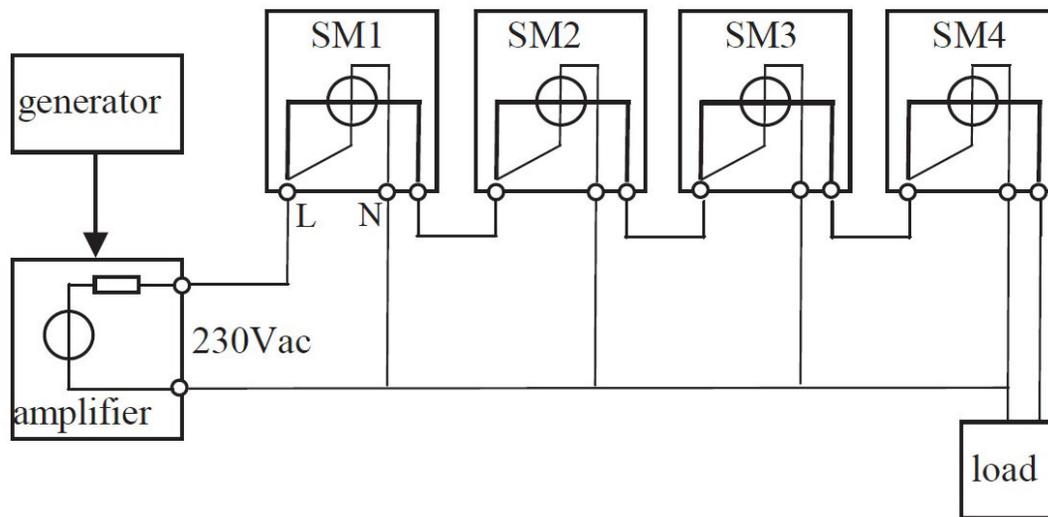


### NEMA Comments on the University Of Twente Electronic Meter Tests

Having reviewed various documents and articles about the Twente University Electronic Meter Tests ('The report'), below are listed some observations. Hopefully, this will provide some points to be utilized in developing a response to the report that will mitigate any concerns that may be brought about by any consumers who may consider the results from that test.

\* The test connection was such that the meters received their voltage signal inputs from the meters before them. The neutral connection was independent for each meter, but the voltage signal relied on the previous meter in series.



\* With the style meter that was tested, the current (A) is also flowing through the meter's voltage signal input, thus negatively influencing the outcome of the test

\* The electromechanical meters used for reference are likely not capable of accounting for the high-frequency harmonics produced from the test loads. Additionally, they were rated (30 A) for loads lower than the static meters they were compared to and were subject to peak currents more than 30 A. This is not an adequate measurement reference system

\* Some of the meters manufactured by NEMA members utilize separate voltage and current inputs in their operation, while others are self-contained with combined voltage and current inputs.

\* The report claims that meters using either Hall effect sensors or Rogowski coils as their internal source of signal acquisition (current sensing) experienced greater accuracy deviations, but made no comment as to the application of the sensor type, implying that all meters with these sensor types are suspect. This claim is false. Meters with well-developed Hall Effect and Rogowski coil current sensors perform well in the presence of harmonics.

\* The report claimed that meters with shunts or CTs experienced lesser accuracy deviations, but again, no comment is made as to the appropriate application of the sensor type. Note that the CTs were internal to the meter and not an external signal source.

\* Non-dimmable CFL and LED lamps were utilized as the meter test load. This was stated as a possible valid load condition because the consumer may use these types of lamps with a dimmer even though they were not designed to be used as such. This scenario is highly unlikely to be seen in reality. The

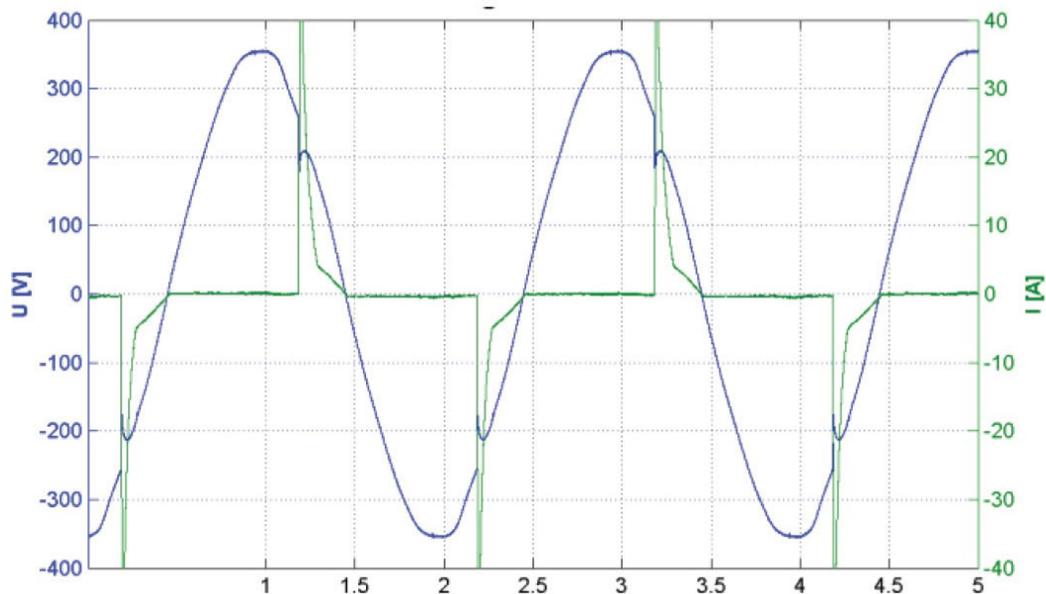
performance of said lights dimmed in this manner would be so poor as to render the problem self-evident, and thus likely to be corrected quickly.

\* In the test, 20 LED lamps and 30 CFL lamps were utilized. It is doubtful that a consumer would create this scenario, where 50 lamps in residence were all dimmed to very low levels using a single dimmer at the same time.

\* The poorest accuracy results showed up under the lowest dimmer setting.

\* The current (A) during the poorest results was very low.

\* The report stated that the worst accuracy occurred when the lamps were all dimmed, and an 1800 W resistive load (a heating element perhaps) was also included. Heating elements are not connected through nor controlled by light dimmers. This concept is way outside of the norm and exceeds the approved watt rating of a standard dimmer switch by 300 %.)



*Fig.5: Voltage and current, for heater, CFL and LED as load, dimmer at 135°*

\* The dimmer switches available for use in homes are typically rated at 600 W, which equates to a steady 5 A load. The current peak shown in fig. 5 is eight (8) times the expected value for a standard dimmer switch.

\* The Spitzenberger & Spies PAS 5000 power supply used in the test process is a 5KVA unit. This would place its designed output at 240 V to be around 20 A, which appears to affect the voltage by the 40 A peak shown in fig. 5, thus negatively influencing the outcome of the experiment.

\* The tested meters were those used by the utility providers in the Netherlands, not meters that were directly designed for metering applications in North America.

## CONCLUSION

The worst results were with the LED and CFL lamps on the dimmer at its very low setting. Considering that the total lamp load is 600 W, and perhaps the dimmer reduces that to 60 W, this is a very low load -- as monitored by a typical kWh meter utilized in North American applications.

Residential service is commonly served by a 240 V, 200 A meter. The meter at full load would address 48,000 W. With this in mind, the load that performed poorly during the testing is at 0.125 % of the meter's rating. This is significantly below a meter's test requirement of 1 % to 100 % loading accuracy.

The report describes a "beyond worst case" experiment with conditions designed to cause the specific types of meters being tested to perform well below their rated accuracy.

\* The test conditions utilized in the experiment would not be expected to be duplicated in any homes in the U.S.—or anywhere else very likely.