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.
Initial measurements confirm specification for output voltage $V_{\text{meas}}$ vs. $V_{\text{set}}$.

Initial measurements confirm maximum specification for $V_{\text{meas}}$ vs. $V_{\text{mon}}$.
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>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage</td>
<td>0±3.5 kV</td>
</tr>
<tr>
<td>Polarity</td>
<td>Positive / Negative depending on purchased version</td>
</tr>
<tr>
<td>Max. Output Current</td>
<td>Dual range: High Power: 3.5 mA; High Resolution: 350 μA</td>
</tr>
<tr>
<td>Voltage Set/Monitor Resolution</td>
<td>5 mV</td>
</tr>
<tr>
<td>Current Monitor Resolution</td>
<td>High Power: 10 nA; High Resolution: 1 nA</td>
</tr>
<tr>
<td>Current Set Resolution</td>
<td>10 nA</td>
</tr>
<tr>
<td>VMAX hardware</td>
<td>0±3.5 kV common for all the board channels</td>
</tr>
<tr>
<td>VMAX hardware accuracy</td>
<td>± 1% of FSR</td>
</tr>
<tr>
<td>VMAX software</td>
<td>0±3.5 kV settable for each channel</td>
</tr>
<tr>
<td>VMAX software resolution</td>
<td>1 V</td>
</tr>
<tr>
<td>IMAX hardware</td>
<td>0±3.5 mA common for all the board channels</td>
</tr>
<tr>
<td>IMAX hardware accuracy</td>
<td>± 1% of FSR</td>
</tr>
<tr>
<td>Ramp Up/Down</td>
<td>1±500 Volt/sec, 1 Volt/sec step settable for each channel</td>
</tr>
<tr>
<td>Voltage Ripple</td>
<td>&lt; 15 mVpp typical</td>
</tr>
<tr>
<td>Voltage Monitor vs. Output Voltage Accuracy</td>
<td>typical: ± 0.3%± 0.2 V max: ± 0.3%± 1 V</td>
</tr>
<tr>
<td>Voltage Set vs. Output Voltage Accuracy</td>
<td>typical: ± 0.3%± 0.2 V max: ± 0.3%± 1 V</td>
</tr>
<tr>
<td>Current Monitor vs. Output Current Accuracy</td>
<td>High Power: typical: ± 1%± 500 nA; max: ± 1%± 5 μA; High Resolution: typical: ± 1%± 100 nA; max: ± 1%± 1 μA</td>
</tr>
<tr>
<td>Maximum output power</td>
<td>9W per channel (software safety limit)</td>
</tr>
</tbody>
</table>
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 µV.
- 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