Accelerometers and Gyros

Accelerometers

McLaren Electronic Systems offer accelerometers which for motion analysis. The sensing element is a MEMs device based on the principle of differential capacitance technology. These are available in one, two or three axis versions. The single axis part is particularly small and suitable for wheel hub acceleration measurement.

Principle of Operation

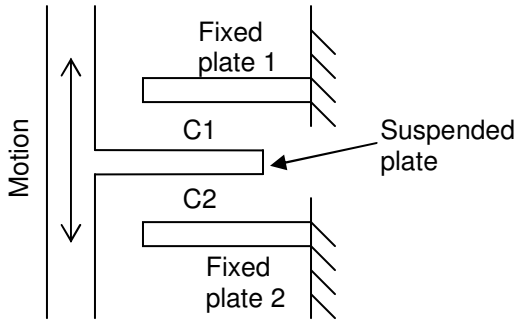


Figure 1

The sensing element of the accelerometer consists of two fixed plates attached to the substrate and a suspended plate.

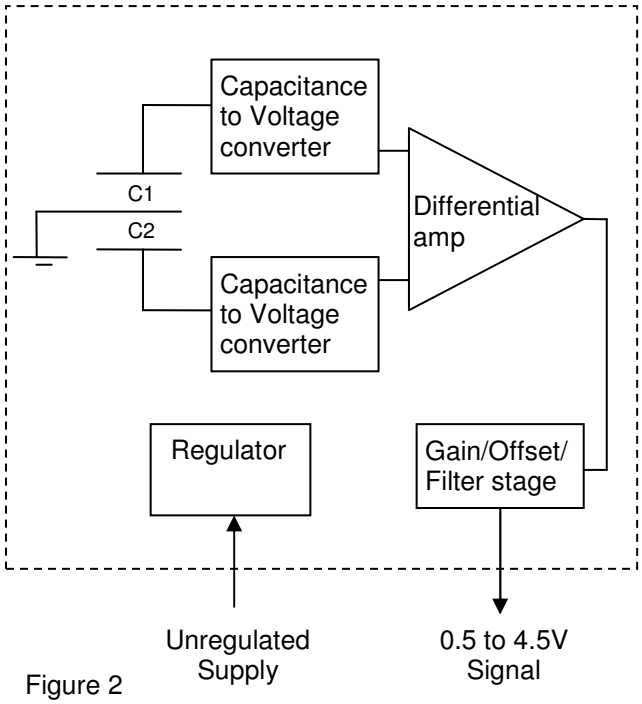
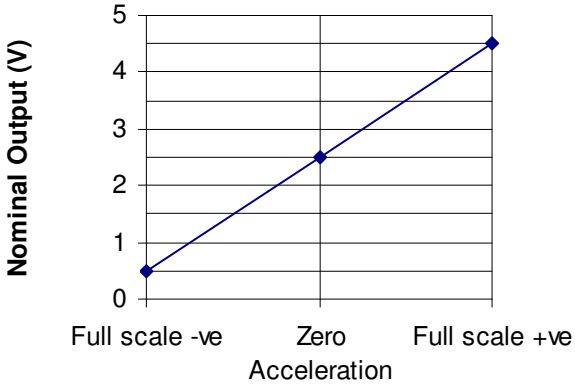


Figure 2

When the unit moves in the direction as marked in figure 1, the displacement of the suspended plate with respect to the two fixed plates changes, resulting in a change in capacitance of C1 and C2. An increase in C1 will result in a decrease in C2 and vice versa. Due to the small capacitances involved, in order to reduce noise and thermal drift and increase the resolution a differential system is employed. The signal from the element is then further processed to obtain a filtered and amplified linear output.

Sensor Output

In order to prevent interference from higher frequency oscillation, the frequency range of the output signal is sharply attenuated by an active DC filter. On the standard accelerometer the -3dB point is set to 40Hz with a roll off of 40dB/dc, however this can be changed to suit customers requirements. Alternatively an 8 pole Butterworth filter is also available.



The nominal output is 0.5V for full scale negative acceleration, 2.5V for zero acceleration and 4.5V for full scale positive acceleration. Each sensor is individually calibrated. The parameters are supplied with the sensor and can be used to manually or automatically minimise any remaining sensor error.

Sensor Design

The sensor is assembled into a sealed, anodised aluminium body, which makes it very robust and resistant to standard motorsport fluids.

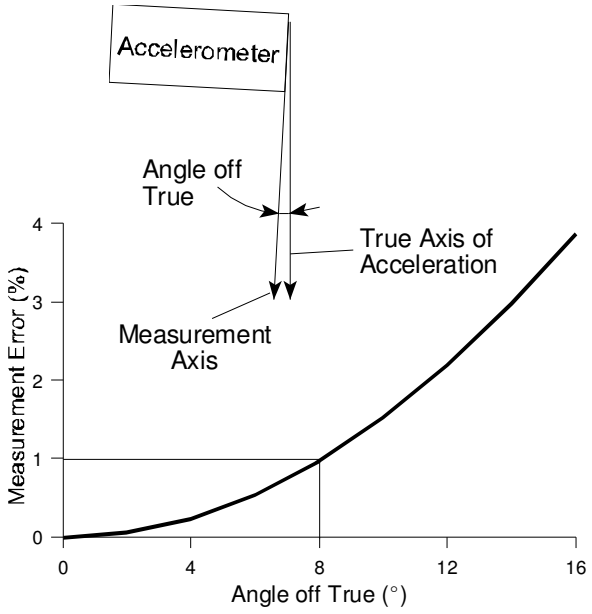
McLAREN TECHNOLOGY CENTRE
CHERTSEY ROAD, WOKING
SURREY GU21 4YH, UNITED KINGDOM
T: +44 (0) 1483 261400
F: +44 (0) 1483 261402
W: www.mclarenelectronics.com
USA: McLAREN ELECTRONICS INCORPORATED
T: +1 (704) 660 3181
Email: sales@mclarenelectronics.com
ASIA: TOKYO R&D CO. LTD
T: +81 (0) 46 226 5501
Email: mes@r-d.co.jp

Accelerometers and Gyros

Accelerometer Installation

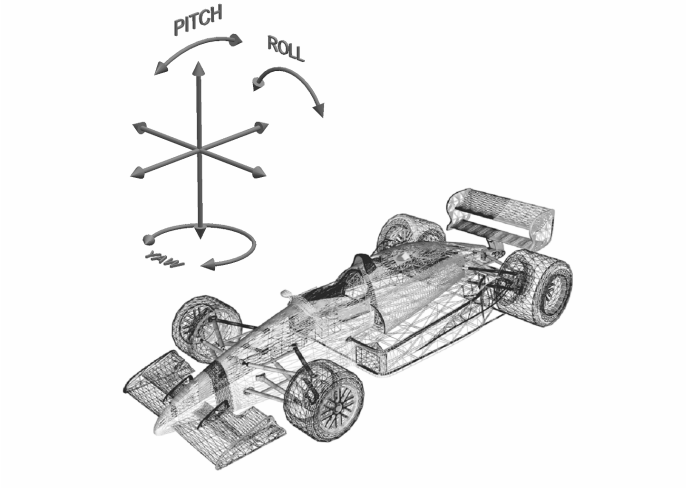
To give an accurate representation of movement, the accelerometer must be rigidly attached to the object being monitored. McLaren Electronic Systems accelerometers have through holes to enable them to be securely fastened to a surface.

The measurement axis of the sensor should be in line with the axis of the motion being measured. Any angular misalignment will give an error which is proportional to the cosine of the angle. For small angles the error is negligible, but it increases rapidly as the angle increases. For example, a misalignment of 8° will give an error of 1%.



Gyros

McLaren Electronic Systems offer gyroscope sensors for use in the development of vehicle dynamics.



Principle of Operation

The gyroscope sensor is a solid state device based on the Coriolis effect to measure angular rate. The sensor consists of a micro-machined vibrating silicon element, which provides an analogue output proportional to the rate of change of angular position about its sensing axis. The silicon element design is based on the principle of a shell resonator whereby a silicon ring is mounted to a substrate by radial spokes. This design of resonator is more resilient to shock and vibration than beam oscillators whereby the suspended silicon beam is mounted vertically with legs supporting the element mass. The Gyros are available to measure a single axis or three axis.

Gyro Output

At zero angular velocity the sensor has an output voltage of 2.5V ±0.1V. The sensitivity of the unit (10mV/°/sec) allows for an output range 10 x 200 = ±2V (i.e. 0.5 to 4.5V).

The sensor design incorporates a 100kohm load resistor internally.

McLAREN TECHNOLOGY CENTRE
CHERTSEY ROAD, WOKING
SURREY GU21 4YH, UNITED KINGDOM
T: +44 (0) 1483 261400
F: +44 (0) 1483 261402
W: www.mclarenelectronics.com
USA: McLAREN ELECTRONICS INCORPORATED
T: +1 (704) 660 3181
Email: sales@mclarenelectronics.com
ASIA: TOKYO R&D CO. LTD
T: +81 (0) 46 226 5501
Email: mes@r-d.co.jp