

TURNIGY®
power systems

3D-H
FBL SYSTEM



INSTRUCTION MANUAL

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INSTRUCTION

Dear customer, thank you for choosing the Turnigy 3D-H V2

Turnigy3D-HV2 is an easy to use three axis gyro system which helps players to fly R/C helicopters without a mechanical flybar. It's higher flying performance, such as higher efficiency, long flying time with less power(fuel) makes it possible to adapt the agility and flying behavior of your helicopter to your individual preference.

The Turnigy3D-HV2 has a built-in high end tail gyro based on the latest MEMS Technology to help you to control and lock perfectly the rudder of your helicopter while helping you to control easily the spinning.

The Turnigy3D-HV2 is suitable for almost all sizes of electric or fuel-powered helicopters. It provides flight stability for beginners and maximum agility and precision for intermediate and professional pilots.

However, the Turnigy3D-HV2 is not a flying aid for beginners! If you are inexperienced in flying model helicopters, please consult an experienced pilot for help with setup and your first flight.

The following manual will lead you step by step through the setup procedure from the correct mounting of the unit up to the first flight. Please read the following instruction manual thoroughly. You will see that during the development of the Turnigy3D-HV2, that our focus is to make the unit user friendly and soon you will be able to operate the system intuitively.

The included overview map of the setup menu can be taken out to the flying field as a quick reference to the various menu options.

1. Packing list

- Turnigy3D-HV2 flybarless system
- Wires for servos
- Manual
- Adjustment tool
- Double-sided soft pads
- Satellite receiver adapter wire

2. Safety Precautions

2.1 Safety Precautions

- 1) Don't fly in the rain or extremely high humidity, as it may cause permanent radio failure. Turnigy3D-HV2 flybarless system consists of highly sensitive electrical components and have to be protected from water, dust and moisture which might cause malfunction to the system.
- 2) Radio controlled (R/C) helicopters are not toys! The rotor blades rotate at high speed and pose potential risk. They may cause severe injury due to improper usage. It is necessary to observe common safety rules for R/C models and the local law. You can gather information from your local R/C model club or from your national modelers association.
- 3) Pay attention to your own safety and the safety of other people and property in your vicinity when using our product. Always fly in areas away from other people. Never use R/C models in close proximity to housing areas or crowds of people. R/C models may malfunction or crash due to several reasons like piloting mistakes or radio interference, and cause severe accidents. Pilots are fully responsible for their actions, and for damage or injuries caused by the usage of their models.
- 4) It is absolutely necessary that you have flying experience and that you are experienced in the operation of R/C helicopters. Otherwise we suggest you to seek the support of an experienced helicopter pilot and then try the flight with Turnigy3D-HV2 flybarless system.
- 5) Don't fly the helicopter with Turnigy3D-HV2 flybarless system in extreme temperature environments, for example, from the warm house inside to extremely cold outside, 20 minutes must be left for flybarless system to adapt to the extreme temperature change and let the moisture on the components to evaporate fully and then power up.
- 6) Flybarless helicopter consume more power and please ensure that your power system could supply enough power.
- 7) Please disconnect the brushless motor wires or remove ESC directly to avoid the accidental turning of motor and main blade during the adjustment.

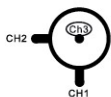
2.2 Precautions before installation and adjustment

- 1) When you setup the Turnigy3D-HV2 flybarless system, please use the traditional 90 degrees swashplate mode. No matter whatever mode the swashplate of your helicopter is, it can't use swashplate mixing (such as 120ECCPM), generally, in the heli mode, you can choose H-1 or 1 servo swashplate mode.
- 2) Any use of mixing function, in the transmitter must be disabled.
Please ensure each movement corresponds to one channel, all trims and sub-trims are disabled and that all servo travel is 100% and neutral point sub-trim are all in zero status or prohibited.
- 3) Keep the pitch curve in the original state, that is a straight line from -100~ to 100%, or 0~ 100% depending on the radio brand.
- 4) Please make sure again that there is not mixing function active. Other functions such as throttle curves, ESC switches or auxiliary functions can be adjusted as usual.
- 5) Don't fly when the Turnigy3D-HV2 flybarless system is in the process of set up. In such situation, the control of gyro and stick is unworkable.
- 6) Don't connect the servo with 3D-H V2 flybarless system before choosing the right servo frequency, the servos and servo horns can't be installed before the first power on.
- 7) Please note that any power supply equipment (such as BEC) is prohibited from inserting into AUX GEAR RUD channel, as it will do damage to 3D-H V2 flybarless system.
- 8) If you need to restore the factory setting, please press the setup button for no less than 10 secs until LED A-N and J blink quickly once and confirmed the reset.
Please note that once you restored the factory setting, all the previous configuration is deleted. Don't fly the helicopter before completing the setting up procedures, otherwise it will cause crash to your helicopter.

3. Servo connection

Connect the three swashplate servos into the Turnigy3D-HV2 as follows:
CH1 is the elevator servo. When using electronic swashplate mixing (120° to 140°) the two roll servos have to be connected to CH2 and CH3, when using mechanical mixed head (H1/traditional 90°CCPM) the roll servo connects to CH2 and pitch servo to CH3. The tail servo is always connected on CH4. Don't plug the servos into the flybarless system unit before selecting the correct servo type and appropriate frequency in the MENU. Please don't install the servo horns before the first power up. When you install the flybarless system unit, please don't tie the wires too tightly as it might pass vibration to the unit.

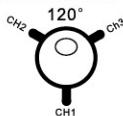
Mechanical mixer



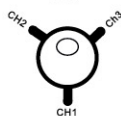
90°



Electronic mixer

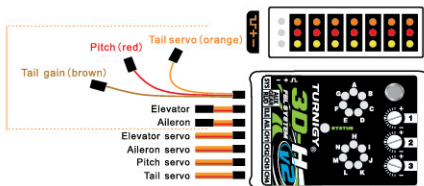


140°

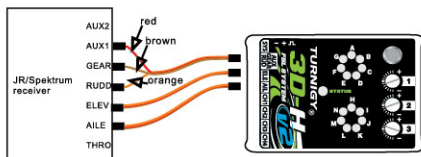


3.1 General connection method for servos

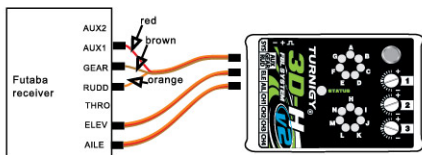
As the diagram shows below, plug in the receiver cables for aileron, pitch, elevator, rudder and tail gain into Turnigy 3D-HV2 correctly. The aileron and elevator connectors are two separate wire leads that provide the current supply. Pitch (red), tail (orange) and tail gain (brown) have only one control signal to the receiver. Please make sure that all plugs are connected correctly.



3.2 JR/Spektrum receiver connection (see the diagram below)



3.3 Futaba receiver connection (see the diagram below)



4. Mode of Operation

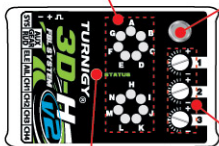
4.1 After powering on, the Turnigy 3D-HV2 will start initialization, during this period, don't move the flybarless system unit and the helicopter. The running LEDs A to G show the calibration of the sensors and the LEDs H to N show the initialization of the receiver. When initialization is finished, the swashplate servo moves and the Status-LED will show blue or purple depending on whether the tail gyro is in head-locking mode or in normal rate. The LEDs A - N light according to the current amount of tail gain.

Operation Mode

Menu LED:

Amount of tail gain A=0% N=100%

(only indicated after powering up or when adjusting the gain)



Status LED:

Tail gyro mode:

off, blue=Heading lock mode
purple=Normal-rate mode

Button
to enter setup menu push
down several seconds until
LED A is steady on
To enter parameters menu
push shortly until LED A is
flashing

Dial1: cyclic gain

Dial2: direct cyclic feed forward

Dial3: tail dynamic

4.2 Please follow the following steps when programming the Turnigy 3D-HV2 :There are two menu levels. From ready mode you can always get into the one or the other menu level. The change from one menu level to another is impossible. You have to get out of current menu level and then enter into the another one.

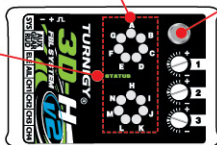
To access the Setup menu and keep the button pressed for several seconds until the LED A stops flashing and lights up steadily. In this menu all the basic settings are made to adjust the Turnigy3D-HV2 to your helicopter.

To access the Parameter menu, press and hold the button briefly until the LED A starts to flash quickly and release immediately the button. This menu is used to fine tune the flight characteristics and is mostly needed at the airfield.

Menu selection

Menu LEDs:  steady on=setup menu
 flashing=parameter menu

Status LED:
 off
 purple
 red
 blue



Button:
 press shortly for
 next menu point

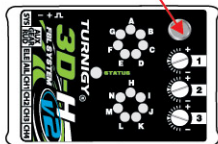
Selection by tail stick input or aileron/elevator/pitch stick within menus needed.

4.3 It usually moves the stick to right or left to select different options and the Status-LED will change it's color to indiate the status. Possible colors are: off, purple, red, and blue. On some of the menus you might have to adjust settings with other stick functions.

5.SET-UP MENU DETAILS

5.1 Enter into SET-UP MENU

No Menu LED is on
Push button for about 3 seconds



Operation mode

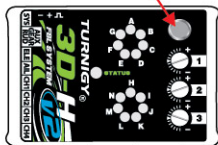
Menu LED A steady on



Setup menu - menu point A

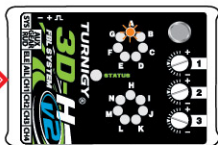
5.2 Enter into Parameter menu

No Menu LED is on
Press button shortly



Operation mode

Menu LED A is flashing quickly



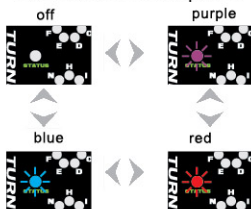
Parameter menu - menu point A

5.3 Selection on the Menu

Example: Selection within the menus

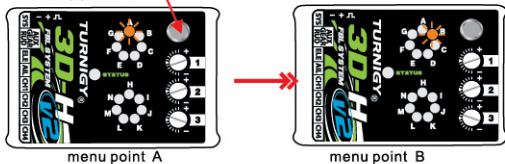


by moving the tail stick left or right
you can select the different options
within a menu point



5.4 Method of switching Menu

Switching to the next menu point shortly press the button



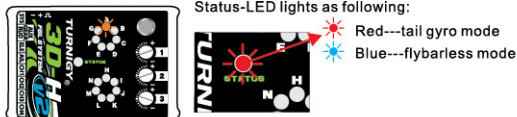
5.5 Set-up menu details

Function:

A. Mode of Operation

At menu point A, you can choose between two different operating modes. One is to use Turnigy 3D-H V2 as for flybarless helicopters and the other is to use it as a conventional tail gyro for flybarred helicopters. In this mode the sensors for aileron and elevator are deactivated.

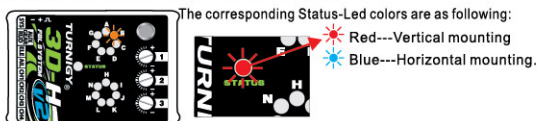
Status-LED lights as following:



Press the button to save the configuration and enter into the next menu point

B. Mounting orientation of the Turnigy 3D-H V2

At menu point B, you have to choose whether the Turnigy 3D-H V2 is mounted horizontally or vertically and you can switch the mode from one to another by moving rudder stick to one direction or another.



Press the button to save the configuration and enter into the next menu point

C. Swashplate servo frequency

If you are using the Turnigy3D-HV2 as stand-alone tail gyro with the optional patch cable, it is not necessary to make any adjustments at this setup menu point. If you do not know what maximum pulse rate tolerated by your servos, please select not more than 50Hz driving frequency. A higher driving frequency can lead the servo to overheat and get damaged.



The colors of Status-LED shows the currently selected frequency:



- Off---->50Hz
- Purple----->65Hz
- Red----->120Hz
- Blue----->200Hz

Press the button to save the configuration and enter into the next menu point

D. Tail servo center position pulse impulse

At setup menu point D you can select the tail servo's center position pulse. Almost all commercially available servos work with 1520 μ s. But there are a few special tail servos on the market which use a different center position pulse.



The colour of the status LED shows the currently selected servo neutral impulse:



- Purple----->960 μ s
- Red----->760 μ s
- Blue----->1520 μ s

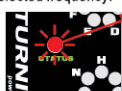
Press the button to save the configuration and enter into the next menu point

E. Tail servo frequency

At the menu point E, you can move the rudder stick repeatedly in one direction to get the desired tail servo frequency.



The colour of the status LED shows the currently selected frequency:



- Off---->50Hz
- Purple----->165Hz
- Red----->270Hz
- Blue----->333Hz

Press the button to save the configuration and enter into the next menu point

F. Tail rotor limits

At menu point F you have to adjust the maximum possible servo throw at your tail rotor. To adjust the limits, move the tail stick in one direction until the servo reaches the maximum endpoint without any binding or stall and release the tail stick, wait the Status-LED to flash and then light steady red or blue.

Please note that the steered direction of your tail stick is similar to the direction your helicopter should rotate. If this is not the case use your transmitter's servo reversing function for the tail stick. If you're not sure in which direction the helicopter should rotate consult the manual of the helicopter.



Press the button to save the configuration and enter into the next menu point

G. Tail sensor direction

At menu point G, you have to check if the Turnigy 3D-H V2 tail gyro does correct to the right direction. Please note that you can find this out very easy: The gyro always tries to steer in the opposite direction of a possible rotation of the helicopter. If you move the helicopter by hand on its vertical axis the gyro must actuate a servo movement to compensate this rotation. If for example you move the nose of the helicopter to the right, the gyro has to steer left the same way as you would steer left with the tail stick. If this is not the case you have to reverse the sensor direction. This happens by moving the tail stick once into a random direction. For confirmation you will see that the status LED will change its colour:



Status LED	Tail sensor direction
red	normal
blue	reversed

Press the button to save the configuration and enter into the next menu point

H. Swashplate servo centering

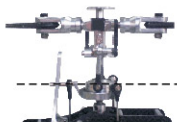
When entering menu point H the status LED is off and all swashplate servos are in their center position (1520 μ s). Mount the servo horns on the servos so that they form a 90 degree angle to the linkage rod as best as possible. Usually this will not work out perfectly depending on the servo's gear train and the servo horn therefore you can sub trim every single servo in the next steps. If you move the tail stick to a single direction once you can select one servo and trim it by moving the elevator stick back and forth. Every colour of the status LED is corresponding to one servo channel. If you move the tail stick once again to the same direction as before you can select the next servo and trim it as mentioned



The colour of the status LED shows the currently selected frequency:



- off----- Swashplate servos at center position
- purple CH 1 – elevator servo center adjust
- red CH 2 – aileron servo center adjust
- blue CH 3 – pitch servo center adjust

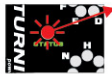


Press the button to save the configuration and enter into the next menu point

I. Swashplate mixing

At menu point I you can select whether your helicopter requires eCCPM or if it has mCCPM. For eCCPM the 3D-H V2 can be used with 90°, 120° and 140° swashplates. (The mixing will be all done by the flybarless system unit. It is prohibited to use radio's swashplate mixing function and program the mixing to mechanical mixing. The color of the status LED indicates which swashplate type is selected in the Turnigy 3D-H V2. Additionally when using eCCPM you always have 4 possibilities to adjust the servo directions which are indicated by the number of flashes (1 to 4) of the status LED:

The color of the status LED shows the currently selected frequency:



Status LED	off	purple	red	blue
swashplate mixing	mCCPM	90°	120°	140°
servo reverse (number of flashes)		1 2 3 4	1 2 3 4	1 2 3 4



Press the button to save the configuration and enter into the next menu point

J. Adjusting the cyclic control loop

Orientate the helicopter's rotor head so that the rotor blades are parallel to the tail boom respectively to the longitudinal axis of the helicopter. Then attach a pitch gauge to the forward rotor blade. The swashplate should be in the neutral position and the blades should have 0 degrees of pitch otherwise repeat the swashplate sub trimming at menu point H. Now move the aileron stick until the rotor blade has an exact 6 degrees of cyclic pitch and then release the stick. If you moved the swashplate too far you can steer the stick to the opposite direction and reduce the pitch. Also by moving the tail stick to one direction you can delete the adjustment and reset the swashplate back to 0 degrees. When reached 6 degrees the status LED should glow in blue color now. This indicates that your helicopter's rotor head geometry is perfect for the use with a flybarless system. Otherwise if the status LED's color is red or purple or the status LED is off this indicates that your helicopter's geometry is not optimal for flybarless usage.



Press the button to save the configuration and enter into the next menu point **K. Adjust the collective pitch range**

At menu point K you have to adjust the maximum negative and positive collective pitch. Move the pitch stick all the way up. With the tail stick you can increase or decrease the maximum amount of pitch. Then move the pitch stick all the way down and again increase or decrease the pitch to the maximum desired value. Don't use any pitch curves in your transmitter when doing these adjustments. Later on you can use pitch curves if you desire.



Press the button to save the configuration and enter into the next menu point

L. Adjusting the swashplate limit

At menu point L you have to adjust the maximum allowed tilting of the swashplate for aileron and elevator. Carefully steer the sticks for aileron, elevator and pitch to the maximum end points. See if the swashplate or the linkage rods are binding somewhere. By moving the tail stick you can increase or decrease the limiter. The higher the swashplate deflection is the higher the maximum rotation rate of the helicopter will be later in flight.



Press the button to save the configuration and enter into the next menu point

M. Checking the sensor directions

At menu point M you have to check if the sensors for the aileron and elevator work correctly. When tilting the helicopter forwards the swashplate has to move backwards and vice versa. When you roll the helicopter to the left the swashplate has to steer right and vice versa. If this is not correct for your helicopter you can invert the sensor directions by moving the tail stick into one direction. For confirmation you will see that the status LED changes its color. Repeat this step until both sensors are correcting in the right direction



There are four possibilities to choose, one must be right:

Status LED	Sensor direction elevator	Aileron
off	normal	normal
* purple	reversed	reversed
* red	reversed	normal
* blue	normal	reversed

Press the button to save the configuration and enter into the next menu point

Tilt the helicopter forwards



The swashplate has to move backwards



Roll the helicopter to the left

The swashplate has to steer to the opposite direction



N.Adjusting the pirouette optimization

When entering menu point N the swashplate will tilt forwards or backwards depending on your helicopter's setup and will show into a specific point of the compass. Now grab your helicopter at the rotor head and rotate it on the vertical axis by hand. The swashplate must always show into the same point of the compass. If the swashplate does not stand still but rotate against the rotation of the helicopter you have to invert the pirouette optimization. This can be done by moving the tail stick into one direction shortly. For confirmation the color of the status LED on the Turnigy3D-HV2 will change:



There are two possibilities to choose, one must be right:

Status LED	Pirouette optimization
red	normal
blue	reversed

Press the button to save the configuration and enter into the next menu point

1. Swashplate points to the left



2. Rotate the helicopter on the vertical axis



3. Swashplate must point to the same direction as before

PARAMETER FUNCTION:

A. Fine trimming the swashplate

The first menu point in the parameters menu gives you the possibility to easily trim your helicopter on the flying field as for instance your helicopter is slightly drifting to one side in hovering or when it drifts during vertical climb outs. Contrary to sub trimming every single servo in the setup menu here you can directly trim aileron or elevator without taking care about the servos. At menu point A just move the aileron or elevator stick to the desired trimming direction until the swashplate is adjusted correctly. The further you move the stick the faster the servos will move. At this menu point it is not possible to trim the collective pitch!

By moving the tail stick to one direction you also can delete the adjustment and bring the swashplate back to the origin position.

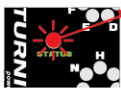


Press the button to save the configuration and enter into the next menu point

B. Control behavior

At menu point B you can choose between different control behaviours for your stick inputs. This includes the maximum rotation rate of the helicopter as well as how sensitive the 3D-H V2 will react to stick inputs for aileron, elevator and yaw around the stick center. If you are a rather unexperienced model pilot it is absolutely suggested to select the option "normal" for the first flights. In this state the rotation rate of the helicopter is decreased very much and the stick inputs are very gentle. It is also possible to adjust the control behaviour by your transmitter's expo function. Therefore switch the status LED color to "blue". The maximum rotation rate for aileron, elevator and yaw can be adjusted by increasing or decreasing the servo travel for the corresponding function in your transmitter.

The color of the status LED shows the currently selected frequency:



- Purple---->normal
- Red flash---->sport
- Red---->pro
- Blue flash---->extreme
- Blue---->transmitter
- Off---->user defined

Press the button to save the configuration and enter into the next menu point

C. Swashplate pitching up behaviour

The helicopter should remain its horizontal position during climbing and descending. If the nose of the helicopter is pitching up and down, increase the value at menu point C to compensate this effect. If the value is too high the helicopter will feel soft and lazy. Try to find a suitable adjustment.



The selected value is indicated by the status LED:



- Purple---->very low
- Red flash---->low
- Red---->medium
- Blue flash---->low
- Blue---->very high
- Off---->user defined

Press the button to save the configuration and enter into the next menu point

D. Adjust tail heading lock gain

If the heading lock gain is too low pirouettes will be inconsistent during fast forward flight or in crosswind situations.

If the heading lock gain is too high the tail will bounce back slowly after stopping maneuvers. It is also possible that the tail in general will not lock in perfectly and that it bounces slightly while flying around. This indicates that the tail gain and the heading lock gain are imbalanced.



Move the tail stick into one direction until the status LED lights in the desired color:



- Purple---->very low
- Red flash---->low
- Red---->medium
- Blue flash---->high
- Blue---->very high
- Off---->user defined

Press the button to save the configuration and enter into the next menu point

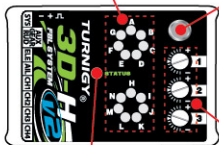
6. DIALS AND TAIL GYRO GAIN

Operation Mode

Menu LED:

Amount of tail gain A=0% to N=100%

(only indicated after powering up or when adjusting the gain)



Button

to enter setup menu push down several seconds until LED A is steady on to enter parameters menu until LED A is flashing

Status LED:

Tail gyro mode:

off, blue=Heading lock mode

purple=Normal-rate mode

Dial1: cyclic gain

Dial2: direct cyclic feed forward

Dial3: tail dynamic

6.1 Swashplate gain

Turn dial 1 clockwise to increase the swashplate gain. Factory set the dial is horizontal corresponding to 100% swashplate gain. For the first flights we suggest not to change this setting. In general the higher the gain the harder the helicopter will stop after cyclic moves and the helicopter will feel more stable in the air. If the gain is too high the helicopter feels spongy and tends to oscillate especially on the elevator axis. If the gain is too low the helicopter does not stop exactly after a cyclic movement and feels unstable in fast forward flight.

6.2 Swashplate direct gain

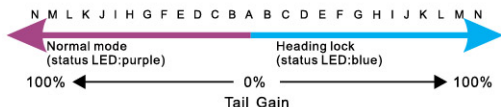
Turn dial 2 clockwise to increase the swashplate direct gain for the cyclic functions. Factory set the dial is horizontal which provides a good setup in most cases. Increasing the direct gain will provide a more aggressive response characteristic to aileron and elevator stick inputs. This assumes servos which have both a high-speed and a high-torque rating.

6.3 Tail dynamic

Turn dial 3 clockwise to increase the tail dynamic. Factory set the dial is horizontal which provides a good setup in most cases. Increasing the tail dynamic will lead to a harder stopping tail and more aggressive response to tail stick inputs. If the dynamic is too high the tail will bounce back shortly after a hard stop and feels spongy when making fast direction changes. Ideally the tail should stop perfectly to the point without making any flapping noises.

6.4 Tail gyro gain (adjusted by transmitter)

As with a conventional tail gyro the tail gain can be adjusted by one of the transmitter's auxiliary channels. In one direction you can select the normal mode and in the other direction the heading lock mode is selected. The color of the status LED indicates the selected mode when the Turnigy 3D-H V2 is ready for operation. Purple indicates the normal mode and blue indicates the heading lock mode. Additionally when adjusting the gain or after the first start up the current amount of gain is indicated by one of the menu LEDs. This ensures that you are always informed about the actual amount of gain in your helicopter independent of the applied transmitter. When the gain channel is nearly centred this will correspond to 45% gain indicated by menu LED A. The maximum adjustable tail gain is 100% corresponding to menu LED N in both modes, but the actual percentage in the transmitter will depend on its brand and/or type. For the initial flight we suggest to start with 70% gain similar to menu LED G in heading lock mode. Then increase the gain step by step until the point is reached when the tail starts to oscillate anxiously. This effect will occur sooner in fast forward flight than in hovering. Therefore reduce the gain approx. by 10% when the oscillation was determined while hovering.



7. First Flight

- 1) Before power up, please place the helicopter in a horizontal place and don't move or touch it, the 3D-HV2 flybarless system's sensor is of high sensitivity and even the strong wind might affect its initialization. If the wind is strong, you could let the helicopter sit aside to avoid being interrupted from initialization. Once you place the helicopter in a stable place, power up and wait for initialization of the 3 axis gyro flybarless system.
- 2) When the initialization is finished, the swashplate will move up and down two times and the Status of LED is steady blue or purple
- 3) Choose the control behavior that you wished, it is recommended to start with Sport for your first flight.
- 4) Before taking off, it's better to check it again, for example, move the stick, to see if the moving direction of swashplate is correct, then tilt the helicopter to right and left to see if the servo will do correct direction compensation.
- 5) After being checked, the swashplate moves back slowly or the servo's moving speed is very slow and the movements is slower than you move the stick, those phenomena are normal.
- 6) Different to the traditional helicopter with flybar, the control orders sent from the radio will no longer be reflected on the servo, just as Fly-By-Wire, the signals sent by radio will come to 3D-HV2 flybarless system and the internal control system of 3D-HV2 flybarless will calculate and then start the flight. Therefore in the headlock mode, when you move the tail stick, it will not react immediately, also, when the rudder servo might run to the endpoints with small stick inputs, those are normal.
- 7) Before taking off, please ensure that the swashplate is in horizontal position. If your tail servo is in the locking mode, tail pitch slider shall be centred. You could move the tail stick slightly and let the tail pitch slider in the center, by this way it could reduce the instant correction for rudder offset.
- 8) Avoid excessive steering when helicopter is to take off, otherwise it might overturn.
- 9) The correction for flybarless helicopter starts when the landing skids leave the ground, the correction may make the flight posture uncomfortable when the landing skid didn't leave the ground completely, the best way is to move the pitch stick quickly and make the helicopter take off. It might take some time for those pilots of flybar helicopters to adjust.

8. Legal provision

The english instruction has been checked carefully, but we can't guarantee all contents are correct and complete.

9. Disclaimer

The accuracy and completeness of information provided in this manual has been checked, but there still might be some potential errors, including operating errors, failure or accident caused by peripheral equipments. so we don't assume any liability for any one of the above failures.

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