QuadPod Brushless Quadcopter

Thank you for purchasing the Snelflight QuadPod, a compact but powerful brushless-motor Quadcopter. The model can be built up in about an hour, thanks to its delightfully simple construction and plain English instructions. Everything is included, no gluing or soldering is required, and the propellers are pre-balanced for exceptionally smooth performance right from the outset.

Once assembled the QuadPod is extremely stable, yet responsive and pleasant to fly. It is small enough to fly about indoors, but is also powerful and may be flown outside with confidence, with flight times of up to 20 minutes. Owing to its straightforward construction it is easy to modify the QuadPod to add a camera or other payload.

Please read through this manual fully, to acquaint yourself with all the features and functions of your QuadPod. It should be followed carefully during the assembly process.

IMPORTANT SAFETY NOTICE

- The QuadPod is not a toy. It is a powerful machine which is capable of causing serious injury if it is not operated safely. This manual should be read carefully before the kit is assembled and flown.

- Always handle the QuadPod carefully, and be mindful that it might start suddenly in the case of an error or malfunction. Sudden start-ups are fortunately rare, but take great care to avoid accidently knocking the throttle stick when the aircraft is powered up and ready to fly. It is safest to switch the transmitter off during pre-flight preparations.

- Always disconnect the battery before leaving the QuadPod unattended, and after use.

- Take precautions against propellers flying off the motors. Check them for tightness frequently, and never point the QuadPod towards anybody or lean over it whilst testing it.

- Never fly over people's heads, or near to children or pets. Make sure that others nearby know that you are flying the QuadPod. The QuadPod is heavy enough to cause serious injury if it falls on somebody, and sudden stoppages can occur in the event of malfunction.

- Remember that the working parts of the QuadPod can get hot during use, particularly the motors. Other parts can also get hot in the event of a malfunction.

- Do not allow the QuadPod to get wet and if it does, disconnect the battery immediately and thoroughly dry everything before testing carefully.

- If a malfunction is suspected, disconnect the battery and remove the propellers before investigating.

- Always treat lithium polymer batteries with great respect, and follow the manufacturer's instructions for safe use. Never leave a lithium batteries unattended whilst charging.

- If charging a lithium polymer battery indoors, a flameproof container is recommended.

- Always disconnect the battery from the QuadPod when not in use. If the battery remains connected it will be seriously damaged by over-discharge, and may overheat or catch fire when next charged.

- Examine the lithium polymer battery extremely carefully after a crash, and do not use it if crushed or if the cell envelope has been ruptured.

- Remember that lithium polymer batteries contain large amounts of energy. They can overheat, catch fire or explode if damaged, mistreated or if they fail internally. Always treat them with the greatest care.

- ALWAYS REMEMBER THAT YOU ARE RESPONSIBLE FOR THE SAFE ASSEMBLY AND OPERATION OF YOUR QUADPOD.

Packing List

Your kit should contain the following parts. If any of these items is missing then please contact us at support@snelflight.co.uk. *Please note: Product contains nuts.*

1) Carbon fibre body, comprising the main cross-shaped airframe, circular upper platform and four straight bracers.
2) 4 x brushless motors.
3) 4 x electronic speed controllers (ESCs) – small circuits with wires at each end.
4) 4 propellers, pre-mounted onto aluminium spinner adapters.
5) 1 x flight computer circuit board.
6) 1 x transparent Lexan dome cover.
7) 5 x 100mm radio receiver connector cables with "servo" plugs on each end.
8) 1 x power distribution lead, with five red "JST" connectors.
9) 1 x packet of black hexagonal spacer posts, together with matching white nylon M3 screws.
10) 1 x packet of small (M2) white nylon screws and matching nuts.
11) 1 x packet of small (M2) steel screws and matching nuts.
12) 1 x packet of small black cable ties.
13) 1 x packet containing various double-sided foam pads.
14) 1 x strip of coloured foam.
15) 4 x thick black foam feet.
16) 1 x Allen key (hex key) to fit propeller mounting grub screws.
17) 1 x lithium polymer battery
18) 1 x Snelflight 2.4GHz Spektrum-compatible park flyer receiver - *not included in the Complete Package*

You will Need

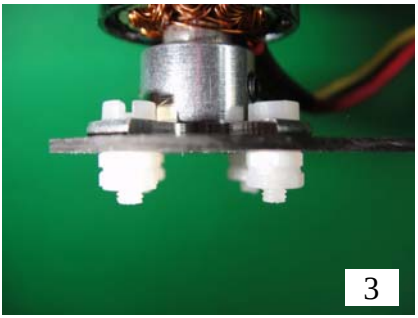
- Medium-sized straight screwdriver.
- A pair of scissors
- Four channels (or more) radio transmitter – see Section 1 steps 12 – 14 for details.

1) Assembly

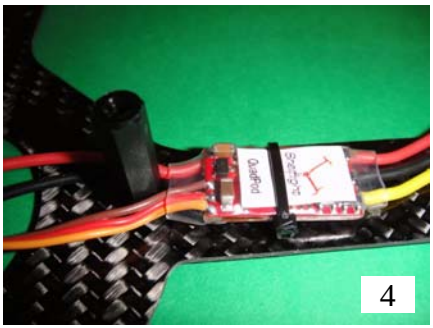
1) Screw the 8 black hexagonal spacer posts to the main carbon frame, using the white M3 nylon screws provided. It doesn't matter which way up the carbon frame is oriented. There are 8 holes in the carbon frame to take the screws, and none of the other holes fit so it is not possible to fix the posts in the wrong place. Be gentle with your screwdriver – take care not to over-tighten (photo 1).

2) Next, screw the 4 motors onto the ends of the carbon arms, using the M2 nylon screws. Orient each motor on the frame so that its wires are directed inward at a diagonal angle (Photo 2), and insert the screws from above. Note that the carbon is drilled for more than one type of motor base plate, so there are some extra holes. **Take care not to bend the motor wires right where they join to the motor, because they can be damaged.** Fasten each screw with an M2 nylon nut under the carbon, and tighten **gentle finger tight only.** Once all 4 screws are in place, add a second nut to each for reinforcement (Photo 3). It is crucial not to over tighten the nuts, otherwise the screws will be damaged. Although metal screws would be stronger, the nylon screws will pull out in the event of a crash, usually preventing damage to the motor or carbon frame. They also save significant weight.

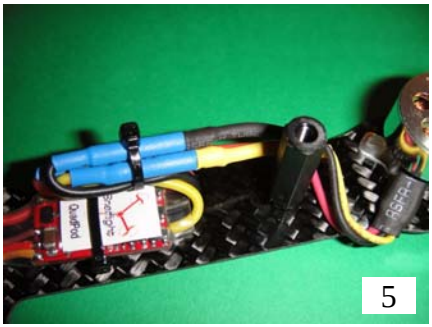

2


3

3) Attach the 4 motor speed controllers (ESCs) to the carbon arms, using the black cable ties provided. There are two holes in each carbon arm, to thread the cable tie through. The ESC should be oriented with the red, black and yellow wires directed outwards towards the motor, and positioned just outside the inner black spacer post (Photo 4).


4

4) Next, connect the motors to the ESCs. There are three connections to make for each motor, and the connectors simply plug together. After making the connections, fold the wires neatly and fasten them with a cable tie (Photo 5). **Make sure that the motor wires are not rubbing on the silver rotating part**, especially the black section where the wires join the motor (see Photo 22 on page 13).


5

It is very important to connect the wires correctly in order that the motors run in the right directions. For clockwise rotation, connect **red – red**, **black – black** and **yellow – yellow**. To get anticlockwise rotation, swap **any two** wires. Figure 1 below details which motors must run clockwise, and which anticlockwise. Please note the curved side of the frame centre platform, which is designated as the rear. Please take care to get the connections right!

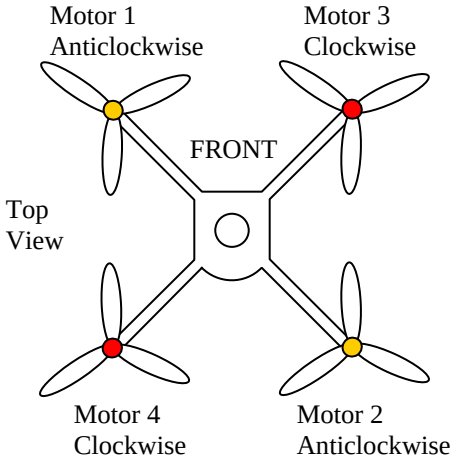
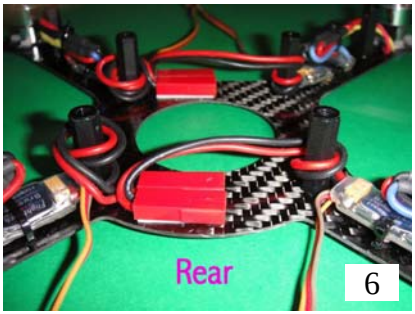
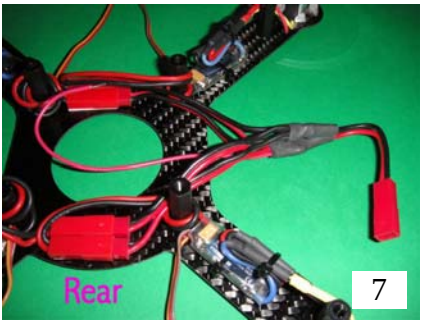


Fig 1. Motor Identifications and Directions

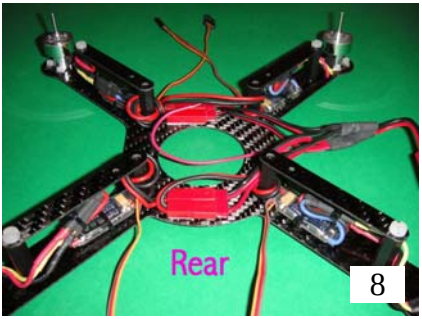
5) Next, arrange the ESC power leads, which have red connector sockets on their ends. The connectors should be attached to the carbon frame using the white adhesive foam pads, as shown in Photo 6. Note that the sockets are oriented towards the right of the aircraft (wires running to the left) but they are positioned left of centre to allow room for the plugs to be inserted later. One foam pad is wide enough to attach two connectors, but it should be shortened to 20mm length – the foam cuts easily with scissors. Excess wire should be kept tidy by wrapping once around the inner black spacer posts.



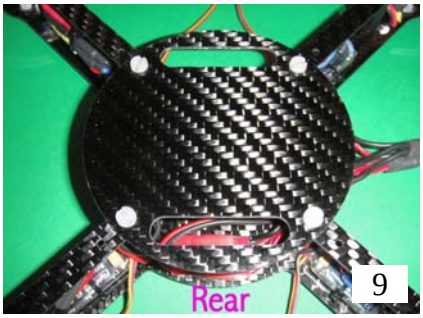
6) Now the power distribution lead should be connected. This has a single red master socket on one end, and four plugs on the other end. Connect one plug to each ESC socket, and arrange the wiring neatly so that the master socket exits from the right hand side of the aircraft. The distribution lead has an extra red wire, which should be allowed to lie across the centre of the frame until needed (Photo 7).



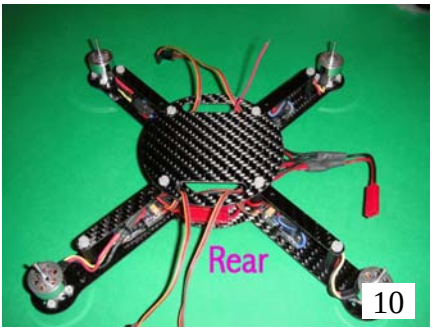
7) Next, the carbon bracer parts can be added to the airframe. These connect between the inner and outer spacer posts along each arm, to form an “upper deck”. Please note that each bracer has two holes at one end. The other end has a single hole, and this end should be screwed to the outer spacer post. Do not screw down the other end yet (Photo 8).



8) Now the circular carbon upper platform should be added. This has two slots, which should be positioned at the front and rear. Screw the platform onto the four inner spacer posts, screwing through the ends of the bracers as well, to lock everything together (Photo 9).



9) Next, feed the ESC control leads (**orange, red** and **brown**) up through the slots in the upper platform. The leads from the two rear ESCs should be passed through the rear slot, and the front ESC leads passed through the front slot. Also, feed the extra red wire from the power distribution lead, up through the front slot (Photo 10).

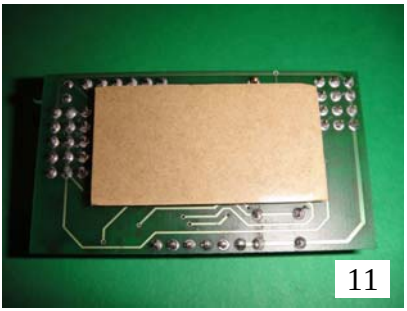


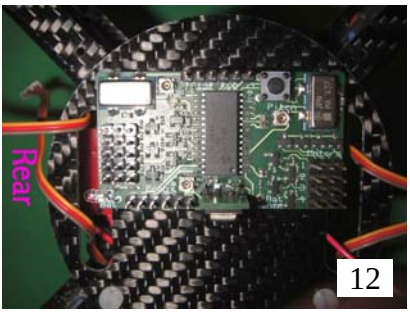
10) Now it is time to install the electronic circuit board onto the upper platform. Begin by applying one of the black double-sided foam pads to the underside of the circuit board, placing it in the central area in between the protruding connection pins (Photo 11). Now attach the board to the central platform. **It is very important to get the orientation right.** It should be positioned so that:

a) the white text on the board is the right way up when viewed from the right-hand side of the aircraft. The small LED labelled "Bat" should be in the right-hand rear corner of the board.

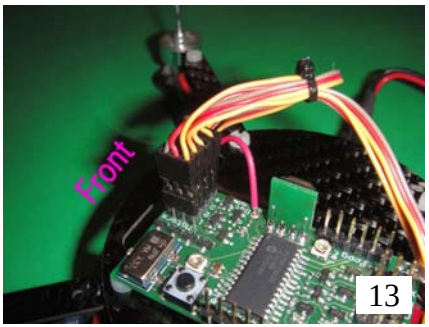
b) The board is located on the left-hand side of the platform, and central from back to front. It should just overlap the inner edges of the two slots, and its corners should mostly cover the two left hand screws. The corners of the board must not overhang the edge of the circular platform area (Photo 12).

The foam pad sticks very firmly. If the board must be removed, particularly after some time, take great care not to bend it. Lifting the board slightly and then cutting the foam works best. However the foam is flexible enough to allow access to the screws underneath the board edge, without removing it.

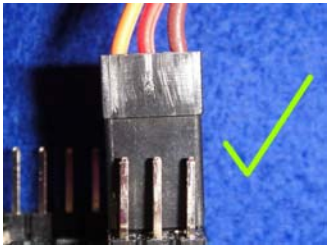




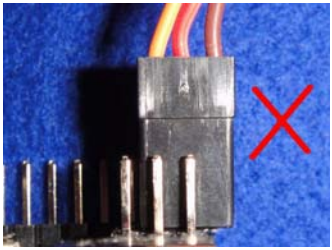
11) Next, plug the ESC control leads onto the terminal pins labelled "Motors" at the front of the circuit board. Each 3-way terminal is numbered, and these numbers correspond to the motor numbers in Fig 1. The **orange** wires should be positioned inwards towards the board. Also, plug the extra red wire from the power distribution lead, into the small socket labelled "Bat sense", located at the edge of the board behind the motor connectors. Arrange all the wiring neatly with a cable tie (Photo 13).



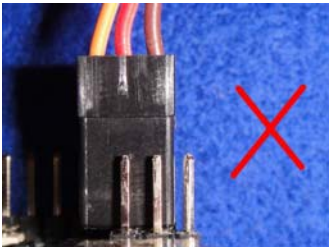
Please note that the QuadPod's motor speed controllers (ESCs) can be damaged if the cables are plugged in wrongly. Please make absolutely sure that none of the plugs are displaced as in the pictures below, BEFORE CONNECTING THE BATTERY.



RIGHT



WRONG



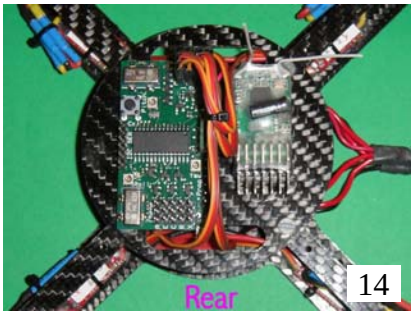
WRONG

It is equally important to ensure that a similar mistake is not made with the receiver cables (see below), where they connect to the QuadPod board and the receiver. If power is applied to the QuadPod with this error present, one or more ESCs may be damaged, preventing the affected motors from running. If this does happen please don't worry; it can be repaired readily but unfortunately the affected ESCs will need to be returned to us. Therefore please take care with the connections to avoid inconvenience.

Receiver

12) The radio receiver should now be installed, in the space next to the circuit board. The receiver needs a minimum of four channels, preferably five – the fifth channel allows Heading Hold to be switched on and off. We recommend using the Snelflight 2.4GHz Spektrum-compatible park flyer receiver which is included in the standard QuadPod kit. Alternatively, the Snelflight 2.4GHz RC System (part of the QuadPod Complete Package) comes with a full-range receiver. Other receivers may also be used.

The receiver will be connected to the terminal pins at the rear of the circuit board, using the leads provided. It needs to be positioned so that the wires reach neatly, so it is a good idea to experiment before fixing the receiver to the platform using the black double-sided foam pad provided. If the receiver is a small one then the pad may need to be cut down to size. When positioning the receiver, keep in mind the antenna, especially if using a 2.4GHz system. If using the Snelflight 2.4GHz Spektrum-compatible receiver, it should be oriented with the connections at the rear and the label downward (Photo 14). If using the Snelflight full-range receiver please note that it is quite long, so it should be mounted well forward to ensure that there is enough space behind it for the plugs and wires.

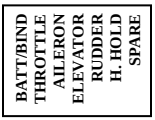


Now connect the receiver to the circuit board, using the leads provided. The **orange** wires (which carry the control signals) should be oriented inwards towards the circuitry on the board. On the Snelflight receivers the orange wires should be uppermost.

It is important to plug each receiver channel to the correct connector on the QuadPod board. The connectors are labelled as follows:

A…..Aileron
E…...Elevator
C.....Collective (throttle)
R…...Rudder
X…...Auxiliary – allows Heading Hold mode to be switched on and off.

Many receivers have the channels named in a similar way. The Snelflight 2.4GHz Spektrum-compatible receiver channels are arranged like this (looking directly at the pins with the receiver mounted as shown):



If the channels on the receiver are numbered instead, then it should be connected up according to Table 1 below:

Brand	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
Snelflight Spektrum	Collective	Aileron	Elevator	Rudder	Aux (H. Hold)
Snelflight RC System	Aileron	Elevator	Collective	Rudder	Aux (H. Hold)
Futaba	Aileron	Elevator	Collective	Rudder	Aux (H. Hold)
JR/Spektrum	Collective	Aileron	Elevator	Rudder	Aux (H. Hold)
Hitec	Aileron	Elevator	Collective	Rudder	Aux (H. Hold)
GWS	Aileron	Elevator	Collective	Rudder	Aux (H. Hold)
Century	Aileron	Elevator	Collective	Rudder	Aux (H. Hold)

Table 1 - Receiver Channel Functions

13) Now is the time to set up your transmitter to work with the QuadPod. The transmitter needs at least four channels, which should be fully independent without any mixing functions applied - exponentials and ATVs (endpoints) may be adjusted as desired. It is often easiest to set the transmitter to "Aeroplane" mode. **Centre all trims and sub-trims.** The fifth channel is optional, but is needed in order to use the Heading Hold function. On most transmitters, channel 5 is used for auxiliary functions (landing gear etc) and is operated by a switch. However channel 6 may be the one used for this – please consult the transmitter manual if necessary.

The transmitter servo reverse switches should be set according to Table 2 below:

Brand	Channel 1	Channel 2	Channel 3	Channel 4
Snelflight Spektrum	Normal	Normal	Normal	Normal
Snelflight RC System	Normal	Normal	Normal	Normal
Futaba	Reversed	Reversed	Reversed	Reversed
JR/Spektrum	Normal	Normal	Normal	Normal
Hitec	Reversed	Normal	Normal	Reversed
GWS	Normal	Reversed	Reversed	Reversed
Century	Normal	Normal	Reversed	Normal

Table 2 - Servo Reverse Switch Settings

If used, it is important to find out which way the Heading Hold switch operates. The Heading Hold function is switched on by long control pulses, and off by short (or absent) ones; unfortunately most transmitter manuals do not state which way to set the switch for each of these states. Fortunately Heading Hold mode can be recognized during testing (details in Step 20), so the question can be resolved. On the Snelflight transmitter, Heading Hold is ON when the switch is up.

Battery

14) The Snelflight 850mAh 3S 25C battery is included. It is small, lightweight and powerful, and has the correct connector pre-fitted. It provides flight times of 11 – 12 minutes. Other batteries can also be used – we have listed some suitable types on our web site. Please note that the correct connector will need to be fitted to some of these. To work, the battery must meet the following requirements:

- 3S – 11.1V nominal
- JST power connector (available as an accessory from our web site)
- At least 700mAh
- At least 20C discharge rate
- Thickness 21mm maximum
- Width 37mm maximum
- Length is not critical, but batteries longer than 80mm will protrude from the housing.
- Weight up to 130g – this allows for capacities up to about 1600mAh.

Charge the battery according to the manufacturer's instructions, using a suitable lithium polymer battery charger. The Snelflight battery should be charged at a current from 800mA – 1500mA.

Binding

15) With a 2.4GHz system, the receiver must be bound to the transmitter before it can be used. Follow the manufacturer's instructions for this. When binding many receivers it is necessary to connect a special binding plug, and on some this is a very tight squeeze next to the channel connectors. It is OK to unplug an adjacent connector to make it easier. When the instructions call for the receiver to be powered on, plug the lithium battery into the red JST power socket on the QuadPod, ignoring the tones emitted by the aircraft. The receiver will be powered via any connected channel lead(s).

Once the system has been bound, remove the binding plug, disconnect the lithium battery and restore the receiver connections to the QuadPod circuit board. Please note that the Snelflight RC system requires no special plug when binding, making it very convenient to use.

Before binding any 2.4GHz system for use with the QuadPod, please take care to ensure that the transmitter servo reversing switches are set correctly, according to Table 2 on the previous page. Additionally, make sure that the throttle joystick is set to minimum. When a 2.4GHz system is bound, "failsafe" settings are often programmed at the same time. If the radio signal is lost during flight, the receiver will restore the controls to the positions set on the transmitter at the time of binding. So if the throttle reversing switch is set incorrectly during binding, the failsafe function will set the throttle to maximum whenever the transmitter is switched off, instead of setting it to minimum. This is obviously quite dangerous, so please take care. The failsafe should be tested after binding to make sure it functions correctly.

Preliminary Testing

16) It is a good idea to test the QuadPod at this stage, **before** the propellers are fitted. This will prevent possible accidents if something goes wrong.

Begin by connecting the lithium battery again, **but whilst doing this, hold down the small push-switch labelled "Cal", located near the front left corner of the circuit board.** We've found that the best way to do this is to hold down the switch with the little finger of the left hand, leaving the thumb and forefinger of the left hand free to hold the power socket. The right hand can then be used to plug in the battery. Left-handers may wish to reverse these suggestions!
Once the battery is connected, release the switch. The red LED labelled "Bat" will illuminate, and a number of musical tones will be emitted by the QuadPod's motors. The purpose of this process is to calibrate the throttle endpoints within the four ESCs, by setting them to the values used by the QuadPod electronics. If it doesn't seem to work first time – if your finger slips off the switch for instance – it doesn't matter. Simply unplug the battery and try again; it can be repeated at any time.

17) Next, ensure that the aircraft is standing completely still and that the throttle stick is at minimum, then switch on the transmitter. A 2.4GHz system will take a moment to link up. There will then be a delay of about a second before the red "OK" LED illuminates on the circuit board. During this time the QuadPod's gyros are auto-calibrated, so it is very important that the aircraft isn't moved.
If the LED does not illuminate, please check that:

- All the plugs are oriented correctly
- The receiver channel leads are connected in the correct order (Table 1)
- The transmitter servo reverse switches are set correctly (Table 2)
- The throttle stick is at minimum.

On some receivers, a light will indicate whether the radio system has linked up, and if it hasn't then this should obviously be checked out first. On other systems there is no light to indicate whether the radio is functioning, so it will be necessary to check manually if problems are experienced. A small servo is very useful for this. It can be plugged into each receiver channel in turn to test function.

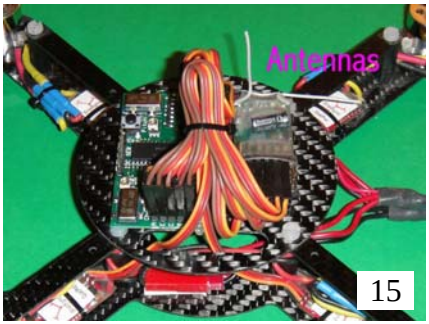
18) Once the red "OK" light has illuminated, press the "Cal" button again. The red "OK" LED will turn off; hold the button down until the LED turns on again and starts flashing, then release. After flashing a few times it will turn on steadily once more. This process calibrates the QuadPod to the transmitter's joystick neutral positions. **All trims must be centred for this to work.**

19) Now raise the throttle to a low setting. All four motors should start. If one diagonal pair slows down and stops, this is probably due to the Heading Hold function. Move the switch on the transmitter to the opposite position, and the motors should all run.

With all four motors running, try raising the throttle gradually all the way. The motors should increase in speed to a high pitched whine. Reduce the throttle to a low setting and check that the motors are running in the correct directions according to Figure 1 – it is easy to tell by gently resting a finger against the outer cylindrical surface of each motor in turn. If any of the motors is turning the wrong way, just swap any two of its three supply wires to correct it – disconnect the battery first!

> **A note about the Heading Hold function:** If Heading Hold is switched on, it will generally have become apparent by now because two of the motors will slow down and stop if the throttle is set to a slow speed. However it is possible that this might not happen, leaving the question unanswered as to which switch position turns Heading Hold on. In order to be sure, run the motors at low speed and then pick up and rotate the aircraft through about 45°. If Heading Hold is on, two of the motors will stop, while the other two speed up. Moving the switch to the opposite position will turn Heading Hold off, and cause all four motors to run at equal speed. Having determined the transmitter switch positions, make a note of them!

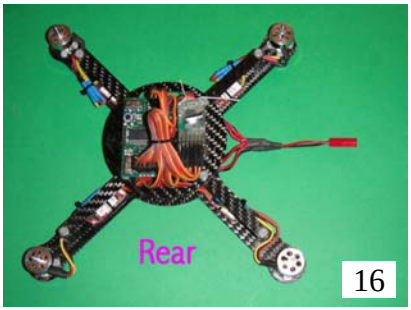
20) Having tested the basic functioning of the QuadPod, the assembly can be completed ready for the first flight. Firstly, arrange the receiver signal wires neatly, and fasten with a black cable tie. There may also be 2.4GHz antennas to locate. The Snelflight Spektrum-compatible receiver has two short antennas. We pointed the left hand one upwards and the right hand one out sideways. This perpendicular arrangement is recommended for all 2.4GHz systems with dual antennas (Photo 15). The best setup will depend on the particular receiver.



A 35/72MHz antenna can be led down through one of the slots in the upper platform, and out of the aircraft through the hole in the bottom.

21) Install the battery into the space under the upper platform, by sliding it in from the right hand side. A strip of foam is provided in the kit – a piece of this should be used if necessary to pad out the battery and hold it in place.

It is up to personal preference how best to arrange all the wires. They can simply be left protruding from the right hand side of the aircraft so that access is easy. The battery can be recharged in situ. **Important: If you do this, make sure the wires can't obstruct the propellers during flight!** One alternative arrangement is to attach the red power socket underneath the aircraft over towards the left, to take up the slack in the wires. A white adhesive foam pad can be used for this (Photos 16 and 17).



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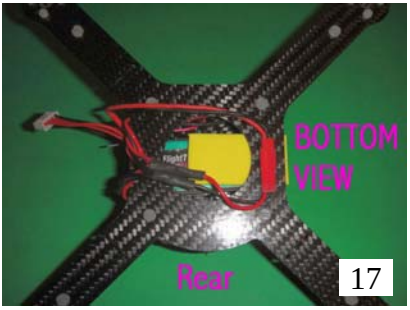


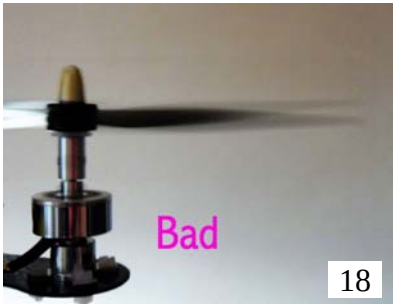
17

Propellers

22) Now, propellers! Notice that these have black adhesive tape attached to some blades. The purpose of this tape is to balance the propellers. It is very important that the propellers are well balanced, as out-of-balance propellers will vibrate and cause unsteady flight. In extreme cases the motors or their mountings may be damaged. Therefore, please observe the following cautions:

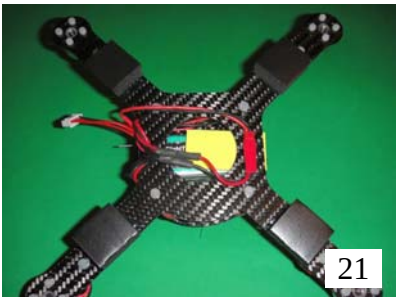
- Do not disturb the tape on the blades.
- Do not loosen the propeller from its spinner adapter. The propeller + spinner is balanced as a unit, and will not remain balanced if disturbed.
- Note that the propeller is assembled onto the spinner with the grub screw aligned 180º opposite the "blank" blade (the other two blades have text embossed on them). If the propeller should become loose in a crash for instance, it will usually remain quite well balanced if it is re-tightened in this same orientation.
- It is a good idea to check the aircraft for vibration before a flight, by holding it from underneath and revving it up. Get used to the way it feels and sounds when it is running smoothly, and if it doesn't feel right, look for the problem.
- A common cause of vibration after a crash is poor blade "tracking". A propeller's three blades should all run level with each other when viewed edge-on. If one blade is bent slightly upwards or downwards, it will cause vibration. Poor tracking is easily spotted if the propeller is gently spun up whilst the aircraft is viewed from the side in front of a white surface (Photos 18 and 19). Blades can get bent if knocked in a crash, but they can often be straightened again. However if there is any sign of cracking of the plastic at the blade root then the propeller should be replaced.

- **DO NOT FLY UNBALANCED OR DAMAGED PROPELLERS**



23) Each propeller carries a red or yellow sticker, to indicate whether it should run **clockwise** or **anticlockwise**. Fit the propellers onto the motor shafts, in the locations indicated in Figure 1. Ensure that each propeller is oriented so that its grub screw (set screw) bears onto the flat area of the motor shaft (Photo 20), then tighten the grub screw with the Allen key (hex key) provided. Take care not to over-tighten the grub screws - it is possible to strip the aluminium threads with extreme force.

24) Finally, attach the four adhesive foam feet to the underside of the QuadPod. Each one fits between the ESC attachment cable tie and the outer M3 airframe screw (Photo 21). This simple “undercarriage” allows quiet, bounce-free landings.



2) Test Flying

Congratulations! Your QuadPod is now ready for its first flight. We recommend test-flying the aircraft before installing the dome cover for easy access to the innards, especially the push button switch. However if you would prefer to fit the dome first, please see the section “Installing the Dome Cover” on page 15.

Test flights are best performed indoors if possible. Choose the largest space available; a clear area 8 feet square should be considered the minimum. Place the aircraft in the middle of the available area and stand at

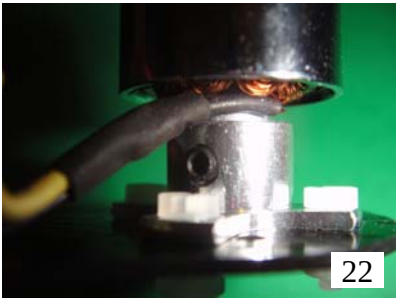
least four feet behind it. Make sure that the aircraft is facing away from you – the curved rear part of the carbon body should be towards you.

We are assuming in this section that the pilot is able to fly rotorcraft such as model helicopters. If not, or if the only experience gained has been flying co-axial "super stable" helicopters, then we strongly recommend obtaining the help of an experienced pilot for the test flights. Although the QuadPod can be used for flight training, this will be much easier if the aircraft has been properly trimmed first.

Pre-Flight Checks

These checks should be performed before all flying sessions, and also after any crash or tumble:

- Check that the propellers are screwed tightly onto the motor shafts.
- Check that the motors are firmly screwed down onto the carbon frame (nylon nuts).
- Check that the motors are tightly screwed into their base plates. There are two grub screws per motor for this, and it is very important that they are not loose (Photo 22). They can be tightened with the Allen key provided. When doing this hold the motor mount firmly – do not use the nylon mounting screws to resist the force of tightening.



- Stand the QuadPod on a firm surface, and connect the Lithium battery. The motors will emit a short series of musical tones. After ensuring that the throttle is at minimum, switch on the transmitter and wait for the red "OK" LED to light up. Make sure that Heading Hold is switched off, then pick up the aircraft and hold it from underneath, grasping it firmly. **Make absolutely sure that the propellers are well away from your body and face, and that they are not pointing at anybody.** Now gradually rev-up the QuadPod, listening and feeling for signs of vibration.

Note 1: While starting the motors, it is very important to hold the aircraft still. If it is moving as the throttle is raised from minimum, the motors will automatically lock out for safety and the "OK" light will flash. If this happens, return the throttle to minimum and try again.

Note 2: As stated earlier, it is crucial that the aircraft isn't moved during the gyro calibration period after the transmitter has been switched on. If it does move, then the gyros will initialize incorrectly, and will not give the correct zero signals when the aircraft is at rest. It will then be impossible to start the motors because they will lock out every time. If this happens, simply reset the QuadPod (please see "Quick Reset" function below), ensuring that the aircraft isn't moved until the "OK" LED lights.

The First Flight

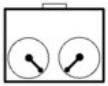
If all is well, place the aircraft in the centre of the flying area for its first flight. Ensure that Heading Hold is switched off, and then rev-up for take off, confirming that all 4 motors have started properly. Never "blast off" without starting the motors first. Be prepared for a lift off at or even slightly below mid-stick throttle, and take care because the QuadPod can climb extremely fast. After getting used to the QuadPod's flight characteristics for a few minutes, the aircraft should be trimmed (see "Programmable Trim System" below).

3) Extra Functions

Quick Reset Function

At any time, the QuadPod can be reset and the gyros re-calibrated, using the following procedure. It is equivalent to connecting the battery and turning on the transmitter. To reset the QuadPod:

- While the aircraft is standing totally still, move the transmitter joysticks to the "cross-eyed" position; move the left-hand stick to the lower right corner, and the right-hand stick to the lower left corner. Please note that this may not work if the transmitter Travel Adjustments are set below about 70%.



- Hold the joysticks in this position until the "OK" light turns off. This normally takes 1 second, but there is an additional 2 seconds delay immediately after the motors have been running.

- When the "OK" LED has turned off, return the joysticks to their neutral positions, making sure that the throttle remains at minimum. This will initiate the reset, which takes about 1 second whilst the gyros are re-calibrated. The "OK" LED will then light up again.

Programmable Trim System

The QuadPod should be trimmed on the transmitter in the standard way. Once this is done however, the trim settings can be programmed into the aircraft's memory. To do so, press the "Cal" button momentarily, whilst the transmitter is on and the "OK" LED is illuminated. Do not hold the button down; press it and release immediately. The "OK" LED will turn off momentarily, then turn on again. The QuadPod will now have stored the transmitter trim settings in its own memory, **and the trims on the transmitter itself should be returned to neutral.**

The QuadPod should now be flown again, to check the settings. If additional trimming is required, make the adjustments on the transmitter and then program them into the QuadPod as above. This process can be repeated at any time, to "zero in" on the best settings.

Heading Hold function

The Heading Hold function assists the pilot in maintaining a steady heading, allowing greater concentration on the other controls. A standard rate gyro causes the aircraft to resist changes in heading, but any rotations that do occur go uncorrected, so they gradually accumulate. Heading Hold "remembers" a heading, and will restore the aircraft to that orientation if it is rotated by an external disturbance. Of course the remembered heading will drift with time (there's no compass involved), but this drift is generally slow.

To use Heading Hold, simply switch it on at the transmitter during flight. **Ensure that the rudder joystick is centred when doing so**. Please note the following:

- Heading Hold only operates when the rudder joystick is centred. If the joystick is moved, the QuadPod switches to rate gyro control so that the aircraft can yaw. When the joystick is returned to the centre, heading hold resumes in the new orientation.

- The QuadPod cannot be trimmed in Heading Hold mode. If the transmitter trim is moved whilst in Heading Hold mode, this will be interpreted as a yaw command and the QuadPod will switch to rate gyro control.

- All gyros sensors suffer some output drift over time, most of which happens immediately after the power is switched on. Therefore to get the best Heading Hold performance, wait for about two minutes after connecting the QuadPod's lithium battery, before switching on the transmitter. This

will allow the sensors to “warm up” before calibration. Note also that the gyros can be re-calibrated at any time using the “Quick Reset” function – see above. If the aircraft heading has a slow drift when in Heading Hold mode, resetting will reduce or eliminate it.

- It is not advisable to take off in Heading Hold mode.

Battery Care / Low Charge Indicator

The QuadPod has a built-in battery charge monitor, which provides an early warning of low charge level. The red LED labelled "Bat” will start to flash when about 90% charge has been used up, and will illuminate solidly a short while later. It is safe to fly for another minute or so, but take care! The final “running out of juice” happens fairly suddenly, so it is important not to fly too high during the final minute. At its standard weight of 240g, the QuadPod will fly until the battery is discharged down to around 3V/cell. This is OK, but it is important to re-charge the battery as soon as possible; it should not be left completely discharged. Please note that batteries should not be stored fully charged either, as this will impair performance in as little as a week. If the battery will not be flown within a few hours, it should be charged to about 50% for storage – some chargers have a program for this. **Never leave the battery connected to the QuadPod. It will be damaged by over-discharge.**

The QuadPod’s charge monitor senses voltage, and will only work correctly when the aircraft is flown at its standard weight. If a payload is added, the battery will have to provide more current in order to fly, and the voltage during flight will be lower due to the cells’ internal resistance. This will cause the charge monitor to trigger earlier than normal.

Calibration Push Button

During the course of setting up the QuadPod, the pushbutton labelled “Cal” has been used several times. This section describes its functions in detail.

- **Hold the button whilst connecting the battery, then release:** This causes the QuadPod circuit board to auto-calibrate the four ESCs with the correct throttle endpoints. The red “Bat” LED will illuminate during the process. Generally this will only need to be done once.

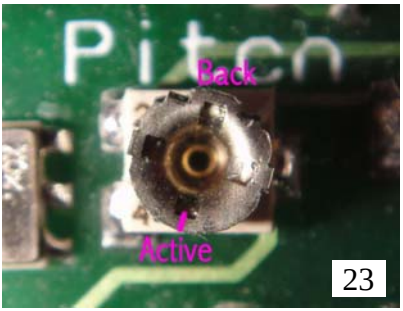
- **While the transmitter is on and the “OK” LED is illuminated, press and hold the button until the “OK” LED starts to flash:** This programs the transmitter’s neutral positions into the QuadPod. All transmitter trims (including sub trims) must actually be at neutral for this to work properly.

- **Press the button momentarily while the transmitter is on and the “OK” LED is illuminated:** This programs the transmitter trim adjustments into the QuadPod. After doing this, the transmitter trims should be returned to neutral.

- **While the QuadPod battery is connected but the transmitter is off, press and hold the button until the “OK” LED lights up:** This is a “factory reset”. It restores the neutral positions to their default settings – 1.52ms pulse width, and zeros the stored trims.

Variable Gyro Gains

In order to allow higher speed manoeuvres, the QuadPod’s gyro gains may be reduced. This is done by adjusting the miniature trimmer potentiometers provided on the circuit board, using a small screwdriver. There is one trimmer for each of the axes of Pitch, Roll and Yaw, and they are labelled on the circuit board. Please note the appearance of the trimmer control knob; the slightly flattened part with a lump in the middle indicates the “back” – the active position is opposite (Photo 23). The trimmers are factory preset to maximum, and may be turned anti-clockwise to reduce gain. Take care not to adjust past the end of the resistance track; the active range is about 200º. **This adjustment is for experienced pilots only.**



4) Finishing Off the Assembly

Installing the Dome Cover

The QuadPod is supplied with a transparent dome cover made from extremely tough Lexan – the material used for bullet proof windows! It will offer real protection for the innards of your QuadPod, so it is well worth installing, unless it is absolutely necessary to save the weight to allow for a heavy payload. In addition to providing impact protection, the dome will also protect the electronics if it starts raining; please note that water droplets hitting the circuit board during flight are likely to cause catastrophe. However, the QuadPod is not suitable for flying in wet weather, with or without dome!

The dome rests on the four carbon arm bracers, which have screw holes which align to holes in the edge of the Lexan. It should be screwed down with the steel M2 nuts and bolts provided. Tip: position each nut and hold in place with a fingertip, before inserting the screw. Steel screws are used despite their weight for two reasons:

- They prevent the dome from coming off, even in a severe crash. The Lexan can withstand heavy impacts, so this combination offers a lot of protection.

- When tightly screwed down, the dome locks the QuadPod's four arms together, improving their torsional rigidity.

Depending upon the receiver used and the antenna arrangements required, it may be necessary to make some small holes in the dome for the wires to exit. In our build using the Snelflight receiver we made a hole in the right hand side of the dome for one antenna to pass through. We let the other antenna lie within the dome, pointing upwards.

Some 2.4GHz receivers have two short antennas, and some have two long ones. Depending upon the arrangement, holes might be needed in various locations, such as a hole on each side part-way up the dome, so that the two antennas can protrude at 45º like little horns. Generally if there are two antennas for 2.4GHz then they should be mounted perpendicular to one another.

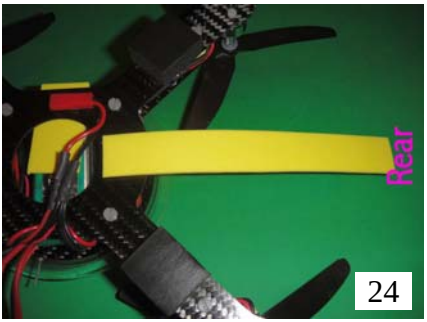
Because the QuadPod is relatively small, it will not be flown at a great distance. Therefore it may be adequate to mount the two antennas within the dome, avoiding the need for holes.

In addition to holes for the antennas, it is useful to make a small hole above the "Cal" push-button, so that it can be operated while the dome is in place, with a thin tool such as a piece of stiff wire or a large needle with the point snipped off.

Holes can be made with a large heated needle or similar tool, a fine-pointed soldering iron, or of course a small drill.

Orientation Flag

One recurring issue with Quadcopters, is that you can't tell which way they are facing! They look much the same from all angles, and this makes it very easy to lose track of orientation during flight. To provide positive identification of heading, we recommend making a little "tail" using the strip of foam provided, and attaching it to the rear of the QuadPod between the two propellers, using a double-sided foam pad (Photo 24). Make sure that it is central and straight, so that it cannot touch the propellers if it flaps upwards. We recommend a maximum length of 6 inches (15cm).



5) Specifications

Size:	9" (23cm) diagonal motor-to-motor
Weight:	240g including recommended battery
Flight time:	About 12 minutes with recommended battery
Battery:	Snelflight 850mAh 3S 25C Lithium Polymer
Power consumption:	Around 50W at hover (240g weight)
Payload:	Up to 140g in addition to recommended battery
Maximum flight weight:	380g

Notes