Engineering and Technical Teaching Equipment

Stand-Alone Wind Turbine Application

AEL-SWT

www.edibon.com
PRODUCTS
4.- ELECTRICITY

INTRODUCTION

Energy saving and environmental pollution reduction are crucial global issues. Using renewable energies as alternative sources to fossil fuels can address both issues, with great benefits especially in countries where traditional energy sources are scarce. Considering the above, this application enables experimental investigation on the conversion of wind energy into electricity by means of a wind power generator.

ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)

European Union Certificate (total safety)

Certificates ISO 14001 and ECO-Management and Audit Scheme (environmental management)

"Worlddidac Quality Charter" and Platinum Member of Worlddidac

GENERAL DESCRIPTION

The Stand-Alone Wind Turbine Aplication, "AEL-SWT", has been designed by Edibon for the training at both the theoretical and practical levels in the field of wind turbines.

The "AEL-SWT" application provides several levels of training to give the user full knowledge and experiences about the most important principles of wind turbines, power generation (stand-alone) and energy storage.

One of the advantages of this application is that it includes real industrial devices such as wind turbine, current controller, stand-alone DC/AC inverter, battery, AC and DC ammetters and voltmeters, AC circuit breakers, residential electrical meter and power distribution panel, DC and AC loads, and finally, the most important element, a DC speed controller. This controller controls a DC motor speed, which is coupled to the wind turbine. This controller allows varying the speed of the wind turbine to simulate different wind speeds.

In addition, this application includes a specific manual, which explains at theoretical level the subjects relating to wind turbines, batteries energy storage, etc. The thematic of the manual covers basic principles of functioning, control and operation of small scale wind turbines at different wind speeds, energy storage in batteries, DC and AC power consumption, etc.

The "AEL-SWT" application includes the following elements:

- N-ALI02. Domestic Main Power Supply.
- N-VREG. Voltage Regulator Module.
- N-INV03. Single-Phase Stand-Alone Inverter Module, 1200 VA.
- N-REG01. Wind Turbine Current Controller Module.
- N-REF. Single-Phase Fixed Resistor.
- N-REL60. Single-Phase Under/Over Current Relay.
- N-MED72. Single-Phase Energy Counter.
- N-MED81. DC Ammeter (0 - 30 A).
- MED65. Digital Multimeter.
- EMT2. DC Series Excitation Motor-Generator.
- PMWT01. Permanent Magnet Wind Turbine, 400 W, 12 V/ 24 V.
- N-DCBUS01. DC Distribution Module 01.
- N-MED10. AC Ammeter (0 - 5 A).
- BAT5. Lead-Acid Battery.

Recommended elements:

- N-REF. Single-Phase Fixed Resistor. (2 units)
- N-IND. Single-Phase Inductance.

The application AEL-SWT can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks:

- N-RACK-M (2 units).

Optionally the AEL-WBR. Electrical Workbench (Rack) can be supplied to place the rack/s.

Option B:

This application can be mounted on rail.

Optionally the AEL-WBC. Electrical Workbench (Rail) can be supplied to mount the modules.

SPECIFICATIONS

The application includes the following modules:

- N-ALI02. **Domestic Main Power Supply.**
  - Supply voltage (Single-Phase): 230 VAC, PH+N+G.
  - ON-OFF removable key.
  - Output Voltage Connections:
    - Two Single-Phase: 230 VAC.
    - Single-Phase supply hose connecting plug.
  - Differential magnetothermal, 2 poles, 25A, 30mA AC 6KA.

N-ALI02

- N-VREG. **Voltage Regulator Module.**
  - Power supply: 230 VAC.
  - Variable output voltage: 0 – 300 VDC.
  - Nominal current: 2 A.
  - Fuse: 2 A.
  - Ammeter: 0 – 2 A.

N-VREG

- N-INV03. **Single-Phase Stand-Alone Inverter Module, 1200 VA.**
  - Single Phase Inverter.
  - Input voltage: 12 VDC.
  - Output voltage: 230 VAC.
  - Nominal power: 1200 VA.

N-INV03

N-REG01

- N-REG01. W**ind Turbine Current Controller Module.**
  - Input voltage: 3 x 24 VAC.
  - Output voltage: 12 VDC.

N-REF

- N-REF. **Single-Phase Fixed Resistor.**
  - Value: 150 Ohm.
  - Maximum power: 500 W.
  - Selector:
    - Position 0:circuit opened.
    - Position 1: circuit closed.
  - Current fuse: 2 A.

N-REL60

- N-REL60. **Single-Phase Under/Over Current Relay.**
  - Current monitoring: AC/DC.
  - Measurable current: 0,05 – 15 A.
  - Adjustable response delay time: 0,1 – 20 seconds.

N-MED72

- N-MED72. **Single-Phase Energy Counter.**
  - Nominal voltage: 230 VAC.

- N-MED81. **DC Ammeter (0 - 30A).**
  - Current range: 0 - 30 A.

N-MED81

Specifications

- MED65. **Digital Multimeter.**

  This module has a digital multimeter of about 3 ½ digits, with double-jack ending cables of about 4 mm to facilitate interconnections.

  With this digital multimeter we will be able to measure:

  Voltage.
  Current.
  Resistance.
  Capacitors capacity.
  Temperature.

N-MED65

- EMT2. **DC Series Excitation Motor-Generator.**

  Nominal power: 300 W.
  Armature voltage: 200 VDC.
  Armature current: 1,5 A.
  RPM: 7500 r.p.m.

EMT2

- PMWT01. **Permanent Magnet Wind Turbine, 400W, 12V/24V.**

  Nominal power: 400 W.Output voltage: 12/24 VAC
  Speed operation range: 3 – 49,2 m/s.
  Starting speed: 3,13 m/s.

PMWT01

- N-DCBUS01. **DC Distribution Module 01.**

  Voltage operation: 12/24 VDC.

N-DCBUS01

- N-MED10. **AC Ammeter (0 - 5A).**

  DC Current measurement range: 0 – 5 A.

N-MED10

- BAT5. **Lead-Acid Battery.**

  Nominal Voltage: 12 VDC.
  Capacity: 90 Ah.

Recommended elements:

- N-REF. **Single-Phase Fixed Resistor. (2 units)**

  Value: 150 Ohm.
  Maximum power: 500 W.
  Selector:
    Position 0:circuit opened.
    Position 1: circuit closed.
  Current fuse: 2 A.

BAT5

- N-IND. **Single-Phase Inductance.**

  Value: 1.4 H.
  Current fuse: 2 A.
  Selector:
    Position 0: circuit opened.
    Position 1: circuit closed.

N-REF

- **All necessary cables to realize the practical exercises are included.**

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.

N-IND

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Study of the over current protection for the stand-alone operation of wind turbine.
2.- Study of the battery to the inverter.
3.- Study of the wind turbine to the wind turbine current controller.
4.- Study of the wind turbine current controller to the battery.
5.- Simulation of different wind conditions.
6.- Start-up of the wind generation system.
7.- Voltage and current measurement at the outlet of the wind turbine and at the battery.
8.- Study of the wind generator to the DC/AC inverter.
9.- Study of AC and DC loads.
10.- Checking the lamps.
11- Power vs Wind Turbine Speed.
12.- Energy storage from a Wind Turbine into battery.
13.- Battery charging fundamentals.
14.- Feeding from the wind generator.
15.- Feeding from the battery.

REQUIRED SERVICES

- Electrical supply: single phase, 220 V /50 Hz or 110 V /60 Hz, 2 kW.

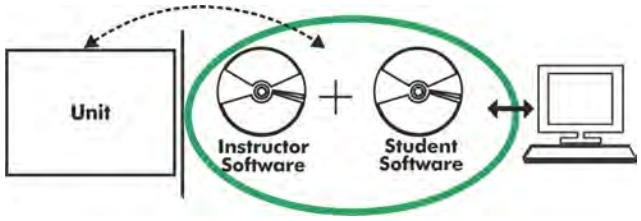
DIMENSIONS AND WEIGHTS

AEL-SWT:

-Dimensions: 1600 x 550 x 2000 mm. approx.
(62.99 x 21.65 x 78.74 inches approx.)

-Weight: 180 Kg. approx.
(397 pounds approx.)

AEL-SWT/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.

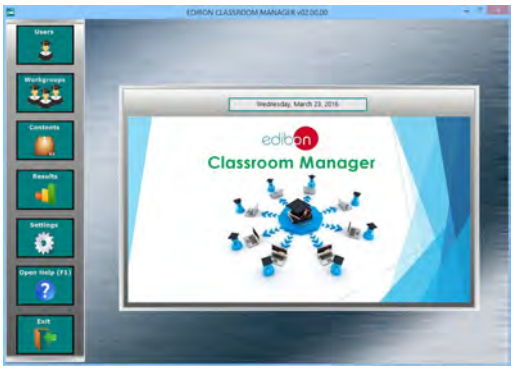
Instructor Software

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

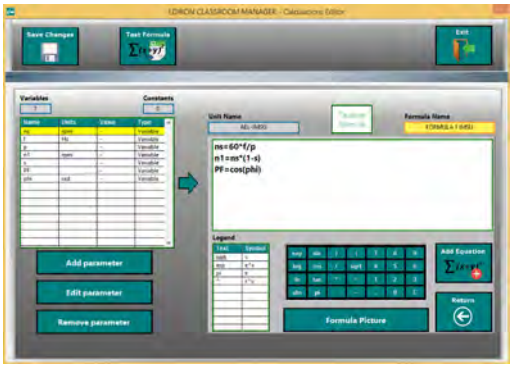
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

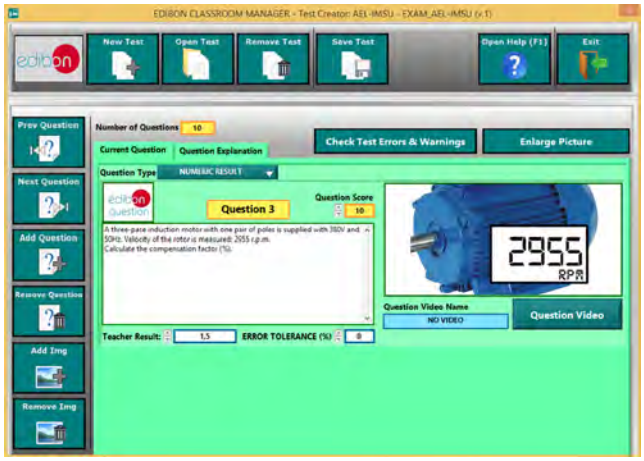
- **User Data Base Management.**
- **Administration and assignment of Workgroup, Task and Training sessions.**
- **Creation and Integration of Practical Exercises and Multimedia Resources.**
- **Custom Design of Evaluation Methods.**
- **Creation and assignment of Formulas & Equations.**
- **Equation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



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



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



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

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:

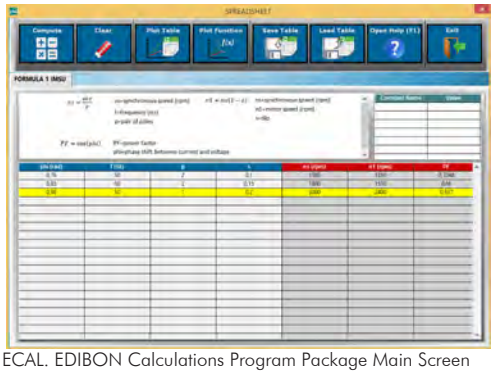
- **Student Log-In & Self-Registration.**
- **Existing Tasks checking & Monitoring.**
- **Default contents & scheduled tasks available to be used from the first session.**
- **Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- **Evaluation Methods to prove your knowledge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

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

EPE. EDIBON Practical Exercise Program Package Main Screen

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



ECAL. EDIBON Calculations Program Package Main Screen

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

edibon INTERNATIONAL

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REPRESENTATIVE: