

① Unit: PPTAC/1. Computer Controlled Water Treatment Plant 1

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.**



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

There are many different ways of treating industrial effluent. Filtration, adsorption and ion-exchange methods are often used in the design of small water treatment plants.

Filtration is the physical process of separating suspended and colloidal particles from water by passing the water through a filtering medium (gravel, sand, etc.). It involves several physical processes.

Organic and inorganic contaminants can be removed from water through adsorption processes. Adsorption of a substance involves its accumulation onto the surface of a solid called the adsorbent (aluminum oxide, active carbon, etc.).

Hardness is most often associated with ground water supplies. The ion exchange is a common method used to reduce hardness.

The Computer Controlled Water Treatment Plant 1, "PPTAC/1", allows to simulate a water treatment plant and to demonstrate three operations of water treatment: depth filtration, adsorption and ion exchange.

GENERAL DESCRIPTION

The Computer Controlled Water Treatment Plant 1, "PPTAC/1", allows to study the main principle of the critical operations in the water treatment.

These operations are: depth filtration, adsorption and ion exchange.

The general objective of the exercises is to achieve the best possible treated water quality. The unit can be used to perform three variations of the specified processes:

- Filtration.
- Filtration and adsorption.
- Filtration, adsorption and ion exchange.

The unit is mounted on a floor standing metallic structure and consists of two modules connected by a set of hoses.

One module is composed of a supply unit and a water treatment unit. The raw water section includes a tank, a computer controlled pump to impel the water from the tank to the gravel filter and a line to introduce air optionally. This aeration ensures the raw water is mixed through and allows to precipitate the dissolved substances. The treated water section includes a tank to collect the water outlet of each operation in the water treatment plant (depth filtration, adsorption and ion exchange). Both tanks have level switches.

The other module includes the water treatment unit, which is connected to the tanks of the supply unit and consists of two filters, two adsorbers and two ion exchangers.

Raw water is pumped from the raw water section of the supply unit into a gravel filter and then routed into a sand filter. In the filtration process, the undissolved particles (suspended solids) are removed by passing the water through the filtering media (gravel and sand).

Filtered water can flow into the second treatment stage or can flow into the treated water tank, depending on the position of the circuit electrovalves. In the second stage, the dissolved particles (organic and inorganic contaminants) of the filtered water are removed by adsorption on aluminum oxide (first filter) and on activated carbon (second filter).

Water can flow into the third treatment stage or can flow into the treated water tank, depending on the position of the circuit electrovalves. In the third stage unwanted ions are removed from the water by ion exchange. First, water is softened by cation exchange, and then it is desalinated in a mixed bed ion exchanger, formed by cations and anions. At last, the treated water flows into the treated water tank.

All the relevant parameters (flow rate, pressure, differential pressure, temperature, conductivity) are recorded by sensors. Samples can be taken at all relevant points of the unit.

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

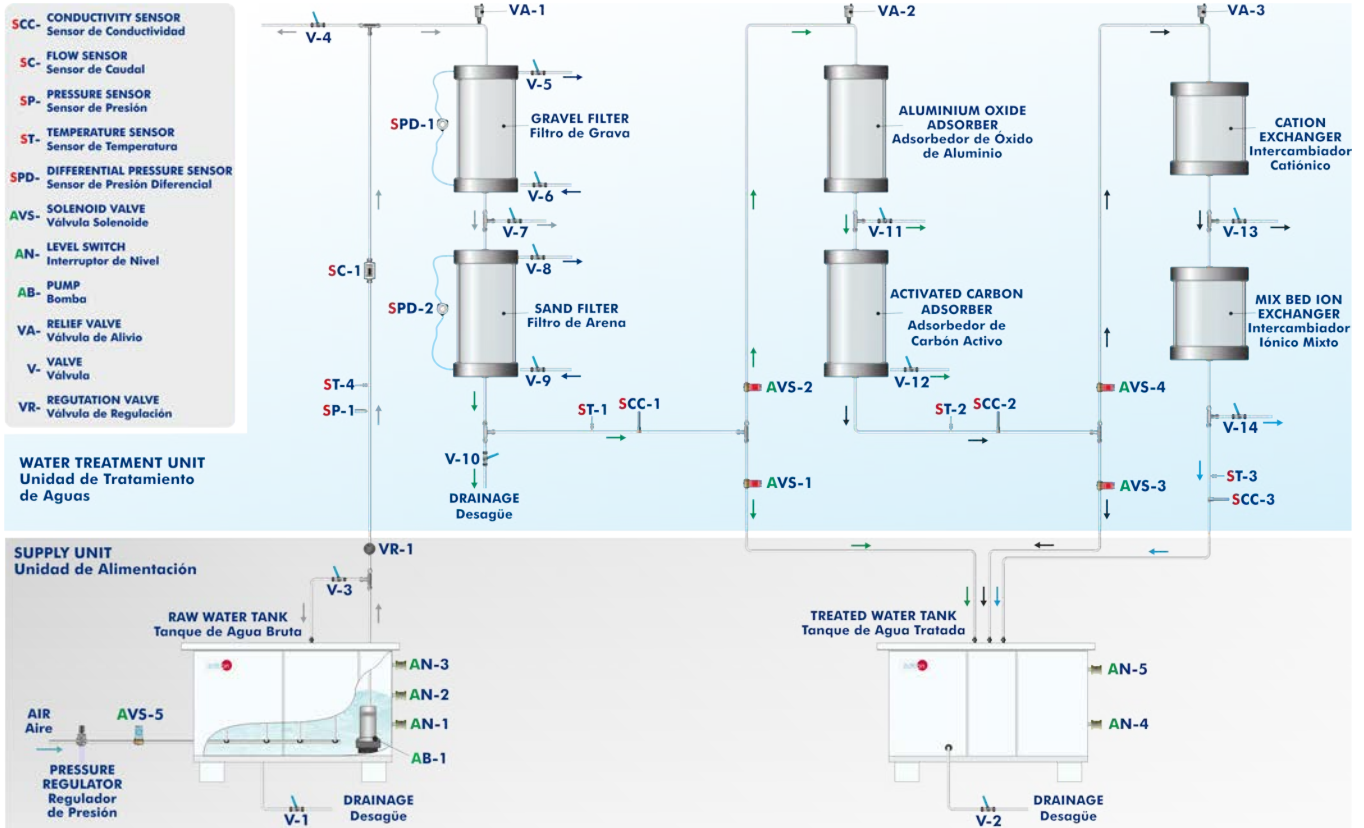


PPTAC/1 detail

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

6 actuators and 11 sensors controlled from any computer, and working simultaneously

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



COMPLETE TECHNICAL SPECIFICATIONS (for main items)

With this unit there are several options and possibilities:

- Main items: 1, 2, 3, 4, 5 and 6.
- Optional items: 7, 8, 9, 10 and 11.

Let us describe first the main items (1 to 6):

① PPTAC/1. Unit:

Anodized aluminum frame and panels made of painted steel.

The unit includes wheels to facilitate its mobility.

Main metallic elements made of stainless steel.

Diagram in the front panel with distribution of the elements similar to the real one.

Supply unit:

Computer controlled pump, max. flow: 20 m³/h, max. head: 18 m.

Raw water storage tank, capacity: 250 l.

Treated water storage tank, capacity: 250 l.

The raw water tank includes a line to introduce air optionally with an external compressed air supply (not included).

The air passes through a computer controlled electrovalve and a pressure regulator to provide constant pressure to the tank.

Five level switches.

Water treatment unit:

Two transparent filters:

Diameter: 200 mm, each one.

Height: 650 mm, each one.

The filters have connections that allows samples to be taken.

The upper filter contains gravel and the lower filter contains sand.

They include two differential pressure sensors, range: 0 – 2 bar.

Two transparent adsorbers:

Diameter: 200 mm, each one.

Height: 650 mm, each one.

The filters have connections that allows samples to be taken.

The upper adsorber contains aluminum oxide and the lower adsorber contains activated carbon.

Two exchangers:

Diameter: 250 mm, each one.

Height: 400 mm, each one.

The filters have connections that allows samples to be taken.

The lower exchanger contains a mixed bed with cations and anions, and the upper exchanger contains cations.

Pressure sensor (range: 0 – 6 bar) to measure the plant pressure.

Inductive magnetic flow sensor (range: 0.21 l/min – 50 l/min) of the raw water input.

“J type” temperature sensor to measure the temperature of the incoming water.

Three “J type” temperature sensors to measure the temperature of the raw water between each purification stage.

Three conductivity sensors (range: 0 – 20 mS/cm) to measure the raw water conductivity between each purification stage.

Flow control valve.

Sampling valves at each purification stage.

The unit includes a pack of sand, a pack of gravel, a pack of aluminum oxide and a pack of active carbon.

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.



Unit: PPTAC/1

② PPTAC/1/CIB. Control Interface Box:

The Control Interface Box is part of the SCADA system.

Control interface box with process diagram in the front panel and with the same distribution that the different elements located in the unit, for an easy understanding by the student.

All sensors, with their respective signals, are properly manipulated from -10V. to +10V. computer output.

Sensors connectors in the interface have different pines numbers (from 2 to 16), to avoid connection errors.

Single cable between the control interface box and computer.

The unit control elements are permanently computer controlled, without necessity of changes or connections during the whole process test procedure.

Simultaneous visualization in the computer of all parameters involved in the process.

Calibration of all sensors involved in the process.

Real time curves representation about system responses.

Storage of all the process data and results in a file.

Graphic representation, in real time, of all the process/system responses.

All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process.

All the actuators and sensors values and their responses are displayed on only one screen in the computer.

Shield and filtered signals to avoid external interferences.

Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process.

Real time computer control for pumps, compressors, heating elements, control valves, etc.

Real time computer control for parameters involved in the process simultaneously.

Open control allowing modifications, at any moment and in real time, of parameters involved in the process simultaneously.

Three safety levels, one mechanical in the unit, another electronic in the control interface and the third one in the control software.



PPTAC/1/CIB

③ 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/O. 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/O.

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

④ PPTAC/1/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).

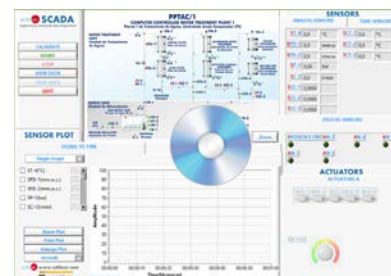
Calibration system for the sensors involved in the process.

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.

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.



PPTAC/1/CCSOF

⑤ Cables and Accessories, for normal operation.

⑥ Manuals:

This unit is **supplied with 8 manuals**: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

*References 1 to 6 are the main items: PPTAC/1 + PPTAC/1/CIB + DAB + PPTAC/1/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

- 1.- Study the main principle of the water treatment plant.
 - 2.- Study the main principle of the water treatment plant operations: depth filtration, adsorption and ion exchange.
 - 3.- Determination of the pressure drop in depth filtration.
 - 4.- Study of the pressure drop and solid concentration in filtrate with the time.
 - 5.- Study of the breakthrough curves (adsorbate concentrations at the outlet of an adsorber over time) in the adsorption step.
 - 6.- Comparison of various adsorption materials.
 - 7.- Familiarization with the fundamental principle of ion exchange.
 - 8.- Study of the relationship between solid concentration and sedimentable solids for the solids used.
- Additional practical possibilities:
- 9.- Sensors calibration.
- Other possibilities to be done with this Unit:
- 10.- Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
 - 11.- 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.
- 12.-The Computer Control System with SCADA allows a real industrial simulation.
 - 13.-This unit is totally safe as uses mechanical, electrical/electronic, and software safety devices.
 - 14.-This unit can be used for doing applied research.
 - 15.-This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
 - 16.-Control of the PPTAC/1 unit process through the control interface box without the computer.
 - 17.-Visualization of all the sensors values used in the PPTAC/1 unit process.
- By using PLC-PI additional 19 more exercises can be done.
 - 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.
- Water supply and drain.
- Computer.

REQUIRED ELEMENTS (Not included)

- Compressed air.

DIMENSIONS AND WEIGHTS

PPTAC/1:

Supply unit:

- Dimensions: 1100 x 620 x 850 mm approx.
(43.30 x 24.40 x 33.46 inches approx.)
- Weight: 40 kg approx.
(88 pounds approx.)

Water Treatment unit:

- Dimensions: 1800 x 600 x 2100 mm approx.
(70.86 x 23.62 x 82.67 inches approx.)
- Weight: 100 kg approx.
(220 pounds approx.)

Control-Interface Box:

- Dimensions: 490 x 330 x 310 mm approx.
(19.29 x 12.99 x 12.20 inches approx.)
- Weight: 10 kg approx.
(22 pounds approx.)

REQUIRED CONSUMABLES (Not included)

- Substances for preparation of the raw water:
 - Fluorescein.
 - Diatomaceous Earth.
 - Clay.
 - Potassium dihydrogen phosphate.

SIMILAR UNITS AVAILABLE

- PPTAC/1. Computer Controlled Water Treatment Plant 1.
Offered in this catalog:
- PPTAC/2. Computer Controlled Water Treatment Plant 2.
Offered in other catalog:

SOFTWARE MAIN SCREENS

SCADA Main screen

The SCADA Main screen displays a comprehensive view of the PPTAC/1 water treatment plant. At the top center is a process flow diagram with various units and sensors labeled. On the left, a vertical menu includes buttons for CALIBRATE, START, STOP, VIEW DATA, SAVE DATA, and QUIT. The top right section, titled 'SENSORS', is divided into 'ANALOG SENSORS' and 'TARE SENSORS', showing real-time values for sensors like ST-4, SPD-1, SPD-2, SP-1, SC-1, SCC-1, SCC-2, and SCC-3. Below this is the 'DIGITAL SENSORS' section with indicators for AN-1 through AN-5. The bottom right section, 'ACTUATORS', shows controls for AVS-1 through AVS-5 and a gauge for AB-1. The bottom left section, 'SENSOR PLOT', features a 'SIGNAL VS TIME' graph with a 'Single Graph' selection and checkboxes for various sensors. The graph shows 'Amplitude' on the y-axis and 'Time(hh:mm:ss)' on the x-axis. A 'Zoom' button is also present.

- ① Main software operation possibilities.
- ② Sensors displays, real time values, and extra output parameters. Sensors: SCC=Conductivity sensor. SC=Flow sensor. SP=Pressure sensor. ST=Temperature sensor. SPD=Differential pressure sensor.
- ③ Actuators controls. Actuators: AB=Pump. AN=Level switch. AVS=Solenoid valve.
- ④ Channel selection and other plot parameters.
- ⑤ Real time graphics displays.

Software for Sensors Calibration

Example of screen

The Sensors Calibration software interface is divided into several sections. On the left, the 'Analog Input Channel' section shows settings for 'Constantes' (ST-4), 'Sensor Averages' (10), 'Calibration Units' (°C), and 'Current Gain' (94,017094). Below this are 'Gain & Offset Settings' with 'New Gain' and 'New Offset' fields, and 'Scaling Parameters' with a 'Least Square Fit' button. The right side features a table of sensor calibration data and a 'Calibrate Window' for individual sensors.

Sensors	Units	Volts	Calibrated	Err(%)	Current Gain	Current Offset
ST-4	°C	0,402183	39,6286	39,6286	94,0171	2,00855
SPD-1	mm.w.c.	0,425435	94,7132	94,7132	418,605	-82,5055
SPD-2	mm.w.c.	0,402238	7,30594	7,30594	418,038	-160
SP-1	bar	0,43448	0,369418	0,369418	0,306814	0,236702
SC-1	l/min	0,390035	1,88881	1,88881	5,15397	-0,111512
SCC-1		0	0	0	1	0
SCC-2		0	0	0	1	0

At the bottom, there are buttons for 'Restore factory Gains & Offsets', 'Set New Gain & Offset', 'Take Measurement', 'Get New Gain & Offset', and 'Taken Data'.

The teacher and the students can calibrate the unit with a password provided by EDIBON. The teacher can restore the factory calibration any time.

SOME REAL RESULTS OBTAINED FROM THIS UNIT

Signal versus signal chart where any of the measured variables can be represented.

PPTAC/1

COMPUTER CONTROLLED WATER TREATMENT PLANT 1

Planta 1 de Tratamiento de Aguas, Controlado desde Computador (PC)

SENSORS

ANALOG SENSORS		TARE SENSORS	
ST-4	20,9 °C	SCT-1	20,3 °C
SPD-1	374,0 mm.w.c.	SCT-2	23,0 °C
SPD-2	0,0 mm.w.c.	SCT-3	22,4 °C
SP-1	0,78 bar		
SC-1	16,1 l/min		
SCC-1	0,1526 mS		
SCC-2	0,8290 mS		
SCC-3	0,0000 mS		

SENSOR PLOT

SIGNAL VS TIME

Signal (y): SPD-1

Signal (x): SPD-1

Plot: A

Acquire Point

Save Acquired Points

Reset Plot

Print Plot

Enlarge Plot

seconds

ACTUATORS

ACTUATORS A

AVS-1

AVS-2

AVS-3

AVE-4

AVS-5

AB-1(%)

Real time representation of any measured variable.

PPTAC/1

COMPUTER CONTROLLED WATER TREATMENT PLANT 1

Planta 1 de Tratamiento de Aguas, Controlado desde Computador (PC)

SENSORS

ANALOG SENSORS		TARE SENSORS	
ST-4	23,9 °C	SCT-1	21,2 °C
SPD-1	70,2 mm.w.c.	SCT-2	22,6 °C
SPD-2	582,7 mm.w.c.	SCT-3	0,0
SP-1	0,10 bar		
SC-1	0,3 l/min		
SCC-1	0,0916 mS		
SCC-2	0,0000		
SCC-3	0,0000		

SENSOR PLOT

SIGNAL VS TIME

Graph B

- ST-4(°C)
- SPD-1(mm.w.c.)
- SPD-2(mm.w.c.)
- SP-1(bar)
- SC-1(l/min)

Reset Plot

Print Plot

Enlarge Plot

seconds

ACTUATORS

ACTUATORS A

AVS-1

AVS-2

AVS-3

AVE-4

AVS-5

AB-1(%)

COMPLETE TECHNICAL SPECIFICATIONS (for optional items)

Additionally to the main items (1 to 6) described, we can offer, as optional, other items from 7 to 11.

All these items try to give more possibilities for:

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

a) Industrial configuration

⑦ PLC. Industrial Control using PLC (it includes PLC-PI Module plus PLC-SOF Control Software):

-PLC-PI. PLC Module:

Metallic box.

Circuit diagram in the module front panel.

Front panel:

Digital inputs (X) and Digital outputs (Y) block:

16 Digital inputs, activated by switches and 16 LEDs for confirmation (red).

14 Digital outputs (through SCSI connector) with 14 LEDs for message (green).

Analog inputs block:

16 Analog inputs (-10 V. to + 10 V.) (through SCSI connector).

Analog outputs block:

4 Analog outputs (-10 V. to + 10 V.) (through SCSI connector).

Touch screen:

High visibility and multiple functions. Display of a highly visible status. Recipe function. Bar graph function. Flow display function. Alarm list.

Multi language function. True type fonts.

Back panel:

Power supply connector. Fuse 2A. RS-232 connector to PC. USB 2.0 connector to PC.

Inside:

Power supply outputs: 24 Vdc, 12 Vdc, -12 Vdc, 12 Vdc variable.

Panasonic PLC:

High-speed scan of 0.32 μ sec. for a basic instruction.

Program capacity of 32 Ksteps, with a sufficient comment area.

Power supply input (100 to 240 V AC).

DC input: 16 (24 V DC).

Relay output: 14.

High-speed counter.

Multi-point PID control.

Digital inputs/outputs and analog inputs/outputs Panasonic modules.

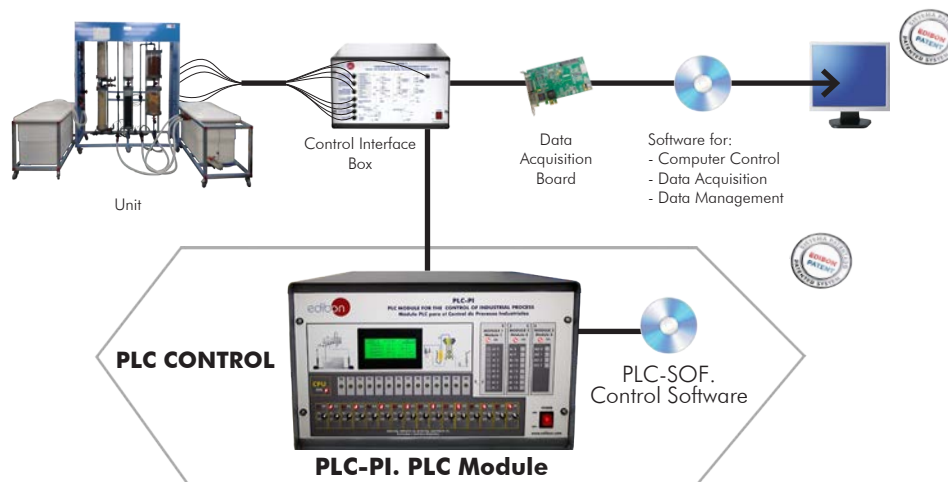
Communication RS232 wire to computer (PC).

Dimensions: 490 x 330 x 310 mm. approx. (19.29 x 12.99 x 12.20 inches approx.). Weight: 30 Kg. approx. (66 pounds approx.).

-PPTAC/1/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

The software has been designed using Labview and it follows the unit operation procedure and linked with the Control Interface Box used in the Computer Controlled Water Treatment Plant 1 (PPTAC/1).



Practices to be done with PLC-PI:

- 1.- Control of the particular unit process through the control interface box without the computer.
- 2.- Visualization of all the sensors values used in the particular unit process.
- 3.- Calibration of all sensors included in the particular unit process.
- 4.- Hand on of all the actuators involved in the particular unit process.
- 5.- Realization of different experiments, in automatic way, without having in front the particular unit. (These experiments can be decided previously).
- 6.- Simulation of outside actions, in the cases do not exist hardware elements. (Example: test of complementary tanks, complementary industrial environment to the process to be studied, etc).
- 7.- PLC hardware general use.
- 8.- PLC process application for the particular unit.
- 9.- PLC structure.
- 10.- PLC inputs and outputs configuration.
- 11.- PLC configuration possibilities.
- 12.- PLC program languages.
- 13.- PLC different programming standard languages (ladder diagram (LD), structured text (ST), instructions list (IL), sequential function chart (SFC), function block diagram (FBD)).
- 14.- New configuration and development of new process.
- 15.- Hand on an established process.
- 16.- To visualize and see the results and to make comparisons with the particular unit process.
- 17.- Possibility of creating new process in relation with the particular unit.
- 18.- PLC Programming Exercises.
- 19.- Own PLC applications in accordance with teacher and student requirements.

b) Technical and Vocational Education configuration

⑧ PPTAC/1/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 6).

- 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

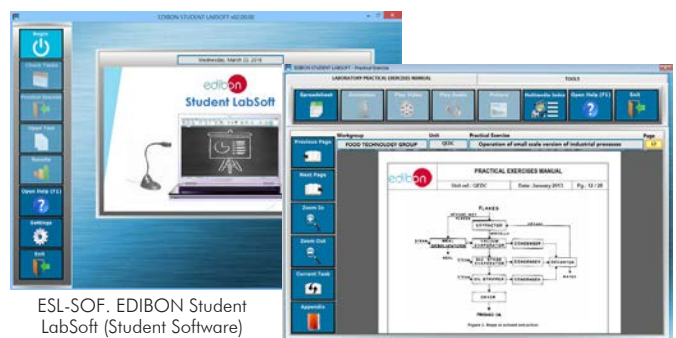
ECAL. EDIBON Calculations Program Package - Formula Editor Screen



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

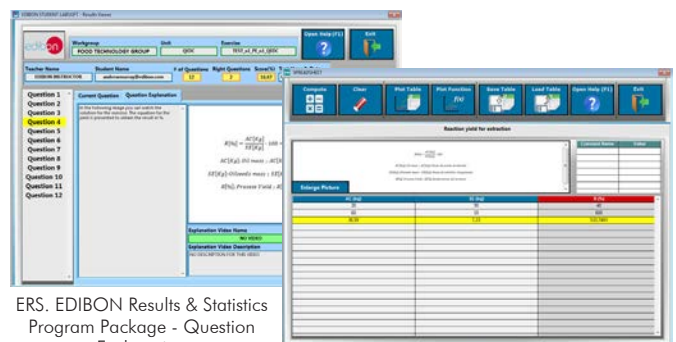
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

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

9 PPTAC/1/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.

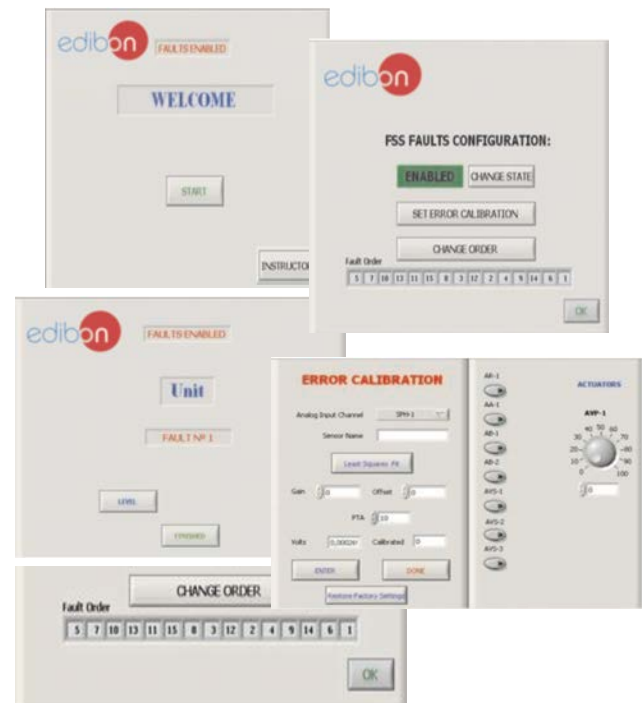
On/off faults:

- Several on/off faults can be included.

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

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

Example of some screens



c) Multipost Expansions options

10 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:

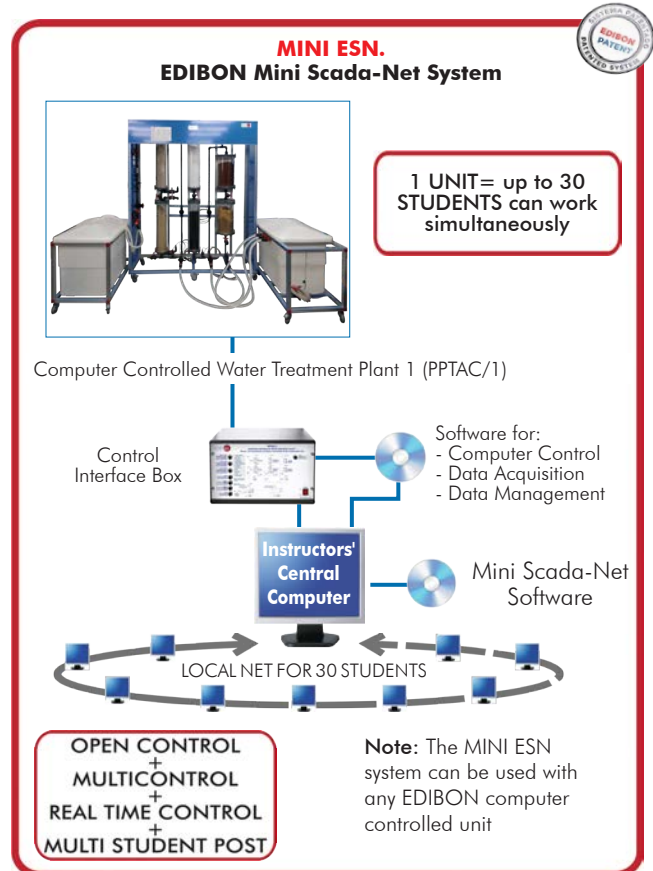
- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work 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



11 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: PPTAC/1. Computer Controlled Water Treatment Plant 1.**
- ② **PPTAC/1/CIB. Control Interface Box.**
- ③ **DAB. Data Acquisition Board.**
- ④ **PPTAC/1/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
- ⑤ **Cables and Accessories**, for normal operation.
- ⑥ **Manuals.**

***IMPORTANT:** Under PPTAC/1 we always supply all the elements for immediate running as 1, 2, 3, 4, 5 and 6.

Optional items (supplied under specific order)

a) Industrial configuration

- ⑦ **PLC. Industrial Control using PLC** (it includes PLC-PI Module plus PLC-SOF Control Software):
 - PCL-PI. PLC Module.
 - PPTAC/1/PLC-SOF. PLC Control Software.

b) Technical and Vocational Education configuration

- ⑧ **PPTAC/1/ICAL. Interactive Computer Aided Instruction Software.**
- ⑨ **PPTAC/1/FSS. Faults Simulation System.**

c) Multipost Expansions options

- ⑩ **MINI ESN. EDIBON Mini Scada-Net System** for being used with EDIBON Teaching Units.
- ⑪ **ESN. EDIBON Scada-Net Systems.**

TENDER SPECIFICATIONS (for main items)

① PPTAC/1. Unit:

Anodized aluminum frame and panels made of painted steel.
The unit includes wheels to facilitate its mobility.
Main metallic elements made of stainless steel.
Diagram in the front panel with distribution of the elements similar to the real one.

Supply unit:

Computer controlled pump, max. flow: 20 m³/h, max. head: 18 m.
Raw water storage tank, capacity: 250 l.
Treated water storage tank, capacity: 250 l.

The raw water tank includes a line to introduce air optionally with an external compressed air supply (not included). The air passes through a computer controlled electrovalve and a pressure regulator to provide constant pressure to the tank.
Five level switches.

Water treatment unit:

Two transparent filters:

Diameter: 200 mm, each one.
Height: 650 mm, each one.

The filters have connections that allows samples to be taken.
The upper filter contains gravel and the lower filter contains sand.
They include two differential pressure sensors, range: 0 – 2 bar.

Two transparent adsorbers:

Diameter: 200 mm, each one.
Height: 650 mm, each one.

The filters have connections that allows samples to be taken.

The upper adsorber contains aluminum oxide and the lower adsorber contains activated carbon.

Two exchangers:

Diameter: 250 mm, each one.
Height: 400 mm, each one.

The filters have connections that allows samples to be taken.

The lower exchanger contains a mixed bed with cations and anions, and the upper exchanger contains cations.

Pressure sensor (range: 0 – 6 bar) to measure the plant pressure.

Inductive magnetic flow sensor (range: 0.21 l/min – 50 l/min) of the raw water input.

“J type” temperature sensor to measure the temperature of the incoming water.

Three “J type” temperature sensors to measure the temperature of the raw water between each purification stage.

Three conductivity sensors (range: 0 – 20 mS/cm) to measure the raw water conductivity between each purification stage.

Flow control valve.

Sampling valves at each purification stage.

The unit includes a pack of sand, a pack of gravel, a pack of aluminum oxide and a pack of active carbon.

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 PPTAC/1/CIB. Control Interface Box:

The Control Interface Box is part of the SCADA system.

Control interface box with process diagram in the front panel.

The unit control elements are permanently computer controlled.

Simultaneous visualization in the computer of all parameters involved in the process.

Calibration of all sensors involved in the process.

Real time curves representation about system responses.

All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process.

Shield and filtered signals to avoid external interferences.

Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process.

Real time computer control for parameters involved in the process simultaneously.

Open control allowing modifications, at any moment and in real time, of parameters involved in the process simultaneously.

Three safety levels, one mechanical in the unit, another electronic in the control interface and the third one in the control software.

③ 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.

Analog input: Channels= 16 single-ended or 8 differential. Resolution=16 bits, 1 in 65536. Sampling rate up to: 250 KS/s (kilo samples per second).

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.

④ PPTAC/1/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.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals:

This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Exercises and Practical Possibilities to be done with the Main Items

- 1.- Study the main principle of the water treatment plant.
- 2.- Study the main principle of the water treatment plant operations: depth filtration, adsorption and ion exchange.
- 3.- Determination of the pressure drop in depth filtration.
- 4.- Study of the pressure drop and solid concentration in filtrate with the time.
- 5.- Study of the breakthrough curves (adsorbate concentrations at the outlet of an adsorber over time) in the adsorption step.
- 6.- Comparison of various adsorption materials.
- 7.- Familiarization with the fundamental principle of ion exchange.
- 8.- Study of the relationship between solid concentration and sedimentable solids for the solids used.

Additional practical possibilities:

- 9.- Sensors calibration.

Other possibilities to be done with this Unit:

- 10.-Many students view results simultaneously.

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

- 11.-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.

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

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

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

- 15.-This unit can be used for giving training courses to Industries even to other Technical Education Institutions.

- 16.-Control of the PPTAC/1 unit process through the control interface box without the computer.

- 17.-Visualization of all the sensors values used in the PPTAC/1 unit process.

- By using PLC-PI additional 19 more exercises can be done.

- Several other exercises can be done and designed by the user.

TENDER SPECIFICATIONS (for optional items)

a) Industrial configuration

⑦ PLC. Industrial Control using PLC (it includes PLC-PI Module plus PLC-SOF Control Software):

-PLC-PI. PLC Module:

Metallic box.

Circuit diagram in the module front panel.

Digital inputs (X) and Digital outputs (Y) block: 16 Digital inputs. 14 Digital outputs.

Analog inputs block: 16 Analog inputs.

Analog outputs block: 4 Analog outputs.

Touch screen.

Panasonic PLC:

High-speed scan of 0.32 μ sec. Program capacity of 32 Ksteps. High-speed counter. Multi-point PID control.

Digital inputs/outputs and analog inputs/outputs Panasonic modules.

-PPTAC/1/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

Practices to be done with PLC-PI:

- 1.- Control of the particular unit process through the control interface box without the computer.
- 2.- Visualization of all the sensors values used in the particular unit process.
- 3.- Calibration of all sensors included in the particular unit process.
- 4.- Hand on of all the actuators involved in the particular unit process.
- 5.- Realization of different experiments, in automatic way, without having in front the particular unit. (These experiments can be decided previously).
- 6.- Simulation of outside actions, in the cases do not exist hardware elements. (Example: test of complementary tanks, complementary industrial environment to the process to be studied, etc).
- 7.- PLC hardware general use.
- 8.- PLC process application for the particular unit.
- 9.- PLC structure.
- 10.- PLC inputs and outputs configuration.
- 11.- PLC configuration possibilities.
- 12.- PLC program languages.
- 13.- PLC different programming standard languages (ladder diagram (LD), structured text (ST), instructions list (IL), sequential function chart (SFC), function block diagram (FBD)).
- 14.- New configuration and development of new process.
- 15.- Hand on an established process.
- 16.- To visualize and see the results and to make comparisons with the particular unit process.
- 17.- Possibility of creating new process in relation with the particular unit.
- 18.- PLC Programming Exercises.
- 19.- Own PLC applications in accordance with teacher and student requirements.

b) Technical and Vocational Education configuration

⑧ PPTAC/1/ICAI. Interactive Computer Aided Instruction Software.

This complete software package consists of an Instructor Software (EDIBON Classroom Manager - ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft - ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc...so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.

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

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

Innovative features:

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

⑨ **PPTAC/1/FSS. Faults Simulation System.**

Faults Simulation System (FSS) is a Software package that simulates several faults in any EDIBON Computer Controlled Unit. 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.

c) Multipost Expansions options

⑩ **MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.**

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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.
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- 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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