Solar Energy Training Unit



Engineering and Technical Teaching Equipment





INTRODUCTION

The sun provides us a wide spectrum of solar energy. Except for the light that we see around us every day, all of the other types of solar energy are invisible. The other parts of the spectrum consist of cosmic rays, gamma rays, x-rays, infrared, heat and ultraviolet energy. Thermal solar systems convert solar energy into usable thermal energy.

Solar Energy Training Unit, "ESET", allows to demonstrate solar thermal heating of domestic water in an illustrative manner and study all the parameters involved in the solar radiation direct conversion into electricity.









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GENERAL DESCRIPTION

This unit is a system that transforms solar energy into usable thermal and photovoltaic energy.

The power obtained from the solar energy can be regulated to obtain a DC power to charge a battery, studying parameters such as solar module's current output charge level, battery voltage, etc. It also can be delivered to DC loads, studying parameters such as solar module's current output and current consumption by the loads.

Converted to AC power to be delivered to AC loads, studying parameters such as current consumption by the loads.

Injected to the grid, studying parameters such as simulated solar module's current and voltage outputs, power injected to the grid, mains voltage and frequency, etc.

This unit uses a thermal solar panel system to heat water or the traditional pumping system. In both cases, the absorbed thermal energy is given by the simulated solar radiation; in our case, it is done using panel with powerful luminous sources. It has elements such as lamps, thermostat, heat exchanger, temperature sensors, flowmeter, etc.

SPECIFICATIONS

Anodized aluminum frame and panels made of painted steel.

The unit includes wheels to facilitate its mobility.

Main metallic elements made of stainless steel.

Diagram in the front panel with distribution of the elements similar to the real one.

Main features: Supply and Consumption at 12 V (DC).

Supply and Consumption in alternating current (AC).

Two lamps to simulate the sunlight, range of regulated power: 0 – 400 W.

Panel Solar photovoltaic collector:

Maximum nominal power: 66 W.

Voltage at maximum power point (Vmpp): 17.8 V.

Current at maximum power point (Impp): 3.70 A.

Thermal solar collector:

Solar panel

Temperature sensors, "J" type.

Circulating pump, range: 0 - 2 l/min.

Water storage tank of 30 l.

Battery offering optimal performance with low power applications.

Modules:

- N-ES10. Solar charge controller with an automatic recognition for operating voltage 12 V or 24 V. It monitors several parameters such as voltage, current and charge level of the battery, load current, status, etc. Additional functions can be activated such as the settings, night light function and auto-test. The regulator is equipped with various devices to protect its electronics, battery and load.
- N-ES20. Loads module that incorporates two 12 V, 20W lamps, with independent switches.
- N-ES30. DC/AC inverter that outputs a sinewave shaped output of 230V/50Hz ± 2% and the nominal input voltage is 12Vdc. Two different operating modes: continuous mode and ASB mode (Auto Standby) to reduce the power consumption. It is provided with a diagnosis system to indicate the user the status by different flash sequences.
- N-ES40. AC Voltage measurements module until 250 V and DC until 250 V (digital multimeter).
- N-ES50. Loads module that incorporates two lamps of 220 V, 50 W, with independent switches.
- N-ES80. Module for measurements of solar irradiation (W/m) and measurements of current until 10 A., with digital multimeter.
- N-ES90. Module for 12 VDC battery charger.

Electronic console:

Metallic box.

Connections for the temperature sensors.

Digital display for the temperature sensors.

Selector for the temperature sensors.

Pump switch.

Cables and accessories, for normal operation.

Manuals: This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

- 1.- Study of the solar photovoltaic panel.
- $\ensuremath{\text{2.-}}$ Study of the DC/AC inverter.
- 3.- Manipulation of the heater cycles control.
- 4.- Determination of temperature and pressure by monitoring.
- 5.- Examing the water heating circulation in repeated heat loops.
- 6.- Determination of water flow rates.
- 7.- Study of the thermostat operation.

REQUIRED SERVICES

Electrical supply: single-phase, 220 V/50 Hz or 110 V/60 Hz.
Water supply.

- 8.- Study of the luminosity profile of the lamps.
- 9.- Study of the efficiency of the solar panel.
- 10.- Solar energy measurement.
- 11.- Measurement of the solar panel voltage with no load.
- 12.- Examination of battery charging.
- 13.- Study of the relation between the flow and the temperature.

DIMENSIONS AND WEIGHTS

ESET:

- Dimensions: 2000 x 800 x 2000mm. approx. (78.73 x 31.49 x 78.73 inches approx.)

OPTIONAL ELEMENTS (Not included)

- PSA/PC. Polycrystalline photovoltaic solar panel.
- PSA/MC. Monocrystalline photovoltaic solar panel.
- PSA/AM. Amorphous photovoltaic solar panel.

Optional



ESET/ICAI. Interactive Computer Aided Instruction Software System:

With no physical connection between unit and computer, this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

Instructor Software

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.



ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question



ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

Optional

Student Software

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- Test self-correction.
- Calculations computing and plotting.
- Equation System Solver Engine.
- User Monitoring Learning & Printable Reports.
- Multimedia-Supported auxiliary resources.

For more information see ICAI catalogue. Click on the following link: www.edibon.com/en/files/expansion/ICAI/catalog



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen

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ECAL. EDIBON Calculations Program Package Main Screen

* Specifications subject to change without previous notice, due to the convenience of improvement of the product.



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