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White Paper

BlueJay App: Power Supply Life Tester

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One of the major US manufacturers of access control and security devices approached us with a pressing need. They and their manufacturer had a new offline switching power supply with UPS that needed to be qualified for production. Their main concern was battery interface and switchover, as well as operation at somewhat elevated temperatures (140 °F / 60 °C). They needed to test a batch and have an answer within three weeks. Note, more comprehensive testing was scheduled, but the need was to check the first articles for common failure points. Similarly, the point here was not so much a fully polished product, but a quick, useful solution to an urgent problem.

Given the time crunch and limited testing resources, we decided to set up several small test chambers, each with two DUT power supplies, and each controlled and monitored by a BlueJay PIC32MZ MultiBoard. For each BlueJay we designed a 'Wing' board. The Wing functionality is threefold:

1. Sense and control the temperature in the chamber. The BlueJay executes a simple PI algorithm. Note, the two boards are *in situ* here. Because the BlueJay has a wide operating temperature range this is not a problem. The Wing was designed to generate up to 100 W of heat using a pulse-width modulated heater element. There is a fan to disperse the thermal energy from the source. With the additional waste heat from the power supply dummy loads, there was no problem reaching the desired temperature.
2. Log the voltages of the power supply output, nominal 24 Vdc, and the SLA battery voltage. In charging phase, the latter is approximately 27.2 Vdc. The Wing board provides voltage attenuation, TVS protections, and signal buffering. The BlueJay is programmed to log samples at 1 minute intervals to Flash memory. It also communicates via USB to an external laptop as a secondary check.
3. Input AC mains and provide relay switching of AC to the two power supplies. Power supplies run with 2 A dummy loads.

The test protocol is:

1. Obtain set point temperature in chamber. Report a fault if detected.
2. Charge batteries for six hours with AC mains enabled.
3. Disable AC mains. Measure battery voltage. If within specified range, allow the batteries to discharge to a one-half charge level voltage.
4. Go to step #2.

Because of the extreme height of the components on the Wing, we had to connect it to the BlueJay with two ribbon cables. This is certainly less than ideal, but it did work all right in practice. Ordinarily, a Wing is mounted 0.25 inch / 6 mm to the top of the BlueJay, with rigid header pins and sockets.

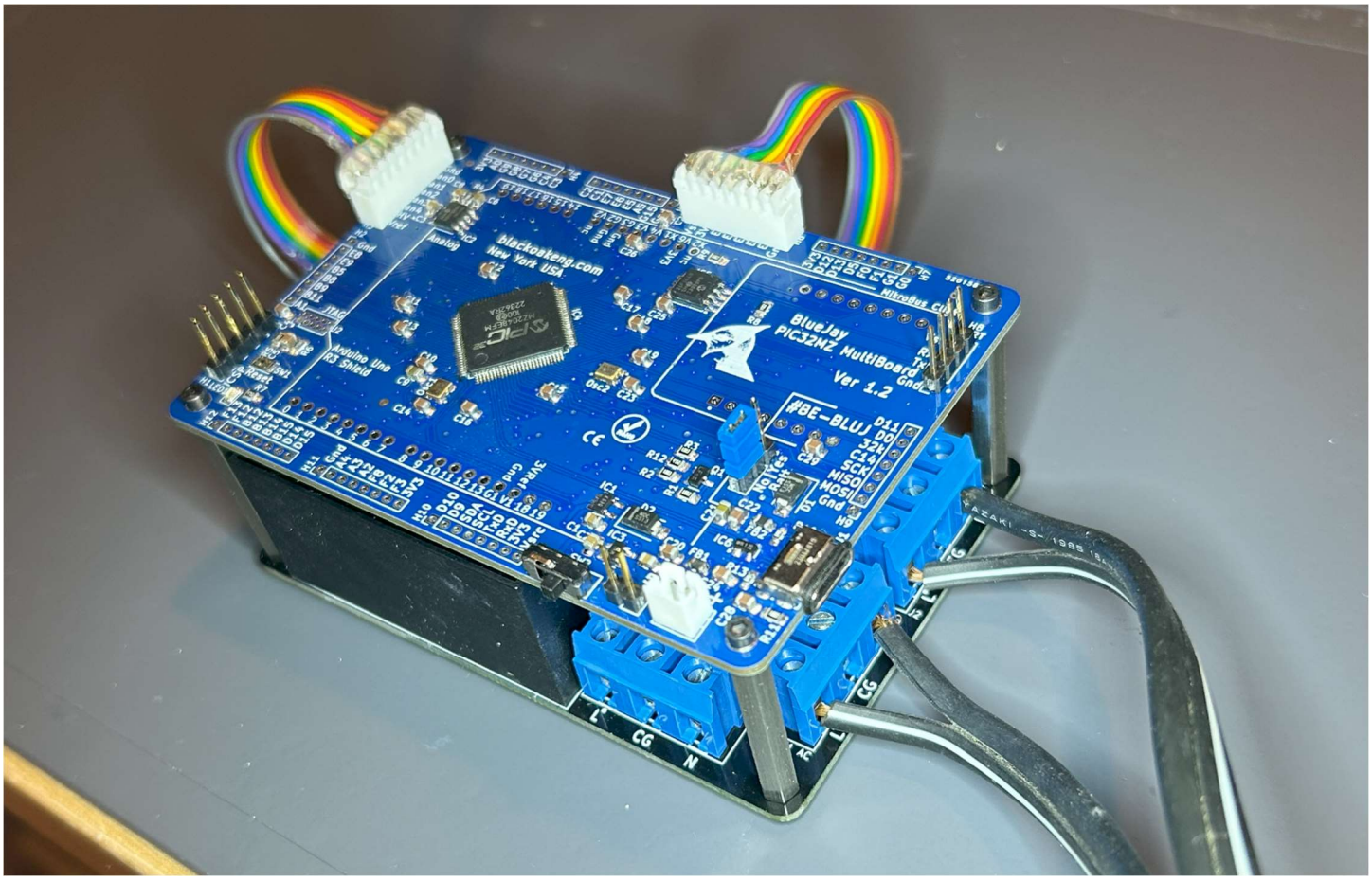

Figure 1 - Custom 'Wing' board below BlueJay

“it just works…”

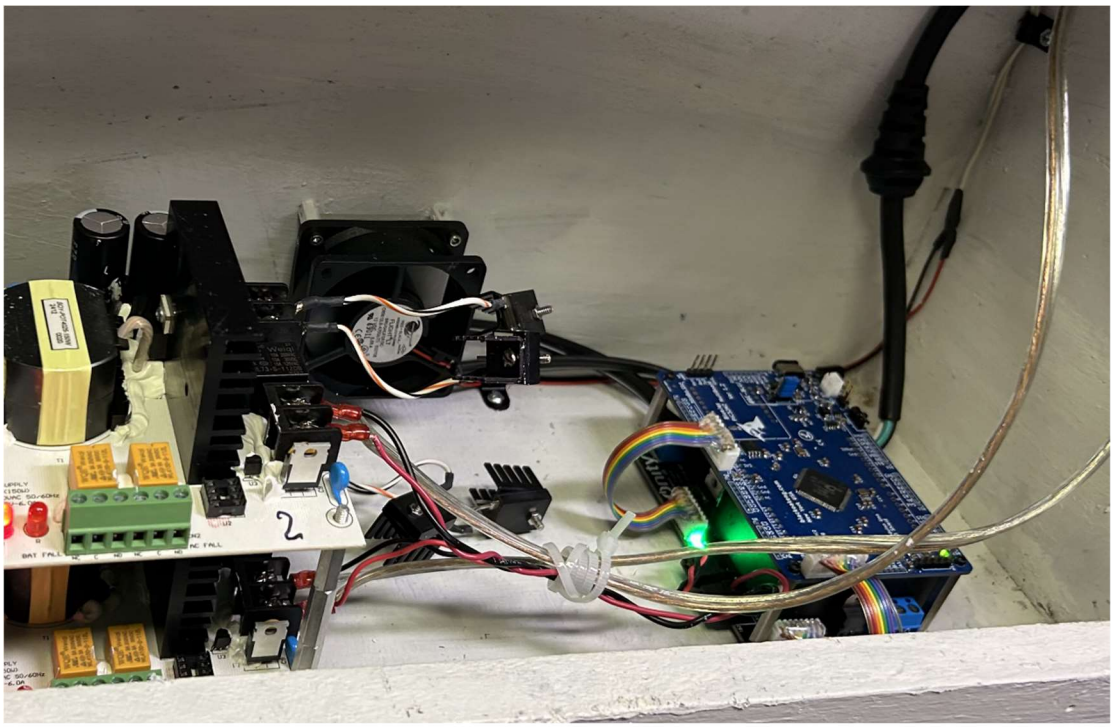

Figure 2 - Slightly unorthodox but effective test setup

All power supplies tested ran for one week without a fault. Actually, the only problem discovered was with the SLA batteries. These were kept outside of the test chamber at normal room temperature. A few of the SLAs failed and had to be replaced. We believe that the root cause is that they had been too long in storage without a float charge to maintain them.

The test is still running as of this writing. The goal is to discover failure modes.

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