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Using GECO2020 to Debug SY4527 Mainframe and A7030TN High Voltage Boards

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Hall C's recently procured CAEN SY4527 system and A7030TN high voltage (HV) boards indicated problems when the system was tested using EPICS for the controls and monitoring system. Hence, retesting was done using GECO2020, a CAEN proprietary software, for the controls and monitoring of the system. This note presents the test results.

EPICS-based tests developed [1] and performed on the A1535 HV boards [2] indicated issues as did the tests performed simultaneously on sixteen A7030TN HV boards. Tests on a single A7030TN HV board [3] also indicated the same problems.

To determine whether these problems were at the board, mainframe, or the EPICS/LabVIEW client software level, GECO was used to control and monitor parameters of a single A7030TN HV board in the SY4527 mainframe, Fig. 1. Specifications of the board are given in Table I.

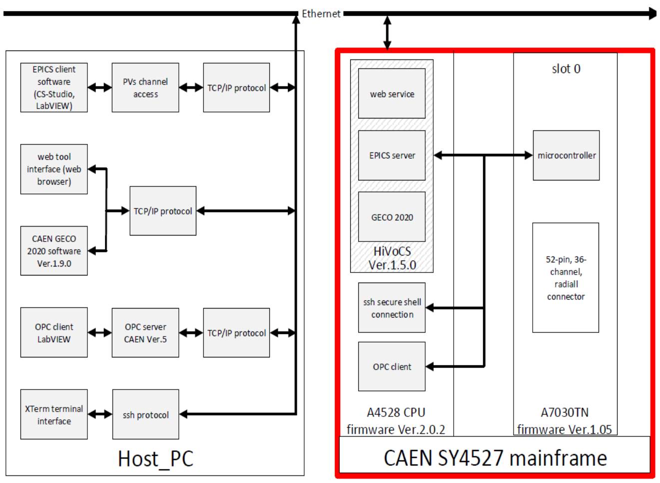

FIG. 1. Possible configurations are shown for control and monitoring of the CAEN SY4527 mainframe and HV cards. The Host PC on the left interfaces with the mainframe and installed cards on the right. For the tests, GECO was used to control and monitor the system. EPICS and ssh were only used to verify GECO's monitoring.

Specification	Value
Mainframe model/ SN	SY4527/400
Board model/SN	A7030TN/304
Board firmware ver.	1.05
CPU model/SN	basic A4528/760
CPU firmware ver.	2.0.2
HiVoCS ver.	1.0.5
Channel load	0 Ω
Total channels tested per board	36

TABLE I. A7030TN specifications.

GECO's script feature allows program development to automate the tests and its logging feature allows recording of parameter changes during the automated test. To verify GECO's monitoring of the automated tests, EPICS/CSS-BOY and Secure Shell Connection (ssh) were used, Fig.1.

Targeted parameter set points for the tests and trial details are given in Table II.

Process Variable (PV)	Description	Set value
Pw	power on/off	1/0
SVMax	maximum voltage set	1800 V
V0Set	set voltage	1500 V
RUp	ramp up rate	250 V/s
RDWn	ramp down rate	250 V/s
I0Set	maximum current set	1000 μA
Trip	trip time	3 s
Trial	up-down ramps/channel	100

TABLE II. Voltage test set parameters.

Test results of 400 up-down ramp cycles per channel show that both GECO and ssh display the same *correct* values; also the set point values did not arbitrarily change on any of the 36 channels. However, the EPICS CSS-BOY monitored values were different from those registered by GECO and ssh.

While monitoring the automated test with the EPICS Voltage Ramp Test–CSS-BOY screen, it was observed that the *Pw*s associated with turn on/off parameter did not update.

GECO, ssh, and EPICs confirmed ramp-up latency, when ramping to the set voltage; this latency does not always occur in the same channels. The hypothesis is that these latency issues are caused by the firmware running in the A7030TN board. The firmware has been updated and further testing is ongoing. It should be noted that except for *Pw*, EPICS CSS-BOY screens' readout matched the GECO data log.

Test results are shown in Figs. 1–7 in the Appendix.

[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] P. Campero, et. al., *Test Results of CAEN SY4527 System Installed with A1535 High Voltage Boards for Hall C*, DSG Note 2019-30, 2019.
[3] P. Campero, et. al., *Debugging SY4527 Mainframe and A7030TN High Voltage Boards with EPICS CSS-BOY*, DSG Note 2019-39, 01 October 2019.

APPENDIX: TEST RESULTS

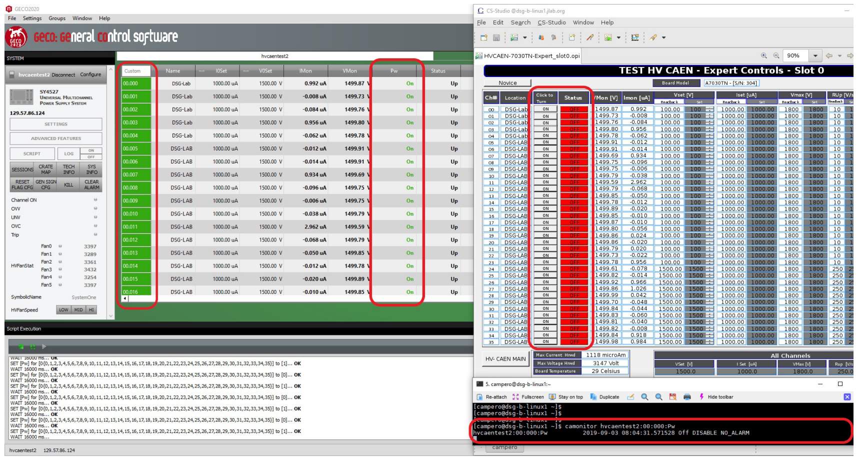

FIG. 1. GECO (left) indicated *Pws* as “on” (red box), while EPICS PVs on CSS-BOY screen (right) indicated that *Pws* (red box) were off. EPICS updated correct values when EPICS “caget” command was executed once more.

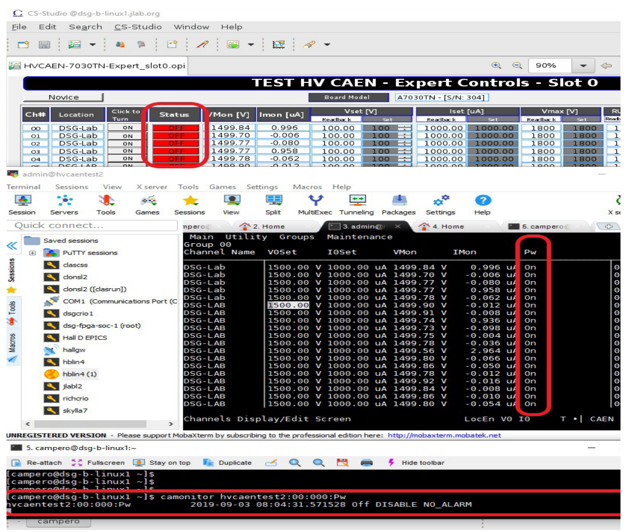

FIG. 2. ssh screen (black) indicated *Pws* as “on” (red box), while EPICS CSS screen (partially seen above) indicated that the *Pws* (red box) were off.

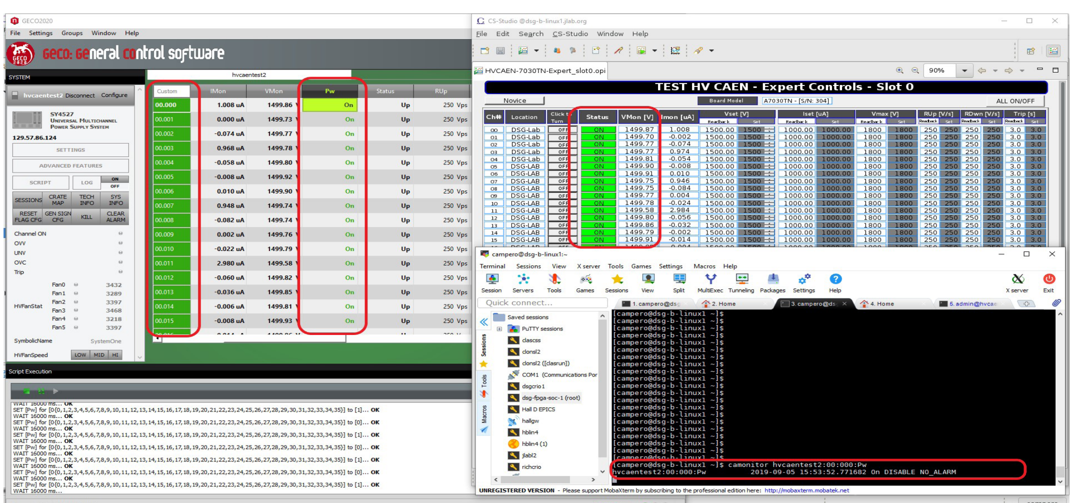

FIG. 3. Figure shows that discrepancies between GECO and EPICS for *Pw* parameter were resolved. To to so, EPICS Voltage Ramp Test–CSS-BOY screen has to be refreshed or the EPICS command camonitor, which displays/prints continuous value updates for PVs that change, has to be re-executed on the host computer (EPICS client). Discrepancy between the ssh screen (not shown here) and EPICS CSS-BOY screen was resolved in the same way.

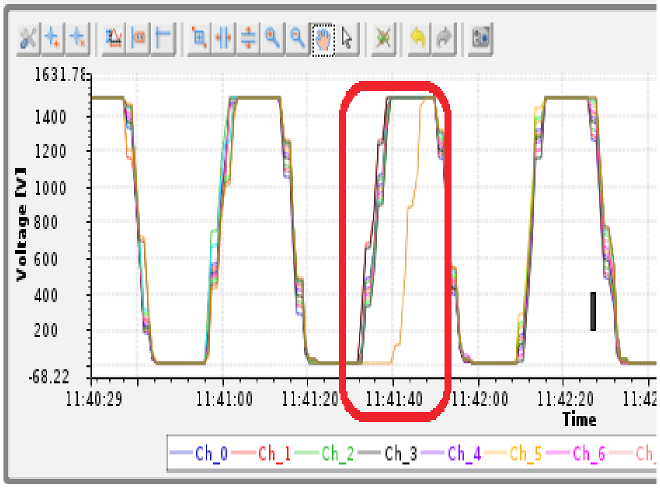

FIG. 4 EPICS CSS-BOY screen shows that channel 11 ramped up to set voltage ~10 s after the other channels. Channel 11 recovered by itself in the next cycle and ramped with no issues, along with the other channels.

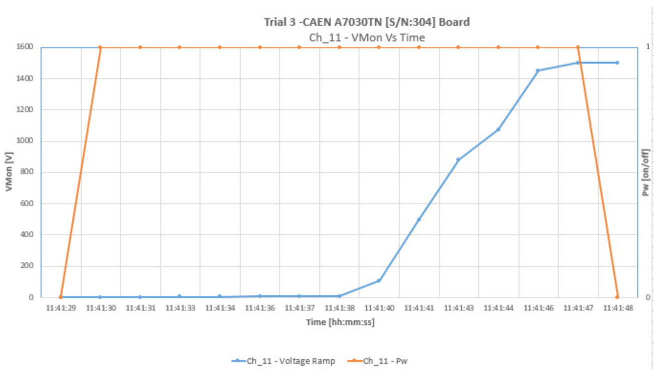

FIG. 5. Logged GECO data plotted in Excel shows that *Pw* parameter was indeed set to 1 to turn channel 11 on, but ramp-up was initiated 10 s after *Pw* reached set value of 1.

GECO2020 Data Logged

Time	Ch_11 - Pw	Ch_11- VMon
hh:mm:ss	[On/Off]	[V]
11:41:29	0	1.23
11:41:30	1	1.23
11:41:31	1	1.88
11:41:33	1	4.37
11:41:34	1	5.54
11:41:36	1	7.3
11:41:37	1	8.69
11:41:38	1	9.05
11:41:40	1	105.62
11:41:41	1	497.64
11:41:43	1	881.71
11:41:44	1	1073.66
11:41:46	1	1449.93
11:41:47	1	1499.54
11:41:48	0	1499.55

Value did not change

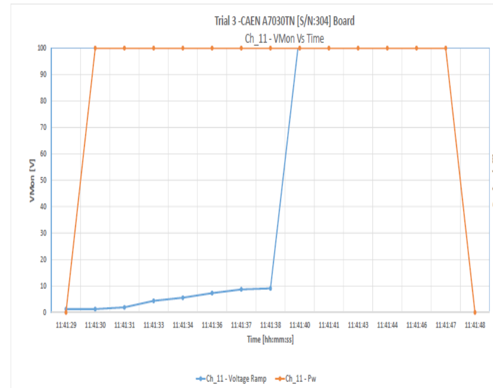

FIG. 6. Data analysis of the logged GECO data in the table above shows that during the time period between 11:41:29 and 11:41:48 (one ramp up/down cycle), ramp-up was initiated 10 s after the *Pw* value was set to 1 (at 11:41:30). Plot of the data is shown to the right of the table.

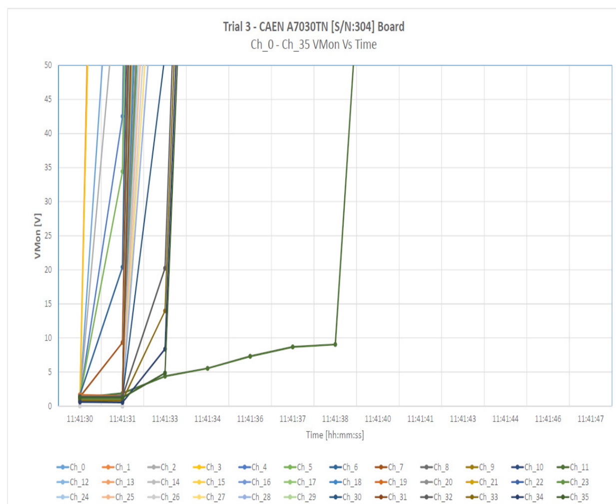

FIG. 7. Plot of all channels from the datalog file generated by GECO in the period mentioned in Fig. 6 found that the remaining 35 channels ramped up in less than 3 s after *Pw* parameter was set to 1.