Test Results of CAEN SY4527 System Installed with A1535 High Voltage Boards for Hall C

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This note presents the results of the tests performed on the CAEN SY4527 system's built-in EPICS server, which is used to control and monitor the system mainframe and the A1535 high voltage boards.

The CAEN SY4527 mainframe has a built-in EPICS server in which the process variables (PVs) are defined. These PVs are accessible to the EPICS Channel Access Client, which resides in the host Linux PC, via Channel Access protocol.

After developing and configuring the CSS-BOY screens in the host PC and in SY4527, communication, firmware version, front panel input status, front panel output status, and module status were verified to ensure that the configured system was running as per CAEN specifications.

Using the developed CSS-BOY screens [1] and the SY4527 mainframe (Serial # 400) [2], the three A1535 high voltage boards (Serial # 775, 776, and 556) [3] installed in the mainframe were tested. Figure 1 shows the screen developed for the mainframe.
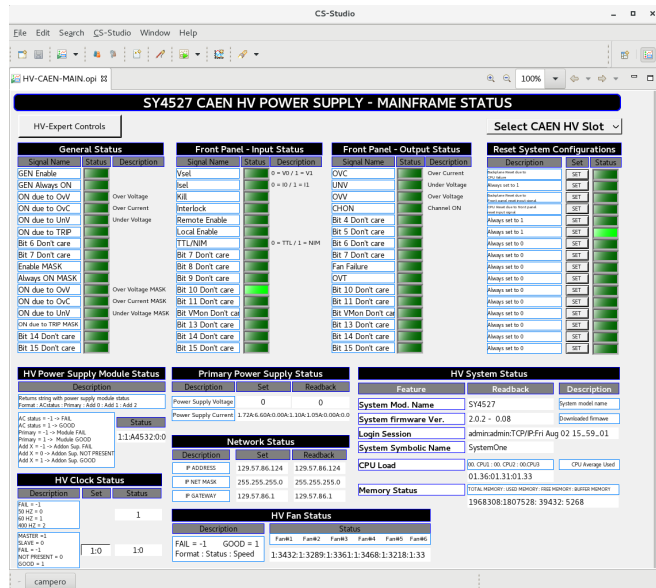

FIG. 1. CAEN HV Power Supply Mainframe Status screen.

For the high voltage boards' tests, HV CAEN - Expert Controls program was developed, screen shown in Fig. 2. For all 24 channels, the screen allows simultaneous setting and reading of parameters—set power on/off, voltage set (*VSet*), maximum voltage allowed (*VMax*), maximum current allowed (*ISet*), voltage ramp up (*RUp*), voltage ramp down (*RDown*), and time over threshold for voltage or current (*Trip*). Eight Java scripts, one for each parameter, running in HV CAEN - Expert Controls program set the values for each channel.

Parameters values, Table I, were set before simultaneously ramping up all 24 channels of each high voltage board to *VSet*.
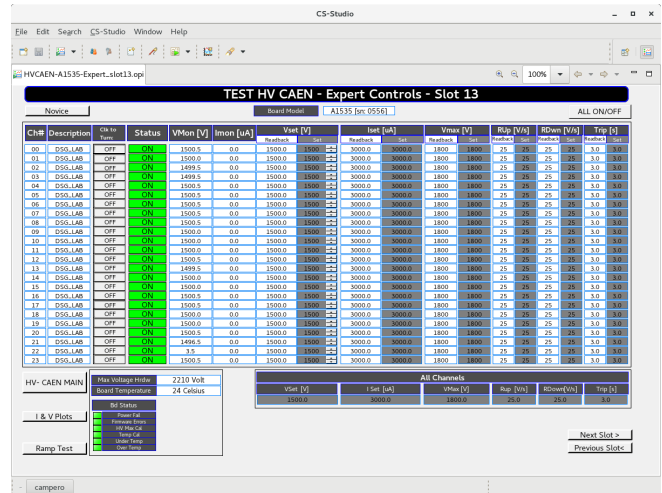

FIG. 2. HV CAEN - Expert Controls screen. *VMon* readback value for channel 22 is 3.5 V, indicating that this channel did not ramp to the set voltage of 1500 V.

Parameter	Value
Slot number	13
Total tests	9
Total no. ramp up/downs	27
Set voltage	1500 V
Set ramp up/down rate	25 V/s
Load	0 Ω
IMon	0 µA
ISet	3000 µA
VMax	1800 V
Trip time	3 s

TABLE I. Test parameters for SY4527 mainframe, boards A1535.

PVs displayed in HV CAEN - Expert Controls screen, Fig. 2, were compared to the values displayed by GECO-2020 (CAEN General Controls interface software) to ensure that there were no discrepancies between the two readouts.

To monitor voltage ramp up/down of 24 channels simultaneously, the HV CAEN - Ramp Test screen was developed to plot voltage vs time for all 24 channels; the plots are displayed in two panels, 12 channels/panel, Fig. 3.

Test results indicated that there were several software issues and one hardware issue. Table II summarizes the results for the tests performed.
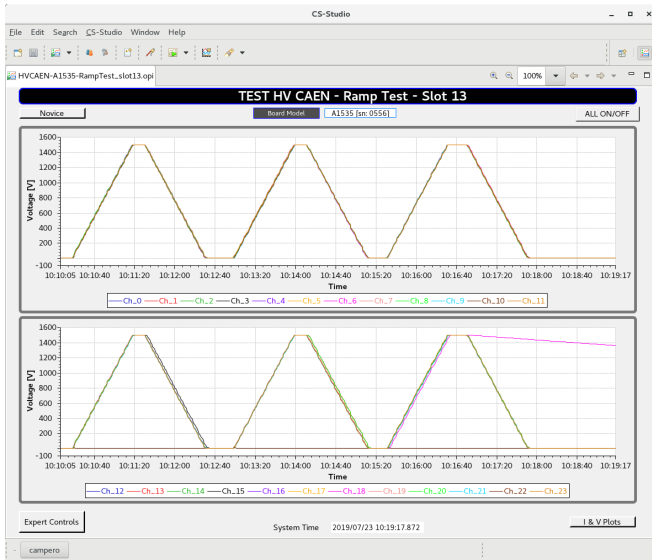
FIG. 3. Bottom panel in the screen shows that channel 22 did not ramp up to the set voltage of 1500 V and channel 18's ramp down value changed from the set 25 V/s to 1 V/s.

Software issue investigation showed some channels' parameters—$IMon$, $VSet$, $RDwn$, $ISet$, $VMon$—changed arbi-

trarily from their pre-set values to random values; this was confirmed by noting that values displayed by GECO-2020 were different from the PV values of the EPICS server displayed by the expert screen.

Except for channel 22 of CAEN-A1535 serial # 556, which has a hardware issue, all other channels of the three high voltage boards tested were able to be ramped up to the set voltage by re-entering the set values, re-setting power on/off, and sometimes resetting the built-in CAEN EPICS Server.

To conclude, CSS-BOY screens were developed to test the three A1535 high voltage boards. Test results show that all three boards installed and running in the SY4527 mainframe have CAEN EPICS software issues and one of them has a hardware issue.

[1] P. Campero, et. al., *Screens to test the CAEN SY4527 High Voltage Power Supply System's Built-in EPICS Server*, DSG Note 2019-22, 2019.

[2] CAEN. (2019). *SY4527 - SY4527LC Universal Multi-channel Power Supply Systems User's Manual*. Retrieved from https://www.caen.it/download/?filter=SY4527.

[3] CAEN. (2015). *A1535/AG535 24 Ch 3.5 kV/3 mA High Voltage Boards Manual*. Retrieved from https://www.caen.it/download/?filter=A1535.

Board	Channel	Failure	Solution
775	8	*VSet* stuck at 0 V	re-entered set value to 1500 V
	4	tripped, *ISet* value changed from 3000 µA to 1 µA; discrepancy between GECO-2020 and PV	changed set value for *ISet* and reset channel on/off
	9	*VSet* stuck at 25 V	reset channel on/off button to ramp to 1500 V
	1, 5	*IMon* stuck at 25 µA and 1800 µA respectively; GECO-2020 indicated correct value at 0 µA	reset CAEN SY4527's built-in EPICS server
776	11, 21	*VSet* changed from 1500 V to 1 V; discrepancy between GECO-2020 and PV	reset power on/off for channel
	7	*VMon* stuck at 1500 V; GECO-2020 showed correct *VMon* value, 0 V	reset power on/off for channel
556	10	*VSet* and *VMax* changed from 1500 V and 1800 V to 1 V; confirmed by PV and GECO-2020	re-entered set point for *VSet* and *VMax*, then reset power on/off for each channel
	17	*RDwn* changed from 25 V/s to 1 V/s; confirmed by PV and GECO-2020	re-entered set point for *RDwn* and reset power on/off for channel
	19	*VSet* changed from 1500 V to 1 V; confirmed by PV and GECO-2020	re-entered set point for *VSet* and reset power on/off for channel
	13	*VSet* changed from 1500 V to 25 V; confirmed by PV and GECO-2020.	re-entered set point for *VSet* and reset power on/off for channel
	18	*RDwn* changed from 25 V/s to 1 V/s; confirmed by PV and GECO-2020	re-entered set point for *RDwn* and reset power on/off for channel
	22	did not ramp up, hardware issue	no solution, recommend return board to CAEN

TABLE II. Summary of test results.