Engineering and Technical
Teaching Equipment

Advanced AC Electrical Motors Application

AEL-ACEMT

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PRODUCTS
4.- ELECTRICITY

Configuration example of AEL-ACEMT application

INTRODUCTION

The use of AC motors is much more prevalent than DC motors due to several practical reasons. AC Motors are playing a vital role in daily life, right from pumping water to overhead tank to modern robotic arms for maneuvers. The main factor which leads to AC rotating machines adoption and wide use in various fields is its flexibility and its huge variety, which can be matched with almost any kind of demand.

Certificate of Approval of the Quality Management System

European Union Certificate
(total safety)

UL and CSA Regulations
(All our products are manufactured according to current UL and CSA regulations)

Certificate of Approval of the Environmental Management System

Worlddidac Association Certificate of Membership

GENERAL DESCRIPTION

The Advanced AC Electrical Motors Application, "AEL-ACEMT", has been designed by EDIBON to carry out electrical/mechanical test for a great variety of AC motors. Such tests allow obtaining the most significant electrical and mechanical characteristics of these motors .In addition, it is advisable to acquire the Control and Data Acquisition System Software for Electrical Machines, "EM-SCADA", with which the user will be able to obtain the characteristic curves for the tested electric motors and fulfill reports and comparisons of the obtained curves for each electric motor to study its advantages and application fields.

The "AEL-ACEMT" enables the user to learn in depth the behavior of a great range of AC motors, such as three-phase squirrel-cage induction motor, three-phase wound induction motor, three-phase squirrel-cage induction motor with two speeds, the Dahlander motor, the three-phase reluctance motor, the single-phase asynchronous motor with starting capacitor, the single-phase asynchronous motor with starting and running capacitor, the three-phase synchronous generator, etc.

For this purpose the application includes several elements such as a servomotor, single-phase and three-phase overcurrent relays and a series of measuring devices such as analog ammeters, a network analyzer, a multimeter and an optical speed meter. Dynamic braking tests can be carried out through the servomotor while parameters such as speed, electrical current, the voltage, the power factor or the active and reactive powers are measured.

For the fulfillment of electric motors advanced tests, it is advisable to acquire the Control and Data Acquisition System Software for Electrical Machines, "EM-SCADA". This advanced software allows monitoring the waveforms for current, voltage, torque and speed to study in depth the electric machines.

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

- N-ALI01. Industrial Main Power Supply Module.
- N-REL09. Time Electronic Relay against Overcurrents Module (0-16 A).
- N-REL60. Single-Phase Over / Undercurrent Relay Module.
- N-ARR12. Direct Starter Module.
- N-EALD. Electrical Network Analyzer Module with Oscilloscope and Data Acquisition.
- N-MED09. AC Ammeter Module (0-2.5 A).
- N-MED11. AC Ammeter Module (0-10 A).
- MED65. Digital Multimeter.
- TECNEL/TM. Hand Tachometer.
- N-SERV1K. 1 kW Servomotor Module.

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

ACEMT-K1: Three-Phase Asynchronous Motor of Squirrel Cage Kit.

- EMT7. 3PH Squirrel-Cage Motor.
- N-TRANS03. Three-Phase Autotransformer 400/230 VAC, 1 kVA, Module.
- N-ARR01. Manual Star-Delta Starter Module.

ACEMT-K1

ACEMT-K2: Three-Phase Asynchronous Motor of Wound Rotor Kit.

- EMT8. 3PH Wound Motor.
- N-TRANS03. Three-Phase Autotransformer 400/230 VAC, 1 kVA, Module.
- N-ARR01. Manual Star-Delta Starter Module.
- N-REFTI. Three-Phase Independent Resistor Module.

ACEMT-K2

ACEMT-K3: Three-Phase Dahlander Motor Kit.

- EMT9. Dahlander Motor, Two Speeds.
- N-ARR07. Manual Dahlander Commutator Module, Two Speeds.

ACEMT-K4: Three-Phase Asynchronous Motor of Two Independent Speeds Kit.

- EMT10. 3PH Squirrel-Cage Motor Module, Two Speeds.
- N-ARR09. Manual Independent Windings Commutator Module, Two Speeds.

ACEMT-K5: Single-Phase Asynchronous Motor with Starting Capacitor Kit.

- EMT11. 1PH Squirrel-Cage Motor with Starting Capacitor.

ACEMT-K6: Single-Phase Asynchronous Motor with Starting and Running Capacitor Kit.

- EMT16. 1PH Squirrel-Cage Motor with Starting and Running Capacitor.

ACEMT-K7: Single-Phase Asynchronous Motor with Split Phase Kit.

- EMT20. Asynchronous Single-Phase Motor with Split Phase.

ACEMT-K8: Three-phase Reluctance Motor Kit.

- EMT21. 3PH Reluctance Motor.

ACEMT-K9: Three-Phase Synchronous Generator Kit.

- EMT6. Independent Excitation 3PH Synchronous Motor-Generator.
- N-WCC/M. DC Motor Speed Controller Module (Intermediate option).
- N-REFTI. Three-Phase Independent Resistor Module.

ACEMT-K9

Additional recommended elements (Not included):

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines.
- N-DMC01. Double Measurement and Control Module 1.
- N-WCA. Advanced AC Motor Speed Controller Module.

The application "AEL-ACEMT" 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.

SPECIFICATIONS

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

- N-ALI01. **Industrial Main Power Supply Module.**
  Supply voltage: 400 VAC, 3PH + N.
  ON / OFF removable key.
  Output voltage connections:
  Three-Phase + Neutral: 400 VAC.
  Single-Phase: 230 VAC.
  Three-Phase supply hose with IP44 3PN + E 32 A 400 V connecting plug.
  Differential magnetothermal 4 poles, 25 A, 300 mA AC 6 KA.
  Emergency stop push-button.


N-ALI01

- N-REL09. **Time Electronic Relay against Overcurrents Module (0-16 A).**
  Overcurrent electronic relay.
  Overload protection.
  Range: 0 – 16 A.
  Test and reset function.
  NO / NC contact.
  Timing.


N-REL09

- N-REL60. **Single-Phase Over / Undercurrent Relay Module.**
  Overcurrent electronic relay.
  Range: 0.05 – 10 A.
  Reset and test function.
  NO / NC contact.
  Timing.


N-REL60

- N-ARR12. **Direct Starter Module.**
  Nominal voltage: 400 VAC.
  Maximum contacts current: 10 A.
  Two positions commutator (ON / OFF):
  0: Open circuit.
  1: Closed circuit.


N-ARR12

- N-EALD. **Electrical Network Analyzer Module with Oscilloscope and Data Acquisition.**
  The network analyzer module allows fulfilling measurements, displaying and analyzing all the parameters of the AC electrical networks. It has an LCD screen and push-buttons for the navigation through the different menus. It includes specific software for monitoring current and voltage curves, harmonics display, tariffs programming, alarms programming and electrical parameters storage.
  Features:
  Multifunctional three-phase power meter:
  Three-phase and single-phase voltage. Up to 690 VAC L-L.
  Line and neutral nominal current: 10 A.
  Active, reactive and apparent power.
  Suitable frequencies: 25 Hz, 50 Hz, 60 Hz and 400 Hz.
  Display of the V-I vector diagram.
  Supply voltage: 85 – 265 VAC.
  Energy quality control:
  Current and voltage individual harmonics measurement. Up to the 40th harmonic.
  Voltage and current THD, TDD and K-Factor.
  Maximums and minimums display.
  Waveforms display, 128 samples/sec.
  Events and data storage:
  Harmonics analyzer:
  Voltage and current THD, current TDD and K-Factor, up to the 40th harmonic.
  Current and voltage harmonic spectrum and angles.
  Tariff programming:
  Class 0.5S IEC 62053 – 22, active and reactive power in four quadrants.
  Measurement of the total and per phase three-phase active, reactive and apparent powers.
  Usage time, four energy/demand records of total tariffs.
  Eight tariffs, four seasons and four types of days.
  Automatic daily report of energy consumption maximums and minimums.
  Communications:
  RS – 485 communication port.


N-EALD

- N-MED09. **AC Ammeter Module (0-2.5 A).**
  Measurement range: 0 – 2.5 A.
  Terminals:
  Measurement terminals.


N-MED09

- N-MED11. **AC Ammeter Module (0-10 A).**
  Measuring range: 0 – 10 A.
  Terminals:
  Measurement terminals.


N-MED11

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


MED65

- TECNEL/TM. **Hand Tachometer.**
  9 V battery.
  Three positions switch to choice the measurement method.
  Speed recording push-button.
  Speed measurement push-button.
  Disassemble pieces for different shafts.
  Speed digital display.


TECNEL/TM

- N-SERV1K. **1 kW Servomotor Module.**
  Dynamic and static operating regime in four quadrants.
  Speed and torque signals.
  Power supply terminals: 3 x 400 VAC.
  Frequency: 50 / 60 Hz.
  Nominal power: 1 kW.
  Maximum power: 3 kW.
  Maximum speed: 5000 rpm.
  Nominal torque: 3.18 Nm.
  Maximum torque: 9.55 Nm.
  Temperature control.
  Speed control potentiometer.
  Torque control potentiometer.
  Mode selection switch: torque/speed control.
  Motor turning reversal switch.


N-SERV1K

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

ACEMT-K1:Three-Phase Asynchronous Motor of Squirrel Cage Kit.

- EMT7. **3PH Squirrel-Cage Motor.**
  Nominal power: 370 W.
  Nominal voltage: 3 x 230 / 400 VAC Δ / Y.
  Frequency: 50 / 60 Hz.
  Number of poles: 2.
  Speed: 2730 rpm.
  Shaft height: 71 mm.


EMT7

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


N-TRANS03

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


N-ARR01

ACEMT-K2: Three-Phase Asynchronous Motor of Wound Rotor Kit.

- EMT8. **3PH Wound Motor.**
  Nominal power: 300 W.
  Nominal voltage: 3 x 230 / 400 VAC Δ / Y.
  Frequency: 50 / 60 Hz.
  Number of poles: 2.
  Speed: 2870 rpm.
  Nominal current: 1 / 0.5 A.
  Shaft height: 71 mm.


EMT8

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


N-TRANS03

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


N-ARR01

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


N-REFTI

ACEMT-K3: Three-Phase Dahlander Motor Kit.

- EMT9. **Dahlander Motor, Two Speeds.**
  Nominal power: 370 W.
  Nominal voltage: 3 x 400 VAC.
  Frequency: 50 / 60 Hz.
  Number of poles: 4 / 2.
  Speed: 1400 / 2800 rpm.
  Nominal current: 1.2 / 1.55 A.
  Shaft height: 71 mm.


EMT9

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


N-ARR07

ACEMT-K4: Three-Phase Asynchronous Motor of Two Independent Speeds Kit.

- EMT10. **3PH Squirrel-Cage Motor, Two Speeds.**
  - Nominal power: 240 / 370 W.
  - Nominal voltage: 3 x 400 VAC.
  - Frequency: 50 / 60 Hz.
  - Speed: 900 / 1420 rpm.
  - Nominal current: 1.05 / 1.35 A.
  - Shaft height: 71 mm.

EMT10

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

N-ARR09

ACEMT-K5: Single-Phase Asynchronous Motor with Starting Capacitor Kit.

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

EMT11

ACEMT-K6: Single-Phase Asynchronous Motor with Starting and Running Capacitor Kit.

- EMT16. **1PH Squirrel-Cage Motor with Starting and Running Capacitor.**
  - Supply voltage: 110 – 220 VAC.
  - Power: 370 W.
  - Speed: 2780 rpm.
  - Frequency: 50 / 60 Hz.
  - Armature current: 1.85 A.
  - Shaft height: 71 mm.

EMT16

ACEMT-K7: Single-Phase Asynchronous Motor with Split Phase Kit.

- EMT20. **Asynchronous Single-phase Motor with Split Phase.**
  - Supply voltage: 220 VAC.
  - Power: 370 W.
  - Speed: 2780 rpm.
  - Frequency: 50 Hz.
  - Armature current: 2.53 A.
  - Shaft height: 71 mm.

EMT20

ACEMT-K8: Three-phase Reluctance Motor Kit.

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

EMT21

ACEMT-K9: Three-Phase Synchronous Generator Kit.

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

EMT6

- N-WCC/M. **DC Motor Speed Controller Module (Intermediate option).**

  Supply voltage: 230 VAC.

  Variable output voltage: 0 – 300 VDC.

  Fuse: 2 A.

N-WCC/M

- N-REFTI. **Three-phase Independent Resistor Module.**

  Nominal voltage: 400 VAC.

  Resistor value: 3 x 150 Ohm.

  Nominal power: 3 x 352 W.

  Manual commutator to switch ON / OFF the resistors.

  Fuses: 3 x 5 A.

  Terminals:

  Three input terminals (3PH).

  Three output terminals (3PH).

N-REFTI

Additional recommended elements (Not included):

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

  Power supply: 230 VAC.

  Input signals:

  Current signal (x2).

  RMS current signal (x2).

  Voltage signal (x2).

  RMS voltage signal (x2).

  Torque and speed signals.

  Output signals:

  Torque control signal for the servomotor.

  Speed control signal for the servomotor.

  The three softwares are part of the SCADA system.

  Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen. Compatible with the industry standards.

  Registration and visualization of all process variables in an automatic and simultaneous way.

  Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.

  Management, processing, comparison and storage of data.

  It allows the registration of the alarms state and the graphic representation in real time.

  Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

  Open software, allowing the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.

  This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

EM-SCADA

- N-DMC01. **Double Measurement and Control Module 1.**

  Digital torque meter:

  Torque signal connector.

  Auxiliary contact NO.

  Digital speed meter:

  Speed signal connector.

  Auxiliary contact NO.

  IP66 protection.

N-DMC01

N-VVCA

- N-VVCA. **Advanced AC Motor Speed Controller Module.**
  - Supply voltage: 230 VAC.
  - Nominal power: 0.75 kW.
  - PWM output voltage connections:
    - Three-Phase: 230 VAC.
  - Digital inputs control panel: five configurable digital inputs.
  - Analog inputs control panel:
    - 0 –10 V analog input for speed control.
    - 4 – 20 mA analog input for speed control.
  - 10 K potentiometer for speed control of induction motor.
  - Two relay outputs for alarms configuration: two outputs NO / NC.
  - Two 50 mA transistor outputs for alarm configuration.
  - Setting and visualization display of the machine parameters.

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

Cables and accessories, for normal operation.

Manuals:

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

Some practical possibilities with Three-Phase Asynchronous Motor Squirrel Cage Kit (ACEMT-K1):

1.- Advanced frequency controller wiring and start-up. (Optional).

2.- Advanced frequency controller programming. (Optional).

3.- Three-Phase Asynchronous Squirrel Cage Motor speed control through the frequency controller. (Optional).

4.- Direct starting of the Three-Phase Asynchronous Motor of Squirrel Cage.

5.- Star-delta starting of the Three-Phase Asynchronous Motor of Squirrel Cage.

6.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of the Three-Phase Asynchronous Motor of Squirrel cage.

7.- Speed digital measurement of the Three-Phase Asynchronous Motor of Squirrel cage.

8.- Braking test with the servomotor for the Three-Phase Asynchronous Squirrel Cage Motor controlled by the frequency controller.

9.- Three-Phase ovecurrent protection calibration and testing.

Some practical possibilities with Three-Phase Asynchronous Motor of Wound Rotor Kit (ACEMT-K2):

10.- Advanced frequency controller wiring and start-up. (Optional).

11.- Advanced frequency controller programming. (Optional).

12.- Three-Phase Asynchronous Motor of Wound Rotor speed control through the frequency controller. (Optional).

13.- Direct starting of the Three-Phase Asynchronous Motor of Wound Rotor.

14.- Star-delta starting of the Three-Phase Asynchronous Motor of Wound Rotor.

15.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of the Three-Phase Asynchronous Motor of Wound Rotor.

16.- Speed digital measurement of the Three-Phase Asynchronous Motor of Wound Rotor.

17.- Braking test with the servomotor for the Three-Phase Asynchronous Motor of Wound Rotor controlled by the frequency controller.

18.- Three-Phase ovecurrent protection calibration and testing.

Some practical possibilities with Three-Phase Dahlander Motor Kit (ACEMT-K3):

19.- Wiring of the Three-Phase Dahlander Motor and the manual commutator of two speeds.

20.- Direct starting of the Three-Phase Dahlander Motor.

21.- Manual change of the Three-Phase Dahlander Motor speed.

22.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of the Three-Phase Dahlander Motor.

23.- Speed digital measurement of the Three-Phase Dahlander Motor.

24.- Braking test with the servomotor for the Three-Phase Dahlander Motor.

25.- Three-Phase ovecurrent protection calibration and testing.

Some practical possibilities with Three-Phase Asynchronous Motor of two independent speeds Kit (ACEMT-K4):

26.- Wiring of the Three-Phase Asynchronous Motor of Two Independent Speeds and the independent windings manual commutator.

27.- Direct starting of the Three-Phase Asynchronous Motor of Two Independent Speeds.

28.- Manual change of the Three-Phase Asynchronous Motor of Two Independent Speeds.

29.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of the Three-Phase Asynchronous Motor of Two Independent Speeds.

30.- Speed digital measurement of the Three-Phase Asynchronous Motor of Two Independent Speeds.

31.- Braking test with the servomotor for the Three-Phase Asynchronous Motor of Two Independent Speeds.

32.- Three-Phase overcurrent protection calibration and testing.

Some practical possibilities with Kit Moteur Asynchrone Monophasé avec Condensateur de Démarrage (ACEMT-K5):

33.- Wiring of the Single-Phase Asynchronous Motor with Starting Capacitor.

34.- Direct starting of the Single-Phase Asynchronous Motor with Starting Capacitor.

35.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of the Single-Phase Asynchronous Motor with Starting Capacitor.

36.- Speed digital measurement of the Single-Phase Asynchronous Motor with Starting Capacitor.

37.- Braking test with the servomotor for the Single-Phase Asynchronous Motor with Starting Capacitor.

38.- Single-phase overcurrent protection calibration and testing.

Some practical possibilities with Kit Moteur Asynchrone Monophasé avec Condensateur de Démarrage et de Marche (ACEMT-K6):

39.- Wiring of the Single-Phase Asynchronous Motor with Starting and Running Capacitor.

40.- Direct starting of the Single-Phase Asynchronous Motor with Starting and Running Capacitor.

41.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of the Single-Phase Asynchronous Motor with Starting and Running Capacitor.

42.- Speed digital measurement of the Single-Phase Asynchronous Motor with Starting and Running Capacitor.

43.- Braking test with the servomotor for the Single-Phase Asynchronous Motor with Starting and Running Capacitor.

44.- Single-phase overcurrent protection calibration and testing.

Exercises and Practical Possibilities

Some practical possibilities with Kit Moteur Asynchrone Monophasé Split Phase (ACEMT-K7):

45.- Wiring of the Single-Phase Asynchronous Motor with Split Phase.

46.- Direct starting of the Single-Phase Asynchronous Motor with Split Phase.

47.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of the Single-Phase Asynchronous Motor with Split Phase.

48.- Speed digital measurement of the Single-Phase Asynchronous Motor with Split Phase.

49.- Braking test with the servomotor for the Single-Phase Asynchronous Motor with Split Phase.

50.- Single-phase overcurrent protection calibration and testing.

Some practical possibilities with Kit Moteur à Réluctance Triphasé (ACEMT-K8):

51.- Wiring of the Three-Phase Reluctance Motor.

52.- Direct starting of the Three-Phase Reluctance Motor.

53.- Measuring of Voltages, Currents, Active Power, Reactive Power, Power Factor, etc. of the Three-Phase Reluctance Motor.

54.- Speed digital measurement of the Three-Phase Reluctance Motor.

55.- Braking test with the servomotor for the Three-Phase Reluctance Motor.

56.- Three-Phase ovecurrent protection calibration and testing.

Some practical possibilities with Kit Générateur Synchrone Triphasé (ACEMT-K9):

57.- Wiring of the Three-Phase Synchronous Generator.

58.- Study of the parameters to be controlled in an Three-Phase Synchronous Generator.

59.- Study of the speed vs voltage at the Three-Phase Synchronous Generator output with a constant excitation current.

60.- Study of the excitation current vs voltage at the Three-Phase Synchronous Generator output with constant frequency.

61.- Study of the voltage drop in the under loaded Three-Phase Synchronous Generator.

Practical exercises with the recommended Control and Data Acquisition System Software for Electrical Machines, with SCADA, "EM-SCADA":

62.- Real time torque measurement.

63.- Real time speed measurement.

64.- Real time current and voltage RMS values.

65.- Real time current and voltage waveforms measurement.

66.- Electrodynamical study of the motor.

67.- Obtaining characteristic curves (torque-speed curve, torque-current curve etc).

68.- Obtaining the saved results.

69.- Braking test and real time monitoring of the results.

- Several other exercises can be done and designed by the user.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

AEL-ACEMT:

- Dimensions: 1380 x 840 x 2010 mm approx.
  (54.33 x 33.07 x 79.13 inches approx.)
- Weight: 80 Kg approx.
  (176 pounds approx.)

REQUIRED ELEMENTS (Not included)

Required (at least one):

- ACEMT-K1. Three-Phase Asynchronous Motor of Squirrel Cage Kit.
- ACEMT-K2. Three-Phase Asynchronous Motor of Wound Rotor Kit.
- ACEMT-K3. Three-Phase Dahlander Motor Kit.
- ACEMT-K4. Three-Phase Asynchronous Motor of Two Independent Speeds Kit.
- ACEMT-K5. Single-Phase Asynchronous Motor with Starting Capacitor Kit.
- ACEMT-K6. Single-Phase Asynchronous Motor with Starting and Running Capacitor Kit.
- ACEMT-K7. Single-Phase Asynchronous Motor with Split Phase Kit.
- ACEMT-K8. Three-phase Reluctance Motor Kit.
- ACEMT-K9. Three-Phase Synchronous Generator Kit.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines.
- N-DMC01. Double Measurement and Control Module 1.
- N-VVCA. Advanced AC Motor Speed Controller Module.

SIMILAR UNITS AVAILABLE

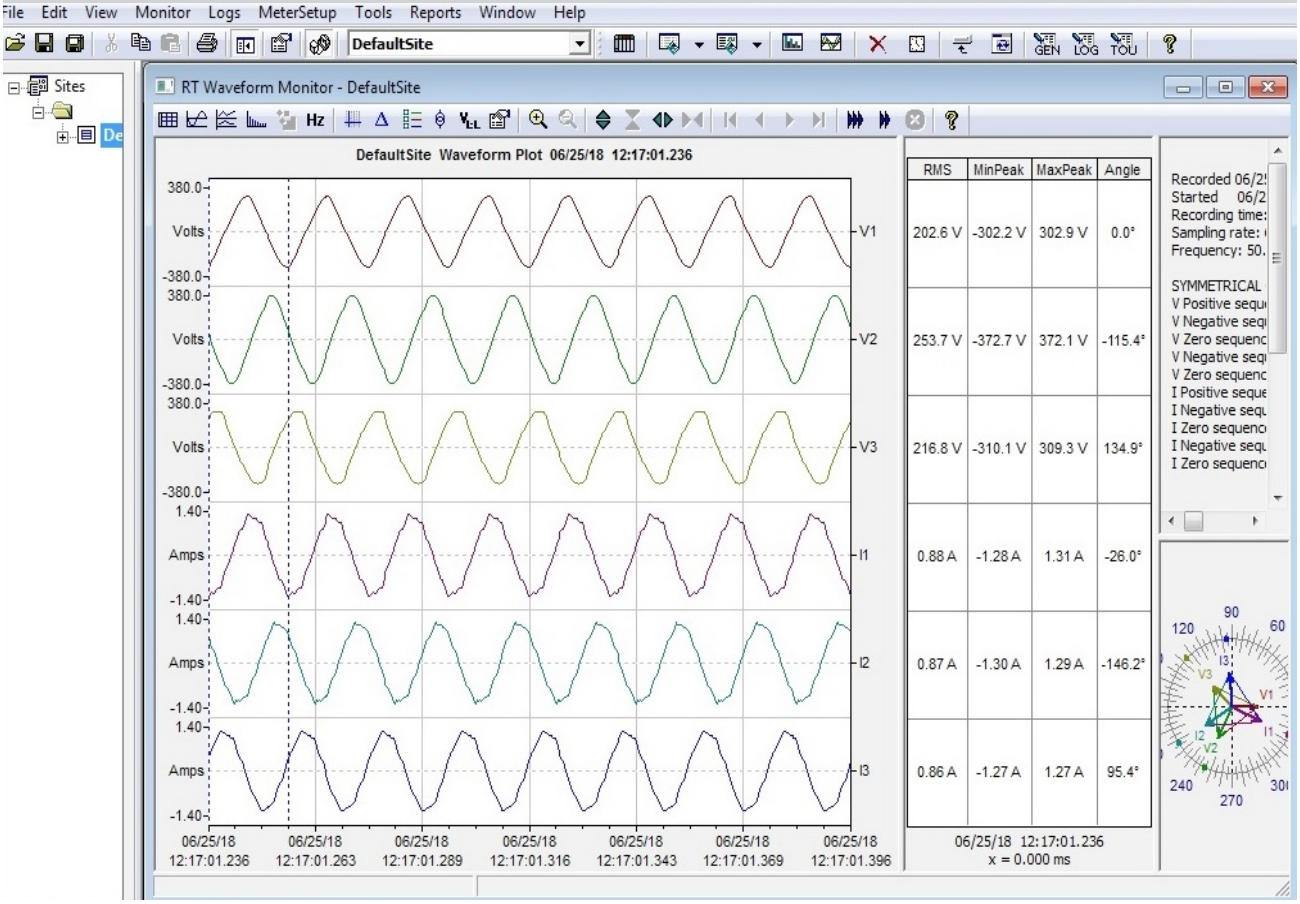
Offered in this catalog:

- AEL-ACEMT. Advanced AC Electrical Motors Application.

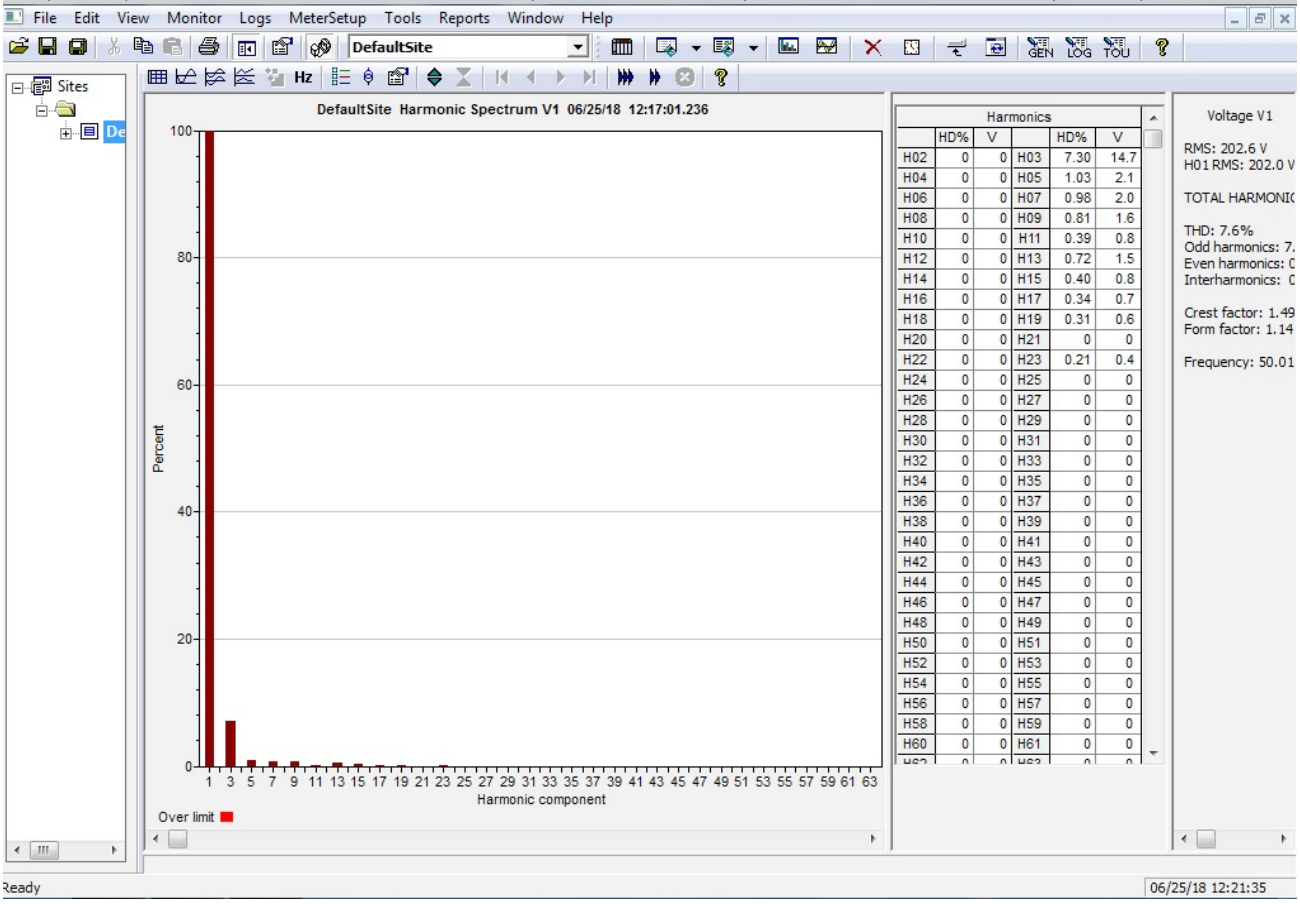
Offered in other catalogs:

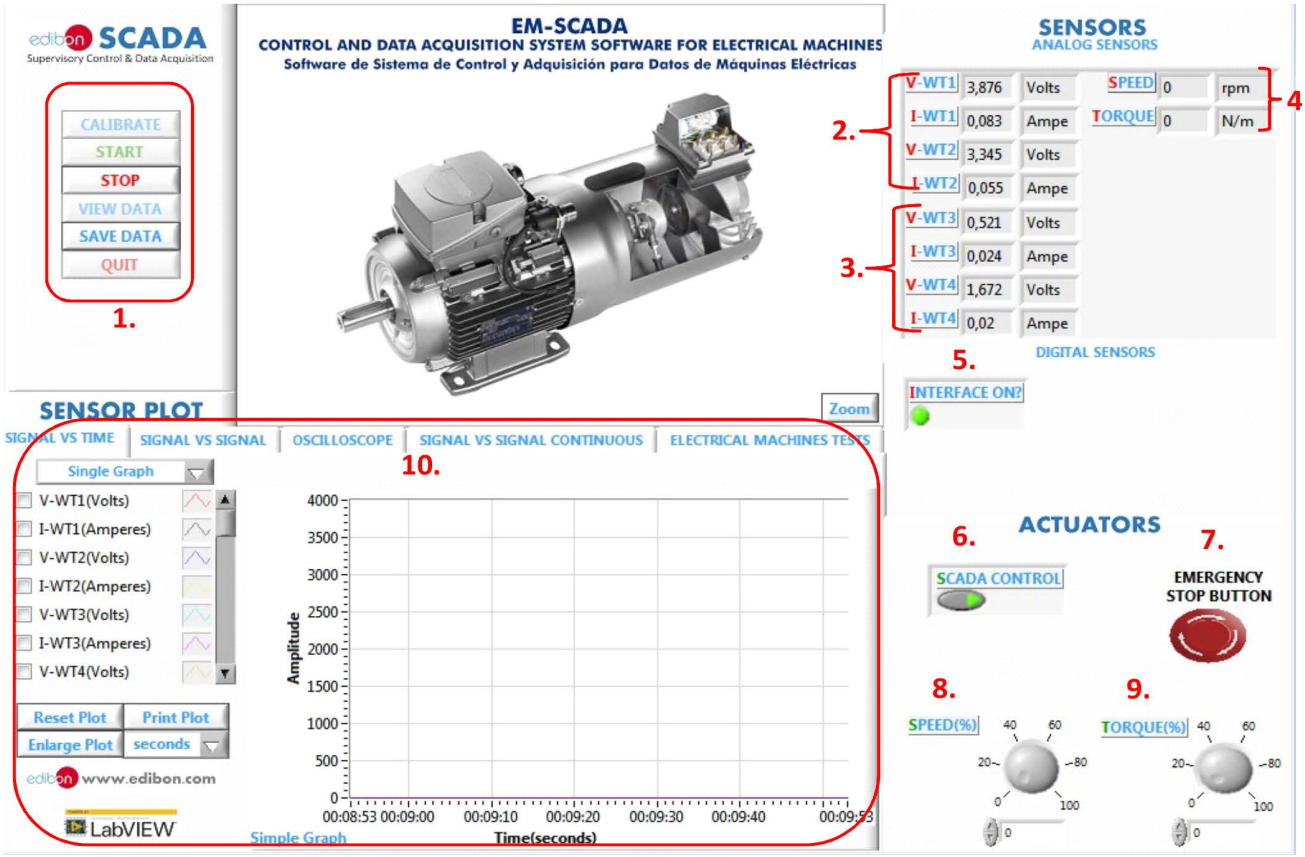
- AEL-ACEM. AC Three-Phase Induction Motors Application.
- AEL-ACINA. Application of AC Three-Phase Induction Motor of Squirrel Cage.

Graphical representation of the waveform of the currents and voltages measured in real time by the analyser, showing the angular, maximum, minimum and effective (RMS) values, and the phasors corresponding to such electrical parameters.



Graphical representation and data table of the harmonic spectrum of the selected parameter measured in real time by the analyzer.





① **Main menu.** Start-up, stop, view data, save data and quit.

② **RMS voltages and currents measurements.** It shows the effective values for the real time measured voltages and currents.

③ **Real voltages and currents measurements.** It shows the exact values for the real time measured voltages and currents.

④ **Torque and speed measurements.** It shows the machine torque and speed real time values.

⑤ **Interface connected warning switch.** The green pilot means the right operation of the control-interface box.

⑥ **SCADA control switch.** To enable the actuators control from the software.

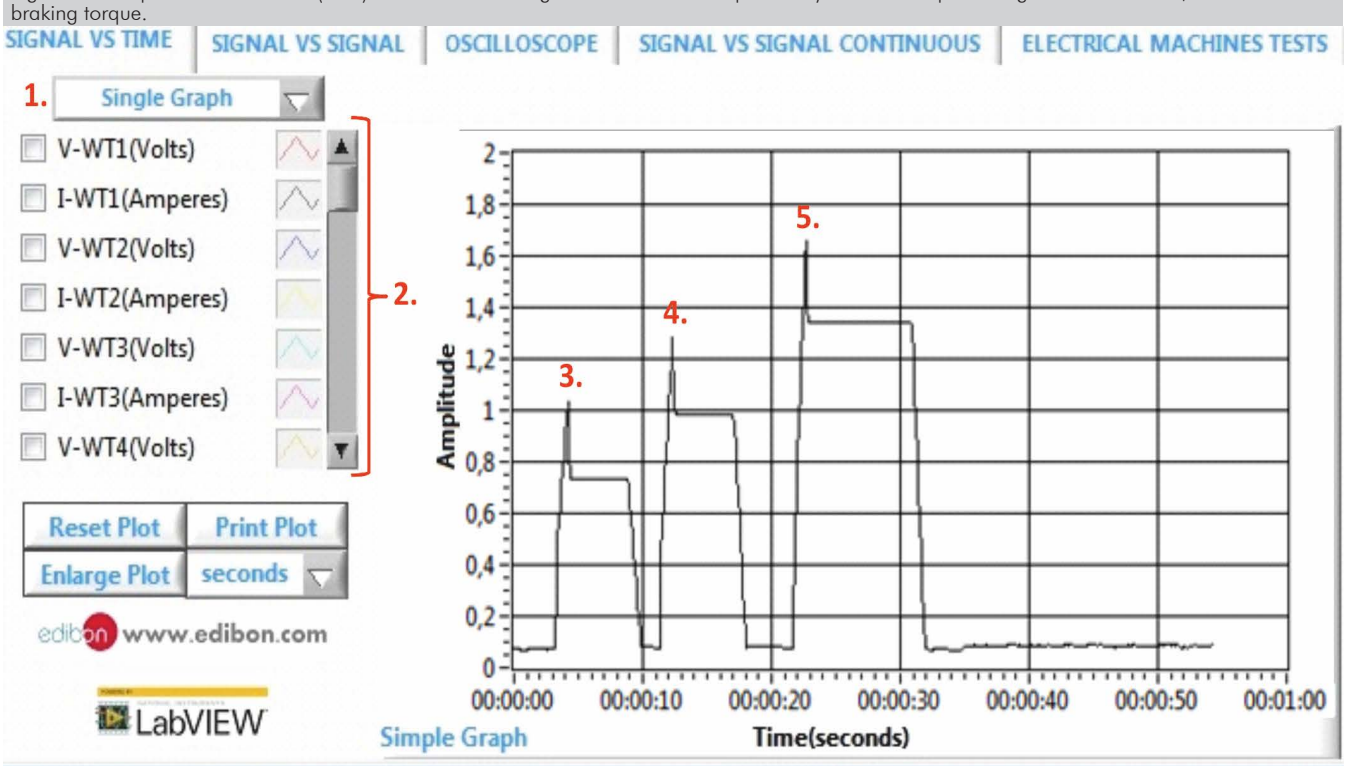
⑦ **Emergency stop buttton.**

⑧ **Speed actuator.** In order to set the desired speed value through the potentiometer or entering the exact value.

⑨ **Torque actuator.** In order to set the desired torque value through the potentiometer or entering the exact value.

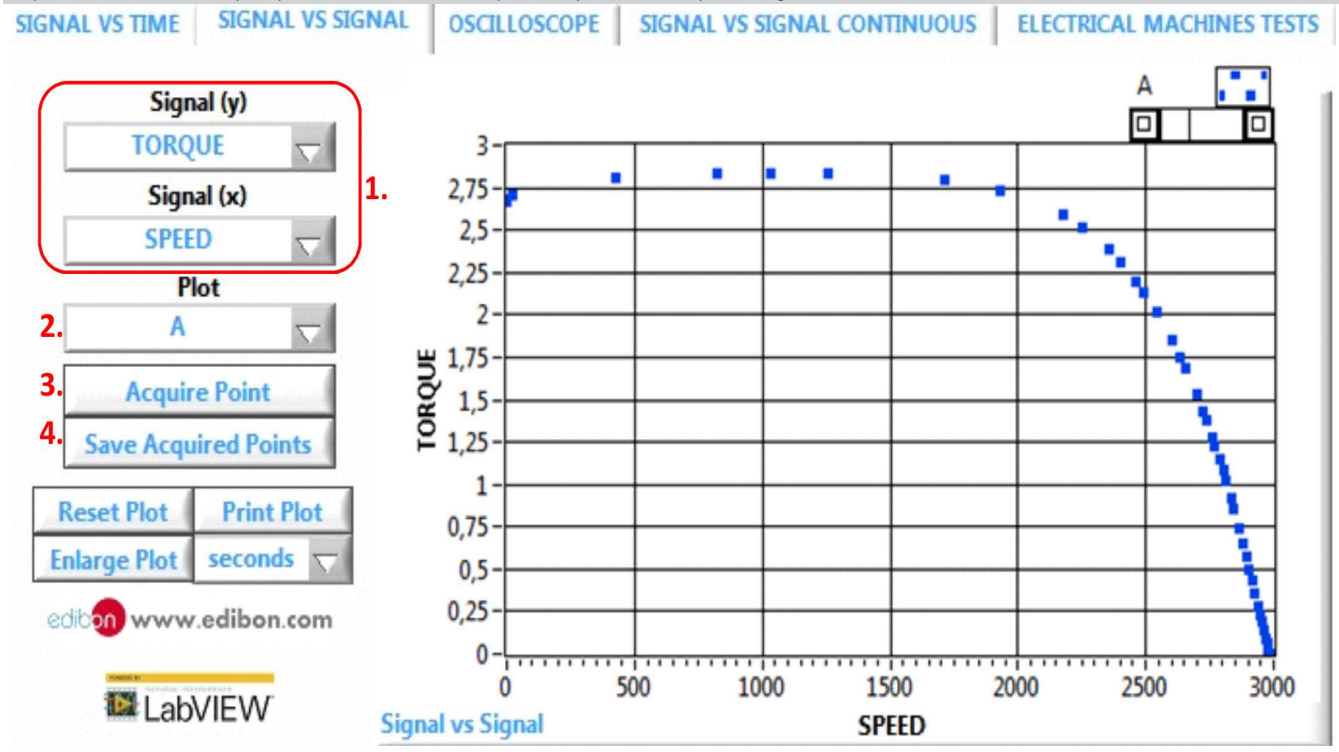
⑩ **Screen selector.**

Signal vs time plot of the effective (RMS) value of the starting current of the three-phase asynchronous squirrel-cage motor for 10 %, 20 % and 30 % braking torque.



① **Type of graph selector.** Simple or several signals overlapping.
② **Parameters selection.** It allows choosing the parameters to be displayed and the setting for its display.
③ **Starting current with 10 % of brake torque.**
④ **Starting current with 20 % of brake torque.**
⑤ **Starting current with 30 % of brake torque.**

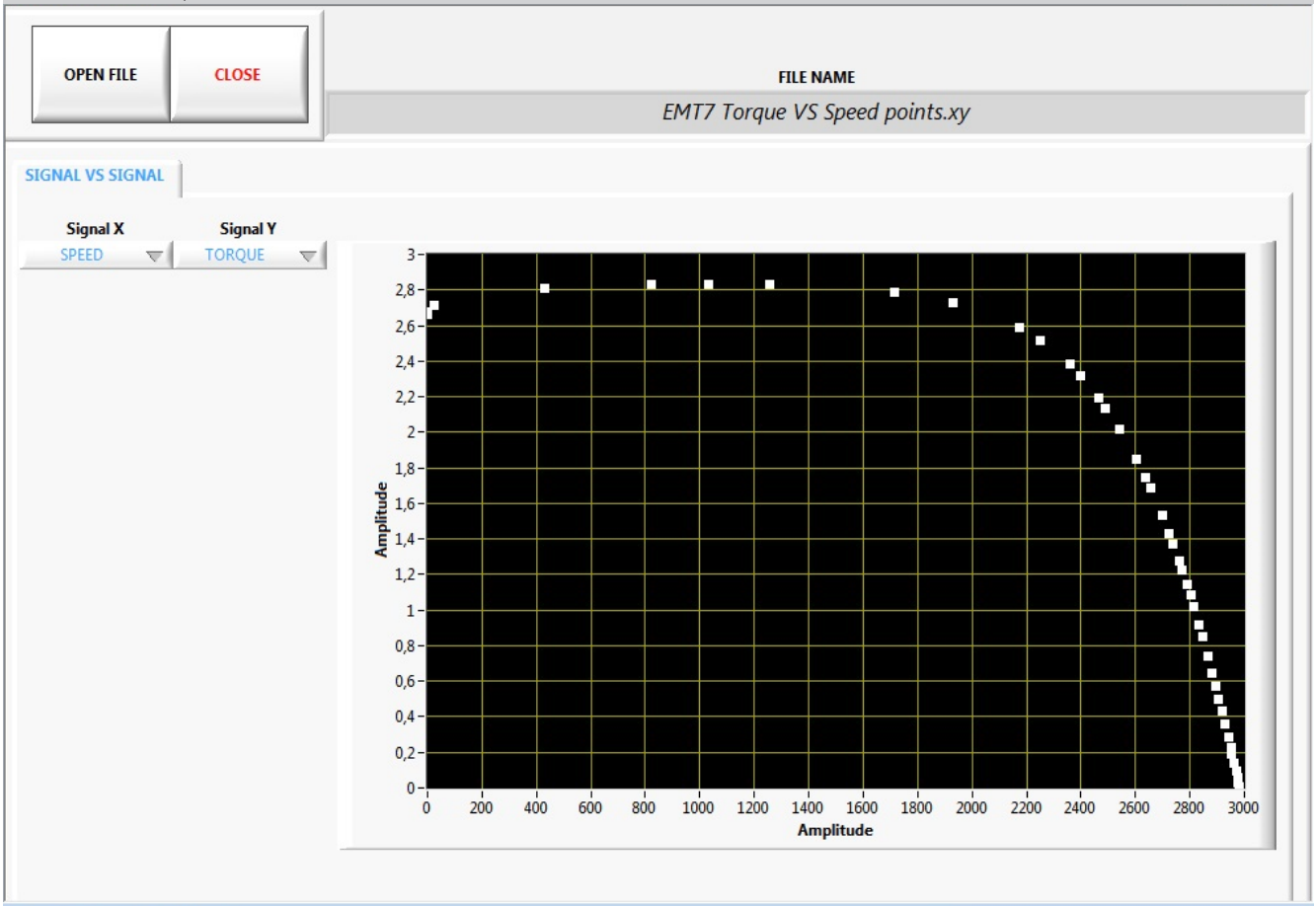
Representation of the torque-speed curve for the three-phase asynchornous squirrel cage motor.



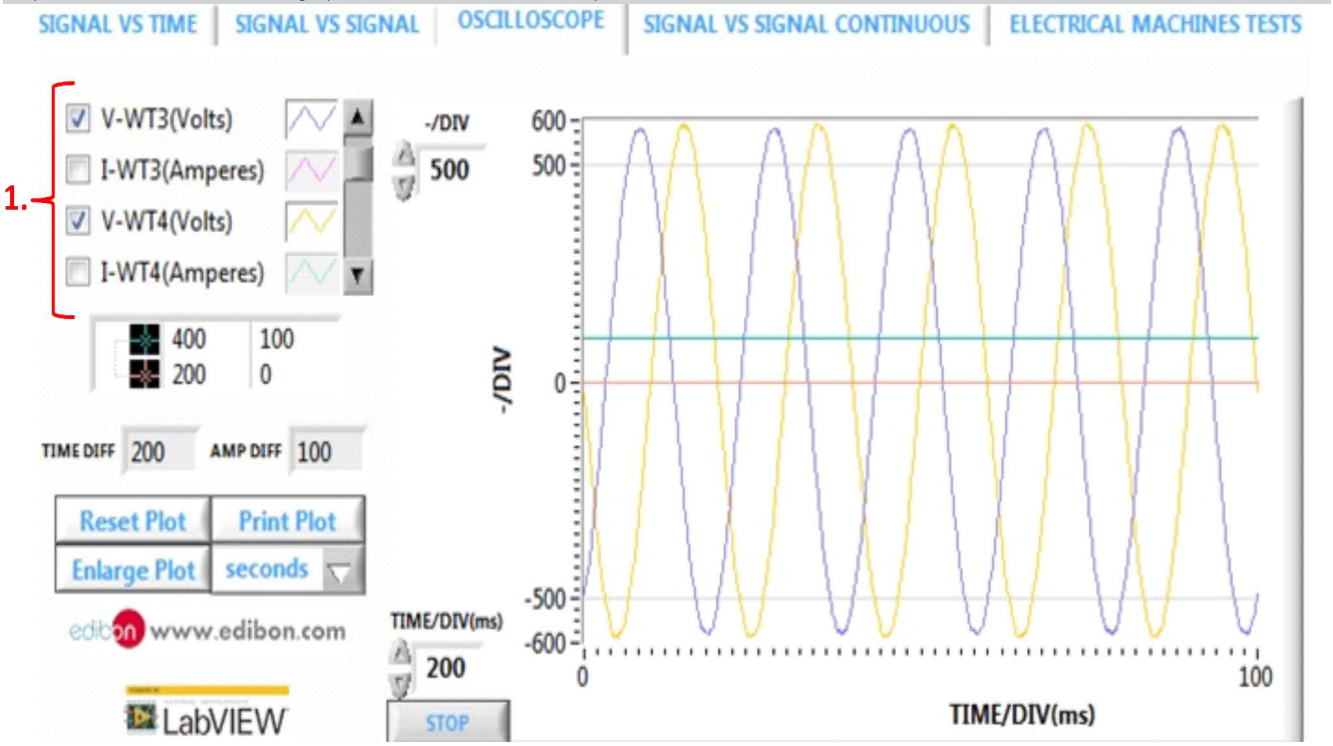
① **Axis signal selector.** It allows selecting the parameter to be monitored in each axis.
② **Type of graph selector.**
③ **Acquire points.** It allows displaying in the graph the point corresponding to the time when it is pressed.
④ **Save acquired points.** It allows saving the acquired points, which will start erasing automatically after 500 samples.

Some **real** results obtained from this unit with the software **EM-SCADA**

Visualisation and representation of saved data.



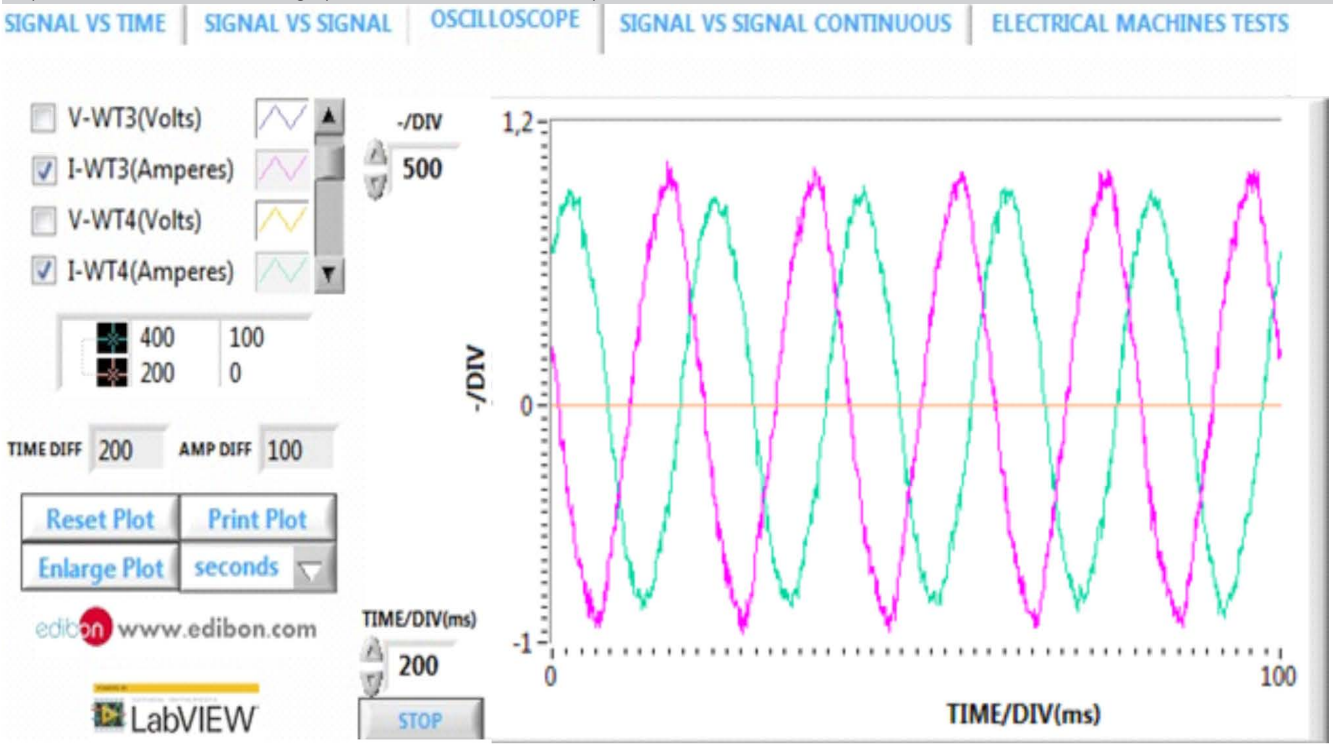
Representation of the waveform graph of the currents measured by the interface in real time.



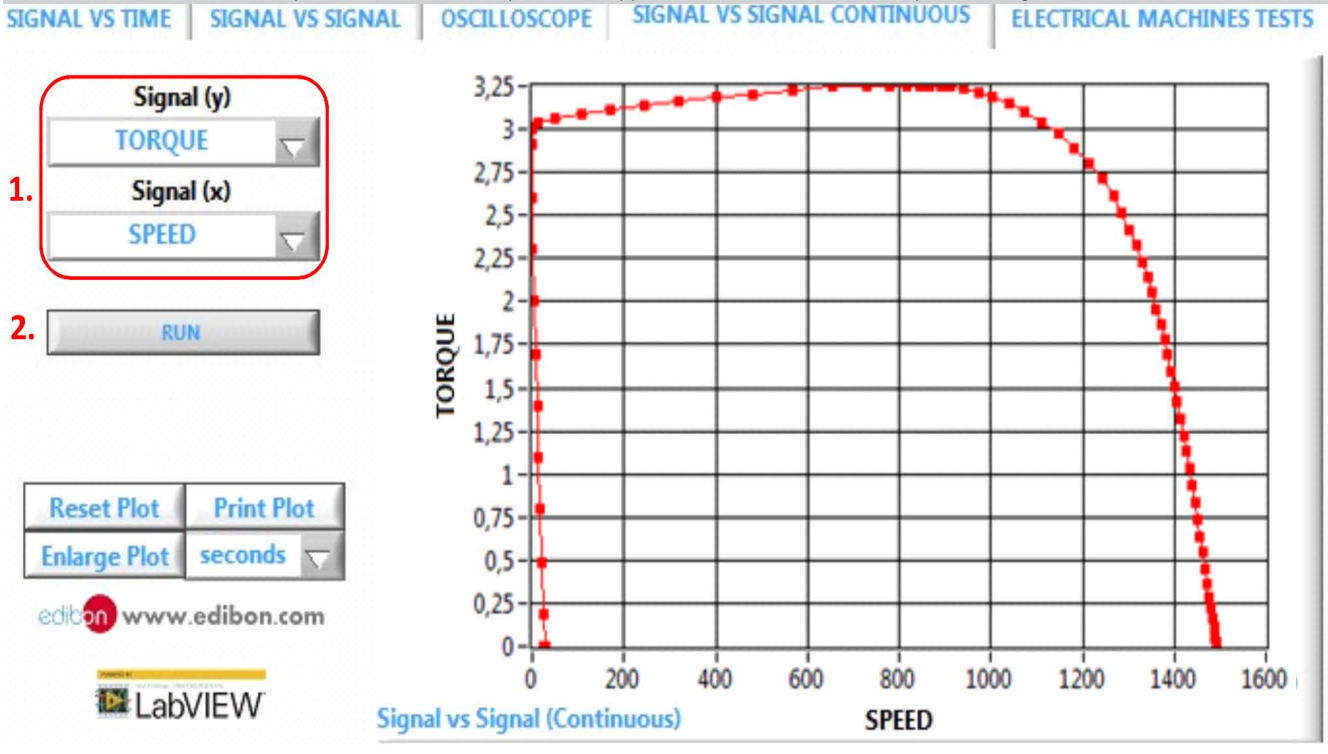
ⓘ **Parameters selector.** It allows choosing the parameters whose waveforms want to be displayed.

Some **real** results obtained from this unit with the software **EM-SCADA**

Representation of the waveform graph of the currents measured by the interface in real time.



Representation of the torque-speed curve of the manual braking test with the two-speed three-phase asynchronous motor, first speed (1500 rpm). Notice that the motor nominal speed and maximum torque can be appreciated, as well as motor complete braking.

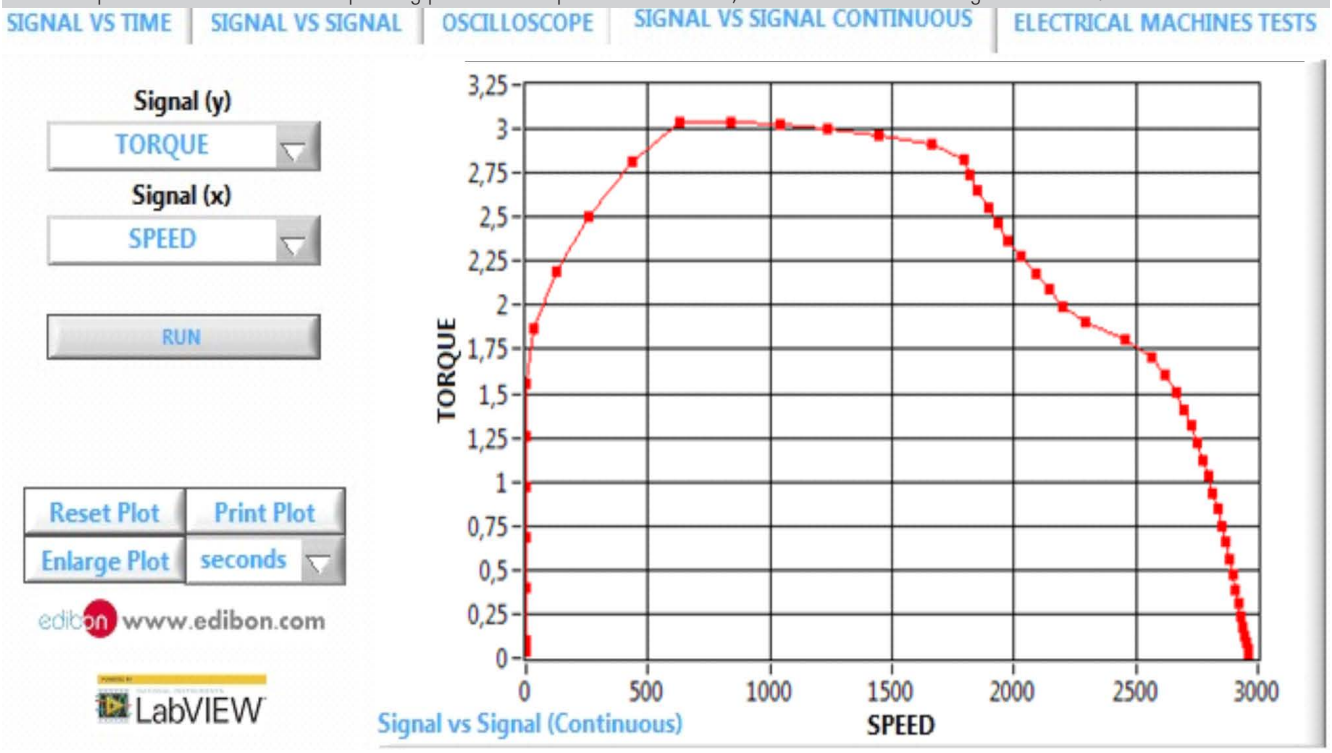


① **Axis signal selector.** It allows selecting the parameter to be monitored in each axis.

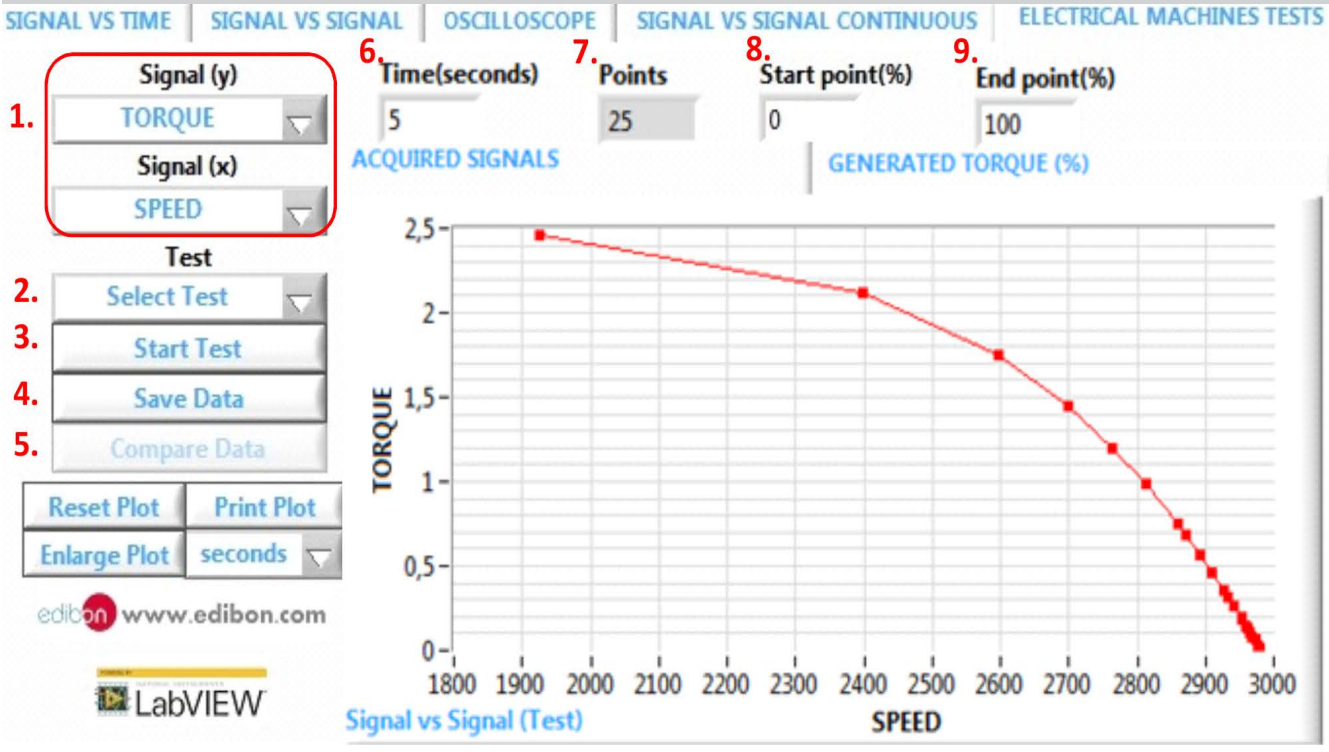
② **Run.** It allows starting the manual braking test.

Some **real** results obtained from this unit with the software **EM-SCADA**

Representation of the torque-speed curve of the manual braking test with the single phase motor with starting and running capacitor. Notice the nominal speed of the motor and the operating point of the capacitor can be seen, as well as the total braking of the motor.



Obtained results for the automatic braking test with the three-phase asynchronous squirrel cage motor with delta connection, from 0 to 100 % and exponetial braking ramp. Notice the nominal speed of the motor and how the exponential braking ramp is not sufficient for total braking of the electric motor.



① **Axis signal selector.** It allows selecting the parameter to be monitored in each axis.

② **Type of test selector.** It allows selecting the type of automatic braking test to be fulfilled: lineal, constant or exponential ramp.

③ **Iniciar test.**

④ **Save data.** It allows saving the obtained test results.

⑤ **Compare data.** It allows up to three different tests to be compared on the same graph, for which the user must have previously saved these results.

⑥ **Test time.** It allows selecting the length of the test to be fulfilled.

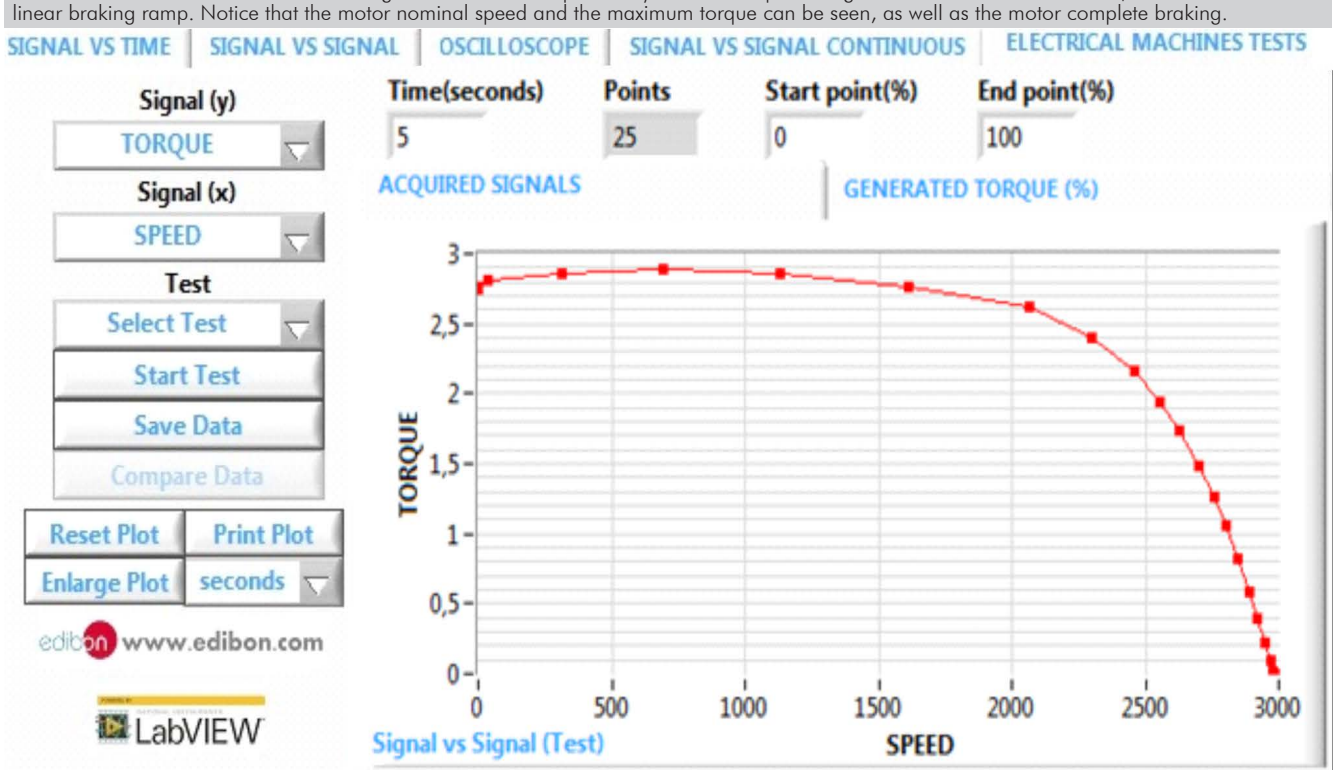
⑦ **Points.** It shows the number of points that will define the resulting plot.

⑧ **Start point.** It allows selecting (as a percentage) the start point for the test to be fulfilled.

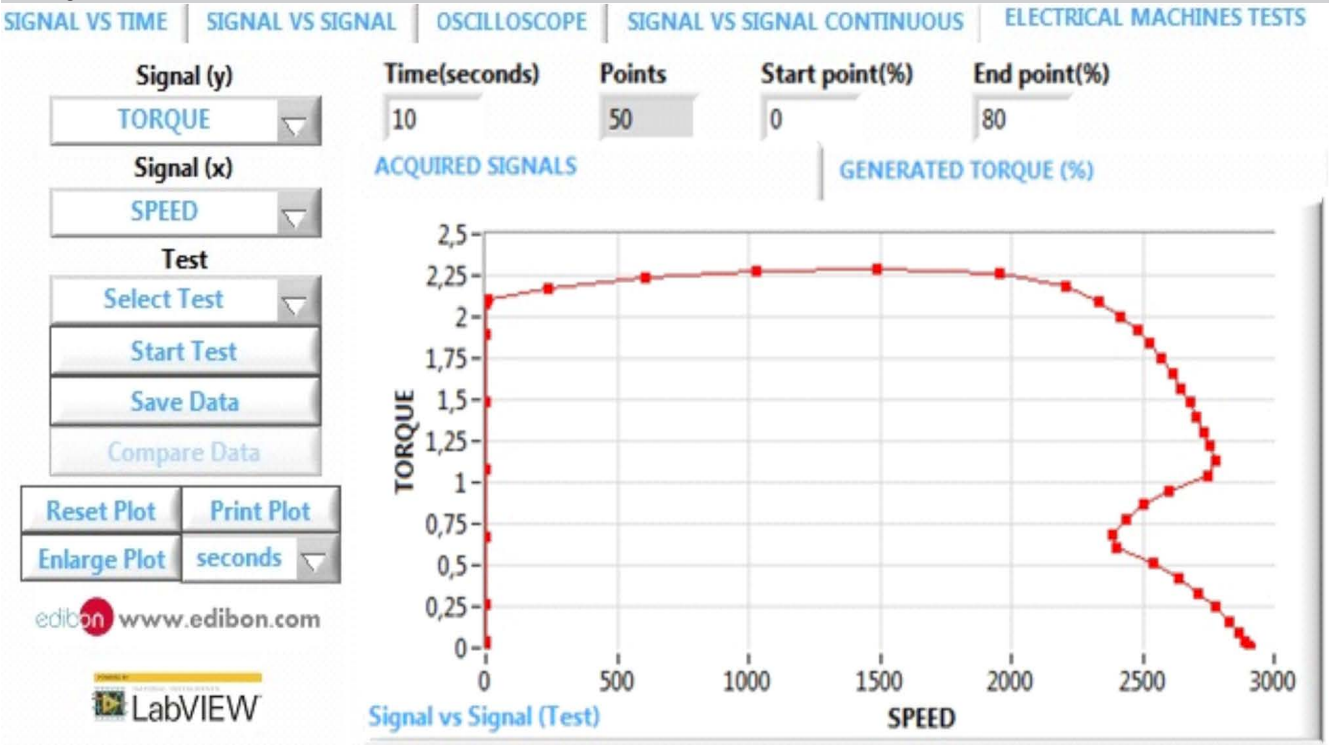
⑨ **End point.** It allows selecting (as a percentage) the end point of the test to be fulfilled.

Some **real** results obtained from this unit with the software **EM-SCADA**

Obtained results for the automatic braking test with the three-phase asynchronous squirrel cage motor with delta connection, from 0 to 100 % and linear braking ramp. Notice that the motor nominal speed and the maximum torque can be seen, as well as the motor complete braking.

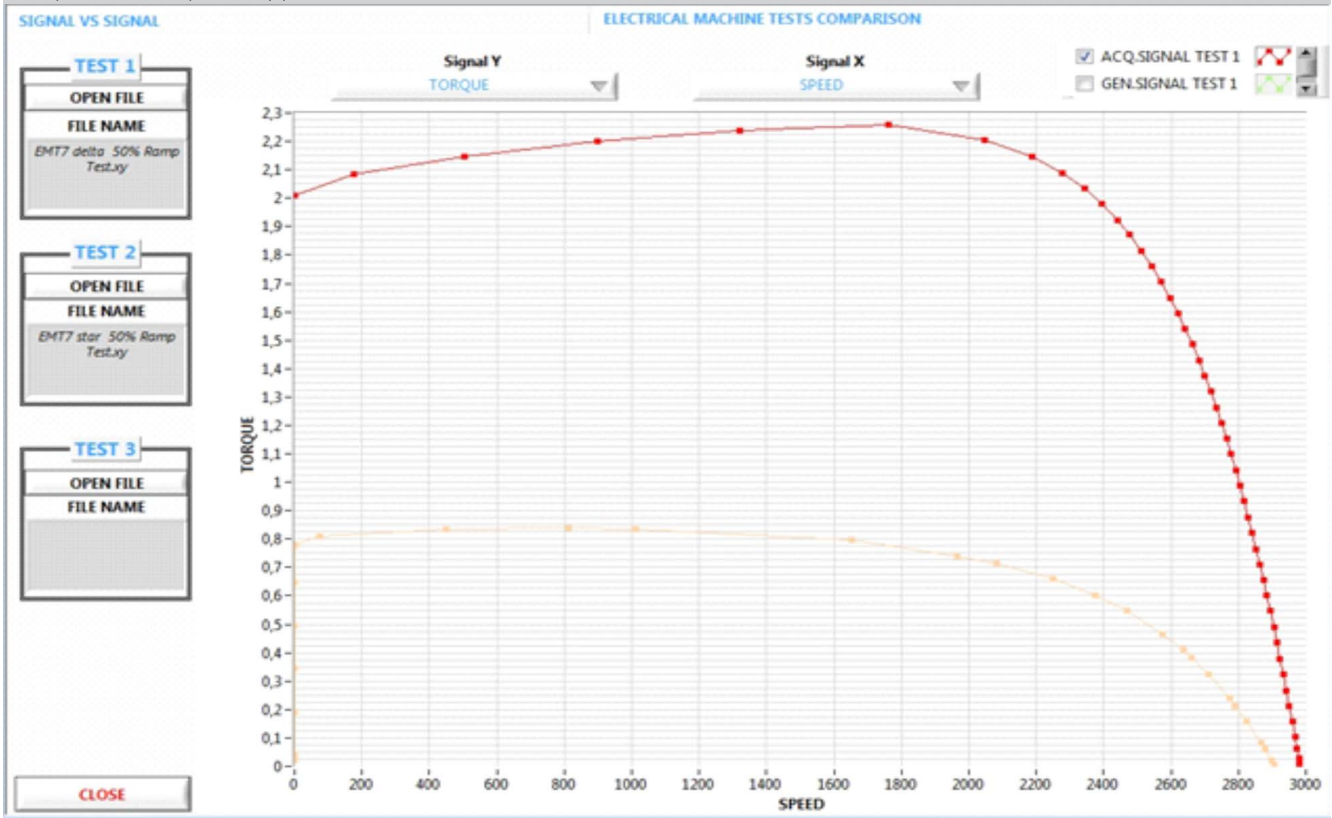


Obtained results for the automatic braking test with the three-phase asynchronous squirrel cage motor, with star-delta starting, from 0 to 80 % and linear braking ramp. Notice that the condenser operating point condenser can be appreciated, as well as the motor nominal speed and its complete braking.

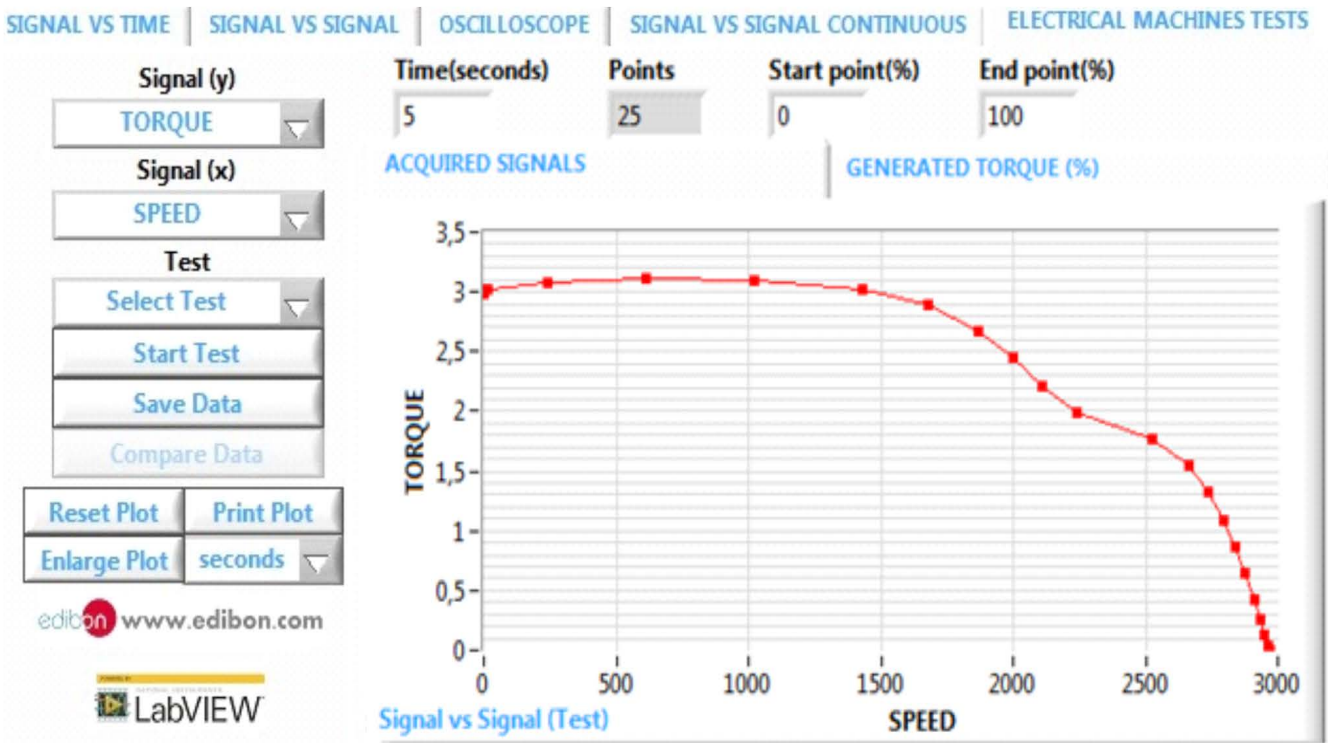


Some **real** results obtained from this unit with the software **EM-SCADA**

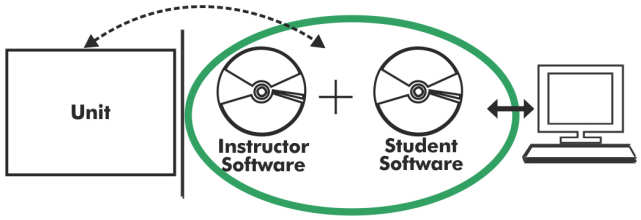
Comparison of two previously performed and stored tests.



Obtained results for the automatic braking test with the single-phase asynchronous motor with starting and running capacitor, from 0 to 100 % and linear braking ramp. Notice the capacitor operating point and the effects on the machine parameters can be appreciated, as well as the motor nominal speed and its complete braking.



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



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

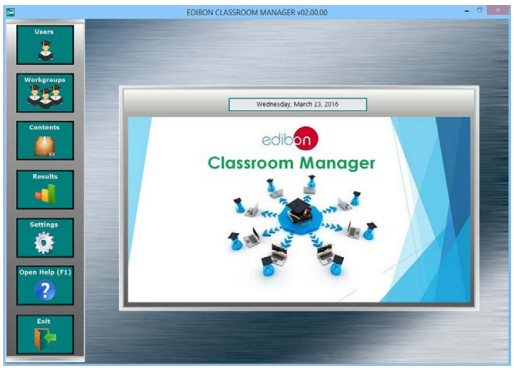
Instructor Software

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

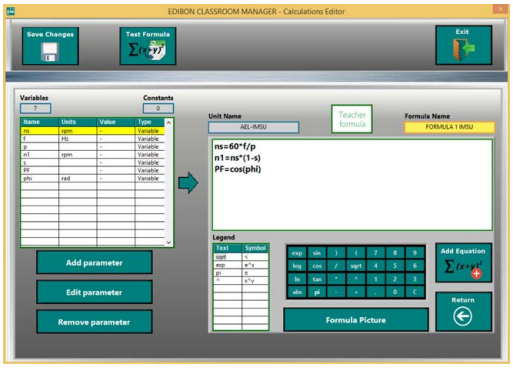
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

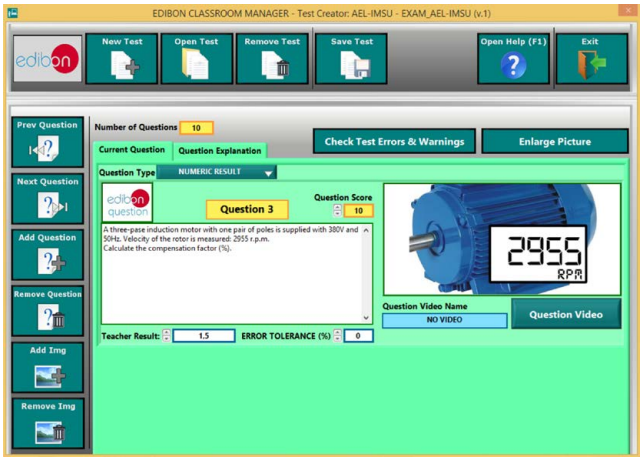
- **User Data Base Management.**
- **Administration and assignment of Workgroup, Task and Training sessions.**
- **Creation and Integration of Practical Exercises and Multimedia Resources.**
- **Custom Design of Evaluation Methods.**
- **Creation and assignment of Formulas & Equations.**
- **Equation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



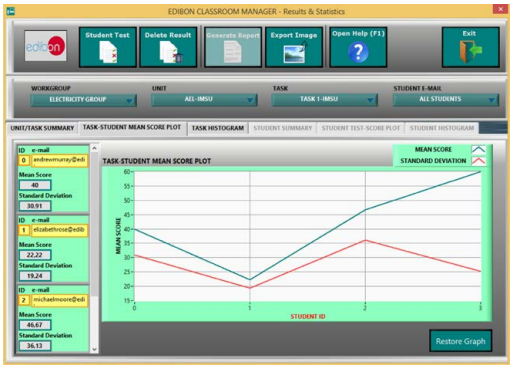
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



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



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

Optional

Student Software

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

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

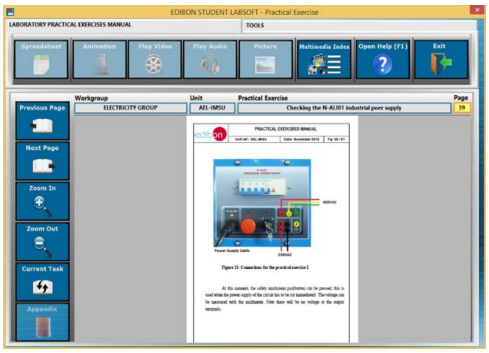
Innovative features:

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

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

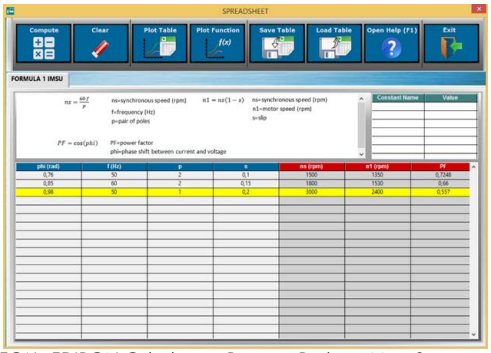
www.edibon.com/en/interactive-computer-aided-instruction-software

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



EPE. EDIBON Practical Exercise Program Package Main Screen

ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

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

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REPRESENTATIVE: