Computer Controlled **Basic Teaching Unit for the Study of Power Electronics (no IGBTS). (Converters: AC/DC+AC/AC),** with SCADA
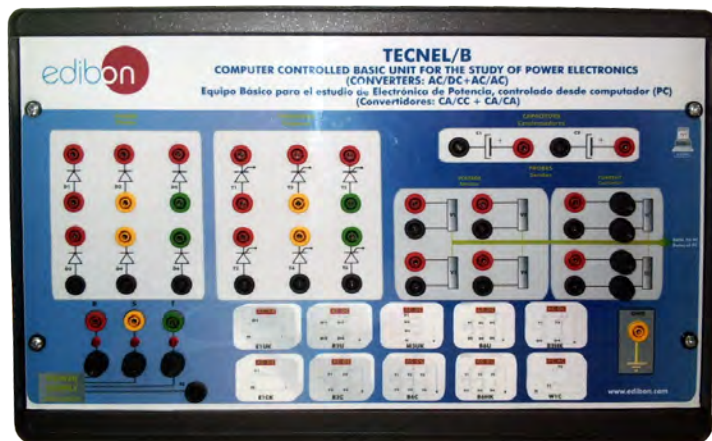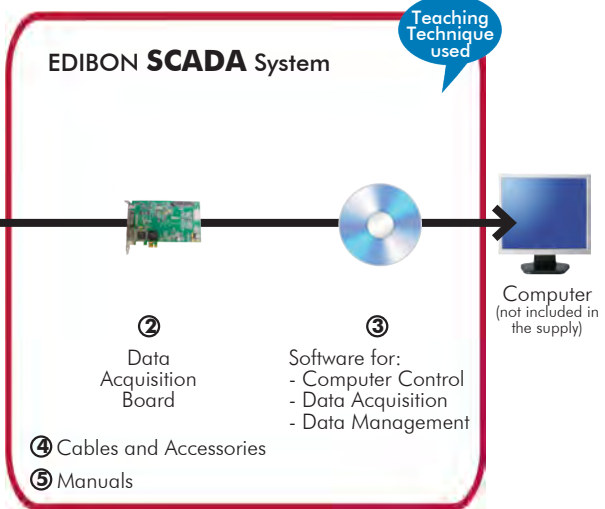
edibon

Engineering and Technical Teaching Equipment

TECNEL/B

① Unit: TECNEL/B. Computer Controlled Basic Teaching Unit for the Study of Power Electronics (no IGBTS). (Converters: AC/DC+AC/AC)

EDIBON **SCADA** System

Teaching Technique used

② Data Acquisition Board

③ Software for:
- Computer Control
- Data Acquisition
- Data Management

Computer (not included in the supply)

④ Cables and Accessories

⑤ Manuals

* Minimum supply always includes: 1 + 2 + 3 + 4 + 5 (Computer not included in the supply)

Key features:

➤ **Advanced Real-Time SCADA.**

➤ **Open Control + Multicontrol + Real-Time Control.**

➤ **Specialized EDIBON Control Software based on LabVIEW.**

➤ **National Instruments Data Acquisition board (250 KS/s, kilo samples per second).**

➤ **Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.**

➤ **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 **LabVIEW**

www.edibon.com
⇨PRODUCTS
⇨2.- ELECTRONICS

For more information about Key Features, click here

PDF Adobe

You Tube

INTRODUCTION

Power electronics is the area of engineering that deals with the conversion of power from one form to another. The main types of conversion are DC to DC, AC to DC, DC to AC and AC to AC.

The conversion of AC to DC is called rectification and it is used to supply DC loads, such as DC motors, using AC power supply. The conversion of DC to AC is known as inversion. Inverters take power from DC sources and convert them to AC power for use, i.e in AC motors.

For speed control of induction motors, AC to AC conversion is used to convert an AC waveform to another waveform with different frequency and/or magnitude. A DC to DC converter converts one DC voltage level to another.

Power electronics converters mainly comprise of semiconductor switches such as IGBTs, thyristors, diodes, etc., and driver and control circuits for driving the switching devices to obtain an accurate output. Passive and lossless components, such as inductors and capacitors are also required.

GENERAL DESCRIPTION

The Computer Controlled Basic Teaching Unit for the Study of Power Electronics (no IGBTS). (Converters: AC/DC+AC/AC), "TECNEL/B", is a unit with Computer Control and Data Acquisition System designed to study the basis of Power Electronics. It allows students to study AC/DC, AC/AC converters.

This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), and includes: The unit itself + a Data Acquisition Board + 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
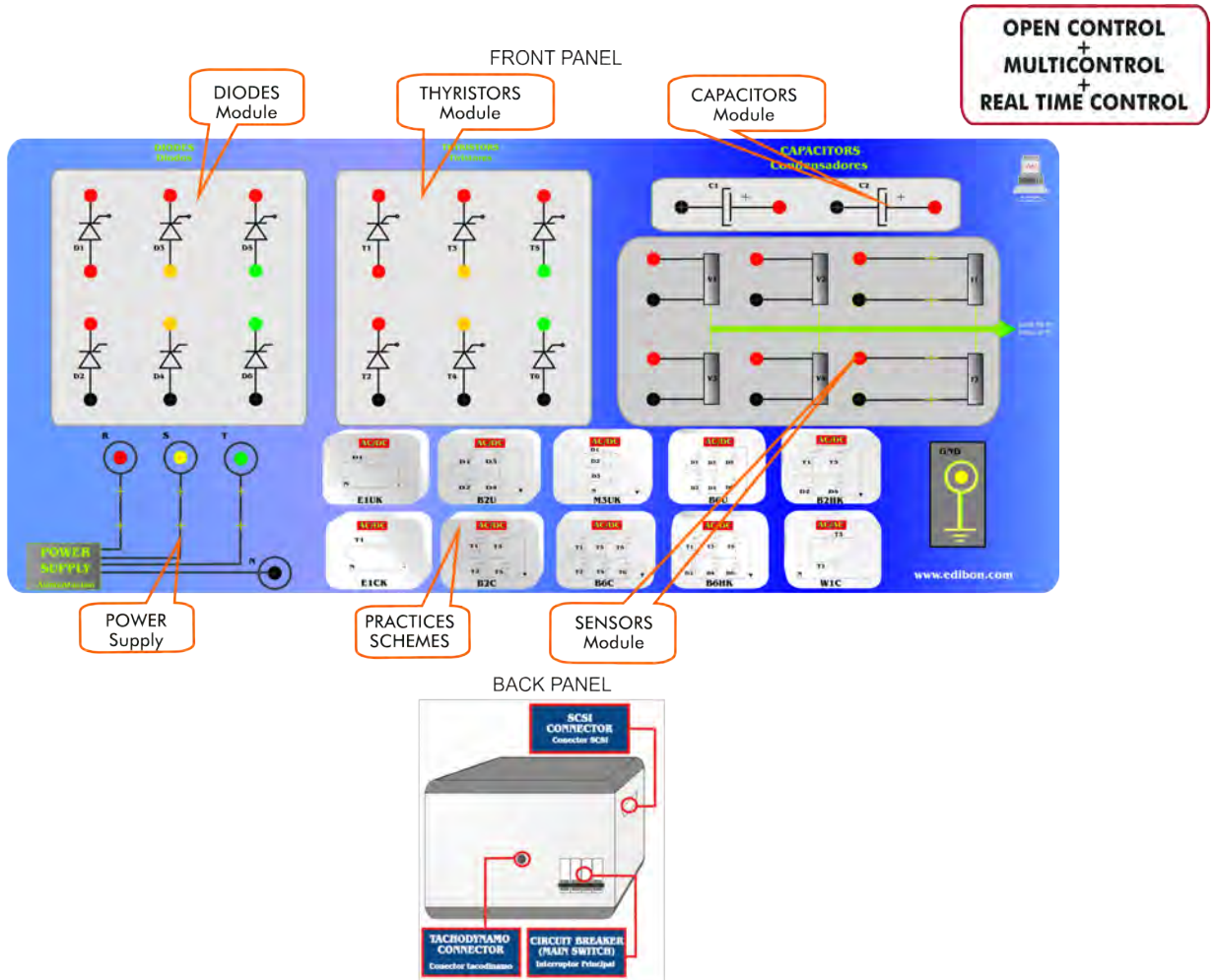
With this unit there are several options and possibilities:
  - Main items: 1, 2, 3, 4 and 5.
  - Optional items: 6, 7 and 8.
 Let us describe first the main items (1 to 5):

① **TECNEL/B. Unit:**

Diagram in the front panel with similar distribution that the elements in the real unit.

Steel box.

Front panel:

    Diodes module: 6 diodes.

    Thyristors module: 6 thyristors.

    Snubber net.

    Sensors module:

        Four voltage sensors.

        Two current sensors.

    Power supply connections for Vr, Vs, Vt, Neutral and Ground.

    Practices schemes.

Back panel:

    Data Acquisition Board connector (SCSI connector).

    Tachodynamo connector.

    Main fuses (Vr, Vs, Vt) and LEDs.

    Circuit breaker (main switch).

Single-phase driver.

Three-phase driver.

TSI board.

Four relays board.

Two Three-phase relays.

Commuted power supply.

Three-phase magnetothermal.

Control Interface.

Unit: TECNEL/B

The complete unit includes as well:

    Advanced Real-Time SCADA.

    Open Control + Multicontrol + Real-Time Control.

    Specialized EDIBON Control Software based on LabVIEW.

    National Instruments Data Acquisition board (250 KS/s, kilo samples per second).

    Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.

    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).

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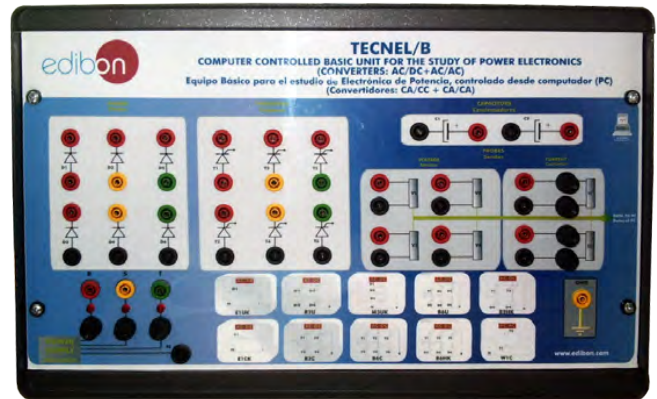
    This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

Required elements (at least one) (with RCL3R more practice) (Not included):

- RCL3R. Resistive, Inductive and Capacitive Loads Group.

- N-REV. Single Phase Variable Resistor (3 units).

Additional recommended elements (Not included):

  - EMT5. DC Shunt/Series/Compound Excitation Motor-Generator.

  - TECNEL/T. Tachogenerator.

  - N-IND. Single-phase Inductance Module.

② **DAB. Data Acquisition Board:**
The Data Acquisition board is part of the SCADA system.
PCI Express Data acquisition board (National Instruments) to be placed in a computer slot. Bus PCI Express.
Analog input:
  Number of **channels= 16** single-ended or 8 differential. **Resolution=16 bits**, 1 in 65536.
  Sampling rate up to: 250 KS/s (kilo samples per second).
  Input range (V)=±10 V. Data transfers=DMA, interrupts, programmed I/0. DMA channels=6.
Analog output:
  Number of **channels=2. Resolution=16 bits**, 1 in 65536.
  Maximum output rate up to: 900 KS/s.
  Output range (V)=±10 V. Data transfers=DMA, interrupts, programmed I/0.
Digital Input/Output:
  Number of **channels=24 inputs/outputs**. D0 or DI Sample Clock frequency: 0 to 100 MHz.
Timing: Number of **Counter/timers=4**. Resolution: Counter/timers: 32 bits.
The Data Acquisition board model may change at any moment, providing the same or better features than those required for the unit.

DAB

③ **TECNEL/B/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.
Sampling velocity up to 250 KS/s (kilo samples per second).
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.

TECNEL/B/CCSOF

④ **Cables and Accessories**, for normal operation.

⑤ **Manuals:**
This unit **is supplied with 7 manuals:** Required Services, Assembly and Installation, Control Software, Starting-up, Safety, Maintenance & Practices Manuals.

∗ References 1 to 5 are the main items: TECNEL/B + DAB + TECNEL/B/CCSOF + Cables and Accessories + Manuals are included in the minimum supply for enabling normal and full operation.

RCL3R. Resistive, Inductive and Capacitive Loads Group

This module represents different static load models:

resistive, inductive and capacitive.

Our module of resistive, capacitive and inductive loads
(RCL3R) offers:

- Single-phase and three-phase fixed resistances.
- Single-phase and three phase variable resistances.
- Single-phase and three-phase inductances.
- Single-phase and three-phase capacitors.

Metallic box.

Diagram in the front panel.

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

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

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

Capacitive loads: 3x [4 x 7 mF]. (400V)

GND terminal.

N-REV. Single phase variable resistor (3 units)

Variable resistor of 150 Ohm.

Maximum power: 500 W.

Potentiometer.

Terminals:

Three terminals to choose all resistance or variable resistance.

Fuse: 2 A.

Additional recommended elements (Not included)

EMT5. DC Shunt/Series/Compound Excitation Motor-Generator

Nominal power: 300 W.
Armature voltage: 200 VDC.
Excitation voltage: 230 VDC.
Armature current: 1,5 A.
Excitation current: 0,4 A.
RPM: 3400/7500 r.p.m.

TECNEL/T. Tachogenerator

The Tachogenerator is an element used to measure the speed of rotation of electric motors, in addition to other applications.

For this purpose, this device generates an output voltage proportional to the rotation speed of the axis.

TECNEL / T is an automatic unit that can remain permanently attached to the motor.

Output Voltage Gradient: 60 ± 5% V / 1,000 rpm.

Dimensions: 200 x 150 x 50 mm approx.

Weight: 1 Kg approx.

N-IND. Single-Phase Inductance Module.

Inductance: 1.4 H.
Switch:
    Position 0: circuit opened.
    Position 1: circuit closed.
Fuse: 2 A.
GND terminal.

EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH THE MAIN ITEMS

1.- Single phase half-wave rectifier with load R.

2.- Single phase half-wave rectifier with load R-L.

3.- Single-phase half-wave rectifier with R-L load with free wheeling diode (FWD).

4.- Single-phase full-wave rectifier.

5.- Three-phase half-wave uncontrolled rectifier.

6.- Three-phase full-wave uncontrolled rectifier.

7.- Single-phase half-wave controlled rectifier.

8.- Single-phase full-wave controlled rectifier.

9.- Single-phase full-wave controlled rectifier with a DC motor.

10.- Three-phase full-wave completely controlled.

11.- Single-phase semi-controlled rectifier.

12.- Three-phase full-wave semi-controlled rectifier.

13.- Alternating regulators: R and R-L load.

Other possibilities to be done with this Unit:

14.- Many students view results simultaneously.

   To view all results in real time in the classroom by means of a projector or an electronic whiteboard.

15.- 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.

16.- The Computer Control System with SCADA allows a real industrial simulation.

17.- This unit is totally safe as uses mechanical, electrical/electronic, and software safety devices.

18.- This unit can be used for doing applied research.

19.- 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 with neutral and ground, 380 VAC- 400 VAC/50 Hz o 190 VAC-240/60 Hz, 2 kW.

REQUIRED ELEMENTS

- AEL-PC. Touch Screen and Computer.

                    or

- PC. PC to work with the unit.

DIMENSIONS AND WEIGHTS

TECNEL/B:
   - Dimensions: 490 x 330 x 310 mm approx.
                    (19.29 x 12.99 x 12.20 inches approx.)
   - Weight: 35 Kg approx.
                    (77 pounds approx.)

REQUIRED ELEMENTS (AT LEAST ONE) (WITH RCL3R MORE PRACTICE) (Not included)

- RCL3R. Resistive, Inductive and Capacitive Loads Group.

- N-REV. Single Phase Variable Resistor. (3 units)

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

- EMT5. DC Shunt/Series/Compound Excitation Motor-Generator.

- TECNEL/T. Tachodynamo.

- IND. Inductance.

SIMILAR UNITS AVAILABLE

Offered in this catalog:
- TECNEL/B. Computer Controlled Basic Teaching Unit for the Study of Power Electronics. (Converters: AC/DC + AC/AC).
Offered in other catalog:
- TECNEL. Computer Controlled Teaching Unit for the Study of Power Electronics.(Converters: DC/AC + AC/DC + DC/DC + AC/AC).
- AEL-SVC. Computer Controlled Voltage Control with SVCs in Transmission Systems Application.
- AEL-PWEC. Power Electronics Application, with SCADA.

SCADA
Main screen

Single-phase Rectifier Half Wave Non-controlled:

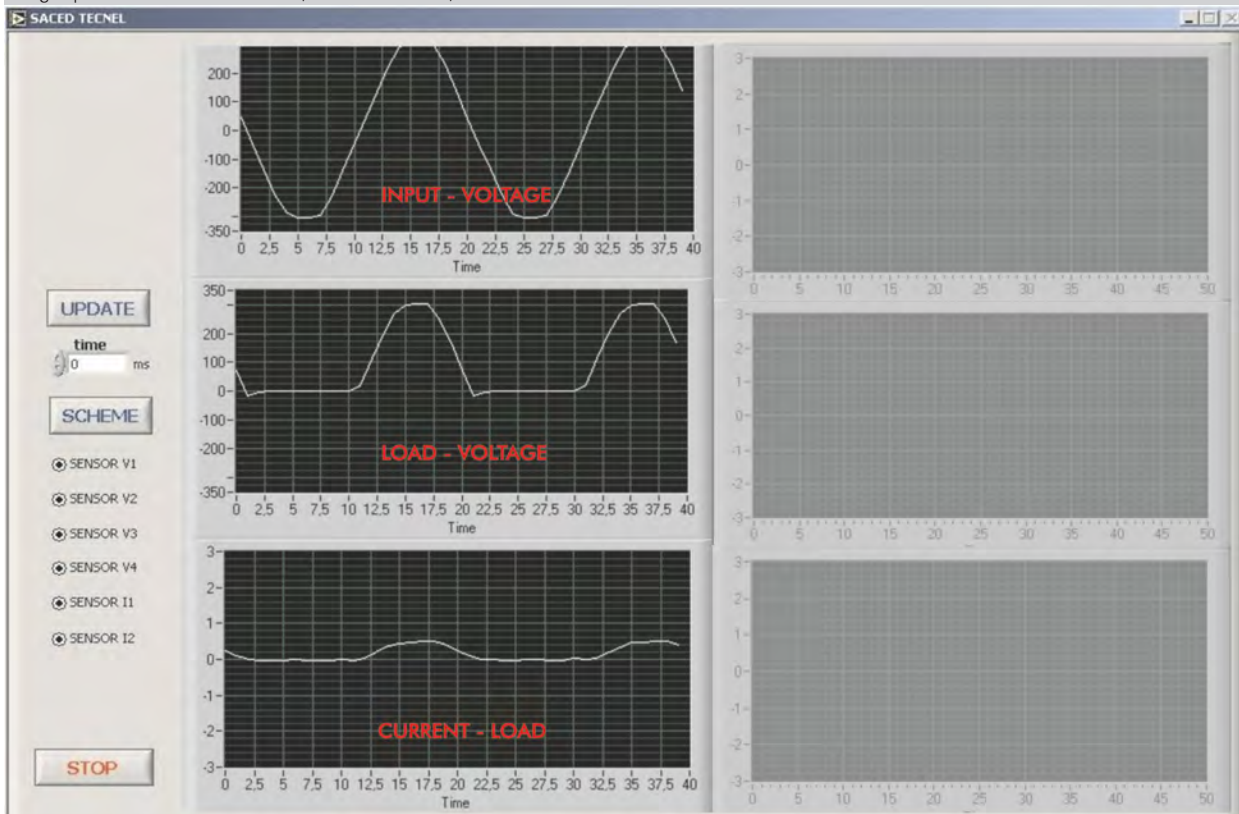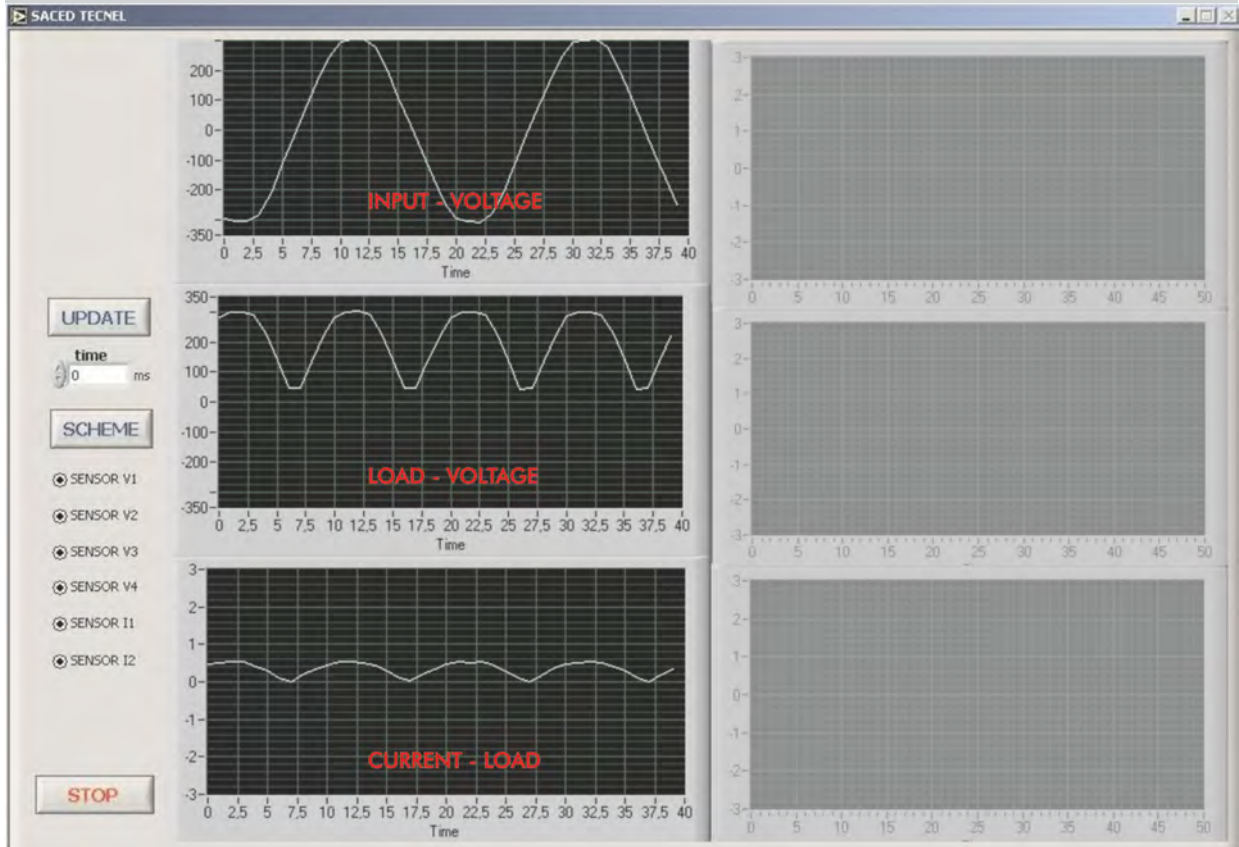

Single-phase Rectifier Half Wave, Non-controlled, RL load:
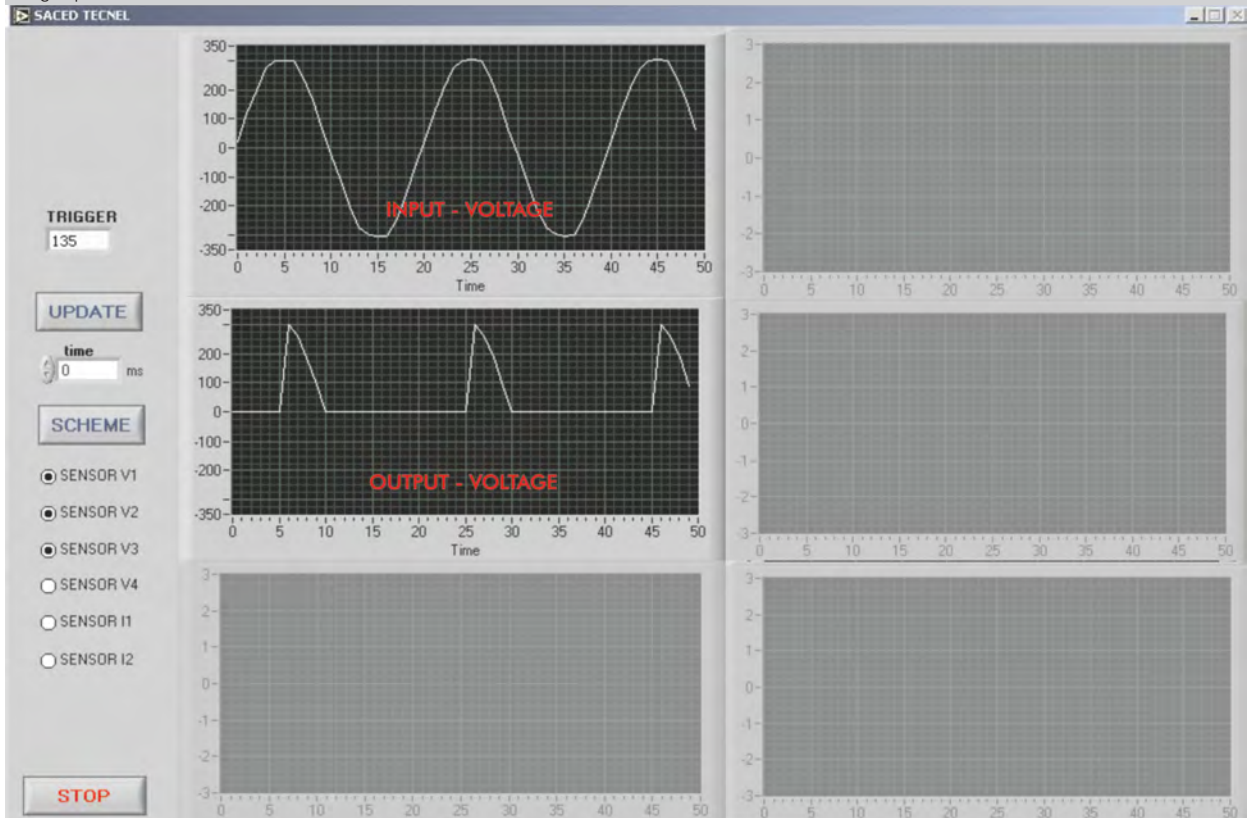
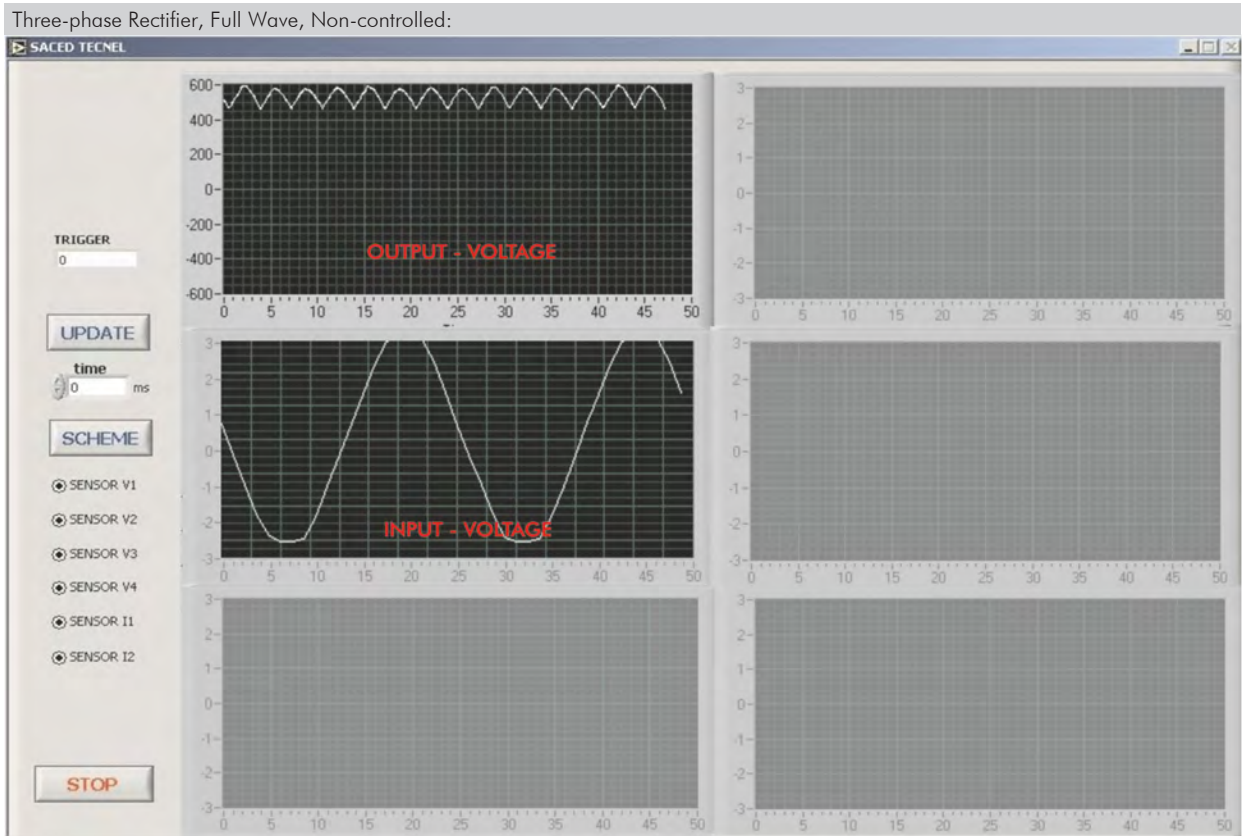Some **real** results obtained from this Unit

Single-phase Rectifier Full Wave, Non-controlled, R load:

Single-phase Rectifier Half Wave Controlled:

www.edibon.com

Three-phase Rectifier, Full Wave, Non-controlled:

COMPLETE TECHNICAL SPECIFICATIONS (for optional items)

Additionally to the main items (1 to 5) described, we can offer, as optional, other items from 6 to 8.

All these items try to give more possibilities for:

a) Technical and Vocational Education configuration. (ICAI)

b) Multipost Expansions options. (MINI ESN and ESN)

<u>a) Technical and Vocational Education configuration</u>

⑥ **TECNEL/B/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 5).

<u>Instructor Software</u>

- **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.
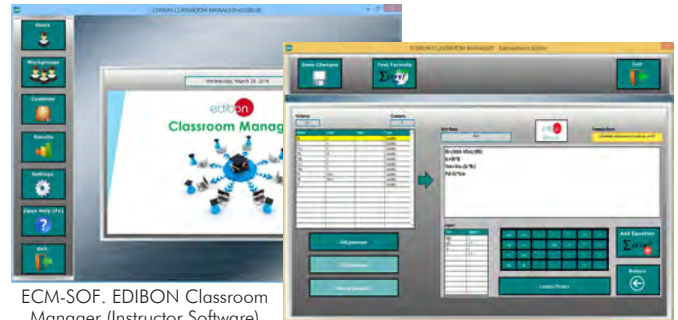
Innovative features:

• **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.**

<u>Student Software</u>

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

EPE. EDIBON Practical Exercise Program Package Main Screen
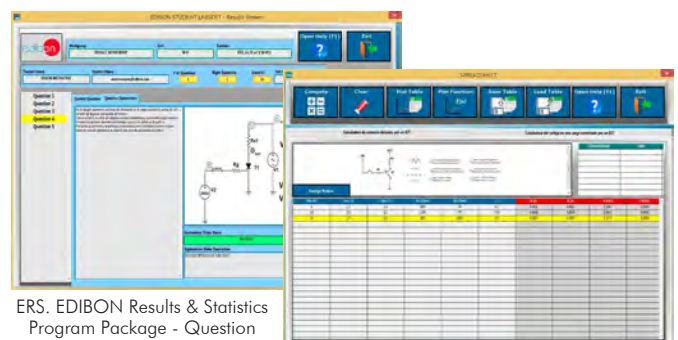
ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

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

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

⑦ **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

MINI ESN.
EDIBON Mini Scada-Net System

1 UNIT= up to 30 STUDENTS can work simultaneously

Computer Controlled Basic Teaching Unit for the Study of Power Electronics (no IGBTS). (Converters: AC/DC+AC/AC) (TECNEL/B)

Software for:
- Computer Control
- Data Acquisition
- Data Management

Instructors' Central Computer

Mini Scada-Net Software

LOCAL NET FOR 30 STUDENTS

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL
+
MULTI STUDENT POST

Note: The MINI ESN system can be used with any EDIBON computer controlled unit

⑧ **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
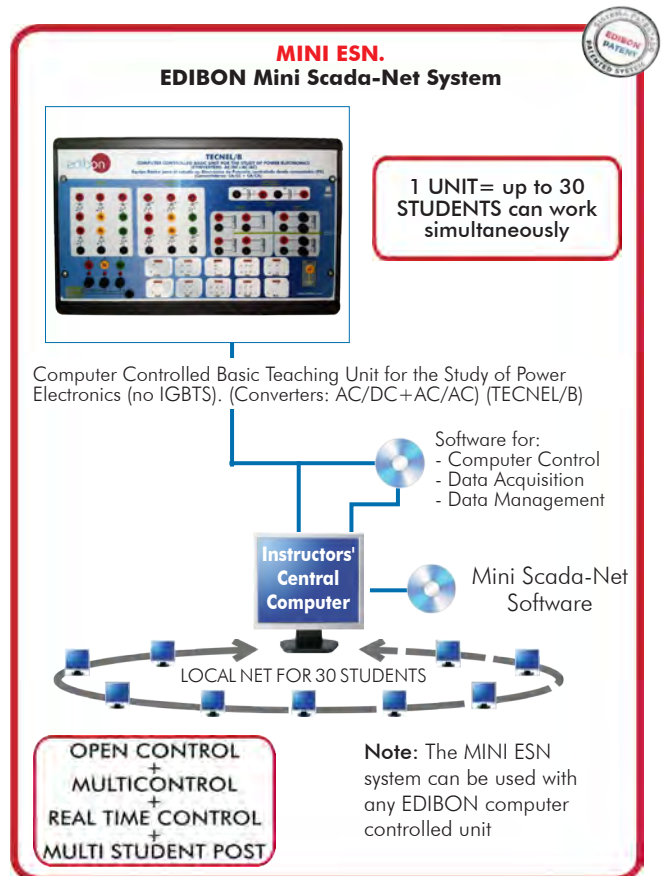
Main items (always included in the supply)

Minimum supply always includes:

① Unit: TECNEL/B. Computer Controlled Basic Teaching Unit for the Study of Power Electronics (no IGBTS). (Converters: AC/DC+AC/AC).

② DAB. Data Acquisition Board.

③ TECNEL/B/CCSOF. Computer Control + Data Acquisition + Data Management Software.

④ Cables and Accessories, for normal operation.

⑤ Manuals.

*IMPORTANT: Under TECNEL/B we always supply all the elements for immediate running as 1, 2, 3, 4 and 5.

Optional items (supplied under specific order)

a) Technical and Vocational Education configuration

⑦ TECNEL/B/ICAI. Interactive Computer Aided Instruction Software.

b) Multipost Expansions options

⑧ MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.

⑨ ESN. EDIBON Scada-Net Systems.

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Diagram in the front panel with similar distribution that the elements in the real unit.

Steel box.

Front panel:

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    Snubber net.

    Sensors module:

        Four voltage sensors.

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    Practices schemes.

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    Main fuses (Vr, Vs, Vt) and LEDs.

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Three-phase driver.

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The complete unit includes as well:

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    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.

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Analog output: Channels=2. Resolution=16 bits, 1 in 65536.

Digital Input/Output: Channels=24 inputs/outputs.

The Data Acquisition board model may change at any moment, providing the same or better features than those required for the unit.

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Exercises and Practical Possibilities to be done with the Main Items

1.- Single phase half-wave rectifier with load R.

2.- Single phase half-wave rectifier with load R-L.

3.- Single-phase half-wave rectifier with R-L load with free wheeling diode (FWD).

4.- Single-phase full-wave rectifier.

5.- Three-phase half-wave uncontrolled rectifier.

6.- Three-phase full-wave uncontrolled rectifier.

7.- Single-phase half-wave controlled rectifier.

8.- Single-phase full-wave controlled rectifier.

9.- Single-phase full-wave controlled rectifier with a DC motor.

10.- Three-phase full-wave completely controlled.

11.- Single-phase semi-controlled rectifier.

12.- Three-phase full-wave semi-controlled rectifier.

13.- Alternating regulators: R and R-L load.

Other possibilities to be done with this Unit:

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To view all results in real time in the classroom by means of a projector or an electronic whiteboard.

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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.

<u>b) Multipost Expansions options</u>

⑦ 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.

REPRESENTATIVE: