ROYAL evo

TUTORIAL

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EVO software version 1.26 (North American)

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1. INTRODUCTION

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This tutorial is primarily catered to new Multiplex EVO pilots who have recently converted to the Multiplex EVO or who are currently in the process of upgrading to an EVO with a background working with and programming Asian-based radios (AR).

The tutorial also assumes that the reader has read the manual. The reader should be comfortable entering information into the EVO and should be reasonably adept in using the input keys as well as the digi-adjuster keys for data input.

1.1. WIDGETS, CONTROLS, CHANNELS, MIXERS

First and foremost the new Multiplex user should immediately endeavor to become acclimated with the specific terminology used in this tutorial as well as within the Multiplex community in general.

The author recommends using Mike Shellim's approach to the following unique Multiplex vocabulary terms:

Widget : Sticks, switches, buttons, and sliders. On the EVO, the trim buttons, the digi-adjusters and the menu buttons near the bottom of the transmitter case are **NOT** considered a widget.

Control : What the function of the widget is. Initially, a widget doesn't do anything on Multiplex radios. The pilot must instruct the EVO as to what the effect that the widget will have.

Channel : Servo input signal. For this tutorial, you cannot have more servos in a plane than you have channels. The RE9 has nine and the RE12 has twelve.

Mixer : A miniature list of up to five control inputs that can each provide a control signal to a servo. Servos only have one physical plug end. Mixers allow for more than one control input to command a servo to move. Mixers will be addressed in detail in a later lesson. Mixers are not physical elements, but are created and stored in the EVO software.

1.2. THE MULTIPLEX PROGRAMMING CONCEPT

For a new user of the EVO, the MPX logic sequence can be very confusing at first. It is helpful to keep in mind the following programming logic sequence:

This is best understood as, "The servo is assigned to the Mixer, which is assigned to a control, which is then assigned to a widget."

With MPX, none of the widgets are established as controls initially. The widgets don't and won't do anything when the EVO is taken right out of the retail box. The actual data streams to the servos (which are the controls), however, already exists within the transmitter, but

since they're not yet assigned to a widget, to a new MPX user it appears that there are no functions on the EVO!

Mixers can be pre-made by Multiplex or can be a custom made that the pilot can create. Mixers will be discussed in detail later in this tutorial.

The idea that widgets don't do anything right out of the box is a major hurdle to overcome when converting from an Asian radio brand to a Multiplex brand radio.

On an AR, the widget (the switch) that commands the flaps is already established to a control (activating the flap servo). This widget is permanently wired to a channel that sends a signal to the flap servo. Because the widget and the channel are permanently connected, none of the attributes such as the widget, control, or channel can be changed on an AR. The flap widget on an AR will always be a flap widget - it cannot be set to effect another servo or control such as a landing gear, tow release or wheel brake. This applies to the other pre-wired widgets on the ARs as well.

With an AR, since the widget and the channel are already hardwired for you from the factory, it is common practice to refer to a "flap channel" or a "spoiler channel." This is a practice that can no longer continue since it will cause the reader a lot of grief when attempting to understand the MPX approach.

With the MPX radios there are no connections between the widgets, controls and servos.

There is, however, a software connection that can be established within the MPX transmitter. In fact, this ability is the pivotal concept that allows the MPX radios such a tremendous amount of flexibility and programming power.

"So, how do these connections become established on the EVO?"

The pilot establishes these connections. The pilot decides which widget should effect which control and then established which servo receives that control signal. With MPX, the pilot will no longer need to plug specific servos into specific slots in the receiver - MPX allows the pilot to determine which control signal goes to which output on the receiver.

So, now that we have an understanding of the MPX logic, should the next step be to jump right in and begin programming the EVO?

No.

Before the pilot begins to program the EVO, they should spend a moment to consider the plane, their preferred flying style, and the specific controls that will be needed for the plane.

They should also consider which widgets that they would like to use and how they should be utilized (always "ON" or switched off or on a slider?)

2. INITIAL CONSIDERATIONS

So, there the EVO sits on the workbench just out of the package. Perhaps the pilot has already read the manual, but perhaps they just charged the EVO up and turned it on and started playing around with the widgets and menu buttons.

"Ugh?" they may have wondered. "Where is the dual-rate switch? Doesn't this thing have a crow switch? How about a simple landing gear switch?"

These are probably all valid first impressions if the pilot is transitioning from an Asian radio (AR) to the EVO.

Notice that all of the widgets on the EVO are designated with a letter. One slider, for example, is labeled as "E" and the other is designated with an "F". Other switches and buttons have their own letter designations.

There is a valid reason for this approach by MPX. Since the widgets are not assigned to a control or to a function from the factory, assigning a generic letter code to each widget allows a way to indicate a particular widget to the EVO by referencing the letter code.

Also, take this time now to consider whether the pilot will be installing the short, medium or long buttoned axis sticks. Install that set that is most comfortable. Although the long sticks are for finger tip flying, they feature extra buttons that can be used later to control features or to turn on and off certain functions.

So, are the readers now ready to begin setting up the EVO?

No.

It's now time to put some thought into how the pilot likes to fly and what type of ship the pilot will be programming into the EVO.

For this example, we will be using the Omega 1.8E that is an ARF composite glider that has ailerons, v-tail and proportional motor controls. This is a plane is representative of many hot liners. The reader should keep in mind, however, that many of the steps that will be illustrated in this tutorial can be used to work with other planes.

2.1. PLANNING THE MODEL

Before commencing the EVO programming, it will be necessary to consider the following items:

- **How many servos will be installed in this plane?**
- **Are non-flying functions such as a landing gear switches or a timer functions needed?**
- **Should certain functions be designated as "Always on" or "Switched on"?**

- **Which widgets should be used and which widgets should remain dormant?**
- **Should more than one control movement affect a servo?**

The plane example used in this tutorial has a total of four servos, one each for the ailerons and one each for the v-tail surfaces. Although there will be no servo controlling the motor, there will be an ESC which will be considered a "servo" since it will require a data stream from one of EVO's channels in order to operate.

This means that there will be at least five essential control channels necessary for flight.

This satisfies the first of the pre-programming questions.

Next, since there will not be a landing gear, this function will not be needed. A tow release function will not be needed as well. However, a timer function that will keep track of the motor run time will be a nice feature. Since the author doesn't want to fool with a switch to turn the timer on or off, the timer should start and remaining running only when the throttle is turned on automatically.

Dual-rates on the aileron, rudder and elevator controls will be needed. This to be turned on and off with a switch.

Rudder should be added with ailerons for coordinated turns. This should be switched on and off with a widget as well.

Aileron differential will possibly be needed in case the Omega experiences adverse yaw when ailerons are used. This should always on, but there needs to be a way to adjust and fine tune the amount of differential compensation while flying the plane.

A spoileron and flaperon function will be needed that will be set on a slider for camber and reflex settings. This widget will work as a set-and-forget slider to adjust the reflex setting for penetration flight and the camber setting for thermal flight.

Another control will be spoilerons and this will be assigned to the left axis stick. This will be used for landing purposes.

2.2. PLANNING THE TRANSMITTER

We've determined which control functions should be used on the plane, but now it's time to decide which widgets should be programmed. The pilot can pick any widget to have any function, but some things are pretty obvious - assigning the elevator control to a two position switch would not be very beneficial. The three main flying functions (elevator, rudder and ailerons) will be assigned on the axis sticks working in mode two. The right control stick will control elevator and ailerons and the left stick will control the rudder.

If the reader has not set ratcheting on the left stick and disabled the spring tensions in the up and down motions, this is ok. The EVO will work fine without this being set, but if the reader would like their EVO to resemble the feel of most Mode 2 factory set transmitters, change the settings of the left stick to be ratcheting in the forward and back motion. The spring tension can also be disabled in the forward and back widget motion. By doing this, the reader can use the left stick as a throttle control or as a landing control for flaps, spoilers or crow functions.

For the throttle functions, the "E" widget will be used. When it's all the way towards the bottom of the transmitter, the motor should be off.

The "L" three-position switch will be used for dual rates since this will allow for two “on” positions for dual rates. One in the upper and another dual rate setting the lower position with the center position being utilized for no dual rate setting (full high-rates.)

The aileron differential should be set to a switch as well. The "I" widget will be used since it's close to the aileron control widget and will be easy to locate by fingers.

The reflex/camber function will be put on the "F" slider. Center detent will be no reflex or camber.

The spoiler function will be assigned to the left axis stick.

Observant readers will note here that three widgets have been assigned to control the spoilerons: the right axis stick, the "F" slider and the left axis stick.

Consider this: the aileron servos should to respond to the aileron widget (the right axis stick), to the reflex/camber ("F" slider) widget so that they both go up and down together and they should also respond to the left axis stick which will be the spoileron landing control.

But, here's the problem: The left and right aileron servos have only one physical plug ending each. We could plug the left aileron servo into a slot on the receiver that is commanding the left aileron signal, but then, how can we get the signals coming from the "F" slider and the left axis stick to the left and right ailerons? With only one plug ending, we can only get one channel signal to the servo!

“How can we work around this?”

The answer is to establish a mixer.

Recall the definition of a mixer that was given earlier.

Mixer :

A miniature list of up to five control inputs that can each provide a control signal to a servo. Servos only have one physical plug end. Mixers allow for more than one control input to command a servo to move.

Our solution is to make a mixer that will accept the widget movement instructions from the "F" slider (reflex control), the left axis stick (spoileron landing control) and from the right axis stick (aileron control). The mixer does not "mix" up these signals, but it will send a signal to the aileron servos whenever one, two or all three of these widgets are moved. With a mixer, whenever a signal is encountered from any of the control inputs, a signal will be sent to the servo that is assigned to the mixer. How much the aileron servos will move, their directions of travel and their limits of travel as a result of getting signals from the mixer will all be set by the pilot.

This mixer must be created before proceeding further. Greater discussion of the MPX mixer concept is necessary as well.

3. MIXING

For new users of the MPX EVO and especially if they are upgrading from an Asian radio (AR), the MPX concept of mixing is probably one of the most difficult concepts to understand at first.

So far, it has been decided which widgets to use for flying the plane. It has also been discovered that since the servos on the aileron only have one physical plug connector, that by plugging it into a receiver port, it would be impossible to send more than one channel signal to the servo.

This is anticipated to be a problem since it will be necessary to have a reflex/camber slider control, a spoileron control on the left axis and the standard aileron controls on the right axis stick. All of these widgets are to send a signal to the aileron servos when the pilot moves them.

A mixer will be necessary in order to accomplish this.

3.1. MIXER OVERVIEW

Mixer definitions (the name of the mixer, the control inputs to the mixer, whether they're always on or switched, and the description of the assigned servo's movement) are considered global. This simply means that the definitions are not created when the model is created in the EVO. If this were the case, the pilot would have to create each mixer from scratch every time they set up a new model.

The Multiplex approach to mixers allows the pilot to save time while programming future models after initially creating their unique mixers.

So, while it may seem strange at first to not be able to make a mixer while you are programming your specific plane into the EVO, keep in mind that by creating the mixer under the SETUP menu, it will become available to other planes. So while the pilot may initially create the mixer for one plane, the mixer can later be used on another plane. This saves a lot of time and programming steps.

So, how many mixer definitions can be saved? On the EVO, there can be up to 14. The first five mixers are made courtesy of Multiplex to assist users who don't want to create from scratch commonly used control scenarios. These are things such as v-tail, delta wings and flap landing mixers. There is also a specialized elevator mixer that was created with spoiler, flap and throttle compensation. There is also a specialized aileron mixer which was created by Multiplex with spoiler, flap and elevator compensation in mind.

Consider this: if a mixer is created (such as the one that will soon be created for the Omega) suppose that while the servo travel functions work fine with this plane. But at a later time when we assign this mixer to another similar glider, the mixer while it causes the servos to move properly in the correct directions has way too much to too little servo travel? Do we need to create another mixer?

The answer reveals that the question was a trick question!

Keep in mind that while a mixer does list the particular controls that will effect a specific servo and describes how that servo will travel when the control's widget is moved (symmetrical, symmetrical with dead zone, single sided with offset, single sided with dead zone or single sided with curve), the mixer does not contain any specific definitions that provide travel volumes or provide travel distances for a servo when it is defined.

"When creating a mixer, the pilot only establishes a frame work, but no specific servo travel distances?"

The answer is yes.

While the newly created mixer will be created as a global element, the travel values of each control listed in the mixer will be modified only once the mixer has been assigned to a model.

This is a good programming approach since by only establishing the controls (or the framework) that will affect a servo in the mixer definition and not the corresponding servo travels of the controls listed in the mixer, it allows us to create "generic" (or global) mixers which can be tweaked and modified when assigned to other planes. Consider that while you may use one mixer with more than one plane, the servo travel limits for each plane will be probably be different.

MPX mixing logic is set up to account for this.

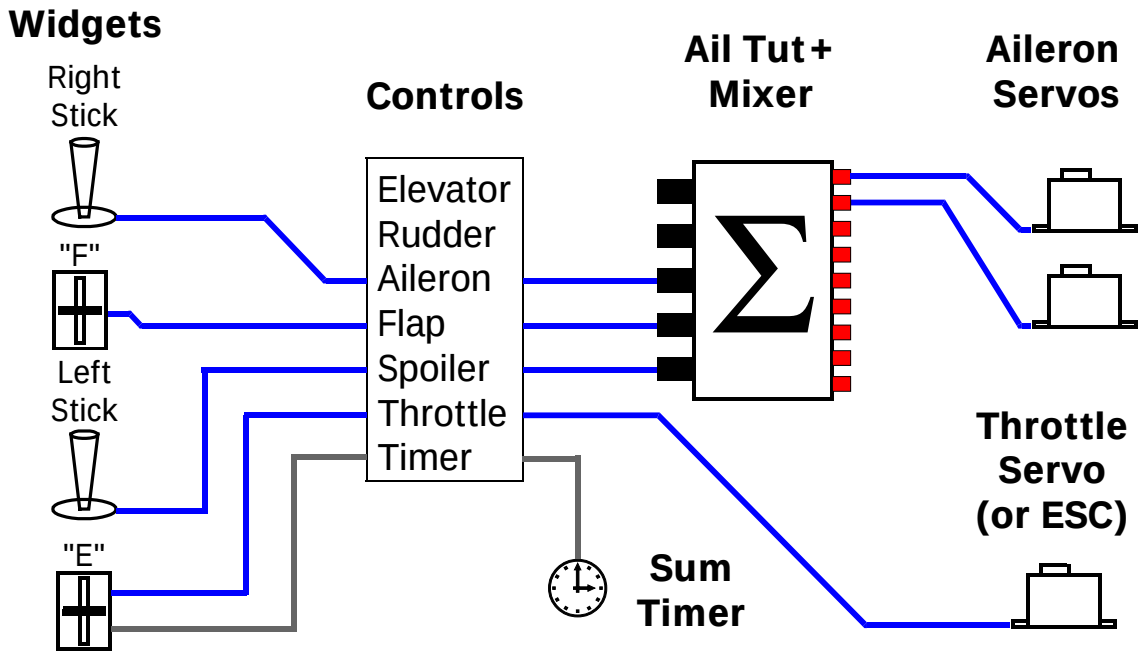
The following illustration shows how the aileron servos (which have only one physical plug ending) are able to receive servo data signals from more than one control. (The Elevator and Rudder widgets are omitted for clarity.) The mixer named “Ail Tut+” (which will later be created in this tutorial) will accept signals from the aileron, flap and spoiler controls. When any one of these controls sends a signal into the “Ail-Tut+” mixer, a corresponding servo signal will be sent to all of the servos attached to the mixer. Observe that the MPX mixer concept is not a slave/master technique. Each control input into the mixer is independent of the other controls also entering into the mixer. When one, two, or all controls are activated, the mixer will send a signal to the servos attached to it. The pilot establishes the levels of signals that are sent to the servos by adjusting the servo output values within the mixer itself. So for example, while the right axis stick widget might be set to give 100% of aileron servo movement the, the “F” slider widget could be set to give only 20% of aileron servo movement.

The pilot establishes the blue lines by making assignments in the EVO. The red-colored squares on the “Ail Tut+” mixer indicate that up to nine servos can be connected to the mixer. On an EVO12, there would be 12 red-colored squares shown. If the pilot had a need to add additional aileron servos (for a large scale plane, perhaps), the additional aileron servos could be plugged into the “Ail Tut+” mixer. As a result, all of the aileron servos would move the same. (The pilot needs not to be concerned about making the left and right aileron servos move in opposite directions; the EVO figures out this by itself.) Observe the choice of widgets and the blue lines that connect the widgets to the controls. The pilot also establishes which widgets to use as well as which control that the widget should be assigned to.

The Throttle control has been assigned to the “E” slider widget in this illustration. The throttle servo (or ESC) is assigned directly to the Throttle control and not to a mixer. The “E” slider will be able to control the throttle servo/ESC without a problem, but this is the only widget will be able to send any signals to this servo.

Observe how the “E” slider is controlling the throttle as well as the Sum Timer. On the EVO, a widget can be used for multiple functions. This will be demonstrated in detail later in the tutorial.

Observe also that there are still two remaining control input slots into the “Ail Tut+” mixer if the pilot decided that additional controls should also effect the aileron servos.



The following diagram shows how one mixer definition can be applied to multiple planes.

The two example planes shown are very different. One is a jet with a v-tail, flap, aileron and throttle controls. The other example is a sailplane with v-tail, flap, aileron, and spoiler controls.

Although each plane has different servo travel distances established within the mixer menu, they both are utilizing the “V-Tail+” default mixer definition that comes pre-programmed within the EVO from the factory.

Notice how some controls are not utilized such as the Spoiler control on the V-Tail Jet and the Throttle control on the V-Tail Sailplane and are thus are dashed out to instruct the EVO to ignore these specific controls.

There is no limit as to the number of times that a servo can be assigned to a defined mixer. In fact, in this example, there are a total of four servos that are taking advantage of the default “V-Tail+” mixer; each plane has two v-tail servos that are assigned to the “V-Tail+” mixer.

As more planes are programmed into the EVO and take advantage of the default “V-Tail+” MPX mixer, the servos of these additional planes can be assigned to the “V-Tail+” mixer. Since the mixers in the EVO are global, they are accessible to all models. Within the setup of each plane, up to nine servos on an EVO9 (and up to 12 servos on an EVO12) can be assigned to this mixer.

On the left side of the diagram in the “Global Mixer Definitions” columns, the reader will notice that there are no specific servo travel distances listed or shown. Travel distances are not entered until a servo as been assigned to the mixer, and then within the plane’s Mixer menu.

Observe also that the first five default mixers from MPX are shown in the Global Mixer Definition column as well as a custom mixer named “CROWflap+”. This custom made mixer was created for flap servos on a sailplane for Crow or Butterfly flight function. This custom mixer contains an additional piece of information that is not observed within the first five MPX-defined mixers; the “CROWflap+” mixer contains a listing in the middle column titled as “Mix 1”.

The Mix 1, Mix 2 and Mix 3 functions will be explained in detail in a future chapter.

For the time being, however, take a moment to commit to memory that global mixer ***definitions*** do not contain specific servo travel distance information.

Specific servo travel distances can be entered only once a servo has been assigned to a mixer. This is done on a per model basis.

Global Mixer Definitions

	Name	Elevator+
1	Elevator	----
2	Spoiler	----
3	Flap	----
4	Thr -Tr	----
5	-------	----

	Name	V-Tail+
1	Elevator	----
2	Rudder	----
3	Spoiler	----
4	Flap	----
5	Thr -Tr	----

	Name	Delta+
1	Aileron	----
2	Elevator	----
3	Thr -Tr	----
4	--------	----
5	--------	----

	Name	Aileron+
1	Aileron	----
2	Spoiler	----
3	Flap	----
4	Ele -Tr	----
5	--------	----

	Name	Flap+
1	Flap	----
2	Spoiler	----
3	Aileron	----
4	Ele -Tr	----
5	--------	----

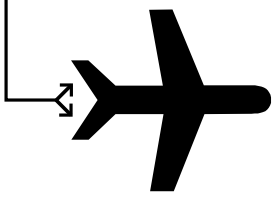
	Name	CROWflp+
1	Flap	- - -
2	Aileron	Mix 1
3	Spoiler	Mix 1
4	Brake	Mix 1
5	-------	-----

A total of 14 mixers can be created and stored in the EVO memory.

Mixer Menu

	V-Tail+	Trv	Trv
1	Elevator	-90%	100%
2	Rudder	-90%	100%
3	Spoiler	----	----
4	Flap	-20%	20%
5	Thr -Tr	OFF	-25%

Both V-Tail Servos Assigned to Mixer

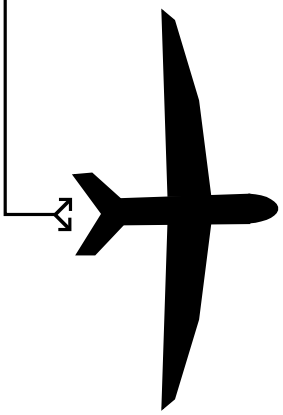


V-Tail Jet

Mixer Menu

	V-Tail+	Trv	Trv
1	Elevator	-80%	100%
2	Rudder	-100%	100%
3	Spoiler	30%	85%
4	Flap	-30%	30%
5	Thr -Tr	----	----

Both V-Tail Servos Assigned to Mixer



V-Tail Sailplane

Some additional things to keep in mind concerning mixers are:

- There can be a maximum of five controls inputting a signal to a specific servo.
- The pilot can have a mixer that only has one control input to a mixer, but if this is the case, it is not necessary to even have a mixer. Instead just assign the control to the servo - no mixer would be necessary in this case. For practical purposes, consider that mixers by nature should contain at least two or more control inputs. The EVO doesn't care, however, if the pilot establishes only one control input to a mixer. The end result will be that the pilot will be using one of the 14 mixer slots for something that is unnecessary.
- Mixers can have up to eight characters in the mixer name. The pilot is not constrained in any fashion as to the schematic or naming conventions of the mixers. It would be wise to develop a habit of mixer naming patterns that is easy to see and recognize. The typical MPX mixer naming schematic is to list the specific servo that will be plugged into the mixer (for example, "Aileron") and then to add a "+" symbol ("Aileron+") to indicate that the mixer does more than just send aileron control signals to the servo - it sends additional control signals from other widgets. This is a simple way of designating a mixer.
- It is **highly** recommended by Multiplex, other MPX users and this tutorial to **not** play with the mixer definitions of the first five mixers that are provided by Multiplex in the SETUP-Mixer Def. menu. You can open them up, look at them, write down their control inputs, note their mixer options symbol and then use that information to create a duplicate mixer that is custom made. This way, experimentation can be later deleted without affecting the functionality of your pre-defined MPX mixers.

3.2. CREATING A MIXER

With this overview of MPX mixers in mind, create the mixer that will be needed for the Omega 1.8E.

STEP ONE

Turn on the EVO and navigate to any of the main screens. Hit the SETUP button near the bottom of the transmitter. Select "Mixer def." On the "Define mixer" menu, the first five pre-made by MPX mixers listed. Slot 6 should say "<<MIX6>>". (If the reader has already built another other mixer in slot 6, use the next available free slot.) Go ahead and select slot 6.

STEP TWO

The next screen shown is the "Define mixer" menu. The name will be blank and all five of the control inputs will have dashes shown since no controls have yet to be assigned to the mixer.

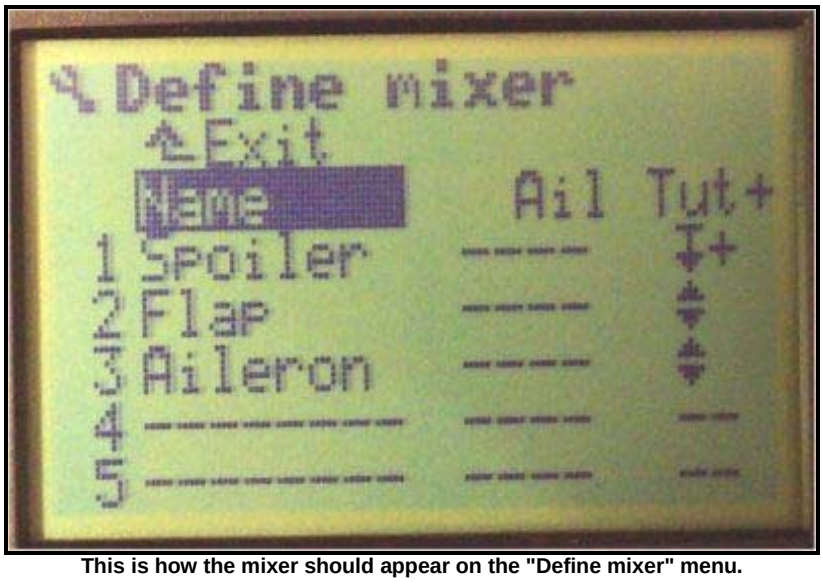
Select the name field and enter the name of this mixer. Name this mixer as, "Ail Tut+". Hit the enter key to confirm the mixer name.

STEP THREE

Now, program the mixer with control inputs. Select the first line and input the "Spoiler" control. The next column will remain as four dashes which means that the spoiler input will always be fed into the mixer - it will not be switched on or off with a switch. The mixer option symbol will be set as "single-sided linear with offset." The full action of the left axis stick should begin to move the spoilerons as soon as it is moved from its full down position. Otherwise, without an offset designated, the left axis stick (although it is being physically moved by the pilot from the bottom-most down position) will not begin to transmit a signal to the aileron servos until it reaches the center point of the left axis movement.

Input number two will be set as "Flap", always on (four dashes in the second column) and the symbol will be symmetrical.

Input number three will be set as "Aileron", always on (four dashes in the second column) and the symbol will be symmetrical.



This is how the mixer should appear on the "Define mixer" menu.

Be sure to save the changes when prompted by the EVO when exiting this screen

Under the "Define mixer" main menu, the readers will see the newly created mixer "Ail Tut+" listed in slot number 6.

4. PROGRAMMING

It may not seem that a lot of progress has been made thus far in getting ready to program the EVO for the plane, but believe it or not, most of the hard work is already past!

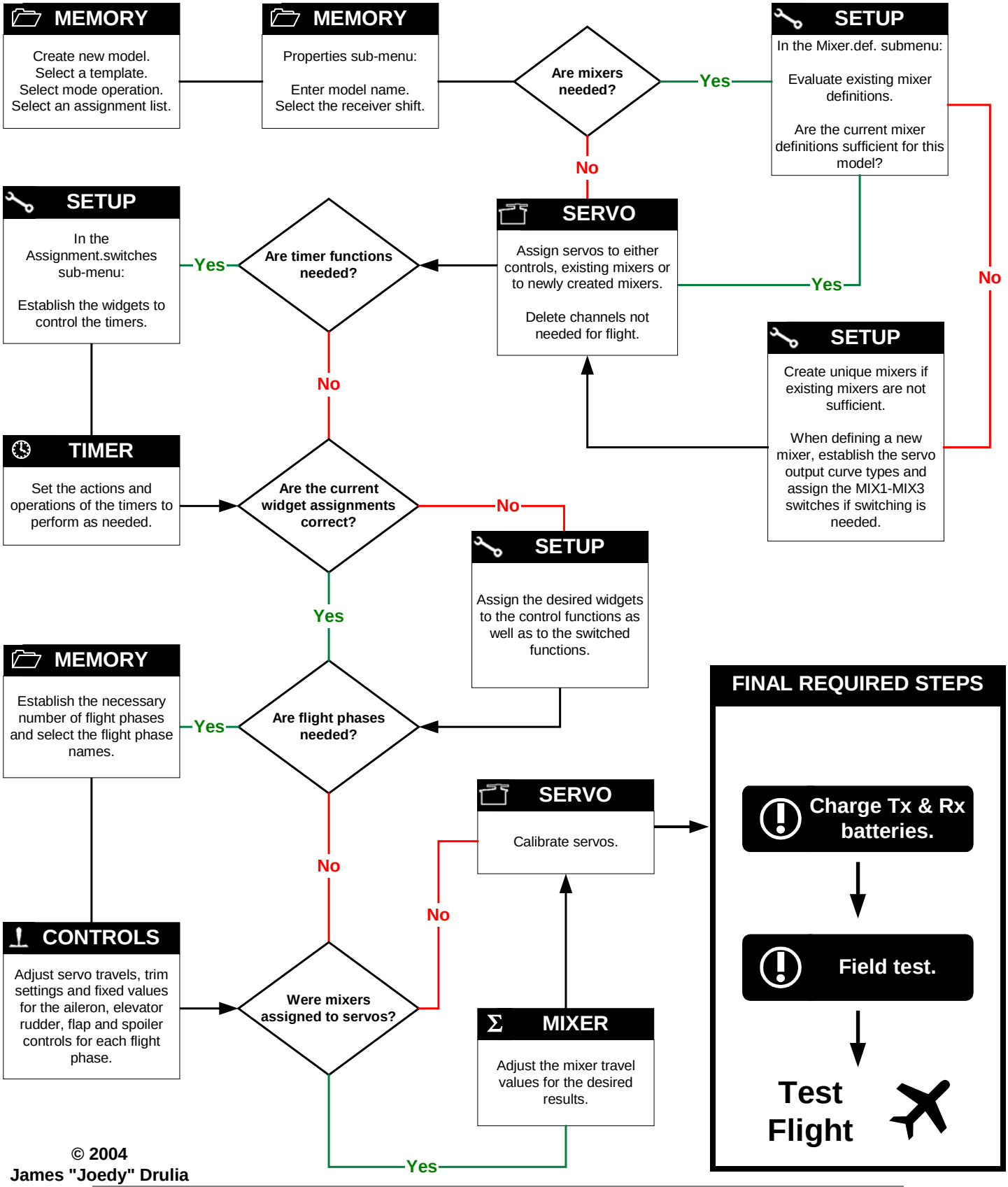
It has already been determined which flight functions that the plane will have as well as how those functions should be set (such as switched or always on.) It has also been decided which widgets will effect specific functions or controls. A unique mixer named “Ail Tut+” has been created that provides for a reflex/camber function, a spoileron function and the typical aileron functions that will all effect the aileron servos.

4.1. EVO PROGRAMMING FLOW CHART

The following flowchart will provide the reader with a visual guide to assist in following the tutorial and for future reference when programming additional planes into the EVO.

The dark highlighted areas above the squares correspond to the menus that are accessed by pressing the buttons near the bottom of the transmitter case.

EVO Model Programming



4.2. EVO PROGRAMMING MENU CHART

The following EVO programming menu chart will provide the reader with a visual guide to assist in following the tutorial and for future reference when programming additional planes into the EVO.

The dark highlighted areas above the squares correspond to the menus that are accessed by pressing the buttons near the bottom of the transmitter case.

For menu items that are not listed or shown in detail, see the EVO manual for instructions.

EVO Programming Menus

software ver.1.26

SETUP

- Transmitter
  - Trim graphics
  - Sounds
  - Battery alarm
  - Battery charge
  - Contrast
  - Check throttle
  - Check RF
- Mixer def.
  - Existing mixers
  - <<New mixer>>
    - 1. Control Mix1-3
    - 2. Control Mix1-3
    - 3. Control Mix1-3
    - 4. Control Mix1-3
    - 5. Control Mix1-3
- Assignment
  - Mode
  - Assignment
    - Name
    - Controls
    - Switches
- Training
- User

CONTROLS

Dynamic Menu
Only controls assigned to model are displayed

- Elevator / Rudder / Aileron
  - Trim %
  - Step 0.5 / 1.5 / 2.5 / 3.5%
  - D/R 0 — 100%
  - Trvl 0 — 100%
  - Expo -100% — 100%
- Throttle
  - T. cut
  - Idle %
  - Step 0.5 / 1.5 / 2.5 /3.5%
  - Slow 0.1 — 4.0 seconds
- Spoiler / Flap
  - Run time 0.1 — 4.0 seconds
  - Fixed val. -100% — 100%
- Contr.switch
  - ↓⊥↑ -100% — 100%
  - E -100% — 100%
  - F -100% — 100%

MEMORY

- Select Model
- Copy Model
- Erase Model
- Flight Phases (names vary)
  - NORMAL
  - SPEED1 x
  - THERMAL1
  - LANDING
- Properties
  - Template
  - Mode
  - Assignment
  - Name
- New Model
  - Memory Nr.
  - Template
  - Servo conf.
  - Mode
  - Assignment
  - OK

MIXER

- Combi.Switch
  - Combi.switch ⊥↑
  - Aileron > Rudder 2 — 200%
  - Aileron < Rudder -2 — -200%
- Aileron differential
  - Mode ON / OFF / Spoiler+ (selection affects all flight phases)
  - Diff. %
- Mixers (must be assigned to a servo to appear)
  - Mixer Name

	trv	trv	
Control	OFF	%	⊥↑
Control	%	%	⊥✶
Control	%	%	⊥↓
Control	%	%	⊥↑
Control	%	%	

SERVO

- Calibrate
  - 1. Control
    - Calbri.Control
    - REV/CLR #
    - P1 %
    - P2 %
    - P3 %
    - P4 %
    - P5 %
  - 2. ....
- Assignment
  - 1. Control MPX/UNI 2/3/5P
  - 2. ....
- Monitor
  - Percentage — Graphical view
- Test Run
  - Control Control Name
  - Time 0.1 — 4.0 seconds

TIMER

- Timer
  - Time 00:00:00
- Model
  - Time 00:00:00
- Slot
  - Time 00:00:00
  - Alarm 00:00:00
  - Difference 00:00:00
  - Switch ⊥✶
- Slot
  - As above
- Sum
  - As above
- Interval
  - As above

Symbol Legend

- See EVO Manual for detailed instructions
- Can be adjusted separately per model
- ⊥↑ ⊥✶ ⊥↓ Widget symbol representation
- Can be adjusted separately per flight phase
- Can be assigned to a digi-adjuster
- Global attribute
- 2. .... Additional controls are available for this menu, but are not displayed in this guide
- Provides information only
- % Indicates a value that is programmed by the pilot

4.3. CREATE A NEW MODEL

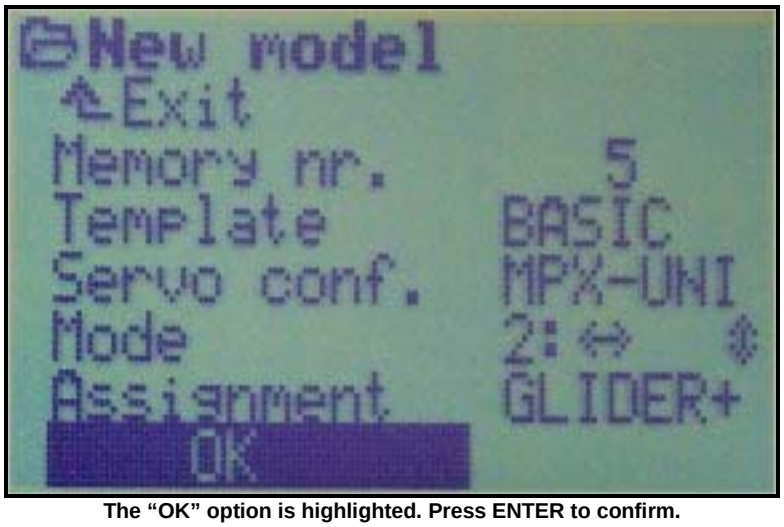
STEP ONE

From any of the main screens, press the Memory button near the bottom of the transmitter. Highlight "New Model" and press enter. On the new model menu the "Memory nr." number will automatically assigned by the EVO. The pilot is not allowed to change this. The reader's individual "Memory nr" value may be different. On the next line, select the "Basic" template. (The "BASIC" template is already built for a plane with one servo per aileron surface, one servo per rudder, one servo per elevator and a motor control. The Omega is pretty close to this setup, but a v-tail will be used instead. Under the "Assignment" pick "Glider+". (Note that the user must pick from one of the existing three assignment lists that are provided by Multiplex. There are also two empty assignment lists that customized by pilots for future use.) An assignment list is just a pre-set list of what widgets will be set to effect which function. Don't fret over these choices, since their default assignments can and will be changed anyway.

Select the Mode as "2". Keep in mind that this tutorial was written assuming that the pilot will be flying in Mode 2.

The "Servo conf." option allows the pilot to instruct the EVO to use Multiplex servo timing pulse or the Universal servo timing pulse. The specifics of the servo timing are beyond the scope of this tutorial. All servos being used in the North American market are set to use the universal mode of servo timing.

Be sure to highlight the "OK" at the bottom of the screen and then press ENTER to create the model.



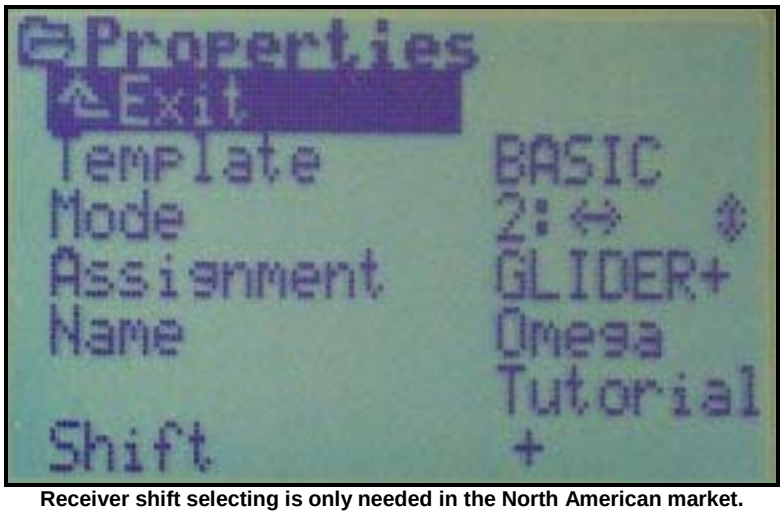
The "OK" option is highlighted. Press ENTER to confirm.

STEP TWO

After hitting ENTER, the EVO will immediately navigate back to the "Memory" menu. Now personalize this new model by selecting "Properties". On the "Properties" menu, notice that the template is set as "BASIC". This cannot be changed now - it is permanently established. The assignment list can be changed, however. Set the mode to number "2". Highlight the name and change it to "Omega Tutorial" (there are two lines available for establishing the

model name - it's easier to set the "Omega" part on the top line and the "Tutorial" part on the lower name line.)

At the bottom of this screen, you can change the shift from "+" to "-" depending on the brand of receiver that you will be using in your plane. *Note that this step only applies to the North American MPX market.*



Receiver shift selecting is only needed in the North American market.

Save the changes and the EVO will navigate back to the "Memory" menu automatically.

STEP THREE

This step is not necessary, but if the reader selects the "Select model" menu, they will see a screen showing the "Omega Tutorial x" listed in the "Select model" menu. The "x" simply means that the Omega is currently selected as our model.

Navigate back to a main screen.

4.4. ASSIGN THE WIDGETS AND CONTROLS

STEP FOUR

Select the "Setup" button at the bottom of the transmitter. It's now time to instruct the EVO as to which widgets will be controlling which functions. At the "Setup" menu, select "Assignment."

On the "Assignment" menu, notice that the mode is already set as well as the assignment of "GLIDER+". The EVO has carried all of these choices over for us.

The "Assignment" sub menu within the main "Setup" menu.

Scroll down to the "Controls ...." field and hit ENTER.

Remember that assignment list (GLIDER+) that was chosen before? On the "Assign. Controls" menu, observe the listing of the controls and their corresponding widgets that the EVO established when we selected the "GLIDER+" assignment list. These can be changed easily. In fact, do that now.

STEP FIVE

Select the "Throttle" control and press ENTER. (Press ENTER again to move past the warning screen that the EVO presents.) Since the motor control should be on the "E" slider, slide the "E" slider around until you see a letter "E" in the second column. Leave the "E" slider in the downward position since this will later be our "no-throttle" position for motor control channel.

Select the "Spoiler" control and move the left axis stick all the way down. This will be the "no spoilerons" position for this widget.

Select the "Flap/RPM" control and set it to the "F" slider, but leave the "F" slider in the center detent position. This will later be the "no reflex/camber" setting for this widget.

The arrows point to the "ON" position of the control widget. The asterisk symbol is shown indicating that the left axis widget (which has been selected to command the Spoiler control) is physically resting in the "On" position. In this screenshot, the left axis stick is currently all the way down.

Since no other controls are needed such as landing gear, tow release, brake, gyro and so fourth, proceed to the next step.

STEP SIX

At the "Assignment" menu, select the "Switches ..." listing. At this screen notice that the EVO has gone ahead and set the dual rates function for aileron, elevator and rudder on the on the "L" switch. This is ok, since this just happens to be the initial widget that was decided to install these functions onto. The "CombiSwitch" is what is used by the EVO for aileron and rudder coupling. Change it to the "I" widget since it was decided earlier that this function's widget was to be close to the aileron axis widget. Be sure to move the "I" down and leave it there since this will tell the EVO that the "On" position will be in the down position. (This can be changed later if it should be ON in the opposite position.)

Make sure that all switches below the "CombiSwitch" are turned off (they should all be set to dashes.)

4.5. ASSIGN SERVOS

STEP SEVEN

The controls for this model have been set and the widgets have been assigned. It's now time to assign the servos.

Navigate to a main screen and press the "Servo" button near the bottom of the transmitter. On the "Servo" menu, select the "Assignment ..." listing.

On the "Servo. Assign" menu, notice that the servos have already been assigned to the receiver slots. The first seven slots have been assigned by the EVO. They are:

Aileron
ELEVATOR+
Rudder
Throttle
Aileron
Spoiler
Spoiler

Since it won't be necessary for this plane to have two separate servos for the spoiler function, delete slots 6 and 7 now.

Currently in slots 1 and 5 are aileron controls. If the reader were to proceed with the model set up and not change this control assignment, while the right axis stick would control the ailerons properly, no signals from the "F" widget and the left axis stick could be sent to the aileron servos. The only way to send more than one control signal to a servo is to assign the servos to a mixer.

But wait, where can we find such a mixer that will send aileron, flap and spoiler signals to the aileron servos?

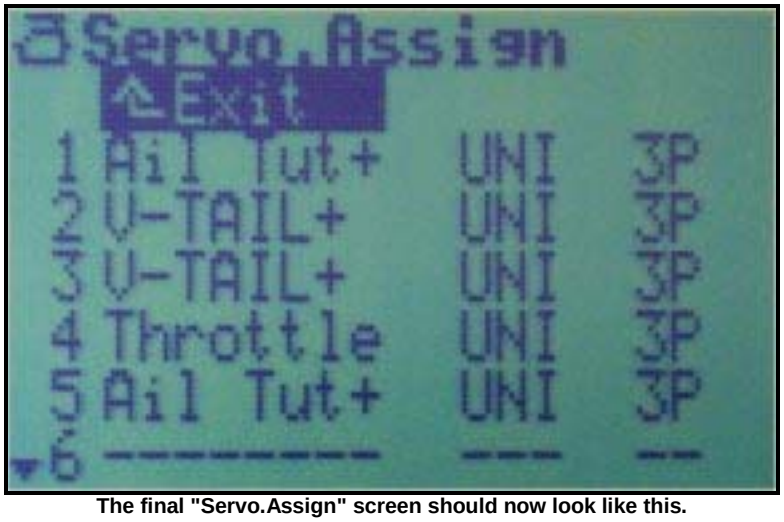
Hey, wasn't one created earlier? Yes!

Change slots 1 and 5 to the "Ail Tut+" mixer that was created earlier.

Since it was also determined that Omega would have a v-tail, change slot 2 ("Elevator+") and slot 3 ("Rudder") both to the mixer "V-tail+".

"Wait," you say. "Where did this mixer come from? We didn't make it!"

That's correct. This is one of the pre-made mixers from Multiplex. It will save time (from needing to create a v-tail mixer from scratch) and will keep the reader from using one of the 8 remaining mixer slots in their EVO.



The final "Servo.Assign" screen should now look like this.

Leave the second column to "UNI" and the third column to "3P" for all slots 1 through 5.

The remaining throttle control does not need to be changed. Leave it as it is.

STEP EIGHT

Now that the servos have been assigned to mixers, the pilot is now able to adjust the travel values of the servos assigned to the mixer.

Navigate to a main screen and press the "Mixer" button at the bottom of the transmitter.

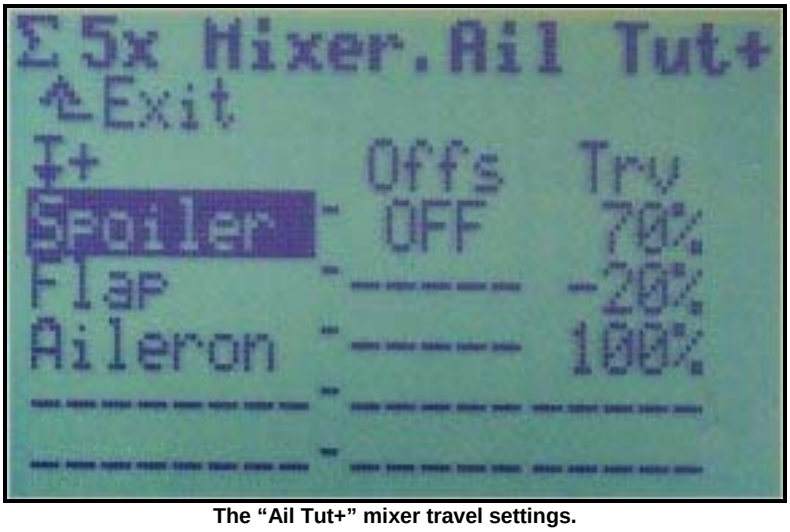
On the "Mixer" menu, only the mixers that have been assigned to the servos in this model will be displayed. "CombiSwitch" and "Ail. Diff" will always be listed at this screen before any other mixers. This is set by Multiplex and cannot be changed. The reader does not have to use these features, just keep in mind that they cannot ever be eliminated from this screen.

The mixer "Ail Tut+" will be listed on this screen. Select it now.

On the "5x Mixer.Ail. Tut+" screen, observe that spoiler, flap and aileron control inputs are all set to "OFF". Keep in mind that these are all controls that will cause the aileron servos to move.

Since it is not likely that the spoileron function should move the aileron surfaces to their ends of travel, input 70% in the third column. The "Flap" control (remember that for this model setup, it will be used as a reflex/camber slider on the "F" widget and not as a standard flap surface) should have only about 20% of movement. You will notice that there is only one input field for the "Flap" and this is because we initially set the "Flap" input in the mixer to be symmetrical. Only one input field means that the travels will go 20% above the center detent on the "F" slider and 20% below the center detent on the "F" slider. *Notice that in the screenshot example, the "20%" has been set to "-20%". This is to reverse the direction of the servo travels when the "F" widget is moved. The reader will have to set their own setting as necessary.*

The "Aileron" should be set to 100%. We want the aileron surfaces to move 100% of their throws when the aileron widget (the right axis stick) is moved left and right.



The "Ail Tut+" mixer travel settings.

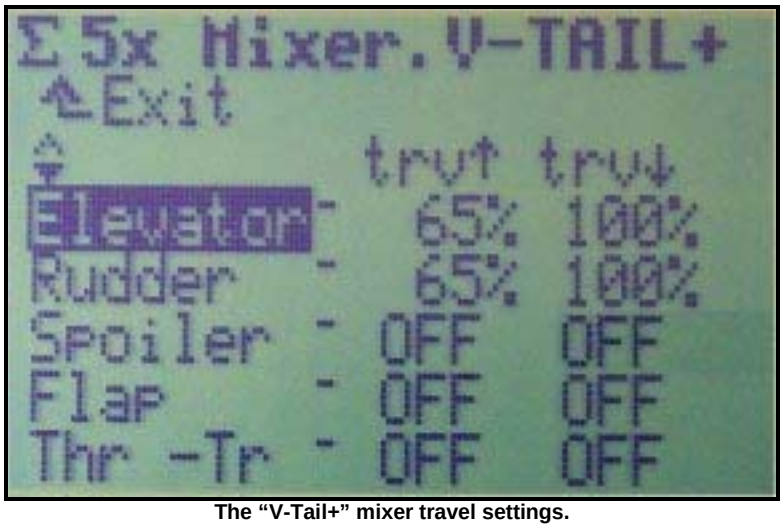
Now, it's time to set the servo travels for the v-tail surfaces. Select the "V-TAIL+" mixer next.

On the "5x Mixer.V-TAIL+" screen, notice that all of the servo travel values have dashes in them.

For the Elevator control, set the "trv {up}" value to 65% and the "trv {down}" value to 100%.

For the Rudder control, set these up and down travel values exactly the same as on the Elevator control row. The Spoiler, Flap and Thr -tr values should all remain in the "OFF" state. The spoiler, flap and throttle (without trim) widget movement should not affect the v-tail servos.

The reason for setting the elevator and rudder servo travel values differently is to demonstrate for the purposes of this tutorial, that you can have different servo travels for a control when used in a mixer. By instructing the EVO to have more down travel than up travel, we are essentially creating a v-tail differential action. Be sure to note that Multiplex created the V-TAIL+ mixer up to have asymmetrical travel distances on the elevator and rudder controls (from the neutral axis stick point.)



The "V-Tail+" mixer travel settings.

Exit this screen and navigate back to one of the main screens.

4.6. ALERT – ERRONEOUS INITIAL FLAP VALUE

All Royal EVO users are indebted to Harry Curzon for discovering and posting this information.

There appears to be a software oversight on the behalf of Multiplex. This isn't really a software malfunction, but if the readers don't anticipate it and account for it, it will cause them to believe that their EVO is malfunctioning.

This is from Harry's posting at the www.rcgroups.com Multiplex Royal EVO thread:

I believe there is a minor error in a default value for new models.

Problem: *New models default to the flap control having a fixed value of 20% instead of being set to OFF.*

Solution: *Every time you create a new model, the first thing to do is go to controls, flap, and set the fixed val[ue] to OFF.*

What is a fixed value? *A fixed value is a set amount of travel that overrides the control switch/slider. The flap control will generate a travel value of 20% (or whatever value you alter it to) and ignore your movement of the flap control widget.*

Why have them? *There is a fixed value for each flight phase. This is useful for example to set a defined landing phase flap, a defined launch phase flap, a defined speed phase reflex, but if set to OFF in the cruise phase then control is returned to the switch/slider for you to set as you see fit.*

What's the problem? *1. Assign your flap servos direct to the flap control, as you might with a scale power model. The flaps will go to 20% and refuse to move no matter what you do with the flap switch/slider. If you are not familiar with MPX and the features it has, this is going to cause you frustration as you try to solve it.*

2. Assign servos to a mixer that has flap as an input and it will generate false servo neutrals, the neutral being the fixed value multiplied by the flap mixer value. Also, when you move the flap control widget, nothing will happen to the flaps, ailerons or elevator trim offset since the flap control is sending its fixed value and ignoring the switch/slider. The servos will respond to the other controls. However because the servo is already offset from its centre by some amount, it will reach either the Txs signal limit or the servo's mechanical limit earlier than expected in one direction of rotation. The servo may stop moving before you have reached the end of the control stick movement in that direction. This problem will not arise if you assign servos to a mixer that has flap as an input but where the flap value is set to OFF in the mixer since the flap control's fixed val[ue] does not get into the mixer.

The Solution: *Press the "Control" button at the bottom of the transmitter. On the "Control" menu, select the "Flap ...." control. On the "Flap.NORMAL" menu, you will see that the "Fixed value" has been set by default to be 20%. Change this to "OFF".*

You will need to do this step manually for each new plane that you set up unless Multiplex releases a software patch that addresses this issue.

4.7. CHECKING INPUTS

Let's see how the EVO is responding now. You will not need a plane in front of you to evaluate your progress; let's use the servo monitoring function built into the EVO for evaluating our results.

Press the "Servo" button at the bottom of the transmitter and select the "Monitor" option.

With the "E" slider all the way down, observe that servo 4 (throttle) moves up and down when the slider is moved.

Switch the "I" widget to the up position (off). Move the right axis stick (aileron widget) left and right and observe servos 1 and 5 move in opposite directions. Flip the "I" widget down and continue moving the aileron widget and observe the screen. Now, rudder is added with our aileron input. Keep in mind this plane is using a v-tail and both v-tail servos will move when rudder is input. In fact, observe this action now - move the left aix stick (rudder widget) left and right and watch servos 2 and 3 move. Notice here that there is a different amount of servo travel in the v-tail servos when the rudder or elevator widget is moved to their extreme ends of travel. This is a result of the settings that was programmed into the V-TAIL+ mixer.

Now, observe the reflex/camber slider "F" in action. Slide this slider down towards the bottom of the transmitter case and observe that channels 1 and 5 (the aileron servos) go upwards. “Wait a minute,” the reader wonders. “They both are moving upwards? Doesn't it make more sense for them to go "down" when the "F" widget is moved "down"?” The author agrees, but how can this be changed?

Navigate back to the mixer screen by pressing the "Mixer" button at the bottom of the transmitter. Select "Ail Tut+" from the menu. In the "trv" value for the flap, highlight it and press the **REV/CLR** button at the bottom of the transmitter. This will automatically change the "20%" value to a "-20%". This is a shortcut and saves a little time from having to manually dial in the opposite number from the "20%" position.

Navigate back to the servo monitor screen and move the "F" slider. The aileron servos 1 and 5 will now move downwards in concert together when the "F" widget is slid down towards the bottom of the transmitter case.

This was very easy to do, indeed.

Also observe how the left axis stick (spoileron function) will move both of the aileron servos upward when the stick is moved up. If the reader’s spoiler widget action shows it working in reverse (the servos go "down" when the stick is raised from the bottom position), just change the servo direction as shown with the previous "F" widget (reflex/camber control).

Since dual rate were another one of the initial requirements for this plane, establish the dual rates now.

4.8. DUAL RATES

From any of the main screens, press the CONTROL button near the bottom of the transmitter. Keep in mind that this menu is considered "dynamic" by MPX. This simply means that the user will not see all of the controls that the EVO is able to support listed on this screen. If that were the case, we would have to navigate among listings such as "L. gear, Tow hook, Brake, Gyro, Mixture, AUX1, AUX2" even if the current plane isn't using these controls.

The Control menu will show only the controls that have been assigned to the current model. This reduces the amount of screen clutter.

A widget for the dual rate control has already been established. This is widget "L". Keep in mind that this widget is a three-position switch. For the purposes of this tutorial, the upper (near the top of the transmitter case) position will be a dual-rate off, the bottom ("L" switch towards the bottom of the transmitter case) position will be a dual-rate on and the last middle position will be considered an "OFF" position. Keep in mind that the position listed on the readers' EVO as "ON" could be set the other way. *(The "ON" position of a widget is dependent on how they were initially set up. If the reader had the "L" widget in the down position when they pressed ENTER to confirm the dual-rates choice, the "ON" position would be established as down.)* If the reader needs to change their widget's ON setting, navigate back to the "Setup" menu by pressing the SETUP button near the bottom of the transmitter. Then move to the "Assignment" sub-menu and from there to the "Switches ...." sub-menu. Change the dual rate setting by highlighting the listing, moving the "L" widget and leaving it in the bottom (towards the bottom of the transmitter case) position. The EVO considers how the widget is positioned when the user presses the ENTER button and considers that widget's position as "ON". In fact, the EVO will display a small graphical arrow near the right of the widget letter on this screen. The arrow will always "point" to the "ON" position for that widget.

Is there any benefit for having the "ON" widget switch in the down position? As far as the EVO is concerned, it does not care one way or the other. However, the author likes to set his dual-rates switch using a mnemonic device:

"Pull the switch DOWN to turn DOWN the control rates."

Back at the main "Controls" menu, observe that the Aileron, Elevator, Rudder, Throttle, Spoiler, Flap and Contr. switch controls are listed. Go ahead and select the Aileron control.

On the next screen, notice the specific settings listed for the aileron control. There will be a trim percentage, a step value for the trim buttons, a "D/R" for the dual rates, a travel and an exponential field displayed. To change the dual rates settings, simply highlight the field and dial in a lower number. Select 50% for this tutorial.

Exit the aileron control menu and change the values of the dual rates for the rudder and the elevator controls using the same procedure that was used for altering the aileron control. Set both the rudder and the elevator to have a dual rate of 50% as well.

Once done, navigate back to any of the main screens.

Now, it's time to observe the progress so far.

Press the SERVO button near the bottom of the transmitter and select the Monitor option on the Servo menu.

With the "L" widget in the top position, move around the aileron, elevator and rudder widgets to the extremes of their motions and observe their ranges of travels on the bar graph. Now, pull the "L" switch in the downward position and observe how the aileron, elevator and

rudder travels have now been cut in half. This is a reflection that our dual rates (which were set to 50% for all of theses controls) is now limiting the travels for these controls by 50%.

5. DIGI-ADJUSTERS

How does the reader know that 50% is enough (or not enough) dual rates for these items? Suppose that after launching the plane, while although the rudder control has too much travel with 50% of dual rates, perhaps the elevator is hyper sensitive even WITH the dual rates set at 50%. Now, the pilot will be forced to land the wildly controllable model (hopefully, safely and without damage), adjust the dual rate settings, hope and pray that they are close to the optimum settings and launch again. This process will need to be repeated as necessary.

The EVO offers a much easier and safer way to solve this issue. They are called digi-adjusters and can be used to alter just about any numerical value input - even **while** flying the model!

This is a perfect scenario and application for the digi-adjusters (DA). In fact, just for the fun of it, assign the rudder and the elevator dual rates on the two DAs. This way, once launching the plane, the digi-adjusters will be able to alter the amount of dual rates on the elevator and the rudder control by simply turning the DAs. Make it easy to remember which of the two DAs will be affecting the elevator or rudder dual rate by establishing the right DA as the elevator dual rate adjuster and the left DA as the rudder dual rate adjuster. If this assignment is forgotten, this will be all right since the EVO will display our choices on the main screens for quick reference.

5.1. ASSIGNING A DIGI-ADJUSTER

Navigate to any of the main screens. Press the CONTROL button near the bottom of the transmitter.

Highlight the rudder control and select enter. Notice that this was the same screen that was accessed when the value for the dual rates was modified earlier.

Highlight the dual rate field (which currently displays "50%" as the value.) Instead of selecting a new numerical value, press the DIGI-ADJUSTER button at the bottom of the transmitter. The "50%" displayed temporarily disappear and a symbol of a circle with a plus sign will now appear in its place. Now, since the dual rate for the function is to be assigned to the left DA, depress and hold down the left DA at the top of the transmitter. While holding down the left DA, a "<" symbol will appear next to the circle with plus sign symbol. This is the EVO confirming the choice of the left DA. Release the left DA and the last numerical figure that was set when the rudder CONTROL screen was opened will be displayed. In this case, it was 50% and "50%" will remain displayed in the D/R field.

Navigate back to the CONTROL menu by pressing the CONTROL button near the bottom of the transmitter. Select the elevator control this time.

Highlight the dual rate field, which currently contains "50%" as the value. Instead of selecting a new numerical value, press the DIGI-ADJUSTER button at the bottom of the transmitter. The "50%" display will temporarily disappear and a symbol of a circle with a plus sign will now appear in its place. Now, since the elevator dual rate function is to be assigned to the right DA, depress and hold down the right DA at the top of the transmitter. As the DA is

held down, a ">" symbol will appear next to the circle with plus sign symbol. This is the EVO confirming the choice of the right DA. Release the right DA and you will see the last numerical figure that was set when the rudder control screen was accessed. The elevator dual rate control will also show "50%" since this was the previous dual rate number that had been set.

Exit this screen and navigate back to any of the main screens. Observe that "<Rudd D-R" on the top left and "Elev D-R>" on the top right of the main screens. Displayed between these two listings at the top of the screen will be either a locked or unlocked padlock symbol.

If the symbol appears to be 'unlocked', press the digi-adjuster key at the bottom of the transmitter until it shows a locked symbol.

Now, turn the left DA either clockwise or counterclockwise. The screen display will show a large "50%" momentarily and then return to the previous screen. Try the right DA, it will also show a "50%" momentarily. *(Note, that if you are at the battery management screen, the screen will not change when you turn the DAs.)*

What the EVO is saying is that the DAs have been locked (indicated by the locked padlock symbol) and when the DAs are turned, the values currently set in the dual rates fields are not being altered.

This is designed to prevent the pilot from accidentally changing the settings while in flight.

Now, unlock the DAs and change the settings. Press the digi-adjuster button at the bottom of the transmitter. Observe that the center padlock symbol change into an 'unlocked' padlock symbol.

Turn the left DA and observe the screen. Now, the numbers will change either up or now depending on which direction that the left DA is rotated - clock or counterclockwise. Pretend that about 75% of dual rate on the rudder is needed. Adjust the left DA until "75%" is displayed on the screen. Keep in mind that in a real situation, the pilot would be currently in flight and the feedback from the plane would be instantaneous. The proper amount of dual rates could be easily set and verified while in flight.

Change the elevator dual rate now. Pretend that only 25% of dual rates is needed after observing the plane while in flight. Turn the right DA until "25%" is displayed.

Now that the dual rates have been tweaked to perfection, lock the settings in place. Press the digi-adjuster button near the bottom of the transmitter.

These choices are now locked again. Turning either DA will no longer change the dual rate settings.

The pilot can observe these results in two ways. The first is to go servo monitor screen and observe the servo travels in the bar graph and the other is to go to the CONTROLS menu and select either the rudder or the elevator control. The pilot will see that the dual-rate numbers for both the rudder and elevator are now showing what was dialed in with the DAs .

The author would like to point out with the EVO and its DAs is that the pilot is not limited to only using them for adjusting dual rates. They could, for example, be set up to adjust the amount of rudder to aileron compensation. In fact, just about any input field that will accept a number can be set to one of the DAs for in-flight adjustment and fine tuning.

5.2. How to Erase the Digi-Adjustor Assignment

If there is a need to erase a DA assignment, do the following:

STEP ONE

Navigate to any of the main screens except the battery management screen. Press and hold down the DA whose assignment that should be erased.

STEP TWO

While holding down the DA, press the "REV/CLR" button at the bottom of the transmitter.

The DA assignment will be erased and the main screens will reflect the erased assignment.

6. TIMERS

Another one of the initial requirements for this plane setup is timer functions.

Initially, since the Omega is a motorized glider, it was decided that a timer function would be established that would keep track of the motor run time. This function could be used to determine how long the motor had been running during the flying session.

But after some consideration, the author has decided that having only a motor run timer would not give us a full idea of the flights with this plane.

Suppose that the pilot also wanted to know how long they were able to thermal the Omega after shutting down the motor? And also, suppose that the pilot wanted like to set up a count down timer so that they could practice timed landings for the local club contests?

With the EVO, all of these scenarios are possible.

Since it must be decided which widget shall control the timer functions, consider which of the remaining widgets that could be used.*(The author is assuming that the readers have not yet installed the long axis sticks with the additional buttons and will not consider these buttons as candidates for timer widget assignments. This will eliminate these two button choices only for the purposes of this tutorial. If the readers have installed the long axis sticks, they will be able to use the buttons on the long axis sticks for timer functions once they learn how to establish the timer widget and program the timer functions.)*

6.1. Motor Run Timer

Ok, consider the timer scenario again. The author would like to have a widget that will allow him to record the amount of motor run time. This would be handy for several reasons. The first would be an immediate direct feedback for the amount of motor run time that will be displayed on the main timer screen. The pilot could use this information to determine how long that the motor has run for the purposes of practicing for limited motor run (LMR) contests. It could also be used as a very rough (and inaccurate) "fuel gauge" for the motor battery. The pilot would have to carefully note over a period of time roughly how many

minutes (or even seconds) of motor run time with a particular motor battery before the ESC cuts off the motor power for this to be of any benefit, though.

WARNING!

This is not a science, nor is it a reliable way to calculate your remaining total flying time if you are using the motor battery to also provide power for the servos (which is how I will be flying my Omega.) This technique is mentioned as a way of gathering a sense of the duration of motor drain. The actual remaining motor battery capacity will be dependent on many factors such as mechanically or unsynchronized stalled servos, battery wear and tear and other electronic failures. Use your own proven methods and techniques for calculating motor battery endurance.

So, which widget should be used for the motor run timer? There are several spare widgets to pick from. If a switch widget is used, the pilot will need to manually turn it on when the motor is started and turn it off when the throttle slider "E" is slid back down. By using one of the buttons mounted on the side of the transmitter case (widgets "H" and "M"), the pilot could set either one to be the widget that starts and stops the timer.

These widgets are different than the switch widgets in that they can be set to be momentarily operated (stays on while the pilot holds it down) or push ON/OFF operated (push one time for "ON" and the function will remain on until the button is pressed again for "OFF".)

But there is one major drawback to these buttons - it requires a vigilant effort on the part of the pilot to always turn the timer on and off as the "E" widget (the throttle control) is slid on and off. Otherwise, the timer results will not be an accurate assessment of the true motor run time.

Wouldn't this particular situation be better served by having the throttle widget ("E") itself be used as a switch for the motor run timer in addition to serving as a throttle control? This way, by merely turning the motor on or off, the motor run timer will automatically be controlled by the EVO! This would be another workload item that the pilot would not need to worry about and the EVO would be happy to do. It will also ensure that the timer results for the motor run time could not be inaccurate due to pilot error. When the "E" slider is slid up, the timer starts. When it is slid down, the timer stops.

In fact, this is a better solution; set this now.

6.2. THE SUM TIMER

STEP ONE

Before proceeding, establish a widget for the motor run timer.

Press the SETUP button at the bottom of the transmitter case. On the next menu, select the "Assignment" option. On the next screen, select the "Switches ." option. On the "Assign.Switches" menu, scroll down until a listing for "Sum" is shown. (There will be a small mathematical SUM symbol displayed in front of the word "Sum" displayed on the screen.) Select this listing (press ENTER to pass the warning screen) and then move the "E" slider. Leave the "E" slider in the up position. The "Sum" listing will now show a letter "E" to indicate that the "E" widget will be used to control the sum timer as well as an up arrow icon to indicate that the on position will be as the "E" widget is slid upwards.

The "Sum" timer allows the pilot to start and stop the timer with a widget while the total amount of time never resets back to zero - the timer continually "sums" up the total amount of time while the widget remains in the "ON" position. In the case of the motor run timer, this is exactly what is needed.

STEP TWO

Now that the "E" widget has been established for the sum timer, program it to work properly. Navigate back to any of the main screens, and press the TIMER button at the bottom of the transmitter. On the next screen, you will see a listing containing:

```
Model ...
Slot ...
Sum ...
Interval ...
```

Select the sum timer. On the "Sum" menu, you will see a display for the Time and the Alarm. Slide the "E" widget in the up position and observe the sum timer clock value increment upward. Slide the "E" widget back down to turn off the sum timer. Select and highlight the "Time" field and press the REV/CLR button at the bottom of the transmitter. The sum time value will now be reset back to zero.

The "Alarm" field will not be used in this tutorial. The Alarm field allows the pilot to set a specified amount of time and the EVO will count down from that specific amount of time and then produce an alarm. This has valuable functions (such as dialing in 30 seconds for LMR timing functions), but for the purpose of this tutorial, the Sum timer should count only upwards without producing an alarm.

STEP THREE

Navigate back to any of the main screens and enable the Timer main screen. In the center of the screen observe the "sum" timer displayed. Also displayed to the right of the sum timer clock is the corresponding widget that turns the sum timer on and off. Go ahead and turn the "E" slider up and observe the sum timer begin to count up. Slide the throttle control back down and see the sum timer stop. The sum timer will continue to count up until it is either

disabled by removing the "sum" timer assignment in the "Assignment.Switches" menu or if the sum timer is reset.

Notice carefully that while the "E" slider widget is moved upward, that until the widget passes the halfway mark, the sum timer does not actually turn on. This could mean that the motor could run slowly without increasing the timer. Change this so that when the "E" slider is moved from its lowest position, it will immediately trigger the sum timer to start.

Press the CONTROL button at the bottom of the transmitter case. Scroll down until you see a listing labeled, "Control.switch". Go ahead and select it. On the "Contr.switch" menu, you will see three listings: an axis stick symbol, "E" and "F" widgets. Select the "E" widget and change the number to "-99%".

What this means is that the trigger point for the "E" widget will be at the -99% point below the center detent. If we set it to be -100% and move the "E" slider down as far as it will go, the slider will not be able to control the sum timer since it cannot go below "-100%" mechanically. In case the readers are curious, they can leave it set on "-100%" and navigate back to the main timer screen. With the "E" slider all the way down, the sum timer will continue to run. In fact, no amount of moving the "E" slider will turn it off. Go back and change this setting to "-99%". Navigate back to the timer screen and now observe the action of the "E" slider. It will now trigger the sum timer when it receives even one click of the slider ratchet as it is moved from its lowest position.

Now that the sum timer has been set up, establish a timer that will record the total amount of flight time- from takeoff to landing.

6.3. THE SLOT TIMER

Use the "H" widget to turn this function on and off. "Why use the "H" widget?" the readers ask. Truthfully, there is no valid reason to use it or another widget; it's just a widget that the author happened to choose.

Press the SETUP button at the bottom of the transmitter and then select the "Assignment" option. On the next screen, select the "Switches …" listing. Scroll down the menu and select "Slot". Once you hit ENTER to pass the warning screen, press the "H" widget. Press the "H" widget repeatedly and observe the symbol listed to the right of the letter H on the screen change from a momentary symbol (which looks like a little hat) to an ON/OFF symbol (which looks like a poorly written letter `s'.) Be sure to establish the action of the "H" widget as ON/OFF. Press ENTER to confirm the selection.

Navigate back to the main Timer screen and observe that there are now **two** sets of timers displayed. A new one has now appeared on top of the sum timer. Press the "H" widget and observe the top line. The slot timer begin to count up until the "H" widget is depressed again. This will be used to record our total flight time.

To clear the slot timer, follow the same procedure that was used for resetting the sum timer. For the purposes of this tutorial, the "Alarm" field that appears on the Slot menu will not be utilized.

6.4. THE COUNT-DOWN TIMER

Now, set the last timer function which will be used to practice count-down timer landing skills.

Please note that this tutorial will be using a truly unrealistic number of 30 seconds for illustration purposes only.

Normally in a real-world setting, the pilot would use a number of several minutes, but since the author does not want the readers to sit mindlessly by while the EVO counts down from 5, 10 or whichever amount of minutes, this tutorial will use a few seconds as an example for demonstration purposes only.

Set the widget that will be used for the count down timer. Since the tutorial hasn't utilized a switch widget for a timer function as an example so far, use the "N" widget.

Navigate to any of the main screens and press the SETUP button at the bottom of the transmitter then select "Assignment" from the menu. Select "Switches …" on the next menu. Scroll down the "Assign.Switches" menu until a listing for "Interval" is displayed. Go ahead and select this. Press ENTER to pass the warning screen. When the Interval field is highlighted, move the "N" widget. Leave the "N" widget in the down position since this will be our "ON" setting.

It is now necessary program 30 seconds into the count down timer. Exit this menu and navigate back to any of the main screens. Now, press the TIMER button at the bottom of the transmitter. Select the "Interval ..." listing. On the next screen, highlight the "Alarm" field and program 30 seconds of time.

If the "N" widget is currently in the down ("ON") position as soon as the reader inputs 30 seconds into the Alarm field, they will see the "Time" field listed above the "Alarm" field begin to count down from 30 seconds.

Exit this screen and navigate back to the main Timer screen. Push the "N" into the up (towards the top of the transmitter case) position, then pull it down and observe the timer clock shown on the bottom of the Timer screen. It will immediately change to 30 seconds and begin to count down. If the reader moves the "N" widget up and back down again, it will reset the count down timer to 30 seconds.

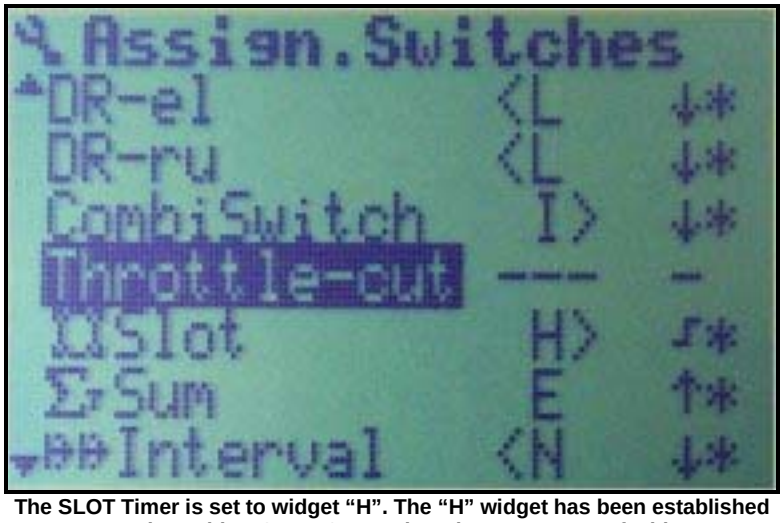
Once the interval timer has been started, and while the "N" widget remains "ON" (the down position in this case) during the count down process, the interval timer will continue to reset itself automatically back to 30 seconds once the interval timer reaches zero and will repeat the cycle indefinitely.

If you reset the "N" widget by moving it up, down and then leaving it in the up position, when the interval timer reaches zero from the 30 seconds, it will not reset itself back to 30 seconds and start the countdown process all over again. It will instead commence counting from zero upwards until it hits 4 hours and 30 minutes. This allows the pilot to turn on the interval timer only occasionally without being forced to hear the alarm beep over and over again as the

interval timer cycles automatically from the count down start (which in this case has been set to 30 seconds.)

The readers can reset their sum and the slot timers back to zero and play with the widgets to see the effect of moving the timer widgets.

Keep in mind, that the readers can change any of the widgets assigned to the timers if they prefer different widgets. They can also make use of the buttons on the long axis sticks if they have been installed.



The SLOT Timer is set to widget "H". The "H" widget has been established to work as either ON or OFF and not in a momentary fashion.

7. FLIGHT PHASES

With the exception of calibrating the servos (which can only occur while the pilot has a plane in front of them), the progress in the EVO programming is now sufficient for flight. Servo calibration will not be covered in this tutorial. The EVO manual does a good job of listing the steps involved in servo calibration.

Flight Phases (FPs) are not required for flight, but are additional tools that can be used to reduce the amount of pilot workload.

So, what are flight phases?

The FP feature on the EVO allows the pilot to assign a specific set of parameters such as servo travel limits, trim settings and specific pre-set servo settings to a widget. With FPs, the pilot can establish a particular flying setup and transition to that setup at the flick or push of a widget. The pilot can also use FPs as another means of establishing multiple dual rates since each FP can have different limits of servo travel ranges.

But still, why bother with FPs?

FPs are very similar to a feature on some automobiles known as driver settings. When a different driver takes control of the automobile, they will adjust the seat to the proper height, adjust the side and rear view mirrors to the proper setting, establish certain environmental temperature controls and perhaps, set certain stations on the radio. When the next driver assumes control, all of these steps must be manually changed again to suit the next driver. With the driver settings feature, all of these particular settings are recorded at the press of a button and saved for future reference. When a new driver sits in the automobile, they merely press their settings button and the mirrors, seat position, temperature controls and radio settings are all automatically set to that driver's preferences.

FPs work very much the same way. Of course, the pilot can manually change each of the widgets on their EVO while changing plane settings for a new flying style, but FPs make it much easier to do this. FPs greatly reduces the amount of pilot workload if there is a need for certain control settings during flight.

Some examples of FPs are:

A "Launch" FP for a glider

The flaps and ailerons would all travel down for increased camber during the winch or highstart launch. The control travels on the elevator control would be reduced to minimize over controlling and thereby minimize airframe stressing.

A "Landing" FP

This FP would pre-set the flap servo settings, give spoileron (crow) on the ailerons and pre-set the elevator servo for compensation.

There are a total of four flight phase settings on the EVO. The tutorial will be establishing four FPs. The "NORMAL" FP will be used when there should be full servo travel limits and no servo pre set positions. Once the readers understand FPs, they will be able to set up their own FPs for their own fleet.

7.1. FLIGHT PHASE NAMES

The FPs have names that are already established and set by MPX. They are as follows:

NORMAL
START1
START2
THERMAL1
THERMAL2
SPEED1
SPEED2
CRUISE
LANDING
AUTOROT
HOVER
3D
ACRO

Be sure to note that these names are not flight phases in themselves, but instead are simply names that the pilot chooses. By themselves, they do nothing but to help you identify which set of servo settings are currently being used. The pilot will choose a name from the above list and then modify the servo settings that will be used when the particular flight phase has been activated.

Can the pilot choose the "CRUISE" FP listing, set the appropriate flap, aileron and elevator travels and pre-sets and use that “CRUISE” FP for landing functions? Yes. The FP name is nothing more than a name that helps the pilot recognize and identify specific servo settings.

Suppose that the pilot would rather have a FP whose name is a little more representative of what the FP is being used for? For example, suppose that the pilot would like to have a pre-set for launching discus-launched gliders called, "DLG LNCH"? Can they simply rename one of the above FPs?

Unfortunately, with the EVO 1.26 software release and below, this is not an implemented feature. Please write to MPX and to HitechUSA and request that this feature be added on future software releases. *[This is one of the few complaints that the author has with his EVO.]*

For the purposes of this tutorial, four flight phases will be set up. The main phase will be selected as "NORMAL" and will feature full servo travels and no servo presets. FPs 1, 2 and 3 will be selected as, "START1, CRUISE, LANDING". This will cover about most of the flying situations. The "NORMAL" FP (which incidentally will be numbered 4 on the Fight Phase menu) will be considered the Main Phase and will override any of the other phases when enacted. This, as it will later be demonstrated, will allow for immediate access to the main phase in the event of a need to immediately exit another phase and gain full servo travels.

To reduce possible confusion while the readers establish and work with FPs, the tutorial is going to undo some of the previous EVO programming. Specifically, it will be removing the dual-rate setting and the dual-rate widget. It will also be deleting the digi-adjuster assignments.

The tutorial is not deleting these programming functions to enable the FPs to work correctly; it is deleting them since there can be come potential confusion which can result by misinterpreting the servo movement results if these previously established widgets were to be accidentally enabled.

Go ahead and delete the digi-adjuster (DA) assignments. From any of the main screens, press and hold down the right DA and while holding down this DA, press the REV/CLR button at the bottom of the transmitter case. Erase the left DA assignment by following the above steps.

Now, change the dual rate setting for the aileron, elevator and the rudder. Hit the CONTROL button at the bottom of the transmitter and select "Aileron ...". On the next screen, change the "D/R" setting back to 100%. Exit this screen and do the same thing for the elevator and the rudder "D/R" fields.

Now, remove the widget that was set for the dual rates. This was widget "L". Navigate back to any of the main screens and press the SETUP button at the bottom of the transmitter. On the next screen, select "Assignment ...." On the next "Assignment" screen, select "Switches ...." On the "Assign.Switches" screen, select the "DR-ai" listing, hit ENTER to bypass the warning screen and then press the REV/CLR button at the bottom of the transmitter to clear the setting from **"<L"** to **"---"**. Do the same thing for the "DR-el" and the "DR-ru" listings, erasing both of their widget assignment from **"<L"** back to **"---"** (unassigned).

7.2. Flight Phase Selection

Pause for a moment to consider which widgets that can be used for the FPs. By choosing a three-position widget, the pilot can gain access to three of the four flight phases all on one switch. They would then need only to choose one additional widget to active the main phase.

The "L" widget has just been freed from being used as the dual-rate control and can be re-used for the FP assignment, but since this tutorial will later re-activate the "L" widget for the dual-rates function, do not choose this widget.

The "O" three-position switch is not being utilized for any function. FPs 1, 2 and 3 can be assigned to this widget. Widget "M" (which is the button underneath the "O" widget) would make a good choice of the Main Phase widget. This puts all of the FPs widgets on one side of the transmitter.

On the EVO, the Main Phase will always override any other phase settings. This will allow the pilots to quickly exit any particular phase for any reason. It will also assist the pilot in preventing any unintentional phase setting activation.

Set the flight phases now.

7.3. Flight Phase Definition

STEP ONE

Since FPs are unique to each model, they are accessed through the Memory menu. Press the MEMORY button near the bottom of the transmitter. On the Memory menu, select the "Flight phase ...." listing. On the Flight phase menu, select listing number one and change it to "START1" and press ENTER.

Phases 2, 3, and 4 will be crossed out with a dashed line through them. If no flight phases are ever set up, the EVO will consider that the first phase (listed in the number 1 row) is the only flight phase and will cross out the other phases automatically.

Select the second field listing and press the REV/CLR button at the bottom of the transmitter. This will remove the crossed out line over the phase name in the second row. Change this phase name to "CRUISE" and press ENTER.

Following the procedure listed above, change the phase names for the third listing to "LANDING" and for the fourth listing to "NORMAL".

Exit this menu back to any of the main screens.

STEP TWO

Now that the names of the FPs have been established, it's time to establish the widgets that will control these flight phases. Keep in mind that the EVO mandates that phases 1, 2, and 3 to be on one widget, but it considers the "Main Phase" to be a separate function. The “Main Phase” can be assigned to another widget. The pilot can choose to use as many or few FPs as they wish, but any phase set up as the "Main phase" will always override any other FPs.

Press the SETUP button at the bottom of the transmitter. Select the "Assignment ...." listing on the Setup menu. On the next menu named "Assignment" select the "Switches ...." listing. On the "Assign.Switches" menu, scroll down the list until "Main phase" is displayed and select it. Hit the ENTER key to pass the warning screen. Press the "M" widget button to assign the main phase to this widget. Be sure to set the "M" widget button action as ON/OFF (which is indicated by a small symbol to the right of the second column that looks something like a poorly written letter 's'.) The button action is changed by repeatedly pressing the "M" widget while remaining in the second column in the Main phase listing. Hit ENTER to confirm the widget assignment.

Below the Main phase listing is the "Phases 1-3" listing. Select this, press ENTER to bypass the warning screen and assign the "O" three-position widget by moving it around. Leave the "O" widget in the uppermost vertical position and press ENTER to confirm the choice.

STEP THREE

Now, observe the progress thus far. Navigate back to any of the main screens and press the MEMORY button at the bottom of the transmitter. Select the "Flight phase ...." listing and press ENTER.

On the "Flight phase" menu, observe that the widgets that are now assigned to each flight phase are displayed to the right of the phase name. Phases 1, 2 and 3 display a "<O" and phase number 4 ("NORMAL") shows a "<M" next to its name.

The "NORMAL" Flight Phase is currently active in this screenshot. The "M" widget enables the "NORMAL" Flight Phase.

Press the "M" widget a few times and observe a small letter 'x' jump from the fourth line to another line above it. The small 'x' indicates which phase is currently activated. Press the "M" widget until the 'x' displayed to the right of the forth phase, the "NORMAL" phase.

Move the "O" three-position widget and observe how the 'x' will not move from the "NORMAL" phase listing. This is indicative of the operation of the "M" widget which stays ON until pressed again for OFF as well as indicative that while the main phase (the fourth phase, named "NORMAL" in this case) is active, no other phases can be activated.

Press the "M" widget one more time which will turn off the "Main Phase".

Now, move the three-position "O" widget and observe how the small 'x' will move from phase to phase as the widget is moved among its three positions. If the "M" widget is pressed again, the phase will revert back to the fourth listing which is the main phase.

Navigate back to the main screens and enable the Flight Phases main screen.

Activate the "M" and "O" widgets and the names of the FPs displayed on the screen will change accordingly. Remember, while the main phase is active (the "NORMAL" phase in this case), no other phases will be allowed to activate.

7.4. FLIGHT PHASE FUNCTIONS

Now it's time to decide on the servo actions of each phase.

For the NORMAL phase, 100% of servo travels and no pre-set trim settings should be set.

For the LANDING phase, the flaps should be set to go down as well as the servo travels on the ailerons and elevator should be reduced. This will help to reduce over control during landing.

For the CRUISE1 phase, the servo travels for the ailerons, rudder and elevator should be reduced further to prevent over controlling.

Go ahead and set the individual FPs now.

7.5. Setting the Flight Phase Settings

Press the CONTROL button at the bottom of the transmitter and then select "Aileron ...." on the Control menu.

On the next screen, the aileron controls are displayed. If the "O" widget is changed, the corresponding FP will be displayed on the top of the screen. Set the "O" widget to LANDING phase by moving it to the lowest vertical position. Notice that is a small number displayed to the right side of the "Trim" and the "Trvl" fields. This number corresponds to the FP number. The LANDING FP was established as the third FP. When the "O" widget is moved to its lowest position, a small number '3' will be displayed to the right of the "Trim" and the "Trvl" fields.

Reduce the "Trvl" field for the ailerons to 75%. Leave the "Trim" field to "0.0%".

Exit this screen and now select the "Elevator ...." listing on the Control menu. Reduce the "Trvl" field to 75% as well.

Set the travel field for the rudder to 75% by using the above steps.

Exit this screen and now select the "Flap ...." listing on the Control menu. The Flap control (as well as the spoiler control) will not look the same as the aileron and the elevator control screens. This control will have a "Run time" value as well as a "Fixed value". Select the "Fixed value" field and change the listing from "OFF" to 100%. Be sure that there is a small number '3' displayed to the right of the "Fixed value" field. If there is another number shown, move the "O" widget to its lowest position. If there is a small number '4' displayed, then the Main Phase has been activated. Press the "M" widget to turn it off.

Exit back to the main Flight Phase screen.

The LANDING FP has now been established. Move the "O" widget to the LANDING phase and press the "M" widget to change to the NORMAL phase.

Go to the servo monitor screen by pressing the SERVO button at the bottom of the transmitter and then selecting the "Monitor ...." listing.

Move the axis sticks around and observe that the servo travels have 100% of the travel motions (or at least as much motion as the current mixers allow for.) Currently the NORMAL FP is enabled. The default settings are already at 100% for this phase (as well as any other phases.) Since 100% servo travel was decided for the NORMAL phase, there are no further steps needed for the NORMAL FP.

Move left axis stick all the way down and then move the "F" widget to the centered position on the detent.

Press the "M" widget to turn off the NORMAL FP. Since the "O" widget is in its lowest position, the FP will change to LANDING FP. Observe how the first and fifth servos go down in conjunction. This reflects the "Fixed value" field that was changed from "OFF" to "100%". Go ahead and move the "F" widget which is the flaps control widget. Notice how the first and fifth servos will not move with the "F" widget motion any longer. This demonstrates that a fixed value amount will always override the widget that controls the flaps or the spoilers. Notice also that the aileron control travels have been limited.

Press the "M" widget again to change back into the NORMAL FP. Observe how the first and fifth servos will slowly transition back to neutral settings. This reflects the EVO's programming which allows for a gradual transition change from one phase to the next without abrupt servo movements.

Enable the LANDING FP once again. Why do the first and fifth servos not go all the way down? Wasn't the "Fixed value" field for the Flap control set to 100%? The answer is in the "Ail Tut+" mixer values. Press the MIXER button at the bottom of the transmitter and then select "Ail Tut+ ...." on the Mixer menu. The travel limit for the Flap was previously to "-20%". If greater flaperon travel distance is desired, change the "-20%" value to a lower number such as "-50%". Go ahead and change the Flap value in the “Ail Tut+” mixer now.

Go back to the servo monitor screen and observe the travel limits of the first and fifth servos. With the LANDING FP activated, the ailerons will travel together downward much more now (the results of the lower fixed value number that was input.) Keep in mind, though, that the "F" widget, which commands the flap control, will also have a greater travel effect for camber/reflex now.

Observe also that the left axis stick (which happens to be the spoiler widget in this tutorial) will continue to effect the first and fifth servos (the ailerons) even though the fixed value for the flaps has been set. This is also because of the mixer "Ail Tut+" which is set to provide "70%" of spoileron travel. The spoiler control has not been altered with a fixed value. If the CONTROL button is pressed at the bottom of the transmitter and then "Spoiler ...." is selected, the spoiler control for all four FPs will indicate a fixed value of "OFF".

The other FPs settings can now be established. Following the above procedures change the travel settings for the ailerons, elevator and rudder to the following travel limits:

```
START1 Trvl=80%  (FP numbered 1)
CRUISE Trvl=25%  (FP numbered 2)
NORMAL Trvl=100% (FP numbered 4)
```

Once the FPs have been set with their appropriate travels, observe their responses in the servo monitor screen. Enable each FP, move the widgets and see what the effects of the servo travels are.

"Are FPs a form of dual rates?"

Yes.

Each FP can be altered to have different amounts of travel, which is what a dual rate function does. Although this lesson has demonstrated how to change the servo travels in the different phases, the official dual rate field has not been utilized.

The Dual Rate setting is universal across all flight phases. Press the CONTROL button at the bottom of the transmitter case and then select the "Aileron ...." listing on the next screen. Set the D/R field to "50%." Exit this screen and then select "Elevator ...." on the Control menu. Change the dual rate for the elevator to 50%. Change the dual rate on the rudder control to "50%" as well.

Earlier in this tutorial lesson, the dual rate widget assignment was deleted. Re-establish this again. Select the SETUP button at the bottom of the transmitter. Select the "Assignment ...." listing and then select the "Switches ...." listing on the Assignment menu. Select the "DR-ail" listing, press ENTER to pass the warning screen and then move the "L" widget towards the bottom of the transmitter case. Press ENTER to confirm. Assign the "DR-el" and the "DR-ru" fields to the "L" widget as well. Sure that the "L" widget is shown as "ON" when it is in the lowest position. (There will be a small arrow pointing down to the right of the "<L" displayed on the screen.)

Go back to the servo monitor screen. Push the "L" widget into the OFF position. Enable the NORMAL FP. Move the axis sticks and observe that the servo travels move to 100% of their range. Move the "L" widget to the ON position and observe the servo travels. They have been reduced to 50%. Enable the FP number one ("START1"). With the "L" in the ON position (dual rates enabled) observe the motion of the servo travels. The servo travels have now been reduced to 40%. This is a result of reducing the original 80% of servo travel in the START1 FP by 50%, which results in 40%. While the dual rates "L" widget is ON, the travel rates in all of the FPs will be reduced by 50% (except for the fixed values in the LANDING phase.)

This has effectively allowed for a total of eight dual rate settings. In the START1 FP, the travels are from 80% without the dual-rate "L" widget set, to 40% with it on. The CRUISE FP has 25% of servo without the dual-rate "L" widget turned on and 14% with it on. The LANDING FP has 75% travel without the "L" widget on and 36% of travel with the dual-rate switch on. The NORMAL FP has 100% of travel with the dual-rates widget in the OFF position and 50% of travel with the dual-rates turned on.

Of course, this does not consider the fact that the travel limits of the aileron, elevator and the rudder in each flight phase can be assigned to one of the digi-adjuster buttons for even more flexibility and adjustment if needed.

8. THE MIX 1, MIX 2, MIX 3 FUNCTION

While the term "mixer" is loosely used within the remote control community, a Multiplex mixer stands apart from what many of the Asian based radios label as a 'mixer'. Be sure to re-read the mixer chapter in this tutorial if there are any doubts as to the concepts and the workings of Multiplex mixers.

Earlier in this tutorial, a specialized mixer was created named “Ail Tut+”. The controls in this mixer are spoiler, flap and aileron. The flap control (the “F” widget), the spoiler control (the left axis widget) and the aileron control (the right axis widget) were established to remain always ON.

Since the sample plane being programmed into the EVO in this tutorial features a v-tail, the elevator and rudder servos were assigned to a mixer that came from Multiplex already programmed into the EVO. This mixer is named “V-TAIL+”. The control inputs in this mixer were set to the following settings:

V-Tail+		
Elevator	65%	100%
Rudder	65%	100%
Spoiler	OFF	OFF
Flap	OFF	OFF
Thr –Tr	OFF	OFF

For the sake of the tutorial, it will be assumed that a test flight has already occurred and it was determined that automatic elevator compensation will reduce the pilot workload when spoilerons are deployed.

Look again at the mixer named, “V-TAIL+”. Although the mixer has been established (by Multiplex) to have a spoiler control input, in this tutorial lesson the spoiler control has been set to “OFF”.

The spoiler control can be modified so that when the spoiler widget (the left axis stick) is engaged, it will cause the v-tail servos to provide up elevator compensation. Simply press the MIXER button at the bottom of the transmitter, select the “V-TAIL+…” listing and change the spoiler control to have the following inputs:

V-Tail+		
Elevator	65%	100%
Rudder	65%	100%
Spoiler	OFF	–20%
Flap	OFF	OFF
Thr –Tr	OFF	OFF

This is a quick and easy solution to providing Elevator->Spoiler Compensation (EPC). Go ahead and view the results on the servo monitor screen. Move the left axis stick and observe how elevator control will be added when the spoiler control is now moved to the end of its travel.

Suppose, however, that the pilot does not want a particular control inputting into a mixer at all times? Suppose that the pilot would like to be able to turn the EPC on and off simply by flipping a switch? Is there a way to accomplish this?

Yes.

This is the purpose of the Mix1, Mix2 and Mix3 switches.

"Wait a minute, where are these switches? They are not on the EVO transmitter case!" the reader asks.

That is true. The MIX1-3 switches are a form of software switch that can be assigned to turn on and off individual control inputs into a mixer.

Let's make the EPC switchable.

STEP ONE

The "J" three-position widget will be used to turn on and off the EPC. It will be ON in its lowest vertical position.

Ordinarily it is HIGHLY recommended that the EVO user not modify the MPX provided mixers, but for the purpose of this tutorial, the "V-TAIL+" mixer will receive a slight alteration which can be reversed without harm. If you are uncomfortable with mixers and do not trust your understanding and ability to perform this modification, it is suggested that you simply read this chapter and not perform the modification of the "V-TAIL+" mixer on your EVO. Failure to perform the modification correctly can result in your v-tailed models operating incorrectly.

Press the SETUP button at the bottom of the transmitter. Select the "Mixer def" listing and then the V-TAIL+ mixer on the Define.mixer screen. Highlight the spoiler control in the middle column, change the **"----"** to **"Mix1"**. Do not change the servo output type symbol in the rightmost column! Press ENTER to confirm the change to the mixer.

Add only the "Mix1" switch to the Spoiler control!

STEP TWO

Establish the "J" widget to the Mix1 function.

Press the SETUP button at the bottom of the transmitter and then select "Assignment". Select the "Switches .." listing on the Assignment menu.

Scroll down and highlight the "Mix-1" listing and press ENTER. Press ENTER again to pass the warning screen. Move the "J" widget to assign it to the Mix-1 field and leave it in its lowest position to indicate to the EVO that this is the "ON" position.

STEP THREE

Navigate back to any of the main screens and press the MIXER button at the button of the transmitter. Select the "V-TAIL+ .." listing.

Now there will be a letter 'j' displayed to the right of the spoiler control listing in the "V-TAIL+" mixer screen. This indicates that the spoiler control input into the mixer is now switchable. It will only be allowed to feed in a signal into the "V-TAIL+" mixer when the "J" widget is in the "ON" position.

Go to the servo monitor screen and observe the action of the v-tail servos when the spoiler control is engaged with the "J" widget in the "ON" position as well as what happens to these servos when the "J" widget is switched to either the middle position or to its uppermost vertical position.

EPC has now been added and its action has been changed from always ON to selectable ON and OFF action.

But I thought that this was supposed to reduce the pilot workload? Can't the EPC be engaged automatically when the spoiler control is input – without the need to flip a separate switch?

Yes.

Earlier in the tutorial (in the Timers chapter) the motor run timer was assigned to the throttle widget so that the timer would start and stop automatically when the motor was turned on and off. The EPC function can work in a similar fashion to reduce pilot workload.

Press the SETUP button at the bottom of the transmitter case. Select “Assignment ..” and then “Switches ..” Scroll back down to the “Mix-1” listing and select it. Press ENTER to pass the warning screen. Move the left axis widget and leave it in its uppermost position to indicate to the EVO that this is the ON position. The “J” widget assignment will be automatically erased when this is done.

Exit this screen and go to the servo monitor screen and observe the servo actions when the spoiler control is engaged. EPC will automatically kick in when the left axis stick is moved upwards and the “J” widget will no longer have any effect to the EPC.

Notice that in this screenshot, channel 4 (the motor control) has been moved to its lowest vertical position. The left axis widget (spoiler control) when move to it’s top vertical position raises both aileron surfaces upwards and also causes the v-tail surfaces to move downward.

The specific point during which the left axis stick begins to move the v-tail servos can be set lower or higher. To do this, press the CONTROL button at the bottom of the transmitter and scroll down to the bottom of the list and then select “Contr.switch ..” The first listing on the “Contr.switch” menu can be modified to change the “trigger point” of the left axis stick. This will be pilot-dependent and no one setting will be appropriate for all pilots.

The Mix2 & Mix3 are simply two more switches that can be used to select two additional control inputs that can selectively switched on or off. These additional MIX switches can be used in other mixers and are not required to all be used within only one mixer.

9. Advanced Mixer Concepts

The EVO has only one official dual-rate (DR) utility. With flight phases (FPs), however, the control travels of the elevator, rudder and aileron controls can be individually limited; this results in essentially of up to four possible "dual-rate" settings on these controls.

If the official dual-rate facility is enabled as well as the four FPs (with their own individual sets of travel limits), the pilot is able to gain access to a total of up to eight different dual rate settings on one model.

Suppose there is a scenario where the pilot does not want to use FPs, but would still like to have different servo actions when a certain set of flight parameters occurs?

For this scenario, it will be assumed that the pilot would like to have three different elevator dual rates. The pilot also does not want to use FPs.

STEP ONE

Create a new model. Use the BASIC Template and set the Assignment to POWER.

On the model Properties screen, name the model "Crazy Plane" and set the Assignment listing to POWER.

STEP TWO

Create a new mixer named "Elev#". The mixer should be set up as shown.

Add the Mix1, Mix2 and Mix3 switches as shown.

Is it permitted to have the same controls listed multiple times in a mixer?

Yes. The rationale will be demonstrated shortly.

STEP THREE

Go to the servo assignment screen and replace the mixer "ELEVATOR+" on servo numbered 2 with the "Elev#" mixer that was just created.

STEP FOUR

Now that a servo has been assigned to the "Elev#" mixer, the servo travels can now be set. Set the servo travels in the mixer menu to the following:

```
Elev#

Elevator ----  100%
Elevator ----  50%
Elevator ----  25%
```

STEP FIVE

When the "Elev#" mixer was defined, each line in the mixer was set to elevator control with symmetrical output curves, however, each of the controls listed will be switched with the MIX1, MIX2 and MIX3 switches.

Establish a widget to control these switches. In the SETUP-ASSIGNMENT-SWITCHES menu, set Mix-1 to the "G" 3 position switch with the ON position towards the top of the transmitter. Set Mix-2 to be also on the "G" widget, but the ON position should be in the lower position. Set MIX3 to the "I" widget with the ON position to be in the lower position.

Go to the servo monitor screen. Set the "I" widget to the OFF position. Set the "G" widget to the up position. Move the elevator control (the right axis stick) and observe that the elevator has 100% of travel. Move the "G" widget in the lowest position and observe that the elevator travel is now only 50%. The "G" widget is currently triggering the MIX2 switch which has been set to activate one of the control inputs from a mixer. In this case, it is activating one of the elevator controls in the "Elev#" mixer, which has been set to have only 50% of servo travel.

Move the "G" widget to the center position and then move the "I" widget to the ON position (down). Observe the elevator servo travel. It has been reduced to 25% which reflects the MIX3 switch which has been assigned to the third elevator control input in the "Elev#" mixer.

Move the "G" widget to the ON (down) position and set the "I" widget to the ON (down) position and observe the results of the elevator servo travel. The resulting travel values will now be 75% which is a reflection of the 50% from MIX2 and the 25% from MIX3. Since both MIX2 and MIX3 are set to the on position, their resulting travels are added up to 75%.

This is a nifty trick to be able to extract additional dual rates by using a mixer and the MIX1-3 switches without using the official dual rate function or flight phases.

Keep in mind that the reader is not limited to using the MIX1, MIX2 and MIX3 switches only one time. You can create a new mixer for the rudder with three inputs and assign one rudder control to MIX1, another rudder control to MIX2 and the third rudder control to MIX3 in the mixer definition screen. Replace the rudder servo assignment with this newly created rudder mixer and set the travel values like the "Elev#" mixer shown above. The end result will be elevator AND rudder dual rates when the "G" and "I" widgets are turned on.

An important note!

The middle position on a three-position switch means, "Neither UP or DOWN." Since widget "G" in the up position means that MIX1 switch is ON and widget "G" in the down position means that MIX2 is on, if widget "G" is in the center, neither one of them are on. If the "I" widget is also set to OFF (in the up position), there will be no elevator servo travel!

This is not a malfunction, but rather a demonstration of one of the few limitations of the Royal EVO. With the Profi 4000, each position of a three position switch can be set as "ON".

An even more important note!

Although you can establish a mixer with multiple rudder and elevator control inputs to create a dual rate function, due to the Multiplex aileron sequencing rule, applying multiple aileron inputs into a mixer to effect a dual rate function on the ailerons will cause the ailerons on the plane to work improperly.

Aileron servos are required to be listed in a Left-Right-Left-Right order fashion so that the EVO will know which aileron is the on the port side and which aileron is on the starboard side. When two aileron controls are listed in a mixer in the aim of allowing for a dual rate function, the EVO counts the occurrence of the second aileron control listed in the mixer as a “right” servo and thereby sends a “left” aileron servo data to the next servo utilizing the mixer. In this case “left” aileron signal will be sent to the right physical aileron servo! To the EVO, it is following the L-R-L-R aileron rule, however both the left and right **physical** aileron servos on the plane will only be receiving “left” aileron servo data signals. This will cause the ailerons on the plane to act like spoilerons and flaperons.

Mixers are powerful programming tools and they are not limited to only providing mixing function outputs to servos. They can also be used as another form of dual rates if the pilot needs additional functionality on their EVO.

10. PROGRAMMING FULL-HOUSE SAILPLANES

This chapter is credited to Geir Wilkran and is used with his generous permission. The author has modified the narration for clarity and has performed formatting alterations for readability.

This chapter provides the readers with a detailed set of instructions for programming a full-house sailplane. Full-house sailplanes typically have the following functions: Elevator, Aileron, Flap, Rudder. Some full-house sailplanes also have a separate spoiler control surface, but the example plane that Mr. Wilkran is proposing in this chapter uses the aileron surfaces as spoilerons for the spoiler channel; there are no separate spoiler flying surfaces on his example full-house sailplane.

10.1. PROGRAMMING OVERVIEW

This full-house sailplane setup assumes that the Elevator and Aileron controls are located on the right stick widget (in mode 2 operation). The Rudder and Spoiler controls are located on the left stick widget. The Flap control is located on the “E” slider widget. The Flap control will be used for small amounts of camber and reflex while in flight.

The aileron surfaces should act as flaperons during full trailing edge flap settings and as spoilerons during crow braking.

The flap surfaces should act as full span ailerons as well as act as conventional flaps.

The elevator surface should compensate when crow braking is enabled.

The “N” widget should switch between allowing the spoiler widget to effect either full span flaps (flap and aileron travel downward together) or crow brake (flap surfaces go down and aileron surfaces go up).

The “I” widget should turn aileron-rudder coupling on and off.

10.2. CREATE A CUSTOM ASSIGNMENT LIST

First, set up a custom assignment list and define the mixers that are needed. Once hese mixers and assignment list have been programmed, they will be considered global and can be used with other sailplanes.

Begin by setting up a custom list of widget-to-control assignments.

Go to the main menu "Setup" and select "Assignment". In the "Assignment" screen move down to "Assignment" and select it (by pressing the digi-adjusters or the ENTER key). Use the digi-adjusters (or up/down keys) to select one of the two empty assignment lists, which

will show up in the display as "4...." and "5....". Change the name of the assignment to something meaningful.

Navigate to the "Controls" listing and select it. Highlight the "Spoiler" listing and select it. Select the widget that will act as the Spoiler control by moving the left stick widget up and down. Leave the stick in a forward position to set stick travel value from forward as negative to backward as positive, and then press ENTER to confirm. This will navigate back to the “Controls” list. Move down to "Flaps/RPM" and select it. Move the “E” slider widget and leave it in an upward position before pressing the ENTER key.

Exit the "Assign Controls" screen.

Back in the "Assignment" screen, select "Switches". Move down to "CombiSwitch" (aileron-rudder combination) and select the “I” widget. Leave the “I” widget in the downward position as the “ON” position and press ENTER to confirm.

Move down to "Mix-1" in the list and select the “N” widget with upwards as being the “ON” position. Move down to "Mix-2" and select the same “N” widget, but this time with downward as being the “ON” position. The Mix-1 and Mix-2 switches will allow the pilot to change between crow brake and full span flaps. This will be demonstrated later in the chapter.

This custom global assignment list is now complete and can now be used with additional models.

10.3. CREATE THE MIXERS

For setting up our full house glider, three different mixers will be needed: one to manage the aileron servos, another to manage the flap servos, and one to manage the elevator servos. These mixers will be named as, AILERONx, FLAPx, and ELEVATRx.

AILERONx mixer:

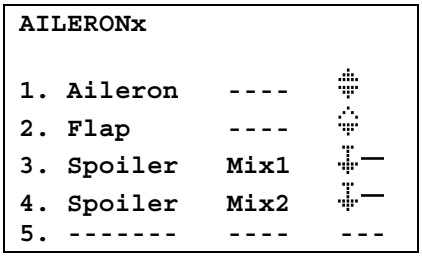
Press the "Setup" button at the bottom of the transmitter and select "Mixer def". In the "Define mixer" screen scroll down the list and select an unused entry. In the next screen change the name to "AILERONx". This is the mixer that will be used to effect the aileron servos, so it must now be decided which controls should cause the aileron servos to move. In the “Programming Overview” chapter, it was determined that the aileron servos should move when the following events occur:

- **When the aileron widget is enabled, the aileron servos should move.**
- **When the flap widget is enabled, the aileron servos should move for camber and reflex adjustments.**

- **When the "N" widget is forward in the Mix1 position, the ailerons should move as spoilerons when crow braking is enabled by the spoiler widget.**

- **When the "N" widget is downward in the Mix2 position, the ailerons should move as flaperons for full trailing edge flaps.**

Define the aileron mixer as shown below:



In the AILERONx mixer, line 1 receives the Aileron control as an input. The aileron servos should move equally up and down in response to the aileron widget, so the symmetrical output option is chosen. Since the symmetrical output option forces the servo to travel equally above and below the neutral servo position, when the aileron servo travel adjustments are later programmed into the mixer, only one value will need to be entered. However, the asymmetrical output option could have been chosen in order to allow fine tuning the specific upward and downward travel distance of the aileron surfaces. Is this how aileron differential is programmed? No, aileron differential is a parameter that is adjusted with a separate function on the EVO and not by the use of mixers. This will later be demonstrated.

Line 2 receives Flap as an input. The flap control is set with an **a**symmetrical output option. With this option, separate values for the upward and for the downward movement of the aileron surfaces can be programmed when the flap widget is enabled. These travel values will be used to fine tune the amount of aileron surface travel when camber or reflex is enabled with the "E" slider widget.

Line 3 receives Spoiler as an input **only** when the Mix1 switch is in the "ON" position. (When the "N" widget is in the upward position.) The Mix1 switch will toggle the crow brake function in response to the Spoiler widget. When the Mix1 switch is set to "ON", the ailerons should move in one direction only (upwards), so the single-sided with offset option is chosen. The offset option allows the entire physical movement of the left axis stick (the spoiler widget) from full up position (0% or neutral) to full down position (+100%) to be utilized to deploy the ailerons as spoilerons.

Line 4 also receives Spoiler as an input, but only when the **Mix2** switch is in the "ON" position (when the "N" widget is in the downward position.) When the **Mix2** switch is set to the "ON" position, it will cause the ailerons to move as flaperons in response to the Spoiler widget. This will be used in conjunction with the flap surfaces to allow the pilot to set full trailing edge flaps.

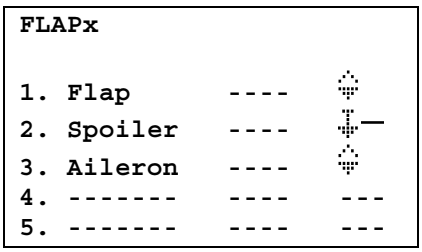
Line 5 is not used and is left empty.

FLAPx mixer:

Press the "Setup" button at the bottom of the transmitter and select "Mixer def". In the "Define mixer" screen scroll down the list and select an unused entry. In the next screen change the name to "FLAPx". This is the mixer that will be used to effect the flap servos, so it must be decided now which controls should cause the flap servos to move. In the “Programming Overview” chapter, it was determined that the flap servos should move when the following events occur:

- **When the flap control is enabled (the “E” slider widget), the flap servos should move a small amount of up for reflex and a small amount of down for camber.**
- **When the spoiler widget is enabled, the flap servos should move down as far as possible.**
- **When the aileron widget is moved, the flap servos should work in conjunction with the aileron servos for full span aileron function.**

Define the mixer as shown below:



Line 1 receives flap as an input. An asymmetrical output option is selected so that the upward and downward movement distance of the flap servos can be adjusted as needed.

Line 2 receives spoiler as an input. The spoiler widget should cause the flap servos to move only in one direction. The output option is chosen as single-sided with offset in order to allow the full physical movement of the spoiler widget to be utilized.

Line 3 receives aileron as an input. An asymmetrical output option is selected so that the upward and downward movement of the flap servos can be adjusted to match the aileron surfaces for full span ailerons.

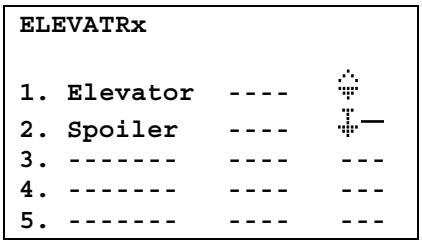
Lines 4 and 5 are unused and are left empty.

ELEVATRx mixer:

Press the "Setup" button at the bottom of the transmitter and select "Mixer def". In the "Define mixer" screen scroll down the list and select an unused entry. In the next screen change the name to "ELEVATRx". This is the mixer that will be used to effect the elevator servo, so it must now be decided which controls should cause the elevator servo to move. In the “Programming Overview” chapter, it was determined that the elevator servo should move when the following events occur:

- **When the elevator widget is enabled, the elevator servo should move.**
- **When the spoiler widget is enabled, the elevator servo should move in order to provide compensation.**

Define the mixer as shown below:



Line 1 receives Elevator as an input. An asymmetrical output option is selected so that the upward and downward movement of the elevator servos can be adjusted as needed.

Line 2 receives Spoiler as an input. This input is used for elevator compensation when Spoilers are deployed.

Lines 3, 4, and 5 are unused and are left empty.

10.4. CREATE THE MODEL

Now that the mixers have been created, the model can now be created. Press the MEMORY button near the bottom of the transmitter and then select "New model". In the "New model" screen select "4 FLAPS" as the Template. Select "2" (Rudder on left stick, Elevator and Aileron on right stick) as the Mode selection. For the Assignment list selection, choose the custom assignment list that was made earlier. Finally, select "OK" and press ENTER.

Press the CONTROLS button near the bottom of the transmitter and then select "Fixed value,” Make sure that the parameter "Fixed value" is set to OFF for the flap and spoiler control.

Press the SERVO button near the bottom of the transmitter and then select "Assignment". Assign the AILERONx mixer to the two channels that will be used for the ailerons. (Remember that that left wing should be on a lower channel number than the right wing in order to observe the aileron sequencing rule.)

Assign the FLAPx mixer to the two channels that will be used for flaps. Remember that that left flap should be on a lower channel number than the right flap in order to comply with the sequencing rule. The two flap channels should be on higher numbered channels than the two aileron channels.

Assign the ELEVATRx mixer to the channels that will be used for elevator.

Assign the Rudder control to the channel that will be used for rudder. The rudder control will not need a mixer.

10.5. ADJUST THE MIXER VALUES

Press the MIXER button near the bottom of the transmitter and then select the AILERONx mixer. Enter the following travel values as shown below.

AILERONx			
Aileron	**----**	**100%**	
Flap	**100%**	**100%**	
Spoiler	**OFF**	**-100%**	**Mix1**
Spoiler	**OFF**	**100%**	**Mix2**

Press the MIXER button near the bottom of the transmitter and then select the FLAPx mixer. Enter the following travel values as shown below.

FLAPx		
Flap	**100%**	**100%**
Spoiler	**OFF**	**100%**
Aileron	**OFF**	**-30%**

Press the MIXER button near the bottom of the transmitter and then select the ELEVATRx mixer. Enter the following travel values as shown below.

```
ELEVATRx

Elevator    100%  100%
Spoiler     OFF   0%
```

By ensuring that all of the channels will receive full output from each control, it will be easier to adjust the mechanical servo linkages and flying surfaces.

10.6. SERVO CALIBRATION

Press the SERVO button near the bottom of the transmitter and then select "Calibrate". Select each channel and make sure that both end points of the servo curve (P1 and P5) are set to -/+100% value. Check that each control surface on the model is moving in the correct direction. If any servo needs to be reversed, select that channel in the SERVO menu, highlight the “REV/TRM” field and then press the REV/CLR button at the bottom of the transmitter to invert the curve.

For each servo, adjust the mechanical linkage so that the full servo movement is used when moving the control surface to its maximum needed deflection. (This may require adjusting the clevises on the servo arms and control horns.) Even after completing this, there may still be some servos that will attempt to move more that the mechanical linkage and control surface will allow for. If this is the case, select the corresponding channel on the SERVO menu and adjust the end points (P1 and P5) on the servo curve so that under no circumstance will the servo move further than the mechanical linkage allows for.

The flap servos will require some special attention in order to synchronize them with the aileron servos. The flap surfaces need to move only a few degrees upward travel for reflex. However, the flaps should also move as much down as possible for braking. Therefore it is desirable to preserve as much physical servo movement as possible for moving the flaps downward. Turn on the receiver. Move the spoiler stick to neutral (full forward). Move the flap slider (the “E” widget) full forward, so that both flap servos (and surfaces) move to their upward ends of travel, and hold it there while turning off the receiver. (This will cause the servos to “freeze” into place.) Adjust the mechanical servo linkages for the flaps so that the flap surfaces are set to their maximum required reflex position. Turn the receiver on again, and set the flap slider to neutral. The flap servos will now move to the servo neutral positions, but the flap surfaces will physically be below the neutral point. Go into the calibration screen for each flap channel and adjust the servo curve point P3 (center position) so that the flap surfaces are at neutral when spoiler, aileron and flap widgets are at their neutral positions.

Go through each mixer (AILERONx, FLAPx, and ELEVATRx) and readjust the mixer travel values as needed for the model.

The Flap control should produce only a small amount of flap surface movement (5-10 degrees) for reflex and camber settings. Within both mixers AILERONx and FLAPx, adjust

the amount of flap control travel so that the flap surfaces move in response to the Flap widget (the “E” slider) in the amounts that are needed for the model.

Press the MIXER button at the bottom of the transmitter and then select the “CombiSwitch” listing. The Rudder-Aileron coupling for coordinated turns can be set up here. This can be set so that either Ailerons or Rudder is considered master. *(See section 15.1 in the manual.)* Within the customer assignment list that was created, the “I” widget has been programmed to turn Aileron-Rudder combination ON and OFF.

Press the MIXER button at the bottom of the transmitter and then select the "Ail.Diff" listing. The “Mode” parameter can be set to +SPOILER. *(See section 15.2 in the manual.)* In this example setup, much of the aileron movement will be used in crow braking and in full span flaps when deploying the Spoiler widget. Less aileron movement is remains for the Aileron control when Spoilers are fully deployed, and this will cause degraded aileron response for the plane when using spoilers. When the mode is set to +SPOILER, aileron differential will be gradually reduced as Spoilers are progressively deployed. This will enable better aileron response when deploying spoilers.

10.7. REFINEMENT POSSIBILITIES

The following discussion are variations of other possibilities and refinements to the prior example setup. There are other alternative EVO programming approaches that are possible, but are not discussed below.

10.7.1. ALTERNATIVE ELEVATOR COMPENSATION POSSIBILITIES

When the ELEVATRx mixer was defined, the Spoiler input was set with the "Single-sided with offset" output option. This option gives linear output to the elevator from the first moment of spoiler deployment.

Perhaps this is not desired. Suppose that very little elevator compensation should occur at the beginning of spoiler deployment, but more elevator compensation should occur after the spoiler has passed a certain point? In this case, a "Single-sided with curve" output option could be chosen instead. This will provide a two-point curve for adjusting the elevator compensation rate instead of a straight linear elevator compensation.

Or perhaps instead, no elevator compensation at all is desired until a given amount of spoiler is deployed? In this case, a "Single-sided with dead zone" output option could be chosen. This will allow the pilot to specify at which point during the spoiler deployment that elevator compensation should begin.

10.7.2. ALTERNATIVE REFLEX/CAMBER POSSIBILITIES

The flap control (which was assigned to the “E” slider widget) was programmed to enable small adjustments of reflex and camber for penetration or thermal situations.

For the fingers to find the “E” slider and moving it to the correct position, is sometimes not as easy and quick as could be desired. In some situations, it is better to flip a switch to set the flaps in speed, thermal, or normal positions. This could be obtained by reassigning the flap control to a switch widget, for example to the 3-position “L” widget (reflex in upper position, neutral in middle position, and camber in lower position).

However, if he pilot desires, they can leave the control assignment as it is and use the forward and backward position of the “L” widget to quickly set reflex and camber while at the same time have the “E” widget action slaved to the middle position of the “L” widget. In another words, when the “L” widget is set to either reflex or camber, the “E” slider will have not effect. When the “L” widget is in the center position, the “E” slider will continue to allow the pilot to manually specify the amount of reflex or camber to effect.

This will be done using a combination of Flight Phases and fixed values.

Press the SETUP button at the bottom of the transmitter and then select "Assignment". Select "Switches", scroll down to "Phases 1-3" and select it. Move the “L” widget to select it, and leave it in the forward position for Phase 1 before pressing ENTER to confirm the choice.

Press the MEMORY button at the bottom of the transmitter and then select "Flight phases". Navigate to the second line listed as Phase 2, select it (by pressing the digi-adjuster or the ENER key) and change the name in the second line to "NORMAL" and press ENTER.

Navigate to the Phase 3 line and change the name to "THERMAL1". Make sure the “L” widget is in the forward position. This will select Phase 1 which is the phase that already contains the previous settings. An "x" will appear on the display to indicate this.

Navigate back to the Phase 1 (line 1), select it and change the name to "SPEED1" and press ENTER. The marker will now move to the "x" after the name of the phase. Use the digi-adjuster (or up/down keys) to copy Phase 1 to Phase 2 (in the display a "c" will show behind the phase that will be copied to). Copy Phase 1 to Phase 3 as well. Now, all of the previous settings have been copied to these two new phases.

Press the CONTROL button at the bottom of the transmitter case and select "Flap". Move the “L” widget to the upward position to enable the "Speed1" phase (phase 1). Set the "Fixed value" to the required amount of reflex for this Flight Phase.

Move the “L” widget to the lower position to select "Thermal1" phase (phase 3), and set the "Fixed value" to the required amount of camber for the Flight Phase.

Move the “L” widget to the middle position and ensure that the "Fixed value" is OFF in the "Normal" phase. This will enable the “E” widget to continue to work as it did before in the "Normal" phase. *(Remember, even if the pilot chooses not to use Flight Phases, the EVO considers that the “Normal” Flight Phase is enabled by default.)*

One thing to be aware is that when you set fixed values the resulting output will be limited to the maximum values set for that control in each mixer. For example, if in the FLAPx mixer the travel values for Flap were set 25% upward travel and 30% downward travel and a fixed value is set for Flap to -100% (up), the actual output from the mixer will only be -25% (the maximum value in the mixer setup).

11. PROGRAMMING ELECTRIC RES SAILPLANES

On electric gliders, it is often beneficial to have a programming set up that allows the left axis stick to control both the ESC (throttle) as well as the spoiler. During the launch stage or during motor power-on, the left axis stick is used as a typical throttle control widget. However, by programming the left axis stick to also control the spoiler function, it reduces the pilot workload since it will not be necessary to utilize another slider widget or switch to enable the spoilers.

This EVO programming scenario will have one widget that will be used to control two independent servos, but not at the same time. Clearly, the spoilers and the throttle should not both enable at the same time!

These two functions on the left axis stick will be switched by the position of widget “O” which is a three-position widget on the left side of the transmitter, although any other three-position switch widget could be utilized instead.

The top-most vertical position of the “O” widget will be for throttle control and the bottom-most position will be for spoiler control. The middle position will be for nether control and thus, will effectively be used as a “master kill switch” to prevent accidental spoiler or throttle inputs during flight. This will be beneficial when the glider is very far away and it will be impossible to quickly notice if the spoilers or the throttle have been accidentally turned on.

In addition to the selectable function of the left axis stick, different rates of elevator to throttle and elevator to spoiler coupling will be added to further reduce the pilot workload while in flight.

One last reduction of the pilot workload will be to combine the rudder control onto the right axis stick for single-stick flying.

This setup will reduce the pilot workload to only three widgets, but will still allow the full range of control for the RES-Electric sailplane.

11.1. PROGRAMMING SOLUTION

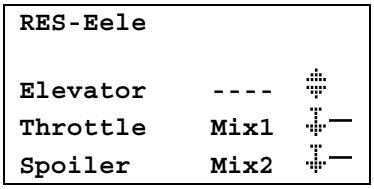
The solution to this programming setup is rather unorthodox and goes against some conventional EVO programming guidelines, but it works well and further demonstrates that the EVO can be configured to work in a variety of ways with a little bit of thinking outside of the box.

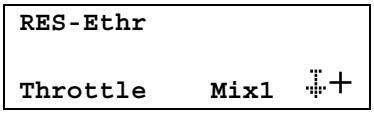
The answer to this programming set up is to use three custom made mixers and a combination of the Mix1 and Mix2 software switches.

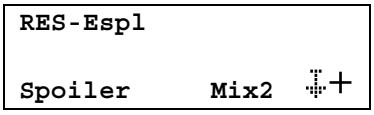
This solution also avoids having to use a Flight Phase (FP) assigned to a switch widget, and thus, frees this tool for additional functions if the pilot determines later that a FP would be of benefit.

11.2. UNIQUE MIXERS THAT ARE NEEDED

There will be three custom mixers that will be needed. Create these mixers as shown below in the Mixer definition menu.







Conventional EVO programming specifies that if there is only a single control listed in a mixer, a mixer is not necessary; the pilot would just assign the control to a widget.

But in this case, assigning the spoiler or the throttle control directly to a widget will not allow the pilot to attach a “Mix1” or “Mix2” software switch to the control. This is why the last two unorthodox mixer definitions are necessary.

11.3. CONTROL WIDGET ASSIGNMENTS

Assign both the throttle control and the spoiler control to the left axis stick. Be sure that the left axis stick remains in the down position when selecting **ENTER** to confirm your selection.

11.4. SWITCH WIDGET ASSIGNMENT

Assign the “O” widget in the up-most position as “Mix1” in the bottom-most position as “Mix2”.

11.5. SERVO ASSIGNMENTS

Assign the elevator servo to the **"RES-Eele"** mixer.

Assign the throttle servo (the ESC) to the **"RES-Ethr"** mixer.

Assign the spoiler servo to the **"RES-Espl"** mixer.

11.6. MIXER TRAVEL SETTINGS

As a starting point, set the servo travels within each mixer to the following settings:

RES-Eele		
Elevator	----	100%
Throttle	15%	25%
Spoiler	30%	50%

RES-Ethr		
Throttle	-100%	100%

RES-Espl		
Spoiler	-100%	100%

11.7. MIXER RESULTS AND EXPLANATIONS

Because the throttle control is set to the "Mix1" software switch, the left stick will only enable the throttle when the "O" widget is moved to its upper-most vertical position. The spoiler servo will not move at this time since it is programmed to move only when the "Mix2" software switch is enabled (which is when the "O" widget is set in its lowest-most position.)

When the "Mix2" switch position is enabled, the left axis stick will control the spoiler only.

The elevator compensation for throttle and spoiler is handled within the "RES-Eele" mixer.

11.7.1. THROTTLE > ELEVATOR COMPENSATION EXPLAINED

Throttle	15%	25%

Because this input was originally defined as “single-sided linear with dead zone” when the mixer was created, it allows the pilot to determine at what point should the elevator servo begin to move when the throttle control (the left axis stick) is moved from it’s lowest position of no throttle to its highest position of full throttle.

Consider this, in an electric glider and especially at low throttle speeds it may not be necessary or even desirable to have the elevator servo attempt to compensate. At higher throttle settings, it may be very necessary to have the elevator compensate the effects of the higher throttle setting.

What the above mixer line is saying is that as the throttle control (the left axis stick) is being moved from its lowest position of 0% travel until it reaches a point 15% along its total travel, don’t add any elevator compensation. This is what the term “dead zone” refers to when setting mixer options in the mixer definition stage. In this example, the dead zone (of which there will be no elevator signal sent to the elevator servo) is from 0%-15% when the throttle (the left axis stick) is moved.

Once the 15% point is passed on the throttle control however, the mixer is instructing the elevator to add a maximum 25% of travel in a linear fashion.

If immediate elevator compensation is desired from the instant that the throttle control widget is moved, change the RES-Eele mixer to the following:

RES-Ethr		
Throttle	Off	100%

This setting will give elevator compensation as soon as the throttle widget is advanced.

11.7.2. SPOILER > ELEVATOR COMPENSATION EXPLAINED

Spoiler	30%	50%

Because this mixer input line also was originally defined as “single-sided linear with dead zone” when the mixer was created, it allows the pilot to determine at what point should the elevator servo begin to move when the spoiler control (the left axis stick) is moved from it’s lowest position of no spoiler to its highest position of full spoiler.

Remember, that the left axis stick is being used for BOTH the spoiler control as well as the throttle control. The position of the widget “O” determines which control is being enabled as the left axis stick is moved.

In this example, because the elevator doesn’t need to compensate much when the spoiler is initially deployed, the dead zone is set to 30%. As the spoiler is deployed in flight, the elevator will not attempt to compensate until the spoiler control (the left axis stick) passes beyond the 30% trigger point in the widget movement travel.

Once this occurs, the mixer is instructing the elevator servo to move up to 50% (in a linear fashion) of its travel to compensate for the full spoiler deployment.

This means basically, that full spoiler is going to drop the glider like a rock and much more elevator compensation will be necessary to maintain the flight path, but lesser amounts of spoiler deployment (less than 30% spoiler deployment in this example) will not need to have any elevator compensation. In this example, the dead zone for elevator compensation when the spoiler control is enabled is from 0% to 30%.

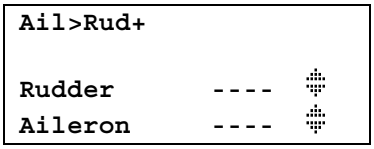
This gives elevator compensation when the spoiler is opened.

11.8. AILERON > RUDDER COUPLING

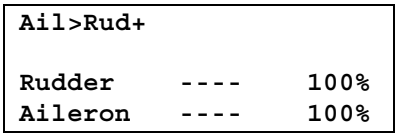
Assign the ailerons to rudder coupling to one of the digi-adjusters (DA) for fine tuning in flight and for quickly setting pilot preferences. In the Mixer menu, select the "Combi…" listing. Under the Combi screen, make sure that the Aileron > Rudder option is displayed and press the Digi-Adjuster button at the bottom of the transmitter. Press either the left or the right DA as desired. The coupling rate can now be adjusted while in flight. Be sure that a widget has been assigned to the Combi function and that it is currently positioned to the "On" position.

11.8.1. AUTOMATIC AILERON > RUDDER COUPLING USING A MIXER

Another way to eliminate pilot workload is to create a custom mixer for the rudder servo that has the following settings:



The travel distances for this mixer should be set to the following:



Assign the rudder servo to the "Ail>Rud+" mixer.

This will cause the aileron control (the right stick on a mode 2 setting in the EVO) to make the rudder servo move. Because the aileron control input is set to be always on within the mixer definition, the pilot will not need to be concerned about flipping a widget to enable coupled aileron > rudder flight.

The EVO will still allow the aileron control within the Ail>Rud+ mixer to be assigned to one of the DA for fine tuning in flight. Highlight the 100% value for the Aileron control in the Ail>Rud+ mixer screen, press the digi-adjuster button at the bottom of the transmitter and then press either one of the DA buttons at the top of the transmitter.

Note:

The numerical values in the mixers in this chapter are purely for instructional purposes only and each plane will need to be adjusted individually to suit pilot and plane preferences.

12. EXAMPLE SCENARIOS

As the tutorial has demonstrated, the EVO is a very flexible and powerful transmitter. The below listed scenarios and their necessary mixers will allow the reader to realize the possibilities and strengths of utilizing MPX mixers.

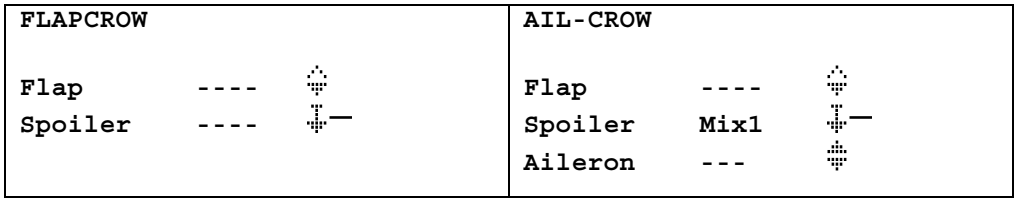
12.1. SELECTABLE CROW (BUTTERFLY) BRAKING

The pilot would like to have a full house glider to have crow braking enabled when the spoiler control is activated. Enabling the Crow function should be handled with a switch widget, which will allow the pilot to switch from full Crow to flaps-only landing setups.

Controls	**Widgets**
Flap control	"F" slider
Spoiler control	Left axis stick
Aileron control	Right axis stick
Crow control	"N" switch as "MIX1"

Two custom mixers will be needed. The **"FLAPCROW"** mixer will be for the flap servos and the **"AIL-CROW"** mixer will have the aileron servos assigned to it.

Define the mixers in the Setup – Mixer def menu to the following:



Set the mixer values in the mixer menu to the following settings:

FLAPCROW			AIL-CROW		
Flap	30%	10%	Flap	30%	10%
Spoiler	OFF	100%	Spoiler	OFF	-70% MIX1
			Aileron	---	100%

Comments:

Since the “F” slider is sending the same amount of servo travel to both the flap servos and to the aileron servos, it will allow for full wingspan camber and reflex. At the neutral point of the “F” slider, the flap and aileron surfaces will be at their neutral positions.

The spoiler control is always set to command the flap servos to move up to 100% of their travels. The output curve is **single-sided, linear with dead zone** which will allow the spoiler widget to be in the all the way up or down position resulting in a neutral position for the flaps.

When the “MIX1” switch is enabled (the “N” widget), moving the spoiler control will cause the ailerons to travel upward to about –70% of their travel limits. With the “MIX1” switch off, the spoiler control will not affect the ailerons.

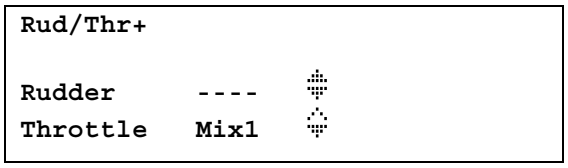
The aileron control will affect the aileron servos up to 100% of their travel distances.

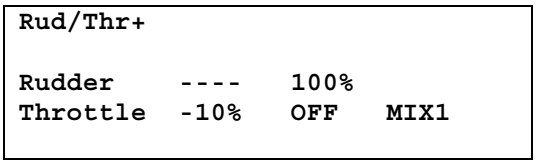
12.2. RUDDER COMPENSATION WITH THROTTLE TRAVEL

The pilot would like to have the EVO automatically add a small amount of rudder to compensate for torque forces during rolling takeoffs. Since the pilot does not want this compensation to always remain on, it should be selectable.

Controls	**Widgets**
Throttle control	Left axis stick (vertically)
Rudder control	Left axis stick (horizontally)
R/T compensation	"N" switch as "MIX1"

Only one mixer will have to be made. The rudder servo will be assigned to it.





Comments:

The rudder control will affect the rudder servo at all times to 100% of its travel distances.

When the "N" widget is in the ON position, advancing the throttle will move the rudder 10% of its travel distance only to one side. When the "N" widget is in the OFF position, there will be no rudder/throttle compensation.

The throttle setting in the mixer may need to be reversed depending on servo installation.

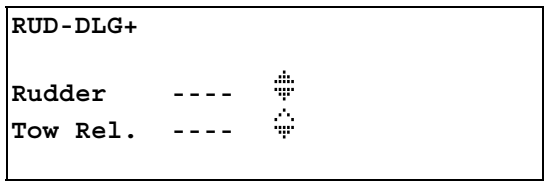
By setting the control switch setting, the rudder servo can be set to give compensation at only high ends of throttle travel such as 90%, for example.

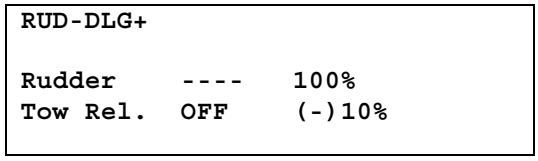
12.3. A DISCUS-LAUNCH MOMENTARY RUDDER PRESET

A pilot would like to have a momentary rudder compensation for launching discus-launched gliders. The pilot does not want to use a Flight Phase for this.

Controls	Widgets
Tow Rel. control	"M" widget (momentary action)
Rudder control	Left axis stick (horizontally)

Only one mixer will be needed. The rudder servo(s) will be assigned to it.





Comments:

The rudder control will affect the rudder servo at all times to 100% of its travel distances.

While the "M" widget is held down, it will enable the Tow Release control, which is set in the above mixer to provide 10% of rudder travel in one direction. The pilot may need to adjust this setting depending on how the rudder servos are installed.

This mixer demonstrates taking advantage of a control that is not being utilized for mixing purposes.

12.4. AUTOMATIC ELEVATOR COMPENSATION WITH THROTTLE AND SPOILER DEPLOYMENT

The pilot desires to program the EVO to automatically give elevator compensation when the throttle and the spoiler controls are deployed.

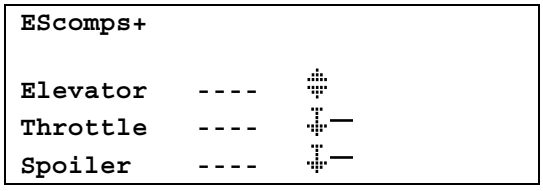
Controls	Widgets
Throttle control	Left axis stick (vertically)
Spoiler control	"E" slider widget
Elevator control	Right axis stick (vertically)

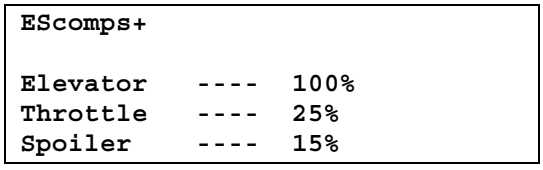
In this scenario, the elevator surface on the model should move when three events occur:

1) ***When the elevator widget is moved, the elevator servo should move.***
2) ***When the throttle widget is moved, the elevator servo should compensate.***
3) ***When the spoiler widget is moved, the elevator servo should compensate.***

Since this scenario has three data streams that must somehow reach the elevator servo and by the fact that there is only one physical plug ending on the elevator servo, a MPX mixer is needed in order to get all three data streams to the elevator servo.

Only one mixer will be to be created. The elevator servo will be assigned to it.





(The Throttle and Spoiler values may need to be converted to a negative number depending on how the servos are installed in the plane.)

Comments:

When the elevator widget is moved, the elevator servo will travel to its 100% position from BOTH sides of the center position. This is because its movement action was set in the mixer definition as being symmetrical.

When the Throttle widget is moved, the elevator servo will only move 25% of its total travel from the center position in one direction only. This is because its movement action was set in the mixer definition as single-sided with dead zone.

When the Spoiler widget is moved, the elevator servo will only move 15% of its total travel from the center position in one direction only. Again, this is a result of the servo action being set as single-sided with dead zone during the mixer definition stage.

12.5. AUTOMATIC RUDDER DUAL RATE WHEN FLAPERONS ARE DEPLOYED PAST A CERTAIN POINT

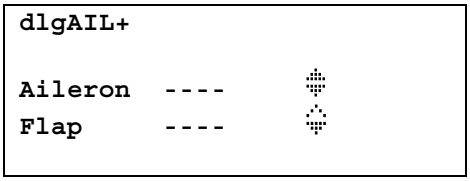
The pilot desires to fly a DLG on a single stick, but notices that when flaperons are deployed steeply, the control of DLG begins to diminish. In order to add greater control authority, it is necessary to use greater amounts of rudder travel. Instead of a separate rudder control dual rate, this programming solution allows for an automatic rudder dual rate that is triggered by the flaperon setting.

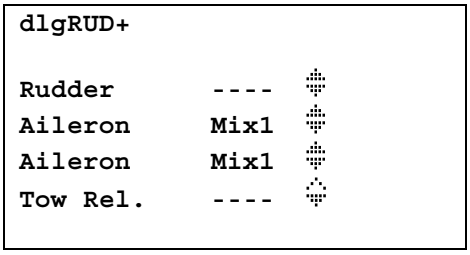
This idea is credited to Mark Drela, but the instructions are the authors'.

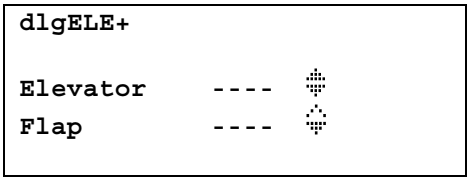
This example plane is a DLG with Flaperons and separate elevator and rudder servos. Note that this scenario is also using a rudder pre-set activated by the Tow Release control which is assigned to the "M" button.

Create the following mixers:

(Use these names or create your own)







Assign the following widget controls:

Controls	Widgets
Flap/RPM control	Left Axis Stick (“ON” is down)
Tow Rel. control	M Button

Assign the following widget switches:

Switches	Widgets
Mix-1	Left Axis Stick (“ON” is down)
Combi.Switch	“I” widget (“ON” is upwards)

Set the control switch point on the left axis stick to “ON” at –65% of travel. The control switch point is accessed by pressing the CONTROL button at the bottom of the transmitter case and then selecting the “Contr. Switch” listing, which is the last item listed on the menu.

Access the MIXER Menu and set the travel for the CombiSwitch to 15%.

Set the travels for the dlgELE+ and the dlgAIL+ to the settings that are needed for your model.

On the dlgRUD+ mixer, use the initial following settings:

dlgRUD+		
Rudder	----	100%
Aileron	----	30%
Aileron	----	-30%
Tow Rel.	20%	OFF

The reader will most likely need to adjust these initial settings for their models.

Comments:

The CombiSwitch function can take care of the ordinary rudder coupling on the right axis stick, but the dlgRUD+ mixer will allow for a dynamic alternate coupling rate of the rudder control.

The greater rudder travel setting in the dlgRUD+ mixer (30% as compared to the 15% that was set with the Combi.switch setting) will only happen when the Mix1 switch has been enabled.

The Mix1 one switch was assigned to the left axis stick, but since this widget isn't a switch (it's really just a plain old slider), the EVO needs to be told at what point should the slider "switch" on or off. This was done by entering a value for the Control Switch.

In this example, the Control Switch "trigger point" was set to –65%.

The flaps are also set to this same widget (the left axis stick). When the stick is pulled down, the ailerons will act like flaperons. This is a result of the flap control being listed in the dlgAIL+ mixer.

When the travel distance of the left axis stick triggers the control switch (passes the –65% travel point), the Mix1 controls listed in the dlgRUD+ definition are turned "ON".

In this case, it means that the rudder travel will be changing from 15% (the amount that was set to the CombiSwitch setting) to 30% and –30% which is the amount of travel that was entered into the eleRUD+ mixer setting.

Note that the Combi.switch is still transmitting the 15% value, but since the dlgAIL+ mixer is sending a greater travel instruction, the end result is that the 15% signal from the Combi.switch is not observed on the plane.

The negative number (-30%) in the dlgAIL+ mixer will allow for symmetrical rudder travel since the rudder servo center point is considered "zero", positive and negative travel values will allow the rudder servo to move left and right from the servo center position.

This gives an automatic increase in the amount of rudder travel when the flaperons are lowered past a certain point, which in turn will give a greater amount of control authority while still allowing for single stick flying on the right axis stick.

12.6. SNAP FLAPS

The pilot desires to have the flaps assist with the elevator control to allow the plane to respond more forcefully to elevator input. This is commonly known as Snap Flaps (SF).

Since minor adjustments of the elevator control should not cause the flaps to move, it is necessary to establish a range of elevator control that do not cause the flaps to move until this range is exceeded. When the specified elevator travel range has been exceeded, the flaps will move in conjunction with the elevator servo(s) to intensify the elevator control response.

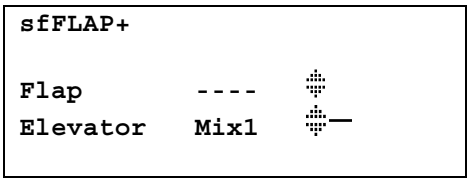
Snap flaps are commonly used for aerobatic maneuvers and to assist in racing events where quick turns are necessary.

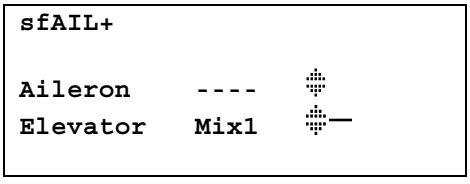
The pilot desires to be able to turn the SF facility on an off with the selection of a switch widget.

This scenario also assumes that the pilot's plane features separate flap and aileron flying surfaces for added complexity and demonstration purposes only.

Create the following mixers:

(Use these names or create your own)





Assign the following widget controls:

Controls	Widgets
Flap	Left Axis Stick (“ON” is down)
Elevator	Right Axis Stick (Mode 2 operation)
Aileron	Right Axis Stick (Mode 2 operation)

Assign the following widget switches:

Switches	Widgets
Mix-1	“I” widget (“ON” is down)

Assign the sfFLAP+ mixer to the flap servos.

Assign the sfAIL+ to the aileron servos.

Use these initial following travel values for the following mixers:

sfFLAP+		
Flap	**----**	**100%**
Elevator	**33%**	**30%**

sfAIL+		
Aileron	**----**	**100%**
Elevator	**33%**	**30%**

The reader will likely need to adjust these initial settings for their models.

Comments:

The flap servos will respond when the flap widget (the left axis stick in the scenario) is moved. The flap servos will also respond when the elevator widget is moved, but since the elevator servo was programmed with a symmetrical with dead zone curve when the mixers

sfFLAP+ and sfAIL+ were created, the elevator widget will only effect the flaps and the ailerons when two events occur:

1. **When the Mix1 switch (the "I" widget) is "ON"**
2. **When the dead band zone of 33% is exceeded**

The initial elevator compensation has been set to a maximum of 30% of travel. This value will need be adjusted differently as the pilot determines.

Another possible benefit of using a SF function is to use it in conjunction with a specific Flight Phase. This will benefit the pilot in that the FP name displayed on the screen will notify the pilot that the SF function has been enabled.

To do this, simply assign the Flight Phase to the same widget as the Mix1 switch. An example could be to assign the "SPEED1" Flight Phase to the "I" widget with the "ON" position being downwards as well as assign the Mix1 switch to the "I" widget with the "ON" position being downwards.

The end result would be that the Snap Flaps would only be turned "ON" when the SPEED1 Flight Phase is enabled (the "I" widget is moved downwards.)

12.7. SNAP ROLL

The idea and general programming approach for this scenario is credited to Harry Curzon, but the instructions are the author's.

The pilot desires to have a facility that allows for snap rolls with the activation of a widget. The example plane used in this scenario has a total of four flying surfaces – elevator, rudder, left aileron and right aileron.

In this scenario, it will be assumed that the pilot desires to have the two button widgets "M" and "H" automatically move the ailerons to a pre-set position for counterclockwise and clockwise axial rolls. These widgets will be set for momentary action. When released, the ailerons will return to neutral position automatically.

To further add and demonstrate additional abilities of the EVO, the pilot should have access to three different snap roll "rates" while flying. One snap roll rate will provide only 25% of aileron travel and the other two should provide 50% and 75% roll "rates" respectively. The f Snap Roll "rates" will be determined by the position of a three-position widget.

This programming approach takes advantage of the following capabilities of the EVO – fixed values, flight phases and the software switches Mix1-Mix2.

On the EVO, the flap and spoiler controls are capable of fixed values. Fixed values are a way of automatically moving the flaps or spoiler surfaces to a pre-set position irregardless of the position of a widget that has been assigned to control the flaps or the spoilers. Fixed values also have the added benefit of being assignable to multiple flight phases with different fixed values.

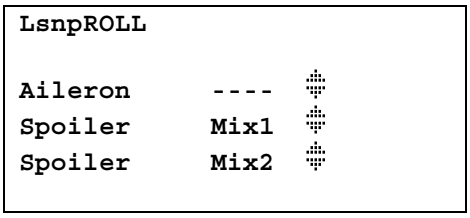
The drawback to using fixed values, though, is that they cannot be assigned to a widget or controlled by a widget. However, by utilizing flight phases (which **can** be assigned to a widget) and the ability to link fixed values to a specific flight phase, the EVO provides the pilot with a crafty work around for this limitation.

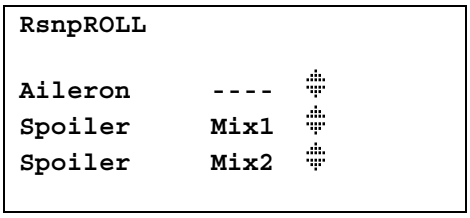
While this example plane does not have spoiler flying surfaces and will not require a widget to be assigned to the spoiler, a data stream from the spoiler channel can still be generated by the EVO. To do this, two custom mixers will be created that will allow the ailerons to receive instructions from a spoiler channel that will not have a widget assigned to it or, furthermore, even have a spoiler surface on the plane! Instead, a flight phase will be programmed to generate a spoiler signal through the use of the fixed values property.

Two mixers will be needed for this example.

Create the following mixers:

(Use these names or create your own)





If your assigned template has the spoiler control assigned to a widget, delete this assignment now. A spoiler widget will not be necessary for this scenario and may cause confusion if inadvertently activated.

Assign the following widget controls:

Controls	Widgets
Rudder	Left Axis Stick
Elevator	Right Axis Stick (Mode 2)
Aileron	Right Axis Stick (Mode 2)

Assign the following widget switches:

Switches	Widgets
Mix-1	"M" widget (momentary action)
Mix-2	"H" widget (momentary action)
Phase 1	"J" widget (upwards for "ON")
Phase 2	"J" widget (center for "ON")
Phase 3	"J" widget (downwards for "ON")
Main Phase	"I" widget (downwards for "ON")

Select "SPEED1" for the flight phase (FP) number 1, "SPEED2" for FP number 2, "3D" for FP number 3 and "NORMAL" for FP number 4.

Press the CONTROLS button at the bottom of the transmitter. Navigate to the spoiler control and change the fixed value for FP number 1 to 25%. For FP number 2, change the value to 50% and for FP number 3, change the value to 100%. The "Normal" FP (phase numbered 4) will **not** have fixed value for the spoiler, so the fixed value should be set to "OFF."

Assign the LsnpROLL mixer to the left aileron servo through the SERVO menu.

Assign the RsnpROLL mixer to the right aileron servo through the SERVO menu.

Enter these values for the mixers in the MIXER menu.

```
LsnpROLL

Aileron   ----  100%
Spoiler   ----  100%  Mix1
Spoiler   ----  -100% Mix2
```

```
RsnpROLL

Aileron   ----  100%
Spoiler   ----  -100% Mix1
Spoiler   ----  100%  Mix2
```

Comments:

When the "I" widget is downwards to the "ON" position, the aileron servos will respond to the right axis widget at all times up to 100% of their programmed travel distances.

Because the LsnpROLL and the RsnpROLL mixers list the spoiler control as an input, the ailerons will also respond when the spoiler control is activated.

Although there is no widget assigned to the spoiler control nor is there a spoiler surface on the plane, the EVO can still produce a spoiler control data stream by using the fixed value facility.

Since a fixed value for the spoilers has been entered for the "SPEED1", "SPEED2", and "3D" flight phases, a spoiler control data stream is generated when these phases are activated.

When the "I" widget is moved upwards, the Main Phase ("NORMAL" FP) is turned off, which allows the "J" three position widget to enable the "SPEED1", "SPEED2" or the "3D" FP.

The spoiler data stream for the FP "SPEED1", "SPEED2" and "3D" have been set to 25%, 50% and 100% respectively.

When one of these FPs is activated by the "J" three position widget, a 25%, 50% or 100% spoiler data stream is generated.

The LsnpROLL and the RsnpROLL mixers instruct the aileron servos to move when two events occur – when the aileron widget is moved and when either the Mix1 or the Mix2 switch is enabled.

1. **When the Mix1 switch is depressed and held down (the "M" widget), the LsnpROLL and the RsnpROLL mixer instructs that either 100% or –100% of the spoiler fixed value should be sent to the aileron servo. The amount of fixed value of the spoiler channel is determined by the position of the "J" widget. When the "J" widget is upwards, 25% of spoiler input will effect the aileron servos. When the "J" widget is in the center position, 50% of the spoiler input will effect the aileron servos and when the "J" widget is in the downward position, 100% of spoiler input will effect the aileron servos.**

2. **When the Mix2 switch is depressed and held down, the LsnpROLL and the RsnpROLL mixer instructs that either 100% or –100% of the fixed value should be sent to the aileron servo. (The negative number "reverses" the direction of the aileron servo for an opposite roll effect.) The amount of fixed value of the spoiler channel is determined by the position of the "J" widget as described above.**

When neither the Mix1 nor the Mix2 software switch is activated (neither “M” nor “H” widgets are depressed), the only widget that will command the aileron servos is the aileron control (right axis widget).

It is important to note that two mixers are necessary to obtain the proper operation of the aileron servos. This is not due to a conflict with the aileron sequencing rule, but due to the nature of how the EVO considers the spoiler channel.

If only one mixer is created and used, when the spoiler control is enabled by the use of either the “M” or the “H” widgets, both aileron surfaces will move as spoilerons or as flaperons. By using two separate mixers for the left and the right aileron servos, the direction of each spoiler input into each mixer can be adjusted for proper aileron action.

If the aileron travel results are backwards, then alter the spoiler values in the LsnpROLL mixer from positive to negative. Do the same for the RsnpROLL mixer.

Some pilots may elect to simplify this scenario by assigning the “J” widget to also be the Mix1 and Mix2 switches in upward and downward positions. The center position can be set to the “NORMAL” flight phase. This will reduce some pilot workload, but it will also eliminate the multiple snap roll “rates” option.

Note that ailerons are not the only surfaces that can be assigned to a snap roll function. The elevator and rudder control can be assigned to custom mixers that make use of the spoiler or the flap control fixed value property in conjunction with flight phases. This opens the possibility of specific “snap” surface settings that the pilot desires for certain maneuvers. This allows for a pre-set snap setting for ailerons, elevator and rudder if desired.

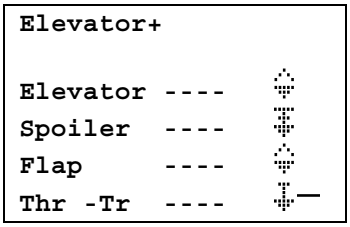
Another possible refinement is to assign the Mix1 switch to the momentary button on the long axis stick (KTa). This would allow pilots to perform a single-direction snap roll without needing to remove their fingers from the long axis stick. The opposite snap roll direction (Mix2) could be assigned to the other button on the long axis stick, KSw. Although this widget cannot be set to momentary action, it can still be utilized for snap functions if the pilot desires.

13. ORIGINAL MULTIPLEX MIXER DEFINITIONS

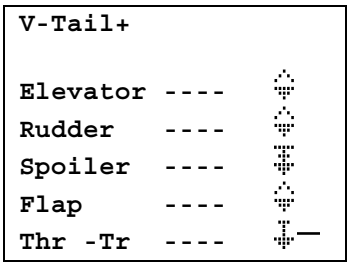
The original factory-established settings of the mixers that come pre-programmed into the EVO are shown below.

If the reader has accidentally erased or modified the original mixers to where they no longer work as designed, the original mixer settings are shown below.

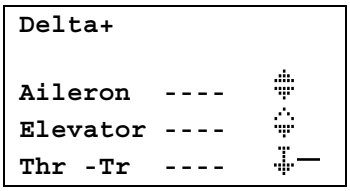
13.1. ELEVATOR+



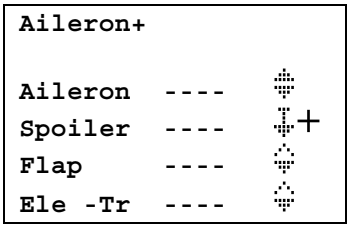
13.2. V-TAIL+



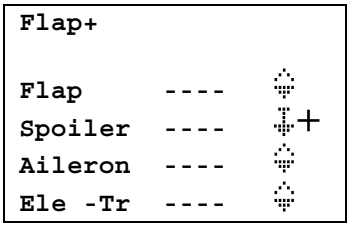
13.3. DELTA+



13.4. AILERON+



13.5. FLAP+



14. ACKNOWLEDGEMENTS AND CREDITS

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To all of the individuals who wrote to say that this tutorial either convinced them to purchase an EVO or that the tutorial allowed them to fully enjoy and understand the possibilities of their EVO.

To all of the individuals who wrote personal notes thanking me for this tutorial.

Fly Multiplex!

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