edibon

Technical Teaching Equipment

Computer Controlled **Solid-Liquid Extraction Unit,** with SCADA and PID Control

UESLC

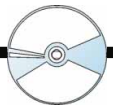
EDIBON PATENT

Teaching Technique used

EDIBON **SCADA** System and **PID CONTROL** included

② Control Interface Box

③ Data Acquisition Board



④ Software for:
- Computer Control
- Data Acquisition
- Data Management

Computer (not included in the supply)

⑤ Cables and Accessories

⑥ Manuals

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

① Unit: UESLC. Solid-Liquid Extraction Unit

OPEN CONTROL + MULTICONTROL + REAL TIME CONTROL

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.**

www.edibon.com
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
(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.

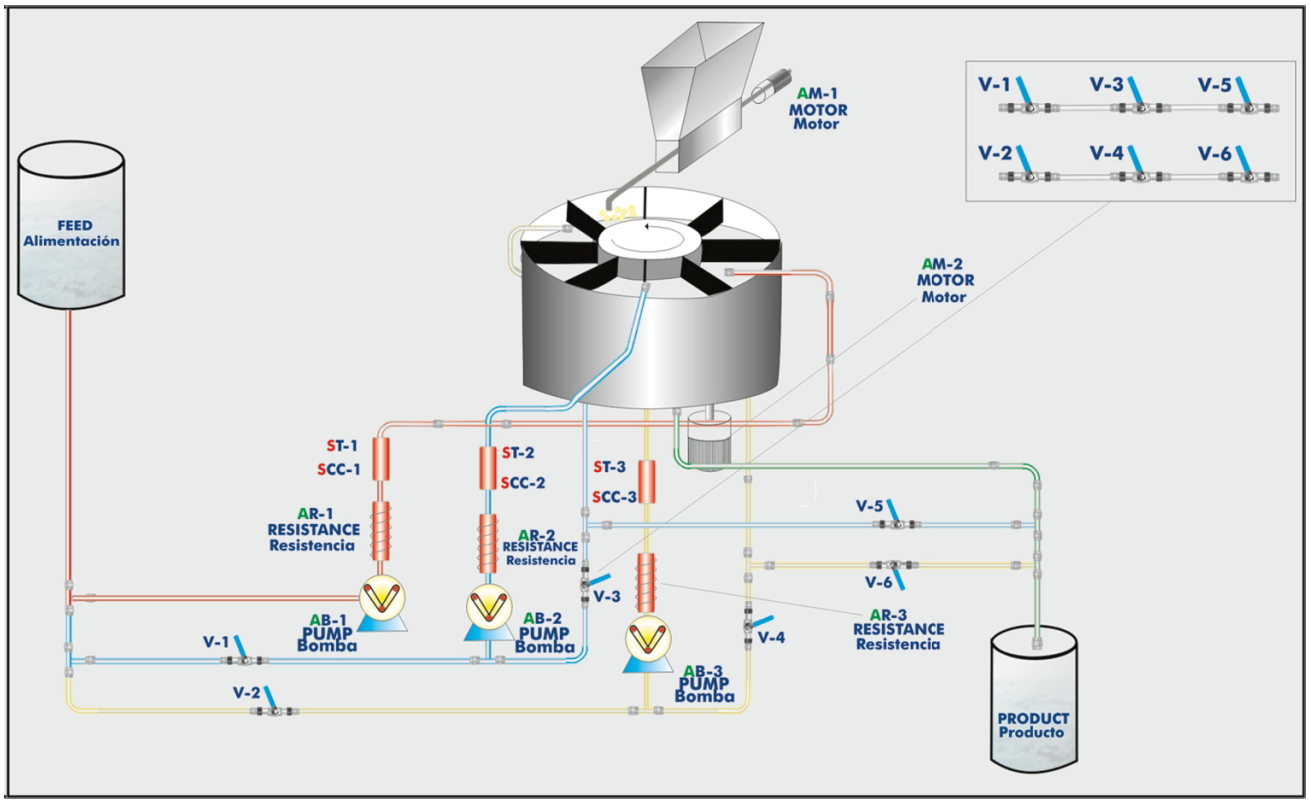
The solid carrier can be a light porous material. It can be impregnated with a salt such as sodium bicarbonate or potassium bicarbonate , which is then extracted by the process.

This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), including: Control Interface Box + Data Acquisition Board +Computer Control and Data Acquisition Software, for controlling the process and the parameters involved.

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

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

OPEN CONTROL + MULTICONTROL + REAL TIME CONTROL



Note: ST= Temperature sensor. SCC= Conductivity sensor. V= Valve.

Items supplied as standard

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 → 0.1 to 199.9 μS.
2 mS → 0.2 to 1.999 mS.
20 mS → 2 to 19.99 mS.
* μS: microSiemens; mS: miliSiemens.
4 Temperature sensors, "J" type.
3 Heating resistances, computer controlled. Range: 360 W each one.
3 Safety thermostats (70ºC).
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 50ºC individually controlled.
This unit incorporates wheels for its mobility.

UESLC. Unit

② UESLC/CIB. Control Interface Box:

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, resistances, 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, other electronic in the control interface and the third one in the control software.

UESLC/CIB

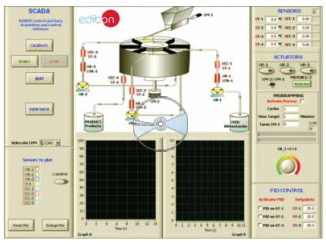
③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. Bus PCI.
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)= ±10V.
Data transfers=DMA, interrupts, programmed I/0. Number of DMA channels=6.
Analog output: Number of **channels=2**. **Resolution=16 bits**, 1 in 65536. Maximum output rate up to: 833 KS/s.
Output range(V)=±10V. Data transfers=DMA, interrupts, programmed I/0.
Digital Input/Output: Channels=24 inputs/outputs. D0 or DI Sample Clock frequency: 0 to 1 MHz.
Timing: **Counter/timers=2**. Resolution: Counter/timers: 32 bits.

DAB

④ UESLC/CCSOF. Computer Control+Data Acquisition+Data Management Software:

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. Menu for PID and set point selection required in the whole work range.
Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data 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 to 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 that the 30 students of the classroom to visualize simultaneously all results and manipulation of the unit, during the process, by using a projector or an electronic whiteboard.



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

Continue...

Additional and optional items to the standard supply

PLC. Industrial Control using PLC (7 and 8):

⑦ PLC-PI. PLC Module:

Circuit diagram in the 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 (-10V. to + 10V.)(through SCSI connector).

Analog outputs block:

4 Analog outputs (-10V. to + 10V) (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 μsec. 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).

PLC-PI

⑧ UESLC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

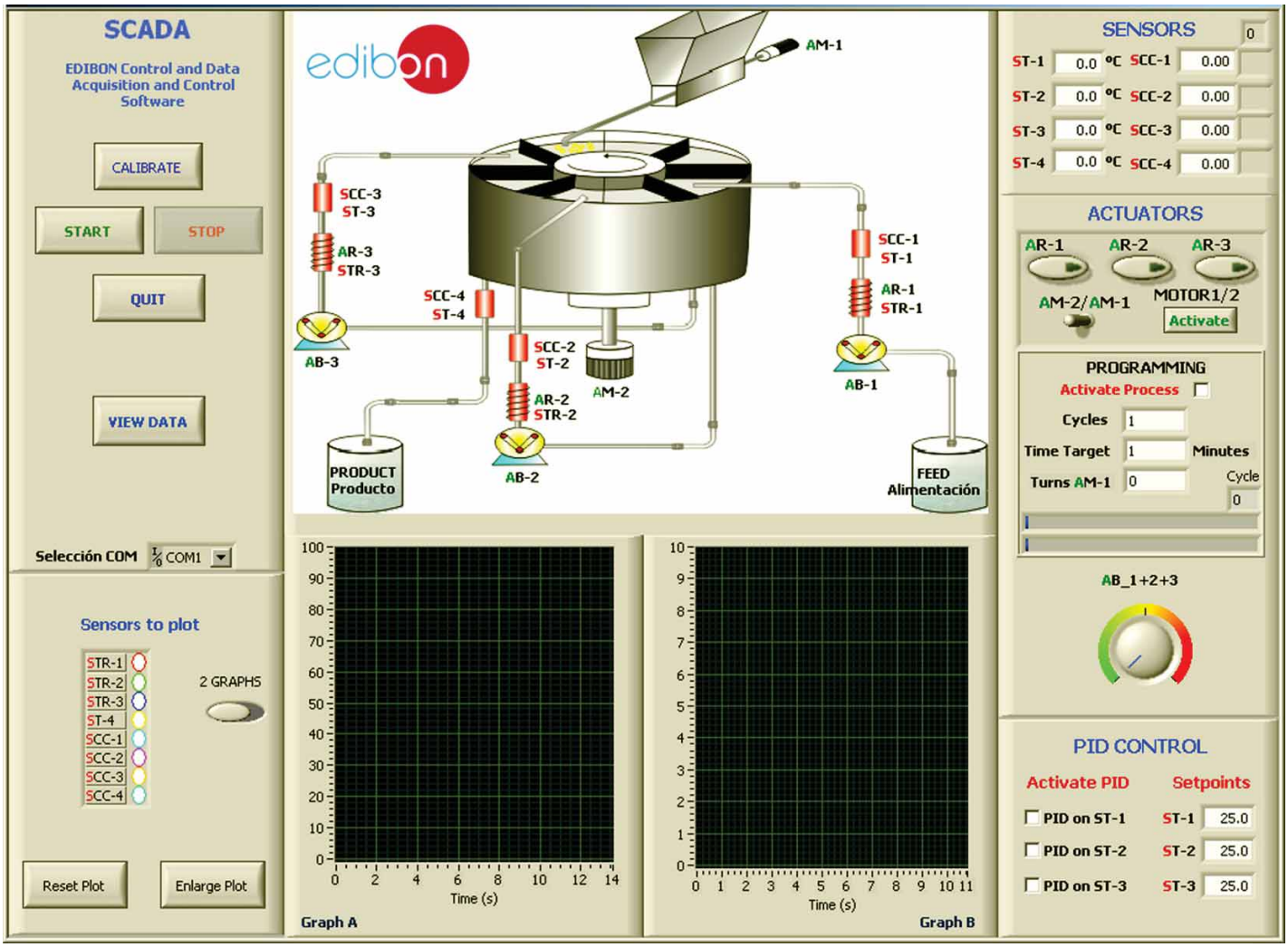
Items available on request

⑨ UESLC/CAL. Computer Aided Learning Software (Results Calculation and Analysis).

⑩ UESLC/FSS. Faults Simulation System.

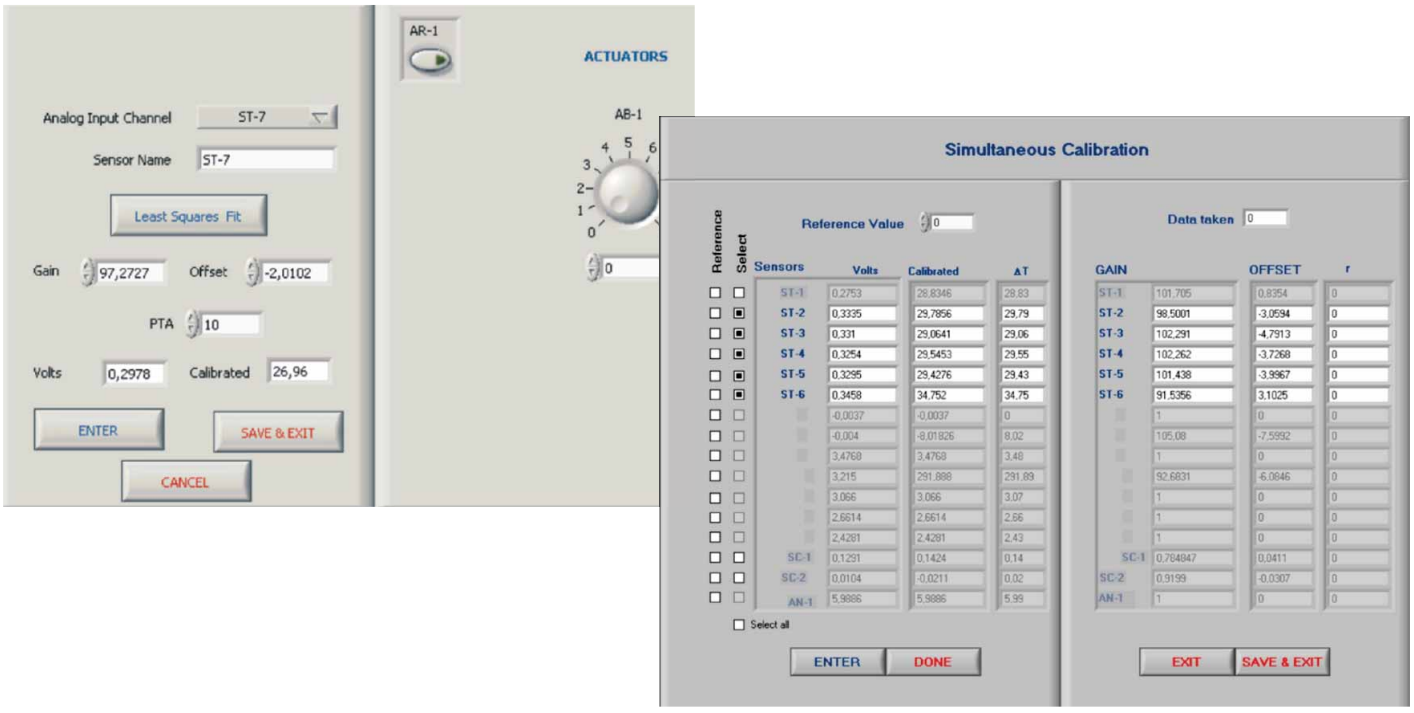
Software Main Screens

Main screen



Note: ST=Temperature Sensor. SCC=Conductivity Sensor. AR=Heating resistance. AM=Motor. AB=Pump.

Examples of Sensors Calibration screens



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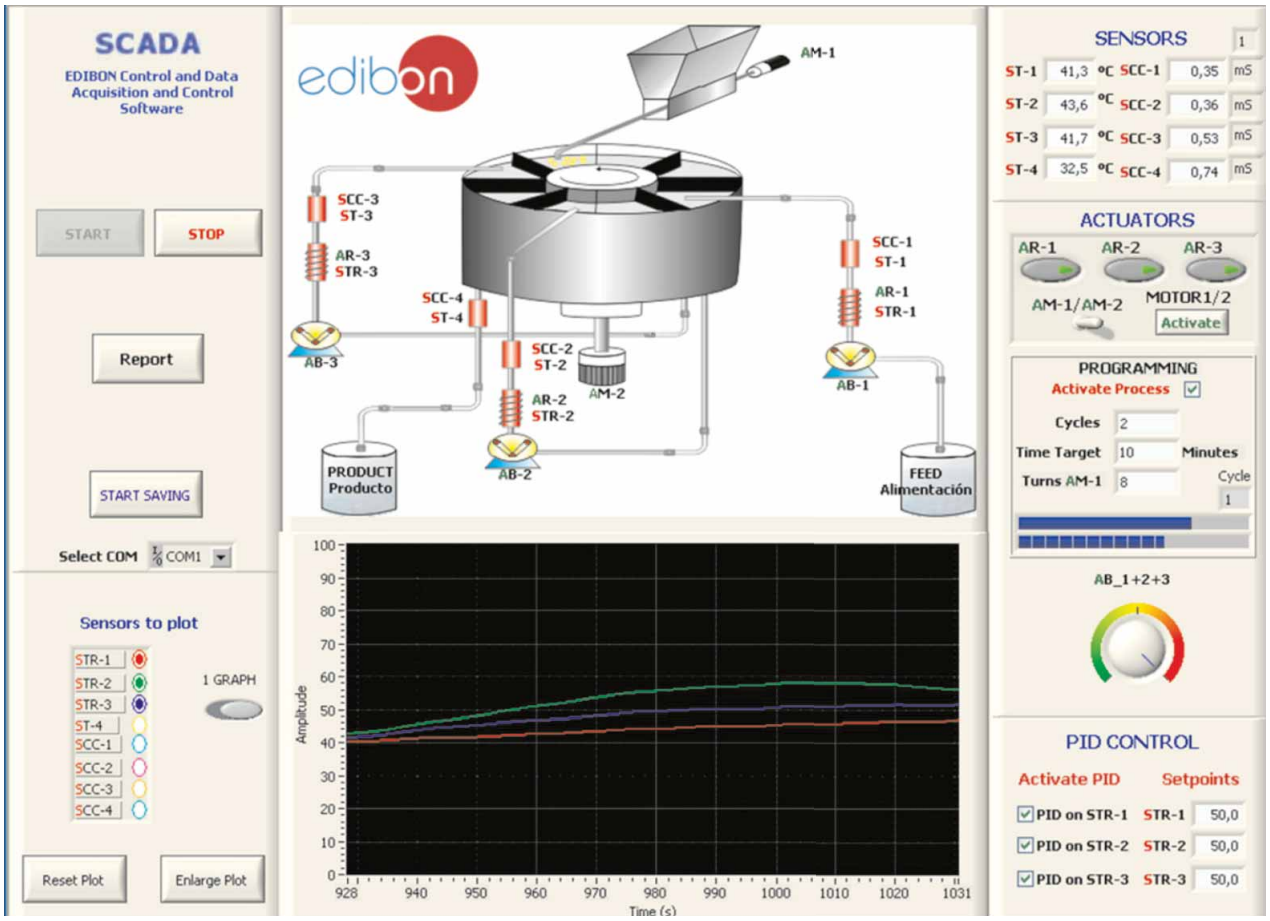
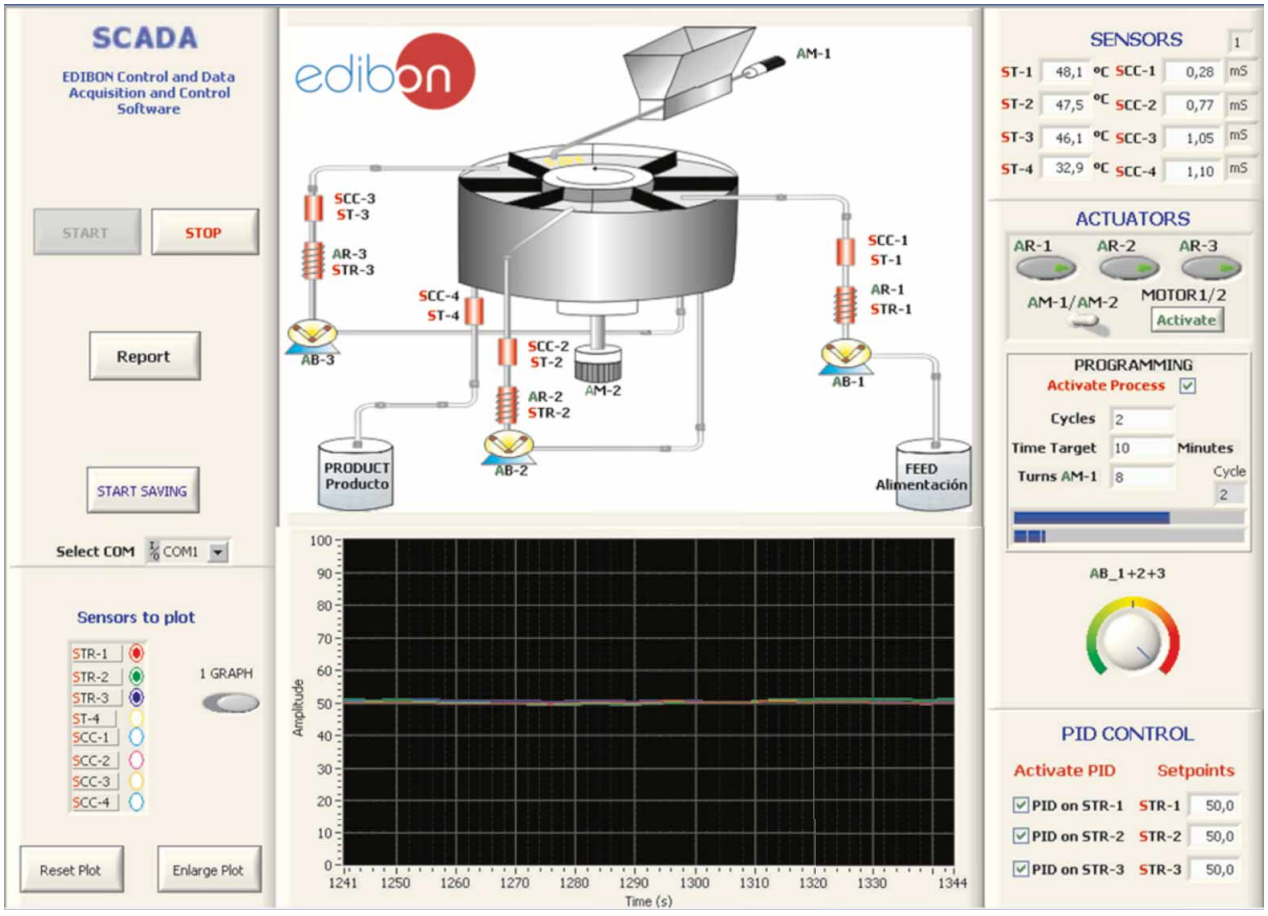
Some typical exercises results





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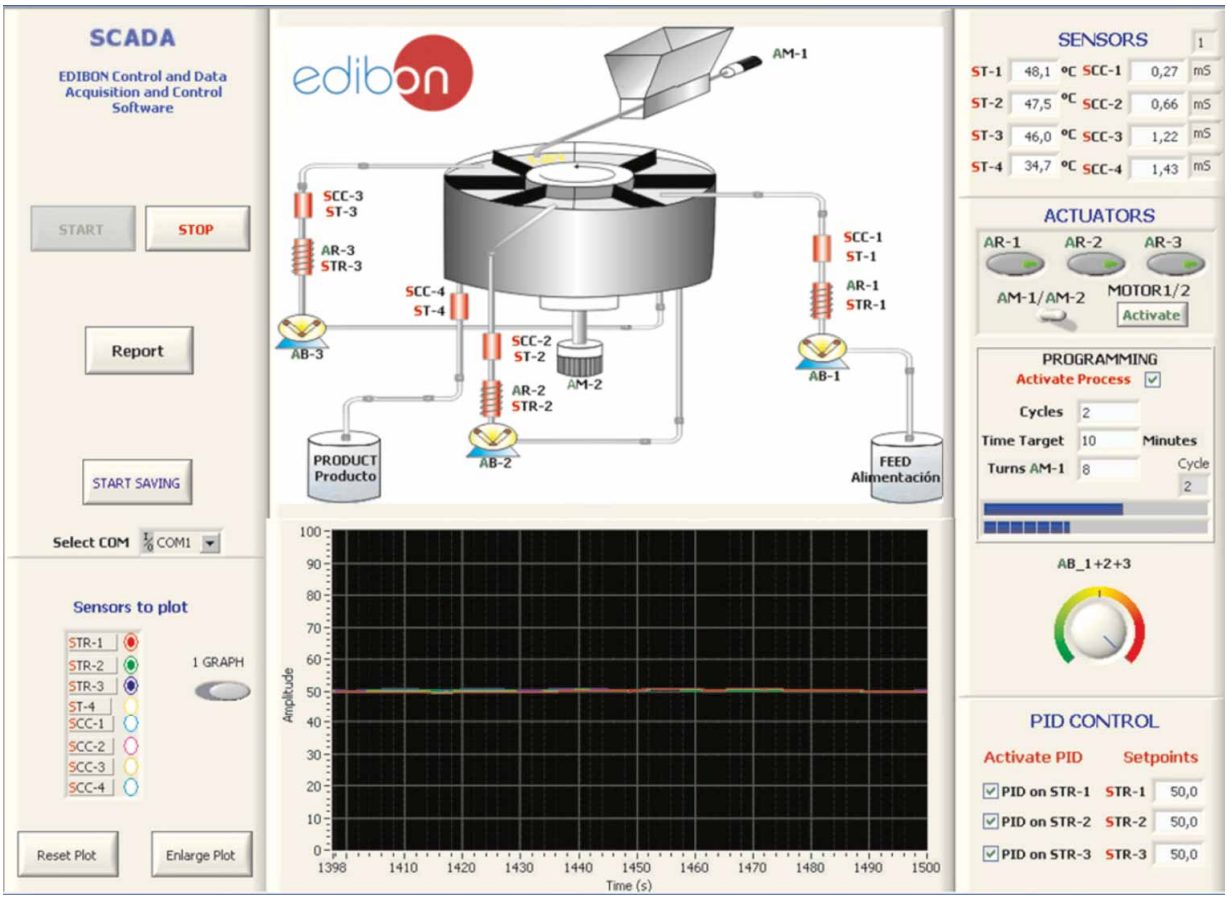
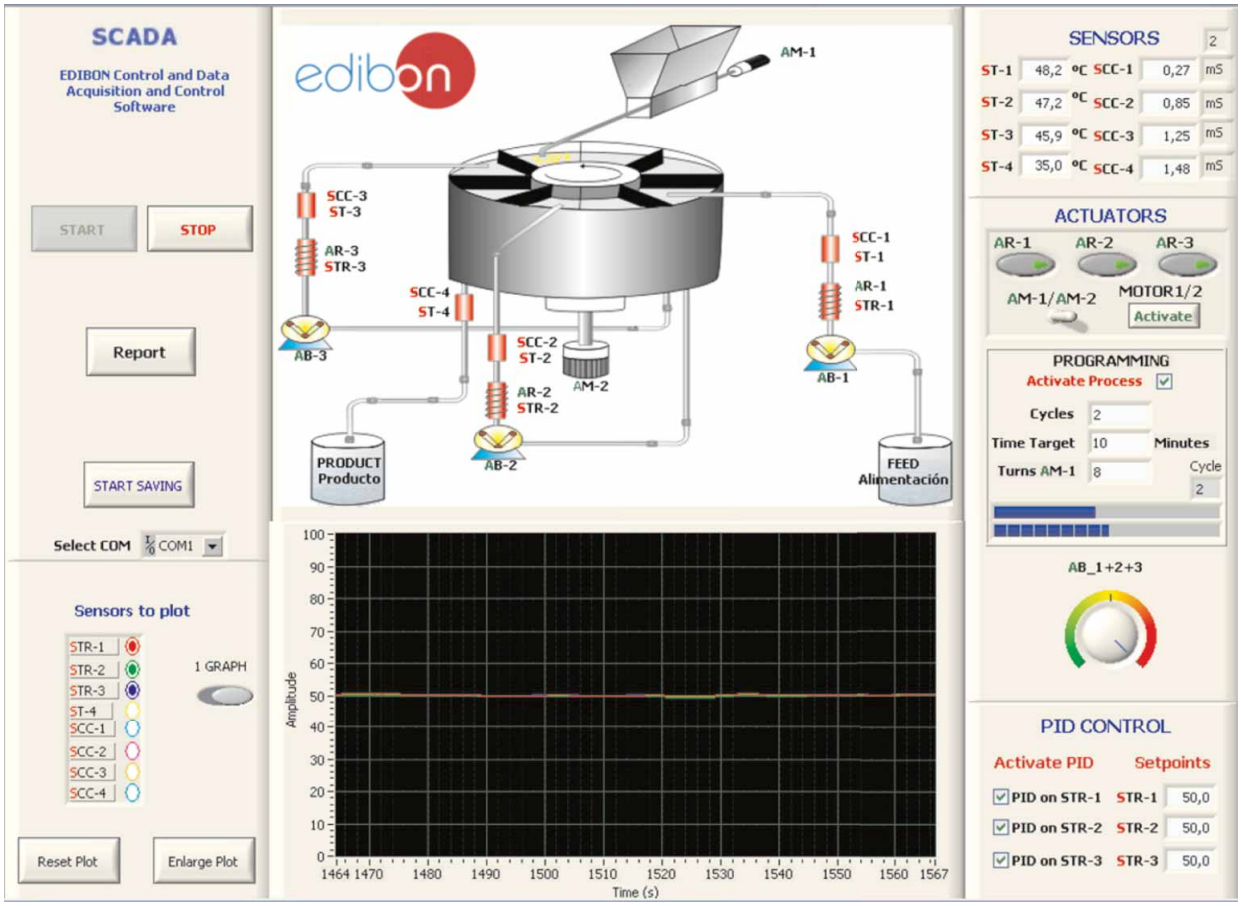
Some typical exercises results





EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

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:

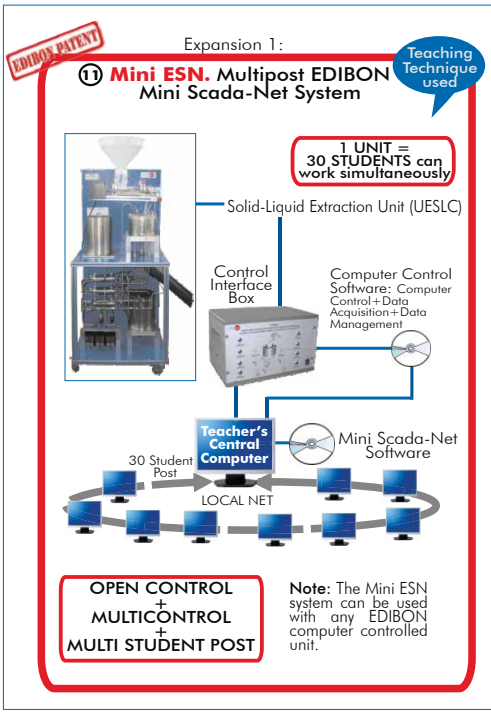
15.- Sensors calibration.

Practices to be done by PLC Module (PLC-PI) + PLC Control Software:

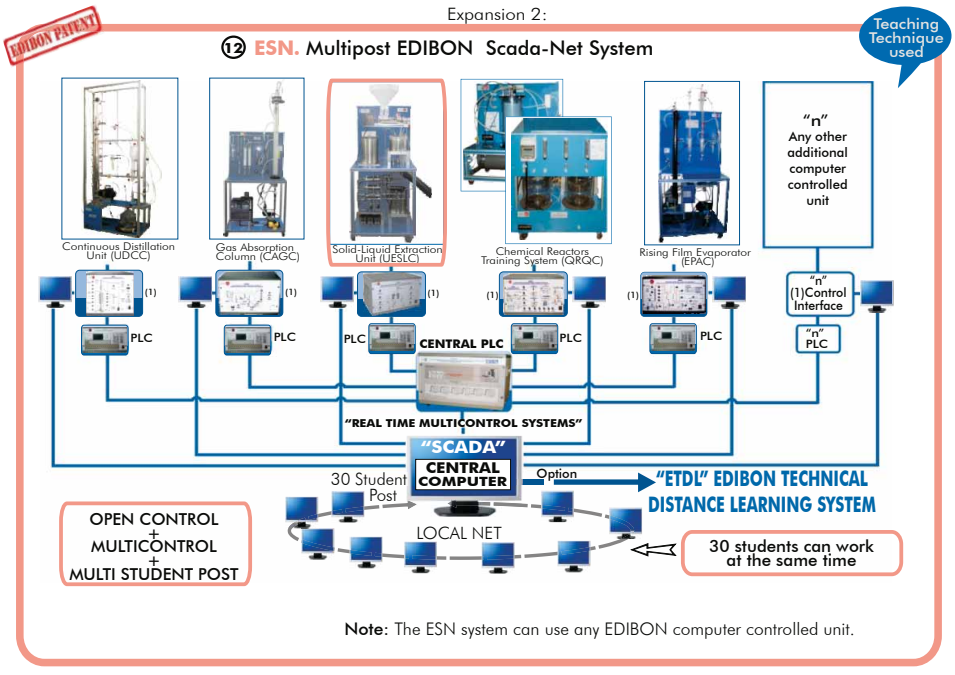
16.- Control of the UESLC unit process through the control interface box without the computer.
17.- Visualization of all the sensors values used in the UESLC unit process.
18.- Calibration of all sensors included in the UESLC unit process.
19.- Hand on of all the actuators involved in the UESLC unit process.
20.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).
21.- 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).
22.- PLC hardware general use and manipulation.
23.- PLC process application for UESLC unit.
24.- PLC structure.
25.- PLC inputs and outputs configuration.
26.- PLC configuration possibilities.
27.- PLC program languages.
28.- PLC different programming standard languages (literal structured, graphic, etc.).
29.- New configuration and development of new process.
30.- Hand on an established process.
31.- To visualize and see the results and to make comparisons with the UESLC unit process.
32.- Possibility of creating new process in relation with the UESLC unit.
33.- PLC Programming Exercises.
34.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS

Expansion 1:



Expansion 2:



ORDER INFORMATION

Items supplied as standard

Minimum configuration for normal operation includes:

① **Unit: UESLC. 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.**

Additional and optional items to the standard supply

PLC. Industrial Control using PLC (7 and 8):

⑦ PCL-PI.PLC Module.
⑧ UESLC/PLC-SOF. PLC Control Software.
⑨ UESLC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request).
⑩ UESLC/FSS. Faults Simulation System. (Available on request).

Expansions

⑪ Mini ESN. Multipost EDIBON Mini Scada-Net System.
⑫ ESN. Multipost EDIBON Scada-Net System.

REQUIRED SERVICES

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

RECOMMENDED ACCESSORIES

- Reactant: Sodium bicarbonate.

DIMENSIONS & WEIGHTS

UESLC Unit: -Dimensions: 705 x 570 x 1680 mm. approx.
-Weight: 120 Kg. approx.
Control Interface Box: -Dimensions: 490 x 330 x 310 mm. approx.
-Weight: 10 Kg. approx.
PLC Module (PLC-PI): -Dimensions: 490 x 330 x 310 mm. approx.
-Weight: 30 Kg. approx.

AVAILABLE VERSIONS

Offered in this catalogue:

- UESLC. **Computer Controlled Solid-Liquid Extraction Unit**.

Offered in other catalogue:

- UESLB. **Solid-Liquid Extraction Unit**.

✱Specifications subject to change without previous notice, due to the convenience of improvements of the product.

edibon INTERNATIONAL

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