AAC CLYDE SPACE

Power Conditioning & Monitoring Units

STARBUCK-MICRO

RELIABILITY, SCALABILITY & PERFORMANCE

The Starbuck-Micro PCDU (Power Conditioning and Distribution Unit) was initially developed under a Swedish national mission and tailored to the requirements of the LEO microsatellite bus InnoSat. This is a state-of-the-art spacecraft architecture designed for innovative low cost research missions. The flexible and modular PCDU is designed for mission life of up to five years in LEO and implements both power conditioning and distribution of the regulated 28 V battery bus, as well an auxiliary isolated 5 V bus. The rigorous testing and extended qualification campaign compliments an innovative design approach that combines COTS and radiation hardened components and optimizes the reliability and performance characteristics of the system.

The Starbuck-Micro design builds on heritage from previous missions with customers such as ESA, NASA, JAXA and other commercial organisations. A number of design features are implemented to achieve optimized reliability characteristics. For example, discrete bipolar design is used for many functions rather than integrated circuits, which enable a thorough part stress design analysis of the system to be performed. Internal supply voltages are current limited with automatic restart and the FPGA design features Triple-Modular-Redundancy (TMR). Worst case analysis, thermal and structural analysis are performed to verify the system functionality at its operational limits.

POWER

With 120 W system power, 28 V nominal bus and battery voltage with power converters for 5 V isolated auxiliary output. High-power 28 V outputs & redundancy for power distribution, as well as FPGA based control & monitoring of all switches & interfaces through RS485. With S3R battery charge regulation for advanced power management.

PERFORMANCE

High-performance power solution for small satellite platforms. Its modular design approach delivers scalability and easy tailoring of interfaces, equipment can be accommodated through the addition of modular design elements to mission requirements. Integrated MTQ driver with precision current control.

RELIABILITY

Reliability and qualification levels suitable for many different mission types. COTS components with verified space performance combined with radiation hardened components. All outputs protected by Latching Current Limiters (LCLs) or Retriggerable LCLs (RLCLs). With system-level Under Voltage Lock-Out (UVLO) protection.

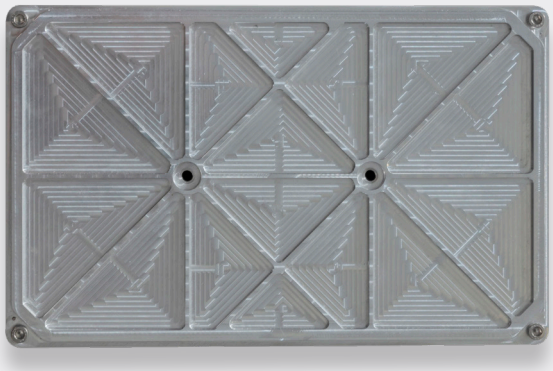
TECHNICAL SPECIFICATIONS

General	
Design Life	5 years in LEO
System Power (average)	80 W
System Power (peak)	120 W
Primary Bus Voltage	28 V
Auxiliary Bus Voltage	5 V isolated
Battery Regulation	S3R
Efficiency - Solar Array	>96% S3R regulation
Efficiency – Battery Discharge	>97% @ 32 V, 94 W load
Efficiency – Battery Charge	<95% @ 4.5 A S/A current
Efficiency – Isolated 5V Regulator	< 81.7% @ 2 A out
Idle Power Consumption	4 W
Operating Temperature Range	-30°C to +60°C
Radiation (TiD)	20 kRAD (qualified >30 kRAD, Si)
Mass	2450 g

Dimensions	
Length	267 mm
Width	167 mm
Height	89 mm

Telemetry and Control Interfaces	
TM/TC	RS485 serial interface Flash-based FPGA controller
Telemetry	Bus voltage Bus current Batter curryent Internal unit temperature Internal unit voltages LCL status Current in each LCL
Pulse Command Reset	RS422 levels
Thermistor Input	13
Actuators and Thermal Knives	Arm and fire actuation strategy
Separation Detection from Launch Vehicle	Triple redundancy with majority voting
Magnetorquer Driver	3 precision current controlled outputs

Electrical Interfaces	
Primary Bus Outputs	17 individual protection (LCL or RLCL)
Auxiliary Bus Outputs	12 individual protection (LCL or RLCL)
Solar Array Interface	19s9p triple junction panels (nominal)
Battery	160Wh Li-Ion (nominal)



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