



# TITAN-2

## SPACECRAFT BATTERY PACKS Family



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## SUMMARY

The TITAN-2 Battery pack family is a Small Satellite format power storage and delivery system designed to provide the highest energy capacity and redundancy. It integrates fast onboard redundant charging circuitry, automatic heating system and temperature sensor in a single unit from a minimum of **400 W/hr to 8000 W/hr**.

For missions from Small Satellites to larger spacecraft like Space Tugs, Launch Vehicles, or even Lunar rovers too, TITAN-2 enables a high energy density, low volume and mass solution for a modular, scalable approach to high power requirements missions. The TITAN2 family is fully customizable to your mission's need in terms of power delivery, power density, 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.

TITAN-2 is based on our exclusive **PowerFlex technology**, which allows the user to generate up to double the nominal power of the PCDU in case of peak demand for long periods of time: 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 battery array for it, TITAN-2 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 36 weeks**



## FEATURES

- All TRL9, advanced battery solution saves the user the charging subsystem of the EPS.
- Very high energy density cells allow to power small satellite missions and larger.
- Designed for LEO/HEO/GEO/GTO and Lunar missions and requirements.
- Stand-alone ground charge port integrated; it also comes with its own charging power unit.
- Manufactured with space grade materials according to space standards.
- 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 DELIVERY AND CONTROLS

- 400 Whr to 8KW/hr true power delivery (depending on the model)
- Power supply voltage: 4.2V, 8.4V, 12.6, 16.8, 25.2, 29.4, 33.6, 50.4, 64 V (user configurable)
- Each battery cell has its own redundant Retriggerable Latch Current Limiter
- Automated heating systems use battery's own energy to heat up the battery cells independently on user command.
- Anti-latch MOSFET gate driver control for the automated heating system ensures mission survivability.
- High discharge capable for deep cycle payloads up to 4 times the nominal capacity
- Over charge, over-discharge, under-voltage/current over-voltage/current built in protections.
- Embedded redundant fast chargers (4) in each cell.



## BATTERY BANKS

- TITAN-2 Battery banks with onboard automatic heater and 4X fast 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.
- 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

## PRODUCT PROPERTIES

- **Controls:** hard current limiter, thermal shutdown. Battery heater on/off/auto with user temperature preset.



- **Operating Temperature:**
  - -30 to +65°C w/o CN/TTB option
  - -60 to +85°C with CN/TTB option
- **Survival Temperature:**
  - -180 to +85°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 cm<sup>2</sup>/mg
- **Mass:** Depends on configuration, i.e:
  - TITAN2/L2A 834 Whr: 3.7 Kg
  - TITAN2/L4A 1666 Whr: 7.4 Kg
  - TITAN2/L6B 3225 Whr: 14,60 Kg
- **Dimensions:** Depends on configuration, i.e:
  - TITAN2/L2A: 113.5H x 250.6W x 218.8L (mm)
  - TITAN2/L4A: 113.5H x 471.2W x 218.8L (mm)
  - TITAN2/L6B: 113.5H 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
- **Cables:** All PTFE

## PACKAGE CONTAINS

- Ships in Pelican Air container
- TITAN2 battery pack as configured by user request.
- Ground charging power supply and matching cables
- CoO/UN38.3/MSDS/TR Certificates



## 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
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, Arienne 5, PSLV, GSLV, other LV profiles available upon request.



## CONFIGURATIONS AND PRICE

Model	Power (W)	Flight Model (€)	Engineering Model (€)
L1A	415	83,000€	83,000€
L2A	833	166,600€	133,280€
L2C	1344	268,800€	215,040€
L4A	1666	333,200€	266,560€
L4B	2150	430,000€	344,000€
L4C	2688	537,600€	430,080€
L6B	3225	645,000€	516,000€
L6C	4032	806,400€	645,120€

## CONTACT

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