PPU
Power Processing Unit for Gridded Ion Thrusters

P o w e r
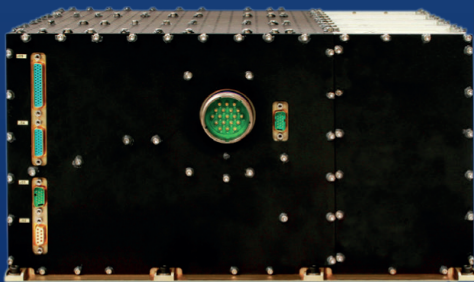
The Power Processing Unit is the central part of the Ion Propulsion Assembly (IPA). It provides Power conditioning and control for the Ion Thrusters and the Xenon Flow Assembly (XFA).

This unit has been developed especially for the GOCE mission, however, it can be readily adapted to satisfy requirements of other applications, particularly small, robotic interplanetary exploration missions, characterised by equally demanding reliability requirements in conjunction with greater autonomy and specific impulse.

For the thrusters, the PPU provides the high and low voltage supplies and the associated current and voltage telemetry. For the XFA, the PPU provides the isolation, temperature measurement and accurate control of the xenon propellant ow. Control is achieved by an ERC32 CPU and its associated software which translate the instructions from the main spacecraft computer to the required thruster operating currents using sophisticated algorithms.

AIRBUS

KEY FEATURES

- Generate and monitor the voltages and currents to the Electric Propulsion System; to perform start up, nominal operation and shut down sequences and to respond to thrust commands
- Manage optimally the high currents and voltages involved: up to 37A input and 1200V output
- Set and control the propulsion system to the necessary thrust levels to achieve the required dynamics and accuracy
- Provide TM and TC to command all thruster functions and monitor all relevant Propulsion system parameters
- Power converters are galvanically isolated from primary power bus
- Ensure isolation between the high voltage electronics, the low voltage electronics and between the 11 independent sources that supply the thrusters

BUDGETS

- Mass: 17.5kg
- Volume: 380 x 270 x 205mm^3
- Efficiency
  - 92-95% Beam Supply
  - < 92% Other Supplies

INTERFACES

- Power bus: Single Non Regulated Bus (+28V or -28V)
- Power input
  - Nominal input voltage range: 22V-37V
  - Maximum input current: up to 37A @ 22V
  - Input under-voltage protection
- Power output
  - Maximum output power: 770W
  - High Voltage Supply: 1200V
  - Voltage Sources: 400V / 250V
  - Current Sources: 4A / 2.7A / 0.1A / 0.7A
  - Current programmable Sources: 250mA-2.5A
- Valves Driving Capabilities
- MIL STD 1553

ENVIRONMENTS / RELIABILITY

- Thermal: -20°C to +50°C
- Radiation: Qualified for LEO application

MAIN APPLICATION FIELDS

- Earth Observation and science missions

CUSTOMERS / APPLICATION

- European Space Agency, GOCE Mission

PPU main functions

- Provide Power to the Ion Thruster Assembly (ITA). Up to 750 W of primary power is taken by the PPU from the power bus. The high voltage of 1200V, used to accelerate the ejected beam ions, is provided and precisely regulated by the beam supply.
- Provide power to the XFA valves and sensors Control the power delivered to the ITA: ON/OFF control and supply level setting for the programmable sources.
- Communicate with the CDMU via MIL 1553 Bus.
- Acquire the PXFA sensor analogue readings including digital 12 bit conversion
- Provide the controlling and processing resources to the Software which is executed by the ERC32 microprocessor with its memory banks.
- Deliver low voltage supplies to power the neutraliser and acceleration grid.

Ion beam converter

The Ion beam Converter is based on the standard Airbus Defence and Space High Voltage Module which has been specifically designed for Electric Propulsion applications.

The modules can easily be combined to form a scalable power supply with up to six modules.

- Output Voltage range: 500V to 2kV
- Fixed or variable Input & Output Voltage
- Scalable Power Module of 1.4kW
- Efficiency: > 95%
- Mass/power ratio: 2kg/kW

AIRBUS