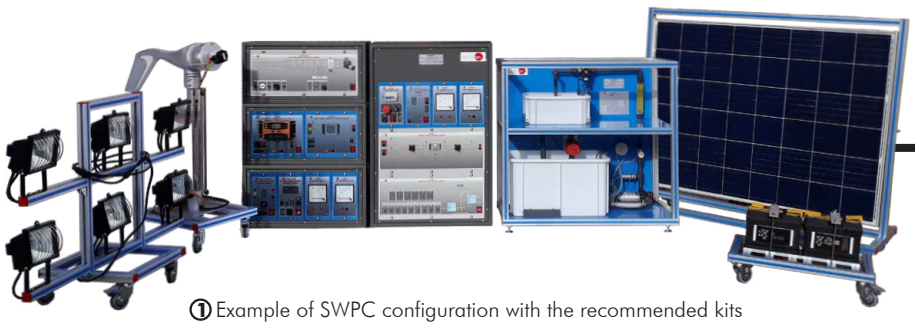
edibon

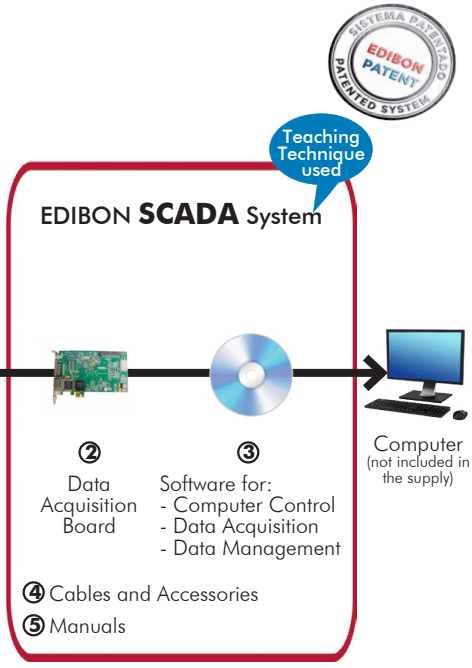
Engineering and Technical Teaching Equipment

Computer Controlled **Single Water Pumping Application,** with SCADA

SWPC



① Example of SWPC configuration with the recommended kits PV-KIT-300W and WT-KIT-400W



* 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 NATIONAL INSTRUMENTS LabVIEW

www.edibon.com
PRODUCTS
5.- ENERGY

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

Today electricity is essential to provide users with the basic necessities of life. The problem arises when the end user is in places where connection to the electricity grid is not available, such as some rural areas. In these situations, isolated power systems come into play.

Basically these systems consist of energy sources that supply a load. Usually the energy sources are photovoltaic panels, wind turbines or diesel generators. The choice of the type of source to be installed will depend on the wind and sun resources of the site.

In these isolated environments, where the basic requirements of a human are maintained, there is usually no water supply. To solve this problem, wells are dug where water is pumped to the surface and stored in a reservoir, by the action of a boost pump.

GENERAL DESCRIPTION

The Computer Controlled Single Water Pumping Application, "SWPC", has been designed by EDIBON to show the user the basic principles of operation of pumping units in isolated networks, exposing in a didactic way the elements involved in the process of generation and pumping. For this purpose, this unit consists of two water tanks positioned at different levels; both tanks are communicated by means of a pump and a PVC pipe to reproduce the same conditions as a real pumping system. One of the peculiarities of this application is that it has a proportional valve that allows the user to control its opening level. This allows the generation of different manometric pressures at the pump outlet, that is, to define different pumping heights of the installation. Thus, once the user configures the manometric pressure of the installation, the water can be pumped by means of an impulse pump from the lower tank (ground water) to the upper level tank (storage tank).

Permanent Magnet Wind Turbine detail

The pumping application has an industrial pumping regulator specially designed to optimize the energy available for pumping. In hours when solar radiation is minimal, the regulator works on optimizing the current-voltage (I-V) curve to extend the total hours of water pumping. Likewise, the student will be able to analyze the operation of these devices and the interest of their installation in systems of these characteristics, in order to adjust the voltage to the nominal operation of the pump.

In addition, the application includes a series of sensors, actuators and indicators to achieve perfect monitoring, supervision and control of the installation: tank level sensor, flow sensor, pressure sensors, stop at maximum level of the upper tank to prevent water overflow, emergency stop at minimum level of the lower tank to prevent the pump from running, various indicators of pump operation and operating switches.

Thanks to the internal meters and the data acquisition system of the SCADA software, the user will be able to visualize at any time the values of the sensors and the status of the actuators, being able to visualize the voltage and current at the input and output of the regulator. In addition, the software allows an analysis of the system's energy flows, where users can evaluate the intrinsic potential energy of the pumped water and the electricity consumption necessary to transfer this energy to the water in the storage tank.

In addition, it is recommended to acquire together with the "SWPC" application the photovoltaic panel, the wind turbine, the batteries and their corresponding current regulators to demonstrate how a real pumping system works in an isolated network.

In order to acquire a wide knowledge, a specific manual is included in which it is explained, at a theoretical and practical level, the aspects related to photovoltaic and wind water pumping systems, the pumping and irrigation systems (deepening in the architecture of the different units), energy flow analysis and the dimensioning of a solar pumping installation.

The "SWPC" application includes the following elements:

- N-ALI02. Domestic Main Power Supply Module.
- N-PRC. Pumping Remote Control Module.
- N-DCPWS-36V/150W. 36 VDC, 150 W Power Supply Module.
- MED65. Digital Multimeter.
- PTWT. Pumping Unit with Two Water Tanks.

Additional recommended elements (Not included):

- PV-KIT-300W. 300 W. Photovoltaic Kit with Regulator and Measurement Instrumentation.
  - LP6. 6 Lamps Panel with Dimming.
  - N-REG-AC/LR. AC Local/Remote Current Regulator Module.
  - N-MED16. DC Voltmeter Module (0-50 V).
  - N-MED81. DC Ammeter Module (0-30 A).
  - PV-24/300W. Photovoltaic Panel, 24 VDC, 300 W.
  - BAT2. AGM Battery, 25 Ah, 12 V (2 units).
  - N-REG03. MPPT Regulator Module.

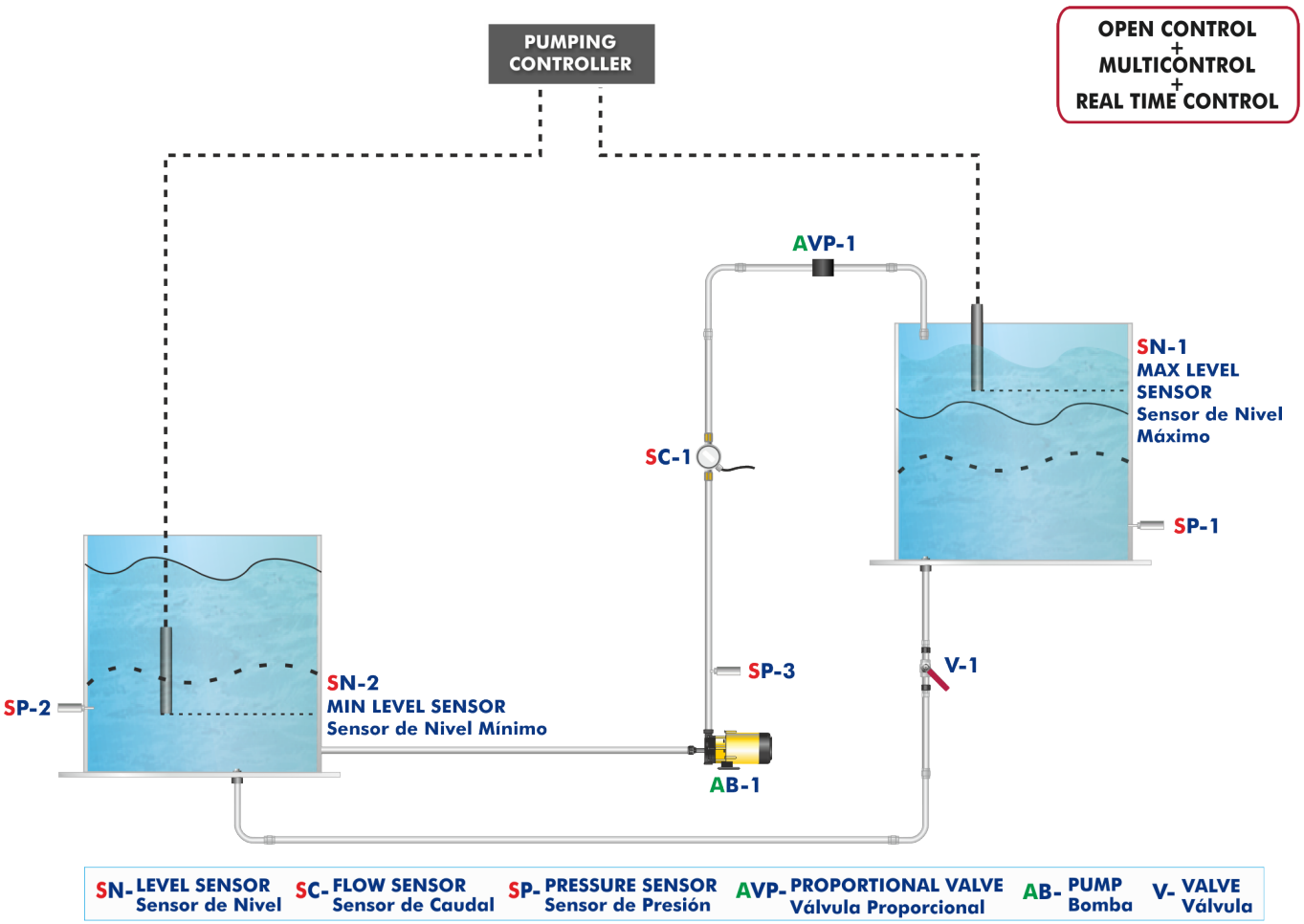
  Rack required for the PV-KIT-300W:

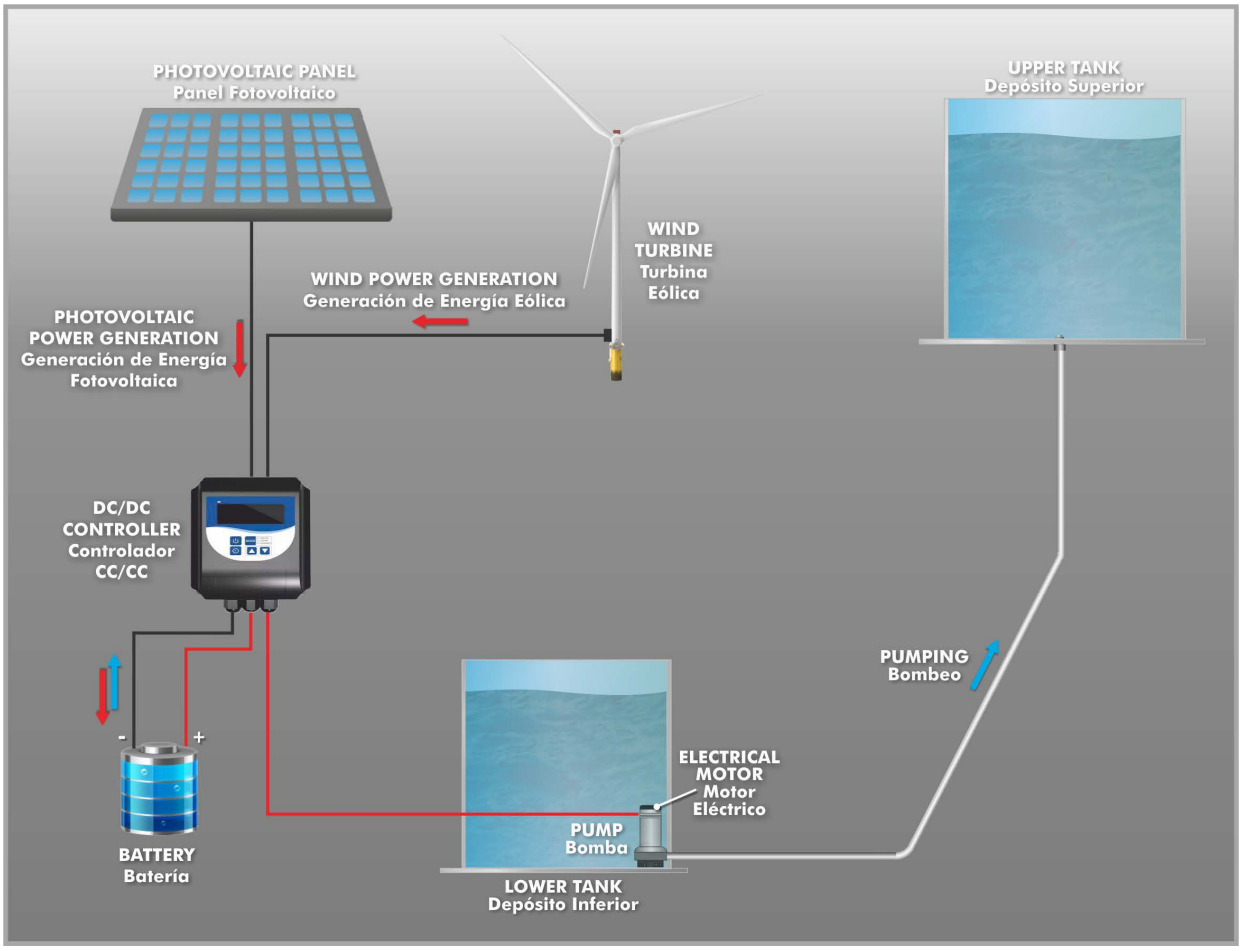
  - N-RACK-M.
- WT-KIT-400W. 400 W Wind Turbine Kit with Regulator and Measurement Instrumentation.
  - WT-24V/400W. Permanent Magnets Wind Turbine 24 V, 400 W.
  - N-REG-24V/400W. Wind Turbine Regulator Module 24 V, 400 W.
  - N-TPAD-3PH/400V. 400 V Three-Phase AC/DC Converter Module.
  - N-MED16. DC Voltmeter Module (0-50 V).
  - N-MED81. DC Ammeter Module (0-30 A).
  - BAT2. AGM Battery, 25 Ah, 12 V (2 units).
  - N-SERV400W. 400 W Servomotor Controller Module.

  Rack required for the WT-KIT-400W:

  - N-RACK-M.

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.





Electrical diagram

With this unit there are several options and possibilities:
- Main items: 1, 2, 3, 4 and 5.
- Optional items: 6, 7, 8 and 9.

Let us describe first the main items (1 to 5):

① SWPC. Unit:

- N-ALI02. **Domestic Main Power Supply Module.**

  Supply voltage (single-phase): 230 VAC, 1PH + N.
  ON/OFF removable key.
  Output voltage connections:
  Two single-phase: 230 VAC.
  Single-shase supply hose connecting plug.
  Differential magnetothermal, 2 poles, 25 A, 30 mA AC, 6 KA.
  Emergency stop push-button.


N-ALI02

- N-PRC. **Pumping Local Control Module.**

  Power source input terminals.
  Measurement connectors.
  Internal meters: voltmeter and ammeter.
  DC/DC converter.
  Output terminals.
  Remote control LED indicator.
  Maximum level LED indicator.
  Minimum level LED indicator.
  Switch for control modes: Local or SCADA.
  Local control switches.
  Flow meter signal connectors.
  Pressure signal connectors.
  Connectors for variable control (communication signal ports).
  ON/OFF switch.
  Supply voltage of the module: 230 VAC.
  Nominal operating voltage with the pump controller: 36 V.
  DC working voltage range (without pump regulator): 24 – 36 V.
  Peak input power with regulator: 175 W.
  Maximum motor output power: 160 W.
  5 A fuses.


N-PRC

- N-DCPWS-36V/150W. **36 VDC, 150 W Power Supply Module.**

  LED indicator.
  DC output terminals.
  Auxiliary outlet sockets.
  5 A fuse.
  ON/OFF switch.
  Output voltage: 36 VDC.
  Power: 150 W.


N-DCPWS-36V/150W

- MED65. **Digital Multimeter.**

  This module has a 3 ½ digit digital multimeter, with 4 mm double connector termination cables to facilitate interconnections.
  With this digital multimeter we can measure:
  Voltage.
  Current.
  Resistance.
  Capacitors capacity.
  Temperature.


MED65

- PTWT. **Pumping Unit with Two Water Tanks.**

  Bench-top unit.
  Anodized aluminum frame and panels made of painted steel.
  Main metallic elements made of stainless steel.
  Diagram in the front panel with similar distribution to that of the elements in the real unit.
  Pumping tank: 25 l (approx.)
  Accumulation tank: 75 l (approx.)
  Pressure pump.
  Pump voltage: 24 – 36 V.
  Maximum pumping current: 4 A.
  Proportional valve (AVP-1).
  Maximum tank level sensor (SN-1).
  Minimum well level sensor (SN-2).
  Tank pressure sensor (SP-1).
  Well pressure sensor (SP-2).
  Pressure sensor of the pipeline.
  Digital flow meter (SC-1).
  Analogue flow meter.
  Drain valve (V-1).
  Pipes and piping.
  Multimeter.
  LabVIEW interface for data acquisition.
  AC power cables.

PTWT

Additional recommended elements (Not included):

- PV-KIT-300W. **300W Photovoltaic Kit with Regulator and Measurement Instrumentation.**
  - LP6. **6 Lamps Panel with Dimming.**

    Power: 6 x 500 W.
    Aluminium frame.

LP6

  - N-REG-AC/LR. **AC Local/Remote Current Regulator Module.**

    16 A fuse.
    Switch for control modes: Local or SCADA.
    ENABLE/DISABLE switch.
    Potentiometer for manual intensity control.
    Current signal control connector.
    ON/OFF switch.
    Power connector.
    Module supply voltage: 230 VAC.
    Working intensity range: 0 – 6.5 A.
    Maximum motor output power: 1500 W.

N-REG-AC/LR

  - N-MED16. **DC Voltmeter Module (0-50 V).**

    Analogue voltmeter.
    Connection terminals.
    Voltage range: 0 – 50 V.

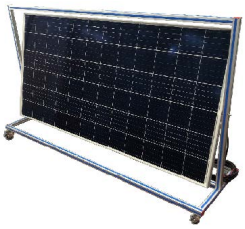
N-MED16

  - N-MED81. **DC Ammeter Module (0-30 A).**

    Analogue ammeter.
    Connection terminals.
    Intensity range: 0 – 30 A.

N-MED81

- PV-24/300W. **Photovoltaic Panel, 24 VDC, 300 W.**
  - Number of cells: 6 x 12.
  - Maximum power: 335 W.
  - Voltage at maximum power: 38.2 V.
  - Current at maximum power: 8.77 A.
  - Short circuit current (Isc): 9.38 A.
  - Open circuit voltage (Voc): 46.1 V.
  - Module efficiency: 17.2 %.



PV-24/300W

- BAT2. **AGM Battery, 25 Ah, 12 V (2 units).**
  - Nominal voltage: 12 VDC.

BAT2

- N-REG03. **MPPT Regulator Module.**
  - MPPT regulator.
  - ON/OFF switch.
  - Output terminals: 12/24 VDC.
  - Battery terminals: 12/24 VDC.
  - Module power supply: 230 VAC.
  - Nominal discharge current: 20 A.
  - Acceptable DC voltage range: 12 – 50 V.
  - 16 A fuses.
  - Monitoring of parameters:
    - Voltage.
    - Current.
    - Charge level of the battery.
    - Charging current.
    - State.
    - Devices with self-protection, battery and loads.

N-REG03

- WT-KIT-400W. **400 W Wind Turbine Kit with Regulator and Measurement Instrumentation.**
  - WT-24V/400W. **Permanent Magnets Wind Turbine 24 V, 400 W.**
    - Wind turbine.
    - Power: 400 W.
    - Voltage: 24 VDC.

WT-24V/400W

  - N-REG-24V/400W. **Wind Turbine Regulator Module 24 V, 400 W.**
    - 16 A fuses.
    - Wind turbine controller.
    - Three-phase input terminals.
    - ON/OFF switch.
    - Output voltage: 24 – 36 VDC.
    - Battery voltage: 24 VDC.
    - DC output terminals.

N-REG-24V/400W

  - N-TPAD-3PH/400V. **400 V Three-Phase AC/DC Converter Module.**
    - 16 A fuses.
    - Three-phase input terminals.
    - ON/OFF switch.
    - Auxiliary ON/OFF switch.
    - DC output terminals.
    - Input voltage range: 0 – 400 VAC.
    - Output voltage range: 0 – 400 VDC.

N-TPAD-3PH/400V

- N-MED16. **DC Voltmeter Module (0-50 V).**
  - Analogue voltmeter.
  - Connection terminals.
  - Voltage range: 0 – 50 V.

N-MED16

- N-MED81. **DC Ammeter Module (0-30 A).**
  - Analogue ammeter.
  - Connection terminals.
  - Intensity range: 0 – 30 A.

N-MED81

- BAT2. **AGM Battery, 25 Ah, 12 V (2 units).**
  - Nominal voltage: 12 VDC.

BAT2

- N-SERV400W. **400 W Servomotor Controller Module.**
  - Servomotor SERV01.
  - Error LED indicator.
  - 5 A fuse.
  - USB connector.
  - Encoder connector.
  - Power connector.
  - Speed control connector.
  - Switch for control modes: Local or SCADA.
  - ON/OFF switch.
  - Potentiometer for manual speed control.
  - Module supply voltage: 230 VAC.
  - Control speed: 0 – 3000 rpm.
  - Specific frequency: 250 Hz.
  - Operating intensity: 1.5 A.
  - Operating voltage: 101 VAC.

N-SERV400W

- **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.

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.

② DAB. Data Acquisition Board:

The Data Acquisition Board is part of the SCADA system.

USB Data Acquisition Board (National Instruments).

Analog input:

Number of **channels= 8** single-ended or 8 differential. **Resolution=14 bits**, 1 in 16384.

Sampling rate up to: 20 KS/s (kilo samples per second).

Input range (V)=±10 V.

Data transfers= USB 2.0 FULL SPEED, 12 Mb/s.

DAB

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=13 inputs/outputs**. D0 or DI Sample Clock frequency: 0 to 5 MHz.

Timing: Number of **Counter=1**. Resolution: Counter: 32 bits.

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

③ SWPC/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.

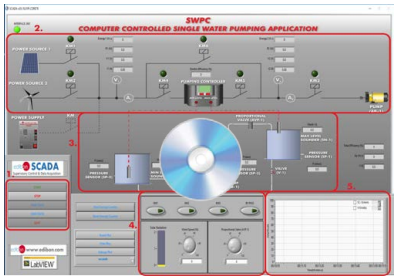
Management, processing, comparison and storage of data.

Sampling velocity up to 250 KS/s (kilo samples per second).

Calibration system for the sensors involved in the process.

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.



SWPC/CCSOF

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.

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, Calibration & Practices manuals.

∗References 1 to 5 are the main items: SWPC + DAB + SWPC/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

- Local Control.

1.- Starting and stopping the pumping system.

2.- Automatic stop in maximum and minimum level conditions.

3.- Study of the working regime of the pumping regulator: adjustment and reduction of voltage.

4.- Commissioning of the solar battery pumping system (requires the PV-KIT-300W).

5.- Commissioning of the solar pumping system without batteries (requires the PV-KIT-300W).

6.- Study of the working regime of the pumping regulator: shadow effect (requires the PV-KIT-300W).

7.- Study of the working regime of the pumping regulator: variations of pumped flow (requires the PV-KIT-300W).

8.- Starting thresholds with and without converter (requires the PV-KIT-300W).

9.- Commissioning of the battery-powered wind pumping system (requires the WT-KIT-400W).

10.- Commissioning of the wind power pumping system without batteries (requires the WT-KIT-400W).

- SCADA Control.

11.- Starting and stopping the pumping system.

12.- Automatic stop in maximum and minimum level conditions.

13.- Study of the working regime of the pumping regulator: adjustment and reduction of voltage.

14.- Manometric height concept: manual adjustment of the proportional valve.

15.- Energy flow analysis: overall system performance.

16.- Commissioning of the solar battery pumping system (requires the PV-KIT-300W).

17.- Commissioning of the solar pumping system without batteries (requires the PV-KIT-300W).

18.- Study of the working regime of the pumping regulator: shadow effect (requires the PV-KIT-300W).

19.- Study of the working regime of the pumping regulator: variations of pumped flow (requires the PV-KIT-300W).

20.- Starting thresholds with and without converter (requires the PV-KIT-300W).

21.- Energy flow analysis: overall system performance (requires the PV-KIT-300W).

22.- Commissioning of the battery-powered wind pumping system (requires the WT-KIT-400W).

23.- Commissioning of the wind power pumping system without batteries (requires the WT-KIT-400W).

24.- Energy flow analysis: overall system performance (requires the WT-KIT-400W).

Other possibilities to be done with this unit:

25.- Many students view results simultaneously.

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

26.- 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.

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

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

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

30.- 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: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz, 1 kW.
- Computer (PC).

DIMENSIONS AND WEIGHTS

SWPC:

PTWT:
- Dimensions: 1000 x 520 x 960 mm approx. (39.36 x 20.47 x 37.79 inches approx.).
- Weight: 70 Kg approx. (154 pounds approx.).

PV-24/300W:
- Dimensions: 2040 x 580 x 1250 mm approx. (80.31 x 22.83 x 49.21 inches approx.).
- Weight: 40 Kg approx. (88 pounds approx.).

LP6:
- Dimensions: 1310 x 410 x 850 mm approx. (51.57 x 16.14 x 33.46 inches approx.).
- Weight: 10 Kg approx. (22 pounds approx.).

BAT2:
- Dimensions: 610 x 370 x 340 mm approx. (24.01 x 14.56 x 13.38 inches approx.).
- Weight: 30 Kg approx. (66 pounds approx.).

ADDITIONAL RECOMMENDED ELEMENTS (Not Included)

- PV-KIT-300W. 300 W Photovoltaic Kit with Regulator and Measurement Instrumentation.
- WT-KIT-400W. 400 W Wind Turbine Kit with Regulator and Measurement Instrumentation.

SIMILAR UNITS AVAILABLE

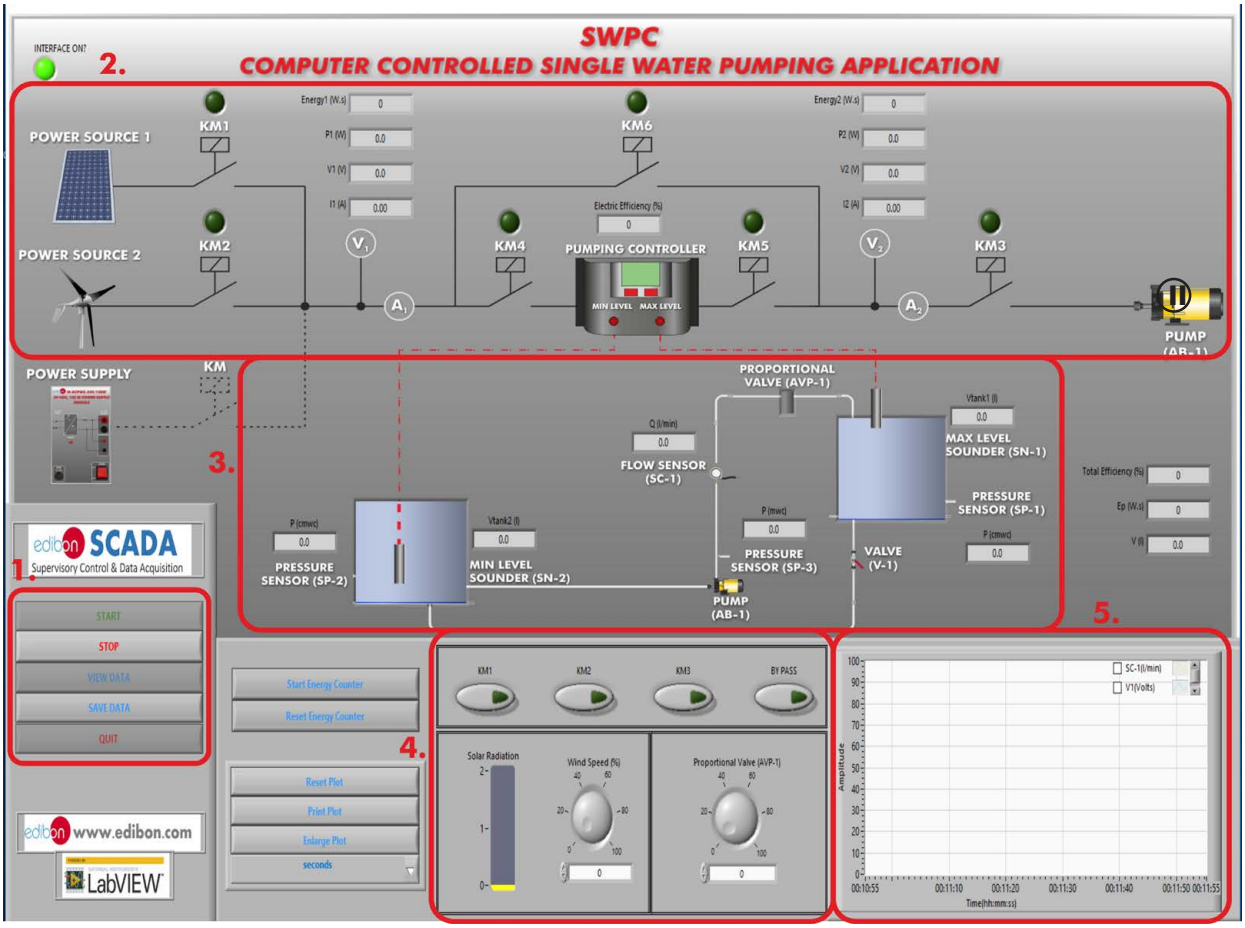
Offered in this catalog:

- SWPC. Computer Controlled Single Water Pumping Application.

Offered in other catalog:

- SWP. Single Water Pumping Application.

SCADA
Main screen



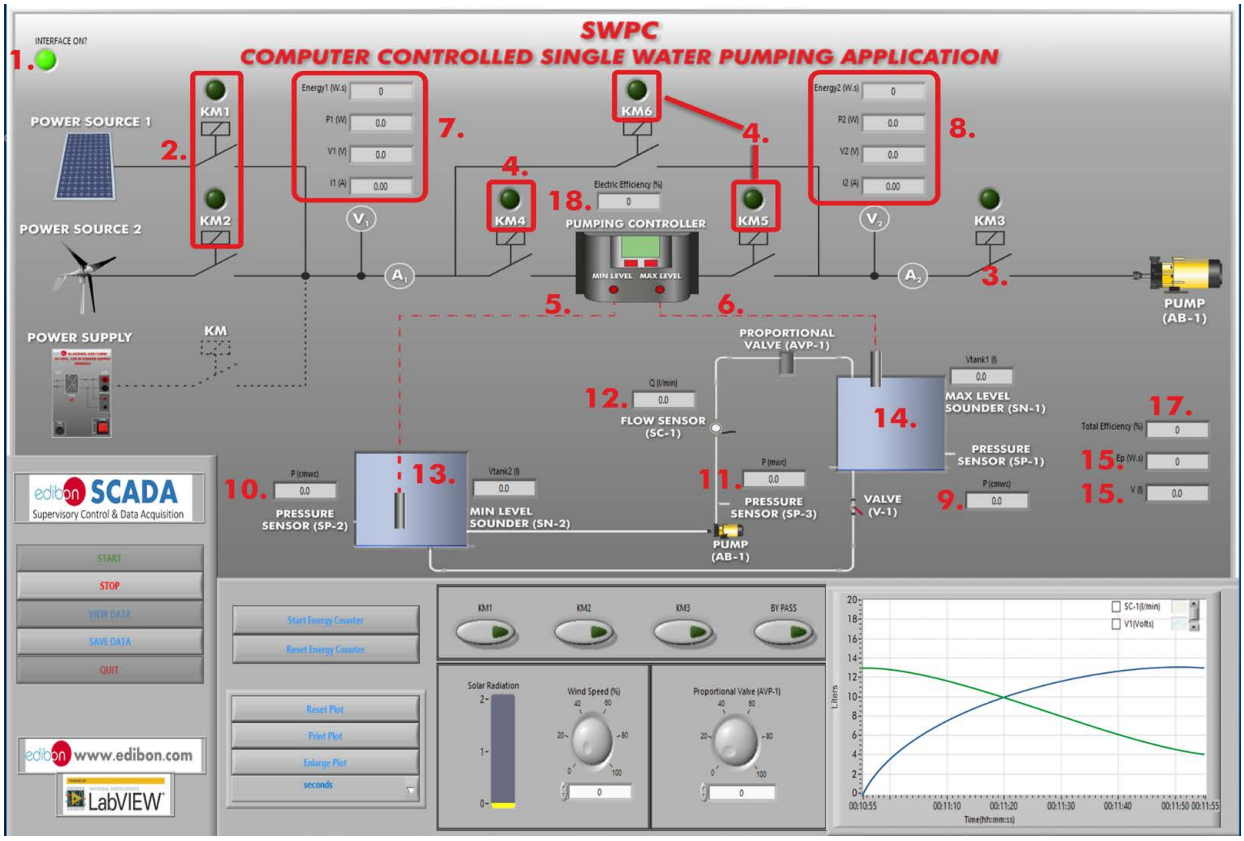
① **SCADA control menu.** This contains the main system commands: system on/off, exit application, data storage and data display.

② **Representative diagram of the power system of the pump controller with DC/DC controller.**

③ **Representative diagram of the pumping unit,** reproducing a water pumping installation in isolated networks.

④ **Remote switch and variable controllers.**

⑤ **Real time graph.** Shows the selected variables.



Status indicator lights:

① INTERFACE ON.
② KM1 - KM2.
③ KM3.
④ KM4 - KM5 // KM6.
⑤ Minimum well level indicator.
⑥ Maximum tank level indicator.
⑦ Electrical parameters at the input of the pump controller.
⑧ Electrical parameters at the output of the pump controller.

Measurement sensors: measurement values of the analog sensors:

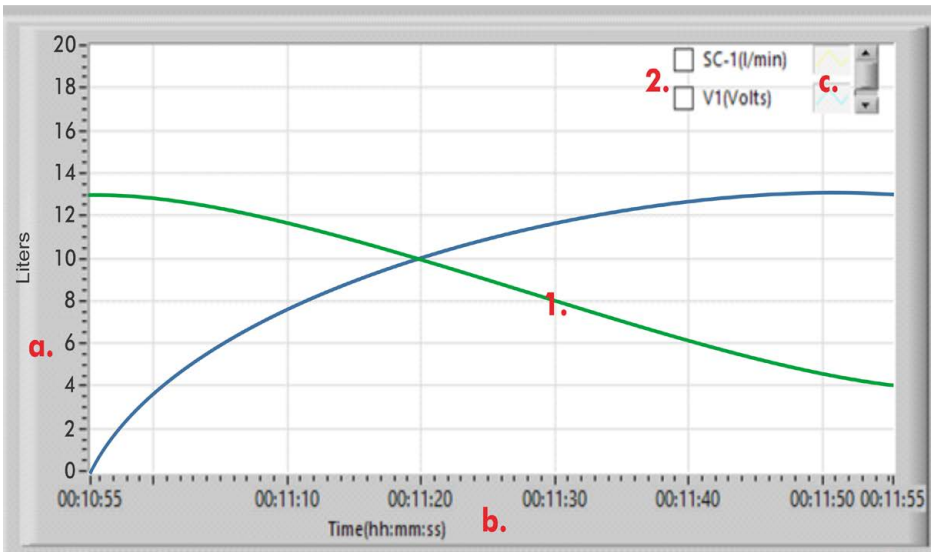
⑨ Tank pressure sensor (SP-1).
⑩ Well pressure sensor (SP-2).
⑪ Drainage pressure sensor (SP-3).
⑫ Digital flow meter - Flow sensor.

Water capacity in the tanks:

⑬ Remaining well capacity (l).
⑭ Capacity in battery (l).
⑮ Pumped volume (l).
⑯ Potential pumped energy (J).

System performance:

⑰ Total efficiency - Overall performance (%).
⑱ Electric efficiency - Regulator performance (%).



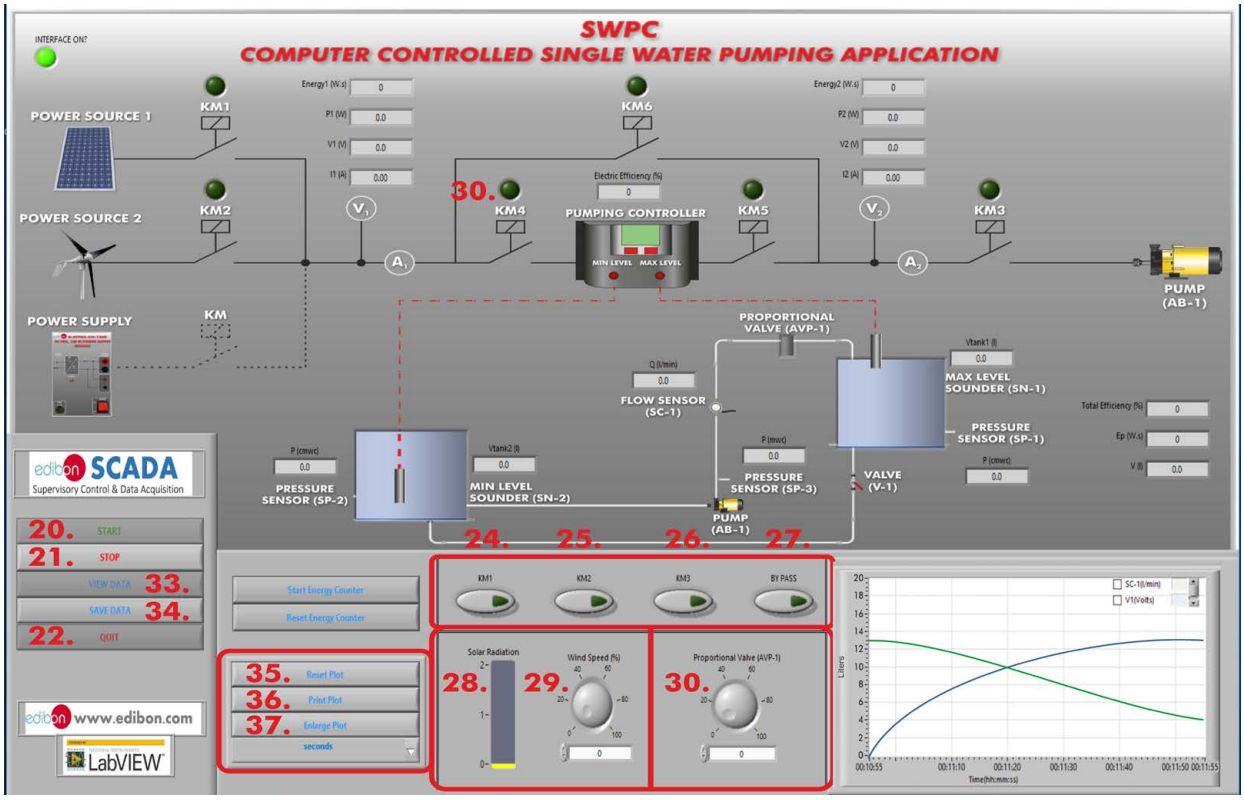
MAX DEPOSIT SUPERIOR LEVEL
Deposito máximo Nivel superior

MIN DEPOSIT SUPERIOR LEVEL
Deposito mínimo Nivel superior

① **Real-time graph.** It shows the selected variables and it is possible to take measurements using the scales of cursors (**a**) and (**b**). To modify these scales, click on the upper number and change its value.

② **Variable selector.** In this section you can select the variables you want to display in real time. To modify colors, line width, line type, etc. click on the icons indicated in (**c**) and a new menu will appear.

Some **real** results obtained from this Unit



Controls for start and stop manoeuvres.

(20) START.

(21) STOP.

(22) QUIT.

Switch control.

(24) KM1.

(25) KM2.

(26) KM3.

(27) BY PASS.

Control of variables.

(28) Solar radiation.

(29) Wind speed.

(30) Proportional valve (AVP-1).

Energy flow meter:

(31) START/STOP COUNTER.

(32) RESET COUNTER

Saving and displaying data and graphs:

(33) SAVE DATA.

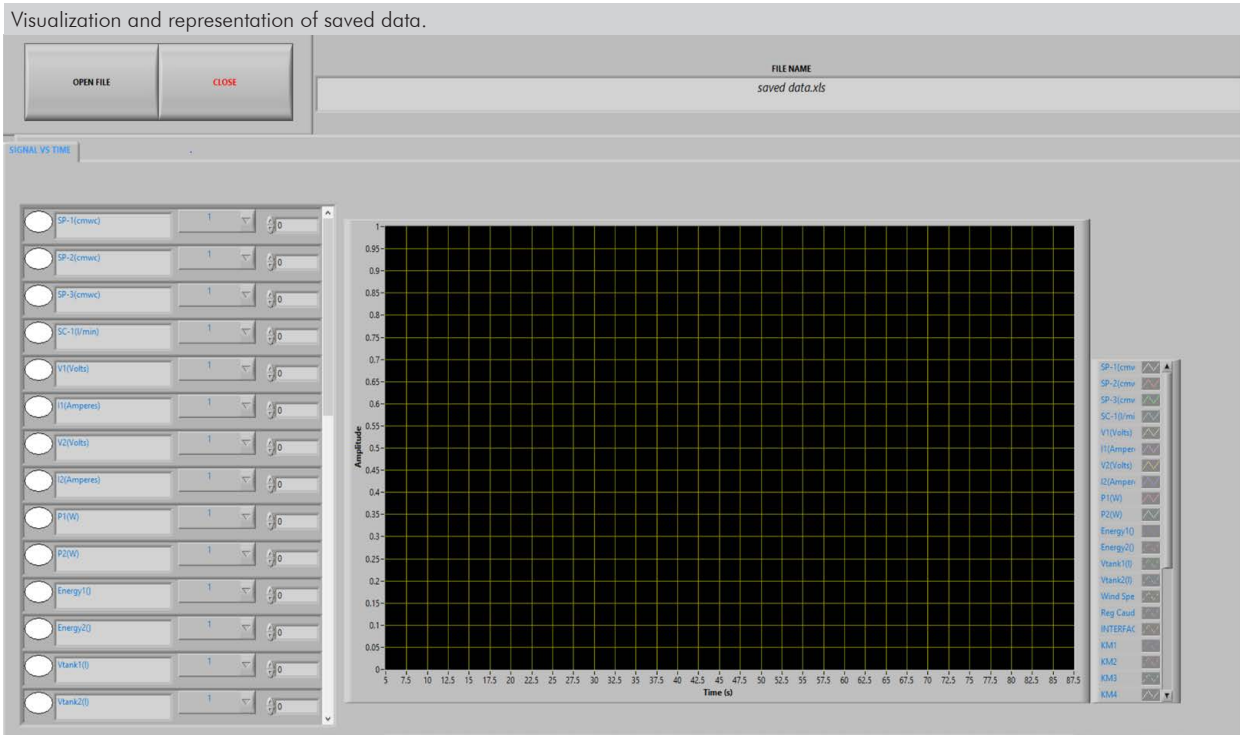
(34) VIEW DATA.

(35) RESET PLOT.

(36) PRINT PLOT.

(37) ENLARGE PLOT.

Visualization and representation of saved data.



Additionally to the main items (1 to 5) described, we can offer, as optional, other items from 6 to 9.
All these items try to give more possibilities for:

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

a) Technical and Vocational Education configuration

⑥ SWPC/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).

- 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.

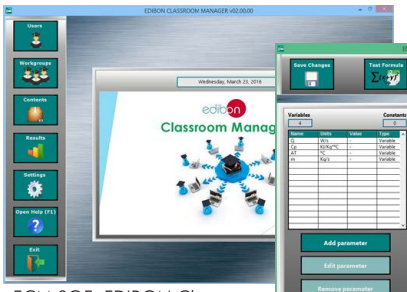
Innovative features:

- **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.**

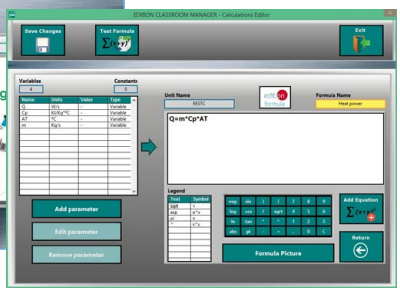
For more information see **ICAI** catalogue. Click on the following link:

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

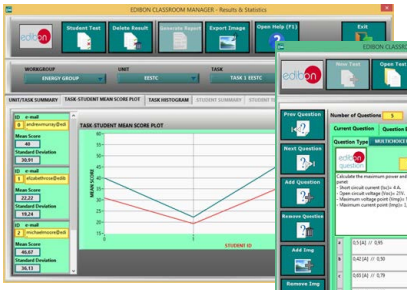
Instructor Software



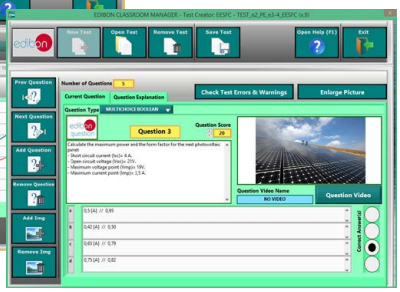
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



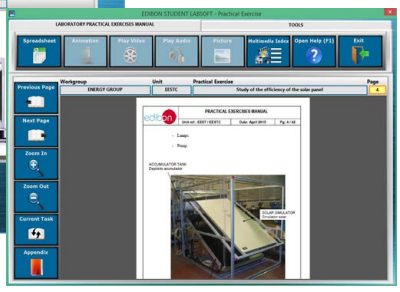
ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram



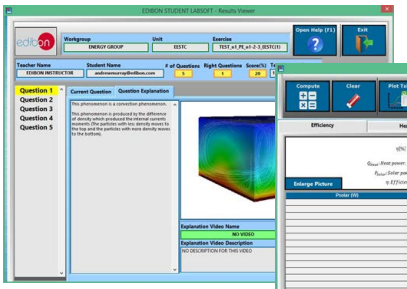
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

Student Software

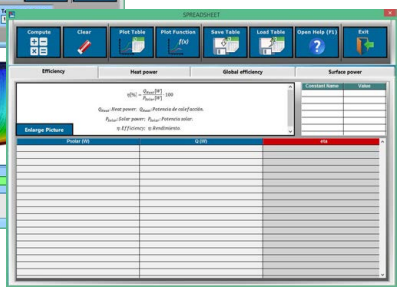
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

⑦ SWPC/FSS. Faults Simulation System.

Faults Simulation System (FSS) is a Software package that simulates several faults in any EDIBON Computer Controlled Unit. It is useful for Technical and Vocational level.

The "FAULTS" mode consists in causing several faults in the unit normal operation. The student must find them and solve them. There are several kinds of faults that can be grouped in the following sections:

Faults affecting the sensors measurement:

- **An incorrect calibration is applied to them.**
- **Non-linearity.**

Faults affecting the actuators:

- **Actuators channels interchange at any time during the program execution.**
- **Response reduction of an actuator.**

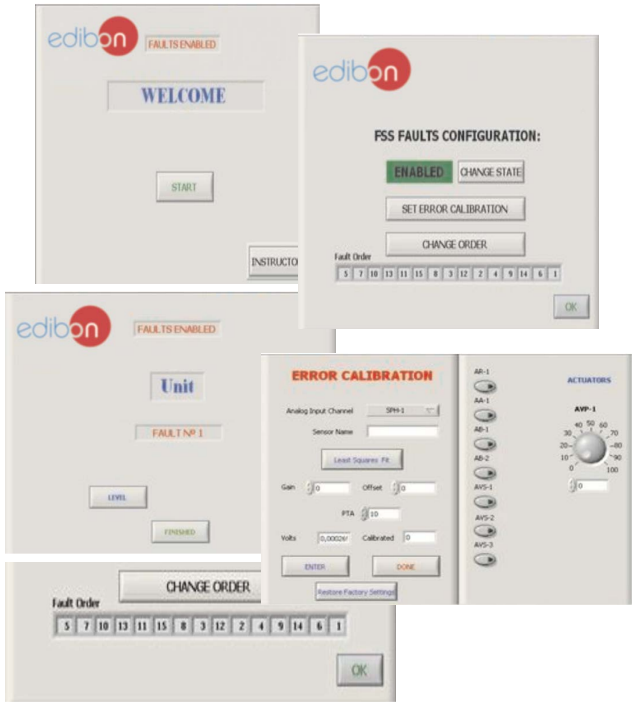
Faults in the controls execution:

- **Inversion of the performance in ON/OFF controls.**
- **Reduction or increase of the calculated total response.**
- **The action of some controls is annulled.**

On/off faults:

- **Several on/off faults can be included.**

Example of some screens



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

www.edibon.com/en/fault-simulation-system/catalog

b) Multipost Expansions options

⑧ 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.

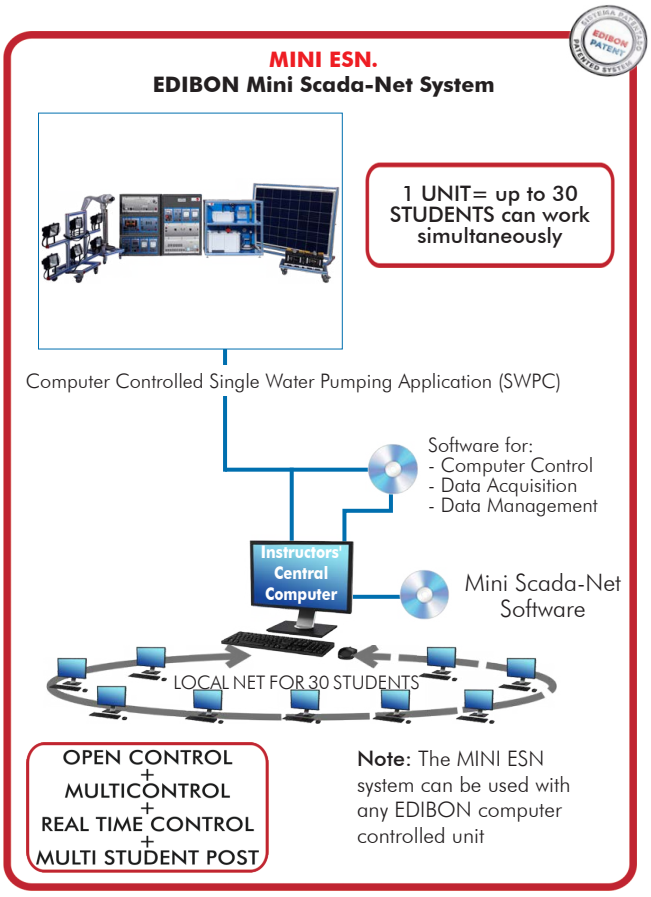
This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit. Then, the number of possible users who can work with the same unit is higher than in an usual way of working (usually only one).

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/catalog

⑨ 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/catalog

ORDER INFORMATION

Main items (always included in the supply)

Minimum supply always includes:

① **Unit: SWPC. Computer Controlled Single Water Pumping Application.**

② **DAB. Data Acquisition Board.**

③ **SWPC/CCSOF. Computer Control + Data Acquisition + Data Management Software.**

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

⑤ **Manuals.**

*IMPORTANT: Under SWPC 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

⑥ SWPC/ICAI. Interactive Computer Aided Instruction Software.

⑦ SWPC/FSS. Faults Simulation System.

c) Multipost Expansions options

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

⑨ ESN. EDIBON Scada-Net Systems.

① SWPC. Unit:

- N-ALI02. Domestic Main Power Supply Module.
  - Supply voltage (single-phase): 230 VAC, 1PH + N.
  - ON/OFF removable key.
  - Output voltage connections:
    - Two single-phase: 230 VAC.
  - Single-shase supply hose connecting plug.
  - Differential magnetothermal, 2 poles, 25 A, 30 mA AC, 6 KA.
  - Emergency stop push-button.
- N-PRC. Pumping Local Control Module.
  - Power source input terminals.
  - Measurement connectors.
  - Internal meters: voltmeter and ammeter.
  - DC/DC converter.
  - Output terminals.
  - Remote control LED indicator.
  - Maximum level LED indicator.
  - Minimum level LED indicator.
  - Switch for control modes: Local or SCADA.
  - Local control switches.
  - Flow meter signal connectors.
  - Pressure signal connectors.
  - Connectors for variable control (communication signal ports).
  - ON/OFF switch.
  - Supply voltage of the module: 230 VAC.
  - Nominal operating voltage with the pump controller: 36 V.
  - DC working voltage range (without pump regulator): 24 – 36 V.
  - Peak input power with regulator: 175 W.
  - Maximum motor output power: 160 W.
  - 5 A fuses.
- N-DCPWS-36V/150W. 36 VDC, 150 W Power Supply Module.
  - LED indicator.
  - DC output terminals.
  - Auxiliary outlet sockets.
  - 5 A fuse.
  - ON/OFF switch.
  - Output voltage: 36 VDC.
  - Power: 150 W.
- MED65. Digital Multimeter.
  - This module has a 3 ½ digit digital multimeter, with 4 mm double connector termination cables to facilitate interconnections.
  - With this digital multimeter we can measure:
    - Voltage.
    - Current.
    - Resistance.
    - Capacitors capacity.
    - Temperature.
- PTWT. Pumping Unit with Two Water Tanks.
  - Bench-top unit.
  - Anodized aluminum frame and panels made of painted steel.
  - Main metallic elements made of stainless steel.
  - Diagram in the front panel with similar distribution to that of the elements in the real unit.
  - Pumping tank: 25 l (approx.)
  - Accumulation tank: 75 l (approx.)
  - Pressure pump.
  - Pump voltage: 24 – 36 V.
  - Maximum pumping current: 4 A.
  - Proportional valve (AVP-1).
  - Maximum tank level sensor (SN-1).
  - Minimum well level sensor (SN-2).
  - Tank pressure sensor (SP-1).
  - Well pressure sensor (SP-2).
  - Pressure sensor of the pipeline.
  - Digital flow meter (SC-1).
  - Analogue flow meter.
  - Drain valve (V-1).
  - Pipes and piping.
  - Multimeter.
  - LabVIEW interface for data acquisition.
  - AC power cables.

Additional recommended elements (Not included):

- PV-KIT-300W. 300W Photovoltaic Kit with Regulator and Measurement Instrumentation.
  - LP6. 6 Lamps Panel with Dimming.
    - Power: 6 x 500 W.
    - Aluminium frame.
  - N-REG-AC/LR. AC Local/Remote Current Regulator Module.
    - 16 A fuse.
    - Switch for control modes: Local or SCADA.
    - ENABLE/DISABLE switch.
    - Potentiometer for manual intensity control.
    - Current signal control connector.
    - ON/OFF switch.
    - Power connector.
    - Module supply voltage: 230 VAC.
    - Working intensity range: 0 – 6.5 A.
    - Maximum motor output power: 1500 W.
  - N-MED16. DC Voltmeter Module (0-50 V).
    - Analogue voltmeter.
    - Connection terminals.
    - Voltage range: 0 – 50 V.
  - N-MED81. DC Ammeter Module (0-30 A).
    - Analogue ammeter.
    - Connection terminals.
    - Intensity range: 0 – 30 A.
  - PV-24/300W. Photovoltaic Panel, 24 VDC, 300 W.
    - Number of cells: 6 x 12.
    - Maximum power: 335 W.
    - Voltage at maximum power: 38.2 V.
    - Current at maximum power: 8.77 A.
    - Short circuit current (Isc): 9.38 A.
    - Open circuit voltage (Voc): 46.1 V.
    - Module efficiency: 17.2 %.
  - BAT2. AGM Battery, 25 Ah, 12 V (2 units).
    - Nominal voltage: 12 VDC.
  - N-REG03. MPPT Regulator Module.
    - MPPT regulator.
    - ON/OFF switch.
    - Output terminals: 12/24 VDC.
    - Battery terminals: 12/24 VDC.
    - Module power supply: 230 VAC.
    - Nominal discharge current: 20 A.
    - Acceptable DC voltage range: 12 – 50 V.
    - 16 A fuse.
    - Monitoring of parameters:
      - Voltage.
      - Current.
      - Charge level of the battery.
      - Charging current.
      - State.
      - Devices with self-protection, battery and loads.
- WT-KIT-400W. 400 W Wind Turbine Kit with Regulator and Measurement Instrumentation.
  - WT-24V/400W. Permanent Magnets Wind Turbine 24 V, 400 W.
    - Wind turbine.
    - Power: 400 W.
    - Voltage: 24 VDC.
  - N-REG-24V/400W. Wind Turbine Regulator Module 24 V, 400 W.
    - 16 A fuses.
    - Wind turbine controller.
    - Three-phase input terminals.
    - ON/OFF switch.
    - Output voltage: 24 – 36 VDC.
    - Battery voltage: 24 VDC.
    - DC output terminals.

- N-TPAD-3PH/400V. 400 V Three-Phase AC/DC Converter Module.
  - 16 A fuses.
  - Three-phase input terminals.
  - ON/OFF switch.
  - Auxiliary ON/OFF switch.
  - DC output terminals.
  - Input voltage range: 0 – 400 VAC.
  - Output voltage range: 0 – 400 VDC.
- N-MED16. DC Voltmeter Module (0-50 V).
  - Analogue voltmeter.
  - Connection terminals.
  - Voltage range: 0 – 50 V.
- N-MED81. DC Ammeter Module (0-30 A).
  - Analogue ammeter.
  - Connection terminals.
  - Intensity range: 0 – 30 A.
- BAT2. AGM Battery, 25 Ah, 12 V (2 units).
  - Nominal voltage: 12 VDC.
- N-SERV400W. 400 W Servomotor Controller Module.
  - Servomotor SERV01.
  - Error LED indicator.
  - 5 A fuse.
  - USB connector.
  - Encoder connector.
  - Power connector.
  - Speed control connector.
  - Switch for control modes: Local or SCADA.
  - ON/OFF switch.
  - Potentiometer for manual speed control.
  - Module supply voltage: 230 VAC.
  - Control speed: 0 – 3000 rpm.
  - Specific frequency: 250 Hz.
  - Operating intensity: 1.5 A.
  - Operating voltage: 101 VAC.
- 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.

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.

② DAB. Data Acquisition Board:

The Data Acquisition Board is part of the SCADA system.

USB Data Acquisition Board (National Instruments).

Analog input: Number of channels= 8 single-ended or 8 differential. Resolution=14 bits, 1 in 16384. Sampling rate up to: 20 KS/s (kilo samples per second).

Analog output: Number of channels=2. Resolution=16 bits, 1 in 65536.

Digital Input/Output: Number of channels=13 inputs/outputs.

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

③ SWPC/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.

Sampling velocity up to 250 KS/s (kilo samples per second).

Calibration system for the sensors involved in the process.

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.

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, Calibration & Practices manuals.

Exercises and Practical Possibilities to be done with the Main Items

- Local Control.

1.- Starting and stopping the pumping system.

2.- Automatic stop in maximum and minimum level conditions.

3.- Study of the working regime of the pumping regulator: adjustment and reduction of voltage.

4.- Commissioning of the solar battery pumping system (requires the PV-KIT-300W).

5.- Commissioning of the solar pumping system without batteries (requires the PV-KIT-300W).

6.- Study of the working regime of the pumping regulator: shadow effect (requires the PV-KIT-300W).

7.- Study of the working regime of the pumping regulator: variations of pumped flow (requires the PV-KIT-300W).

8.- Starting thresholds with and without converter (requires the PV-KIT-300W).

9.- Commissioning of the battery-powered wind pumping system (requires the WT-KIT-400W).

10.- Commissioning of the wind power pumping system without batteries (requires the WT-KIT-400W).

- SCADA Control.

11.- Starting and stopping the pumping system.

12.- Automatic stop in maximum and minimum level conditions.

13.- Study of the working regime of the pumping regulator: adjustment and reduction of voltage.

14.- Manometric height concept: manual adjustment of the proportional valve.

15.- Energy flow analysis: overall system performance.

16.- Commissioning of the solar battery pumping system (requires the PV-KIT-300W).

17.- Commissioning of the solar pumping system without batteries (requires the PV-KIT-300W).

18.- Study of the working regime of the pumping regulator: shadow effect (requires the PV-KIT-300W).

19.- Study of the working regime of the pumping regulator: variations of pumped flow (requires the PV-KIT-300W).

20.- Starting thresholds with and without converter (requires the PV-KIT-300W).

21.- Energy flow analysis: overall system performance (requires the PV-KIT-300W).

22.- Commissioning of the battery-powered wind pumping system (requires the WT-KIT-400W).

23.- Commissioning of the wind power pumping system without batteries (requires the WT-KIT-400W).

24.- Energy flow analysis: overall system performance (requires the WT-KIT-400W).

Other possibilities to be done with this unit:

25.- Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.

26.- 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.

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

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

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

30.- 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

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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.
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- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.

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Faults in the controls execution:

- Inversion of the performance in ON/OFF controls.
- Reduction or increase of the calculated total response.
- The action of some controls is annulled.

On/off faults:

- Several on/off faults can be included.

b) Multipost Expansions options

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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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REPRESENTATIVE: