ACOUSTIC TRANSMITTER

ACTIVITY

The Thelma Biotel activity transmitter contains a 3-axis accelerometer similar to what you find in a smartphone. The embedded ultra low power sensor registers both static and dynamic acceleration with 1 mg resolution. We use it to measure the level of activity of animals, and it may even be custom programmed to detect and report specific motion patterns (Behavioural signature capture).

FEATURES

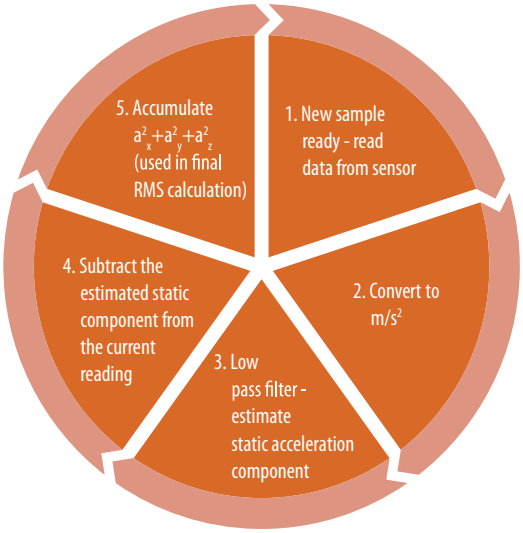
- Activity sensor range 0-3.465 m/s^2
- Available in all transmitter sizes 6, 7, 9, 13 and 16
- Long operational lifetime ~ 4 months - 5 years
- Can be combined with other sensor options
- Additional max survival depth available upon request

ACTIVITY LEVEL

One central feature of the activity transmitter is its ability to register the level of activity to which it is exposed, like what is found in modern pace counters and activity trackers. This is accomplished by rapid sampling and monitoring the changes in acceleration on the transmitter over time.
The most common version of the acceltag is the activity level measurement version (outputs an RMS or ODBA over a chosen sample period).

On-board Processing Algorithm

Raw acceleration data is sampled from the accelerometer at the desired frequency, converted to m/s^2, and then passed through a low-pass filter to determine static components such as gravity or other offsets. This provides a static acceleration vector to which the current data sample is compared to extract the acceleration dynamics.



SPECIFICATIONS

Activity

Range activity:	0-3.465 m/s^2
Resolution:	0.013588 m/s^2
Sampling frequency:	5/25 Hz
Max survival depth:	500 m*

Sensor Combinations

DEPTH

TEMPERATURE

TILT

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Rotational movement causes changes in the static acceleration vector and will as such be detected as activity along with linear accelerations. For persisting rotational movement, the influence will be less dominant over time as the low pass filter updates the static acceleration vector estimate. It is possible to tune the strength of the filter by adjusting the cut-off frequency. By default, this is set to 0.2 Hz.

The acceleration dynamics are accumulated over the desired sampling duration, and then a Root Mean Square (RMS) or Overall Dynamic Body Acceleration (ODBA) is calculated. This is the value transmitted by the transmitter and provides an estimate of total activity/movement during the sampling window.

$$ODBA = |A_x| + |A_y| + |A_z| \qquad A_{RMS} = \sqrt{\frac{\Sigma_{n=1}^{N} a_x^2 + a_y^2 + a_z^2}{N}}$$

As the characteristics of the activity may vary significantly between use cases the value transmitted by the tag can be programmed with user defined parameters:

- **Sample window duration:** The acceleration sample window is started right after the previous transmit has completed. To make sure the sampling has time to finish before the next transmit, the sampling window should be less than tx_{min}.
- **Sample frequency:** Number of acceleration samples (each sample consists of 3 data points – a_x, a_y and a_z) collected in one second. Default sampling frequency is 5 Hz.
- **A_{RMS} acceleration range:** Most acoustic transmits contains 1 byte of sensor data [0-255]. For example, a resolution of 0.013588 m/s^2 gives a range of 0 - 3.465 m/s^2. The range has proven useful for smaller and larger pelagic fish species as well as different species of crustaceans.

BEHAVIORAL SIGNATURE CAPTURE

Another key feature of the activity transmitter is the capability of detecting various motion signatures based on the raw data from the 3-axis accelerometer. Detection algorithms can be tailored to meet your specific needs and developed by Thelma Biotel. Ideally this is based on real data and video from controlled conditions where the relevant specimen is set up to log data directly from the desired motion pattern. Relevant movements include feeding- or spawning behavior, body tilt/orientation, rest- or activity level, comfort- or stress state and much more. The transmitter can for example be programmed to detect attacks against a prey, count how many times this movement signature is detected during a time period, and transmit the stored number of detected movement signatures wirelessly. After logging data on the specimen under controlled conditions, typically with video recording, the data can be analyzed and used during programming.

*Expanded max survival depth can be available on request.

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