Flight Notes By Flightengr

Modify SAFE Settings on an AR636 Receiver Using SAFE Model Builder

This issue of Flight Notes will walk through the process of modifying the SAFE settings on a Spektrum AR636 receiver with the help of a program I wrote called the "SAFE Model Builder for AR636".

At the time of this writing, Spektrum does not allow you to modify the settings specific to the SAFE features (such as self-level, bank angle limits, throttle-to-elevator mix, and panic mode) using the Spektrum Programmer software. So instead, it will take a combination of steps that will accomplish the task in a slightly different way. The program I wrote will save most people the trouble of editing the settings manually in a text file editor, instead making changes through a typical point-and-click process.

What You Need To Get Started

Of course, you'll need an AR636 (or AR636A) receiver that's running version 2.xx of the AR636 receiver software (firmware). You must have that version for SAFE features to be available.

You'll also need the latest version of the Spektrum Programmer software (which I'll call "SPS") for a Windows PC. **This document was based on version 3.3 of SPS.** At the time of this writing, there was not a version of the phone app that was compatible with SAFE Select receivers. The software can be obtained from Spektrum here:
http://spektrumrc.cachefly.net/apps/spektrum_programmer.html
(The link is posted on the product page for the AR636 on Spektrum's Web Site.)

To go along with the PC software, you'll need the SPMA3065 USB Interface cable.

Finally, you'll need a copy of the SAFE Model Builder for AR636 program. There's nothing to install – you just unzip the file from the RCGroups.com site, and run the EXE file. I'm not a commercial developer, so the program is not signed. Therefore, your anti-virus software may question the use of the program the first time you run it.

The process of installing the SPS software is typical for PC software (run the EXE file), so there isn't much to say about that. Windows will probably ask you if you want to allow this program to install device drivers – yes, you want it to do that.

Running the Spektrum Programmer Software (SPS)

Since this document is more advanced than the basic operation of SPS, I'm going to assume that you're somewhat familiar with the software. You should be able to connect the receiver to

the computer and view the model settings (even if you don't change them). If you're not at that level, then you'll find more information about the program screens in my other walkthrough document in my blog here: https://www.rcgroups.com/forums/showthread.php?2899256-Modify-Settings-on-an-AR636-SAFE-Select-Receiver

The Advanced Editing Process

Because you can't make the desired changes using SPS, it's necessary to work around the software and make the changes another way.

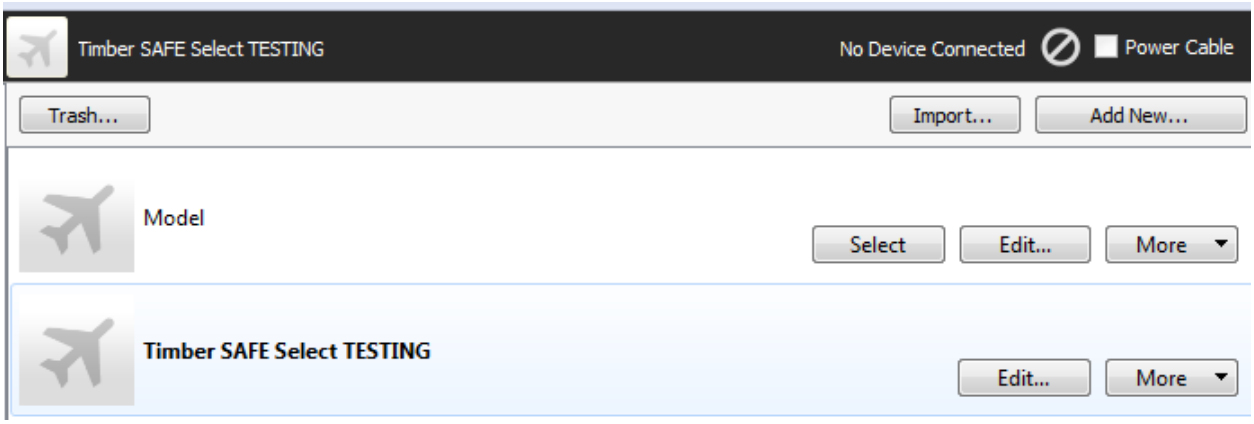
In a nutshell, this is the process that this document will walk you through:

1. Have the SPS read the settings in your receiver.
2. Export those settings to an SRM file, which is a text file.
3. Use the SAFE Model Builder program to make changes, and save the improved SRM file.
4. Import that SRM file back into SPS.
5. Have SPS load the changes into the receiver.

This document is only going to cover the details of configuring the SAFE features available in the SAFE Model Builder. You're strongly encouraged to make other changes, including reversing the control directions, and adjusting things such as gains, dual rate, and expo, through the SPS software.

Section 1 – Exporting the Model to an SRM File

In SPS, you should already see the model for your receiver. If you don't, connect the receiver and create a model.



I'm going to work with the model called "Timber SAFE Select TESTING".

The model originally got there by connecting the receiver to SPS, and then assigning it a name (by clicking that “Edit…” button on the line with the model).

With the model in the software, let’s export it to a file on the computer. Choose “Export…” from the “More” button.

The software will ask for a name for file and a location to put it. The default name will be the model name plus “.srm” on the end. Choose any folder you like, and you can also rename the file if you wish to.

Make a backup copy!

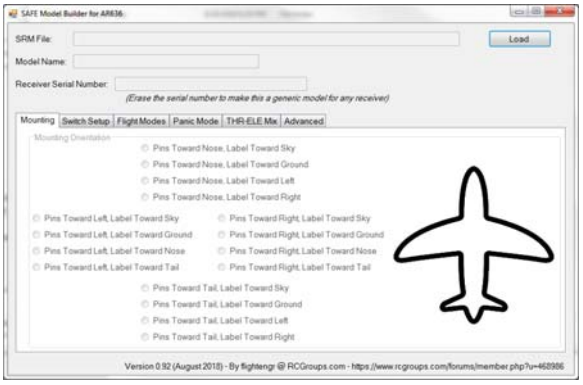
It would be a good idea to make a backup copy of the SRM file as well, just in case you want to come back to the settings you have in the receiver right now. You can use Windows to copy the SRM file, or you can use SPS to export the file a second time to a different place.

Section 2 – Editing the Exported SRM File

Now that the settings for your model are out in a text file, you're able to access them with the SAFE Model Builder.

Run the SAFE Model Builder program (the EXE file).

You'll see a screen that looks like this:



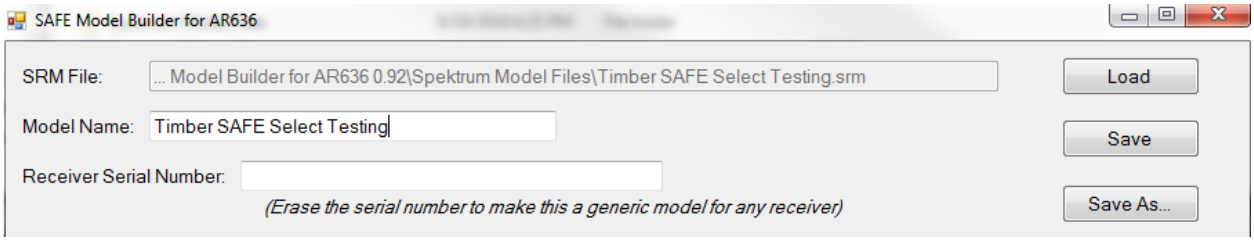
To begin working with your model, click the "Load" button in the upper-right corner. I'm going to bring in my Timber SAFE Select Testing file.

The lower portion of that screen updates with the receiver orientation, and you can begin using the different tabs and settings.

When you make a change to any setting, a "Save" and a "Save As" button will appear beneath the "Load" button so you can save your work.

Section 2.1 – Model Name and Receiver Serial Number

In the top section of the program's screen, you'll always see the name of the SRM file that you're working with, along with the name of the model that's displayed in SPS and the serial number of the receiver that this model came from.



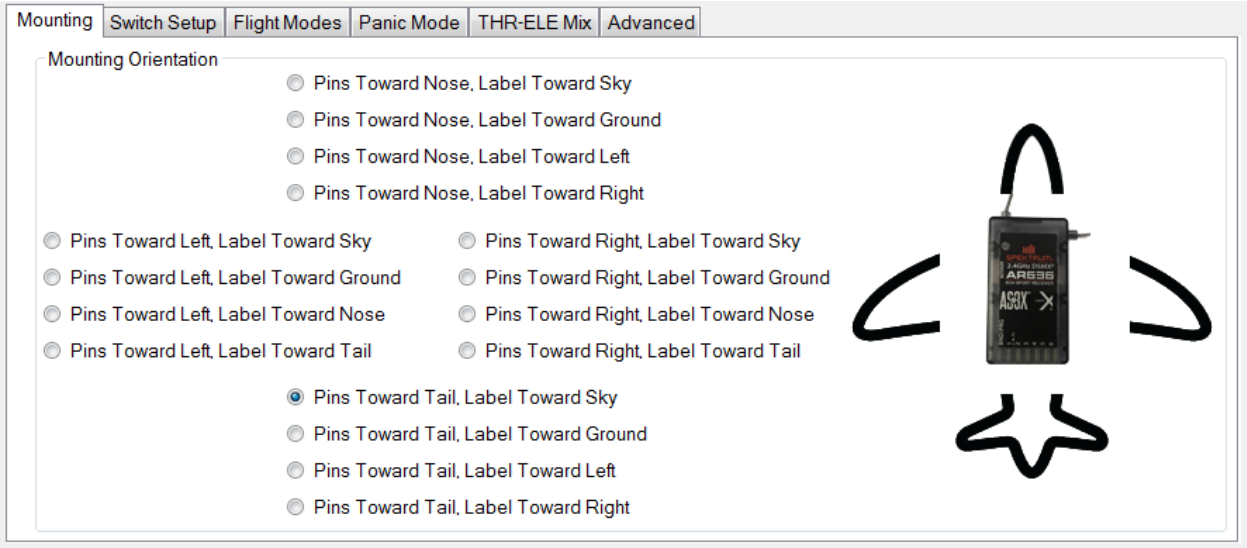
When you load a model into SPS from a receiver, or you install a model from SPS onto a receiver, SPS will save that receiver's serial number with the model. That allows the SPS

program to show you models that are associated with the receiver that's currently plugged in, and hide models that are associated with other receivers.

To make a model file more generic – to share it with other people, or to save it as a template for your own use – blank out the serial number field. In addition to showing you models for a specific receiver, SPS will show you any models that do not have a serial number and are compatible with the version of firmware on your receiver.

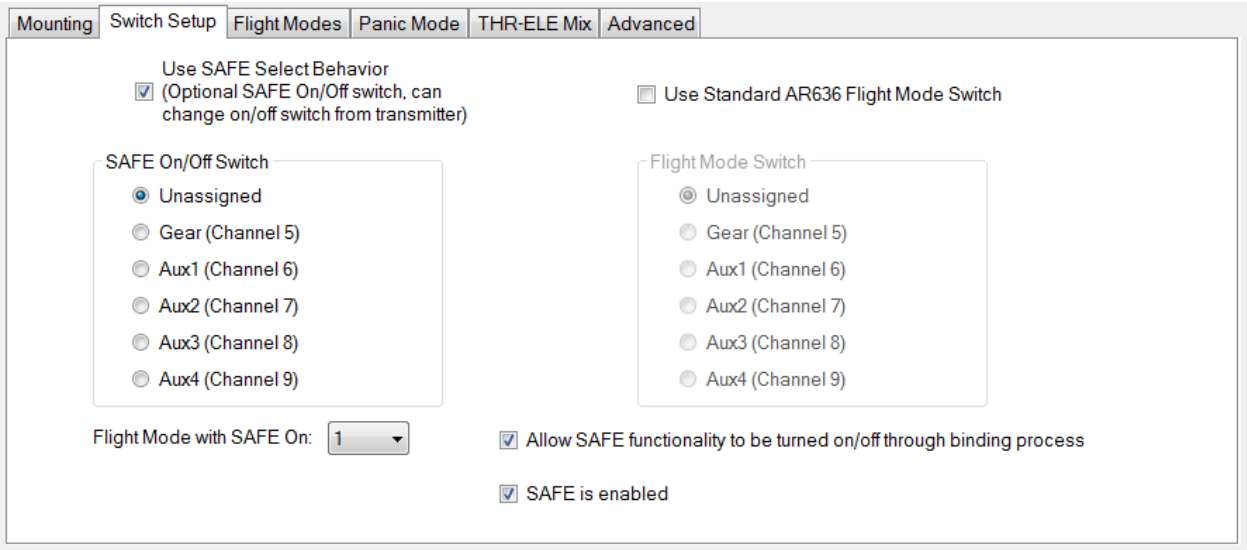
Section 2.2 – Mounting Orientation Tab

The Mounting Orientation tab lets you configure the receiver for how it will be mounted in your airplane. There are 16 possible directions.



Section 2.3 – Switch Setup Tab

The settings on the Switch Setup tab allow you to configure the radio channel used for changing the receiver's active flight mode, and also control the SAFE Select functionality.



SAFE Select

In the picture above, you see the settings for the Timber's SAFE Select program. SAFE Select differs from the standard operation of the receiver's three flight modes in these respects:

- SAFE Select setups usually have one flight mode with SAFE features (self-level, bank angle limits, and the throttle-to-elevator mix), and then the other two flight modes are both set up the same without SAFE features.
- SAFE Select is meant to behave as two flight modes – SAFE On and SAFE Off. But what's really happening is that two of the receiver's three flight modes are set up the same way. If you assign your SAFE On/Off switch to a three-position switch on your transmitter, it still switches among all three flight modes on the receiver but you wouldn't see a difference between the two SAFE Off modes.
- SAFE Select does not require you to have a SAFE On/Off (flight mode) switch. Instead, it needs for one of the three flight modes to be designated as the SAFE On mode. There are two ways to bind a SAFE Select receiver, and through that binding process, you can either lock the receiver into the SAFE On flight mode or one of the other SAFE Off flight modes.
- You can assign the SAFE On/Off switch from the transmitter using special steps.

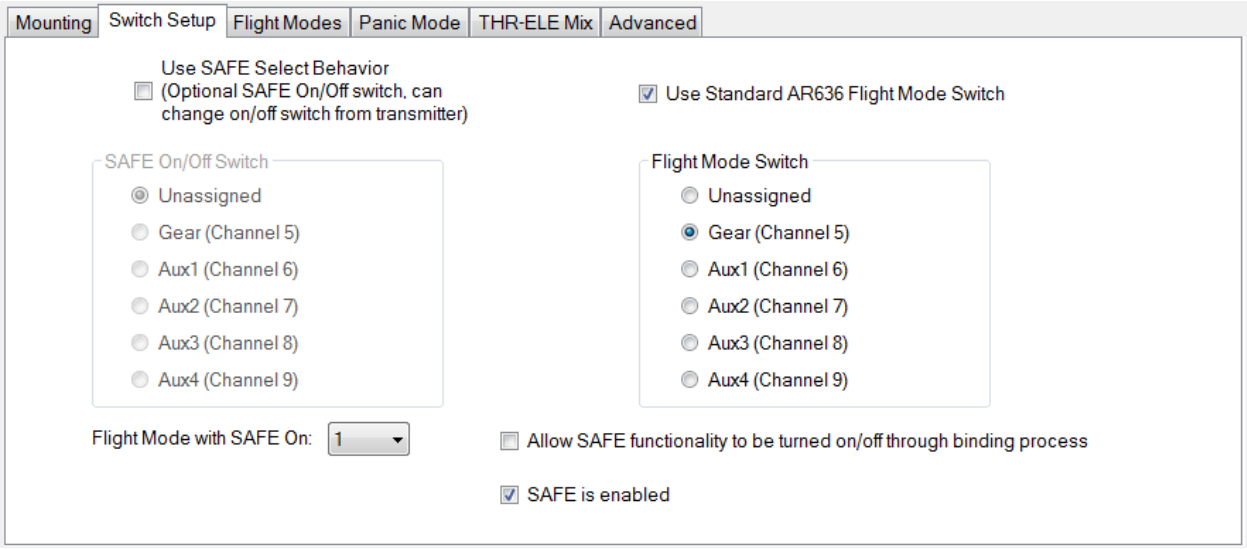
To function correctly with SAFE Select, you must indicate with flight mode should be used as the "SAFE On" flight mode.

If you turn on the check box for “Allow SAFE functionality to be turned on/off through bind process”, then you are able to toggle between SAFE On and SAFE Off using SAFE Select’s binding process.

The “SAFE is enabled” check box indicates whether or not SAFE is currently enabled.

Standard Flight Mode Switch

To contrast with the Timber’s SAFE Select setup, let’s look at the standard setup with three flight modes for the Mini Apprentice.



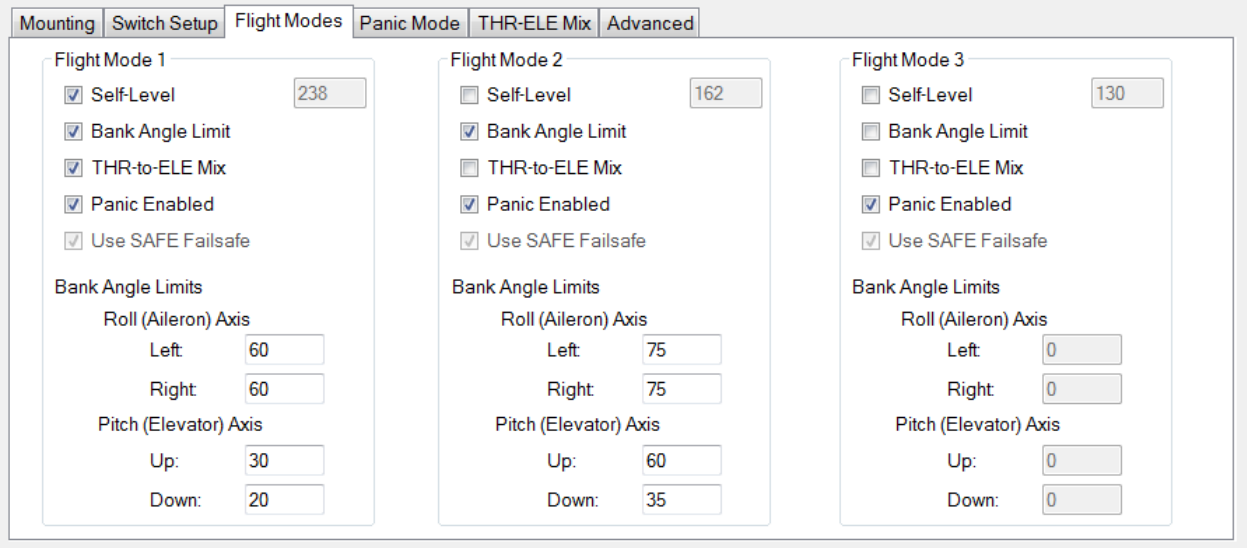
For standard operation, you don’t need to use any of the SAFE Select functions. You can ignore the settings for “Flight Mode with SAFE On”, and you would uncheck the box that allows the bind process to set SAFE as On or Off.

To change between the receiver’s flight modes while in mid-air, you must assign a flight mode switch. Unlike SAFE Select, you cannot assign the standard switch from the transmitter.

Section 2.4 – Flight Modes Tab

The settings on the Flight Modes tab allow you to customize the SAFE features that are used in each of the receiver's three flight modes.

Pictured below is the configuration from the Mini Apprentice, showing the settings for the traditional three-mode SAFE (Beginner, Intermediate, and Experienced).



For each flight mode, you can choose to enable the SAFE self-level feature, the bank angle limit feature (limits on roll and pitch), the throttle-to-elevator mix, and whether the panic feature is enabled. The throttle-to-elevator mix feature is described in Section 2.6, THR-ELE Mix Tab.

When the bank angle limit is enabled, you can adjust the settings for the angle limits. The angle limits are approximately in degrees, so you may want to experiment a little bit with different values to see how the plane reacts as it is rolled or pitched away from level flight. In the Mini Apprentice example, notice that the pitch down is slightly more restricted than pitch up, discouraging the pilot from pointing the nose down too sharply.

A typical Beginner Mode has all of those features enabled. Intermediate Mode does not self-level, and it does not have the throttle-to-elevator mix. Finally, Experienced Mode doesn't provide any SAFE features except for the panic button.

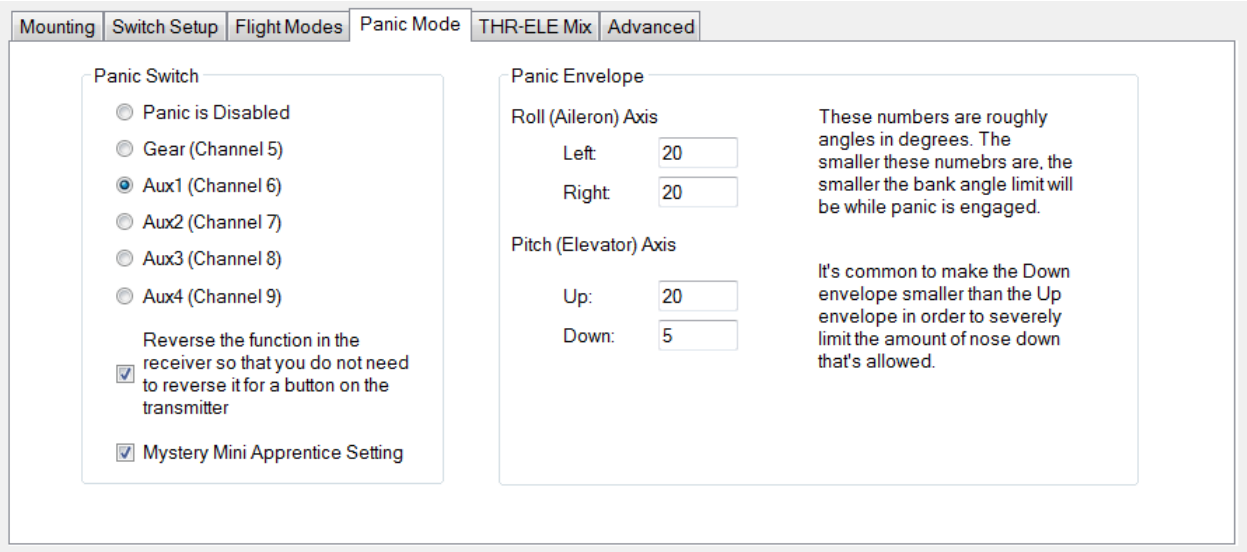
If this were a SAFE Select setup, then one flight mode would have self-level, bank angle limits, and the throttle-to-elevator mix turned on, and the other two flight modes would have none of those things. SAFE Select does not come with the panic feature enabled.

If you would like to enable the panic feature, you must also configure the settings on the Panic Mode tab, described in Section 2.5.

Section 2.5 – Panic Mode Tab

The settings on the Panic Mode tab control the behavior of the Panic function.

The example below is from the setup for the Mini Apprentice.



To use Panic Mode, you must assign it a control switch, and it must be a different switch than the flight mode switch selected on the Flight Modes tab.

If you're familiar with the original Apprentice S and some of the other early models with SAFE and Panic Mode, then you'll know that in order to make Panic Mode work correctly with the button on the transmitter, you must reverse that channel in Servo Setup on the transmitter. The AR636 program gives you the option of reversing that control in the receiver instead of on the transmitter. Here are the values the receiver expects the transmitter to send based on whether or not you check the "Reverse" box on this screen:

	Reverse box NOT checked (Older Apprentice S setup)	Reverse box CHECKED (New Mini Apprentice setup)
Panic Mode On	+100%	-100%
Panic Mode Off (normal flight)	-100%	+100%

The transmitter button usually sends +100% in the unpressed position and -100% when pressed. That's why it was necessary to reverse the channel on the transmitter and reverse that behavior. If you check the box in this screen, you can leave your transmitter set to "Normal" for this channel and assign it to the button.

The other settings on this screen control the envelope (similar to bank angle limit) that is imposed while Panic Mode is active. Notice that the Mini Apprentice S has them set to be very restrictive – the idea is to quickly return the plane to level flight and keep it there, ignoring most input from the pilot. There is almost no nose down allowed while panic is on!

Finally, there's a check box for "Mystery Mini Apprentice Setting". I don't know what that changes! I have only seen this setting enabled for panic with the Mini Apprentice S setup.

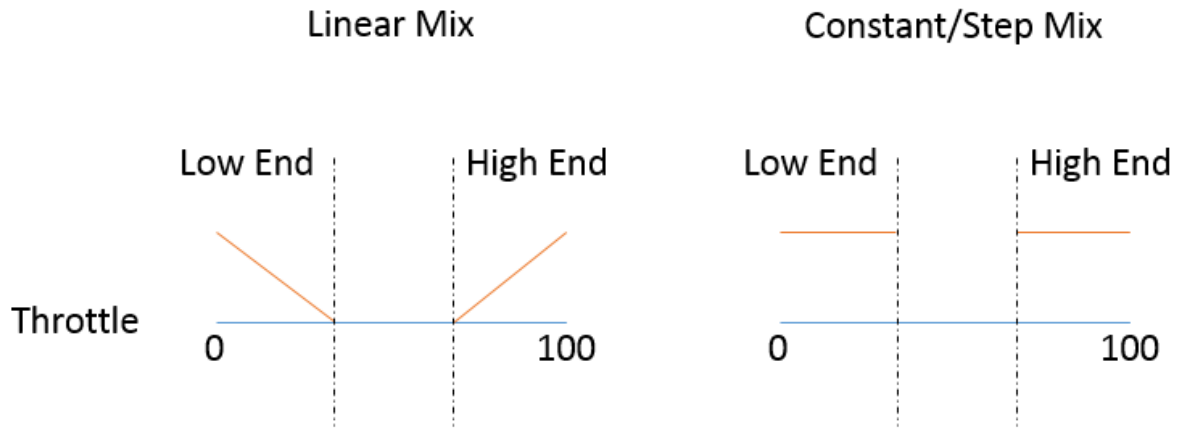
Section 2.6 – THR-ELE Mix Tab

The settings on the THR-ELE Mix tab allow you to adjust the built-in throttle-to-elevator mix that's part of the SAFE feature set.

Dating back to the Apprentice S with SAFE, the SAFE receivers have always had a built-in throttle-to-elevator mix that's intended to help beginners control the pitch of the plane in part by using only the throttle stick. This mix is considered a feature of SAFE, and does not appear in the normal mix configuration screen for the AR636 receiver.

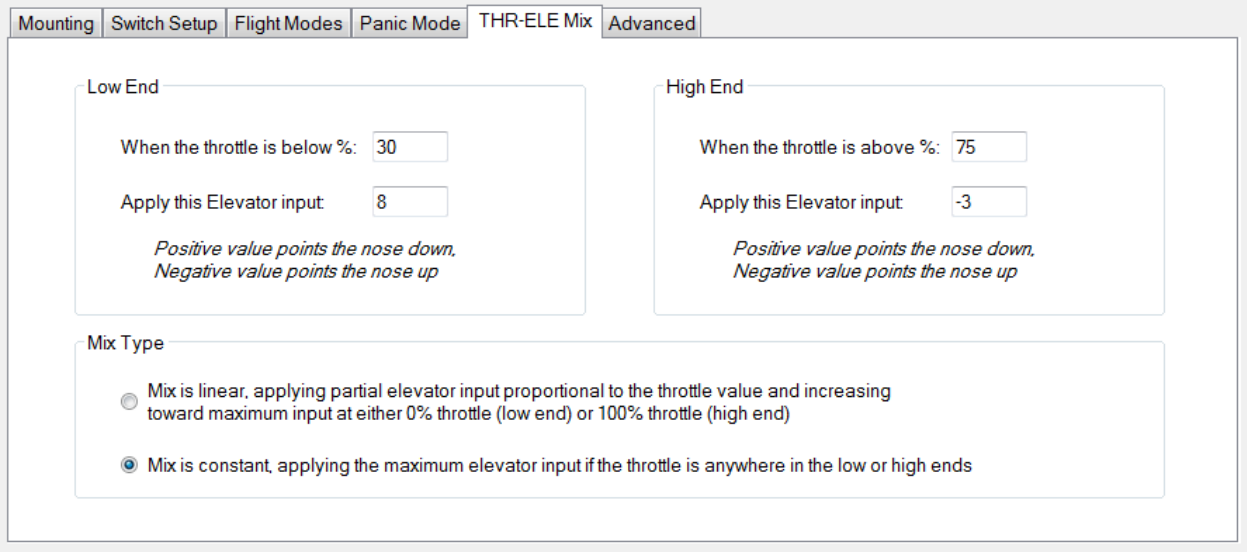
The AR636's version of this mix is based on two control points, creating a "Low End" and a "High End" of the range of the throttle stick. You specify those two points, as well as what happens either when the throttle is below the low end point or above the high end point.

Additionally, the AR636 offers two type of mix behavior – either a linear mix, where the amount of mix added is proportional to the value of the throttle at the time, or a constant (or step) mix, where the amount of mix added is constant as long as the throttle is within either the Low End or the High End.



Setting the Elevator Input to a negative number lifts the nose up, and setting it to a positive number points the nose down. If you don't want to use either the Low End or the High End, set the Elevator Input to 0 for that end.

Here's a typical constant version of the mix, from the Timber:

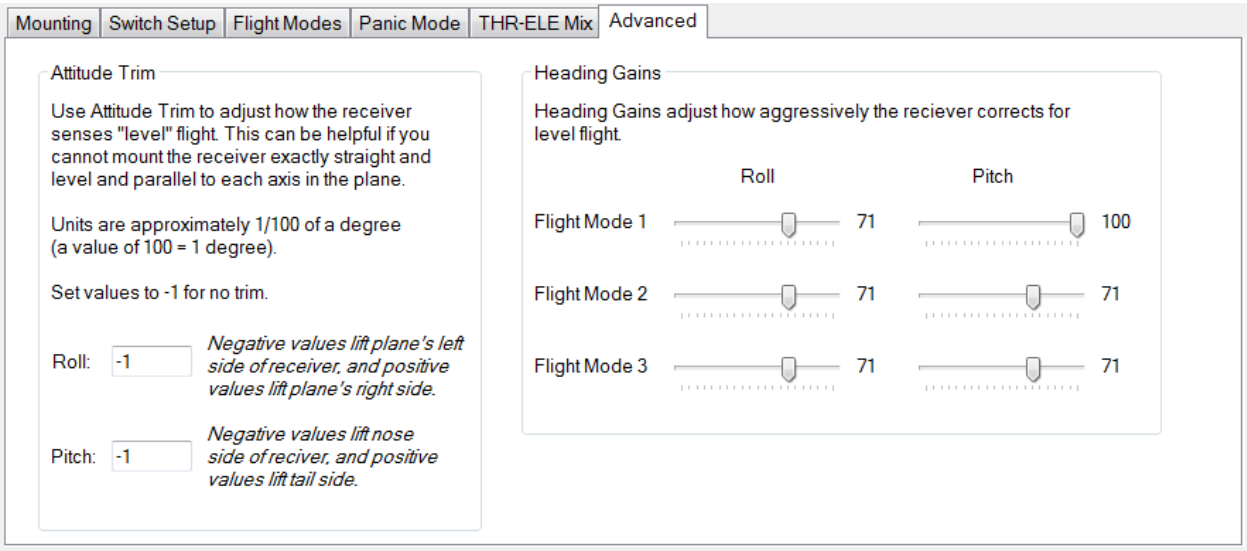


When using a constant mix type, it's typical to have distinct low end and high end areas, such as the 30% and 75% above. In this example, the Timber is applying down elevator at low throttle, presumably to counteract some bounce from the large flaps on that plane. It adds up elevator at high throttle, helping to push the nose up into the sky.

When using a linear mix, the two throttle levels are often at 50% and 51%, making some amount of mix active almost all the time.

Section 2.7 – Advanced Tab

The Advanced tab has some settings that you may not need to change unless you're trying to tune the receiver for the most optimal performance of the SAFE features in your plane.



<u>Attitude Trim</u>

You can adjust how the receiver senses the "level" flight position. This is helpful if you need to compensate for how the receiver is mounted in the airplane and it isn't sitting level when the plane is in a level flight attitude.

You can make adjustments for both the roll and pitch axes of the airplane, and the direction of the adjustment is determined by whether the number is positive or negative.

<u>Heading Gains</u>

Heading Gains adjust how aggressively the receiver would take action to correct for level flight when self-level is enabled.

Section 2.8 – Save Your Work!

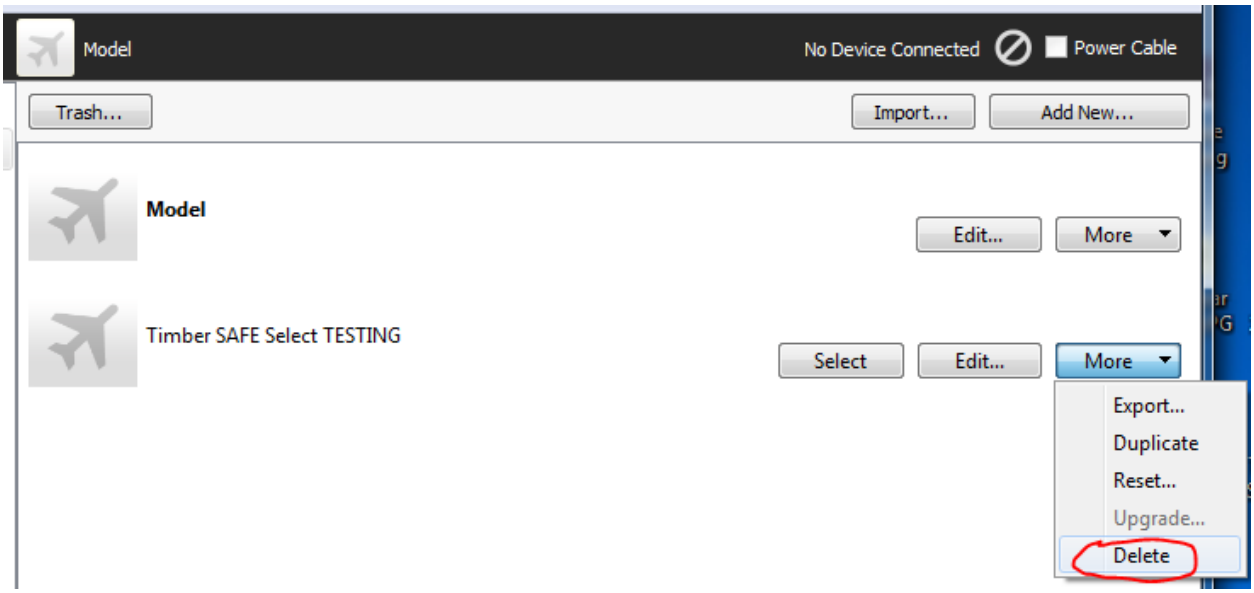
Be sure to save any changes you made! Click the "Save" button to save the changes back to the original SRM file, or use "Save As" to create a new SRM file.

Section 3 – Apply the Changes to Your Receiver

If you haven't done it yet, save the changes you made inside the SAFE Model Builder! Then, close the SAFE Model Builder program.

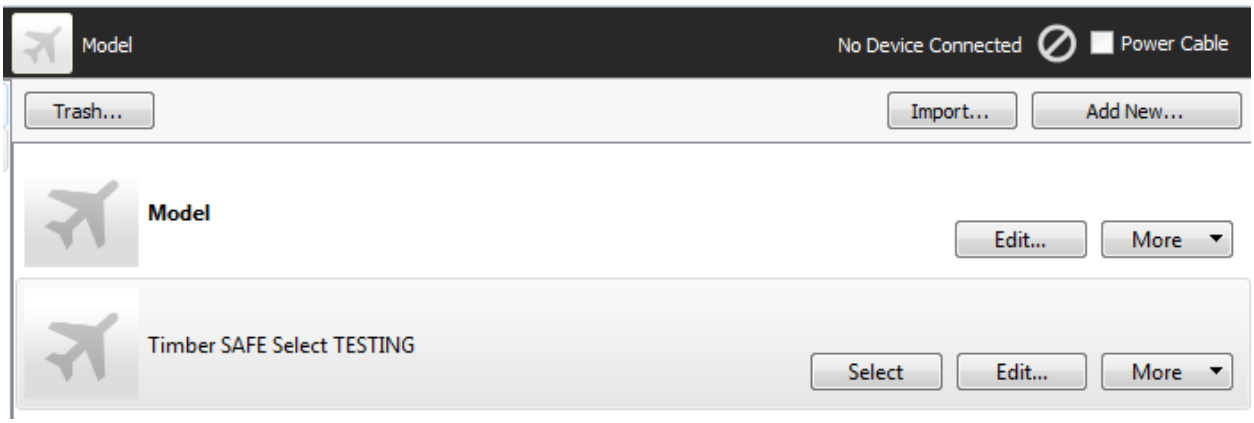
Go back to SPS, and go to the Model screen.

When you export an SRM file with settings that came from an actual receiver, the file will include the receiver's serial number. SPS may get confused if you have two models loaded that have the same serial number. Therefore, I recommend you delete the model that you exported from SPS. In order to delete the model, you'll need to choose "Select" on a different model (such as the default "Model" model) first.



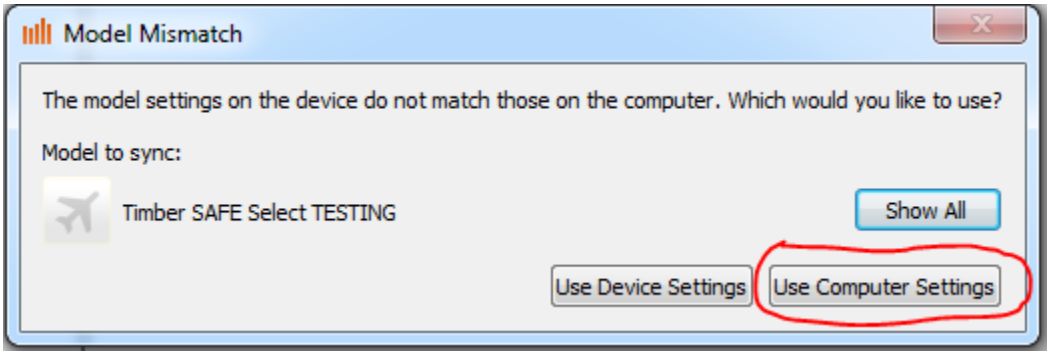
With the model removed, click the Import… button to bring in your modified SRM file.

Choose the location of the SRM file you've been working with, and bring it into SPS.

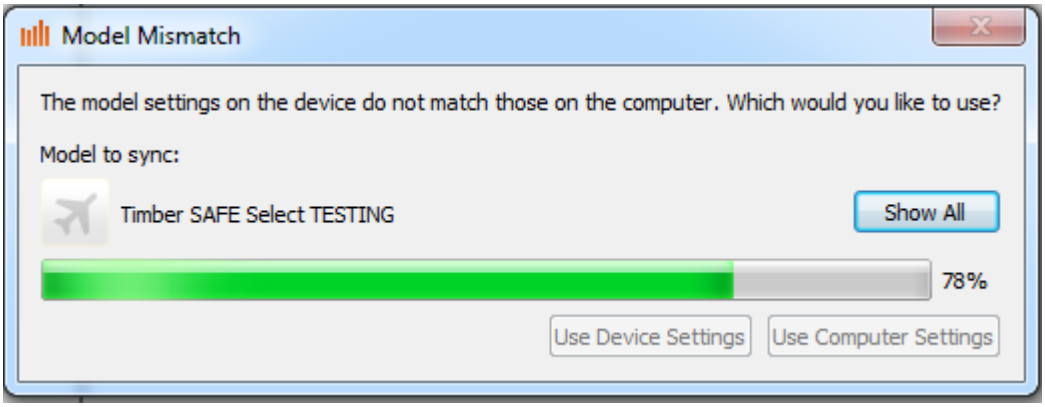


It's back!

Now, you can connect SPS to the receiver. But when you do that, SPS will notice that something has changed! There will be a conflict between the settings on the receiver and the settings in SPS that you just imported. It will ask you which settings to use. Choose "Use Computer Settings".



When you click the button, SPS will immediately apply the settings to the receiver.



At this point you can now disconnect the receiver and test its behavior!

If you want to make more changes, you can go back to the SRM file you're already working with. You don't need to export it again and start the entire process over. You can open up the same SRM file with SAFE Model Builder again, make more changes, and then go to the beginning of Section 3.

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