



Modify SAFE Settings on an AR636 SAFE Select Receiver

This issue of Flight Notes will walk through the process of modifying the SAFE settings on a Spektrum AR636 receiver running a SAFE Select program.

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.

What You Need To Get Started

Of course, you'll need an AR636 (or AR636A) receiver that's running a SAFE Select program.

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 3.1 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.

You'll also need a program that can edit text files that's aware of a technical detail called "UNIX-style line breaks." Windows Notepad won't work well for this task, and a word processor program can't be used either. I'd strongly recommend a program called Notepad++, available here: <https://notepad-plus-plus.org/>

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:

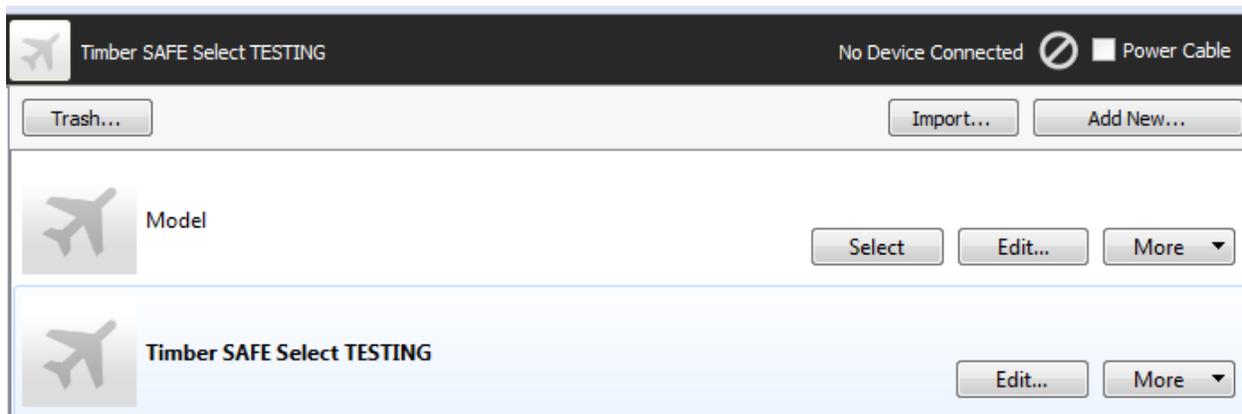
1. Have the SPS read the settings in your receiver.
2. Export those settings to an SRM file, which is a text file.
3. Use a text file editor to read the file, type in strategic changes, and save the file.
4. Import that SRM file back into SPS.
5. Have SPS load the changes into the receiver.

This document is only going to cover the details of configuring the SAFE features (such as self-level, bank angle limits, and Panic Mode) by editing the SRM text file.

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.



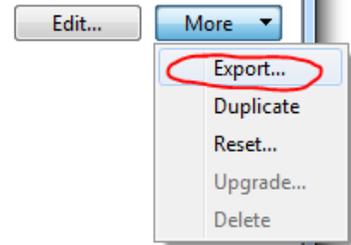
I'm going to work with the model called "Timber SAFE Select TESTING".

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.



Timber SAFE Select TESTING



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!

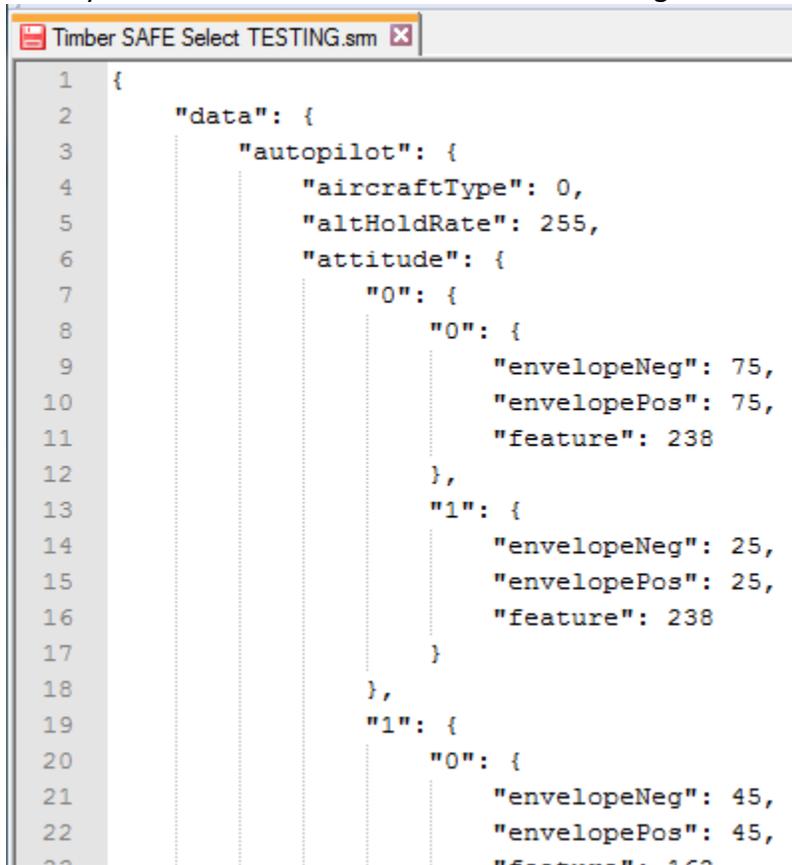
It would be a good idea to make a backup copy of the SRM file as well, just in case you want to come back to the settings you have in the receiver right now. You can use Windows to copy the SRM file, or you can use SPS to export the file a second time to a different place.

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 a text file editor.

Go ahead and open the SRM file you just saved using a programmer's-style text file editor, such as Notepad++. I'm going to use Notepad++.

What you'll see is a file that's about 1500 lines long that starts out like this:



```
1 {
2   "data": {
3     "autopilot": {
4       "aircraftType": 0,
5       "altHoldRate": 255,
6       "attitude": {
7         "0": {
8           "0": {
9             "envelopeNeg": 75,
10            "envelopePos": 75,
11            "feature": 238
12          },
13          "1": {
14            "envelopeNeg": 25,
15            "envelopePos": 25,
16            "feature": 238
17          }
18        },
19        "1": {
20          "0": {
21            "envelopeNeg": 45,
22            "envelopePos": 45,
```

If you see that, you're in the right place!

The following sub-sections will step you through making changes that are specific to the SAFE features of the receiver. You don't have to do all of these things – you only have to make the changes that you want to in order to change the behavior of your receiver. If one of the sub-sections is dependent on a change in another sub-section, I'll point that out.

Section 2.1 – Changing the Mounting Orientation

SPS doesn't allow you to change the mounting orientation of the receiver when it's set up as a SAFE Select receiver.

The mounting orientation is dictated by a combination of two settings in the file – `axis2aircraft` and `axisDirection`.

You'll want to find this section of the file. If you're using Notepad++, you can press Control-F (for "find") and type in "axis2aircraft".

```
1475     "system": {  
1476         "axis2aircraft": 36,  
1477         "axisDirection": 7,  
1478         "channel2slot": [  
1479             0
```

Here's a chart that will tell you how to set those two values for the various mounting orientations.

Pin Direction	Label Direction	axis2aircraft	axisDirection
Pins Facing Toward Nose	Label Toward Sky	36	4
	Label Toward Ground	36	2
	Label Toward Left	24	6
	Label Toward Right	24	0
Pins Facing Toward Tail	Label Toward Sky	36	7
	Label Toward Ground	36	1
	Label Toward Left	24	3
	Label Toward Right	24	5

Section 2.2 – Changing the Throttle-to-Elevator (THR > ELE) Mix

You can change the setup of the THR > ELE mix that's enabled in SAFE On mode in SAFE Select, or Beginner Mode on a three-mode SAFE receiver such as the Mini Apprentice.

There are several settings that work together to configure the mix, under the heading "thr2pitch". You'll want to find this section of the file. If you're using Notepad++, you can press Control-F (for "find") and type in "thr2pitch".

```
191     "thr2pitch": {
192         "0": {
193             "angle": 8,
194             "threshold": 30
195         },
196         "1": {
197             "angle": -3,
198             "threshold": 75
199         }
200     },
```

There are two sections "0" and "1", each with their own settings for "angle" and "threshold".

Section "0" is applied by the receiver when the throttle stick is below the value of "threshold" on a scale of 0% (no throttle) to 100% (full throttle).

Similarly, section "1" is applied by the receiver when the throttle stick is above the value of "threshold".

A positive number for "angle" applies elevator down, and a negative number applies elevator up.

So in the snippet above, the receiver will apply 8 points of down elevator when the throttle is less than 30%, and it will apply 3 points of up elevator when the throttle is above 75%. (NOTE: I'm not sure at this point how the value of "angle" relates to a specific unit of measurement, such as degrees of movement of the elevator, or some other range of movement. That's why I'm referring to it as "points".)

You may edit this mix to adjust the amount of elevator control that's applied and when, or you may choose to disable it.

If you want to disable the mix, set both values of "angle" to -1 and both values of "threshold" to 255.

If you want to edit the mix instead, feel free to experiment.

Another way to effectively disable the mix would be to set both values of angle to 0. The mix would still be active, but it wouldn't do anything because it won't create any extra input.

It seems to be common in some of Horizon's other models to set threshold "0" to 50 and threshold "1" to 51 such that there's always a mix being applied through the entire range of throttle.

The Mini Apprentice is set up this way:

```
191     "thr2pitch": {
192     "0": {
193         "angle": -8,
194         "threshold": 50
195     },
196     "1": {
197         "angle": -20,
198         "threshold": 51
199     }
200 },
```

It's always adding up elevator such that the plane is encouraged to climb in Beginner Mode, and it adds even more elevator above 51% throttle.

Section 2.3 – Configure Panic Mode

Panic Mode is a feature that will immediately activate the self-level capability inside the receiver. It's intended to be associated with the push button on your transmitter for a quick "help me" mode.

You can configure both the radio channel assigned to panic mode and the bank angle limits that will be applied in that mode, under the heading "panic". You'll want to find this section of the file. If you're using Notepad++, you can press Control-F (for "find") and type in "panic".

```
85 "panic": {
86   "envelope": {
87     "0": {
88       "neg": 20,
89       "pos": 20
90     },
91     "1": {
92       "neg": 20,
93       "pos": 10
94     }
95   },
96   "source": 3
```

The image shows a code editor window with a JSON configuration for panic mode. The code is as follows:

```
"panic": {
  "envelope": {
    "0": {
      "neg": 20,
      "pos": 20
    },
    "1": {
      "neg": 20,
      "pos": 10
    }
  },
  "source": 3
}
```

Two callout boxes are present:

- A box labeled "Aileron (Roll) Axis" with a line pointing to the "0" section of the "envelope" object.
- A box labeled "Elevator (Pitch) Axis" with a line pointing to the "1" section of the "envelope" object.

The "envelope" section contains the settings for the bank angle limits that will be applied while Panic Mode is active. Normally you would set these limits to be rather tight, enabling the receiver to level out the plane faster regardless of any input you may be applying from the sticks.

Section "0" contains the settings for aileron (roll), and section "1" contains the settings for elevator (pitch). It's common to set up the down elevator ("pos" under section "1") to be a smaller number than the other in order to drastically limit the amount of nose down that's possible in Panic Mode. The numbers are angles in degrees.

The value for "source" has two purposes. First, it lets you select the radio channel that you will assign to the panic function. Do not use the same channel as your flight mode or SAFE on/off switch! Second, it also lets you decide whether you want to have the receiver reverse the signal on the channel. On the original SAFE receivers, you had to reverse the channel on the transmitter in order for the panic function to work properly in conjunction with the button. Normally the button sends a value -100% on the radio channel when it's pressed, but the original design of the SAFE receivers activated SAFE on a +100% signal. Therefore, you had to reverse the channel on the transmitter. Now you have a choice – you can stay with that traditional setup and reverse the channel on the transmitter, or you can configure the receiver to reverse that channel and leave your transmitter set to normal.

The table on the next page shows the options available for the "source" setting.

Radio Channel for Panic Button	Value for source to Activate Panic at +100% (Reverse in Transmitter)	Value for source to Activate Panic at -100% (Reverse in Receiver)
Gear (channel 5)	1	129
Aux1 (channel 6)	2	130
Aux2 (channel 7)	3	131
Aux3 (channel 8)	4	132
Aux4 (channel 9)	5	133
DISABLE PANIC MODE	255	255

After you have configured Panic Mode, you must enable the use of Panic Mode in the various flight modes. In other words, even though the “source” and the “envelope” are all set up, the receiver will still ignore a request for Panic Mode unless you also turn it on somewhere else.

More About Flight Modes in General

If you want to work with Panic Mode while also understanding how the receiver handles flight modes and other SAFE features such as self-level and bank angle limits, keep reading to section 2.4.

Add Panic Mode to the Stock SAFE Select with SAFE on/SAFE off Flight Modes

If you only want to add Panic Mode on an otherwise standard configuration of your SAFE Select receiver, here’s the short answer for how to do that.

Near the very beginning of the file, you’ll see a section called “Attitude”. The beginning of it looks like this:

```

6      "attitude": {
7          "0": {
8              "0": {
9                  "envelopeNeg": 75,
10                 "envelopePos": 75,
11                 "feature": 238
12             },
13             "1": {
14                 "envelopeNeg": 75,
15                 "envelopePos": 75,
16                 "feature": 238
17             }
18         },
19         "1": {
20             "0": {
21                 "envelopeNeg": 45

```

To turn on Panic Mode on the standard SAFE Select setup, change all values of “feature” that say 236 to 238, and all values of “feature” that say 128 to 130. For what it’s worth, the values of

236/238 have self-level (SAFE) enabled, and the values 128/130 have SAFE disabled. That's how you can tell the difference between the SAFE on and SAFE off modes.

Section 2.4 explains all of the other things under "attitude", including other possible values for "feature".

Section 2.4 – Configure SAFE Features in Flight Modes

The receiver allows you to enable or disable certain SAFE features (self-level, bank angle limits, Panic Mode) for each one of the receiver’s flight modes.

Before we get too deep into that, let’s go over how the receiver’s flight modes work.

Receiver Flight Modes on the AR636

From the factory, a SAFE Select receiver doesn’t appear to use any flight modes. If you choose not to enable SAFE, or you enable SAFE but do not set up the SAFE on/off switch, then you’re flying in one flight mode all the time.

If you enable SAFE and set up the SAFE on/off switch, then you’re going to experience two modes – SAFE on and SAFE off.

The AR636 receiver actually supports three flight modes. In the SPS software, they’re displayed as flight mode 1, 2, and 3. In the SRM file, you’ll see them referred to as 0, 1, and 2 respectively.

So behind the scenes, inside the receiver, you’re always flying in at least one flight mode. If you have the SAFE on/off switch, then you’re toggling between two of the receiver’s three flight modes.

Of course, it’s possible to change your SAFE Select receiver so that it uses all three of the receiver’s flight modes. You can even pick and choose which of the three modes have the various SAFE features enabled. For example, you can make your SAFE Select receiver behave just like a traditional three-mode SAFE receiver, the same way that the Mini Apprentice provides the three different flight modes and a Panic Mode.

Choose Between SAFE Select On/Off Modes and Standard Three Modes

The SRM file has several settings that it uses to differentiate between SAFE Select operation and three-mode operation.

Those settings are called “flightModeSwitch”, “safeLimitedFlightModeSwitch”, and “safeLimitedFlightModesDisabled”. They’re located near the end of the SRM file.

SAFE Select Operation

When the receiver is operating with two modes, SAFE on and SAFE off, you’ll see a configuration in the file that looks something like this:

```
1501     "flightModeSwitch": 255,  
1502     "gyroThresholdEnable": 1,  
1503     "safeLimitedFlightModeSwitch": 4,  
1504     "safeLimitedFlightModesDisabled": 0,
```

With “flightModeSwitch” set to 255, the AR636’s normal flight mode switch is disabled. You’ll see that in the SPS software as “unassigned”.

The setting for “safeLimitedFlightModeSwitch” tells the receiver which radio channel is being used to toggle SAFE on/off. In the example pictured above, it’s 4, or the Gear channel.

Radio Channel for SAFE on/off	Value of safeLimitedFlightModeSwitch
Gear (channel 5)	4
Aux1 (channel 6)	5
Aux2 (channel 7)	6
Aux3 (channel 8)	7
Aux4 (channel 9)	8

Additionally, “safeLimitedFlightModesDisabled” is set to 0, meaning that the feature is *not* disabled.

Standard Three-Mode Operation

When the receiver is operating with all three of its flight modes, you’ll see a configuration in the file that looks something like this:

```
1501      "flightModeSwitch": 4,  
1502      "gyroThresholdEnable": 1,  
1503      "safeLimitedFlightModeSwitch": 255,  
1504      "safeLimitedFlightModesDisabled": 1,
```

Now, “safeLimitedFlightModeSwitch” is set to 255, or disabled. The “flightModeSwitch” is now assigned to a radio channel. In the example above, it’s the Gear channel.

Radio Channel for Flight Mode Switch	Value of FlightModeSwitch
Gear (channel 5)	4
Aux1 (channel 6)	5
Aux2 (channel 7)	6
Aux3 (channel 8)	7
Aux4 (channel 9)	8

Also note that “safeLimitedFlightModesDisabled” is now set to 1, meaning the SAFE on/off switch has been disabled in favor of the normal flight mode switch.

Configuring SAFE Features for Each Flight Mode

The configuration details for the SAFE features are listed at the beginning of the SRM file, under a section called "attitude".

Under the heading "attitude", you'll find sections for up to five flight modes! You cannot use the last two, so you can safely ignore sections "3" and "4" under "attitude". The three flight modes you can use – modes 1, 2, and 3 – are listed in the SRM file as "0", "1", and "2" respectively.



To take full advantage of the options presented here, you will want to change your receiver to operate with three flight modes instead of SAFE Select’s normal two (SAFE on/SAFE off).

For each flight mode, there is a section “0” for the aileron (roll) axis, and a section “1” for the elevator (pitch) axis.

For each axis, there’s a setting for “envelopeNeg”, “envelopePos”, and “feature”.

The envelope settings are the bank angle limits, in degrees.

The settings for “feature” are described in the table below.

SAFE Features	feature Value With Panic	feature Value Without Panic
“Beginner Mode” Self-Level, Bank Angle Limits, THR > ELE Mix, AS3X	238	236
Self-Level, Bank Angle Limits, AS3X	226	224
“Intermediate Mode” Bank Angle Limits, AS3X	162	160
“Experienced Mode” AS3X Only	130	128

You may use any features you would like for any flight mode. You can mimic the three-mode SAFE receivers by setting up one flight mode for each mode described in the table above. Or, if you’d like two modes like Beginner Mode but maybe with different bank angle limits, you can do that too.

I would strongly recommend setting the value for “feature” the same way for both the aileron and elevator sections within in one flight mode.

You can disable the THR > ELE mix in “Beginner Mode” based on the table above, or you can disable it as described in section 2.2. There is an advantage to disabling it here, though. When the THR > ELE mix feature is turned on, the receiver is always comparing your current attitude angle to the bank angle limit, and reduces your control rate accordingly as you approach the limit. Sometimes this behavior of the receiver manifests itself as reduced control rates overall, especially on the elevator when the that axis usually has lower limits than the roll/aileron axis.

Section 2.5 – Changing the Name of the Model in SPS

If you would like to take this opportunity to change the name of the model as it appears inside SPS, you can do that in the “name” setting at the end of the file.

```
1512     "name": "Timber SAFE Select TESTING",
```

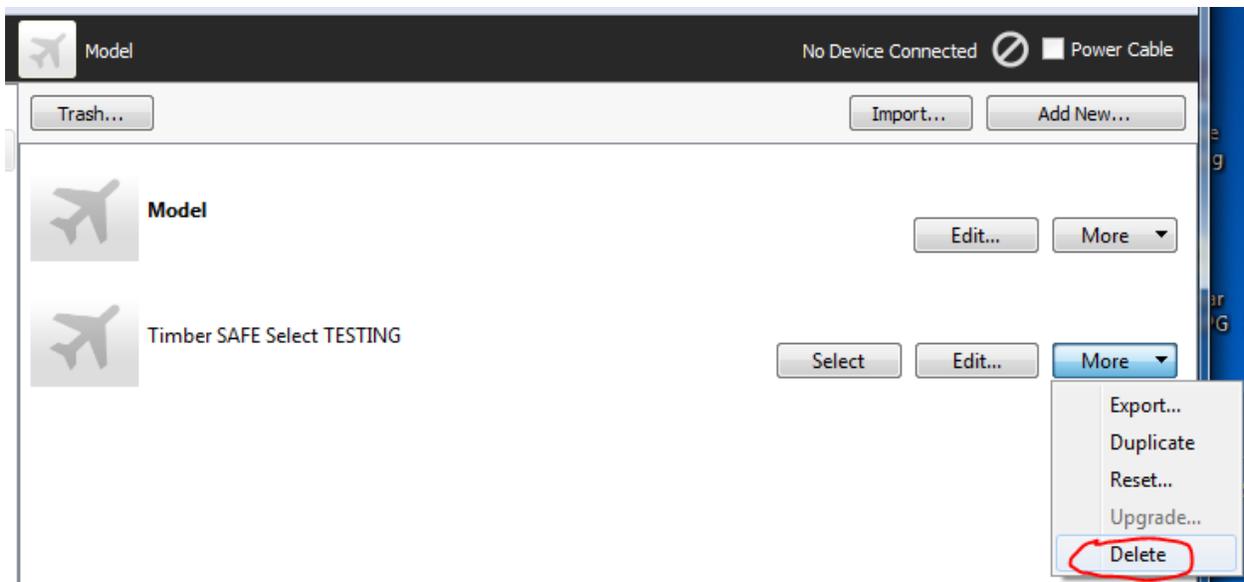
SPS goes by that setting, and not the name of the Windows file when you import it.

Section 3 – Apply the Changes to Your Receiver

If you haven't done it yet, save the changes you made inside the text file editor! Then, close the text file editor program.

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

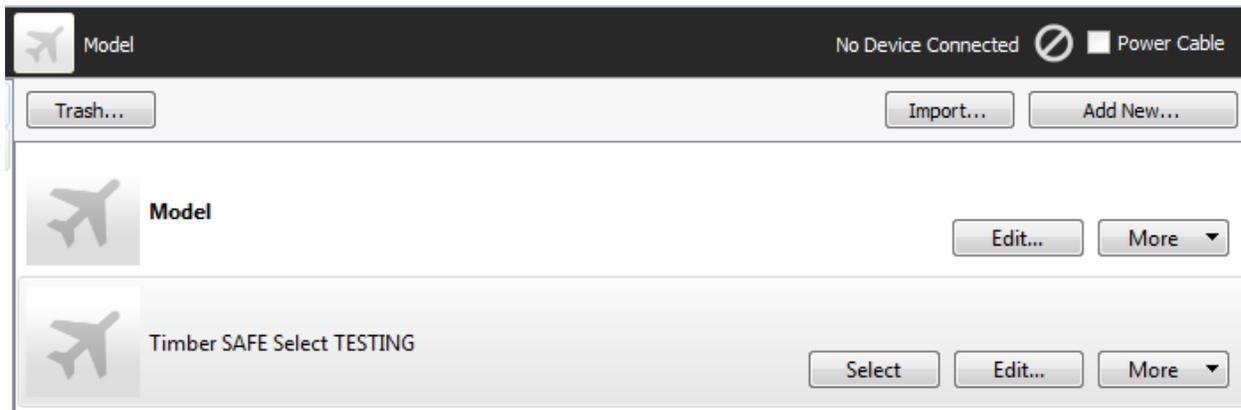
When you export an SRM file with settings that came from an actual receiver, the file will include the receiver's serial number. SPS may get confused if you have two models loaded that have the same serial number. Therefore, I recommend you delete the model that you exported from SPS. In order to delete 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.

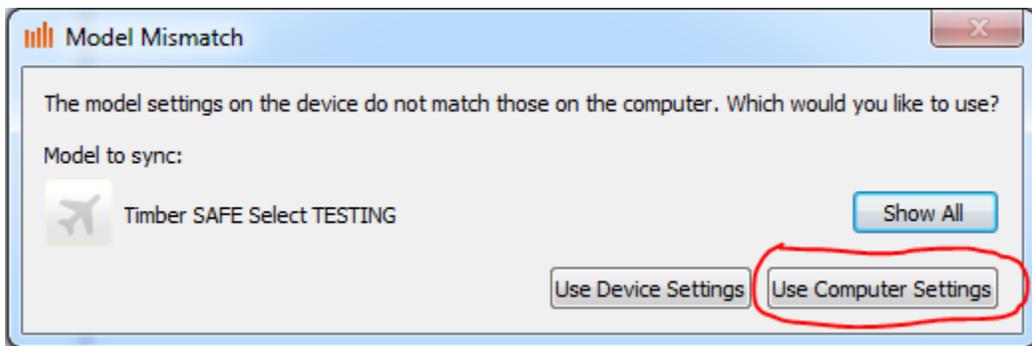


Choose the location of the SRM file you've been working with, and bring it into SPS.

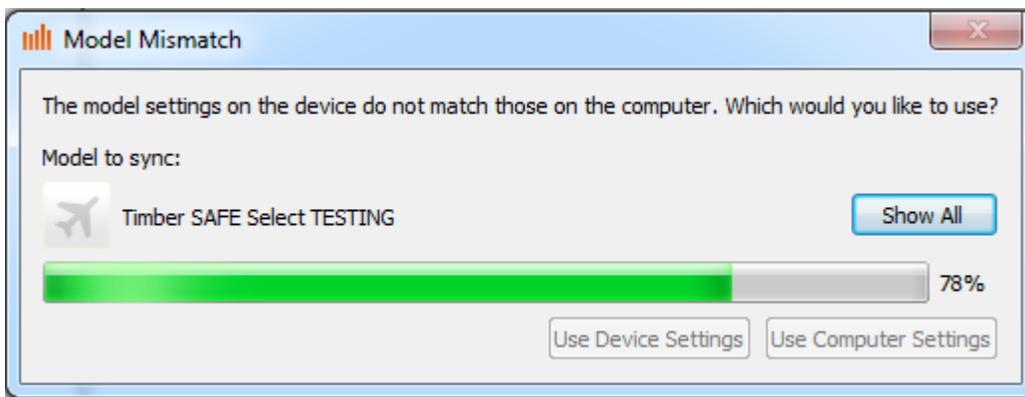


It's back!

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 SRM file with the text file editor again, make more changes, and then go to the beginning of Section 3.

Revision 3 – December, 2017