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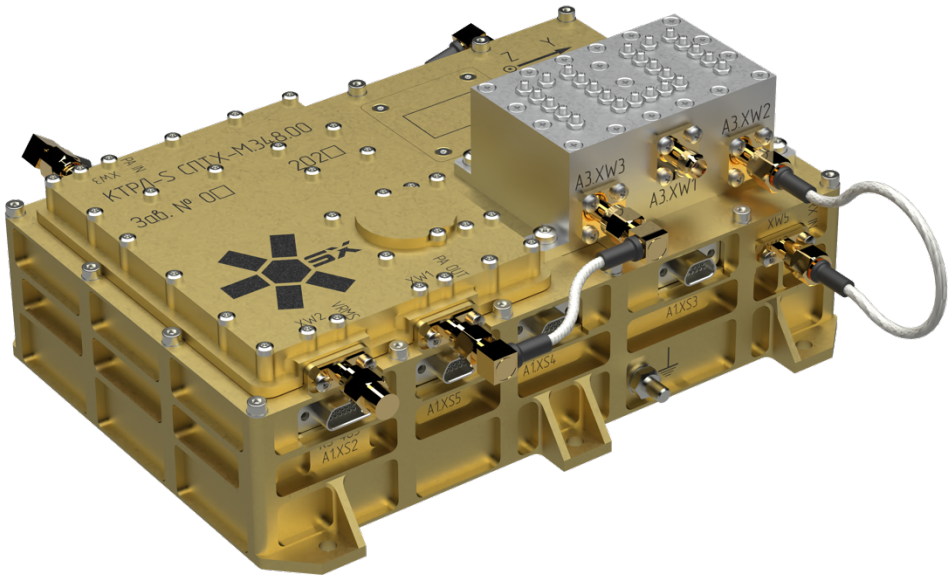
Line of microsatellite devices
SX-SBOX



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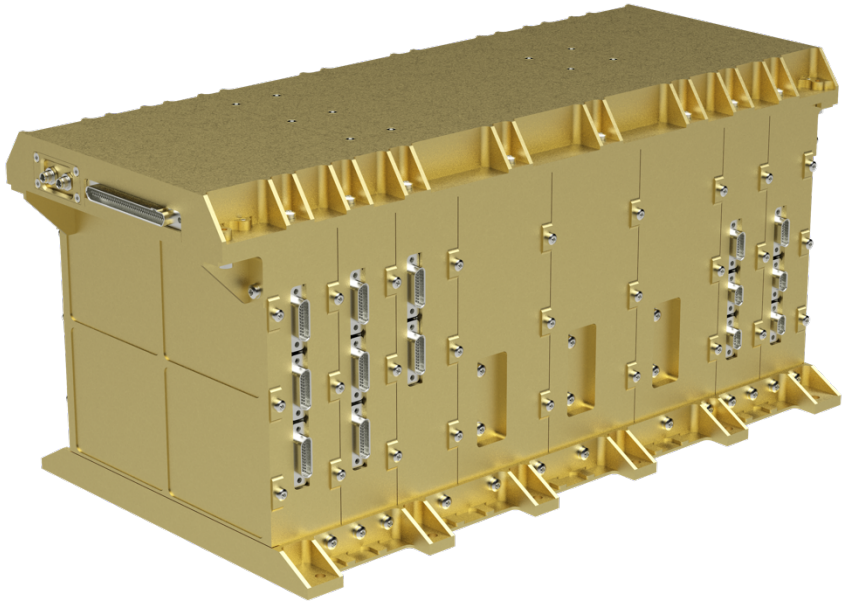
Regulation and control equipment (RCE)

SX-SBOX-PRU-01



Parameters	Value
Power consumption	10 W
Power voltage	22-34 V
Mass	7 kg
Dimensions	306 x 161 x 140 mm (without fasteners)
Duplicated interfaces	CAN2B, RS485, SpaceWire
Redundant galvanically separated stabilized subscriber power bus	27 V, ECSS-E-ST-20-20C
Redundant unstabilized subscriber power bus	27 V, ECSS-E-ST-20-20C

RCE, when working in conjunction with solar batteries (SB) and storage batteries (SB), provides:

1) on-board equipment (BE) with stabilized constant voltage of 27 V;

2) BE with unstabilized constant voltage (24-33) V;

3) battery charge with limitation of the maximum charging current, maximum voltage depending on temperature;

4) battery discharge with limitation of the maximum discharge current, minimum voltage depending on temperature;

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5) telemetric control of the parameters of power supply units, the formation and delivery of information arrays via wired circuits about the state of the parameters of power supply units during normal operation;

6) receiving and executing commands;

7) electrical tests from both ground and standard power sources.

The RCE includes:

• A set of chargers, consisting of several identical channels of chargers (CH);

• Power cross-module with power switching units (PSU) of unstabilized bus channels (BC) with load current limitation;

• Voltage stabilizer 27 V with a power switching unit (PSU) of stabilized bus channels (BS);

• RCE control system.

Structurally, the RCE is made in the form of a monoblock made of modules, the number of which varies depending on the average power consumed by the BE in the shade, the average power consumed by the BE in the illuminated area, and the peak power. From theseparameters, the number and type of memory channels and discharge device channels, as well as the number of SB panels and AB configuration are selected. The upper peak power scaling limit for a regulated 27 V rail is 1,500 W.

The RCE control system is universal and consists of two microcontrollers operating in hot standby. The volume of peripheral devices for measuring analog parameters (multiplexers and ADCs) and issuing control commands (registers) corresponds to the most powerful EPS.

The power line of the memory is tied to the area of the SB based on three-stage GaAsPEC and has the form:

1) for the area of the SB panel up to 0.5 m2 ZU200 (rated power 200 W);
2) for the area of the SB panel (0.5-0.75) m2 ZU300 (rated power 300 W);
3) for the area of the SB panel (0.75-1) m2 ZU400 (rated power 400 W);
4) for the area of the SB panel (1-1.5) m2 ZU600 (rated power 600 W).

The storage battery used in the EPS must have a voltage range of (24-33) V, the accumulator capacity is increased by increasing the number of parallel connected strings. The capacity of the battery depends on the depth of the battery discharge, the duration of the shadow section of the orbit and the average power consumed by the battery in the shadow.

Non-stabilized bus channels are separate modules and can be expanded depending on the platform requirements.

Own development of the company according to company standards, compatible withECSS recommendations, relatively low cost, modular scalable structure; availability of stabilized and unstabilized power rails 27V; use of unified electrical, information and mechanical interfaces; the GEM cycle has been successfully completed

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High-power distribution and control unit

SX-SBOX-PDU-HI-01

Parameters	Value
Power consumption	5 W
Power voltage	22-34 V
Dimensions	244 x 171 x 45 m m (without fasteners)
Mass	1100 g
Duplicated interfaces	CAN2B
Number of ports	Up to 8
Reservation	cold redundancy

The high-power supply switching unit (PSU-h) is used to organize power distribution between onboard devices, providing switching of the main and backup power lines of onboard equipment according to commands from the onboard computer, organizing redundant CAN data lines, organizing redundant second timestamp lines. Suitable for integrating powerful devices into one power supply network and data exchange. The use of PSU-h makes it possible to reduce the volume of the cable network and increase the reliability of the connection of onboard devices as part of the spacecraft. Each of the 8 PSU-h channels, to which the devices are connected, has:

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- independent control of switching on and off;
- adjustable overcurrent protection;
- support for information exchange and power switching.

If there are more than 8 on-board devices, you can use several PSU-h, switching them with each other. Moreover, each PSU-h has the ability to independently connect to the power supply system.

The PSU-h switch is designed in accordance with the ECSS-E-ST-20-20C standard.

Consumer power supply is routed through two independent channels through different connector contacts. The currents flowing are monitored and can be transferred to an external control device. One of the channels is considered the main one, the other is the backup one. The channels themselves are identical in their set of keys with switched current meters and control circuits.

The arbitration scheme implemented in the device monitors the health of the active control node and, when it stops, activates the backup one, shutting down the main one.

The board of power switching channels consists of 16 switching channels for powering 8 terminal devices (separate switching on the main and backup bus), which generate control commands for switching on for the switching channels, collect telemetry. The onboard equipment, including payloads, are connected to the PSU-h via a 25-pin Micro-D connector, which implements the following lines:

- Power line: 2 pcs
- Common bus of data exchange: 2 pcs
- Line of the second time mark: 2 pcs.

The pinout of the standard PSU-h connector is shown in the figure.

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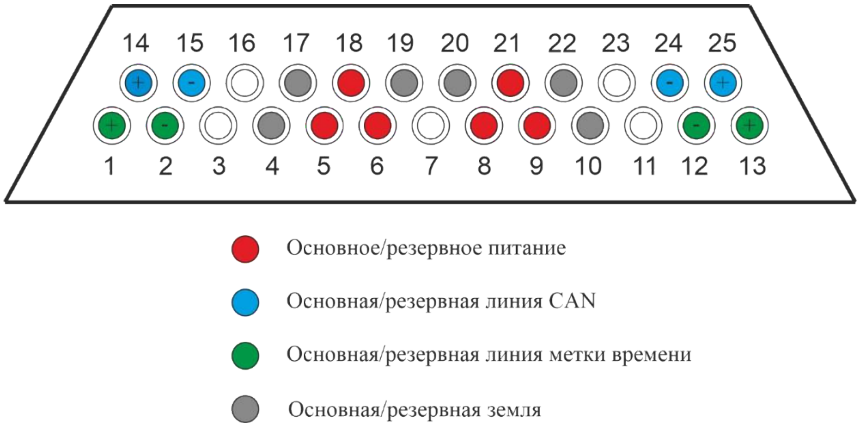

Figure - Pinout of the standard PSU-h connector

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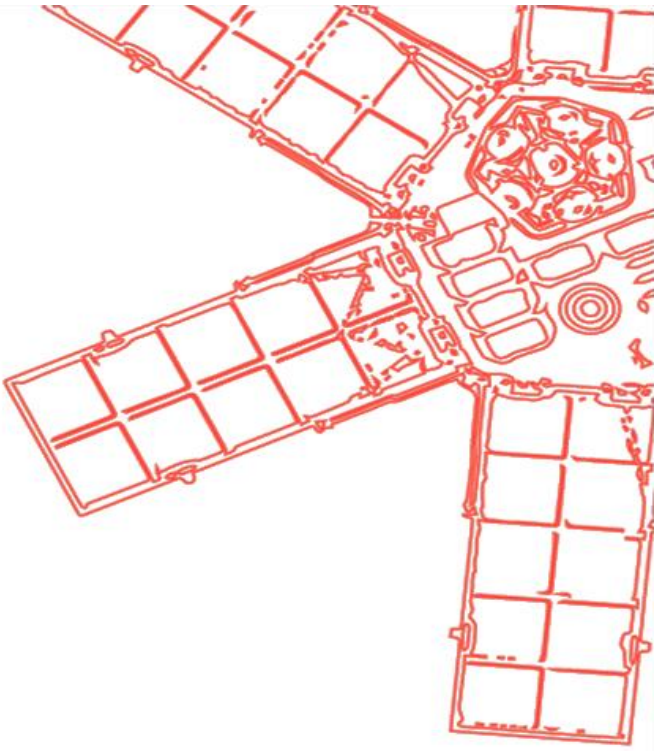
				specified in Technical conditions (or Operational Manual)
5	Electromagnetic Acceptance Tests	-	+*	Tests for resistance to electrical external influences specified in Technical conditions (or Operational Manual)
Notes: *Inspection can be carried out, carried out partially or excluded as agreed with the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