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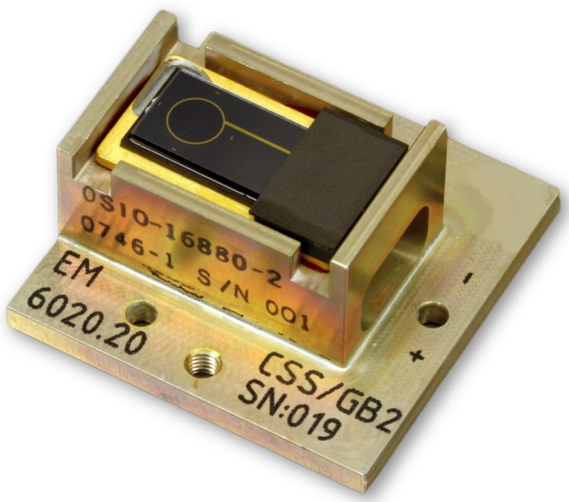
COSINE SUN SENSOR



The Cosine Sun Sensor (CoSS) delivers coarse information about the position of the sun relative to the spacecraft. This information is used for coarse maneuvering of the spacecraft and to inform the spacecraft about the position of the sun.

The CoSS delivers coarse information about the polar angle of the sun. This information is derived from the fact that the sensor output varies approximately proportional to the cosine function of the angle of incidence of sunlight.

With a suite of CoSS, of which at least three sensors with different viewing directions have the sun in their field of view, the Attitude & Orbit Control Subsystem (AOCS) can retrieve the position of the sun in the coordinate reference system of the spacecraft. Typically there are eight to twelve CoSS per space platform.

Key Advantages

- Large FOV (160˚ full cone) for measurement of solar aspect offset angle
- On-board computer can reconstitute the sun vector unambiguously from illumination of three units
- Qualified for several different orbits, including low earth orbits with many temperature excursions
- Qualified for very severe radiation regions (LEO in Van Allen belts)
- Virtually zero EMC susceptibility and no emissions

Cosine Sun Sensor

Characteristic	Performance / Interfaces Budget
Mass	Exclusive cable: 24 grams With 1.5 meter of cable: 50 grams
Dimension	30 x 30 x 14.5 mm3 (exclusive cable fixation provisions) : i.e. height is perpendicular to mounting plane Overall height including cable clamp: 35 mm
FOV	Minimum operational FOV: 160 degrees of arc full cone angle (±80°)
Outputs	Typical Sun induced analog current about 5 mA. Albedo will also produce disturbing output with a magnitude depending on orbit characteristics. In LEO worst case albedo signal can be as high as about 60%@ 500 km of the direct sun input. At 5000 km worst case albedo can be 10% of direct sun input, at GEO albedo is less than 0.7% of direct sun input.
Power Consumption	nil: CoSS is passive
Accuracy	Individual output has approximate cosine response with angle of incidence. OBC can retrieve solar aspect angles from CoSS suit ; accuracy typically in the order of ±3 degrees of arc (if on-board corrections are made for sun sensor temperature). Note: this accuracy figure can be derived from units, which are solely lit by direct sunlight, (i.e. no albedo). S/C coarse attitude must be resolved from those CoSS units in the sensor suit which are not exposed to albedo.
Noise equivalent angle	Negligible
Redundancy and reliability	In case of a suit of 6 to 8 units in a S/C redundancy exists Failure rate of one device: 5FIT @ 50°C
Alignment	Orthogonality better than 0.5 degrees of arc. No dedicated alignment cube incorporated in design.
Qualification temperature	-50°C to +80°C (With qualified excursions of –145 °C to +120 °C)
Qualification Sine Vibration	20 g
Qualification Random Vibration	In-plane: 23.3 grms Out-of-plane: 36.4 grms
Qualification Shock	2000 g
Radiation hardness	Detectors are radiation hard (EPI technology) with 300 microns thick coverglass.

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ABOUT

Bradford is a high-tech European developer and manufacturer of satellite control sub-systems and components.

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