Engineering and Technical
Teaching Equipment

Transparent and Functional Motors Application

AEL-FTM

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PRODUCTS
4.- ELECTRICITY

Configuration example of AEL-FTM application

INTRODUCTION

Electric machines have a special importance considering that they are involved in most of the industrial processes that are carried out in different sectors. The electric motors are used in all kinds of applications such as elevators, cranes, sliding doors, conveyor belts, escalators, trains, etc. Therefore, given their wide range of applications, it is essential to study electric motors at different levels.

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)

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GENERAL DESCRIPTION

The Transparent and Functional Motors Application "AEL-FTM" has been designed by EDIBON for the formation at theoretical-practical and functional levels about the electric rotating machines.

This application offers several study options which will provide the user of the knowledge, at a functional level, of the electric motors. For this purpose, the application includes a specific manual explaining, at theoretical level, the relative aspects to the electric machines. The theme covers from the parts that form different types of electric machines to how their operations are. Furthermore, a set of both optional transparent motors and modules are provided for the study of the same from a practical point of view.

The "AEL-FTM" application offers a series of requered electric transparent motors: DC Independent Excitation Motor-Generator, DC Series Excitation Motor-Generator, DC Shunt Excitation Motor-Generator, DC Compound Excitation Motor-Generator, DC Serie/Shunt/Compound Excitation Motor-Generator, Independent Excitation 3PH Synchronous Motor-Generator, 3PH Squirrel-Cage Industrial Motor, 3PH Wound Motor Study Kit, Dahlander Motor, 2 speeds, 3PH Squirrel-Cage Motor, 2 speeds, Universal Motor, DC Permanent Magnet Motor, 1PH Squirrel-Cage Motor with Starting Capacitor, 1PH Squirrel-Cage Motor with split phase, 3PH Reluctance Motor, 1PH Squirrel-Cage Motor with Starting Capacitor, 1PH Squirrel-Cage Motor with Starting and Running Capacitor and 1PH Shaded Pole Motor.

In addition, a set of modules are recommended with each electric machine in order to put into operation each one. Besides, it is possible to visualize in dynamic regime the inside of each transparent motor through the stroboscope.

One of the advantages of this application is that is included a stroboscope to visualize the rotor in operation. This technique is employed frequently in the industry to calibrate or repair the unit. In addition, with the modules which are offered in each option, can be done speed regulation tests and in some cases to study the drop voltage produced by the loads.

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

- N-ALI01. Industrial Main Power Supply Module.
- MED65. Digital Multimeter (2 units).
- STRO. Stroboscope.

Required elements (at least one) (Not included):

- EMT1-T-DC-KIT. Transparent and Functional DC Independent Excitation Motor-Generator Study Kit.
  - EMT1-T. Transparent and Functional DC Independent Excitation Motor-Generator.
  - N-VVCC/M. DC Motor Speed Controller Module (intermediate option) (2 units).
- EMT2-T-DC-KIT. Transparent and Functional DC Series Excitation Motor-Generator Study Kit.
  - EMT2-T. Transparent and Functional DC Series Excitation Motor-Generator.
  - N-VVCC/M. DC Motor Speed Controller Module (intermediate option).
- EMT3-T-DC-KIT. Transparent and Functional DC Shunt Excitation Motor-Generator Study Kit.
  - EMT3-T. Transparent and Functional DC Shunt Excitation Motor-Generator.
  - N-VVCC/M. DC Motor Speed Controller Module (intermediate option).
- EMT4-T-DC-KIT. Transparent and Functional DC Compound Excitation Motor-Generator Study Kit.
  - EMT4-T. Transparent and Functional DC Compound Excitation Motor-Generator.
  - N-VVCC/M. DC Motor Speed Controller Module (intermediate option).
- EMT5-T-DC-KIT. Transparent and Functional DC Serie/Shunt/Compound Excitation Motor-Generator Study Kit.
  - EMT5-T. Transparent and Functional DC Shunt/Series/Compound Excitation Motor-Generator.
  - N-VVCC/M. DC Motor Speed Controller Module (intermediate option) (2 units).
- EMT6-T-AC-KIT. Transparent and Functional Independent Excitation 3PH Synchronous Motor-Generator Study Kit.
  - EMT6-T. Transparent and Functional Independent Excitation 3PH Synchronous Motor-Generator.
  - N-VVCC/M. DC Motor Speed Controller Module (intermediate option).
  - EMT7. 3PH Squirrel-Cage Motor.
  - N-REFTI. Three-Phase Independent Resistor Module.
  - N-VVCA/M. AC Motors Speed Controller Module (intermediate option).
- EMT7-T-AC-KIT. Transparent and Functional 3PH Squirrel-Cage Industrial Motor Study Kit.
  - EMT7-T. Transparent and Functional 3PH Squirrel-Cage Motor.
  - N-ARR01. Manual Star-Delta Starter Module.
  - N-TRANS03. Three-Phase Autotransformer 400/230 VAC, 1 kVA, Module.

- EMT8-T-AC-KIT. Transparent and Functional 3PH Wound Motor Study Kit.
  - EMT8-T. Motor de Rotor Bobinado 3PH, Transparente y Funcional.
  - N-TRANS03. Three-Phase Autotransformer 400/230 VAC, 1 kVA, Module.
  - N-ARR01. Manual Star-Delta Starter Module.
  - N-REFTI. Three-Phase Independent Resistor Module (3 units).
- EMT9-T-AC-KIT. Transparent and Functional Dahlander Motor, 2 speeds Study Kit.
  - EMT9-T. Transparent and Functional Dahlander Motor, 2 speeds.
  - N-ARR07. Manual Dahlander Commutator Module, 2 Speeds.
- EMT10-T-AC-KIT. Transparent and Functional 3PH Squirrel-Cage Motor, 2 speeds Study Kit.
  - EMT10-T. Transparent and Functional 3PH Squirrel-Cage Motor, 2 speeds.
  - N-ARR09. Manual Independent Windings Commutator Module, 2 speeds.
- EMT12-T-DC-KIT. Transparent and Functional Universal Motor Study Kit.
  - EMT12-T. Transparent and Functional Universal Motor.
  - N-REV. Single Phase Variable Resistor Module.
  - N-VVCC/M. DC Motor Speed Controller Module (intermediate option).
- EMT15-T-DC-KIT. Transparent and Functional DC Permanent Magnet Motor Study Kit.
  - EMT15-T. Transparent and Functional DC Permanent Magnet Motor.
  - N-VVCC/M. DC Motor Speed Controller Module (intermediate option).
- EMT20-T-AC-KIT. Transparent and Functional 1PH Squirrel-Cage Motor with split phase Study Kit.
  - EMT20-T. Transparent and Functional 1PH Squirrel-Cage Motor with split phase.
  - N-VVCA/M. AC Motors Speed Controller Module (intermediate option).
- EMT21-T-AC-KIT. Transparent and Functional 3PH Reluctance Motor Study Kit.
  - EMT21-T. Transparent and Functional 3PH Reluctance Motor.
  - N-VVCA/M. AC Motors Speed Controller Module (intermediate option).
- EMT11-T. Transparent and Functional 1PH Squirrel-Cage Motor with Starting Capacitor.
- EMT16-T. Transparent and Functional 1PH Squirrel-Cage Motor with Starting and Running Capacitor.
- EMT22-T. Transparent and functional 1PH Shaded Pole Motor.

Recommended additional elements (Not included):

- FRECP. Eddy Current Brake.
- FRENP. Magnetic Powder Brake.
- FRE-FE. Electronic Brake.
- FREPR. Prony Brake.

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

Option A:

This application needs the following racks.

- N-RACK-B.

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

Option B:

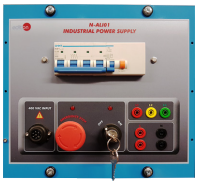
This application can be mounted on rail.

Optionally the AEL-WBC, Electrical workbench (rail) can be supplied to mount the modules.

SPECIFICATIONS

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

- N-ALI01. **Industrial Main Power Supply Module.**
  Supply voltage: 400 VAC, 3PH + N.
  ON / OFF removable key.
  Output voltage connections:
  Three-phase + Neutral: 400 VAC.
  Single-phase: 230 VAC.
  Three-phase supply hose with IP44 3PN + E 32 A 400 V connecting plug.
  Differential magnetothermal 4 poles, 25 A, 30 mA AC 6 KA.
  Emergency stop push button.


N-ALI01

- MED65. **Digital Multimeter (2 units).**
  Digital multimeter with 3 ½ digits, with 4 mm double connector termination cables to facilitate interconnections.
  With this digital multimeter we can measure:
  Voltage.
  Current.
  Resistance.
  Capacitors capacity.
  Temperature.


MED65

- STRO. **Stroboscope.**
  Flash speed: 100 – 10000 flash per minute.
  Speed rate: 100 – 10000 rpm.
  Display: flash speed.


STRO

<u>Required elements (at least one)</u> (Not included):

- **EMT1-T-DC-KIT. Transparent and Functional DC Independent Excitation Motor-Generator Study Kit.**
  - EMT1-T. **Transparent and Functional 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.
    Speed: 3000 rpm.
    Shaft height: 71 mm.


EMT1-T

  - N-VVCC/M. **DC Motor Speed Controller Module (intermediate option) (2 units).**
    Supply voltage: 230 VAC.
    Variable output voltage: 0 – 300 VDC.
    Fuse: 2 A.


N-VVCC/M

- EMT2-T-DC-KIT. **Transparent and Functional DC Series Excitation Motor-Generator Study Kit.**
  - EMT2-T. **Transparent and Functional DC Series Excitation Motor-Generator.**
    Nominal power: 300 W.
    Armature voltage: 200 VDC.
    Armature current: 1.5 A.
    Speed: 7500 rpm.
    Shaft height: 71 mm.


EMT2-T

  - N-VVCC/M. **DC Motor Speed Controller Module (intermediate option).**
    Supply voltage: 230 VAC.
    Variable output voltage: 0 – 300 VDC.
    Fuse: 2 A.


N-VVCC/M

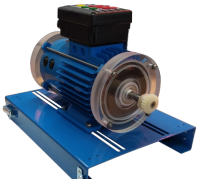
- **EMT3-T-DC-KIT. Transparent and Functional DC Shunt Excitation Motor-Generator Study Kit.**
  - EMT3-T. **Transparent and Functional DC Shunt Excitation Motor-Generator.**
    Nominal power: 300 W.
    Nominal voltage: 200 VDC.
    Nominal current: 1.5 A.
    Speed: 3400 rpm.
    Shaft height: 71 mm.

EMT3-T

  - N-WCC/M. **DC Motor Speed Controller Module (intermediate option).**
    Supply voltage: 230 VAC.
    Variable output voltage: 0 – 300 VDC.
    Fuse: 2 A.

N-WCC/M

- **EMT4-T-DC-KIT. Transparent and Functional DC Compound Excitation Motor-Generator Study Kit.**
  - EMT4-T. **Transparent and Functional DC Compound Excitation Motor-Generator.**
    Nominal power: 250 W.
    Armature voltage: 200 VDC.
    Armature current: 1.5 A.
    Excitation current: 0.3 A.
    Speed: 3000 rpm.
    Shaft height: 71 mm.



EMT4-T

  - N-WCC/M. **DC Motor Speed Controller Module (intermediate option).**
    Supply voltage: 230 VAC.
    Variable output voltage: 0 – 300 VDC.
    Fuse: 2 A.

N-WCC/M

- **EMT5-T-DC-KIT. Transparent and Functional DC Serie/Shunt/Compound Excitation Motor-Generator Study Kit.**
  - EMT5-T. **Transparent and Functional DC Shunt/Series/Compound Excitation Motor-Generator.**
    Nominal power: 300 W.
    Armature voltage: 200 VDC.
    Excitation voltage: 230 VDC.
    Armature current: 1.5 A.
    Excitation current: 0.4 A.
    Speed: 3400 / 7500 rpm.
    Shaft height: 71 mm.

EMT5-T

  - N-WCC/M. **DC Motor Speed Controller Module (intermediate option) (2 units).**
    Supply voltage: 230 VAC.
    Variable output voltage: 0 – 300 VDC.
    Fuse: 2 A.

N-WCC/M

- **EMT6-T-AC-KIT. Transparent and Functional Independent Excitation 3PH Synchronous Motor-Generator Study Kit.**
  - EMT6-T. **Transparent and Functional Independent Excitation 3PH Synchronous Motor-Generator.**
    Nominal power: 250 W.
    Nominal output voltage: 3 x 400 VAC.
    Frequency: 50 / 60 Hz.
    Speed: 3000 rpm.
    Nominal output current: 1 A.
    Nominal excitation current: 0.25 A.
    Shaft height: 71 mm.

EMT6-T

- N-VVCC/M. **DC Motor Speed Controller Module (intermediate option).**
  - Supply voltage: 230 VAC.
  - Variable output voltage: 0 – 300 VDC.
  - Fuse: 2 A.

N-VVCC/M

- EMT7. **3PH Squirrel-Cage Motor.**
  - Nominal power: 370 W.
  - Nominal voltage: 3 x 400 VAC.
  - Frequency: 50 / 60 Hz.
  - Speed: 900 / 1420 rpm.
  - Nominal current: 1.05 / 1.35 A.
  - Shaft height: 71 mm.

EMT7

- N-VVCA/M. **AC Motors Speed Controller Module (intermediate option).**
  - ON / OFF switch.
  - Supply voltage: 230 VAC.
  - Nominal power: 750 W.
  - PWM output voltage connections:
    - Three-phase: 230 VAC.
  - 10 K potentiometer for the induction motor control speed.
  - Setting and visualization display of the machine parameters.

N-VVCA/M

- N-REFTI. **Three-Phase Independent Resistor Module.**
  - Nominal voltage: 400 VAC.
  - Resistor value: 3 x 150 Ohm.
  - Nominal power: 3 x 352 W.
  - Manual commutator to switch ON / OFF the resistors.
  - Fuses: 3 x 5 A.
  - Terminals:
    - Three input terminals (3PH).
    - Three output terminals (3PH).

N-REFTI

- EMT7-T-AC-KIT. **Transparent and Functional 3PH Squirrel-Cage Industrial Motor Study Kit.**
  - EMT7-T. **Transparent and Functional 3PH Squirrel-Cage Motor.**
    - Nominal power: 370 W.
    - Nominal voltage: 3 x 400 VAC.
    - Frequency: 50 / 60 Hz.
    - Speed: 900 / 1420 rpm.
    - Nominal current: 1.05 / 1.35 A.
    - Shaft height: 71 mm.

EMT7-T

- N-ARR01. **Manual Star-Delta Starter Module.**
  - Nominal voltage: 400 VAC.
  - Maximum contacts current: 10 A.
  - Star-delta three positions commutator:
    - 0: Open circuit.
    - Y: Star connection.
    - Δ: Delta connection.

N-ARR01

- N-TRANS03. **Three-Phase Autotransformer 400/230 VAC, 1 kVA, Module.**
  - Three-phase autotransformer.
  - Input voltage: 400 VAC (3PH).
  - Output voltage: 3 x 230 VAC (3PH).
  - Nominal power: 1 kVA.
  - Three-phase ON / OFF switch.
  - Fuses: 3 x 5 A.


N-TRANS03

- **EMT8-T-AC-KIT. Transparent and Functional 3PH Wound Motor Study Kit.**
  - EMT8-T. **Transparent and Functional 3PH Wound Motor.**
    - Nominal power: 300 W.
    - Nominal voltage: 3 x 230 / 400 VAC Δ / Y.
    - Frequency: 50 / 60 Hz.
    - Poles number: 2.
    - Speed: 2870 rpm.
    - Nominal current: 1 / 0.5 A.
    - Shaft height: 71 mm.


EMT8-T

  - N-TRANS03. **Three-Phase Autotransformer 400/230 VAC, 1 kVA, Module.**
    - Three-phase autotransformer.
    - Input voltage: 400 VAC (3PH).
    - Output voltage: 3 x 230 VAC (3PH).
    - Nominal power: 1 kVA.
    - Three-phase ON / OFF switch.
    - Fuses: 3 x 5 A.


N-TRANS03

  - N-ARR01. **Manual Star-Delta Starter Module.**
    - Nominal voltage: 400 VAC.
    - Maximum contacts current: 10 A.
    - Star-delta three positions commutator:
      - 0: Open circuit.
      - Y: Star connection.
      - Δ: Delta connection.


N-ARR01

  - N-REFTI. **Three-Phase Independent Resistor Module (3 units).**
    - Nominal voltage: 400 VAC.
    - Resistor value: 3 x 150 Ohm.
    - Nominal power: 3 x 352 W.
    - Manual commutator to switch ON / OFF the resistors.
    - Fuses: 3 x 5 A.
    - Terminals:
      - Three input terminals (3PH).
      - Three output terminals (3PH).


N-REFTI

- **EMT9-T-AC-KIT. Transparent and Functional Dahlander Motor, 2 speeds Study Kit.**
  - EMT9-T. **Transparent and Functional Dahlander Motor, 2 speeds.**
    - Nominal power: 370 W.
    - Nominal voltage: 3 x 400 VAC.
    - Frequency: 50 / 60 Hz.
    - Poles number: 4.
    - Speed: 1400 / 2800 rpm.
    - Nominal current: 1.2 / 1.55 A.
    - Shaft height: 71 mm.


EMT9-T

- N-ARR07. **Manual Dahlander Commutator Module, 2 speeds.**
  - Nominal voltage: 400 VAC.
  - Maximum contacts current: 10 A.
  - Three positions commutator:
    - 0: Open circuit.
    - 1: Low speed.
    - 2: High speed.


N-ARR07

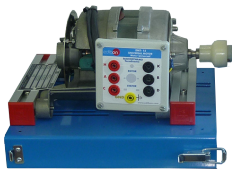
- **EMT10-T-AC-KIT. Transparent and Functional 3PH Squirrel-Cage Motor, 2 speeds Study Kit.**
  - EMT10-T. **Transparent and Functional 3PH Squirrel-Cage Motor, 2 speeds.**
    - Nominal power: 240 / 370 W.
    - Nominal voltage: 3 x 400 VAC.
    - Frequency: 50 / 60 Hz.
    - Speed: 900 / 1420 rpm.
    - Nominal Current: 1.05 / 1.35 A.
    - Shaft height: 71 mm.


EMT10-T

  - N-ARR09. **Manual Independent Windings Commutator Module, 2 speeds.**
    - Nominal voltage: 400 VAC.
    - Maximum contacts current: 10 A.
    - Three positions commutator:
      - 0: Open circuit.
      - 1: Winding 1.
      - 2: Winding 2.


N-ARR09

- **EMT12-T-DC-KIT. Transparent and Functional Universal Motor Study Kit.**
  - EMT12-T. **Transparent and Functional Universal Motor.**
    - Nominal power: 230 W.
    - Nominal voltage: 110 – 240 VAC / VDC.
    - Speed: 9000 rpm.
    - Shaft height: 71 mm.


EMT12-T

  - N-REV. **Single Phase Variable Resistor Module.**
    - Variable resistor: 150 Ohm.
    - Maximum power: 500 W.
    - Potentiometer.
    - Terminals:
      - Three terminals to choose all resistance or variable resistance.
    - Fuse: 2 A.


N-REV

  - N-VVCC/M. **DC Motor Speed Controller Module (intermediate option).**
    - Supply voltage: 230 VAC.
    - Variable output voltage: 0 – 300 VDC.
    - Fuse: 2 A.


N-VVCC/M

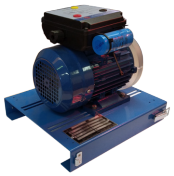
- **EMT15-T-DC-KIT. Transparent and Functional DC Permanent Magnet Motor Study Kit.**
  - EMT15-T. **Transparent and Functional DC Permanent Magnet Motor.**
    - Nominal power: 300 W.
    - Nominal voltage: 200 VDC.
    - Nominal current: 0.5 A.
    - Speed: 3400 rpm.
    - Shaft height: 71 mm.


EMT15-T

- N-WCC/M. **DC Motor Speed Controller Module (intermediate option).**
  - Supply voltage: 230 VAC.
  - Variable output voltage: 0 – 300 VDC.
  - Fuse: 2 A.

N-WCC/M

- **EMT20-T-AC-KIT. Transparent and Functional 1PH Squirrel-Cage Motor with Split Phase Study Kit.**
  - EMT20-T. **Transparent and Functional 1PH Squirrel-Cage Motor with Split Phase.**
    - Nominal power: 370 W.
    - Nominal voltage: 220 VAC.
    - Speed: 2780 rpm.
    - Frequency: 50 Hz.
    - Armature current: 2.53 A.
    - Shaft height: 71 mm.



EMT20-T

  - N-WCA/M. **AC Motors Speed Controller Module (Intermediate option).**
    - ON / OFF switch.
    - Supply voltage: 230 VAC.
    - Nominal power: 750 W.
    - PWM output voltage connections:
      - Three-phase: 230 VAC.
    - 10 K potentiometer for the induction motor control speed.
    - Setting and visualization display of the machine parameters.

N-WCA/M

- **EMT21-T-AC-KIT. Transparent and Functional 3PH Reluctance Motor Study Kit.**
  - EMT21-T. **Transparent and Functional 3PH Reluctance Motor.**
    - Nominal power: 300 W.
    - Nominal voltage: 3 x 400 VAC.
    - Frequency: 50 / 60 Hz.
    - Speed: 3000 rpm.
    - Nominal current: 1.4 A.
    - Shaft height: 71 mm.

EMT21-T

  - N-WCA/M. **AC Motors Speed Controller Module (Intermediate option).**
    - ON / OFF switch.
    - Supply voltage: 230 VAC.
    - Nominal power: 750 W.
    - PWM output voltage connections:
      - Three-phase: 230 VAC.
    - 10 K potentiometer for the induction motor control speed.
    - Setting and visualization display of the machine parameters.

N-WCA/M

- EMT11-T. **Transparent and Functional 1PH Squirrel-Cage Motor with Starting Capacitor.**
  - Nominal power: 370 W.
  - Nominal voltage: 3 x 230 VAC.
  - Frequency: 50 / 60 Hz.
  - Speed: 2780 rpm.
  - Nominal current: 2.53 A.
  - Shaft height: 71 mm.

EMT11-T

- EMT16-T. **Transparent and Functional 1PH Squirrel-Cage Motor with Starting and Running Capacitor.**

  Nominal power: 370 W.
  Nominal voltage: 110 / 220 VAC.
  Speed: 2780 rpm.
  Frequency: 50 / 60 Hz.
  Nominal current: 1.85 A.
  Shaft height: 71 mm.

EMT16-T

- EMT22-T. **Transparent and Functional 1PH Shaded Pole Motor.**

  Nominal power: 34 W.
  Nominal voltage: 230 / 240 VAC.
  Frequency: 50 / 60 Hz.
  Speed: 1550 rpm.
  Shaft height: 71 mm.

EMT22-T

<u>Recommended additional elements</u> (Not included):

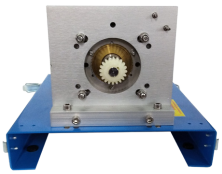
- FRECP. **Eddy Current Brake.**

  Maximum supply voltage: 60 VDC.
  Nominal current: 1.67 A.
  Maximum current: 1.8 A.
  Maximum braking torque: 1.4 Nm.
  Shaft height: 71 mm.

FRECP

- FRENP. **Magnetic Powder Brake.**

  Nominal torque: 5 Nm.
  Maximum power dissipation: 100 W.
  Maximum output current adjustment.
  Operating modes “freewheel “ and “blocking”.
  Nominal voltage: 24 VAC / VDC.
  Maximum output current: 2 A.
  Output load (resistor): 4 – 20 Ohm.
  Maximum power consumed: 70 W.
  Remote voltage control: 0 – 10 VDC.
  Weight: 4 Kg.



FRENP

- FRE-FE. **Electronic Brake.**

  The electronic brake is a unit that allows the braking torque of a motor to be regulated.
  The unit is composed of two main elements:
    Control module:
      Front panel:
        Braking torque control.
        ON / OFF switch.
        Electrical parameters indicator.
        Display manipulation: Key “FUNC / DATA”. Keys “RUN” / “STOP”.
        Forward / reverse switch.
    Braking motor mounted on a bench-support.
  Cable to connect the two elements.
  Power: 370 W.
  Armature voltage: 220 / 240 VDC.
  The motor braking torque is controlled by a control potentiometer located on the front of the control module.
  The direction of the braking motor is controlled by a switch located on the front panel of the control module.
  In addition, the user will be able to visualize on a display various electrical parameters (such as: current, frequency, active power, etc.).

FRE-FE

- FREPR. **Prony Brake.**

  Two dynamometers: 50 N.

  Rotating wheel for braking torque regulation.

  Aluminum pulley brake.

  External diameter: 136 mm.

  Throat diameter: 125 mm.

  Leather strap.

  Shaft height: 71 mm.

FREPR

- **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.

Some practical possibilities with Transparent and Functional DC Independent Excitation Motor-Generator Study Kit (EMT1-T-DC-KIT).

1.- Wiring and starting of the DC Independent Excitation Motor-Generator.
2.- Speed control of the DC Independent Excitation Motor-Generator.
3.- Visualization of the rotor rotating.
4.- Visualization of the internal elements of the motor.
5.- Usage of the stroboscope for the static visualization of the rotor.
6.- Change of direction of rotation of the DC Motor-Generator with Independent Excitation.
7.- Excitation current control.

Some practical possibilities with Transparent and Functional DC Series Excitation Motor-Generator Study Kit (EMT2-T-DC-KIT).

8.- Wiring and starting of the DC Series Excitation Motor-Generator.
9.- Speed control of the DC Series Excitation Motor-Generator.
10.- Visualization of the rotor rotating.
11.- Visualization of the internal elements of the motor.
12.- Usage of the stroboscope for the static visualization of the rotor.
13.- Change of direction of rotation of the DC Series Excitation Motor-Generator.
14.- Excitation current control.

Some practical possibilities with Transparent and Functional DC Shunt Excitation Motor-Generator Study Kit (EMT3-T-DC-KIT).

15.- Wiring and starting of the DC Shunt Excitation Motor-Generator.
16.- Speed control of the DC Shunt Excitation Motor-Generator.
17.- Visualization of the rotor rotating.
18.- Visualization of the internal elements of the motor.
19.- Usage of the stroboscope for the static visualization of the rotor.
20.- Change of direction of rotation of the DC Shunt Excitation Motor-Generator.
21.- Excitation current control.

Some practical possibilities with Transparent and Functional DC Compound Excitation Motor-Generator Study Kit (EMT4-T-DC-KIT).

22.- Wiring and starting of the DC Compound Excitation Motor-Generator.
23.- Speed control of the DC Compound Excitation Motor-Generator.
24.- Visualization of the rotor rotating.
25.- Visualization of the internal elements of the motor.
26.- Usage of the stroboscope for the static visualization of the rotor.
27.- Change of direction of rotation of the DC Compound Excitation Motor-Generator.
28.- Excitation current control.

Some practical possibilities with Transparent and Functional DC Serie/Shunt/Compound Excitation Motor-Generator Study Kit (EMT5-T-DC-KIT).

29.- Wiring and starting of the DC Serie/Shunt/Compound Excitation Motor-Generator.
30.- Speed control of the DC Serie/Shunt/Compound Excitation Motor-Generator.
31.- Visualization of the rotor rotating.
32.- Visualization of the internal elements of the motor.
33.- Usage of the stroboscope for the static visualization of the rotor.
34.- Change of direction of rotation of the DC Serie/Shunt/Compound Excitation Motor-Generator.
35.- Excitation current control.

Some practical possibilities with Transparent and Functional Independent Excitation 3PH Synchronous Motor-Generator Study Kit (EMT6-T-AC-KIT).

36.- Checking the main power supply.
37.- Wiring and starting of the Independent Excitation 3PH Synchronous Motor-Generator.
38.- Visualization of the rotor rotating.
39.- Visualization of the internal elements of the motor.
40.- Usage of the stroboscope for the static visualization of the rotor.
41.- Study of drop voltage of Independent Excitation 3PH Synchronous Motor-Generator.

Some practical possibilities with Transparent and Functional 3PH Squirrel-Cage Motor Study Kit (EMT7-T-AC-KIT).

42.- Checking the main power supply.
43.- Wiring and starting of the 3PH Squirrel-Cage Industrial Motor.
44.- Visualization of the rotor rotating.
45.- Visualization of the internal elements of the motor.
46.- Usage of the stroboscope for the static visualization of the rotor.
47.- Manual reversing operations of the 3PH Squirrel-Cage Industrial Motor.

Some practical possibilities with Transparent and Functional 3PH Wound Motor Study Kit (EMT8-T-AC-KIT).

48.- Checking the main power supply.
49.- Wiring and starting of the 3PH Wound Motor.
50.- Visualization of the rotor rotating.
51.- Visualization of the internal elements of the motor.
52.- Usage of the stroboscope for the static visualization of the rotor.
53.- Manual reversing operations of the 3PH Wound Motor.

Some practical possibilities with Transparent and Functional Dahlander Motor, 2 speeds Study Kit (EMT9-T-AC-KIT).

54.- Checking the main power supply.
55.- Wiring and starting of the Dahlander Motor, 2 speeds.
56.- Visualization of the rotor rotating.
57.- Visualization of the internal elements of the motor.
58.- Usage of the stroboscope for the static visualization of the rotor.
59.- Manual reversing operations of the Dahlander Motor, 2 speeds.
60.- Manual speed variation of a Dahlander Motor, 2 speeds.

Some practical possibilities with Transparent and Functional 3PH Squirrel-Cage Motor, 2 speeds Study Kit (EMT10-T-AC-KIT).

61.- Checking the main power supply.
62.- Wiring and starting of the 3PH Squirrel-Cage Motor, 2 speeds.
63.- Visualization of the rotor rotating.

64.- Visualization of the internal elements of the motor.

65.- Usage of the stroboscope for the static visualization of the rotor.

66.- Manual reversing operations of the 3PH Squirrel-Cage Motor, 2 speeds.

67.- Manual speed variation of 3PH Squirrel-Cage Motor, 2 speeds.

Some practical possibilities with Transparent and Functional Universal Motor Study Kit (EMT12-T-DC-KIT).

68.- Checking the main power supply.

69.- Wiring and starting of the Universal Motor.

70.- Visualization of the rotor rotating.

71.- Visualization of the internal elements of the motor.

72.- Usage of the stroboscope for the static visualization of the rotor.

73.- Manual reversing operations of the Universal Motor.

Some practical possibilities with Transparent and Functional DC Permanent Magnet Motor Study Kit (EMT15-T-DC-KIT).

74.- Wiring and starting of the DC Permanent Magnet Motor.

75.- Speed control of the DC Permanent Magnet Motor.

76.- Visualization of the rotor rotating.

77.- Visualization of the internal elements of the motor.

78.- Usage of the stroboscope for the static visualization of the rotor.

79.- Change of direction of rotation of the DC Permanent Magnet Motor.

80.- Excitation current control.

Some practical possibilities with Transparent and Functional 1PH Squirrel-Cage Motor with split phase Study Kit (EMT20-T-AC-KIT).

81.- Checking the main power supply.

82.- Wiring and starting of 1PH Squirrel-Cage Motor with split phas.

83.- Visualization of the rotor rotating.

84.- Visualization of the internal elements of the motor.

85.- Usage of the stroboscope for the static visualization of the rotor.

86.- Manual reversing operations of the 1PH Squirrel-Cage Motor with split phas.

Some practical possibilities with Transparent and Functional 3PH Reluctance Motor Study Kit (EMT21-T-AC-KIT).

87.- Checking the main power supply.

88.- Wiring and starting of 3PH Reluctance Motor.

89.- Visualization of the rotor rotating.

90.- Visualization of the internal elements of the motor.

91.- Usage of the stroboscope for the static visualization of the rotor.

92.- Manual reversing operations of the 3PH Reluctance Motor.

Some practical possibilities with Transparent and Functional 1PH Squirrel-Cage Motor with Starting Capacitor (EMT11-T).

93.- Checking the main power supply.

94.- Wiring and starting of the 1PH Squirrel-Cage Motor with Starting Capacitor.

95.- Visualization of the rotor rotating.

96.- Visualization of the internal elements of the motor.

97.- Usage of the stroboscope for the static visualization of the rotor.

98.- Manual reversing operations of the 1PH Squirrel-Cage Motor with Starting Capacitor.

Some practical possibilities with Transparent and Functional 1PH Squirrel-Cage Motor with Starting and Running Capacitor (EMT16-T).

99.- Checking the main power supply.

100.- Wiring and starting of 1PH Squirrel-Cage Motor with Starting and Running Capacitor.

101.- Visualization of the rotor rotating.

102.- Visualization of the internal elements of the motor.

103.- Usage of the stroboscope for the static visualization of the rotor.

104.- Manual reversing operations of the 1PH Squirrel-Cage Motor with Starting and Running Capacitor.

Some practical possibilities with Transparent and functional 1PH Shaded Pole Motor (EMT22-T).

105.- Checking the main power supply.

106.- Wiring and starting of 1PH Shaded Pole Motor.

107.- Visualization of the rotor rotating.

108.- Visualization of the internal elements of the motor.

109.- Usage of the stroboscope for the static visualization of the rotor.

110.- Manual reversing operations of the 1PH Shaded Pole Motor.

REQUIRED SERVICES

- Electrical supply: three-phase, 380 VAC – 400 VAC/50 Hz or 190 VAC – 240/60 Hz, 1 kW.

DIMENSIONS AND WEIGHTS

AEL-FTM:

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.)

Motors:

- Dimensions: 330 x 400 x 300 mm approx.
  (12.99 x 15.74 x 11.81 inches approx.)
- Weight: 5 Kg approx.
  (88 pounds approx.)

REQUIRED ELEMENTS (Not Included)

Required (at least one):

- EMT1-T-DC-KIT. Transparent and Functional DC Independent Excitation Motor-Generator Study Kit.
- EMT2-T-DC-KIT. Transparent and Functional DC Series Excitation Motor-Generator Study Kit.
- EMT3-T-DC-KIT. Transparent and Functional DC Shunt Excitation Motor-Generator Study Kit.
- EMT4-T-DC-KIT. Transparent and Functional DC Compound Excitation Motor-Generator Study Kit.
- EMT5-T-DC-KIT. Transparent and Functional DC Serie/Shunt/Compound Excitation Motor-Generator Study Kit.
- EMT6-T-AC-KIT. Transparent and Functional Independent Excitation 3PH Synchronous Motor-Generator Study Kit.
- EMT7-T-AC-KIT. Transparent and Functional 3PH Squirrel-Cage Motor Study Kit.
- EMT8-T-AC-KIT. Transparent and Functional 3PH Wound Motor Study Kit.
- EMT9-T-AC-KIT. Transparent and Functional Dahlander Motor, 2 Speeds Study Kit.
- EMT10-T-AC-KIT. Transparent and Functional 3PH Squirrel-Cage Motor, 2 Speeds Study Kit.
- EMT12-T-DC-KIT. Transparent and Functional Universal Motor Study Kit.
- EMT12-T. Transparent and Functional Universal Motor.
- EMT15-T-DC-KIT. Transparent and Functional DC Permanent Magnet Motor Study Kit.
- EMT20-T-AC-KIT. Transparent and Functional 1PH Squirrel-Cage Motor with split phase Study Kit.
- EMT21-T-AC-KIT. Transparent and Functional 3PH Reluctance Motor Study Kit.
- EMT11-T. Transparent and Functional 1PH Squirrel-Cage Motor with Starting Capacitor.
- EMT16-T. Transparent and Functional 1PH Squirrel-Cage Motor with Starting and Running Capacitor.
- EMT22-T. Transparent and functional 1PH Shaded Pole Motor.

RECOMMENDED ADDITIONAL ELEMENTS (Not Included)

- FRECP. Eddy Current Brake.
- FRENP. Magnetic Powder Brake.
- FRE-FE. Electronic Brake.
- FREPR. Prony Brake.

SIMILAR UNITS AVAILABLE

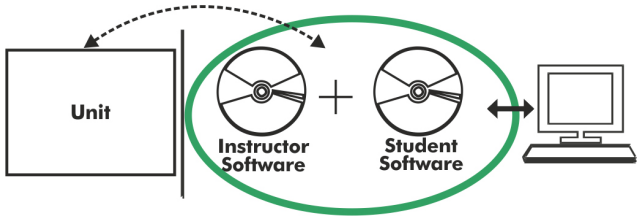
Offered in this catalog:

- AEL-FTM. Transparent and Functional Motors Application.

Offered in other catalog:

- AEL-DIM-KIT. 4 Dissectible Induction Motors Application.
- AEL-MGTC. Motors, Generators and Transformers Construction Application.
- AEL-DMG-KIT. Dissectible Motors-Generators Application.

AEL-FTM/ICAI. Interactive Computer Aided Instruction Software:



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.

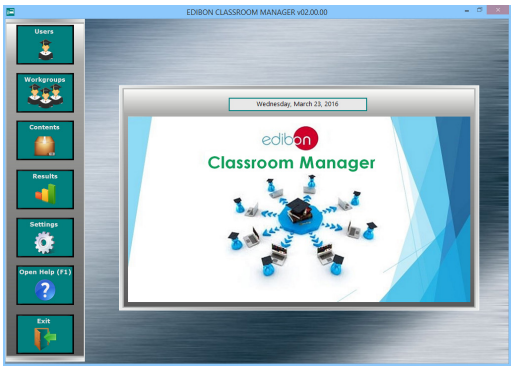
Instructor Software

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

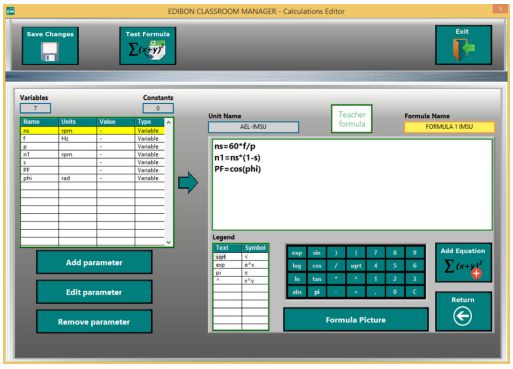
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

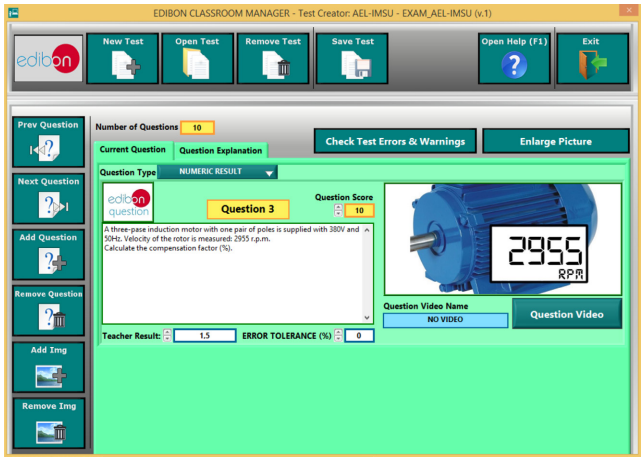
- **User Data Base Management.**
- **Administration and assignment of Workgroup, Task and Training sessions.**
- **Creation and Integration of Practical Exercises and Multimedia Resources.**
- **Custom Design of Evaluation Methods.**
- **Creation and assignment of Formulas & Equations.**
- **Equation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



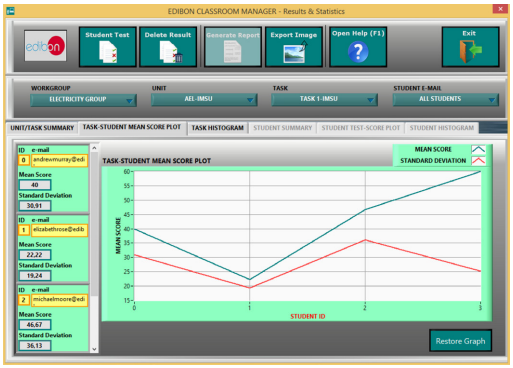
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



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.

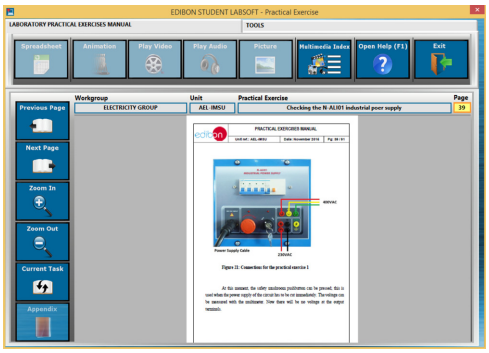
Innovative features:

- **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.**

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

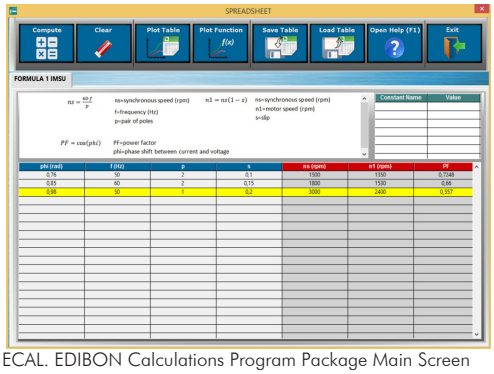
www.edibon.com/en/interactive-computer-aided-instruction-software

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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Edition: ED01/22
Date: January/2022

REPRESENTATIVE: