



www.edibon.com
↳ PRODUCTS
↳ 40.- ELECTRICITY



Key features:

- ▶ **SCADA Control System.**
- ▶ **Specialized EDIBON Softwares, based on Labview, for:**
 - SCADA Control Software.
 - Data Acquisition Software.
 - Computer Aided Instruction Software.
 - ... and others.
- ▶ **Touch Screens and computers.**
- ▶ **Functional and self contained Electrical Workbench with instrumentation panel with all the required elements to supply power and control in the workbench.**
- ▶ **Intuitive, quick and accurate interaction of the user with the Electrical Workbench.**
- ▶ **Complete and functional training solution for electricity learning purposes.**
- ▶ **Covering all areas of electricity field.**
- ... and others possibilities.



ISO 9000: Quality Management
(for Design, Manufacturing,
Commercialization and After-sales service)



European Union Certificate
(total safety)

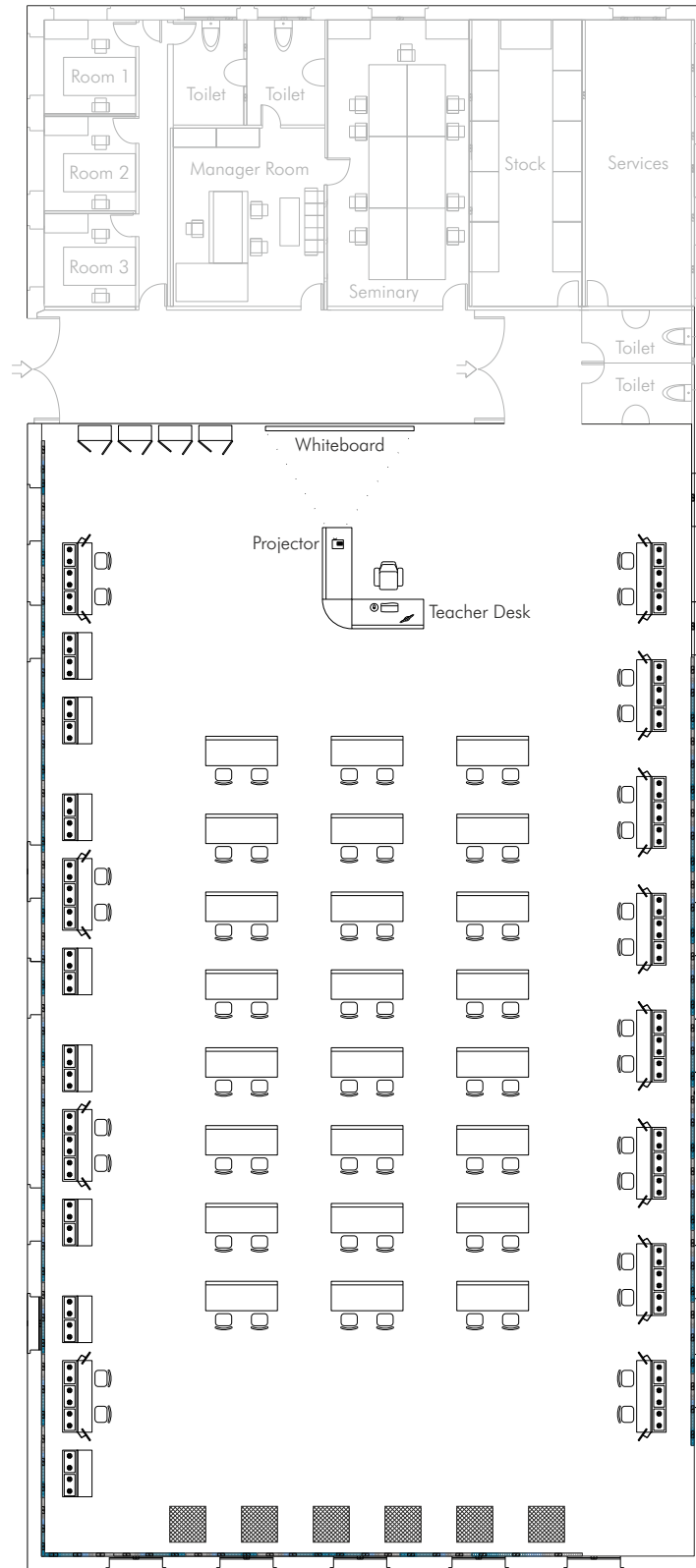







Certificates ISO 14000 and
ECO-Management and Audit Scheme
(environmental management)



Worlddidac Quality Charter
Certificate and
Worlddidac Member

Classroom and Laboratory Lay Out



-  AEL-WTS. Laboratory Workplace Table
-  AEL-WBC. Electrical Workbench (Rail) + 2 x AEL-PC. Two Touchscreen and computers
-  AEL-WBM. Electrical Workbench (Mobile)
-  AEL-MC. Multipurpose Cabinet
-  AEL-WIC. Electrical Installations Cabinet

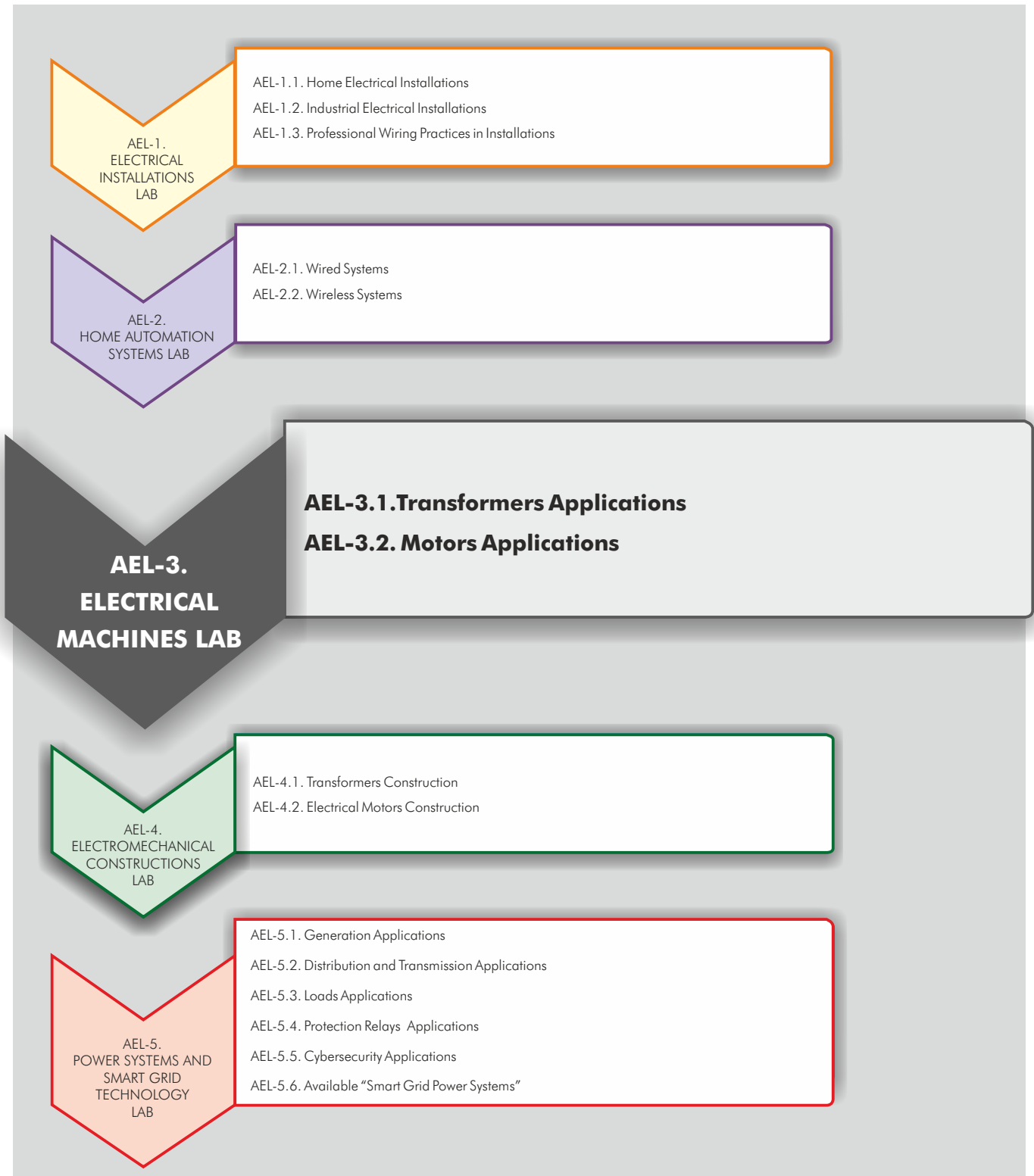
EDIBON, a company with more than 35 years of experience designing and implementing training systems, has a wide variety of applications adapted to 21st century new technologies.

Apart from providing a solid theoretical basis, EDIBON units and applications are aimed at technical professional training, vocational training, for higher education and even applied research, as well as at the improvement in all fields through advanced systems.

The electricity area includes five great groups that cover Electrical Installations, Home Automation Systems, **Electrical Machines**, Electromechanical Constructions, Power Systems and Smart Grid Technology.

All the units have a modular and intuitive design, with real elements used in the industry and technological market.

In this catalogue we will cover "AEL-3. Electrical Machines Lab."



AEL-4. Electromechanical Constructions Lab

The AEL-4. Electromechanical Constructions Lab is formed by:

AEL-WBC. Electrical Workbench (Rail)



AEL-WBR. Electrical Workbench (Rack)



+

Applications
(to be mounted on rail)



AEL-AD33



AEL-AD3A

...



AEL-AD33 + N-RACK-A



AEL-AD3A + N-RACK-A

...

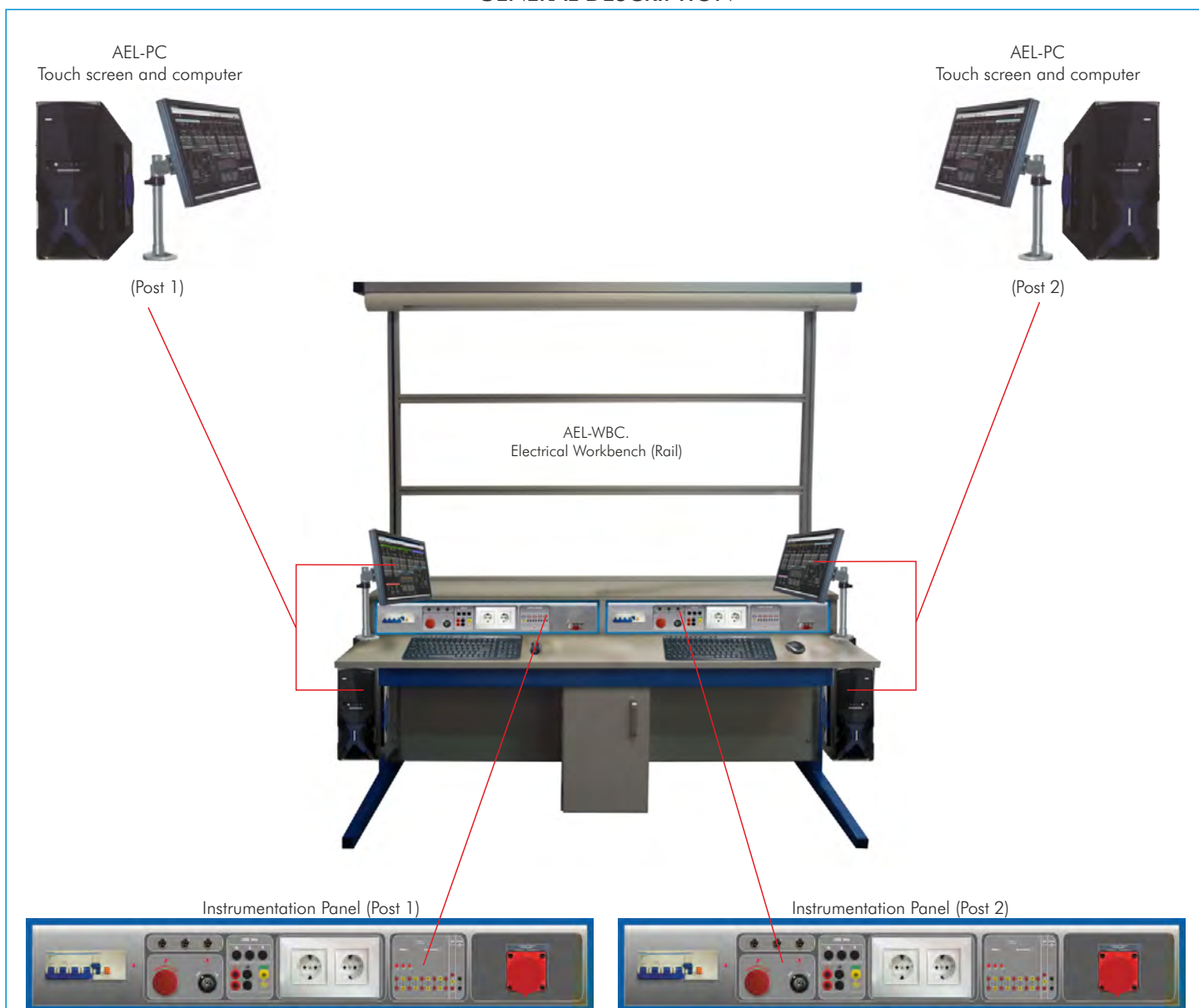
+

Learning Software Packages



Electrical Workbench

GENERAL DESCRIPTION



The Electrical Workbench has been designed to offer the students and teachers the necessary tools to learn and teach about the XXI century technologies.

The Electrical Workbench consists of:

Furniture, itself:

Consists of the frame that allows to locate the applications, lighting fitting, table, supports, etc.

Instrumentation Panel:

The workbench has been designed to be used by one or two students. Each student has access to its own instrumentation panel.

There are two Electrical Workbench versions:

AEL-WBC. Electrical Workbench (Rail).

The AEL-WBC is a workbench designed with rails in order to put and remove all electrical modules free.

AEL-WBR. Electrical Workbench (Rack).

The AEL-WBR is a workbench designed with strong rack in order to fix all electrical modules.

Optional:

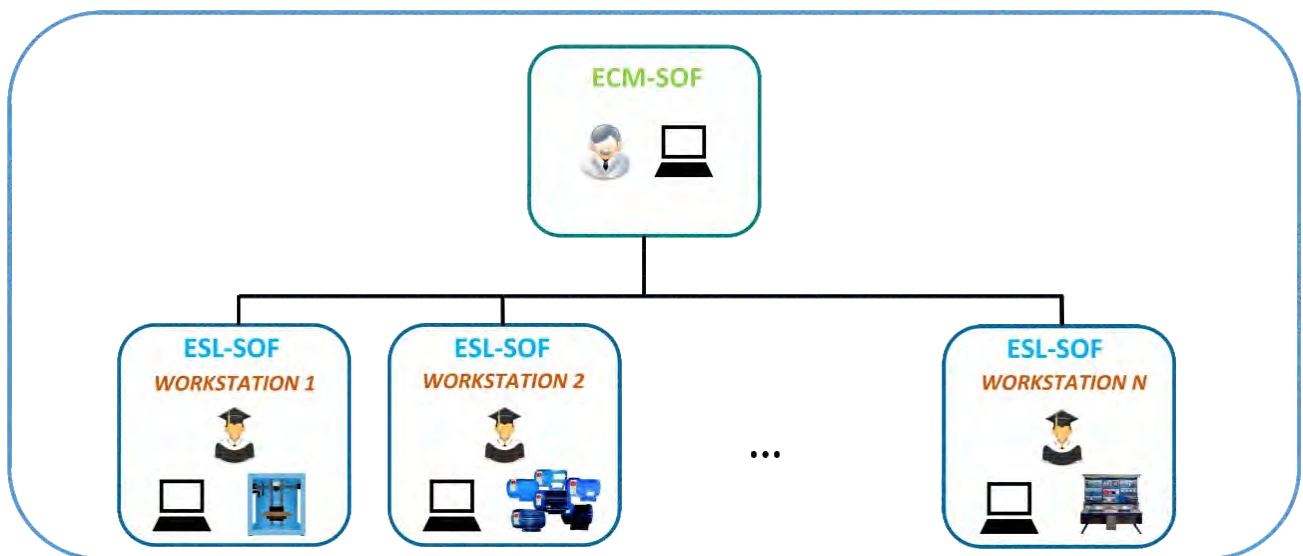
Touch screen and computer (AEL-PC):

The workbench can be supplied with one or two touch screens and computers. Thus, both students and teachers gain quick access to the applications to control them better, obtaining the maximum man-machine interaction.

In summary, technology, quality and aesthetics are combined in this piece of furniture in order to offer the best features for both research and teaching fields.

Learning Software Packages

GENERAL DESCRIPTION



* Contents included for all ECM-SOF and ESL-SOF Workstations.

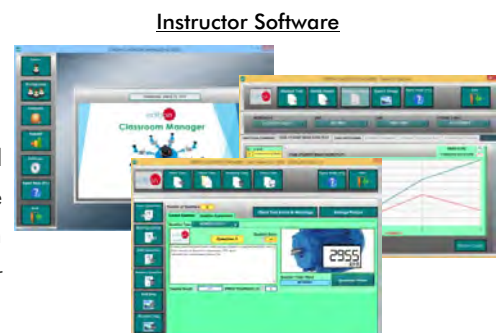
EDIBON has different software packages to provide students the maximum level in training systems.

Example of some Software Screens:

Interactive Computer Aided Instruction Software System

- 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.



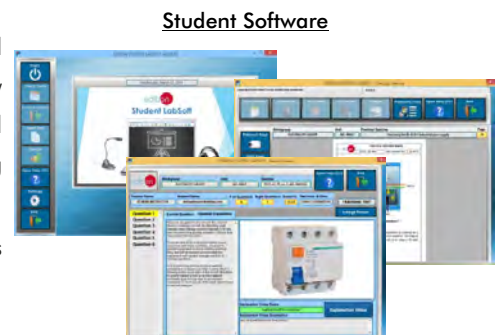
Instructor Software

- ESL-SOF. EDIBON Student Labsoft (Student Software):

ESL 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.

NOTE: Will be necessary acquire a license per student.



Student Software

List of Applications

AEL-3. ELECTRICAL MACHINES LAB

AEL-3.1.

Transformers Applications

Applications

- AEL-SPTT. Single-Phase Transformer Application.
- AEL-TPTT. Three-Phase Transformer Application.
- AEL-AI13-D. Modular Application for Electrotecnics (Transformers).

AEL-3.2.

Motors Applications

Applications

AC Electrical Motors Applications

- AEL-EEEM. Energy Efficiency in Electrical Motors Application.
- AEL-EMSS. Electrical Machines Soft Starters Application.
- AEL-EMCF. Electrical Machines Control through Frequency Controller Application.
- AEL-AI13. Modular Application for Electrotecnics (RLC Circuits, Electrostatics, Motors, Transformers, Lighting).
- AEL-AI13-C. Modular Application for Electrotecnics (Motors).
- AEL-EMRP. Electrical Machines Relays Protection Application.
- AEL-SERIN/CA-1k. Computer Controlled Advanced Industrial Servo systems Application- 1 kW (for AC Motors).
- AEL-MMRT. Motor Management Relays Application.
- AEL-PRTS. Industrial Protective Relaying Training Application.
- AEL-ACEMT. AC Electrical Motors Application.
 - Option 1 (EMT7): Study of Three-Phase Asynchronous Motor of Squirrel cage.
 - Option 2 (EMT8): Study of Three-Phase Asynchronous Motor of wound rotor.
 - Option 3 (EMT9): Study of Three-Phase Dahlander Motor.
 - Option 4 (EMT10): Study of Asynchronous three-phase motor of two independent speeds.
 - Option 5 (EMT11): Study of Asynchronous single-phase motor with starting capacitor.
 - Option 6 (EMT12): Study of Universal Motor.
 - Option 7 (EMT16): Study of Asynchronous single-phase motor with starting and running capacitor.
 - Option 8 (EMT20): Study of Asynchronous single-phase motor with split phase.
 - Option 9 (EMT21): Study of Three-Phase Reluctance Motor.
- AEL-ACINA. Application of AC Three-Phase Induction Motor of Squirrel Cage.
- AEL-ACDHA. Application of AC Dahlander Three-Phase Induction Motor.
- AEL-ACWRA. Application of AC Three-Phase Induction Motor of Wound Rotor.
- AEL-ACLA. Application of AC Linear Motor Operations.
- AEL-ACRLA. Application of AC Three-Phase Reluctance Motor.
- AEL-ACSPA. Application of Asynchronous Single-Phase Motor with Split Phase.
- AEL-AI12. Modular Application (AC Motors).
- AEL-IMSU. General Application of AC Induction Motor.
- AEL-ACEMA. AC Electrical Motors Applications.
 - Option 1 (EMT7): Study of Three-Phase Asynchronous Motor of Squirrel cage.
 - Option 2 (EMT8): Study of Three-Phase Asynchronous Motor of wound rotor.
 - Option 3 (EMT9): Study of Three-Phase Dahlander Motor.
 - Option 4 (EMT10): Study of Asynchronous three-phase motor of two independent speeds.
 - Option 5 (EMT11): Study of Asynchronous single-phase motor with starting capacitor.
 - Option 6 (EMT12): Study of Universal Motor.
 - Option 7 (EMT16): Study of Asynchronous single-phase motor with starting and running capacitor.
 - Option 8 (EMT20): Study of Asynchronous single-phase motor with split phase.
 - Option 9 (EMT21): Study of Three-Phase Reluctance Motor.
- AEL-EEA. Alternator Study Application.
- AEL-EGMG24. Motor-Generator Group.

DC Electrical Motors Applications

- AEL-DCEMT. DC Electrical Motors Applications.
 - Option 1 (EMT1): Study of DC Machine with independent excitation.
 - Option 2 (EMT2): Study of DC Machine with Series excitation.
 - Option 3 (EMT3): Study of DC Machine with shunt excitation.
 - Option 4 (EMT4): Study of DC Machine with Compound excitation.
 - Option 5 (EMT5): Study of all types of DC Machines.
- AEL-DCSHT. DC Shunt Excitation Motor Application.
- AEL-DCSEA. Application of DC Series Motor.
- AEL-DCSHA. Application of DC Shunt Motor.
- AEL-DCCOA. Application of DC Compound Motor.
- AEL-DCSPA. Application of DC Separately Excited Motor.
- AEL-DCGEA. Application of DC Generator.
- AEL-DCPMA. Application of DC Permanent Magnet Motor.
- AEL-DCBRA. Application of DC Brushless Motor.
- AEL-DCEMA. DC Electrical Motors Applications.
 - Option 1 (EMT1): Study of DC Machine with independent excitation.
 - Option 2 (EMT2): Study of DC Machine with Series excitation.
 - Option 3 (EMT3): Study of DC Machine with shunt excitation.
 - Option 4 (EMT4): Study of DC Machine with Compound excitation.
 - Option 5 (EMT5): Study of all types of DC Machines.
 - Option 6: (EMT15): Study of Permanent Magnet DC Motor.
 - Option 7: (EMT1): Study of DC Generator.
- AEL-UMA. Application of Universal Motor.
- AEL-STMA. Application of Stepper Motor.

Electrical Motors Faults Applications

- AEL-ESAM. Faults Simulation Application in Electrical Motors.
- AEL-ESAT. Faults Simulation Application in Transformers.

The Electrical Machines Lab (AEL-3) covers all the field of electric machines. It has different motors, as well as transformers applications to study them.

Furthermore, to study more advanced electric machines systems, it includes a great variety of brakes for their dynamic test.

It also includes motor protection relays applications to study their calibration and how to develop a selective protection plan.

This Electrical Machines section consists of a group of applications, applications, faults simulators and units dedicated for studying the electrical machines used nowadays.

Due to the great variety of electrical motors, electronic braking devices, real time measuring systems, different types of electrical loads, etc., the Electrical Machines area becomes the ideal laboratory to study this field.

Besides, EDIBON has a control and data acquisition system for more advanced students, so that they can study the electrical machines in depth, with test benches to study the braking torque, mechanical power, efficiency calculations, etc.

The complete Home Electrical Machines Lab (AEL-3) includes:

- Electrical Workbench.
- Software packages.
- Applications.

Electrical Workbench:

There are two Electrical Workbench versions:

AEL-WBC. Electrical Workbench (Rail).

The AEL-WBC is a workbench designed with rails in order to put and remove all electrical modules free. The frame consists of three levels to get a maximum space for the modules and applications. Besides, the user can put and remove manually all electrical modules and make free configurations to construct different applications.

The advantage of this workbench is that all modules can be put and removed free and quick, so the student can change quickly to other practical exercises.

AEL-WBR. Electrical Workbench (Rack).

The AEL-WBR is a workbench designed with strong rack in order to fix all electrical modules. Each module will be fixed with screws. The frame consists of three racks to support different applications.

The advantage of this workbench is that all applications are perfectly covered to get a homogeneity and strong unit.



The Electrical Workbench is ready to use Specialized EDIBON Softwares, based on Labview, for:

- SCADA Control Software.
- Data Acquisition Software.
- Computer Aided Instruction Software.
- ...others.

It is a complete and functional training solution for electricity learning purposes, with intuitive, quick and accurate interaction of the user with the Electrical Workbench.

It is a functional and self contained Electrical Workbench, with wide working area for several applications, with instrumentation panel including all the required elements to supply power and control in the workbench.

The Electrical Workbench is mainly formed by:

Furniture, itself:

- Formed by the frame that allows to allocate the applications, lighting fitting, table, supports, etc.
- Dimensions: 2000 x 1000 x 1900 mm approx.

Instrumentation Panel:

- 2 x Control and supply panels.
- Three-phase and single-phase power systems.
- Independent Residual Circuit Breaker (RCB).
- Two single-phase sockets.
- Different level control voltages for signals applications.
- Integrated lighting system.

Technical data:

- 1 x Differential Protection, 1 x Emergency Stop Button and 1 x Safety Key.
- Power Terminal Connections: 1 x Three-phase terminals: 380 Vac + N+ GND and 1 x Single-phase terminals: 230 Vac + GND and 2 x Single-phase plugs + 2 x Three-phase plugs.
- Control terminals: 2 x 24 Vac., 2 x (+24) Vdc., 2 x (+12) Vdc., 2 x (-12) Vdc. and 2 x (+5) Vdc.
- Power Supply required: 380 Vac 3PH + N + GND.

Optional:

- Touch screen and computer (AEL-PC).
- The workbench can be supplied with one or two touch screens and computers.

Software packages:**ICAI. Interactive Computer Aided Instruction Software System:****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 Workgroups, Tasks 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.

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.

Instructor Software

ECM-SOF. EDIBON Classroom Manager Software Application main screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



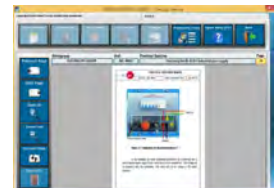
ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram



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

Student Software

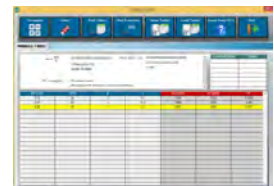
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package-Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

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

www.edibon.com/en/files/equipment/ICAI-ELEC/catalog

Applications:
**AEL-3.1
Transformers Applications**

Transformers Applications

AEL-SPTT. Single-Phase Transformer Application.

The Single-Phase Transformer Application has been "AEL-SPTT" designed by Edibon to allow the students to learn how realize different single-phase transformer test and how they work.

With this application, the user can realize the open circuit and short circuit test. Thus, the student will be able to determinate the equivalent circuit and obtain the losses of the machine. This application includes a series of resistive, inductive and capacitive loads to study different behavior of the transformer such as internal drop voltages, energy losses, etc. On this way the user will analyze the differences among resistive, inductive and capacitive loads. One important parameter to analyze is the efficiency of the transformer, which can be studied with this application.

The AEL-SPTT includes all necessary modules in order to realize all practical exercises described before, such as transformer, network analyzers, power supply and resistive, inductive and capacitive loads.

Optionally, this application can be acquired with the Control and Data Acquisition System of Electrical Machines, EM-SCADA. This system is designed to analyze and monitoring all voltajes, currents and performance curves of dynamic and static electrical machines. After testing procedures, the user can obtain result reports.

The AEL-SPTT includes the following modules:

- N-VPS01. AC 3PH Variable Power Supply.
- N-MED09. AC Ammeter (0-2.5 A). (2 units)
- N-MED22. AC Voltmeter (0-400 VAC).
- N-MED32. 1-Phase Wattmeter 230 V.
- N-MED65. Digital Multimeter.
- TRA31. 1 kVA Single-Phase Transformer.
- N-REV. Variable Resistor.
- N-CON. Capacitor Module.
- N-IND. Inductance module.

Expansion testing software:

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines, with SCADA.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-SPTT/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-SPTT 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.

Some practical exercises possibilities:

- 1.- Calculation of transformer ratio.
- 2.- Open circuit test.
- 3.- Short circuit test.
- 4.- Determination of equivalent circuit.
- 5.- Drop voltage with resistive load.
- 6.- Drop voltage with inductive load.
- 7.- Drop voltage with capacitive load.
- 8.- Study the efficiency of the transformer.
- 9.- Determination of load which allows the maximum efficiency of the transformer.

For more information see **AEL-SPTT** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-SPTT/catalog



AEL-SPTT

Applications:

AEL-3.1

Transformers Applications

Transformers Applications

AEL-TPTT. Three-Phase Transformer Application.

The Three-Phase Transformer Application "AEL-TPTT" has been designed by Edibon to allow the students to learn how carry out different transformer test and how they work. With this application, the user can wire the transformer and get different vector groups. The transformer ratio depends on the transformer connection and the user will can check it.

The student can analyze in depth the transformer since he will obtain the equivalent circuit and the losses of the machine. Besides, the user will study the behavior when resistive, inductive and capacitive loads are connected. On this way, different characteristic curves can be obtained such as open circuit characteristic, efficiency curve, etc.

The AEL-TPTT includes all necessary modules in order to realize all practical exercises described before, such as a transformer, ammeters, voltmeters, a power supply module and resistive, inductive and capacitive loads. Optionally, this application can include another transformer which allows studying the transformers connected in parallel.

Optionally, this application can be acquired with the Control and Data Acquisition System of Electrical Machines, EM-SCADA. This system is designed to analyze and monitoring all voltajes, currents and performace curves of dinamyc and static electrical machines. After testing procedures, the user can obtain result reports.

The AEL-TPTT includes the following modules:

- N-VPS01. AC 3PH Variable Power Supply.
- N-MED09. AC Ammeter (0-2.5 A). (2 units)
- N-MED22. AC Voltmeter (0-400V).
- N-MED33. 3-Phase Balanced Wattmeter 440V.
- TPPT. Three-phase Power Transformer Unit.
- N-REVT/1K. 1kW Three-Phase Resistors Module.
- N-CONT/1K. 1kVA Three-Phase Capacitors Module.
- N-INDT/1K. 1 kVA Three-Phase inductances module.
- N-ARR12. Direct Starter Module.

Second optional module:

- TPPT. Three-phase Power Transformer Unit.

Expansion testing software:

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines, with SCADA.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-TPTT/ICAL) 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-TPTT can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-B. (6 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.

Some practical exercises possibilities:

- 1.- Wiring the three-phase transformer according with different configurations.
- 2.- Calculation of transformer ratio according with different configurations.
- 3.- Open circuit test.
- 4.- Short circuit test.
- 5.- Determination of equivalent circuit.
- 6.- Drop voltage with resistive load.
- 7.- Drop voltage with inductive load.
- 8.- Drop voltage with capacitive load.
- 9.- Study the efficiency of the transformer.
- 10.- Determination of load which allows the maximum efficiency.

Some practical exercises possibilities in order to study transformers in parallel connection:

- 11.- Objectives of transformers connected in parallel and conditions.
- 12.- Study of equivalent circuit of the coupling with load.
- 13.- Study of equivalent circuit of the coupling without load.
- 14.- Analyzing of currents varying the power, short-circuit voltage and transformer ratio.

For more information see **AEL-TPTT** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-TPTT/catalog



AEL-TPTT

Applications:

AEL-3.1

Transformers Applications

Transformers Applications

AEL-AI13-D. Modular Application for Electrotecnics (Transformers).

The Modular Application of Electrotecnics (Transformers) "AEL-AI13-D" is a basic application which has been designed by Edibon to introduce the students in the basic concepts about how three-phase and single-phase transformers work.

Transformers are used extensively in the industry. For example, a step-up transformer is needed in power plants in order to avoid losses in the transmission lines. The customers consume energy in another level voltage, so a step-down transformer is needed now. Besides, transformers are used in electronic devices to decrease the supply voltage to a level suitable for the low voltage circuits which they contain.

This application is provided with a set of practical exercises, which the user will understand how to work with different types of transformer. The student will learn to assemble single phase and three-phase transformers, realize connections, study the three-phase autotransformer and analyze the behavior of this important machine.

The AEL-AI13-D includes the following modules:

- N-AI01. Industrial Power Supply.
- VAR17. Dismantled Transformer Kit.
- TRA28. Three-Phase Transformer Module.
- N-MED65. Digital Multimeter.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-AI13-D/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-D 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.

Some practical exercises possibilities:

- 1.- Checking the industrial power supply.
- 2.- Assembling the single phase transformer.
- 3.- Studying of the step-down transformer.
- 4.- Studying of the step-up transformer.
- 5.- Studying of the autotransformer.
- 6.- Wiring of a single-phase transformer.
- 7.- Wiring of Three-phase direct delta/delta configuration.
- 8.- Wiring of Three-phase star/delta configuration.
- 9.- Wiring of three-phase delta/star connection.
- 10.- Wiring of three-phase/six-phase connection.
- 11.- Wiring of transformers with coils in series.

For more information see **AEL-AI13-D** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-AI13-D/catalog



AEL-AI13-D + RACK

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-EEEM. Energy Efficiency in Electrical Motors Application.

The Energy Efficiency in Electrical Motors Application "AEL-EEEM" has been designed by Edibon to allow the students to understand how cutting-edge devices used in high performance systems to control electrical motors work : frequency controllers versus conventional electrical power.

Actual frequency controllers can automatically control (PID) the speed of the motors depending on different conditions, such as loads variations in the motor's shaft. In the AEL-EEEM application allows controlling different loads conditions through the Eddy Current Brake. The results can be analyzed thanks to an included network analyzer which shows the most important electric parameters. The AEL-EEEM shows how to program the frequency controller to get an optimal consumption depending on the braking load.

The AEL-EEEM includes the following modules:

- N-ALI01. Industrial Power Supply.
- N-EAL. Network Analyzer Unit.
- N-WCA/M. AC Motor Speed Controller (Intermediate option).
- N-WCC/M. DC Motor Speed Controller (Intermediate option).
- FRECP. Eddy Current Brake.
- EMT7. Asynchronous Three-Phase Motor of Squirrel Cage.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-EEEM/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-EEEM can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-M.

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.

Some practical exercises possibilities:

- 1.- Wiring an Asynchronous Three-Phase Motor of Squirrel Cage.
- 2.- Start-up of the frequency controller.
- 3.- Forward and reverse operations with the induction motor and the frequency controller.
- 4.- Comparison of the energy consumption by the conventional electrical power and the frequency controller.
- 5.- Programming of the frequency controller according to different electrical machines operations.
- 6.- Checking the behavior of the electrical machine in function of the braking torque.
- 7.- Study the motor functioning for a demand instruction.
- 8.- Programming of the frequency controller for different loads.
- 9.- Programming of the frequency controller to get an optimal consumption.
- 10.- Analyze the electrical parameters.

For more information see **AEL-EEEM** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-EEEM/catalog



AEL-EEEM

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-EMSS. Electrical Machines Soft Starters Applications.

The Electrical Machines Soft Starters Applications “AEL-EMSS” has been designed by Edibon to instruct the student in managing soft-starters of three-phase electrical machines. This application basically consists of three types of optional starters: electronic soft starter (option 1), frequency controller (option 2) and star/delta starter (option 3). The students will learn to configure these type of starters and they will compare the characteristics and functionality observing the induction motor behavior with each starter.

Description of the soft starter types:

Option 1: through the electronic soft starter, the user will learn to configure the most important parameters that allow considerably reduce the induction motor starting/stopping currents. These parameters are, for example, the starting voltage, the acceleration ramp time and the deceleration ramp time.

Option 2: through the advanced frequency controller, the user will learn to configure several parameters to get different induction motor functionalities. Thus different parameters can be set such as torque limiter, frequency limiter, acceleration and deceleration ramps, starting voltage and much more parameters explained in the user’s manual. It is very important to understand how a motor works with a frequency controller because it is the most important method used in the industry for induction motor control to get a maximum control and performance. Besides, the user can visualize, program the alarms and associate them to relays in order to get a complex control circuit. The frequency controller module has some digital signals which can be programmed to get more than 100 different functions.

Option 3: through the manual star/delta starter, the user will take experience on this type of maneuvers and how the response of the induction motor is.

This application includes an advanced braking system that consists of a servomotor (brake) to study the response of the induction motor against different load conditions. The servomotor has a controller to realize different braking conditions.

When the braking torque is increased, the power consumption of the induction motor is increased too, the power factor changes, etc. In order to analyze the power consumption of the induction motor a network analyzer is included. It shows the main electrical parameters which are relevant in industrial installations: voltages, currents, frequencies, Power Factor, active power, reactive power, apparent power, etc.

Optionally, this application can be supplied with the Electrical Machines SCADA Control Software EM-SCADA, a Data Control and Acquisition Software developed by Edibon that allows monitoring all voltage, current and torque waves shape. This allows studying the behavior of the three-phase induction motor via different soft starters offered in this application.

The AEL-EMSS includes the following modules:

- N-ALIO1. Industrial Power Supply.
- N-EALD. Network Analyzer Unit with Data Acquisition.
- EMT7B/1K. 1kW Three-Phase Induction Motor of Squirrel Cage.
- N-SERV1K. 1kVA Servomotor Module.

The following are options to study different type of starters (they can be acquired independent or in conjunction):

Option 1:

- N-ARR16. Electronic Soft Starter.

Option 2:

- N-WVCA. Advanced AC Motors Speed Controller (Intermediate option).

Option 3:

- N-ARR01. Manual Star-Delta Starter.
- N-TRANS03. Three-Phase Autotransformer 400/230 VAC, 1kVA, Module.

Expansion testing software:

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines, with SCADA.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-EMSS/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-EMSS can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-M.

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.



AEL-EMSS

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-EMSS. Electrical Machines Soft Starters Application. (Continuation).

Some practical exercises possibilities:

Option 1:

- 1.- Wiring of electronic soft starter.
- 2.- Setting of the starting voltage parameter.
- 3.- Measuring of the induction motor electrical parameters with different starting voltage configurations.
- 4.- Setting of acceleration ramp parameter.
- 5.- Measuring of the induction motor electrical parameters with different acceleration ramp configurations.
- 6.- Setting of deceleration ramp parameter.
- 7.- Comparing the starting methods through frequency controller, electronic soft starter and star/delta starter (depending on the acquired options).
- 8.- Braking test with the servomotor and its controller.
- 9.- Starting of the induction motor with constant load.
- 10.- Starting of the induction motor with variable load.
- 11.- Visualization of Torque VS Speed, Current VS Speed with the EM-SCADA optional software (optional).

Option 2:

- 12.- Wiring of the advanced frequency controller.
- 13.- Basic programming of the frequency controller.
- 14.- Soft starting of the induction motor through manual speed control.
- 15.- Run investment soft control of the induction motor.
- 16.- Setting of acceleration time.
- 17.- Setting of deceleration time.
- 18.- Comparing the starting methods through frequency controller, electronic soft starter and star/delta starter (depending on the acquired options).
- 19.- Braking test with the servomotor and its controller.
- 20.- Starting of the induction motor with constant load.
- 21.- Starting of the induction motor with variable load.

- 22.- Visualization of Torque VS Speed, Current VS Speed with the EM-SCADA optional software (optional).

Option 3:

- 23.- Wiring of the manual star/delta starter.
- 24.- Star/Delta starting of the induction motor of squirrel cage.
- 25.- Measuring of electrical parameters of the induction motor of squirrel cage during star/delta starting procedure.
- 26.- Comparing the starting methods through frequency controller, electronic soft starter and star/delta starter (depending on the acquired options).
- 27.- Braking test with the servomotor and its controller.
- 28.- Starting of the induction motor with constant load.
- 29.- Starting of the induction motor with variable load.
- 30.- Visualization of Torque VS Speed, Current VS Speed with the EM-SCADA optional software (optional).

Some practical exercises possibilities with the EM-SCADA:

- 31.- Visualization of torque/current VS speed of the induction motor with the electronic soft starter.
- 32.- Visualization of torque/current VS speed of the induction motor with the advanced frequency controller.
- 33.- Visualization of torque/current VS speed of the induction motor with the star/delta starter.
- 34.- Comparison of graphs of the different starting types.

For more information see **AEL-EMSS** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-EMSS/catalog



AEL-EMSS

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-EMCF. Electrical Machines Control through Frequency Controller Application.

The Electrical Machines Control through Frequency Controller Application "AEL-EMCF" has been designed by Edibon to instruct in managing of frequency controllers for the control of three phase induction electrical machines.

This application offers the possibility to study the commissioning of the frequency controller by programming basic functions such as the adjusting of the rotation direction parameter, starting/stopping functions, the frequency commutation parameter, programming the nominal voltage, nominal current, nominal frequency, etc. Besides, the user can study the operational performance, measuring power and RMS and realize different experiments with loads through to the Eddy Current Brake.

The AEL-EMCF includes the following modules:

- N-ALI01. Industrial Power Supply
- N-WCA. Advanced AC Motor Speed Controller (Intermediate option).
- N-WCC/M. DC Motor Speed Controller (Intermediate option).
- FRECP. Eddy Current Brake.
- EMT7. Asynchronous Three-Phase Motor of Squirrel Cage.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-EMCF/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-EMCF can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-M.

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. (Rail) can be supplied to mount the modules.

Some practical exercises possibilities:

- 1.- Wiring the Asynchronous Three-Phase Motor of Squirrel Cage.
- 2.- Adjusting the necessary values in the frequency controller to put in operation the induction motor.
- 3.- Adjusting the rotation direction.
- 4.- Adjusting the start function.
- 5.- Adjusting the frequency commutation, nominal voltage, nominal current, nominal frequency, etc.
- 6.- Study the operational performance in the frequency controller.
- 7.- Measuring power and RMS.
- 8.- Realize different experiments with loads.
- 9.- U/f function optimization.
- 10.- Study of acceleration and deceleration ramps.
- 11.- Study of stopping methods of a motor.
- 12.- Study of power factor and efficient improvement.

For more information see **AEL-EMCF** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-EMCF/catalog



AEL-EMCF

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-AI13. Modular Application for Electrotecnics (RLC Circuits, Electrostatics, Motors, Transformers, Lighting).

The Modular Application for Electrotecnics (RLC Circuits, Electrostatics, Motors, Transformers, Lighting) "AEL-AI13" is designed by Edibon to study the basic knowledge about electric engineering. The application 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-EMCF 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. (Rail) can be supplied to mount the



AEL-AI13 + RACKS

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-AI13. Modular Application for Electrotecnics (RLC Circuits, Electrostatics, Motors, Transformers, Lighting).(Continuation).

Some practical exercises possibilities:

- 1.- Checking the operation of the Industrial Main Power Supply.
- 2.- Checking the operation of the Auxiliary Power Supply.
- 3.- Electrostatic demonstration on several materials.
- 4.- Verification of the electrotechnic effects with Acetate.
- 5.- Verification of the electrotechnic effects with Rabbit fur.
- 6.- Verification of the sign of the charge with the Electroscopes.
- 7.- Resistance measurement.
- 8.- Resistors in series association.
- 9.- Resistors in parallel association.
- 10.- Coils in series association.
- 11.- Coils in parallel association.
- 12.- Star/delta transformation.
- 13.- Delta/star transformation.
- 14.- Capacity measurement of a capacitor.
- 15.- Capacitors series association.
- 16.- Capacitors parallel association.
- 17.- Analysis of the charge of a capacitor.
- 18.- Analysis of the discharge of a capacitor.
- 19.- Calculation of the time constant of discharge of the capacitor.
- 20.- Wiring and put into operation of a Single-Phase Motor.
- 21.- Wiring and put into operation of a Universal Motor.
- 22.- Wiring and put into operation of a Squirrel-Cage Three-Phase Motor.
- 23.- Electric energy into mechanic energy conversion.
- 24.- Mechanic energy into electric energy conversion.
- 25.- Electric energy into magnetic energy conversion.
- 26.- Magnetic induction: Lenz's Law.
- 27.- Assembling the transformer.
- 28.- Analysis of a Back Transformer.
- 29.- Wiring of a Back Transformer.
- 30.- Verification of the transformer ratio of a Back Transformer.
- 31.- Analysis of a Boost Transformer.

- 32.- Wiring of a Boost Transformer.
- 33.- Verification of the transformer ratio of a Boost Transformer.
- 34.- Analysis of an Auto-Transformer.
- 35.- Wiring of an Auto-Transformer.
- 36.- Connection as single-phase transformer.
- 37.- Direct delta/delta three-phase connection.
- 38.- Star/delta three-phase connection.
- 39.- Delta /star three-phase connection.
- 40.- Three-phase/six-phase connection.
- 41.- Transformer with coils in series in phase.
- 42.- Calculation of the time constant in different configurations of RLC circuits.
- 43.- Analysis of a RL circuit in series.
- 44.- Analysis of a RL circuit in parallel.
- 45.- Analysis of a RC circuit in series.
- 46.- Analysis of a RC circuit in parallel.
- 47.- Analysis of a RCL circuit in series.
- 48.- Low-pass filter.
- 49.- High-pass filter.
- 50.- Lamp controlled by a switch and a push button.
- 51.- Lamp controlled from two points
- 52.- Lamp controlled from three points.
- 53.- Lamp controlled by relays.
- 54.- Verification of the electrotechnic effects into an acoustic circuit.
- 55.- Verification of the electrotechnic effects into a fluorescent tube.



AEL-AI13 + RACKS

For more information see **AEL-AI13** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-AI13/catalog

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-AI13-C. Modular Application for Electrotecnics (Motors).

The Modular Application for Electrotecnics (Motors) "AEL-AI13-C" has been designed by Edibon to study different motor types: single-phase induction motor with starting and running capacitor, universal motor, three-phase squirrel cage induction motor.

This application allows the user to acquire basic concepts with respect to the magnetic and electric flow relation easily. It includes the modules required for the study of the Electric Magnetic Field (EMF) and several motors in order to analyze its response when are configured in different ways.

The AEL-AI13-C includes the following modules:

- N-ALI01. Industrial Main Power Supply.
- N-ALI10. Power Supply Module.
- EMT16. Asynchronous single-phase motor with starting and running capacitor.
- EMT12. Universal Motor.
- EMT7. Asynchronous three-phase motor of squirrel cage.
- N-VAR16. Electromagnetism Kit with group of motor/generator.
- N-MED65. Digital Multimeter.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-AI13-C/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-C can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-M.

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.

Some practical exercises possibilities:

- 1.- Checking the industrial power supply.
- 2.- Assembling the single phase transformer.
- 3.- Studying of the step-down transformer.
- 4.- Studying of the step-up transformer.
- 5.- Studying of the autotransformer.
- 6.- Wiring of a single-phase transformer.
- 7.- Wiring of Three-phase direct delta/delta configuration.
- 8.- Wiring of Three-phase star/delta configuration.
- 9.- Wiring of three-phase delta/star connection.
- 10.- Wiring of three-phase/six-phase connection.
- 11.- Wiring of transformers with coils in series.

For more information see **AEL-AI13-C** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-AI13-C/catalog



AEL-AI13-C + RACK

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-EMRP. Electrical Machines Relays Protection Application.

The Electrical Machines Relays Protection Application, "AEL-EMRP", has been designed by Edibon to study the elementary protections for three phase squirrel cage induction motors.

In order to study the behavior of the electrical machines protections, this application consists of a three-phase induction motor of squirrel cage coupled to a servomotor. On this way, the user can control the servo machine and modify the loads condition of the motor to be studied. With the servomotor the user can increase the current consumption by the induction motor and provoke overcurrent and overheating to study the electrical protections performance.

The AEL-EMRP includes the following modules:

- N-ALI01. Industrial Main Power Supply.
- N-REL09. Time Electronic Relay against Overcurrents (1.2 - 7 A).
- N-REL47. Thermal Relay.
- EMT7B/1K. 1 kVA Asynchronous Three-Phase Motor of Squirrel Cage.
- N-SERV1K. 1 kW Servomotor Module.
- N-MED65. Digital Multimeter.
- N-EAL. Network Analyzer Unit.
- N-CON01. 3-Pole Contactor (24 VAC)
- N-ALI03. AC Auxiliary Power Supply.

Expansion learning software:

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

This software is formed by:

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

The application AEL-EMRP 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. (Rail) can be supplied to mount the modules. (Rail) can be supplied to mount the modules.

Some practical exercises possibilities:

- 1.- Wiring and put into operation of an Asynchronous Three-Phase Motor of Squirrel Cage.
- 2.- Studying and testing of configuration of overcurrent time electronic relay.
- 3.- Studying and testing of configuration of thermal protection relay.
- 4.- Studying in combination of motor protection relays.
- 5.- Load protection for disconnecting the power supply to the motor.
- 6.- Studying of servomotor working as load.
- 7.- Studying of the joint operation of motor with servomotor.
- 8.- Selectivity and coordination of the protection relays.
- 9.- Analyze the network parameters with different load conditions.
- 10.- Configuration of the protection relays for the motor starter.

For more information see **AEL-EMRP** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-EMRP/catalog



AEL-EMRP

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-SERIN/CA-1KW. Computer Controlled Advanced Industrial Servosystems Application-1kW (for AC Motors).

The Computer Controlled Advanced Industrial Servosystems Application - 1 kW (for AC Motors) "AEL-SERIN/CA-1KW" has been designed by Edibon for testing the rotating electrical machines and controllers. This application is designed to work with different selectable operation modes according to different types of electrical machines.

Operation modes: as flywheel, lifting, rolling device, fan, compressor, with torque and speed control.

On the other hand this application consists of a Control Interface module connected to a three-phase motor. The motor is controlled by mean the Control Interface module and the last one is configured from a PC and the manufacture software. The control interface has a 20-bits incremental encoder that controls the speed, position and torque of the motor.

In addition, the AEL-SERIN/CA-1KW has an optional Data Acquisition and Data Control Software, EM-SCADA, for the dynamic analysis of the rotating electrical machines. This software allows observing characteristic curves, data reports and graphs, etc.

The AEL- SERIN/CA-1KW includes the following module:

- N-SERV1K. 1 kW Servomotor Module.

Expansion testing software:

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines, with SCADA.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-SERIN/CA-1KW/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-SERIN/CA-1KW 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.(Rail) can be supplied to mount the modules.(Rail) can be supplied to mount the modules.

Some practical exercises possibilities:

- 1.- Wiring and put into operation of an AC servomotor.
- 2.- Starting/stopping operations of the servomotor.
- 3.- Speed/torque control operations.
- 4.- Variable speed control operation.
- 5.- Variable torque control operation.
- 6.- Warning by alarm.
- 7.- Introduce resistant torque.
- 8.- Variable speed control with different configurations.
- 9.- Variable torque control with different configurations.
- 10.- Acceleration ramp configuration.
- 11.- Deceleration ramp configuration.

The included software allows carry out the following practical possibilities:

- 12.- Static and dynamic determination of the operating point.
- 13.- Measure and graphic representation of the main electrical and mechanical parameters (current, voltage, active power, reactive power, apparent power, power factor, efficiency, turning speed, torque and mechanical power).
- 14.- Operation with automatic torque and turning speed control.
- 15.- Operation in the four quadrants.

Some possible practices with EM-SCADA:

DC/AC Motor experiments:

- 16.- Braking test and real time monitoring results.
 - 17.- Study of starting currents and voltages of rotating machines.
 - 18.- Starting of motors with different methods such as star-delta starting, direct starting, starting resistors, etc.
 - 19.- Comparison of the performance characteristics between different motors.
 - 20.- Real time torque measurement waveform of rotating machines.
 - 21.- Real time speed measurement waveform of rotating machines.
 - 22.- Real time current and voltage measurement waveforms of rotating machines.
 - 23.- Electrodinamic study of different rotating machines.
 - 24.- Obtainment of characteristics curves of different rotating machines.
 - 25.- Obtainment of stored results of the tests.
- Single/Three-Phase Transformer experiments:
- 26.- Three-Phase transformer short circuit tests.
 - 27.- No-Load Three-Phase transformer tests.
 - 28.- Single-Phase transformer short circuit tests.
 - 29.- No-Load Single-Phase transformer tests.

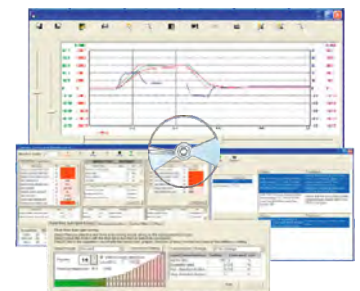
For more information see **AEL-SERIN/CA-1KW** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-SERIN/CA-1KW/catalog



AEL-SERIN/CA-1KW + RACK



AEL-SERIN/CA-1KW/CCSOF

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-MMRT. Motor Management Relays Application.

The Motor Management Relays Application "AEL-MMRT" has been designed by Edibon in order to study the behavior of three-phase induction motors when they are managed with a PLC.

This application allows the students learning the main operations and programs (through the PLC), in order to carry out different functions such as direct starting, star-delta starting, starting with a frequency controller, forward/reverse operation, countercurrent breaking, and protection relays management.

The AEL-MMRT includes the following modules:

- N-ALI01. Industrial Main Power Supply.
- N-REL09. Time Electronic Relay against Overcurrents (1.2 - 7 A).
- N-REL47. Thermal Relay Module.
- EMT7B/1K. 1 k V A t h r e e - p h a s e Asynchronous motor of squirrel cage.
- N-SERV1K. 1 kW Servomotor Module.
- MED65. Digital Multimeter.
- N-EALD. Network Analyzer Unit with Computer Data Acquisition.
- N-CON02. 3-pole Contactor (220 Vac). (3 units)
- N-EME-PLCE. Electrical Machines PLC Unit.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-MMRT/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-MMRT can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-A.
- 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.(Rail) can be supplied to mount the modules.(Rail) can be supplied to mount the modules.

Some practical exercises possibilities:

- 1.- Studying of configuration of various motor protection systems.
- 2.- Studying of motor protection switches.
- 3.- Studying of motor protection relays.
- 4.- Studying of thermistor protection circuits.
- 5.- Load protection for disconnecting the power supply to the motor.
- 6.- Configuration and operation of the installation (commissioning software and hardware).
- 7.- Programming the main functions through PLC software: Direct starter motor, start-delta starting, starting of polarity-switchable motors, etc.
- 8.- Measurement of power and RMS values.
- 9.- Loads Experiments.

For more information see **AEL-MMRT** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-MMRT/catalog



AEL-MMRT + RACK

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-PRTS. Industrial Protective Relaying Application.

The Industrial Protective Relaying Application, "AEL-PRTS", has been designed by Edibon for the study of the industrial protection relays more frequently used in low voltage electrical installations and distribution systems.

This application provides a full program for the training in the installation, configuration and implementation at system level, of a great variety of protective relays such as the generator protective relay, the transformer protective relay and the induction motor protective relay.

The application AEL-PRTS is formed by different modules which can be classified according to the following structure:

Common electrical modules: power supply, voltmeters, ammeters, induction motor, synchronous generator, resistive loads, etc.

Power system modules: specific modules for training in the protective relay field such as current transformers, voltage transformers, power transformers, impedances, transmission lines, etc.

Protective relays: the application is constituted by protective relays of under/over-voltage, synchronism, under/over-frequency, phase balance, phase sequence, reverse power and power factor.

Optional and additional equipment: several optional modules can be acquired to increase the practical possibilities of the application. These modules are, for example, distribution busbar, ring busbar, transmission lines, distribution transformers protective relays, inductive loads, etc.

The AEL-PRTS includes the following modules:

Power supplies:

- N-VPS01. AC 3PH Variable Power Supply.
- N-ALIO3. AC Auxiliary Power Supply.
- N-SPI. Power Supply Impedance.

Measurement instrumentation:

- N-TRA32. Three-Phase Current Transformer 5/0,5A.
- N-TRA33. Three-Phase Current Transformer 5/2,5-1 A.
- N-TRA34. Three-Phase Voltage Transformer 400/230 V.
- N-MED17. DC Voltmeter (0-200V).
- N-MED79. DC Milliammeter (0 - 300 mA).
- N-MED80. DC Ammeter (0 - 3A).
- N-MED09. AC Ammeter (0-2.5 A). (2 units)
- N-MED11. AC Ammeter (0 - 10A).
- N-MED21. AC Voltmeter (0 - 250 VAC). (2 units)
- N-MED22. AC Voltmeter (0 - 400 VAC).
- N-MED33. Three-Phase Balanced Wattmeter (350-0-350 W, 440 VAC, 500 mA).
- N-MED39. Three-Phase Balanced Varmeter (350-0-350VAr, 440VAC, 500mA).

Power transmission lines and distribution:

- N-TRAG1. Transmission Grid 1 Module.

Faults injection modules:

- N-UFAM. Universal Fault Module.
- N-PTFI. Power Transformer with Faults Injection.

Protection relays:

- N-REL23/C. Three-Phase Over/Under-current Protection Relay.
- N-REL51. Reverse-Forward Protection Relay.
- N-REL52. Power Factor Protection Relay.

- N-REL53. AC/DC Sensivity Current Protection Relay.
- N-REL54. AC/DC Sensivity Voltage Protection Relay.
- N-REL55. Over/Under-frequency Protection Relay.
- N-REL56. Three-Phase Sequence/Balance and Over/Under-voltage Protection Relay.
- N-REL62. Synchronization and Synchronism-Check Relay.

Motors, generators and loads:

- EMT6. Synchronous Three-Phase Motor Alternator.
- EMT7/B. Asynchronous Three-Phase Motor of Squirrel Cage (4 Poles).
- N-CAR37. Three / Single - Phase Resistor Load.
- N-SYM. Synchronizing Lamps Module.
- N-CAR20/B. Power Diodes Module.
- FLYW. Flywheel.

Optional modules Transformers:

- N-TRA32. 3 - Phase Distribution Transformer 120:240 / 120:240, 100 VA.

Power transmission lines and distribution:

- N-TRAG2. Transmission Grid 2 Module.
- N-AE1/F. Faultable Transmission Line.
- N-AE1/B. Transmission Lines Simulation Basic Module.

Busbars:

- N-DISB1. Distribution Bus 1 Module.
- N-DISB2. Distribution Bus 2 Module.
- N-RBUS. Ring Bus Module.

Protection Relays:

- N-REL58. Single-Phase Under / Over Voltage Relay.
- N-REL60. Single-Phase Under / Over Current Relay.

Loads:

- N-CAR38. Three / Single - Phase Inductive Load.
- N-CAR39. Three / Single - Phase Capacitive Load.

Measurement instrumentation:

- N-MED26. Frequency meter (45 - 55 Hz).
- N-MED78. Three-Phase Power Factor Meter.

Starters:

- N-ARR12. Direct Starter Module.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-PRTS/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-PRTS can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-A (2 units).

- 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. (Rail) can be supplied to mount the modules. (Rail) can be supplied to mount the modules.



AEL-PRTS + RACKS

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-PRTS. Industrial Protective Relaying Application. (Continuation).

Some practical exercises possibilities:

- 1.- Analysis of the X/R ratio in short-circuits.
- 2.- Wiring of the current transformer and setting of the three-phase over/under-current protection relay.
- 3.- Wiring of the current transformer and setting of the reverse-forward protection relay.
- 4.- Wiring of the current transformer and setting of the AC/DC sensivity current protection relay.
- 5.- Wiring of the current transformer and setting of the AC/DC sensivity voltage protection relay.
- 6.- Wiring of the current transformer and setting of the power factor protection relay.
- 7.- Setting and testing of over/under-frequency protection relay.
- 8.- Setting and testing of Three-Phase Sequence/Phase Balance and Over/Under-voltage protection relay.
- 9.- Setting and testing of synchronism check relay.
- 10.- Analysis of electrical system perturbations against phase to phase and phase to ground. Utilization of analog ammeters to visualize the perturbations.
- 11.- Wiring of resistive loads to the power system and measurement of balanced/unbalanced loads.
- 12.- Voltage system variation and study of the protection relays performance.
- 13.- Study of rotor earth fault protection.
- 14.- Study of loss of excitation protection.
- 15.- Study of over and under speed protection.
- 16.- Study of generator synchronization operations.
- 17.- Study of the Inrush magnetization current.
- 18.- Study of the differential protection.
- 19.- Study of three-phase distribution transformer protection diagram.
- 20.- Study of the stator-winding fault protection.
- 21.- Study of phase reversal protection.

For more information see **AEL-PRTS** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-PRTS/catalog



AEL-PRTS + RACKS

Applications:

AEL-3.2
Motors Applications

—AC Electrical Motors Applications—

AEL-ACENT. A.C. Electrical Motors Applications.

The A.C. Electrical Motors Applications, "AEL-ACENT", consists of base equipment which is formed by a serial of modules. This base equipment is complemented by different motors and their specific modules. Edibon offers several options to study these motors and users can choose one or more different motors. In this way, the user can compare the motors and so his training will be more complete.

With this application, the user can learn in depth the behavior of wide range of AC motors, such as three-phase induction motor with squirrel cage, with wound rotor, with two independent speeds, Dahlander motor and Reluctance motor. Besides, the student can train with the universal motor and the single-phase induction motors with different starting methods such as starting with a capacitor and with split phase.

In order to learn how AC motors work, the application includes a servomotor, a time electronic relay against over-currents and a series of measurement devices such as analog ammeter and network analyzer. With this equipment the user can simulate different loads conditions, simulate dynamic loads and measure the mechanical torque, speed and the most important electric parameters. Another important device included in this application is the frequency controller which allows regulating the speed of the motor and programming a lot of functions. All these elements included are indispensable to study the AC Motor characteristics.

Optionally, this application can be provided with the EM-SCADA, a revolutionary Data Acquisition Software developed by Edibon that allows monitoring all voltages, currents and torque waveforms in order to study in depth the machine. Through the EM-SCADA the user can carry out an AC Motor electrodynamic study with braking tests and to obtain the results after analysis.

The "AEL-ACENT" includes the following modules:

- N-ALI01. Industrial Power Supply.
- N-RELO9. Time Electronic Relay against Overcurrents (1.2 - 7 A).
- N-ARR12. Direct Starter Module.
- N-CON02. 3-pole Contactor (220 VAC).
- N-WVCA. Advanced AC Motor Speed Controller Module (Intermediate option).
- N-EALD. Network Analyzer Unit with Computer Data Acquisition.
- N-MED09. AC Ammeter (0-2.5 A).
- N-SERV1K. 1 kW Servomotor Module.

Optional AC motors to be acquired:

- Option 1: Study of Three-Phase Asynchronous Motor of Squirrel cage.
- EMT7. Asynchronous three-phase motor of squirrel cage.
 - N-TRANS03. Three-phase Autotransformer.
 - N-ARR01. Manual Star-Delta Starter.
- Option 2: Study of Three-Phase Asynchronous Motor of wound rotor.
- EMT8. Asynchronous three-phase motor of squirrel cage.
 - N-TRANS03. Three-phase Autotransformer.
 - N-ARR01. Manual Star-Delta Starter.
 - N-ARR12. Direct Starter.
 - N-REFTI. Three-phase Independent

Resistor Module.

Option 3: Study of Three-Phase Dahlander Motor.

- EMT9. Dahlander three-phase motor.
- N-ARR07. Manual Dahlander Commutator, 2 Speeds.

Option 4: Study of Asynchronous three-phase motor of two independent speeds.

- EMT10. Asynchronous three-phase motor of two independent speeds.
- N-ARR09. Manual Independent Windings Commutator, 2 speeds

Option 5: Study of Asynchronous single-phase motor with starting capacitor.

- EMT11. Asynchronous single-phase motor with starting capacitor.

Option 6: Study of Universal Motor.

- EMT12. Universal motor (single-phase).
- N-REV. Variable Resistor
- N-WVCC/M. DC Motor Speed Controller (Intermediate option).

Option 7: Study of Asynchronous single-phase motor with starting and running capacitor.

- EMT16. Asynchronous single-phase motor with starting and running capacitor.

Option 8: Study of Asynchronous single-phase motor with split phase.

- EMT20. Asynchronous single-phase motor with split phase.

Option 9: Study of Three-Phase Reluctance Motor.

- EMT21. Three-phase reluctance motor.
- N-TRANS03. Three-phase Autotransformer.
- N-ARR01. Manual Star-Delta Starter.

Option 10: Study of Three-phase synchronous generator

- EMT6. A.C. Synchronous Three-Phase Motor Alternator.
- N-WVCC/M. DC Motor Speed Controller (Intermediate option).
- N-REFTI. Three-phase Independent Resistor Module.

Expansion testing software:

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines, with SCADA.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-ACENT/ICAI) to reinforce knowledge about this field. This software is formed by:

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

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

Option A:

This application needs the following racks.

- N-RACK-A.
- 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



AEL-ACENT + RACKS

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-ACENT. A.C. Electrical Motors Applications. (Continuation).

Some practical possibilities with Option 1: Study of Three-Phase Asynchronous Motor of Squirrel cage.

- 1.- Checking the main power supply.
- 2.- Wiring of the Advanced Frequency Controller.
- 3.- Wiring of Three-Phase Asynchronous Motor of Squirrel cage.
- 4.- Wiring the servomotor.
- 5.- Programming of the Advanced Frequency Controller.
- 6.- Manual control speed of Three-Phase Asynchronous Motor of Squirrel cage with the frequency controller.
- 7.- Forward and reverse operations with the frequency controller.
- 8.- Braking test with the servomotor and Frequency Controller.
- 9.- Study of starting currents and voltages of Three-Phase Asynchronous Motor of Squirrel cage.
- 10.- Starting of Three-Phase Asynchronous Motor of Squirrel cage with different load conditions.
- 11.- Comparison between start with frequency controller, Star/Delta starter and direct starter of Three-Phase Asynchronous Motor of Squirrel cage.
- 12.- Analysis of Three-Phase Asynchronous Motor of Squirrel cage with star connection.
- 13.- Analysis of Three-Phase Asynchronous Motor of Squirrel cage with delta connection.
- 14.- Comparison of the energy consumption by the conventional electrical power and the frequency controllers.
- 15.- Torque/Speed digital measurement of Three-Phase Asynchronous Motor of Squirrel cage.
- 16.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of Three-Phase Asynchronous Motor of Squirrel cage.
- 17.- Comparison of theoretical parameters with real experiments of the electrical machine.
- 18.- Check the motor protection.
- 19.- Comparison with other acquired motors.

Some practical possibilities with Option 2: Study of Three-Phase Asynchronous Motor of wound rotor.

- 20.- Checking the main power supply.
- 21.- Wiring of the Advanced Frequency Controller.
- 22.- Wiring the Three-Phase Asynchronous Motor of wound rotor.
- 23.- Wiring the servomotor.
- 24.- Programming of the Advanced Frequency Controller.
- 25.- Manual control speed of Three-Phase Asynchronous Motor of wound rotor with the frequency controller.
- 26.- Forward and reverse operations with the frequency controller.
- 27.- Braking test with the servomotor and Frequency Controller.
- 28.- Study of starting currents and voltages of Three-Phase Asynchronous Motor of wound rotor.

29.- Starting of three-phase induction motor with different load conditions.

- 30.- Comparison between start with frequency controller, Star/Delta starter, direct starter and starting with resistor of Three-Phase Asynchronous Motor of wound rotor.
- 31.- Analysis of Three-Phase Asynchronous Motor of wound rotor with star connection.
- 32.- Analysis of Three-Phase Asynchronous Motor of wound rotor with delta connection.
- 33.- Comparison of the energy consumption by the conventional electrical power and the frequency controllers.
- 34.- Torque/Speed digital measurement of Three-Phase Asynchronous Motor of wound rotor.
- 35.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of Three-Phase Asynchronous Motor of wound rotor.
- 36.- Comparison of theoretical parameters with real experiments of the electrical machine.
- 37.- Check the motor protection.
- 38.- Comparison with other acquired motors.

Some practical possibilities with Option 3: Study of Three-Phase Dahlander Motor.

- 39.- Checking the main power supply.
- 40.- Wiring of the Advanced Frequency Controller.
- 41.- Wiring of Three-Phase Dahlander Motor.
- 42.- Wiring the servomotor.
- 43.- Programming of the Advanced Frequency Controller.
- 44.- Manual control speed of Three-Phase Dahlander Motor with the frequency controller.
- 45.- Forward and reverse operations of Three-Phase Dahlander Motor with the frequency controller.
- 46.- Braking test with the servomotor and Frequency Controller.
- 47.- Study of starting currents and voltages.
- 48.- Starting of three-phase induction motor with different load conditions.
- 49.- Manual speed variation of a Dahlander motor.
- 50.- Comparison between start with frequency controller and direct starter.
- 51.- Comparison of working with different pair of poles.
- 52.- Comparison of the energy consumption by the conventional electrical power and the frequency controllers.
- 53.- Torque/Speed digital measurement of Three-Phase Dahlander Motor.
- 54.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of Three-Phase Dahlander Motor.
- 55.- Comparison of theoretical parameters with real experiments of the electrical machine.
- 56.- Check the motor protection.
- 57.- Comparison with other acquired motors.

Some practical possibilities with Option 4: Study of Asynchronous three-phase motor of two independent speeds.

- 58.- Checking the main power supply.
- 59.- Wiring of the Advanced Frequency Controller.



AEL-ACENT + RACKS

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-ACENT. A.C. Electrical Motors Applications. (Continuation).

- 60.- Wiring of Asynchronous three-phase motor of two independent speeds.
 - 61.- Wiring the servomotor.
 - 62.- Programming of the Advanced Frequency Controller.
 - 63.- Manual control speed of Asynchronous three-phase motor of two independent speeds with the frequency controller.
 - 64.- Forward and reverse operations with the frequency controller.
 - 65.- Braking test with the servomotor and Frequency Controller.
 - 66.- Study of starting currents and voltages of Asynchronous three-phase motor of two independent speeds.
 - 67.- Starting of three-phase induction motor with different load conditions.
 - 68.- Manual speed variation of Asynchronous three-phase motor of two independent speeds.
 - 69.- Comparison between start with frequency controller and direct starter.
 - 70.- Comparison of working with different speeds of Asynchronous three-phase motor of two independent speeds.
 - 71.- Comparison of the energy consumption by the conventional electrical power and the frequency controllers.
 - 72.- Torque/Speed digital measurement of Asynchronous three-phase motor of two independent speeds.
 - 73.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of Asynchronous three-phase motor of two independent speeds.
 - 74.- Comparison of theoretical parameters with real experiments of the electrical machine.
 - 75.- Check the motor protection.
 - 76.- Comparison with other acquired motors.
- Some practical possibilities with Option 5: Study of Asynchronous single-phase motor with starting capacitor.
- 77.- Checking the main power supply.
 - 78.- Wiring of the Advanced Frequency Controller.
 - 79.- Wiring of Asynchronous single-phase motor with starting capacitor.
 - 80.- Wiring the servomotor.
 - 81.- Programming of the Advanced Frequency Controller.
 - 82.- Manual control speed of Asynchronous single-phase motor with starting capacitor with the frequency controller.
 - 83.- Forward and reverse operations of Asynchronous single-phase motor with starting capacitor with the frequency controller.
 - 84.- Test of Asynchronous single-phase motor with starting capacitor without load.
 - 85.- Braking test with the servomotor and Frequency Controller.
 - 86.- Study of starting currents and voltages of Asynchronous single-phase motor with starting capacitor.
 - 87.- Starting of Asynchronous single-phase motor with starting capacitor with different load conditions.
 - 88.- Comparison of the energy consumption by the conventional electrical power and the frequency controllers.
- 89.- Torque/Speed digital measurement of Asynchronous single-phase motor with starting capacitor.
 - 90.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of Asynchronous single-phase motor with starting capacitor.
 - 91.- Comparison of theoretical parameters with real experiments of the electrical machine.
 - 92.- Check the motor protection.
 - 93.- Comparison with other acquired motors.
- Some practical possibilities with Option 6: Study of Universal Motor.
- 94.- Checking the main power supply.
 - 95.- Wiring of the Advanced Frequency Controller.
 - 96.- Wiring the universal motor with AC current supply.
 - 97.- Wiring the universal motor with DC current supply.
 - 98.- Wiring the servomotor.
 - 99.- Programming of the Advanced Frequency Controller.
 - 100.- Manual control speed of the universal motor with the frequency controller.
 - 101.- Manual control speed of the universal motor with DC current supply.
 - 102.- Test of the universal motor without load.
 - 103.- Braking test with the servomotor.
 - 104.- Study of Speed-intensity characteristic universal motor.
 - 105.- Torque/Speed digital measurement universal motor.
 - 106.- Study of torque-intensity characteristic universal motor.
 - 107.- Study of starting currents and voltages universal motor.
 - 108.- Starting of the universal motor with different load conditions.
 - 109.- Comparison of the energy consumption by the conventional electrical power and the frequency controllers.
 - 110.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. universal motor.
 - 111.- Comparison of theoretical parameters with real experiments of the electrical machine.
 - 112.- Check the motor protection.
 - 113.- Comparison with other acquired motors.
- Some practical possibilities with Option 7: Study of Asynchronous single-phase motor with starting and running capacitor.
- 114.- Checking the main power supply.
 - 115.- Wiring of the Advanced Frequency Controller.
 - 116.- Wiring of Asynchronous single-phase motor with starting and running capacitor.
 - 117.- Wiring the servomotor.
 - 118.- Programming of the Advanced Frequency Controller.
 - 119.- Manual control speed of Asynchronous single-phase motor with starting and running capacitor with the frequency controller.
 - 120.- Test of Asynchronous single-phase motor with starting and running capacitor without load.
 - 121.- Braking test with the servomotor and Frequency Controller.



AEL-ACENT + RACKS

Applications:

AEL-3.2
Motors Applications

—AC Electrical Motors Applications—

AEL-ACENT. A.C. Electrical Motors Applications. (Continuation).

- 122.- Study of starting currents and voltages of Asynchronous single-phase motor with starting and running capacitor.
- 123.- Starting of single-phase induction motor with different load conditions.
- 124.- Comparison of the energy consumption by the conventional electrical power and the frequency controllers.
- 125.- Torque/Speed digital measurement of Asynchronous single-phase motor with starting and running capacitor.
- 126.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of Asynchronous single-phase motor with starting and running capacitor.
- 127.- Comparison of theoretical parameters with real experiments of the electrical machine.
- 128.- Check the motor protection.
- 129.- Comparison with other acquired motors.
- Some practical possibilities with Option 8: Study of Asynchronous single-phase motor with split phase.
- 130.- Checking the main power supply.
- 131.- Wiring of the Advanced Frequency Controller.
- 132.- Wiring of Asynchronous single-phase motor with split phase.
- 133.- Wiring the servomotor.
- 134.- Programming of the Advanced Frequency Controller.
- 135.- Manual control speed of Asynchronous single-phase motor with split phase with the frequency controller.
- 136.- Test of Asynchronous single-phase motor with split phase without load.
- 137.- Braking test with the servomotor and Frequency Controller.
- 138.- Study of starting currents and voltages of Asynchronous single-phase motor with split phase.
- 139.- Starting of Asynchronous single-phase motor with split phase with different load conditions.
- 140.- Comparison of the energy consumption by the conventional electrical power and the frequency controllers.
- 141.- Torque/Speed digital measurement of Asynchronous single-phase motor with split phase.
- 142.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of Asynchronous single-phase motor with split phase.
- 143.- Comparison of theoretical parameters with real experiments of the electrical machine.
- 144.- Check the motor protection.
- 145.- Comparison with other acquired motors.
- Some practical possibilities with Option 9: Study of Three-Phase Reluctance Motor.
- 146.- Checking the main power supply.
- 147.- Wiring of the Advanced Frequency Controller.
- 148.- Wiring of Three-Phase Reluctance Motor.
- 149.- Wiring the servomotor.
- 150.- Programming of the Advanced Frequency Controller.
- 151.- Manual control speed of Three-Phase Reluctance Motor with the frequency controller.
- 152.- Forward and reverse operations of Three-Phase Reluctance Motor with the frequency controller.
- 153.- Braking test with the servomotor and Frequency Controller.
- 154.- Study of starting currents and voltages of Three-Phase Reluctance Motor.
- 155.- Starting of Three-Phase Reluctance Motor with different load conditions.
- 156.- Comparison between start with frequency controller, Star/Delta starter and direct starter of Three-Phase Reluctance Motor.
- 157.- Analysis of Three-Phase Reluctance Motor with star connection.
- 158.- Analysis of Three-Phase Reluctance Motor with delta connection.
- 159.- Comparison of the energy consumption by the conventional electrical power and the frequency controllers.
- 160.- Torque/Speed digital measurement of Three-Phase Reluctance Motor.
- 161.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of Three-Phase Reluctance Motor.
- 162.- Comparison of theoretical parameters with real experiments of the electrical machine.
- 163.- Check the motor protection.
- 164.- Comparison with other acquired motors.
- Some practical possibilities with Option 10: Study of Three-Phase Synchronous Generator.
- 165.- Checking the main power supply.
- 166.- Wiring the AC Synchronous generator.
- 167.- Study of the parameters to be controlled in AC Synchronous generator.
- 168.- Study of speed VS output voltage of synchronous generator at current excitation constant.
- 169.- Study of current excitation VS output voltage of synchronous generator at frequency constant.
- 170.- Study of drop voltage of synchronous generator with load.
- Additional practical exercises with optional EM-SCADA:
- 171.- Real time torque measurement waveform.
- 172.- Real time speed measurement waveform.
- 173.- Real time current and voltage measurement waveforms.
- 174.- Electrodynamics study of the motor.
- 175.- Obtainment of characteristics curves.
- 176.- Obtainment of stored results.
- 177.- Braking test and real time monitoring results.
- For more information see **AEL-ACENT** catalogue.
Click on the following link:
- www.edibon.com/en/files/equipment/AEL-ACENT/catalog



AEL-ACENT + RACKS

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-ACINA. Application of AC Three-Phase Induction Motor of Squirrel Cage.

The Application of AC Three-Phase Induction Motor of Squirrel Cage, "AEL-ACINA", is designed for the study of the main operations performed in the industrial field with three-phase squirrel cage induction motors. The student will learn the most important operations of these electrical machines faithfully by using commutators, timers and contactors.

The AEL-ACINA includes the following modules:

- N-ALI01. Industrial Power Supply.
- N-PUL48. 3 Double Chamber PushButtons.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-pole Contactor (24 VAC). (4 units).
- N-ARR01. Manual Star-Delta Starter.
- N-REL30. Synchronization Relay. (3 units)
- N-ALI03. AC Auxiliary Power Supply.
- EMT7. Asynchronous three-phase motor of squirrel cage.
- N-TRANS03. Three-phase Autotransformer.
- FLYW. Flywheel.
- N-ARR13. Direct Starter with Inversion.

Additional and recommended measurement instrumentation modules:

- Digital Instrumentation:
 - N-EALD. Network Analyzer Unit with Computer Data Acquisition.
- Analog Instrumentation:
 - N-MED10. AC Ammeter (0-5 A).
 - N-MED22. AC Voltmeter (0-400 VAC).
 - N-MED33. 3-phase balance Wattmeter 440V.
 - N-MED31. 3-Phase Phasemeter 400V.
 - N-MED39. 3-Phase Balanced Varmeter 440V.

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-ACINA/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-ACINA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks:

- N-RACK-A.
- 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.

Some practical exercises possibilities:

- 1.- Checking the Industrial Main Power Supply.
- 2.- Checking the AC Auxiliary Main Power Supply.
- 3.- Checking the lamps.
- 4.- Study of the control elements of alternating current motors.
- 5.- Manual star-delta circuit of three-phase induction motor.
- 6.- Manual reversing operations of three-phase induction motor.
- 7.- Automatic star-delta starter of three-phase induction motor.
- 8.- Automatic star-delta reversing circuit of three-phase induction motor.
- 9.- Use of the flywheel.

For more information see **AEL-ACINA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-ACINA/catalog



AEL-ACINA + RACKS

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-ACDHA. Application of AC Dahlander Three-Phase Induction Motor.

The Application of AC Dahlander Three-Phase Induction Motor, "AEL-ACDHA", is designed for the study of the main operations performed in the industrial field with dahlander electrical motors.

The student will learn the most important operations of these electrical machines faithfully by using commutators, timers and contactors.

The AEL-ACDHA includes the following modules:

- N-ALI01. Industrial Power Supply.
- N-ARR12. Direct Starter.
- N-ARR01. Manual Star-Delta Starter.
- N-ARR13. Direct Starter with Inversion.
- N-ARR05. Manual Star-Delta Starter with Inversion.
- N-ARR07. Manual Dahlander Commutator, 2 Speeds.
- N-ARR11. Poles Commutation with Inversion.
- N-PUL48. 3 Double Chamber Push-Buttons.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-pole Contactor (24 VAC). (4 units)
- N-REL30. Synchronization Relay. (3 units)
- N-ALI03. AC Auxiliary Power Supply.
- N-TRANS03. Three-Phase Autotransformer 400/230 VAC, 1 kVA, Module.
- EMT9. Dahlander three-phase motor (2 speeds).
- FLYW. Flywheel.
- EMT7. Asynchronous three-phase motor of squirrel cage.

Additional and recommended measurement instrumentation modules:

- Digital Instrumentation:
 - N-EALD. Network Analyzer Unit with Computer Data Acquisition.
- Analog Instrumentation:
 - N-MED10. AC Ammeter (0-5 A).
 - N-MED22. AC Voltmeter (0-400 VAC).
 - N-MED33. 3-Phase Balanced Wattmeter 440 V.
 - N-MED31. 3-Phase Phasemeter 400V.
 - N-MED39. 3-Phase Balanced Varmeter 440 V.

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-ACDHA/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-ACDHA can be mounted on rack (option A) or on rail (option B):

Option A:

- This application needs the following racks:
- N-RACK-A. (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.

Some practical exercises possibilities:

- 1.- Checking the Industrial Main Power Supply.
- 2.- Checking the AC Auxiliary Main Power Supply.
- 3.- Checking the lamps.
- 4.- Study of the control elements of alternating-current motors.
- 5.- Manual star-delta circuit of three-phase induction motor.
- 6.- Manual star and reverse operation of Dahlander motor.
- 7.- Manual star-delta with inversion circuit of three-phase induction motor.
- 8.- Manual speed variation of a Dahlander motor.
- 9.- Manual speed variation of a Dahlander motor with inversion.
- 10.- Automatic star-delta starter of three-phase induction motor.
- 11.- Automatic star-delta reversing circuit of three-phase induction motor.
- 12.- Automatic velocity variation of a Dahlander motor.
- 13.- Use of the flywheel.

For more information see **AEL-ACDHA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-ACDHA/catalog



AEL-ACDHA + RACKS

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-ACWRA. Application of AC Three-Phase Induction Motor of Wound Rotor.

The Application of AC Three-Phase Induction Motor of Wound Rotor, "AEL-ACWRA", is designed for the study of the main operations performed in the industrial field with this three-phase induction motors with wound rotor.

The student will understand the most important operations of these electrical machines faithfully by using commutators, timers and contactors.

The AEL-ACWRA includes the following modules:

- N-ALI01. Industrial Main Power Supply.
- N-ARR12. Direct Starter.
- N-PUL48. 3 Double Chamber Push-Buttons.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-pole Contactor (24 VAC). (4 units)
- N-REL30. Synchronization Relay. (3 units)
- N-ALI03. AC Auxiliary Power Supply.
- EMT8. Asynchronous three-phase motor with wound rotor.
- FLYW. Flywheel.
- N-TRANS03. Three-phase Autotransformer 400/230 VAC, 1KVA.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-ACWRA/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).

Additional and recommended measurement instrumentation modules:

- Digital Instrumentation:

- N-EALD. Network Analyzer Unit with Computer Data Acquisition.

- Analog Instrumentation:

- N-MED10. AC Ammeter (0-5 A).
- N-MED22. AC Voltmeter (0-400 VAC).
- N-MED33. 3-Phase Balanced Wattmeter 440V.
- N-MED31. 3-Phase Phasemeter 400V.
- N-MED39. 3-Phase Balanced Varmeter 440V.

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

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

Option A:

This application needs the following racks:

- N-RACK-A (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.

Some practical exercises possibilities:

- 1.- Manual star-delta circuit of Asynchronous three-phase motor with wound rotor.
- 2.- Manual reversing operations of Asynchronous three-phase motor with wound rotor.
- 3.- Timer Sequential Control operations of Asynchronous three-phase motor with wound rotor.
- 4.- Automatic star/delta starter of Asynchronous three-phase motor with wound rotor.
- 5.- Automatic star-delta reversing circuit of Asynchronous three-phase motor with wound rotor.
- 6.- Countercurrent braking.
- 7.- Automatic soft starter of Asynchronous three-phase motor with wound rotor.

For more information see **AEL-ACWRA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-ACWRA/catalog



AEL-ACWRA + RACKS

Applications:

AEL-3.2
Motors Applications

—AC Electrical Motors Applications—

AEL-ACLA. Application of AC Linear Motor Operations.

The Application of AC Linear Motor Operations "AEL-ACLA" has been designed by Edibon to study how AC linear induction motors (LIM) work.

This application includes all necessary to understand the basic principles of linear motors. The variable power supply allows to vary the voltage and thus the user can start the machine softly and voltage and current can be analyzed. The AEL-ACLA consists of a linear induction motor which allows changing the air gap and the tractive force. This force can be measured with the dynamometer. In addition, this application has two limit switches installed at the end of the rail to commutate automatically the phases and change the direction of the linear motor.

One of the advantages of the application AEL-ACLA is the combination of power and rail length of the motor. The student can deepen in the knowledge of great importance linear motors such as the mentioned Sanghai Transrapid. Besides, the dynamometer and the Hall sensor modules allow study two of the most important parameters of this type of motor: torque and position.

The AEL-ACLA includes the following modules:

- N-VPS01. AC 3PH Variable Power Supply.
- EMT23. Hysteresis Motor.
- DMM. Dynamometer.

Additional and recommended elements:

- WEI. Set of Weights.
- Hall sensor.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-ACLA/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-ACLA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks:

- N-RACK-B (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.

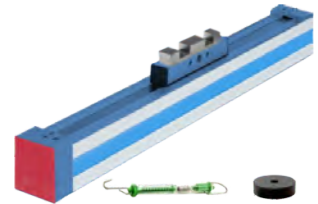
Some practical exercises possibilities:

- 1.- Basic practice for the study of the magnetism principles applied to linear induction machines.
- 2.- Speed control of a linear induction motor.
- 3.- Inversion of the operation of a linear induction motor.
- 4.- Study of the linear induction motor force with a dynamometer.
- 5.- Study of the Lorentz Force principle.
- 6.- Study of the electric and mechanical parameters.
- 7.- Determinate the position of the linear induction motor with a Hall sensor (additional and recommended).
- 8.- Compare the linear induction motor with the rotary motors.

For more information see **AEL-ACLA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-ACLA/catalog



AEL-ACLA + RACK

Applications:

AEL-3.2
Motors Applications

 AC Electrical Motors Applications

AEL-ACRLA. Applications of AC Three-Phase Reluctance Motor.

The Applications of AC Three-Phase Reluctance Motors, "AL-ACRLA", is designed for the study of the main operations performed in the industrial field with three-phase reluctance motors.

The student will learn the most important operations of this type of electrical machines faithfully, through manual or automatic operations, by using manual commutators, timers and contactors.

The AEL-ACRLA includes the following modules:

- N-ALI01. Industrial Power Supply.
- N-ARR12. Direct Starter.
- N-PUL48. 3 Double Chamber Push-Buttons.
- N-ARR11. Poles Commutation with Inversion.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-pole Contactor (24 VAC). (3 units)
- N-ALI03. AC Auxiliary Power Supply.
- N-REL30. Synchronization Relay. (2 units)
- EMT21. Three-phase reluctance motor.
- N-TRANS03. Three-Phase Autotransformer 400/230 VAC, 1 kVA, Module.
- FLYW. Flywheel.

Additional and recommended measurement instrumentation module:

- N-EALD. Network Analyzer Unit with Computer Data Acquisition.

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-ACRLA/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-ACRLA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks:

- N-RACK-A.
- 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.

Some practical exercises possibilities:

- 1.- Manual starter of AC Three-Phase Reluctance Motor.
- 2.- Manual reversing operations of AC Three-Phase Reluctance Motor.
- 3.- Automatic starter of AC Three-Phase Reluctance Motor.
- 4.- Automatic reversing operations of AC Three-Phase Reluctance Motor.
- 5.- Timer Sequential Control operations of AC Three-Phase Reluctance Motor.
- 6.- Countercurrent braking.



AEL-ACRLA + RACKS

For more information see **AEL-ACRLA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-ACRLA/catalog

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-ACSPA. Application of Asynchronous Single-Phase Motor with Split Phase.

The Application of Asynchronous Single-Phase Motor with Split Phase, "AEL-ACSPA" is designed for the study of the main operations performed in the industrial field with split phase electrical motors.

The student will learn the most important operations of this type of electrical machines faithfully by using commutators, timers and contactors.

The AEL-ACSPA includes the following modules:

- N-ALI01. Industrial Power Supply.
- N-PUL48. 3 Double Chamber Push-Buttons.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-pole Contactor (24 VAC). (2 units).
- N-REL30. Synchronization Relay. (2 units).
- N-ALI03. AC Auxiliary Power Supply.
- EMT20. Asynchronous single-phase motor with split phase.
- FLYW. Flywheel.

Additional and recommended measurement instrumentation module:

- N-EALD. Network Analyzer Unit with Computer Data Acquisition.

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-ACSPA/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-ACSPA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks:

- 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.

Some practical exercises possibilities:

- 1.- Manual starter of asynchronous single-phase motor with split phase.
- 2.- Automatic starter of asynchronous single-phase motor with split phase.
- 3.- Timer Sequential Control operations of asynchronous single-phase motor with split phase.
- 4.- Starter of asynchronous single-phase motor with split phase with Flywheel.

For more information see **AEL-ACSPA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-ACSPA/catalog



AEL-ACSPA + RACK

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-AI12. Modular Application (AC Motors).

The Modular Application (AC Motors), "AEL-AI12", consisting of several modules which allows the user realize logic control circuits in order to manage the motors included in this unit: three-phase induction motor of squirrel cage, single-phase induction motor with starting and running capacitor and Dahlander motor.

At first, the student gets theory knowledge about how the motors described before work. After that, the student will be ready to wire logic control circuits to start the motors by different ways, working in forward and reverse speed of the machine, breaking the motors and study several protections.

Optionally several AC electrical machines are offered in this application such as three-phase induction motor with wound rotor, three-phase induction motor of squirrel cage with two speeds, single-phase induction motor with starting capacitor, single-phase motor with split shift, three-phase reluctance motor and single-phase shaded pole motor.

The AEL-AI12 includes the following modules:

- N-ALI01. Industrial Main Power Supply.
- N-ALI03. AC Auxiliary Power Supply.
- N-PUL48. 3 Double Chamber Pushbuttons. (2 units)
- N-LAM02. Auxiliary Lamps (3 lamps, 24 Vac).
- N-CON01. 3-pole Contactor (24 Vac). (4 units)
- N-VAR09. Frequency Variator.
- N-REL30. Synchronization Relay.
- N-REL47. Thermal Relay. (2 units)
- N-REL45. Module with Disjuncter.
- N-IAM31. 4-pole Magneto-thermal Automatic Switch, 4 A, Curve C.
- N-FUS10. Module with 3 fuse-holders and power fuses.
- TRA06. 3-Phase Power Transformer.
- N-MED60. Network Analyzer.
- N-CAR10. Capacitive Load.
- EMT7. Asynchronous three-phase motor of squirrel cage.

- EMT9. Dahlander three-phase motor.
- EMT16. Asynchronous single-phase motor with starting and running capacitor.

Expansion electrical machines:

- EMT8. Asynchronous three-phase motor with wound rotor.
- EMT10. Asynchronous three-phase motor of two independent speeds.
- EMT11. Asynchronous single-phase motor with starting capacitor.
- EMT20. Asynchronous single-phase motor with split phase.
- EMT21. Three-phase reluctance motor.
- EMT22. Single-phase shaded pole motor.

Expansion loads:

- N-REF/T. Three-Phase Resistor Load with commutator module.
- N-CON/T. Three-phase Capacitor module.
- N-IND/T. Three-phase Inductance module.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-AI12/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-AI12 can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-A. (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.



AEL-AI12

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-AI12. Modular Application (AC Motors). (Continuation).

Some practical exercises possibilities:

- 1.- Identification of the element of the Main Power Supply.
- 2.- Study of the elements in the control of AC motors.
- 3.- Study of the protection elements for AC motors.
- 4.- Direct starting of a three-phase motor through contactor, with some stop and start push-buttons.
- 5.- Configuration of a magnetic protection system, with stop mushroom button.
- 6.- Direct starting of a three-phase motor with thermal relay with control coil.
- 7.- Direct starting of a three-phase motor through impulses contactor.
- 8.- Direct starting of a three-phase motor with thermal relay and with push-buttons and signalling.
- 9.- Turning inverted starter of a three-phase motor stopping before turning in the opposite direction.
- 10.- Turning inverted starter of a three-phase motor without stopping before turning in the opposite direction.
- 11.- Turning inverted starter of a three-phase motor with microswitch and push-buttons box.
- 12.- Star/delta starting with a turn inverter of a three-phase motor.
- 13.- Automatic star-delta starting of a three phase motor.
- 14.- Turning inverted starter of a three-phase motor with micro switch, with start pushbuttons, stop and function cycle. (Direct).
- 15.- Manual star-delta starting of a three-phase motor.
- 16.- Control of a single phase motor direct and, with time -delay connection and disconnection.
- 17.- Starting of a three-phase motor with single phase voltage.
- 18.- Motor speed control with a frequency variator.
- 19.- Parameters of the motor.
- 20.- Starting and control of a two-speed Dahlander motor.
- 21.- Measurement with digital measurement system of the voltage, current, power factor and active power parameters of electric motors and transformers.

- 22.- Study of control systems with pushbuttons, lamps Signaling, relays, timers and contactors.

Some practical possibilities with optional electric machines:

- 23.- Direct start of the asynchronous three-phase motor with rotor Coiled.
- 24.- Star/Delta starting of the asynchronous three-phase motor with wound rotor with pushers and contactors.
- 25.- Start and reverse rotation of the asynchronous three-phase motor with wound rotor with pushers and contactors.
- 26.- Direct start-up of the asynchronous three-phase motor with two independent speeds.
- 27.- Direct start and motor speed switching of three-phase asynchronous with two independent speeds with push buttons and contactors.
- 28.- Start and reverse rotation of the asynchronous three-phase motor with two independent speeds with pushers and contactors.
- 29.- Direct starting of the asynchronous single-phase motor with capacitor.
- 30.- Direct starting of the asynchronous single-divided phase.
- 31.- Direct start of three-phase reluctance motor.
- 32.- Star/delta starting of three-phase reluctance motor with pushers and contactors.
- 33.- Direct starting with reluctance motor reversal three-phase with pushers and contactors.
- 34.- Direct starting of single-phase motor with short-circuited winding auxiliary.

For more information see **AEL-AI12** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-AI12/catalog



AEL-AI12

Applications:

AEL-3.2
Motors Applications

—AC Electrical Motors Applications—

AEL-IMSU. General Application of AC Induction Motor.

The General Application of AC Induction Motor, "AEL-IMSU", is an application designed by Edibon in order to study several starting and control methods of Three-Phase Induction Motors of Squirrel Cage in industrial installations.

These motors are the most employed machines in the industry. For this reason, this application studies in depth different performed operations with these electric machines: manual star-delta starter operation, direct starter with inversion operation, study of advanced controls in electric machines with variable speed controller, etc.

This application includes an Eddy Current Brake to study the induction motor response against different load conditions. Eddy Current Brake includes a DC variable power supply with which the user can control the braking torque. When the braking torque is increased, the power consumption of the induction motor is increased too, the Power Factor changes, etc. In order to analyze the power consumption of the induction motor a network analyzer is included to show the main electrical parameters which are relevant in industrial installations: voltages, currents, frequencies, Power Factor, active power, reactive power, apparent power, etc.

The AEL-IMSU includes the following modules:

- N-ALI01. Industrial Power Supply.
- N-WCA. Advanced AC Motor Speed Controller.
- N-ARR01. Manual Star-Delta Starter.
- N-ARR13. Direct Starter with Inversion.
- N-WVCC/M. DC Motor Speed Controller (Middle option).
- N-ARR12. Direct Starter.
- N-TRANS03. Three-Phase Autotransformer.
- FRECP. Eddy Current Brake.
- N-EALD. Network Analyzer Unit with Computer Data Acquisition.
- EMT7. Asynchronous Three-Phase Motor of Squirrel Cage.

Expansion testing software:

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines, with SCADA.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-IMSU/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-IMSU can be mounted onrack (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.

Some practical exercises possibilities:

- 1.- Advanced programming of a Variable Frequency Controller.
- 2.- Manual control speed of the induction motor with the frequency controller.
- 3.- Forward and Reverse operations with the induction motor and the frequency controller.
- 4.- Programming of the acceleration time of the induction motor with the frequency controller.
- 5.- Programming of the deceleration time of the induction motor with the frequency controller.
- 6.- Programming different conditions with digital inputs in the frequency controller to simulate different real situations in the industry.
- 7.- Programming the speed response of the induction motor with the frequency controller.
- 8.- Study of load consumption of the induction motor changing the braking torque.
- 9.- Study of different alarms that can be programmed in the frequency controller.
- 10.- Manual star-delta starter operation.
- 11.- Direct starter with inversion operation.
- 12.- Direct starter operation.

Some practical exercises possibilities with the EM-SCADA:

- 13.- Visualization of torque/current VS speed of the induction motor with manual star/delta starter.
- 14.- Visualization of torque/current VS speed of the induction motor with the frequency controller.
- 15.- Visualization of torque/current VS speed of the induction motor with direct starter.
- 16.- Comparison of graphs with different starting types.

For more information see **AEL-IMSU** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-IMSU/catalog



AEL-IMSU + RACKS

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-ACEMA. A.C. Electrical Motors Applications.

The A.C. Electrical Motors Application, "AEL-ACEMA", consists of a base equipment which is formed by several modules such as power supplies, push buttons, three-phase autotransformer, AC ammeter, circuit breakers, timers, flywheel, etc. In addition, this base equipment is complemented by different options. Each option includes a different motor with its specific modules to carry out properly operations.

With this application, the user will take a complete experience about the most important operations carried out with several industrial machines such as Asynchronous three-phase motor of squirrel cage, asynchronous three-phase motor of wound rotor, Dahlander three-phase motor, asynchronous three-phase motor of two independent speeds, asynchronous single-phase motor with starting capacitor, Universal Motor, asynchronous single-phase motor with starting and running capacitor, Asynchronous single-phase motor with split phase, three-phase reluctance motor, three-phase AC synchronous generator, etc.

The AEL-ACEMA includes the following modules:

- N-ALI01. Industrial Power Supply.
- N-ALI03. AC Auxiliary Power Supply.
- N-PUL48. Three Double Chamber Push-Buttons Module.
- N-CON01. 3-pole Contactor (24 Vac). (4 units).
- N-REL30. Synchronization Relay Module. (3 units).
- N-TRANS03. Three-Phase Autotransformer Module.
- N-LAM02. Three Auxiliary Lamps Module.
- N-MED09. AC Ammeter (0-2.5 A).
- N-ARR13. Direct Starter with Inversion Module.
- N-MED65. Digital Multimeter.
- FLYW. Flywheel.

Optional AC motors to be acquired:

Option 1: Study of Three-Phase Asynchronous Motor of Squirrel cage.

- EMT7. Asynchronous three-phase motor of squirrel cage.
- N-ARR01. Manual Star-Delta Starter.

Option 2: Study of Three-Phase Asynchronous Motor of wound rotor.

- EMT8. Asynchronous three-phase motor of wound rotor.
- N-ARR01. Manual Star-Delta Starter.
- N-REFTI. Three-phase Independent Resistor Module.

Option 3: Study of Three-Phase Dahlander Motor.

- EMT9. Dahlander three-phase motor.
- N-ARR07. Manual Dahlander Commutator, 2 Speeds.

Option 4: Study of Asynchronous three-phase motor of two independent speeds.

- EMT10. Asynchronous three-phase motor of two independent speeds.

- N-ARR09. Manual Independent Windings Commutator, 2 speeds.

Option 5: Study of Asynchronous single-phase motor with starting capacitor.

- EMT11. Asynchronous single-phase motor with starting capacitor.

Option 6: Study of Universal Motor:

- EMT12. Universal motor (single-phase).
- N-REV. Single phase variable resistor.
- N-WVCC/M. DC Motor Speed Controller (intermediate option).

Option 7: Study of Asynchronous single-phase motor with starting and running capacitor.

- EMT16. Asynchronous single-phase motor with starting and running capacitor.

Option 8: Study of Asynchronous single-phase motor with split phase.

- EMT20. Asynchronous single-phase motor with split phase.

Option 9: Study of Three-Phase Reluctance Motor.

- EMT21. Three-phase reluctance motor.
- N-ARR01. Manual Star-Delta Starter.

Option 10: Study of Three-phase synchronous generator:

- EMT6. A.C. Synchronous Three-Phase Motor Alternator.
- N-WVCC/M. DC Motor Speed Controller (intermediate option).
- EMT7. Asynchronous three-phase motor of squirrel cage.
- N-WVCA/M. AC Motor Speed Controller (intermediate option).
- N-REFTI. Three-phase Independent Resistor Module.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-ACEMA/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-ACEMA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-A.
- N-RACK-M.

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.



AEL-ACEMA

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-ACEMA. A.C. Electrical Motors Applications. (Continuation).

Some practical possibilities with Option 1: Study of Three-Phase Asynchronous Motor of Squirrel cage.

- 1.- Checking the main power supply.
- 2.- Wiring the Three-Phase Asynchronous Motor of Squirrel cage.
- 3.- Study of the control parameters of the Three-Phase Asynchronous Motor of Squirrel cage.
- 4.- Study the direct starting of the Three-Phase Asynchronous Motor of Squirrel cage.
- 5.- Manual star-delta starting circuit of the Three-Phase Asynchronous Motor of Squirrel cage.
- 6.- Manual reversing operations of the Three-Phase Asynchronous Motor of Squirrel cage.
- 7.- Automatic star-delta starter of the Three-Phase Asynchronous Motor of Squirrel cage.
- 8.- Automatic star-delta reversing circuit of the Three-Phase Asynchronous Motor of Squirrel cage.
- 9.- Autotransformer starting.
- 10.- Comparison of the operations with other acquired motors.

Some practical possibilities with Option 2: Study of Three-Phase Asynchronous Motor of wound rotor.

- 11.- Checking the main power supply.
- 12.- Wiring the Three-Phase Asynchronous Motor of wound rotor.
- 13.- Study of the control parameters of the Three-Phase Asynchronous Motor of wound rotor.
- 14.- Study the direct starting the Three-Phase Asynchronous Motor of wound rotor.
- 15.- Manual starting with rotor resistor.
- 16.- Manual star-delta starting circuit of the Three-Phase Asynchronous Motor of wound rotor.
- 17.- Manual reversing operations of the Three-Phase Asynchronous Motor of wound rotor.
- 18.- Automatic starting with rotor resistor.
- 19.- Automatic star-delta starting of the Three-Phase Asynchronous Motor of wound rotor.
- 20.- Automatic star-delta reversing circuit of the Three-Phase Asynchronous Motor of wound rotor.
- 21.- Autotransformer starting.
- 22.- Comparison of the operations with other acquired motors.

Some practical possibilities with Option 3: Study of Three-Phase Dahlander Motor.

- 23.- Checking the main power supply.
- 24.- Wiring the Three-Phase Dahlander Motor.
- 25.- Study of the control parameters of the Three-Phase Dahlander Motor.
- 26.- Study the direct starting of the Three-Phase Dahlander Motor.
- 27.- Manual speed variation of a Dahlander motor.

- 28.- Manual reversing operations of the Three-Phase Dahlander Motor.

- 29.- Autotransformer starting.

- 30.- Comparison of the operations with other acquired motors.

Some practical possibilities with Option 4: Study of Asynchronous three-phase motor of two independent speeds.

- 31.- Checking the main power supply.
- 32.- Wiring the Asynchronous three-phase motor of two independent speeds.
- 33.- Study of the control parameters of the Asynchronous three-phase motor of two independent speeds.
- 34.- Study the direct starting of the Asynchronous three-phase motor of two independent speeds.
- 35.- Manual speed variation of a motor with two independent speeds.
- 36.- Manual reversing operations of the Asynchronous three-phase motor of two independent speeds.
- 37.- Automatic speed variation of a motor with two independent speeds.
- 38.- Autotransformer starting.
- 39.- Comparison of the operations with other acquired motors.

Some practical possibilities with Option 5: Study of Asynchronous single-phase motor with starting capacitor.

- 40.- Checking the main power supply.
- 41.- Wiring the Asynchronous single-phase motor with starting capacitor.
- 42.- Study of the control parameters of the Asynchronous single-phase motor with starting capacitor.
- 43.- Study the direct starting the Asynchronous single-phase motor with starting capacitor.
- 44.- Manual reversing operations of the Asynchronous single-phase motor with starting capacitor.
- 45.- Direct and time-delay control of a single phase motor.
- 46.- Comparison of the operations with other acquired motors.

Some practical possibilities with Option 6: Study of Universal Motor.

- 47.- Checking the main power supply.
- 48.- Wiring the Universal Motor.
- 49.- Study of the control parameters of the Universal Motor.
- 50.- Study the direct starting of the Universal Motor.
- 51.- Manual reversing operations of the Universal Motor.
- 52.- Direct and time-delay control of a single phase motor.
- 53.- Comparison of the operations with other acquired motors.



AEL-ACEMA

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-ACEMA. A.C. Electrical Motors Applications. (Continuation).

Some practical possibilities with Option 7: Study of Asynchronous single-phase motor with starting and running capacitor.

54.- Checking the main power supply.

55.- Wiring the Asynchronous single-phase motor with starting and running capacitor.

56.- Study of the control parameters of the Asynchronous single-phase motor with starting and running capacitor.

57.- Study the direct starting the Asynchronous single-phase motor with starting and running capacitor.

58.- Manual reversing operations of the Asynchronous single-phase motor with starting and running capacitor.

59.- Direct and time-delay control of a single phase motor.

60.- Comparison of the operations with other acquired motors.

Some practical possibilities with Option 8: Study of Asynchronous single-phase motor with split phase.

61.- Checking the main power supply.

62.- Wiring the Asynchronous single-phase motor with split phase.

63.- Study of the control parameters of the Asynchronous single-phase motor with split phase.

64.- Manual reversing operations of the Asynchronous single-phase motor with split phase.

65.- Direct and time-delay control of a single phase motor.

66.- Comparison of the operations with other acquired motors.

Some practical possibilities with Option 9: Study of Three-Phase Reluctance Motor.

67.- Checking the main power supply.

68.- Wiring the Three-Phase Reluctance Motor.

69.- Study of the control parameters of the Three-Phase Reluctance Motor.

70.- Study the direct starting of the Three-Phase Reluctance Motor.

71.- Manual star-delta circuit of the Three-Phase Reluctance Motor.

72.- Manual reversing operations of the Three-Phase Reluctance Motor.

73.- Automatic star-delta starter of the Three-Phase Reluctance Motor.

74.- Automatic star-delta reversing circuit of the Three-Phase Reluctance Motor.

75.- Comparison of the operations with other acquired motors.

Some practical possibilities with Option 10: Study of Three-Phase Synchronous Generator.

76.- Checking the main power supply.

77.- Wiring of the AC Synchronous generator.

78.- Study of the parameters to be controlled in AC Synchronous generator.

79.- Study of speed VS output voltage of synchronous generator at current excitation constant.

80.- Study of current excitation VS output voltage of synchronous generator at frequency constant.

82.- Study of drop voltage of synchronous generator with load.

83.- Comparison of the operations with other acquired motors.

For more information see **AEL-ACEMA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-ACEMA/catalog



AEL-ACEMA

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-EEA. Alternator Study Application.

The Alternator Study Application, "AEL-EEA", has been designed by Edibon to study the behavior of three-phase synchronous generators with independent excitation.

This application consists of a motor-generator group and a series of modules that allow studying the most important concepts of three-phase synchronous generators with independent excitation. The driver is an induction motor which is used to simulate a turbine.

This application allows the student acquire a depth knowledge about synchronous generators with independent excitation. The user will learn to connect this kind of machines and commissioning the rest of components. For this purpose, the application includes excitation and frequency controllers. The behavior of the machine changes when the load varies, so all types of static loads are included and the user will be able to see the electrical effects thanks to the included network analyzer module. This module shows the most important electric parameters. Other important operation that can be carried out in this application is the power factor compensation. This practical exercise is carried out with the capacitors that are included in the AEL-EEA.

Optionally, this application can be supplied with the Electrical Machines SCADA Control Software EM-SCADA, a Data Control and Acquisition Software developed by Edibon that allows monitoring all voltage, current and torque waves shape. This allows studying the behavior of the three-phase induction generator.

The AEL-EEA includes the followings modules:

- N-ALI02. Domestic Power Supply
- N-VVCA/M. AC Motor Speed Controller (Intermediate option).
- EMT7. Asynchronous Three-Phase Motor of Squirrel Cage.
- EMT6. Synchronous Three-Phase Motor Alternator
- N-VREG. Voltage Regulator Module.
- N-REFT300. 300 Ohms Three-phase Fixed Resistor Module
- N-INDT. Three-phase Inductance Module.
- N-CONT. Three-phase Capacitor Module
- N-MED60. Network Analyzer Module.
- N-MED65. Digital Multimeter.

Expansion testing software:

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines, with SCADA.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-EEA/ICAL) 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-EEA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks:

- 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.

Some practical exercises possibilities:

- 1.- Checking the main power supply.
- 2.- Commissioning of the Frequency Controller.
- 3.- Adjusting the necessary values in the frequency controller.
- 4.- Adjusting the rotation direction.
- 5.- Adjusting the start function.
- 6.- Adjusting the frequency commutation, nominal voltage, nominal current, nominal frequency, etc.
- 7.- Study the operational performance in the frequency controller.
- 8.- Measuring power and RMS.
- 9.- Realize different experiments with the generator and the loads.
- 10.- U/f function optimization.
- 11.- Field current regulation and open circuit voltage.
- 12.- Generator drop voltage with resistive load.
- 13.- Generator drop voltage with inductive load.
- 14.- Generator get output voltage constant.
- 15.- Generator power factor compensation.

Some practical exercises possibilities with the EM-SCADA:

- 16.- Visualization of synchronous generator waves.

For more information see **AEL-EEA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-EEA/catalog



AEL-EEA + RACK

Applications:

AEL-3.2
Motors Applications

AC Electrical Motors Applications

AEL-EGMG24. Motor-Generator Group.

The Motor -Generator Group, "AEL-EGMG24", has been designed by Edibon in order to study the behavior of permanent magnet alternator with main motor control.

Thanks to this application, the student will be able to train the permanent magnet synchronous generator, wire the generator-motor group, analyze the power factor, observe the relationship between speed and voltage, study the behavior without load and check the drop voltage when the user connects resistive, inductive and capacitive loads.

The AEL-EGMG24 includes the following modules:

- N-ALI02. Domestic Power Supply.
- N-WCA/M. AC Motor Speed Controller (intermediate option).
- EMT7C. Asynchronous Three-Phase Motor of Squirrel Cage (8 poles).
- EMT6B. Permanent Magnets Synchronous Three-Phase Generator (24VAC).
- N-TRA30. Three-Phase Isolating Transformer 24VAC/380VAC.
- N-REFT300. 300 Ohms Three-Phase Fixed Resistor Module. (2 units)
- N-INDT. Three-Phase Variable Inductive Load with commutator.
- N-CONT. Three-Phase Variable Capacitor Load with commutator.
- N-EAL. Network Analyzer Unit.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-EGMG24/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-EGMG24 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.

Some practical exercises possibilities:

- 1.- Wiring of the motor-generator group.
- 2.- Commissioning of the Frequency Controller.
- 3.- Adjusting the necessary values in the frequency controller.
- 4.- Adjusting the rotation direction.
- 5.- Adjusting the start function.
- 6.- Frequency/speed control of permanent magnet synchronous generator.
- 7.- Study of voltage control generation.
- 8.- Study of electrical generator with no load.
- 9.- Study of drop voltage with resistive load.
- 10.- Study of drop voltage with inductive load.
- 11.- Study of drop voltage with capacitive load.
- 12.- Study of power factor.
- 13.- Study of electrical generator with different power factors.
- 14.- Study of the voltage versus speed of the permanent magnet synchronous generator.

For more information see **AEL-EGMG24** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-EGMG24/catalog



AEL-EGMG24

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-DCEMT. D.C. Electrical Motors Applications.

The D.C. Electrical Motors Applications, "AEL-DCEMT", consists of base equipment which is formed by a serial of modules. This base equipment is complemented by different motors and their specific modules. Edibon offers several options to study these motors and users can choose one or more different motors. In this way, the user can compare the motors and his training will be more complete.

There are different types of electrical connections for DC electric motors: series, shunt, compound and self-excited. Each of them has unique speed/torque characteristics appropriate for different loading torque profiles. This application allows the students to acquire depth knowledge about different methods to obtain characteristic curves such as with and without load characteristic, external characteristic, regulation characteristic and torque-speed curves.

For this purpose, the application includes a servomotor and a series of measurement devices, such as analog ammeter, analog voltmeter and multimeter. All these elements included are indispensable to study the DC Motor characteristics.

Optionally, this application can be provided with the EM-SCADA, a revolutionary Data Acquisition Software developed by Edibon that allows monitoring all voltages, currents and torque waveforms in order to study in depth the machine. Through the EM-SCADA the user can carry out a DC Motor electrodynamic study with braking tests and to obtain the results after analysis.

The AEL-DCEMT includes the following modules:

- N-ALI02. Domestic Power Supply.
- N-WVCC. DC Motor Speed Controller Module.
- N-MED17. DC Voltmeter Module.
- N-MED05. DC Ammeter (1-1,5A) Module.
- N-MED65. Digital Multimeter.
- N-SERV1K. 1 kW Servomotor Module.
- N-REV. Variable Resistor.

Optional DC motors to be acquired:

Option 1: Study of DC Machine with independent excitation.

- EMT1. DC Independent excitation motor-Generator.

Option 2: Study of DC Machine with Series excitation:

- EMT2. DC Series Excitation Motor-Generator.

Option 3: Study of DC Machine with shunt excitation.

- EMT3. DC Shunt Excitation Motor-Generator.

Option 4: Study of DC Machine with Compound excitation.

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

Option 5: Study of all types of DC Machines.

- EMT5. DC Independent-Shunt-series-compound excitation motor.
- N-REV. Variable Resistor.

Option 6: Study of brushless motor.

- EMT18. Brushless Motor.
- N-ALI03. AC Auxiliary Power Supply.

Expansion testing software:

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines, with SCADA.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-DCEMT/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-DCEMT can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-M.
- 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.



AEL-DCEMT + RACK

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-DCEMT. D.C. Electrical Motors Applications.

Some practical possibilities with DC Machine with independent excitation:

- 1.- Wiring and starting of DC independent excitation motor.
- 2.- Utilization of a DC Motor speed controller with torque and speed control.
- 3.- Braking test with the servomotor and DC independent excitation motor.
- 4.- Obtaining of speed VS torque curve of DC Independent excitation motor.
- 5.- Obtaining of current VS torque curve of DC Independent excitation motor.
- 6.- Obtaining of performance curve of the DC Independent excitation motor.

Some practical possibilities with DC Machine with series excitation:

- 7.- Wiring and starting of DC series Excitation motor.
- 8.- Utilization of a DC Motor speed controller with torque and speed control.
- 9.- Braking test with servomotor and DC series Excitation motor.
- 10.- Obtaining of speed VS torque curve of DC series Excitation motor.
- 11.- Obtaining of current VS torque curve of DC series Excitation motor.
- 12.- Obtaining of performance curve of DC series Excitation motor.

Some practical possibilities with DC Machine with shunt excitation:

- 13.- Wiring and starting of DC shunt Excitation motor.
- 14.- Utilization of a DC Motor speed controller with torque and speed control.
- 15.- Braking test with the servomotor and DC shunt Excitation motor.
- 16.- Obtaining of speed VS torque curve of DC shunt Excitation motor.
- 17.- Obtaining of current VS torque curve of DC shunt Excitation motor.
- 18.- Obtaining of performance curve of DC shunt Excitation motor.

Some practical possibilities with DC Machine with compound excitation:

- 19.- Wiring and starting of DC compound Excitation motor.
- 20.- Utilization of a DC Motor speed controller with torque and speed control.
- 21.- Braking test with the servomotor and DC compound Excitation motor.

22.- Obtaining of speed VS torque curve of DC compound Excitation motor.

23.- Obtaining of current VS torque curve of DC compound Excitation motor.

24.- Obtaining of performance curve of DC compound Excitation motor.

Some practical possibilities with Brushless motor:

- 25.- Wiring and starting of brushless motor.
- 26.- Utilization of brushless motor speed controller.
- 27.- Braking test with the servomotor and brushless motor.
- 28.- Obtaining of speed VS torque curve of brushless motor.
- 29.- Obtaining of current VS torque curve of brushless motor.
- 30.- Obtaining of performance curve of brushless motor.

Additional practical exercises with optional EM-SCADA:

- 31.- Real time torque measurement waveform.
- 32.- Real time speed measurement waveform.
- 33.- Real time current and voltage measurement waveforms.
- 34.- Electrodynamics study of Shunt DC Motors.
- 35.- Obtaining characteristic curves.
- 36.- Obtaining the results stored.
- 37.- Braking test and real time monitoring results.

For more information see **AEL-DCEMT** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-DCEMT/catalog



AEL-DCEMT + RACK

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-DCSHT. DC Shunt Excitation Motor Application.

The Shunt Excitation Motor Application "AEL-DCSHT" has been designed by EDIBON to study the electrical characteristics and mechanical parameters of Shunt Wound DC Motors. This application allows the students to acquire a basic knowledge about different methods to obtain characteristic curves of the DC motors. For this purpose, the application includes a series of measurement devices, such as mechanical torque measurement unit, analog ammeter, analog voltmeter, multimeter and manual speed meter. All these elements included are indispensable to study the DC Motor characteristics.

Additionally it is recommended the EM-SCADA, a revolutionary Data Acquisition Software developed by Edibon that allows monitoring all voltages, currents and torque waveforms in order to study in depth the machine. Through the EM-SCADA the user can carry out a DC Motor electrodynamic study with braking tests and to obtain the results after analysis.

The AEL-DCSHT includes the following modules:

- N-ALI02. Domestic Power Supply.
- FRECP/LC. Eddy Current Brake with Load Cell.
- EMT3. DC Shunt excitation motor-generator.
- N-WCC/M. DC Motor Speed Controller (Intermediate option).
- N-WCC. Advanced DC Motor Speed Controller.
- N-MED65. Digital Multimeter.
- TECNEL/TM. Optical Speed Meter.
- N-REV. Variable Resistor.
- N-TM. Torque Measurement Unit.
- N-MED05. DC Amperimeter (0-1,5 A).
- N-MED17. DC Voltmeter (0-200 V).

Expansion testing software:

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines, with SCADA.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-DCSHT/ICAL) 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-DCSHT can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs 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.

Some practical exercises possibilities:

- 1.- Checking the domestic power supply.
- 2.- Wiring and starting of Shunt Wound DC Motor.
- 3.- Use of measurement instrumentation.
- 4.- Braking test with Eddy Current Brake and Shunt Wound DC Motor.
- 5.- Obtaining of performance curve of the Shunt Wound DC Motor.
- With EM-SCADA. Control and Data Acquisition System of Electrical Motors:
 - 6.- Torque/Speed measurement waveforms.
 - 7.- Real Time Measuring and Monitoring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc.
 - 8.- Electrodynamic study of electrical machines.
 - 9.- Obtained results storage.
 - 10.- Braking tests and monitoring of results in real time.

For more information see **AEL-DCSHT** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-DCSHT/catalog



AEL-DCSHT + RACK

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-DCSEA. Application of DC Series Excitation Motor.

The Application of DC Series Excitation Motor, "AEL-DCSEA", is designed for the study of the main operations performed in the industrial field with DC Series Excitation Motors.

The student will learn the most important operations of these electrical machines faithfully by using commutators, timers and contactors.

The AEL-DCSEA includes the following modules:

- N-ALI02. Domestic Power Supply.
- N-PUL48. 3 Double Chamber Push-Buttons.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-pole Contactor (24 VAC). (3 units).
- N-ALI03. AC Auxiliary Power Supply.
- FLYW. Flywheel.
- N-WCC/M. DC Motor Speed Controller (Intermediate option).
- N-REV. Variable Resistor.
- EMT2. DC Series excitation motor-generator.

Additional and recommended measurement instrumentation modules:

- N-MED17. DC Voltmeter (0-200 V).
- N-MED16. DC Voltmeter (0-50 V).
- N-MED05. DC Ammeter (0-1.5 A).

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-DCSEA/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-DCSEA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs 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.

Some practical exercises possibilities:

- 1.- DC motor speed control.
- 2.- DC machine turning direction control.
- 3.- DC machine speed reading.

For more information see **AEL-DCSEA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-DCSEA/catalog



AEL-DCSEA + RACK

Applications:

AEL-3.2
Motors Applications

 DC Electrical Motors Applications

AEL-DCSHA. Application of DC Shunt Excitation Motor.

The Application of DC Shunt Excitation Motor, "AEL-DCSHA", is designed for the study of the main operations performed in the industrial field with DC shunt excitation motors.

The student will learn the most important operations of these electrical machines faithfully by using commutators, timers and contactors.

The AEL-DCSHA includes the following modules:

- N-ALI02. Domestic Power Supply.
- N-PUL48. 3 Double Chamber Push-Buttons Module.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-poles Contactor (24 VAC). (3 units).
- N-ALI03. AC Auxiliary Power Supply.
- FLYW. Flywheel.
- N-WVCC/M. DC Motor Speed Controller (Intermediate option).
- N-REV. Variable Resistor.
- EMT3. DC Shunt excitation motor-generator.

Additional and recommended measurement instrumentation modules:

- N-MED17. DC Voltmeter (0-200 V).
- N-MED05. DC Ammeter (0-1.5 A).

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-DCSHA/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-DCSHA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs 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.

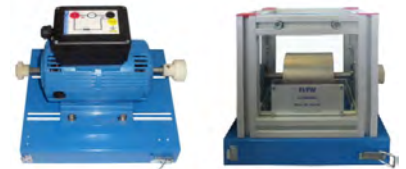
Some practical exercises possibilities:

- 1.- DC motor speed control.
- 2.- DC machine turning direction control.
- 3.- DC machine speed reading.
- 4.- Excitation current control.

For more information see **AEL-DCSHA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-DCSHA/catalog



AEL-DCSHA + RACK

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-DCCOA. Application of DC Compound Excitation Motor.

The Application of DC Compound Excitation Motor "AEL-DCCOA" is designed for the study of the main operations performed in the industrial field with DC compound excitation motors.

The student will understand the most important operations of these electrical machines faithfully by using commutators and speed controllers.

The AEL-DCCOA includes the following modules:

- N-ALI02. Main Power Supply.
- N-PUL48. 3 Double Chamber Push-Buttons.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-poles Contactor (24 VAC). (3 units)
- N-ALI03. AC Auxiliary Power Supply.
- FLYW. Flywheel.
- N-WVCC/M. DC Motor Speed Controller (Intermediate option).
- N-REV. Variable Resistor. (2 units)
- EMT4. DC Compound excitation motor-generator.

Additional and recommended measurement instrumentation modules:

- Digital Instrumentation:
 - N-EAL-DC. DC Network Analyzer Unit.
- Analog Instrumentation:
 - N-MED17. DC Voltmeter (0-200 V).
 - N-MED05. DC Ammeter (0-1.5 A).

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-DCCOA/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-DCCOA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs 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.

Some practical exercises possibilities:

- 1.- DC motor speed control.
- 2.- DC machine turning direction control.
- 3.- DC machine speed reading.
- 4.- Armature current control.
- 5.- Field current control.

For more information see **AEL-DCCOA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-DCCOA/catalog



AEL-DCCOA + RACK

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-DCSPA. Application of DC Separately Excited Motor.

The Application of DC Separately Excited Motor “AEL-DCSPA” is designed for the study of the main operations performed in the industrial field with DC separately excited motors.

The student will learn the most important operations of these electrical machines faithfully by using commutators, timers and contactors.

The AEL-DCSPA includes the following modules:

- N-ALI02. Domestic Power Supply.
- N-PUL48. 3 Double Chamber Push-Buttons.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-poles Contactor (24 VAC). (3 units)
- N-ALI03. AC Auxiliary Power Supply.
- FLYW. Flywheel.
- N-WVCC/M. DC Motor Speed Controller (Intermediate option). (2 units)
- N-REV. Variable Resistor.
- EMT1. DC Independent excitation motor-generator.

Additional and recommended measurement instrumentation modules:

- N-MED17. DC Voltmeter (0-200 V). (2 units)
- N-MED05. DC Ammeter (0-1.5 A). (2 units)

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-DCSPA/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-DCSPA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs 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.

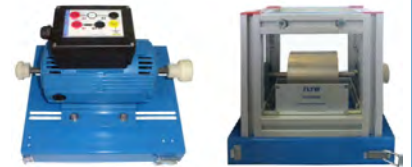
Some practical exercises possibilities:

- 1.- DC motor speed control.
- 2.- DC machine turning direction control.
- 3.- DC machine speed reading.
- 4.- Armature current control.
- 5.- Field current control.

For more information see **AEL-DCSPA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-DCSPA/catalog



AEL-DCSPA + RACK

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-DCGEA. Application of DC Generator.

The Application of DC Generator “AEL-DCGEA” is designed for the study of the main operations performed in the industrial field with DC Generators.

The student will learn the most important operations of these electrical machines faithfully by using loads and voltage controllers.

The AEL-DCGEA includes the following modules:

- N-ALI02. Domestic Power Supply.
- N-WCC/M. DC Motor Speed Controller (Intermediate option).
- N-REV. Variable Resistor.
- N-REF. Resistor Load with commutator.
- EMT1. DC Independent excitation motor-generator.
- N-WCA/M. AC Motor Speed Controller (Intermediate option).
- EMT7. Asynchronous three-phase motor of squirrel cage.

Additional and recommended measurement instrumentation modules:

- N-MED17. DC Voltmeter (0-200 V). (2 units)
- N-MED05. DC Ammeter (0-1.5 A). (2 units)

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-DCGEA/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-DCGEA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following rack:

- N-RACK-M.

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.

Some practical exercises possibilities:

- 1.- Control of generated voltage.
- 2.- Control of the excitation of the DC generator.
- 3.- Driving motor speed variation.
- 4.- Loading of the DC generator.

For more information see **AEL-DCGEA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-DCGEA/catalog



AEL-DCGEA + RACK

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-DCPMA. Application of DC Permanent Magnet Motor.

The Application of DC Permanent Magnet Motors "AEL-DCPMA" is designed for the study of the main operations performed in the industrial field with DC Permanent Magnet Motors.

The student will learn the most important operations of these electrical machines faithfully by using commutators, timers and contactors.

The AEL-DCPMA includes the following modules:

- N-ALI02. Domestic Power Supply.
- N-PUL48. 3 Double Chamber Push-Buttons.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-pole Contactor (24 VAC). (3 units)
- N-ALI03. AC Auxiliary Power Supply.
- N-WCC/M. DC Motor Speed Controller (Intermediate option).
- EMT15. DC Permanent magnet motor.

Additional and recommended measurement instrumentation modules:

- N-MED17. DC Voltmeter (0-200 V).
- N-MED05. DC Ammeter (0-1.5 A).

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-DCPMA/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-DCPMA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following rack:

- N-RACK-M.

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.

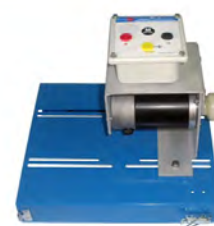
Some practical exercises possibilities:

- 1.- Speed control of the DC permanent magnet motor.
- 2.- Turning direction control of the DC permanent magnet motor.
- 3.- Speed reading of the DC permanent magnet motor.
- 4.- Current control of the DC permanent magnet motor.
- 5.- Turning inversion of the DC permanent magnet motor.
- 6.- Starting of the DC permanent magnet motor.

For more information see **AEL-DCPMA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-DCPMA/catalog



AEL-DCPMA + RACK

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-DCBRA. Application of DC Brushless Motor.

The Applications of DC Brushless Motor "AEL-DCBRA" has been designed by Edibon for the study of the main operations performed in the industrial field with this type of electrical machines.

The student will simulate the operation of these electrical machines faithfully by using the own control system of this type of motors. These operations are, for example, start and stop of the DC brushless motor, run investment and speed control.

The AEL-DCBRA includes the following modules:

- N-ALI02. Main Power Supply.
- N-ALI03. AC Auxiliary Power Supply.
- N-MED65. Digital Multimeter.
- EMT18. DC Brushless motor.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-DCBRA/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-DCBRA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following rack:

- 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.

Some practical exercises possibilities:

- 1.- Wiring of the DC Brushless Motor.
- 2.- Starting of the DC Brushless Motor.
- 3.- Change rotation direction of the DC Brushless Motor.
- 4.- Speed control of the DC Brushless Motor.

For more information see **AEL-DCBRA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-DCBRA/catalog



AEL-DCBRA + RACK

Applications:

AEL-3.2
Motors Applications

—DC Electrical Motors Applications—

AEL-DCEMA. D.C. Electrical Motors Applications.

The D.C. Electrical Motors Applications "AEL-DCEMA", 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 AEL-DCEMA includes 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).

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-DECEMA/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.



AEL-DCEMA

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-DCEMA. D.C. Electrical Motors Applications. (Continuation).

Some practical exercises 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.

For more information see **AEL-DCEMA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-DCEMA/catalog



AEL-DCEMA

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-UMA. Application of Universal Motor.

The Application of Universal Motor "AEL-UMA" is designed for the study of the main operations performed in the industrial field with universal motors.

The student will learn the most important operations of these electrical machines faithfully by using commutators, timers and contactors.

The AEL-UMA includes the following modules:

- N-ALI02. Domestic Power Supply.
- N-PUL48. 3 Double Chamber Push-Buttons.
- N-LAM02. Auxiliary Lamps.
- N-CON01. 3-pole Contactor (24 VAC). (3 units)
- N-ALI03. AC Auxiliary Power Supply.
- FLYW. Flywheel.
- N-WCC/M. DC Motor Speed Controller (Intermediate option).
- N-REV. Variable Resistor. (2 units)
- EMT12. Universal Motor.

Additional and recommended measurement instrumentation modules:

- N-MED21. AC Voltmeter (0-250 V).
- N-MED09. AC Ammeter (0-2.5 A).
- N-MED17. DC Voltmeter (0-200 V).
- N-MED05. DC Ammeter (0-1.5 A).

If the Option A (modules mounted on rack) is chosen, the rack/s required will depend on the optional modules requested by the customer.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-UMA/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-UMA can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs 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.

Some practical exercises possibilities:

- 1.- Universal motor speed control.
- 2.- Universal motor turning direction control.
- 3.- Universal motor speed reading.
- 4.- Universal motor current control.
- 5.- Universal motor operation in AC and DC mode.

For more information see **AEL-UMA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-UMA/catalog



AEL-UMA + RACK

Applications:

AEL-3.2
Motors Applications

—————DC Electrical Motors Applications—————

AEL-STMA. Application of Stepper Motor.

The Application of Stepper Motor "AEL-STMA" has been designed by Edibon for the study of the main operations performed in the industrial field with this type of electrical machines.

The student will learn the operations performed to control the sequence of actions of this type of machines by using several stepper motor controllers (basic and advanced).

Basic stepper motor controller (optional) allows manual poles commutation of the stepper motor to get the rotation of the machine.

Advanced stepper motor controller has installed a PLC that can be programmed by the user. On this way, the PLC can be programmed from scratch to develop the commutation sequence to control the stepper motor, the run investment and the speed.

The AEL-STMA includes the following modules:

- N-ALIO2. Domestic Main Power Supply.
- N-ALIO3. AC Auxiliary Power Supply.
- EMT19. Stepper Motor.

Additional and recommended modules (at least one these modules must be acquired):

- N-VVPP/B. Stepper Motor Controller (manual control).
- N-VVPP. Stepper Motor Controller (manual control and automatic control).

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-STMA/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-STMA 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.

Some practical exercises possibilities:

- 1.- Wiring and put into operation of a Stepper motor.
- 2.- Manual control of the step sequence of the Stepper motor (with the N-VVPP/B).
- 3.- Manual control of the Stepper motor shaft position (with the N-VVPP/B).
- 4.- Manual control of the turning speed of the Stepper motor (with the N-VVPP/B).
- 5.- PLC sequence commutation programming of the stepper motor poles (with the N-VVPP).
- 6.- Automatic control of the turning speed of the Stepper motor (with the N-VVPP).
- 7.- PLC programming of the switching sequence of the Stepper motor (with the N-VVPP).
- 8.- PLC programming of the switching speed of the Stepper motor (with the N-VVPP).
- 9.- PLC automation of the Stepper motor motion (with the N-VVPP).

For more information see **AEL-STMA** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-STMA/catalog



AEL-STMA + RACK

Applications:

AEL-3.2
Motors Applications

—————Electrical Motors Faults Applications—————

AEL-ESAM. Fault Simulation Application in Electrical Motors.

The Faults Simulation Application in Electrical Motors, "AEL-ESAM", has been designed by EDIBON to simulate non-destructive faults in three-phase motors and application of diagnostic and localization techniques.

This application allows simulating different breakdowns that can usually take place in electric motors, such as: Phase loss detection, power supply loss detection, short-circuited turn-coil detection, open coil detection, short-circuit between different phase coils detection and ground derivation detection.

All this simulations are carried out by the AEL-ESAM application, which has a circuit control that realizes the failures randomly.

The AEL-ESAM includes the following modules:

- N-ALI01. Industrial Main Power Supply.
- N-FMAC. Fault Injection Module for Three-Phase Induction Motors.
- N-MED65. Digital Multimeter.
- EMT9. Dahlander Three-Phase Motor.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-ESAM/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-ESAM can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following rack:

- N-RACK-M.

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.

Some practical exercises possibilities:

- 1.- Detection of fault on a phase.
- 2.- Detection of fault on the supply voltage.
- 3.- Phase lost detection.
- 4.- Coils with turns in short circuit.
- 5.- Measurement the resistance of the windings.
- 6.- Detection of open-ended coil.
- 7.- Detection of short circuit in coils from different phase.
- 8.- Measurement the resistance between coils from different phases.
- 9.- Detection of ground fault.
- 10.- Measurement of the insulation resistance between the winding and the motor case.
- 11.- Motor in star connection.
- 12.- Motor in delta connection.

For more information see **AEL-ESAM** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-ESAM/catalog



AEL-ESAM + RACK

Applications:

AEL-3.2
Motors Applications

—————Electrical Motors Faults Applications—————

AEL-ESAT. Faults Simulation Application in Transformers.

The Fault Simulation Application in Transformers "AEL-ESAT" has been designed by Edibon to simulate non-destructive faults in three-phase transformers and application of diagnostic and localization techniques.

This application allows simulating different breakdowns that can usually take place in in three-phase transformers, such as: Phase loss detection, power supply loss detection, short-circuited turn-coil detection, open coil detection, short-circuit between different phase coils detection and ground derivation detection.

All this simulations are carried out by the AEL-ESAT application, which has a circuit control that realizes the failures randomly.

The AEL-ESAT includes the following modules:

- N-ALI01. Industrial Main Power Supply.
- N-FTAC. Fault Injection module for three-phase transformers.
- N-MED65. Digital Multimeter.
- Three-Phase transformer for faults simulation.

Expansion learning software:

In addition, Edibon provides expansion learning software (AEL-ESAT/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-ESAT can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following rack.

- N-RACK-M.

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.

Some practical exercises possibilities:

- 1.- Detection of fault on a phase.
- 2.- Detection of fault on the supply voltage.
- 3.- Coils with turns in short circuit.
- 4.- Measurement the resistance of the windings.
- 5.- Detection of open-ended coil.
- 6.- Detection of short circuit in coils from different phase.
- 7.- Measurement the resistance between coils from different phases.
- 8.- Detection of ground fault.
- 9.- Measurement of the insulation resistance.

For more information see **AEL-ESAT** catalogue.

Click on the following link:

www.edibon.com/en/files/equipment/AEL-ESAT/catalog



AEL-ESAT + RACK

ALL Advanced Electrical Laboratories (AEL-LABS)

AEL-1. ELECTRICAL INSTALLATIONS LAB		
AEL-1.1. Home Electrical Installations	AEL-1.2. Industrial Electrical Installations	AEL-1.3. Professional Wiring Practices in Installations
<p style="text-align: center; margin-bottom: 5px;"><u>Applications</u></p> <p style="text-align: center; margin-bottom: 5px;">Lighting and Control</p> <ul style="list-style-type: none"> • AEL-AD13. Audio Door Entry System. • AEL-AD14. Audio and Video Door Entry System. • AEL-AD6A. Luminosity Control Station. • AEL-AD6B. Basic Luminosity Control Station. • AEL-AD24. Position Switch. • AEL-AD5. Stair Lights Timing. • AEL-AI13-E. Modular Application for Electrotechnics (Lighting). <p style="text-align: center; margin-bottom: 5px;">Climatization</p> <ul style="list-style-type: none"> • AEL-AD9A. Heating Control Station. • AEL-AD9B. Basic Heating Control Station. 	<p style="text-align: center; margin-bottom: 5px;"><u>Applications</u></p> <p style="text-align: center; margin-bottom: 5px;">Industrial Control Engineering</p> <ul style="list-style-type: none"> • AEL-CM1. Manual Control Operations. • AEL-CM2. Operations with Manual Commutators. • AEL-CM3. Automatic Control Operations. • AEL-CM4. Automatic Control Operations with contactors and sensors. <p style="text-align: center; margin-bottom: 5px;">Fault Simulators</p> <ul style="list-style-type: none"> • AEL-AD33. Single-Phase Installations Faults Simulator. • AEL-AD33T. Three-Phase Installations Faults Simulator. <p style="text-align: center; margin-bottom: 5px;">Relays Application</p> <ul style="list-style-type: none"> • AEL-AE4. Test Unit for Differential Automatic Switches. • AEL-AE5. Relay Control Station. • AEL-PRTS. Protective Relaying Training System. <p style="text-align: center; margin-bottom: 5px;">Loads</p> <ul style="list-style-type: none"> • AEL-AI13-A. Modular Application for Electrotechnics (RLC Circuits). • AEL-MED. Industrial Measurement Technology. 	<p style="text-align: center; margin-bottom: 5px;"><u>Applications</u></p> <p style="text-align: center; margin-bottom: 5px;">Cubicle Wiring Installations</p> <ul style="list-style-type: none"> • AEL-AEBI. Assembly Exercises in Building Installations. • AEL-AEBM. Assembly Exercises on Building Mains Feeds and Meter Cabinets. • AEL-AESI. Assembly Exercises for Signals Electrical Installations. • AEL-AESU. Assembly Exercises on Switching Units.
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> See catalogue of: AEL-1. Electrical Installations Lab www.edibon.com/en/files/equipment/AEL-1/catalog </div>		

AEL-2. HOME AUTOMATION SYSTEMS LAB	
AEL-2.1. Wired Systems	AEL-2.2. Wireless Systems
<p style="text-align: center; margin-bottom: 5px;"><u>Applications</u></p> <p style="text-align: center; margin-bottom: 5px;">General Wired Home Automation Systems</p> <ul style="list-style-type: none"> • AEL-AD1A. Robbery Alarm Station. • AEL-AD1B. Basic Robbery Alarm Station. • AEL-AD3A. Fire Alarm Station. • AEL-AD3B. Basic Fire Alarm Station. • AEL-AD15A. Position Control Station. • AEL-AD15B. Basic Position Control Station. • AEL-AD25A. Control Station for Home Electric Service through the telephone. • AEL-AD22. Flooding Control Station. • AEL-AD30. Gas Control Station. • AEL-AD31. Movement and Sound Detection and Control. • AEL-AD40. Remote Control Station Via Telephone. <p style="text-align: center; margin-bottom: 5px;">KNX/EIB Systems</p> <ul style="list-style-type: none"> • AEL-KNX1. KNX/EIB Lighting and Shutter Control System. • AEL-KNX2. KNX/EIB Heating Control System. • AEL-KNX3. KNX/EIB Robbery Alarm System. • AEL-KNX4. KNX/EIB Fire Alarm System. • AEL-BCS. BacNet Systems. 	<p style="text-align: center; margin-bottom: 5px;"><u>Applications</u></p> <p style="text-align: center; margin-bottom: 5px;">General Wired Home Automation Systems</p> <ul style="list-style-type: none"> • AEL-AD28A. Integral Control Station of Home Electric Systems. • AEL-AD28B. Basic Control Station of Home Electric Systems. • AEL-AD28C. Elementary Control Station of Home Electric Systems. • AEL-AD23. Wireless Basic Control Station (RF).
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> See catalogue of: AEL-2. Home Automation Systems Lab www.edibon.com/en/files/equipment/AEL-2/catalog </div>	

AEL-3. ELECTRICAL MACHINES LAB

AEL-3.1.

Transformers Applications

Applications

- AEL-SPTT. Single-Phase Transformer Application.
- AEL-TPTT. Three-Phase Transformer Application.
- AEL-AI13-D. Modular Application for Electrotecnics (Transformers).

AEL-3.2.

Motors Applications

Applications

AC Electrical Motors Applications

- AEL-EEEM. Energy Efficiency in Electrical Motors Application.
- AEL-EMSS. Electrical Machines Soft Starters Application.
- AEL-EMCF. Application Electrical Machines Control through Frequency Controller.
- AEL-AI13. Modular Application for Electrotecnics (RLC Circuits, Electrostatics, Motors, Transformers, Lighting).
- AEL-AI13-C. Modular Application for Electrotecnics (Motors).
- AEL-EMRP. Electrical Machines Relays Protection Application.
- AEL-SERIN/CA-1k. Computer Controlled Advanced Industrial Servo systems Application- 1 kW (for AC Motors).
- AEL-MMRT. Motor Management Relays Application.
- AEL-PRTS. Industrial Protective Relaying Training Application.
- AEL-ACEMT. AC Electrical Motors Application.
 - Option 1 (EMT7): Study of Three-Phase Asynchronous Motor of Squirrel cage.
 - Option 2 (EMT8): Study of Three-Phase Asynchronous Motor of wound rotor.
 - Option 3 (EMT9): Study of Three-Phase Dahlander Motor.
 - Option 4 (EMT10): Study of Asynchronous three-phase motor of two independent speeds.
 - Option 5 (EMT11): Study of Asynchronous single-phase motor with starting capacitor.
 - Option 6 (EMT12): Study of Universal Motor.
 - Option 7 (EMT16): Study of Asynchronous single-phase motor with starting and running capacitor.
 - Option 8 (EMT20): Study of Asynchronous single-phase motor with split phase.
 - Option 9 (EMT21): Study of Three-Phase Reluctance Motor.
- AEL-ACINA. Application of AC Three-Phase Induction Motor of Squirrel Cage.
- AEL-ACDHA. Application of AC Dahlander Three-Phase Induction Motor.
- AEL-ACWRA. Application of AC Three-Phase Induction Motor of Wound Rotor.
- AEL-ACLA. Application of AC Linear Motor Operations.
- AEL-ACRLA. Application of AC Three-Phase Reluctance Motor.
- AEL-ACSPA. Application of Asynchronous Single-Phase Motor with Split Phase.
- AEL-AI12. Modular Application (AC Motors).
- AEL-IMSU. General Application of AC Induction Motor.
- AEL-ACEMA. AC Electrical Motors Applications.
 - Option 1 (EMT7): Study of Three-Phase Asynchronous Motor of Squirrel cage.
 - Option 2 (EMT8): Study of Three-Phase Asynchronous Motor of wound rotor.
 - Option 3 (EMT9): Study of Three-Phase Dahlander Motor.
 - Option 4 (EMT10): Study of Asynchronous three-phase motor of two independent speeds.
 - Option 5 (EMT11): Study of Asynchronous single-phase motor with starting capacitor.
 - Option 6 (EMT12): Study of Universal Motor.
 - Option 7 (EMT16): Study of Asynchronous single-phase motor with starting and running capacitor.
 - Option 8 (EMT20): Study of Asynchronous single-phase motor with split phase.
 - Option 9 (EMT21): Study of Three-Phase Reluctance Motor.
- AEL-EEA. Alternator Study Application.
- AEL-EGMG24. Motor-Generator Group.

DC Electrical Motors Applications

- AEL-DCEMT. DC Electrical Motors Applications.
 - Option 1 (EMT1): Study of DC Machine with independent excitation.
 - Option 2 (EMT2): Study of DC Machine with Series excitation.
 - Option 3 (EMT3): Study of DC Machine with shunt excitation.
 - Option 4 (EMT4): Study of DC Machine with Compound excitation.
 - Option 5 (EMT5): Study of all types of DC Machines.
- AEL-DCSHT. DC Shunt Excitation Motor Application.
- AEL-DCSEA. Application of DC Series Motor.
- AEL-DCSHA. Application of DC Shunt Motor.
- AEL-DCCOA. Application of DC Compound Motor.
- AEL-DCSPA. Application of DC Separately Excited Motor.
- AEL-DCGEA. Application of DC Generator.
- AEL-DCPMA. Application of DC Permanent Magnet Motor.
- AEL-DCBRA. Application of DC Brushless Motor.
- AEL-DCEMA. DC Electrical Motors Applications.
 - Option 1 (EMT1): Study of DC Machine with independent excitation.
 - Option 2 (EMT2): Study of DC Machine with Series excitation.
 - Option 3 (EMT3): Study of DC Machine with shunt excitation.
 - Option 4 (EMT4): Study of DC Machine with Compound excitation.
 - Option 5 (EMT5): Study of all types of DC Machines.
 - Option 6 (EMT15): Study of Permanent Magnet DC Motor.
 - Option 7: (EMT1): Study of DC Generator.
- AEL-UMA. Application of Universal Motor.
- AEL-STMA. Application of Stepper Motor.

Electrical Motors Faults Applications

- AEL-ESAM. Faults Simulation Application in Electrical Motors.
- AEL-ESAT. Faults Simulation Application in Transformers.

AEL-4. ELECTROMECHANICAL CONSTRUCTIONS LAB

<p style="text-align: center;">AEL-4.1. Electrical Machines Construction</p>	<p style="text-align: center;">AEL-4.2. Electrical Motors Construction</p>
<p style="text-align: center;"><u>Applications</u></p> <p style="text-align: center;">Dissectible and Configurable Electrical Motors Application</p> <ul style="list-style-type: none"> • AEL-EMT-KIT. Advanced Dissectible and Configurable Electrical Machines. <p style="text-align: center;">Wiring & Construction of Motors, Generators and Transformers</p> <ul style="list-style-type: none"> • AEL-MGTC. Motors, Generators and Transformers Construction Application. • AEL-TPTC. Three-Phase Transformer Construction Kit. <p style="text-align: center;">Disassembly Motors</p> <ul style="list-style-type: none"> • AEL-DMG-KIT. Disassembly Motors-Generators Kit. • AEL-DIM-KIT. 4 Disassembly Induction Motors Kit. 	<p style="text-align: center;"><u>Applications</u></p> <p style="text-align: center;">Cut Away Electrical Motors</p> <ul style="list-style-type: none"> • EMT1-S. Cut away DC independent excitation motor-generator. • EMT2-S. Cut away DC series excitation motor-generator. • EMT3-S. Cut away DC shunt excitation motor-generator. • EMT4-S. Cut away DC compound excitation motor-generator. • EMT5-S. Cut away DC shunt-series compound excitation motor. • EMT6-S. Cut away AC synchronous three-phase motor alternator. • EMT7-S. Cut away asynchronous three-phase motor of squirrel cage. • EMT8-S. Cut away asynchronous three-phase motor with wound rotor. • EMT9-S. Cut away Dahlander three-phase motor. • EMT10-S. Cut away asynchronous three-phase motor of two independent speeds. • EMT11-S. Cut away asynchronous single-phase motor with starting capacitor. • EMT12-S. Cut away universal motor. • EMT14-S. Cut away repulsion motor, single-phase with short circuited brushes. • EMT15-S. Cut away DC permanent magnet motor. • EMT16-S. Cut away asynchronous single-phase motor with starting and running capacitor. • EMT17-S. Cut away asynchronous three-phase motor of squirrel cage with "Y" connection. • EMT18-S. Cut away DC Brushless motor. • EMT19-S. Cut away stepper motor. • EMT20-S. Cut away asynchronous single-phase motor with split phase. • EMT21-S. Cut away three-phase reluctance motor. • EMT22-S. Cut away single-phase shaded pole motor. <p style="text-align: center;">Transparent and Functional Electrical Motors</p> <ul style="list-style-type: none"> • AEL-FTM. Transparent and Functional Motors Application • AEL-EMT1-T. Transparent and functional DC independent excitation motor-generator. • AEL-EMT2-T. Transparent and functional DC series excitation motor-generator. • AEL-EMT3-T. Transparent and functional DC shunt excitation motor-generator. • AEL-EMT4-T. Transparent and functional DC compound excitation motor-generator. • AEL-EMT5-T. Transparent and functional DC shunt-series compound excitation motor-generator. • AEL-EMT6-T. Transparent and functional AC synchronous three-phase motor alternator. • AEL-EMT7-T. Transparent and functional asynchronous three-phase motor of squirrel cage. • AEL-EMT8-T. Transparent and functional asynchronous three-phase motor with wound rotor. • AEL-EMT9-T. Transparent and functional Dahlander three-phase motor. • AEL-EMT10-T. Transparent and functional asynchronous three-phase motor of two independent speeds. • AEL-EMT11-T. Transparent and functional asynchronous single-phase motor with starting capacitor. • AEL-EMT12-T. Transparent and functional universal motor. • AEL-EMT14-T. Transparent and functional repulsion motor, single-phase with short circuited brushes. • AEL-EMT16-T. Transparent and functional asynchronous single-phase motor with starting and running capacitor. • AEL-EMT17-T. Transparent and functional asynchronous three-phase motor of squirrel cage with "Y" connection. • AEL-EMT20-T. Transparent and functional asynchronous single-phase motor with split phase. • AEL-EMT21-T. Transparent and functional three-phase reluctance motor. • AEL-EMT22-T. Transparent and functional single-phase shaded pole motor.
<p>See catalogue of: AEL-4. Electromechanical Constructions Lab www.edibon.com/en/files/equipment/AEL-4/catalog</p>	

AEL-5. POWER SYSTEMS AND SMART GRID TECHNOLOGY LAB

**AEL-5.1.
Generation Applications**

Applications

Basic Synchronization Applications

- AEL-MOSC. Manual Operations of Synchronization Circuits.

Advanced Synchronization Applications

- AEL-EESD. Advanced Digital Synchronization Application.

Wind Energy

- AEL-WPP. Wind Power Plants with Double Feed Induction Generator.
- AEL-WPT. Wind Power Application with Permanent Magnets Synchronous Generator.
- AEL-WPPI. Wind Power Plants with Induction Generator.

Photovoltaic Energy

- AEL-PHVG. Photovoltaic Application with Connection to Grid.

Fuel Cell Energy

- AEL-FCLL. Fuel Cell Energy Application.

Power Plants

- AEL-EPP. Energy Power Plants Application.
- AEL-HPPP. Hydroelectric Power Plants Application with Pelton Turbine.
- AEL-MEPD. Marine Electrical Power Distribution System.
- TDEGC. Computer Controlled Diesel Engine Electricity Generator.

Basic Smart Grid Power Systems

- AEL-BSG. Basic Smart Grid Application.
- AEL-BSGC. Basic Smart Grid Application, with SCADA.

Microgrid Series

- AEL-MGR. Micro-Grids Power System Series.

**AEL-5.2.
Distribution and Transmission Applications**

Applications

Distribution and Transmission Applications

- AEL-AE1A. Aerial Line Model.
- AEL-TI-01. Analysis of Three-phase Power Lines.
- AEL-TI-02. Distribution Transformer with Motor Regulation.
- AEL-TI-03. Arc suppression Coil.
- AEL-TI-04. Underground Transmission lines.
- AEL-TI-05. Parallel and Series Transmission Lines.
- AEL-TI-06. Analysis of flow power on Transmission Lines.
- AEL-TI-07. Transmission Systems with Synchronous Generator.
- AEL-SST-01. Basic Operations in Switching Transmission Substation Application.
- AEL-SST-02. Switching Substation Protection Application.
- AEL-HVDC. High Voltage DC Transmission Lines.

**AEL-5.3.
Loads Applications**

Applications

Basic Load Controller Applications

- AEL-MRPC. Manual Reactive Power Compensation.
- AEL-ARPC. Automatic Reactive Power Compensation.
- AEL-EECFP. Advanced Power Factor Compensation.
- AEL-APFC. Single-phase Automatic Power Factor Compensation.
- AEL-DLT. Dynamic Loads Application.

Advanced Loads Control

- AEL-FUSG. Final User Smart Grid Application.
- AEL-FUSG-M. Final User Smart Grid-Smart Meter Application.
- AEL-FUSG-E. Final User Smart Grid-Smart Energy Application.
- AEL-FUSG-N. Final User Smart Grid-Net Metering Application.

**AEL-5.4.
Protection Relays Applications**

Applications

Fundamental Concepts

- AEL-CTFP. Current Transformer Fundamentals for Protections Devices.
- AEL-VTFP. Voltage Transformer Fundamentals for Protections Devices.

Protection Applications Relays

- ERP. Protection Relays Test Application.
- ERP-CBM. Cybersecurity Module.

Protection Systems for Generators

- AEL-GPRE. Generator Protection Relay Application.

Protection Systems for Transmission and Distribution Lines

- AEL-TPT-01. Overcurrent Time Protection Relay for Lines.
- AEL-TPT-02. Directional Overcurrent Protection Relay for Transmission Lines.
- AEL-TPT-03. Overvoltage and Undervoltage Protection Relay.
- AEL-TPT-04. Directional Power Protection Relay.
- AEL-TPT-05. Earth-Fault Voltage Protection Relay.
- AEL-TPT-06. Parallel Transmission Lines Protection Relay.
- AEL-TPT-07. High Speed Distance Protection Relay.

**AEL-5.5
Cybersecurity Applications**

Applications

- ERP-CBM. Cybersecurity Module.

**AEL-5.6.
Available "Smart Grid Power Systems"**

Applications

- APS12. Advanced Mechanical, Electrical and Smart Grid Power Systems (Utilities).
- AEL-MPSS-01. Modular Smart Grid Power Systems Simulator, with Automatic Control Generation, Transmission Line, Loads and Protection Relays, with SCADA.
- AEL-MPSS-02. Modular Smart Grid Power Systems Simulator, with Automatic Control Generation, Transmission Line and Loads, with SCADA.
- AEL-MPSS-03. Modular Smart Grid Power Systems Simulator, with Manual Control Generation, Transmission Line, Loads and Protection Relays, with SCADA.
- AEL-MPSS-04. Modular Smart Grid Power Systems Simulator, with Manual Control Generation, Transmission Line and Loads, with SCADA.
- AEL-CPSS-01S. Smart Grid Power Systems Application, with Automatic Control Generation, Transmission Line and Loads.
- AEL-CPSS-02S. Smart Micro-Grids Power Systems Application, with Automatic Control Generation and Loads.
- AEL-CPSS-03S. Smart Grid Power Systems Application with Two Parallel Generators, Two Distribution Lines and Loads, with SCADA.

See catalogue of: **AEL-5. Power Systems and Smart Grid Technology Lab**
www.edibon.com/en/files/equipment/AEL-5/catalog

*Specifications subject to change without previous notice, due to the convenience of improvements of the product.



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