

A Device for Evaluating Photovoltaic (PV) Module Output Performance and Degradation



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Abstract This paper aims to design and develop a system that can extract the PV module Standard Test Condition (STC) parameters of a PV module under real operating conditions (ROC) using Arduino Board Technology. The system captures the voltage and current under ROC and by applying reverse calculation to get the STC parameters. Then the power degradation of the PV module is calculated by comparing the calculated power at STC with the actual power stated in the data specification. Based on experimental results showed that the developed system was able to identify the power degradation almost equal to the actual power degradation. 5.04% of the power degradation was obtained from the tested PV module.

Keywords PV module · Degradation · Standard test condition · Real operating condition

1 Introduction

Over the previous several decades, global energy demand has risen considerably and forecast a further increase in the coming years. Therefore, photovoltaic (PV) plants are increasingly being built on a big scale and are continuing to expand [1]. Nowadays, the main issue facing the world is to improve the effectiveness of the PV scheme as most solar cells can only convert to electrical electricity from 15 to 25% of the available electricity. Due to many inner variables owing to components used in production as well as external and environmental variables such as wind, dust, moisture, and others the effectiveness of solar cells is impacted [2]. Different improvements have been implemented in recent years by evaluating a PV system's performance information under varying conditions and it still needs to be greatly enhanced. Most of it is manually calculated where they need to know the real operating condition (ROC) parameters of their module first before calculating the standard test condition (STC) parameters. Besides that, no device can determine the degradation of a PV module.

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