شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومـــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
ELECTRICAL POWER & MACHINES ENG. DEPT.

DESIGN AND MODERNIZING TESTING EQUIPMENT FOR PHOTOVOLTAIC PANELS

By

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A Thesis Submitted to Electrical Power and Machines Department of Ain Shams University for the Award of Doctor of Philosophy Degree in Electrical Engineering (Power and Machines)

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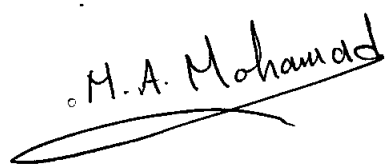
4- Prof. Dr. Mansour A. Mohamad Solar Energy Dept. National Research Center Supervisor	

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α	The temperature coefficient for voltage modification	
η_{max}	The PV array maximum efficiency	
τ	The time constant	s
$\tau_{charging}$	The time constant of charging the capacitor	s
$\tau_{Discharging}$	The time constant of discharging the capacitor	s
λ	The light wave length	m

ABSTRACT

There are currently many thousands of small stand alone photovoltaic systems operating through out the world for power applications. They range in size from a few watts to several tens of kilowatts. Due to the increasing importance and spread of photovoltaic systems and to increase the life time of these systems; a modified equipment is designed, constructed, and implemented to measure the I-V characteristics of PV generators in the field. The equipment can measure the characteristics of PV generators in the range of 30 W (one PV module) up to 16 kW PV array without any problem. It uses a developed electronic load to get more accurate data for the PV generator under test.

The electronic load depends on the use of 16 MOSFET power transistors; enhancement type that have unique characteristics and capabilities not offered by bipolar power transistors. The MOSFET power transistors are controlled by a gate-source voltage rather than base current which means that their driving circuits can be simplified. All the transistors are connected in parallel to decrease the drain to source on state resistance that affects on the short circuit current measurements, also the current of large PV arrays can be shared among them. All the transistors are operating together at the same instant to represent the electronic load. The time of measurements is less than 6 ms that is a very short time and is suitable for the measurements of PV systems under field conditions. The system is designed to use only one transistor during the measurements of the characteristics of PV generators less than 1 kW while it uses 8 transistors for measuring the characteristics of PV generators of sizes between 1 kW and 8 kW. The measuring system is tested by using it in the measurement of I-V characteristics of different sizes of PV generators. To ensure the good performance of the developed electronic load, the measured I-V characteristic of a PV generator is compared with the calculated I-V characteristics of that PV generator using the solar cell model. A good matching is achieved between the measured and calculated I-V characteristics.

The developed electronic load is used in detecting the common faults that occur in PV systems such as short circuit faults and partial shadowing. These types of faults don' t only affect the operation and performance of PV generators but they may lead to a large damage in these PV generators. When only one module is short circuited in a PV array consisting of two parallel strings each of three modules connected in series, the maximum output power of the

PV generator is decreased by 29.3 %. When two modules in the same string are short circuited, the maximum output power is decreased by 51.2 %. When 30 % of one module in the same PV generator is shaded, the PV array lost about 34.45 % from its maximum output power and the same result is obtained when the percentage of shading is increased to 60 % from the module area. It is noticed during these experiments that these types of faults don't affect on the short circuit current or open circuit voltage of PV generators but they have a large effect on the fill factor and consequently on the maximum output generated power from PV generators. Also it has been shown that these faults change the voltage at which maximum power takes place.

KEYWORDS

PV panels; I-V characteristics; Field conditions; Electronic load; Power MOSFET; PV Faults; Short Circuit fault; Partial shadowing;

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