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↳ PRODUCTS  
↳ 40.- ELECTRICITY

## INTRODUCTION

Electrical engineering is the base of the electric knowledge. Motors, RLC circuits, transformers and lighting belong to this discipline. Motors are electric machines capable of transforming electric energy into mechanical energy or vice versa. The RLC circuits can be used as load system or as filtering of electric signals. Transformers are devices which adapt the electric energy to the appropriate conditions for its usage. Lighting is the most primitive part of the electricity and, therefore, it is necessary its study to understand the electric fundamentals.



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)



Certificate and Worlddidac Member

## GENERAL DESCRIPTION

The Modular Trainer for Electrotechnics (RLC Circuits, Electrostatics, Motors, Transformers, Lighting) "AEL-AI13" designed by Edibon to study the basic knowledge about electric engineering. The trainer teaches the student several topics like electric circuits, static electricity, magnetism, electromagnetism, electromagnetic induction, electric capacity, dynamic electricity, lightning, motors, transformers, rectification and filtrate and electric circuits of application.

Once the user realizes all practical exercises, he must be able to do association of different loads, logic control circuits, rectification circuits, commissioning motors and transformers. Besides, the user gets wide knowledge in all this fields with the aid of the included manual with all necessary theory.

The AEL-AI13 includes the following modules:

- N-ALI01. Industrial Main Power Supply.
- N-ALI10. Power Supply Module.
- N-CAR30. Inductances Module.
- N-CAR31. Capacitors Module.
- N-CAR32. Rectifier Diodes Module.
- N-CAR33. Resistive Components Module.
- N-LAM26. Lighting Module.
- N-LAM09. Fluorescent Lamp.
- N-MED65. Digital Multimeter.
- N-REL50. Relays Module.
- TRA28. Three-Phase Transformer.
- VAR17. Dismantled Transformer Kit.
- EMT16. Asynchronous Single-Phase Motor with Starting and Running Capacitor.
- EMT7. Asynchronous Three-Phase Motor of Squirrel Cage.
- EMT12. Universal Motor.
- N-VAR16. Electromagnetism Kit with Group of Motor/Generator.
- VAR18. Electrostatic Kit.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-AI13/ICAI) to reinforce knowledge about this field.

This software is formed by:

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).
- ESL-SOF. EDIBON Student Labsoft (Student Software).

The application AEL-AI13 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 trainer includes the following modules:

- **N-ALI01. Industrial Power Supply.**

Supply voltage: 400 VAC, 3PH+N+G.

ON-OFF removable key.

Output voltage connections:

Three-Phase + Neutral: 400 VAC.

Single-Phase: 230 VAC.

Three-Phase supply hose with IP44 3 PN+E 32A 400 V connecting plug.

Differential magnetothermal, 4 poles, 25 A, 300 mA AC 6 KA.



N-ALI01

- **N-ALI10. Power Supply Module.**

Supply voltage (Single-Phase): 230 VAC PH+N+G.

Output voltage:

15-0-15 VAC.

24 VAC.

24 VDC.

0-24 VDC (adjustable).



N-ALI10

- **N-CAR30: Inductances Module.**

Nominal voltage: 24 V.

Inductances:

Two 1 mH inductances.

One 2.2 mH inductance.

Two 3.3 mH inductances.

Two 10 mH inductances.

Two 22 mH inductances.

Ground terminal.



N-CAR30

- **N-CAR31: Capacitors Module.**

Nominal voltage: 24 V.

Capacitors:

One 47 nF non-polarised capacitor.

One 68 nF non-polarised capacitor.

Two 100 nF non-polarised capacitors.

One 220 nF non-polarised capacitor.

One 330 nF non-polarised capacitor.

One 470 nF non-polarised capacitor.

One 220 uF polarised capacitor.

One 470 uF polarised capacitor.

Ground terminal.



N-CAR31

- **N-CAR32: Rectifier Diodes Module.**

Nominal voltage: 230 V.

Rectifiers: 6 x 40 A rectifier diodes.

Ground terminal.



N-CAR32

• N-CAR33: **Resistive Components Module.**

Nominal voltage: 24 V.

Resistors:

- Three 47 k Ohm resistors.
- Three 51 k Ohm resistors.
- Two 82 k Ohm resistors.
- Two 100 k Ohm resistors.
- One 120 k Ohm resistors.
- Three 150 k Ohm resistors.
- One 10 k Ohm linear 5 W wound potentiometer.
- One 50 k Ohm linear potentiometer.
- One 10 k Ohm logarithmic potentiometer.
- One 50 k Ohm logarithmic potentiometer.

Ground terminal.



N-CAR33

• N-LAM26: **Lighting Module.**

Four 24 V red lamps.

Two switches.

Two simple switches.

One crossover-switch.

One pushbutton.

One buzzer.

Ground terminal



N-LAM26

• N-LAM09: **Fluorescent Lamp.**

Nominal voltage: 230 VAC (PH+N)

Switch on/off.

Fluorescent lamp

Nominal Power: 8 W.

Supply terminals (LN)

Ground terminal



N-LAM09

• N-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

• N-REL50: **Relays Module.**

Nominal voltage 24 V.

Two relays.

Two Normally Open contact (NO).

Two Normally Close contact (NC).

Ground terminal.



N-REL50

• **TRA28. Three-Phase Transformer Module.**

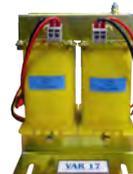
Nominal supply voltage: 400 and 230 VAC (3 PH).  
 Nominal output voltage: 3 x (3 x 73 VAC).  
 Nominal power: 500 VA.  
 Free configuration (delta, star and zig-zag).



TRA28

• **VAR17. Dismantled Transformer Kit.**

Nominal supply voltage: 230 V.  
 Nominal output voltage: 110 V.  
 Nominal power: 185 VA.  
 Four removable elements.  
 Coil of 2000 turns (0.8 A).  
 Coil of 1000 turns (1.6 A).



VAR17

• **EMT16: Single-phase Capacitor Motor.**

Supply voltage: 110-220 V.  
 Power: 370 W.  
 Speed: 2780 r.p.m.  
 Frequency: 50/60 Hz.  
 Armature current: 1,85 A.



EMT16

• **EMT7. Asynchronous Three-Phase Motor of Squirrel Cage.**

Nominal power: 370 W.  
 Nominal voltage: 3x 230/400 VAC  $\Delta/Y$ .  
 Frequency: 50/60 Hz.  
 Number of poles: 2.  
 RPM: 2730 r.p.m.  
 Nominal current: 1,67/ 0,97 A



EMT7

• **EMT12. Universal Motor.**

Supply voltage: 110-240 VAC/ VDC.  
 Power: 0,3 HP.  
 Speed: 9000 r.p.m.



EMT12

• **N-VAR16: Electromagnetism Kit with Group of Motor/generator.**

Solenoids of 1000 turns and 2000 turns.  
 Cores of brass, stainless steel, ferrite and magnetic materials.  
 Motor/generator set with attached tachometer (24 VDC).



N-VAR16

• **VAR18: Electrostatic Kit.**

PVC bar.  
 PVC tube.  
 Nylon bar.  
 Aluminium bar.  
 Homemade electroscope:  
 PMMA tube with cover, metal hook, aluminium ball and silver foil strip folded in half.  
 Two Acetate strips.  
 Rabbit fur.



N-VAR18

• **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.

## EXERCISES AND PRACTICAL POSSIBILITIES

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| <ol style="list-style-type: none"> <li>1.- Checking the operation of the Industrial Main Power Supply (N-ALI01).</li> <li>2.- Checking the operation of the Auxiliary Power Supply (N-ALI10).</li> <li>3.- Electrostatic demonstration on several materials.</li> <li>4.- Verification of the electrotechnic effects with Acetate.</li> <li>5.- Verification of the electrotechnic effects with Rabbit fur.</li> <li>6.- Verification of the sign of the charge with the Electroscope.</li> <li>7.- Resistance measurement.</li> <li>8.- Resistors in series association.</li> <li>9.- Resistors in parallel association.</li> <li>10.- Coils in series association.</li> <li>11.- Coils in parallel association.</li> <li>12.- Star/delta transformation.</li> <li>13.- Delta/star transformation.</li> <li>14.- Capacity measurement of a capacitor.</li> <li>15.- Capacitors series association.</li> <li>16.- Capacitors parallel association.</li> <li>17.- Analysis of the charge of a capacitor.</li> <li>18.- Analysis of the discharge of a capacitor.</li> <li>19.- Calculation of the time constant of discharge of the capacitor.</li> <li>20.- Wiring and put into operation of a Single-Phase Motor.</li> <li>21.- Wiring and put into operation of a Universal Motor.</li> <li>22.- Wiring and put into operation of a Squirrel-Cage Three-Phase Motor.</li> <li>23.- Electric energy into mechanic energy conversion.</li> <li>24.- Mechanic energy into electric energy conversion.</li> <li>25.- Electric energy into magnetic energy conversion.</li> <li>26.- Magnetic induction: Lenz´s Law.</li> <li>27.- Assembling the transformer.</li> </ol> | <ol style="list-style-type: none"> <li>28.- Analysis of a Back Transformer.</li> <li>29.- Wiring of a Back Transformer.</li> <li>30.- Verification of the transformer ratio of a Back Transformer.</li> <li>31.- Analysis of a Boost Transformer.</li> <li>32.- Wiring of a Boost Transformer.</li> <li>33.- Verification of the transformer ratio of a Boost Transformer.</li> <li>34.- Analysis of an Auto-Transformer.</li> <li>35.- Wiring of an Auto-Transformer.</li> <li>36.- Connection as single-phase transformer.</li> <li>37.- Direct delta/delta three-phase connection.</li> <li>38.- Star/delta three-phase connection.</li> <li>39.- Delta /star three-phase connection.</li> <li>40.- Three-phase/six-phase connection.</li> <li>41.- Transformer with coils in series in phase.</li> <li>42.- Calculation of the time constant in different configurations of RLC circuits.</li> <li>43.- Analysis of a RL circuit in series.</li> <li>44.- Analysis of a RL circuit in parallel.</li> <li>45.- Analysis of a RC circuit in series.</li> <li>46.- Analysis of a RC circuit in parallel.</li> <li>47.- Analysis of a RCL circuit in series.</li> <li>48.- Low-pass filter.</li> <li>49.- High-pass filter.</li> <li>50.- Lamp controlled by a switch and a push button.</li> <li>51.- Lamp controlled from two points</li> <li>52.- Lamp controlled from three points.</li> <li>53.- Lamp controlled by relays.</li> <li>54.- Verification of the electrotechnic effects into an acoustic circuit.</li> <li>55.- Verification of the electrotechnic effects into a fluorescent tube.</li> </ol> |
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### REQUIRED SERVICES

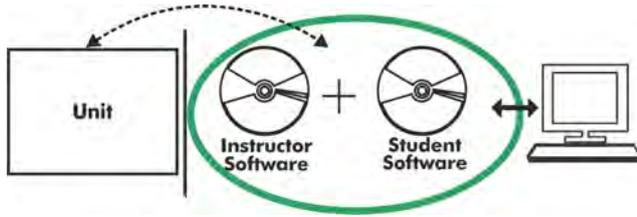
- Electrical supply: three-phase, 380V/50 Hz or 208V/60 Hz, 20 Kw.

### DIMENSIONS AND WEIGHTS

- AEL-AI13:
- Dimensions: 640 x 320 x 670 mm approx.  
(25.19 x 12.59 x 26.37 inches approx.)
  - Weight: 50 Kg approx.  
(110 pounds approx.)

## Optional

### AEL-AI13/ICAI. Interactive Computer Aided Instruction Software System:



With no physical connection between unit and computer (PC), 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.

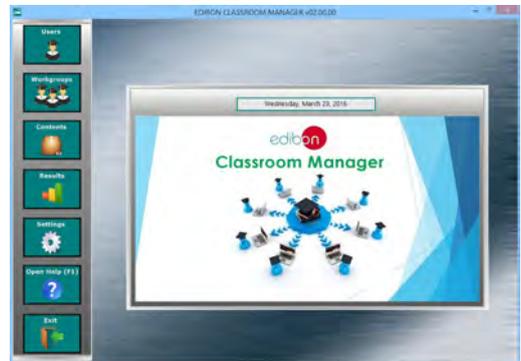
### Instructor Software

- 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:

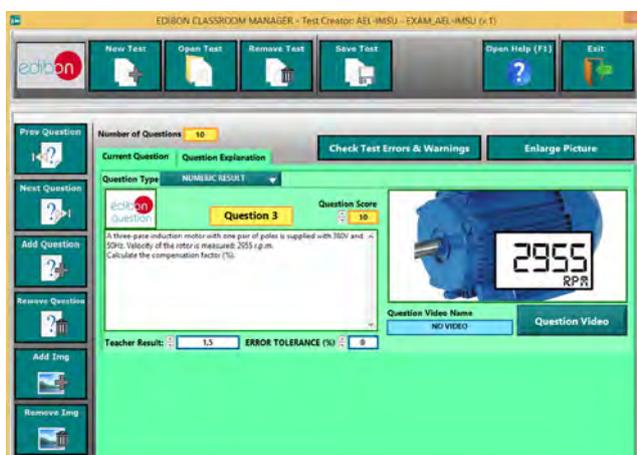
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.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

For more information see **ICAI** catalogue. Click on the following link:

[www.edibon.com/en/files/expansion/ICAI/catalog](http://www.edibon.com/en/files/expansion/ICAI/catalog)



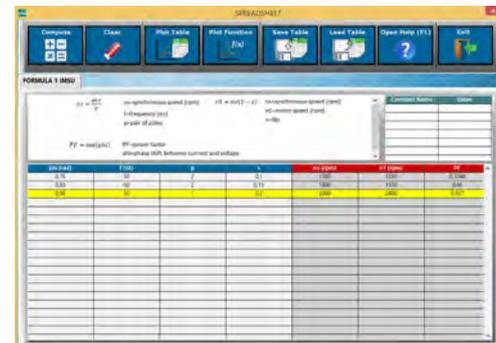
ESL-SOF. EDIBON Student LabSoft (Student Software)  
Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



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.



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REPRESENTATIVE:

