edibon
Technical Teaching Equipment

# Computer Controlled **Batch Distillation Unit**

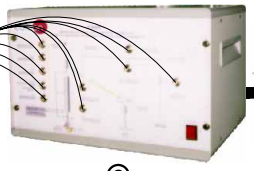
## UDDC

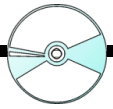
EDIBON PATENT

Always included in the supply:

Teaching Technique used

**SCADA.** EDIBON Computer Control System





② Control Interface Box

③ Data Acquisition Board

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

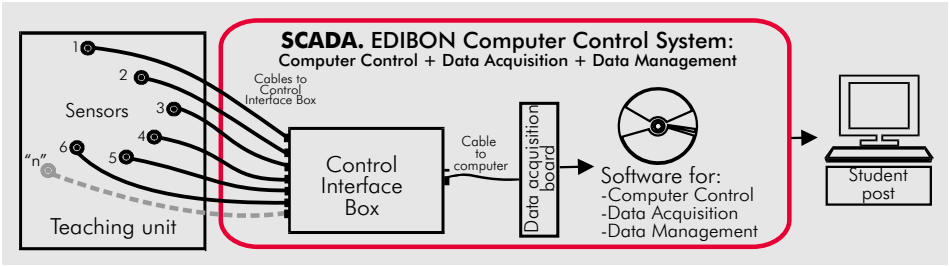
Computer (not included in the supply)

⑤ Cables and Accessories

⑥ Manuals

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

① Unit: UDDC. Batch Distillation Unit

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Products
Products range
Units
11.-Chemical Engineering

**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)

## DESCRIPTION

Distillation is used to separate liquid mixtures made up of individual liquids that are soluble in one another.

EDIBON's distillation unit is one of the most powerful laboratory tools for the study of the variables that affect the distillation process.

The student can investigate the principles that rule the material and energy transference, as well as determine the optima operation point to carry out a big quantity of separations.

This unit is basically composed by a boiler on which two types of interchangeable columns can be adapted (plate columns and Raschig Rings column), a reflux system and a tank for the distillation.

The steam that goes to the head of the column is sent to a total condenser. The cooling water flow that crosses the condenser is regulated and indicated in a flow sensor. The pressure loss in the column can be measured with a pressure sensor.

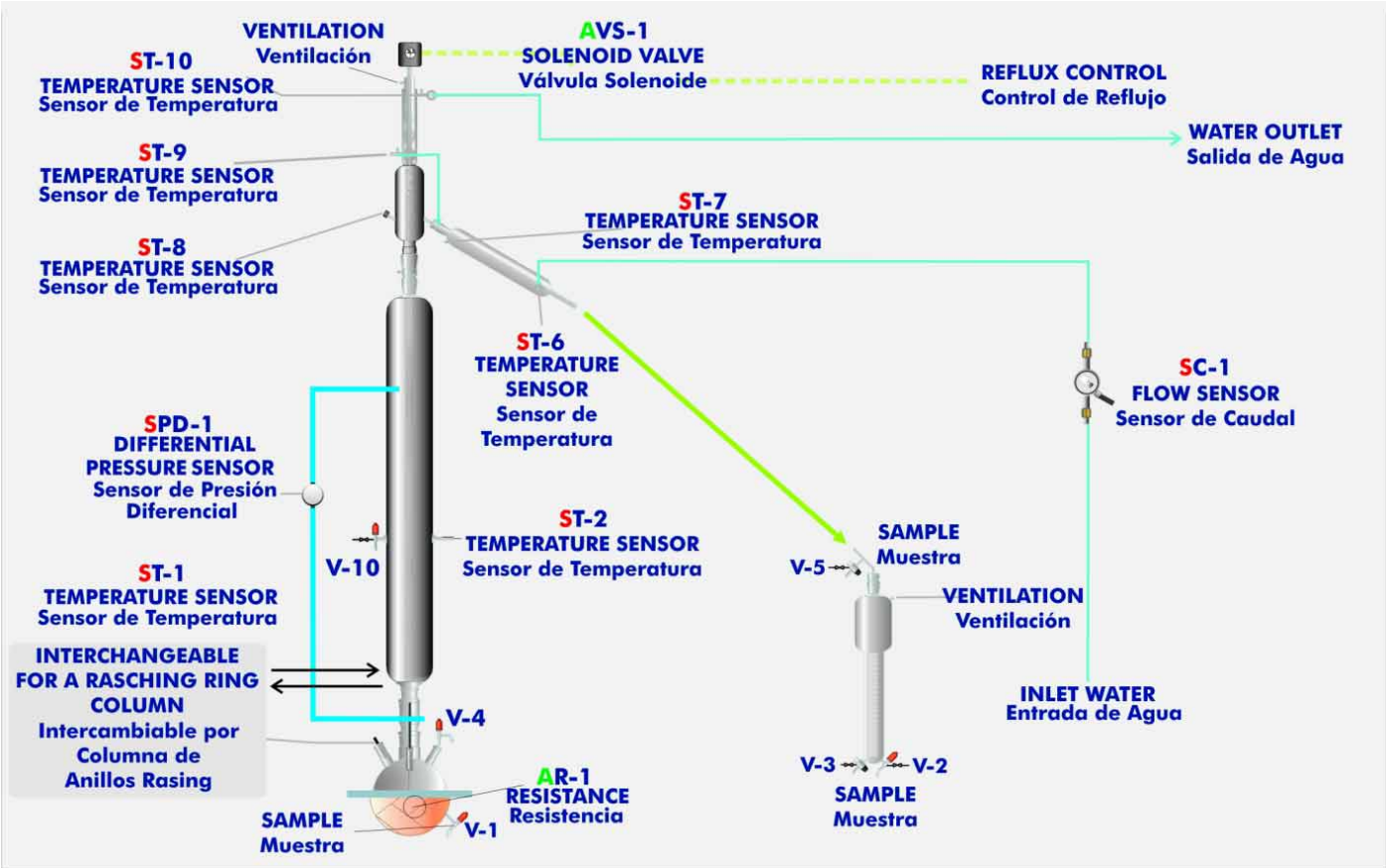
The temperatures of the system are measured by sensors placed in strategic positions.

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 ELEMENTS ALLOCATION

2 actuators and 9 sensors controlled from any computer and working simultaneously

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




**Note:**
ST= Temperature sensor.
SC= Flow sensor.
SPD= Differential pressure sensor.
AR= Heating resistance.
AVS= Solenoid valve.
V= Valve.

## Items supplied as standard

### ① UDDC. Unit:

Anodized aluminium structure and panels in painted steel (epoxy paint).

Main metallic elements in stainless steel.

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

Sieve Plates Column with 8 plates with one temperature taking and sample, 50 mm. internal diameter and 1000 mm length. Vacuumed, silver-plated and double transparent band for vision.

Column head with temperature taking and conical output for distilled product.

Head column with a valve for the steam distribution.

2 l. Boiler (with sample outputs) with heating mantle, computer controlled.

Boiler temperature computer controlled. Temperature PID control.

2l. Distillation collector of graduated glass.

Refrigerator.

Temperature measurement system.

7 Temperature sensors ("J" type).

Flow sensor.

Differential pressure sensor.

Working temperature: Ambient temperature up to 125°C.

Solenoid valve, computer controlled.

The computer control system acts directly on:

The temperature of the heating resistance (heating mantle).

The solenoid valve (reflux ratio).

UDDC Unit

**Optional Columns** (not included in the standard supply):

- CAR1. Raschig Rings Column.
- C8P8. 8 Plates Type Column (8 Temperature points).
- C10P10. 10 Plates Type Column (10 Temperature points).
- C14P14. 14 Plates Type Column (14 Temperature points).
- C20P20. 20 Plates Type Column (20 Temperature points).

### ② UDDC/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.

**Simultaneously 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.

UDDC/CIB

**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 placed in only one computer screen.

**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 time and in a 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 control interface and the third one in the control software.**

**Continue...**

**Items supplied as standard** (continuation)

**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.

DAB

**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:**

Number of **channels=24 inputs/outputs**.

D0 or DI Sample Clock frequency: 0 to 1 MHz.

Timing:

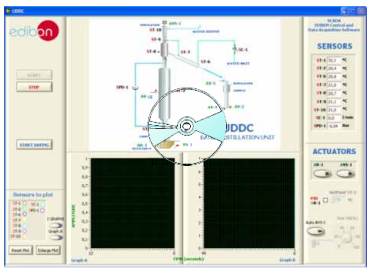
**Counter/timers=2**.

Resolution: Counter/timers: 32 bits.

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

Compatible with actual Windows operating systems.

Graphic and intuitive simulation of the process in screen.




UDDC/SOF

**Compatible with the industry standards.**

Registration and visualization of all process variables in an automatic and simultaneously 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 guaranteed.**

**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 at different work levels.

**This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.**

**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: UDDC + UDDC/CIB + DAB + UDDC/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.

PLC-PI

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.

Free input AC voltage(100 to 240 V AC).

DC input:16 (24 V DC).

Relay output: 14 (250 V A AC/2 A).

**High-speed counter**.

**Multi-point PID control**.

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

Communication RS232 wire, to computer (PC).

**⑧ UDDC/PLC-SOF. PLC Control Software:**

For this particular unit, always included with PLC supply.

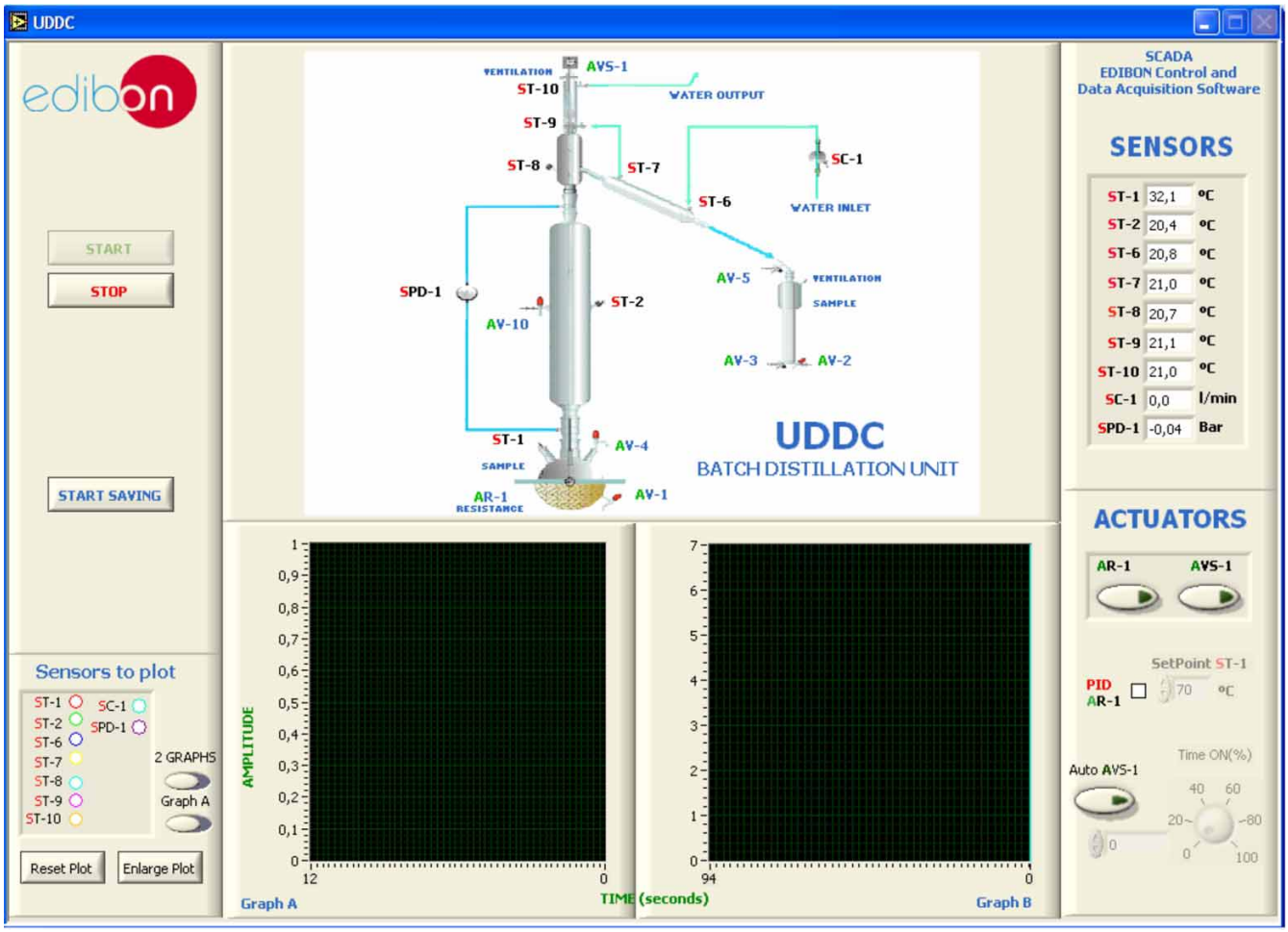
## Items available on request

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

**⑩ UDDC/FSS. Faults Simulation System.**

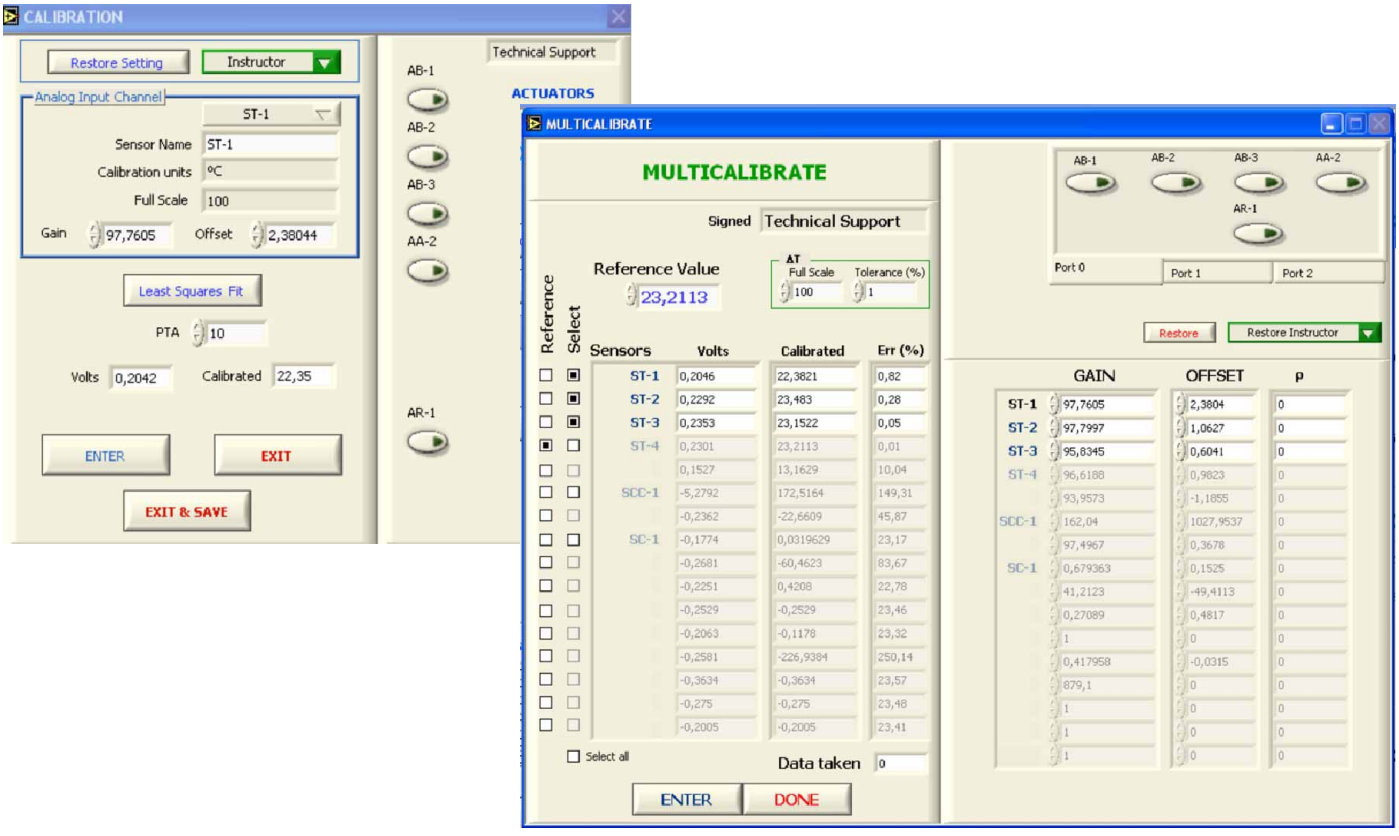
## Software Main Screens

Main screen




**Note:** ST=Temperature sensor. SC= Flow sensor. SPD=Differential Pressure sensor. AR=Heating resistance. AVS=Solenoid valve.

Examples of Sensors Calibration screens



## EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

1 .- Preparation of solutions.
2 .- Analytic valuation techniques.
3 .- Filling of the column.
4 .- Batch operation.
5 .- Obtaining the McCabe-Thiele diagram. Without reflux.
6 .- Obtaining the number of plates. Without reflux.
7 .- Efficiency calculations. Without reflux.
8 .- Variation of the composition of the distilled product: constant reflux ratio.
9 .- Constant composition of the distilled product: variation of reflux ratio.
10.- Constant composition of the distilled product: constant reflux ratio.
11.- Mass and energy balances across the system.
12.- Plates fluid dynamics studies, including load loss and column flooding.
13.- Calculation of the theoretical number of floors in the plates columns, and the equivalent height of the theoretical floor ( HEPT) in the Raschig rings columns.
14.- Pursuit of the temperatures in all plates in the column (Plates columns).
15.- Study of the rectification efficiency.
16.- Demonstration of azeotropic distillation.
17.- Work different heating contribution with regulation by the computer.
18.- Studies of heating interchange in glass refrigerators.

Other possible practices:

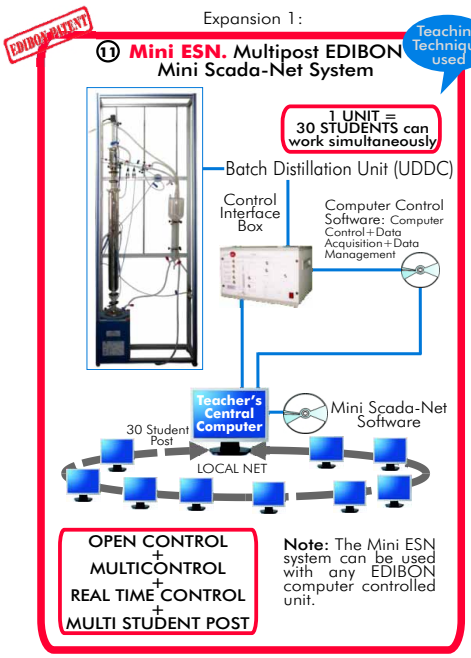
19.- Temperature sensors calibration.
20.- Flow sensor calibration.
21.- Pressure sensor calibration.

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

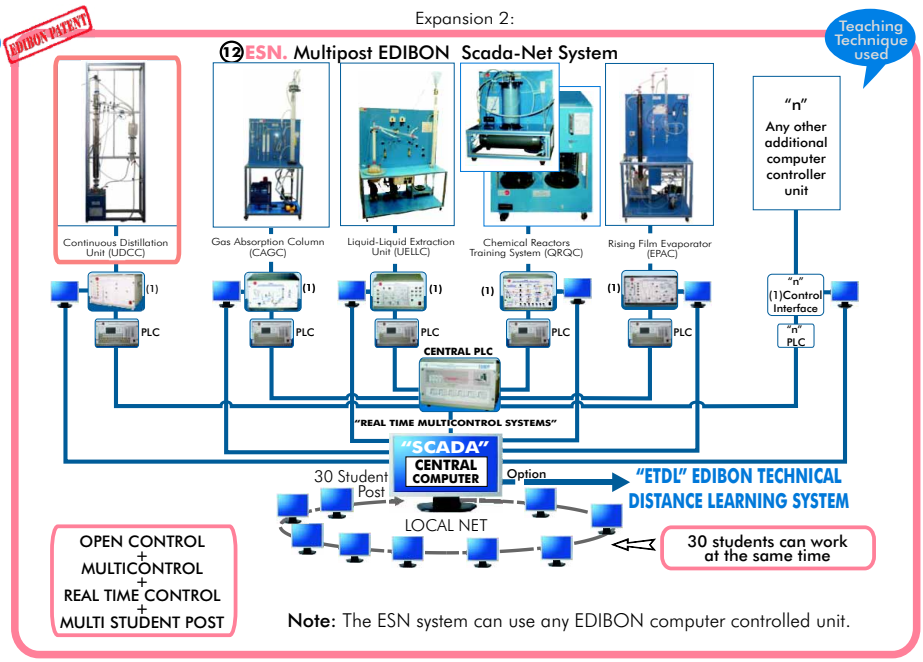
22.- Control of the UDDC unit process through the control interface box without the computer.
23.- Visualization of all the sensors values used in the UDDC unit process.
24.- Calibration of all sensors included in the UDDC unit process.
25.- Hand on of all the actuators involved in the UDDC unit process.
26.- Realization of different experiments, in automatic way, without having in front the unit.(This experiment can be decided previously).
27.- 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).
28.- PLC hardware general use and manipulation.
29.- PLC process application for UDDC unit.
30.- PLC structure.
31.- PLC inputs and outputs configuration.
32.- PLC configuration possibilities.
33.- PLC program languages.
34.- PLC different programming standard languages.
35.- New configuration and development of new process.
36.- Hand on an established process.
37.- To visualize and see the results and to make comparisons with the UDDC unit process.
38.- Possibility of creating new process in relation with the UDDC unit.
39.- PLC Programming Exercises.
40.- 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: UDDC. Batch Distillation Unit.**
② **UDDC/CIB.Control Interface Box.**
③ **DAB.Data Acquisition Board.**
④ **UDDC/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
⑤ **Cables and Accessories,** for normal operation.
⑥ **Manuals.**

* **IMPORTANT: Under UDDC 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 UDDC/PLC-SOF. PLC Control Software.
⑨ UDDC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request).
⑩ UDDC/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: 220 V./50Hz. or 110V./60Hz.
-Water supply.
-Computer (PC).

## RECOMMENDED REAGENTS

-Water/Methanol.
-Heptane/Methylcyclohexane.
-P-Xylene/Methylcyclohexane.

## DIMENSIONS & WEIGHTS

| | |
|---|---|
| UDDC Unit: | -Dimensions: 900 x 500 x 2800 mm. approx. |
| | -Weight: 170 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. |

## OPTIONAL COLUMNS

- CAR1. Raschig Rings Column.
- C8P8. 8 Plates Type Column (8 Temperature points).
- C10P10. 10 Plates Type Column (10 Temperature points).
- C14P14. 14 Plates Type Column (14 Temperature points).
- C20P20. 20 Plates Type Column (20 Temperature points).

## AVAILABLE VERSIONS

Offered in this catalogue:

-UDDC. Computer Controlled **Batch Distillation Unit.**

Offered in other catalogues:

-UDDB. **Batch Distillation Unit.**

-UDCC. Computer Controlled **Continuous Distillation Unit.**

-UDCB. **Continuous Distillation Unit**.

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

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Issue: ED01/11
Date: April/2011

REPRESENTATIVE: