Inertial Tech Note:

Effects Of Gravitational Force And Compensation With Inclinometers or Tilt Sensors

Inclinometers or Tilt Sensors are measuring based on the gravitational forces. However, gravitational forces are not consistent around the globe, varying with latitude and height above sea level. Variations of the density in the lithosphere cause additional local deviations.

As an example, the gravity at sea level is

- 9.78033 m/s^2 at the equator
- 9.80620 m/s^2 at 45 degree of latitude
- 9.83219 m/s^2 at the poles

In the table below the values of gravity for some cities are listed.

Amsterdam	9.813	Istanbul	9.808	Paris	9.809
Athens	9.807	Havana	9.788	Rio de Janeiro	9.788
Auckland	9.799	Helsinki	9.819	Rome	9.803
Bangkok	9.783	Kuwait	9.793	San Francisco	9.800
Brussels	9.811	Lisbon	9.801	Singapore	9.781
Buenos Aires	9.797	London	9.812	Stockholm	9.818
Calcutta	9.788	Los Angeles	9.796	Sydney	9.797
Cape Town	9.796	Madrid	9.800	Taipei	9.790
Chicago	9.803	Manila	9.784	Tokyo	9.798
Copenhagen	9.815	Mexico City	9.779	Vancouver	9.809
Nicosia	9.797	New York	9.802	Washington	9.801
Jakarta	9.781	Oslo	9.819	Wellington	9.803
Frankfurt	9.810	Ottawa	9.806	Zurich	9.807

An inclinometer or Tilt Sensor is calibrated at Jewell Instruments in Manchester, NH, USA. The results of any inclination data is exact only in this location. In different locations the displayed value must be corrected. If the correction of the local gravity is switched on, the inclination measured will be corrected accordingly before the value is displayed.

The correction is calculated according the following formula: $a_{ett} = \arcsin [g_c/g_m \times \sin(a_m)]$

Where:

g_c	gravity at the location of calibration
a_m	displayed inclination at location of measurement
g_m	gravity at the location of measurement
a_{ett}	effective inclination

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