Sea Gyro
SG series K

Technical Information
2011

Manufacturing company:

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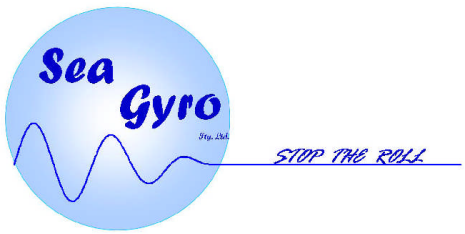

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Product Fact Sheet

Sea Gyro SG series K

Description

Roll reduction unit for pleasure and commercial boat applications. Suitable for single or multi-unit installation

Applications

Pleasure and commercial vessels.
Variations may occur due to recent bearing service and operating temperatures. An increase in wattage will occur with vessels in large seas and heavy rolling conditions (allow for 20% increase)

Service life

Units are designed for a service life exceeding 25,000 hours, with a 6 monthly maintenance service

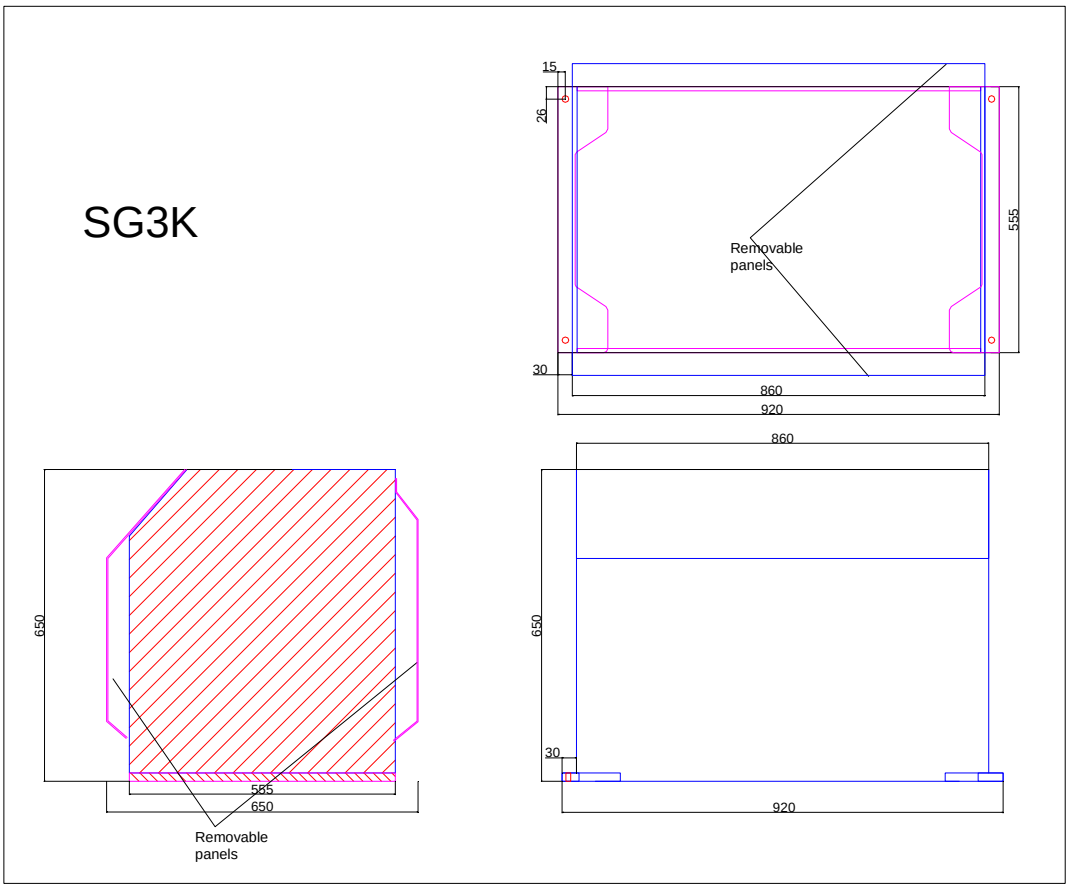
Class notification

No class classification approval has been sought by Sea Gyro for any of its equipment or components, whether in part or assembled. BV has advised that the equipment falls outside of their scope of assessment.

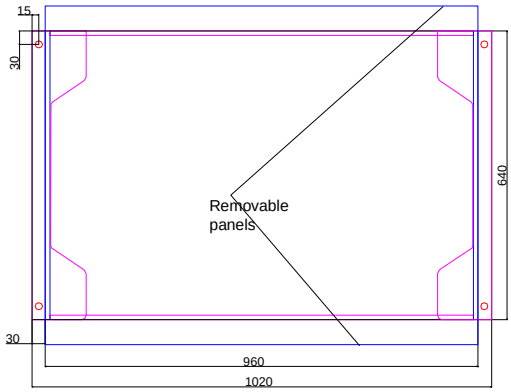
Technical Data

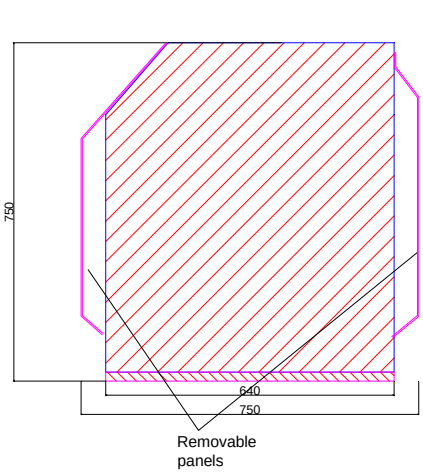
This data sheet should be used as an aid to assist in the appraisal of the SG series K. Structural vessel design should be undertaken by qualified engineers in association with survey requirements.

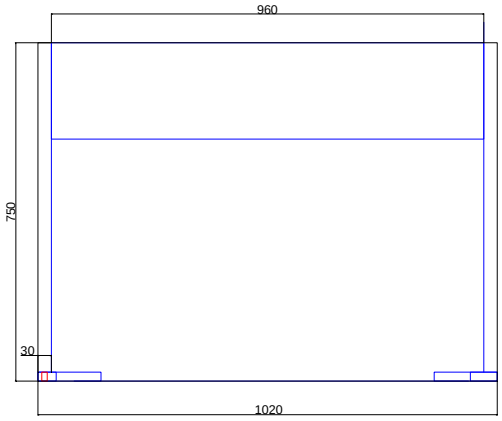
Sea Gyro's Standard range.
Sizes and hole placements are for guide only
Scale: 1 unit = 1 mm.
Date:1st. May 2011



SG5K and SG7K







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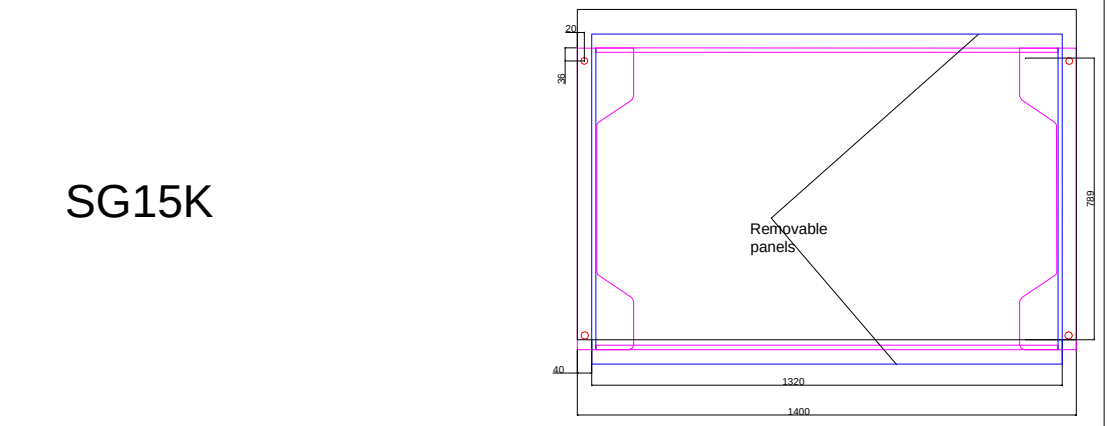
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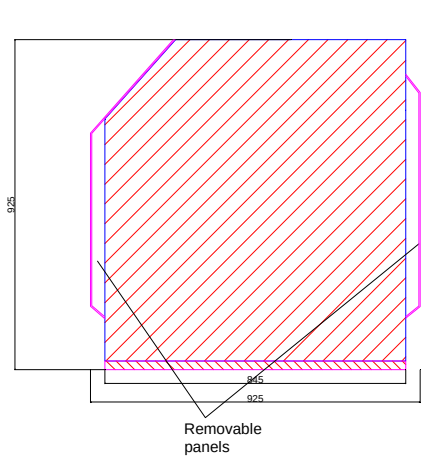
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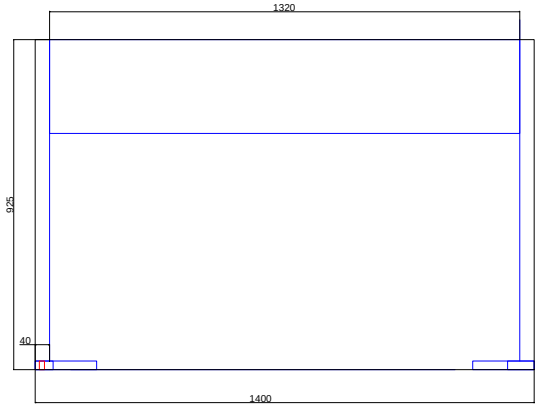
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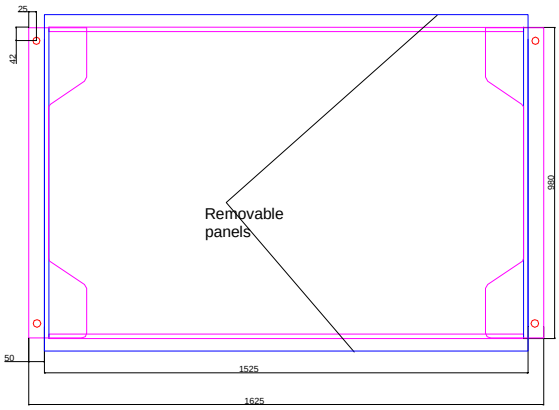
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50
1525
1625


1060
980
1060
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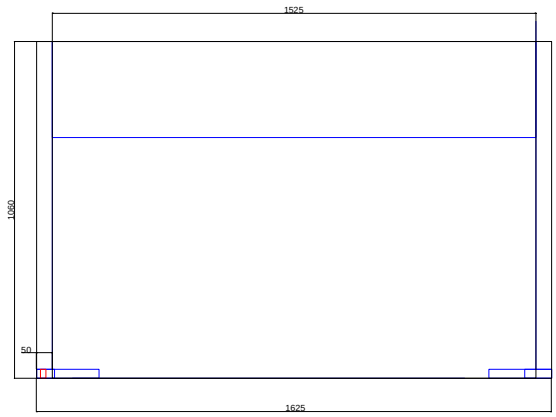
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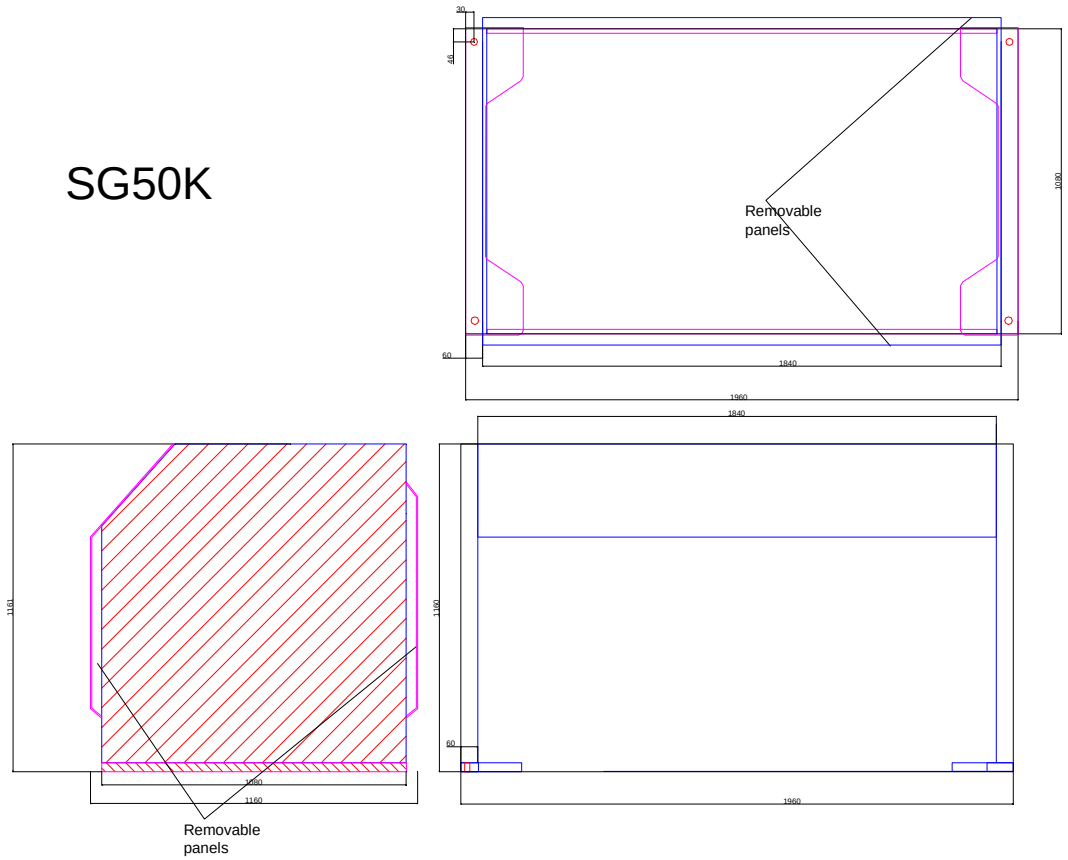
SG50K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1160
1160
60
1960
1160
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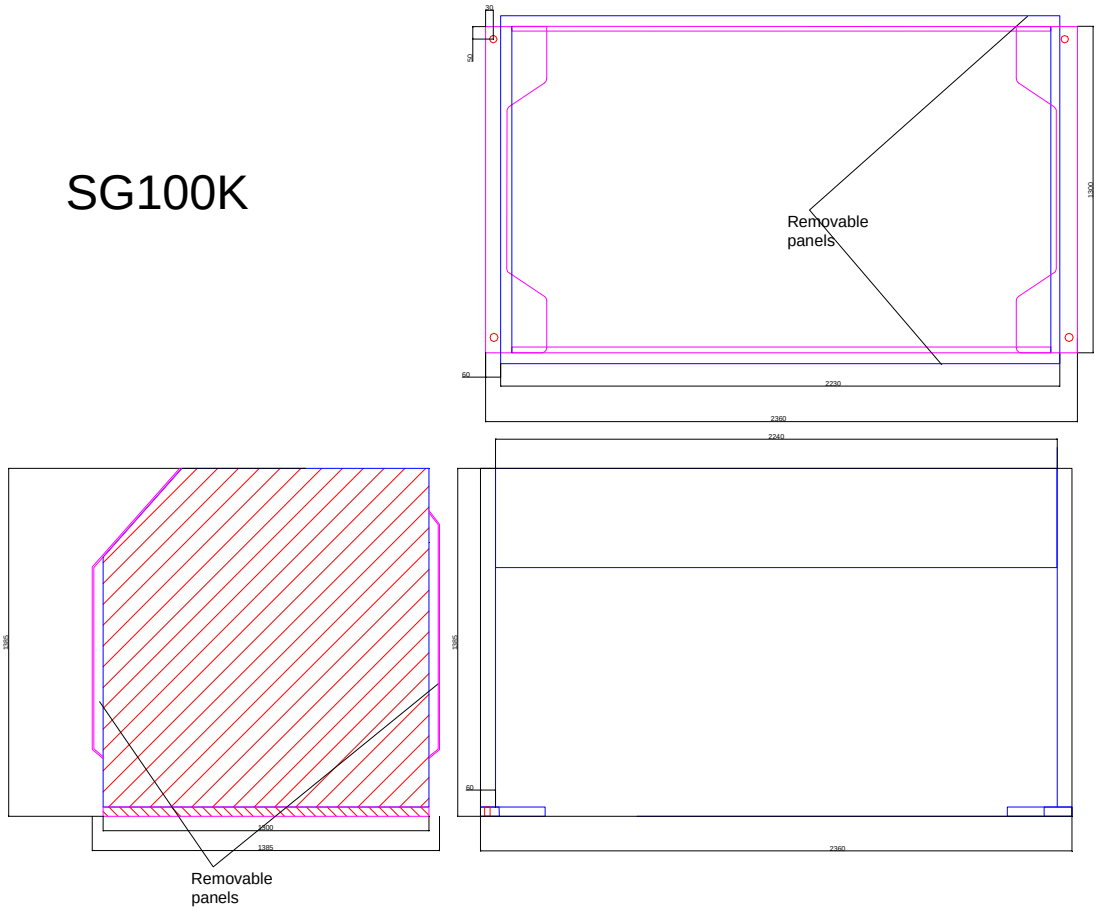
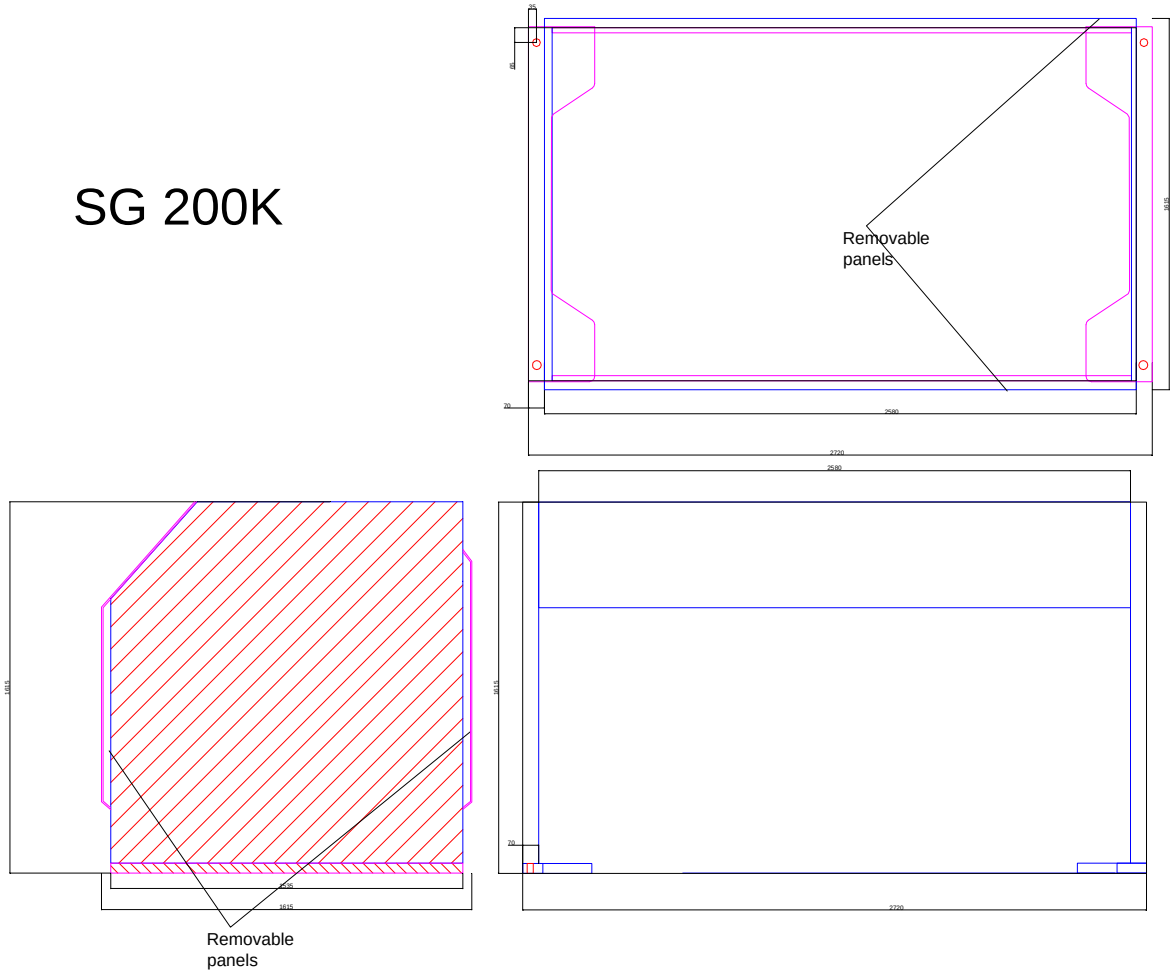
panels

SG100K



SG 200K



Vessel loading

Large oscillating forces may be experienced on the structure of the vessel; therefore it is essential to locate the Sea Gyro near structural bulkheads and floor members. Also minimise panel sizes around equipment base to reduce resonance sound effects. Metal boats should use rubber isolation to reduce metal to metal sound transfer.
The gyroscopes provide torque in all three rotation planes and forces in both lateral and vertical planes.

Values to be included in load calculations are:

Base width :	Width of base in metres
Torque from gyro (Unit size) :	kilo Nm. ie An SG50K produces 50,000Nms
Force on base (typical) :	kilo Nm / base width. ie An SG50K produces 50,000Nms/1.96m = 25,510N

A minimum Safety Factor of 3 should be considered. ie 76,530N

Additional loads may be experienced in collisions, knockdowns and groundings.

Heat Dissipation

Typical installations in engine rooms normally require little consideration for the Sea Gyro to dissipate heat, when compared to the heat generated by the main engines and generations.
However, installations in confined area may need an extraction fan system to vent to the outside.

Noise

The Sea Gyro is enclosed in an aluminium enclosure and generates only a modest amount of noise (typically 76db at 1 metre for the smaller units). This is considerably less than the noise produced by the main engines and generations.
Installation of the Sea Gyro in crew areas is not recommended. Some installations may need additional sound insulation requirements.

Installation

The base has either 4 or 8 location holes of varying diameter. The mounting pad on the vessel must be square, level and with no twist. Variations greater than 0.5mm in height may be compensated with shims. Attention should be given to possible wave slamming loads and vessel racking.

Servicing of the Sea Gyro is through removable panels. This area should be assessable for the service technician to do maintenance.

An air space of at least 20mm should be around the sides and back of the Sea Gyro.

Variable frequency drives (VFD).

The Meridian's electric motor is powered by an inverter drive unit that controls the electricity and monitors the power and condition of the motor.

This unit needs to be located in a well ventilated area. The removable front control face can be located in a more convenient location by using an extension cable.

Options can include isolation switch, clock and extraction fan.

Figure 1 VFD

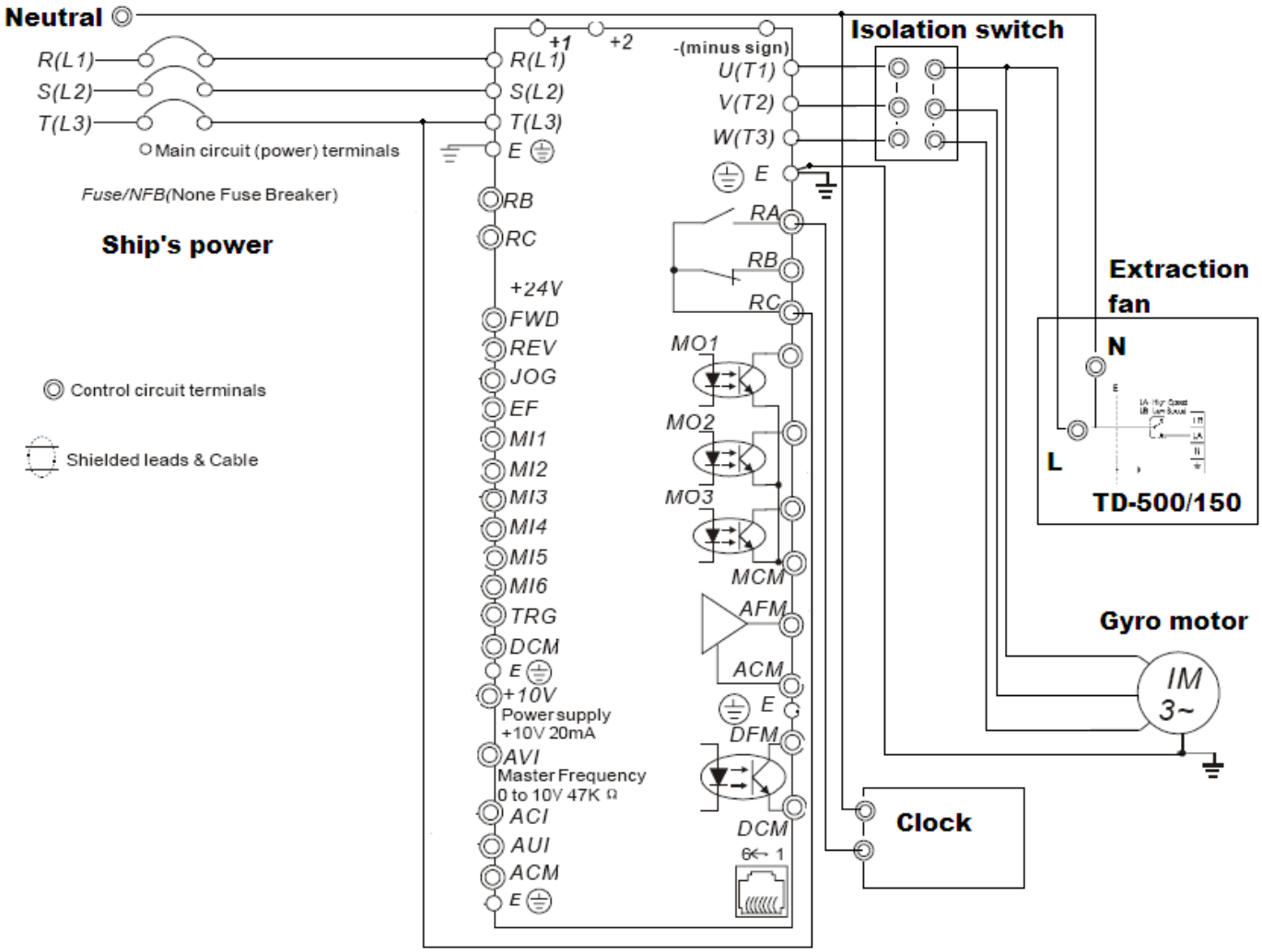


Figure 2 Wiring diagram for VFD

Appendix

Expected results

It will be apparent from the initial start-up of the gyro's flywheel that there will be a change in the motion of the vessel.

Figure 5 displays actual results from vessel testing which demonstrated a significant reduction in roll. These time series however do not explain the full effects of the "feel good" motion of the roll reduction of the vessel. However, by using the time series only, the general attenuation should be about 50% for rolls of 2 degrees and above (fig 9).

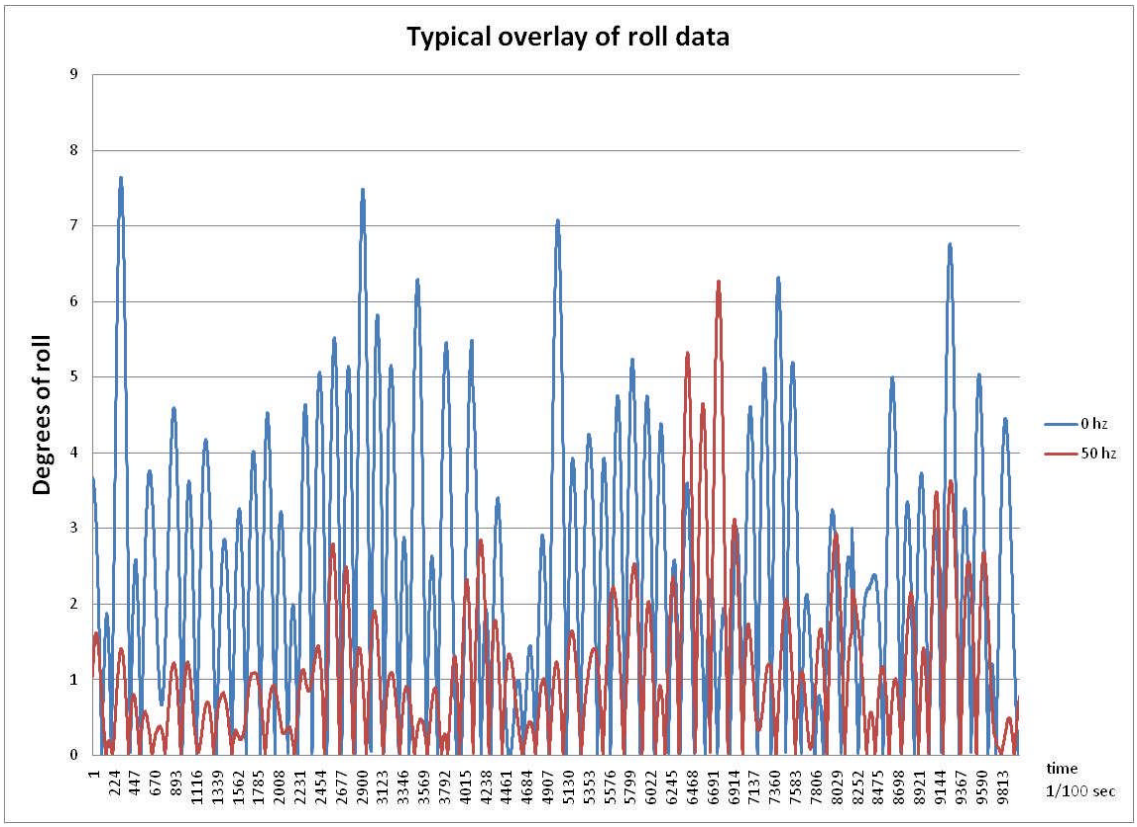


Figure 3 overlay of data

Gyroscopic roll reduction

It is generally accepted that roll reduction (attenuation) is a linear function based on the roll velocity. For results with bilge keels, hull form and most hydrodynamic methods this is a typical statement for small angles of roll (Fig 6.). However, for the patented gyroscopic stabilizer the effect to roll reduction is not linear. (Fig 7.). As such the gyroscopic stabilizer acts as a low amplitude filter, where the rolls of low amplitude (2 degrees) are passed, while the higher roll angles are severely attenuated.

In Fig 8 it is demonstrated that the roll spectrum is moved to the left for normal operations, which clearly shows the reduction in the larger roll angles.

An explanation of this effect can be gained by understanding that the gyroscopic equipment is passive, and as such, requires movement to initiate precession. Without precession the gyroscope's flywheel can not apply a counter torque to the wave's action.

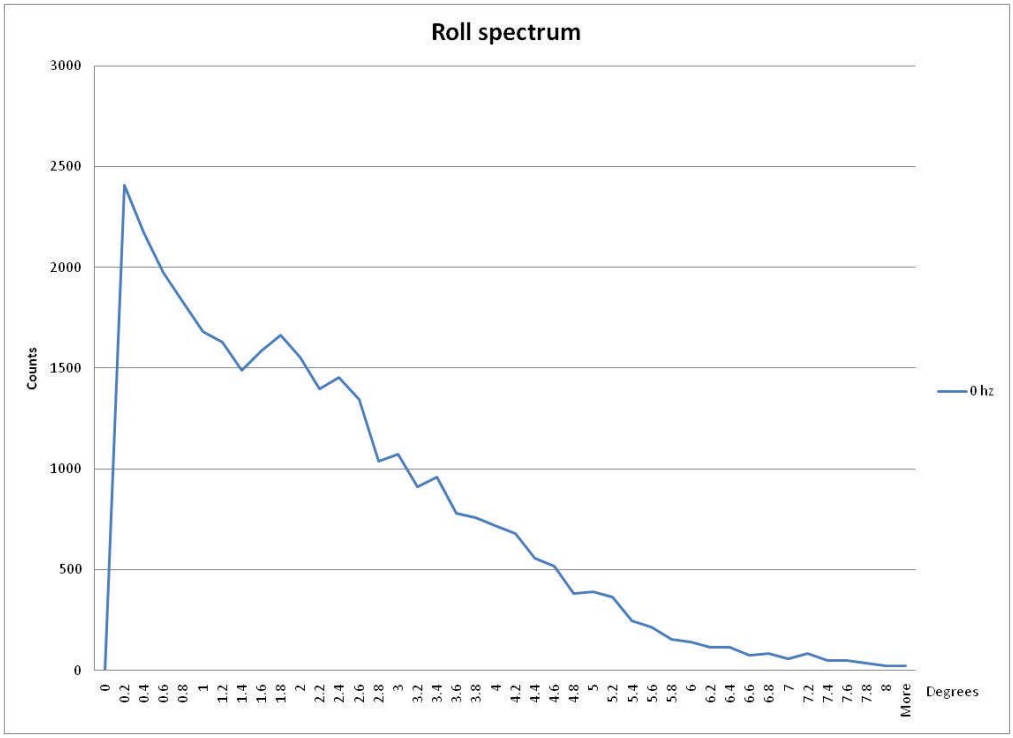


Figure 4 Linear roll damping- hydrodynamic

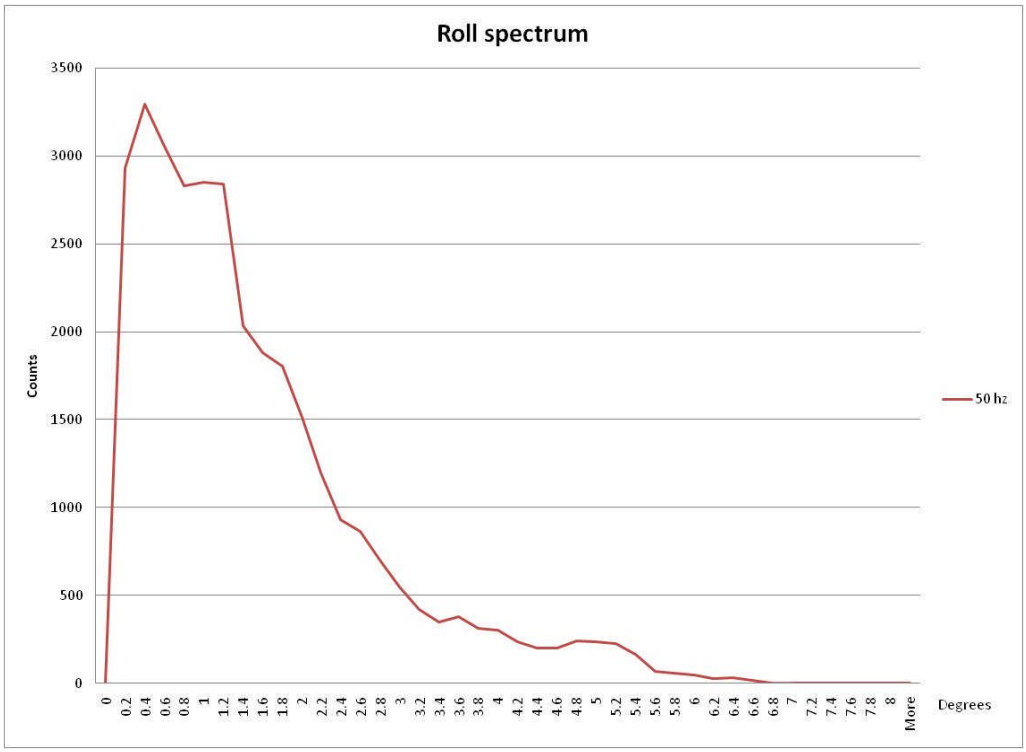


Figure 5 Non linear roll damping- gyroscopic

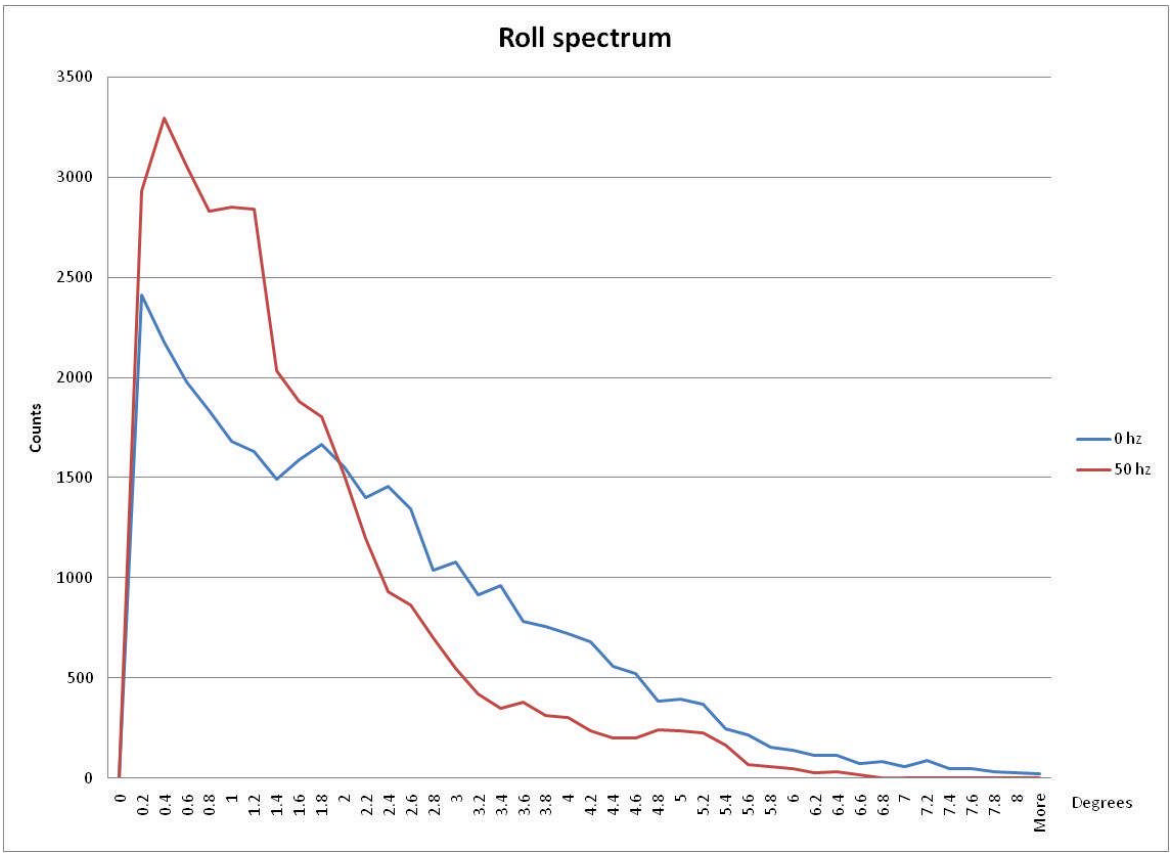


Figure 6 Overlay of roll spectrums

Benefits

In order to clarify the benefits of using the gyroscopic stabilizer it is necessary to stipulate at what roll angle attenuation is relevant. The expectations from passengers normally require a roll attenuation of 50% at 2 degrees while achieving roll attenuation greater than 60% for higher values.

It should be appreciated that as the wave action varies it may be possible to achieve a higher level of attenuation of up to about 90%.

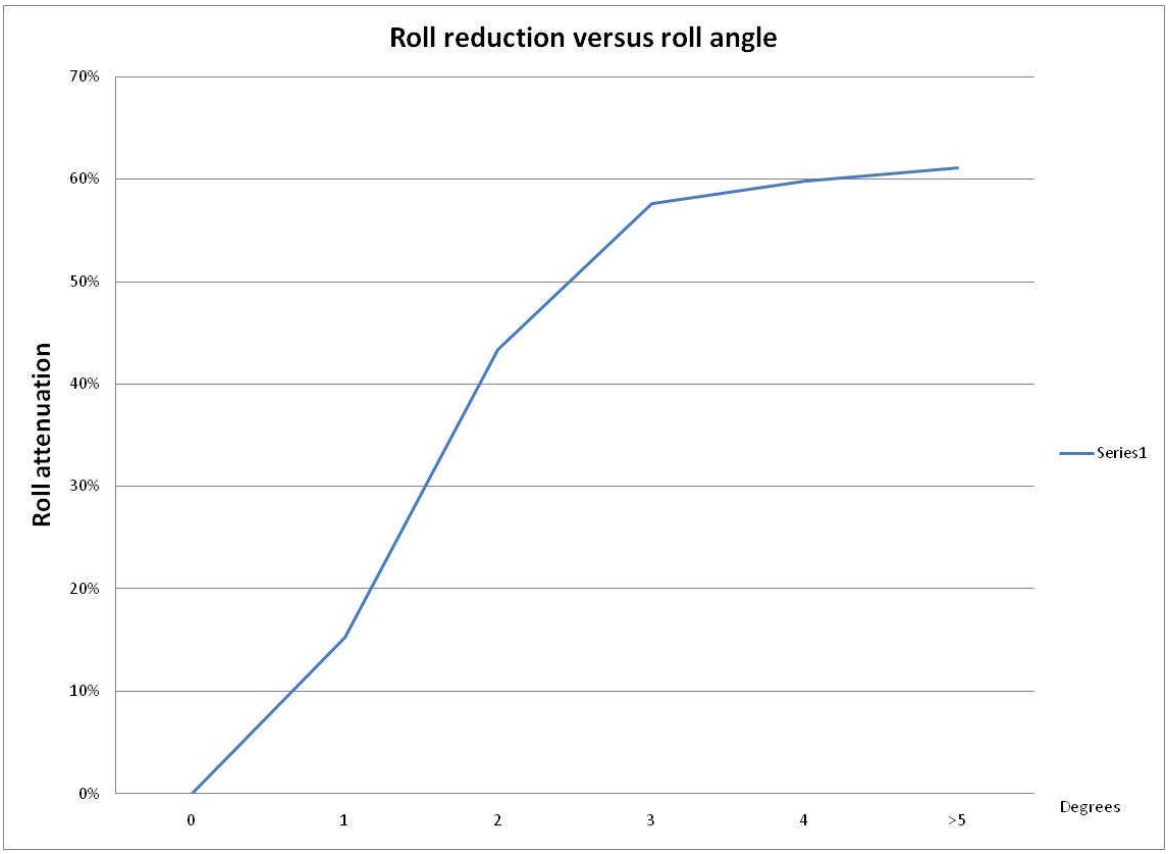


Figure 7 Roll attenuation

"Feel good" motion

It will become apparent to all the passengers on the vessel that the motion is better with the Sea Gyro on. If we examine the planer platform with respect to the sea, we have roll and pitch. At Sea Gyro, research into the motion of the vessel indicated that low roll amplitudes were not a major contributor to motion sickness. Furthermore, if roll was of the same order as pitch the planer platform would not be improved with increasing the roll reduction. (ie. There is little point in reducing roll below that of pitch). Typically a pitch or roll of 2 degrees may be of little concern. Therefore roll control above 2 degrees is the critical area to control in order to prevent sea sickness. This advancement in motion reduction has been achieved using non-linear control methods for the gyroscope's flywheel.

Reduction in roll acceleration

The initial use of gyroscopes in ships included altering the roll period of the vessel to be outside the wave spectrum. While this was possible in ships with roll periods of 12 seconds (moving them to about 16 seconds), it was not possible in small craft with fast roll periods of 3 seconds. However, the roll period is altered in a fitted vessel (fig 10) and as such the acceleration will be reduced marginally. The motion thus appears more subtle.

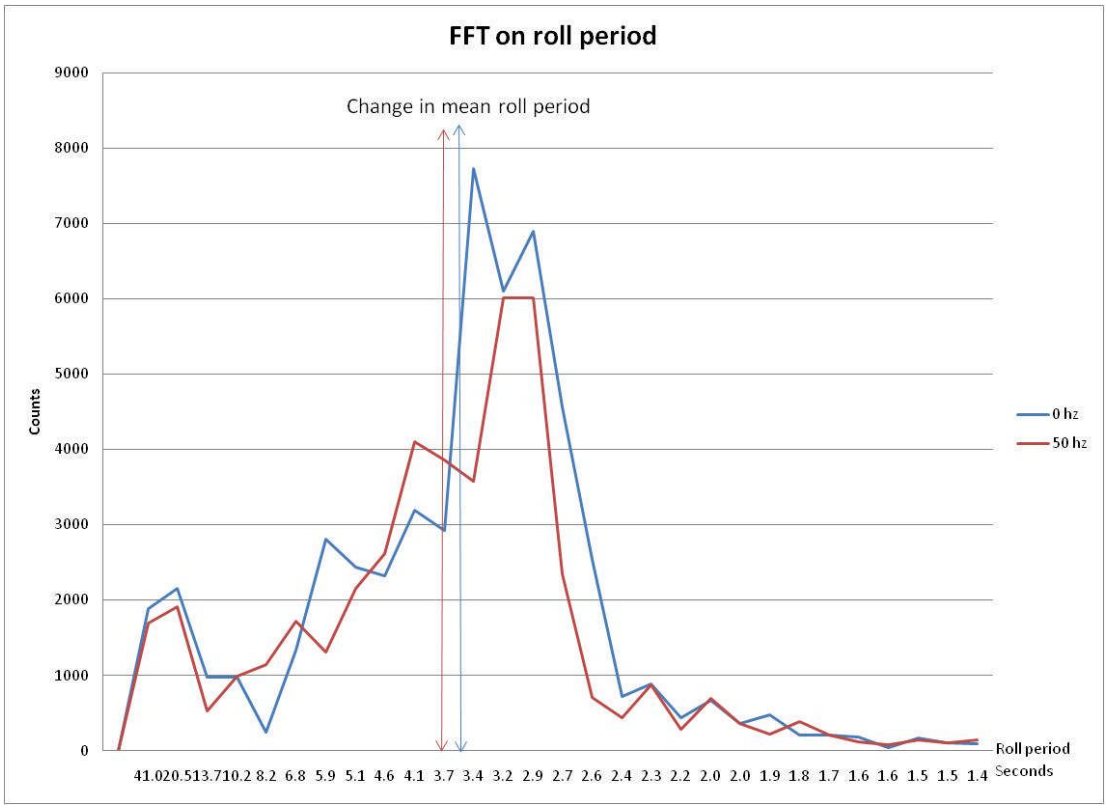


Figure 8 Change in roll period

Maximum Roll reduction

Typical installations of the gyroscopic stabilizer will achieve a roll reduction of 50% with a significant wave height of 0.4m.
Further roll reductions may be possible with lesser seas, giving reduction up to a maximum of 90%.
For significant wave heights greater than 0.4m, a roll reduction of less than 50% may be experienced.

However, a point is reached where roll reduction will not improve regardless of what size gyroscope is installed. This point can be generally determined by the company (Sea Gyro) and it will make suggestions as to the best system for the vessel.

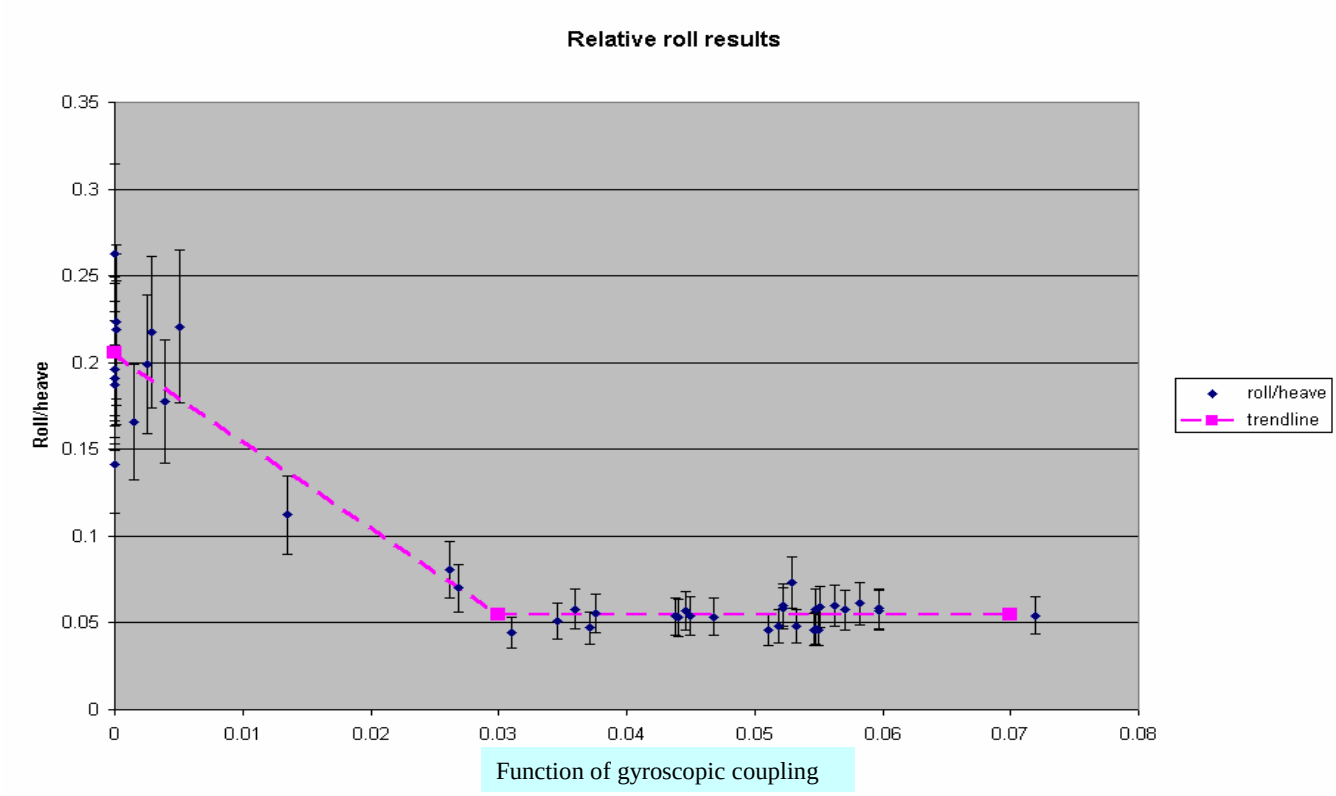


Figure 9 Roll reduction limitations

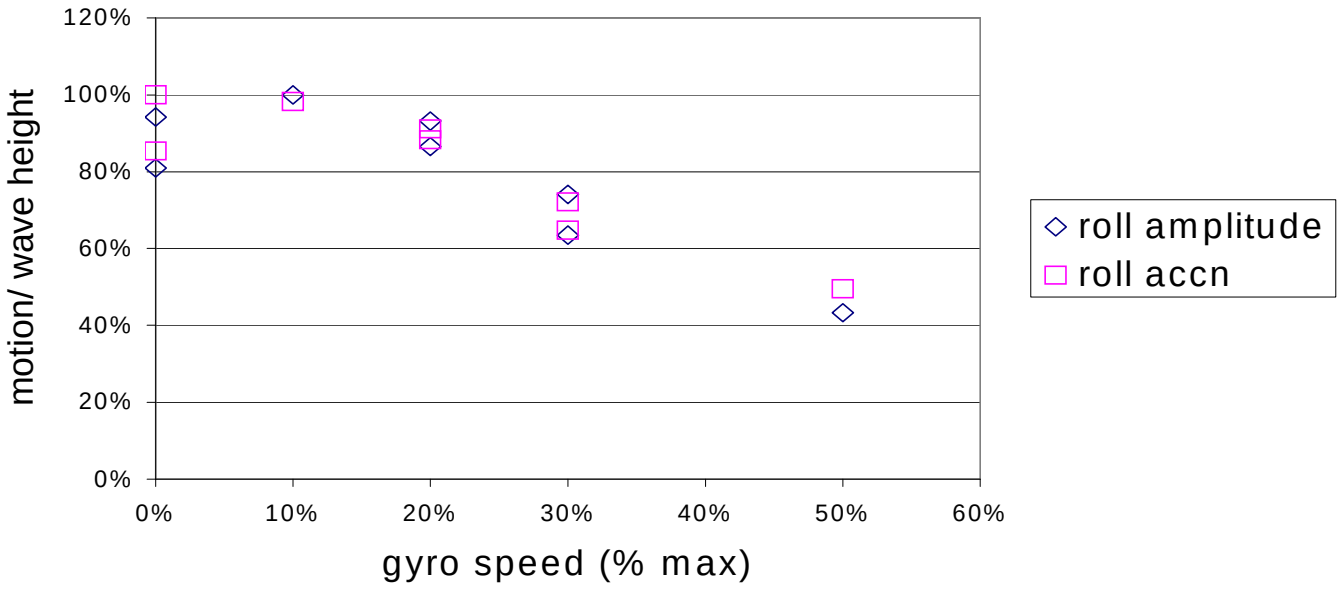


Figure 10 Roll reduction with gyro speed