CSM HLG 200 Heading Lock Gyro

Please read this manual fully before installing and flying.

The HLG200 sets new standards of performance at an entry level price.
Key features:-

- **Heading Lock** (as pioneered by CSM)
- **Built-in Linear+Exponential Yaw-Rate-Demand for smooth stick response.**
- **Input filtering** to improve performance with PPM (FM) receivers.
- **High Resolution** pulse measurement and generation systems.
- **Two stage power supply regulation.**
- **Internal vibration damping**.
- **Small, lightweight, single box design.**

Radio system compatibility
The wiring of this gyro is compatible with JR, Futaba*, Hi-Tec, Graupner, Robbe* and the new style only (Blue Plug) Sanwa/Airtronics radio systems. For information about other makes of radio please check with the service centre in your country or e-mail the CSM service centre (tech@csm-ltd.co.uk). Although not essential, the use of an RC system with a travel adjustment facility on the rudder channel is an advantage. Most current production computer RC transmitters have this facility.
(* Remove polarising ridge from plug when using these makes of servo)

Servo choice
Optimum performance from the HLG200 is obtained when it is used in conjunction with a high speed servo (0.12 seconds/60 degrees or better).

Installation
Radio Setup
First enter the menus of your transmitter and set up as follows:-

Centre rudder trims and (if fitted) rudder sub trim.

Set rudder travel adjustment (ATV) to 100%. Most transmitters have separate adjustments for left and right movements and you should make sure you have set the travel adjustment for both directions. Once the gyro has been installed the rudder ATV can be adjusted in flight tests to give the required maximum yaw.

Ensure that the rudder rates are set to the default value of 100%.

Ensure that Automatic Tail Stabilisation (ATS) or 'REVO' mixing is INHIBITED.

Connecting to the RC system
To connect, simply plug in-line between the receiver and the appropriate servo. For tail stabilisation this will be the rudder servo.
Adjust the gyro gain control to the middle of its travel (50% gain).

Adjust the gyro's Gain control to the middle of its range to give approximately 50% gain.

Before final fixing you will need to identify which way up it needs to be for it to operate in the correct sense (as described below), however at this stage identify an appropriate location and fix temporarily (using "Blu-Tack" or similar) until the sense check has been done.

Make sure the gyro is mounted parallel to the axis being sensed. For tail stabilisation yaw movements are detected and the gyro should be mounted vertically (parallel to the main rotor shaft)

The location should be as rigid as possible. Avoid the extreme front of the model. Avoid locations exposed to extreme heat or vibration.
To prevent vibration being transferred to the gyro make sure that the location allows at least 3mm clearance between the gyro case and any part of the model. Once the correct operating sense has been established mount the gyro on the supplied foam tape.

Remember to locate the gyro so that the gain adjustment pot will be accessible.

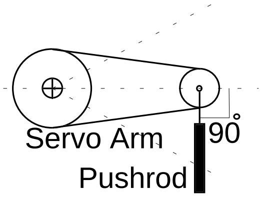
Tail linkage adjustment.
Although the heading lock function of the gyro can to a great extent compensate for imperfect linkage adjustment, the best performance of the tail rotor system is only gained if the linkage is in good adjustment. We suggest that you proceed as follows:-

Centre the rudder trim and any sub trim on the rudder channel of your transmitter.
Turn on the radio.

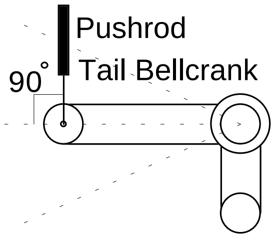
Wait 5 seconds for the radio and gyro to initialise. Do not touch the the rudder stick during this time.

Operate the rudder stick to drive the tail servo through its full available travel and observe the servo arm.

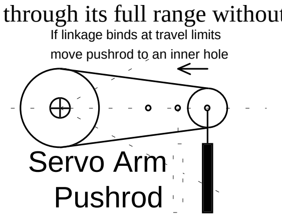
Adjust the servo arm on the servo output shaft until the arm is at 90° to the tail push-rod when in the middle of the servo travel.



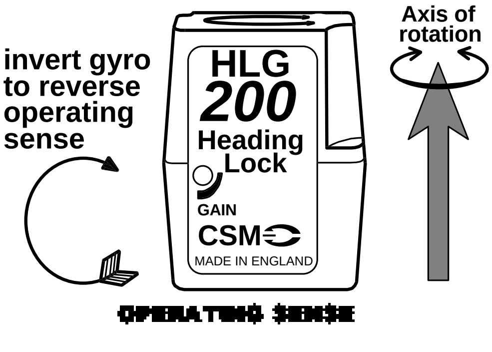
Adjust the push-rod length so that the tail control bellcrank is at 90° to the push-rod with the servo in the middle of the servo travel.



Adjust the length of the servo arm (i.e. the arm hole to which the push-rod goes) to ensure that the tail pitch slider is driven through its full range without the linkage binding at either extreme of servo travel.

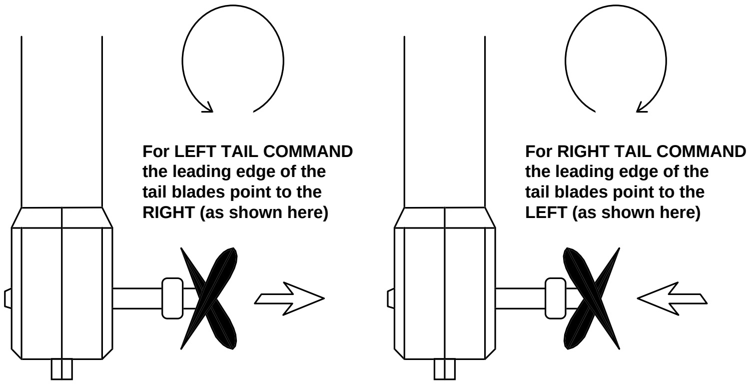


Checking the gyro is working in the correct sense.
<u>It is vital to ensure that the gyro operates in the correct sense</u>. <u>Failure to do so will cause an uncontrollable pirouette on take off.</u> Beginners who are in any doubt about how to set the sense correctly should seek experienced help.
First establish that the sense of the transmitter control is correct (i.e. that the application of a right rudder command causes a change in tail pitch that will move the nose of the model to the right)
Once this has been done, check that **turning the helicopter to the <u>left</u> makes the gyro apply a tail rotor command to the <u>right</u>, and vice versa.**



If the gyro needs it's sensing reversed simply mount the unit the other way up.
Remember that the final fixing should be done using the foam tape supplied with your gyro. (Spare foam is available as a CSM part)

<u>Useful tip.</u>
To work out which way the tail rotor will go just remember the leading edge (front) of the tail blades will point in the direction that the tail rotor will go, so for a left stick command you want the tail blades to point to the right (tail swings to the right and the nose goes left)



Flying the gyro

Turn-on sequence

- Centre the rudder trim on the transmitter.
- Turn on your transmitter.
- With the model stationary on the ground turn on your receiver.
- Wait for about 5 seconds while the gyro goes through its self test/boot up sequence. **Keep the model still and don't touch the rudder stick during this time.**
- Move the rudder stick fully in both directions and ensure that the tail rotor servo responds to stick movements.
- Rotate the helicopter both ways and check that the tail servo responds.
- Your HLG200 is now ready for flight.

Initial flight trials.

Setting the gyro gain.

The gyro gain is adjusted via the Gain pot which is accessed through the front of the gyro case, this is rotated clockwise to increase the gain or anti-clockwise to lower the gain.
A gain value of approximately 50% is a good starting point; optimum gain is established by flight-testing.

We suggest that you **reduce the rudder travel adjustments in your transmitter to 60% for the first few flights until you get used to the response of the gyro system**.
First hover the helicopter. Use short small 'stabs' of rudder control to disturb the helicopter in yaw and observe. If some tendency to oscillate is seen, slightly reduce the gyro gain. Conversely if no tendency to oscillate is seen try increasing the gain. You are looking at this stage for the highest gain that gives no sign of oscillation when the tail is disturbed by sudden changes in tail command.

Once this has been done you may wish to check for tail wagging in fast forward flight. Should this be observed, you should lower the gyro gain slightly. For those used to conventional gyros, caution should be exercised until you are familiar with the very special handling characteristics that Heading Lock gives.

Adjusting the stick response

Use the rudder ATV, Rates, and Exponential facilities of the transmitter to tailor the control response as required. **Beware that the HLG200 makes high rates of yaw available (at all gain settings).** If an increase in available yaw rate is required increase the rudder travel on your transmitter **gradually** until the desired response is obtained. Remember that increasing the rudder travel adjustment will not increase the overall tail servo throw as this is set by the gyro's own travel limiters.
See trouble Shooting Section for more tuning information.

Getting the most from your gyro

To get the best from this gyro system it is useful to understand how the HLG200 differs from conventional gyros.

Conventional gyro systems

In a conventional gyro the pilot applies a rudder command which is transmitted through the gyro to the servo. As the helicopter responds to the command the gyro detects the movement and opposes the pilot's command and reduces the servo deflection. The yaw rate achieved in such a system depends on the 'gain' of the gyro. The more gain the gyro has the lower the yaw rate that can be achieved. It is common with such systems to have to reduce the gyro gain to achieve the required yaw rate for some manoeuvres (this being accomplished with the gyro gain switch).

The HLG200 system

The HLG200 employs a 'Yaw Rate Demand' philosophy making it a true yaw rate gyro. In this system the rudder command from the pilot is interpreted as a request to the gyro to establish the desired yaw rate. The gyro drives the tail rotor servo as needed to obtain this yaw rate. This means that the HLG200 makes full yaw rate available even at high gain settings. With this system you can use the rudder travel adjustments ('Travel Volume', 'ATV') and rudder rates facilities to set up the desired full-stick yaw rate.

It is important to realise that with this system the limits to the servo travel are set by the gyro and not by the transmitter's rudder channel travel adjustment. You should adjust the length of the servo arm to ensure that the tail pitch linkage is driven through its full travel without binding or stalling the servo.

Behaviour on the ground
For those used to conventional gyro systems the behaviour of the HLG200 on the ground may seem unusual.

With the helicopter on the ground you will find that even very small movements of the rudder stick will set the servo moving slowly and may, over the course of a few seconds, reach full travel. This apparently strange behaviour is caused by the stationary helicopter not responding to the heading corrections requested by the gyro. In the absence of a response from the helicopter the gyro continues to increase the servo command in an attempt to get the helicopter to obey. In flight the helicopter will, of course, respond to the tail servo movements and the system will act normally. When turned on the HLG200 samples the mid-stick signal to ensure that with the stick centred the Yaw Rate Demand is zero. This feature saves you having to use the rudder trim on the transmitter and also accommodates the variations in servo pulse standards adopted by RC manufacturers.

Preparing the helicopter mechanics
Attention to the tail control linkage is important to getting the best from this gyro. You should aim for a easy-moving but slop-free linkage between the tail servo and the tail blades. Inspect the bearings/thrust races in the tail hub for smoothness of operation. Check the pitch slider and ball links for slop and replace if needed. Some helicopters that have noticeable 'give' in the tail linkage may benefit from the addition of a rear-mounted tail servo and rigid pushrod. You should select a servo arm length that allows the tail pitch linkage to be driven through its full travel without binding.

Remember that during aerobatic manoeuvres the combination of a high performance gyro and a fast tail servo can place very high loads on the tail rotor drive train. While you have the helicopter on the bench to install the gyro is a good time to check the condition of tail rotor gears etc. Inspect them regularly to ensure that they are in good condition.

Batteries, power consumption, and wiring
Although the power consumption of the gyro unit itself is very low, as with all high performance Solid State gyro systems, the speed of the gyro response will work the tail rotor servo harder than slower mechanical gyro systems. Especially where a high performance servo is being used the battery drain from the tail rotor servo can be high. We recommend that you use a good quality battery state monitor and check it carefully before and after each flight.
Your receiver battery is a vital part of your tail rotor system. Remember that a battery in a low state of charge or an old battery that has developed a high internal resistance will adversely affect servo performance, especially its acceleration, and may even cause the tail to wag on an otherwise well set up helicopter. You may wish to consider maintaining the charge in your receiver battery between flights by the use of a quality Delta Peak type field charger. In installing the gyro also bear in mind that voltage drops down long servo extension leads will also detract from servo performance. Where the installation requires extensions to be used (either between the receiver and gyro or between the gyro and the servo) avoid using ones that are unnecessarily long.

Boom supports
Tests have shown that the use of boom supports significantly increase the rigidity of the tail boom and so allow a higher gyro gain to be used. Generally the longer the boom supports the better they will work. Note: A loose/cracked boom support or a loose/cracked boom support clamp can have a significant effect on the gyro gain. Even a slightly loose boom clamp or support will have a dramatic effect on the amount of gain that can be used. Stand on the skids of the model and try to flex the end of the boom from side to side while holding a finger against the joint to feel any movement.

Humidity
Under conditions of extremely high humidity it is possible for condensation to form on the piezo sensor. This can adversely affect gyro performance. Where it is not possible to avoid subjecting the gyro to such humidity levels it is advisable to leave the model standing for a few minutes with the radio switched on so that the internal heating of the gyro helps disperse the condensation. Always protect the gyro from ingress of water (e.g. rain).

DOs and DON'Ts

DOs:
Do mount the gyro with its axis of rotation parallel to the helicopter main shaft.
Do mount the gyro on the supplied self-adhesive foam strips.
Do mount the gyro to a hard, smooth clean surface.
Do use the rudder ATV and rates to tailor required stick response.
Do check the sense of the gyro operation **before flight**.
Do use a battery state monitor and check it before and after each flight.
Do remove slop and stiffness from tail control linkage.
Do inspect tail gears etc. for wear.
Do explore the performance limits of this gyro with care.

DON'Ts:
Don't subject the gyro to mechanical shock.
Don't mount the gyro where it will be subjected to high vibration levels.
Don't mount the gyro where it will be heated by engine or exhaust.
Don't use Automatic Tail Stabilisation (ATS) or Throttle-Tail mixing.

Don't use unnecessarily long servo extension leads with the gyro.
Don't move the model during gyro self-test time.
Don't touch the rudder stick during gyro self-test time.

Trouble shooting
Model pirouettes violently as soon as it starts to lift off.
Gyro is reversed: re-mount the gyro the other way up in the model.

Model tail wags from side to side in the hover.
Reduce the gyro gain.

Tail response is not crisp.
Too little gyro gain. Gradually increase the gain until tail shows some tendency to wag and then reduce it back until wag just stops.

Model wags even when the gain is very low.
Possible causes: Slop in pitch linkage. Friction in pitch linkage. Boom support or clamp loose. Tail hub bearings locking up under load. Servo is very slow. Receiver battery discharged or defective. Vibration.

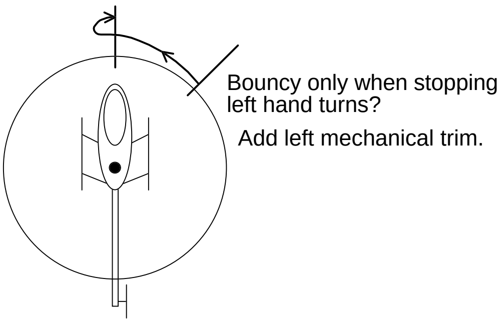
Tail twitches and will not sit still in the hover.
Vibration: check for out of balance model, rough running motor, loose components.

Model flies OK on first few flights of the day but tail starts to wag on later flights.
Servo consumption with fast gyros is high, and falling battery voltage reduces servo performance making the tail system less stable. Cycle receiver battery and check its capacity. Also consider using a fast Delta -peak charger to top up battery between flights.

Model was OK last season but after the winter in store the tail now wags.
Check the tail control linkage for free movement. Pay special attention to the pitch slider and the tail hub bearings. Receiver battery may have developed a high internal resistance. Cycle the battery and check its capacity. It may show a normal capacity at low discharge rates, but a much reduced capacity when measured at say 3 amps discharge rate indicating a high internal resistance.

Model rotates OK one way but is slow and/or inconsistent the other way.
Too little tail pitch available in the affected direction. Re-check tail rotor linkage.

Left and right hand stops are not equal. Stops from right hand turns are slow but clean while left hand stops are bouncy.
Mechanical trim of the tail linkage is wrong. With bouncy left hand stops (as shown here) adjust the tail pushrod to give more left tail rotor. (or vice versa)



The model suffers violent erratic twitches in yaw.
With belt-driven tails very high voltage static electrical charges can build up on the tail boom, etc and discharge via the tail servo to the RC system. In severe cases damage to RC components can result. Your helicopter supplier will be able to advise on a suitable grounding scheme to eliminate this problem.

Ratings
Supply voltage range: 4.1v to 7.2v**
** Warning: Check your RC system voltage limits as these may be more restrictive.

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