

Abstract

Global warming is one of the major world problems. In addition, the most important fossil fuels, e.g. oil, are disappearing. A sustainable alternative is a solar energy which has been growing significantly for generating electricity. However, to improve the efficiency and quality of power supply, solar plants have to function flawlessly. Therefore, a surveillance device is required to detect defective and dirty cells so that any damage can be fixed quickly and to guarantee users a constant power supply. Solar Measurement System (SMS) is a surveillance device which has a sensor board, mounted on each solar panel and a central control unit from which information of the modules can be collected. The control unit obtains its supply voltage directly from the mains, whereas the sensor board is supplied from the Photovoltaic (PV)-module. The control unit receives information about current state of each module's voltage from the sensor board. The communication between sensor board and control unit occurs through a power line. Hence, there will be no extra cables needed. The coupling into the power line happens inductively. Data is converted by means of a transceiver. If a module is defective or dirty, a report appears on the control unit display which then shows the identification number of the sensor board for the defective module. This identification number locates the problem. Every few seconds the sensor board measures the voltage of its solar module. Every minute the sensor board sends the average of all voltage measurements to the control unit where it is stored and processed. The control unit calculates the average over all the inputs and the standard deviation. If a voltage value of a panel is 20% higher or lower than the standard deviation and if it has the same value to more than an hour, a problem report will be displayed. With a rotary knob of the control unit, the user can scroll the menu forwards and backwards. The current measurements can be requested and shown on an LCD display. The measurements contain the voltages and power output of a particular string of modules. In addition to the knob, SMS has a relay to send an alarm message. In assistance of Dual in Line (DIL) switches placed on every sensor board, an identification number can be given to the solar modules. The navigation of the menu works well and the menu's structure as well as the whole user interface functions intuitively. Data from the sensor board can be transferred successfully through serial peripheral interface (SPI) onto the power line.

Keywords: surveillance, control unit, sensor, solar plant, solar module, photovoltaic, solar energy, electric energy