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FINE SUN SENSOR

The Fine Sun Sensor (FSS) is designed to deliver exact information about the position of the sun. This information is used for yaw steering of the spacecraft and therefore applied in earth pointing devices and solar array orientation.

The FSS is an analogue sensor, based on the use of a quadrant detector which is capable of measuring the solar aspect angle in two axes. Processing the four quadrant outputs results in the two components of the solar aspect angle.

The applied algorithms cancel out all disturbances that are common to the four quadrants, such as temperature effects, particle radiation degradation, window performance and scale factors. The FSS provides four quadrant output voltage and a sun presence output voltage.

Key Advantages

- Analog sun-presence signal provided
- Internal thermistor on electronics
- Qualified for low earth orbits with many temperature excursions
- Qualified for very severe radiation regions (HEO in Van Allen belts)
- Extremely low EMC susceptibility and emissions

Fine Sun Sensor

Characteristic	Performance / Interfaces Budget
Mass per sensor unit	Approximately 375 grams
Envelope dimension	<108 x 108 x 52.5 mm, including all protrusions by mounting feet, connectors, alignment cube and bondpin, exclusive dowel pins. Floor space: 104 x 94 mm
Nominal FOV	128° x 128° of the COTS sensor version
Unobstructed FOV (to be free of straylight sources)	138° x 138°
Accuracy	Two-axis measurement of solar aspect angles: EOL Bias error less than 0.3° (3 σ) in whole 128° x 128° FOV (throughout mission lifetime), after on-board implementation of ground calibration parameters. Note: This figure applies for condition without albedo
Resolution	Better than 0.03 degrees of arc
Noise equivalent angle	Less than 0.05° (3 σ)
Cross coupling between two axis read-outs	Change of $\Delta\alpha$ in one axis direction (α) may cause error $\Delta\beta < 0.05°$ in other direction (β).
Outputs	Analogue voltages in the range of 0-5V per quadrant; multiplexed on the basis of address command (rate should be about 1 ms).
Power consumption	< 0.25 W from ±15 V secondary power. No DC/DC converter included. (current per unit drawn from V+ approx 12 mA; current drawn from V- approx 3 mA)
Reliability	Failure rate: approx 70 FIT @30°C per unit; Reliability for 5 years in orbit for a single unit > 0.997.
Alignment	Alignment cube will be included; accuracy of faces of the cube: <10 arcsec; accuracy of alignment < 0.05 degrees of arc
Qualification temperature	-50 to +85 °C
Radiation Environment	The detector active element is made of p-type epitaxial silicon. With the shielding (>3 mm of cover glass thickness) the accumulated dose will be about 10 kRad. The degradation of the device output will be limited to less than 5% in current and an increase in temperature coefficient to 0.10%/°C max. Degradation will be common mode, common mode effects are cancelled out in sensor algorithms. EEE parts rad tolerance larger than 100 kRad, shielding > 7.5 mm aluminium. SEU and SEL Immune.
Electrical Stimuli / closed loop testing	Four voltage input interface provided, which by-passes the detector and enables closed loop testing.

Variants of FSS Available

1 Mini-FSS without readout electronics

2 Filtered variant for high solar input regions

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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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