CAEN A7030TN Module Testing

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This note presents results of tests conducted to check the performance of eight (288 channels) CAEN A7030TN High Voltage (HV) modules, which will power the photomultiplier tubes of the calorimeter of the Neutral Particle Spectrometer in Hall C.

To test the CAEN A7030TN modules in the HV CAEN Test Stand [1], two LabVIEW programs were written: one to sequence HV operations (ramp up, dwell, trip, and ramp down) and record data to a text file, the other to analyze data.

At test start, process variable (PV) values shown in Table I were set via EPICS. Then channels were ramped from 0 V to *V0Set*, in 50 V steps, with a dwell time of 15 s at each step. For successful tests, ramp down was initiated when the power level of the channel exceeded the power trip threshold of 1.5 W, which for a load of 1.5 MΩ occurs when *V0Set* > 1500 V; unsuccessful tests did not reach 1500 V.

EPICS PV	Variable description	Value
SVMax	set voltage max	3000 V
V0Set	voltage set point	0 V–1550 V
I0Set	current trip set point	1 mA
RUp	ramp up rate	250 V/s
RDWn	ramp down rate	250 V/s
Pw	power enable	1(enabled)
POn	power on	1(on)

TABLE I. Preselected PV values for the test.

Tests indicated three issues.

- *VMon,* CAEN monitored voltage, out of specification.

Figure 1 shows that when *V0Set* (red line) is 50 V for channel 13 of module 0302, *VMeas* (green line)*,* value measured by the DMM, indicates the output to be 50 V, confirming *V0Set*. However, *VMon* (blue line), voltage measured by CAEN, is 53.5 V, clearly out of specification bounds (dashed red lines). Because *VMon* is out of bounds there is a warning, even though channel 13 completed the ramp up, Fig. 2.
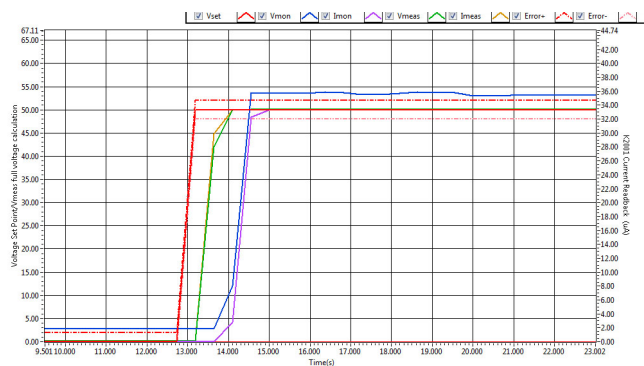
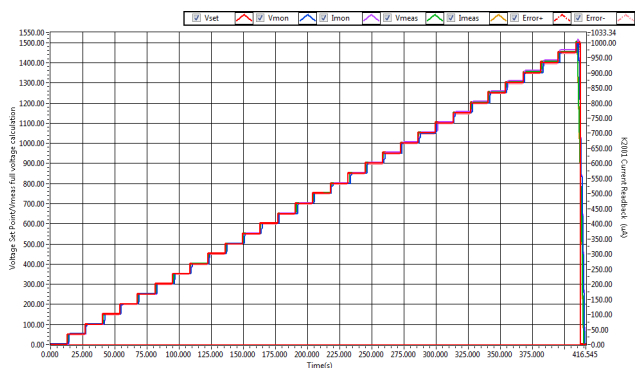FIG. 1. Module 0302 channel 13 set to 50 V.

FIG. 2. Module #0302 channel 13 completes ramp up and trips.

- $|VMon - V0Set| \geq 105$ V.

A safety feature designed in the LabVIEW code resets *V0Set* to 0 V if at any time the $|VMon - V0Set| \geq 105$ V. Many cases were observed in which the ramp up was aborted due to this condition. Figure 3 shows such a case.
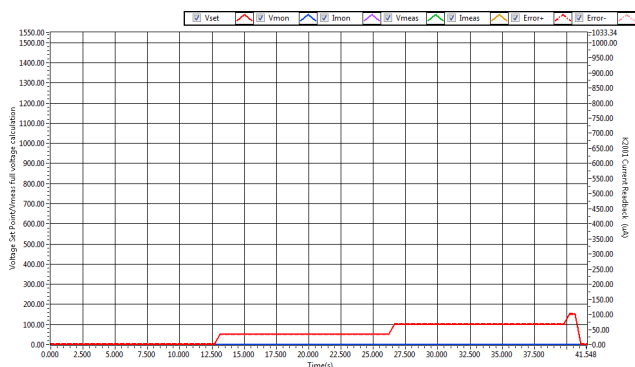
FIG. 3. Channel 20 of module 0324 fails test because channel is unresponsive to *V0Set*.

- Failures due to randomly changing *SVMax* values.

A reason for failing to ramp up to 1500 V is that the preset value of *SVMax* randomly changes; if at any time *V0Set* > *SVMax,* the channel ramps down to 0 V, Fig. 4. Of the 25 ramp up failures that occurred, ten are attributed to *SVMax* changes.

In conclusion, eight of the new A7030TN modules were tested, 288 channels in all. Tests indicated issues with the system.

[1] M. McMullen, et al. *Testing of CAEN SY4527 and A74355N High Voltage Modules*, DSG Note 2019-19, 2019.
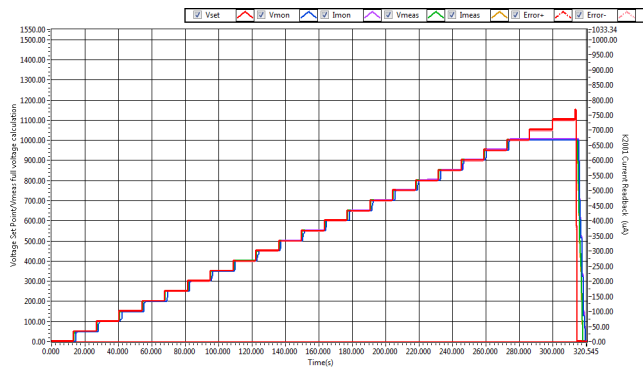
FIG. 4. Module 0302, channel 6 fails due to *SVMax* process variable changing from 3000 V to 1000 V during the test, blue line.