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Aeronautics and Space > LEO Products >

Power Distribution Module

PDU-1441 power distribution board with high efficiency, current protection in all outputs, compact size, is designed for robust operation in Low Earth Orbit (LEO) environments.

Module main characteristics: 17 Latch current limiters for payload electronic, 3 Power H-Bridged for brushed DC motors or magneto torque devices, 3 Power switches for heaters, telemetries, telecommands, compact form factor 3U (100mm x 160mm), and 247 grams of mass; are some characteristics of PDU-1441 module.
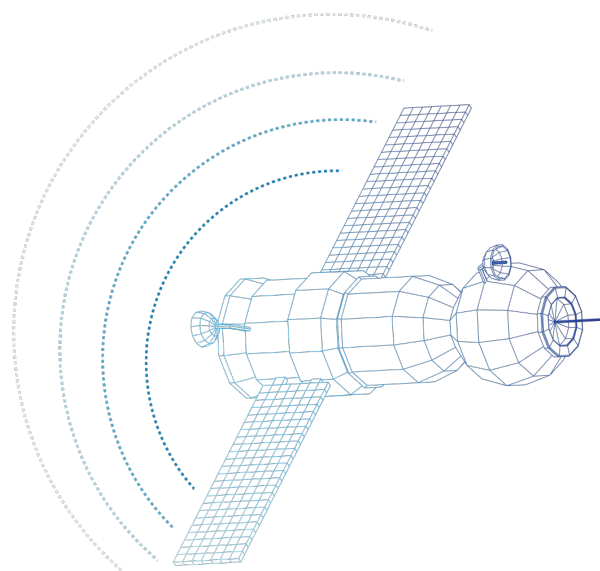
Flight Experience:

This module is working in LEO application form SEP-2020.

Qualified in vacuum chamber & vibration.

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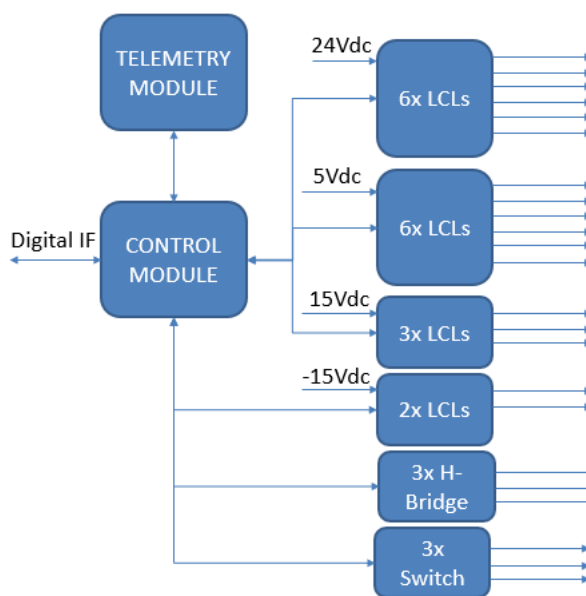Telephone: +34 916 617 161   Fax: +34 916 619 840

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2 Product Overview

PDU-1441 used as stand-alone power distribution unit or combine with other Tecnobit modules for a powerful, robust & redundancy capabilities. The main characteristics of this module are shown in the following table:

PDU-1441 Specifications	
Input Voltages & Maximum currents	
+24V	Max. 15A
+15V	Max. 2A
+5V	Max. 2.5A
+3.3V	Max. 2.5A
-15V	|Max|. 0.6A
Payload Latch Current Supply Outputs	
LCL Power outputs of +5V	6 outputs of +5V, 0.5A max. each.
LCL Power Outputs of +15V	3 outputs of +15V, 0.9A max. each.
LCL Power Outputs of -15V	2 outputs of -15V, 0.6A max. each.
LCL Power Outputs of +24V	6 outputs of +24V, 2.5A max. each.
Power H Bridges	
Power H Bridge of +24V	3 H Bridge of +24V, 2.5A max. each.
Power Switches	
Power Heaters	3 Switches 3A max. each.
Telecommands & Telemetries	
Telecommands	Yes, to switch on/off each protection.
Telemetries	Yes, to read the status of each protection.
Current Sense	Yes, analogy outputs.
Radiation	
TID	See section: Radiation Tolerance.
SEE	See section: Radiation Tolerance.
Mechanical	
Form factor	100mm x 160mm
Total Mass	247 grams
Processor Drivers	
Available TM/TC drivers	YES, in source code format.
Qualification (*1)	
Operational temperature	-40ºC to +70ºC
Vibration	12.3grms, 11.6grms & 13.2grms in x, y & z respect.
Shock	40Gs 11msec, half sine

Notes:

(*1) See additional information in section 6.1

3 Key Design Features

3.1 General

PDU-1441 is a hardware module based on the following architecture. Main blocks are Latch current limiters, H-bridges, Power switches, Control module and telemetry.

3.2 Additional hardware Features

- EMI filter in all external interfaces.
- Overcurrent protection for PDU-1441 control electronic.
- Synchronization between protections in case of fail. For example if a payload device uses several power supplies.
- Overvoltage and over current protections in all power outputs: Power distribution, H-bridges and power switches.
- Sense of currents.
- Control module to receive the processor telecommands and to send the requested telemetries.

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3.2.1 Electrical ICD

PDU-1441 module incorporates the following connectors:

J1 & J2: Internal ICD

- Nominal communication

- Redundant communications

- Power supply output: -15V, 3V3, 5V and +15V

- Internal telemetries

J3: SUB-D 78 pins (External ICD)

- 6 outputs of +5V.

- 2 outputs of -15V.

- 3 H Bridge of +24V.

- 3 outputs of +15V.

- 6 outputs of +24V.

- Heaters 3 Power Switches.

3.3 Key software features

PDU-1441 is an open frame hardware module to be adapted to several LEO applications. The customer can development its own software application without any restriction.

3.3.1 Software drivers

Source code of driver (ADA) is available to manage:

- Driver of digital interfaces for PDU-1441 board for telemetries and telecommands: For example, to enable from the processor the LCL protections or to read the status on/off for each protection.

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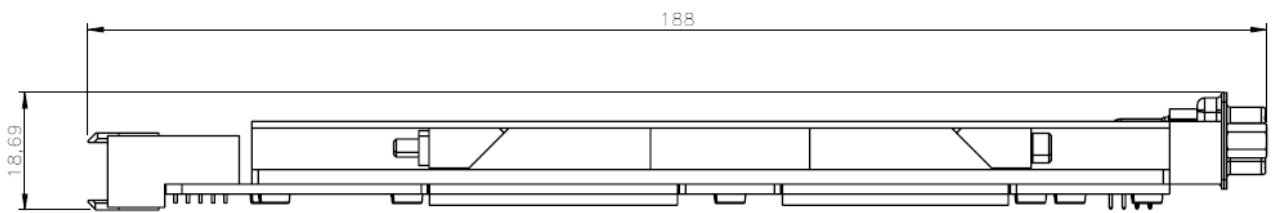Telephone: +34 916 617 161   Fax: +34 916 619 840

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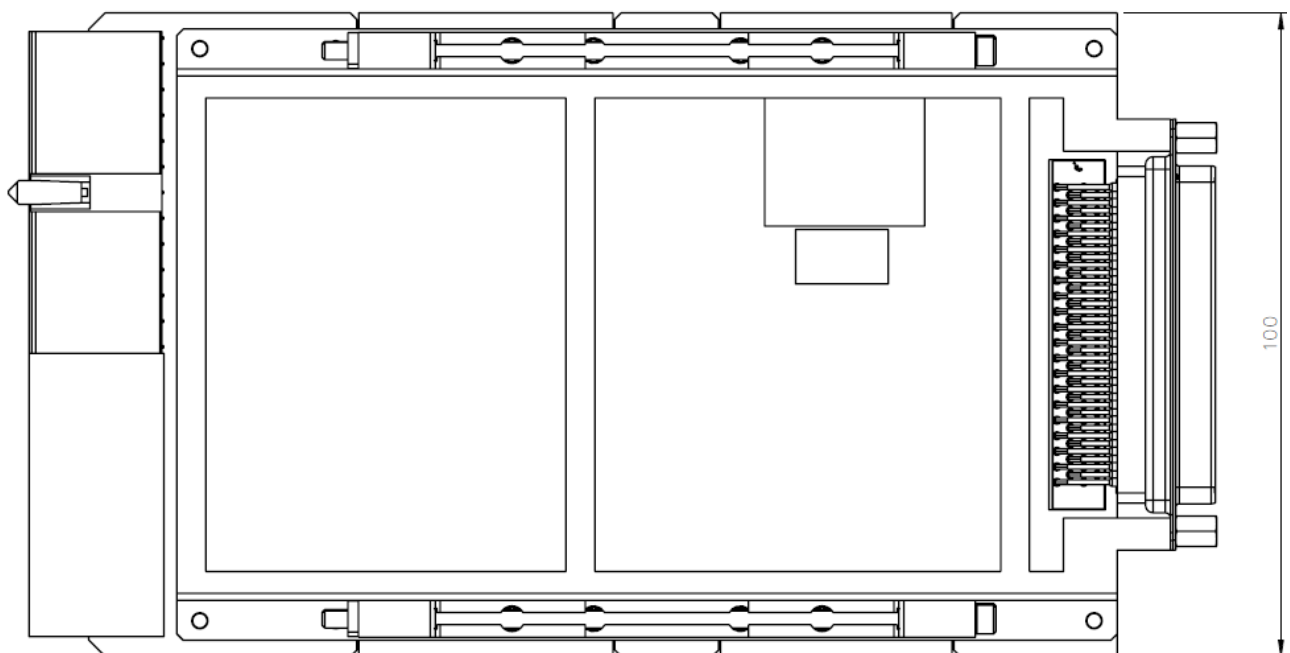
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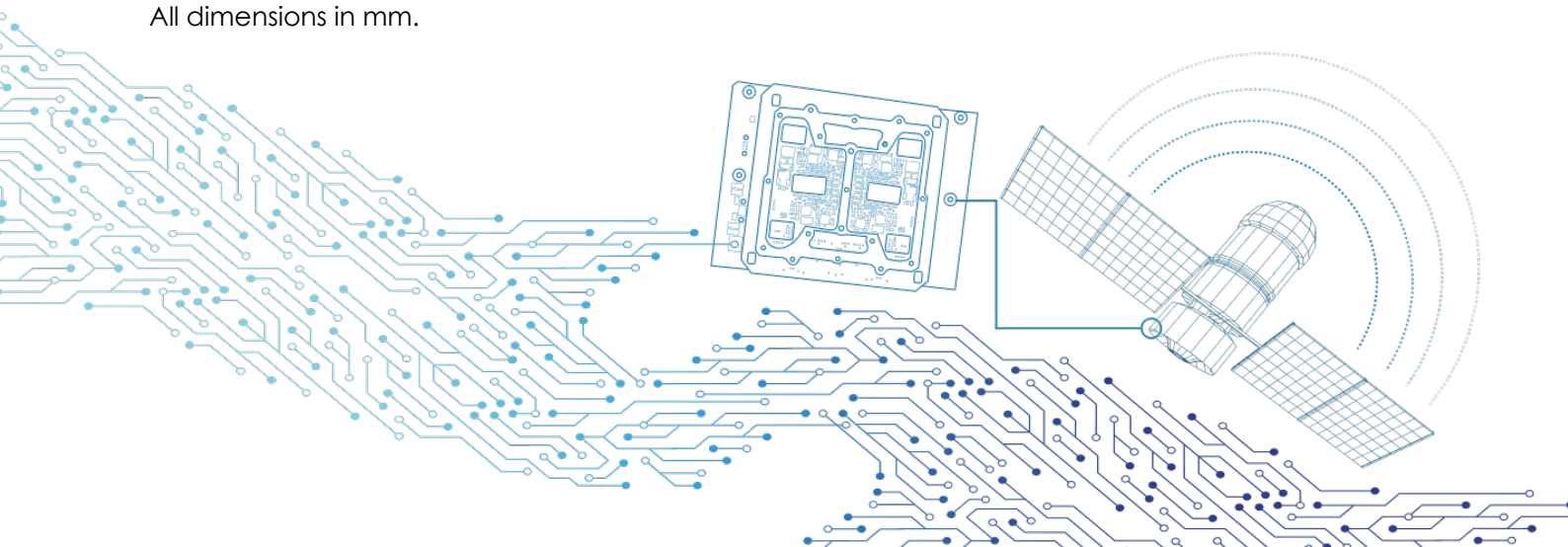
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3.4   Outline Drawing:

LATERAL VIEW

TOP VIEW

All dimensions in mm.

4   Radiation Tolerance

According to the section 6.2 Ordering Information, PDU-1441 can be adapted to the quality requested by the application. The following paragraph describe the main rules to carried out this part selection:

- **Quality 1:** Parts according to Class 1 of ECSS-Q-ST-60-15C. Expected more than 15 years in LEO orbit. To guarantee this lifetime in GEO a radiation analysis is needed, due to the final housing is important in this orbit. TID better than 100krad, LET Threshold 120 MeV.cm2 /mg and Non-destructive Single Event Effects (SEE) rad hard.

- **Quality 2:** Rad tolerant parts, JANTXV for semiconductors & new space considerations. Expected more than 10 years for LEO applications. In this case the parts used has been designed by manufactured to withstand levels of TID and SEE. TID from 30krad (Si) to 300krad (Si), LET Threshold from 43 to 96 MeV.cm2 /mg and Non-destructive Single Event Effects (SEE) tolerant.

- **Quality 3:** Technology analysis & new space consideration. Expected more than 5 years in orbit. For this quality of parts, the selection is based on technologies, but the datasheets of components do not indicate any rad tolerance. This quality is only recommended for sort time missions where we can accept the risk.

- **Quality 4:** Industrial parts. Expected only 0.5 years in orbit. This quality option is the lower cost, but it is not recommended for flight.

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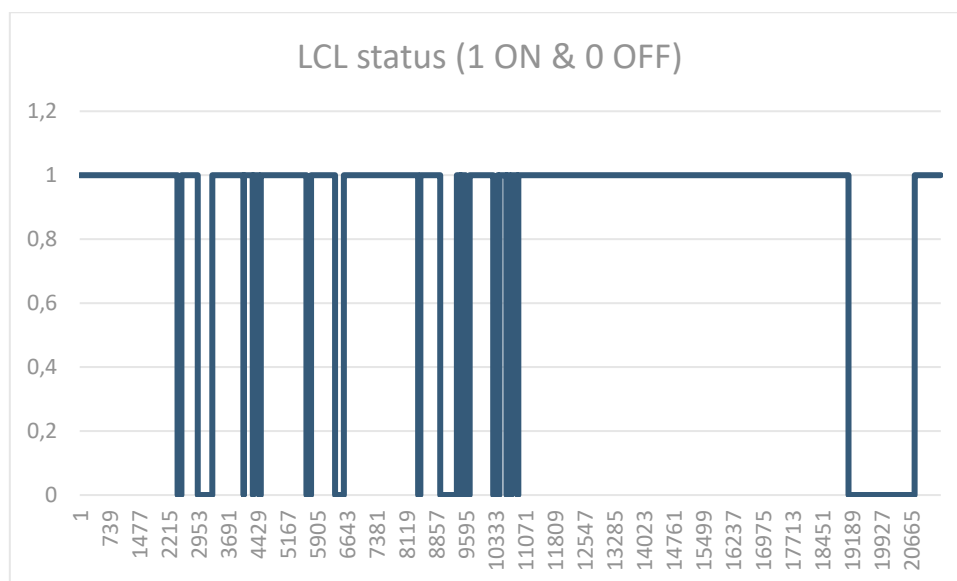
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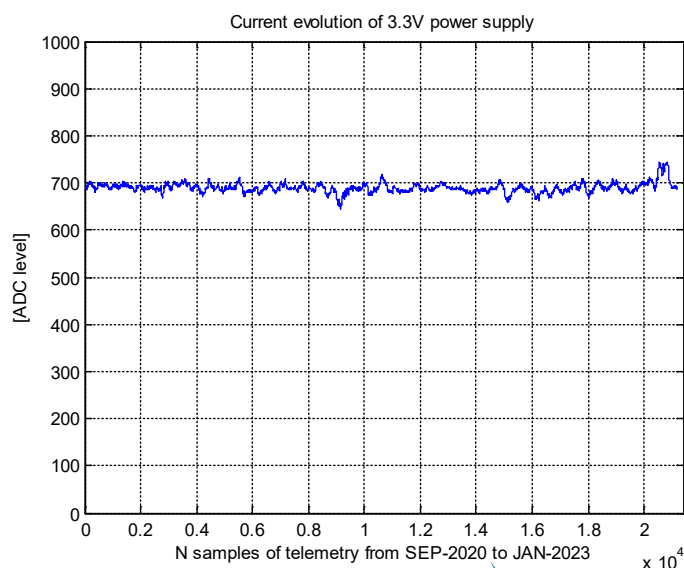Telephone: +34 926 347 830   Fax: +34 926 312 896

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5 Flight Experience

PDU-1441 is working in LEO applications from SEP-2020 with components "Quality 3" (see radiation levels in section 4). In orbit telemetries of currents supports us to justify the quality of this product and the expected alive time in LEO.

The following picture show real telemetries from Sep2020 to Jan2023 of a non rad tolerant device placed in the payload. PDU-1441 is switched off this device when the current increases over the programmed limits.

PDU-1441 control consumption is also very stable and this current does not present any mean increase in orbit. This behaviour presents additional evidence about the stability of PDU-1441 in LEO.

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6 General

6.1 Qualifications tests

- **Random vibration test levels:** (12,3 grms, 11,6 grms, 13,2 grms) in x, y & z axis, respectively.
- **Shock test level:** Designed for 40Gs 11msec, half sine.
- **Vacuum temperature test range:** -40 to 70ºC (*1).

Notes:

(*1) Designed for this range, but only tested in vacuum chamber at satellite level from -23ºC to +58ºC.

6.2 Ordering Information

Standard Reference:

- Tecnobit Reference: **PDU-1441-XY** (where XY are according to the following options)
- LEO Flight experience from sep-2020 over the reference: PDU-1441-31

Options for X:

- **1:** Parts according to Class 1 of ECSS-Q-ST-60-15C. See quality 1 in section 4.
- **2:** Rad tolerant parts & new space considerations. See quality 2 in section 4.
- **3:** Technology analysis & new space consideration. See quality 3 in section 4.
- **4:** Industrial components. See quality 4 in section 4.

Options for Y:

- **1:** Original design of PDU-1441 (first version).
- Etc... (new customized solution)

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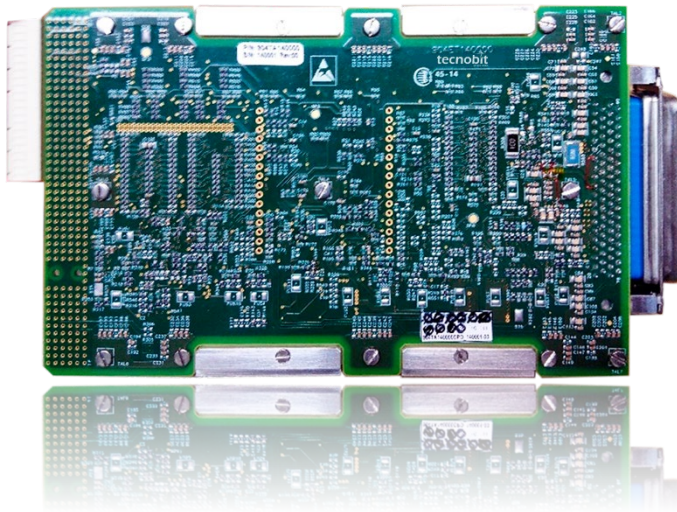
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6.3   Data Package

- User manual to manage all TM/TC

- Electrical ICD

- Mechanical ICD

- Outline 3D model

- Source code of digital IF driver

We accompany you throughout the entire product life cycle

- **Design**
- **Development,**
- **QUAL & CERT,**
- **Manufacturing,**
- **In-service support,**
- **Enhancements**

Open Frame Hardware to final user application

Optimum balance between quality and cost for LEO applications.

Flexibility adapting this module to the requested interfaces of end user.

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