

TreeTalker®G

User Manual



Nature 4.0

Inspired to invent change

Index

Contents

Product specificationPage 3

Device description Page 3

Troubleshooting and maintenance Page 7

Product Specifications

Device operating voltage	3.7 V – internal LiPo battery
Battery capacity	10000 mAh
Operating temperature	-20 to +60 °C
Operating Humidity	0 ~100%RH
Protection grade	Suitable for outdoor scenes

Device description

The TreeTalker G (TTG) is a device developed for the measurement of stability of a tree in terms of tridimensional orientation in space. The evolution over time of the position in space of trunks and branches can help identifying possible cause of danger.

Every monitoring period the devices wake up and continuously take measurements over a monitoring time. The standard deviation for every monitoring time is performed and then the device returns to sleep. The cycle is repeated for an hour. At the end of the hour the average and the standard deviation of all the acceleration data collected for every axis are performed and the standard deviations collected for every monitoring time are compared to select the maximum value for every axis.

An example of TTG string can be found below:

1. serial_number: the identifier of the device;
2. string_type: identifier of the string format (11 for TTG)
3. cycle duration [ms]: milliseconds from the activation of the device
4. acceleration_component_X [d.n.]: average acceleration along the X axis collected over the hour;

5. `acceleration_std_X` [d.n.]: standard deviation along the X axis collected over the hour;
6. `acceleration_component_Y` [d.n.]: average acceleration along the Y axis collected over the hour;
7. `acceleration_std_Y` [d.n.]: standard deviation along the Y axis collected over the hour;
8. `acceleration_component_Z` [d.n.]: average acceleration along the Z axis collected over the hour;
9. `acceleration_std_Z` [d.n.]: standard deviation along the Z axis collected over the hour;
10. `max_X` [d.n.]: maximum standard deviation collected along the X axis registered during the hour;
11. `max_Y` [d.n.]: maximum standard deviation collected along the Y axis registered during the hour;
12. `max_Z` [d.n.]: maximum standard deviation collected along the Z axis registered during the hour;
13. `Vbat` [mV]: battery voltage, the battery is discharged below 3600;
14. `Monitoring_time` [s]: seconds used to collect and average data every monitoring period (default 10 s);
15. `Monitoring_period` [min]: time period between two monitoring times (default 10 minutes).

In order to convert the acceleration values collected in m/s², the following formula must be applied:

$$acceleration \left[\frac{m}{s^2} \right] = \left(\frac{acceleration[d.n.]}{16000} \right) * g$$

where g is the gravitational acceleration.

The orientation in space of the object the TTG is mounted on can be calculated under the hypothesis the device is exposed only to gravitational acceleration.

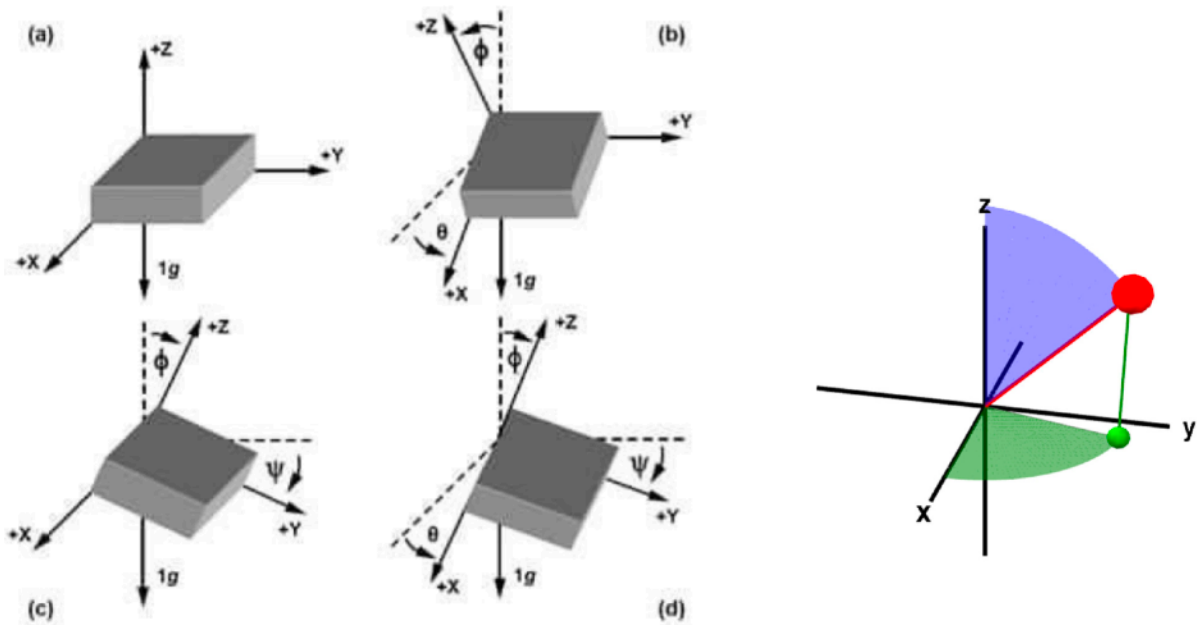


Figure 1. Accelerometers angle and movements

The reference position is the one where a TTG is mounted on a trunk perpendicular to the terrain (Figure 2).

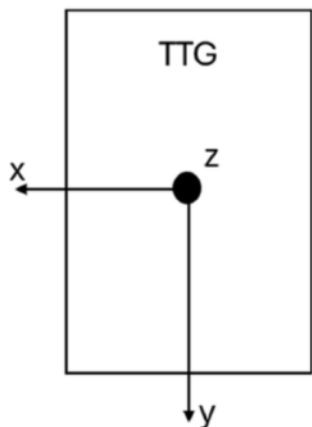


Figure 2. TTG reference orientation when mounted on a trunk

Calling A_x , A_y and A_z the accelerations along the respective axis in d.n. or in m/s^2 , the calculation of the angles between the reference configuration and the actual configuration can be calculated using the following equations:

$$\theta = \tan^{-1} \left(\frac{A_x}{\sqrt{A_y^2 + A_z^2}} \right)$$

$$\psi = \tan^{-1} \left(\frac{A_z}{\sqrt{A_x^2 + A_y^2}} \right)$$

$$\phi = \tan^{-1} \left(-\frac{\sqrt{A_x^2 + A_z^2}}{A_y} \right)$$

A positive angle indicates the axis is pointing in the opposite direction of g.

Reference: [Using An Accelerometer for Inclination Sensing | DigiKey](#)

Troubleshooting and maintenance

For every issue please contact: **technicalteam@nature4.org**