FSM-9
Freespace® Sensor Module
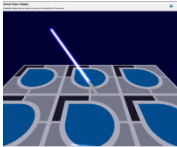
hillcrestlabs™

Ultra-High Performance 9-Axis Inertial Measurement Unit (IMU)

The FSM-9 is a low power, high performance motion tracking system which brings unprecedented motion realism to head mounted display (HMD), virtual reality, and augmented reality applications. The factory calibrated, tested, and optimized chip combines high performance MEMS sensors with MotionEngine Universal sensor fusion and cursor control software on a 32-bit MCU in a compact surface-mounted package.

FSM-9 BENEFITS

Unprecedented Realism for HMDs, VR, and AR

- Contextual smoothing eliminates jumps and jitter
- High accuracy maintains immersive environment
- Minimal latency with superior and predictive fusion

Ultimate Performance with Real-Time Calibration

- Comprehensive automated calibration
- Magnetometer calibration eliminates all electrical, magnetic, and metallic interference
- Real-time gyro calibration eliminates gyro drift

Complete System for Rapid Deployment

- Highest performance MEMS sensors selected
- Industry leading sensor fusion software included
- Simple API, development tools, and both USB and SPI outputs

KEY FEATURES

- ✓ **9-Axis MEMS motion sensing IMU**

- ✓ **Comprehensive factory calibration**

- ✓ **Real-time sensor calibration**

- ✓ **Zero gyro drift**

- ✓ **Contextual smoothing**

- ✓ **Configurable sampling rate**

- ✓ **Temperature compensation**

FSM-9 Freespace Sensor Module

ADVANCED FEATURES

The FSM-9's advanced features ensure unparalleled performance. Features include:

- **9-Axis MEMS Motion Sensing –** The accelerometer, gyroscope and magnetometer represent the latest in MEMS technology and are pre-qualified by our lab as the highest performance sensors.

- **Comprehensive Factory Calibration -** Industry's most comprehensive calibration process corrects for 52 factors including scale, linearity, aging and temperature.

- **Real-Time Calibration –** continuous automated calibration improves performance and eliminates all manual calibration requirements.

- **Zero Gyro Drift –** proprietary algorithms eliminate gyro drift.

- **Contextual Smoothing –** produces the smoothest motion record to minimize jumps and jitter for immersive apps.

- **Configurable Sampling Rate -** enables customer-configurable sampling rates up to a blazing fast 250 Hz.

- **Temperature Compensation –** calibrated to operate from 0 to 50°C.
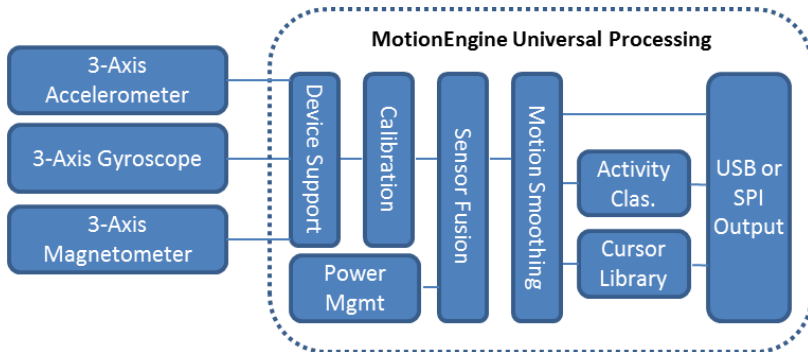
PERFORMANCE SPECIFICATION

Parameter	Typical
Sampling Rate	125 Hz
Angular Velocity	
Range	+/- 1833°/s
Resolution	0.05°/s
Bias (zero rate offset)	TBD
Sensitivity accuracy	1%
Non-linearity (% full scale)	0.2%
Linear Acceleration	
Range	+/- 4g
Resolution	< 6mg
Bias (zero-g offset)	< 20mg
Sensitivity accuracy	2%
Non-linearity (% full scale)	3%
Orientation Specification	
Static Accuracy	2.1°
Static Heading	2.0°
Static Nonheading	1.0°
Dynamic Accuracy	2.5°
Dynamic Heading	2.0°
Dynamic Nonheading	1.5°
Resolution	TBD
Pointer Performance	
Sensitivity	33 mickeys/°
Angle Error	< 2°
Ripple	1 mickey
Tremor Cancellation	70%

SYSTEM INTEGRATION

The FSM-9 communicates with an external system via SPI and USB. The FSM-9 runs Hillcrest's HCOMM protocol, a message based protocol allowing the system to configure the module and receive calibrated motion data, fused sensor data or mouse data. Data is presented in HID-like messages to allow simple integration with host software.

FSM-9 Freespace Sensor Module

COMPACT SIZE, COMPLETE PACKAGE

MotionEngine Universal Processing

- 3-Axis Accelerometer
- 3-Axis Gyroscope
- 3-Axis Magnetometer
- Device Support
- Calibration
- Sensor Fusion
- Motion Smoothing
- Activity Clas.
- Cursor Library
- Power Mgmt
- USB or SPI Output

FSM-9

freespace®
by Hillcrest Labs

Dimensions: 0.68" x 0.75" x 0.11"

- **Small form factor** PCA module ideal for embedded applications

- **Solder cups** (castellations) enable integration to custom applications for prototyping and production

- **Communication** with an external system via Serial Peripheral Interface (SPI) or USB

POTENTIAL APPLICATIONS

Head Mounted Displays

GOLDEN·I

The FSM-9 can enable a wide range of hands-free controls on head mounted displays.

Virtual Reality Systems

The FSM-9 enables the most immersive virtual reality experiences.

Gaming

SmartGoggles
by SENSICS

The FSM-9 provides smooth and responsive motion for ultimate gaming.

ABOUT HILLCREST LABS

Hillcrest Labs is the leading global supplier of software and hardware for motion-enabled products. Our Freespace® technology transforms human movement into high quality, application-ready motion information. With a decade of development and many unique patented features, products come to life with Freespace® motion.

Find out more at www.hillcrestlabs.com, or contact us at sales@hillcrestlabs.com.