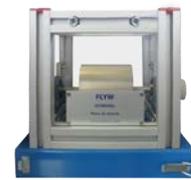




Some Optional DC Motors



FLYW



EMT1



EMT2



EMT3



EMT4



EMT5



EMT7



EMT15

INTRODUCTION

DC motors were the first type widely used, but the advent of power electronics has made replacement of DC motors with AC motors possible in many applications. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills.

The AEL-DCEMA DC Electrical Motors Application has been designed by Edibon to study how DC electric motors are wired and how realize control circuits in order to manage the DC motors.



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

With this application, the user will take a complete experience about the most important operations carried out with several industrial machines such as DC Machine with independent excitation, DC Series Excitation Motor-Generator, DC Machine with shunt excitation, DC Compound Excitation Motor-Generator, DC Permanent magnet motor.

The AEL-DCEMA consists of a base equipment which is formed by several modules such as power supplies, push buttons, auxiliary lamps, DC ammeter, DC voltmeter, circuit breakers, flywheel, etc. This base equipment is complemented by different options. Each option includes a different motor and its specific modules to carry out properly operations.

The basic equipment of AEL-DCEMA is formed by the following modules:

- N-ALI02. Domestic Power Supply.
- N-ALI03. AC Auxiliary Power Supply.
- N-PUL48. Three Double Chamber Push-Buttons Module.
- N-CON01. 3-pole Contactor (24 VAC). (3 units).
- N-WCC/M. DC Motor Speed Controller.
- N-LAM02. Three Auxiliary Lamps Module.
- FLYW. Flywheel.
- N-MED17. DC Voltmeter Module.
- N-MED05. DC Ammeter (1-1,5A) Module.
- N-MED65. Digital Multimeter.

Optional DC motors:

Option 1: Study of DC Machine with independent excitation.

- EMT1. DC Independent excitation motor-Generator.
- N-REV. Variable Resistor.

Option 2: Study of DC Machine with Series excitation.

- EMT2. DC Series Excitation Motor-Generator.
- N-REV. Variable Resistor.

Option 3: Study of DC Machine with shunt excitation

- EMT3. DC Shunt Excitation Motor-Generator.
- N-REV. Variable Resistor.

Option 4: Study of DC Machine with Compound excitation

- EMT4. DC Compound Excitation Motor-Generator.
- N-REV. Variable Resistor.

Option 5: Study of all connections of DC Machines.

- EMT5. DC Independent-Shunt-series-compound excitation motor.
- N-REV. Variable Resistor. (2 units).

Option 6: Study of permanent magnet DC motors.

- EMT15. DC Permanent magnet motor.

Option 7: Study of DC generator.

- EMT1. DC Independent excitation motor-Generator.
- EMT7. Asynchronous three-phase motor of squirrel cage.
- N-REV. Variable Resistor.
- N-REF. Resistor Load with commutator.
- N-WCA/M. AC Motor Speed Controller (Intermediate option).

Optional learning software:

In addition, Edibon provides optional software (AEL-DCEMA/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-DCEMA 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.

The trainer includes the following modules:

• **N-ALI02. Domestic 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-ALI03. AC Auxiliary Power Supply.**

Supply voltage (Single-Phase): 230VAC PH+N+G.
 Output voltage:
 Single-Phase 24VAC/12VAC.
 24 VDC.
 0-24VDC through potentiometer.



N-ALI03

• **N-PUL48. Three Double Chamber Push-Buttons Module.**

Two independent chambers.
 Nominal voltage: 24 VAC.
 Three double chamber push-buttons (green and red).
 Contacts:
 Three Normally Open Contacts (NO) for green switch.
 Three Normally Close Contacts (NC) for red switch.
 Ground terminal.



N-PUL48

• **N-CON01. Three-Pole Contactor Module. (3 units).**

Nominal voltage for power contacts: 400 VAC.
 Nominal voltage for control contacts: 24 VAC.
 Nominal voltage for the control coil: 24 VAC.
 Contacts:
 One three-phase Normally Open Contact (NO) for power circuit.
 Three Normally Open Contacts (NO) for control circuit.
 Two Normally Close Contacts (NC) for control circuit.
 Ground terminal.



N-CON01

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

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



N-WCC/M

• **N-LAM02. Three Auxiliary Lamps Module.**

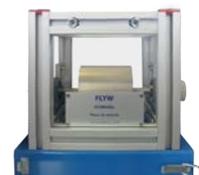
Nominal voltage: 24 VAC.
 Three lamps (red, yellow and green).
 Ground terminal.



N-LAM02

• **FLYW. Flywheel.**

Weight: 2 kg.
 Maximum recommended speed: 4000 r.p.m.
 Moment of inertia: 0,0025 Km².



FLYW

• **N-MED17. DC Voltmeter Module.**

Measurement range: 0-200 VDC.
 Terminals:
 Measurement terminals.
 Ground terminals.



N-MED17

Specifications

- **N-MED05. DC Ammeter (1-1,5A) Module.**

Measurement range: 0-2 ADC.

Terminals:

Measurement Terminals.

Ground Terminal.

Fuse: 3A.



N-MED05

- **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

Optional modules:

- **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

- **N-WCA/M. AC Motor Speed Controller (Intermediate option).**

Supply voltage: 230 VAC.

Nominal power: 0,4 kW.

PWM output voltage connections:

Three-Phases: 230 VAC.

10K, potentiometer for the induction motor control speed.

Setting and visualization display of the machine parameters.



N-WCA/M

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

Value: 150 Ohm.

Maximum power: 500W

Selector:

Position 0: circuit opened.

Position 1: circuit closed.

Current fuse: 2 A.



N-REF

- **EMT1. DC Independent excitation motor-Generator.**

Nominal power: 250 W.

Armature voltage: 200 VDC.

Excitation voltage: 190 VDC.

Armature current: 1,5 A.

Excitation current: 0,3 A

RPM: 3000 r.p.m.



EMT1

- **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

- **EMT3. DC Shunt Excitation Motor-Generator.**

Nominal power: 300 W.
 Nominal voltage: 200 V.
 Nominal current: 1,5 A.
 RPM: 3400 r.p.m.



EMT3

- **EMT4. DC Compound Excitation Motor-Generator.**

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



EMT4

- **EMT5. DC Independent-Shunt-series-compound excitation motor.**

Nominal power: 300 W.
 Armature voltage: 200 VDC.
 Excitation voltage: 230 VDC.
 Armature current: 1,5 A.
 Excitation current: 0,4 A.
 RPM: 3400/7500 r.p.m.



EMT5

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

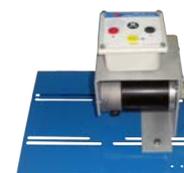
Nominal power: 370 W.
 Nominal voltage: 3x 230/400 VAC Δ/Y .
 Frequency: 50/60 Hz.
 Number of poles: 2.
 RPM: 2730 r.p.m.
 Nominal current: 1,67/ 0,97 A.



EMT7

- **EMT15. DC Permanent magnet motor.**

Nominal power: 100 W.
 Armature voltage: 200 VDC.
 Armature current: 0,5 A.
 RPM: 3000 r.p.m.



EMT15

- **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 DC Machine with independent excitation:

- 1.- Wiring and starting of DC independent excitation motor.
- 2.- Study of the control parameters of DC current motors
- 3.- DC motor speed control.
- 4.- DC machine turning direction control.
- 5.- Excitation current control.
- 6.- Comparison with other acquired motors.

Some practical possibilities with DC Machine with series excitation:

- 7.- Wiring and starting of DC series Excitation motor.
- 8.- Study of the control parameters of DC current motors
- 9.- DC motor speed control.
- 10.- DC machine turning direction control.
- 11.- Excitation current control.
- 12.- Comparison with other acquired motors.

Some practical possibilities with DC Machine with shunt excitation:

- 13.- Wiring and starting of DC shunt Excitation motor.
- 14.- Study of the control parameters of DC current motors
- 15.- DC motor speed control.
- 16.- DC machine turning direction control.
- 17.- Excitation current control.
- 18.- Comparison with other acquired motors.

Some practical possibilities with DC Machine with compound excitation:

- 19.- Wiring and starting of DC compound Excitation motor.
- 20.- Study of the control parameters of DC current motors
- 21.- DC motor speed control.
- 22.- DC machine turning direction control.
- 23.- Excitation current control.
- 24.- Comparison with other acquired motors.

Some practical possibilities with the permanent magnet DC motor:

- 25.- Wiring and starting of permanent magnet DC motor.
- 26.- Study of the control parameters of DC current motors
- 27.- Speed control of the DC permanent magnet motor.
- 28.- DC machine turning direction control.
- 29.- Speed reading of the DC permanent magnet motor.
- 30.- Current control of the DC permanent magnet motor.
- 31.- Comparison with other acquired motors.

Some practical possibilities with the DC generator:

- 32.- Wiring the DC generator.
- 33.- Study of the control parameters of DC current motors
- 34.- Control of generated voltage.
- 35.- Control of the excitation of the DC generator.
- 36.- Driving motor speed variation.
- 37.- Loading of the DC generator.

REQUIRED SERVICES

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

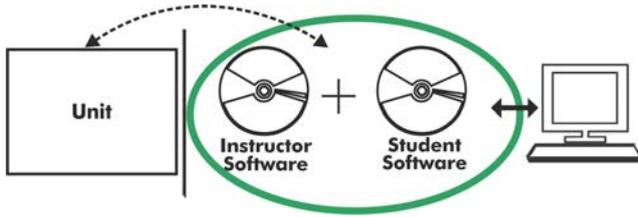
DIMENSIONS AND WEIGHTS

AEL-DCEMA:

- Dimensions: 1380 x 840 x 2010 mm. approx.
(54.33 x 33.07 x 79.13 inches approx.).
- Weight: 80 Kg. approx.
(176 pounds approx.).

Optional

AEL-DCEMA/ICAI. Interactive Computer Aided Instruction Software System.



Without 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.

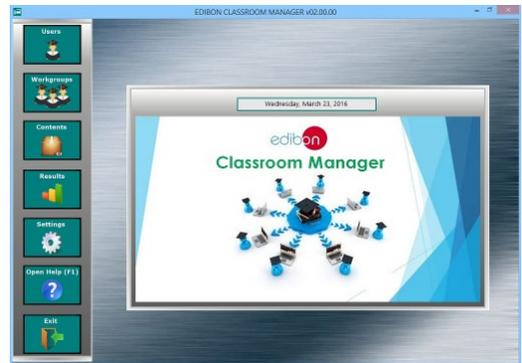
Instructor Software

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

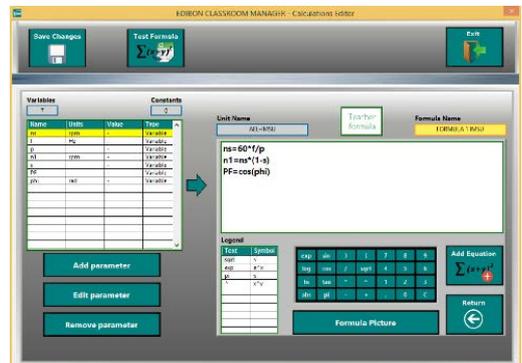
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

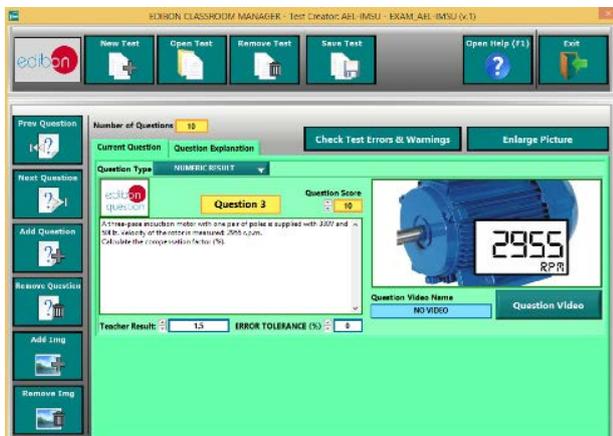
- User Data Base Management.**
- Administration and assignment of Workgroup, Task and Training sessions.**
- Creation and Integration of Practical Exercises and Multimedia Resources.**
- Custom Design of Evaluation Methods.**
- Creation and assignment of Formulas & Equations.**
- Equation System Solver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

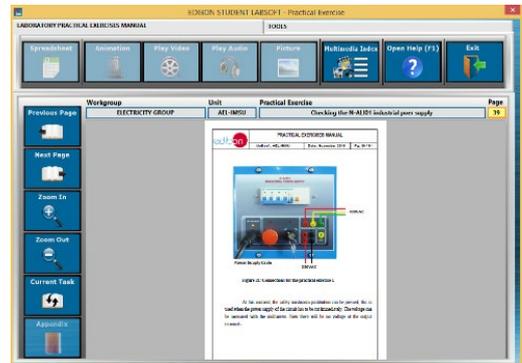
- Student Log-In & Self-Registration.**
- Existing Tasks checking & Monitoring.**
- Default contents & scheduled tasks available to be used from the first session.**
- Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- Evaluation Methods to prove your knowledge and progression.**
- 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/products/catalogues/en/units/electricity/ICAI-Electricity/ICAI-Electricity.pdf



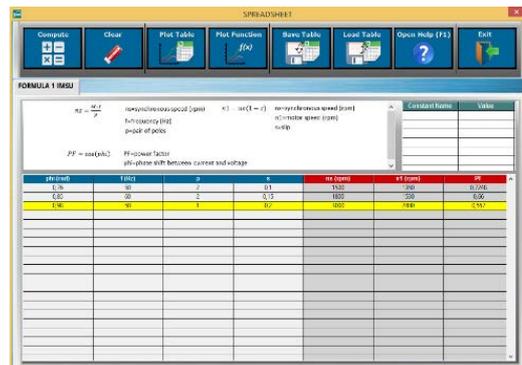
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



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:

