Solar Cell Based Sunlight Radiation Meter

Nvis 591

Features

- Microcontroller based measurement
- Low power consumption and 5V operating voltage
- Water and dust proof sensor casing
- Light weight design with dedicated connector for easy to carry
- 1meter long cable with handheld display device

Technical Specifications

- Detection Range 0 to 1000w/m
- Operating voltage: 5V
- 16x2 LCD output
- Sensor connector -DIN type

Introduction

Use of Solar cell for global solar irradiation measurements

Pyranometers are expensive and not easily available. Therefore in order to measure the global solar irradiation a solar cell can be used.

It is known fact that the current output of solar cells is a linear function of solar irradiation. Also, the current output of solar cell does not depend strongly on the temperature of the solar cell. Therefore solar cell current can be used as a measure of solar irradiation at a given time.

Cell current Solar Irradiation α Solar Irradiation

or

Solar Irradiation (W/m^2) = K * Cell current (Amp)

Here K is the proportionality constant.

Normally solar cells in short circuit mode are used for measurement of solar irradiation. A calibrated solar cell (Figure 5) is provided with the laboratory kit of '1000 teachers training program'. This solar cell is calibrated against the Pyranometer.

Calibrated solar cell

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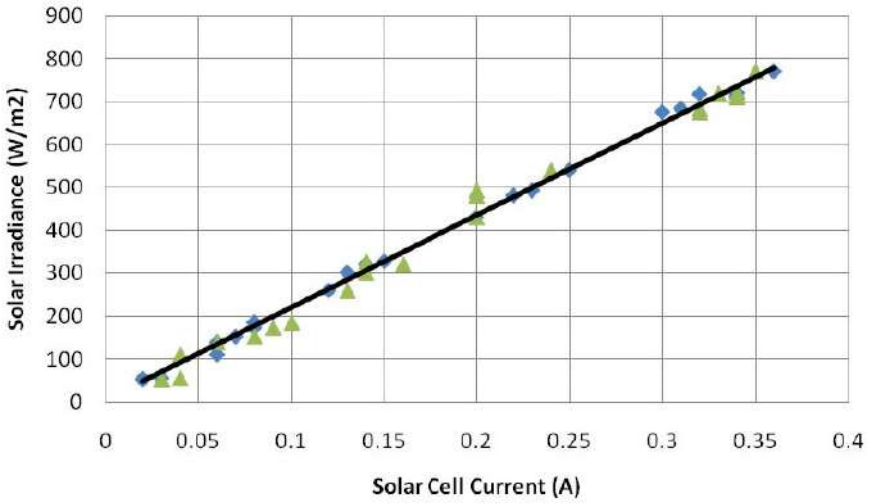
Note here the Pyranometer provides instantaneous value of global solar irradiation on horizontal plane.

The solar cell used for the irradiation measurement is a mono-crystalline Si cell of 4 x 4 cm^2 area.

The measured value of short circuit current (Amp) and Pyranometer readings (W/m2) is plotted in Figure 6. From Figure 6 once can notice the linear relationship between short circuit current of solar cell and global solar irradiation on horizontal plane. From the slope of the linear fit, one can obtain the proportionality constant between solar irradiation and cells short circuit current. The value of K obtained from Figure 6 is 2175. In this we can write the following relationship for global solar irradiation and solar cell current.

Solar Irradiation (W / m^2) = 2175*Cell current(Amp)



Measurement of solar cell current with measured value of solar irradiation using a pyranometer

How to measure solar irradiation (W/m^2) from calibrated solar cell

Step 1 : At any instance, measure the short circuit current of the solar cell by keeping the solar cell on a horizontal surface.

One can also measure the solar irradiation not only horizontal plane, for at any other plane. For instance when PV modules are installed at an angle, we need to measure the solar irradiation at the same tilted plane in which solar PV modules are installed. In this case the calibrated solar cell should also be installed in the same plane.

Step 2 : Multiply the value of short circuit current (in Amps) obtained with 2175. This will give the value of radiation in Watt/m^2 in a plane where calibrated solar cell is installed.

Check yourself. Measure the value of short circuit current of solar cell provided to you and multiply with the constant 2175 and calculates the value of global solar irradiation at that particular time (in the plane of installation of solar cells). Comment if the measured value of solar irradiation is per expectation or now.

Note 1 : Please note here that current output of this solar cell is linear function of solar irradiation.

Particularly for solar irradiation of more than 200 W/m^2, the accuracy of irradiation measurements is within 10%. For the lower than 200 W/m2 solar irradiation the accuracy was within 25%.

Note 2 : The constant multiplying factor used in this case, that is 2175, is only valid for the solar cell provided with the laboratory kit. If you wish to use any other cell for measuring global solar radiation, you will have to calibrate your cell against Pyranometer.

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Operating Instructions

- Connect the Solar Cell Based sensor DIN Cable connector to meter connector as shown in the figure below.

- Connect 5V DC adapter to Mains Socket and Switch on the Mains Plug.
- Connect the DC adaptor pin to the meter as shown in the figure.

- Switch on the Power by toggle switch .
- Place the Solar Cell Based Sunlight Radiation Meter in a flat surface and the reading will be shown on the LCD Display.

Subject to change - Version 2.0

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