Trainer-Students Advanced Settings for OpenTx

There are a few different ways of doing settings for Trainer-Student radio. What I'm writing here is not about "Is it better to share access or to completely swap between trainer and student".

At our club we are intending to do much more student training so I was looking for a way to use multiple planes, different student radios and also sharing models on different Frsky radios. So the idea is to do a copy of a model and have all the settings for student radios inside the model settings (not using the calibration/multiplier of the basic trainer radio functionality). It should also be very easy for complex models.

This should enable us to do a very fast switch from one combination to another.

Following is a description of how this can be achieved. Why this may look a little be complex at the first glimpse it is in fact rather easy because 90% is all the same for every configuration. So the actual variation is mainly done in four mixers. The rest can be done by copy and paste in companion or (for experts: doing some Lua scripts). And we are not touching the normal mixer lines of the model so the risk of messing something up is reduced.

Example G (my favorite)

After 3 years student training this is my personal favorite.

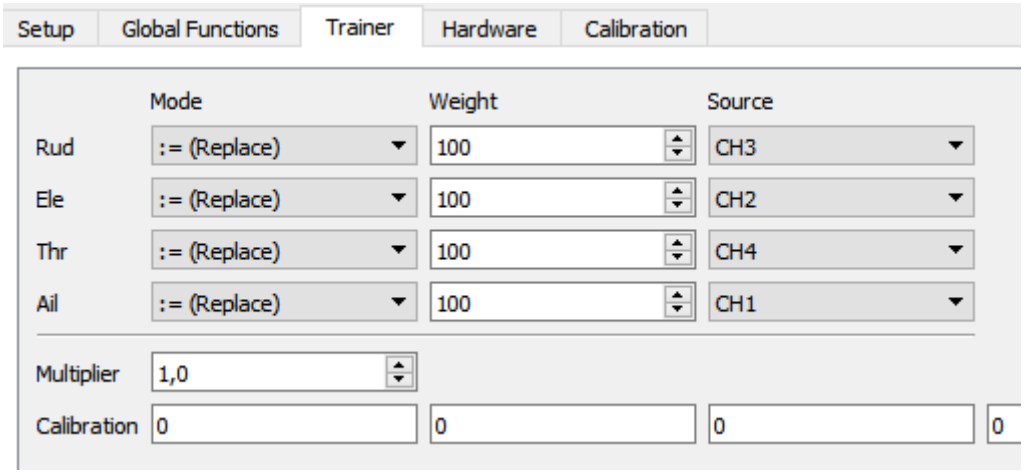
The control of rudders (A/E/R) and throttle are handled separate.
To switch the plane to student the trainer has to set a hardware switch in the required position and also move the sticks (aileron, elevator, rudder) in neutral position. As soon as the trainer moves a stick (aileron, elevator, rudder) he has control again (100%). Control goes back to student when the sticks (aileron, elevator, rudder) are in neutral position again.
The same is done with throttle but independent of A/E/R . Student controls throttle only if the throttle stick of the trainer is at -100%.
It's best to set student completely off by hardware switch when starting or landing.
I also use a switch position to switch off throttle completely for the student.

Warning: When trainer sticks are in idle position but student sticks are not then engine is running. So if you want to take control over throttle as trainer while flying you have to move the throttle stick a little away from the idle position.

Step G.1

On my Taranis x9lite S I select the trainer page of the basic radio configuration. It's important that there is no student radio connected. You set Multiplier to 1.0 and calibrate. So everything should show zero. (Mode, weight and source on this page you do not care because they are not used in our settings.)

So we end up with values of TR… that are exactly how they are transmitted from the student radio. We do not adapt this to different student radios anymore in the basic settings of the radio. (This has to be done only once on every Master radio.)



Step G.2

You define mixer CH23 calculating the sum of the stick movements of the rudders.

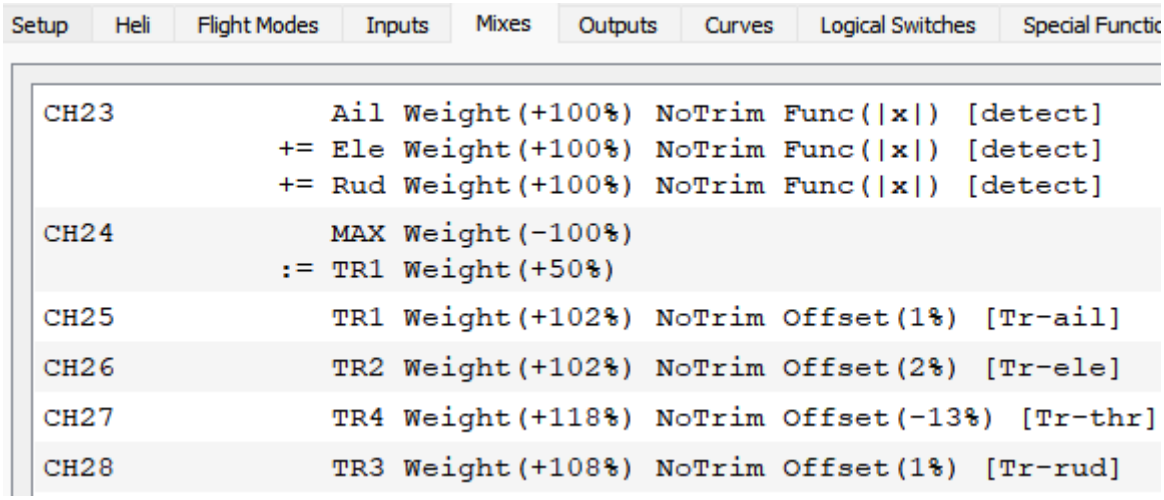
You define Ch24 and assign TR1 as source, weight = 50. Ch24 is used for safety reasons to check whether there is a trainer signal. (The value is -100 if there is no signal. If there is a signal the value will be something in the range -50 to +50)

You are defining mixers (channel 25, 26, 27, 28). Sources are TR1, TR2, TR3, TR4. By choosing the order you are doing the channel mapping. By defining a weight we achieve a range of 200% (-100% to +100%). Last step is to define an offset so that the center-position of the trainer sticks shows 0%. You can easily monitor the values by watching channel or mixer monitor.

The results are four channels calibrated to this specific student radio. In this screenshot it is a very old Multiplex Pico. So the channel Tr4 is throttle, mapped to channel 27 in my Taranis. Also there is a very wide spectrum of weight I have to use. Shouldn't be like that for a modern quality radio.

I use AETR so (Ch25=aileron, Ch26=elevator, Ch27=throttle, Ch28=rudder).

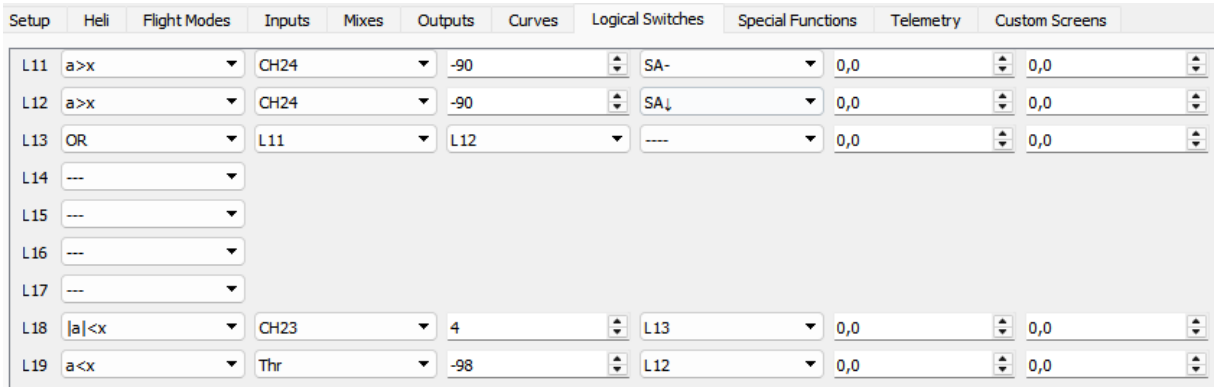
Safety issue: Do carefully check that the channel for throttle really achieves -100% at the minimum position!!!
And also do check that CH25,Ch26 and Ch8 (rudders) are at a minimum deviation to zero. (Best to use channel monitor and do fine tuning with trims of student/spotter radio)



Step G.3

We do need a few logical switches. The results of these are:

L18 on: means Student has access to aileron/elevator/rudder
L19 on: means student has access to throttle

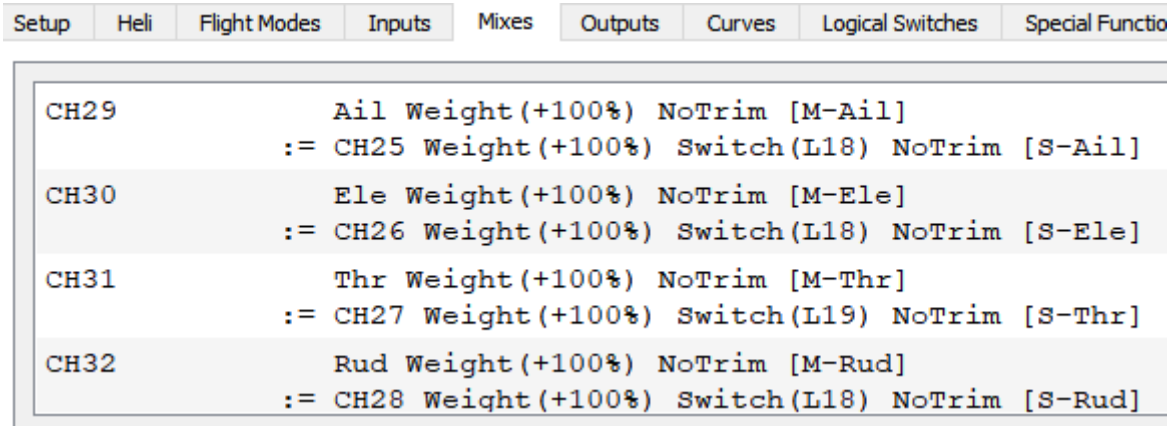


I do use Switch SA for enabling control to student.

SA^ control for student completely off.
SA- student can use rudders.
SAv student can also control throttle

Step G.4

For the student we need a mixer line for every function switched by L18 (rudders) or L19 (throttle).

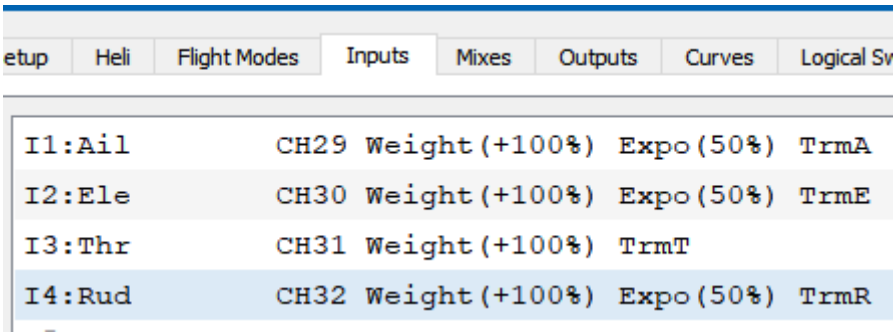


Step G.5

We change the sources of our inputs. I use AETR so it's (Ail to Ch29), (Ele to Ch30) ….

Be aware that by this you lose the Trims in the input line (from ON to OFF). So you have to edit the inputs and select the proper trim-source manually. (Example: for Ail select TrmA)

(The weight and Expo you use in inputs are affecting both trainer and student accordingly. They are not part of trainer-student settings)



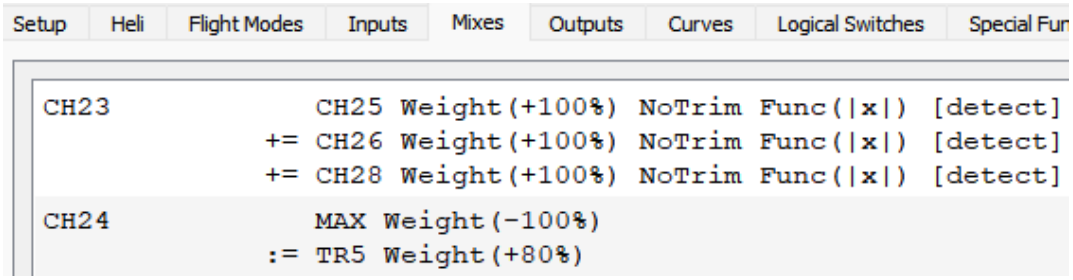
That's it.

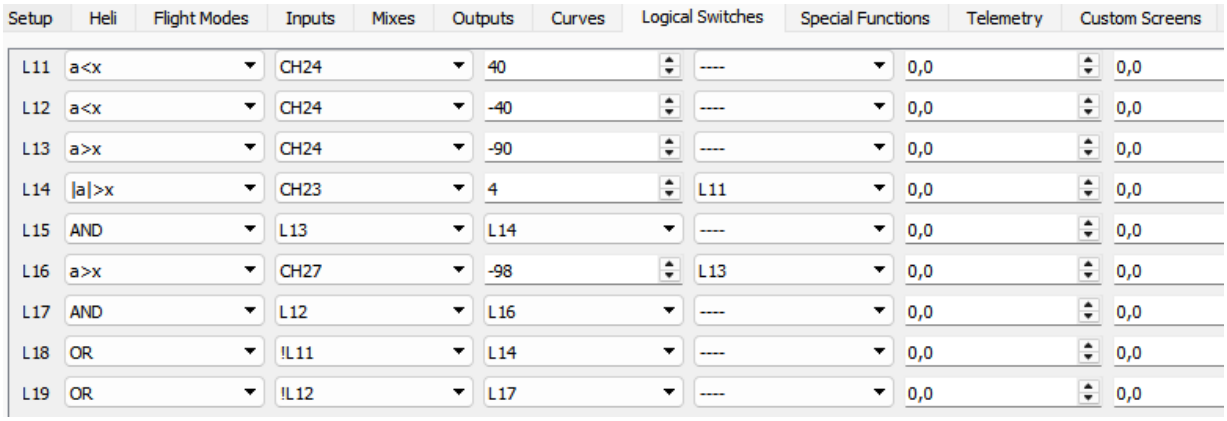
We do not have to modify anything of the other existing settings like mixers for servos.

Spotter Functionality

You can also use this configuration as spotter.
In fact that's what I prefer.

You have to change the mixers for CH23 and Ch24 and also the logical switches.





The functionality of the SA switch is replaced by Ch24 (Tr5) signal.

-100% < Ch24 < -90% student (master radio) has all controls
(cause there is no TR5 signal)

-90% < CH24 < -40% student controls rudders and throttle (TR5 signal ~ -100%)

-40% < CH24 < +40% student controls rudders (TR5 signal ~ 0%)

+40% < CH24 < +100% student has no control (TR5 signal ~ 100%)
(switched off by TR5 signal)

This may be a little confusing. But keep in mind that spotter mode means that the student is operating the master radio that is bound to the plane while the trainer/spotter is operating the slave radio.

Safety issue: Do carefully check that the channel for throttle really achieves -100% at the minimum position!!!
And also do check that CH25,Ch26 and Ch8 (rudders) are at a minimum deviation to zero.
Otherwise student will not get access to controls in spotter mode.
(Best to use channel monitor and do fine tuning with trims of student/spotter radio)

If you have:

To use same model but new student radio:

Make a copy of the model
Adapt mixer channel 25 to 28 to new student radio

Prepare a new model:

Copy logical switches (11 to 19)
Copy mixer channel 23 to 32
Adapt mixer channel 25 to 28 (only if other student radio)
Modify inputs

That's if you don't want to use the scripts.

Safety

Security

The greatest safety risk in trainer/student operation is the unintentional engine start-up (particularly on the ground before takeoff or after landing).

It is therefore essential that you

unlock the engine safety switch when starting only and immediately secure it after landing again.

Switch off student operation immediately using a switch if you don't want the student to be in control.

Reasons for unintentional motor starting

The termination of the trainer/student connection is fundamentally a potential danger. The motor could start uncontrollably.

I have found that the behavior of different connection types is quite different and cannot be predicted with certainty.

Here are some examples (disconnection, causes and consequences):

Bluetooth, Para system:

Cause: Distance between the transmitters is too great (just a few meters are enough)
Or the student switches off the transmitter.

Consequence: Trainer transmitter assumes the value ZERO for the student signals.

With throttle, ZERO means half throttle.
The engine immediately runs at half throttle.

Radio with receiver (e.g. receiver with Sbus or CPPM, or via PWM/PPM converter)

Cause: Student switches off the transmitter, DSC cable disconnected, power supply for receiver switched off...

Consequence: not predictable, depends on the receiver (e.g. failsafe setting) or on the behavior of the converter.

Cable connection:

Cause: Cable accidentally disconnected or student switches off the transmitter.

Consequence: Trainer transmitter assumes the value ZERO for the student signals.
With throttle, ZERO means half throttle.
The engine immediately runs at half throttle.

Countermeasure:

In general, it is important to examine the possible effects of your own constellation before putting it into operation. **To do this, you should first remove the propeller and explore all the options.**

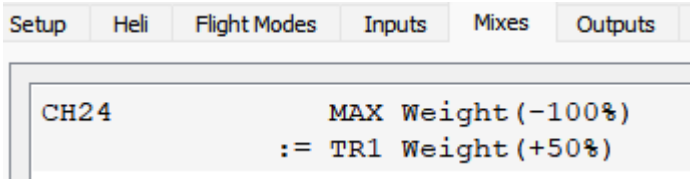
Then you see what happens when you observe the behavior of the engine. But if you want to identify the cause, it is best to also look at the values in the channel monitor (channels 25-29).

Technical solution for Bluetooth connection:

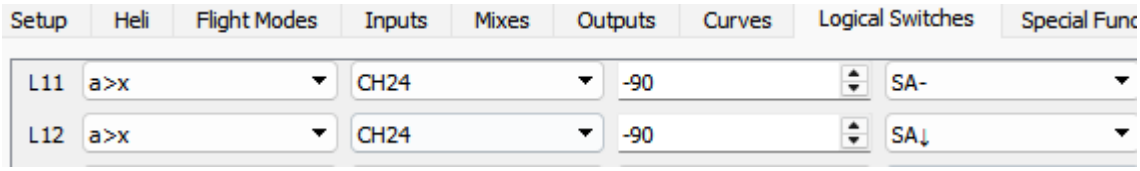
A Bluetooth connection failure has actually led to the engine starting twice for me (once when the student switched off, once because I went to the model to align it on the runway again after a bad takeoff).

To secure this technically, I programmed the following on my transmitter:

I have two mixer lines for CH24. The first line sets the value of Ch24 to -100%.
The second line **replaces** this value with a TR… signal (**weight=50% or 80%**).
In fact the second line is only active in OTx if there really is a signal on TR..
So the value of Ch24 is either -100% if there is no active signal or >-90% if there is a signal.
(In Trainer mode I can use every existing Tr.. value. There so need for an additional channel from slave radio to master radio. In Spotter mode I use Tr5 because I also transmit information what kind of access the student should have.)



A logical switch checks whether CH24 > -90%

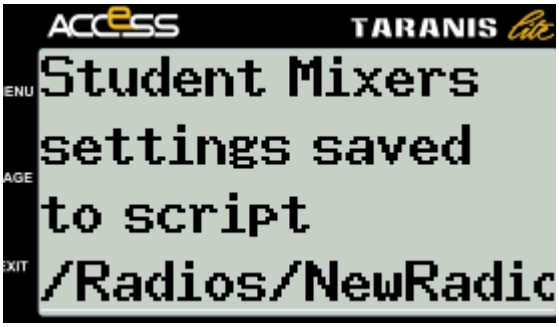


This can also work with other types of connection, but it doesn't have to.

Use of scripts

If you want to make the basic settings using a script, as described here in steps G.1 to G.5, you must proceed as follows:

- It is best to back up the model data or create a copy of the model.
- Select the desired model as active.
- Switch to the basic settings station in menu 2/7
- Start the script "SCRIPTS/TOOLS/stuRadio/TrainerRadio.lua" (or " SpotterRadio.lua")



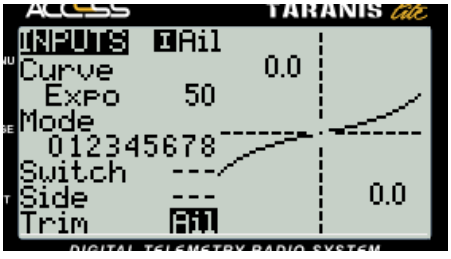
- Pressing the EXIT button takes you back to the normal menu.

- Be aware that the model name will be changed. Characters 9 and 10 have the following meaning.

  "-" for trainer functionality (or "," for spotter functionality)

  "X" represents student/spotter radio is a Radio (example Taranis with AETR)
  (There are also sample scripts "X9lite, Pico, CockMM" that change the definition to another radio type. There is also a script "stuRad" that can generate these scripts)

- Up to and including openTx 2.3.15, the trim must be assigned manually to the inputs. The reason is a bug in the LUA API that was fixed with 2.3.16. (see picture last line, example aileron)



- With the student transmitter connected, carry out the calibration for the student transmitter. (This has to be done only once for every student radio). To do this, start the scripts " calAil.lua , calEle.lua , calRud.lua , calTHr.lua) one after the other from the SD card. The calibration is similar to the calibration of a simulator (such as Phoenix). (Sometimes you have to do throttle manually.)

- Check all calibration values in the "Channel Monitor Channel 25 to 28)". Value range should be from -100% to +100%, zero position of the rudder should really be at zero. It is very important that the throttle reaches -100% (real idle). Please also check that the direction of the deflections corresponds to that of the trainer transmitter.

- If the settings are correct, you can save them in a script. For other models for this student radio, you just start the script from the SD card and the calibration channels (25-28) are overwritten with these values.

  Start the script "SCRIPTS/TOOLS/stuRad /stuRad.lua ".
  A script named "NewRadio.lua " is stored in the same subfolder "/Radios/"
  The first line in the script "/Radios/NewRadio.lua" will be:

  ```
  local studentChar = "X";
  ```

  You can change the "X" to a character that you want as the last character of the model name.
  It's best to change the name of this script to something appropriate for the student/spotter radio (starting with the same Character).

  Trick: Renaming and editing the file NewRadio.lua is very annoying or even impossible on the radio. As an alternativ you can name the highest Flightmode 8 before you start the script stuRad.lua. Then the name of this flightmode and the leading character is used.
  (I recommend to remove the name of the flightmode 8 afterwards).

- If you use a model with a different student/spotter radio, you can easily switch from one student/spotter Radio to another by calling the appropriate script.

Generally

I assume no responsibility or liability for the use of the general procedure and the function of the scripts. Every pilot is responsible for testing the settings sufficiently before putting into operation.

ChrisOHara 04-February2025