

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 and remote control for 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

POWERED BY
NATIONAL INSTRUMENTS
LabVIEW™

www.edibon.com
PRODUCTS
4 - ELECTRICITY

For more information about Key Features, click here



ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)



European Union Certificate (total safety)



Certificates ISO 14001 and ECO-Management and Audit Scheme (environmental management)



"Worlddidac Quality Charter" and Platinum Member of Worlddidac

INTRODUCTION

Nowadays Power Electronics play an important role in order to control the flow of electrical energy.

Power Electronics is the technology behind switching power supplies, power converters, power inverters, motor drives, and motor soft starters. Besides, power electronics is very widespread in the field of Smart Grids Power Systems, for instance, in back-to-back power inverters, PWM controllers, SVCs, STATCOMs, High Voltage DC Transmission Systems (HVDC), etc.

GENERAL DESCRIPTION

The Power Electronics Application, with SCADA "AEL-PWEC", has been designed to study the most important applications related to DC Power Electronics, Single-Phase AC Power Electronics, Three-Phase AC Power Electronics and Thyristor Power Electronics.

The "AEL-PWEC" application provides several levels of training to give the user full knowledge and experiences about the most important principles of control, operation and functioning of power electronics. For this purpose, this application includes a specific manual, which explains at theoretical level the subjects relating to this topic. The thematic of the manual covers from basic principles of functioning, control and operation of DC Power Electronics, Single-Phase AC Power Electronics, Three-Phase AC Power Electronics and Thyristor Power Electronics. On the other hand, it is provided a series of modules to put into practice all theoretical concepts previously studied in this manual.

One of the advantages of this application is its modularity and flexibility. This application offers different possibilities to be adapted to the technical requirements of the end user. The application is divided according to the following thematic:

- DC Power Electronics: Diode, Switching Transistor, High-Speed Switching, Ripples, Battery Charger, Buck and Boost Choppers, Four-Quadrant Chopper.
- DC Motor Drives: PWM DC Drive, Unidirectional and Bidirectional PWM DC Drive, Regenerative Braking, Speed Feedback, Current Control.
- Single-Phase AC Power Electronics: Diode Rectifiers, PWM Inverter.
- Three-Phase AC Power Electronics: Rectifiers, Single-Phase PWM Inverter with Dual Polarity DC Bus, Three-Phase PWM Inverter.
- Thyristor Power Electronics: Diode Rectifiers, Solid State Relay, Single and Three AC Power Control, Three-Phase Rectifier/Inverter.
- Three-Phase Induction Motor Starters.
- Three-Phase Motor Drives: Variable-Frequency, Constant V/f ratio.

The "AEL-PWEC" application includes a SCADA Control and Data Acquisition System which represents faithfully the different signals of the power electronics. The SCADA is designed to control in real time the pulse with modulation, frequency and many others characteristics of power electronics.

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

The "PWEC-UB" includes the following elements:

- N-ALI01. Industrial Main Power Supply.
- N-REFT/3C. 3 x 300 W Three-Phase Configurable Resistors Module.
- N-CAR19T/3C. 3 x 300 VAr Three-Phase Configurable Capacitors Module.

General Description

- EMT10. 3PH Squirrel-Cage Motor, 2 speeds.
- N-FILT02. Inductances and Capacitor Filter Module 2.
- N-FILT01. Three-Phase filter Module 1.
- N-TRANS09. Three- phase Isolating Transformer, 400/400 VAC, 1 kVA, Module.
- N-IGBT01. Chopper/Inverter Module 1.
- BAT5. Lead-Acid Battery.
- N-THY01. Three-Phase Power Thyristors Module 1.
- N-TRDC01. Three-Phase Rectifier Diodes and Capacitors Module 1.
- N-PEDA. Power Electronics Data Acquisition and Control Interface.

Required element/s to operate with "PWEC-UB" unit:

- AEL-PC. Touch Screen and Computer.

Recommended elements to increase the functionality of the "PWEC-UB" unit:

- EMT7. 3PH Squirrel-Cage Motor.
- N-ASYB. Basic Synchronization Module.
- N-INDT/3C. 3 x 300 VAR Three-Phase Configurable Inductances Module.
- N-AE1. Transmission Lines Simulation Module.
- N-TRANS3R/1K. Three-phase Transformer with Motor Voltage Regulator.
- AEL-SERIN/CA-1KW. 1 kW AC Industrial Servomotor Application.

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

Option A:

This application needs the following racks:

- N-RACK-A.
- N-RACK-M.

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

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 **AEL-PWEC Application.**

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

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

ON-OFF removable key.

Output voltage connections:

Three-Phase + Neutral: 400 VAC.

Single-Phase: 230 VAC.

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

Differential magnetothermal, 4 poles, 25 A, 30 mA AC 6 KA.

Emergency stop push button.

GND terminal.



N-ALI01

• **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-CAR19T/3C. 3 x 300 VAr Three-Phase Configurable Inductances Module.**

Configurable Star and Delta connection.

Three benches with three-phase capacitors of 2 μF each one.

Nominal voltage: 400 VAC.

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



N-CAR19T/3C

• **EMT10. Asynchronous Three-Phase Motor Of Two Independent Speeds.**

Nominal power: 240/370 W.

Nominal voltage: 3 x 400 VAC.

Frequency: 50/60 Hz.

RPM: 900/1420 rpm.

Nominal Current: 1.05 / 1.35 A.

Shaft height: 71 mm.



EMT10

• **N-FILT02. Inductances and Capacitor Filter Module 2.**

Filter for power electronics.

Nominal current: 5 A.



N-FILT02

• **N-FILT01. Three-Phase filter Module 1.**

Filter for power electronics.

Nominal current: 5 A.



N-FILT01

- **N-TRANS09. Three- phase Isolating Transformer, 400/400 VAC, 1 kVA, Module.**

Nominal power: 1kVA.
 Primary Winding Voltage: 3 x 400 VAC Δ.
 Secondary Winding Voltage: 3 x 400 VAC Y.
 Adjustable overcurrent protection: 1.6 - 2.5 A.
 GND terminal.



N-TRANS09

- **N-IGBT01. IGBT Chopper-Inverter Module 1.**

6 x IGBTs.
 Digital inputs for firing of IGBTs.
 Fuses.



N-IGBT01

- **BAT5. Lead-Acid Battery.**

Lead-Acid battery.
 Battery capacity: 70 Ah.



BAT5

- **N-THY01. Three-Phase Power Thyristors Module 1.**

6 x Thyristors.
 Digital inputs for firing of Thyristors.
 Fuses.



N-THY01

- **N-TRDC01. Three-Phase Rectifier Diodes and Capacitors Module 1.**

Diodes module for three-phase rectifier purposes.
 6 x Diodes.



N-TRDC01

- **N-PEDA. Power Electronics Data Acquisition and Control Interface.**

Data acquisition interface for power electronics control.
 Power supply: 230 VAC.



N-PEDA

- **AEL-PC. Touch Screen and Computer.**

Touch Screen:
 Energy efficiency class: A.
 Screen diagonal: 68.6 cm (27 inch (s)).
 Power consumption (operating): 26 watts.
 Annual energy consumption: 38 kWh.
 Power consumption (standby / off) 0.49 watts.
 Screen resolution: 1920 x 1080 pixels.

Computer:
 Processor Number: Intel Core i7-6600U Processor (4M Cache, up to 3,40 GHz).
 Cache: 4 MB Intel Smart Cache.
 Clock speed: 2.6 GHz.
 # Of Cores/# of Threads: 2/4.
 Max. TDP/Power: 15 W.
 Memory Types: DDR4-2133, LPDDR3-1866, DDR3L-1600.
 Graphics: Intel HD Graphics 530.
 Slot for PCI Express.



AEL-PC

• **EMT7. 3PH Squirrel-Cage Motor.**

Nominal power: 370 W.
 Nominal voltage: 3x 230/400 VAC Δ/Y
 Frequency: 50/60 Hz.
 Poles number: 2.
 RPM: 2730 rpm.
 Shaft height: 71 mm.



EMT7

• **N-ASYB. Analog Synchronization Module.**

Input terminals: L1, L2, L3 and N generation input terminals.
 Output terminals: L1, L2, L3 and N grid input terminals.
 Synchronization switch: this switch allows close the synchronization switch. In addition, this switch has two 24 VDC connections for remote close switch.
 Analog voltmeter: it allows to measure the generation bus bar output voltage.
 Digital synchronoscope: it allows to monitor the synchronization process of the generator with the grid.
 Double analog voltmeter: it allows to compare the voltages between generator and grid bus-bars.
 Double frequency meter: it allows to compare the frequencies between the generator and the grid.
 400 VAC lamps: it allows to realize the different synchronization procedures with the dark and light lamps method.
 GND terminal.



N-ASYB

• **N-INDT/3C. 3 x 300 VAR Three-Phase Configurable Capacitors Module.**

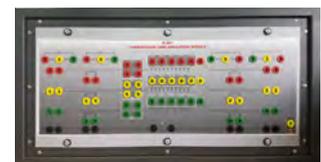
Configurable Star and Delta connection.
 Three benches with three-phase inductances of 5 H each one.
 Nominal voltage: 400 VAC.
 Nominal power: 3 x (3 x 300) VAR.



N-INDT/3C

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

Supply voltage: 400 VAC, 3PH+N.
 Three-phase line with variable parameters.
 Concentrated parameters line.
 Four capacitances benches between lines with three capacitances of 1 μF each one.
 Two capacitances benches between line and ground composed by two capacitances of 1 and 2 μF.
 Resistance of the line that can be wiring independently:
 Three resistors of 15 Ω.
 Three resistors of 30 Ω.
 Inductance of the line with several set values: 33 mH, 78 mH, 140 mH, 193 mH and 236 mH.
 Neutral resistor of 10 Ω.



N-AE1

• **N-TRANS3R/1K. Three-phase Transformer with Motor Voltage Regulator.**

Primary: 3x 400 VAC.
 Secondary: 3x 0 ... 450 V.
 Nominal power: 1 kVA.
 Frequency: 50/60 HZ.
 25 V input/"Increase voltage" button.
 25 V input/"Decrease voltage" button.



N-TRANS3R/1K

- **AEL-SERIN/CA-1KW. 1 kW AC Industrial Servomotor Application.**

Power supply: 230 VAC.

3 Digital outputs.

Encoder outputs:

Two pairs of outputs (CH A Out, CH B Out and their respective denied outputs) that are TTL signals of incremental position generated by the encoder feedback. These signals indicate the direction of rotation of the motor.

One pair of outputs (CH Z Out and their denied) that TTL works as marker of pulses. This signal indicates the motor speed.

Relay output.

3 Analog outputs.

6 Digital inputs.

6 push-buttons.

6 Switches.

1 Analog input.

1 Potentiometer.

1 Digital encoder.

Reset push-button:

Servomotor:

Nominal voltage: 3PH, 400 VAC.

Nominal power: 2 kW.

Nominal current: 5 A.

Speed range: 0 – 4200 r.p.m.

Torque: 0 – 19,1 Nm.

IP65.

Sensor resolver (20 bits, 1048576 resolution).

Incremental encoder.



AEL-SERIN/CA-1KW

- **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 and remote control for 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-PWEC/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.

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

④ **Manuals:**

This unit **is supplied with 7 manuals:** Required Services, Assembly and Installation, Control Software, Starting-up, Safety, Maintenance & Practices Manuals.

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



AEL-PWEC/CCSOF

EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH THE MAIN ITEMS

- 1.- DC Power Electronics: Diode, Switching Transistor, High-Speed Switching, Ripples, Battery Charger, Buck and Boost Choppers, Four-Quadrant Chopper.
 - 2.- DC Motor Drives: PWM DC Drive, Unidirectional and Bidirectional PWM DC Drive, Regenerative Braking, Speed Feedback, Current Control.
 - 3.- Single-Phase AC Power Electronics: Diode Rectifiers, PWM Inverter.
 - 4.- Three-Phase AC Power Electronics: Rectifiers, Single-Phase PWM Inverter with Dual Polarity DC Bus, Three-Phase PWM Inverter.
 - 5.- Thyristor Power Electronics: Diode Rectifiers, Solid State Relay, Single and Three AC Power Control, Three-Phase Rectifier/ Inverter.
 - 6.- Three-Phase Induction Motor Starters.
 - 7.- Three-Phase Motor Drives: Variable-Frequency, Constant V/f ratio.
- Other possibilities to be done with this unit:
- 8.- Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
 - 9.- 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
 - 10.- The Computer Control System with SCADA allows a real industrial simulation.
 - 11.- This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
 - 12.- This unit can be used for doing applied research.
 - 13.- 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

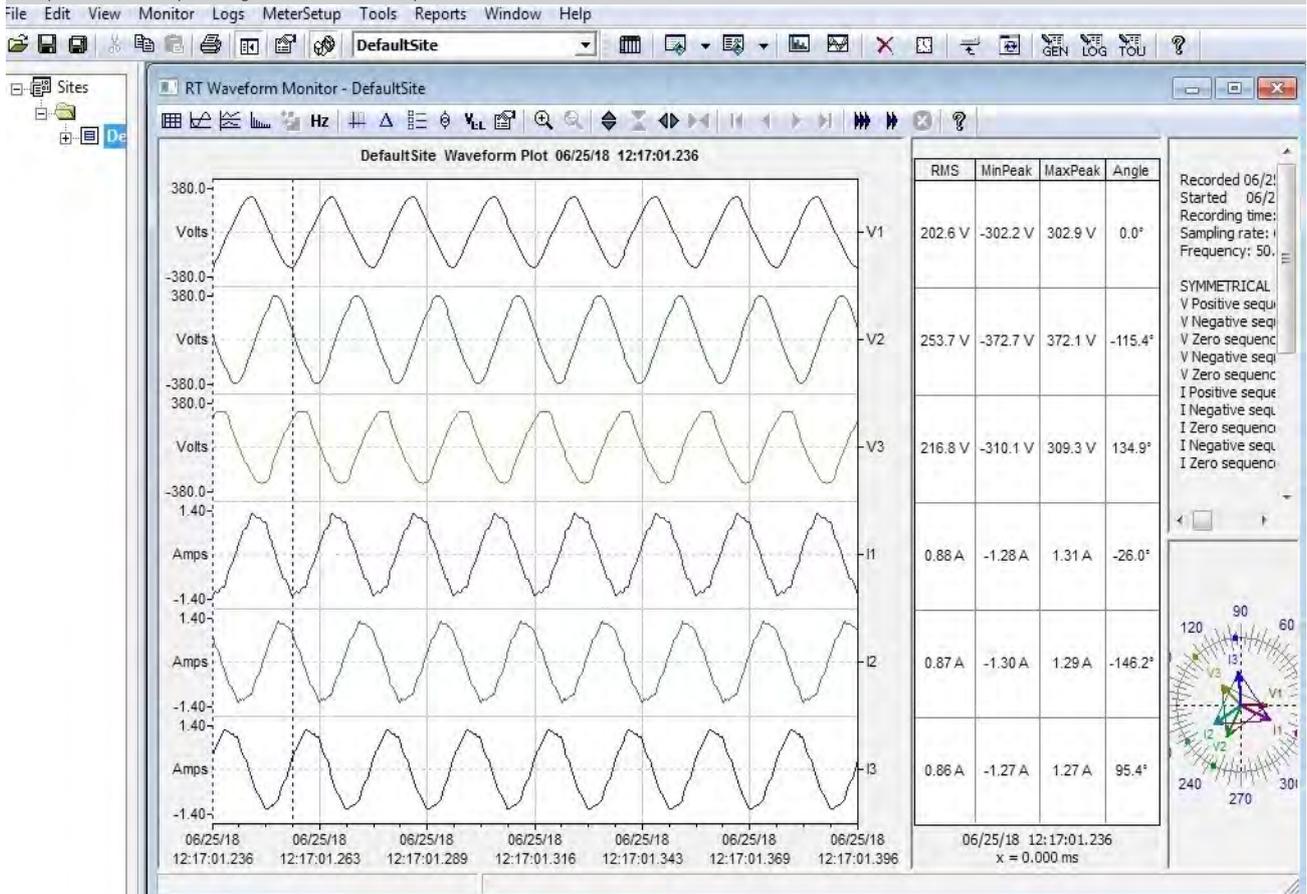
- Electrical supply: three phase, 380 VAC- 400 VAC/50 Hz o 190 VAC-240/60 Hz, 2 kW.
- Computer (PC).

DIMENSIONS AND WEIGHTS

- AEL-PWEC:
- 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.)

SOME REAL RESULTS OBTAINED FROM THIS UNIT

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



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-PWEC/ICAI. Interactive Computer Aided Instruction Software System.

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.

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

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

Innovative features:

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

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

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

Instructor Software



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

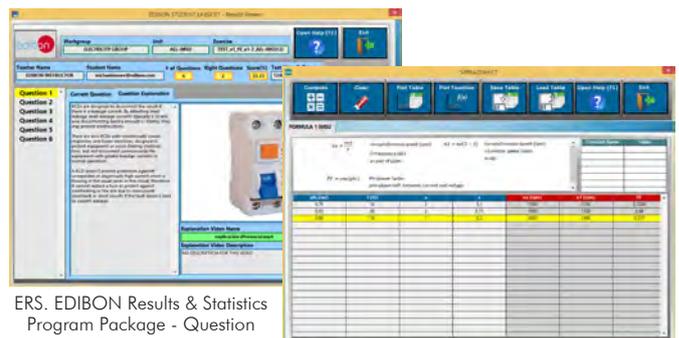
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

Student 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

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:

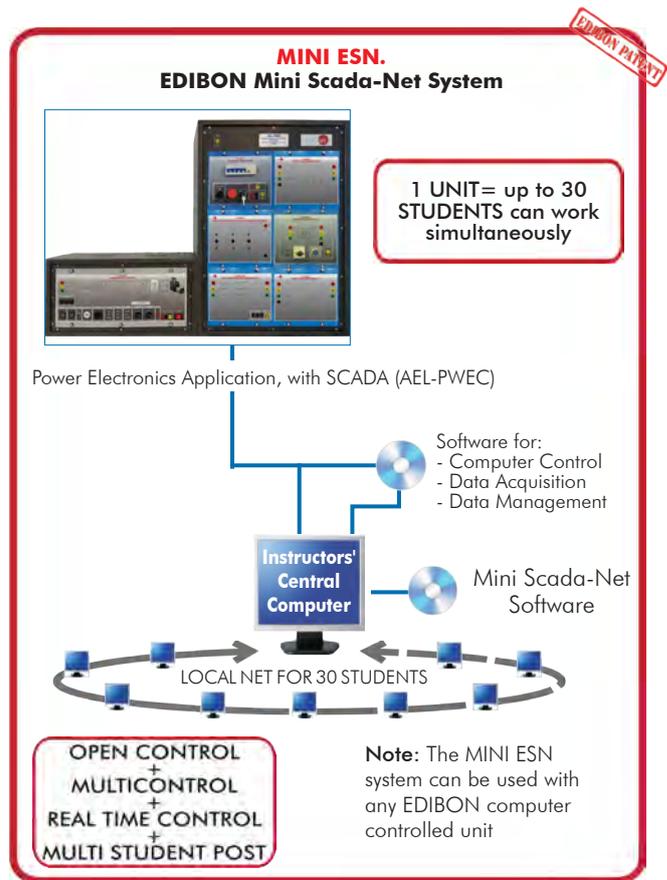
www.edibon.com/en/files/expansion/MINI-ESN/catalog

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/files/expansion/ESN/catalog



ORDER INFORMATION

Main items (always included in the supply)

Minimum supply always includes:

- ① **Unit: AEL-PWEC. Power Electronics Application, with SCADA.**
- ② **AEL-PWEC/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
- ③ **Cables and Accessories**, for normal operation.
- ④ **Manuals.**

***IMPORTANT:** Under AEL-PWEC 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-PWEC/ICAI. Interactive Computer Aided Instruction Software System.

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 **AEL-PWEC Application.**

- N-ALI01. Industrial Main Power Supply.
Supply voltage: 400 VAC, 3PH+N+G.
ON-OFF removable key.
Output voltage connections:
 Three-Phase + Neutral: 400 VAC.
 Single-Phase: 230 VAC.
Three-Phase supply hose with IP44 3PN+E 32A 400 V connecting plug.
Differential magnetothermal, 4 poles, 25 A, 30 mA AC 6 KA.
Emergency stop push button.
GND terminal.
- 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-CAR19T/3C. 3 x 300 VAr Three-Phase Configurable Inductances Module.
Configurable Star and Delta connection.
Three benches with three-phase capacitors of 2 μ F each one.
Nominal voltage: 400 VAC.
Nominal power: 3 x (3 x 300) Var.
- EMT10. Asynchronous Three-Phase Motor Of Two Independent Speeds.
Nominal power: 240/370 W.
Nominal voltage: 3 x 400 VAC.
Frequency: 50/60 Hz.
RPM: 900/1420 rpm.
Nominal Current: 1.05 / 1.35 A.
Shaft height: 71 mm.
- N-FILT02. Inductances and Capacitor Filter Module 2.
Filter for power electronics.
Nominal current: 5 A.
- N-FILT01. Three-Phase filter Module 1.
Filter for power electronics.
Nominal current: 5 A.
- N-TRANS09. Three- phase Isolating Transformer, 400/400 VAC, 1 kVA, Module.
Nominal power: 1kVA.
Primary Winding Voltage: 3 x 400 VAC Δ .
Secondary Winding Voltage: 3 x 400 VAC Y.
Adjustable overcurrent protection: 1.6 - 2.5 A.
GND terminal.
- N-IGBT01. IGBT Chopper-Inverter Module 1.
6 x IGBTs.
Digital inputs for firing of IGBTs.
Fuses.
- BAT5. Lead-Acid Battery.
Lead-Acid battery.
Battery capacity: 70 Ah.
- N-THY01. Three-Phase Power Thyristors Module 1.
6 x Thyristors.
Digital inputs for firing of Thyristors.
Fuses.
- N-TRDC01. Three-Phase Rectifier Diodes and Capacitors Module 1.
Diodes module for three-phase rectifier purposes.
6 x Diodes.
- N-PEDA. Power Electronics Data Acquisition and Control Interface.
Data acquisition interface for power electronics control.
Power supply: 230 VAC.

Tender Specifications (for main items)

- AEL-PC. Touch Screen and Computer.

Touch Screen:

Energy efficiency class: A.
Screen diagonal: 68.6 cm (27 inch (s)).
Power consumption (operating): 26 watts.
Annual energy consumption: 38 kWh.
Power consumption (standby / off) 0.49 watts.
Screen resolution: 1920 x 1080 pixels.

Computer:

Processor Number: Intel Core i7-6600U Processor (4M Cache, up to 3,40 GHz).
Cache: 4 MB Intel Smart Cache.
Clock speed: 2.6 GHz.
Of Cores/# of Threads: 2/4.
Max. TDP/Power: 15 W.
Memory Types: DDR4-2133, LPDDR3-1866, DDR3L-1600.
Graphics: Intel HD Graphics 530.
Slot for PCI Express.

- EMT7. 3PH Squirrel-Cage Motor.

Nominal power: 370 W.
Nominal voltage: 3x 230/400 VAC Δ/Y
Frequency: 50/60 Hz.
Poles number: 2.
RPM: 2730 rpm.
Shaft height: 71 mm.

- N-ASYB. Analog Synchronization Module.

Input terminals: L1, L2, L3 and N generation input terminals.
Output terminals: L1, L2, L3 and N grid input terminals.
Synchronization switch: this switch allows close the synchronization switch. In addition, this switch has two 24 VDC connections for remote close switch.
Analog voltmeter: it allows to measure the generation bus bar output voltage.
Digital synchronoscope: it allows to monitor the synchronization process of the generator with the grid.
Double analog voltmeter: it allows to compare the voltages between generator and grid busbars.
Double frequency meter: it allows to compare the frequencies between the generator and the grid.
400 VAC lamps: it allows to realize the different synchronization procedures with the dark and light lamps method.
GND terminal.

- N-INDT/3C. 3 x 300 VAR Three-Phase Configurable Capacitors Module.

Configurable Star and Delta connection.
Three benches with three-phase inductances of 5 H each one.
Nominal voltage: 400 VAC.
Nominal power: 3 x (3 x 300) VAR.

- N-AE1. Transmission Lines Simulation Module.

Supply voltage: 400 VAC, 3PH+N.
Three-phase line with variable parameters.
Concentrated parameters line.
Four capacitances benches between lines with three capacitances of 1 μ F each one.
Two capacitances benches between line and ground composed by two capacitances of 1 and 2 μ F.
Resistance of the line that can be wiring independently:
Three resistors of 15 Ω .
Three resistors of 30 Ω .
Inductance of the line with several set values: 33 mH, 78 mH, 140 mH, 193 mH and 236 mH.
Neutral resistor of 10 Ω .

- N-TRANS3R/1K. Three-phase Transformer with Motor Voltage Regulator.

Primary: 3x 400 VAC.
Secondary: 3x 0 ... 450 V.
Nominal power: 1 kVA.
Frequency: 50/60 HZ.
25 V input/"Increase voltage" button.
25 V input/"Decrease voltage" button.

Tender Specifications (for main items)

- AEL-SERIN/CA-1KW. 1 kW AC Industrial Servomotor Application.

Power supply: 230 VAC.

3 Digital outputs.

Encoder outputs:

Two pairs of outputs (CH A Out, CH B Out and their respective denied outputs) that are TTL signals of incremental position generated by the encoder feedback. These signals indicate the direction of rotation of the motor.

One pair of outputs (CH Z Out and their denied) that TTL works as marker of pulses. This signal indicates the motor speed.

Relay output.

3 Analog outputs.

6 Digital inputs.

6 push-buttons.

6 Switches.

1 Analog input.

1 Potentiometer.

1 Digital encoder.

Reset push-button:

Servomotor:

Nominal voltage: 3PH, 400 VAC.

Nominal power: 2 kW.

Nominal current: 5 A.

Speed range: 0 – 4200 r.p.m.

Torque: 0 – 19,1 Nm.

IP65.

Sensor resolver (20 bits, 1048576 resolution).

Incremental encoder.

- 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 and remote control for 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-PWEC/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 7 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

- 1.- DC Power Electronics: Diode, Switching Transistor, High-Speed Switching, Ripples, Battery Charger, Buck and Boost Choppers, Four-Quadrant Chopper.
- 2.- DC Motor Drives: PWM DC Drive, Unidirectional and Bidirectional PWM DC Drive, Regenerative Braking, Speed Feedback, Current Control.
- 3.- Single-Phase AC Power Electronics: Diode Rectifiers, PWM Inverter.
- 4.- Three-Phase AC Power Electronics: Rectifiers, Single-Phase PWM Inverter with Dual Polarity DC Bus, Three-Phase PWM Inverter.
- 5.- Thyristor Power Electronics: Diode Rectifiers, Solid State Relay, Single and Three AC Power Control, Three-Phase Rectifier/Inverter.
- 6.- Three-Phase Induction Motor Starters.
- 7.- Three-Phase Motor Drives: Variable-Frequency, Constant V/f ratio.

Other possibilities to be done with this unit:

- 8.- Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
 - 9.- 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
 - 10.- The Computer Control System with SCADA allows a real industrial simulation.
 - 11.- This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
 - 12.- This unit can be used for doing applied research.
 - 13.- 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.

TENDER SPECIFICATIONS (for optional items)

a) Technical and Vocational Education configuration

⑤ **AEL-PWEC/ICAL. Interactive Computer Aided Instruction Software System.**

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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