

Scalable SIRU™

The high reliability Scalable SIRU™ ensures precision performance for critical space missions



HRG – A Design with Proven Reliability

The Hemispherical Resonator Gyro (HRG) sensor is composed of three simple machined quartz parts—a high-Q vibrating hemispherical resonator, and inner and outer shells which support the resonator within. The quartz construction of the HRG is inherently stable, impervious to aging effects, and naturally radiation-hard. Operating in a completely evacuated hermetically sealed case, the HRG sensor is not affected by any phenomena that could make it wear out or limit its life—making it an ideal gyro for space applications.

Scalable SIRU™ Unique Benefits for Space Applications

The HRG-based Scalable SIRU™ incorporates unmatched features:

- Proven high reliability and long life, due to the simple HRG sensor design
- HRG technology offers ultra-low angle random walk and is inherently free of dead band
- Fault-tolerant, redundant system architecture with cross-strapped HRGs and electronics, ensuring success for missions lasting 15 or more years
- Demonstrated gyro capability, providing an inertially stable, low noise, wide bandwidth reference
- Radiation hard sensors and electronics that operate reliably when subjected to long-term radiation exposure in space

Redundancy Ensures High Performance for Over 15 Years

The efficient and redundant architecture of the Scalable SIRU™ minimizes subassembly count. It contains:

- Four HRGs and four (optional) accelerometers, with independent associated loop control/readout/thermal control electronics, and sensing along the octahedral-tetrad axes
- Two power supplies and two sets of sensor processors with input/output electronics

Each of the four inertial sensor channels can be operated independently by either of the two power supply/processors, providing a probability of mission success of 0.997 for a 15 year mission.

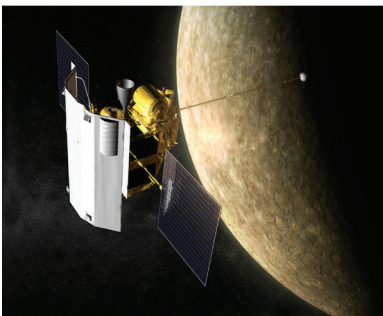
In a compact 15.7 lb package, the internally redundant Scalable SIRU™ provides a significant size, weight and power savings over competitive systems.

Applications

The Scalable SIRU™ is the spacecraft manufacturer's choice for sensor pointing/stabilization and spacecraft attitude control on demanding long term space missions, including:

- Earth orbits at all altitudes/angles
- Interplanetary missions
- Deep space missions

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Demonstrated Inertial Reference Performance

The Scalable SIRU™ features precision inertial rate measurements, characterized by extremely stable gyro bias, low noise, and precise scale factor. The tables below illustrate these features.

Rad Hardness Can be Scaled for Varying Environments

Radiation hardness can be scaled by selecting specific parts and variable thickness bolt-on shielding for low total dose, high total dose, high dose rate [2E8 rad (Si/s),] and SEU/SEL tolerance.

Performance

Ps (15 years continuous operation)	>0.997
Gyro Bias Stability	<0.0015°/hr, 1σ at constant temperature over 12 hours
Gyro Noise	
– Noise Equivalent Angle	<3 arc sec pk-pk
– Angle Random Walk	<0.00015 deg/√hr
– Angle White Noise	<0.003 arc sec/√Hz
Scale Factor short term stability	<5 ppm, 1σ at constant temperature over 12 hours
Scale Factor Non-Linearity	<20 ppm, (1σ), -7 to +7 deg/sec at gyro input axis <0.1 deg/hr, -1 to +1 deg/sec
High Accuracy Mode Rate Range	±7°/sec at gyro input axis

Features

Lightweight, small size, low power
Four solid-state HRGs and cross-strapped electronics in a redundant architecture
Optional accelerometers
Optional one and two optical cube configurations

Heritage

The space qualified Scalable SIRU™ evolved from the heritage Core SIRU™, which has operated in space since 1996 for over 16 million hours with 100 percent mission success. SIRU™ systems have been launched more than 100 times for use aboard NASA, Department of Defense, commercial, and international space applications, including: Deep Impact, MESSENGER, Cassini, NEAR, GLAST, EOS, Geolite, Aura, Aqua, KOMPSAT 1, GOES, 601-HP, TDRS, GPM, WGS, 702 bus, EchoStar, IKONOS, AEHF, A2100 bus, 1300 bus, STAR bus, MUOS, SBSS, Worldview, Herschel, GeoEye, TerreStar, and Landsat.

Environmental Capability

Temperature Range	-55°C (-67°F) to +85°C (185°F) (non-operational) -10°C to +60°C (full performance)
Random Vibration	18.56g rms
Sine Vibration	20g pk
Shock (Pyrotechnic)	3000g peak
Altitude	Sea level to space
Radiation Hardness	Scalable up to >15 year GEO missions

Characteristics

Size	7.1 W x 5.9 H x 11.4* L in. (18.0 W x 14.9 H x 28.9 L cm) (* without Optical Cube)
Weight	15.7 lb (7.1 kg)
Power	28 or 70 Vdc, 43 W max
Interface	1553B and/or RS-422
Cooling	Base-plate conduction

For more information, please contact:

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