MILLSWOOD engineering

Generator PMU

PRODUCT BRIEF

General Description

The Millswood Engineering Generator Power Management Unit provides up to 500 Watts of on-board electrical power generation for small to medium-sized UAVs. The Generator PMU includes active rectification technology for cooler, more efficient operation, as well as several other innovative features not found on competing products.

Figure 1 - Generator PMU

The PMU connects to a suitable brushless DC electric motor, which is in turn driven by the aircraft's primary power plant, usually an internal combustion engine.

Features

- Active rectification avoids the diode losses with traditional passive rectifiers, resulting in superior low voltage performance and higher efficiency.
- Buck-boost converter keeps the output voltage on target and the battery being charged even when the input voltage is less than the output voltage.
- Programmable main output voltage can be set to any voltage from 10 to 30VDC in 0.1V steps. Rated at 15A continuous.
- Auxiliary power output provides 6V at 5A continuous.
- Built-in universal (CCCV) battery charger with charging current programmable up to 5A in 0.1A steps.
- Programmable input current and input power limits prevent overloading the internal combustion engine and BLDC motor.
- RS232 or CAN control and monitoring interface.
- Main 3-phase input voltage range of 10 to 70Vpp.
- External DC input voltage range of 12 to 70VDC.
- Inputs and outputs protected from reverse polarity, over-voltage, ESD and short-circuits.
- Extensive monitoring and reporting of voltages, currents, battery charge status, temperature.

Benefits of on-board electrical power generation

Minimising the mass that must be carried by an airframe is central to maximising performance and range. Batteries can constitute a significant part of the overall mass of small to medium-sized UAVs, and so storing the necessary electrical energy in an alternative form is one way of reducing the battery mass.

The gravimetric energy density of liquid hydrocarbon fuels remain more than an order of magnitude better than the best battery technology (12 kWh/kg for aviation fuel versus 0.35 kWh/kg for Li-S). Even allowing for the relatively poor efficiency of internal combustion engines, onboard electric power generation remains a highly effective way of reducing the battery mass.

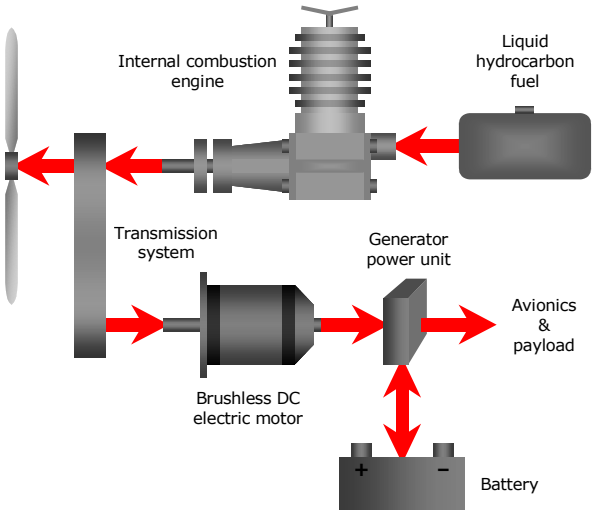

Figure 2: Typical generator system

Existing solutions typically use a brushless DC electric motor configured as a generator as shown in figure 2. The Millswood Engineering PMU also uses this arrangement.

Benefits of active rectification

The first step in turning high-voltage AC into regulated DC is rectification. This process is traditionally performed using a diode bridge, which is an inefficient device that wastes some potentially useful power as heat. Active rectification replaces the diodes with FETs, which have lower loss than either Silicon or Schottky diodes.

As can be seen from figure 3, there is up to 90% reduction in the power lost in the rectification process when an active rectifier is used. This translates into improved overall efficiency, particularly at low rpm where the diode drop is a significant fraction of the rectifier's total voltage.

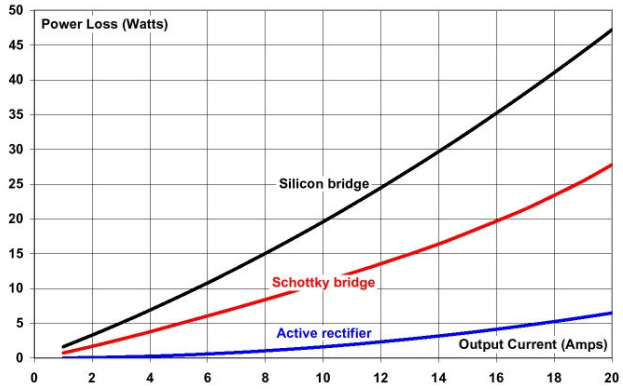

Figure 3: Power loss of a typical 3-phase Silicon diode bridge, a high-performance 3-phase Schottky diode bridge, and our 3-phase active rectifier

For the UAS, active rectification means:

- Higher efficiency and therefore reduced fuel consumption and greater aircraft endurance;
- Reduced heating and heatsinking requirements and therefore smaller enclosed volume; and
- Operation to lower rpm.

Specifications in brief

Electrical:

BLDC motor voltage:	10 to 70 V_{PP}
External DC voltage:	12 to 70 VDC
Battery voltage:	10 to 30 VDC
Battery charger:	up to 5 Amps (150 Watts maximum)
Main output:	10 to 30 VDC, 15 Amps continuous (450 Watts maximum)
Main converter efficiency:	> 87.5% (typically 90%) at rated output
Auxiliary output:	6 VDC, 5 Amps continuous (30 Watts maximum)

User programmable parameters:

Main output voltage: ***Note 1***	10 to 30 VDC in 0.1 V steps	(default: 12.0 VDC)
Maximum battery charge rate:	2 to 5 Amps in 0.1 Amp steps	(default: 2.0 Amps)
Input current limit:	0 to 25 Amps in 0.1 Amp steps	(default: 12.0 Amps)
Input power limit:	0 to 999 Watts in 1 Watt steps	(default: 500 Watts)

Note 1: The main output voltage must be the same as the battery's fully charged no-load terminal voltage. The battery charger will attempt to charge the battery up to this value.

Reported parameters:

- BLDC motor voltage (XX.X V)
- BLDC motor current (±XX.X A)
- Main output voltage (XX.X V)
- Main output current (±XX.X A)
- Auxiliary output voltage (X.X V)
- Auxiliary output current (±X.X A)
- Battery voltage (XX.X V)
- Battery current (±XX.X A)
- Battery energy (±XXXXX mAH)
- Temperature (±XXX C)

LED indicators:

- Auxiliary power output (green)
- Main power output (green)
- Generation / Battery (green/red)
- Charging battery (green)

Miscellaneous:

Environmental protection class:	IP50
Operating temperature range:	-40 to +70°C
Cooling:	Natural convection, conduction and radiation
Dimensions:	193 x 103 x 37.1mm
Weight:	625g (22 ounces)
Connectors:	ODU Mini-snap series L, size 3, cylindrical push-pull
Communications protocols:	RS232, CAN (factory set by internal jumper)

Further Information

Visit us on the web at www.millswoodeng.com.au

Didn't find what you wanted? Send us an email or give us a call – contact details are on our website.

MILLSWOOD engineering Generator PMU

The Fine Print

Regarding this document: Millswood Engineering makes no warranty, representation or guarantee regarding the accuracy or completeness of this document and reserves the right to make changes to specifications and product descriptions at any time without notice.

Regarding this product: Millswood Engineering makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Millswood Engineering assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Millswood Engineering reserves the right to make changes without further notice to any products herein to improve reliability, function or design.

Regarding typical specifications: "Typical" parameters which may be provided in Millswood Engineering datasheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts.

Regarding life support applications: Millswood Engineering products are not designed, intended, or authorised for use as components in systems intended to support or sustain life, or for any other application in which the failure of the Millswood Engineering product could create a situation where personal injury or death may occur.

Regarding intellectual property: No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document.