edibon

Engineering and Technical Teaching Equipment

INTRODUCTION

The electric machines are devices capable of transforming electrical energy into mechanical energy or vice versa. The squirrel cage motor is very used in industrial installations due to its great robustness, reliability and low cost. The starting current consumed by these motors is very high, being harmful to the machine and the protections. The soft starters aim at reducing these currents close to the nominal values.

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 "Electrical Machines Soft Starter trainer", AEL-EMSS, has been designed by Edibon to instruct the student in managing soft-starters of three-phase electrical machines. This trainer 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 staring 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 programed 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 trainer 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 trainer 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 trainer.

The AEL-EMSS requires the following modules:

- N-ALI01. Industrial Power Supply.

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

- EMT7B/1K. 1kW Three-Phase Induction Motor of Squirel 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-VVCA. Advanced AC Motors Speed Controller.
Option 3:
- N-ARR01. Manual Star-Delta Starter.
- N-TRANS03. Three-Phase Autotransformer 400/230 VAC, 1kVA, Module.
Optional testing software:

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

Optional learning software:

In addition, Edibon provides optional 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 (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.

Basic required modules:

- **N-ALI01. Industrial Main Power Supply**

    Supply voltage: 400 VAC, 3PH+N+G.

    ON-OFF removable key.

    Output voltage connections:

    Three-Phase + Neutral: 400 VAC.

    Single-Phase: 230 VAC.

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

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

N-ALI01

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

    ON-OFF switch.

    Supply voltage: 400 VAC.

    Input terminals: Input connection with the measurement point.

    Output terminals: Output connection with the measurement point.

    Digital outputs: Three digital outputs are used for pulses or alarms, or for combining both.

    RS-485 Communication port.

    Fuses: 3x10 A.

    Network Analyzer Display. It shows:

    Active, reactive and apparent power.

    Active, reactive and apparent energies.

    Lines and phase currents.

    Line and phase voltages.

    Frequencies.

    Power Factor.

N-EALD

- **EMT7B/1K. Three-phase Asynchronous Motor of Squirrel Cage**

    Nominal power: 1KW.

    Speed: 1405 rpm.

    Nominal torque: 7,48 Nm.

    Performance:

    75,5 % (at 50% of full load).

    77,8 % (at 75% of full load).
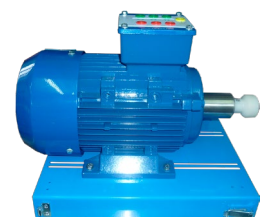
    76,7 % (at 100% of full load).

    Power Factor: 0,8.

    Nominal current:

    4,5 A (at 230 VAC).

    2,7 A (at 380 VAC).

    2,6 A (at 400 VAC).

EMT7B/1K

• **N-SERV1K. 1 kW Servomotor Module**

    Dynamic and static four-quadrant operation.

    Speed and torque displays.

    Four-quadrant monitor.

    Thermal monitoring of the machine under test.

    Testing for the presence of a shaft cover.

    Connection voltage: 400 V.

    Frequency: 50 Hz.

    Maximum power output: 10 kVA.

    Maximum speed: 4000 r.p.m.

    Maximum torque 30 Nm.

    Temperature monitoring.

N-SERV1K

Option 1:

• **N-ARR16. Electronic Soft Starter**

    Nominal Voltage: 400 VAC.

    Nominal current: 3,6 A.

    Nominal Power: 1,5 kW.

    IP: IP20.

    Three poles.

    Regulating potentiometer for setting the acceleration/deceleration ramp.

    Regulating potentiometer for starting voltage.

N-ARR16

Option 2:

• **N-VVCA. Advaced AC Motors speed controller**

    Supply voltage: 230 VAC.

    Nominal power: 0,75 kW.

    PWM output voltage connections:

        Three-Phases: 230 VAC.

    Digital inputs control panel: 5 configurable digital inputs.

    Analog inputs control panel:

        0-10V analog input for speed control.

        4-20mA analog input for speed control.

    10K, potentiometer for the induction motor control speed.

    2 relay outputs for alarms configuration: 2 outputs NO/NC.

    50 mA, 2 transistor outputs for alarms configuration.

    Setting and visualization display of the machine parameters.

N-VVCA

Option 3:

- **N-ARR01. Manual Star-Delta starter**
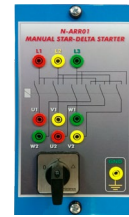
    Nominal voltage: 400 VAC.

    Maximum contacts current: 10A.

    Star-Delta three positions commutator:

    0: Open circuit.

    Y: Star connection.

    Δ: Delta connection.

N-ARR01

- **N-TRANS03. Three-phase Autotransformer 400/230 VAC, 1 kVA, Module**

    Three-phase autotransformer.

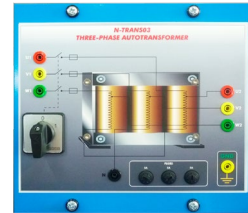   Nominal supply voltage: 400 VAC (3PH).

    Nominal output voltage: 3 x 230 VAC (3PH+N).

    Nominal power: 1 kVA.

    Free configuration (delta, star and zig-zag).

    Start/stop commutator for instantaneous connection/disconnection of the grid transformer.

    Fuses: 3x5 A.

N-TRANS03

- **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

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 osft 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 osft 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 durgin star/delta starting procedure.

26.- Comparing the starting methods through frequency controller, electronic osft 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.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

AEL-EMSS:

- Dimensions: 1380 x 840 x 2010 mm. approx.

(54.33 x 33.07 x 79.13 inches approx.).

- Weight: 85 Kg. approx.

(187 pounds approx.).
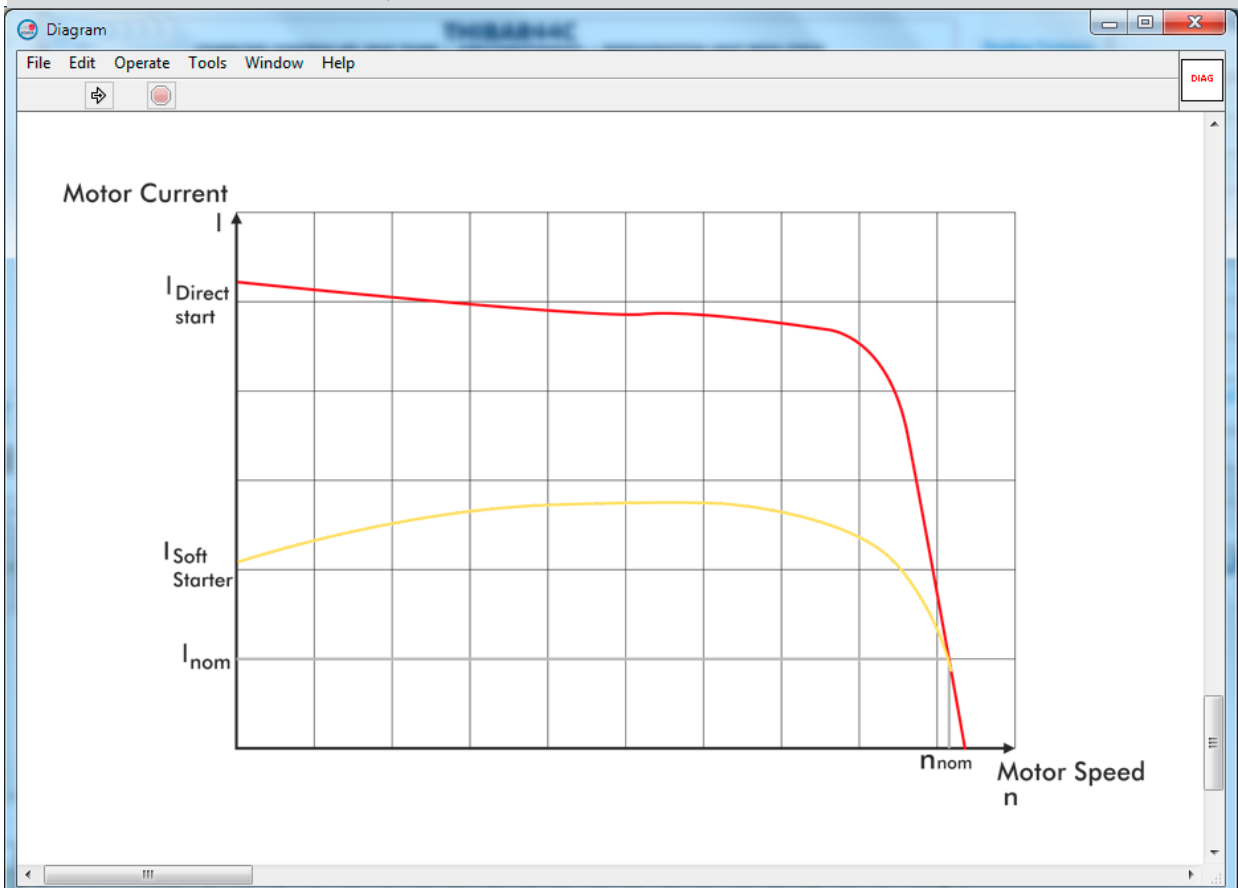
OPTIONAL SOFTWARE

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines, with SCADA. (For more information see catalogue. Click on the following link: http://www.edibon.com/en/files/equipment/EM-SCADA/catalog
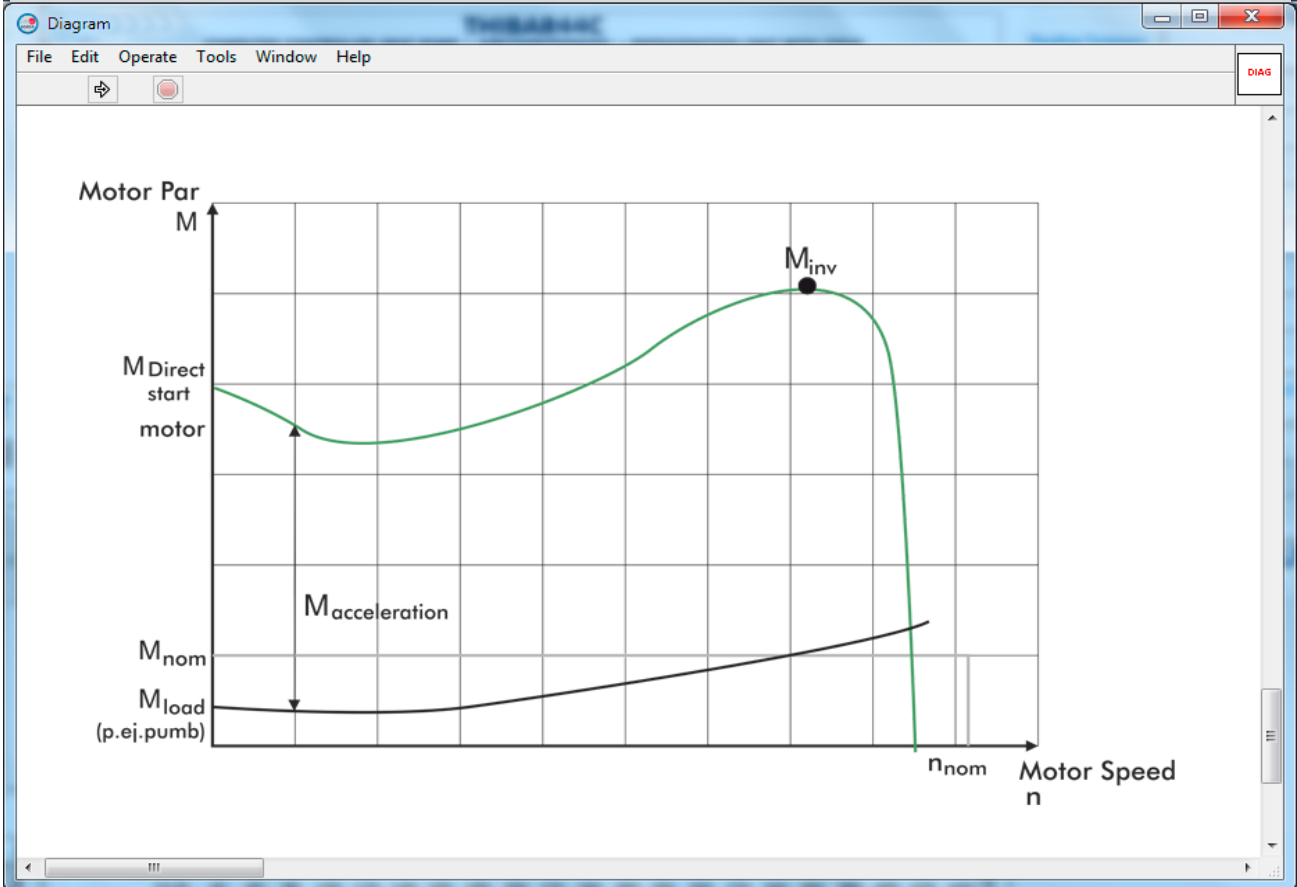
Direct starting current evolution of three-phase induction motor.
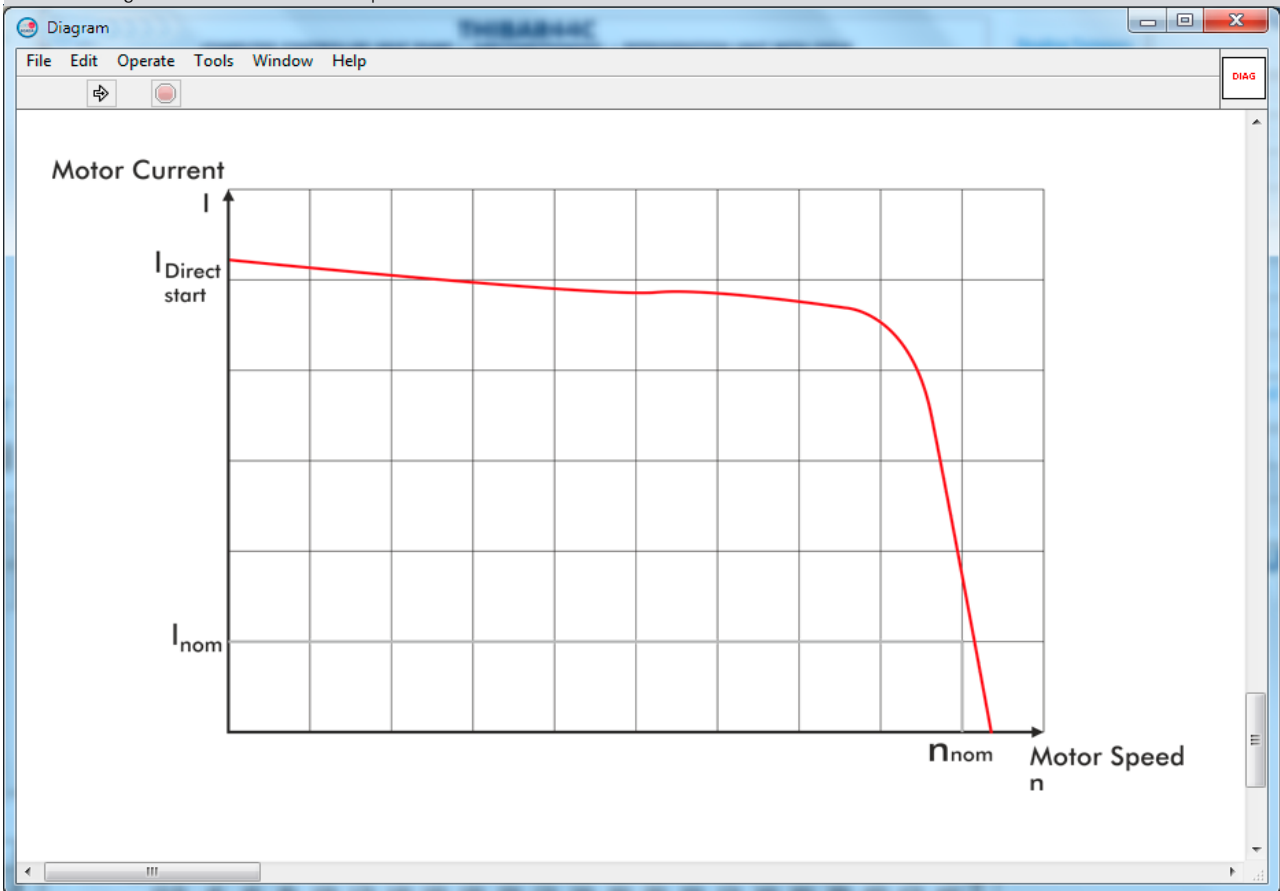
Reduced current evolution with soft starter.

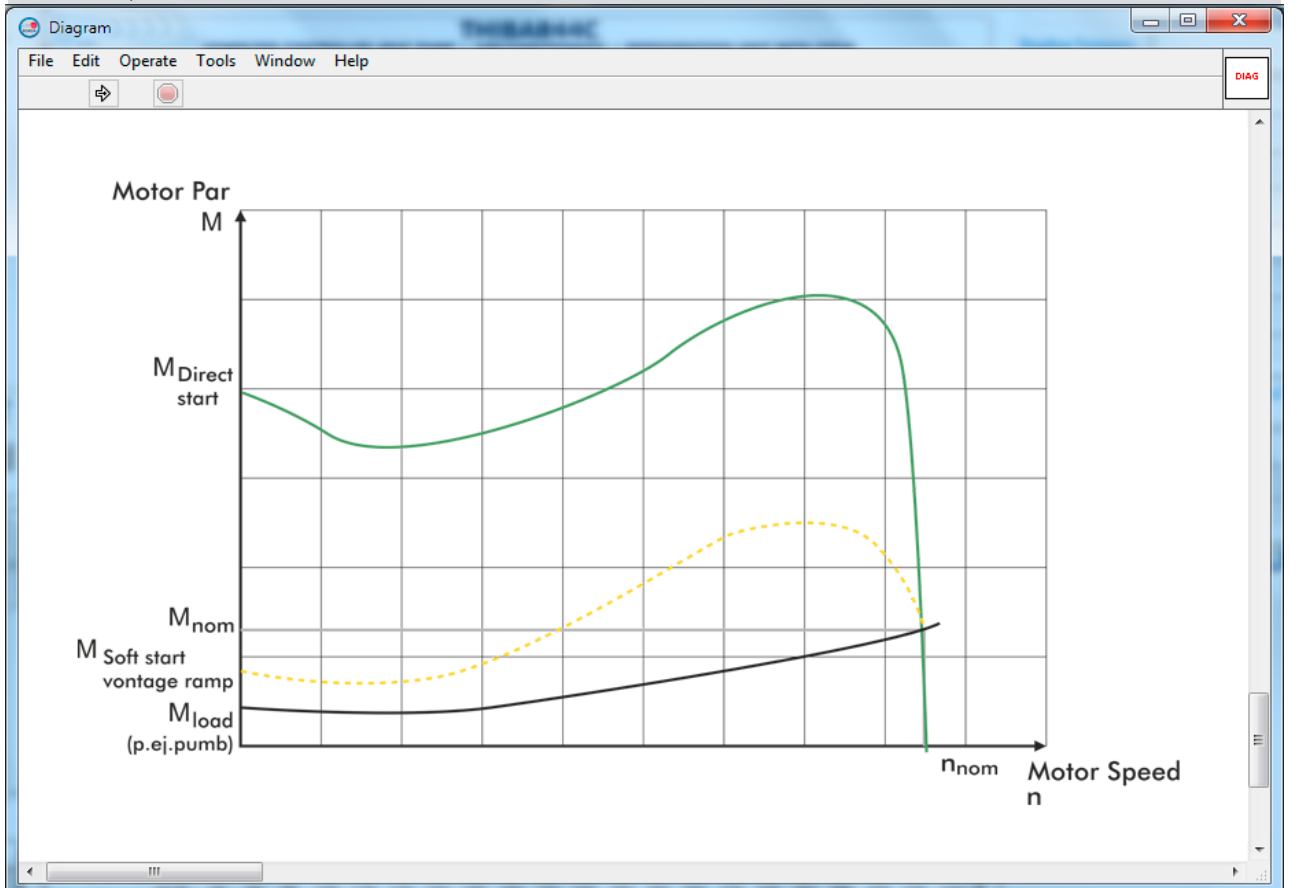Some results with EM-SCADA

Starting torque evolution with the induction motor
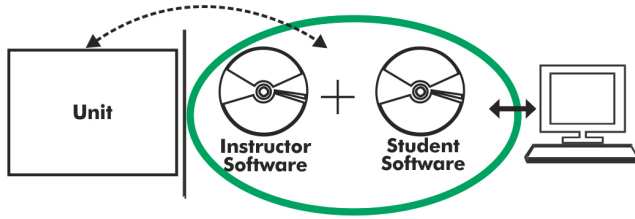

Reduced torque evolution of the induction motor with the soft starter.

AEL-EMSS/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.
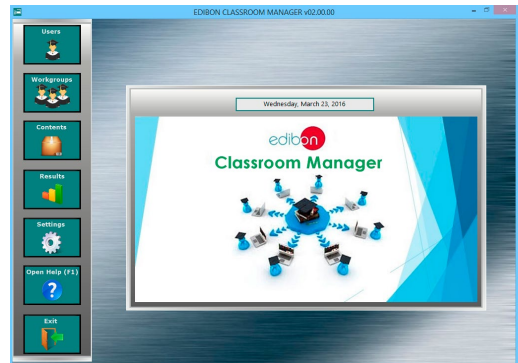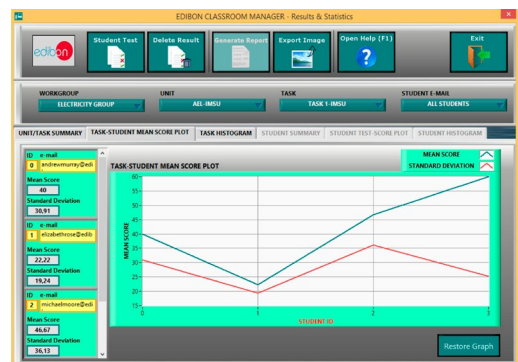

ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen
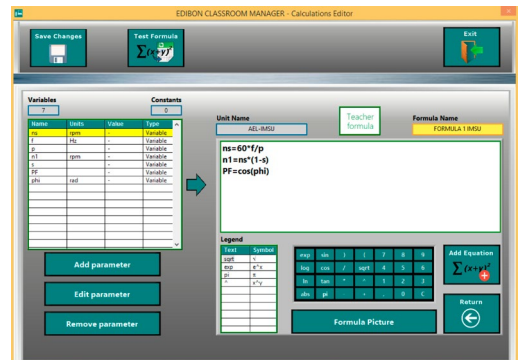
ECAL. EDIBON Calculations Program Package - Formula Editor Screen
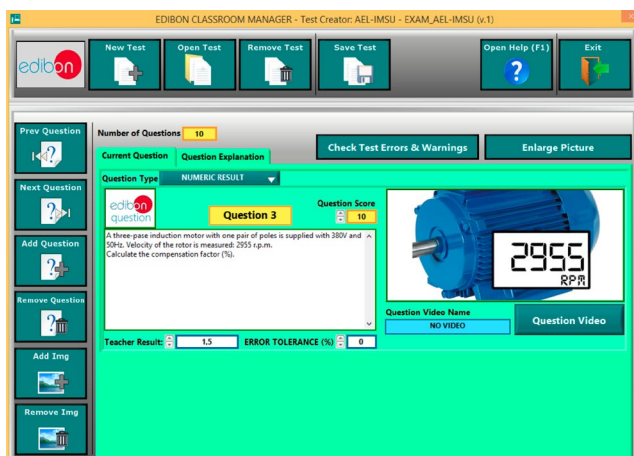
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

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

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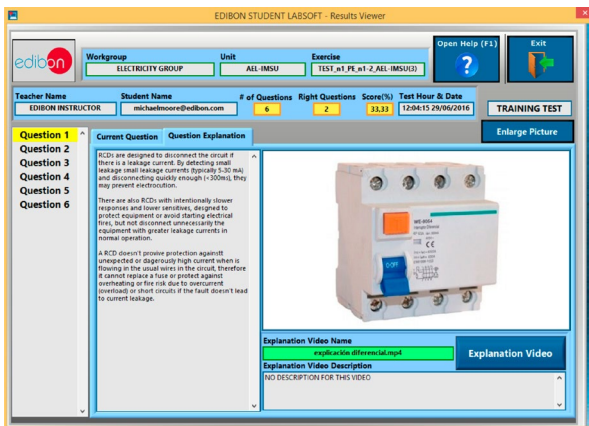
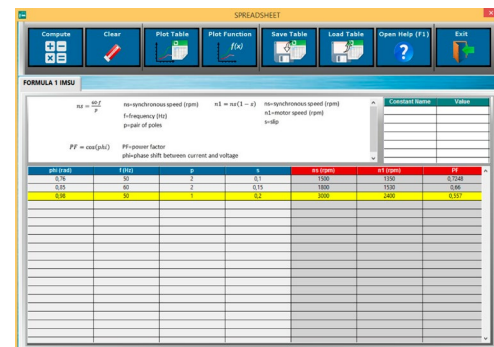**www.edibon.com/en/files/expansion/ICAI/catalog**

ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen
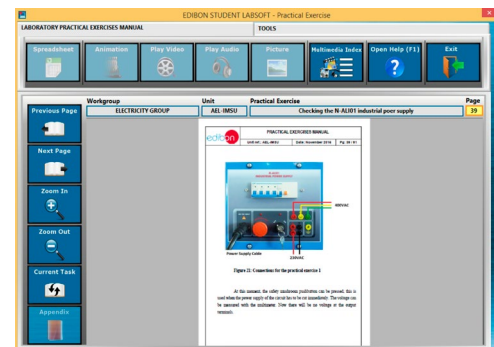
EPE. EDIBON Practical Exercise Program Package Main Screen

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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