Empowering the Electronics Industry

2019 PSMA POWER SUPPLY SOFTWARE / FIRMWARE RELIABILITY IMPROVEMENT REPORT

PSMA Power Supply Software / Firmware Reliability Improvement Report

A Comprehensive Study on Digital Implementations of Power Supplies Commissioned by the PSMA Board of Directors and Executed by the PSMA Reliability Committee

Purpose of the PSMA

The Power Sources Manufacturers Association (PSMA) is a not-for-profit organization incorporated in the state of California. As stated in the papers of incorporation, the purpose of the Association shall be to enhance the stature and reputation of its members and their products; improve their knowledge of technological and other developments related to power sources; and educate the electronics industry, academia, and government and industry agencies as to the importance of, and relevant applications for, all types of power sources and conversion devices.

PSMA Mission

The PSMA mission is to integrate the resources of the power sources industry to more effectively and profitably serve the needs of the power sources users, providers, and PSMA members.

Reliability Committee Mission

In alignment with the PSMA mission of bringing value and utility to members as well as the power electronics industry as a whole, the PSMA Reliability Committee aims to spearhead industry initiatives that identify and attempt to solve the pertinent industry challenges related to the reliability and performance of power supplies and associated products. The scope of the Committee shall include anything that impacts the life and desired application of a power supply, including (but not limited to) interaction with a system and/or other power supplies.

Reliability Report

As with so many things, power electronics are transitioning from analog control to digital control. Power supply designers now need to create and embed software in power supply products. Vendors of power control chips and power control processors have started to provide code. While some is helpful, this software is often not well engineered for software development and software maintenance. Moving from power electronics with analog control to power electronics with digital control is a significant transition and this report attempts to present key finding related to the challenges and solutions to reliability in the of digital control of power electronics.

Software Reliability

Software Reliability is the ability of software to repeatedly perform intended functionality for defined operating condition(s) or environment(s) over a specified length of time. While the focus here is on software reliability, hardware variation and evolution over time impacts software reliability and legacy software function.

High quality software with high reliability requirements is typically implemented following a standards-based regulatory process. Examples of applications where software has strict reliability specifications include aviation control, medical devices, and transport vehicle control.

Power electronics control software is often required to have performance levels as high as aviation software. If the power supply is for use in aviation or other such applications, any safety standards also apply to the power supply control code.

Software engineering best practices are being adopted for digital power electronics control for power supplies to ensure reliability does not suffer with the transition to digital control. Some of these best practices are relatively new, evolving, and unfamiliar in the power electronics world.

Report Structure

This report examines a wide array of problems and challenges in the field of digitally controlled power supplies, then proceeds through observed and proposed improvements and best practices.

- Section 1 is a summary of the typical issues, challenges, and points of failure in digitally controlled power supplies.
- Section 2 covers what best practices are useful for high quality digital power electronics.
- Section 2 addresses the quality of software in digital power electronic power supplies.
- Section 3 contains guidance on design process improvement, allowing development to move toward best practices. Some standards from related and comparable product sectors using processes to achieve high quality software are introduced.
- Section 4 delves into various specifications and templates that support best practices and quality.
- Section 5 describes program management and integration of different engineering cultures and tools to create reliable product.
- Section 6 addresses a range of tests, inspections, types of analysis, plans, and tools that support developing high-quality product.
- Section 7 reviews key metrics from both power hardware and software control backgrounds.
- Section 8 considers some new metrics that might benefit the power supply industry.

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- *Co-Chair: Brian Zahnstecher, PowerRox*

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Table of Contents