ON-GRID SOLAR ENERGY WITH STORAGE

DL SOLAR-GTS

Modular trainer for the theoretical and practical study of the electric energy generation from photovoltaic panels. With the on-grid solar energy with storage, it is possible to perform experiments to determine the characteristics of a photovoltaic panel, study its on-grid operation with the connection to the mains network and its operation with a grid-tie battery charge controller for storage.

The complete system is supplied with a sun simulation module for indoor use.

TRAINING OBJECTIVES

Solar panel characterization:
- o Measuring solar radiation: Changing the inclination and azimuth of the solar panel
- o Investigating the PV module response to shadow formation
- o Recording the characteristics of the solar modules: Solar Panel Voltage-Irradiation Curve, Solar Panel Current-Irradiation Curve (calculating the inner resistance of the solar panel), Obtaining the solar panel current-voltage curve, Obtaining the solar panel power-voltage curve, Measurement of the voltage and current of the photovoltaic module with overload.

Solar on-grid system:
- o Measuring the electricity delivered to the mains grid
- o Measuring the electricity produced by the solar panel, delivered/taken from the mains grid, and the loading of AC lamps
- o Determining the efficiency of the grid connected inverter
- o Investigating the response of a PV system to a mains failure

TECHNICAL SPECIFICATIONS

- − Inclinable photovoltaic panel, approx. 90W, 12V, complete with a cell for measuring the solar irradiation and a temperature sensor.
- − Sun simulator consisting of halogen lamps to provide energy to the photovoltaic module for indoor use.
- − Multifunction measurement module: solar irradiation (up to 1000 W/m2), solar panel temperature (up to 400°C), 2 DC power meters (65Vdc, 20Adc, 1000W) and 1 AC power meter (512Vac, 20Aac, 1000W).
- − Load management module with three independent single-phase outputs for the dynamic study of different load types.
- − Active DC load used in the renewable energies' laboratories configurable as constant resistance or constant current.
- − Single phase transformer with full-wave rectifier and capacitive filter to power DC load from AC single phase supply.
- − A Grid-tie inverter output at mains voltage, 12V, 300W.

Solar on-grid storage system:
- o Measuring the generated power of a PV system and battery charging.
- o Using Solar Panel and Battery to supply an AC Load.
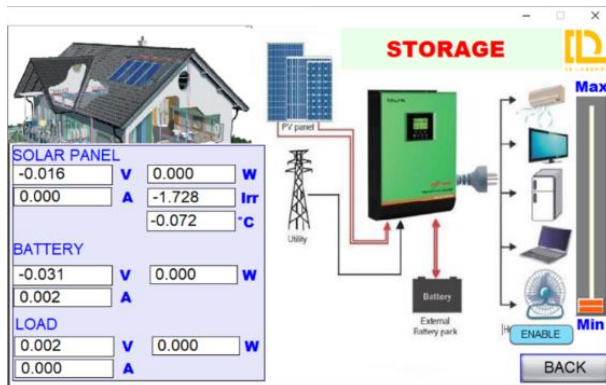
The on-grid solar energy with storage is supplied with a software pre-loaded on the HMI that communicates with the main components of the modular system via RS485 serial communication using Modbus RTU protocol to perform data acquisition and processing.

- – Three-phase power analyser. Measurement of voltages, currents, frequencies, active power, reactive power, apparent power.
- – Inverter charger module used in on grid system to manage the energy stored in the battery, combining with solar & utility charging and AC output. It offers four charging modes including Solar priority, Utility priority, Solar and Utility & Solar and two output modes for Battery and Utility. It utilizes the MPPT technology. Its output is protected against over current and reverse polarity.
- – Single-phase supply at the mains voltage and frequency. Key operated Output: Phase + N + T though 4mm safety terminals, protected with differential magneto-thermal switch.
- – Industrial Human Machine Interface module with 7'' TFT display. It is designed to be used and interfaced with the renewable energies' laboratories instruments and drives, through its communication ports.
- – Variable DC power supply that emulates a photovoltaic panel. The V/I characteristic of the output varies in function of the irradiation setting. Local or remote control via serial communication using Modbus RTU.
- – Three-level frame.