

Photovoltaic box variable data acquisition module

Article Overview

A photovoltaic box variable data acquisition module is a system that collects, monitors, and transmits electrical and environmental data from PV modules, inverters, and combiner boxes, often with variable load control for performance testing and real-time monitoring.

Overview

A PV box variable data acquisition module serves as the interface between PV system components and monitoring/control systems, enabling accurate measurement of voltage, current, power, and environmental parameters. These modules are designed for both laboratory testing of PV modules and field deployment in large-scale PV plants. They can handle variable loads, allowing the system to automatically adjust the operating point of PV modules to optimize data collection and performance analysis.

Key Components

- **Sensors:** Voltage, current, temperature, humidity, and irradiance sensors are integrated to capture both electrical and environmental data.
- **Variable Load Control:** Laboratory systems use MOSFET-based variable loads (e.g., IRF250) controlled via microcontrollers like Arduino to adjust current draw and measure PV module performance under different conditions.
- **Data Acquisition Hardware:** ADC channels, Hall effect sensors (e.g., ACS712), and differential amplifiers convert analog signals into digital data for processing.
- **Communication Interfaces:** Modules support multiple protocols including RS485, Ethernet, Wi-Fi, 3G/4G, and fiber optics for real-time data transmission to SCADA or cloud-based monitoring systems.
- **Control and Automation:** Embedded microcontrollers or Linux-based systems manage data acquisition, relay control, inverter start/stop, and remote load regulation.

Functionality

- **Data Collection:** Measures PV module voltage, current, and power, as well as environmental conditions like sunlight and temperature.
- **Variable Load Testing:** Adjusts the load on PV modules to determine maximum power point and efficiency under different operating conditions

Article Content

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Two ATmega328 microcontrollers are utilized for real-time monitoring of PV system's performance data and voltage,

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The multifunctional data acquisition system can be used to measure PV plants with different capacity and configuration. A set of data

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For more information, pricing, or custom solutions, please contact us:

Website: <https://iiss.co.za>

Email: sales@iiss.co.za

Phone: +27 63 174 2895

Address: Unit 8, Innovation Park, 15 Rivonia Road, Sandton, Johannesburg, 2196, South Africa

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