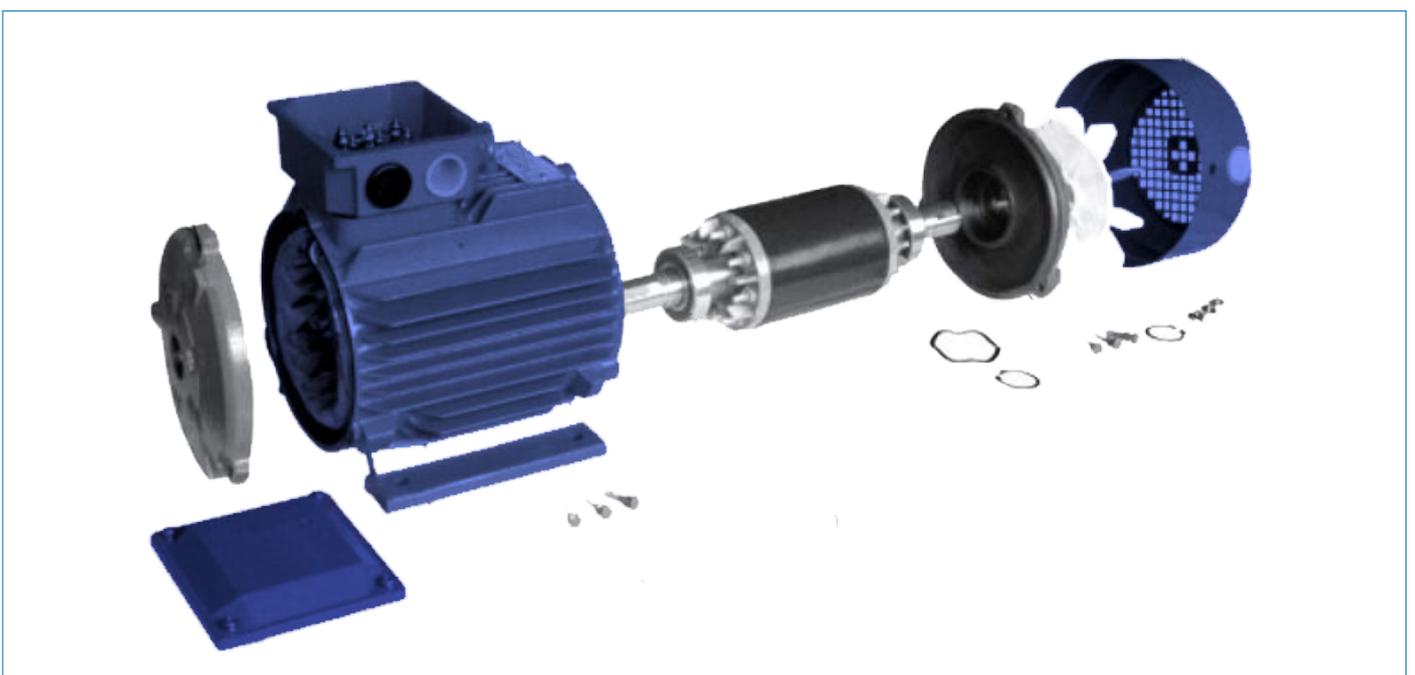




### INDUCTION MOTOR DISASSEMBLY



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

## INTRODUCTION

The electrical machines are devices capable of transforming any form of energy into electrical energy and vice versa. Also, they are considered as electrical machines those that transform the electrical energy into its same form but adapting the electrical parameters to the own conditions for their use. These are classified in three main groups: motors, generators and transformers.

## GENERAL DESCRIPTION

The Motor-Generator and Transformers Construction Application, "AEL-MGTC", has been designed by EDIBON for the formation at theoretical-practical level in the field of the electromechanical construction of electric machines such as DC Motor-Generator, Three-Phase Asynchronous Motor of Squirrel Cage, Three-Phase Reluctance Motor, Three-Phase Transformer and Single-Phase Transformer.

This application offers several levels of formation that provide the user the knowledge and the essential skills about the fundamental principles of the electromechanical construction of electric machines. For this purpose, this application includes a specific manual in which is explained, at theoretical level, the relative aspects to the design, the fabrication, the construction and the winding of electric motors, generators and transformers. The application AEL-MGTC offers a manual winding machine for the realization of winding practices in the optional motors and transformers that can be acquired. The Manual Winding for Motors and Transformers, MWMT, provides several templates for the construction of the windings with different sizes. Once the windings are constructed, the user will proceed to its placing in the corresponding electric machines and the verification of the functioning of the same.

The electric motors, as well as the transformers, are provided disassembled by parts: a solid rotor supported in a bracket and a stator completely accessible allows the realization of the winding practices. In the case of the transformers, iron pieces in the shape of U are supplied for the arrangement of the windings.

One of the advantages of this application is that this covers from the construction of the electric machines to the operation of the same. This application has a variable power supply, a multimeter for the verification of the electrical parameters of the machines, a coil of copper wire and a toolbox for the montage and construction of the same. Besides, a compass is offered for the verification of the rotation magnetic field after assembly of the windings.

The "AEL-MGTC" includes the following elements:

- N-VPS01. AC 3PH Variable Power Supply.
- MWMT. Manual Winding for Motors and Transformers.
- MED65. Digital Multimeter.
- BRLA. Compass.
- CHER. Toolbox.

Required elements. At least one kit is required:

MGTC-K1: Construction of a DC Motor-Generator Kit.

- DCMG-KIT. DC Motor-Generator Kit.
- N-REV. Single-Phase Variable Resistor.

MGTC-K2: Construction of a Three-Phase Asynchronous Motor of Squirrel Cage Kit.

- ACIMS-KIT. Three-Phase Asynchronous Motor of Squirrel Cage Kit.

MGTC-K3: Construction of a Three-Phase Reluctance Motor Kit.

- ACRM-KIT. Three-Phase Reluctance Motor Kit.

MGTC-K4: Construction of a Three-Phase Asynchronous Motor with Wound Rotor.

- ACWR-KIT. Three-Phase Asynchronous Motor with Wound Rotor kit

MGTC-K5: Construction of a Three-Phase Synchronous Motor.

- ACSM-KIT. Three-Phase Synchronous Motor kit.
- N-WCC/M. DC Motor Speed Controller (intermediate option).

MGTC-K6: Construction of a Three-Phase Transformer Kit.

- PTSIM-KIT. Three-Phase Transformer Kit.
- N-REFT. Three-Phase Resistor Load with Commutator.
- N-INDT. Three-Phase Inductance with Commutator.
- N-CONT. Three-Phase Capacitor with Commutator.

MGTC-K7: Construction of a Single-Phase Transformer Kit.

- PSPIM-KIT. Single-Phase Transformer Kit.
- N-REF. Fixed resistor module.
- N-IND. Variable Inductance.
- N-CON. Variable Capacitor.

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

Option A:

This application need the following rack:

- N-RACK-A.

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 "AEL-MGTC" includes the following elements:

- **N-VPS01. AC 3PH Variable Power Supply.**

ON-OFF removable key.

Input Voltage: 400 VAC, 3 PH + N.

Output Voltage:

0...450 VAC.

0...240 VDC.

Maximum current: 2 A.

Frequency: 50/60 Hz.

Wheel to regulate the voltage.

Three lamps.

Measurement commutators:

One commutator to measure the voltage:

6 positions: L1-N ; L2-N ; L3-N ; L1-L2 ; L1-L3 ; L2-L3

One commutator to measure the current:

3 positions: I1, I2, I3.

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

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



N-VPS01

- **MWMT. Manual Winding for Motors and Transformers.**

Mechanical flywell.

Winding templates.

Spin counter.



MWMT

- **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

- **BRLA. Compass.**



BRLA

- **CHER. Toolbox.**

Crimper.

Tin.

Meter.

Insulation tape.

Heat shrink.

Voltage tester screwdriver.

Cross-head screwdriver and flat-head screwdriver.

Allen keys.

Soldering iron.

Rubber hammer.

Wire terminals and Connection terminals.

Flanges.

Wire cutter.

Screw Clamp Terminals.



CHER

## Specifications

- **DCMG-KIT. DC Motor-Generator Kit.**

Nominal power: 250 W.  
 Armature voltage: 200 VDC.  
 Excitation voltage: 190 VDC.  
 Armature current: 1,5 A.  
 Excitation current: 0,3 A  
 RPM: 3000 rpm.



DCMG-KIT

- **N-REV. Variable Resistor.**

Variable resistor of 150 Ohm.  
 Maximum power: 500 W.  
 Potentiometer.  
 Terminals:  
 Three terminals to choose all resistance or variable resistance.  
 Fuse: 2 A.



N-REV

- **ACIMS-KIT. Three-Phase Asynchronous Motor of Squirrel Cage Kit.**

Nominal power: 370 W.  
 Nominal voltage: 3x 230/400 VAC Δ/Y.  
 Frequency: 50/60 Hz  
 Number of poles: 2.  
 Speed: 2730 rpm.  
 Nominal current: 1,67/ 0,97 A.



ACIMS-KIT

- **ACRM-KIT. Three-Phase Reluctance Motor Kit.**

Nominal power: 300 W.  
 Nominal voltage: 3x 400 VAC.  
 Frequency: 50/60 Hz.  
 Speed: 3000 rpm.  
 Nominal current: 1,4 A.



ACRM-KIT

- **ACWR-KIT. Three-Phase Asynchronous Motor with Wound Rotor kit.**

Nominal power: 300 W.  
 Nominal voltage: 3x 230/400 VAC Δ/Y.  
 Frequency: 50/60 Hz.  
 Number of poles: 2.  
 Speed: 2870 rpm.  
 Nominal current: 1/ 0,5 A.



ACWR-KIT

- **ACSM-KIT. Three-Phase Synchronous Motor kit.**

Nominal power: 250 W.  
 Nominal output voltage: 3x 400 VAC.  
 Frequency: 50/60 Hz.  
 Speed: 3000 rpm.  
 Nominal output current: 1 A.  
 Nominal excitation current: 0,25 A.



ACSM-KIT

- **N-WCC/M. DC Motor Speed Controller (intermediate option)**

Supply voltage: 230 VAC.  
 Variable output voltage: 0-300 VCC.  
 Fuse: 2 A.



N-WCC/M

- **PTSIM-KIT. Three-Phase Transformer Kit.**

Core: Iron.  
 Dimensions: 350 x 150 x 100 mm. (approx.)



PTSIM-KIT

## Specifications

- **N-REFT. Three-Phase Resistor Load with Commutator.**

Three-phase resistor: 150 Ohm.

Nominal power: 500 W.

Commutator.

Terminals:

Three terminals to connect resistance.



N-REFT

- **N-INDT. Three-Phase Inductance with Commutator.**

Nominal voltage: 400 VAC.

Inductance value: 1,4H.

Nominal current: 1,6 A.

Manual commutator to switch on/off the inductances.

Fuses: 3 x 2 A.

Terminals:

Four inputs terminals (3PH+N).

Four outputs terminals (3PH+N).

Ground terminal.



N-INDT

- **N-CONT. Three-Phase Capacitor with Commutator.**

Nominal Voltage: 400 VAC.

Capacitor value: 3 x 7 uF.

Manual commutator to switch on/off the capacitors

Fuses: 3 x 4 A.

Terminals:

Four inputs terminals (3PH+N).

Four outputs terminals (3PH+N).

Ground terminal.



N-CONT

- **PSPIM-KIT. Single Phase Transformer Kit.**

Core: Iron.

Dimensions: 250 x 150 x 100 mm. (approx.)



PSPIM-KIT

- **N-REF. Fixed resistor module.**

Resistor value: 150 Ohm.

Maximum power: 500 W.

Selector:

Position 0: circuit opened.

Position 1: circuit closed.

Current fuse: 2 A.



N-REF

- **N-IND. Variable Inductance.**

Inductance value: 1.4H.

Selector:

Position 0: circuit opened.

Position 1: circuit closed.

Fuse: 2 A.



N-IND

- **N-CON. Variable Capacitor.**

Nominal Voltage: 400 VAC.

Capacitor value: 7 uF.

Selector:

Position 0: circuit opened.

Position 1: circuit closed.

Fuse: 4 A.



N-CON

- **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

Some practical possibilities with MGTC-K1: DC Motor-Generator Kit.

- 1.- Windings construction using a manual winding machine.
- 2.- Place the winding in the stator.
- 3.- Put into operation the DC Motor-Generator.
- 4.- Wiring of DC motor.
- 6.- DC Motor Speed Control.
- 7.- DC Motor turning direction control.
- 8.- Excitation current control.

Some practical possibilities with MGTC-K2: Three-Phase Asynchronous Motor of Squirrel Cage Kit.

- 9.- Windings construction using a manual winding machine.
- 10.- Place the winding in the AC motor stator.
- 11.- Put into operation the AC induction motor.
- 12.- Wiring of Three-Phase Asynchronous Motor of Squirrel Cage.

Some practical possibilities with MGTC-K3: Three-Phase Reluctance Motor Kit.

- 13.- Windings construction using a manual winding machine.
- 14.- Place the winding in the AC reluctance motor stator.
- 15.- Put into operation the AC induction motor.
- 16.- Wiring of Three-Phase Reluctance Motor.

Some practical possibilities with MGTC-K4: Three-Phase Induction Motor with Wound Rotor Kit.

- 17.- Windings construction using a manual winding machine.
- 18.- Place the winding in the machine.
- 19.- Put into operation the machine.

Some practical possibilities with MGTC-K5: Three-Phase Synchronou Motor Kit.

- 20.- Windings construction using a manual winding machine.

- 21.- Place the winding in the machine.

- 22.- Put into operation the machine.

Some practical possibilities with MGTC-K6: Three-Phase Transformer Kit.

- 23.- Windings construction using a manual winding machine.

- 24.- Place the winding in the transformer core.

- 25.- Put into operation the transformer.

- 26.- Wiring of Three-Phase Transformer according to different configurations.

- 27.- Calculation of the transformer ratio according to different configurations.

- 28.- Drop voltage calculation with resistive load.

- 29.- Drop voltage calculation with inductive load.

- 30.- Drop voltage calculation with capacitive load.

Some practical possibilities with MGTC-K7: Single-Phase Transformer Kit.

- 31.- Windings construction using a manual winding machine.

- 32.- Place the winding in the transformer core.

- 33.- Put into operation the transformer.

- 34.- Wiring of Single-Phase Transformer according to different configurations.

- 35.- Calculation of the transformer ratio according to different configurations.

- 36.- Drop voltage calculation with resistive load.

- 37.- Drop voltage calculation with inductive load.

- 38.- Drop voltage calculation with capacitive load.

### REQUIRED SERVICES

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

### DIMENSIONS AND WEIGHTS

AEL-MGTC:

Modules in Rack: - Dimensions: 640 x 320 x 920 mm approx.

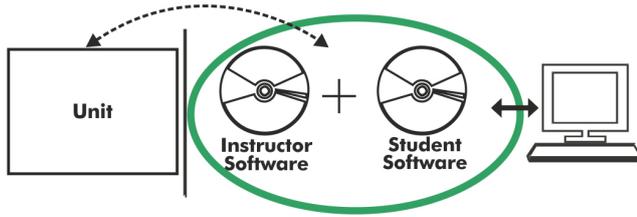
(25.19 x 12.59 x 36.22 inches approx.)

- Weight: 35 Kg approx.

(77 pounds approx.)

## Optional

### AEL-MGTC/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.

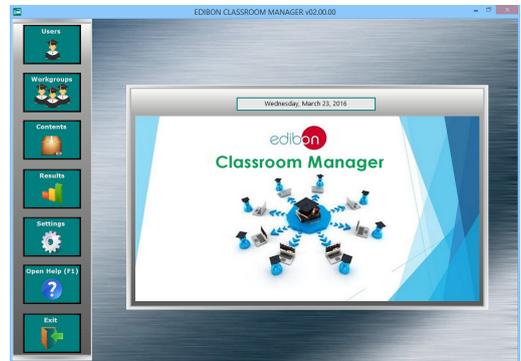
### Instructor Software

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

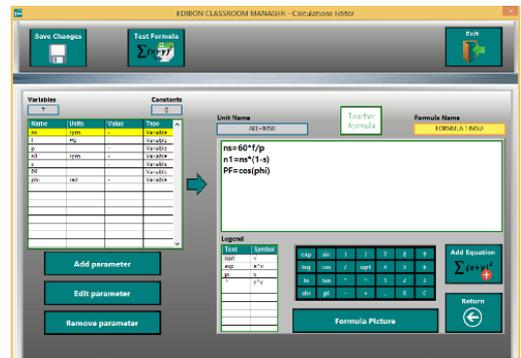
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

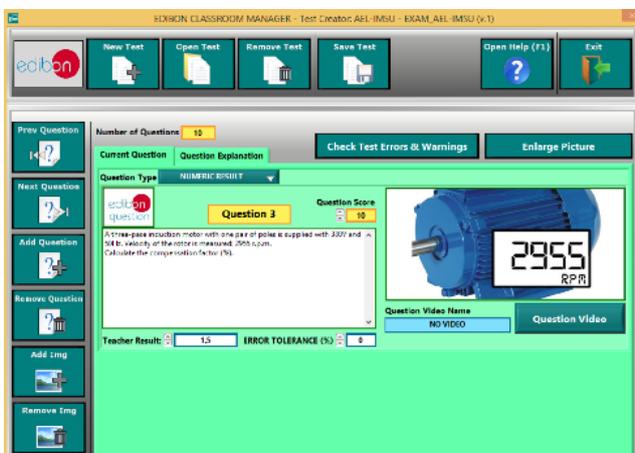
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.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



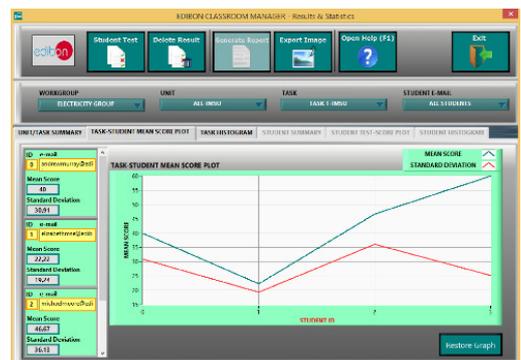
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



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:

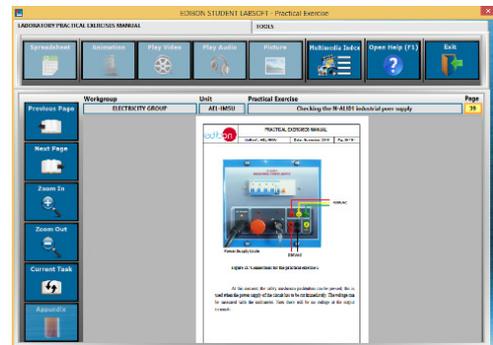
- **Student Log-In & Self-Registration.**
- **Existing Tasks checking & Monitoring.**
- **Default contents & scheduled tasks available to be used from the first session.**
- **Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- **Evaluation Methods to prove your knowledge 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)



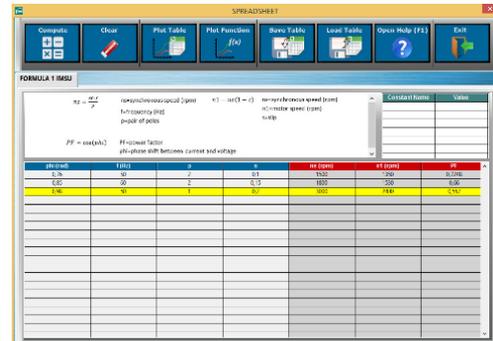
ESL-SOF. EDIBON Student LabSoft (Student Software)  
Application Main Screen



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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