

* Minimum supply always includes: 1 + 2 + 3 + 4 + 5 + 6
(Computer not included in the supply)

① Unit: UESLC. Computer Controlled Solid-Liquid Extraction Unit

Key features:

- **Advanced Real-Time SCADA and PID Control.**
- **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 CAL software helps the user perform calculations and comprehend the results.**
- **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**

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- ↳ Products
- ↳ Products range
- ↳ Units
- ↳ 11.-Chemical Engineering

For more information about Key Features, click here



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

European Union Certificate
(total safety)

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

Worlddidac Quality Charter
Certificate and
Worlddidac Member

INTRODUCTION

The extraction is a basic operation of mass transfer based on the dissolution of one or some components of a mixture, liquid or part of a solid, through a suitable solvent. In the liquid-liquid extraction, the mass to be extracted is in a liquid, and in the solid-liquid extraction is in a solid.

The way of performing the extraction will depend on the proportion of the component to be extracted, on the distribution of this component in the solid, on the nature of the solid and on the of particle size.

The UELSC unit allows a continuous solid-liquid process of extraction in countercurrent which is the most commonly used in industry because it is the one with the highest efficiency.

DESCRIPTION

The "UESLC" unit is laboratory-scale unit designed for studying the separation of a soluble fraction from a solid with the help of a solvent in a continuous multistage and countercurrent way.

The unit utilises a continuous feed, counter current flow, multiple stage (but may also configured as one or two stage process for teaching purposes), rotary extractor system of the type frequently seen in industrial applications. The effects of temperature, multiple stages, and throughput rate can all be investigated.

The design of the unit is based on the continuous rotation extraction cell used in industrial scale, which is called 'Rotocel'. This is the main part of the solid/liquid extraction system and it is divided into compartments. The raw material is fed into these compartments from the input hopper. The material is then passed under three solvent sprinklers, and the dissolved product captured in three drainage compartments. Pumps are provided to pump the product from the drainage compartment of one stage to the sprinkler of the next stage. At the end of the process the spent carrier material will go to a collection container.

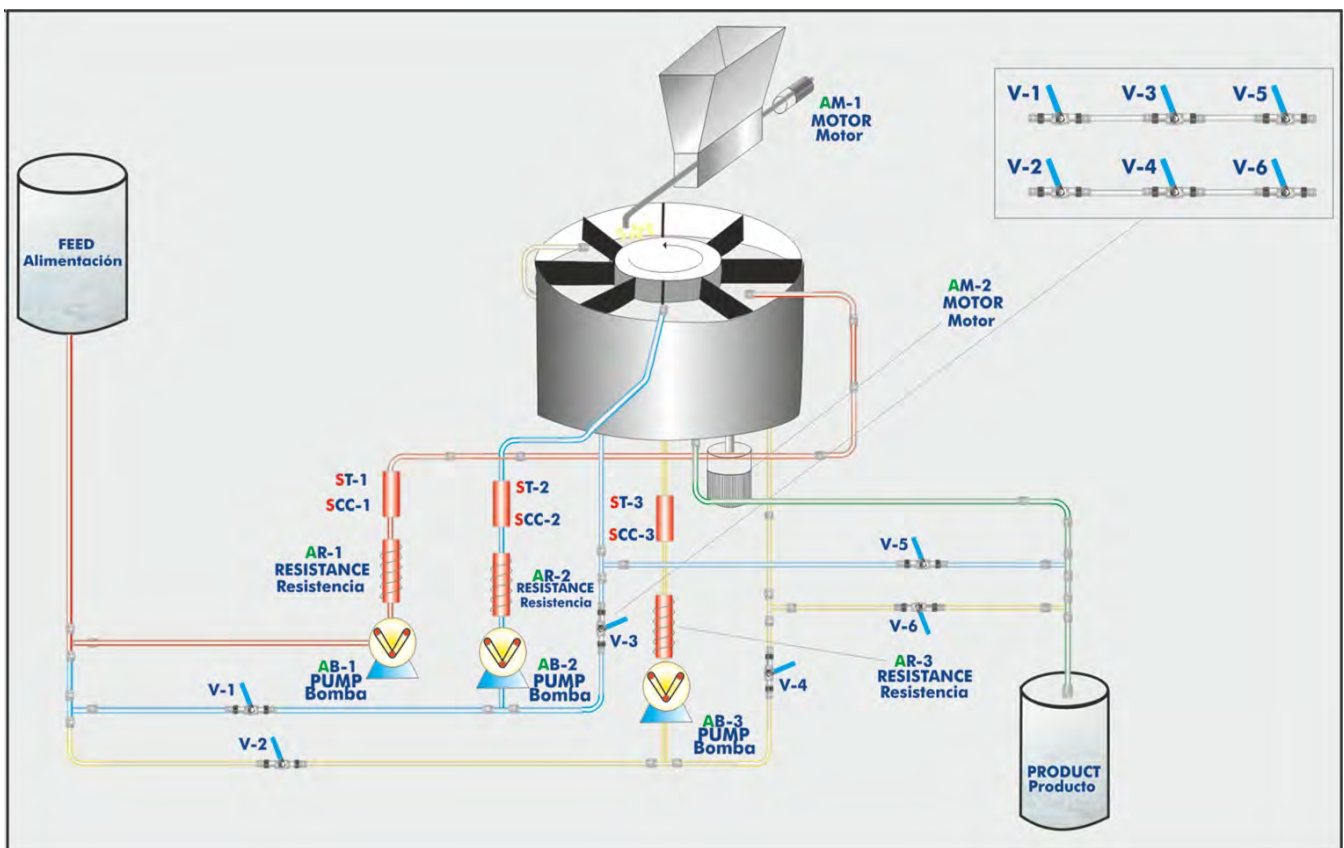
The solid carrier can be a light porous material. It can be impregnated with a salt such as sodium bicarbonate or potassium bicarbonate, which is then extracted by the process.

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.

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

6 actuators and 8 sensors controlled from any computer, and working simultaneously

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL



With this unit there are several options and possibilities:

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

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

① UESLC. Unit:

- Anodized aluminium structure and panels in painted steel.
- Main metallic elements in stainless steel.
- Diagram in the front panel with similar distribution to the elements in the real unit.
- Feed liquid vessel, capacity: 9 litres.
- Product liquid vessel, capacity: 9 litres.
- Feed hopper with feed endless screw for solids.
- Motor for feed endless screw.
- Main rotary extraction vessel with 8 cells of extraction.
- Motor for the rotation of the main extraction vessel.
- Variable rotation speed.
- 3 Sprinklers.
- Solid products exit.
- 4 Conductivity sensors, 3 scales, ranges:
 - 200 μS \rightarrow 0.1 to 199.9 μS .
 - 2 mS \rightarrow 0.2 to 1.999 mS.
 - 20 mS \rightarrow 2 to 19.99 mS.
- * mS: microSiemens; mS: miliSiemens.
- 4 Temperature sensors, "J" type.
- 3 Heating resistances, computer controlled. Range: 360 W each one.
- 3 Safety thermostats (70°C).
- 3 Peristaltic pumps (12.7 l./h), with variable speeds, computer controlled.
- 3 Decanting filters (in-line strainer).
- Circulation valves to change the circuit configuration.
- Solvent temperatures: ambient to 50°C individually controlled.
- This unit incorporates wheels for its mobility.

The complete unit includes as well:

- Advanced Real-Time SCADA and PID Control.**
- 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 CAL software helps the user perform calculations and comprehend the results.**
- 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.**



UESLC. Unit

② UESLC/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 PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process.

Real time PID and on/off control for pumps, compressors, heating elements, control valves, etc.

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

Proportional control, integral control and derivative control, based on the real PID mathematical formula, by changing the values, at any time, of the three control constants (proportional, integral and derivative constants).

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

Possibility of automatization of the actuators involved in the process.

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. 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.

④ UESLC/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.

Analog and digital PID control.

PID menu and set point selection required in the whole work range.

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.

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.

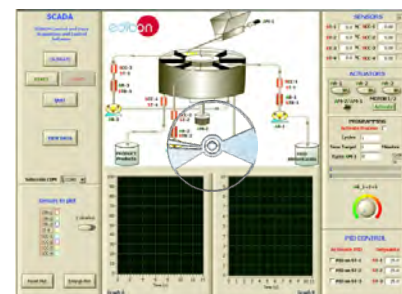
* References 1 to 6: UESLC + UESLC/CIB + DAB + UESLC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply, enabling a normal operation.



UESLC/CIB



DAB



UESLC/CCSOF

EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH MAIN ITEMS

- 1.- Demonstration of the operation of a continuous multiple stage process.
 - 2.- Closed circuit percolation extraction (batch reaction).
 - 3.- Open loop percolation extraction (continuous operation).
 - 4.- Investigation of one, two and three stage continuous processes.
 - 5.- Investigation into effect of solvent temperatures.
 - 6.- Investigation into effect of solvent flow rates.
 - 7.- Investigation into effect of processing time.
 - 8.- Process economics. Process efficiency.
 - 9.- Mass balances.
 - 10.- Influence of the particle size.
 - 11.- Influence of the stages numbers.
 - 12.- Influence of the solvent type.
 - 13.- Extractions of inorganic and aqueous components.
 - 14.- Test of extractions for industrial use.
- Other possible practices:
- 15.- Sensors calibration.

Other possibilities to be done with this Unit:

- 16.- Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
- 17.- Open Control, Multicontrol and Real Time Control.
This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivate parameters; etc, in real time.
- 18.- The Computer Control System with SCADA and PID Control allow a real industrial simulation.
- 19.- This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
- 20.- This unit can be used for doing applied research.
- 21.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
- 22.- Control of the UESLC unit process through the control interface box without the computer.
- 23.- Visualization of all the sensors values used in the UESLC unit process.
- Several other exercises can be done and designed by the user.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110V./60Hz.
- Water supply.
- Computer (PC).

DIMENSIONS & WEIGHTS

UESLC:

Unit:

- Dimensions: 705 x 570 x 1680 mm. approx.
(27.75 x 22.44 x 66.14 inches approx.)
- Weight: 120 Kg. approx.
(264.55 pound approx.)

Control Interface Box:

- Dimensions: 490 x 330 x 310mm. approx.
(19.29x12.99x12.20 inches approx.)
- Weight: 10Kg. approx.
(22pounds approx.)

RECOMMENDED ACCESSORIES

- Reactant: Sodium bicarbonate.

AVAILABLE VERSIONS

Offered in this catalogue:

- UESLC. Computer Controlled Solid-Liquid Extraction Unit.

Offered in other catalogue:

- UESLB. Solid-Liquid Extraction Unit.

SCADA and PID Control
Main screen

The main screen displays a central process diagram of a reactor with various sensors (AR, AM, AB, SCC, ST) and actuators. On the left, the 'SCADA' panel includes buttons for CALIBRATE, START, STOP, QUIT, and VIEW DATA. On the right, the 'SENSORS' panel shows real-time values for ST-1 to ST-4 and SCC-1 to SCC-4. Below this is the 'ACTUATORS' panel with controls for AR-1, AR-2, AR-3, AM-2/AM-1, and MOTOR1/2. The 'PROGRAMMING' section allows setting Cycles, Time Target, and Turns. A 'PID CONTROL' section at the bottom right has checkboxes for PID on ST-1, ST-2, and ST-3, with setpoints of 25.0. Two real-time graphs, Graph A and Graph B, are shown at the bottom center. A 'Sensors to plot' list is on the left, and a 'Selección COM' dropdown is above the graphs.

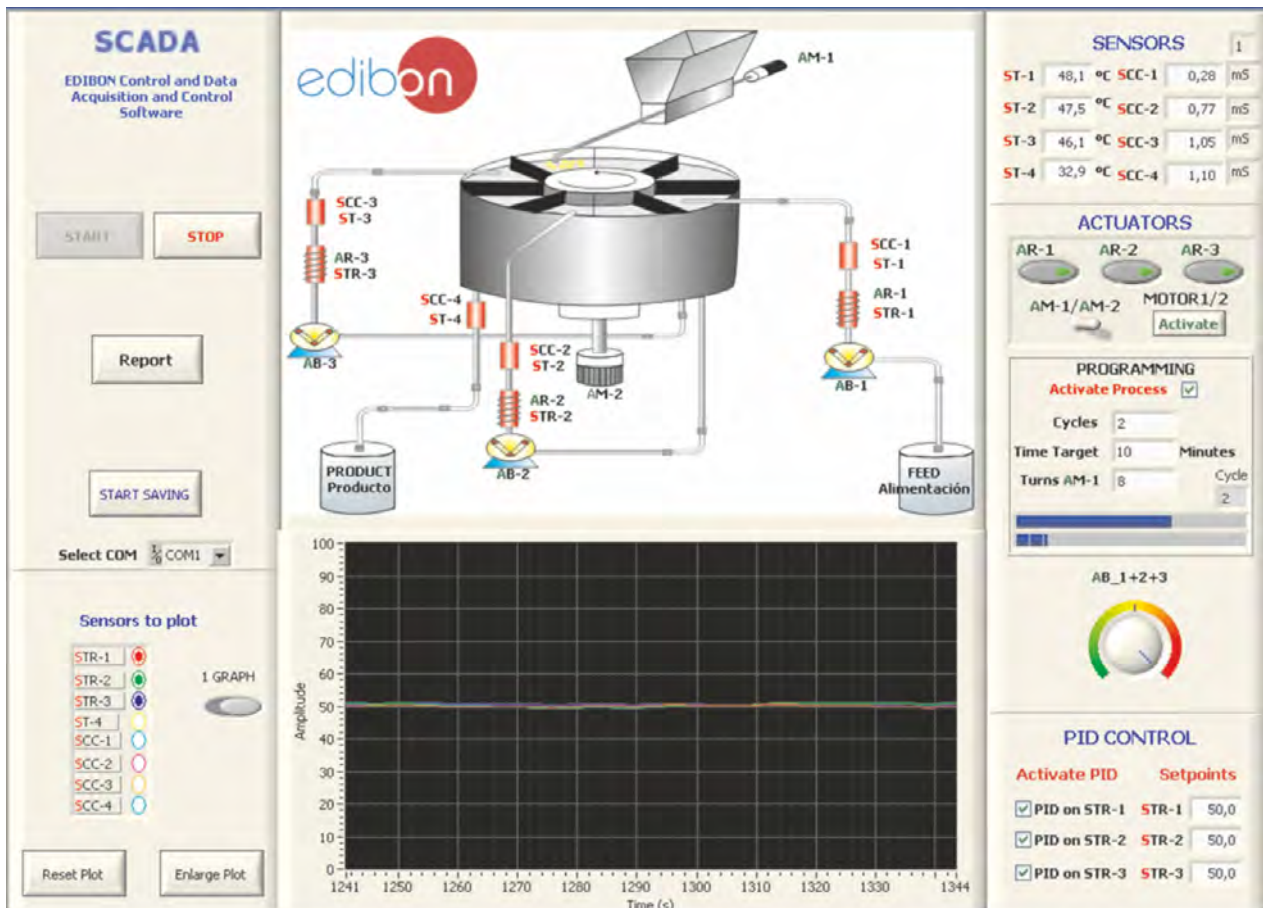
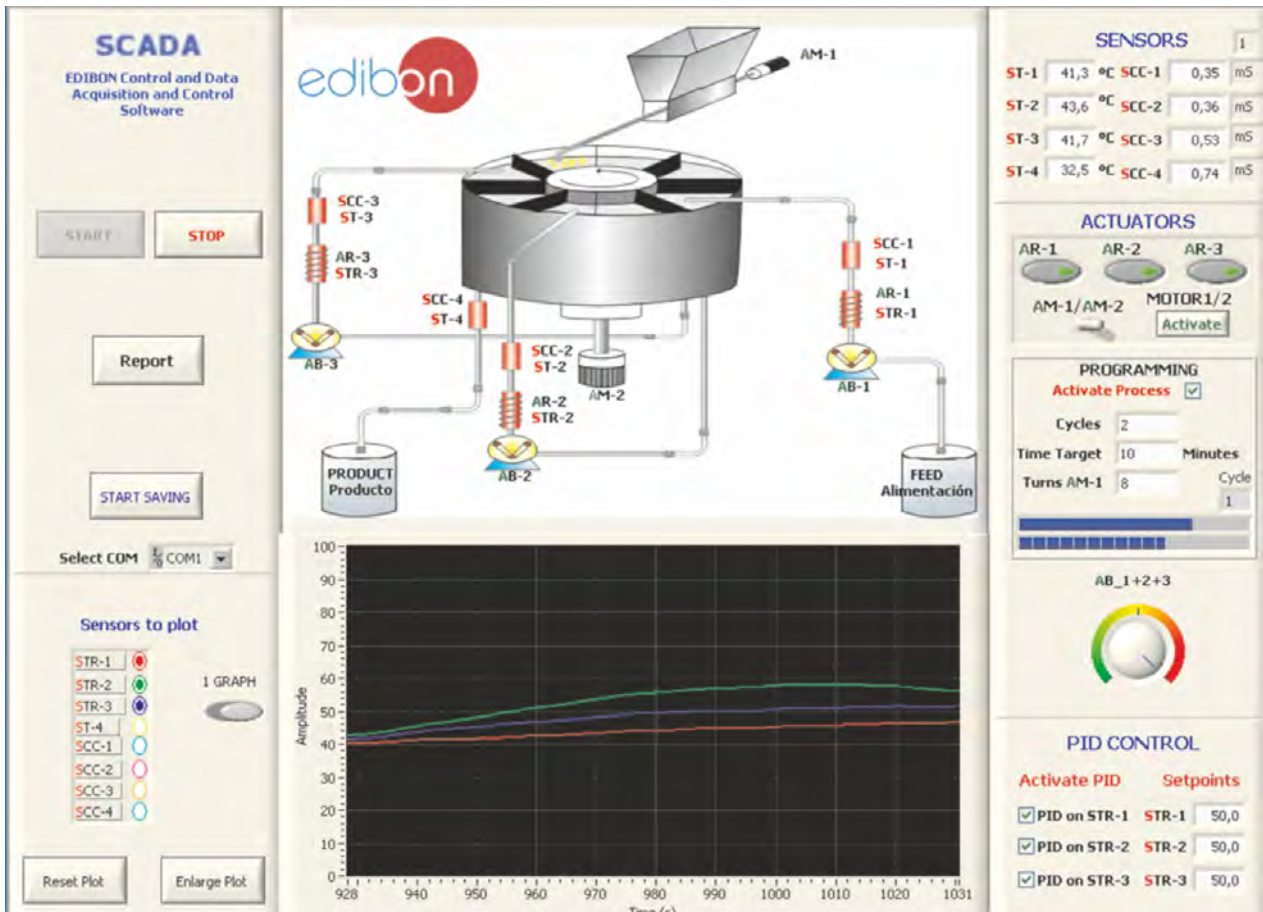
- Ⓘ Main software operation possibilities.
- Ⓜ Sensors displays, real time values, and extra output parameters. Sensors: ST=Temperature sensor. SCC=Conductivity Sensor..
- Ⓝ Actuators controls. Actuators: AR=Heating resistance. AM=Motor. AB=Pump.
- Ⓥ Channel selection and other plot parameters.
- Ⓟ Real time graphics displays.

Software for Sensors Calibration
Example of screen

The calibration interface is divided into two main parts. The left part shows a 'Least Squares Fit' screen for a single sensor (ST-7) with fields for Gain (97,2727), Offset (-2,0102), PTA (10), Volts (0,2978), and Calibrated (26,96). The right part shows a 'Simultaneous Calibration' table with columns for Reference Value, Sensors, Value, Calibrated, ΔT, GAIN, and OFFSET. The table lists various sensors and their corresponding calibration data.

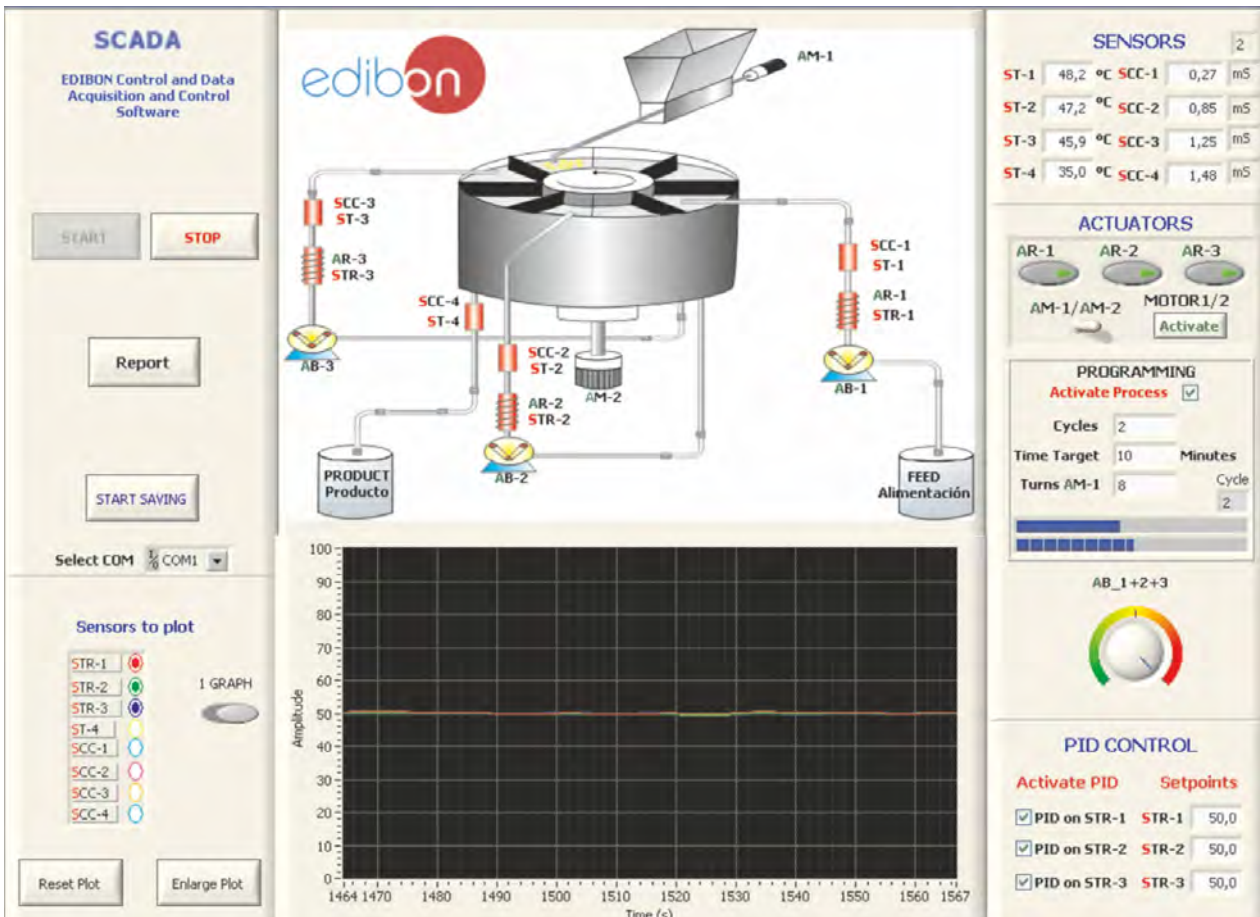
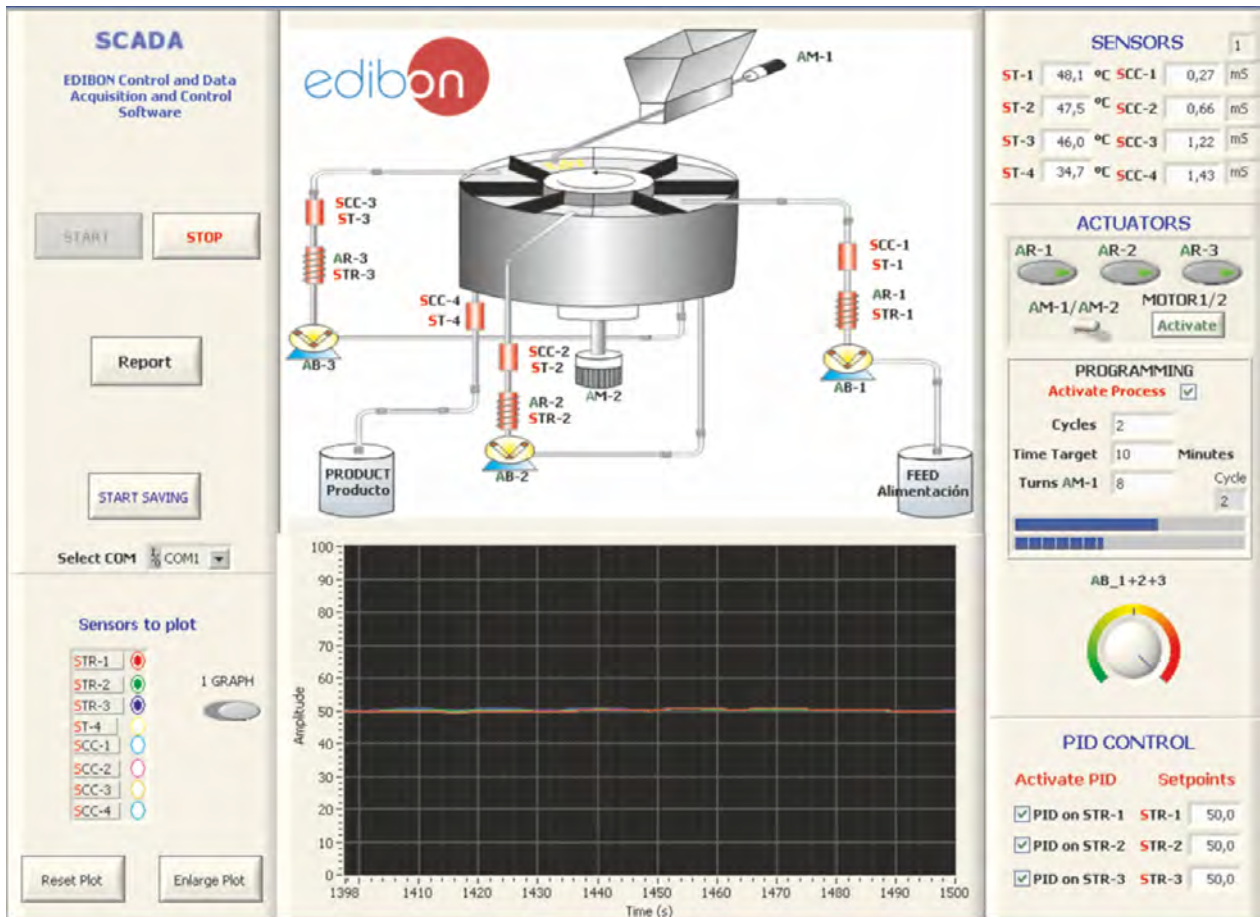
Sensors	Value	Calibrated	ΔT	GAIN	OFFSET	r
ST-1	0.2703	28.8266	29.83	1101.705	0.0254	0
ST-2	0.3325	29.7866	29.79	98.5001	-3.0594	0
ST-3	0.331	29.0641	29.06	102.291	-4.7913	0
ST-4	0.3254	29.5453	29.55	102.262	-3.7268	0
ST-5	0.3295	28.4276	28.43	101.438	-3.9867	0
ST-6	0.3458	34.752	34.75	91.5356	3.1025	0
ST-7	0.2978	26.96	26.96	0	0	0
ST-8	0.2978	26.96	26.96	0	0	0
ST-9	0.2978	26.96	26.96	0	0	0
ST-10	0.2978	26.96	26.96	0	0	0
ST-11	0.2978	26.96	26.96	0	0	0
ST-12	0.2978	26.96	26.96	0	0	0
ST-13	0.2978	26.96	26.96	0	0	0
ST-14	0.2978	26.96	26.96	0	0	0
ST-15	0.2978	26.96	26.96	0	0	0
ST-16	0.2978	26.96	26.96	0	0	0
ST-17	0.2978	26.96	26.96	0	0	0
ST-18	0.2978	26.96	26.96	0	0	0
ST-19	0.2978	26.96	26.96	0	0	0
ST-20	0.2978	26.96	26.96	0	0	0
ST-21	0.2978	26.96	26.96	0	0	0
ST-22	0.2978	26.96	26.96	0	0	0
ST-23	0.2978	26.96	26.96	0	0	0
ST-24	0.2978	26.96	26.96	0	0	0
ST-25	0.2978	26.96	26.96	0	0	0
ST-26	0.2978	26.96	26.96	0	0	0
ST-27	0.2978	26.96	26.96	0	0	0
ST-28	0.2978	26.96	26.96	0	0	0
ST-29	0.2978	26.96	26.96	0	0	0
ST-30	0.2978	26.96	26.96	0	0	0
ST-31	0.2978	26.96	26.96	0	0	0
ST-32	0.2978	26.96	26.96	0	0	0
ST-33	0.2978	26.96	26.96	0	0	0
ST-34	0.2978	26.96	26.96	0	0	0
ST-35	0.2978	26.96	26.96	0	0	0
ST-36	0.2978	26.96	26.96	0	0	0
ST-37	0.2978	26.96	26.96	0	0	0
ST-38	0.2978	26.96	26.96	0	0	0
ST-39	0.2978	26.96	26.96	0	0	0
ST-40	0.2978	26.96	26.96	0	0	0
ST-41	0.2978	26.96	26.96	0	0	0
ST-42	0.2978	26.96	26.96	0	0	0
ST-43	0.2978	26.96	26.96	0	0	0
ST-44	0.2978	26.96	26.96	0	0	0
ST-45	0.2978	26.96	26.96	0	0	0
ST-46	0.2978	26.96	26.96	0	0	0
ST-47	0.2978	26.96	26.96	0	0	0
ST-48	0.2978	26.96	26.96	0	0	0
ST-49	0.2978	26.96	26.96	0	0	0
ST-50	0.2978	26.96	26.96	0	0	0

By using a free of charge code, the teacher and the students can calibrate the unit. The teacher can recover his/her own calibration by using the EDIBON code that we give free of charge.



Continue...

Some **real** results obtained from this unit



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 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

⑦ **UESLC/ICAI. Interactive Computer Aided Instruction Software System.**

This complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM) totally integrated with the Student Software (EDIBON Student Labsoft -ESL). 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. EDIBON Classroom Manager (Instructor Software).

ECM 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 Workgroups, Tasks 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. EDIBON Student Labsoft (Student Software).

ESL 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.

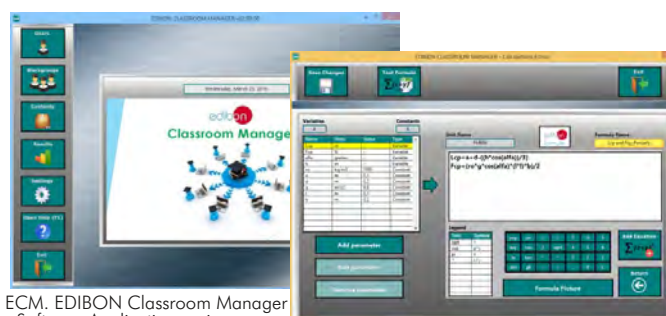
Calculations computing and plotting.

Equation System Solver Engine.

User Monitoring Learning & Printable Reports.

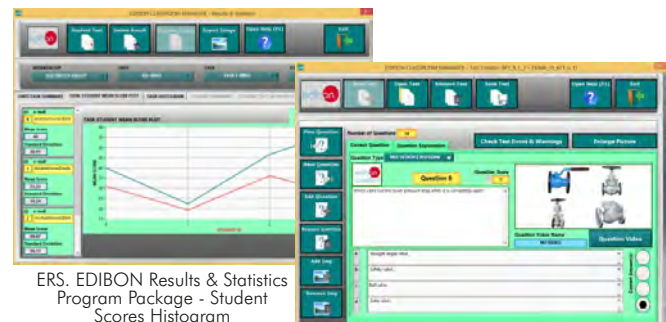
Multimedia-Supported auxiliary resources.

EDIBON Classroom Manager



ECM. EDIBON Classroom Manager 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

EDIBON Student Labsoft



ESL EDIBON Student LabSoft Software Application main screen

EPE. EDIBON Practical Exercise Program Package main screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package main screen

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

www.edibon.com/products/catalogues/en/ICAI.pdf

⑧ **UESLC/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 on 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/products/catalogues/en/FSS.pdf

Example of some screens



b) Multipost Expansions options

⑨ **Mini ESN. EDIBON Mini Scada-Net System.**

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 on the adaptation of any EDIBON Computer Controlled Unit with SCADA and PID Control 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 and PID Control, 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:

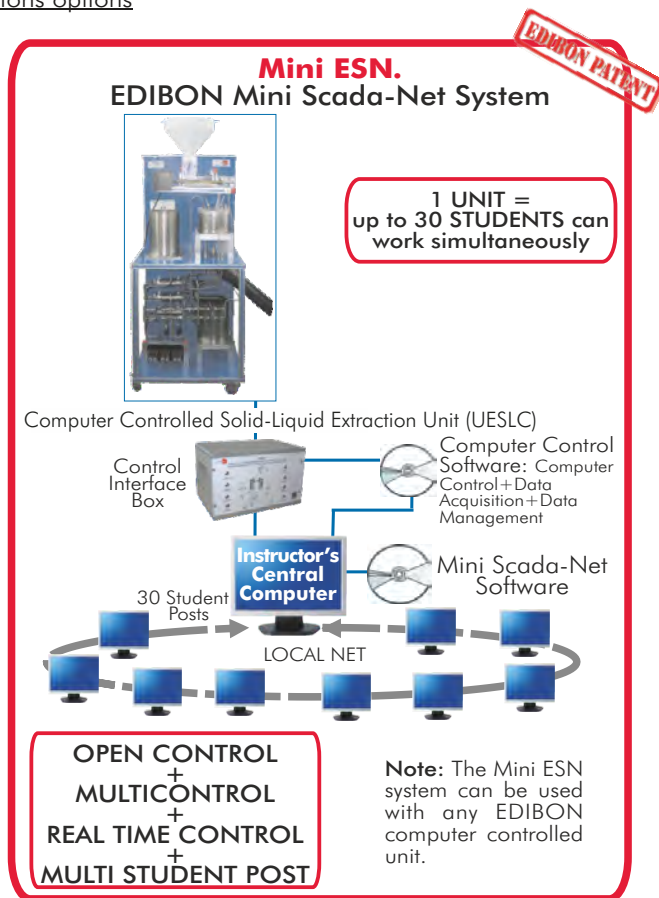
www.edibon.com/products/catalogues/en/Mini-ESN.pdf

⑩ **ESN. EDIBON Scada-Net System.**

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/products/catalogues/en/units/chemicalengineering/esn-chemicalengineering/ESN-CHEMICAL_ENGINEERING.pdf



ORDER INFORMATION

Main items (always included in the supply)

Minimum supply always includes:

- ① **Unit: UESLC. Computer Controlled Solid-Liquid Extraction Unit .**
- ② **UESLC/CIB. Control Interface Box.**
- ③ **DAB. Data Acquisition Board.**
- ④ **UESLC/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
- ⑤ **Cables and Accessories**, for normal operation.
- ⑥ **Manuals.**

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

Optional items (supplied under specific order)

a) Technical and Vocational configuration

- ⑦ UESLC/ICAI. Interactive Computer Aided Instruction Software System.
- ⑧ UESLC/FSS. Faults Simulation System.

b) Multipost Expansions options

- ⑨ Mini ESN. EDIBON Mini Scada-Net System.
- ⑩ ESN. EDIBON Scada-Net System.

① UESLC. Unit:

Anodized aluminium structure and panels in painted steel.

Main metallic elements in stainless steel.

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

Feed liquid vessel, capacity: 9 litres.

Product liquid vessel, capacity: 9 litres.

Feed hopper with feed endless screw for solids.

Motor for feed endless screw.

Main rotary extraction vessel with 8 cells of extraction.

Motor for the rotation of the main extraction vessel.

Variable rotation speed.

3 Sprinklers.

Solid products exit.

4 Conductivity sensors, 3 scales, ranges:

200 μ S \rightarrow 0.1 to 199.9 μ S.

2 mS \rightarrow 0.2 to 1.999 mS.

20 mS \rightarrow 2 to 19.99 mS.

* μ S: microSiemens; mS: miliSiemens.

4 Temperature sensors, "J" type.

3 Heating resistances, computer controlled. Range: 360 W each one.

3 Safety thermostats (70°C).

3 Peristaltic pumps (12.7 l./h), with variable speed, computer controlled.

3 Decanting filters (in-line strainer).

Circulation valves to change the circuit configuration.

Solvent temperatures: ambient to 50°C individually controlled.

This unit incorporates wheels for its mobility.

The complete unit includes as well:

Advanced Real-Time SCADA and PID Control.

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 CAL software helps the user perform calculations and comprehend the results.

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 UESLC/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 PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process.

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

Proportional control, integral control and derivative control, based on the real PID mathematical formula, by changing the values, at any time, of the three control constants (proportional, integral and derivative constants).

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.

④ UESLC/CCSO. PID 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.

Analog and digital PID control. PID menu and set point selection required in the whole work range.

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 Main Items

- 1.- Demonstration of the operation of a continuous multiple stage process.
 - 2.- Closed circuit percolation extraction (batch reaction).
 - 3.- Open loop percolation extraction (continuous operation).
 - 4.- Investigation of one, two and three stage continuous processes.
 - 5.- Investigation into effect of solvent temperatures.
 - 6.- Investigation into effect of solvent flow rates.
 - 7.- Investigation into effect of processing time.
 - 8.- Process economics. Process efficiency.
 - 9.- Mass balances.
 - 10.- Influence of the particle size.
 - 11.- Influence of the stages numbers.
 - 12.- Influence of the solvent type.
 - 13.- Extractions of inorganic and aqueous components.
 - 14.- Test of extractions for industrial use.
- Other possible practices:
- 15.- Sensors calibration.
- Other possibilities to be done with this Unit:
- 16.- Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
 - 17.- Open Control, Multicontrol and Real Time Control.
This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivate parameters; etc, in real time.
 - 18.- The Computer Control System with SCADA and PID Control allow a real industrial simulation.
 - 19.- This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
 - 20.- This unit can be used for doing applied research.
 - 21.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
 - 22.- Control of the UESLC unit process through the control interface box without the computer.
 - 23.- Visualization of all the sensors values used in the UESLC unit process.
- Several other exercises can be done and designed by the user.

a) Technical and Vocational Education configuration

⑦ UESLC/ICAI. Interactive Computer Aided Instruction Software System.

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

-ECM. EDIBON Classroom Manager (Instructor Software).

ECM 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. EDIBON Student Labsoft (Student Software).

ESL 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.

⑧ UESLC/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 on 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.

b) Multipost Expansions options

⑨ Mini ESN. EDIBON Mini Scada-Net System.

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 improvements of the product.



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