How to set up your model aircraft correctly

It is very easy with modern computerised transmitters to set a model up quickly using the multitude of software functions but that doesn't necessarily mean it will be set up as it should be to ensure the ultimate performance, or just to fly straight..!

Regardless of the manufacturer of the radio equipment you use, most of this process will identical. Where you find settings such as sub trim, trims, rates and exponential may differ in the menu structure of different brands, but the process is still the same

The setup is such an important part of getting the best possible performance from your plane yet many don't take the time or maybe have the knowledge to do it correctly. Follow this guide and your plane will be set up to give the best possible performance.

Now.! a good radio setup will not compensate for an aircraft that isn't built straight. Check the aircraft carefully for warps or any deviation in flight or control surfaces. Where necessary, make amends to any surface to ensure that it's straight and that wings and tailplanes are mounted squarely and securely.

Installation of the Receiver (RX) is important. It must be secured (not floating around, especially if the RX has a gyro inside.!). The Receiver (RX) ideally needs to be placed far from metal components (including wiring) and away from the battery and ESC/motor. The aerial should also be placed as far away from carbon fibre rods and components covered in carbon fibre (There are special Rx's that have longer aerials that can be located external to the fuselage if it is made of Carbon fibre).

For 2.4Ghz radios, the active part of the aerial is the silver portion at the end of the leads. It is 30mm in length. The remainder is merely the wire to connect the aerial to the RX and is shielded, so receives no signal. If there are 2 aerials the ends should be placed at 90 deg to one another. This is called Diversity Reception and ensures that an aerial will always be visible to radio signal.

If there is a satellite Rx then it should be placed as far from the main unit as possible and follow the same rules. Also remember if you cover your model in a covering containing metal then this will also shield the aerials and reduce the signal. If there are no visible aerials then it is internal to the Rx and the whole RX should be placed following these rules

CAUTION

The first thing you should do is **remove your prop.** When messing around with settings the last thing you want is for the motor to start running. That can lead to a bad day! Better still, consider using a receiver battery to power the radio and totally unplug the ESC from the receiver for the time being.

Basic Model Setup (there are some advanced notes at the end of the document)

When setting up a model you are doing so to fly it in the style that you want or that is suited to the aircraft and to give the response that needed to do so. You cannot have a model, for instance, that will perform both 3D and normal aerobatics AND be perfectly set up for both. You would need to compromise and any compromise means it isn't giving of its best.

First, you need to know what the maximum throws that you require are. The manufacturer will usually give some guidance on this. You are trying to achieve these when you are at maximum stick movement on the TX and maximum rates.

ON YOUR TRANSMITTER (TX) Make sure all your trims and sub trims are set to zero.

Power on the receiver (and ensure it is bound to the Tx - i.e. you have control of the surfaces).

If all of the servo arms are EXACTLY at 90 deg to the servo body then fine but this is highly unlikely.

For each servo in turn that isn't at exactly 90 deg, remove the servo arm and reposition it on the spline that puts it **nearest** to 90 deg.* Repeat for Rudder, Elevator, Ailerons. Now you can go to the sub trim menu and adjust the settings to get each arm EXACTLY at 90 deg to the servo body (**Totally ignore** the position of the flight surfaces while doing this). Note: if the ailerons are on a Y lead then you do as above but when using the sub-trim you may need to compromise and use the setting that puts both servo arms as close to 90 deg as possible. If possible, the servos should be on separate channels to avoid this compromise

Now adjust the length of each pushrod to get the control surfaces at the neutral position. with the clevises in the holes you believe to give maximum throws you require. Now check that at maximum stick movement on 100% rates you have the correct throws.. If not then move the clevises to new holes to achieve it - further out on servo arm and further in on control horn increases movement and vice versa. Again note, use the shortest arms and horns possible to achieve the throws desired.** Readjust the control rod lengths to achieve the neutral position on all surfaces

It is only now that you start to set the rates and exponential settings to finalise the throws and feel that suits you.
Remember, the Expo setting on your TX is specific to the manufacturer. Expo is used for softer control around the centre of the servo throw, allowing for large movements of control surface without losing the finer control around the centre of the stick movement.
Futaba and most other radio systems use negative expo, while Spektrum and JR use positive expo. Check before flight or expect an exciting maiden flight.!

Setting up the Electronic Speed Control (ESC)
For an electric model, now reconnect your ESC and carry out a calibration. Your throttle cut should give the same setting as the throttle stick being fully closed. Do not have it at a greater setting as this can corrupt the calibration.
For the large majority of ESC's, this process will work:
Ensure that your model is restrained and that you stay out of the prop sweep. Ensure that there are no loose objects near the plane. With the battery disconnected (Rx not powered) put the Transmitter throttle at full open with the throttle cut off. Plug the battery in to power the ESC ensuring you stay away from the prop, you may or may not hear some beeps. Move the throttle to fully closed. Apply the throttle cut and disconnect the battery to make the plane safe. The ESC should now have learned the max and min settings of the throttle.

Failsafe

Still with the plane restrained check the failsafe is correctly set to cut the throttle on an electric model (and reduce to tick-over on an IC model). Note: if your equipment is capable of having a failsafe set then you are legally required to set it up correctly. If your model weighs more than 7.5kg it MUST have a failsafe. To check if it works as it should apply just a little power to the motor. Turn the Transmitter off (or use the setting that turns the radio output off if you have one) and confirm the motor stops (or goes to tick-over/idle for an IC). If the setting is incorrect then put the throttle to minimum and check the fail-safe process, referring to manufacturers' instructions.
Note: On some more capable Receivers it is also possible to set the position that the flight surfaces go to in the event of a loss of signal. To achieve this, program the surface defelctions in the positions to give the required surface movement, either by holding the sticks or setting values. Otherwise the default setting is Hold Last Position.

Range Test
Perform a range test as described for your radio equipment, this is crucial to ensure that you will have full control of your model. Finding out that your radio signal is weak after you've taken off will very rarely end well.!

Centre of Gravity
Check that your C of G (Centre of Gravity) is set within the defined range for the model. In general, the more forward the C of G within the range the more stable, the more rearward the less stable. 3D models usually have a rearward C of G compared to other models.

Control Function Check
Check and double check all surfaces are moving freely in the correct direction (look at BOTH ailerons when doing this check if they are on separate channels).

You should now be ready to carry out your first flight – just be sure you have your Operator ID displayed on the model

There are further settings you can now carry out such as aileron differential and mixes. Differential can be achieved mechanically but many modern Transmitters can achieve the same result electronically if the ailerons have their own servos. If they are on a Y lead then you would need to achieve the differential by mechanical means

After the first flight and any necessary trimming, alter the control rod lengths such that you can set the Tx trims back to zero but retain the control surface position for the correct trim. It all takes time but it does give a model the best setup and the most resolution possible.

It isn't a quick process but it will give good results.

ADVANCED SETUP.

*** Servos that are not at 90 degrees to control surface.**
In some cases, you may not want to set the servo output horn at 90 degrees to the servo. Why? What we're trying to achieve when setting the servos is to have equal movement in both directions, but this is relative to the hinge line of the control surface.
In the examples above its generally assumed that setup will be a trainer type model, usually with parallel wings and a simple servo installation.

For tapered or swept wings, or even a delta type flying wing, the servo may not be installed perpendicular to the hinge line.
If this is the case it will be necessary to ensure that the servo output horn is parallel to the hinge line of the control surface, after all, the output horn is the important part of the servo and connects us to the surface.
All other setup guidance above still applies.

**** Servo Power.**
It's unfortunate that fashion dictates a lot of trends in RC. There are many companies that sell fancy servo control arms that are exceptionally long and aimed at 3d type flying to give the maximum movement.
Unless your model is very large or you're in the top few percent of model flyers, it's unlikely that you will need fancy servo arms.
Long servo arms can also greatly reduce the effective power of your servo and its resolution.

The power given on servo specifications will be measured over a distance, check your servo and you'll see that the torque (turning power) is given as weight/distance or for example 3kg/1cm
This indicates that the torque generated is at 1cm from the centre of rotation, or put more simply, when using the hole in the servo arm that is 1cm away from the centre.

Using a servo arm that is unnecessarily long will reduce the amount of power the servo has.
This is why it's important to mechanically set up your model first.
Using end point adjustments or rates to reduce the servo throw also removes the resolution and precision of the control.
A servo has a resolution, a certain number of 'steps' that it can operate over. Reducing the servo throw electronically by using rates will remove the precision that's needed to fly nicely.