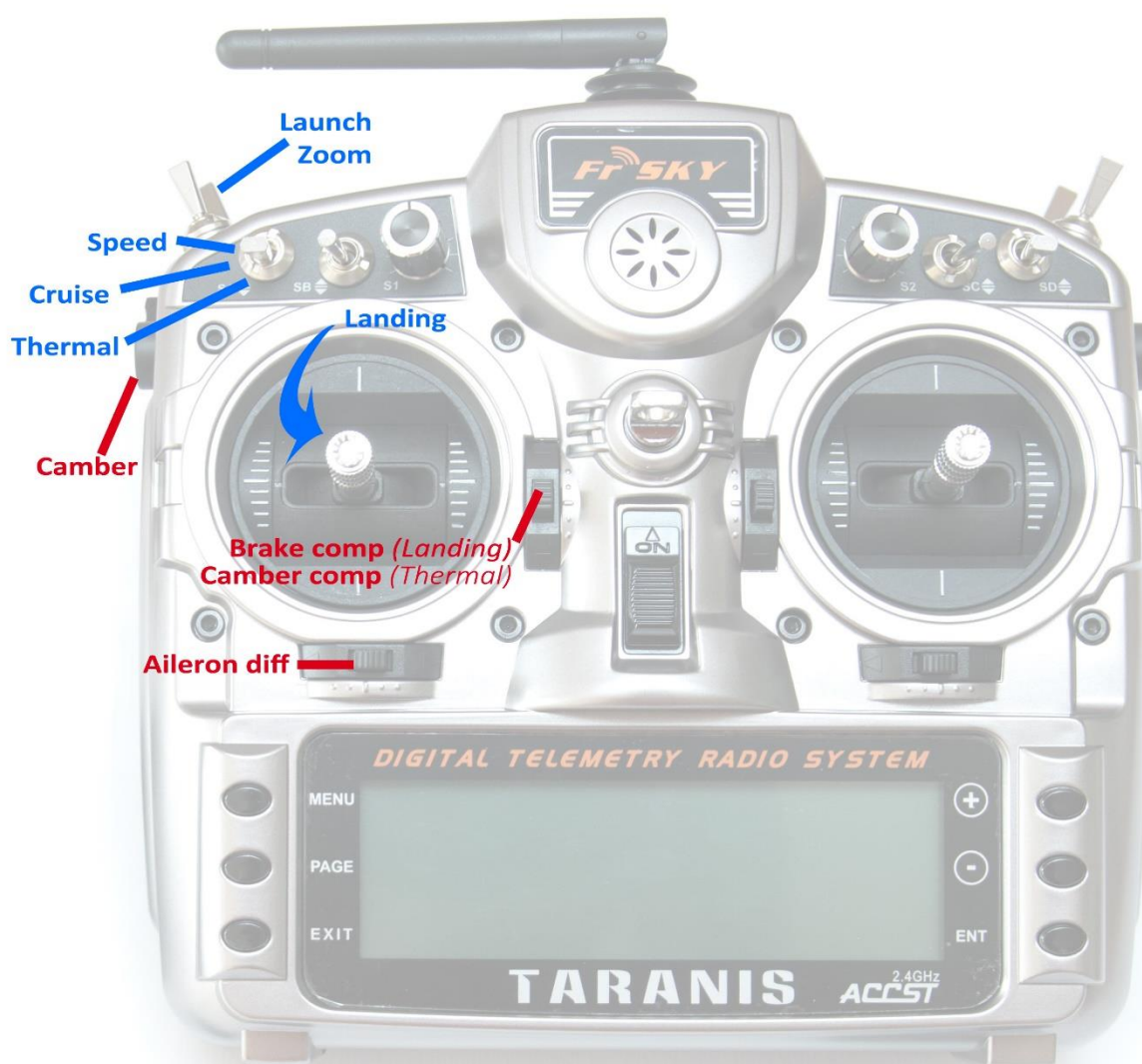
1 CONTENTS

2 INTRODUCTION

2.1 DESCRIPTION

DLG is a full-feature template for discus launch gliders with four servos. It has all the mixers including a Zoom mode for quick relaunches. A special CAL mode ensures precise configuration of brakes.

DLG is designed to be easy to install and operate. If you already have a DLG, you can reassign the channels to match the model using the author's ChannelChanger script.

Please read once through these instructions before installing!

2.2 PACKAGE CONTENTS

Filename	Description
DLG_10_SetupGuide.pdf	This document
DLG _10_SettingsRef.xls	Settings reference
DLG _10x.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 FLIGHT MODES

There are 6 flight modes: Launch, Zoom, Landing, Thermal, Cruise and Speed.

Flight Mode	ID	Activated by	Priority
Launch	FM2	SH↓ (momentary switch)	High
Zoom	FM3	*Follows Launch mode – see next section*	High
Landing	FM4	Throttle stick ↓	Mid
Thermal	FM5	SA ↓	Low
Cruise	FM0	SA —	Low
Speed	FM6	SA ↑	Low

3.2 LAUNCH PROCEDURE

Launch procedure as follows:

1. Pull on the launch switch (SH) and start the rotation. Rudder offset is applied.
2. As the model leaves the hand, release the launch switch. Model goes into Zoom mode, timer starts.
3. At the top of the climb, push forward on the elevator to exit Zoom mode.
4. Once out of Zoom mode, the flight mode is determined by switch SA and the brake (throttle) stick.
   Note: Brakes have priority, so the brake stick should be pushed forward during the zoom phase.

3.3 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:

Control	Assigned to
Throttle stick	Brakes / Landing mode
Throttle trim	Brake compensation (Landing mode) Camber compensation (Thermal mode)

Rudder trim	Aileron diff adjust (per flight mode)
	   Full left = 70% diff (min roll rate)
	   Full right = 0% diff (max roll rate)

SA *(to change, see section 8.1)*	3-pos flight mode switch
SH *(to change, see section 8.2)*	Launch/Zoom switch

3.4 MIXERS

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

Flight mode	Diff	Ail→ Rud	Brake Comp	Camber	Reflex	Camber comp	Snapflap
Launch	Y(RudTrm)	Y					Y
Zoom	Y(RudTrm)	Y					Y
Landing	Y(RudTrm)	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

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, so please ensure they are connected correctly!
Channel assignments can be changed using the author's ChannelChanger script.

3.6 FLIGHT TIMER

Timer1 is configured as an automatic flight timer. The timer is named 'Flight'.

- *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. It allows precise adjustment of aileron tracking. When CAL mode is active, mixers and trims are disabled. To enable CAL mode:

1. Apply full left aileron and full up elevator, and hold
2. Pull SH
3. Release SH
4. Release stick(s)

To exit CAL mode, pull SH.

There are two sub-modes selected via switch SA:

- Mode 1 (SA—): for calibrating servo curves
- Mode 2 (SA↓): for calibrating aileron neutral offset

In sub-mode 1 , the response of the throttle stick is stepped to aid calibration.

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)

Launch offsets
- Rudder offset is preset
- Elevator offset is via the regular elevator trim

Aileron differential
- Diff is adjustable via the Rudder trim.
- Diff settings are stored per flight mode.

Camber mixes
- In Thermal mode, camber is preset by default. Alternatively, you can assign a 3-pos switch – see section 8.3. Or, for transmitters with sliders, you can use a slider – see 8.3.
- In Speed mode, reflex is preset.

Brake compensation (brake to elevator)
- Brake compensation allows you to cancel 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
- Aileron to rudder mix can be applied individually for each flight mode.

Snapflap
- Snapflap (elevator to flap 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_10.otx*. 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 if necessary (see section 8).
3. From the File menu, choose *Read Models And Settings From Radio*. The model list from the radio is displayed in a second window.
4. Drag the *DLG_10* model into an empty slot in the model list.
5. Close the *dlg_10.otx* window.
6. From the File menu, choose *Write Models And Settings To Radio*.
7. Close OpenTx Companion

4.2 CALIBRATE STICKS
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 FAMILIARISATION
Using the transmitter on its own, familiarise with the following:

- Selecting Launch, Zoom, Thermal, Cruise, Speed and Landing modes (see Section 3.1)
- Activating 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)

From now on, you'll need the actual model. In this section you will calibrate the outputs.

5.1 SET SERVO ROTATION

The first task is to set the correct 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 END POINTS AND CENTRES

In this section, you will adjust the servo travel and centres, and balance the left and right ailerons. ***All adjustments are made in CAL mode***.

- Travel adjustments are made with curves. ***Do not alter min, max or Subtrim!***
- Set servo travel to ***maximum possible as limited by the linkages*** (while maintaining left/right and up/down symmetry).

Channel	Calibration procedure
CH 2 – Ele	Calibrate elevator **IMPORTANT: in CAL mode, the elevator moves in the opposite direction to normal. This is to aid the calibration procedure. Once out of CAL mode, the direction 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

Channel	Calibration procedure
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
☐ CH 3 – Lt Ail	Start by calibrating the left 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. 8. Move throttle stick from one end to the other, observing step intervals. You can fine tune point 2 to equalise intervals for best linearity. *Do not worry that the point 2 does not correspond to the airfoil centre line – that will be fixed later!*
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 flap.
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 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 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! Make a backup copy of your work now.

6 CONFIGURING TRAVEL AND MIXERS

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

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

6.1 AILERON/ELEV/RUDDER TRAVEL (INPUTS)

Set travel as follows:

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 movement.
7. If Expo is required, skip to Curve field, choose 'Expo' as the curve type. Set required value.

Important note for ailerons

When adjusting ailerons, consider only the *upward* travel. Downward travel is set via rudder trim which adjusts differential. ***Do not use the Input->Diff function to adjust diff!***

6.2 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

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

Brake compensation is used to counteract pitch changes as brake is applied. It may be adjusted in flight using the throttle trim.

- Trim fully back = zero compensation
- Trim forward = down compensation

First, set the adjustment range:
1. Enable Landing mode.
2. Open **GLOBALVARS** menu, highlight Cmp→FM4
3. Move throttle stick down (maximum brake)
4. Move throttle trim fully forward (max compensation)
5. Adjust GV to set max compensation.
6. Move throttle trim to recommended compensation. If not known, set trim fully back (zero comp).

During flight tests, adjust pitch trim as follows:
1. Enter landing mode
2. Apply full brake, adjust throttle trim.

Adjusting the response: after intial flight tests, you can fine-tune the response by editing curve 'BrC'. End point (-100,-100) corresponds to throttle stick back/full brake. End point (100,100) corresponds to throttle stick forward/zero brake. Do not adjust end points, alter the intermediate points only. The default curve is 'S' shaped, and is a good starting point.

6.4 CAMBER IN THERMAL MODE (GVARS:CAM→FM5)

Camber is set in Thermal mode:
1. Open **GLOBALVARS** menu
2. Enable Thermal mode. If using variable camber option, apply maximum camber.
3. Go to Cam→FM5
4. Adjust GV for required camber

6.5 REFLEX IN SPEED MODE (GVARS:CAM→FM6)

Reflex is set Speed mode:
1. Enable Speed mode
2. Open **GLOBALVARS** menu, go to Cam→FM6
3. Adjust GV for required reflex

6.6 AIL→RUDDER (GVARS:A2R)

This mix can help smooth turns without the need to coordinate rudder and aileron controls. 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

6.7 ELEVATOR-TO-FLAP ('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 PRE-FLIGHT

Just a couple further task before flight.
- Set the battery alarm threshold to suit your battery chemistry, for both the tx and rx.
- Set the failsafe so that the motor channel (CH7:Motor) is -100 on loss of signal.

8 CUSTOMISATIONS

This section describes various simple customisations. Apply these after the basic setup is complete and backed up. Customisations will not affect mixer adjustments, so you can customise at any time without breaking the setup.

8.1 CHANGING THE FLIGHT MODE SWITCH

By default the flight mode switch is SA. It can be changed as follows:

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

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

8.2 CHANGING THE MOMENTARY SWITCH

The momentary switch is used as for Launch mode, and for selecting the CAL sub-mode. By default, the momentary switch is **SH**, however you can specify a different switch:

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

8.3 ENABLING VARIABLE CAMBER (THERMAL MODE)

By default, camber is preset (source=MAX). However you can assign it a switch or slider.

Function	Assign to	Menu point	Default
Camber control	Switch, slider or preset (MAX)	Mixers→CH19:CamCtl→Source	Preset (Max)

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

8.4 ENABLING CAMBER COMPENSATION

If using a switch or slider for camber (see 8.3), you can enable the camber compensation. Compensation is controlled by the throttle trim.

Function	Menu point	Default
Camber compensation	Logical switches→L5 99 = disabled 100 = enabled	99 (disabled)
Max compensation	GVARS→Cmp:FM5	---

Set the maximum compensation as follows:
1. Activate Thermal mode
2. Apply max camber
3. Move throttle trim fully forward (max down compensation).
4. Open the GVARS menu
5. Adjust Cmp:FM5 for max down compensation.
6. Move throttle trim back to centre (zero compensation)

During flight tests:
1. Apply minimum camber, adjust elevator trim.
2. Apply full camber, adjust throttle trim.

8.5 ADDING DUAL RATES

To set up dual rates, you add extra lines in the INPUTS menu associated with a flight mode or switch.

1. Create an input
2. Tick the applicable flight modes or you can specify the switch. Flight mode numbers as follows
   0: Cruise, 2: Launch, 3: Zoom, 4: Landing, 5: Thermal, 6: Speed

Safety note: the last input should be a 'catchall'; that is with all flight modes enabled, and *switch = '---'*. This ensures that the control will be active even if no other line is selected.

Below are examples showing triple rates (a) linked to flight-modes and (b) selected by switch:

(a) Aileron rate by flightmode: FM0 40%; FM2 30%; all other flight modes: 60%

(b) Aileron rate by switch: SB↓ 40%; SB↑80%; default (SB—): 60%

```
INPUTS  5/64                    5/13
IAil    40▪Ail      SB↓    Low
        80▪Ail      SB↑    High
        60▪Ail      ---    CATCHALL
I04
I05
I06
I07
```

> **How OpenTx handles inputs:** Starting with the first Input line, 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** be a 'CATCHALL' with **all flightmodes checked and no switch**.
> If both flightmode and switch are specified in the same line, both must match for the line to be active.

8.6 ADJUSTING BRAKE STICK DEADBAND

The brake stick response incorporates some deadband at the idle end to help prevent accidental deployment. The default value should be fine for most pilots; however it can be adjusted as follows:

1. Go to Curves menu
2. Open CV9:Thr
3. Adjust pt2 -> X. Decrease value to increase the deadband. Default value is 85.

8.7 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.

9 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