Hardware Emulators Modules

N-EM

Engineering and Technical Teaching Equipment

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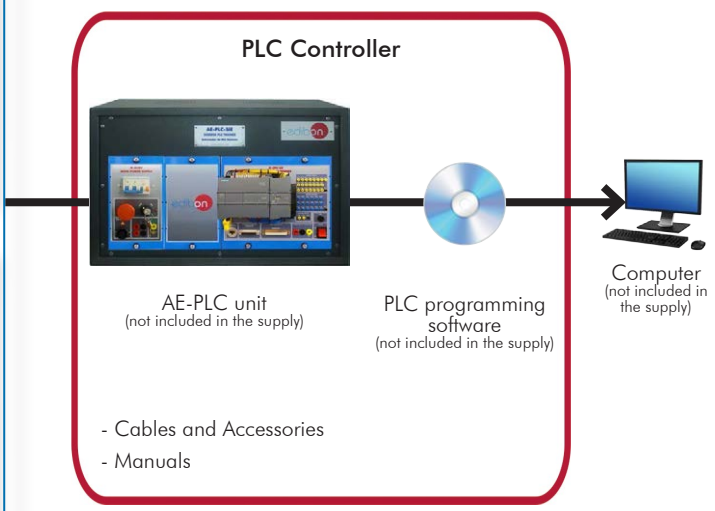
PRODUCTS
6.- MECHATRONICS, AUTOMATION & COMPUMECHATRONICS



Unit: N-EM. Hardware Emulators Modules

INTRODUCTION

The emulation of the systems with small scale hardware, is one of the last steps before work with the real system. The emulators are used to test the controls, equipment and programming code, before implementing it in a real system.

The Hardware Emulators Modules, "N-EM", are a wide number of modules that emulate the most common applications in automation as: a traffic light system, an elevator, an industrial mixing machine, an automatic storage, etc. The "N-EM" modules are designed to work with all types of the "AE-PLC".

The "N-EM" modules are provided with a different set of practical exercises for each one, through which the students will understand how to work with the different components of the modules and how to program the emulated system correctly.

GENERAL DESCRIPTION

The "N-EM" are a series of emulators that provide the students the required hardware to emulate the most common automatic systems.

The "N-EM" modules are designed to work with the "AE-PLC" units to obtain the fundamental knowledge of PLC programing, PLC management, etc.

The "N-EM" modules are a wide variety of emulators classified in the following branches: Traffic and Parking, Small Industrial Machines, Simple Industrial Systems, Big Industrial Systems, Simple Control Applications, Industrial Control Applications, Thermal Applications, Electrical Machines Control and Alarms & Current.

SPECIFICATIONS

All "N-EM" modules contains:

Painted Metallic front panel with an ABS plastic case, which can be mounted in vertical position or used on the surface of a table.

Diagram or drawing of the emulated system.

Connector in the front panel that contains all the required signals to work with the emulator.

Different led colors lamps, switches, push buttons, etc. depend on the type of hardware emulator.

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.

<u>Traffic and Parking</u>:

- N-EM-CST. **Traffic Signal Control.**

  It represents an automatic traffic signal control, which emulates a traffic crossroad. We can select the operation mode choosing between day and night, and control the traffic state using traffic lights and vehicle detectors. The pedestrians can request to stop the vehicles flow by pushing a button.

N-EM-CST

- N-EM-AV. **Car Parking.**

  It represents a car parking, which emulates the common components used in an automated car parking such as barrier motor, vehicles presence detectors, traffic lights, etc. We are able to know the number of vehicles inside the parking with lights and if the parking is full or there is some free spot available.

N-EM-AV

- N-EM-AG2Z. **Two Zones Parking Garage.**

  It represents a car parking garage with two zones, which emulates the control of four barriers, two barriers to exit, one to enter and other one to change the parking zone. We can know the number of vehicles inside the parking with lights and if the parking is full or there is some free spot available.

N-EM-AG2Z

<u>Small Industrial Machines</u>:

- N-EM-CA. **Elevator Control.**

  It represents a three floor elevator, which emulates the control of the movement of the elevator cabin, the opening and closing of the doors, the indicators of an elevator control panel, etc. The different pushbuttons emulate the request of elevator in each floor, the people detector when someone enters and exits the elevator cabin, etc.

N-EM-CA

- N-EM-CLA. **Automatic Washing Machine Control.**

  It represents an automatic washing machine, which emulates the sequence of actions carried out when the different programs are selected. The different switches and pushbuttons emulate if the door is open or closed, the selection of the three different washing machine programs, the water level, etc.

N-EM-CLA

- N-EM-MB. **Drinks Machine.**

  It represents an automatic drinks machine, which emulates the sequence of actions carried out to provide beverage cans automatically. The "N-EM-MB" also emulates the automatic coin machine to pay the beverage cans. The different pushbuttons emulates the coins introduced, the selection of the beverage type, if there is some beverage sold out, etc.

N-EM-MB

- N-EM-MBC. **Hot Drinks Machine.**

  It represents an automatic hot drinks machine, which emulates the scheme of action carried out by a hot drink machine to provide the hot drink desired. The different switches and pushbuttons emulate the level of the different drinks inside the machine, the choice of the drink type of the user, etc.

N-EM-MBC

- N-EM-CB. **Pump Control.**

  It represets the automatic control of four pumps that fills a tank. The different switches and pushbuttons emulate the level of the tank, the filling speed of the tank selected, etc. It is possible to regulate the discharge rate with the output valve of the tank.

N-EM-CB

- N-EM-MA. **Embossing Machine.**

  It represets the automatic embossing process of metal disks, which emulates the series of actions carried out to emboss disks from metallic plates. The different switches and pushbuttons emulate the position of the different pneumatic actuators, the position of the embossing machine, the number of metallic disks, etc.

N-EM-MA

<u>Simple Industrial Systems</u>:

- N-EM-ST. **Drilling System.**

  It represets an automatic drilling system, which emulates the steps to transport pieces to the drilling zone, emulates a drilling process and transport the drilled pieces to the output area. The different switches and pushbuttons emulate the position of the drilling machine, the position of the transport system, the state of the drilling refrigeration system, etc.

N-EM-ST

- N-EM-SBAR. **Dirty-Water Pump System.**

  It represents a dirty-water pump system, which emulates the control of the dirty-water flow using a valve and two pumps that move the dirty-water pipe from a dirty-water tank. The different switches and pushbuttons emulates the level of dirty-water inside the tank, the state of the valves, etc.

N-EM-SBAR

- N-EM-SBP. **Pump System (Pressure).**

  It represents a pressure system, which emulates two pumps that fills a tank. The different switches and pushbuttons emulates the state of the three-phase contactor that control the pumps, the level sensors of the tank, the pressure sensor of the tank, etc.

N-EM-SBP

- N-EM-SL. **Cleaning System.**

  It represents an automatic cleaning system of vegetables in a continuous process with quality control system. The different switches and pushbuttons emulate the state of the position detectors, a product counter, the quality control system, etc.

N-EM-SL

- N-EM-SALL. **Automatic Filling System.**

  It represents an automatic filling system with a filling and corking system. The different switches and pushbuttons emulate the position of the pneumatic actuators, the level sensor of each bottle, the presence sensors, the movement of the conveyor, etc.

N-EM-SALL

- N-EM-SBT. **Conveyor Belts System.**

  It represents a conveyor belts system to transport three different pieces and sorting them to three different areas. The different switches and pushbuttons emulate the three phase motors, the position sensors, the piece material detectors, etc.

N-EM-SBT

- N-EM-SCCT. **Conveyor Charging System.**

  It represents a conveyor charging system with four conveyor belts. The conveyor system fills two different material boxes through different paths. The different switches and pushbuttons emulate the three phase motors, the position sensors, the lock gates, etc.

N-EM-SCCT

- N-EM-SCA. **Canalization System.**

  It represents a canalization system which provides water to two houses through two pipes with valve. The different switches and pushbuttons emulate the use of water inside the houses, the water flow sensor for the canalization, etc.

N-EM-SCA

- N-EM-SDT. **Pipe Bending System.**

  It represents a pipe bending system with conveyor. The system is composed by a bending machine with gripper to hold the pieces while the machine is working, then, a conveyor system transports the bended pieces to a container. The different switches and pushbuttons emulate the pieces sensors, the piece counter, etc.

N-EM-SDT

- N-EM-PAE. **Automatic Stamping Press.**

  It represents an automatic stamping press with a transport system. The systems is composed by two conveyor belts and the stamping press. The different switches and pushbuttons emulate the piece counter, the position of the pressing machine, etc.

N-EM-PAE

<u>Big Industrial Systems</u>:

- N-EM-PLLT. **Filling Process of Tanks.**

  It represents a filling process system composed by three tanks which fill the tank where the desired product is mixed. The system allows to select the desired product by controlling the amount of liquid poured by each tank.

N-EM-PLLT

- N-EM-SCC. **Collecting Belt Conveyor.**

  It represents a collecting belt conveyor system composed by three auxiliary conveyors that transport the products to a main conveyor. The main conveyor transport the products to the containers located at the beginning and end of the conveyor. The different switches and pushbuttons emulate the pieces sensors located at different position of the conveyor belts.

N-EM-SCC

- N-EM-MCC. **Mails Allocation Machine.**

  It represents a mails allocation machine which sort the mails at three different allocations. The switches and pushbuttons emulate the different envelope detectors.

N-EM-MCC

- N-EM-RAC. **Compressed Air Network.**

  It represents a compressed air network composed by a service unit with an air compressor and an air tank and a pipe network to provide with air compressed an installation. The different switches and pushbuttons emulate the pressure sensors, the drain valve, different process valves, etc.

N-EM-RAC

- N-EM-TC. **Coal Treatment.**

  It represents a coal treatment system used to get a desired coal mix from three different coal type storages. The coal treatment system controls the amount of coal type spilled by each tank. The different switches and pushbuttons emulate the coal tank level sensors, the valve of each tanks, the state of the doors, etc.

N-EM-TC

- N-EM-PELE. **Packing Line and Bottling Plant.**

  It represents an automatic packing line and bottling machine where is possible to emulate the processes of bottling, sealing, labeling, packing and palletizing. In this automatic plant we can control the movement of the conveyor belt and obtain information about the process using sensors. The different switches and pushbuttons emulate the optical sensors, the presence sensors, the level sensors, etc.

N-EM-PELE

<u>Simple Control Applications</u>:

- N-EM-CA2P. **Two-Doors Access Control.**

  It represents two automatic doors where is possible to emulate the movements and positions of each automatic door using sensors and electrical motors. The different switches and pushbuttons emulate the presence sensors, the state of the doors, etc.

N-EM-CA2P

- N-EM-CI. **Fire Control.**

  It represents a fire control station where is possible to emulate different emergency situations with fire. The different switches and pushbuttons emulate the activation and deactivation of the alarm buttons, the fire detectors, the smoke detectors, the elevator, the emergency door, the exit signs, and the temperature sensors. We can also activate the water pump for the fire sprinklers.

N-EM-CI

- N-EM-CP. **Proximity Control (security).**

  It represents a proximity and presence security control where we can obtain information about the presence in different places of a bank office using: a PIR sensor, presence sensor, magnetic sensor and infrared electronic barriers. The office has an alarm, a bell, security cameras and security keys.

N-EM-CP

- N-EM-CCO. **Sluice Gate Control.**

  It represents a sluice gate control system. The sluice system is composed by three sluice gates, and we have to control them using the water pumps and the gates control. The switches and pushbuttons emulate the state of the sluice doors, the level sensors of each tanks, the state of the presence sensors, etc.

N-EM-CCO

- N-EM-CNC. **Level and Flow Control.**

  It represents a level and flow control system composed by a pressurized circuit with a pneumatic valve that regulate the flow rate of the main water tank. The different switches and pushbuttons emulate the level sensors of the water tank.

N-EM-CNC

- N-EM-CNTA. **Water Tower Level Control.**

  It represents a water tower level control where is possible to emulate the water flow control with the input valve and the motor of the pump. The different switches and pushbuttons emulate the state of different output valves, the water level sensors, alarms, etc.

N-EM-CNTA

- N-EM-CF. **Photo Control.**

  It represents a photomaton, which emulates the sequence of actions carried out by the system to make and print the photos. The different switches and pushbuttons emulate the automatic coins machine, the presence sensor, etc.

N-EM-CF

- N-EM-CMM. **Molding Machine Control.**

  It represents a molding machine control with three different molding machines. The system has a main conveyor to feed each molding machine with pieces to mold. The different pushbuttons and switches emulate the different presence sensors located along the system.

N-EM-CMM

- N-EM-CPOS. **Position Control.**

  It represents a position control system which emulates the control of a cutting machine with storage system. The storage has four levels to storage the cut pieces depends on the size of the piece. The different switches and pushbuttons emulate the presence sensors located along the system.

N-EM-CPOS

- N-EM-CS. **Silo Control.**

  It represents a silo control system where we can emulate the filling process. The filling motor has a manual rate or an automatic rate and the output valve has its own discharge rate. We can measure the level with four presence sensors and to know if the silo is full with the full sensor.

N-EM-CS

- N-EM-CACV. **Vehicle Feeding & Loading Control.**

  It represents a vehicle feeding control system in a tequila manufacturing industry. The system use two conveyor belts and pumps to transport the material through the different stages of the process till the final container. The different switches and pushbuttons emulate the level sensors, the presence sensors, etc.

N-EM-CACV

<u>Industrial Control Applications</u>:

- N-EM-ACC. **Feeding and Loading Control.**

  It represents a voltage control with four switches in an "H" bridge. The system can control de frequency, the polarity, the amplitude, etc. The different switches and pushbuttons emulate the function mode selected.

N-EM-ACC

- N-EM-CML. **Liquids Mixing Control.**

  It represents a liquids mixing control inside a tank with four feeding pipes. The tank also has a stirring and a heater element. The different switches and pushbuttons emulate the level sensors along the tank.

N-EM-CML

- N-EM-CME. **Mixer Control.**

  It represents a mixer control system with two different products in a central tank. The tank is fed with two little chutes using conveyor belts, once the product is mixed, a main conveyor belt transport the mix to the output zone. The different switches and pushbuttons emulate the level sensor signals located at the main tank.

N-EM-CME

- N-EM-CR. **Reactor Control.**

  It represents a reactor control, which emulate the mix of a catalyst, an inert gas and a substance. We can regulate the catalyst and the inert gas flow with valves, and the substance with different pumps. The switches and pushbuttons emulate the level sensors, the temperature sensor, etc.

N-EM-CR

- N-EM-CCP. **Count and Position Control.**

  It represents a count and position control which emulate a robot movement. The robot takes the pieces from a table and place them to three different containers.

N-EM-CCP

- N-EM-CL. **Rolling Mill Control.**

  It represents an automatic laminate control system, which produces metallic plates with different thickness. The different switches and pushbuttons emulate the presence sensors located along the system.

N-EM-CL

- N-EM-CTRA. **Workcell Application.**

  It represents an automatic working cell which produces pieces by soldering two simple pieces. The working cell include a transport system to place the two simple pieces at the soldering machine. The different switches and pushbuttons emulate the presence sensors located along the workcell.

N-EM-CTRA

- N-EM-CTI. **Tower Lighting Control.**

  It represents an automatic tower light control. The system allows to control each lamp, to create the desired light sequence.

N-EM-CTI

<u>Thermal Applications</u>:

- N-EM-AC. **Buffer Storage.**

  It represents a buffer storage system which emulates a solar thermal system to get and storage heat from the sun. The different switches and pushbuttons emulate the temperature sensors, the working mode selector, etc.

N-EM-AC

- N-EM-RT. **Temperature Regulation.**

  It represents the temperature regulation system of a house, which allows to control the temperature using a heater element inside a tank and temperature sensors. The different switches emulate the state of the thermostat, the level sensors, the temperature sensor, etc.

N-EM-RT

- N-EM-CSC. **Heating System Control.**

  It represents a heating control system of a house, which emulates a home heating system with a heating circuit and two radiators. The different switches and pushbuttons emulate the most common components in this systems such electro-valves, control switches, thermostats, etc.

N-EM-CSC

- N-EM-CSV. **Ventilation System Control.**

  It represents an automatic ventilation system of an underground car park which control the smoke level and the CO level to activate the extractor fans. The different switches and pushbuttons emulate the CO sensor, smoke sensor, presence sensors, etc.

N-EM-CSV

Electrical Machines Control:

- N-EM-M. **Motor Control.**

  It represents a three phase motor control connection. The system emulates the use of three phase contactors to change the turning direction of the motor. The motor control module also allows to connect the three phase motor in delta or star configuration.

N-EM-M

- N-EM-MPP. **Stepper Motor Control.**

  It represents a stepper motor control to manage the direction, the speed and the position of a stepper motor.

N-EM-MPP

- N-EM-MET. **Star-Delta Connection.**

  It represents a star-delta connection of a three phase motor. The system also allows to use the different switches to emulate faults in the three phase fuses and magnetothermics.

N-EM-MET

- N-EM-MCETI. **Reversing Star-Delta Connection.**

  It represents a reversing motor with star-delta connection control to manage the direction of a three phase motor by configuring the connection through three phase contactors. The system also allows to use the different switches to emulate faults in the three phase fuses and magnetothermics.

N-EM-MCETI

- N-EM-MD. **Dahlander Motor Circuit.**

  It represents a Dahlander motor circuit which has two connection configuration for connect 2 and 4 poles and emulates the motor's movement. The system also allows to use the different switches to emulate faults in the three phase fuses and magnetothermics.

N-EM-MD

- N-EM-M2BS. **Motor with 2 separate Windings.**

  It represents a three phase motor with two separate windings and emulates the motor's movement. The system also allows to use the different switches to emulate faults in the three phase fuses and magnetothermics.

N-EM-M2BS

- N-EM-MAC. **Starting a Wound - Rotor Motor.**

  It represents the starting of a wound-rotor motor where is possible to emulate the motor's movement when different load are connected through three phase contactors. The system also allows to use the different switches to emulate faults in the three phase fuses and magnetothermics.

N-EM-MAC

Alarms & Current:

- N-EM-AN. **Annunciator.**

  It represents an access control system with a seven digits display and keypad. The different switches and pushbuttons emulate the buttons of the keypad to introduce the password of the system.

N-EM-AN

- N-EM-SLU. **Running Lights.**

  It represents a running lights system which emulates the control of a series of lamps to configure the sequence and direction. The system allows to configure three type of light configuration at the same time and select the desired one through switches.

N-EM-SLU

- N-EM-CPR. **Reactive Current Compensation.**

  It represents a reactive current compensation system which emulates the connection of three-phase capacitive loads. The system allows to connect each load using the three-phase contactors and simulates faults with the three-phase fuses.

N-EM-CPR

- N-EM-MCI. **Reversing Contactor.**

  It represents a three-phase motor with reversing contactors which emulates a three phase motor connection to change the turning direction of the motor through three phase contactors. The system also allows to use the different switches to emulate faults in the three phase fuses and magnetothermics.

N-EM-MCI

EXERCISES AND PRACTICAL POSSIBILITIES

All "N-EM" modules allow to perform the following practical exercises:

1.- Temporization.

2.- Counting.

3.- Sequential counting.

4.- All the practical exercises include the diagrams and the flow charts of the example programs used.

REQUIRED SERVICES

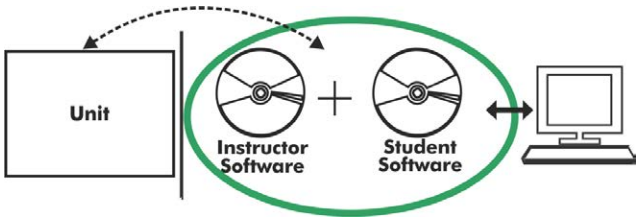
- Electrical supply: single-phase, 220 V/50 Hz or 110 V/60 Hz.
- AE-PLC unit.

DIMENSIONS AND WEIGHTS

N-EM modules:

- Dimensions: 275 x 250 x 250 mm approx.
  (10.82 x 9.84 x 9.84 inches approx.)
- Weight: 4 Kg approx.
  (8.81 pounds approx.)

N-EM/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.

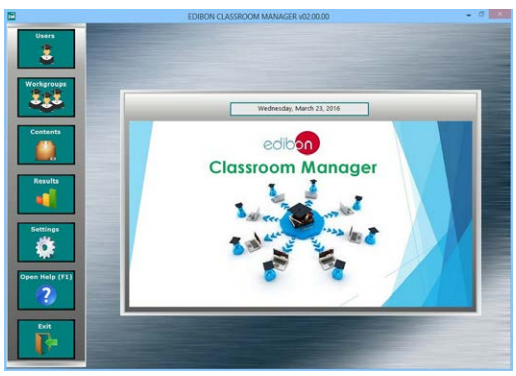
Instructor Software

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

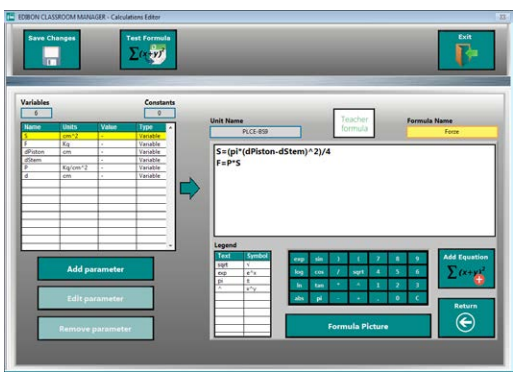
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

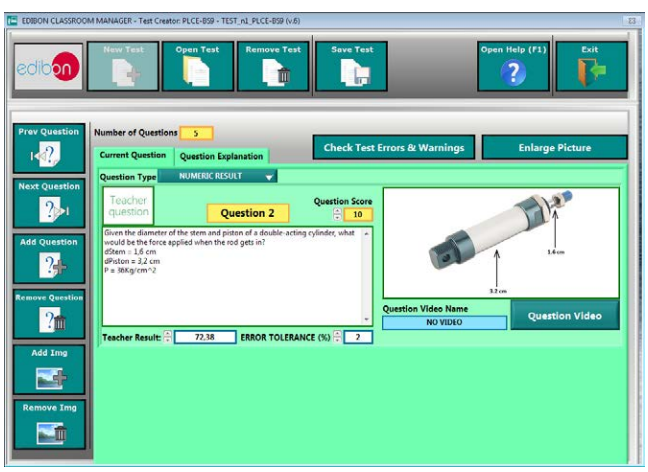
- **User Data Base Management.**
- **Administration and assignment of Workgroup, Task and Training sessions.**
- **Creation and Integration of Practical Exercises and Multimedia Resources.**
- **Custom Design of Evaluation Methods.**
- **Creation and assignment of Formulas & Equations.**
- **Equation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



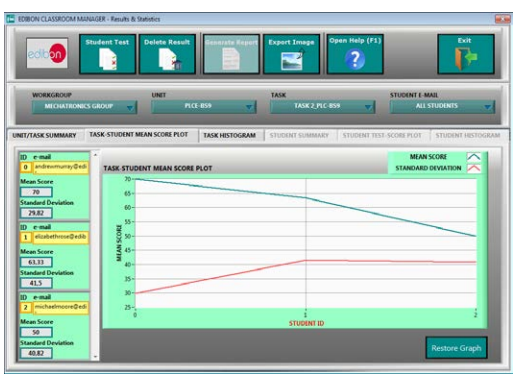
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



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).

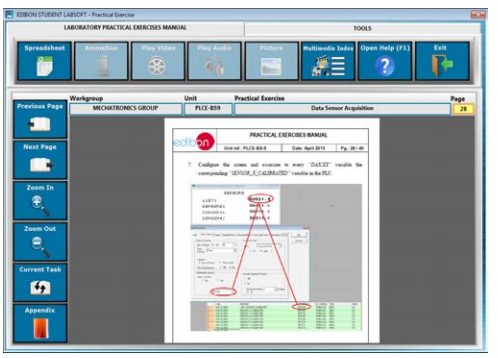
ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are 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:

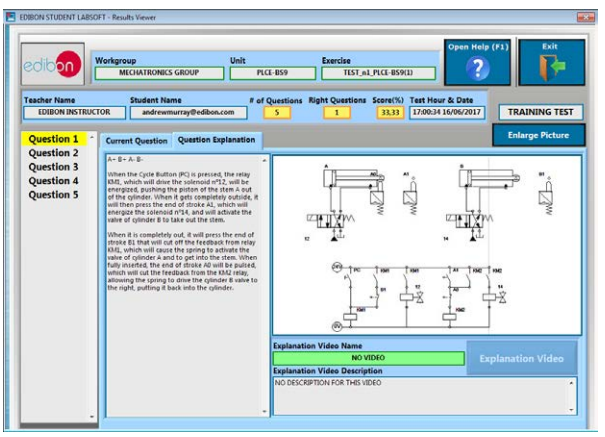
- **Student Log-In & Self-Registration.**
- **Existing Tasks checking & Monitoring.**
- **Default contents & scheduled tasks available to be used from the first session.**
- **Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- **Evaluation Methods to prove your knowledge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

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

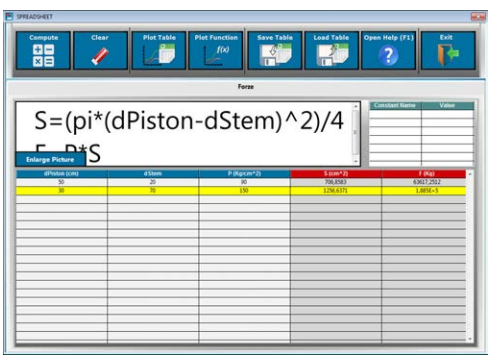
For more information see **ICAI** catalogue. Click on the following link:
www.edibon.com/en/interactive-computer-aided-instruction-software



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.

C/ Del Agua, 14. Polígono Industrial San José de Valderas.
28918 LEGANÉS. (Madrid). ESPAÑA - SPAIN.
Tel.: 34-91-6199363 Fax: 34-91-6198647
E-mail: edibon@edibon.com Web: **www.edibon.com**

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REPRESENTATIVE: