

# Helicopter

# MIXING

## Introduction

One of the mixed (no pun intended!) blessings of modern radio equipment is the amount of functionality provided. With such a wealth of abilities it is easy to get confused and start typing all the wrong things into that lovely LCD screen! Fear not because help is at hand. Luckily JR radio is some of the easiest to program systems around, and with the advent of super precise piezo gyros life is becoming much easier for us pilots.

## Revolution Mixing

First up is probably all our primary introduction to the modern radio set and helicopter mixing, revolution mixing (or ATS). What is it, and how do we use it? Simply when a helicopters throttle/collective is varied then the torque on the helicopter changes too. To counter act this we would normally feed a small amount of tail rotor in to correct any swing of the model. (Naturally if you are running a heading hold gyro in heading hold mode you can ignore this!). Revolution mixing effectively does this for you, but you have to program it to tell you how much you need. This is simply a job of trial and error.



Revolution Mixing on X-3810

When you climb with the model you will probably notice a small swing to the left, and when you descend, a small swing to the right. Therefore using the revolution mix you want to set it up so that it knows which direction to put in the correction for you. The actual set-up differs from Tx to Tx but the basic principle will be the same throughout, although some transmitters may have more features and ability than others. First of all the transmitter needs to know your hover point, and possibly where zero pitch is. Then it's just a case of adjusting the up and the down values until you eradicate the swing from your model. This can also be used in aerobatics too, not just hovering.

## Cyclic/Tail Rotor to Throttle Mixing

The next form of mixing is to overcome the loss of power when control commands are put in to the model. Obviously any form of control is going to add or remove pitch from the blades, and therefore change the amount of power required from the engine to hold a steady height.



Aileron to Throttle mixing on X-3810

Cyclic to throttle mixing is generally only required in aerobatics, so that when a large cyclic command is put in that the engine doesn't bog down. The PCM 10x has a dedicated mixing system for this, although it is easy enough to implement in a standard mix. All you need to do is select Aileron or Elevator as the primary channel, and mix it to the Throttle channel. Then you need to set the mix to about 20% in both directions. This may be negative or positive 20%, you need to check the model and make sure you are increasing the throttle when the cyclic is moved, and not decreasing it!

The same system applies to the tail rotor control, but only in the hover. With a clockwise rotating helicopter you will want to increase the power with right tail rotor, and reduce it with left tail rotor.

One downside with this mixing is that if you don't have a PCM10x with a built in mix, that you are in danger of over travelling the throttle servo and causing it to damage itself or the model. To overcome this simply set the throttle travel to 150% either way, and then readjust the linkage to prevent binding (shorter servo arm, longer throttle arm). This way if you are at 100% throttle and the transmitter ask for more power, the servo can not move any further mechanically or electronically, therefore stopping it travelling too far. If the travel adjust was only at 100%, then the servo would still have another 50% available!

## Swashplate Timing

This is the daddy of the mixing world. Although the theory and depth behind the need for it is

beyond the scope of this article it is very important you understand how to use it! The basic problem is that the theory of 90 degree gyroscopic procession is never quite true on the model helicopter. You will probably find it's about 85 or 95 degrees. This means that when you input a control, such as up elevator, you may get a little aileron control as well. This means that the controls are not pure, and can cause havoc when you are trying to do aerobatics. Clearly when you do a roll you don't want any elevator command interfering and causing the model to not roll axially.

Again most transmitters have a function for this built in. And it is a simple case of activating it and playing around with the percentages



Built in Swashplate Timing with PCM10x

until the interaction is minimalised. The easiest way to check whether you need it is to perform a loop but away from yourself. As the model pulls up it should track round and exit the loop on the same heading to which it entered it. If this is not the case, note which way it is rolling off and land. In the Swashplate Timing function adjust up elevator so that it gives you the corrective aileron response. If you have the ability to adjust the values separately for all control directions, then you will need to set these too. Most transmitters just have one general percentage value that covers all control directions.

To give you greater control, or if you are using CCPM, you will need to do this manually. Again this is not as hard as it seems. Simply choose a free mixer, and select the control that is not pure and mix it to the other cyclic control. For example if when you loop the model is rolling out, then choose elevator as the primary channel, and aileron as the secondary channel. If the model pulls its nose up or down during a roll, then select aileron as the primary channel and elevator as the secondary channel. Then simply adjust the end point to be around 5% to start with (positive or negative depending on what you

need). The chances are that in the opposite cyclic direction you will probably need an equal and opposite value of what you have just entered. This will give you a straight line curve going from about -5% to 5%.

## General Tips

To make life easier for you always choose to have the mix active on the throttle hold as well as on the normal/stunt modes (where applicable). This allows you to check the direction of a mix on the ground with out the need to stop the engine, or to be in stunt mode. This clearly helps with the cyclic to throttle mixing and the swashplate timing function as the transmitter deals in positive and negative percentages, and you will be working in left/right and up/down! Therefore you can check on the ground in throttle hold what you have just programmed before risking it in the air!

Always start with small values of around 5% and increase from there. These are powerful functions and large percentages could cause control difficulties!



Manual Swashplate Timing with PCM10x

Finally don't be afraid to experiment. This is how you learn most, and you will get a greater understanding of the model and the mechanics of its flight. The manufacturers provide you with these facilities in the transmitter so give them a try! You will be surprised how much easier you can make the model fly!