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OBCM-1401

On Board Computer Module

OBCM-1401 module with integrated, power management, LEON 3 processor, up to 64 ADC channels and Payload power distribution is designed for robust operation in Low Earth Orbit environments.

Module main characteristics: management of separation switch, solar cells & battery management, electronic protected by Latch current limiters, compact form factor 207x157x113mm, 3.2Kg of mass & 5W of power consumption; are some characteristics of OBCM-1401.

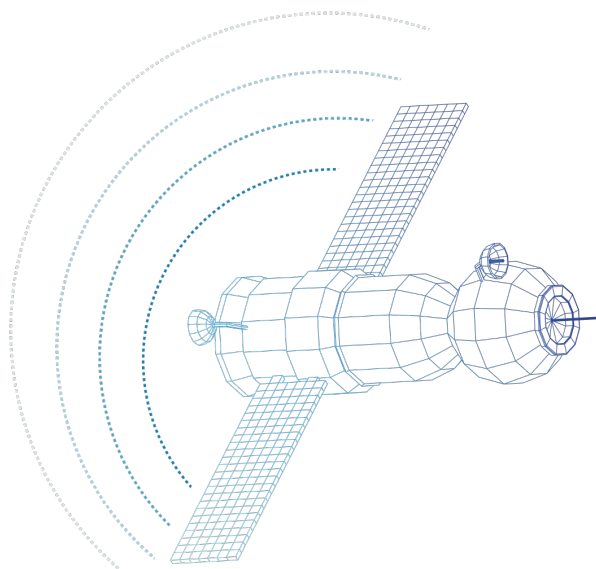
Flight Experience:

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

Qualified in vacuum chamber & vibration.

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2 Product Overview

OBCM-1401 is based on several Tecnobit modules within the same mechanical housing:

- Processor board: **OBC-1411**
- 64 ADC inputs: **ADC-1421**
- Power supply unit: **PSU-1431**
- Power distribution unit: **PDU-1441**

OBCM-1401 Specifications

Processor board	
Processor	LEON3 SPARC V8
RAM memory	4MBytes SRAM Memory (3D Plus)
NVM memory	2MBytes EEPROM Memory (3D Plus)
EDAC	Yes (see details in OBC-1411 doc.)
PROM	Yes (see details in OBC-1411 doc.)
Power supply	
Input / Output Voltages	Input from 18V to 30V / Outs -15V, 3V3, 5V & 15V
Over voltage & Overcurrent protections	Yes
Manage of launcher separation switch	Yes, Programmable SPS delay.
Battery charger manager	Yes
Power solar cells control	Up to 180 Space Photovoltaic Sheets (SPVS)
Analog to Digital board	
Signal conditioning	Yes, based on Operational amplifiers
ADC	Conditioning & conversion of 64 inputs
Payload Power Distribution	
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 Bridge of +24V	3 H Bridge of +24V, 2.5A max. each.
Power Heaters	3 Switches 3A max. each.
Isolated Primary power Input	Yes
Radiation	
TID	See section: Radiation Tolerance.
SEE	See section: Radiation Tolerance.
Consumption & Mechanical	
Nominal Power consumption	5 W
Boards Form factor	100mm x 160mm
Main Housing Size	207mm x 157mm x 113mm (6 slots version) 194mm x 116mm x 113mm (4 slots version)
Total Mass	3.2 Kg (6 slots version) 2.65 Kg (4 slots version)
Processor Drivers	
Available Drivers source code	YES

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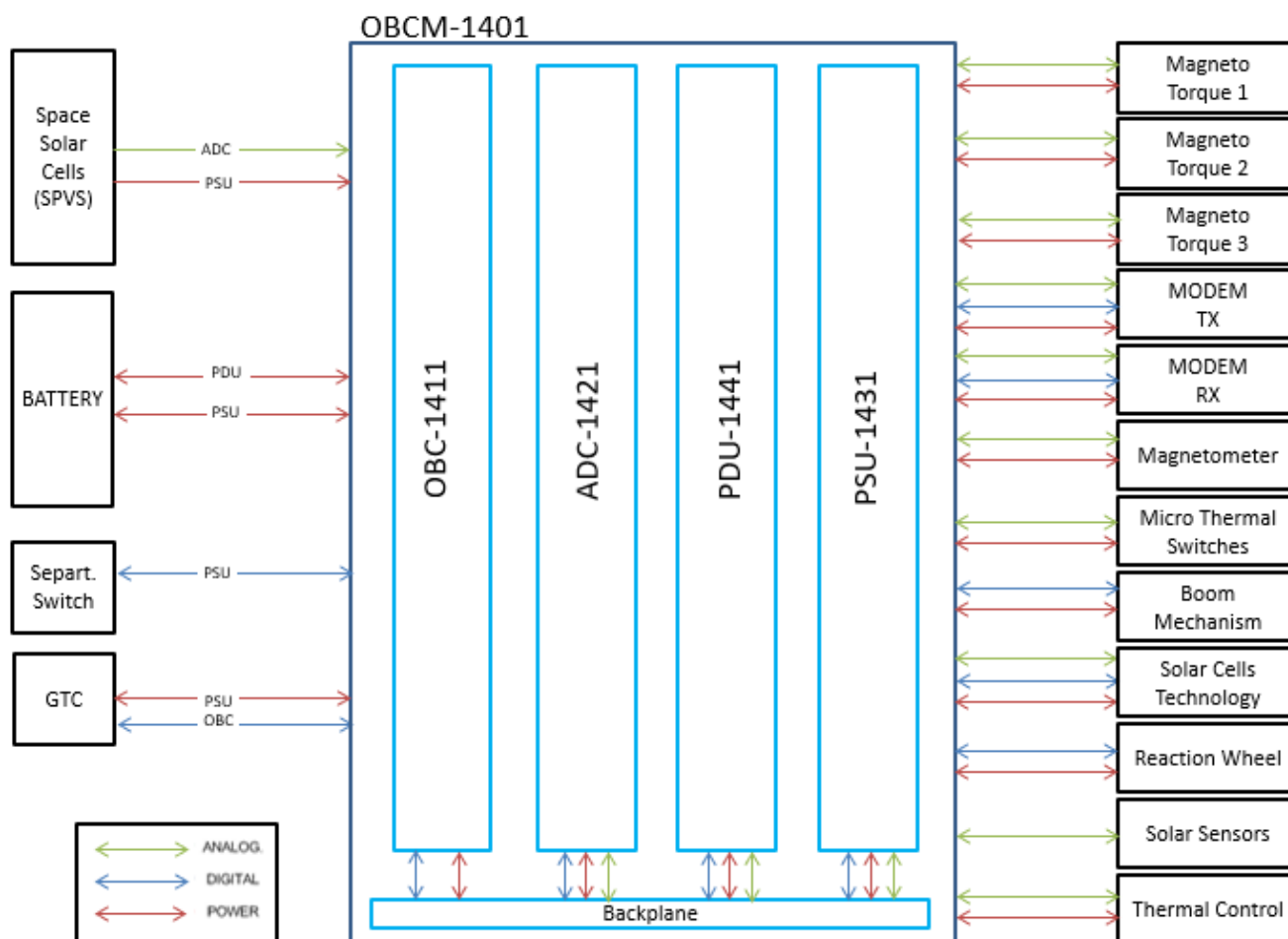
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3 Key Design Features

3.1 General

OBCM-1401 is a hardware module based on an aluminium alloy housing which integrates the following functional blocks:



3.2 Hardware Features

- DC/DC isolated primary power line & EMI filters in all interfaces.
- Magnetometer, temperatures, solar sensors, voltages, and currents acquisition.
- LCL protections for inner and outer electronic of OBCM-1401.
- Power management of magneto torque units, reaction wheel, heaters, and boom mechanism.
- Battery controller to charge and discharge.
- EIA-485/EIA-422 modem communications.
- Non-volatile total elapsed time recorder.

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3.2.1 External Electrical ICD

OBCM-1401 Module incorporates the following connectors:

J1: SUB-D 78 socket (Module OBC-1411)

- 4x RS422
- 1x I2C
- 28 GPIO LVTTL 5962-9668601QXA
- 4x LVDS Inputs
- 4x LVDS Outputs
- HPC On
- HPC Off
- BSM Status
- MIL-STD-1553 long stub

J2: SUB-D 78 socket (Module ADC-1421)

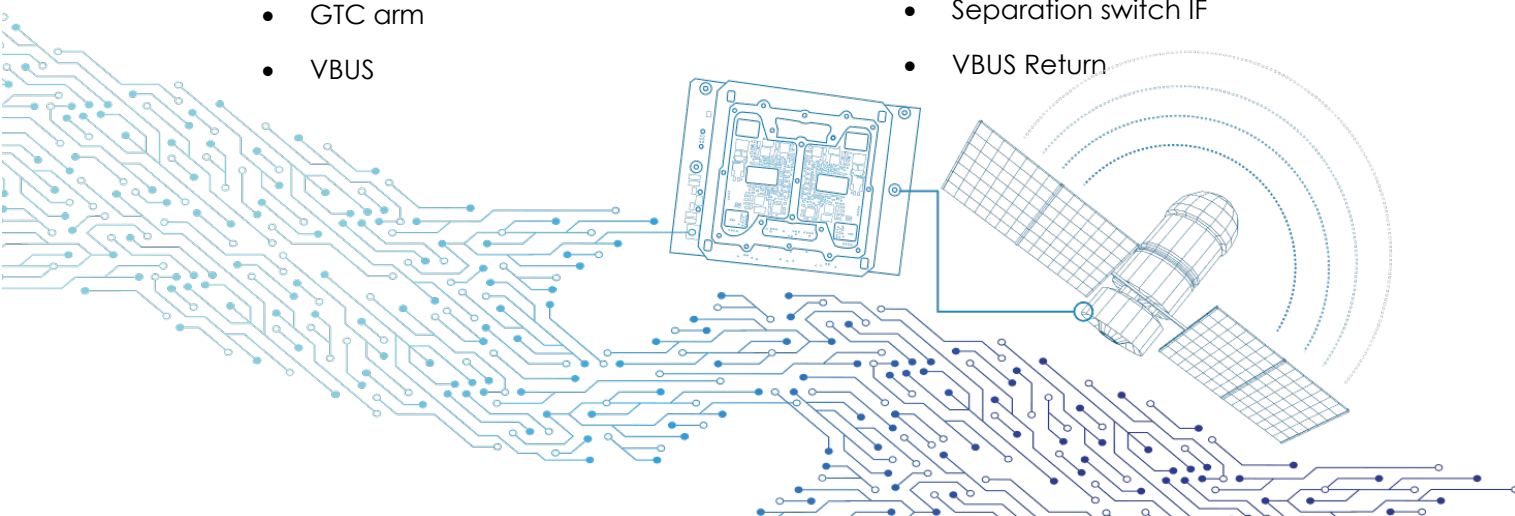
- Battery telemetries
- Voltage telemetries
- Magnetometer telemetries
- Solar sensors telemetries
- Solar cells telemetries
- Currents telemetries
- Temperature telemetries

J3: SUB-D 78 pins (Module PDU-1441)

- 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.

J4: SUB-D 78 pins (Module PSU-1431)

- Battery interface
- GTC arm
- VBUS
- Power Solar cells IF
- Separation switch IF
- VBUS Return



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3.3 Key software features

OBCM-1401 is an open frame hardware module to be adapted to several LEO applications. Hardware and LEON 3 processor soft core is supplied by TECNOBIT. The customer can development its own software application without any restriction.

3.3.1 Software drivers

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

- Nominal and Redundant digital interfaces of ADC-1421, PSU-1431 and PDU-1441 boards, from the processor module OBC-1411. Around 100 parameters can be read or control through this interface. Only the PDU-1441 manage 48 TM/TC signals.
 - Telemetries of on/off for 17 PDU LCLs circuits, status of GTC interface, battery status levels, etc.
 - Tele commands to switch on/off PDU LCLs, control H bridge, manage heaters or select ADC channels are some examples of the control capabilities of this driver.
- Driver to manage the analogy to digital converters.

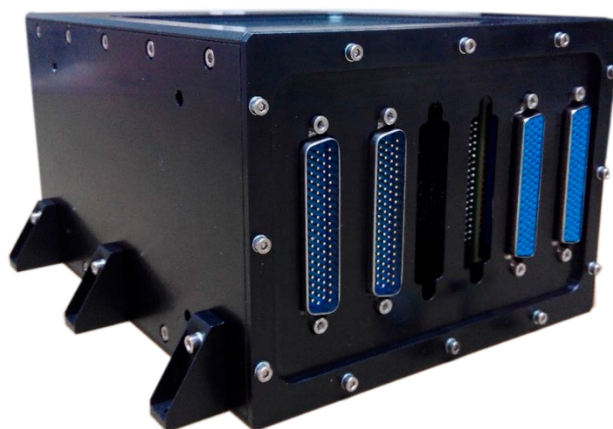
3.3.2 Linux for LEON 3

Option for Linux: support for LEON3 is available in the LEON Linux 5.10 and 4.9 kernels distributed in the official Linux kernel (Kernel.org).

3.3.3 VxWorks® for LEON 3

Option for VxWorks®. VxWorks 7 SPARC architectural port (HAL), supporting LEON3.

Debug connector in rear side of the unit.



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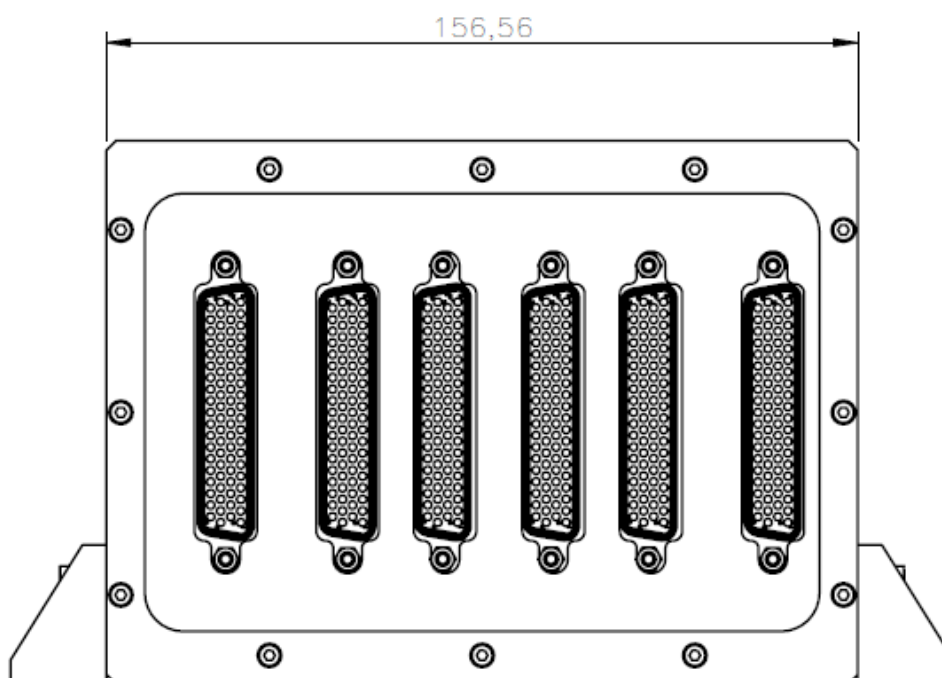
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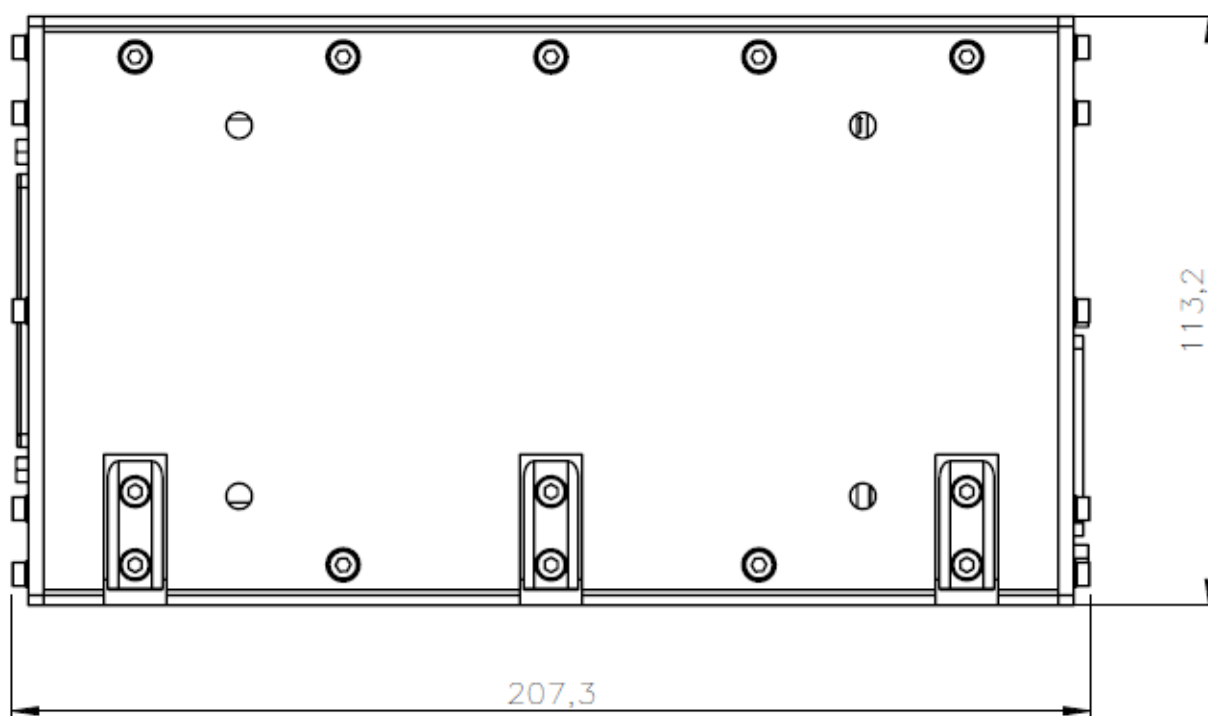
3.4 Mechanical Features

FRONT VIEW (6 slots configuration)



4 slots configuration 116mm instead of 157mm (20.5mm per slot)

LATERAL VIEW



All dimensions in mm.

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4 Radiation Tolerance

According to the section 6.2 Ordering Information, OBCM-1401 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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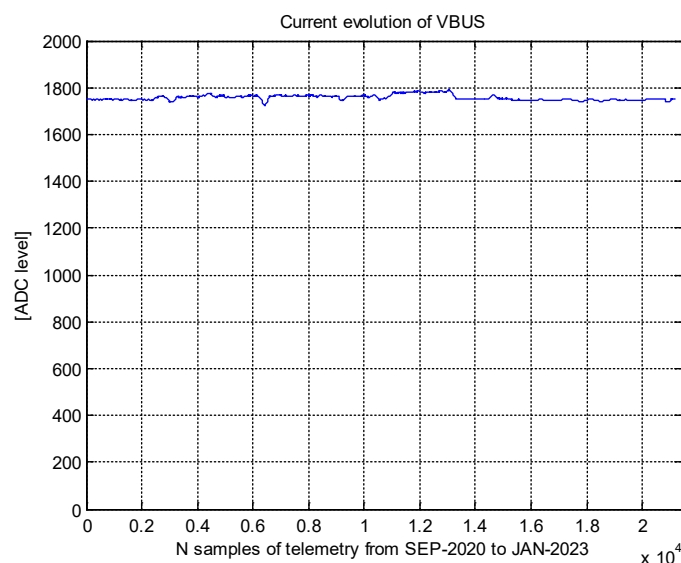
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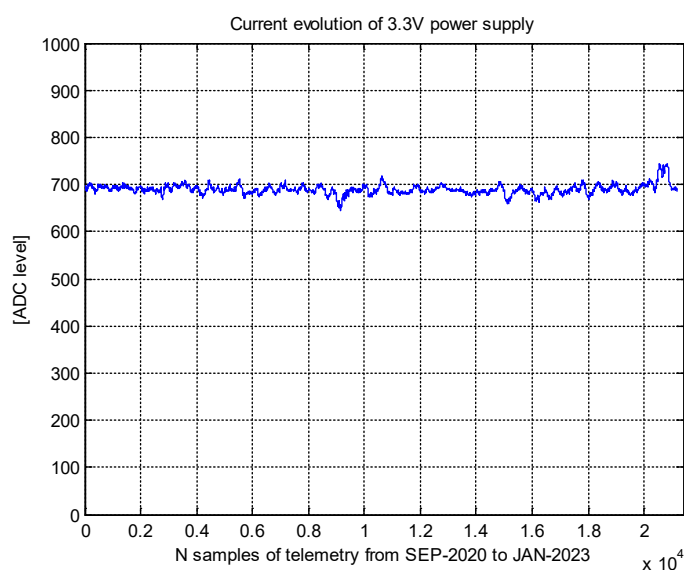
5 Flight Experience

OBCM-1401 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 evolution of supplied current of VBUS is constant and this do not present any incrementation due to the electronic degradation.



OBCM-1401 digital 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 OBCM-1401 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 50°C (*1).

Notes:

(*1) Designed for this range, but only tested in vacuum chamber at satellite level from -23°C to +38°C.

6.2 Ordering Information

Standard Reference:

- Tecnobit Reference: **OBCM-1401-XY** (where XY are according to the following options)
- LEO Flight experience from sep-2020 over the reference: OBCM-1401-36

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:

- **6:** Housing with 6 slots. Two free slots for: modem, camera video recorder, redundancy of OBC-1411, redundancy of PSU-1431, etc.
- **4:** Housing with 4 slots.

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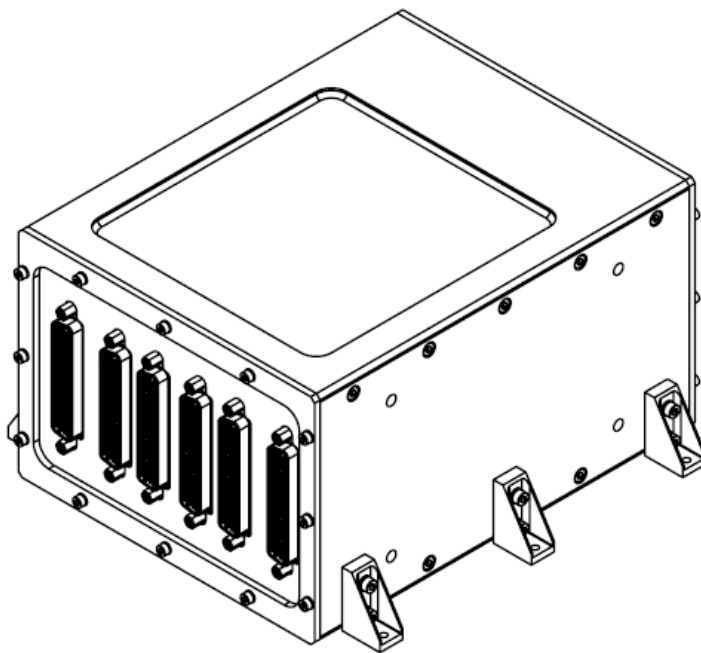
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6.3 Data Package

- User manual to manage all TM/TC
- Electrical ICD
- Mechanical ICD
- Outline 3D model
- Source code of drivers



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-  **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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