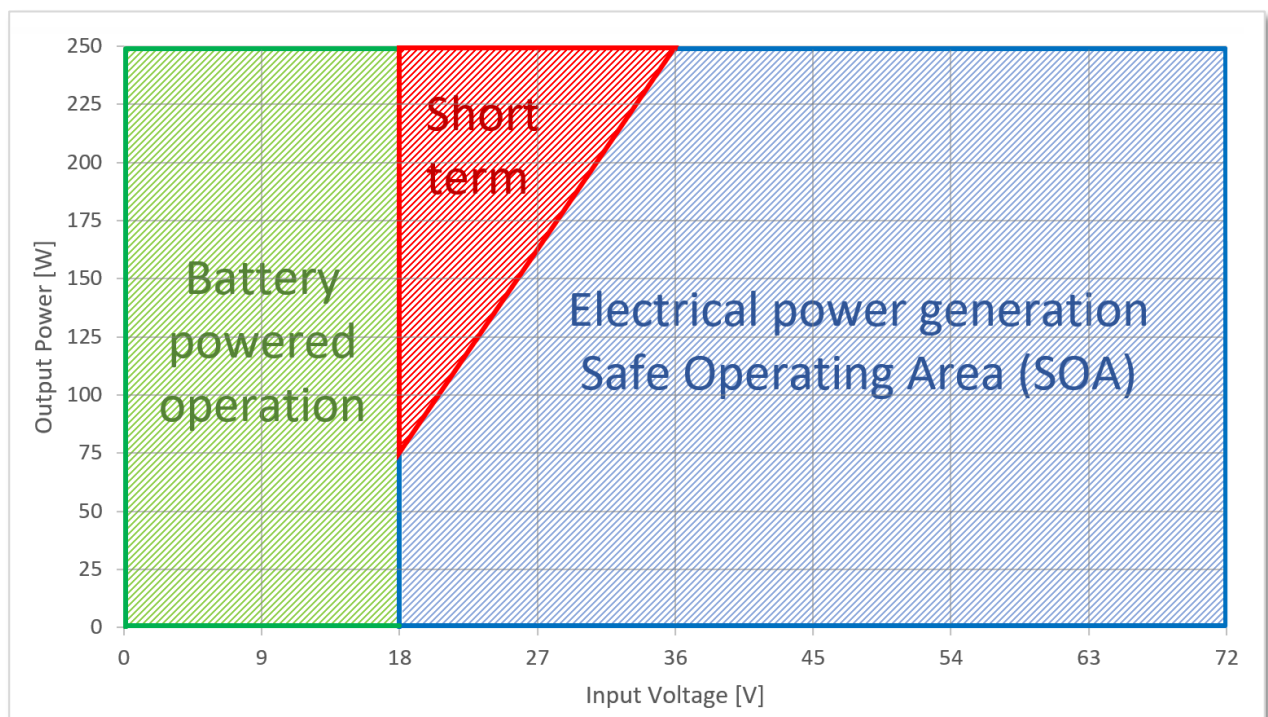


## 1 Reason for update

Although the 250W PMU is capable of generating 250W of output power across a wide range of input voltages, caution must be exercised when operating from low input voltages. The difficulty with low input voltages is that the 28V Buck-Boost converter in the PMU is maximally stressed and generates a significant amount of heat.

In order to achieve reliable operation, it is important to stay within the PMU's Safe Operating Area (SOA) shown in Graph 1 below:



Graph 1 – Safe Operating Area (ambient temperature +25°C, fan fitted and running)

As can be seen from Graph 1, the critical area is from 18 to 36V input voltage. When the input voltage is in this range, the output power should be limited so that the PMU stays within its SOA (shown in blue). It is permissible to draw rated power (250W) when the input voltage is in this range, but only for short periods of time (10 seconds max. at 10% duty cycle max.).

**Operating in the red "Short term" area for greater than 10 seconds or with a duty cycle greater than 10% risks catastrophic thermal failure.**

Managing the operating point to remain within the SOA at all times can be challenging to do manually, and so the firmware has been modified to be able to perform this task automatically.

Section 4.5 of the 250W PMU product manual includes a description of the SOA and the new feature available in firmware version 1.16.

## 2 Scope

### 2.1 Hardware

No changes.

### 2.2 Embedded firmware

#### 2.2.1 Application code

Firmware version 1.16 includes a new feature called safe operating area management. This firmware version is compatible with all hardware revisions.

The firmware upgrade process does not modify any user-configured parameters.

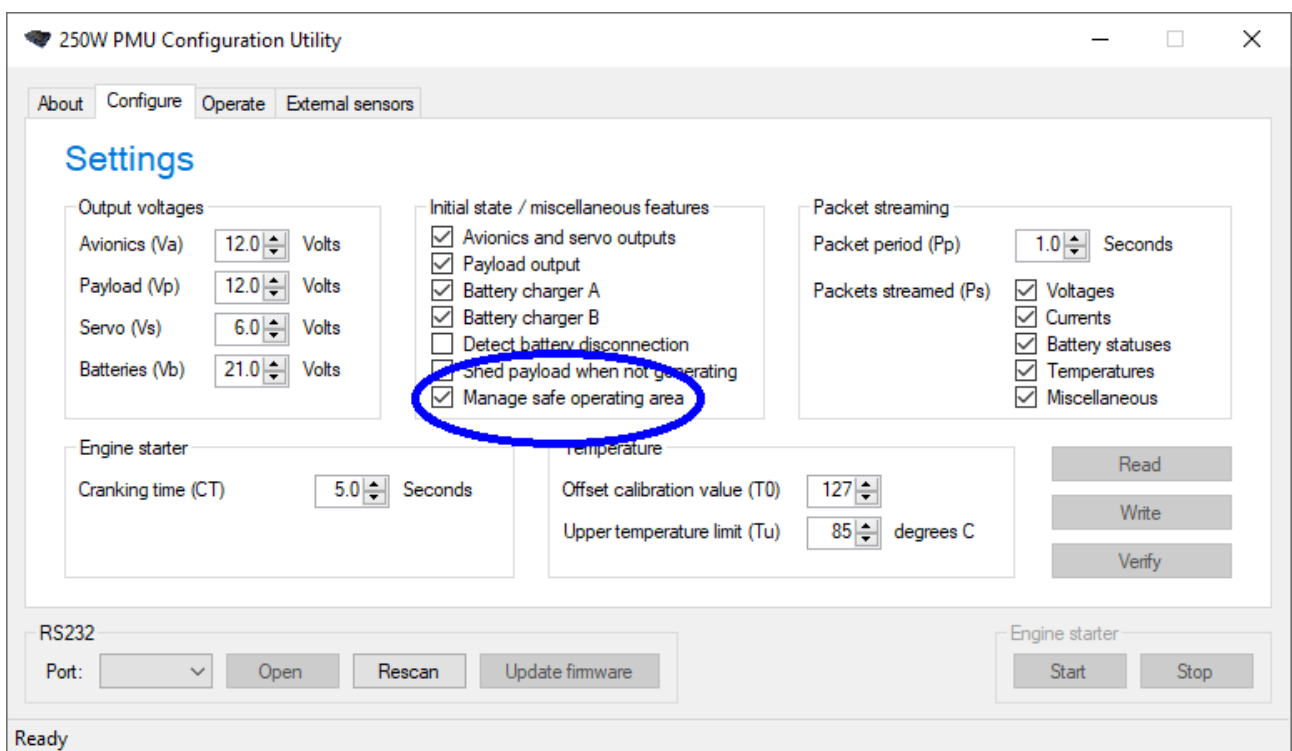
Enabling safe operating area management on firmware versions less than 1.16 has no effect.

#### 2.2.2 Bootloader

No changes.

### 2.3 PC software and configuration parameters

The configuration utility has been updated to version 1.0.0.6 to access the new feature. It is available on the Configure tab and is called "Manage safe operating area". It may be enabled or disabled.



### 2.4 Communications protocols (CAN and RS232)

The CAN and RS232 protocols have been updated to describe the new feature flag. This flag occupies a previously unused bit of an existing byte, and so the overall structure of the protocols remains unchanged.

See the updated RS232 and CAN protocol documents for details.

## 3 Changes made

### 3.1 Manage safe operating area

Firmware version 1.16 calculates the operating point to determine whether it lies inside or outside the electrical power generation SOA as shown in Graph 1. It uses the generated input voltage and total output power to make this determination. A dual-slope integration technique is then used to ensure that both the 10 second time limit as well as the 10% duty cycle are observed. If either of these criteria are violated, electrical power generation ceases until the criteria are once again met.

The Avionics, Servo and Payload outputs are not affected by cessation of electrical power generation, as long as there is sufficient voltage headroom available from battery supply for these outputs to remain in regulation. The 28V output assumes the highest battery voltage available when electrical power generation is not occurring.

One consequence of turning electrical power generation off is that the engine will see a reduced mechanical load from the PMU. This may give rise to a change in RPM. Generally it is advised that full power should only be drawn from the PMU when the input voltage is greater than 36V, and the Manage safe operating area feature be used as an additional safety measure.

It is recommended that PMUs be upgraded to firmware version 1.16, and the "Manage safe operating area" feature be enabled.