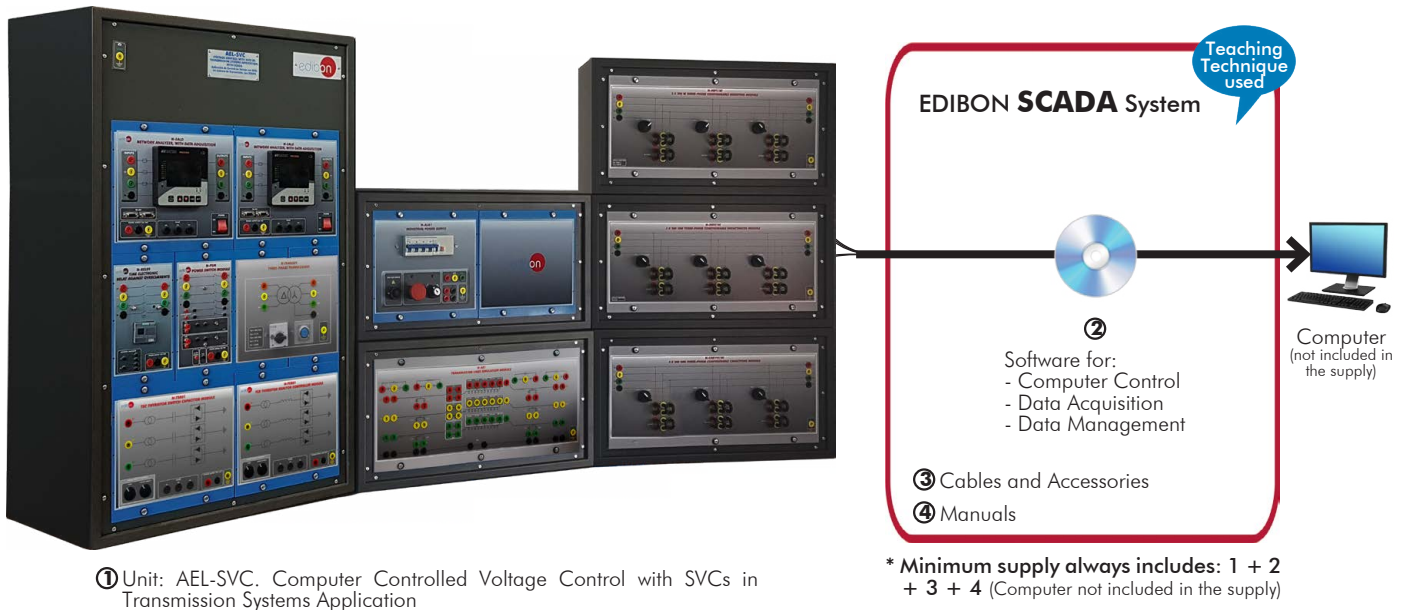


Computer Controlled Voltage Control with SVCs in Transmission Systems Application, with SCADA

AEL-SVC



Key features:

- **Advanced Real-Time SCADA.**
- **Open Control + Multicontrol + Real-Time Control.**
- **Specialized EDIBON Control Software based on LabVIEW.**
- **Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.**
- **Capable of doing applied research, real industrial simulation, training courses, etc.**
- **Remote operation and control by the user, as well as remote support from EDIBON technical support, are always included.**
- **Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).**
- **Designed and manufactured under several quality standards.**
- **Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user's knowledge and progress reached.**
- **This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.**

**OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL**



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↳ PRODUCTS
↳ 5.- ENERGY

For more information about Key features, click here



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

INTRODUCTION

Nowadays Static Var Compensators SVCs play an important role in transmission systems. The purpose of this power electronic devices is to solve voltage regulation and system dynamic performance deficiencies. The "SVC" is a type of "Flexible AC Transmission System" (FACTS) and it consists of a thyristor based controller which allows rapid voltage control to support electric power transmission voltages during immediately after major disturbances.

GENERAL DESCRIPTION

The Computer Controlled Voltage Control with SVCs in Transmission Systems Application, "AEL-SVC", has been designed by EDIBON to study the most important applications based on thyristor controlled reactor (TCR) and thyristor switched capacitor (TSC). The goal of this application is to demonstrate the actual SVC topologies used in power systems and the advantages of the utilization of this cutting-edge technology. SVCs are part of Smart Grids and it is unthinkable an actual grid without the SVCs to control the reactive power flows and voltage levels in transmission systems.

The "AEL-SVC" application provides different modules in order to the students and teachers configure their own Flexible AC Transmission System. This application allows various levels of training and research for beginners and advanced researchers who want to start from scratch or improve their knowledge in this field.

Additionally, it is recommended a series of modules for a better understanding of the importance of SVCs in transmission systems. The "AEL-SVC" application offers the possibility of the integration of a real synchronous generator to study the influence of sudden reactive energy changes (droop voltage) and how the SVCs solve this problem compensating the power factor and avoiding significant droops voltage in the synchronous machine.

On the other hand, it is recommended too to acquire the Control and Data Acquisition System Software for Electrical Machines, "EM-SCADA", for the fulfillment of SVCs advanced tests. This advanced software allows monitoring the waveforms for currents and voltages to study in depth these signals.

The "SVC-UB" is the base unit of the "AEL-SVC" application.

The "SVC-UB" base unit includes the following elements:

- N-ALI01. Industrial Main Power Supply Module.
- N-AE1. Transmission Lines Simulation Module.
- N-EALD. Electrical Network Analyzer Module with Oscilloscope and Data Acquisition (2 units).
- N-PSM. Power Switch Module.
- N-REL09. Time Electronic Relay against Overcurrents Module (0-16 A).
- N-TRANS09. Three-Phase Galvanic Isolation Transformer Module, 400/400 VAC, 1 kVA.
- N-REFT/3C. 3 x 300 W Three-Phase Configurable Resistors Module.
- N-INDT/3C. 3 x 300 Var Three-Phase Configurable Inductances Module.
- N-CAR19T/3C. 3 x 300 Var Three-Phase Configurable Capacitors Module.

Required elements to operate with "SVC-UB" unit (at least one) (Not included):

- SVC-K1. TCR Thyristor Reactor Controller Kit.
 - N-TCR01. TCR Thyristor Reactor Controller Module.
 - N-INDT. Three-phase Commutable Inductive Load Module.
- SVC-K2. TSC Thyristor Switch Capacitor Kit.
 - N-TSC01. TSC Thyristor Switch Capacitor Module.
 - N-CONT. Three-phase Commutable Capacitive Load Module.

Additional recommended elements for a greater functionality of the "SVC-UB" unit (at least one) (Not included):

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines.
- TPEL/1800W. Single-phase AC/DC Electronic Load of 1800W (3 units).
- SVC-K3. Dynamic Load Kit 1.
 - N-DLC01. Módulo Controlador de Carga Dinámica 1.
 - EMT7B/1K-E. 3PH Squirrel-Cage Industrial Motor, 1 kW, 4 poles.

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

- N-ALI01. Industrial Main Power Supply Module.
- N-AE1. Transmission Lines Simulation Module.
- N-EALD. Electrical Network Analyzer Module with Oscilloscope and Data Acquisition (2 units).
- N-PSM. Power Switch Module.
- N-REL09. Time Electronic Relay against Overcurrents Module (0-16 A).
- N-TRANS09. Three-Phase Galvanic Isolation Transformer Module, 400/400 VAC, 1 kVA.
- N-REFT/3C. 3 x 300 W Three-Phase Configurable Resistors Module.
- N-INDT/3C. 3 x 300 Var Three-Phase Configurable Inductances Module.
- N-CAR19T/3C. 3 x 300 var Three-Phase Configurable Capacitors Module.
- SVC-K1. TCR Thyristor Reactor Controller Kit.
- SVC-K2. TSC Thyristor Switch Capacitor Kit.

General Description

Additional recommended elements (at least one) (Not included):

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines.
- TPEL/1800W. Single-phase AC/DC Electronic Load of 1800W (3 units).

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

Option A:

This application needs the following rack:

- N-RACK-A.
- N-RACK-M.
- N-RACK-B (4 units).

Optionally the AEL-WBR, Electrical workbench (rack) can be supplied to place the rack/s.

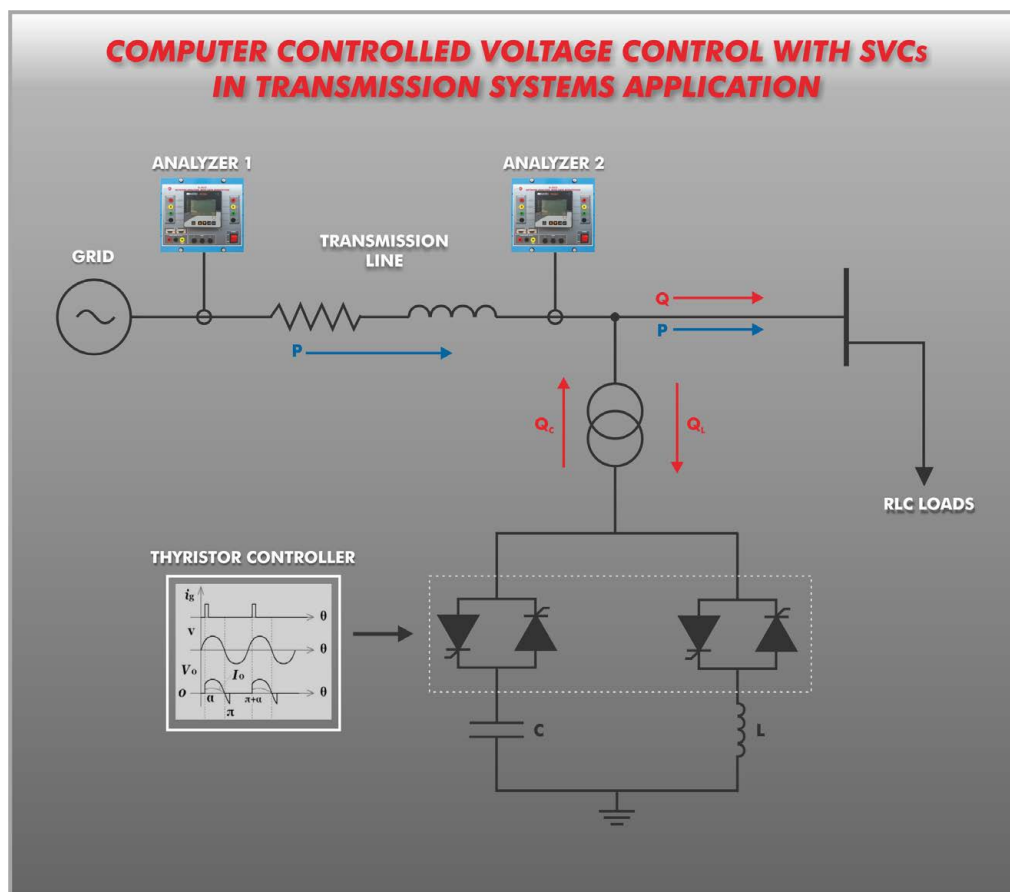
Option B:

This application can be mounted on rail.

Optionally the AEL-WBC, Electrical workbench (rail) can be supplied to mount the modules.

This Computer Controlled Application is supplied with the EDIBON Computer Control System (SCADA), and includes: The Application itself + Computer Control, Data Acquisition and Data Management Software Packages, for controlling the process and all parameters involved in the process.

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



With this unit there are several options and possibilities:

- Main items: 1, 2, 3, and 4.
- Optional items: 5, 6 and 7.

Let us describe first the main items (1 to 4):

① SVC-UB. Base Unit for AEL-SVC.

• **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-AE1. Transmission Lines Simulation Module.**

Return line of 10 Ohm.

The resistive part: two resistance values of 15 Ohm and 33 Ohm with the next possible connections:

Only one:

15 Ohm.

33 Ohm.

Series:

48 Ohm.

Parallel:

10.31 Ohm.

The inductive part:

Possibilities:

33 mH, 78 mH, 140 mH, 193 mH, 236 mH.

The capacitance between conductors:

0.5 μ F and 1 μ F for each conductor.

The capacitance between conductor and ground:

1 μ F and 2 μ F, also at the beginning and at the end of the line.



N-AE1

• **N-EALD. Electrical Network Analyzer Module with Oscilloscope and Data Acquisition (2 units).**

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 a 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 THD current, TDD current and K-Factor.

Maximums and minimums display.

Waveforms display, 128 samples/sec.

Events and data storage:

Harmonics analyzer:

Voltage and THD current, TDD current 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-PSM. Power Switch Module.**

Supply voltage: single-phase 230 VAC.

Power terminals:

Four power input terminals (3PH + N).

Four power output terminals (3PH + N).

Auxiliary contacts:

One "NO" contact.

One "NC" contact.

Two push-buttons to open/close the power terminals and auxiliary contacts.

Two control contacts of 24 VDC.

Two voltage supply outputs of 24 VDC.



N-PSM

- **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-TRANS09. Three-Phase Galvanic Isolation Transformer Module, 400/400 VAC, 1 kVA.**

Nominal power: 1 kVA.

Primary winding voltage: 400 VAC Y – 230 VAC Δ.

Secondary winding voltage: 400 VAC Y – 230 VAC Y.

Fuses: 3 x 5 A.



N-TRANS09

- **N-REFT/3C. 3 x 300 W Three-Phase Configurable Resistors Module.**

Configurable star and delta connections.

Three banks with three three-phase resistors of 1600 Ω.

Nominal voltage: 400 VAC.

Nominal power: 3 x (3 x 300) W.



N-REFT/3C

- **N-INDT/3C. 3 x 300 Var Three-Phase Configurable Inductances Module.**

Configurable star and delta connection.

Inductance: 3 x (3 x 5) H.

Nominal voltage: 400 VAC.

Nominal power: 3 x (3 x 100) Var.

Supply voltage: 230 VAC.

Common point of normally close/open contacts.



N-INDT/3C

- **N-CAR19T/3C. 3 x 300 var Three-Phase Configurable Capacitors Module.**

Configurable star and delta connections.

Three banks with three three-phase capacitors of 2 μF.

Nominal voltage: 400 VAC.

Nominal power: 3 x (3 x 300) Var.



N-CAR19T/3C

Required elements to operate with "SVC-UB" unit (at least one) (Not included):

- **SVC-K1. TCR Thyristor Reactor Controller Kit.**

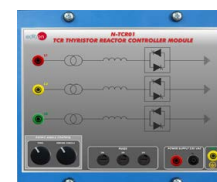
- **N-TCR01. TCR Thyristor Reactor Controller Module.**

Supply voltage: 230 VAC.

Nominal power: 1 kVA.

Rated current: 1.44 A.

Thyristor bridge firing angle control.



N-TCR01

- **N-INDT. Three-phase Commutable Inductive Load Module.**

Nominal voltage: 400 VAC.

Inductance: 1.4 H.

Nominal current: 1.6 A.

Manual switch to turn ON/OFF inductances.

Fuses: 3 x 2 A.

Terminals:

Four input terminals (3PH + N).

Four output terminals (3PH + N).



N-INDT

- **SVC-K2. TSC Thyristor Switch Capacitor Kit.**

- **N-TSC01. TSC Thyristor Switch Capacitor Module.**

Supply voltage: 230 VAC.

Nominal power: 1 kVA.

Rated current: 1.44 A.

Thyristor bridge firing angle control.

- **N-CONT. Three-phase Commutable Capacitive Load Module.**

Nominal voltage: 400 VAC.

Capacitance: $3 \times 7 \mu\text{F}$.

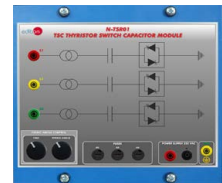
Manual switch to turn ON/OFF capacitors.

Fuses: $3 \times 4 \text{ A}$.

Terminals:

Four input terminals (3PH + N).

Four output terminals (3PH + N).



N-TSC01



N-CONT

Additional recommended elements for a greater functionality of the "SVC-UB" unit (at least one) (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

- **TPEL/1800W. Single-phase AC/DC Electronic Load of 1800W (3 units).**

The TPEL/1800W electrical load stands out for its versatility in operating in both AC and DC. With a wide power range from 0 to 1800VA and an adjustable frequency from 45 Hz to 450 Hz, this electronic source offers exceptional capabilities.

With its advanced measurement capabilities, 7-inch LCD display, and features such as the built-in oscilloscope, the TPEL/1800W is the ideal solution for laboratory testing of most of EDIBON's unit such as UPS, inverters, AC power supplies, electrical generators and AC electronic components. In addition, its connectivity via LAN and USB interfaces ensures reliable and fast control, adding an additional level of efficiency to its capabilities.

Technical Features:

Frequency Range: 45 Hz~450 Hz.

Power Range: 0~1.8 kVA.

Voltage Range: 50-420 Vrms, 15-260 Vrms.

Parallel Connection/Three Phase Control: Capacity can be extended up to 43.2 kVA.

7 Inch LCD Display: Provides a clear and accessible interface.

Oscilloscope Function: Allows display of voltage and current waveforms.

High Speed AD Sampling: Captures real-time waveforms.

Measurement Modes: Includes Vrms, Vpk, Vdc, Irms, Ipk, Idc, W, VA, VAR, CF, PF and FREQ.

Harmonic Measurement: Up to harmonic 50 (THD-V).

AC Electronic Load: DC/CR/CP modes.

DC Electronic Load: DC/CR/CP/CV modes.

External Analog Control: 0~10 V analog input, with voltage and current monitoring functions.

Protection Functions: OTP, OCP, OVP, UVP and OPP.

Communication Interfaces: LAN and USB, plus external interface for USB flash disk.



TPEL/1800W

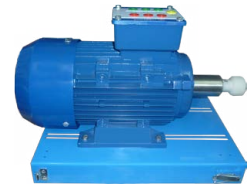
- SVC-K3. **Dynamic Load Kit 1.**
 - N-DLC01. **Dynamic Load Controller 1 Module.**

Nominal voltage: 230 VAC.
Includes brake with 5 Nm nominal torque.
LCD display.
Daily load curve configuration by means of 5 potentiometers:
Test time from 30 to 300 s.
Definition of maximums and minimums of the load curve.
 - EMT7B/1K-E. **3PH Squirrel-Cage Industrial Motor, 1 kW, 4 poles.**

Nominal power: 1000 W.
Nominal voltage: 230 VAC/400 VAC.
Frequency: 50/60 Hz.
Nominal load speed: 1400 rpm.
Nominal current: 4.57 A/2.64 A.



N-DLC01



EMT7B/1K-E



EM-SCADA

Additional recommended elements (at least one) (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.

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

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7 Inch LCD Display: Provides a clear and accessible interface.

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Harmonic Measurement: Up to harmonic 50 (THD-V).

AC Electronic Load: DC/CR/CP modes.

DC Electronic Load: DC/CR/CP/CV modes.

External Analog Control: 0~10 V analog input, with voltage and current monitoring functions.

Protection Functions: OTP, OCP, OVP, UVP and OPP.

Communication Interfaces: LAN and USB, plus external interface for USB flash disk.



TPEL/1800W

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

The complete unit includes as well:

Advanced Real-Time SCADA.

Open Control + Multicontrol + Real-Time Control.

Specialized EDIBON Control Software based on LabVIEW.

Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.

Capable of doing applied research, real industrial simulation, training courses, etc.

Remote operation and control by the user, as well as remote support from EDIBON technical support, are always included.

Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).

Designed and manufactured under several quality standards.

Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user's knowledge and progress reached.

This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

② **AEL-SVC/CCSOF. Computer Control + Data Acquisition + Data Management Software:**

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.



AEL-SVC/CCSOF

③ **Cables and Accessories**, for normal operation.

④ **Manuals:**

This unit is **supplied with 8 manuals**: Required services, Assembly and Installation, Control software, Starting-up, Safety, Maintenance & Practices manuals.

*References 1 to 4 are the main items: AEL-SVC + AEL-SVC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply for enabling normal and full operation.

EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH THE MAIN ITEMS

Practical possibilities with the base unit SVC-UB and SVC-K1:

- 1.- Manual reactive power control with manual commutable inductances and capacitors loads.
- 2.- Automatic reactive power compensation with the thyristor reactor controller module (TCR).
- 3.- Manual reactive power compensation with the thyristor reactor controller module, varying the firing "alfa".
- 4.- Comparison of the behavioral dynamics of the transmission system with the manual reactive power control and the automatic reactive power control with thyristors (TCR).
- 5.- Visualization of the grid parameters with the influence of the manual reactive power control.
- 6.- Visualization of the grid parameters with the influence of the automatic reactive control with the thyristors reactor module (TCR).
- 7.- Manual control of the thyristor firing angle in the TCR and visualization of the grid reactive power response.
- 8.- Visualization of the voltages nodes in the transmission line and droop voltages compensation against sudden load changes.

Practical possibilities with the base unit SVC-UB and SVC-K2:

- 9.- Automatic reactive and active power compensation with the thyristor reactor controller module (TCR) and thyristor capacitor switch controller module (TCS).
- 10.- Manual reactive power compensation with the thyristor reactor controller module and the thyristor capacitor switch controller module, varying the firing "alfa".
- 11.- Comparison of the behavioral dynamics of the transmission system with the manual reactive power control and the automatic reactive power control with both thyristors reactor and capacitor controllers (TCR and TSC).
- 12.- Visualization of the grid parameters with the influence of the manual reactive and active power control.
- 13.- Visualization of the grid parameters with the influence of the automatic power factor control with the thyristors reactor and capacitor modules (TCR and TSC).
- 14.- Manual control of the thyristor firing angle in the TCR and TSC, and visualization of the grid power factor response.
- 15.- Visualization of the voltages nodes in the transmission line and droop voltages compensation against sudden load changes.

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

- 16.- Optimum firing angle determination for each load condition.
- 17.- Visualization and comparison of the reactive power compensation waves working with both TCR and TSC.
- 18.- Visualization of the voltage and current gaps according to the thyristors firing angle.
- 19.- Thyristors firing angle identification with the high speed data acquisition system.

Other possibilities to be done with this unit:

- 20.- Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
 - 21.- Open Control, Multicontrol and Real Time Control.
This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivative parameters; etc, in real time.
 - 22.- The Computer Control System with SCADA allows a real industrial simulation.
 - 23.- This unit is totally safe as uses mechanical, electrical/electronic, and software safety devices.
 - 24.- This unit can be used for doing applied research.
 - 25.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
- 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, 3 kW.
- Computer (PC).

DIMENSIONS AND WEIGHTS

AEL-SVC:

- Dimensions: 2000 x 400 x 2000 mm approx.
(78.74 x 15.75 x 78.74 inches approx.)
- Weight: 85 Kg approx.
(187 pounds approx.)

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (at least one):

- EM-SCADA. Control and Data Acquisition System Software for Electrical Machines.
- TPEL/1800W. Single-phase AC/DC Electronic Load of 1800W (3 units).

SIMILAR UNITS AVAILABLE

Offered in this catalog

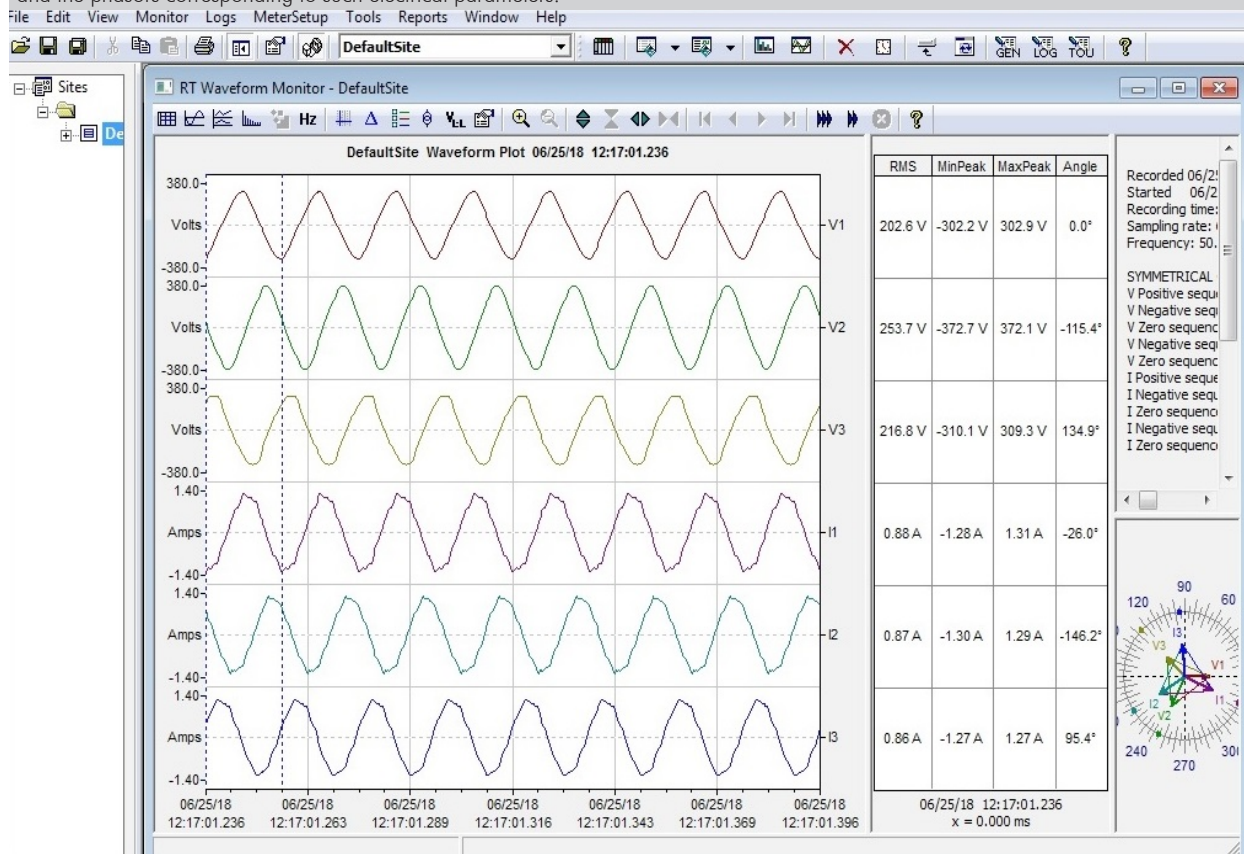
- AEL-SVC. Computer Controlled Voltage Control with SVCs in Transmission Systems Application.

Offered in other catalog:

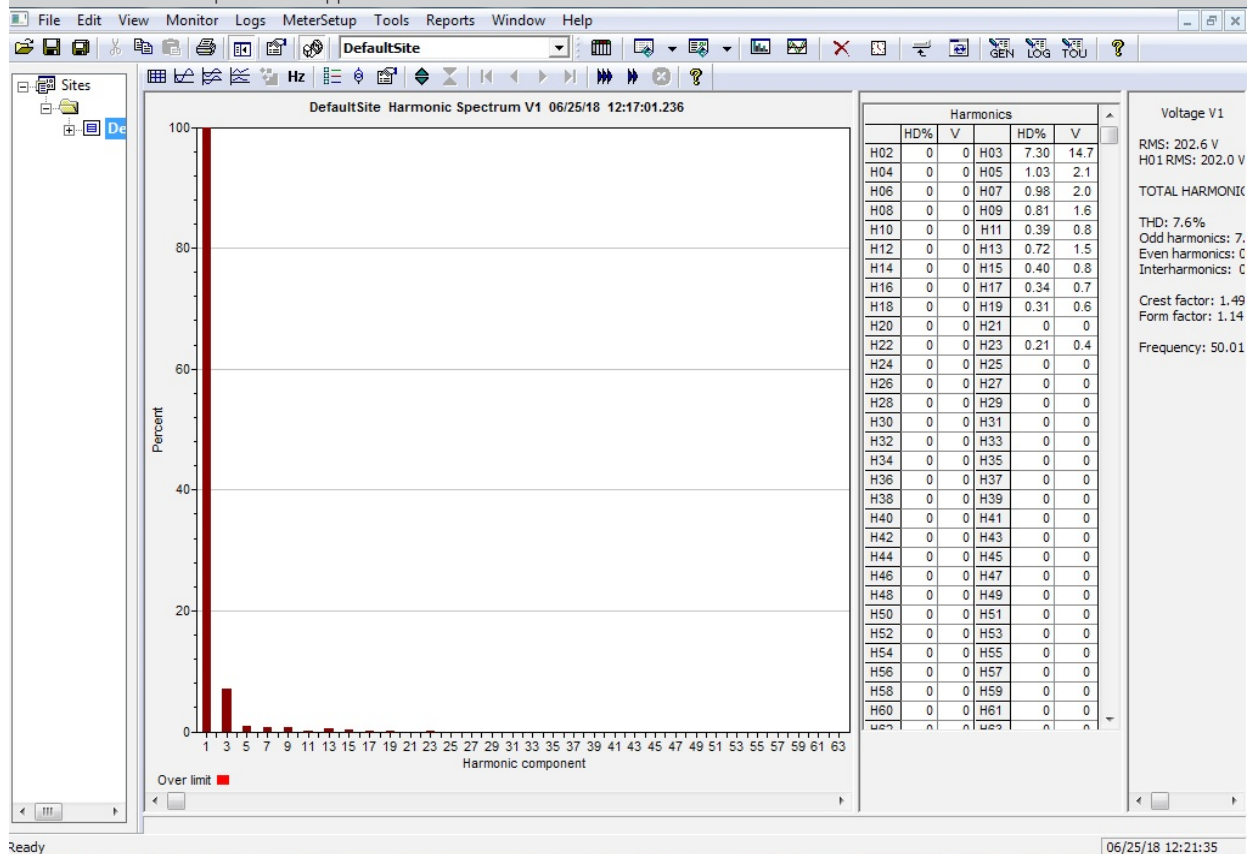
- AEL-APFC. Single-phase Automatic Power Factor Compensation Application.
- AEL-EECFP. Advanced Power Factor Compensation Application.
- AEL-RPC. Reactive Power Compensation Application.
- AEL-MRPC. Manual Reactive Power Compensation Application.

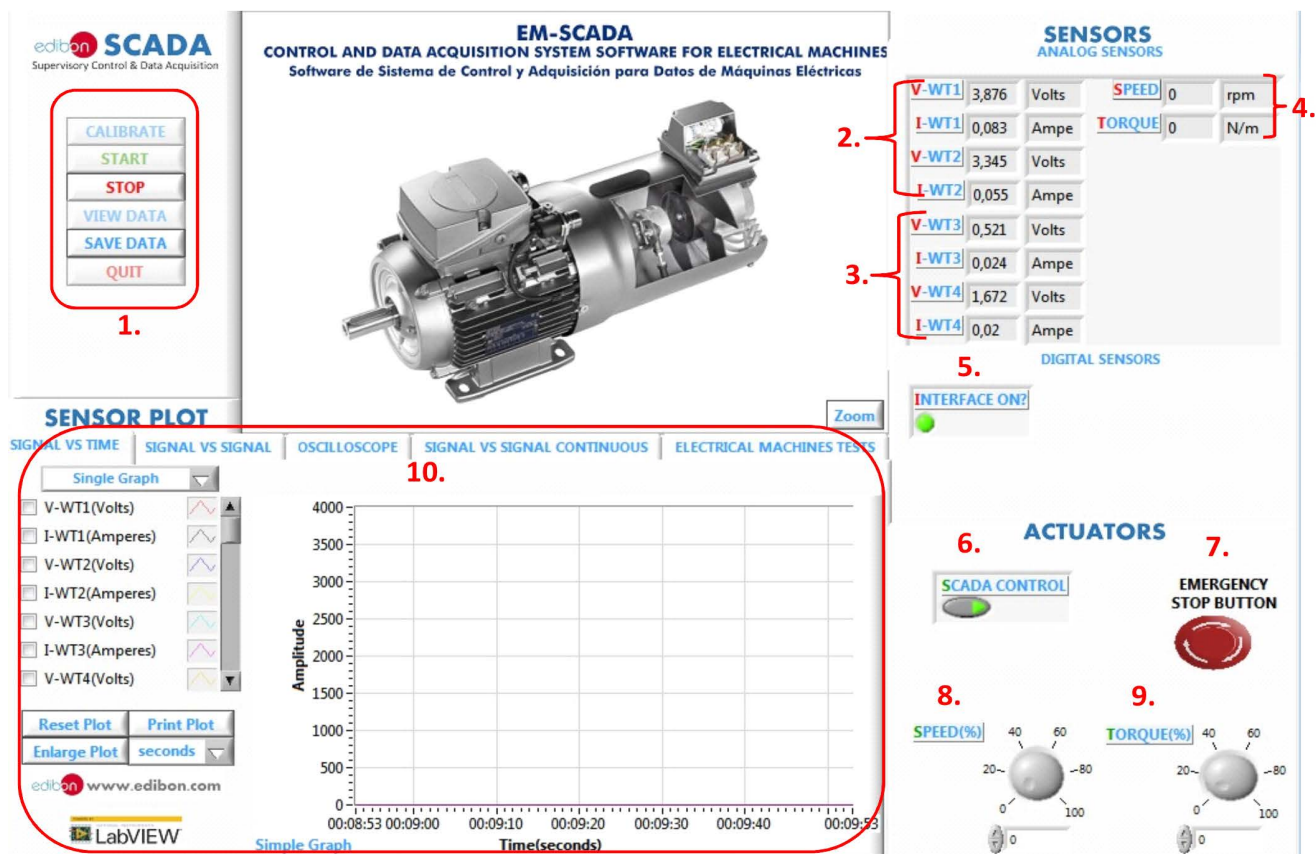
SOME REAL RESULTS OBTAINED FROM THIS UNIT

Waveform plot of the real time currents and voltages measured by the analyzer, showing the angular, maximum, minimum and RMS values, and the phasors corresponding to such electrical parameters.



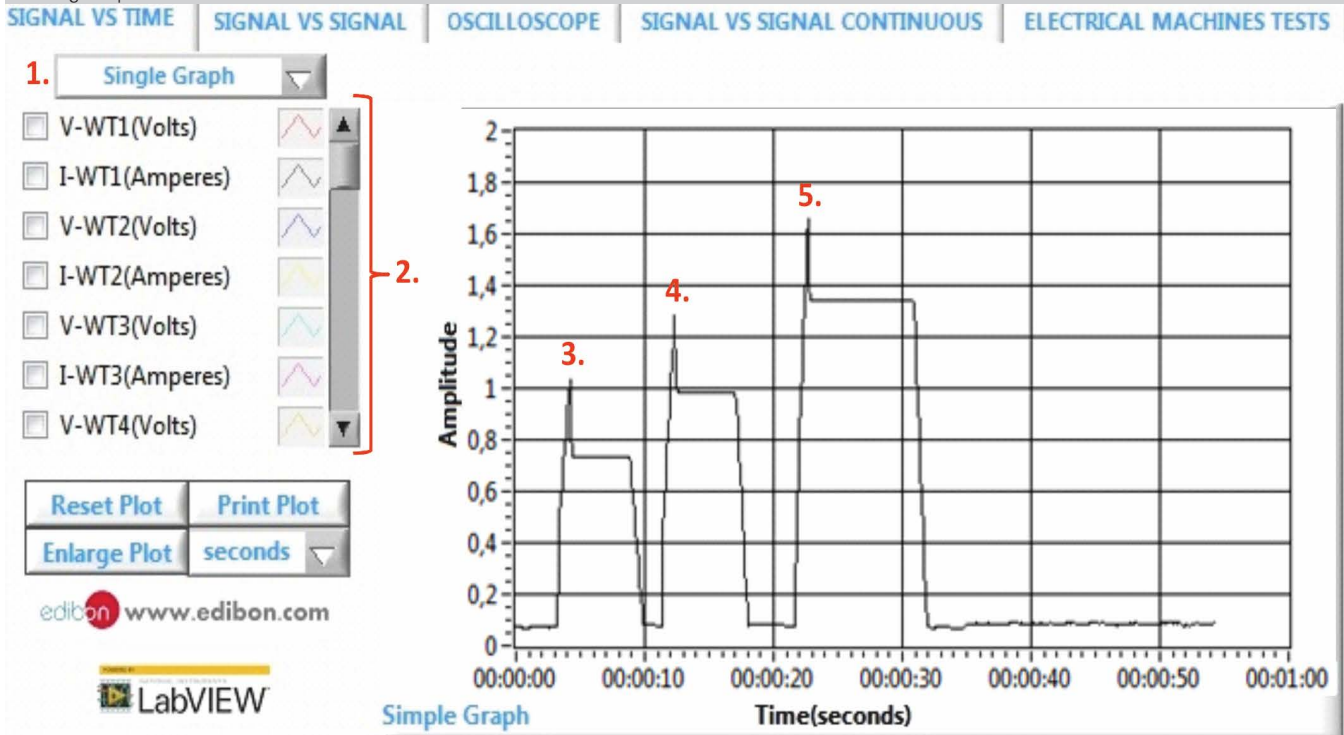
Representation of the torque-speed curve for the Three-Phase Asynchronous Squirrel Cage Motor. Notice that the motor nominal speed and the maximum torque can be appreciated.





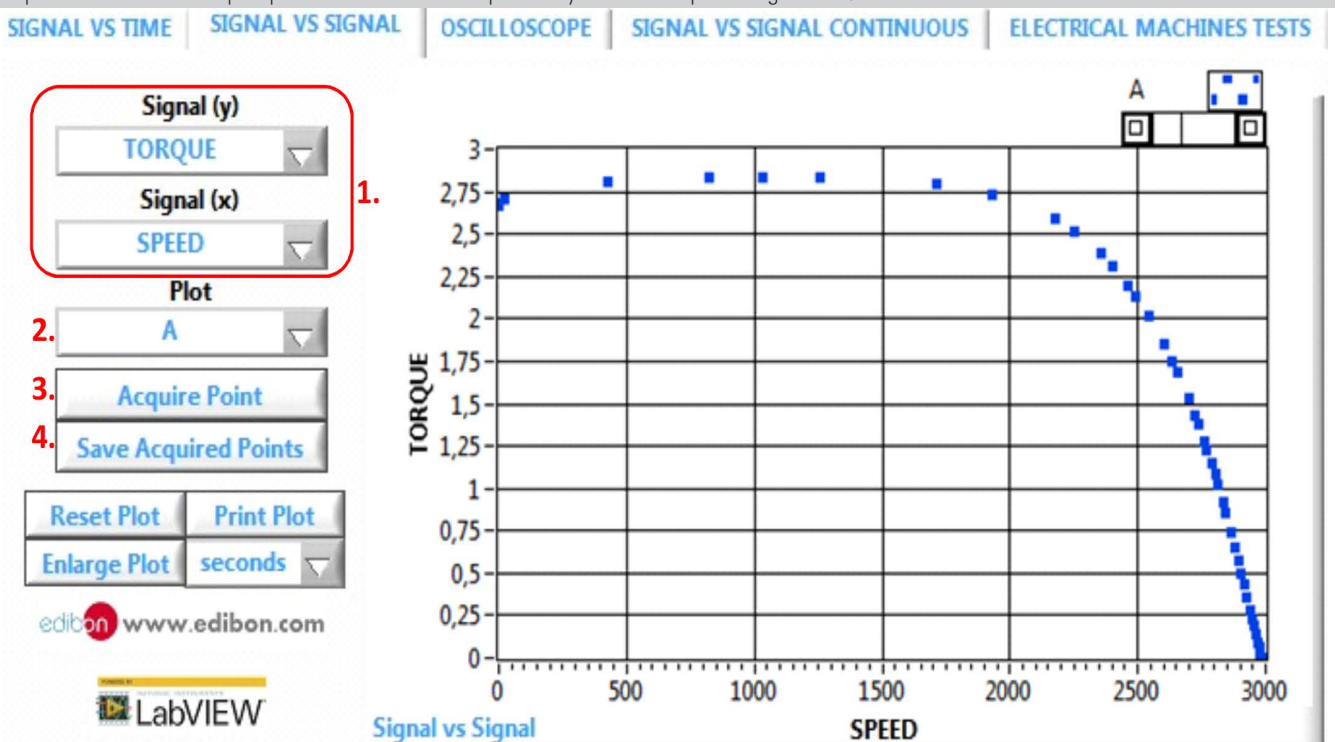
- ① Main menu. Start-up, stop, view data, save data and quit.
- ② RMS voltages and currents measurements. It shows the effective values for the real time measured voltages and currents.
- ③ Real voltages and currents measurements. It shows the exact values for the real time measured voltages and currents.
- 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 button.
- 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.

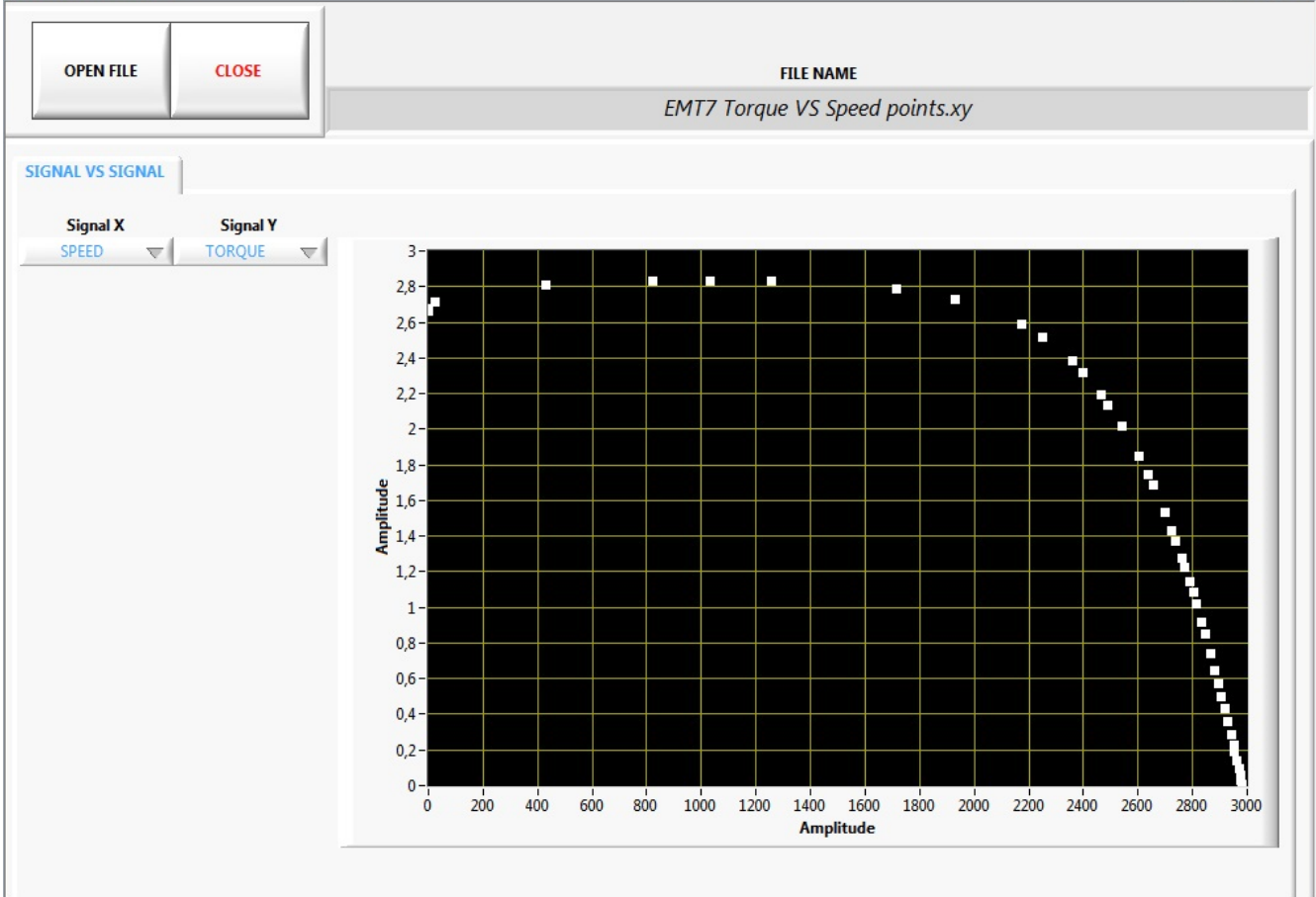
Representation of the torque-speed curve for the three-phase asynchronous squirrel cage motor.



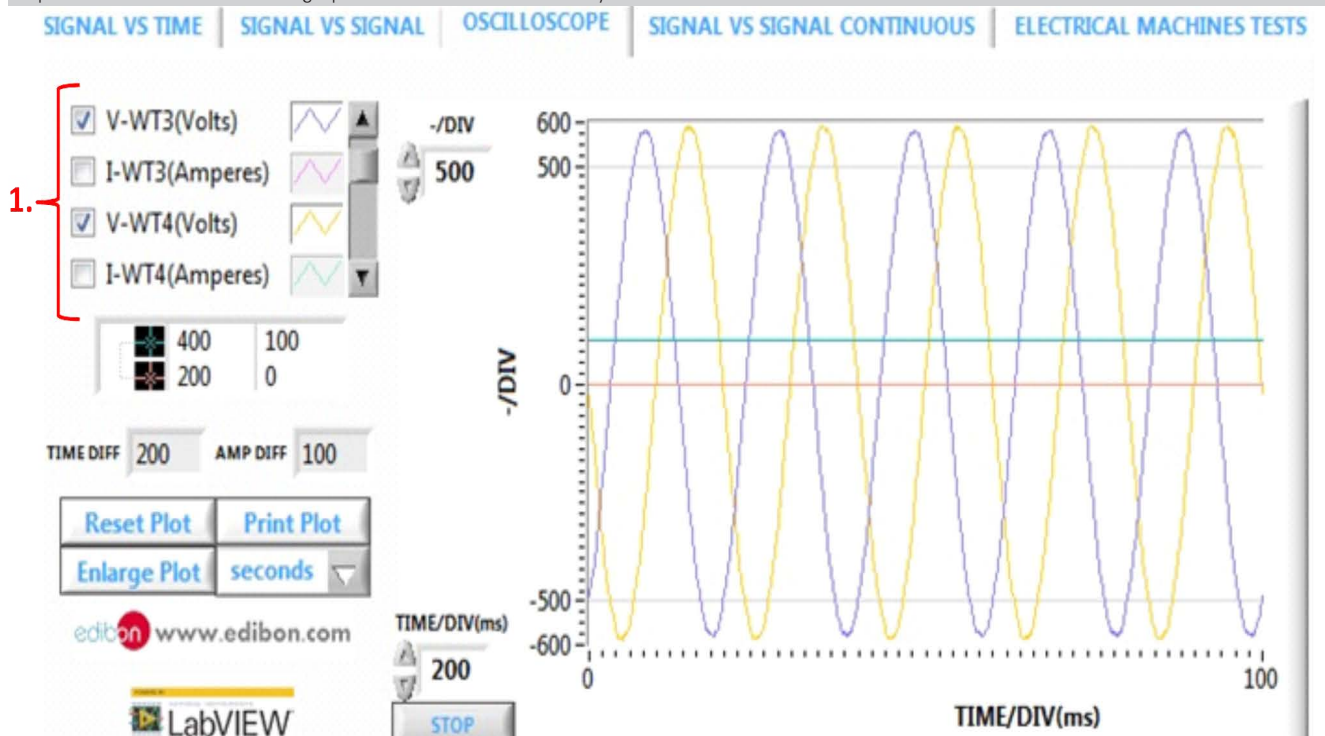
- ① Axis signal selector. It allows selecting the parameter to be monitored in each axis.
- ② Type of graph selector.
- ③ Acquire points. It allows displaying in the graph the point corresponding to the time when it is pressed.
- ④ Save acquired points. It allows saving the acquired points, which will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

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

Visualisation and representation of saved data.

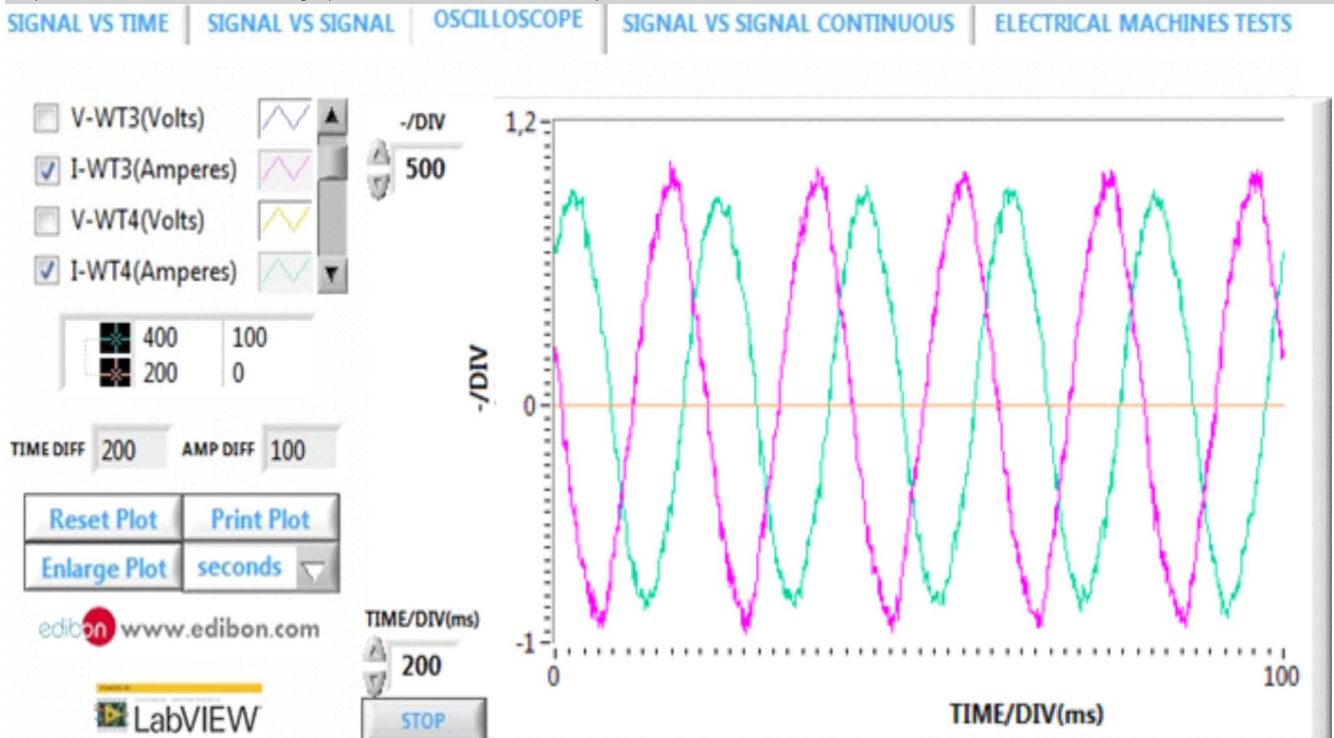


Representation of the waveform graph of the currents measured by the interface in real time.

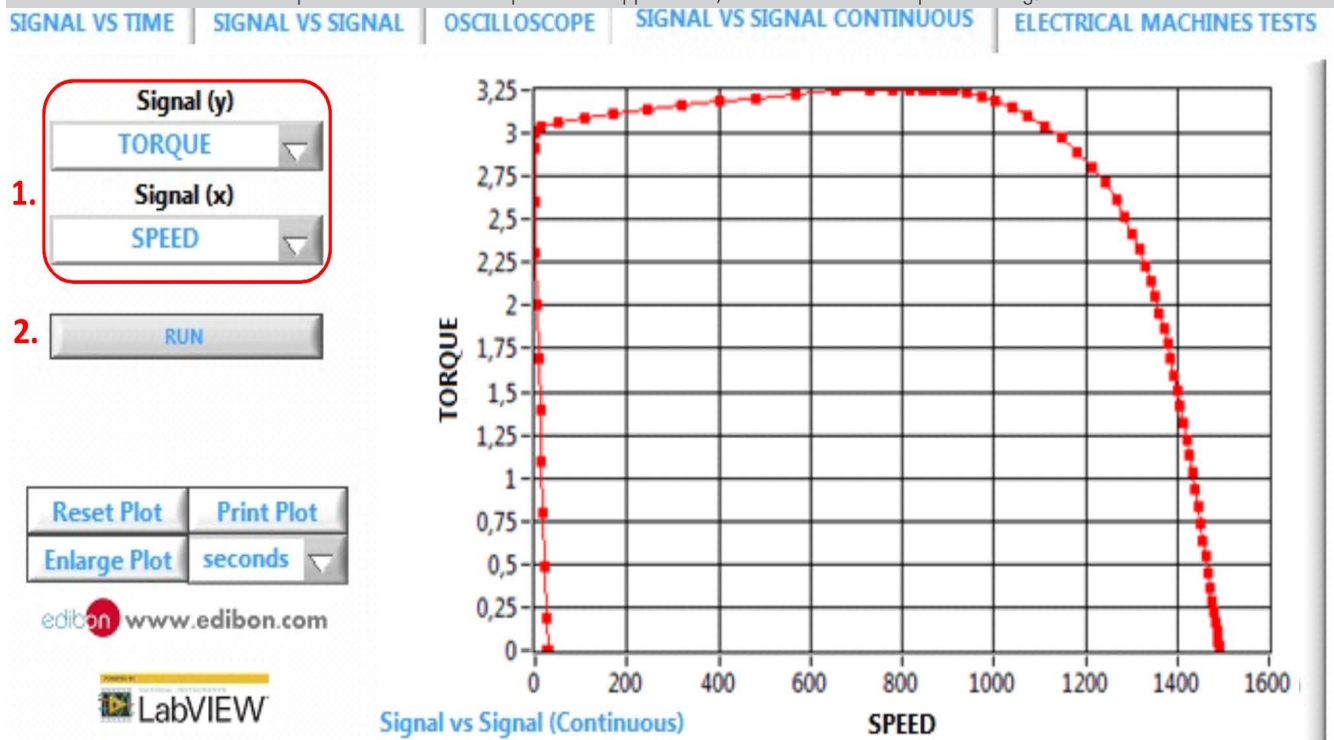


① Parameters selector. It allows choosing the parameters whose waveforms want to be displayed.

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



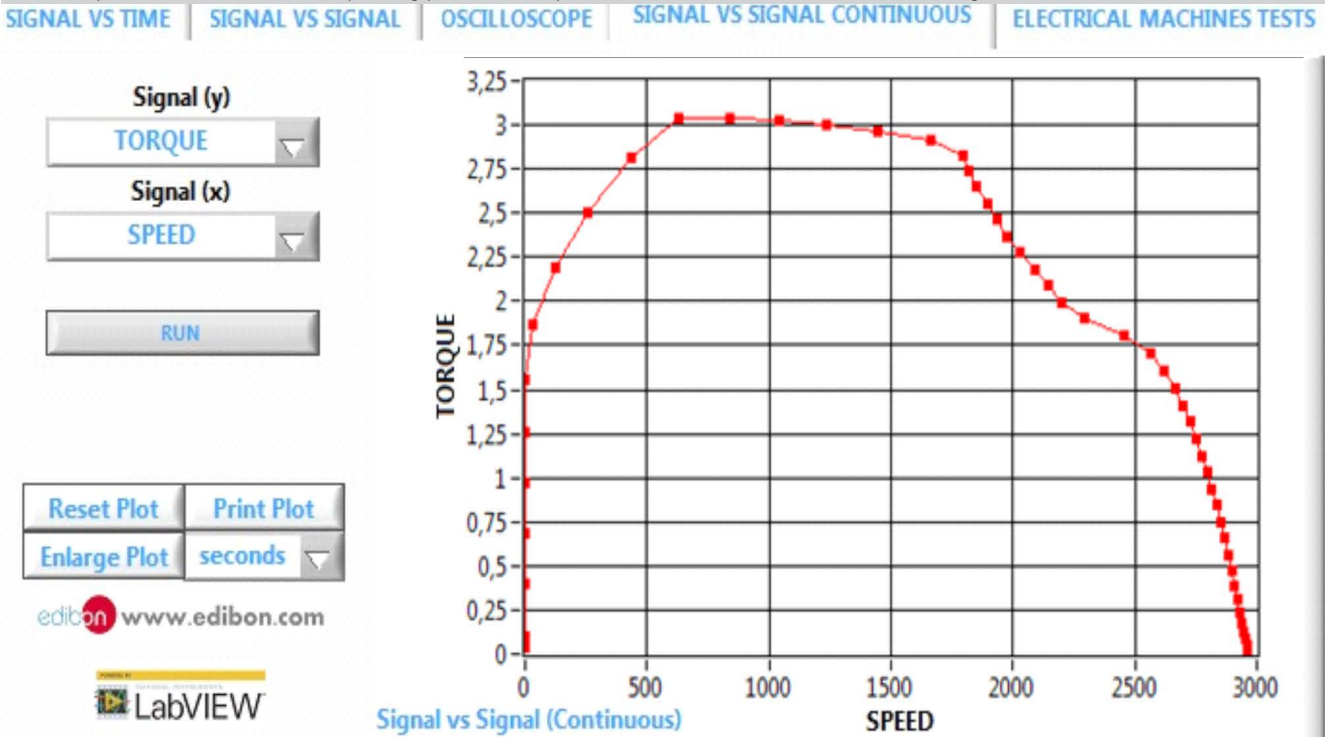
Representation of the torque-speed curve of the manual braking test with the two-speed three-phase asynchronous motor, first speed (1500 rpm). Notice that the motor nominal speed and maximum torque can be appreciated, as well as motor complete braking.



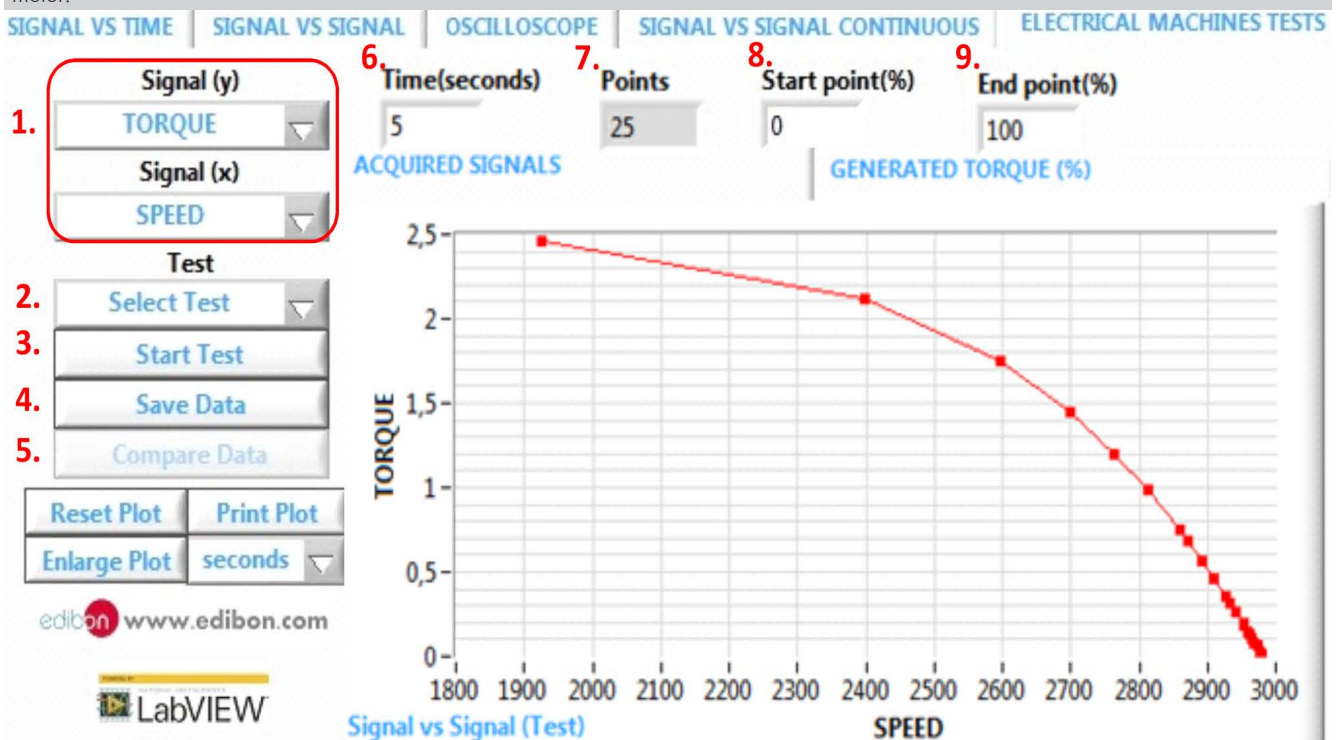
① **Axis signal selector.** It allows selecting the parameter to be monitored in each axis.

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

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.



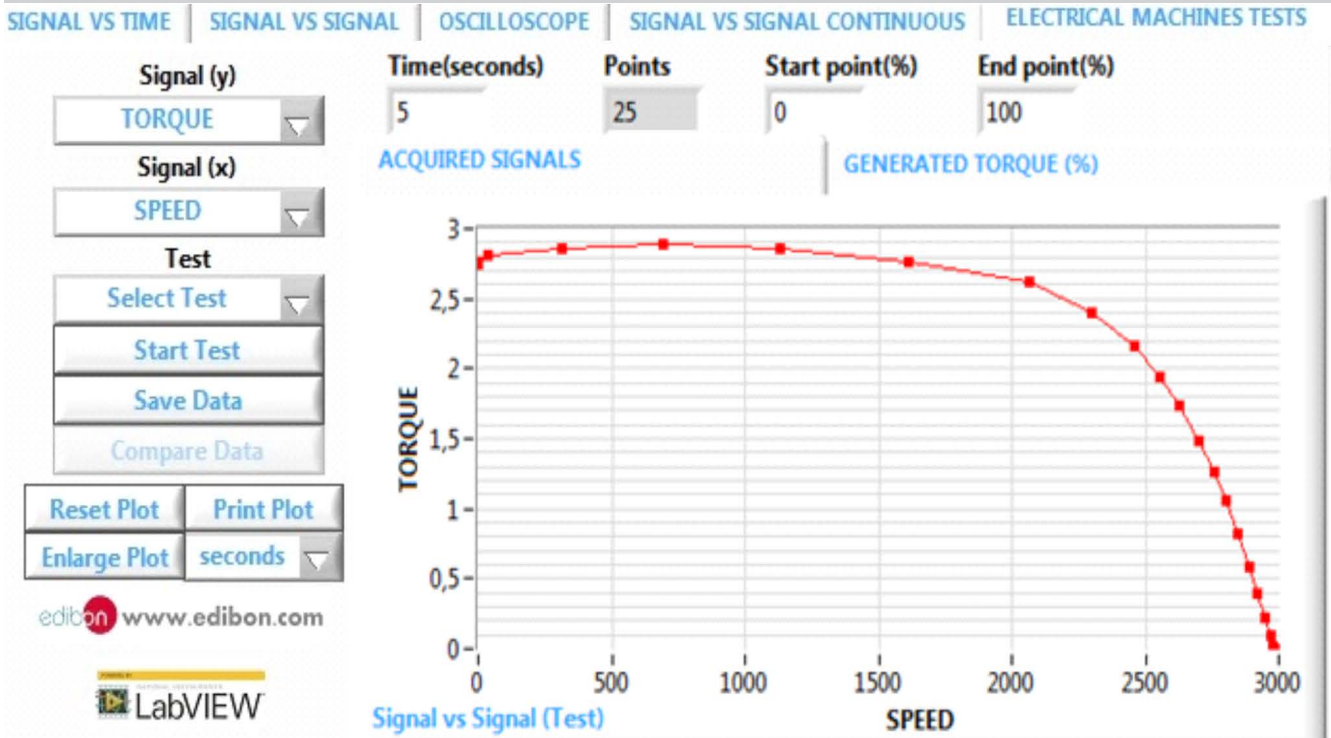
Obtained results for the automatic braking test with the three-phase asynchronous squirrel cage motor with delta connection, from 0 to 100% and exponential braking ramp. Notice the nominal speed of the motor and how the exponential braking ramp is not sufficient for total braking of the electric motor.



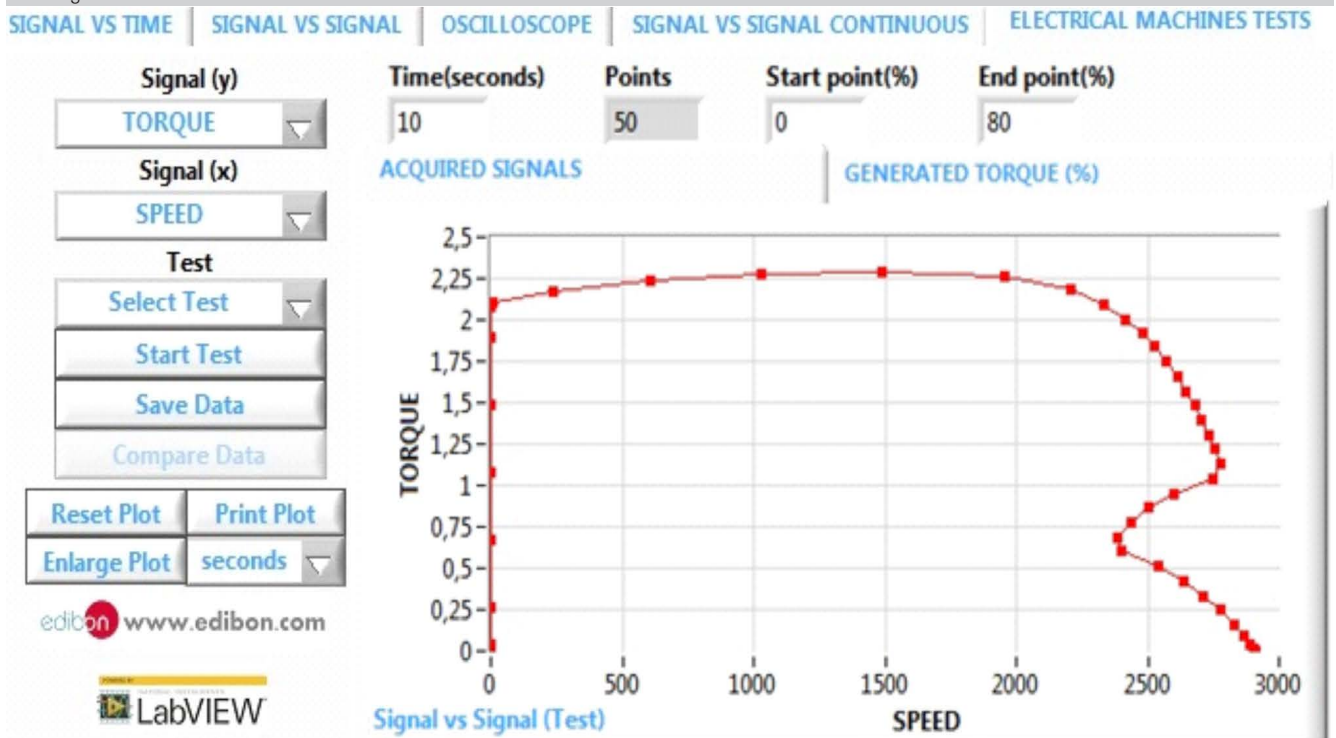
- ① Axis signal selector. It allows selecting the parameter to be monitored in each axis.
- ② Type of test selector. It allows selecting the type of automatic braking test to be fulfilled: lineal, constant or exponential ramp.
- ③ Iniciar test.
- ④ Save data. It allows saving the obtained test results.
- 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** (recommended)

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.

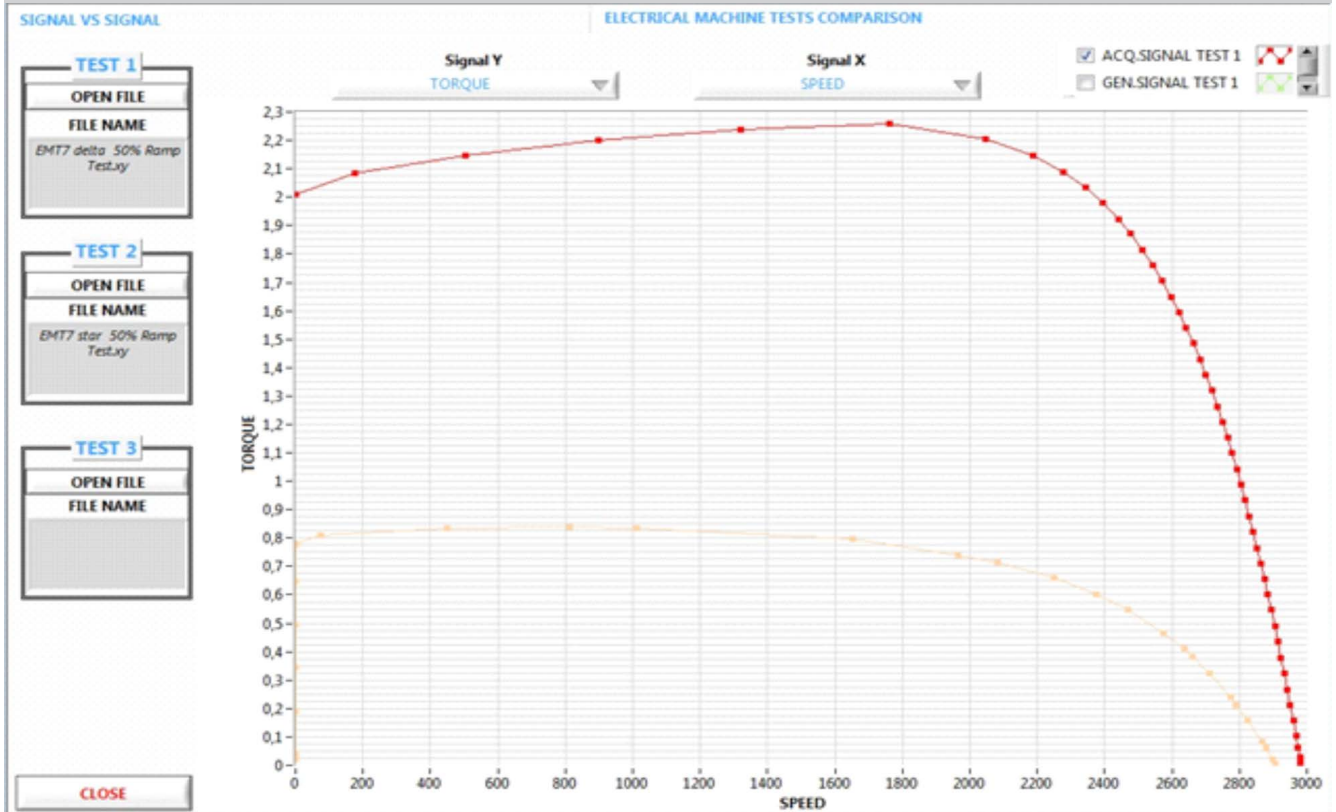


Obtained results for the automatic braking test with the three-phase asynchronous squirrel cage motor, with star-delta starting, from 0 to 80% and linear braking ramp. Notice that the condenser operating point condenser can be appreciated, as well as the motor nominal speed and its complete braking.

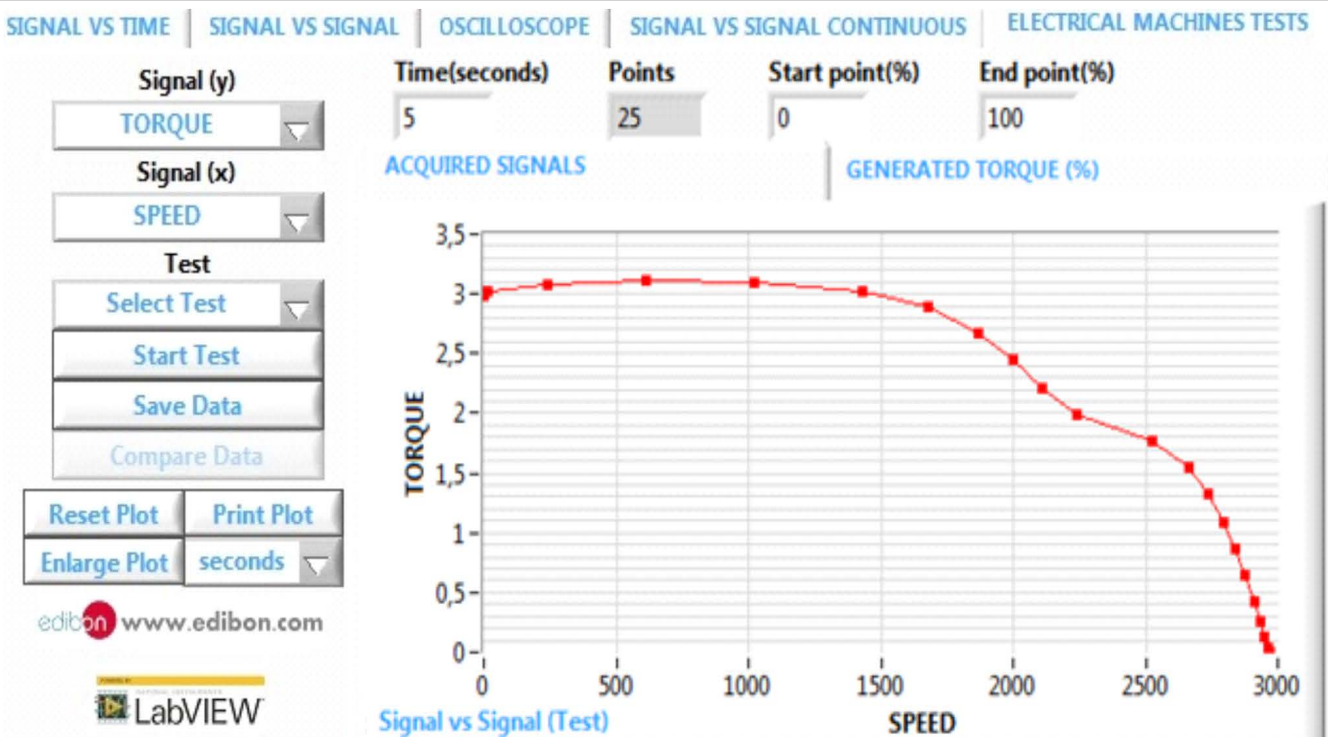


Some **real** results obtained from this unit with the software **EM-SCADA** (recommended)

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.



COMPLETE TECHNICAL SPECIFICATIONS (for optional items)

Additionally to the main items (1 to 4) described, we can offer, as optional, other items from 5 to 7.

All these items try to give more possibilities for:

- a) Technical and Vocational Education configuration. (ICAI)
- b) Multipost Expansions options. (MINI ESN and ESN)

a) Technical and Vocational Education configuration

⑤ AEL-SVC/ICAI. Interactive Computer Aided Instruction Software.

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.

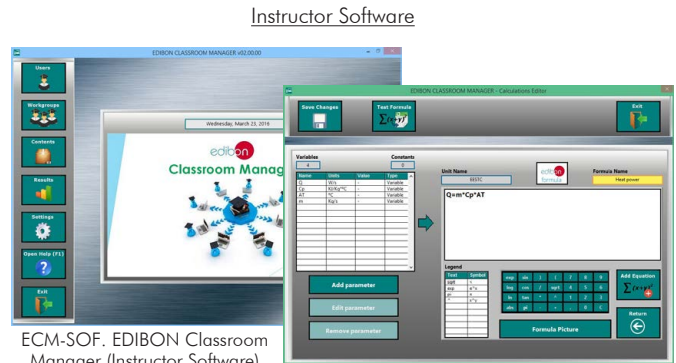
This software is optional and can be used additionally to items (1 to 4).

- 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



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

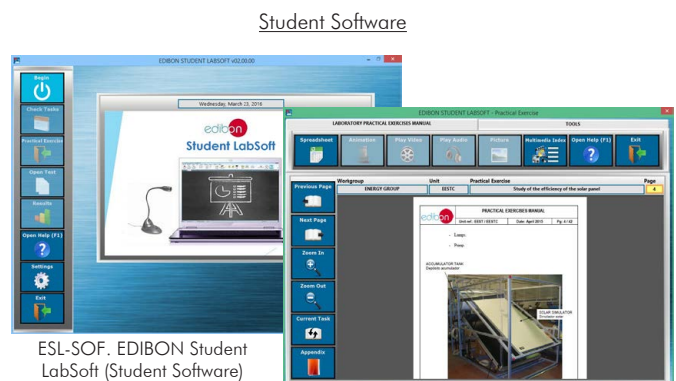
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

- 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.

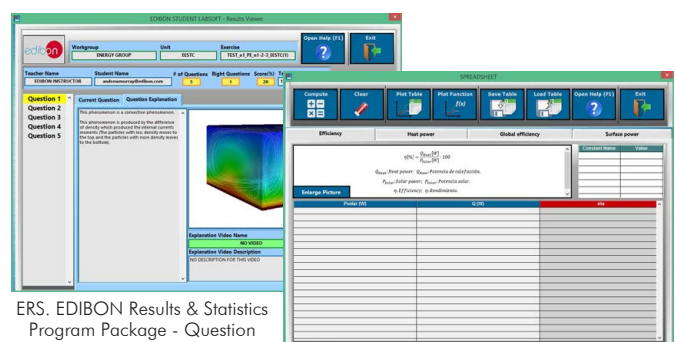
Innovative features:

- 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

EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

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

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

b) Multipost Expansions options

⑥ **MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.**

MINI ESN. EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously. It is useful for both, Higher Education and/or Technical and Vocational Education.

The MINI ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit. Then, the number of possible users who can work with the same unit is higher than in an usual way of working (usually only one).

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing "real time" control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

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

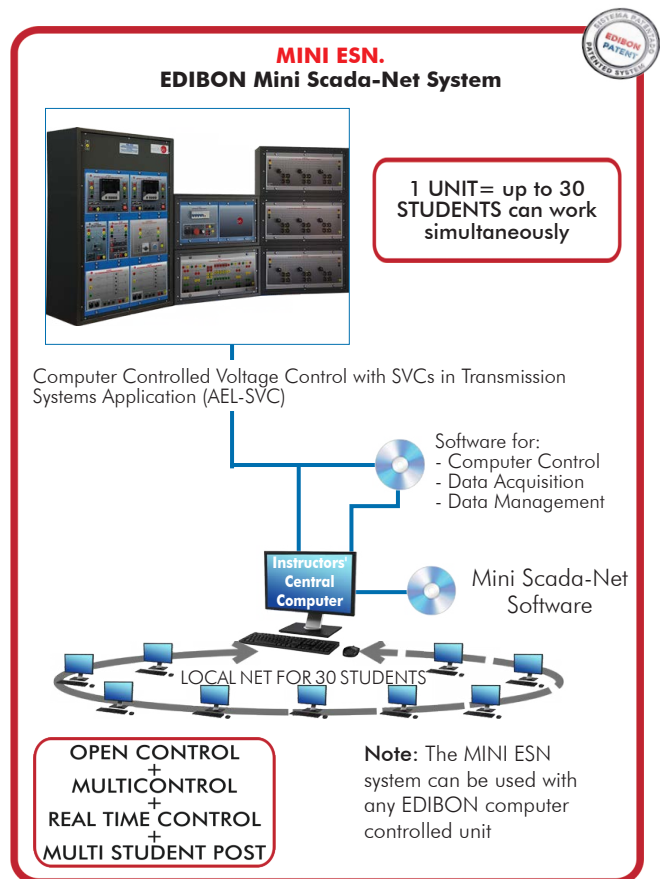
www.edibon.com/en/edibon-scada-net

⑦ **ESN. EDIBON Scada-Net Systems.**

This unit can be integrated, in the future, into a Complete Laboratory with many Units and many Students.

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

www.edibon.com/en/edibon-scada-net



ORDER INFORMATION

Main items (always included in the supply)

Minimum supply always includes:

- ① **Unit: SVC-UB. Base Unit for AEL-SVC.**
- ② **AEL-SVC/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
- ③ **Cables and Accessories**, for normal operation.
- ④ **Manuals.**

Required elements (at least one) to be used with the Base Unit for AEL-SVC "SVC-UB":

SVC-K1. Kit de Controlador de Reactancias por Tiristores TCR.

SVC-K2. Kit de Controlador de Condensadores por Tiristores TSC.

***IMPORTANT:** Under SVC-UB we always supply all the elements for immediate running as 1, 2, 3 and 4.

Optional items (supplied under specific order)

a) Technical and Vocational Education configuration

- ⑤ AEL-SVC/ICAL. Interactive Computer Aided Instruction Software.

b) Multipost Expansions options

- ⑥ MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.
- ⑦ ESN. EDIBON Scada-Net Systems.

① SVC-UB. Base Unit for AEL-SVC.

- 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-AE1. Transmission Lines Simulation Module.

Return line of 10 Ohm.

The resistive part: two resistance values of 15 Ohm and 33 Ohm with the next possible connections:

Only one:

15 Ohm.

33 Ohm.

Series:

48 Ohm.

Parallel:

10.31 Ohm.

The inductive part:

Possibilities:

33 mH, 78 mH, 140 mH, 193 mH, 236 mH.

The capacitance between conductors:

0.5 μ F and 1 μ F for each conductor.

The capacitance between conductor and ground:

1 μ F and 2 μ F, also at the beginning and at the end of the line.

- N-EALD. Electrical Network Analyzer Module with Oscilloscope and Data Acquisition (2 units).

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 a 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 THD current, TDD current and K-Factor.

Maximums and minimums display.

Waveforms display, 128 samples/sec.

Events and data storage:

Harmonics analyzer:

Voltage and THD current, TDD current 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-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-PSM. Power Switch Module.
Supply voltage: single-phase 230 VAC.
Power terminals:
Four power input terminals (3PH + N).
Four power output terminals (3PH + N).
Auxiliary contacts:
One "NO" contact.
One "NC" contact.
Two push-buttons to open/close the power terminals and auxiliary contacts.
Two control contacts of 24 VDC.
Two voltage supply outputs of 24 VDC.
- N-REFT/3C. 3 x 300 W Three-Phase Configurable Resistors Module.
Configurable star and delta connections.
Three banks with three three-phase resistors of 1600 Ω .
Nominal voltage: 400 VAC.
Nominal power: 3 x (3 x 300) W.
- N-INDT/3C. 3 x 300 Var Three-Phase Configurable Inductances Module.
Configurable star and delta connection.
Inductance: 3 x (3 x 5) H.
Nominal voltage: 400 VAC.
Nominal power: 3 x (3 x 100) Var.
Supply voltage: 230 VAC.
Common point of normally close/open contacts.
- N-CAR19T/3C. 3 x 300 var Three-Phase Configurable Capacitors Module.
Configurable star and delta connections.
Three banks with three three-phase capacitors of 2 μ F.
Nominal voltage: 400 VAC.
Nominal power: 3 x (3 x 300) Var.
- N-TRANS09. Three-Phase Galvanic Isolation Transformer Module, 400/400 VAC, 1 kVA.
Nominal power: 1 kVA.
Primary winding voltage: 400 VAC Y – 230 VAC Δ .
Secondary winding voltage: 400 VAC Y – 230 VAC Y.
Fuses: 3 x 5 A.

Required elements to operate with "SVC-UB" unit (at least one) (Not included):

- SVC-K1. TCR Thyristor Reactor Controller Kit.
 - N-TCR01. TCR Thyristor Reactor Controller Module.
Supply voltage: 230 VAC.
Nominal power: 1 kVA.
Rated current: 1.44 A.
Thyristor bridge firing angle control.
 - N-INDT. Three-phase Commutable Inductive Load Module.
Nominal voltage: 400 VAC.
Inductance: 1.4 H.
Nominal current: 1.6 A.
Manual switch to turn on/off inductances.
Fuses: 3 x 2 A.
Terminals:
Four input terminals (3PH + N).
Four output terminals (3PH + N).
- SVC-K2. TSC Thyristor Switch Capacitor Kit.
 - N-TSC01. TSC Thyristor Switch Capacitor Module.
Supply voltage: 230 VAC.
Nominal power: 1 kVA.
Rated current: 1.44 A.
Thyristor bridge firing angle control.
 - N-CONT. Three- phase Commutable Capacitive Load Module.
Nominal voltage: 400 VAC.
Capacitance: 3 x 7 μ F.
Manual switch to turn on/off capacitors.
Fuses: 3 x 4 A.
Terminals:
Four input terminals (3PH + N).
Four output terminals (3PH + N).

Tender Specifications (for main items)

Additional recommended elements for a greater functionality of the "SVC-UB" unit (at least one) (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.

- TPEL/1800W. Single-phase AC/DC Electronic Load of 1800W (3 units).

The TPEL/1800W electrical load stands out for its versatility in operating in both AC and DC. With a wide power range from 0 to 1800VA and an adjustable frequency from 45 Hz to 450 Hz, this electronic source offers exceptional capabilities.

With its advanced measurement capabilities, 7-inch LCD display, and features such as the built-in oscilloscope, the TPEL/1800W is the ideal solution for laboratory testing of most of EDIBON's unit such as UPS, inverters, AC power supplies, electrical generators and AC electronic components. In addition, its connectivity via LAN and USB interfaces ensures reliable and fast control, adding an additional level of efficiency to its capabilities.

Technical Features:

Frequency Range: 45 Hz~450 Hz.

Power Range: 0~1.8 kVA.

Voltage Range: 50-420 Vrms, 15-260 Vrms.

Parallel Connection/Three Phase Control: Capacity can be extended up to 43.2 kVA.

7 Inch LCD Display: Provides a clear and accessible interface.

Oscilloscope Function: Allows display of voltage and current waveforms.

High Speed AD Sampling: Captures real-time waveforms.

Measurement Modes: Includes Vrms, Vpk, Vdc, Irms, Ipk, Idc, W, VA, VAR, CF, PF and FREQ.

Harmonic Measurement: Up to harmonic 50 (THD-V).

AC Electronic Load: DC/CR/CP modes.

DC Electronic Load: DC/CR/CP/CV modes.

External Analog Control: 0~10 V analog input, with voltage and current monitoring functions.

Protection Functions: OTP, OCP, OVP, UVP and OPP.

Communication Interfaces: LAN and USB, plus external interface for USB flash disk.

- SVC-K3. Dynamic Load Kit 1.

- N-DLC01. Dynamic Load Controller 1 Module.

Nominal voltage: 230 VAC.

Includes brake with 5 Nm nominal torque.

LCD display.

Daily load curve configuration by means of 5 potentiometers:

Test time from 30 to 300 s.

Definition of maximums and minimums of the load curve.

- EMT7B/1K-E. 3PH Squirrel-Cage Industrial Motor, 1 kW, 4 poles.

Nominal power: 1000 W.

Nominal voltage: 230 VAC/400 VAC.

Frequency: 50/60 Hz.

Nominal load speed: 1400 rpm.

Nominal current: 4.57 A/2.64 A.

Additional recommended elements (at least one) (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.

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Management, processing, comparison and storage of data.

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Technical Features:

Frequency Range: 45 Hz~450 Hz.

Power Range: 0~1.8 kVA.

Voltage Range: 50-420 Vrms, 15-260 Vrms.

Parallel Connection/Three Phase Control: Capacity can be extended up to 43.2 kVA.

7 Inch LCD Display: Provides a clear and accessible interface.

Oscilloscope Function: Allows display of voltage and current waveforms.

High Speed AD Sampling: Captures real-time waveforms.

Measurement Modes: Includes Vrms, Vpk, Vdc, Irms, Ipk, Idc, W, VA, VAR, CF, PF and FREQ.

Harmonic Measurement: Up to harmonic 50 (THD-V).

AC Electronic Load: DC/CR/CP modes.

DC Electronic Load: DC/CR/CP/CV modes.

External Analog Control: 0~10 V analog input, with voltage and current monitoring functions.

Protection Functions: OTP, OCP, OVP, UVP and OPP.

Communication Interfaces: LAN and USB, plus external interface for USB flash disk.

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

The complete unit includes as well:

Advanced Real-Time SCADA.

Open Control + Multicontrol + Real-Time Control.

Specialized EDIBON Control Software based on LabVIEW.

Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.

Capable of doing applied research, real industrial simulation, training courses, etc.

Remote operation and control by the user, as well as remote support from EDIBON technical support, are always included.

Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).

Designed and manufactured under several quality standards.

Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user's knowledge and progress reached.

This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

② AEL-SVC/CCSOF. Computer Control + Data Acquisition + Data Management Software:

The three softwares are part of the SCADA system.

Compatible with the industry standards.

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.

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.

③ Cables and Accessories, for normal operation.

④ Manuals:

This unit is supplied with 8 manuals: Required services, Assembly and Installation, Control software, Starting-up, Safety, Maintenance & Practices manuals.

Exercises and Practical Possibilities to be done with the Main Items

Practical possibilities with the base unit SVC-UB and SVC-K1:

- 1.- Manual reactive power control with manual commutable inductances and capacitors loads.
- 2.- Automatic reactive power compensation with the thyristor reactor controller module (TCR).
- 3.- Manual reactive power compensation with the thyristor reactor controller module, varying the firing "alfa".
- 4.- Comparison of the behavioral dynamics of the transmission system with the manual reactive power control and the automatic reactive power control with thyristors (TCR).
- 5.- Visualization of the grid parameters with the influence of the manual reactive power control.
- 6.- Visualization of the grid parameters with the influence of the automatic reactive control with the thyristors reactor module (TCR).
- 7.- Manual control of the thyristor firing angle in the TCR and visualization of the grid reactive power response.
- 8.- Visualization of the voltages nodes in the transmission line and droop voltages compensation against sudden load changes.

Practical possibilities with the base unit SVC-UB and SVC-K2:

- 9.- Automatic reactive and active power compensation with the thyristor reactor controller module (TCR) and thyristor capacitor switch controller module (TSC).
- 10.- Manual reactive power compensation with the thyristor reactor controller module and the thyristor capacitor switch controller module, varying the firing "alfa".
- 11.- Comparison of the behavioral dynamics of the transmission system with the manual reactive power control and the automatic reactive power control with both thyristors reactor and capacitor controllers (TCR and TSC).
- 12.- Visualization of the grid parameters with the influence of the manual reactive and active power control.
- 13.- Visualization of the grid parameters with the influence of the automatic power factor control with the thyristors reactor and capacitor modules (TCR and TSC).
- 14.- Manual control of the thyristor firing angle in the TCR and TSC, and visualization of the grid power factor response.
- 15.- Visualization of the voltages nodes in the transmission line and droop voltages compensation against sudden load changes.

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

- 16.- Optimum firing angle determination for each load condition.
- 17.- Visualization and comparison of the reactive power compensation waves working with both TCR and TSC.
- 18.- Visualization of the voltage and current gaps according to the thyristors firing angle.
- 19.- Thyristors firing angle identification with the high speed data acquisition system.

Other possibilities to be done with this unit:

- 20.- Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
 - 21.- Open Control, Multicontrol and Real Time Control.
This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivative parameters; etc, in real time.
 - 22.- The Computer Control System with SCADA allows a real industrial simulation.
 - 23.- This unit is totally safe as uses mechanical, electrical/electronic, and software safety devices.
 - 24.- This unit can be used for doing applied research.
 - 25.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
- Several other exercises can be done and designed by the user.

a) Technical and Vocational Education configuration

⑤ AEL-SVC/ICAI. Interactive Computer Aided Instruction Software.

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.

- 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.

- 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.

b) Multipost Expansions options

⑥ MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.

MINI ESN. EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously.

The MINI ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit.

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing "real time" control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

The system basically will consist of:

This system is used with a Computer Controlled Unit.

- Instructor's computer.
- Students' computers.
- Local Network.
- Unit-Control Interface adaptation.
- Unit Software adaptation.
- Webcam.
- MINI ESN Software to control the whole system.
- Cables and accessories required for a normal operation.

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



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