

1 Reason for update

One of the internal connectors in the 250W PMU became obsolete in 2017, and this connector has become increasingly difficult to obtain. No suitable footprint-compatible connector exists, meaning that a board change was required in order to allow the use of a new connector. The opportunity for a design review and product update was taken at this time, and the rest of this document outlines the changes and improvements that have been made.

No performance specifications were reduced or downgraded in this update, and several aspects of the PMU's performance were improved.

2 Scope

2.1 Hardware

Both internal boards inside the PMU were revised. New boards have the following designations:

- High-voltage board: ADD026 Rev. 03
- Distribution board: ADD027 Rev. 03

Manufacture of Rev. 03 boards commenced in October 2019. Units with a serial number of 00075 or higher contain revision 3 boards.

2.2 Embedded firmware

2.2.1 Application code

No changes to the application code are required for the updated boards to work successfully. However, in order to benefit from the improved current sensing hardware present on revision 3 boards, an update to firmware version 1.14 is required. This firmware version has been calibrated to extract the maximum possible accuracy from the new hardware. Revision 3 boards are shipped with firmware version 1.14 by default.

Loading firmware version 1.14 onto older boards is permitted and will result in normal behaviour. Current measurements will differ from those reported using firmware version 1.13, but have a similar level of accuracy.

2.2.2 Bootloader

The bootloader was modified to take advantage of the new hardware and implement a faster start-up sequence. Bootloaders are programmed at manufacture and never modified, and the new bootloader is forward and backward compatible with the original bootloader.

2.3 PC software and configuration parameters

Unaffected and unchanged.

2.4 Communications protocols (CAN and RS232)

The updated hardware does not require any changes to the RS232 or CAN protocols. However, a new command has been added to the CAN protocol at firmware version 1.14. This is mentioned here because firmware version 1.14 is the default firmware shipped with revision 3 boards. The new command is unrelated to the hardware update.

The new command allows a supervising entity to poll for measured values, as an alternative to having them streamed. Please refer to the latest CAN protocol document for details.

Changes made

2.5 Engine starter connectors

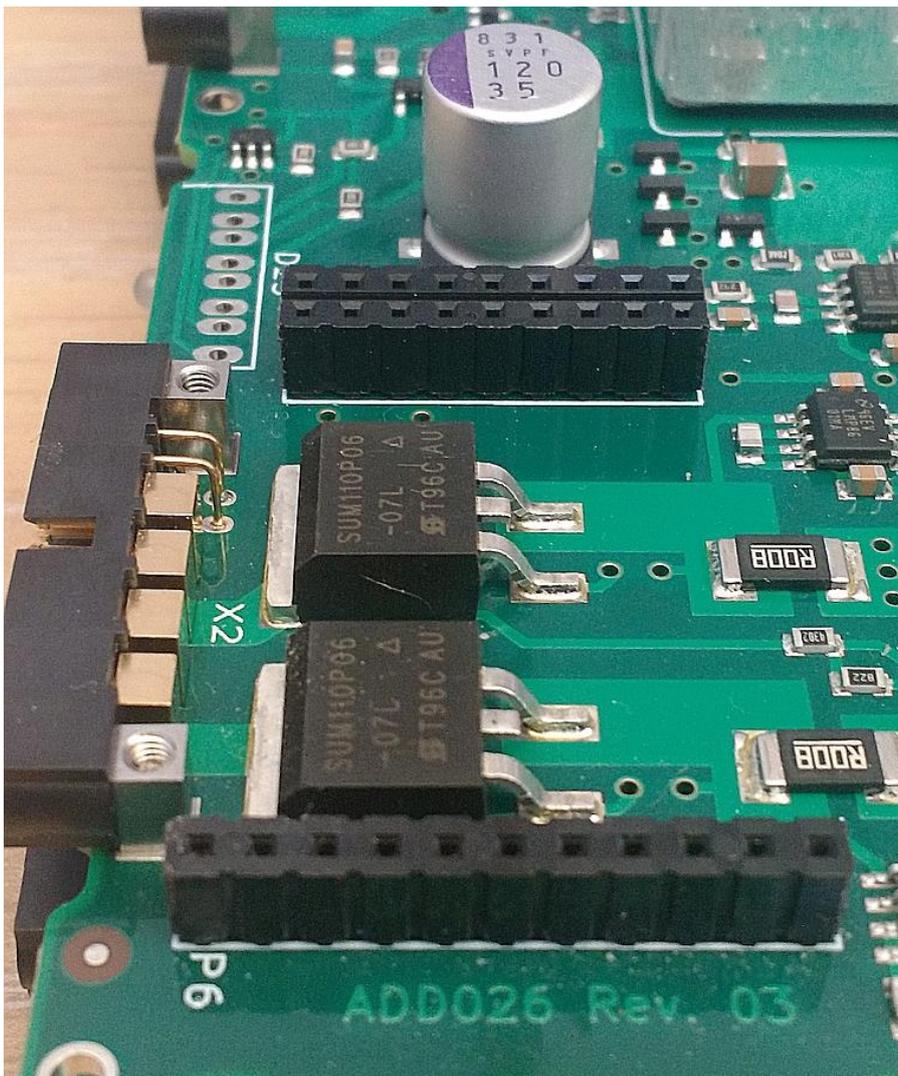
The obsolete engine starter connector was replaced with a current production connector. The second engine starter connector was also replaced in order to match the connector heights. The new connectors have the following part numbers:

- 11-way single row socket: Samtec CES-111-01-S-S
- 18-way dual row socket: Samtec CES-109-01-S-D

Unlike the original connectors (which were through-board types), these connectors do not allow the inserting header pins to penetrate all the way to the surface of the PCB. These new sockets only allow the pins to penetrate to within about 1mm of the surface of the PCB. Accordingly, in order for the engine starter board to remain at approximately the same mounted height, shorter pins on the engine starter board are required. The recommended connectors are:

- 11-way single row pin header: Samtec MTLW-111-05-G-S-185
- 18-way dual row pin-header: Samtec MTLW-109-05-G-D-185

These pin headers have exposed pin lengths of 4.70mm (the original pin-headers had exposed pin lengths of 5.85mm). Engine starters fitted with the new pin-headers may still be fitted into older PMU boards whilst maintaining adequate pin insertion.



2.6 Engine starter CAN connector

The engine starter CAN connector has been added to the distribution board. The connector part number used is:

- JST BM02B-GHS-TBT(LF)(SN)(N)

This connector is fitted by default.



2.7 Mature components

Hard to obtain and components listed as “mature” have been replaced with “preferred” components. In some cases this has resulted in minor performance improvements.

The inductor in the main 28V Buck-Boost converter, and the inductors in the Servo and Payload converters were replaced with slightly higher performance (i.e. lower-loss) equivalents. The efficiency improvements were small and have not been quantified in detail.

The CAN transceiver was replaced with a newer device which has the capability of operating at higher speeds, although no changes to the baud rate are currently planned.

2.8 Start-up latency

The start-up latency has been reduced. Previously the time from power being applied until the Avionics LED illuminated was approximately 3 seconds. This time is now less than 1 second when powered-up from battery power.

Note that if a valid RS232-level connection is detected at start-up, the latency will still be approximately 3 seconds, as the PMU attempts to negotiate an X-Modem connection for possible firmware update.

2.9 Quiescent power consumption

The quiescent (no load) power consumption has been improved by between 10% and 35%. The amount of improvement depends on the operating conditions.

Quiescent power consumption when operating from battery power is significant because it affects battery charge state. Under typical operating conditions (all outputs enabled, fully-charged 6S battery), the quiescent power consumption when operating from battery power is now 100mA, down from 150mA. This represents an improvement of 33%.

Reduced quiescent power consumption also means that the PMU generates less heat and runs cooler, regardless of whether operating from battery, umbilical or generated power.

2.10 Light-load efficiency

The light-load efficiency of the Servo and Payload converters has been improved. The improvement is small and has not been quantified in detail.

2.11 Current monitoring accuracy

Hardware has been added to the Distribution board to improve the current monitoring of the Servo and Payload outputs. Current measurements are now more linear and more accurate.

Firmware version 1.14 is required in order to take advantage of the improved current sensing hardware.

3 Mechanical compatibility

The interfaces between the two boards were maintained both electrically and mechanically. Rev. 03 boards may be mated with earlier revision boards with no restrictions.

No changes were made to the mechanical outline, profile or mounting points. New boards fit into the existing enclosure without modification.

The hardware compatibility issues arising from changing the engine starter connectors was addressed in section 2.5.