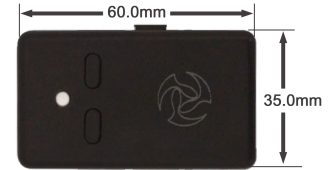




Yost Labs 3-Space Sensor™ Data-logging

Miniature High-Performance Attitude & Heading Reference Systems / Inertial Measurement Units



Product Overview

The 3-Space Sensor™ Data-logging integrates a miniature, high-precision, high-reliability, Attitude and Heading Reference System (AHRS) / Inertial Measurement Unit (IMU) with a micro-SD card storage device and a rechargeable lithium-polymer battery solution into a single low-cost end-use-ready unit. The Attitude and Heading Reference System (AHRS) uses triaxial gyroscope, accelerometer, and compass sensors in conjunction with advanced processing and on-board quaternion-based orientation filtering algorithms to determine orientation relative to an absolute reference in real-time.

Orientation can be returned in absolute terms or relative to a designated reference orientation. The gradient descent calibration process and high update rates increase accuracy and greatly reduce and compensate for sensor error. The 3-Space Sensor system also utilizes a dynamic sensor confidence algorithm that ensures optimal accuracy and precision across a wide range of operating conditions.

When attached to a USB 2.0 host, the 3-Space Data-logging unit can enumerate as both a virtual COM port and a USB mass-storage device. The virtual COM port allows access to real-time sensor data and configuration parameters and the mass-storage device allows access to logging & config options and captured sensor data. Versatile commands provide for raw sensor data, normalized sensor data, and filtered absolute and relative orientation outputs in multiple formats including: quaternion, Euler angles (pitch/roll/yaw), rotation matrix, axis angle, two vector (forward/up).

Applications

- Robotics performance analysis
- Motion capture
- Information gathering
- Personnel / pedestrian tracking
- Unmanned air/land/water vehicle tracking
- Education and performing arts
- Healthcare monitoring
- Asset tracking
- Vibration analysis and monitoring
- Event detection and monitoring

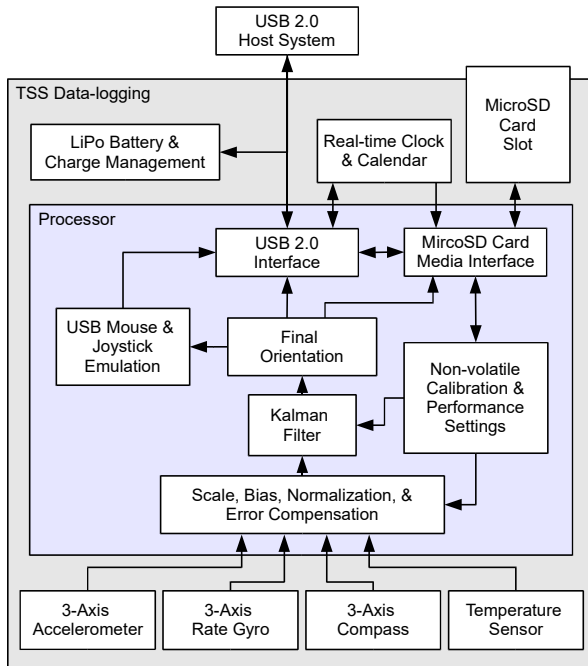
Key Features

The 3-Space Sensor Data-logging has many features that allow it to be a flexible all-in-one solution for your orientation sensing needs. Below are some of the key features:

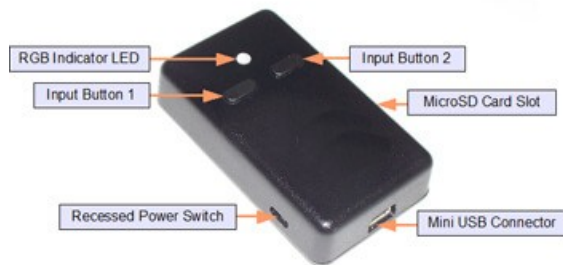
- Small self-contained high-performance data-logging AHRS at 35mm x 60mm x 15mm and 28 grams
- Integrated Lithium-Polymer battery and charge control allows battery life of 5+ hours at full performance
- Fast sensor update and filter rate allow use in highly dynamic applications, including motion capture, performance & motion analysis, and navigation
- Highly customizable orientation sensing with options such as tunable filtering, oversampling, and orientation error correction
- Advanced integrated Kalman filtering allows sensor to automatically reduce the effects of sensor noise and sensor error
- Robust open protocol allows commands to be sent in human readable form, or more quickly in machine readable form
- Orientation output format available in absolute or relative terms in multiple formats (quaternion, rotation matrix, axis angle, two-vector)
- Absolute or custom reference axes
- Access to raw sensor data
- MicroSD card allows for data-logging applications, USB allows for real-time applications
- Flexible data logging configuration allows customization of logged data and allows event-based and time-based logging options
- Built-in clock/calendar provides for fully time-stamped event logging at high resolution
- USB communication through a virtual COM port
- Enumeration as USB mass-storage device makes access to logged data easy
- Upgradeable firmware
- RGB status LED, two programmable input buttons
- Available in either hand-held or screw-down packaging

High-reliability MEMS technology combined with advanced processing and multiple quaternion-based filtering algorithms allows for accurate orientation outputs across a wide range of performance conditions.

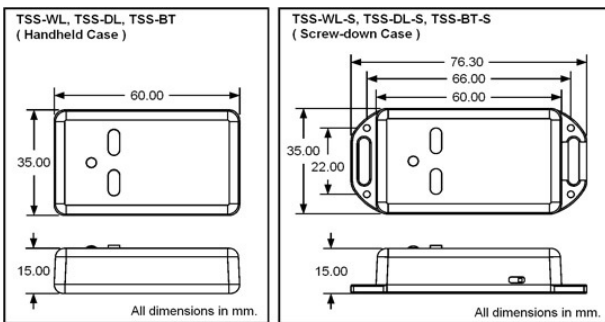
Block Diagram



Hardware Overview



Case Dimensions



Specifications

General	
Part number	TSS-DL (Handheld Sensor Unit) TSS-DL-S (Screw-down Sensor Unit)
Dimensions	35mm x 60mm x 15mm (1.38 x 2.36 x 0.59 in.)
Weight	28 grams (0.98 oz)
Supply voltage	+5v USB
Battery technology	rechargeable Lithium-Polymer
Battery lifetime	5+ hours continuous use at full performance
Communication interfaces	USB 2.0
Storage media	MicroSD card
Filter update rate ¹	up to 250Hz with Kalman AHRS (higher with oversampling) up to 850Hz with QCOMP AHRS (higher with oversampling) up to 1350Hz in IMU mode
Orientation output	absolute & relative quaternion, Euler angles, axis angle, rotation matrix, two vector
Other output	raw sensor data, corrected sensor data, calibrated sensor data, temperature, date/time.
Shock survivability	5000g
Temperature range	-40C ~ 85C (-40F ~ 185F)
Sensor	
Orientation range	360° about all axes
Orientation accuracy ²	±1° for dynamic conditions & all orientations
Orientation resolution	<0.08°
Orientation repeatability	0.085° for all orientations
Accelerometer scale	±2g / ±4g / ±8g selectable for standard models ±6g / ±12g / ±24g selectable for HH models ±100g / ±200g / ±400g selectable for H3 models
Accelerometer resolution	14 bit, 12 bit(HH), 12 bit(H3)
Accelerometer noise density	99µg/√Hz, 650µg/√Hz(HH), 15mg/√Hz(H3)
Accelerometer sensitivity	0.00024g/digit-0.00096g/digit 0.003g/digit-0.012g/digit(HH) 0.049g/digit-0.195g/digit(H3)
Accelerometer temperature sensitivity	±0.008%/°C, ±0.01%/°C(HH, H3)
Gyro scale	±250/±500/±1000/±2000 °/sec selectable
Gyro resolution	16 bit
Gyro noise density	0.009°/sec/√Hz
Gyro bias stability @ 25°C	2.5°/hr average for all axes
Gyro sensitivity	0.00833°/sec/digit for ±250°/sec 0.06667°/sec/digit for ±2000°/sec
Gyro non-linearity	0.2% full-scale
Gyro temperature sensitivity	±0.03%/°C
Compass scale	±0.88 Ga to ±8.1 Ga selectable (±1.3 Ga default)
Compass resolution	12 bit
Compass sensitivity	0.73 mGa/digit
Compass non-linearity	0.1% full-scale

1. Depends upon model, communication mode, and filter mode.
2. Average value when calibrated.

Specifications are subject to change.
Version: 2.2.1



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Patents Pending
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