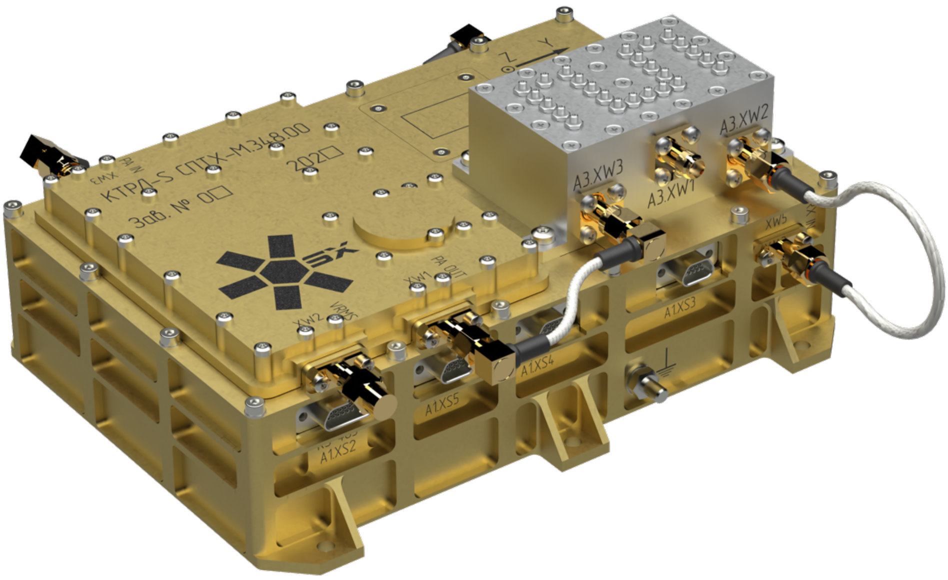
Line of microsatellite devices

ADCS Sensors

SX-SBOX



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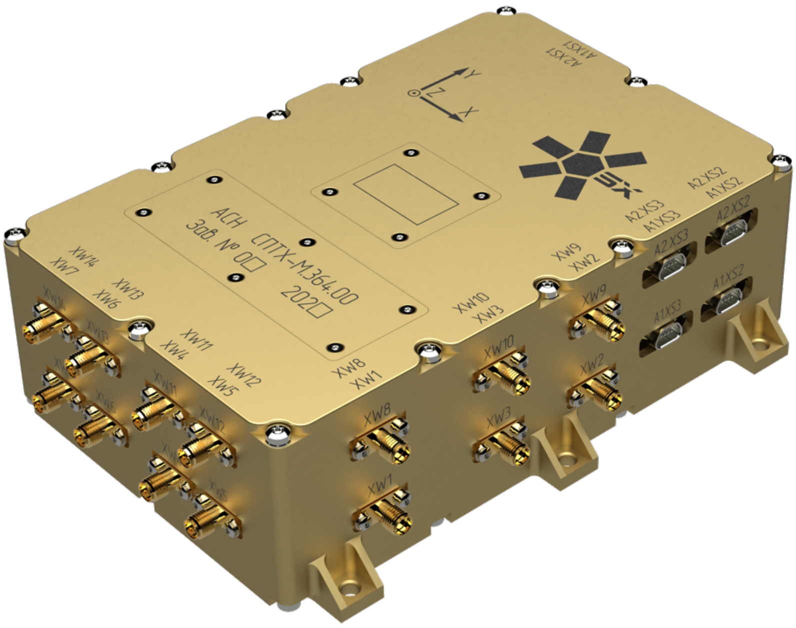
Satellite navigation equipment

SX-SBOX-GNSS-01



Parameters	Value
Power consumption	2 W
Power voltage	22-34 , galvanic isolation 500 V
Mass	700 g
Dimensions	171 x 111 x 51 mm (without fasteners)
Duplicated interfaces	CAN2B, SpaceWire
Coordinate determination error	10 m (sigma)
Speed determination error,	0.01 m/s (sigma)
Time error	$\pm 10^{-8}$ s during the battery life of at least 48 hours.

The task of the device is to adjust the output signal of 1 Hz bearing to the signal of 1 Hz of the navigation receiver in time so that the averaged position of the signal of 1 Hz CNE coincides with 1 Hz bearing, and to keep the signal of 1 Hz bearing in its current position in the absence of signal 1 Hz navigation receiver.

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The device uses a highly stable (high short-term stability) crystal oscillator with a typical frequency of 10 MHz as its own source of time and frequency. The adjustment depending on the change in the control voltage is $\pm 3 \cdot 10^{-7}$, which is approximately 3 Hz. This change in frequency to the extreme positions relative to real 10 MHz creates a lead or, accordingly, a lag of the signal divided by 107 1 Hz relative to the divided real 10 MHz for a period of 1 s by 300 ns. As real 1 Hz, you can take the averaged position of 1 Hz of the navigation receiver.

Own development of the company according to company standards, compatible with ECSS recommendations, relatively low cost, light weight and energy consumption; adaptation to customer requirements; use of unified electrical, information and mechanical interfaces; the GEM cycle has been successfully completed.

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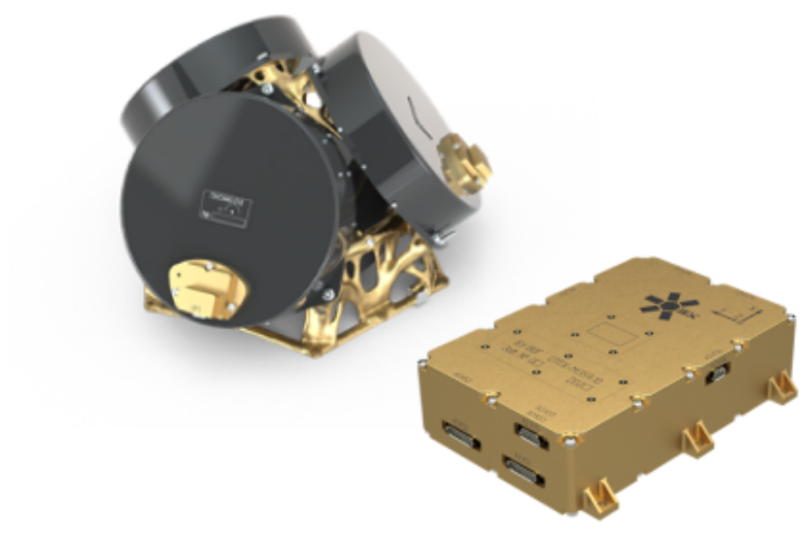
Fibre-Optic Gyroscope

SX-SBOX-AVS-FOG-01



Parameters	Value
Power consumption	Up to 33 W
Power voltage	22-34 V, galvanic isolation 500 V
Dimensions of the sensor unit	275 x 275 x 160 mm (without fasteners)
Dimensions of the control unit	171 x 111 x 44 mm (without fasteners)
Weight of the control unit with sensor unit	1700 g
Duplicated interfaces	CAN2B
The random component of the zero signal drift at a constant temperature (100 sec-averaging, 1σ) along each of the axes	≤0,005 °/h
The random component of the zero signal drift when the temperature changes from -40	≤0,02 °/h

°C to +60 °C (100 sec-averaging, 1σ) along each of the axes	
The spectral density of the noise power (according to the Allan variation) along each of the axes	≤0,0007°/√h

Fibre-Optic Gyroscope (FOG) is designed for use in the contour of the orientation determination system of small satellites. Angular velocity measurements are based on the sensitive elements of a third-party Russian manufacturer. FOG consists of a control unit and an assembly of 4 sensitive elements (three main and one backup).

The company's own development according to the company's standards compatible with ECSS recommendations, relatively low cost, low weight and energy consumption; adaptation to customer requirements; use of unified electrical, information and mechanical interfaces; the GEM cycle has been successfully completed.

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Angular velocity sensor (AVS)

SX-SBOX-AVS-MEMS-01

Parameters	Value
Power consumption	0,6 W
Power voltage	6 — 36 V, galvanic isolation
Dimensions	54 x 52 x 20 mm (without fasteners)
Mass	75 g
Duplicated interfaces	CAN2B
The random component of the zero signal drift at constant temperature, 1σ	2 °/h

The triaxial angular velocity sensor (AVS) is intended for use in the loop of the system for determining the orientation of small satellites. The angular velocity measurements are based on a sensitive MEMS element.

Own development of the company based on the experience of creating sensors for the orientation and stabilization system of spacecraft TabletSat-Aurora, OrbiCaft-Pro. This device is made in the framework of the ideology of the unity of hardware and software solutions of the company's product line. As a result, it makes it possible to effectively use it both with onboard systems of third-party manufacturers and to provide the fastest possible hardware and software integration into the spacecraft onboard with the rest of the company's onboard systems.

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Magnetometer

SX-SBOX-MAG-01

Parameters	Value
Power consumption	0,8 W
Power voltage	6 — 36 V without galvanic isolation
Dimensions	54x52x16 mm (without fasteners)
Mass	70 g
Measurement range	±100 000 nT
Measurement noise (σ)	100 nT

The magnetometer is designed to measure the magnetic induction vector. It is a three-axis measuring device and is intended for use in the loop of the system for determining the orientation of the spacecraft. As a rule, it is used in conjunction with electromagnetic coils for damping the spacecraft rotation, as well as for unloading the control flywheel motors.

Magnetic field measurements are carried out using anisotropic magnetoresistive sensors, which provide the necessary accuracy to operate in the spacecraft attitude control and stabilization system loop with small dimensions, weight and power consumption.

Own development of the company based on the experience of creating sensors for the orientation and stabilization system of spacecraft TabletSat-Aurora, OrbiCaft-Pro. This device

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is made in the framework of the ideology of the unity of hardware and software solutions of the company's product line. As a result, it makes it possible to effectively use it both with onboard systems of third-party manufacturers and to ensure the fastest possible hardware and software integration into the spacecraft onboard with the rest of the company's onboard systems.

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Solar sensor

SX-SBOX-SUNS-01

Parameters	Value
Power consumption	0.4 W
Power voltage	6 — 36 V, with galvanic isolation
Dimensions	43 x 43 x 16 mm (without fasteners)
Mass	45 g
Duplicated interfaces	CAN2B
line of sight	half-angle cone 45°
Accuracy (sigma)	0,15°

The solar sensor (SS) is intended for use in the attitude control loop to determine the ort of the direction to the Sun.

Information from the sensor is presented in the form of unit vector projections on the axis of the coordinate system associated with the sensor. The work is based on the transformation of information about the exposure of the matrix photodetector to sunlight.

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A known problem with solar sensors operating in low orbits is the glare of reflected light from the Earth. This device includes algorithms that allow you to combat such flares and provide the required accuracy.

The minimization of the dimensions and weight of this device made it possible to use it in spacecraft such as Cubesat. At the same time, it can be used in any other small spacecraft.

Own development of the company according to company standards, compatible with ECSS recommendations, relatively low cost, light weight and energy consumption; availability of flight qualifications for analogue products; adaptation to customer requirements; use of unified electrical, information and mechanical interfaces; the GEM cycle has been successfully completed.

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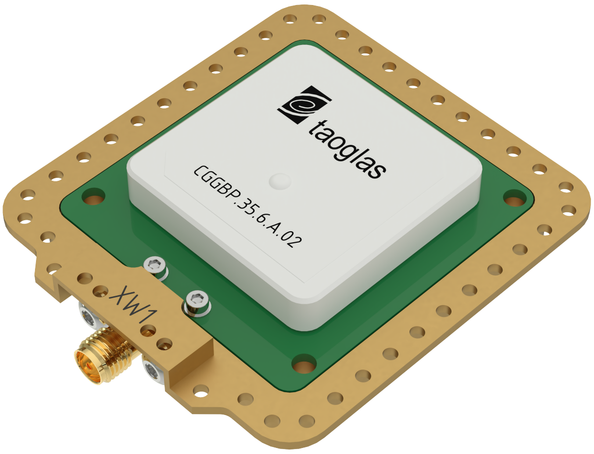
Antenna-feeder system of global navigation satellite systems
SX-SBOX-AGG-01



Parameters	Value
Antenna Type	Printed
Gain	at least 5.5 dB
Operating frequency range	1559 - 1607 MHz
Standing wave voltage coefficient	no more than 1.5
The width of the radiation pattern at the level of minus 3 dB	at least 84 degrees
Normal ellipticity coefficient	no more than 1.7 dB
Mass	61 g
Dimensions	68 x 68 x 15 mm
Type of polarization	Circular, RHCP

AFS-GNSS is a passive printed antenna for receiving GNSS signals of the L1 band.

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Options of devices delivery

- EM – engineering model
- FM – flight model

The differences between the EM and FM options are in the scope of the tests. Options are shown in the table.

№	Test	Model		Comment
		EM	FM	
1	Preliminary tests: - Checking power supply circuits; - Verification of information exchange (with the device and device nodes); - Calibration (if necessary)	+	+	Carried out in the laboratory of SPUTNIX LLC under normal climatic conditions.
2	Functional Acceptance Tests (FAT)	-*	+*	Checks for compliance of the device with the functional characteristics specified in the Operational Manual and compliance with the MS
3	Vibrodynamic Acceptance Tests	-	+*	Tests for resistance to mechanical external influences specified in Technical conditions (or Operational Manual)
4	Thermovacuum Acceptance Tests	-	+*	Checks for resistance to thermal and climatic external influences

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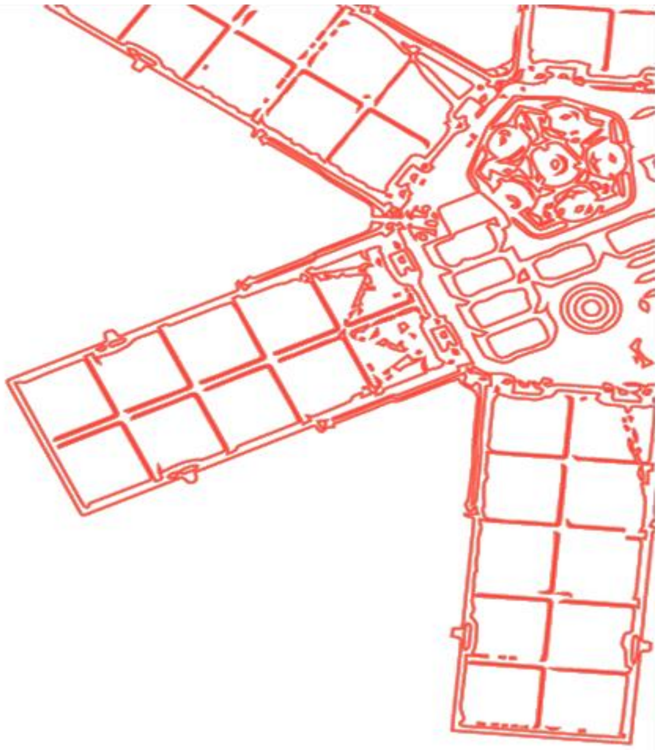
				specified in Technical conditions (or Operational Manual)
5	Electromagnetic Acceptance Tests	-	+*	Tests for resistance to electrical external influences specified in Technical conditions (or Operational Manual)
Notes: *Inspection can be carried out, carried out partially or excluded as agreed with the Customer				

If the requested device intended for laboratory testing will not be installed in a real satellite, EM with test type 1 (minimum test scope) should be used.

If the requested device is intended for use as part of a specialized functional stand, EM should be used with preliminary and functional acceptance tests (1 and 2).

If the requested device is intended for installation on a satellite, or for use as part of a stand for ground experimental testing of a flight product, it is required to use a FM with a full scope of tests (1, 2, 3, 4, 5).

If the requested device is intended for installation on a satellite (flight model), but for some reason it is not possible to conduct a full scope of tests, it is allowed to exclude certain types of tests for external influences (3,4,5) in a combination and sequence discussed with the Supplier. In this case, the responsibility for carrying out the missing tests lies with the Customer.



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SPUTNIX LLC is a Russian private company manufacturing high-tech satellite components and platforms, as well as ground equipment for sat testing, ground-based satellite stations, and equipment for aerospace education.