

## Low Voltage Chassis Power Filtering

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June 1, 2018

This note presents the results of the removal of a power filter from a printed circuit board in the Low Voltage Chassis.

The Hall B superconducting magnets, Torus and Solenoid, use a multi-sensor excitation and readback chassis, called the Low Voltage chassis, Fig. 1.



FIG. 1. Low Voltage chassis with board Q0131 in the lower right corner.

The Low Voltage chassis provides the excitation voltage/current to several types of sensors—Cernoxes, PT-100s, Hall sensors, strain gauges, and load cells—and reads back the voltages via a serial port.

After failures of all Cernox sensors on an entire chassis<sup>1,2</sup>, the cause of the failure was narrowed down to a failed capacitor on the Current Source and Sense Board (Q0131) in the chassis, Fig. 2.

1 <https://logbooks.jlab.org/entry/3481735>

2 <https://logbooks.jlab.org/entry/3487421>

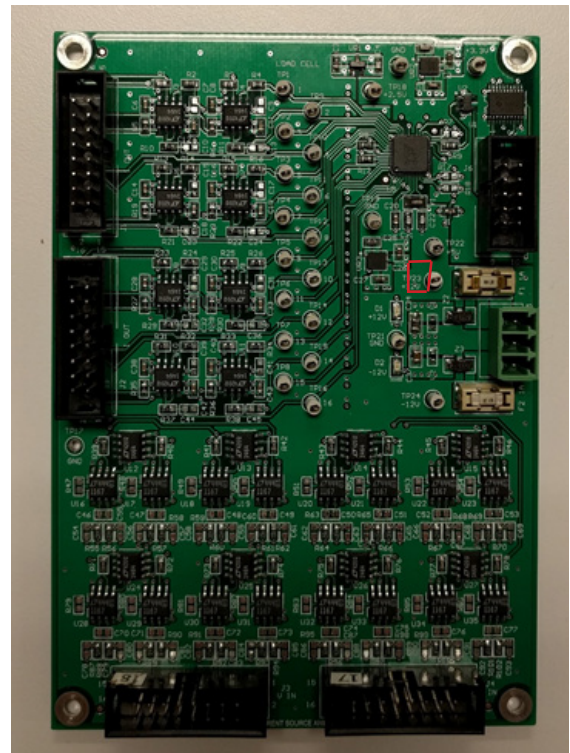


FIG. 2. Board Q0131, with the failed capacitor in the red box.

The capacitor (C34) is a 22  $\mu\text{F}$ , 35 V ceramic capacitor used for filtering the 12 VDC input power. When the capacitor failed, it shorted to ground causing the onboard fuse to blow.

Due to multiple boards failing in the same way, it was decided to study the behavior of the sensors with the capacitor removed from the board. The results are presented in Tables I, II, and III.

In conclusion, there is  $\sim 5\text{--}6$  mK difference between the min/max values,  $\sim 1.6$  mK for the average value, and  $\sim 0.5$  mK for the sigma between the two board configurations, an insignificant change.

Cernox sensors												
	21	22	16	71	12	13	14	15	17	18	19	20
Min	4.655	4.627	5.260	4.748	4.731	4.669	4.666	4.616	4.707	4.636	4.614	4.687
Max	4.791	4.747	5.409	4.852	4.890	4.814	4.801	4.733	4.851	4.765	4.744	4.793
Avg	4.733	4.688	5.341	4.799	4.817	4.751	4.743	4.683	4.785	4.710	4.689	4.749
Sigma	0.023	0.016	0.024	0.014	0.026	0.023	0.023	0.020	0.022	0.020	0.022	0.018

TABLE I. Temperature (K) summary with C34 capacitor (86764 samples).

Cernox sensors												
	21	22	16	71	12	13	14	15	17	18	19	20
Min	4.660	4.630	5.265	4.744	4.736	4.677	4.673	4.621	4.718	4.645	4.621	4.693
Max	4.791	4.761	5.424	4.858	4.894	4.815	4.801	4.734	4.855	4.773	4.749	4.797
Avg	4.734	4.689	5.343	4.798	4.818	4.752	4.745	4.685	4.788	4.712	4.691	4.750
Sigma	0.023	0.017	0.025	0.014	0.026	0.024	0.023	0.020	0.022	0.020	0.023	0.018

TABLE II. Temperature (K) summary without C34 capacitor (92373 samples).

	Cernox sensors												Overall			
	21	22	16	71	12	13	14	15	17	18	19	20	Min	Max	Avg	Sigma
Min	0.005	0.003	0.005	0.004	0.005	0.008	0.007	0.005	0.011	0.009	0.007	0.006	0.003	0.011	0.006	0.002
Max	0.000	0.015	0.015	0.006	0.004	0.001	0.001	0.001	0.004	0.008	0.004	0.004	0.000	0.015	0.005	0.005
Avg	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.002	0.001	0.001	0.003	0.002	0.001
Sigma	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000

TABLE III. Absolute value of difference between Tables I and II.