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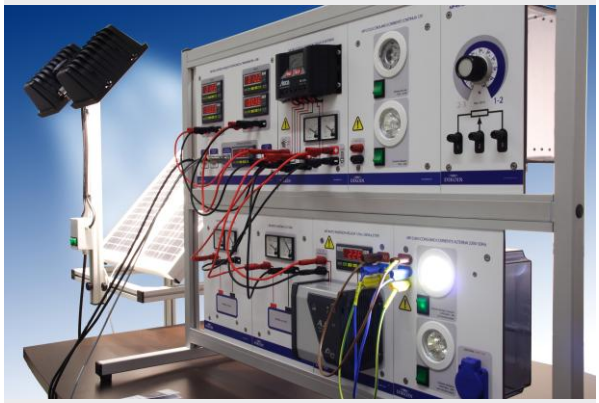
EN 01.4 - STAND ALONE PHOTOVOLTAIC INSTALLATION DEMONSTRATOR



The equipment EN 01.4 is designed like a stand alone photovoltaic solar power plant, with 2 modules and all the elements necessary to complete the installation.

The equipment consists of: 2 photovoltaic panels of 20Wp, 2 batteries, regulator, inverter, pyranometer, different loads in DC and AC, and module of control and data acquisition.

The equipment has measurers of tension and current in the key points of the installation, for a correct interpretation of the student in the operation.

The system works exactly just as the photovoltaic stand alone facilities of electrical generation, that are normally used in boats, caravans, pumping groups, or remote locations where access to the public mains does not exist.

In addition, this equipment allows the connection of the panels and the batteries, in series or in parallel.

EN 01.5 - STAND ALONE AND NETWORK CONNECTED PHOTOVOLTAIC INSTALLATION DEMONSTRATOR

The equipment EN 01.5 reproduces on scale a complete photovoltaic solar installation. The equipment has been designed with special emphasis in the didactic aspect, being able to observe all the components that a photovoltaic solar installation has and its disposition.

It is provided with prepared cables to connect and disconnect the elements of the installation in different ways, being able to observe and analyze the operation of the connected panels in series, parallel, with batteries in series or in parallel, with direct exit in DC or AC, working standalone or connected to the network.

The equipment is provided with measurement elements of the variables necessary to analyze the characteristics of the panels and their behavior. Also, it has a pyranometer that indicates the intensity of solar radiation that affect the panels, with measurers of tension and current to show to the generated voltage and the intensity.

It also has measurers of tension and current in each one of the batteries to indicate the state of these and the direction of the current, if they are being loaded or contributing load, and it also has measurement instrument that provides all the characteristics of the obtained alternating current after the standalone inverter.

The grid connected inverter has a software where the parameters of generation can be observed. To feed the grid connected inverter, there are 3 panel simulators, with power regulation and tension and current measurers.

EN 01.6 - COMPUTERIZED PHOTOVOLTAIC INSTALLATION DEMONSTRATOR

The EN 01.6 equipment scales a complete photovoltaic solar system. It has been designed with special emphasis on the didactic aspect of the same, being able to observe at a glance all the components that a solar photovoltaic installation has and its arrangement. It allows the study, of both isolated photovoltaic solar energy installations and grid connection.

The equipment consists of: 2 photovoltaic panels of 20Wp, 2 batteries, regulator, insulated inverter, grid inverter, solar panel emulator, pyranometer, temperature sensors in panels, various DC and AC loads, and module control and data acquisition.

It has cables ready to connect and disconnect the various elements of the installation in different ways, being able to observe and analyze the operation of the panels connected independently, in series, in parallel, with batteries in series or in parallel, with direct output in Direct current or direct current to AC converter, working in isle or connected to the grid.

It is provided with elements of measurement of the variables necessary to analyze the characteristics of the panels and their behavior. Thus, it has a pyranometer that indicates the intensity of radiation that affects the panels, with voltmeters and ammeters that show us respectively the voltage and the intensity generated.

It also has ammeter and voltmeter in each of the batteries to indicate the state of these and the direction of flow of the current in them, that is to say if they are loading or providing load, and also has a measuring instrument that provides us all the characteristics of the alternating current obtained after the inverter.

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EN 04.1 - WINDMILL TEST-BENCH

The Windmill Test-bench (EN 04.1), is configured like a wind tunnel of 2 meters length designed to work with windmills of less or equal to 600mm diameter. The equipment has a 600 mm windmill included, which has a torque and rotation speed measurement system connected to the computer, to see real time, the behavior of it.

The wind tunnel has a transparent part, so a complete sight of the windmill working is allowed. That part, can also be opened, to facilitate the access and manipulation of the system.

The tunnel has a built-in system for the measurement of the speed of the air by means of electronic pressure transducers, to monitor in real time the speed of the air that the windmill is put under.

The new system also has an electronic control of the pitch, to be modified from the control panel or from the computer.

All the system, is monitored and controlled through a control module, which also can be connected to a computer with a USB port.

EN 04.2 - GRID CONNECTED WINDMILL ENERGY PLANT TRAINER

With the equipment EN 04.2, we emulate the behaviour of a wind turbine in a practical and educational way. An electric motor operates as the turbine on a windmill moving a three-phase synchronous permanent magnet generator, which converts the transmitted mechanical energy to electric energy. The generated electricity is alternating current three-phase, having to be transformed into direct current to feed the inverter, which transforms it into alternating current at an appropriate frequency, in our case 50 Hz, and other necessary features to connect to the network.

The equipment is designed for a very visual and intuitive operation, quickly understand the functioning of the whole system, not just knowing the elements that compose the unit, but also having to connect them through the supplied cables for this purpose. This is achieved by the provision of equipment in modular panels. It also has a computer from which to control the operation of the equipment and get all the necessary variables for system analysis.

EN 04.3 - GRID CONNECTED DC WINDMILL GENERATOR TRAINER

With this equipment the behavior of a windmill is emulated in a practical and didactic way. An electrical motor does the times of the turbine of a windmill to move the DC generator, which transforms the transmitted mechanical energy to the axis into electrical energy.

The generated DC feeds the inverter which transforms this in AC with the suitable frequency, in our case 50 Hz, and other characteristics necessary to be able to connect to the public grid.

The equipment is designed to be very visual and work in an intuitive way, the operation of the set is understood quickly, not only knowing the elements of which it consists, but having also to connect the different modules by means of provided wires.

This is obtained by means of the disposition of the equipment in schematic and connectable panels.

From the computer with touch screen (provided) we can control the operation of the equipment and obtain the reading of all the necessary variables for the analysis of the system.

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EN 04.4 - INSULATED WIND POWER PLANT TRAINER

With the EN 04.4 equipment, we emulated the behavior of a wind turbine in a practical and didactic way. An electric motor acts as the blades and bush of a wind turbine, dragging a three-phase synchronous generator of permanent magnets, which transforms the mechanical energy transmitted to the shaft into electrical energy at the output.

The current generated is alternating three-phase, having to transform into direct current to be able to feed the regulator of charge of batteries and consumptions, and later to the inverter that in turn turns this into alternating current with the appropriate frequency, in our case 50 Hz So that the generated electric energy can be stored in batteries or consumed directly, or also use the stored charge for consumption when is no wind.

The equipment is designed to understood in a very visual and intuitive way quickly the operation of the assembly, not only knowing the elements of which it consists, but having them also to connect by means of the security cables supplied for that purpose. This is achieved by arranging the equipment in schematic and connectable panels.

In addition it counts on a computer from which we control the operation of the equipment and we obtain the reading of all the necessary variables for the analysis of the system.

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