Flight Notes By Flightengr

RadioMaster TX16S Mark II – Horizon BNF Plane Setup

This edition of Flight Notes will cover the creation of a basic model that will fly a Horizon Hobby "Bind-and-Fly" (BNF) aircraft with a TX16S on EdgeTX.

My goal with this guide is to bring together all the key pieces of information that you'll need to configure a Horizon BNF plane on your transmitter. I'm using EdgeTX 2.8.4 for the step-by-step process and the screen shots. There is a lot more information on the Internet about various settings in EdgeTX and how to customize the appearance on the TX16S color touch screen, so I'll defer to those sources for additional things you can do when setting up the model.

Overview

Horizon configures the Spektrum BNF receivers to be as simple as possible to set up with the transmitter. Regardless of the actual configuration of the plane, just about all of the receivers are set up to use a very simple wing type with a single channel each for aileron, elevator, throttle, and rudder. If the plane has flaps, then you'll assign another channel to a switch for that purpose. A few of the planes have retractable landing gear, so you'd have a channel for that as well. Finally, you'll need a channel assigned to a switch to change the flight modes on the receiver. Many of their receivers are set up for a two-mode system called SAFE Select, which gives you the ability to turn a self-level feature on and off. Airplanes that are intended to be trainer aircraft will have a three-mode setup, with two modes offering different amounts of pilot assistance and one mode for advanced pilot control.

While it's difficult to cover every possible configuration in one document, going through the configuration for one SAFE Select aircraft with flaps will cover most of Horizon's BNF planes. It will get you a model setup that will work with the other planes with just small modifications.

Getting Started with the Airplane Manual

Everything you need to know about configuring the plane is covered in the manual. However, the people writing the manuals assume you already know quite a bit about programming your transmitter, so the information they give you is consolidated to save paper. This is a bit of a struggle for people using Spektrum radios, too. Let's look at what the manual says and figure out what it's trying to tell us.

I'm going to use a UMX Turbo Timber Evolution as the example for this guide. It has flaps, and it has the SAFE Select configuration that's common on most Horizon BNF aircraft.

Here's what the manual shows about transmitter setup.

Computerized Transmitter Setup DX series, NX series, iX series	
Start all transmitter programming with a blank ACRO model (do a model reset), then name the model.	
Reversing	All Normal
Dual Rates	HIGH 100%
	LOW 70%
Exponential	10% on aileron, elevator and rudder
Servo Travel	100%
Timer	5 minutes
Set Throttle Cut To	-100%

Set FLAP SYSTEM:
    SELECT SWITCH
    POS 0: -100% FLAP   0% Elevator
    POS 1:   0% FLAP   17% Elevator
    POS 2: 100% FLAP 30% Elevator	

First, they tell you to start with a "blank ACRO model". That's telling you to create a new model on a Spektrum radio using the default configuration for an airplane. That will set the following things:

- A Spektrum wing type of "Normal", which means there is one channel each for aileron, elevator, throttle, and rudder.
- All four of those channels are in the "Normal" (not "Reverse") direction in Spektrum terms.
- All servo travel is set to Spektrum's normal range of -100% to +100% with 0% in the center.

Just to help us out, this example then emphasizes that controls are all normal direction and travel should be 100%.

They suggest setting the rates to 100% (normal) for High and 70% for Low, as well as 10% expo on the three servo control channels. When using the recommended battery, the flight timer should be set for 5 minutes (5:00). Finally, the Spektrum Throttle Cut feature should be set to a value of -100%, the normal position for the bottom of the throttle stick.

In this case we're working with a plane with flaps. They should have told us to select a different Wing Type of "1 Ail 1 Flap" on a Spektrum radio to activate the "Flap System" that it mentions. Spektrum has a feature that automatically configures the correct radio channel for flaps (channel 6) and adds some mix input to the elevator to counteract the lift from the flaps. The settings shown can be entered into that screen, but of course we can do something similar with EdgeTX and these numbers will be helpful when we do that.

Important Note About EdgeTX Channel Order

Before going any farther, it's necessary to go over how I have the channel order set on my TX16S. Spektrum arranges the control functions on channels in a different order in their radios

than some other radio manufacturers, and of course I'm bringing this up because it's different than the convention you'll find on EdgeTX.

On EdgeTX, the default channel order for the first four channels is known as "AETR", which means that channel 1 = Aileron, 2 = Elevator, 3 = Throttle, and 4 = Rudder.

On Spektum, the channel order is "TAER", or 1 = Throttle, 2 = Aileron, 3 = Elevator, and 4 = Rudder.

You have to set the MULTI-Module (also called the "4-in-1" radio module or MPM) on the TX16S to be one way or the other, as it's set in the firmware for the MULTI-Module. You can't have it one way for your models with Spektrum receivers and another way for other models.

You'd think that this difference would be a huge problem, but it really isn't. If you leave everything configured for the default of AETR, then the MULTI-Module will do some magic for you and swap the channels around before they get sent out over the air when you're using a Spektrum DSM radio protocol. While you see channel 1 is Aileron, 2 is Elevator, and so forth on your transmitter, the receiver will hear those four channels in the correct order that Spektrum wants to hear.

Bottom line, I strongly suggest that you leave your radio set up for AETR in general, even if you only plan to use Spektrum receivers. If you change it to Spektrum's ordering, you'll be very confused when you read other reference information on the Internet about EdgeTX.

The rest of this guide assumes the transmitter is set for AETR, and I'm going to let the MULTI-Module handle the details behind the scenes.

Creating the Model on the TX16S

To add a new model, I'm going to start from the main model screen and press the roller wheel, and then choose the "Select Model" option.
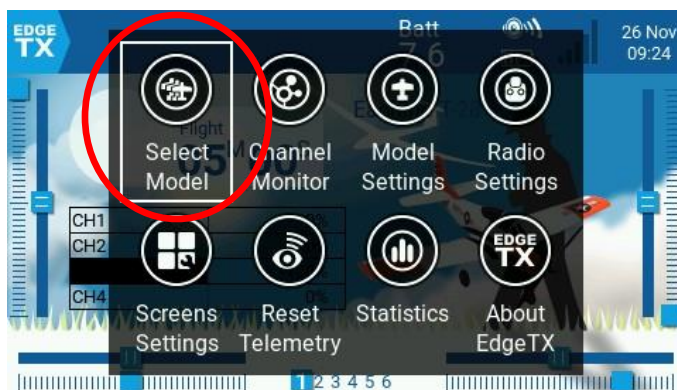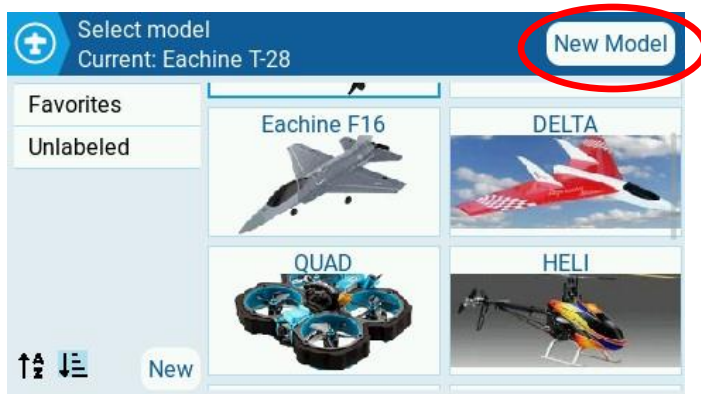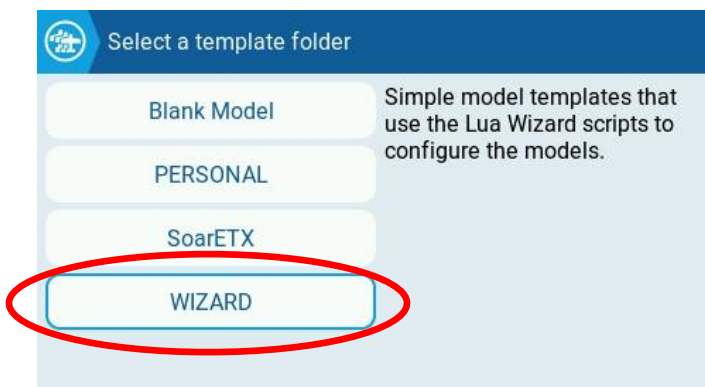
On the Select Model screen, I'm going to select "New Model" in the upper right corner. That will present a screen that gives four choices for how to create that new model.
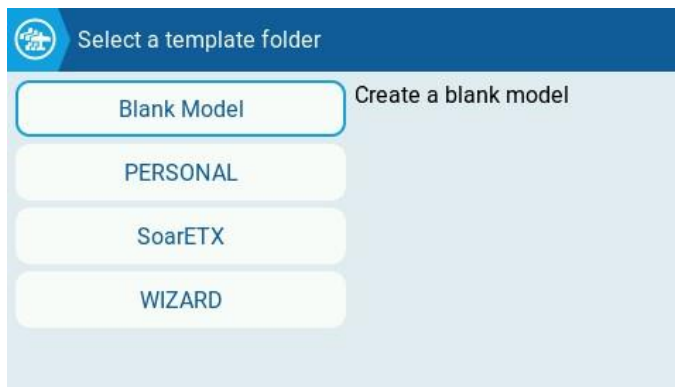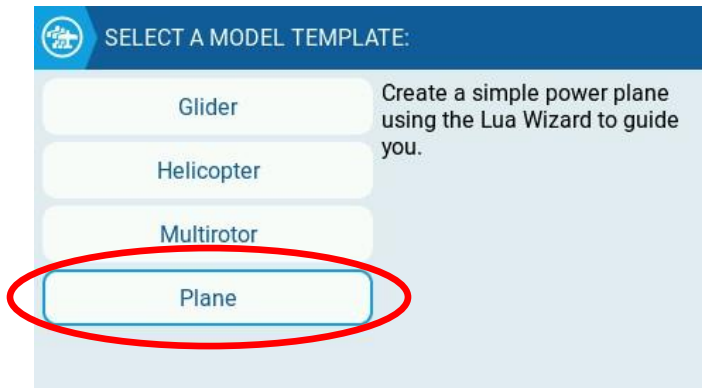

To save a little time, I'm going to use the Wizard Lua script to help set things up.
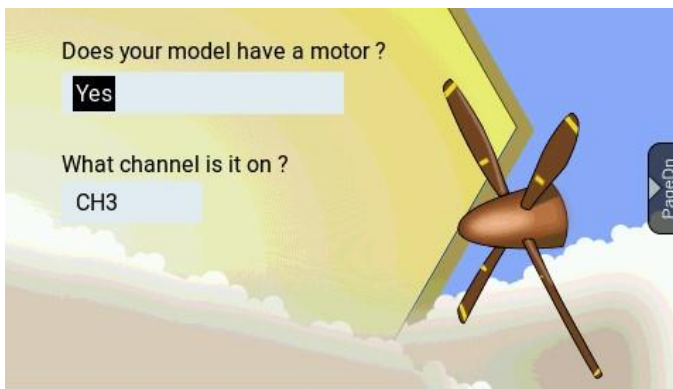
New Model Wizard

The wizard will ask a few questions about the model. The first choice is the type of model, and I'm going to choose "Plane".

Next it asks if the plane has a motor, and if so, which channel it's on (the Throttle channel). I'll stay with the defaults on this – yes, it has a motor on channel 3 (CH3).

To navigate the wizard, use the PAGE buttons to the left of the screen. Press PAGE > for the next page of the wizard.

Next it asks how many ailerons your model has. This is really the number of aileron control channels, not the real number of ailerons on the plane. If your plane has two aileron servos but they're connected to the receiver by a Y-cable (which is the case for my plane and all Horizon BNF's), then you have *one* aileron from the transmitter's point of view. Channel 1 is correct.
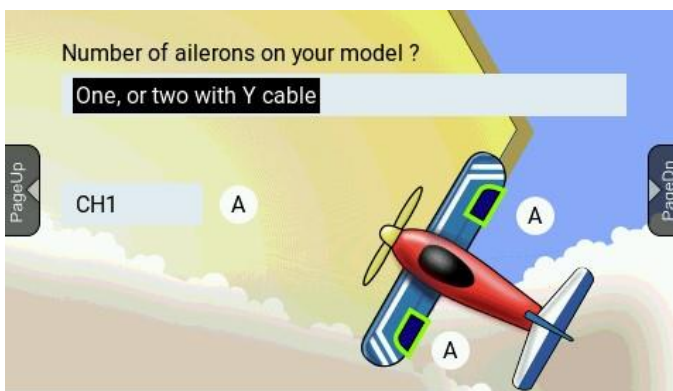
The next question is whether the plane has flaps. In my case it does, so I'm going to answer "Yes on one channel". Like the ailerons, they're really connected with a Y-cable and use one radio channel. I'm going to change the channel to 6, which is the default channel for flaps on a Spektrum radio.
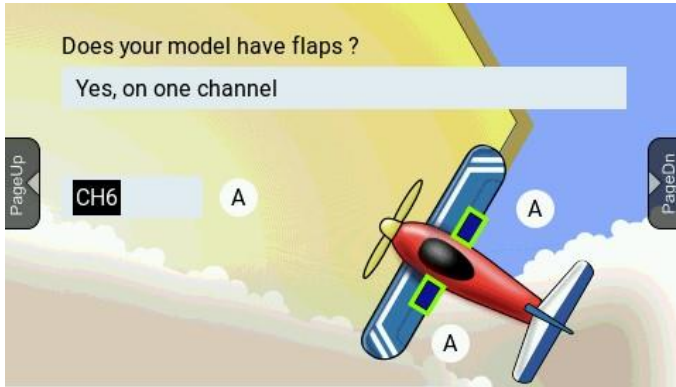
Next it asks about the tail configuration. Again, this is really about the configuration from the transmitter's perspective and how many channels are used for each control. I'm going to choose "One channel for Elevator, one for Rudder". That's really how the plane is wired in my case, and it's how most Horizon BNF's expect to be controlled. Elevator is on channel 2, and Rudder is on channel 4.
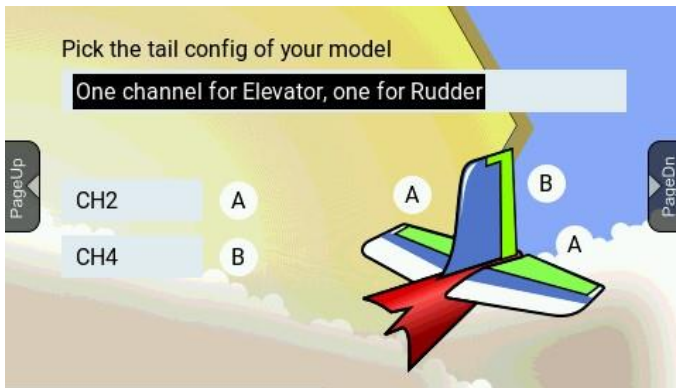
Finally, you'll see a summary of what the wizard will create. The wizard is going to set up inputs with the proper names and associate them with the channels shown.

To complete the wizard, select the "No, I need to change something" text and change it to "Yes, all is well, create the plane!"

When the wizard is done, a basic model screen appears without any widgets.

Behind the scenes, the wizard has created four items in the Model Setup as Inputs.
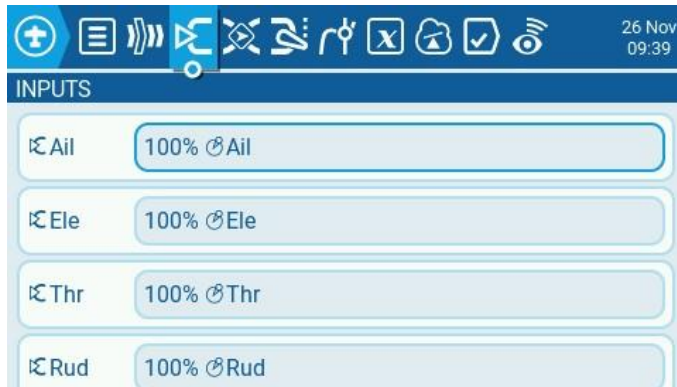
It also created five mixes, the fifth being for the flaps.

Configure the Model Settings (Radio and Timer)

After the wizard is done, there are still a lot more things that need to be configured. Let's go into the Model Setup screen. When looking at the main model screen, press the MDL button to get there.

First the model needs a name. I'm going to call my example "BNF with Flaps".

Next I'm going to go down to "Internal RF" to configure the radio settings.

It starts with the Mode set to "Off".

Change it to "MULTI". Then a second selection box will appear for the desired radio protocol. Change that to "DSM" for Spektrum.

The next item we'll want to set is "RF Protocol". You should change this to "Auto" for the moment, and then the MULTI-Module will select the best choice when you bind the transmitter to the receiver.

What is "Enable max throw"?
Another setting you'll see on this screen is "Enable max throw". It's important to understand what that means for Spektrum DSM.

When you work with Spektrum radios, you always see values for radio channels in terms of percentages. Spektrum has a normal range of -100% to +100%, with 0% in the center. They allow you to adjust things as far as -150% to +150% if you choose to.

On EdgeTX, when you're looking at radio channel values, you will sometimes see numbers that indicate the pulse width of the servo in microseconds (us).

A key difference between EdgeTX and Spektrum is the default range of servo movement. EdgeTX considers normal 100% movement to be from to 988 us to 2012 us. In contrast, Spektrum considers 100% to be from 1100 us to 1900 us.

As it does with the channel order, the MULTI-Module can handle this magically in the background for you if you leave things at the default settings. When "Enable max throw" is turned off, then the MULTI-Module will automatically translate the EdgeTX 100% (2012 us) to the Spektrum 100% (1900 us). If you set everything in EdgeTX for normal 100% values, the radio will send normal Spektrum 100% values.

EdgeTX has a separate setting for "Extended Limits" in the Output settings for individual channels. That allows you to go past 100% in the EdgeTX settings. Should you find that a Spektrum aircraft wants something set to 125%, you can accomplish this by leaving the "Enable max throw" still turned off and then change that one channel in Outputs. Although EdgeTX would let you set something as high as 150%, the MULTI-Module will limit it to 125%, matching Spektrum's 125%.

If you turn on "Enable max throw", then the MULTI-Module will not automatically lower the output to match Spektrum's normal range. When this is turned on, you'd have to do the conversion yourself. Spektrum's value of 100% corresponds to about 84% of the EdgeTX range. 100% of EdgeTX is about 125% of Spektrum. Turning EdgeTX up to 125% or more will equate to 150% of Spektrum. (You cannot output more than 150% on the Spektrum range.)

For airplanes, the Frame Rate of 22ms is correct.

The only other default setting that should be changed is the "Receiver" ID number. Spektrum has a feature called "Model Match", where the receiver will listen to not only a certain transmitter, but also a certain model on that transmitter. If the current model on your transmitter is not the one that was bound with the receiver, the receiver will recognize that and it won't initialize. The MULTI-Module implements this as the Receiver ID number. This is a number from 0 to 63. It doesn't really matter what the number is, as long as it's reasonably unique among all the models on your radio. EdgeTX 2.8 is helpful in that it tells you right on this screen *when you change the number* if the number is unique or if it's being used by other models. If possible, you should choose a unique number.
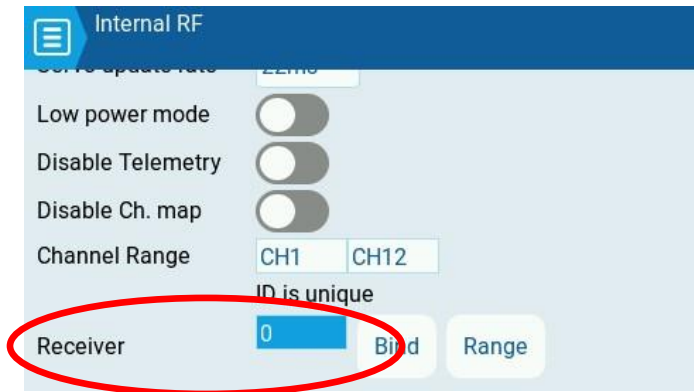
When you back out of the Internal RF settings, you can change the configuration for Timer 1 from the Model Setup screen.

First, assign the timer a name. "Timer 1" is fine, which is the default name in Spektrum radios and the generic name for the first timer in EdgeTX.
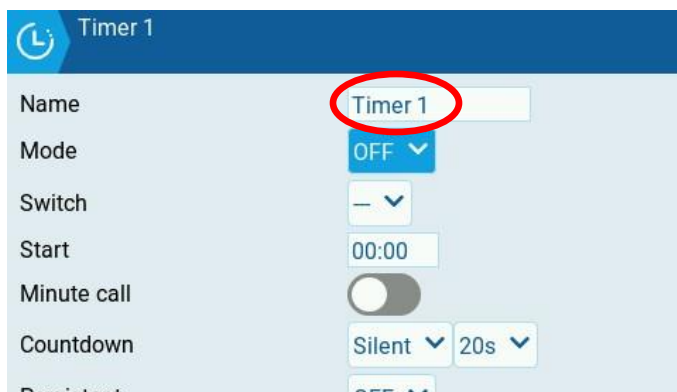
Change the "Mode" to "Throttle %". Change the "Start" to 5:00 as suggested by the airplane's manual. (This may vary from plane to plane.)
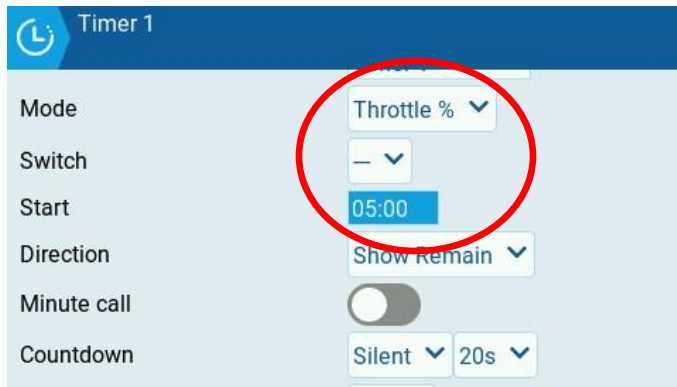

You can easily turn on a callout every minute and tell it when to begin a second-by-second countdown if you'd like to.

Reverse Rudder and Aileron Channels for Spektrum

Earlier I mentioned that Horizon will configure the receiver on a BNF plane such that all control directions on a Spektrum transmitter will be normal, not reversed.

Another key difference between EdgeTX and Spektrum is that the two horizontal stick channels – Rudder and Aileron – are reversed in EdgeTX as compared to Spektrum.

Therefore, to control the plane correctly, you'll have to reverse those two channels in your model setup. Go to the Model Setup, and then PAGE > over to the "Outputs" screen.
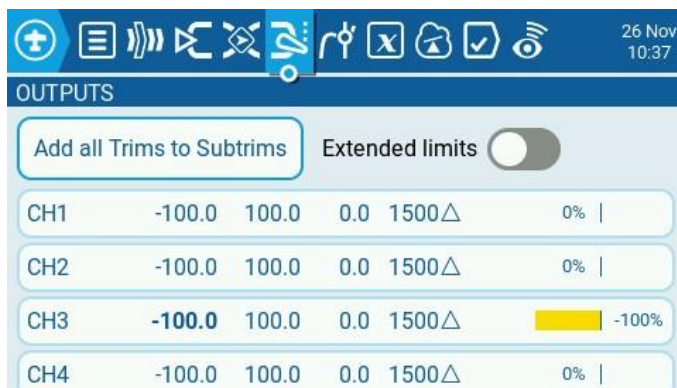
Select CH1 (Aileron) and Edit it. Change "Inverted" to turn it on.
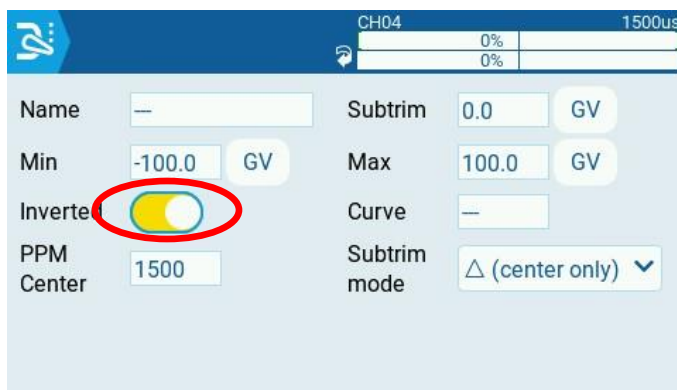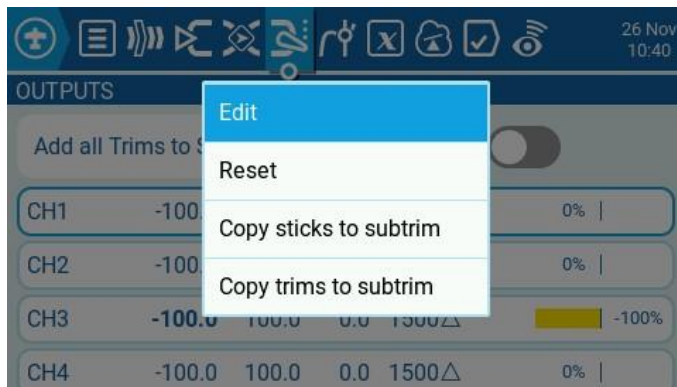
Back out and select CH4 (Rudder). Edit that and turn on "Inverted" there as well.
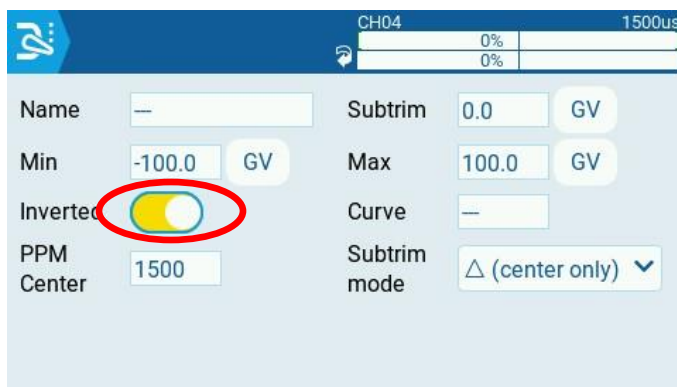
Notice that there's a new symbol on the Outputs list to show that those channels have been reversed.
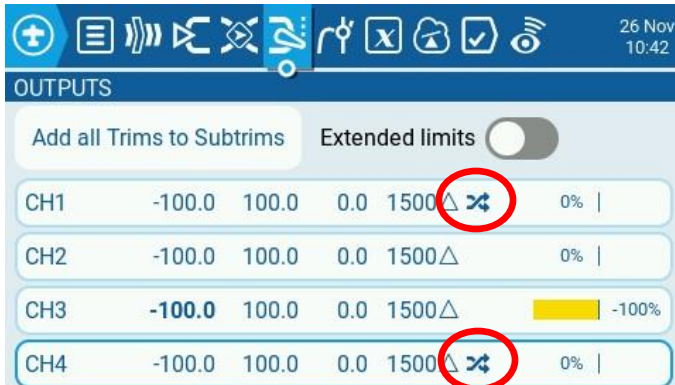
Add a Switch for SAFE Select

You'll need to assign a switch to another radio channel to control the receiver's flight modes, such as SAFE Select or on planes with the three-mode SAFE training setup.

Go into Model Setup (MDL button), and then PAGE > to Mixes.
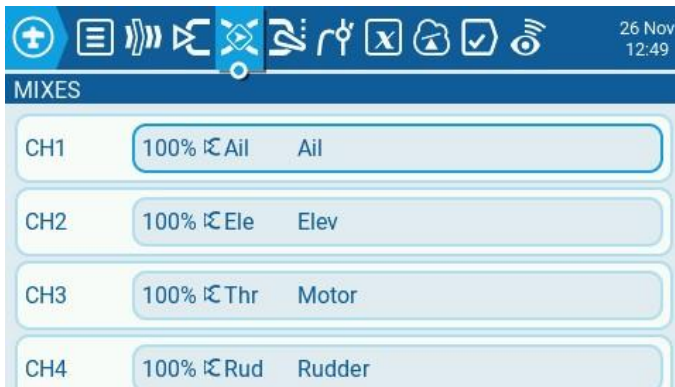
Scroll to the bottom and select the + to add a new mix.
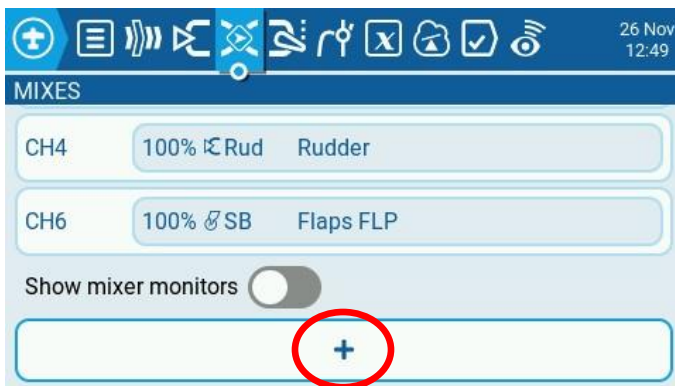
Then select the channel to use for this function. I'll use CH5. It's common to use channel 5 for the flight mode switch for the BNF's unless the model has retractable landing gear. The receivers can listen to more channels than they have ports, so you can also use channel 7 or higher on what appears to be a six-channel receiver.
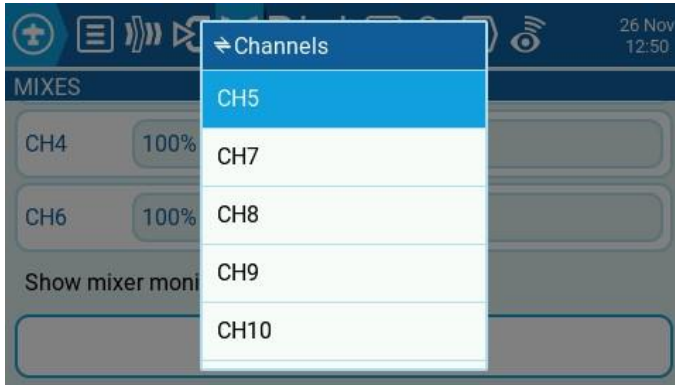
Give the mix a short name (I'll use "SAFE"), and choose the source switch I'll use Switch SE.

Setting Direction of Switches
If you're familiar with using Spektrum transmitters, then you'll see that position 0 on a Spektrum switch corresponds to the up (^) position of a switch in EdgeTX.

However, you'll find that EdgeTX and Spektrum differ in how the default outputs are assigned to each position of the switch. Spektrum would assign 100% to position 0, 0% to position 1, and -100% to position 2. EdgeTX does it the opposite way, with -100% in the up (^) position and 100% in the down (v) position.

If you'd like to flip the functions of the switch around, effectively reversing it, change the "Weight" setting from 100% to -100%.

Adjust the Flap Settings

Adjusting the Flap Positions and the Movement Speed

Although it's common to assign the flaps to a three-position switch, you may want to adjust how far the flaps move for each position of the switch. It's not often that you'll want the flaps to start at 0%, then move to exactly 50%, and then finally to 100% with each move of the switch. You'll also want to apply the flap movement gradually and not instantly.

To be able to adjust the three positions of the switch, we'll make a curve that will be assigned to the flap output channel (CH6). To create the curve, go into Model Setup (MDL button), and then PAGE > to Curves.
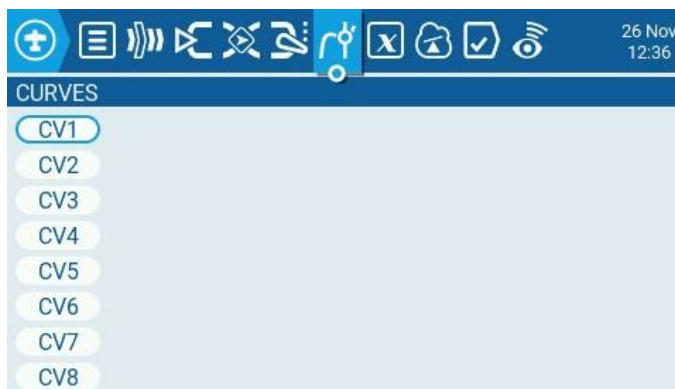
With CV1 selected, go ahead and Edit it.
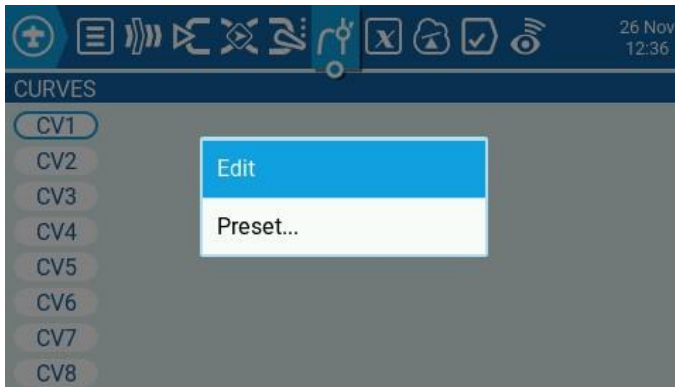
The name can only be three characters long, so let's use FLP. It's going to be a Standard 3-Point Curve.

The manual for this plane tells us that the three positions should be -100%, 0%, and +100%. That's how the curve is set by default, so we'll leave it set that way and stop here. If your plane has different settings, or you want to adjust them later, you'd change the values in this curve.

Now we're going to assign the curve to the channel. Back out one screen to the list of curves (which now shows the one we just created).
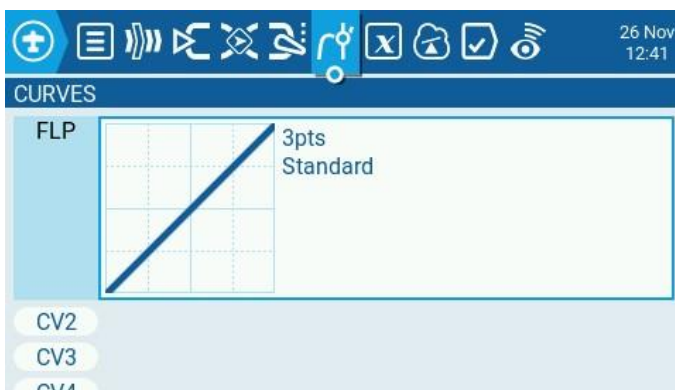
Then go to Mixes by pressing PAGE < twice.
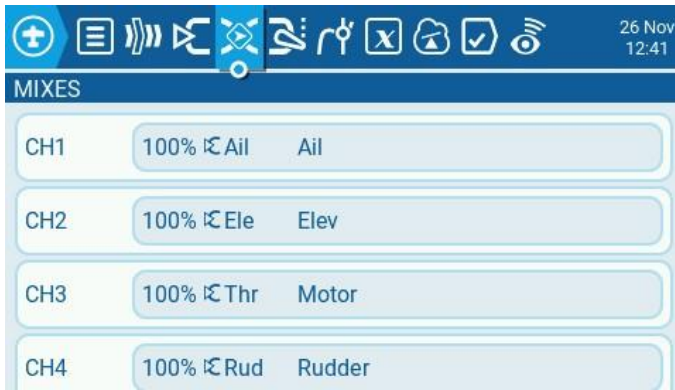
Scroll down to CH6, select it, and edit it.

While I'm here, I'm going to change the Source to SB, since that corresponds to where I'm used to having the flap switch.

To assign our curve, go to "Curve" and change it to "Cstm" (for Custom), and then in the second list choose "FLP" (*not* !FLP). Now the switch will output three values based on the settings in the FLP curve.

To set the movement speed, select the Gear icon to open more settings. Change both "Slow Up" and "Slow Down" to a speed that you'd prefer. I'm going to use 2.0 seconds, as that's a common recommendation on the Horizon BNF's.
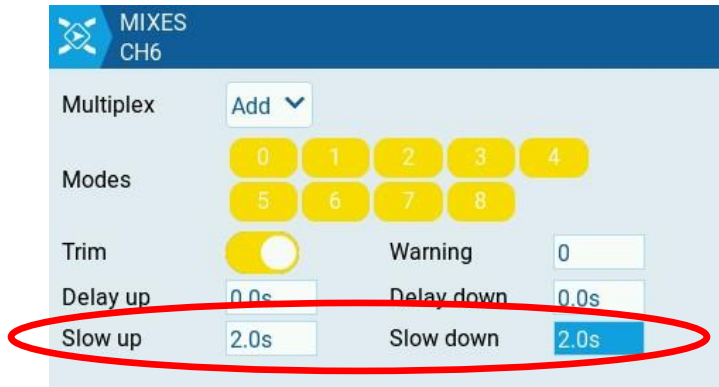
Adding the Elevator Mix
If you'd like to add some down elevator as the flaps are deployed, you can add some mixes to the Elevator channel that are controlled by the same switch as the flaps.

Go into Model Setup (MDL button), and then PAGE > to Mixes if you're not already there.
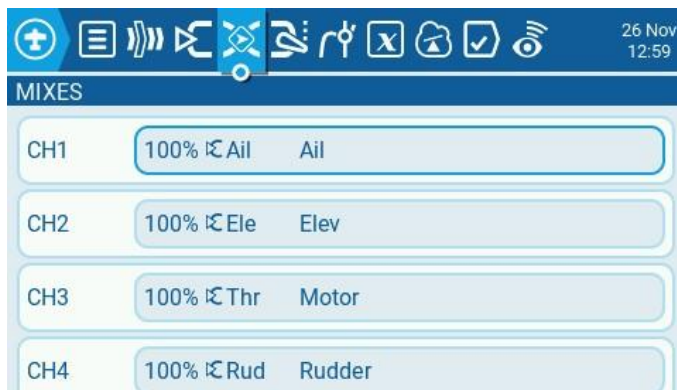
Select the mix for CH2 Elevator, and then choose "Insert After".
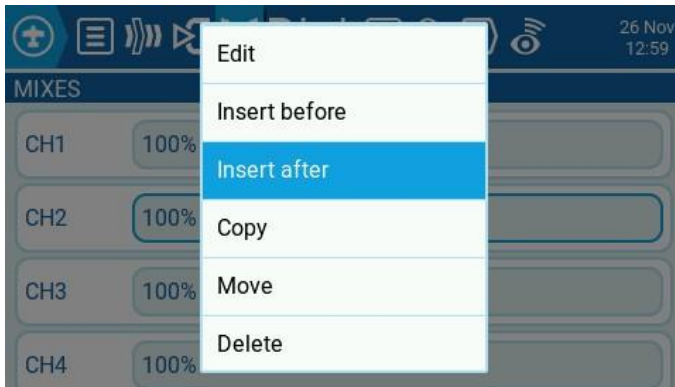
Configure this mix to have a Source of "MAX", a Weight of 0% (as suggested by the plane's manual for this position), and a Switch that matches the switch position with the flaps up (SB^ in my example).
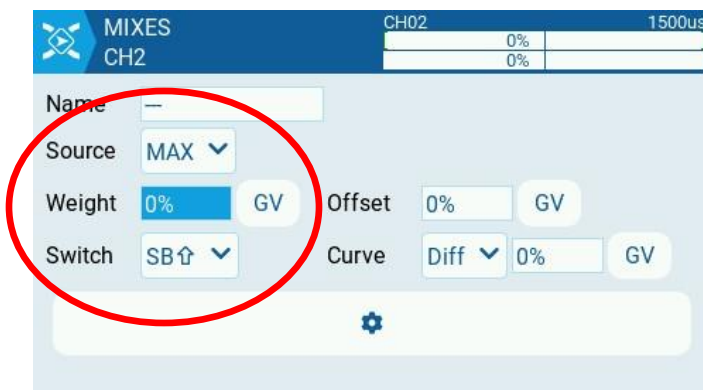
Then select the gear and open the additional mix settings. Set the Slow Up and Slow Down to match the speed of the flaps (2.0 seconds in my example).
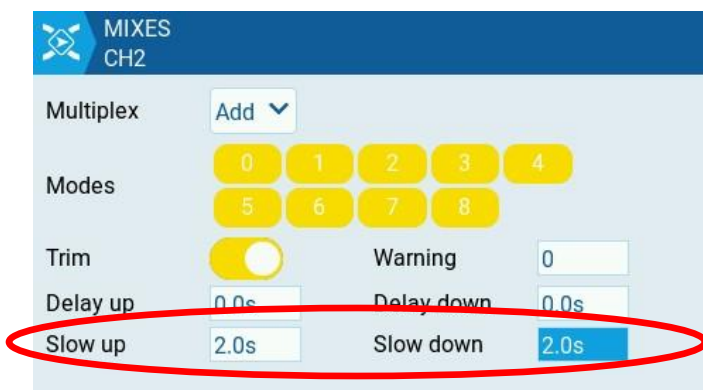
Back out to the list of mixes again, select the one you just made, and choose "Insert After". Configure this mix to have a Source of "MAX", a Weight of 17% (as suggested by the manual), and a Switch that matches the flap switch in the middle position.
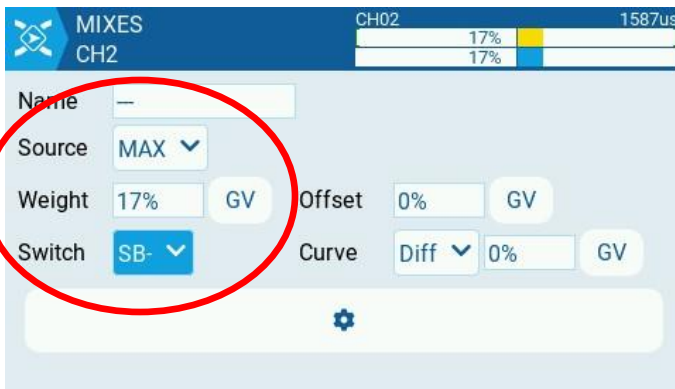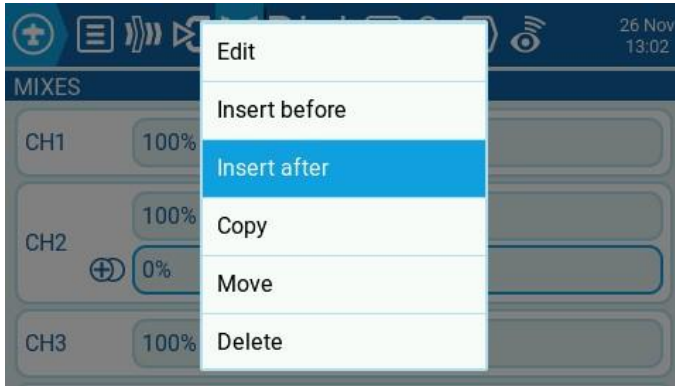
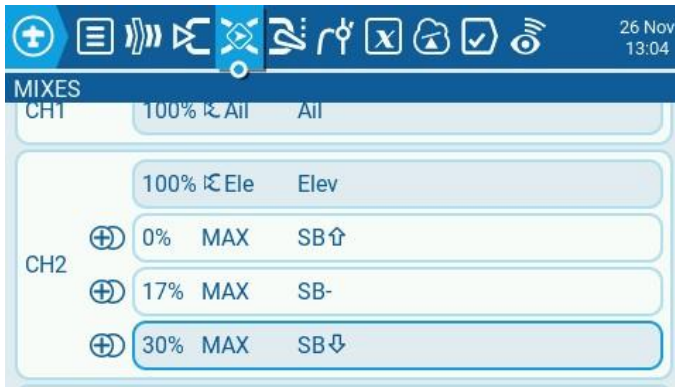Set the speed on this mix as well.
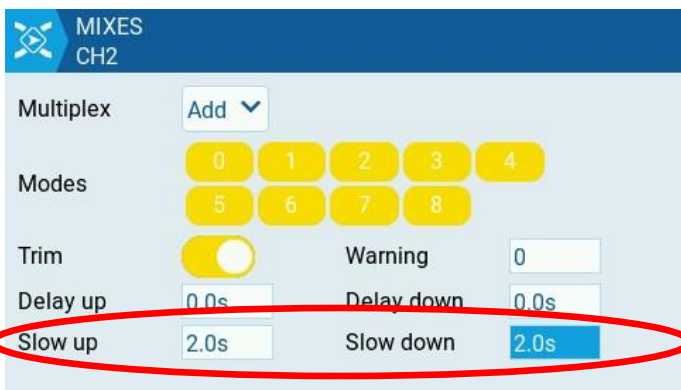
Back out to the list of mixes again, select the one you just made, and choose "Insert After". Configure this third mix to have a Source of "MAX", a Weight of 30% (again, from the manual), and a Switch that matches the switch position with the flaps fully down.
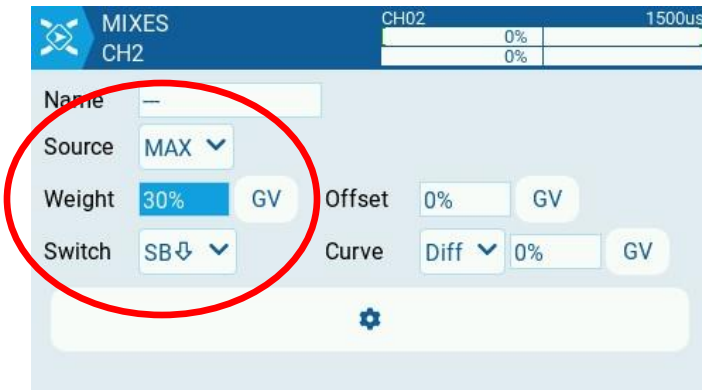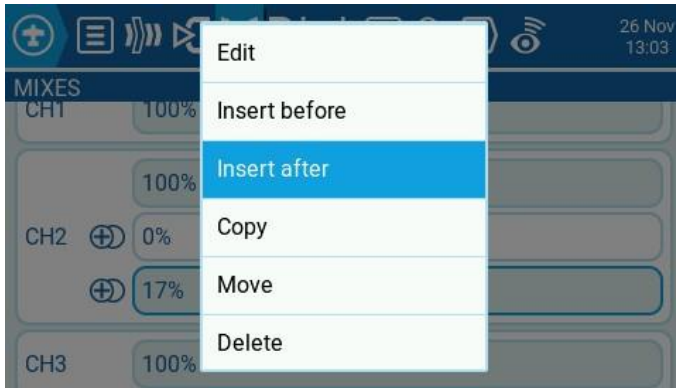
Set the speed on this mix as well.
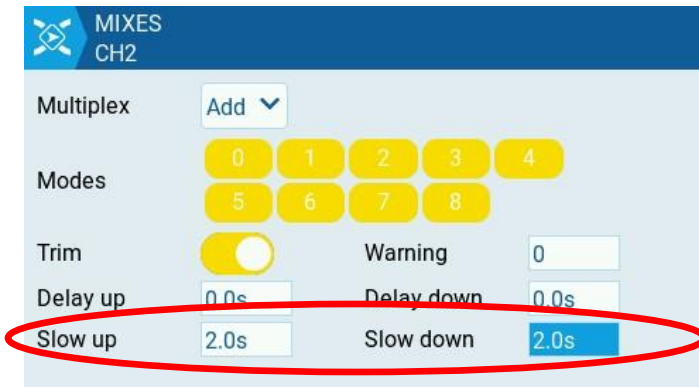
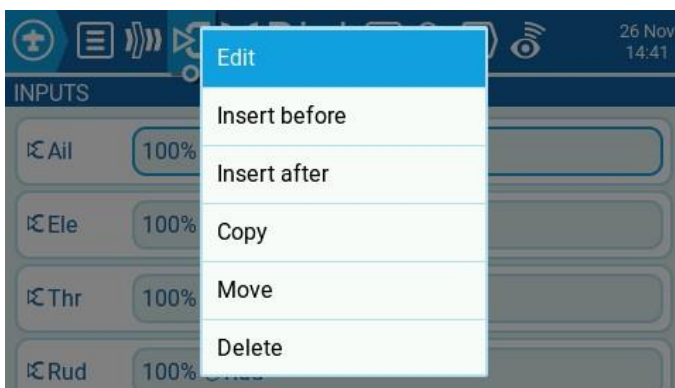When you're done, CH2 will look like this.

Low Rates and Expo

EdgeTX facilitates Low Rates and Expo through settings on the Inputs page. We'll modify three of the four stick inputs (Aileron, Elevator, Rudder) so that a switch will toggle between high and low rates.
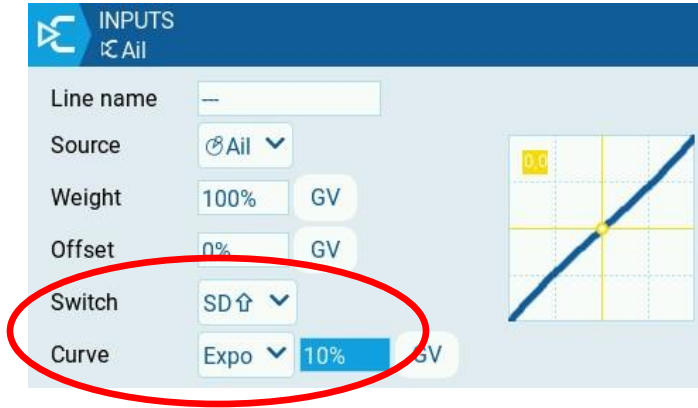Go into Model Setup, and then PAGE > to Inputs.
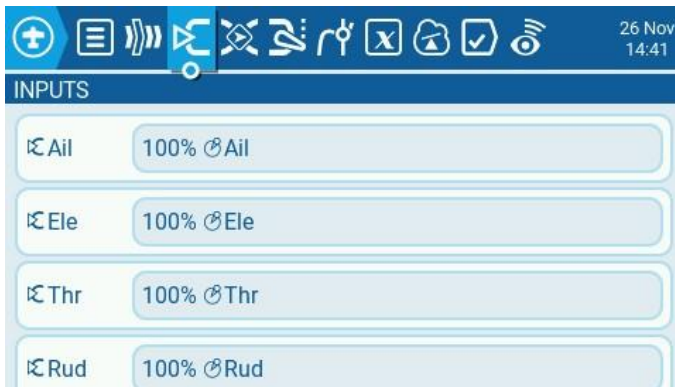
Select the Aileron (Ail) input and Edit it.

I'm going to use Switch SD for changing between high and low rates. Edit the settings for Ail so that the settings are effective for Switch SD in the up position. Also add 10% expo (as suggested by the plane's manual).


Now we need to duplicate the Ail input so that we have different settings for the other positions of Switch SD.

Select Ail again, but this time choose "Insert after" to make another group of settings.
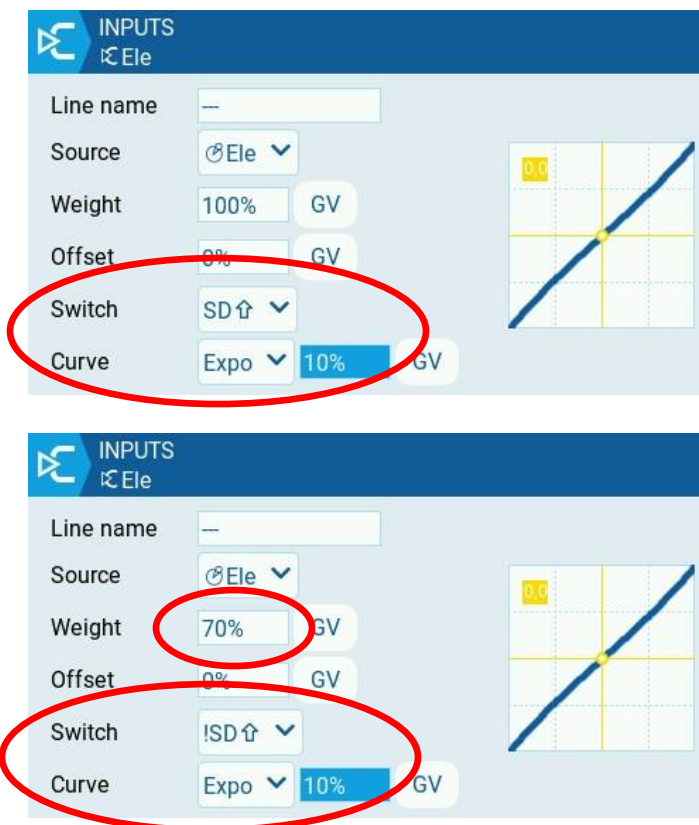
Configure this screen to have a Weight of 70% (for the low rates), switch position !SD^ and also 10% expo. The exclamation point in !SD^ means "Switch SD *not* in the up position".
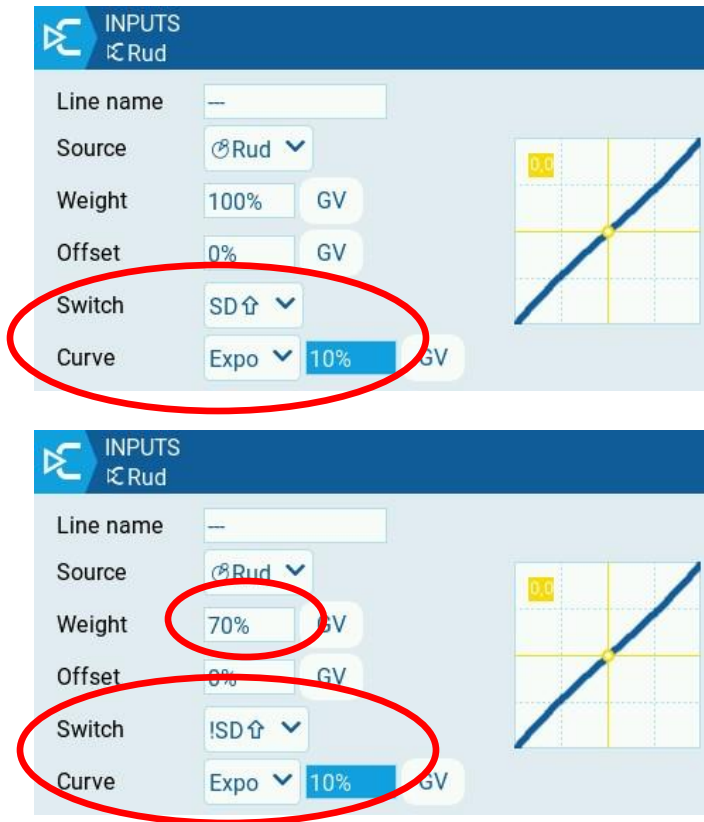
You should see this for Ail when you're done.
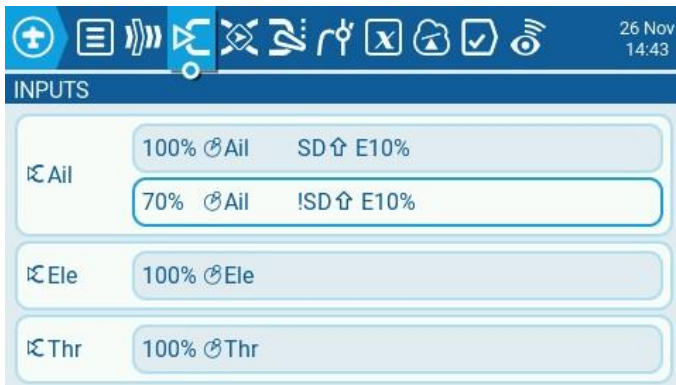
Repeat this process for Ele and Rud. I'm going to use the same switch for all three, but you could use different switches for different channels if you'd like to.
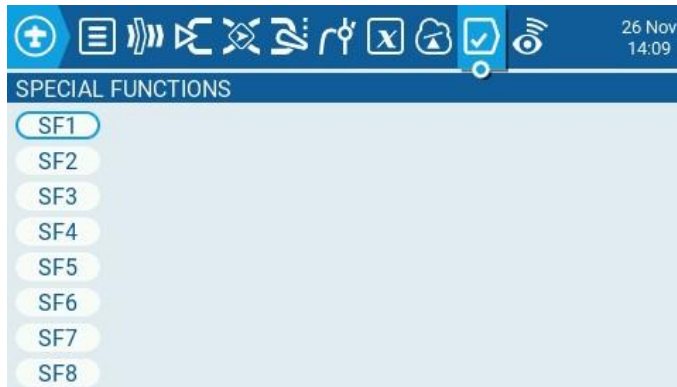
Throttle Cut

Throttle Cut is a safety switch that's commonly added to electric airplanes. The idea of Throttle Cut is to override the throttle stick and constantly send the same radio value that the stick would send if it were in its lowest position. That's normally -100%, although it could change if you were using throttle trim for some reason.

In EdgeTX, you can create a Throttle Cut through the use of a Special Function.

Go into Model Setup (MDL button), and then PAGE > to Special Functions.

Select SF1 and Edit it.

Create a new function on the desired Switch position for Throttle Cut to be on (I chose SG down). Set the Func (function) to "Override". Choose the channel to override; throttle is on 3 if you're using AETR channel order. Set the value to -100%. Finally, turn on Enable.
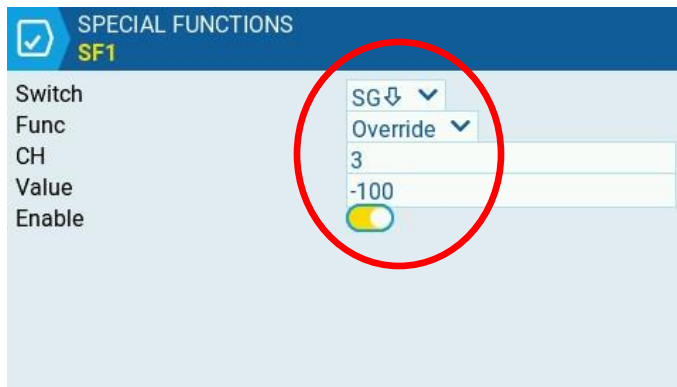
When you exit back out to the Special Functions page, it will look like this.

Add Screen Widgets

On my TX16S, I'd like to see a little more information on the main model screen now.

Press the roller wheel, and then choose "Screen Settings".
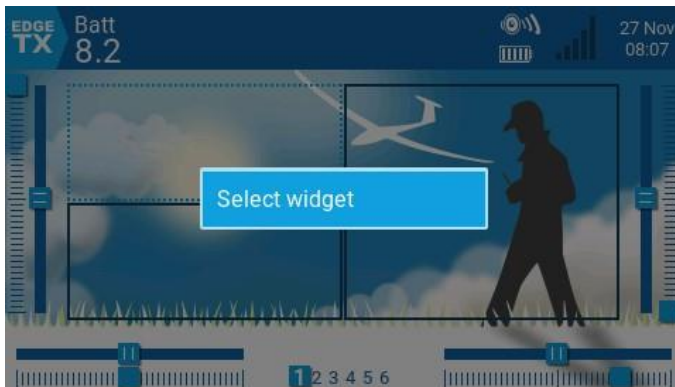

On the page for "Main view 1", I want to add some widgets to the screen. I'm going to choose "Setup Widgets".
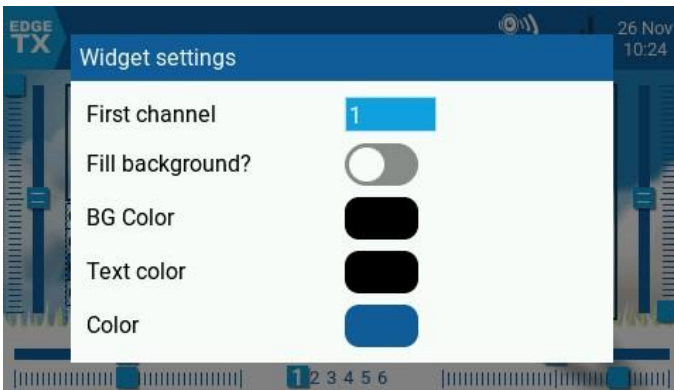

That takes me back to the main screen but with some boxes to choose from based on the selected Layout for the widgets.

Touch a box, and then choose "Select widget". In the upper left, I'm going to place the Timer. I'll choose Timer 1 as the source.
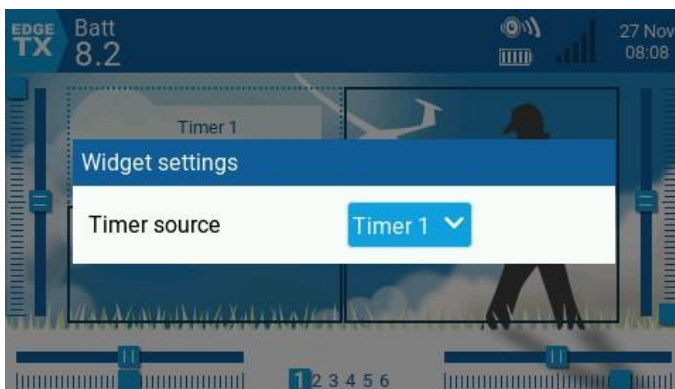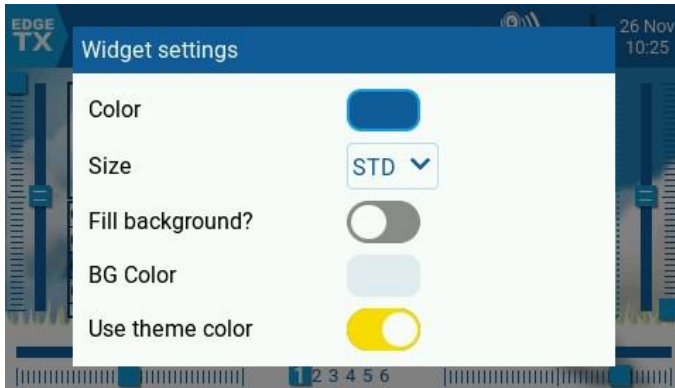

Now I'm going to touch the box in the lower left, Select widget, and choose the Outputs. I'm just going to use the default settings.

(Press the RTN button to close this Widget settings screen.)

Finally, in the box on the right, I'm going to choose "Model Info" as the widget. That gets the name of the model on the screen.
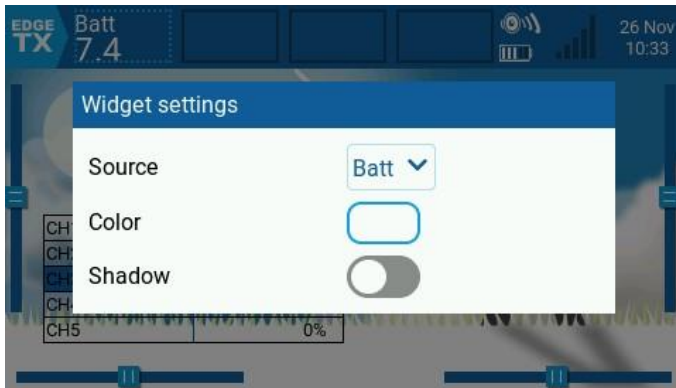
Press the RTN button to get out of the widget editing screen and back to the "Main view 1" page. Finally, I'm going to turn off the edge displays for the Sliders. That's just a personal preference since I don't need to use the sliders on this model.
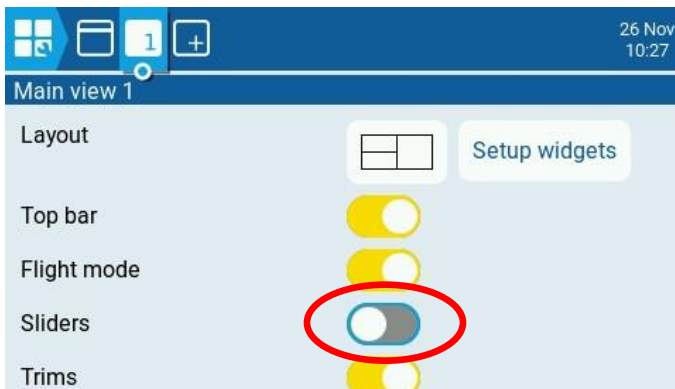
Next I'm going to press PAGE < to get to the "User interface" page. This is where you can change the overall theme colors and also add some widgets to the Top Bar.

Select "Setup widgets" and you get another screen with some adjustable boxes on top. In the box on the left, I'm going to put in a Value widget and choose "Batt", the voltage of the internal battery on the TX16S. I'm also going to set the color of the Value to white so it's readable against the blue bar.

Press the RTN button to get out of the widget editing screen and back to the "User interface" page.

Binding with the Receiver

When you're ready to bind the TX16S to the airplane, go to Model Setup and scroll down to Internal RF.

Scroll down to Receiver, where you'll see a bind button.

Make sure your airplane's receiver is powered and ready for binding with the transmitter, and then select "Bind".

After a few moments, you'll find out if the bind was successful based on whether the receiver initializes and gives you control. Receivers with SAFE will usually take a bit of time to get ready, and they'll wiggle the control surfaces in the process.

SAFE On/Off Flight Mode Switch

You'll need to follow the instructions in the airplane manual for teaching the receiver which channel the SAFE On/Off flight mode switch is assigned to. With SAFE Select, there are a couple of ways to do it, including one way that uses a special stick movement where you move the sticks into the corners to start the process. Ensure that you have your high rates active when you do that; it will not work with low rates. With planes that have AR630, AR631, or AR637TA receivers, the second way is to assign the channel through Forward Programming if you're familiar with that process on EdgeTX.

SAFE trainers will tell you in the manual which channel should be used for the flight mode switch (often it's channel 5), and they'll also tell you if you need to assign a switch to another channel for Panic Mode. You must configure a switch for Panic Mode properly, or else your plane could be "stuck" in Panic Mode and won't fly correctly.

Telemetry
After you have established a radio link with the receiver, you can tell the transmitter to look for telemetry data if the plane has such information available.

Go to Model Setup, and use PAGE > to get to the Telemetry page.
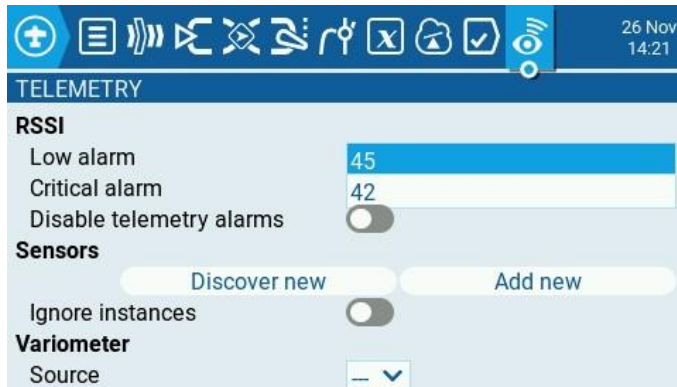
Select "Discover New" to have EdgeTX add new sensors (data elements) automatically by listening to what's being sent from the receiver.

After a bit of time, you'll see a bunch of sensors appear. My plane has the basic radio signal telemetry, plus data from what Horizon calls the Smart ESC and Smart Battery.

Whenever data is received for a particular sensor, a blue dot will appear.

To make the data visible while flying, you'll need to configure your screen to show some data widgets. On the main model screen, press the roller wheel, and then choose "Screen Settings".

You'll see the configuration page for Main view 1, which is the first screen you see all the time. You can edit widgets on this screen, or you can add another view screen. When you have more than one view screen, you can swipe left and right to change between them.
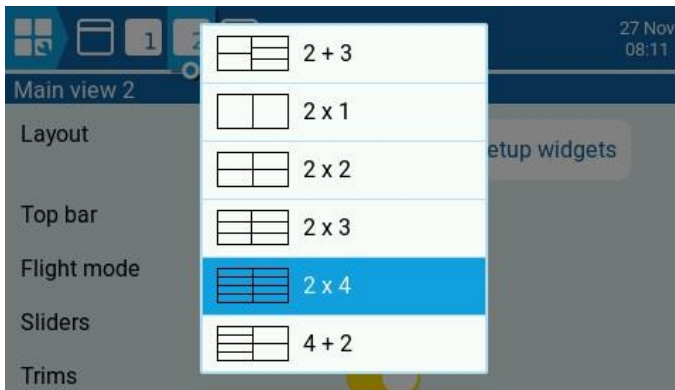
To create a Main view 2 screen for the telemetry widgets, PAGE > over to the "Add main view" page, and select "Add main view."
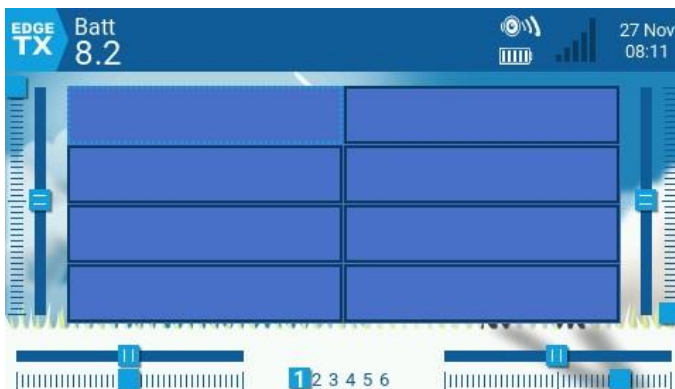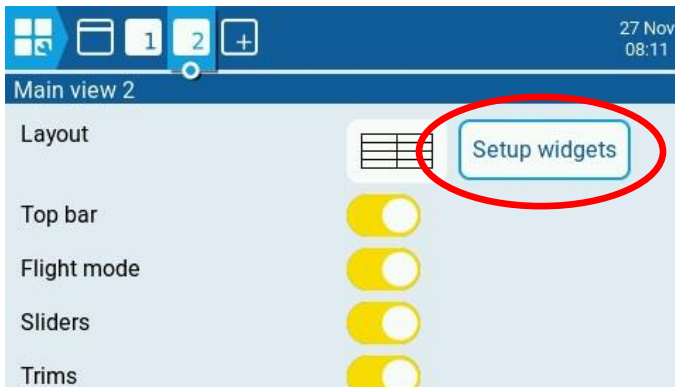

That gives you another view to work with, titled "Main view 2".

I'm going to change the layout to a screen with eight positions. Touch the Layout view, and then make a selection.
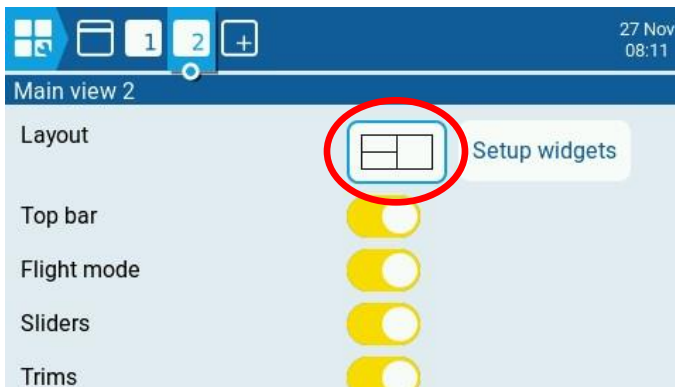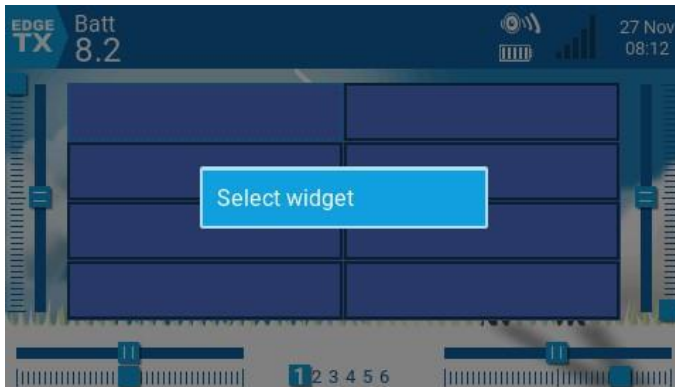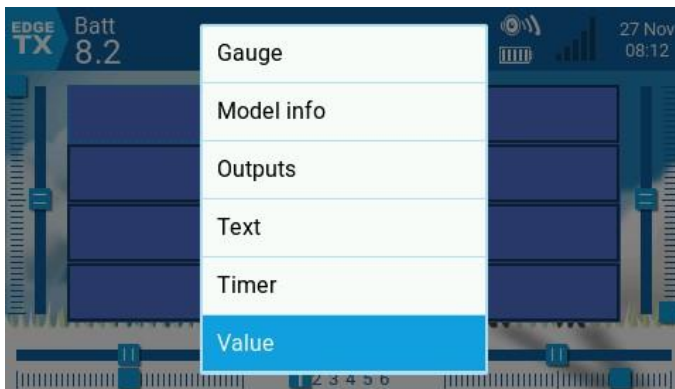
Next, choose "Setup widgets" to add widgets.

I'm going to repeatedly add Value widgets to each box.

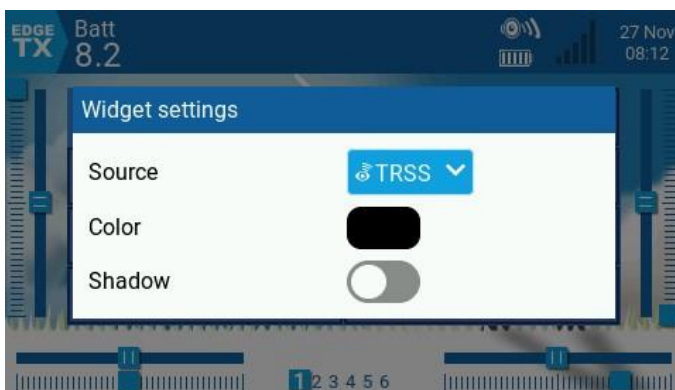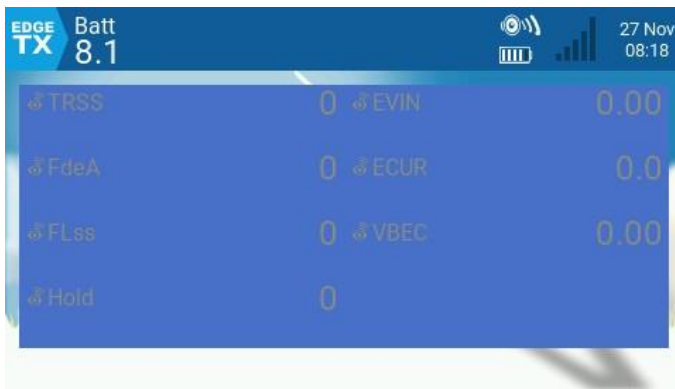Touch the empty box, and choose "Select widget".

Add a "Value" widget.

For the first one, I selected "TRSS". (Telemetry data is shown in a group that's preceded by this

icon:

After doing this several times, I created this screen.

All of the values are shown in gray, even though the color is set to black. That's because the airplane is not on, and no data is being sent. When the airplane is functioning, the screen looks better.

What are these data elements?

TRSS = Received signal strength
FdeA = Fades on Antenna A (loss of a single bit within a frame)
FLss = Frame Loss (loss of an entire frame; 90 frames are sent per second)
Hold = Loss of 45 or more consecutive frames (one half-second of no signal)
EVIN = ESC Voltage in from the battery
ECUR = ESC Current
VBEC = Voltage out from the BEC (this is a UMX plane; typically, this is around 5v)

Conclusion

This guide went through the basic things to get the model working. There's a lot more you can do with EdgeTX, such as playing sounds when you move switches or when the telemetry reports certain data. Check out some of the other documentation for EdgeTX and videos on the Internet to learn more.

Revision 1 – November 2023