Keithley donation to Oregon State University Solar Vehicle Team boosts power by 50 percent

Keithley Instruments, Inc. is helping the electrical engineers of tomorrow characterize photovoltaic devices accurately and efficiently. Oregon State University's Solar Vehicle Team (OSUSVT) has been putting the company's donated Model 2440 5A SourceMeter instrument to work in analyzing and troubleshooting mono-crystalline silicon solar modules. These modules are powering the Phoenix, the solar race car in which the team competed in the 2012 American Solar Challenge, held July 14-21. The donated instrument has already helped the team boost the power output of this year's vehicle by 50 percent over last year's. The Phoenix finished in sixth place in the American Solar Challenge and in fifth place in the Formula Sun Grand Prix.

The team, made up of students, staff, and faculty members, has developed a soldering, testing, and laminating procedure to produce slightly flexible, lightweight solar modules based on mono-crystalline solar cells. To maximize vehicle performance, the team requires parametric data on each of the solar modules they construct in order to arrange the sub-arrays on the car in the most efficient manner. The Keithley Model 2440 SourceMeter instrument, acquired through a donation arranged between OSU's Kathy Han and Chuck Cimino, one of the company's marketing directors, is used to characterize each module's overall power output and maximum power point current using an I-V curve tracing technique. The Model 2440 allows students to gather accurate data on the performance of each module quickly and simplifies making side-by-side comparisons. Each solar module is characterized both before and after lamination and the data obtained is used in troubleshooting problems such as shorted cells and cracked cells. In addition, this data was employed in current matching in the sub-arrays, as well in projecting the output of the vehicle's entire solar array.

Kathy Han, the OSUSVT manager and lead for the body and co-lead for the solar module team, notes, "The Model 2440 allows us to obtain accurate I-V curve data on all our solar modules consistently and easily both before and after lamination. The data we obtained on maximum power output, open-current voltage, short-circuit current, maximum voltage, and maximum current let us detect problems like shorted and cracked cells, as well as to determine the best sub-array location for each module to maximize overall power output or to reject a module outright. Before we had access to the Model 2440, we had problems with one of our previous solar arrays that used solar cells that had been laser-cut from the front side, which we now know produces some melting of the p/n junction. This caused internal shorts and increased internal resistance in the cells. The Model 2440 made it possible to detect problems that simply weren't detectable before and to match solar cells better. Because of Keithley's generous donation, this year's vehicle has 50 percent higher power output (900W instead of 600W) than last year's."

Keithley's Cimino explains, "The Model 2440 SourceMeter instrument is part of Keithley's Series 2400 line of source measurement units (SMUs), and is capable of sourcing and measuring up to 40V and 5A. Series 2400 instruments are optimized for test applications that demand tightly coupled sourcing and measurement, like the OSU's Solar Vehicle Team's. We were delighted to be asked to participate in their pursuit of the American Solar Challenge by making the SMU available for their use. We've also donated similar instrumentation to other college solar vehicle teams in previous years because of our long term commitment to supporting the development of the next generation of innovative and well trained electrical engineers and scientists."

All seven models in the Series 2400 SourceMeter line provide precision voltage and current sourcing as well as measurement capabilities. Each is both a highly stable DC power source and a true instrument-grade 6-1/2-digit multimeter. The power source characteristics include low noise, high precision, and flexible voltage, current and resistance readback. The multimeter capabilities include high repeatability and low noise signal conditioning and A-D conversion. The result is a compact, single-channel, DC parametric tester. In operation, these instruments can act as a voltage source, a current source, a voltage meter, a current meter, and an ohmmeter. By linking source and measurement circuitry in a single unit, these instruments minimize the time required for test station development, setup, and maintenance, while lowering the overall cost of system ownership. They also simplify the test process itself by eliminating many of the complex synchronization and connection issues associated with using multiple instruments.