Solar Panel Testing - An Automated Approach to Electrical Safety Testing of Photovoltaic Modules

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Manufacturers of photovoltaic (PV) modules must ensure that their devices have been tested and certified by a nationally recognized laboratory for compliance with the applicable UL/IEC standards. In addition to a third party certification, evidence of electrical safety testing is required on a 100% basis for the production of solar panels. Selecting the proper electrical safety compliance analyzer and associated test automation software is key to obtaining maximum test throughput while ensuring the highest level of product quality.

By its very nature, the design of a solar panel is a large flat surface with a relatively high internal capacitance. The capacitance of a PV module acts a battery that must be charged when elevating the panel to a high voltage during DC voltage withstand (DCW) testing. The Vitrek 950i Series Compliance Analyzers can charge a PV module with a test current of up to 50mA, allowing it to ramp the test voltage five times faster than typical hipot testers - which provides a substantial time savings.

During the dwell segment of the DCW test, the applied voltage is held at a constant level (normally between 1200 and 2100 VDC) and the leakage current is measured to insure the safety of the electrical insulation and also determine the quality of the dielectric substrate. For the sake of test speed and product quality, it is imperative that the tester has the capability to use a high current limit during ramp (up to 50mA) and a very low current limit during the dwell (as low as 100 nano-amps up to several micro-amps). The advantage of testing to lower current limits is to ensure quality and efficiency - a leaky substrate equates to a less efficient, lower quality solar panel. If you are running tests at more than one dwell voltage, such as a 500VDC insulation resistance (IR) test followed by a 1500VDC DCW test - the Vitrek 950i Series Compliance Analyzers have the unique capability to ramp from one test to the next test without returning to 0V in between, saving time and increasing test throughput.

Following the dwell portion of the DCW test, the tester needs to discharge the PV module down to a safe voltage level. The 950 Series is uniquely suited accomplish this task, with the assistance of a solid-state discharge circuit that rapidly and safely drains the charge off of the panel in a constant current mode providing additional time savings as compared to other testers which use passive bleed resistors to remove the charge.

If the panel contains a protective earth ground lead, then it may be necessary to make a low resistance measurement from this lead to the conducive frame of the panel (typically resistance limit is 100 milli-ohms maximum). The 4-wire milli-ohmmeter built into each 950i series tester is an ideal function for this measurement or high current ground bond test capability (up to 40A) is also available on several models.

The 950 series testers store 100 test sequences of up to 100 steps each for convenient front panel operation. Stored tests can be run automatically with the touch of a button or an even higher level of automation can be achieved with the use of Vitrek's Quicktest Pro - Test Automation Software which includes an easy to use graphical environment for test sequence development and electronic data storage of all test results. Test result data files can be exported for archival purposes or SPC analysis.

So whether you are testing to UL1703 or IEC 61646, doing dry testing with a foil wrapped frame or wet testing in a detergent based surfactant liquid tank - the 950 Series Electrical Safety Compliance Analyzers have been designed from the ground up to test solar panels and PV modules faster and better than ordinary hipot testers. Contact Vitrek for technical assistance in designing your automated electrical safety test system.

Summary of 950 Features and Benefits in Solar Panel test applications:

50mA Constant Current Charge Mode - Allows 950 to ramp 5 times faster than ordinary testers
100 Pico-Amp Leakage Current Resolution - Tests leakage at lower levels for higher PV panel quality
Multiple Current Limits - Promotes fast ramp and precision low leakage dwell tests
Test to Test Ramping - Permits testing a multiple dwell voltages without returning to 0V
Constant Current Solid-State Discharge technology - Faster than bleed resistor discharge units
Insulation Resistance Measurement to 4 Tera-ohms - Tests in leakage current or IR units
Built in 4-Wire Milli-ohmmeter - Precision low resistance measurement
Available 40A Ground Bond - Meets high current protective earth test requirements
High Speed Ultra Sensitive Arc Detection - Capable of detecting insulation failure before catastrophic damage
LAN, RS232, PLC and GPIB Interfaces - Select the I/O best suited for your needs
Quicktest Pro Test Automation Software - Easy graphic test environment, electronic results storage
Made in the USA - Quality built and backed by a 3 year extended warranty