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 ↳ PRODUCTS
 ↳ 40.- ELECTRICITY

INTRODUCTION

Electrical installations and lines require to be protected against overload and faults. These phenomena may cause irreparable damages in the electrical installations, producing significant economic repercussions and risks for persons.

The relay is an electromagnetic or electronic device whose purpose is to monitor the current of an electrical circuit. The current may exceed a determinate level and then the relay operates a circuit breaker that cut off the current line. On this way the line is protected.

There are several types of protection relays according to their applications: over/under-current protection, over/under-frequency protection, over/under-voltage protection, differential protection, reverse power protection, phase sequence protection, overload protection, etc.



ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)



European Union Certificate (total safety)



Certificates ISO 14001 and ECO-Management and Audit Scheme (environmental management)



Certificate and Worlddidac Member

GENERAL DESCRIPTION

The "Protective Relaying Training System", 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 trainer 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 trainer 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 trainer 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 trainer. 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-ALI03. AC Auxiliary Power Supply.
- N-SPI. Power Supply Impedance.

Measurement instrumentation:

- N-TRA32. Three-Phase Current Transformer 5 / 0,5 A.
- N-TRA33. Three-Phase Current Transformer 5 / 2,5-1 A.
- N-TRA34. Three-Phase Voltage Transformer 400 / 230 V.
- N-MED17. DC Voltmeter (0-200 V).
- 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 (350-0-350W, 440VAC, 500mA).
- 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, 100VA.

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-ESAM can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following rack:

- 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.

This includes the following modules:

- Power supplies

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

ON-OFF removable key.

Input Voltage: 400 VAC, 3PH+N

Output Voltage:

0...450 VAC.

0...240 VDC.

Maximum current: 2 A.

Frequency: 50/60 Hz.

Wheel to regulate the voltage.

Three lamps

Measurement commutators:

One commutator to measure the voltage.

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

One commutator to measure the current.

3 positions: I1, I2, I3.

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

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

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

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

Output voltage:

Single-Phase 24VAC/12VAC.

24 VDC.

0-24VDC through potentiometer.

• N-SPI. **Supply Power Impedance.**

Resistor value: 14 ohm.

Inductance value: 433 mH.

- Measurement instrumentation:

• N-TRA32. **Three-Phase Current Transformer 5 / 0,5 A.**

Set of six current transformers:

Input current: 5 A.

Output current: 0,5 A.

Nominal Power: 5 VA.

• N-TRA33. **Three-Phase Current Transformer 5 / 2,5-1 A.**

Set of three current transformers:

Input current: 5 A.

Output current: 2,5 A.

Nominal Power: 5 VA.

Set of three current transformers:

Input current: 5 A.

Output current: 1 A.

Nominal Power: 5 VA.

• N-TRA34. **Three-Phase Voltage Transformer 400 / 230 V.**

Set of six voltage transformers:

Input voltage: 400 V.

Output voltage: 230 V.

Nominal Power: 8 VA.

- **N-MED17. DC Voltmeter (0-200 V).**
Measurement range: 0-200 VDC
Terminals:
Measurement terminals
Ground terminals.
- **N-MED79. DC Milliammeter (0 – 300mA).**
Measurement range: 0-300 mA
Terminals:
Measurement terminals.
Ground terminals.
- **N-MED80. DC Ammeter (0 – 3 A).**
Measurement range: 0-3 A
Terminals:
Measurement terminals.
Ground terminals.
- **N-MED09. AC Ammeter (0-2.5 A).**
Measurement range: 0-2.5 A.
Terminals:
Measurement Terminals.
Ground Terminal.
- **N-MED11. AC Ammeter (0 – 10 A).**
Measurement range: 0-10 A
Terminals:
Measurement Terminals.
Ground Terminal.
- **N-MED21. AC Voltmeter (0-250 V).**
Measurement range: 0-250 VCA.
Terminals:
Measurement Terminals.
Ground Terminal.
- **N-MED22. AC Voltmeter (0-400 V).**
Measurement range: 0-400 VCA.
Terminals:
Measurement Terminals.
Ground Terminal.
- **N-MED33. Three-Phase Balanced Wattmeter (350-0-350W, 440VAC, 500mA).**
Nominal voltage: 440 VAC.
Terminals:
Measurement Terminals.
Ground Terminal.
- **N-MED39. Three-Phase Balanced Varmeter (350-0-350VAr, 440VAC, 500mA).**
Nominal voltage: 440 VAC.
Terminals:
Measurement Terminals.
Ground Terminal.

- Power transmission lines and distribution

- N-TRAG1. Transmission Grid 1 Module.
Nominal voltage: 450 VAC 3P.
Nominal current: 5 A.
4 switches.
4 3-pole Normally Open (NO) contacts.

- Faults injection modules

- N-UFAM. **Universal Fault Module.**

Winding Inductive Fault:

Nominal voltage: 400 V.
Apparent power: 100 VA

This module can insert the following typical faults:

Line to line:

Resistive.
Power: 500 W.
Resistance: 500 ohm.

Line to earth:

Resistive.
Power: 500 W.
Resistance: 200 ohm.

Shunt:

Power: 100 W.
Resistance: 100 ohm.
Fault injection push button.

- N-PTFI. **Faultable Transformers 240:480 / 24:240:480 V.**

Three single-phase power transformers with several possible configurations:

Apparent power: 120 VA.
Primary voltage: 240, 480 V.
Secondary voltage: 24, 240, 480 V.

Each transformer has a fault insertion module which introduces three types of faults in the winding:

Primary to earth.
Secondary to earth.
Primary to secondary.

- Protection relays

- N-REL23/C. **Three-Phase Over/Under-current Protection Relay.**

Supply voltage: 24 VDC.
Nominal Current: 5 A.
Maximum Current: 10 A.
Set point current range: 50 – 140 %.
Hysteresis: 1 – 10 % (máx. 1 – 50 %).
Delay: 3 – 30 sec. (máx. 1 – 360 sec.)
Auto Reset: Automatic/manual.
Relay Output Contacts:
Threshold contacts: 1NO/1NC
Trip contacts: 1NO/1NC

- **N-REL51. Reverse-Forward Protection Relay.**

Supply voltage: 24 VDC.
 Input Voltage: 63 – 690 VAC.
 Nominal Current: 5 A.
 Maximum Current: 10 A.
 Frequency Permissible Range: 35 – 75 %.
 Set point current range:
 Reverse Power: (2 – 20 %, max. 2 – 50 %)
 Forward Power: (50 – 140 %, max. 50 – 150 %)
 Hysteresis: 1 – 10 % (máx. 1 – 50 %).
 Delay: 3 – 30 sec. (máx. 1 – 360 sec.)
 Auto Reset: Automatic/manual.
 Relay Output Contacts:
 Threshold contacts: 1NO/1NC.
 Trip contacts: 1NO/1NC.

- **N-REL52. Power Factor Protection Relay.**

Digital programming relay.
 Supply Voltage: 90 - 690 VAC.
 Input Voltage: 90 - 690 VAC.
 Delay: 0,1 – 20 seg.
 Auto Reset: Automatic/manual.
 Relay Output Contacts:
 Trip contacts: 1NO/1NC

- **N-REL53. AC/DC Sensivity Current Protection Relay.**

Digital programming relay with display.
 Supply Voltage: 24 - 240 VAC/VCC.
 Input Voltage: 24 - 240 VAC/VCC.
 Set Point Current Range: 2 – 500mA.
 Delay: 0,1 – 20 seg.
 Auto Reset: Automatic/manual.
 Relay Output Contacts:
 Trip contacts: 1NO/1NC.

- **N-REL54. AC/DC Sensivity Voltage Protection Relay.**

Digital programming relay with display.
 Supply Voltage: 24 - 240 VAC/VCC.
 Input Voltage: 24 - 240 VAC/VCC.
 Set Point Current Range: 2 – 500mA.
 Delay: 0,1 – 20 seg.
 Auto Reset: Automatic/manual.
 Relay Output Contacts:
 Trip contacts: 1NO/1NC.

- **N-REL55. Over/Under-frequency Protection Relay.**

Supply voltage: 24 VDC.
 Input Voltage: 63 – 690 VAC.
 Frequency Permissible Range: 35 – 75 %.
 Set Point Current Range:
 Over-Frequency: (85 – 115 %, max. 75 – 125 %)
 Under-Frequency (85 – 115 %, max. 75 – 125 %)
 Delay: 1 – 10 sec. (máx. 1 – 360 sec.)
 Auto Reset: Automatic/manual.
 Relay Output Contacts:
 Threshold contacts: 1NO/1NC.
 Trip contacts: 1NO/1NC.

Specifications

- **N-REL56. Three-Phase Sequence/Balance and Over/Under-voltage Protection Relay.**

Supply voltage: 24 VDC.

Input Voltage: 63 – 690 VAC.

Frequency Permissible Range: 35 – 75 %.

Set point voltage range:

Over-Voltage (100 – 120 %, max. 1 – 130 %)

Hysteresis: 1 – 10 %

Delay: 1 – 10 sec. (máx. 1 – 360 sec.)

Auto Reset: Automatic/manual.

Relay Output Contacts:

Threshold contacts: 1NO/1NC.

Trip contacts: 1NO/1NC.

- **N-REL62. Synchronization and Synchronism-Check Relay.**

Maximum Input Voltage: 450 VAC.

Set Point Frequency Range: 45 – 65 Hz.

Adjustable Frequency Range: 0,2 – 0,3 Hz.

Adjustable Voltage Range: 15 – 20 %.

Adjustable offset range: 9 – 13,5 %

Auto Reset: Automatic/manual.

NO Synchronization Output Contact.

- **Motors, generators and loads:**

- **EMT6. Synchronous Three-Phase Motor Alternator.**

Nominal Power: 200 W.

Nominal Voltage: 3x 400/230VCA Y/ Δ.

Frequency: 50/60 Hz.

Poles Number: 2.

Speed: 3000 rpm.

Nominal Current: 1 A.

Nominal Excitation Current: 0,7 A.

- **EMT7/B. Asynchronous Three-Phase Motor of Squirrel Cage (4 Poles).**

Nominal Power: 370 W.

Nominal Voltage: 3x 240/400 VCA Δ/Y.

Frequency: 50/60 Hz.

Poles Number: 4.

Speed: 1370 rpm.

Nominal Current: 1,92/ 1,11 A.

- **N-CAR37. Three / Single - Phase Resistor Load.**

Three benches, one per phase, which consists of three parallel connected resistors. Each resistor has a switch to increase or decrease, in seven steps, the total resistor.

Resistor values: 1200, 2400, 4800 ohm.

Three benches can be connected together to work with single phase circuits.

- **N-SYM. Synchronizing Lamps Module.**

Nominal Voltage: 480 VCA.

Three lamps whose luminosity is increased with the voltage difference between AC two circuits. 1 x Three pole circuit breaker.

1 x Enable/Disable synchronization switch.

- **N-CAR20/B. Power Diodes Module.**

Maximum Peak Voltage: 1200 V.

Maximum Current: 1 A.

6 x Power Diodes interconnected in three groups.

- **FLYW. Flywheel.**

Weight: 2 Kg.

Maximum recommended speed: 4000 rpm.

Moment of inertia: 0,0025 kgm²

Recommended additional modules**- Transformers**

- **N-TRA32. 3-Phase Distribution Transformer 220:400 / 220:400, 100VA.**

Several configurations and different transformer ratio for increase or decrease the voltage level.

Input voltage:

220 V.

400 V.

Output voltage:

220 V.

400 V.

- **N-DISB1. Distribution Bus 1 Module.**

Nominal voltage: 450 VAC 3P.

Nominal current: 5 A.

6 switches.

6 3-pole Normally Open (NO) contacts.

- **N-DISB2. Distribution Bus 2 Module.**

Nominal voltage: 450 VAC 3P.

Nominal current: 5 A.

6 switches.

6 3-pole Normally Open (NO) contacts.

- **N-RBUS. Ring Bus Module.**

Supply voltage: 415 VAC.

Nominal current: 5 A.

6 Normally Open (NO) contacts to connect several protective relays.

- Power Lines and Distribution

- **N-TRAG2. Transmission Grid 2 Module.**

Nominal voltage: 450 VAC 3P.

Nominal current: 5 A.

5 switches.

5 3-pole Normally Open (NO) contacts.

- **N-AE1/F. Fault Transmission Line.**

Transmission line for Line - Line and Line – Neutral fault injection.

Intermediate fault connections.

- **N-AE1/B. Transmission Lines Simulation Basic Module.**

High voltage transmission lines simulation module.

Line impedance configurable at four levels: 0, 200, 400, 600 Ohm.

- Protection Relays

- **N-REL58. Single-Phase Under / Over Voltage Relay.**

Supply voltage: 24 VDC.

Input Voltage: 63 – 690 VAC.

Frequency Permissible Range: 35 – 75 %.

Set point voltage range:

Over-Voltage (80 – 120 %, max. 70 – 130 %).

Under-Voltage (80 – 120 %, max. 70 – 130 %).

Delay: 1 – 10 sec. (máx. 1 – 360 sec.)

Auto Reset: Automatic/manual.

Relay Output Contacts:

Threshold contacts: 1NO/1NC

Trip contacts: 1NO/1NC.

- **N-REL60. Single-Phase Under / Over Current Relay.**

Supply Voltage: 230VAC/400VAC.

Input Voltage: 63 – 690 VAC.

Set Point Current Range: (1 – 10 A).

Delay: 1 – 10 seg.

Relay Output Contacts: 1NO/1NC.

- Loads

- **N-CAR38. Three / Single - Phase Inductive Load.**

Three banks, one for each phase, compound by three inductors interconnected in parallel. Each inductor has a switch to increase or decrease the equivalent inductance in seven steps.

Inductance values: 3.8, 7.6, 15.3 H.

Reactance values: 1200, 2400, 4800 ohm.

The three banks can be connected together for single-phase circuits.

- **N-CAR39. Three / Single - Phase Capacitive Load.**

Three banks, one for each phase, compound by three capacitors interconnected in parallel. Each inductor has a switch to increase or decrease the equivalent capacitance in seven steps.

Capacitance values: 0.66, 1.33, 2.65 uF.

Reactance values: 1200, 2400, 4800 ohm.

The three banks can be connected together for single-phase circuits.

Each bank is provided with a discharge resistor to reduce the applied voltage to 5 % within 25 seconds after a load is disconnected from the supply.

- Measurement instrumentation

- **N-MED26. Frequency Meter.**

Measurement range: 44 – 55 Hz.

- **N-MED78. Three-Phase Power Factor Meter.**

Measurement range:

Lagging power factor module: 0,5 – 1.

Leading power factor module: 0,5 – 1.

Maximum current: 2,5 A.

- Starters

- **N-ARR12. Direct Starter Module.**

Nominal voltage: 400 VAC.

Maximum contacts current: 10A.

Two positions commutator (ON-OFF):

0: Open circuit.

1: Closed circuit.

- **All necessary cables to realize the practical exercises are included.**

Cables and Accessories, for normal operation.

Manuals:

This unit is **supplied with the following manuals**: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

EXERCISES AND PRACTICAL POSSIBILITIES

- 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 sensitivity current protection relay.
- 5.- Wiring of the current transformer and setting of the AC/DC sensitivity 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.

REQUIRED SERVICES

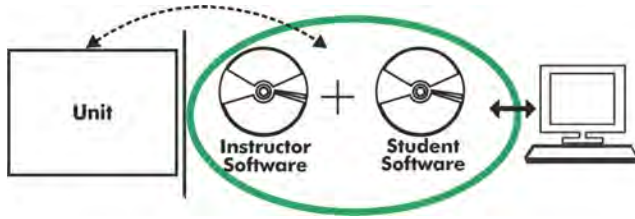
- Electrical supply: three-phase, 380 V/50 Hz or 208 V/60 Hz, 20 Kw.

DIMENSIONS AND WEIGHTS

- AEL-PRTS:
- Dimensions: 1500 x 400 x 1800 mm approx.
(59.05 x 15.74 x 70.86 inches approx.)
 - Weight: 80 Kg approx.
(176 pounds approx.)

Optional

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



With no physical connection between unit and computer (PC), this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

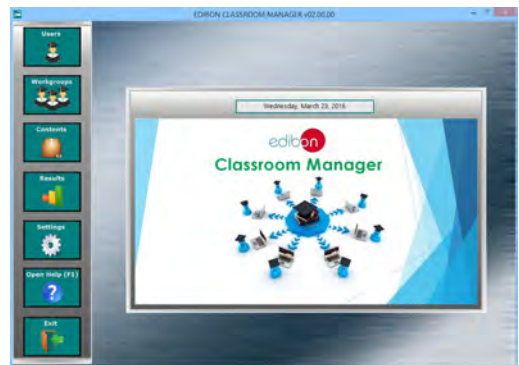
Instructor Software

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

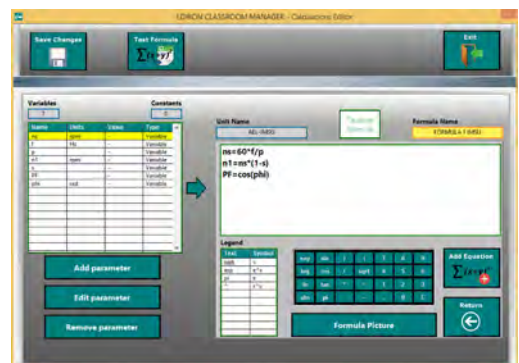
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

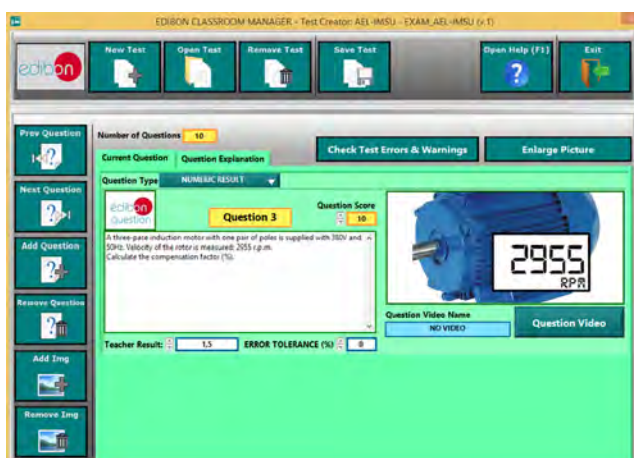
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.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



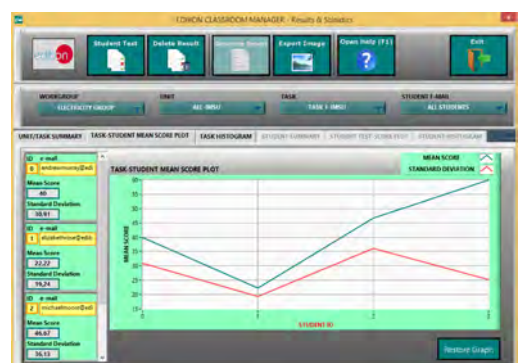
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



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



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

Optional
Student Software

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

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

- **Student Log-In & Self-Registration.**
- **Existing Tasks checking & Monitoring.**
- **Default contents & scheduled tasks available to be used from the first session.**
- **Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- **Evaluation Methods to prove your knowledge and progression.**
- **Test self-correction.**
- **Calculations computing and plotting.**
- **Equation System Solver Engine.**
- **User Monitoring Learning & Printable Reports.**
- **Multimedia-Supported auxiliary resources.**

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

www.edibon.com/en/files/expansion/ICAI/catalog



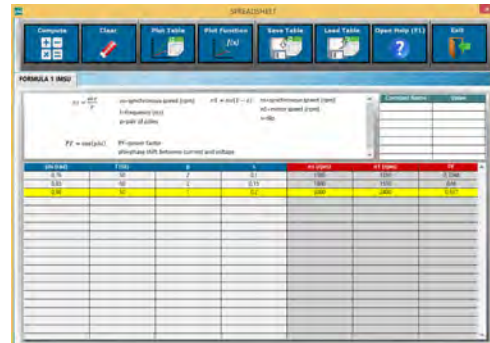
ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

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



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REPRESENTATIVE:

