About this user guide

This user guide provides detailed information for the installation and configuration of your new Spartan gyro. It assumes that the model aircraft is correctly assembled and that the user is familiar with model helicopters and is a competent pilot. Please read this user guide entirely even if some sections may not appear applicable to your requirements. This user guide [Doc. v1.2] was accurate at the time of printing. As the firmware evolves some of the configuration options described in here may have changed. It is recommended to always use the latest version of firmware and user guide which are published on the Spartan RC website.

Safety notes

Model helicopters are not toys and they have the potential to be very dangerous. Beginners are advised to seek advice from a competent adult pilot.

CONTENTS

Overview

Your new Spartan gyro is designed to the highest specifications and is capable of delivering unparalleled aerobatic performance. At its heart a premium quality Silicon Micro Machined (SMM) sensor and powerful Digital Signal Controller together with Spartan RC's adaptive angular velocity control algorithms offer exceptionally consistent yaw rates that remain unaffected by outside variables like the helicopter's rotor head speed variations, rotor disc loading, flight speed, wind, etc. This is a significant feature that not many gyros are capable of and is a necessity for doing complex pirouetting 3D manoeuvres. The holding ability of the gyro is excellent and precise giving a very solid feel.

Depending on the gyro model you chose the flight characteristics and other features will very. For a comparison chart detailing the features offered by the latest firmware of each gyro visit the Spartan RC website.

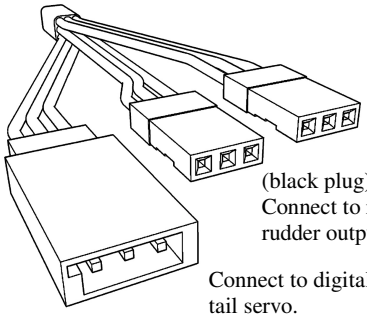
Setting up your gyro for the first time

Follow the steps below in the specified order to successfully deploy your new Spartan gyro. Additional information is available in later sections of this user guide.

- Read the Addendum section at the end of this user guide.
- Spektrum and 2.4GHz JR users, refer to Troubleshooting section.
- Connect the gyro to a receiver as shown in the Interconnections section. Do not connect the servo to the gyro at this time.
- Ensure that the transmitter trims and sub-trims are set to zero and that collective pitch to tail pitch mixing is disabled. Power on the gyro and check that the LED responds when toggling the gain switch and make a mental note of which side if the switch activates AVCS mode (LED on) and which side activates Rate mode (LED off).
- Perform servo type configuration as described in detail later in this guide.
- Connect the servo to the gyro.
- Adjust rudder direction reversing at your transmitter.

- With the gain switch in Rate mode perform mechanical adjustment of the servo horn and control linkages to achieve approximately 8° tail pitch.
- Perform the gyro configuration (gyro reversing and servo endpoint) as described in detail later in this guide.
- Adjust gyro gain for both Rate and AVCS modes via your transmitter.
- Perform final checks. Confirm correct relationship of rudder stick and gyro response to tail rotor pitch. Confirm that there is no mechanical binding.

Interconnections



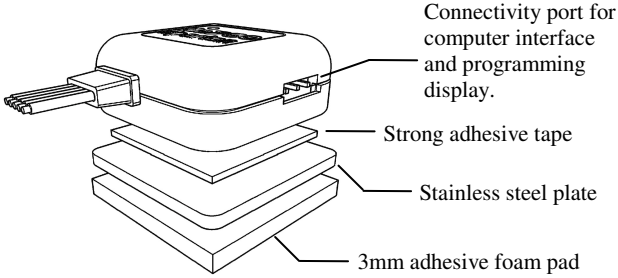
Status indicator

During normal operation the LED provides simple status information to the user.

On:	AVCS mode. Stick at neutral.
Short double blink:	AVCS mode. Rudder input detected.
Off:	Rate mode.
Slow repeating flash:	Error. Gyro not receiving valid signal from the receiver or unable to calibrate because the rudder stick is not centred.

Mounting

The correct operation, performance and stability of your Spartan gyro can be greatly affected by the way it is fixed on the aircraft. It is essential that the gyro is mounted on a flat surface accurately perpendicular to the main shaft. When possible choose a rigid mounting location close to the centre of gravity (CoG) of the aircraft. Avoid mounting the gyro on weak structures far away from the CoG such as the electronics tray at the front of the helicopter; these locations are often subject to substantially more vibration. Avoid mounting the gyro in direct proximity to other electronic equipment and particularly servos. The supplied mounting kit contains a stainless steel plate and adhesive foam pads which have been selected by Spartan RC to give the correct mass and shore hardness for effective vibration damping. Using other types of adhesive tape will affect the balance and the performance of your gyro. Small electric helicopters often have much lower vibration levels and it may be possible to mount the gyro only using a single 3mm foam pad without the steel plate. In high vibration environments the strong adhesive tape can be substituted with a second 3mm foam pad. Where possible do not fix the cable to the helicopter for the first 5cm (2 inches) from the gyro end to reduce transmission of vibrations through the cable.

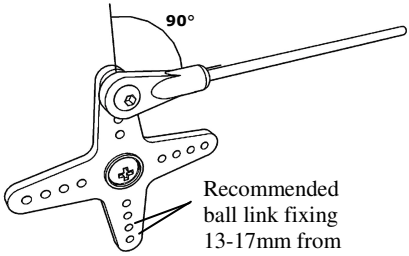


Important: Do not mount the gyro in locations where it may be subjected to high levels of oily smoke, fuel, or other liquids. Do not allow the cable to touch the sharp edge of the helicopter frames as over time the cable insulation may be damaged. Inspect the condition of the adhesive pads as part of your regular pre-flight checks.

Linkage setup

The optimal mechanical setup is essential for getting the best performance from your gyro. Ensure that any slop in the system is kept to a minimum and that the tail pitch linkages can move freely without excessive friction through any guides, stiff ball links or other joints.

With the gyro set to Rate mode and the rudder stick positioned at the centre the servo arm should be at a 90° angle with the pushrod as illustrated. To fly in Rate mode set the linkage lengths for approximately 8° tail pitch in the direction that compensates the main rotor torque.



We recommend that the ball-link is mounted 13-17mm from the servo shaft unless a different distance is deemed essential for a particular helicopter. Ultimately, the most important factor is the servo travel which ideally should be around 45° on either side of the mid-point (+/-15%). For most servos this will result to gyro endpoints in the range 85-115%. This combination gives a good balance between tail pitch correction speed and available torque. If the servo travel or endpoints are significantly different than this recommendation you may wish to change the ball-link position to restore this balance.

Always set the gyro endpoints for the maximum available tail rotor pitch. This defines how much pitch the gyro can demand and has no effect on how responsive the gyro feels in flight. If you find the yaw very responsive or very slow for your preference you may adjust this via the transmitter's endpoints or Dual Rate setting for the rudder channel.

Servo type selection

Spartan gyros are designed to work with all modern digital tail servos. They can drive servos using the standard 1520uSec or narrow 760uSec control pulses and supports both 333Hz and 250Hz modes. The factory default setting is the most frequently used type 1520uSec / 333Hz. If you wish to use a narrow pulse or 250Hz servo you must change the servo type before connecting the servo to the gyro.

The lists below show the required setting for a selection of the most popular tail servos. This list is not exhaustive. If in doubt, please contact the Spartan RC support team to check compatibility with other makes and models of servos.

1520uSec servos capable of 333Hz
Futaba S9253 / S9254 / S9257 / S9650 / S3153 / S3154, JR 8900G / 3400G, Sanwa ERG-WRX, Airtronics 94758 / 94761, Hitec 5925MG / 6965HB, Robbe FS61BB, LogicTech 3100G

760uSec servos capable of 333Hz
Futaba S9251 / S9256 / BLS251, LogicTech 6100G

1520uSec servos capable of 250Hz
JR 2700G / 8700G / 810G, Sky HDS-577 / HDS-877

Attention: Do not attempt to use analogue servos. Severe damage may be caused to your servo or loss of tail control.

To access the servo configuration mode hold the rudder stick to full left and toggle the gain switch continuously and immediately after powering on the gyro. Once the configuration mode is active the LED on the gyro will start flashing indicating the currently selected servo type.

1 flash	2 flashes	3 flashes
1520uSec, 333Hz	760uSec, 333 Hz	1520uSec, 250Hz

Move the rudder stick left or right to change to the desired servo type.

When satisfied, toggle the gain switch to Rate and back to AVCS mode to store your selection. The gyro will acknowledge that the servo type is successfully changed by switching the LED continuously on. You may now power off the gyro and connect your tail servo.

Configuration

Attention: Before configuring your gyro ensure that the rudder reversing has been correctly set at the transmitter. The gyro relies on this configuration to adjust its internal gyro direction reversing as required. Before proceeding confirm the correct operation of the rudder stick by observing the tail rotor blades as explained later in this guide. If in doubt, seek expert advice.

To access the configuration mode leave the rudder stick to neutral and toggle the gain switch continuously and immediately after powering on the gyro. Once the configuration mode is active the tail servo will chatter twice then rest in its centre position.

Step 1: Gyro direction reversing
The first parameter to be configured is gyro direction reversing. Simply push the rudder stick to the left and the gyro will automatically match your radio system. The tail blades will move to allow visual confirmation of the correct rudder behaviour. The LED will also switch on/off to indicate if reversing is active. When satisfied, toggle the gain switch to Rate and back to AVCS mode. The servo will chatter once to confirm completion of this step. Note: If the gyro is mounted in inverted orientation you will need to push the rudder stick to the right instead.

Step 2: Adjust low servo endpoint
The servo will now be resting at the low endpoint position and the LED will be flashing twice followed by a short pause. Using the rudder stick adjust the servo position until you achieve maximum tail rotor pitch without binding on the mechanical limits. When satisfied, toggle the gain switch to Rate and back to AVCS mode. The servo will chatter once to confirm completion of this step.

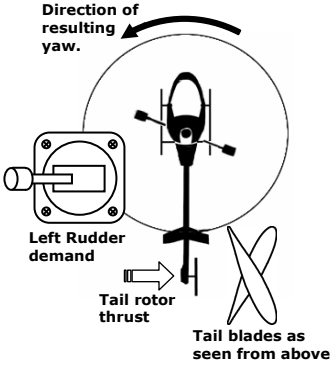
Step 3: Adjust high servo endpoint

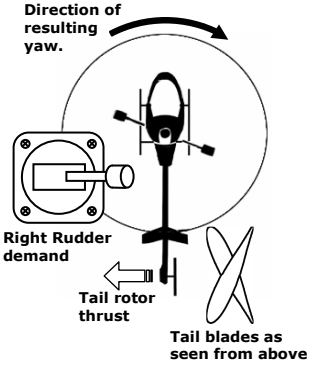
The servo will now be resting at the high endpoint position and the LED will be flashing three times followed by as short pause. Similarly to setting the low endpoint use the rudder stick to adjust the servo position for maximum tail rotor pitch without binding. When satisfied, toggle the gain switch to Rate and back to AVCS mode. The servo will chatter twice to confirm completion of the configuration mode.

Upon completion the gyro will store the new configuration to its internal memory and switch the LED continuously on. You may now power off.

Gyro direction reversing

The diagrams below illustrate the pitch of the tail blades for left and right rudder demand. It is absolutely vital to correctly configure rudder reversing on your transmitter before proceeding with configuring the gyro. The gyro relies on this configuration to adjust its internal gyro direction reversing as required. Failure to follow this step correctly could result in violent pirouetting on take off and loss of tail control.



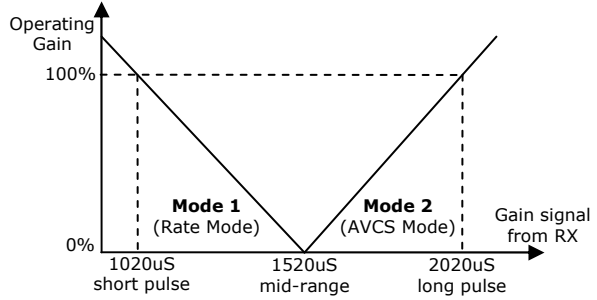


When performing the final checks of the gyro installation, you should also check the correct operation of the gyro direction. To do this set the

gyro in AVCS mode (LED on) and rotate the helicopter at least 90 degrees counter-clockwise. In an attempt to oppose the rotation and maintain the aircrafts heading the gyro should have now moved the tail blades in the same manner as if right rudder was applied. If this test fails you should check the reversing of your radio and reconfigure the gyro.

Setting the gyro gain and mode

Spartan gyros offer two operating modes. Mode 1 defaults to the classic Normal/Rate type while Mode 2 is an Angular Velocity Control System (AVCS). The diagram below illustrates the relationship between the gain input and the resulting operating gain and mode. This adjustment requires assigning the gain channel to a two position switch on your transmitter. The gain channel endpoint may then be used to adjust the resulting gyro gain for each side of the switch. Your radio may also offer more advanced configuration options for the gyro gain setting.



The optimal gain value is a function of several parameters including rotor speed, tail rotor diameter, tail blade efficiency, servo arm length, servo make/model and mechanical design of the aircraft. As such, it is not possible to make a general recommendation and the gain will need to be adjusted experimentally. Starting with a gain of 30% should provide enough stability to at least hover; however you should always proceed with care. If insufficient stabilisation or tail wag is seen the gain should be raised or lowered respectively. The optimal gain value is the highest value you can reach that goes not cause tail wag at any time during flight.

It is not uncommon to find that the optimal gain value for a helicopter may be a small number such as 35-45%. The small value does not mean that the gyro will be limited in performance. Any gain value performs well as long as it is the optimal gain value. However, a gain below 35% indicates that the mechanical gain of the tail is too high and it is therefore recommended moving the servo arm ball link further in. Similarly if 100% is reached and no tail wagging is seen the ball link needs to be moved further out and repeat the gain adjustment procedure.

Operation

Immediately after powering on the gyro performs automatic calibration of the rudder stick and gyro sensor resting positions. During this time the helicopter must remain undisturbed and the rudder stick must be left at the centre position. Calibration lasts approximately 4 seconds and upon completion the gyro will enter flight mode and the tail servo will move to its midpoint. The calibration will not start if the gyro is not receiving a valid rudder signal from the receiver or if the rudder stick is not centred. In both cases the LED will emit the Error flashing sequence (see Status LED section).

Once the power on calibration is completed you may recalibrate the rudder stick neutral by rapidly toggling the gain switch three times and then return it to the AVCS position. The rudder stick must be left at the centre position while this takes place. Similarly, you can instruct the gyro to drive the servo to its midpoint by rapidly moving the rudder stick side to side three times before returning it to the centre position.

Whilst the gyro operates in AVCS mode the tail pitch is entirely controlled by the gyro. In this mode the pilot's rudder inputs become a command for the gyro telling it how fast to yaw; the gyro then controls the tail pitch as needed to maintain the commanded yaw rate. It is also possible to command the gyro to open the tail pitch fully which – depending on the mechanical capability of the helicopter – can result to spectacular yaw rates well over 3 turns per second. To achieve this you should set the rudder endpoints of your radio to a very high value effectively commanding the gyro to yaw faster than its sensor's

measurement capability.

Advanced configuration

The gyro configuration can also be modified by connecting it to Spartan RC's detachable programming display, a Windows based computer, most Pocket PCs and certain mobile phones. For such connectivity we offer USB and Bluetooth interfaces as an optional accessory. This method also provides access to additional advanced configuration parameters. However, the number and purpose of these parameters may vary between gyro models. Visit the Spartan RC website for details.

Firmware Update

Spartan RC is committed to the continuous improvement of their products and from time to time we produce new firmware versions offering optimisations and/or new functionality. These new firmware releases are published on the Spartan RC website. To support such firmware updates your Spartan gyro has a robust built in firmware update utility (firmware loader). It is designed so that the gyro can always be brought back to operating state even if the update process fails to complete. However, for a smooth update always ensure that the receiver battery is sufficiently charged. In order to install a new firmware you will need:

- The Spartan Flash-Link (USB) or Blue-Link (Bluetooth) interface which can be purchased from Spartan RC and their distributors.
- The Windows firmware loader application which is available on the Spartan RC website.

Troubleshooting

Please note that additional troubleshooting information and answers to frequently asked questions can be found on the Spartan RC website's technical support section. If you still experience difficulties with gyro you may also contact the Spartan RC support team who will be happy to assist with your specific issue.

Difficulties entering setup mode when using Spektrum and 2.4GHz JR radios

These receivers produce servo signals at power on and before the link with the transmitter is established. This initiates the gyro calibration process which is sometimes completed before the link is established. At this point it is no longer possible to enter the setup modes as this must be done during the calibration period.

Starting from firmware version v1.02 the gyro will not start calibration until the rudder stick is seen at the centre. Spektrum users should bind their radios while holding the rudder stick off centre. This becomes the default rudder output when the receiver is powered on which will now prevent the gyro from starting calibration until the link with the transmitter is established.

Can't enter configuration mode

- Check that the rudder and gain inputs of the gyro are plugged to the correct receiver outputs.
- Check that the LED responds when toggling the gain switch. On one side the LED should be lit (AVCS mode) and on the other side the LED should be off (Rate mode).
- The gain value may be too low resulting to the switch toggling not being detected. Temporarily increase the gyro gain to 100% in both AVCS and Rate modes.
- When using a Spektrum DX6/DX7 radio place the mode selection switch to Rate mode during pairing.
- Ensure the correct servo type has been set.

Can't enter servo selection mode

- Check that the rudder and gain inputs of the gyro are plugged to the correct receiver outputs.
- Check that the LED responds when toggling the gain switch. On one side the LED should be lit (AVCS mode) and on the other side the LED should be off (Rate mode).

- The gain value may be too low resulting to the switch toggling not being detected. Temporarily increase the gyro gain to 100% in both AVCS and Rate modes.

The servo is not moving

- Check that the rudder and gain inputs of the gyro are plugged to the correct receiver outputs.
- Make sure that the correct servo type has been selected.

The servo sometimes moves and sometimes does not

This is almost certainly the result of using incorrect servo type. Change the servo type to 760uSec or 1520uSec as needed for your servo.

The helicopter tail drifts

Spartan gyros offer exceptional tolerance to the vibration levels that are commonly found on model helicopters. However, there are many factors that can manifest as drift varying from incorrect transmitter configuration to incorrect mounting or a very rich engine. If you have tried all sensible measures and you are still having drift issues please contact the Spartan RC support team which will be able to guide you further. You may also consider the following:

- Some radios offer different trim setting on each flight mode. Ensure that the trim setting for all modes is identical.
- Never use trim to cancel drift in AVCS mode.
- Use the supplied steel plate and two layers of the 3mm foam tape for mounting the gyro.
- Do not fix the cable to the helicopter for the first 5cm (2 inches) from the gyro end to reduce transmission of vibrations through the cable.
- Check you engine is not excessively rich.
- Unclip the tail pitch control rod from the servo arm and check that it can move freely with minimal amount of force.
- Ensure that there is not excessive backlash in the tail pitch control mechanics.

- Check your servo runs smooth and does not have excessive backlash or a worn potentiometer which often results in a dead-band.
- Check that your transmitter rudder stick centring operates correctly. Worn potentiometers affect the centring accuracy of the joystick which will manifest as drift.

Spare parts and accessories

SRC03458 Adhesive foam pad set.

SRC03468 Vibration attenuation kit. Includes pads and metal plate.

SRC03478 Flash-Link offers a convenient way to access the advanced configuration parameters and load the latest firmware updates using your computer's USB port.

SRC03438 Blue-Link offers a convenient way to access the advanced configuration parameters and load the latest firmware updates wirelessly via Bluetooth.

SRC03488 Detachable display with keypad enables easy access to advanced configuration parameters at home or at the field.

Specification

- Radio compatibility: All PCM, PPM and 2.4GHz radios supporting the standard servo connector pinout (signal, power, ground).
- Servo compatibility: Digital servos as specified in this user guide.
- Servo pulse resolution: 250nSec
- Operating voltage: 4 – 8.4 Volts, current draw <75mA
- Dimensions: 28.4mm x 28.4mm x 12mm
- Weight: 16 grams with cables. Metal plate 14 grams.
- Operating conditions: -15 to 55 deg C, 5 to 131 deg F, 20 to 85 % humidity non condensing.
- Storage: 10 to 70 deg C, 50 to 158 deg F, 20 to 90 % humidity non condensing.

Addendum

This area is intentionally left blank. If any labels were included in the retail box containing information specific to your gyro model or firmware you may affix them here for future reference.

Important notes

For enquiries of any nature including repairs, servicing, technical support or distribution of this product visit the support page at the Spartan RC website: http://www.spartan-rc.com/

Remember to register your product online to qualify for 3 years free service. You must do so via the Spartan RC website within 30 days of the original purchase and retain the original dated sales receipt.

Warranty

This product is warranted to be free from defects in materials or workmanship for twelve months from the date of original purchase. Within this period, Spartan RC will, at its sole option, repair or replace any components which fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labour, provided that the customer shall be responsible for any transportation costs. This warranty does not cover failures due to wear and tear, abuse, misuse, accident or unauthorized alterations or repairs. All warranty is return to base and the original dated sales receipt must be provided; we will not replace items in advance. Spartan RC retains the exclusive right to repair or replace the product or offer a full refund of the purchase price at its sole discretion. In no event shall Spartan RC be liable for any incidental, special, indirect or consequential damages resulting from the use, misuse or inability to use the product or from defects in the product.

Copyright and Licence

Liability Disclaimer

Because Spartan RC and their distributors have no control over the installation and use of this product, no liability may be assumed nor will any liability be accepted for any damages resulting from the use of this product. Under no circumstances will the buyer be entitled to consequential or incidental damages. By the act of installing this product, the buyer accepts all resulting liability.