

## How to Perform / Issues Performing the Insulation Resistance Measurement with the PV200 / PV210 or PV150

The following document is intended to be a troubleshooting guide to ensure you are setting up your Seaward instrument in the correct manner. Please check all aspects of this before contacting the technical support helpline.

- Please register your Seaward product at <http://www.seaward.co.uk/userfiles/register-product/select-product.php> to activate your warranty, receive support and other benefits.

### Background information on Insulation Resistance Measurement

According standard **IEC 62446-1:2016** there are two methods used to perform the Insulation Resistance measurement on PV systems (please reference the standard for full details);

- "Method 1: Test between array negative and earth followed by a test between array positive and earth."
- "Method 2: Test between earth and short circuited array positive and negative."

In addition;

- "Where the structure/frame is bonded to earth, the earth connection may be to any suitable earth connection or to the array frame (where the array frame is used, ensure a good contact and that there is continuity over the whole metallic frame)."
- "For systems where the array frame is not bonded to earth (e.g. where there is a class II installation) a commissioning engineer may choose to do two tests: i) between array cables and earth and an additional test ii) between array cables and frame."

### Issues that can occur when performing the Insulation Resistance Measurement;

#### 1) Auto Sequence Measurement on the PV200 / PV210 / PV150;

- Using the Auto Sequence Measurement, the positive and negative connections are linked together and the insulation resistance measurement is between these and ground - therefore you do not actually place the test voltage across the module connections (positive and negative). You do, however, need to perform this test with reference to ground, this is why the red 4mm test probe is also required.

#### 2) Grounded systems;

- Note; If either DC pole is bonded to ground, you cannot measure the insulation resistance between two points that are shorted together.
- To successfully perform an Insulation Resistance Measurement, on a bonded system, the bonding from this leg needs to be removed.

## Application Note 0084

### 3) Low Insulation Resistance Reading – System Capacitance;

- For safety reasons, the output on all insulation testers is current limited. If a circuit with capacitance is connected to the output terminals of the tester it will start to charge the capacitance. The rate at which it charges the capacitance is limited by the fact that the output is current limited.
- Initially, the tester output current is high and the voltage is low because the initially discharged capacitance behaves like a short circuit or very low resistance. The insulation tester sees a very low resistance between its terminals.
- As the capacitance charges, the voltage rises exponentially and the current falls exponentially - the insulation tester sees an exponentially rising resistance.
- The time constant, which depends on the capacitance, could be tens of seconds so during a 1s insulation test (as is the case with the PV150) the resistance will only reach a fraction of its final value. During say a 30s test, the insulation will reach its final value and so the reading will be considerably greater than the PV150 value. The point to point measurement on the PV200 / PV210 allows the user to perform a continuous test for their chosen duration.
- The larger the PV system, the more cabling there will be, the more surface area for moisture to ingress and the greater the parasitic capacitance. This is why low apparent insulation is more prevalent on large systems.

## Performing an Insulation Resistance Measurement with the PV200 / PV210, Method 1: (Probe to Probe)

**Note:** For full instructions, see the PV200 / PV210 manual.

- 1) Connect the red and black 4mm test leads to the PV200 / PV210.
- 2) Connect the test probes to the circuit under test.
- 3) Use  to select 250V, 500V or 1000V insulation test voltage.
- 4) To make a **2s measurement**, press and release .
- 5) The resistance between the test probes is displayed.
- 6) To make a **continuous measurement**, press and hold  for 3s until the lock icon appears on the PV200 / PV210.
- 7) Press  to terminate the continuous measurement mode.
- 8) The resistance between the test probes is displayed.
- 9) Press  to save all data shown on the display.



## Application Note 0084

**Note 1:** Always ensure that the circuit under test is electrically isolated from the mains supply.

**Note 2:** If the test probes are connected to a voltage  $>30V$  the measured voltage will be displayed on the LCD, the Riso measurement function will be disabled.

**Note 3:** Do not connect the PV200 / PV210 to a voltage source while performing the resistance measurement as this will blow the fuse located in the battery compartment.

**Note 4:** The Point to Point Insulation measurement cannot be stored in memory with the Automatic test sequence. Point to Point Insulation measurements are stored in records that only record the Insulation measurement.

## Performing an Insulation Resistance Measurement with the PV200 / PV210, Method 2: (Auto Test Sequence)

**Note:** For full instructions, see the PV200 / PV210 manual.

- 1) Connect the PV200 / PV210 to the PV module as shown, using the PV test lead adaptors.

- 2) Use  to select the required test sequence.
- 3) Use  to select 250V, 500V or 1000V insulation test voltage.
- 4) Press  to start the test sequence.
- 5) When the test sequence is complete the display will show Store?  
Press  to save all data shown on the display.



**Note 1:** Always ensure that the circuit under test is electrically isolated from the mains supply.

**Note 2:** The red test probe must be connected to earth/ground to measure insulation resistance.

**Note 3:** All test leads must be securely attached to the PV system under test. Always use the solar PV connectors supplied or alligator clips to connect test leads to the PV system under test. Test probes without alligator clips must not be used.

**Note 4:** Never disconnect the test leads whilst any measurement is active. This may result in electrical arcing and may damage the PV200 / PV210.

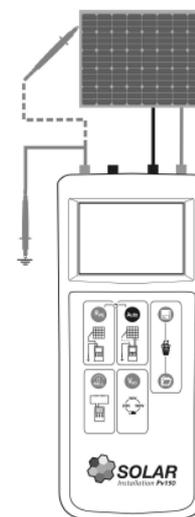
**Note 5:** Due to the high input impedance of the red 4mm test terminal, voltage caused by leakage currents may be measured prior to starting a test.

## Application Note 0084

## Performing an Insulation Resistance Measurement with the PV150, (Auto Test Sequence)

**Note:** For full instructions, see the PV150 manual.

- 1) Connect the PV150 to the PV module as shown, using the PV test lead adaptors.
- 2) The open circuit voltage (Voc) is automatically displayed on the PV150.
- 3) If the voltage polarity is incorrect the reversed polarity icon will appear on the PV150. The auto test sequence is inhibited if the polarity is reversed.
- 4) Use  to select 250V, 500V or 1000V insulation test voltage.
- 5) Press  to automatically measure Short Circuit Current and Insulation Resistance.
- 6) When the test sequence is complete the display will show Store?  
Press  to save all data shown on the display.



**Note 1:** Always ensure that the circuit under test is electrically isolated from the mains supply.

**Note 2:** The red test probe must be connected to earth/ground to measure insulation resistance.

**Note 3:** All test leads must be securely attached to the PV system under test. Always use the solar PV connectors supplied or alligator clips to connect test leads to the PV system under test. Test probes without alligator clips must not be used.

**Note 4:** Never disconnect the test leads whilst any measurement is active. This may result in electrical arcing and may damage the PV150.

**Note 5:** If the DC polarity is incorrect or the voltage is <5V or >1000V the Auto Test will be inhibited until the problem is corrected.