Additional information for Revision 4 gyros
to be read in conjunction with the gyro manual and PC interface manual for Revision 3

For full manuals on the Revision 4 gyro and its PC interface please refer to the documentation included on the PC interface disk. Please note that the Revision 4 PC interface will NOT work with previous revisions of gyro.

The internal code of the SL range of gyros has been changed to take account of recent trends in model helicopter design and equipment. In particular we have addressed the effects of engine governors on the gyro situation as well as the increasing vibration levels that the use of ever bigger capacity motors is creating.

For those familiar with the Revision 3 gyros please note that as part of the revised code many of the internal parameters (as seen using the PC interface) have been re-scaled so it is not possible to make direct comparison of internal parameter values between Revision 4 and earlier versions of the gyro. For example the Heading Lock gain has been re-scaled by about a factor of four.

How governors affect the gyro

With the use of an engine governor the gyro has the luxury of operating with much more consistent tail power because the governor almost completely eliminates the variations in tail rotor rpm present in conventional un-governed set-ups. Because the tail thrust increases with the square of the tail rpm even quite small rpm changes give rise to significant changes in tail power.

This is seen by the need to reduce gyro gain to prevent tail wagging when the helicopter rotor over-speeds. Since this is often the gain-limiting situation removing overspeed situations by governing allows significantly higher gains to be run.

However, a governor also increases the demands on the gyro. A governor maintains constant head speed by changing the torque output of the engine. So a governor generally introduces bigger variations in main rotor torque than are seen in un-governed systems and it is, of course, the responsibility of the gyro/tail rotor system to compensate for these torque variations. In Revision 4 CSM's gyro software has been extensively re-written to meet the new challenge. Those familiar with our Revision 3 gyros will notice a significant increase in lock and better suppression of tail swing in high torque situations.

Vibration

In Revision 4 we have addressed the problem of increased vibration levels. In many gyro systems these show up as low receiver battery duration and high wear rates on tail servo gearboxes. While our earlier gyros were class leaders in conserving power and tail servos, in Revision 4 we have increased the lock capability without dramatically increasing the demands on the servo. Our new approach has, however, changed the way in which stop equalisation is achieved.

Stop equalisation

This is the aspect of gyro/tail rotor set-up that requires the most attention if optimum performance is to be obtained. The available tail rotor authority dominates stop times from fast pirouettes and most stop equalisation problems arise from a lack of tail-rotor authority one way, usually in the leftward (anticlockwise) direction. This lack shows up in slower entry into left pirouettes and slower stops from right pirouettes. This is especially noticeable with governed systems in low-g manoeuvres (e.g. stall turns) where the amount of assistance from torque is much reduced. We find that good tail performance is obtained with 45 degrees of right tail pitch and 35 degrees of left tail pitch.

During the initial installation of the gyro you should make sure that the travel limits of the servo are set such that the pitch throw is **limited only by the mechanical limits of the pitch linkage**. To assist in this we have increased the available servo travel in Revision 4. With the SL560 use the PC interface to check the throw limits and if these exceed 120% we recommend you fit a longer arm to the tail servo and reduce the throw limits correspondingly. Ideally aim for a servo arm length that gives throw limits between 90% and 120%. With the SL420 and SL310 you can measure the required throw limits by temporarily connecting the tail servo directly to the receiver and adjusting the rudder ATV values until the mechanical limits are reached. (Remember to return the rudder ATVs to 100% after you have finished this check). We find it's a common problem to have the tail servo arm too short; we rarely find one that's too long.

During the initial flight carry out the Quick-trim procedure, adjust the gyro gain to the maximum that gives no wagging and assess the quality of the left and right stops from **fast** pirouettes (**i.e. full stick**). If there is a marked difference note which stop is the softer.

After the flight, switch the gyro into Mode 0 (conventional, non-heading lock mode) and compare the left and right pitch throws at full stick from the hover pitch (stick centred). Generally, if you have noticed a difference in the fast pirouette stops there will be a corresponding imbalance in the left and right throws. If the softer of the two stops is acceptable for your style of flying then it will be satisfactory to simply reduce the throw to soften the harder stop. To soften the stop from right hand pirouettes reduce the available left pitch and to soften the stops from left-hand pirouettes reduce the available right pitch. If you do this via the quick set-up remember to repeat the Quick trim procedure on the following flight. (If you adjust the throw via the PC interface the Quick-trim value will be preserved)

If on the other hand the softer stop is unacceptable you will need to increase the available tail thrust. Check if more pitch throw is available in the appropriate direction. If there is change the throw limit to make it available. If no more pitch is available the simplest way to increase the tail thrust is by fitting longer tail blades. This increases the tail rotor disk area, the tail blade area, and the tip speed so a 10% increase in blade length will raise the available tail thrust by about 30%. Once the softer of the two stops is satisfactory the equalising the two stops can be done by adjustment of the throw limits as described above.

Generally this will be all that is required to obtain matched stops from all speeds. However if stops from more modest speeds of about 180 deg./s show some left-right imbalance then on the SL560 these can be matched by use of the stop tracking controls via the PC interface.