



COLOSSUS PCDU Family

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SUMMARY

The COLOSSUS PCDU is a Small Satellite format Power Conditioning and Distribution Unit designed to provide the highest energy capacity and redundancy. It integrates EPS, TITAN2 Batteries and UMPPT Solar Management including release and deploy control with a powerful MCU and 32GB onboard storage in a single unit from a minimum of 400 W/hr to 8000 W/hr, from 8 to 56 power rails with power outputs as high as 150W per rail.

For missions from Small Satellites to larger spacecraft like Space Tugs or Launch Vehicles too, COLOSSUS enables a high energy density, low volume and mass solution for a modular, scalable approach to high power requirements missions. The COLOSSUS PCDU is fully customizable to your mission's need in terms of power rails, output power, cable, connectors or interfaces and options are available as integrated Carbon Nanotubes Thermal Transfer Bus (CN/TTB) shield which allows missions to reuse the spacecraft self-generated heat. It also comes shielded internally to attenuate SUEs and SLEs.

COLOSSUS includes the PowerFlex technology, which allows the user to generate up to double the nominal power of the PCDU in case of peak demand: This means that if you have payloads that require huge loads for a short period of time, you don't need to dimension the whole PCDU for it, COLOSSUS can rush up to 2 times the power surge needed and serve those needs safely and under some conditions, up to 4 times.

AVAILABILITY

- **12 to 16 weeks for engineering model, 16 to 24 weeks for flight model**

FEATURES

- All in one solution: Power conditioning, Battery banks, Solar Array Management controlled by an onboard MCU with 32GB storage capacity.
- Very high energy density cells allow to power small satellite missions and larger.
- 2 Remove Before Launch switches and 2 Separation switches supported.
- Designed for LEO/HEO/GEO/GTO and Lunar missions and requirements.
- Stand-alone ground charge port integrated; it also comes with is own charging power unit.
- Manufactured with space grade materials according to space standards.

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- Functional, performance, thermal bake out and vibration tests provided with documentation.
- Custom electrical and mechanical interface available.
- Extendable and scalable, custom hardware solutions per user request.

POWER CONDITIONING AND CONTROLS

- 400 Whr to 8KW/hr true power delivery (depending on the model)
- Power rail supply voltage: 3v3, 5V, 9V, 12, 28, 50, 60 V (user configurable)
- Minimum of 8 power rails, maximum 56 power rails, max power delivery per rail is 150W.
- Each Power rail has its own RLCL, on/off control, current and voltage sensors.
- User Programmable current controls in each power rail
- Shielded for radiation internally.
- Multiple redundant power converters per rail, RLCLs on input and output, anti-latch OPTOMOS gate drivers, ensure mission survivability.
- On-board MCU provided with flight software customizable to user CONOPS.
- High discharge capable for deep cycle payloads up to 4 times the nominal capacity
- Automatic thermal shutdown on each power rail.
- Power rail control via anti-latch driven OPTOMOS gate to resist radiation events.
- Onboard micro controller unit MCU, allows logging, logic, sensor, and actuator control.
- MCU communications port to main OBC can be RS232/RS485, up to 119K bauds.
- Onboard 32GB storage for logs and command files

BATTERY BANKS

- TITAN2 Battery banks with onboard automatic heater and 4X charging modules.
- Battery bank capacity ranges from 400W/hr to 8000W/hr
- Very high energy density cells allow to power peak discharges for long times and fast recovery periods.
- AHT technology: All battery banks include temperature sensors and can be heated independently with minimal use of energy automatically by MCU command to levels selected by the user.
- PowerFlex technology: Flexible power capability allows discharging up to 2X to 4X the nominal power.

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- Redundant RLCL in each cell
- Typical Battery internal resistance: < 55 milliohms @ 25°C
- Charge / Discharge rate: nominal to 4C
- Depth of Discharge: 94%.
- Energy density 260 Wh/Kg
- Thermal capacity: 2.45 J/g/C
- Power dissipated as heat at:
  - 50W discharge 0.05 W
  - 100W discharge 0.11 W
  - 250W discharge 0.55 W
  - 400W discharge 1.05 W
  - 800W discharge 2.20 W
- Recharge cycles: 700 to 1800 (using UMPPT)
- Heater and Thermostat are included in each battery cell.
- Electronics: OVP, OCP, ODP, Automatic Balancing
- Telemetry: Battery Temperature, pack voltage, SoC
- Cell Technology: Li-Ion Polymer

SOLAR MANAGER

- **UMPPT: Manages up to 4 deployable solar arrays of 3 panels each.**
- UMPPT Solar management allows to collect energy from all panels concurrently.
- UMPPT technology allows for battery bank charge and discharge at the same time.
- Can manage up to 4 solar arrays of up to 150W each.
- Repeatable Release and Deploy operation of the solar arrays with sensors on each stage.
- Current and voltage sensors per panel (3) and per array (4), total 12
- Switch off capability per panel or per array on MCU command.

PRODUCT PROPERTIES

- Space grade HARWIN connectors for all ports
- Aluminum T6061 case, black anodized (user can choose anodizing color)
- Telemetry: power rail state, voltage, current, solar array temperature, sun sensors, temperature sensor state.
- Controls: Power rail on/off, hard and soft current limiter per rail, thermal shutdown. Battery heater on/off/auto with user temperature preset.
- Operating Temperature:
  - -30 to +65°C w/o CN/TTB option

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- -60 to +85°C with CN/TTB option
- **Survival Temperature:**
  - -180 to +155°C
- Radiation Tolerance: 2 years minimum in LEO, 4 years minimum when the S/C has NEMEA shielding, SLE, SUE resistance up to 70 MeV x cm2/mg
- **Mass:**
  - COLOSSUS L2: 8.7 Kg
  - COLOSSUS L4: 16.2 Kg
  - COLOSSUS L6: 24,60 Kg
- **Dimensions:**
  - COLOSSUS L2: 153.5H x 250.6W x 218.8L (mm)
  - COLOSSUS L4: 153.5H x 471.2W x 218.8L (mm)
  - COLOSSUS L6: 153.5H x 691.8W x 218.8L (mm)
- CoG: within 2 cm of CoM
- Maturity: TRL9 only components

MATERIALS

- Base PCB panels: FR4-Tg170
- Shielding: NEMEA L2. Integrated Carbon Nanotubes Thermal Transfer Bus (CN/TTB) shield
- Cell Material: Lithium-ion polymer
- PCDU Casing: Aluminum T6061 Black Anodized.
- Interfaces: HARWIN connectors for power rails, RBLs, activation, charge and discharge, DB9/S for programming, debug and OBC communications
- Communications: Selectable from RS485, RS232.
- Cables: All PTFE, HARWIN connectors

PACKAGE CONTAINS

- COLOSSUS PCDU with installed TITAN2 batteries
- Ground charging power supply and matching cables
- Remove Before Launch sockets and cables (customized length)
- Activation switch socket and cable (customized length)
- Ground support programming equipment for the MCU
- Customized communications cable between MCU and your OBC
- CoO/UN38.3/MSDS/TR Certificates

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TESTING

All units are provided with tests reports regarding the following tests:

Test	Engineering Model	Flight Model
Functional	✓	✓
Vibration	✗	✓
Thermal Cycling	✗	✓
Thermal Vacuum	✗	✓
Vacuum swelling protection	✗	✓
Cable/Connector integrity	✓	✓
Overcharge/Overdischarge	✓	✓
AHT Automatic Battery heater subroutine	✓	✓
Powerflex to 2C/4C	**2C**	**4C**
MCU functional & comms	✓	✓
MCU Sensors & actuators integrity	✓	✓
RBLs & Activation switch (100 times)	✓	✓
Solar Array Release/Deploy & sensor output	✓	✓
UMPPT Solar Manager	✓	✓
Performance	✓	✓
Short circuit protection	✓	✓
Freezing/Overheating	✗	✓
Polarity	✓	✓

- Thermal Bake out (10E-7 mbar @ 50C for 48 hours)
- Full vibration test for Falcon-9, Falcon heavy, Soyuz, Electron, Vega, Arianne 5, PSLV, GSLV, other LV profiles available upon request

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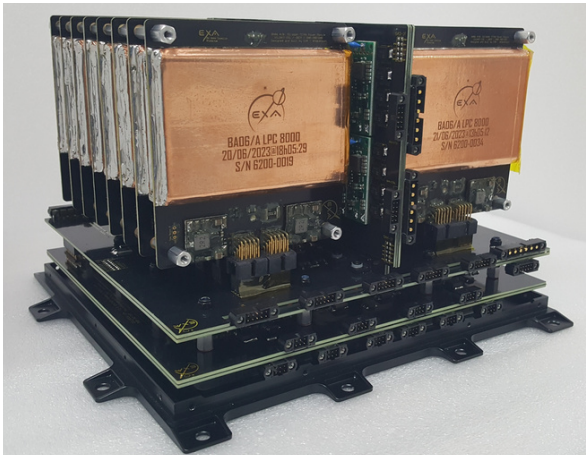
FIGURES (COLOSSUS L2 SERIES)









COLOSSUS L2 Series: From 400 to 1344 Whr
Internal and External View, Engineering unit (gold)

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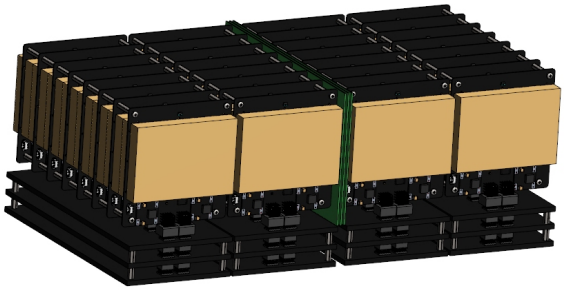
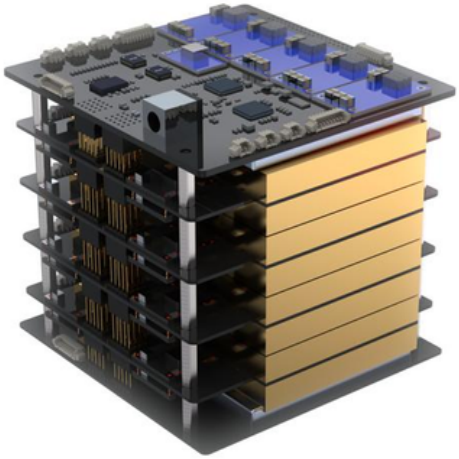
FIGURES



COLOSSUS L6 Series:
From 3225 to 8000 Whr
Internal View



COLOSSUS L4 Series:
From 1666 to 2688 Whr
Internal View



COLOSSUS 12U
Internal View

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