

### GENERAL DESCRIPTION

The Aerial Line Model AE1A consists of a set of modules that represent basically the Transport Electric System, the Electrical Generation and the Consumption. Through these modules, the student will understand the main concepts of Generation, Transport and Consumption: drop voltages, reactive energy compensation, measuring of currents, voltages, active and reactive power, power losses at the transmission lines, etc.

Each module represents a part of the electrical system:

- Generation: in order to simulate the generation central, the Aerial Line Model includes the EME/B unit. The EME/B unit is a three-phase power source with contacts and pushbuttons that will supply to the AE1 module.
- Transport: in order to simulate the energy transport, the student will work with the AE1 module. This module consists of a series of diagrams with resistors, inductances and capacitances that represent, through the concentrated parameters method, the main characteristics of the Transport Lines.
- Consumption: on the consumption area, the student will work with a special module, the RCL3R. This module consists of different loads to simulate the consumption: resistors, capacitors and variable resistors.



ISO 9000: Quality Management  
(for Design, Manufacturing,  
Commercialization and After-sales service)



European Union Certificate  
(total safety)

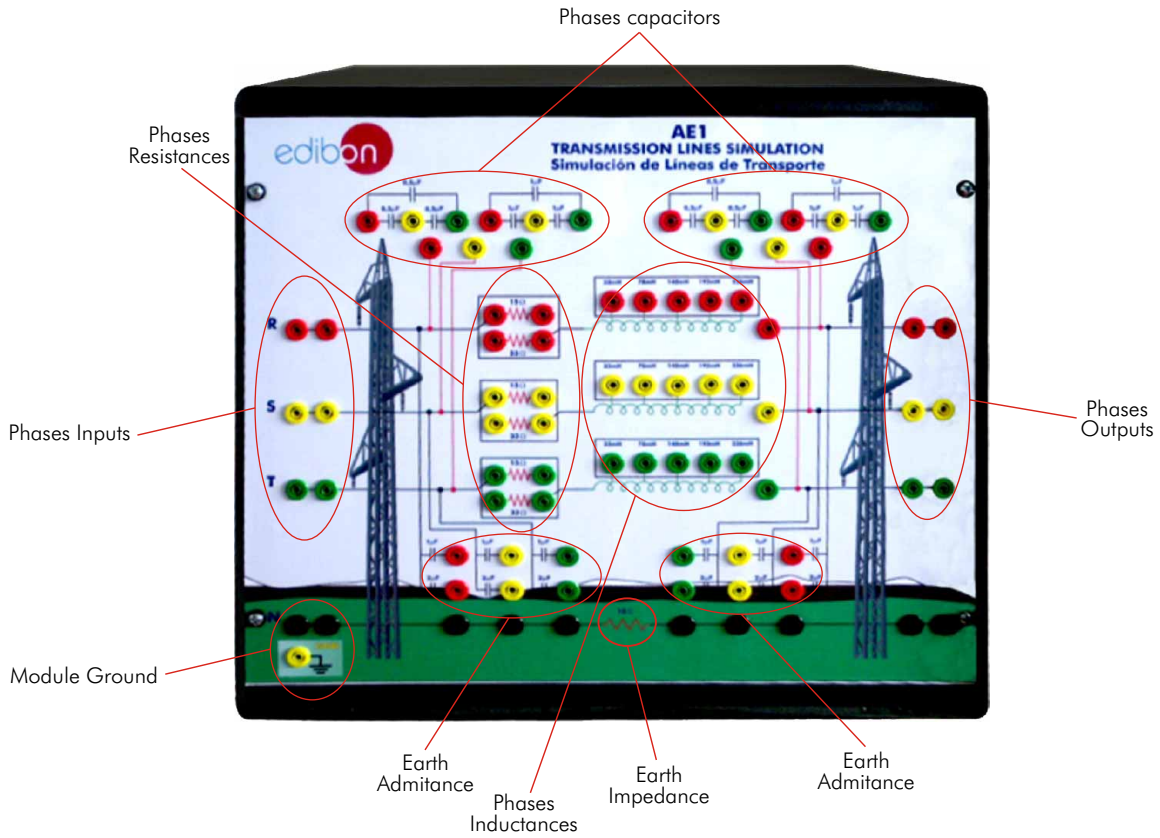
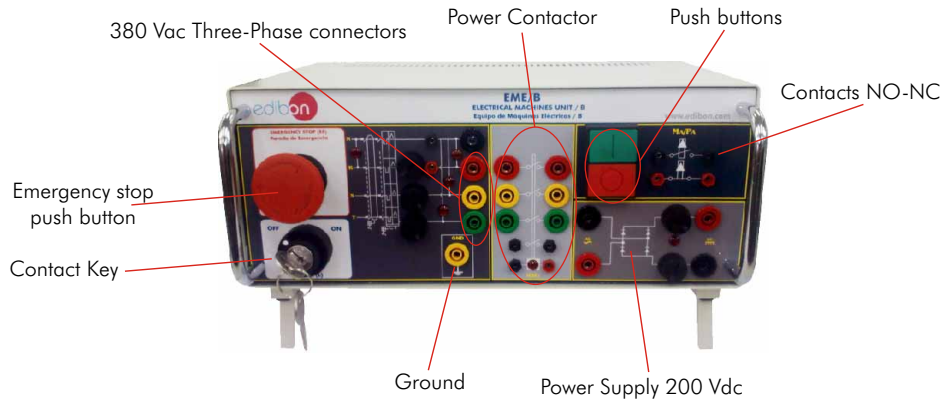


Certificates ISO 14000 and  
ECO-Management and Audit Scheme  
(environmental management)



Worlddidac Quality Charter  
Certificate  
(Worlddidac Member)

## ELEMENTS ALLOCATION



The complete application AE1A is formed by a set of modules:

**EME/B. Electrical Machines Unit:**

This unit simulates the electrical generation and will be connected to the inputs of the AE1 module.

Metallic box.

Diagram in the front panel.

Thermal magnetic circuit breaker.

AC Three-Phase supply with fuses.

DC supply 200 Vdc with fuses.

Connection Key.

Emergency stop push button.

Two push buttons (1NO + 1NC).

One contactor, with three power connections, one control connection and supply control.

Required electrical supply: Three-phase with neutral and ground, 380 V.

**AE1. Transmission Lines Simulation Module:**

This module represents basic concepts of the Electric Energy high-voltage three-phase transmission lines operation. It simulates a value modifying concentrated parameter line that allows different configurations and consists of three conductor line (R, S, T) and a Neutral or return line (N).

Each one of the phases is represented following the concentrated parameters theoretical model, through a resistance series association and inductances, along with a parallel association between each one of them in a capacitance effect.

The AE1 module has impedance in the neutral to reduce the earth short circuits and ensure the module functionality.

Besides, it has a series of capacitors to simulate the capacitance between the conductors and ground and between conductors.

Besides, each line has resistances and inductances to simulate the parameters of the transmission line.

The parameters that represent a real transmission line are following:

Resistances and inductances on each line:

R= 15 ohms, 33 ohms with the possibility of making parallel-series connections between them.

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

Capacitance between conductors:

The capacitance between conductors is simulated with a pair of capacitors at the beginning and at the end of the line with different values for each conductor:

C= 0,5  $\mu$ F, 1  $\mu$ F.

Capacitance between conductor and ground at the beginning and at the end of the line for each conductor:

C= 1  $\mu$ F, 2  $\mu$ F.

Neutral resistance:

R= 10 ohms.

Different plugs to connect the power supply and different loads.

With all these values it is possible to simulate a great number of line configurations, beginning with different line distances with different types of conductor, through the unbalanced lines with different conductors groups (simplex, duplex, triplex and cuadruplex).

Technical data:

Power supply: 400 Vac three-phase.

Maximum Current: 2 A.

Capacitors between conductors: 6 x (0,5  $\mu$ F and 1  $\mu$ F).

Capacitors between conductor and ground: 6 x (1  $\mu$ F and 2  $\mu$ F).

Resistors: 3 x (15 ohms and 33 ohms).

Inductances: 3 x (33 mH, 78 mH, 140 mH, 193 mH, 236 mH).

**RCL3R. Resistive, Inductive and Capacitive Loads Module:**

This module represents different static models of load: Resistive, Inductive and Capacitive loads.

Our Resistive, Capacitive and Inductive Loads Module (RCL3R) offers:

Single and Three-phase fixed resistances.

Single and Three-phase variable resistances.

Single and Three-phase inductances.

Single and Three-phase capacitors.

Metallic box. Diagram in the front panel.

Variable resistive loads: 3 x [150 $\Omega$  (500 W)].

Fixed resistive loads: 3 x [150 $\Omega$  (500 W) + 150 $\Omega$  (500 W)].

Inductive loads: 3 x [0, 33, 78, 140, 193, 236 mH]. 230 V / 2A.

Capacitive loads: 3 x [4 x 7 $\mu$ F]. (400 V).

Cables and Accessories, for normal operation.

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

Recommended Accessories: (not included in the standard supply).

EAL. Network Analyzer Unit. (See details in section "Recommended accessories" in page 3).

## EXERCISES AND PRACTICAL POSSIBILITIES

### Some practical possibilities:

- 1.- Studying of the energy power losses on the transport lines.
- 2.- Calculating drops voltage on the transport lines.
- 3.- Studying the unbalanced power systems.
- 4.- Studying the balanced power systems.
- 5.- Directly measure of energy losses on the electrical grid and comparison with theory calculus.
- 6.- Variation of type of loads and visualizing the power factor of the grid.

## REQUIRED SERVICES

-Electrical supply: three-phase, 380V./50 Hz or 220V./60 Hz.

## DIMENSIONS & WEIGHT

AE1A. Aerial Line Model:

EME/B Unit:

-Dimensions: 300 x 190 x 120 mm. approx.  
(11.81 x 7.48 x 4.72 inches approx.).

-Weight: 5 Kg. approx.  
(11 pounds approx.).

AE1 Module:

-Dimensions: 490 x 450 x 470 mm. approx.  
(19.29 x 17.72 x 18.50 inches approx.).

-Weight: 10 Kg. approx.  
(22.05 pounds approx.).

RCL3R Module:

-Dimensions: 490 x 450 x 470 mm. approx.  
(19.29 x 17.72 x 18.50 inches approx.).

-Weight: 30 Kg. approx.  
(66.14 pounds approx.).

## RECOMMENDED ACCESSORIES

### EAL. Network Analyzer Unit:

This unit shows the main electric parameters on the electric network through the interface and easy parameter selection.

Metallic box. Diagram in the front panel.

Measurements of current, voltage, power, power factor, frequency, energy, TRMS measurement of distorted waves (voltage, current) for each phase and average.

Display for instantaneous variables: 3 x 3 digits.

Display for energies: 8 + 1 digits.

Voltage:  $V_{LN} = 185 \text{ V to } 460 \text{ V}$ .  $V_{LN} = 320 \text{ V to } 800 \text{ V}$ .

Current: Phase current: 0.03 to 5A.

Frequency: 48 to 62 Hz  $\pm 0.1$  Hz.

Power: Active, Reactive and Apparent.

Power Factor: Power factor for resistive, inductive and capacitive load types.

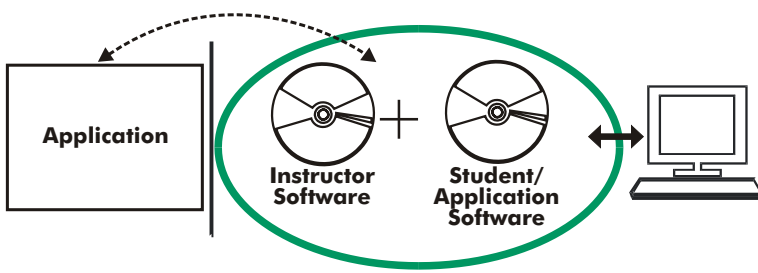
Required power supply: 220 V, 50/60 Hz.

Dimensions: 300 x 190 x 120 mm. approx.

Weight: 3 Kg. approx.



## CAI. Computer Aided Instruction Software System



With no physical connection between the application and computer, this complete package consists on an Instructor Software (INS/SOF) totally integrated with the Student/Application Software. Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students. These, on the other hand, get a virtual instructor who helps them to deal with all the information on the subject of study.

Examples of the Software screens

### Instructor Software

#### INS/SOF. Classroom Management Software Package (Instructor Software).

The Instructor has a whole range of options, among them:

- Organize Students by Classes and Groups.
  - Create easily new entries or delete them.
  - Create data bases with student information.
  - Analyze results and make statistical comparisons.
  - Print reports.
  - Develop own examinations.
  - Detect student's progress and difficulties.
- ...and many other facilities.



This Instructor Software working in network configuration allows controlling all the students in the classroom.

### Student Software

#### A.../SOF Computer Aided Instruction Software (Student/Application Software).

It explains how to use the application, run the experiments and what to do at any moment.

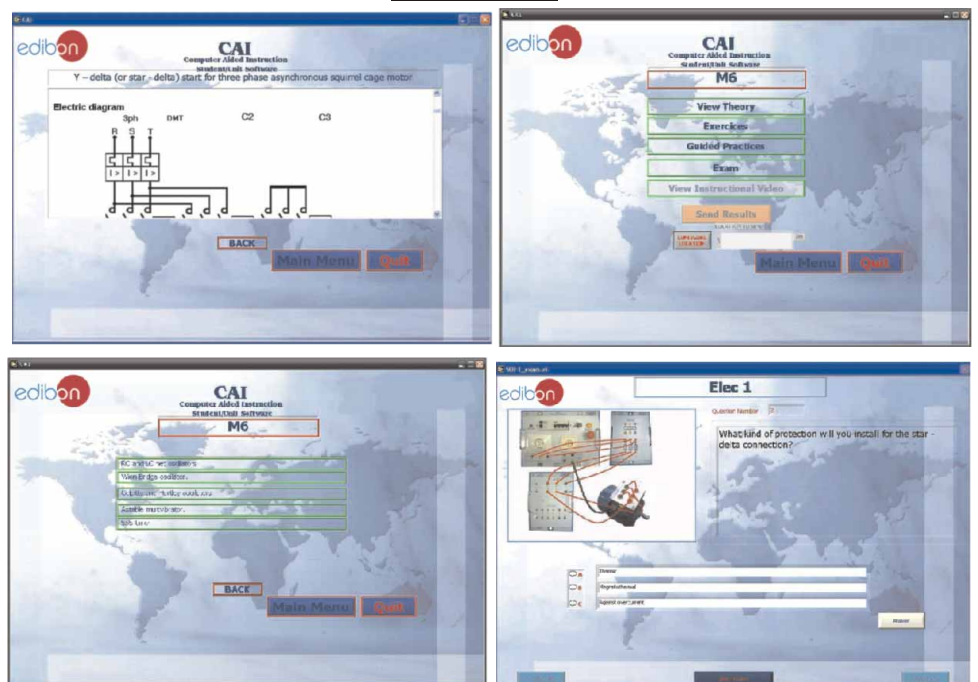
- The options are presented by pull-down menus and pop-up windows.
- This software contains:

**Theory:** that gives the student the theoretical background for a total understanding of the studied subject.

**Exercises:** divided by thematic areas and chapters to check out that the theory has been understood.

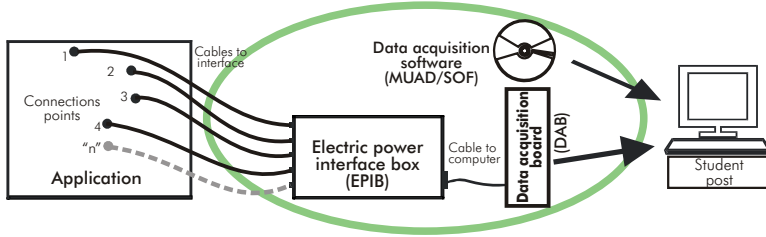
**Guided Practices:** presents several practices to be done with the application, showing how to complete the exercises and practices.

**Exams:** set of questions presented to test the knowledge obtained.



For more information see CAI catalogue. Click on the following link:  
[www.edibon.com/products/catalogues/en/CAI.pdf](http://www.edibon.com/products/catalogues/en/CAI.pdf)

## MUAD. Electric Power Data Acquisition System



MUAD is the perfect link between the application and the PC. MUAD is a continuous data acquisition system with virtual instrumentation, that measures, analyzes and represents the parameters involved in the process.

MUAD allows voltage and current acquisition and measurement, data processing, frequency spectrum and all the functions of a digital oscilloscope.

We easily connect the Electric Power Interface Box (EPIB) to the application with the supplied cables (there are several connection points placed for it). The EPIB is connected to the PC through the Data Acquisition Board (DAB), and by using the Data Acquisition software with virtual instrumentation, the student can get results from the undertaken experiment/practice, see them on the screen and work with them.

MUAD System includes EPIB + DAB + MUAD/SOF:

1) Hardware:

1.1) EPIB. **Electric power interface box** (dimensions: 300 x 180 x 120 mm. approx.):

Interface that carries out the conditioning of the diverse signals that can be acquired in a process, for their later treatment and visualisation.

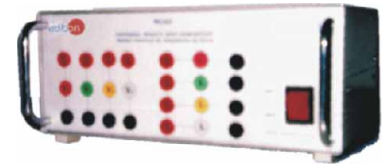
In the front panel, the elements are separated in two parts: left-hand part for VOLTAGE sensors, and right-hand part for CURRENT sensors.

8 analog input channels.

Sampling range: 250KSPS (Kilo samples per second).

4 Tension sensors AC/DC, 400V.

4 Current sensors.



EPIB

1.2) DAB. **Data acquisition board**:

PCI Data acquisition board (National Instruments) to be placed in a computer slot.

Bus PCI.

**Analog input:**

Number of channels= 16 single-ended or 8 differential.

Resolution=16 bits, 1 in 65536.

Sampling rate up to: 250 KSPS (Kilo samples per second).

Input range (V)=± 10V.

Data transfers=DMA, interrupts, programmed I/O.

Number of DMA channels=6.

**Analog output:**

Number of channels=2.

Resolution=16 bits, 1 in 65536.

Maximum output rate up to: 833 KS/s.

Output range(V)=±10.

Data transfers=DMA, interrupts, programmed I/O.

**Digital Input/Output:**

Number channels=24inputs/outputs.

D0 or DI Sample Clock frequency: 0 to 1 MHz.

Timing: Counter/timers=2.

Resolution: Counter/timers: 32 bits.



DAB



MUAD/SOF

2) MUAD/SOF. **Data acquisition software**:

Data Acquisition Software with Graphic Representation:

Friendly graphical frame.

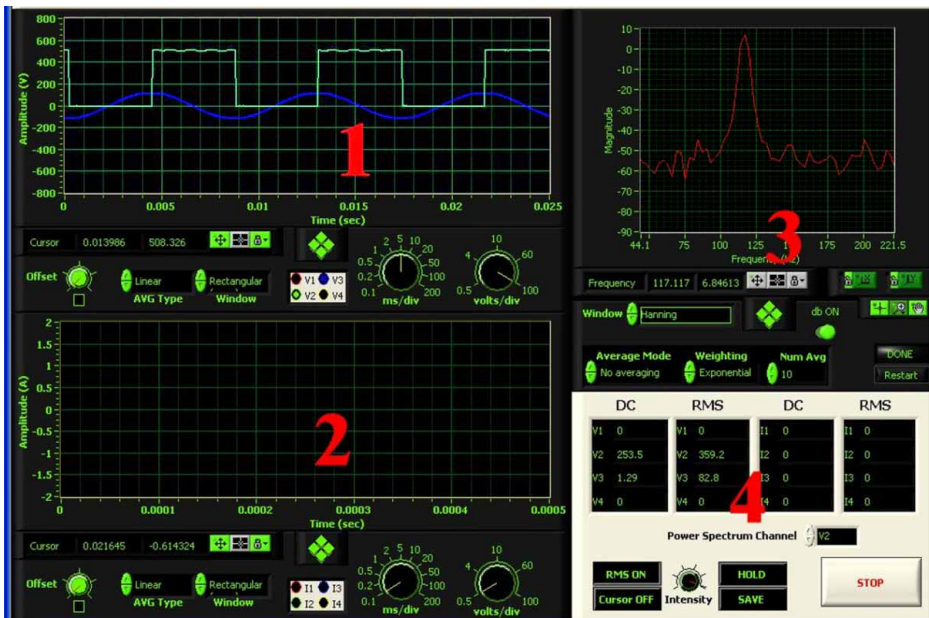
Compatible with actual Windows operating systems.

Configurable software allowing the representation of temporal evolution of the different signals.

Visualization of a tension of the circuits on the computer screen.

Sampling velocity up to 250 KSPS. (Kilo samples per second).

Software Main Screen



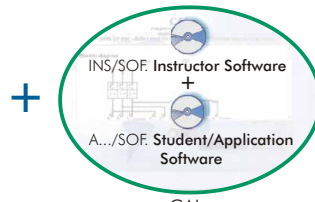
- 1.- Voltage channels section
- 2.- Current channels section
- 3.- Power spectrum section
- 4.- General control panel section

Some working possibilities:

1) CAI + MUAD working possibility (complete EDIBON system)



Application (AE1A)



CAI.  
Computer Aided Instruction Software System

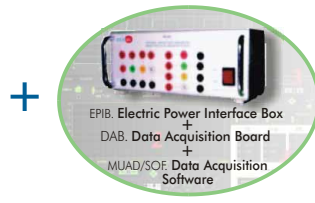


MUAD  
Electric Power Data Acquisition System

2) MUAD working possibility



Application (AE1A)

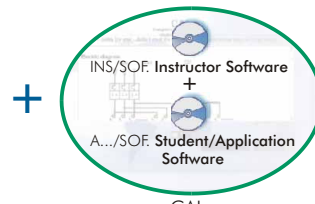


MUAD  
Electric Power Data Acquisition System

3) CAI working possibility



Application (AE1A)



CAI.  
Computer Aided Instruction Software System

4) Simplest working possibility



Application (AE1A)

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



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REPRESENTATIVE:

