Spartan

Quark

Gyro Installation Guide

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: 3.8V – 8.4 Volts, current draw <75mA
- Dimensions: 20.6mm x 20.6mm x 9.1mm
- Weight: Alloy case 10.2g, plastic 8.2g with all cables.
- 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.

TROUBLESHOOTING, WARRANTY & REPAIRS

Should you encounter any problems, please do not return this product to the store until you have carefully read this user guide, consulted the knowledge base on the Spartan website and sought advice from our technical support staff.

For repairs, servicing, technical support or questions regarding the distribution of this product visit the support page at the Spartan website: http://www.spartan-rc.com/

CONTENTS

Important: This user guide [Doc. v1.0] was accurate at the time of printing. As the firmware evolves some of the configuration options described in here may have changed. For firmware release notes visit the support knowledge base on the Spartan website and consult topic 89.

WARNING!

Model helicopters are not toys and have the potential to be very dangerous. Failure to follow the safety precautions and warnings in this user guide may result in severe injury to yourself and others. Beginners are advised to seek further advice from an experienced adult pilot.

Read through the entire manual before operating this product.

This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.
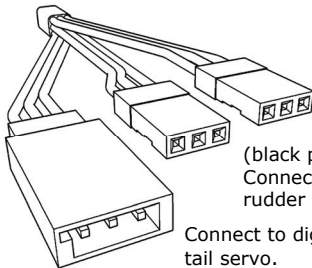
Safety Precautions

BEFORE EACH FLIGHT:
• Verify that the gyro operates correctly.
• Verify that the gyro compensates in the correct direction.
• Verify that the gyro is operating in the desired mode.
• Verify that the gyro mounting pads are in good condition.
• Verify that the gyro wires are not contacting the frame of the helicopter.
• Verify that all tail linkages, ball links and tail hub bearings can move freely without excessive friction.

OVERVIEW

Measuring a mere 20.6mm square and 9.1mm tall (0.81 x 0.81 x 0.36 inch) your new Spartan Quark™ gyro is the smallest and lightest heading hold gyro in its class. Its cutting-edge MEMS (Micro Electrical Mechanical System) sensor, powerful Digital Signal Controller and Spartan's market leading adaptive tail control technology offer optimal gyro performance and exceptionally consistent yaw rates on any size helicopter from tiny electric to the largest nitro helicopters. The holding ability of the gyro is excellent and precise giving a very solid and dependable feel.

INTERCONNECTIONS

(red plug)
Connect to receiver's gyro gain output. Also used for data link.

(black plug)
Connect to receiver's rudder output.

Connect to digital tail servo.

STATUS LIGHT

	Status Light	Description
Operating Mode	Steady red	Rate mode.
	Steady blue	AVCS mode.
	Blue 2 flashes	AVCS mode - Rudder stick not centred.
	Blue slow flashing	Start conditions not met. Gyro gain is set to less than 5%.
	Alternating blue/red	Gyro calibrating.
Error Codes	Red slow flashing	Gyro not receiving both rudder and gain signals. Possibly not produced by the receiver.
	Red 1 flash	Gyro not receiving rudder signal. Rudder plug is fitted incorrectly or broken yellow wire.
	Red 2 flashes	Gyro not receiving gain signal. Gain plug is fitted incorrectly or broken orange wire.
	Red 3 flashes	Power on calibration or self-test failed. Cycle power. If the problem persists contact technical support.
Set up	Steady violet or flashing	See Servo Type Selection and Gyro Configuration sections.

SETTING UP YOUR GYRO FOR THE FIRST TIME

Follow the steps below in the specified order to successfully deploy your new Spartan gyro.

- Fix the gyro on your model following the instructions shown in the **Gyro Mounting** section later in this guide.
- Connect the gyro to the receiver as shown in the **Interconnections** section of this guide. 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.
- Select the correct servo type as described in the **Servo Type Selection** section of this guide.
- Connect the servo to the gyro.
- Follow the instruction in the **Linkage Setup** section of this guide to set the correct mechanical geometry of the tail.
- Adjust rudder direction reversing at your transmitter.
- Configure gyro reversing and servo endpoint as described in the **Gyro Configuration** chapter if this guide.
- Adjust gyro gain for both Rate and AVCS modes via your transmitter. See **Gyro Gain and Mode** section.
- Confirm tail rotor pitch changes in the correct direction to oppose any movement of the tail. Confirm the rudder stick produces the desired tail pitch movement and that there is no mechanical binding. See **Tail Rotor Pitch** section.

GYRO MOUNTING

The correct operation, performance and stability of your Spartan gyro can be greatly affected by the way it is fixed on the aircraft.
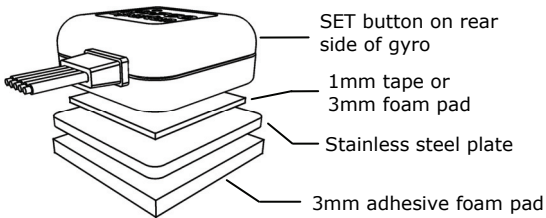
WARNING!

• It is essential that the gyro is mounted on a rigid flat surface accurately perpendicular to the main shaft.
• 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 gyro case to touch other objects.
• Do not allow the gyro cable to touch the sharp edge of the helicopter frames.
• Avoid mounting the gyro in direct proximity to other electronic equipment and particularly servos.
• Avoid fixing the cable to the helicopter for the first 5cm (2 inches) from the gyro end to reduce transmission of vibrations through the cable.
• Do not fit cable braid over the gyro wires.
• Inspect the condition of the adhesive pads as part of your regular pre-flight checks.

The supplied mounting kit contains a stainless steel plate and adhesive foam pads which have been selected by Spartan to give the correct mass and shore hardness for effective vibration damping. Always use the supplied mounting pads or the Spartan replacement mounting pads available from your Spartan gyro retailer.

Small electric helicopters (250, 450 and 500 size) – Use a single 3mm foam pad without the steel plate.

Larger electric and nitro helicopters – Use a piece of the 1mm adhesive tape to mount the gyro on the steel plate and a 3mm foam pad to mount the plate to the helicopter.
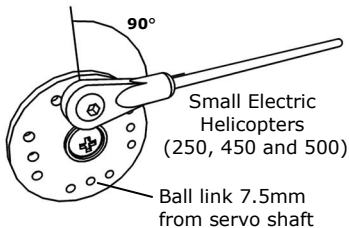
High vibration environments – Use a 3mm foam pad on each side of the supplied steel plate.

SET button on rear side of gyro

1mm tape or 3mm foam pad

Stainless steel plate

3mm adhesive foam pad

LINKAGE SETUP

The optimal mechanical setup is essential for getting the best performance from your high end Spartan 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, 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.

90°

Small Electric Helicopters (250, 450 and 500)

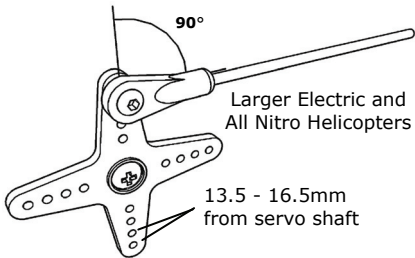Ball link 7.5mm from servo shaft

Follow the advice in the helicopter's assembly manual regarding the placement of the ball link onto the tail servo horn. When such advice is not provided or has resulted in poor tail performance we recommend placing

the ball link at 7.5mm in the case of small electric helicopters and 13.5 - 16.5mm for the larger electric and all nitro helicopters. Alternatively

90°

Larger Electric and All Nitro Helicopters

13.5 - 16.5mm from servo shaft

you may choose to place the ball link at a distance that allows the servo to have a combined travel of around 80° from the low endpoint to the high endpoint.

SERVO TYPE SELECTION

Spartan gyros are designed to work with all modern digital tail servos and offer a selection of servo pulse modulations in order to achieve such broad compatibility.

To access the servo configuration mode hold the SET button pressed before powering on the gyro. Continue to hold the SET button pressed until the Status light starts flashings in

violet colour. The number of flashes indicates the currently selected servo type.

WARNING!

The selected servo type must match the servo you are using. Incorrect setting may damage the servo and possibly resulting in a loss of tail control during flight.

You must change the servo type <u>before</u> connecting the servo to the gyro. Disconnect the servo if already connected.

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

Do not attempt to fly your model while the servo type selection mode is active, tail stabilisation will not function.

To change the servo type move the rudder stick left or right until the desired option is reached. Press the SET button once to store your selection. The Status light turns on in steady violet colour to acknowledge that the servo type is changed. You may now power off the gyro.

Light	Servo modulation
1 flash (default)	**1520uSec at 333Hz** Futaba S9253 / S9254 / S9257 / S9650 / S3153 / S3154, BLS254, JR 8900G / 3400G / 3500G, Align DS410 / DS420 / DS510 / DS520 / DS610 / DS620 / DS650, Sanwa ERG-WRX, Airtronics 94758 / 94761, Hitec 5925MG / 6965HB / 5083MG, Robbe FS61BB
2	**760uSec at 560Hz** Futaba S9251 / S9256 / BLS251, MKS DS8910 / BLS980
3	**1520uSec at 250Hz** JR 2700G / 8700G / 810G, Sky HDS-577 / HDS-877
4	**960uSec at 333Hz** LogicTech 6100G / 3100G, Hitec 5083MG

Not listed servos - If your servo is not listed in the above table please visit the support knowledge on the Spartan website and consult topic 12.

GYRO CONFIGURATION

To access the configuration mode power on the gyro and wait until it has finished calibrating. Press and hold the SET button for a few seconds. Once the configuration mode is active the tail servo chatters twice then rests 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. As the rudder stick is operated the tail blades move to allow visual confirmation of the correct rudder behaviour. The Status light switches on/off in violet to indicate if reversing is active.

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When satisfied, press the SET button briefly. The servo will chatter once to confirm completion of this step.

Important: If the gyro is mounted in an inverted orientation you will need to push the rudder stick to the right instead.

Step 2: Adjust low servo endpoint
The servo is now resting at the low endpoint position and the Status light is flashing violet twice. Using the rudder stick adjust the servo position until you achieve maximum tail rotor pitch without binding on the mechanical limits. When satisfied, press the SET button briefly. The servo chatters once to confirm completion of this step.

Important: Always set the gyro endpoints for the maximum available tail rotor pitch. This defines how much pitch the gyro can use 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.

Note: Whilst crossing the 100% endpoint value the servo pauses momentarily and the status light flashes blue.

Step 3: Adjust high servo endpoint
The servo is now resting at the high endpoint position and the Status light is flashing violet three times. Using the rudder stick adjust the servo position for maximum tail rotor pitch without binding. When satisfied, press the SET button briefly. The servo chatters twice to confirm completion of the configuration mode.

Upon completion the gyro stores the new configuration to its internal memory and the Status light is steady violet. You may now power off the gyro.

GYRO GAIN AND MODE

Spartan gyros offer two operating modes, the classic Rate type and the AVCS (Angular Velocity Control System). To control the operating mode assign the gain channel to a two position switch of your transmitter. This switch now selects the operating mode whilst the gain channel endpoints control gyro gain for each mode. Your radio may also offer a dedicated gyro menu with more advanced configuration options for the gyro gain setting.

The following table shows the relationship of the gyro operating gain in respect to the displayed value on the screen of some popular radio control transmitters.

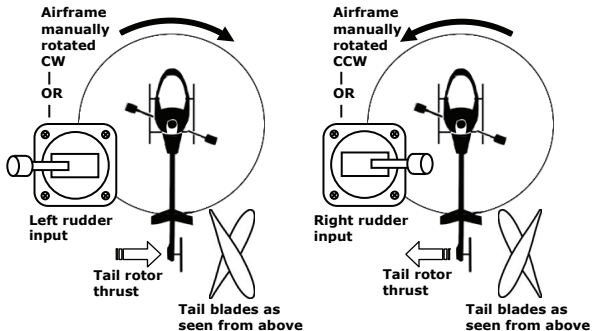| Gyro Operating Gain >	100% Rate	80%	0%	77%	100% AVCS
Gain Pulse Width	1020uS		1520uS		2020uS
Futaba Gyro Menu	100%		0%		100%
Futaba Endpoints	90%		0%		90%
JR/Spektrum Gyro Menu	-	0%	51%	100%	-
JR/Spektrum Endpoints	126%		1%		129%

Important:
• The optimal gain value is the highest value you can reach that does not cause tail wag <u>at any time</u> during flight.
• Do not use any type of stick priority mixing or other gain reduction mixing.

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 therefore the gain will need to be adjusted experimentally. Start with a gain of 30%, this 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. It is not uncommon to find that the optimal gain value for a helicopter could be as small as 35-45%. A small

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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 30% indicates that the mechanical gain of the tail is too high and therefore it is recommended to move 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.

TAIL ROTOR PITCH

Airframe manually rotated CW

OR

Left rudder input

Tail rotor thrust

Tail blades as seen from above

Airframe manually rotated CCW

OR

Right rudder input

Tail rotor thrust

Tail blades as seen from above

OPERATION

It is advisable to power on the gyro in AVCS mode which enables it to recalibrate the rudder stick neutral. Stick neutral recalibration is not possible in Rate mode as any tail rotor mixing will interfere with the accuracy of this measurement. However should the gyro be accidentally powered on in Rate mode it will make use of the last known calibration value.

WARNING!

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. During calibration the Status light colour alternates rapidly between red and blue.

The calibration will not start if the gyro is not receiving the required rudder and gain signal from the receiver, or the start conditions are not met. In both cases the Status light will emit a flashing pattern to indicate the cause. These flashing patterns are listed in Status Light section of this guide.

WARNING!

If you plan on using the gyro in Rate mode you may need to program collective to tail rotor mixing on your transmitter. You must ensure that such mixing is active in Rate mode only. If the tail rotor mixing remains active in AVCS mode it can result in violent pirouetting and loss of tail control.

If tail drift is seen in Rate mode it is advisable to trim the model mechanically by adjusting the linkage lengths. Small corrections can be done using the transmitter's rudder trim, though this is not recommended. In the event that the transmitter's trim is changed the gyro needs to recalibrate the rudder stick neutral. To do this, land and spool down the model, then rapidly toggle the gain switch three times (transitioning between Rate and AVCS modes) before returning it to the AVCS position. The rudder stick must be resting at the centre position while recalibration takes place.

Important: If the radio's rudder endpoints are set to a very high value, which results in a yaw demand above the sensing range of the gyro, the tail pitch will open fully producing ultra-fast yaw rate of over 3 turns per second. While such fast yaw rates are spectacular you must ensure that your model is mechanically capable to withstand the increased loads.

ADVANCED CONFIGURATION OPTIONS

The gyro configuration can also be modified using the optional Spartan Fusion EDGE™ field programming unit, Flash-Link™ USB computer interface or Blue-Link™ radio module (see Spare Parts and Accessories section of this guide). Software is available on the Spartan website for Windows based computers and certain handheld devices. This configuration method provides access to a far greater number of operating parameters and thus more detailed customisation of your gyro's flight performance and pilot's feel.

Spartan is committed to the continued improvement of their products and from time to time we produce new firmware versions offering optimisations and/or new functionality. The firmware of your gyro can be updated using the computer connectivity options mentioned above.

COPYRIGHT AND LICENCE

WARRANTY AND PRODUCT REGISTRATION

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.

Important: Register your product via the Spartan website within 30 days of the original purchase to qualify for 3 years free service and discounted crash replacements. The original dated sales receipt is required for all claims. Terms and Conditions apply.

SPARE PARTS AND ACCESSORIES

Order Code	Description
SRC-QPADS	Adhesive foam pad set.
SRC-QVKIT	Vibration attenuation kit. Includes pads and metal plate.
SRC-FSN	Fusion EDGE™ field programming unit and multifunction tester.
SRC-FL	Flash-Link™ (USB computer interface) *
SRC-BL	Blue-Link™ (Bluetooth radio module) *
SRC-SLX	* Also required: Simplex Data Adapter.
SRC-QCMG	Metal CNC gyro case. Dark Gold colour.
SRC-QCLR	Clear plastic gyro case.
SRC-QPBK	Black plastic gyro case.

LIABILITY DISCLAIMER