

## The Core of the Freespace Motion Solution

Hillcrest Labs' patented Freespace motion solution interfaces with low-cost, commercially available MEMS accelerometers and gyroscopes to sense motion in three dimensions and precisely translate movements to control a cursor for use in pointing remote controls and computer peripherals. The solution also enables motion control and tracking for use in immersive video game systems, gestural interfaces and many more applications. The core of the Freespace motion solution is the Freespace MotionEngine that performs the essential motion computing functions enabled by proprietary software and algorithms to create accurate and highly responsive in-air pointing and motion control applications.

### Core Motion Sensing Features

- Produces accurate, low-latency X-Y pointer data for use by a host to control cursor motion
- Produces linear acceleration (mm/s<sup>2</sup>) and angular velocity (mrad/s)
- Produces angular position (quaternion)
- Supports 5-axis and 6-axis sensor configuration
- Supports MEMS inertial sensors from multiple suppliers

### Advanced Motion Processing Features

- Orientation compensation – Compensates for tilt by translating motion from the body frame of reference to the user frame of reference
- Button motion suppression – Compensates for inadvertent movement caused by button and scroll events
- Adaptive tremor removal – Cancels the effects of unintended motion caused by user tremor
- Power management – Performs wake-on-motion and on-table detection

### Host Interface Features

- Supports HCOMM (Hillcrest Communication Protocol) SPI slave
- Supports HCOMM IRF and HCOMM LCP services
- Produces HCOMM USB HID report
- Integrates with intelligent RF devices

### User Interface Features

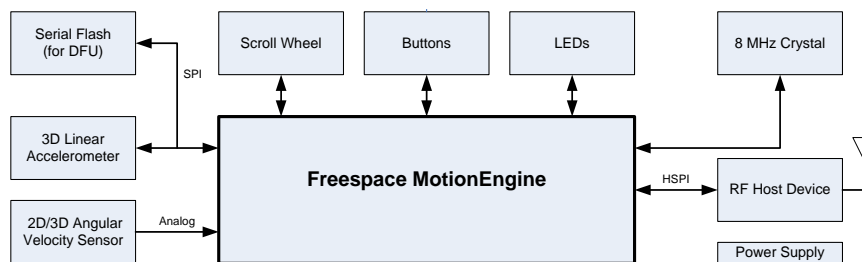
- Supports configurable buttons
- Supports programmable PWM LED
- Supports programmable on/off LEDs
- Supports scroll wheel or encoder with quadrature output
- Produces mouse button events, keyboard events and consumer page events

### General Features

- Battery voltage monitoring
- Intelligent, automatic power management
- Upgradeable device firmware (DFU)
- Supported by Hillcrest's Freespace MotionStudio
- Supported by Hillcrest's libfreespace open source library

### Applications

- TV remote controls
- Game controllers
- Computer mice
- Wireless presenters
- Mobile handsets
- Head trackers
- Virtual reality systems
- Robotics
- Physical motion tracking and monitoring



Freespace MotionEngine in a Typical Remote Control Block Diagram

## Delivery Options

The Freespace MotionEngine is an embedded software solution available as a software license or through the purchase of pre-programmed Freespace Sensor Modules. The software delivery option allows customers to program devices with the Freespace MotionEngine at the factory. The module delivery option allows customers to quickly and cost-effectively integrate a complete solution that includes the Freespace MotionEngine and microprocessor together with MEMS inertial sensors.

## Embedded Solutions

- The Freespace MotionEngine is easily embedded in remote controls to allow users to point-and-click to navigate media applications and play motion-based video games on televisions, set-top boxes, PCs and game consoles. It can also be used as an embedded motion tracking solution for military, medical, sports/fitness, industrial, and virtual reality markets. To enable complete solutions, the Freespace MotionEngine supports a number of configurable peripherals, operating modes, and communication protocols, including USB, Bluetooth, and Hillcrest's proprietary RF protocol, Wireless Consumer Electronics (WiCE™).

- The Freespace MotionEngine is integrated with off-the-shelf MEMS inertial sensors to enable rapid design and manufacture of products with Freespace motion technology.

## Reference Kits

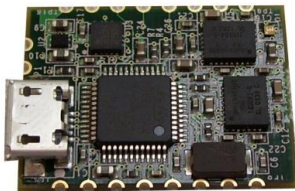
Hillcrest offers the Freespace Reference Kits (FSRKs) and Freespace Sensor Modules which include the Freespace MotionEngine running on a processor in a variety of configurations. The FSRKs enable easy evaluation of Freespace motion technology for in-air pointing and motion control applications. The FSRKs give product designers and software developers all the components, tools, and documentation needed to rapidly prototype motion control devices without any prior knowledge of motion control.

## Additional Information

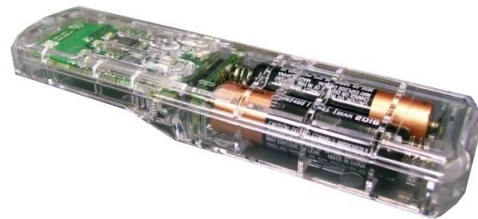
Product information, white papers, and tools are available at <http://www.hillcrestlabs.com/freespace>

## Patent Protection

Hillcrest Labs has a worldwide portfolio of over 200 patents and patents pending including foundational patents for Freespace motion technology and the HōME® application creation platform.



Freespace Sensor Module



Freespace Reference Kit

Hillcrest Laboratories (a.k.a. Hillcrest Labs) sells products to enable a new class of motion and interactive applications. Hillcrest Labs offers its Freespace motion technology as a turnkey solution for motion sensing, motion control, and motion tracking applications including in-air pointing remote controls, motion-sensing game controllers, wireless presenters, mobile handsets, and gesture recognition systems. Freespace motion technology is also used in Hillcrest's Loop™ pointer, a direct-to-consumer in-air mouse for TV that lets users control an on-screen cursor with a flick of the wrist and navigate the Web or their home media content on TV. Hillcrest's products have received numerous awards and recognitions including two CES Innovations Awards, PC World's 100 Best Products and Greatest Tech Designs, ECN's Reader's Choice Tech, Popular Mechanics' Editors Choice, and others.

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