VORTEX FINE TUNING GUIDE

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Spartan

PREFACE

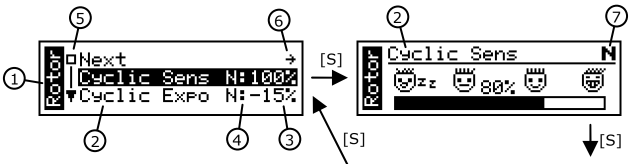
This document explains the operation of the numerous parameters that can be used to fine tune the flight characteristics of the Spartan Vortex flybarless system. This document should be used in conjunction with the "Vortex Setup & First Flight" guide.

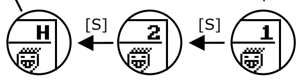
In this guide the tag [FAQ***] indicates that additional information is available at the online knowledge base found at the Spartan website. The number in place of the stars denotes the knowledge base topic number.

The tuning parameters have been split into to three groups, each identified in this user guide by an icon preceding the parameter name. In general parameters of the "Expert Users" group are more complex to comprehend and less likely that will need adjusting.

General Tuning   Expert Users   Experimental [FAQ148]

MENU NAVIGATION

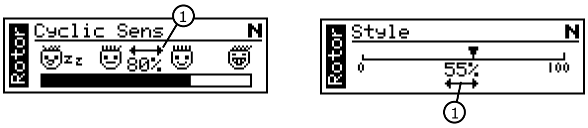




1. Menu name
2. Parameter name
3. Parameter value
4. The colon symbol indicates that different values can be set for each flight mode. The active flight mode is shown on the left of the colon.
5. The square indicates that the top/end of the menu has been reached.
6. The first option in each menu is "Next". This takes us to the next menu.
7. Displayed only for parameters that offer different value in each flight mode. It indicates which flight mode is currently being edited.

DATAPOD REMOTE ADJUST

A spare channel and dial of your radio system can be used to remotely control any bar or slider type menu. You can choose the channel that controls the remote adjust function in the System::DataPod Ctrl menu.

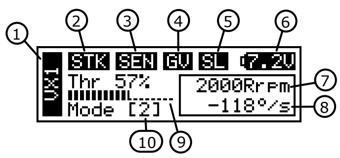


Open the parameter you wish to adjust and press both [+] and [-] buttons for two seconds. The DataPod will beep and the remote adjust indicator (1) will appear on the screen. The value is now adjusted using the dial of your radio. To exit remote adjust mode press either button.

WARNING!

Adjusting some configuration parameters too high or too low can make the helicopter unflyable. For example, setting the tail gain too high will result to rapid tail oscillations. Before taking off ensure that the remotely adjusted value is set to an acceptable safe level for flight. Always proceed in small steps and be prepared to reverse any changes made. If you wish to limit the remote adjustment range you can do so using the control channel endpoints in your radio.

HOME SCREEN



1. The Product name is an indication that we are in the home screen.
2. Displayed when the throttle stick is raised above the value set in Gov::Stick On/Off
3. Displayed when the governor sensor is detecting the magnet.
4. Indicates that the governor is armed. It appears when all of these conditions are met: i) The governor function is enabled in the Setup menu. ii) The governor is enabled in the current flight mode. iii) The STK label (2) is displayed.
5. Indicates that self-levelling is active (currently not available).
6. Displays the voltage at the Vortex servo power bus.
7. "2000rpm" – The currently selected governor RPM. "Gov.Inh" - The governor is inhibited via the Setup menu. "Gov.Off" - The governor is set to Off in the currently active flight mode. "RPM Error" - The combination of rotor RPM and gear ratio has pushed the engine RPM outside the range that the governor can regulate.
8. The commanded yaw rate. Changes when the rudder stick is operated.
9. The throttle stick position.
10. The currently selected flight mode.

ROTOR MENU

Cyclic Sensitivity: Operates in a similar way as dual rates on the radio and allows using different cyclic sensitivity for each flight mode.

Cyclic Exponential: Operates in a similar way as exponential on the radio and allows using a different value for each flight mode. Negative values make the control slower and more precise near the stick centre.

Paddle Dynamic: This parameter enables the helicopter to roll/flip faster without compromising the hover stability. This is achieved by dynamically changing the weight of the simulated paddles based on flight conditions. Higher values provide faster rotation. [FAQ143]

Style: When this value is set close to 0% the control is predominately based on flybar simulation. Higher values introduce more of the digital stabilisation algorithms. As a result the flight characteristics start to feel more locked in but also more artificial (also referred to as "robotic").

Trim (flight): The trim flight can greatly improve piro compensation and the behaviour of the helicopter during certain aerobatic manoeuvres. Activate the trim flight and put the helicopter is a stationary hover. Once stable, try not to touch the cyclic stick for 5 seconds. Completion of the trim flight is indicated by the Vortex gently stepping up the collective thus causing the helicopter to slightly rise. During the trim flight the helicopter does not need to remain perfectly stationary however do not allow it to move at a rapid pace. Also, avoid performing the trim flight in windy conditions. When the "Hover Now" screen closes the new trim values have been saved. A bad trim flight can have negative effect to the flight performance of the Vortex thus pay particular attention that it is performed correctly and repeat if any doubts exist. If weather conditions prevent you from performing a successful trim flight it is best to set the trims to zero. To do this, start a new trim flight and then press [S] to cancel it. An example trim result of +120-40 means the cyclic trim is 1.20° to the right and 0.4° towards the back. Large values are typical when the airframe is misbalanced, the swashplate is not mechanically level or the trim flight was affected by a wind gust. For better results perform the trim flight with the fuel tank half full.

Gain (aka Flybar Ratio): Defines the mixing ratio between the simulated flybar and main blades. It can therefore also be seen as the rotor stabilisation gain. The default mixing ratio 46% means that the main blade pitch changes by 4.6° when the simulated flybar tilts 10°. Increasing this value is similar to increasing the stabilisation gain and oscillations may start to appear if the value becomes too high.

Elevator Debounce: This parameter allows the Vortex to compensate for the angular momentum of the tail which would normally result to a soft bouncy stop at the end of rapid fore/aft cyclic movements. Increase this parameter in steps of 10% until the vertical tail bounce is eliminated. Smaller changes are not always easy to notice but can be useful for fine tuning. Always proceed with care during take off and do not increase this value in larger steps as excessive debounce gain can cause rapid tail oscillations and render the helicopter unflyable. It is not uncommon for the elevator debounce gain to be in the 100-140% range and typically 600 size helicopters will work best at around 130%. However, do not jump straight to 130% as a starting point.

Aileron Debounce: Similar to the Elevator Debounce above but operates on roll. As the helicopters angular momentum is much less on the roll axis we anticipate that this parameter will not often need adjusting. If you need to adjust it proceed in small increments of 2-5%.

Cyclic Acceleration: Controls how fast the helicopter responds to cyclic stick movement. Reducing this parameter makes the cyclic response more gradual as if the pilot is gently pushing the cyclic away from its centre. If this parameter is set too low the cyclic response will start to feel delayed. Helicopters with soft head dampeners may benefit from slightly reduced cyclic acceleration.

Cyclic Deceleration: Controls how fast the cyclic returns to neutral. Reducing this parameter makes the cyclic response more gradual as if the pilot is gently returning the cyclic to its centre. Helicopters with soft head dampeners may benefit from a reduced cyclic deceleration.

Collective Boost: Increasing this value makes the collective feel crisper in manoeuvres like tic-tocs and rainbows.

Paddle Response: Doubling this value has the same effect as halving the weight of the flybar paddles thus making the helicopter more agile. At the same time the helicopter becomes less stable. [FAQ143]

Elevator Pre-compensation: Mixes a small amount of collective pitch to elevator. Some helicopters benefit from this adjustment in full collective fast-forward flight. However, if this parameters is set too high it is likely to affect the behaviour of the helicopter during pitch-pumping.

Cyclic Deadband: This adjustment creates a small range around the stick neutral where the helicopter is not affected by rudder stick movement. The default value is negligible and primarily acts as a filter for minute variations when re-centring the rudder stick.

(Piro) Cyclic Decay: Gradually reduces the cyclic sensitivity as the pirouetting speed increases. As a result the helicopter feels more controllable in fast pirouetting manoeuvres.

Rotor Phase: Used to set the correct phase in some scale multi-bladed rotor heads. It is not needed for the popular 3D helis and should remain at 0 degrees.

Piro Tracking: Used by the piro optimisation algorithm. The benefits of adjusting this parameter are currently reviewed by our test pilots. Please keep this parameter at the default value.

Phase Compensation: Enables the piro optimiser to compensate for the control phase lag of the main rotor. INH= Automatic phase compensation is inhibited. 0ms= Phase compensation is entirely based on main rotor RPM using the governor RPM setting. Values higher than 0ms can be used to compensate for the slower response time of analog servos.

TAIL MENU

Gyro Gain: Sets the gain for that tail gyro. The optimal gain value is the highest value you can reach that does not cause tail wag at any time during flight. [FAQ3]

Gyro Type: Select the desired tail gyro mode. The options are *Rate* and *AVCS* (Heading Hold).

Rudder Exponential: Operates in a similar way as exponential on the radio and allows using a different value for each flight mode. Negative values make the control slower and more precise near the stick centre.

Rudder Sensitivity: Sets the maximum pirouetting speed in °/s when the rudder stick is at full deflection.

Acceleration: Sets the acceleration rate of the tail thus reducing strain on the drive gears when the rudder stick is operated sharply.

Deceleration: Sets the deceleration rate of the tail thus reducing strain on the tail drive gears. Also, by matching the deceleration rate of the gyro with the mechanical capabilities of the heli fast stops will become crisper and reduce bounce back.

CW/CCW Stop Gain: The stop gain parameters allow a different amount of gain to be used for stops and can be separately adjusted for clockwise and counter-clockwise rotations. If your helicopter does not wag in flight but is showing wag at the stops lower the stop gain of the corresponding direction that causes the wag. Similarly if the stop appears too soft increase the stop gain of that direction. Increasing the stop gain will make the stops more aggressive which can help in eliminating stop bounce.

Stick Deadband: This adjustment creates a small range around the rudder stick neutral where the gyro is not affected by rudder stick movement. Some pilots prefer a moderate amount of deadband as this allows fast collective pitch changes without accidentally affecting the rudder. The default value is negligible and primarily acts as a filter for minute variations when re-centring the rudder stick.

Cyclic to Tail: This parameter mixes a percentage of the cyclic pitch to tail rotor pitch, thus pre-compensating for any additional torque as a result of repid cyclic inputs.

Collective to Tail: This parameter mixes a percentage of the collective pitch to tail rotor pitch, thus pre-compensating for any additional torque as a result of repid cyclic inputs.

AVCS Gain: The benefits of adjusting this parameter are currently reviewed by our test pilots. Please keep this parameter at the default value.

AVCS Gain Piro: The benefits of adjusting this parameter are currently reviewed by our test pilots. Please keep this parameter at the default value.

GOVERNOR MENU

Governor: Selects if the governor is operational or not for each of the flight modes.

Rotor RPM: Selects the desired RPM for the main rotor. The selected value is used by the governor, rotor phase optimiser and vibration filtering algorithms. Set this parameter even if you are not using the built in governor. In this case the RPM value does not need to be precise and a best guess within ±100RPM would be acceptable.

Governor Gain: If the engine is hunting (rapidly revving up and down) reduce the gain until the hunting stops. Similarly, if the engine to responds too slowly to rapid changes of the collective pitch the governor gain will need to be increased.

Engage Ramp: The governor engages when the actual rotor RPM is over 75% if the programmed RPM. For example, when this parameter is set to 3.5s and the head speed is set to 2000RPM the governor will engage at 1500RPM and will ramp up to 2000RPM over the next 3.5sec. This parameter also affects the transition time between different RPM selections.

Autorotation Abort (Time): When aborting an autorotation there is often a sudden jump of throttle as the flight mode is changed from Hold to Idle-Up. This can cause the blades to fold. The autorotation abort function provides a gradual increase of throttle over a set time. It is activated when the throttle is less than 15% and suddenly jumps to over 30%.

(**Autorotation) Abort Exponential:** When set to 0% the throttle ramps linearly from Hold to Idle-Up. Higher values cause the ramp to start slowly and progressively speed up. Since a faster spinning rotor can tolerate more rapid throttle changes the use of an exponential ramp will maintain a soft start but help shorten the overall autorotation abort time.

Minimum Throttle: The governor throttle range is limited by this parameter. The governor will never drive the throttle below this point.

Stick On/Off: The governor is armed when the throttle stick is higher than this value. It disarms at 5% less. For example if this adjustment is 20% the governor will arm when the throttle stick is over 20% and will disarm when the throttle stick comes down to below 15%.

Cyclic to Throttle: Mixes cyclic to throttle thus enabling the engine to provide the additional power needed for large cyclic movements. This process eases the workload of the governor and helps maintain more consistent RPM. Large .120 size nitro engines may slightly overspeed during rolls with the default value which will need to be reduced.

Collective to Throttle: Mixes collective pitch to throttle thus enabling the engine to provide the additional power needed for large collective movements. This process eases the workload of the governor and helps maintain more consistent RPM.

Collective to Throttle Boost: The boost process monitors the manner in which the collective stick is operated to predict if more throttle will be needed in the near future. This process allows the engine to pre-compensate with additional power before it is bogged down by the increase in collective pitch.

SYSTEM MENU

Flight Log: This sub-menu provides access to noteworthy information for your last flight. For example you can view how many times the Vortex switched between satellite receivers or the minimum voltage encountered in flight when the battery/BEC was under the load. These data are cleared when the Vortex is powered off; as such, they must be reviewed at the end of the flight.

Vibration Analysis: This screen provides a frequency vs magnitude plot of the vibrations present on the helicopter. Use the [+] and [-] buttons to position the cursor. The plot freezes whist the cursor is active thus allowing to examine any areas of interest. At the bottom of the screen the frequency that corresponds to the cursor position is displayed in RPM and Hz. The corresponding vibration magnitude is shown at the bottom right corner.

Vibration Hold: If *Never* is selected the vibration plot always runs live. When a time interval is selected the plot will freeze after the specified time has lapsed. This delay makes it possible to capture vibration data whist the helicopter is in flight.

Throttle Failsafe: Throttle failsafe takes effect when the Vortex stops receiving updates of the throttle stick position. When using Spektrum satellites or receivers without a built-in failsafe feature this becomes the primary failsafe. If your receiver offers a built-in failsafe it should be programmed in addition to this parameter. Move the throttle stick to the desired failsafe position and confirm that you wish to update the failsafe position. [FAQ150]

Aux Outputs: When the AUX/3 port is not used for receiver signal inputs it can drive accessories like retract, night lights or glow igniters. This menu option selects which transmitter channels are routed to the spare pins of the AUX/3 port. [FAQ140]

DataPod Ctrl: This parameter selects a spare channel of your radio system to be used for the DataPod Remote Control function.

Battery Alarm: When the receiver battery voltage is below the alarm voltage the Vortex will not confirm that it has completed initialisation by zipping the swashplate up and down. The pilot should treat this as an indication that it is not safe to fly. However, the Vortex remains operational and is able to fly.

Menu Type: My default some of the parameters in Rotor, Tail and Gov menus are hidden to avoid unnecessary complexity and clutter. Expert users can enable these additional parameters by setting the menu type to "Full".

System Info: Displays the Vortex serial number and other production data.

Factory Reset: You will be promoted to confirm your selection. Once "Yes" is selected the factory default values are loaded to all configuration parameters.

Setup Menu

The Setup menu is covered in separate document with title "Vortex Setup & First Flight".

WARNING!

To aid adjustment of certain parameters the setup process will override the pilot's controls.

- Do not disconnect the DataPod whist Setup menu adjustments are active as this may leave servo override functions enabled.
- Do not attempt to fly the helicopter whist Setup menu adjustments are active.
- Switch off the engine and disconnect electric motors before accessing Setup menu options.

Always confirm that that collective pitch, cyclic, rudder and throttle controls operate properly before takeoff.

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