Based on the requirements for the ESA Rosetta deep space mission Terma has developed and qualified the Power Conditioning Unit (PCU) with the following special properties:

- Regulated 28 volt, 2400 watt power bus
- Maximum Power Point Tracking capability
- Low mass of 8.3 kg
- Autonomy redundancy of all functions
- Very high power transfer efficiency

The unit is built in a new Terma developed power module technology allowing a power density up to 1kW / kg. It comprises the following module types:

- (6) Array Power Regulation (APR)
- (3) Battery Charge / Discharge Regulation (BCDR)
- (2) Command and Monitoring (CM)
- (1) Back plane module

The PCU provides interfaces to two independent solar array sections. Each interface is formed by three APR modules operating in hot redundancy, providing full autonomy, single point failure free Maximum Power Point Tracker function. In addition the solar array voltage is due to this technique not directly linked to the main bus voltage and allows the PCU to fit a wide range of Solar Array configurations.

The BCDR modules provides the charge and discharge regulation for three independent Li-Ion batteries, in single string configuration.

For detailed ground monitoring the PCU provides a large number of analogue and digital telemetry that can be accessed through each of the two CM modules, operating in hot redundancy. All adjustable control parameters and protections can be uploaded and reset from ground control.

The bus voltage is regulated by a voted set of Main Error Amplifiers, regulating all nine power modules in a 3-domain characteristic and providing an excellent load transient performance and very low bus impedance.

Each of the applied power modules is a self contained function able to initialize and start up providing bus power whenever energy is available on either solar arrays or batteries. The system will recover autonomously from any single point failure without any bus power interruption.

References:
- One unit onboard Mars Express, flying since June 2003.
- One unit onboard Rosetta, flying since March 2004.
- One unit onboard Venus Express, flying since November 2005.
Specifications:

Dimensions (L x W x H) 267 x 238 x 158 [mm]
Mass 8.3 kg
Reliability 11 years > 0.98
Regulated bus voltage 28V ± 0.5%
Output power capability up to 2400 watt
Output impedance < 20 mΩ
Bus voltage transient regulation < ± 1%
Idle power consumption < 15 watt
Solar array interface 2 Sections each of 750 watt
Maximum Power Point Tracking performance > 99.7%
SA voltage range 30V → 80 volt
Transfer efficiency > 95%
Battery interface 3 x Li-Ion
Charge / Discharge power 3 x 225 / 3 x 300 watt
Transfer efficiency (charge / discharge) > 96% / > 94%
DMS communication interface 2 x ESA ML/TM Interface