

1. ELECTRICAL POWER DISTRIBUTION AND CONVERSION

1.1. Primary Power Interface

It is assumed that two primary power lines (nominal + redundant) of 120V will be available from the ISS. Only one power line will be active at any time.

The following characteristics will be implemented on the EUSO side:

- a) Galvanic decoupling;
- b) Inrush current limiter;
- c) Undervoltage protection;
- d) Overvoltage protection;
- e) Load overcurrent protection;
- f) Low conducted and radiated emissions;
- g) Low conducted susceptibility.

1.2. Power Distribution Philosophy

A preliminary analysis of the requirements of EUSO has yielded the distribution philosophy approach described in this section that is shown in Fig. 1.2-1. The nominal power line available from the ISS will be connected to the nominal Trigger & Control Unit (TCU) and the redundant power line will be connected to the redundant TCU. Since only one power line is active at any time, then only one TCU is active at any time.

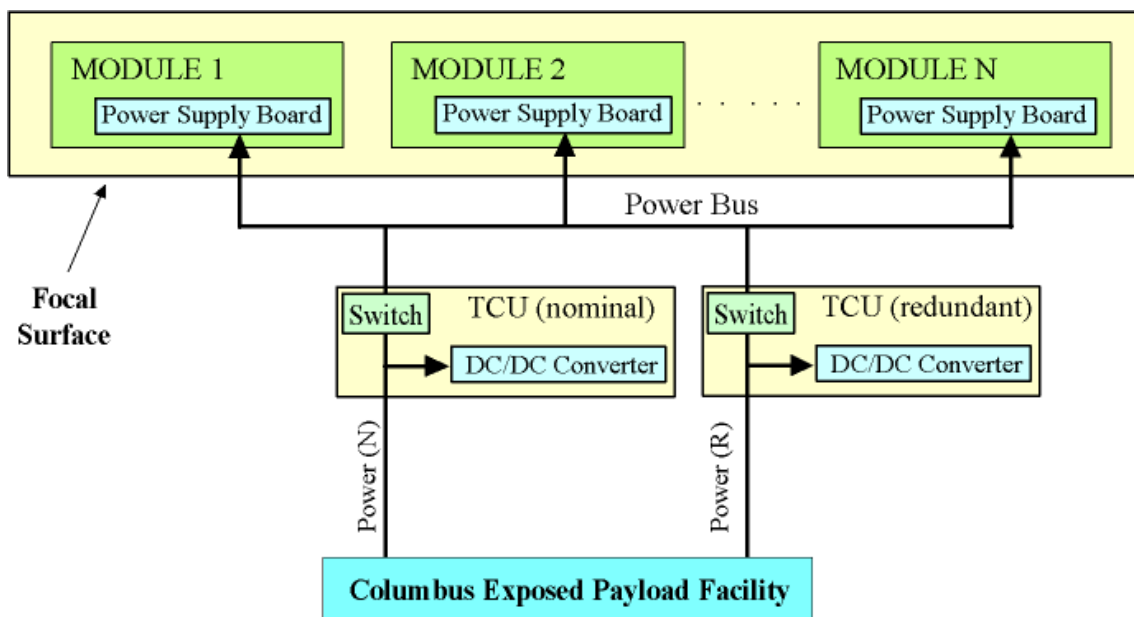


Fig. 1.2-1 - Power architecture of the EUSO instrument.

The TCU will convert primary power only for its internal power consumption and for all the actuators and heaters of the instrument. The TCU will route the 120V power to the FS Power Bus after controlling the power line by the implementation of protection and fault isolation devices (to be defined). Each module will convert primary power for its internal power consumption.

The rationale for this philosophy is the reliability requirement that no single-point failure can result in a

damage greater than the loss of one and only one module. This solution reduces the cabling by a great amount and simplify the integration flow.

1.3. Power Supply Board

Each module will contain a Power Supply Board (PSB) composed of two dedicated DC/DC converters:

- a) Low Voltage Power Supply (LVPS) for direct conversion from 120V to +/- 5V and to +/- 12V (to be confirmed).
- b) High Voltage Power Supply (HVPS) for direct conversion from 120V to -900V and -300 V (to be confirmed); at this time, an option is being considered for a triple divider; this option is intended to minimize the power consumption further).

Each module is connected to the FS Power Bus via a single-point failure free interface which grants that no failure propagation to the FS Power Bus can occur.

An always wake telecommand I/F shall be implemented on the PSB: this I/F will have the function of receiving proper ON/OFF commands from the TCU so as to allow insertion or exclusion of any module in the EUSO active configuration.

The PSB will include an EMI filter to match the ISS EMI requirements.

The HV levels will be adjustable by telecommand maintaining the same fixed ratio.

The efficiency (with respect to primary power) will be 75% for LV lines and 60% for HV lines.

The physical dimensions of the Power Supply Board will be approximately 160mm x 160mm including board frame and connectors. This dimensions will fit the projection of the structure of the module mechanical frame.

The estimated weight of the Power Supply Board (including frame and connectors) is about 390g.

In addition, the overall design will be compliant with the following requirements:

- The derating requirements of PSS-01-301 will be applied; a detailed Part Stress Analysis (PSA) will be provided.
- A Worst Case Analysis (WCA) will be provided in order to assess the end-of-life performances (including initial tolerance, temperature, ageing, total dose, single event upset, latch-up, etc.).
- Single-point failure free at the FS Power Bus interface.
- At least 100Mohm and less than 1nF isolation between primary power return and secondary ground.
- Inrush current limiter.
- Overcurrent protection, not only in case of failure of the load itself but also in case of failure of the power supply itself.
- Input power bus undervoltage protection.
- Output overvoltage protection (in case of internal failure).
- Input polarity inversion protection.
- Controlled conducted emissions and susceptibility at both input and output (ripple and spikes).
- Controlled radiated emissions and susceptibility (magnetic and electrical field).
- Precautions for the high voltages:
 - Controlled electrical field distribution at PCB level, soldering procedures, etc.
 - Electrical design will guarantee that no single-point failure will lead to HV propagation outside power module (including HV current and voltage monitors).