

# Hall C CAEN SY4527 Crate and A7435SN Module Test Stand: Voltage Verification

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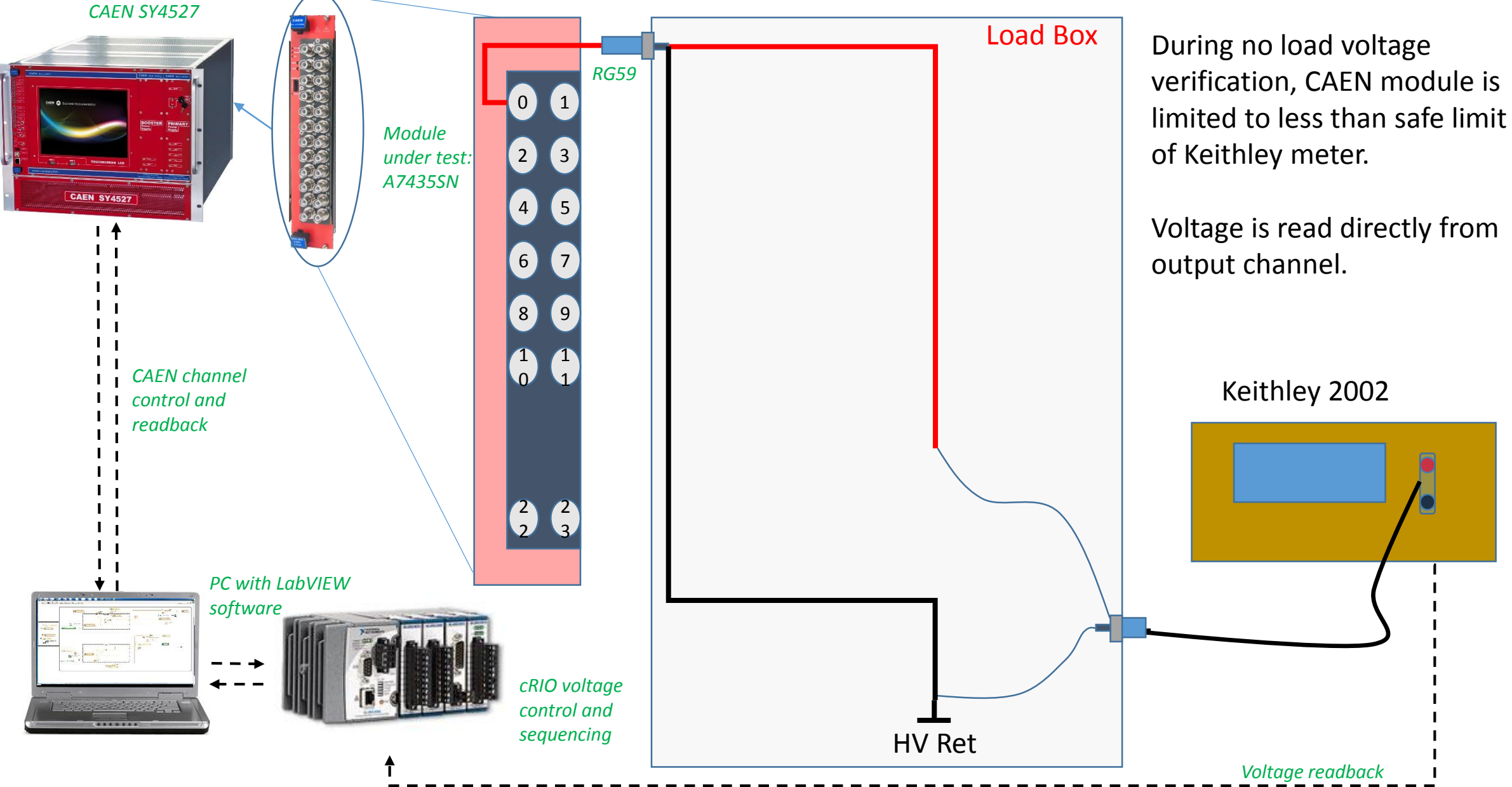
# Hall C CAEN A7435SN Module Test Stand: Voltage Verification Tests

- CAEN SY4527 modular HV system can be used for different detector systems.
  - A7435SN module provides a negative voltage, commonly used for photo multiplier tubes.
- Tests will verify voltage accuracy specifications from manufacturer.
- Knowledge of precision and accuracy of output voltage is critical for use with other detector systems.

# Hall C CAEN 7435SN Module Test Stand: Voltage Verification Tests

- Check monitored voltage ( $V_{\text{mon}}$ ) displayed by supply vs. actual output voltage measured ( $V_{\text{meas}}$ )
- Verify manufacturers accuracy specification for:
  - $V_{\text{mon}}$  vs.  $V_{\text{meas}}$ .
  - set voltage ( $V_{\text{set}}$ ) vs.  $V_{\text{meas}}$ .

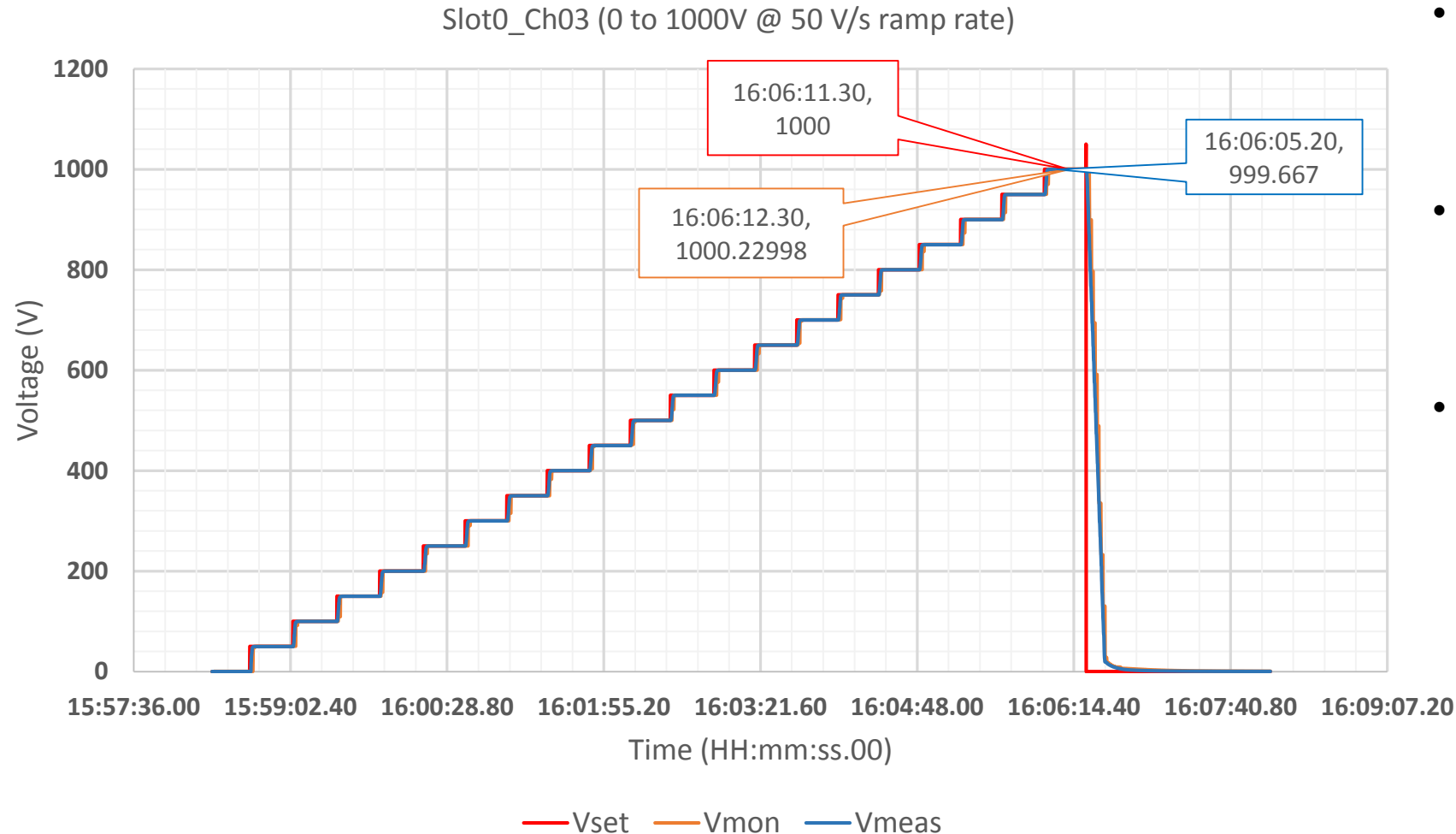
# Test Stand Setup: No Load Voltage Verification



During no load voltage verification, CAEN module is limited to less than safe limit of Keithley meter.

Voltage is read directly from output channel.

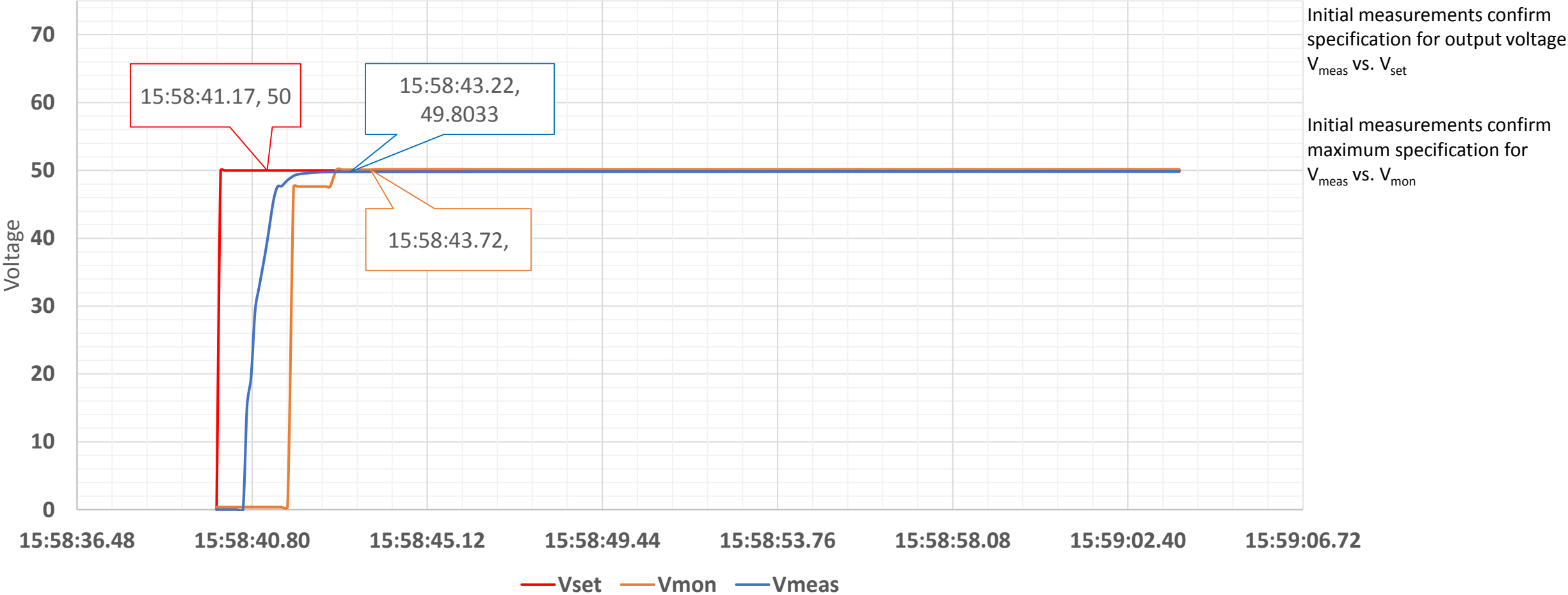
# Slot 0 Channel 3 Measurement (0 V – 1000 V)



- Test ramps voltage from 0 V to 1000 V. Dwelling on each set point for 10 s.
- LabVIEW program continuously monitors and records  $V_{\text{set}}$ ,  $V_{\text{mon}}$ , and  $V_{\text{meas}}$ .
- Measurements are recorded every 0.1 s.

# Slot 0 Channel 3 Measurement (0 V – 50 V)

Slot0\_Ch3\_No Load 0 to 50V



# Challenges

- The no load test provides data of actual output of supply, however, supply output must be limited to the limit of the meter. To measure voltage directly, a resistive load box was modified to test channel output directly. The software was modified to limit channel output.
  - A resistive load will be necessary to test full output of the supply and to perform further test, such as current accuracy.
- The test software was developed to be semi-automated to ensure precise measurements. Each tests takes 7 to 10 minutes depending on dwell set point. The operator must set up the test for each channel.

# Conclusion

- Initial testing has verified the manufacturers voltage accuracy specifications.
- Further test stand development is necessary to verify all manufacturer specifications.
- To improve efficiency, the test stand will be fully automated so that multiple channel tests can be performed, sequentially.



END

# Backup Material

# A7435 Module Specification

## Channel Characteristic Table

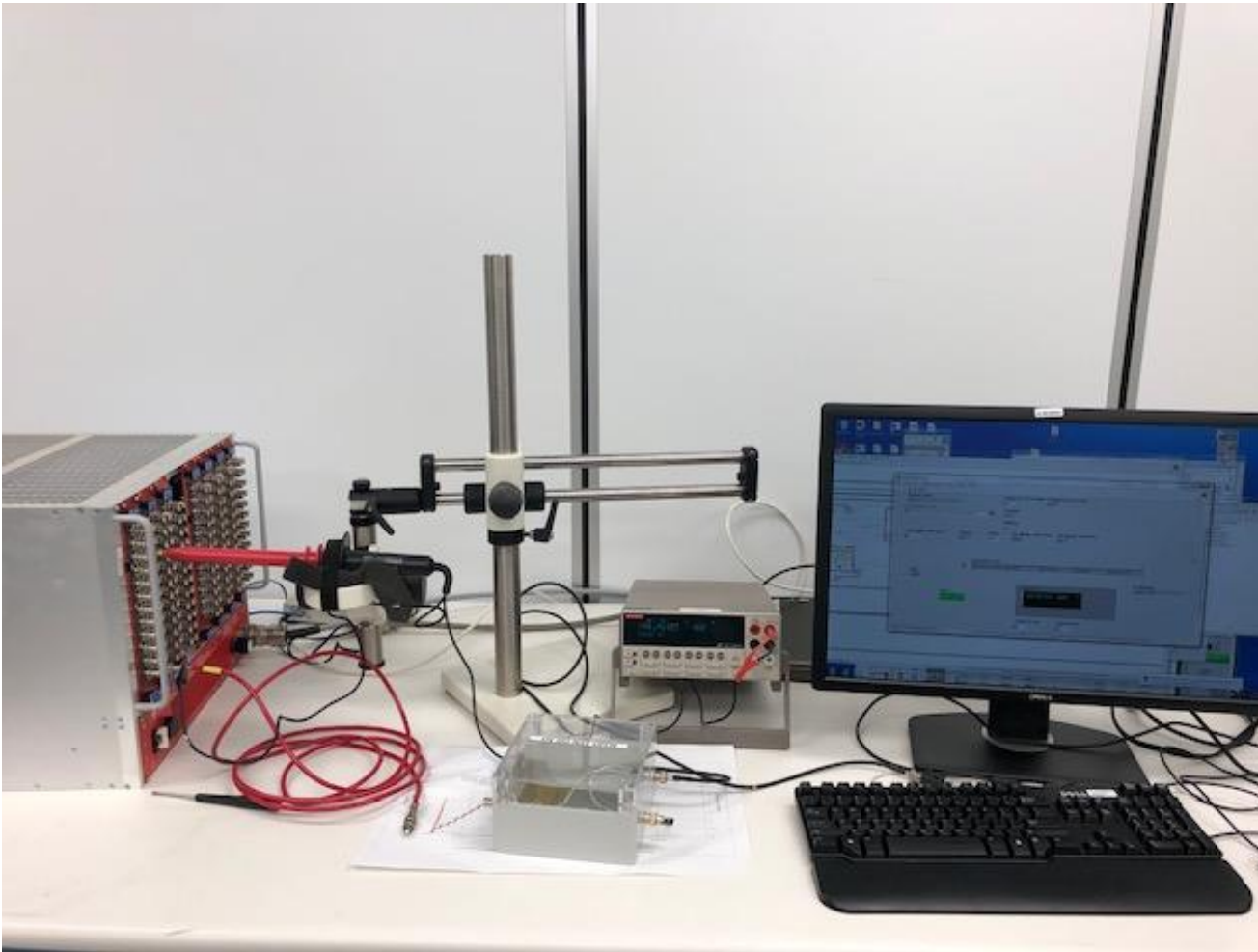
Table 1 – Channel characteristics of the Mod. A7435 / AG7435 HV Board

<b>Output Voltage</b>	0÷3.5 kV
<b>Polarity</b>	Positive / Negative depending on purchased version
<b>Max. Output Current</b>	dual range: High Power: 3.5 mA High Resolution: 350µA
<b>Voltage Set/Monitor Resolution</b>	5 mV
<b>Current Monitor Resolution</b>	High Power: 10 nA High Resolution: 1 nA
<b>Current Set Resolution</b>	10 nA
<b>VMAX hardware</b>	0÷3.5 kV common for all the board channels
<b>VMAX hardware accuracy</b>	± 1% of FSR
<b>VMAX software</b>	0÷3.5 kV settable for each channel
<b>VMAX software resolution</b>	1 V
<b>IMAX hardware</b>	0÷3.5 mA common for all the board channels
<b>IMAX hardware accuracy</b>	± 1% of FSR
<b>Ramp Up/Down</b>	1÷500 Volt/sec, 1 Volt/sec step settable for each channel
<b>Voltage Ripple</b>	< 15 mVpp typical
<b>Voltage Monitor vs. Output Voltage Accuracy</b>	typical: ± 0.3% ± 0.2 V max: ± 0.3% ± 1 V
<b>Voltage Set vs. Output Voltage Accuracy</b>	typical: ± 0.3% ± 0.2 V max: ± 0.3% ± 1 V
<b>Current Monitor vs. Output Current Accuracy</b>	High Power: typical: ± 1% ± 500 nA; max: ± 1% ± 5 µA High Resolution: typical: ± 1% ± 100 nA; max: ± 1% ± 1 µA
<b>Maximum output power</b>	9W per channel (software safety limit)

# Test equipment specs and Software info

- Keithley 1600A HV Probe is used to make initial measurements.
  - HV output to probe output ratio is 1000:1.
  - Specified measurement accuracy is 1%.
- Keithley 2001 multimeter is used to acquire measurements.
  - Resolution is set to 10  $\mu$ V.
- Voltage, dwell time, readback, and data storage is handled by LabVIEW software.

# Test Stand Configuration: Voltage Verification



## Components:

- CAEN SY4527
- Keithley 1600A HV Probe
- Keithley 2001 Bench Multimeter
- PC Running LabVIEW 18