

DEFENCE AND SPACE

Space Products

ASTRIX[®] 120

Very high performance FOG
fibre optic inertial measurement
unit for space multi-application
purpose



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Astrix 120 provides the AOCS with a 0.01 arcsec resolution three-axis measurement of the satellite's rotation. It offers internal redundancy, failure detection and isolation capabilities.

This Inertial Measurement Unit features 4 independent inertial rotation sensors based on FOG technology, benefiting from the outstanding performances of a fibre optic gyroscope.

The inertial sensors - 4 optical coils of 120mm diameter and 1km of optical fibre - dissipating only a few mW, have been separated from the processing electronics which ensures a perfect control of the detection axes mechanical stability.

The EEE, opto-electronic and opto components are carefully selected for their compatibility with the most demanding space quality level.

With its high performances, low consumption, low mass, quick start and versatile interfaces, the Astrix[®] 120 is ideally suited to any space application.

KEY FEATURES

- Very high inertial performance: high resolution and stability, very low noise from low to high frequencies
- The motion sensors are separated from the electronic, offering an ICU (Inertial Core Unit) dissipating a few mW only one side and the GEU (Gyro Electrical Unit) on the other side
- 4 independent angular rate detection axes in a skewed configuration (ICU)
- FOG materials compatible with optical payload
- More than 15 years continuous operation (no life limited item)
- Ps > 0.995 after 5 years continuous operation
- Very simple fault tolerant architecture with no cross-strapping
- Auto failure detection for each channel
- 1553B or RS422 digital interface
- Stimulation capability for AOCS ground test
- HiRel components

MAIN FIELDS OF APPLICATION

- LEO, MEO and GEO satellites
- Observation, science and telecom satellites

CUSTOMERS / APPLICATION

- Astrix® 120 on Planck and Sentinel1 (ESA), Spot6&7 (Airbus DS), Export Customers (Asia, US, South America)

ENVIRONMENT / RELIABILITY

- Thermal: -10 to +50°C (full performance), -20 to +60°C (operation)
- Vibration: 25g sine, 16g rms in plane, 23g rms out of plane
- Shock: 1200g from 1200Hz to 10kHz
- Radiation: 50krad total dose, SEP tolerant, latchup immune
- Lifetime: up to 15 years depending on mission profile
- EMI/EMC: MIL-STD-461

BUDGETS

- Mass: 6.5kg (ICU 2.0kg, GEU 4.5kg, compact configuration)
- Volume: ICU $\varnothing$ 215 x h 180mm, GEU 270 x 150 x 145mm³
- Power: 6W per ON channel

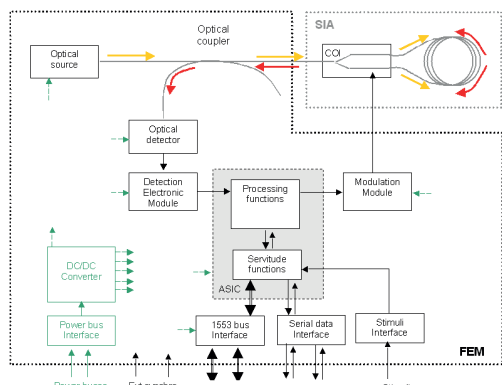
INTERFACES

- Power bus: 22-50V
- Turn-on: < 3s
- Dialog: 1553, RS422
- Synchro hardware link for accurate time-tagging, 1553 broadcast or autonomous mode available
- Testability BIT, RS422 stimulation for AOCS test

HERITAGE

- 27 satellites on orbit flying Astrix 120/200: 104 channels cumulating 500 years ON (as of January 2022)

Astrix® 120 gyroscopic channel architecture



Performances, end of life

General

- Full performance measurement range $\pm 10^\circ/\text{s}$
- Measurement range up to $\pm 140^\circ/\text{s}$
- Scale factor angular resolution $\approx 0.01 \text{ arcsec/LSB}$

Scale factor knowledge and stability

- | | | |
|--|-----------|----------|
| - Linearity over full performance range | 3σ | < 10ppm |
| - Thermal modelling error | 3σ | < 30ppm |
| - Stability over 1 month | 3σ | < 10ppm |
| - Stability over 5 years
(all effects included) | 3σ | < 200ppm |

Bias knowledge and stability

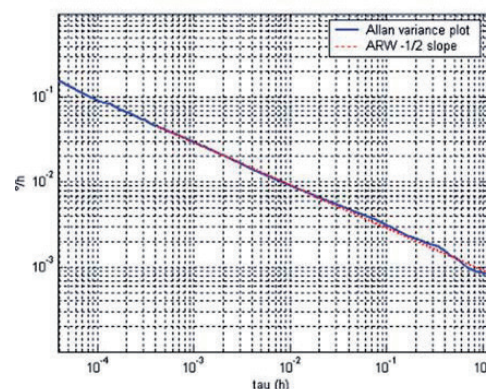
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|---------------------------|-----------|-------------------------|
| - Stability over 1 hour | 3σ | $< 0.01^\circ/\text{h}$ |
| - Thermal modelling error | 3σ | $< 0.03^\circ/\text{h}$ |

ARW

- | | | |
|--|------------|--------------|
| - No other noise contributor (AWN, RF, etc.) | 1 σ | < 0.0016°/√h |
|--|------------|--------------|

Alignment stability (over mechanical and thermal environment)

- Absolute (wrt mechanical reference) < 130μrad
- Relative (inter-axes of a same ICU) < 200μrad



Typical ARW is $0.0016^{\circ}/\sqrt{\text{h}}$
No HF and LF noise (unlike BLG or HRG techno)