Technical Teaching Equipment

Summarized
Catalogue

five (5)

Process Control

Chemical Engineering

Food & Water Technologies

Environment

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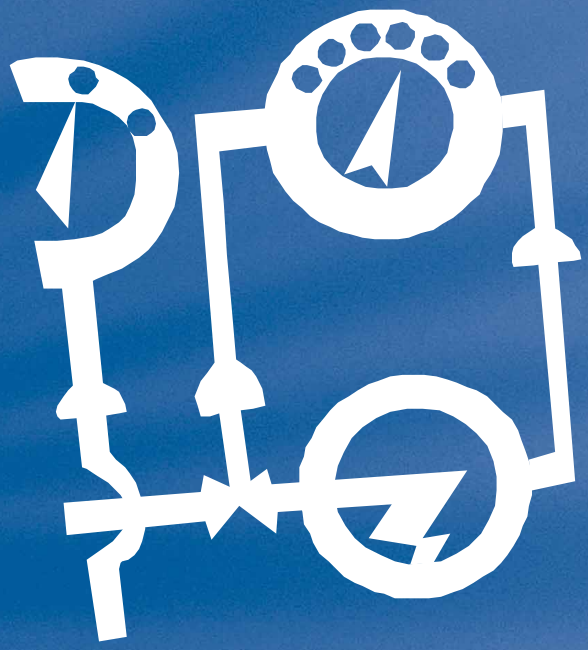

10. Process Control

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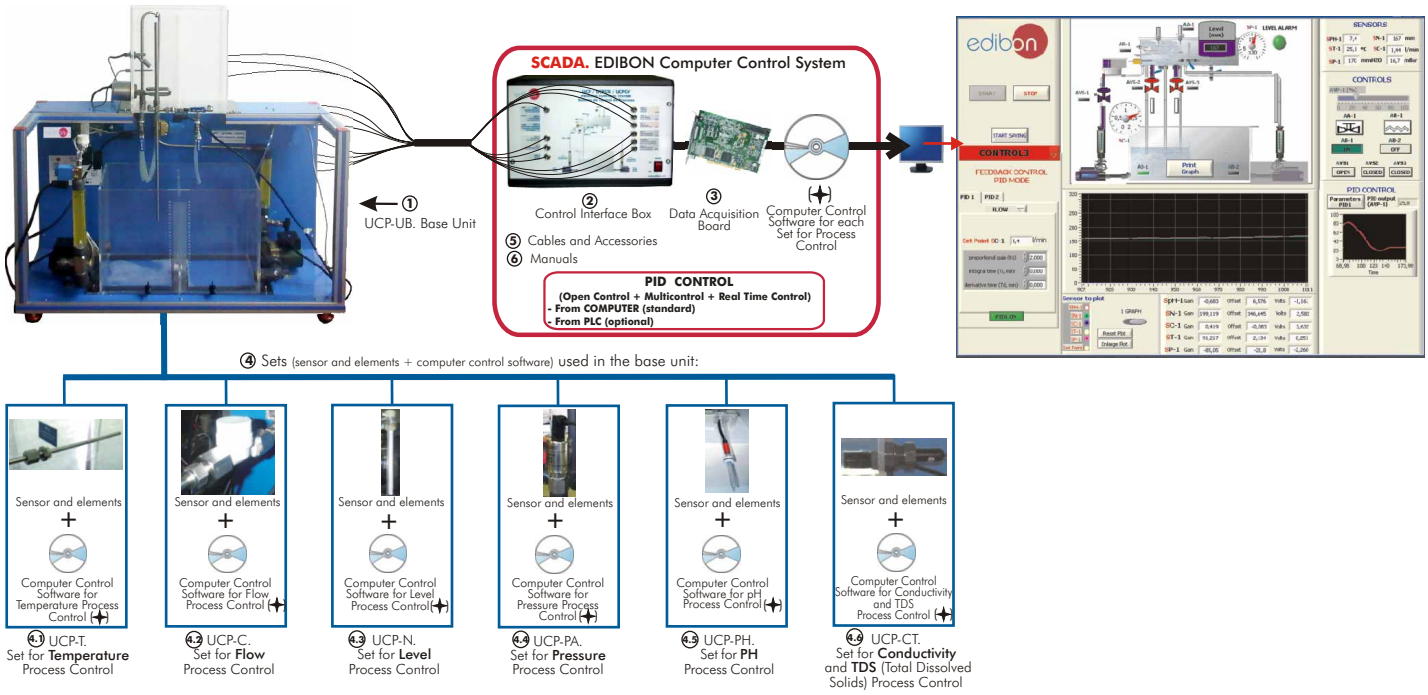
10.- Process Control

Equipment list

UCP. Computer Controlled **Process Control System, with electronic control valve :**



SPECIFICATIONS SUMMARY

Common items for all Process Control parameters:

① UCP-UB. Unit:
This unit is common for all Sets for Process Control type "UCP" and can work with one or several sets.
Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit. Main tank and collector with an orifice in the central dividing wall. (2 x 25 dm^3), and drainage in both compartments. Dual process tank (2 x 10 dm^3), interconnected through an orifice and a ball valve and an overflow in the dividing wall; a graduate scale and a threaded drain of adjustable level with bypass. Centrifugal pumps. Variable area flow meters (0.2-2 l/min, and 0.2-10 l/min), and with a manual valve. Line of on/off regulation valves (solenoid), and manual drainage valves of the upper tank. Proportional valve: motorized control valve.

② UCP/CIB. Control Interface Box :
This is common for all Sets for Process Control type "UCP" and can work with one or several sets.
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/ Outputs.

④ Sets (sensor and elements + computer control software) used in the base unit: (These Sets will be supplied and installed in the Base Unit and ready for working)

④.1 UCP-T. Set for Temperature Process Control:
Temperature sensor "J type". Electric resistor (0.5 KW). Helix agitator. On/off level switch.
Computer Control Software for Temperature Process Control:
(#) Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

④.2 UCP-C. Set for Flow Process Control:
Turbine type flow sensor.
Computer Control Software for Flow Process Control. **(#)**

④.3 UCP-N. Set for Level Process Control:
0-300mm level sensor (of capacitive immersion, 4-20mA).
Computer Control Software for Level Process Control. **(#)**

④.4 UCP-PA. Set for Pressure Process Control:
Pressure sensor.
Computer Control Software for Pressure Process Control. **(#)**

④.5 UCP-PH. Set for pH Process Control:
pH sensor. Helix agitator.
Computer Control Software for pH Process Control. **(#)**

④.6 UCP-CT. Set for Conductivity and TDS (Total Dissolved Solids) Process Control:
Conductivity and TDS (Total Dissolved Solids) sensor.
Computer Control Software for Conductivity and TDS Process Control.**(#)**

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.) = UCP-UB. Unit: 500 x 1000 x 1000 mm. Weight: 40 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/UCP.pdf

PRACTICAL POSSIBILITIES

Temperature Process Control:
1.- Temperature control loops (Manual).
2.- Temperature control loops (On/Off).
3.- Temperature control loops (Proportional).
4.- Temperature control loops (Proportional + Integral).
5.- Temperature control loops (Proportional + Derivative).
6.- Temperature control loops (Proportional + Derivative +Integral).
7.- Adjustment of the constant of a controller of temperature (Ziegler-Nichols).
8.- Adjustment of the constant of a controller of temperature (Reaction Curves).
9.- Temperature sensor calibration.

Flow Process Control:
10.- Flow control loops (Manual).
11.- Flow control loops (On/Off).
12.- Flow control loops (Proportional).
13.- Flow control loops (Proportional + Integral).
14.- Flow control loops (Proportional + Derivative).
15.- Flow control loops (Proportional + Derivative + Integral).
16.- Adjustment of the flow controller constants (Ziegler-Nichols).
17.- Adjustment of the flow controller constants (Reaction Curves).
18.- Flow sensor calibration.

Level Process Control:
19.- Level control loops (Manual).
20.- Level control loops (On/Off).
21.- Level control loops (Proportional).
22.- Level control loops (Proportional + Integral).
23.- Level control loops (Proportional + Derivative).
24.- Level control loops (Proportional + Derivative + Integral).
25.- Adjustment of the constants of a flow controller (Ziegler-Nichols).
26.- Adjustment of the constants of a flow controller (Reaction Curves).
27.- Level sensor calibration.

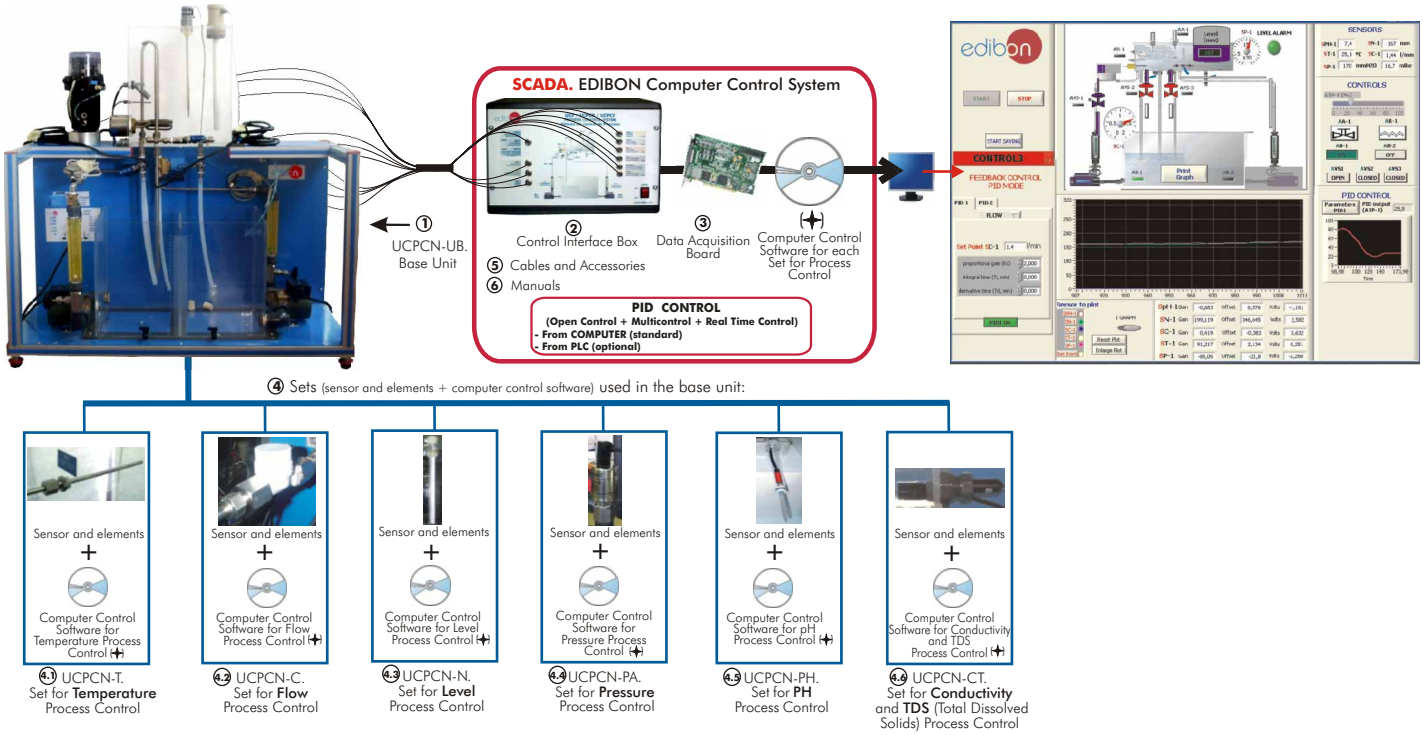
Pressure Process Control:
28.- Pressure control loops (Manual).
29.- Pressure control loops (On/Off).
30.- Pressure control loops (Proportional).
31.- Pressure control loops (Proportional + Integral).
32.- Pressure control loops (Proportional + Derivative).
33.- Pressure control loops (Proportional + Derivative + Integral).
34.- Adjustment of the constant of a Pressure controller (Ziegler-Nichols).
35.- Adjustment of the constant of a Pressure controller (Reaction Curves).
36.- Pressure sensor calibration.

pH Process Control:
37.- pH control loops (Manual).
38.- pH control loops (On/Off).
39.- pH control loops (Proportional).
40.- pH control loops (Proportional + Integral).
41.- pH control loops (Proportional + Derivative).
42.- pH control loops (Proportional + Derivative + Integral).
43.- Adjustment of the constant of a pH controller (Ziegler-Nichols).
44.- Adjustment of the constant of a pH controller (Reaction Curves).
45.- pH sensor calibration.

Conductivity and TDS (Total Dissolved Solids) Process Control:
46.- Conductivity control loops (Manual).
47.- Conductivity control loops (On/Off).
48.- Conductivity control loops (Proportional).
49.- Conductivity control loops (Proportional + Integral).
50.- Conductivity control loops (Proportional + Derivative).
51.- Conductivity control loops (Proportional + Derivative + Integral).
52.- Adjustment of the constant of a Conductivity controller (Ziegler-Nichols).
53.- Adjustment of the constant of a Conductivity controller (Reaction Curves).
54.- TDS control loops (Manual).
55.- TDS control loops (On/Off).
56.- TDS control loops (Proportional).
57.- TDS control loops (Proportional + Integral).
58.- TDS control loops (Proportional + Derivative).
59.- TDS control loops (Proportional + Derivative + Integral).
60.- Adjustment of the constant of a TDS controller (Ziegler-Nichols).
61.- Adjustment of the constant of a TDS controller (Reaction Curves).
62.- Conductivity and TDS sensor calibration.
63-81.- Practices with PLC.

10.1- Process Control. Fundamentals

UCPCN. Computer Controlled **Process Control System, with pneumatic control valve :**



SPECIFICATIONS SUMMARY

Common items for all Process Control parameters:

① UCPCN-UB. Unit:

This unit is common for all Sets for Process Control type "UCPCN" and can work with one or several sets.

Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit. Main tank and collector with an orifice in the central dividing wall.(2 x 25 dm^3), and drainage in both compartments. Dual process tank (2 x 10 dm^3), interconnected through an orifice and a ball valve and an overflow in the dividing wall; a graduate scale and a threaded drain of adjustable level with bypass. Centrifugal pumps. Variable area flow meters (0.2-2 l/min, and 0.2-10 l/min), and with a manual valve. Line of on/off regulation valves (solenoid), and manual drainage valves of the upper tank. Pneumatic Control Valve.

② UCPCN/CIB. Control Interface Box :

This is common for all Sets for Process Control type "UCPCN" and can work with one or several sets.

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/ Outputs.

④ Sets (sensor and elements + computer control software) used in the base unit: (These Sets will be supplied and installed in the Base Unit and ready for working)

④.1 UCPCN-T. Set for Temperature Process Control:

Temperature sensor "J type". Electric resistor (0.5 KW). Helix agitator. On/off level switch.

Computer Control Software for Temperature Process Control:

(#) Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

④.2 UCPCN-C. Set for Flow Process Control:

Turbine type flow sensor.

Computer Control Software for Flow Process Control. **(#)**

④.3 UCPCN-N. Set for Level Process Control:

0-300mm level sensor (of capacitive immersion, 4-20mA).

Computer Control Software for Level Process Control. **(#)**

④.4 UCPCN-PA. Set for Pressure Process Control:

Pressure sensor.

Computer Control Software for Pressure Process Control. **(#)**

④.5 UCPCN-PH. Set for pH Process Control:

pH sensor. Helix agitator.

Computer Control Software for pH Process Control. **(#)**

④.6 UCPCN-CT. Set for Conductivity and TDS (Total Dissolved Solids) Process Control:

Conductivity and TDS (Total Dissolved Solids) sensor.

Computer Control Software for Conductivity and TDS Process Control.**(#)**

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.) = UCPCN-UB. Unit: 500 x 1000 x 1000 mm. Weight: 40 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/UCPCN.pdf

PRACTICAL POSSIBILITIES

Temperature Process Control:
1.- Temperature control loops (Manual).
2.- Temperature control loops (On/Off).
3.- Temperature control loops (Proportional).
4.- Temperature control loops (Proportional + Integral).
5.- Temperature control loops (Proportional + Derivative).
6.- Temperature control loops (Proportional + Derivative + Integral).
7.- Adjustment of the constant of a controller of temperature (Ziegler-Nichols).
8.- Adjustment of the constant of a controller of temperature (Reaction Curves).
9.- Temperature sensor calibration.

Flow Process Control:
10.- Flow control loops (Manual).
11.- Flow control loops (On/Off).
12.- Flow control loops (Proportional).
13.- Flow control loops (Proportional + Integral).
14.- Flow control loops (Proportional + Derivative).
15.- Flow control loops (Proportional + Derivative + Integral).
16.- Adjustment of the flow controller constants (Ziegler-Nichols).
17.- Adjustment of the flow controller constants (Reaction Curves).
18.- Flow sensor calibration.

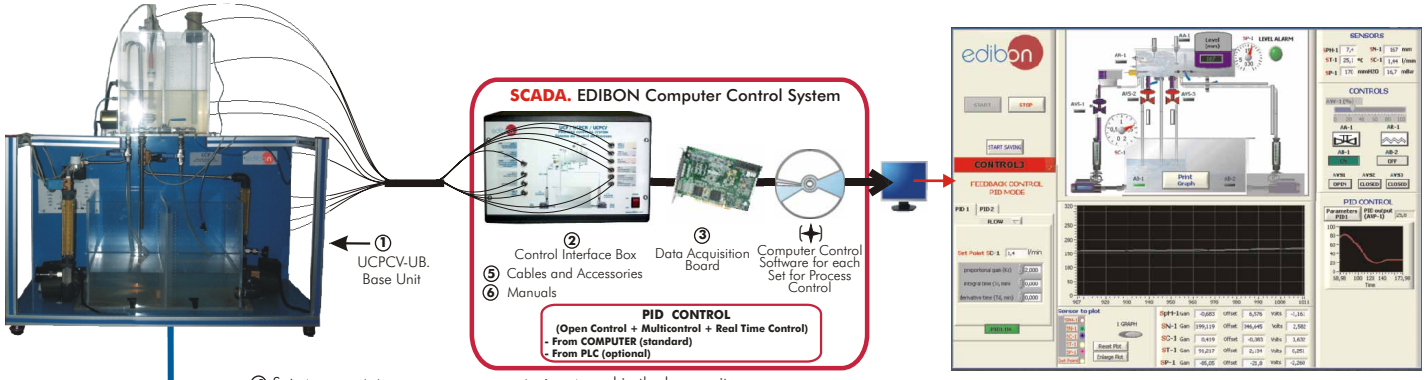
Level Process Control:
19.- Level control loops (Manual).
20.- Level control loops (On/Off).
21.- Level control loops (Proportional).
22.- Level control loops (Proportional + Integral).
23.- Level control loops (Proportional + Derivative).
24.- Level control loops (Proportional + Derivative + Integral).
25.- Adjustment of the constants of a flow controller (Ziegler-Nichols).
26.- Adjustment of the constants of a flow controller (Reaction Curves).
27.- Level sensor calibration.

Pressure Process Control:
28.- Pressure control loops (Manual).
29.- Pressure control loops (On/Off).
30.- Pressure control loops (Proportional).
31.- Pressure control loops (Proportional + Integral).
32.- Pressure control loops (Proportional + Derivative).
33.- Pressure control loops (Proportional + Derivative + Integral).
34.- Adjustment of the constant of a Pressure controller (Ziegler-Nichols).
35.- Adjustment of the constant of a Pressure controller (Reaction Curves).
36.- Pressure sensor calibration.

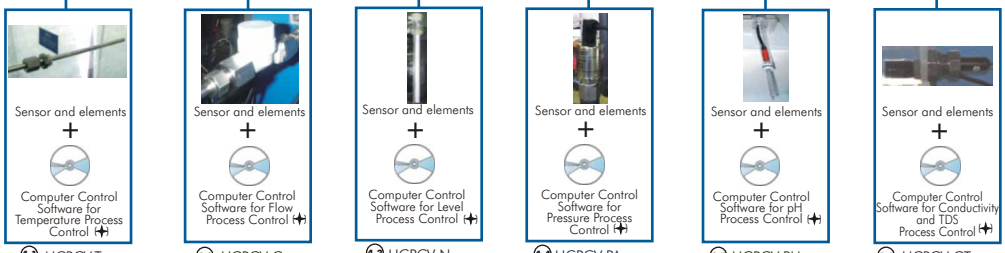
pH Process Control:
37.- pH control loops (Manual).
38.- pH control loops (On/Off).
39.- pH control loops (Proportional).
40.- pH control loops (Proportional + Integral).
41.- pH control loops (Proportional + Derivative).
42.- pH control loops (Proportional + Derivative + Integral).
43.- Adjustment of the constant of a pH controller (Ziegler-Nichols).
44.- Adjustment of the constant of a pH controller (Reaction Curves).
45.- pH sensor calibration.

Conductivity and TDS (Total Dissolved Solids) Process Control:
46.- Conductivity control loops (Manual).
47.- Conductivity control loops (On/Off).
48.- Conductivity control loops (Proportional).
49.- Conductivity control loops (Proportional + Integral).
50.- Conductivity control loops (Proportional + Derivative).
51.- Conductivity control loops (Proportional + Derivative + Integral).
52.- Adjustment of the constant of a Conductivity controller (Ziegler-Nichols).
53.- Adjustment of the constant of a Conductivity controller (Reaction Curves).
54.- TDS control loops (Manual).
55.- TDS control loops (On/Off).
56.- TDS control loops (Proportional).
57.- TDS control loops (Proportional + Integral).
58.- TDS control loops (Proportional + Derivative).
59.- TDS control loops (Proportional + Derivative + Integral).
60.- Adjustment of the constant of a TDS controller (Ziegler-Nichols).
61.- Adjustment of the constant of a TDS controller (Reaction Curves).
62.- Conductivity and TDS sensor calibration.
63-81.- Practices with PLC.

UCPCV. Computer Controlled **Process Control System, with speed controller :**



④ Sets (sensor and elements + computer control software) used in the base unit:



④.1 UCPCV-T. Set for **Temperature** Process Control

④.2 UCPCV-C. Set for **Flow** Process Control

④.3 UCPCV-N. Set for **Level** Process Control

④.4 UCPCV-PA. Set for **Pressure** Process Control

④.5 UCPCV-PH. Set for **PH** Process Control

④.6 UCPCV-CT. Set for **Conductivity** and **TDS** (Total Dissolved Solids) Process Control

SPECIFICATIONS SUMMARY

Common items for all Process Control parameters:

① UCPCV-UB. Unit:

This unit is common for all Sets for Process Control type "UCPCV" and can work with one or several sets.

Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit. Main tank and collector with an orifice in the central dividing wall.(2 x 25 dm^3), and drainage in both compartments. Dual process tank (2 x 10 dm^3), interconnected through an orifice and a ball valve and an overflow in the dividing wall; a graduate scale and a threaded drain of adjustable level with bypass. Centrifugal pumps. Variable area flow meters (0.2-2 l/min, and 0.2-10 l/min), and with a manual valve. Line of on/off regulation valves (solenoid), and manual drainage valves of the upper tank. Speed controller (into the Control Interface Box).

② UCPCV/CIB. Control Interface Box :

This is common for all Sets for Process Control type "UCPCV" and can work with one or several sets.

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/ Outputs.

④ Sets (sensor and elements + computer control software) used in the base unit: (These Sets will be supplied and installed in the Base Unit and ready for working)

④.1 UCPCV-T. Set for Temperature Process Control:

Temperature sensor "J type". Electric resistor (0.5 KW). Helix agitator. On/off level switch.

Computer Control Software for Temperature Process Control:

(#) Flexible, open and multicontrol software. Management, processing,comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

④.2 UCPCV-C. Set for Flow Process Control:

Turbine type flow sensor.

Computer Control Software for Flow Process Control. **(#)**

④.3 UCPCV-N. Set for Level Process Control:

0-300mm level sensor (of capacitive immersion, 4-20mA).

Computer Control Software for Level Process Control. **(#)**

④.4 UCPCV-PA. Set for Pressure Process Control:

Pressure sensor.

Computer Control Software for Pressure Process Control. **(#)**

④.5 UCPCV-PH. Set for pH Process Control:

pH sensor. Helix agitator.

Computer Control Software for pH Process Control. **(#)**

④.6 UCPCV-CT. Set for Conductivity and TDS (Total Dissolved Solids) Process Control:

Conductivity and TDS (Total Dissolved Solids) sensor.

Computer Control Software for Conductivity and TDS Process Control.**(#)**

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.) = UCPCV-UB. Unit: 500 x 1000 x 1000 mm. Weight: 40 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 12 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/UCPCV.pdf

PRACTICAL POSSIBILITIES

Temperature Process Control:
1.- Temperature control loops (Manual).
2.- Temperature control loops (On/Off).
3.- Temperature control loops (Proportional).
4.- Temperature control loops (Proportional + Integral).
5.- Temperature control loops (Proportional + Derivative).
6.- Temperature control loops (Proportional + Derivative +Integral).
7.- Adjustment of the constant of a controller of temperature (Ziegler-Nichols).
8.- Adjustment of the constant of a controller of temperature (Reaction Curves).
9.- Temperature sensor calibration.

Flow Process Control:
10.- Flow control loops (Manual).
11.- Flow control loops (On/Off).
12.- Flow control loops (Proportional).
13.- Flow control loops (Proportional + Integral).
14.- Flow control loops (Proportional + Derivative).
15.- Flow control loops (Proportional + Derivative + Integral).
16.- Adjustment of the flow controller constants (Ziegler-Nichols).
17.- Adjustment of the flow controller constants (Reaction Curves).
18.- Flow sensor calibration.

Level Process Control:
19.- Level control loops (Manual).
20.- Level control loops (On/Off).
21.- Level control loops (Proportional).
22.- Level control loops (Proportional + Integral).
23.- Level control loops (Proportional + Derivative).
24.- Level control loops (Proportional + Derivative + Integral).
25.- Adjustment of the constants of a flow controller (Ziegler-Nichols).
26.- Adjustment of the constants of a flow controller (Reaction Curves).
27.- Level sensor calibration.

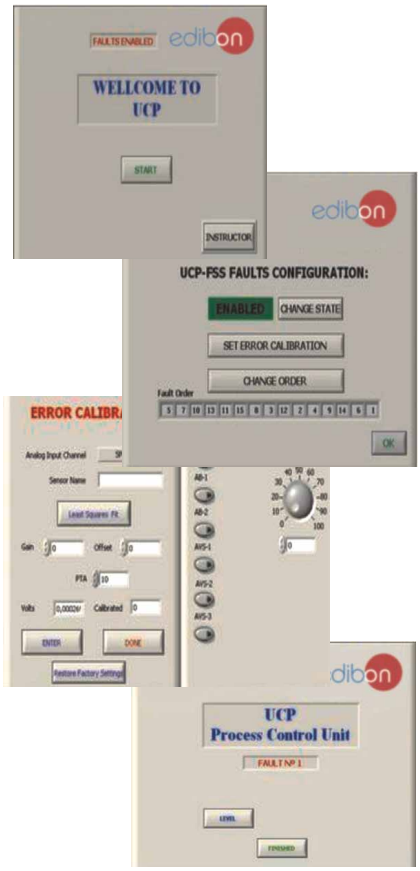
Pressure Process Control:
28.- Pressure control loops (Manual).
29.- Pressure control loops (On/Off).
30.- Pressure control loops (Proportional).
31.- Pressure control loops (Proportional + Integral).
32.- Pressure control loops (Proportional + Derivative).
33.- Pressure control loops (Proportional + Derivative + Integral).
34.- Adjustment of the constant of a Pressure controller (Ziegler-Nichols).
35.- Adjustment of the constant of a Pressure controller (Reaction Curves).
36.- Pressure sensor calibration.

pH Process Control:
37.- pH control loops (Manual).
38.- pH control loops (On/Off).
39.- pH control loops (Proportional).
40.- pH control loops (Proportional + Integral).
41.- pH control loops (Proportional + Derivative).
42.- pH control loops (Proportional + Derivative + Integral).
43.- Adjustment of the constant of a pH controller (Ziegler-Nichols).
44.- Adjustment of the constant of a pH controller (Reaction Curves).
45.- pH sensor calibration.

Conductivity and TDS (Total Dissolved Solids) Process Control:
46.- Conductivity control loops (Manual).
47.- Conductivity control loops (On/Off).
48.- Conductivity control loops (Proportional).
49.- Conductivity control loops (Proportional + Integral).
50.- Conductivity control loops (Proportional + Derivative).
51.- Conductivity control loops (Proportional + Derivative + Integral).
52.- Adjustment of the constant of a Conductivity controller (Ziegler-Nichols).
53.- Adjustment of the constant of a Conductivity controller (Reaction Curves).
54.- TDS control loops (Manual).
55.- TDS control loops (On/Off).
56.- TDS control loops (Proportional).
57.- TDS control loops (Proportional + Integral).
58.- TDS control loops (Proportional + Derivative).
59.- TDS control loops (Proportional + Derivative + Integral).
60.- Adjustment of the constant of a TDS controller (Ziegler-Nichols).
61.- Adjustment of the constant of a TDS controller (Reaction Curves).
62.- Conductivity and TDS sensor calibration.
63-81.- Practices with PLC.

10.1- Process Control. Fundamentals

UCP/FSS. **Faults Simulation System** (Process Control Unit)



SPECIFICATIONS SUMMARY

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. In this case, the student should proceed to calibrate the affected sensor through the values collection.
- Non-linearity. When we have the measures taken by the sensor, a quadratic or inverse function is applied to them. Thus, the value measured will not be the real one, as in the case above mentioned, but when we calibrate again, the sensor will not operate linearly and we will not be able to calibrate it by lest squares fits.

Faults affecting the actuators:
- Actuators canals interchange at any time during the program execution. This error does not admit any solution.
- Response reduction of an actuator. By the reduction of the output voltage in analog outputs, we can get an response with a fraction of what it should be, either with a manual execution or with any control type (ON/OFF, PID...).

Faults in the controls execution:
- Inversion of the performance in ON/OFF controls. The state of some actuator is inverted, when it should be ON is OFF instead, and vice versa. The student should provide the correct operating logic.
- Reduction or increase of the calculated total response. We multiply by a factor the total response calculated by the PID, causing, thus, the reduction or increase of the action really applied to the actuator, and the consequent instability of the control. The student should notify it and try to calculate this factor.
- The action of some controls is annulled.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/UCP.pdf

PRACTICAL POSSIBILITIES

Incorrect Calibration:
1.- Load the calibration error of the PH sensor.
2.- Load the calibration error of the Level sensor.
3.- Load the calibration error of the Flow sensor.
4.- Load the calibration error of the Temperature sensor.

Non Linearity:
5.- Non inverse linearity of the pH sensor.
6.- Non quadratic linearity of the Level sensor.
7.- Non quadratic linearity of the Flow sensor.
8.- No inverse linearity of the Temperature sensor.

Interchange of actuators:
9.- Interchange the bombs AB-1 and AB-2 between them during the operations of the controls ON/OFF and PID. (Affected sensor: Level sensor).

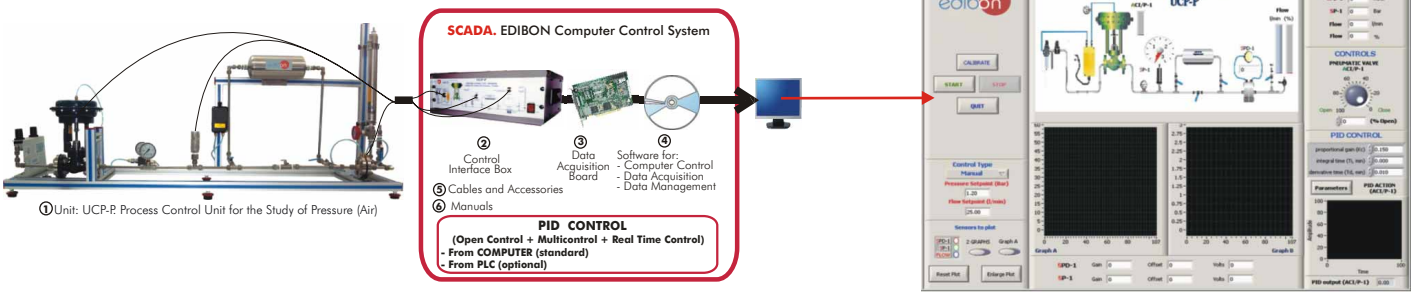
Reduction of an actuator response:
10.- In the PID, the real response of the proportional valve is half the amount calculated by the PID control. Thus, the maximum real opening that will be able to reach is 50%. (Affected sensor: Flow sensor).

Inversion of the performance in ON/OFF controls:
11.- In the ON/OFF control, the actuation sensor of the AVS-1 is inverted, acting, thus, on the same way as the others 2 valves (for a good control, it should operate the other way around to how the others 2 do it). (Affected sensor: pH).

Reduction or increase of the calculated total response:
12.- In the PID, the real action in the resistance is half of the total calculated. (Affected sensor: Temperature sensor).

The action of some controls is annulled:
13.- The Integral control does not work. It is reduced to a PD control (Proportional-Derivative).
14.- The Derivative Control does not work. It is reduced to a PI Control (Proportional-Integral).
15.- The Integral and Derivative controls do not work. They are reduced to a Proportional Control.

UCP-P. Computer Controlled **Process Control Unit for the Study of Pressure (Air)**



①Unit: UCP-P. Process Control Unit for the Study of Pressure (Air)

SPECIFICATIONS SUMMARY

Items supplied as standard

①UCP-P. Unit:
This unit basically consist of the following elements:
Pneumatic circuit consisting of a tank, valves, pressure sensors, pressure regulators and pressure manometers.
For the pressure and flow control, a pneumatically operated control valve, an I/P converter and an absolute pressure sensor and a differential pressure sensor are used.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
2 Pressure regulators, one for controlling the pneumatically operated control valve and the second for suppling the necessary flow and/or pressure to the circuit that is to be adjusted.
I/P Converter.
On/off valves. Inlet/outlet valves.
Pneumatically operated control valve.
Storage (air) tank, capacity: 2 l.
Absolute pressure sensor. Differential pressure sensor.
Diaphragm. Flow meter. 3 pressure manometers.

② UCP-P/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, other electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ UCP-P/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)=Unit: 1000 x 500 x 600 mm. Weight: 20 Kg. Control Interface: 490 x 330 x 175 mm. Weight: 5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/UCP-P.pdf

PRACTICAL POSSIBILITIES

1.- Calculating the fluid flow in function of different pressure sensor.
2.- Calibration processes.
3.- Pressure sensor calibration. Study of the hysteresis curve.
4.- I/P converter calibration.
5.- Identification of the pneumatic valve type.
6.- Determination of the influence of the flow rate of the conduction.
7.- Pressure control in conduction using a PID controller.
8.- Proportional control (P) characteristics.
9.- Characteristics of a proportional and integral control (P+I).
10.- Characteristics of a proportional and derivative control (P+D).
11.- Optimization of the variables of a PID controller.
12.- Optimization of the variables of the PID controller, flow control.
13.- Flow rate control in conduction with a PID controller.
14-32.- Practices with PLC.

CECI. **Industrial Controllers Trainer**

SPECIFICATIONS SUMMARY

Trainer for industrial process controllers. This trainer allows students the study and familiarisation with the function and operation of a industrial process controller.
Configurable digital controller:
2 inputs, 1 output. Configurable as P, PI or PID controller. Proportional gain X_p: 0 -999.9%. Integral action time T_n: 0-3600s. Derivative time T_v: 0-1200s. RS232 interface for configuration on computer (PC).
Digital voltmeter: 0 -20V.
Signal generator with potentiometer. Reference variables generator: 2 voltages selectable. Output voltage: 0-10V.
Controlled system simulator:
Controlled system type: First order lag. Time constant: 20s.
All variables accessible as analog signals at lab jacks .
Possibility of connection of external instruments via lab jacks (for example: line recorder, plotter, oscilloscope...).
Configuration software CD. Interface cable. Set of lab cables.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 8 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/CECI.pdf

PRACTICAL POSSIBILITIES

To study methods and terminology of process control:
1.- Closed loop control.
2.- Static and dynamic transfer function.
3.- To study the step response.
4.- Reference variable step.
To learn and to familiarise with a process controller:
5.- Configuration level.
6.- Parameter level.
7.- Operation control levels.
Control parameters:
8.- Setting input channels.
9.- Setting output channels.
10.- To use computer (PC)-based configuration tools.
11.- Scaling displays.

CRCI. **Industrial Controllers Networking**

SPECIFICATIONS SUMMARY

This trainer enables to take the first steps in process automation using field buses. This trainer demonstrates the operation of a process control system based on a simple application. This trainer allows student the familiarisation with the function and operation of an industrial process controller.
2 Digital process controllers, with field bus interface:
Configurable as P, PI or PID controller. Proportional gain X_p: 0-999.9%. Integral action time T_n: 0-3600s. Derivative time T_v: 0- 1200s. Controller parameter setting via field bus system.
2 Signal generators: 0-10V. Profibus DP interface card for computer (PC).
Process variables as analog signals: 0-10V. All variables accessible as analog signals at lab jacks.
Software CD with driver software, OPC server and process control software.
Possibility of connection of external instruments via lab jacks (for example: line recorder, oscilloscope, etc). Set of cables.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 12 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/CRCI.pdf

PRACTICAL POSSIBILITIES

1.- Function of a digital industrial controller.
2.- Layout of a field bus system.
To learn and to familiarise with the operation and structure of a process control system under Profibus DP:
3.- Controller parameter setting via field bus system.
4.- Profibus DP field bus system.
5.- OPC (OLE for Process Control) server function.
6.- Online controller parameters setting.
7.- Master / slave assignment.
8.- To configure and display alarms.
9.- Reading control variables and displaying them online.
10.- Scaling displays.
11.- Bus configuration.

CEAB. **Trainer for Field Bus Applications**

SPECIFICATIONS SUMMARY

This Trainer is used to teach the initial or first steps in field bus tecnology based on Profibus DP. The field bus permits networking terminal devices (controllers, actuators or sensors) in the plant system (field level) with the control room (control level).
Several devices (slaves) are activated and read by a computer (PC) with a Profibus DP interface (master).
Different subjects or topics can be covered and studied: bus topology, system configurator with Device Master File "DMF", communication protocols, tags, OPC server, output and input process data, etc.
Digital process controller, with Profibus DP interface:
Configurable as P, PI or PID controller. Proportional gain X_p:0-999.9%. Derivative time T_v:0-1200s. Integral action time T_n: 0-3600s.
Signal generators: 0-10V. Digital voltmeter: 0-20V.
Digital Profibus DP I module. Digital Profibus DP O module. Four digital inputs. Four digital outputs.
Analog Profibus DP I module. Analog Profibus DP O module. Four analog inputs: 0-10V. Two analog outputs: 0-10V.
Profibus DP interface card for computer (PC).
Process variables as analog signals at lab jacks: 0-10V.
Software CD with driver software, system configurator, OPC server and process control software.
Possibility of connection of external instruments via lab jacks (for example: chart recorder, oscilloscope, etc). Set of cables.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 12 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/CEAB.pdf

PRACTICAL POSSIBILITIES

1.- Operation and function of a digital industrial controller.
2.- Function of an analog input/outputs module.
3.- Function of a digital input/output module.
4.- Layout of a field bus system.
5.- Familiarisation with the field bus stations.
6.- Defining the bus technology with the stations.
7.- Reading out and in, and online displaying of analog and digital process variables.
8.- Communication protocols.
9.- To define tags.
10.- Familiarisation with the device master file "DMF".
11.- OPC server.
12.- Access to the OPC database from the process control program.

CEAC. **Controller Tuning Trainer**

SPECIFICATIONS SUMMARY

Trainer for controller tuning. This unit permits the interaction between controller and controlled system. The objective is that the closed control loop, formed by the controller and the controlled system, to show the desired optimum response.
With a simulation software the setting of controller parameters can be practised safely. Closed and open loop control, step response, stability, disturbance and control response are demonstrated.
This trainer no needs real controlled systems, the controlled system is simulated on a computer (PC) by the simulation program. In this program the most important types of controlled systems can be selected.
The process controller used can be easily configured from the computer (PC). The controller and the computer (PC) are connected by a data acquisition card with AD and DA converters.
Configurable digital process controller, with interface:
Configurable as P, PI or PID controller. Proportional gain X_p: 0-999.9%. Integral action time T_n: 0-3600s. Derivative time T_v: 0-1200s.
Interface for computer (PC). Data acquisition card for computer (PC).
Simulation Software for controlled system models, such as 1st and 2nd order lags, time-delayed systems etc. Controlled system simulation models with proportional, integral, 1st order lag, 2nd order lag, time-delayed response, non-linearity and limitation.
Configuration software for process controller. Recording and evaluation of time response on computer (PC). Set of cables.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 8 Kg.

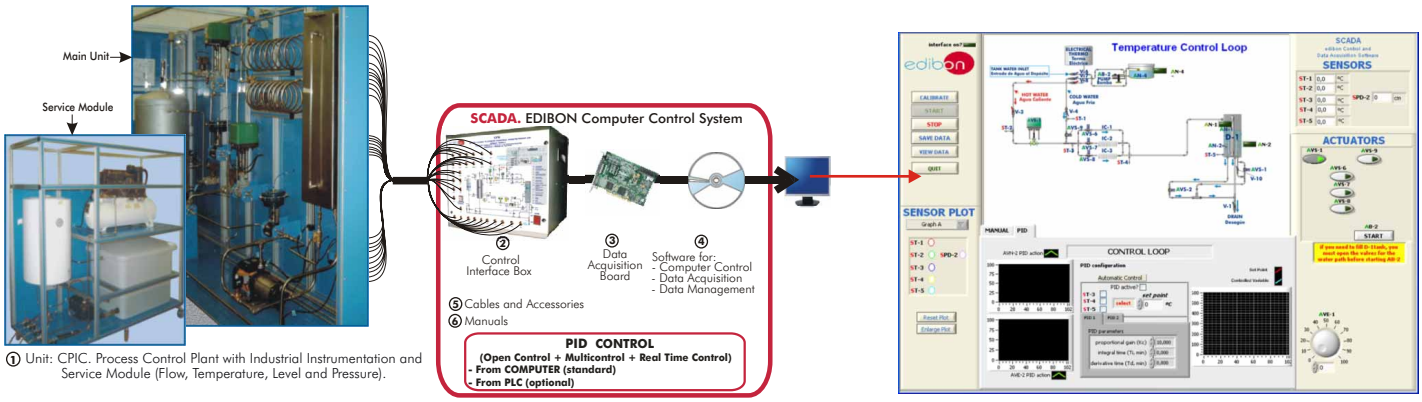
More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/CEAC.pdf

PRACTICAL POSSIBILITIES

1.- To use commonly applied tuning rules, such as Ziegler-Nichols.
2.- To study the difference between open and closed loop control.
3.- Control loop comprising controller and controlled system.
4.- To determine the system parameters.
5.- Closed-loop control system response.
6.- Choice of optimum controller parameters.
7.- Stability, steady state and transient response.
8.- Study and investigation of control and disturbance response.
9.- Study of the stability of the closed control loop.
10.- Learning methods and terminology involved in process control.
11.- To adapt the process controller to different controlled systems.
12.- Use and practices with the simulation software.

10.2- Industrial Process Control

CPIC. Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (Flow, Temperature, Level and Pressure)



① Unit: CPIC. Process Control Plant with Industrial Instrumentation and Service Module (Flow, Temperature, Level and Pressure).

SPECIFICATIONS SUMMARY

Items supplied as standard

① CPIC. Unit:

CPIC is a "Computerized Industrial Process Control Plant", that offers, on a reasonable laboratory scale, the different process and elements that are commonly used by any kind the industry. It also shows the complexity that can take place while controlling in processes the same variable.

Metallic structure. Panels and main metallic elements in stainless steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Main Unit contains the following elements:

Two pneumatics valves with C_v: 0.25. Actuator (I/P) from 0.2 to 1.0 bar for electric signal from 4 to 20 mA.
Two electronic valves for electric signal from 4 to 20mA.
Twelve solenoid valves, normally closed.
Two solenoid valves, normally open, placed at the air loop and flow loop.
Three differential pressure sensors.
Five temperature sensors placed along the unit to control the temperature in different lines.
One level sensor (effective length: 300 mm.).
Four level switches.
Water pump: maximum water flow: 106 l./min. and maximum pressure: 7 bar.
Stainless steel water tank: maximum capacity: 100 l.
Stainless steel tank: maximum capacity: 200 l., maximum pressure:16 bar. It has eight takings, but only six are used in this unit. In the upper part, there is a safety valve that opens when the pressure exceeds 4 bar. Two takings are used to measure the water height by the means of a differential pressure sensor. Other differential pressure sensor gives us the inner pressure.

Service Module contains the following elements:

Heater unit: A tank with a maximum capacity of 80 litres and an electrical resistance of 1.2 kW as maximum electrical power, the temperature control is placed in the electrical resistance. It has a safety valve and purge valve. The lower part of the unit has an inlet pipe (cold water) and an outlet pipe (hot water).
Compressor unit: Maximum pressure: 10 bar. This unit has a regulating valve with a manometer to fix the outlet maximum pressure.
Water system: Water tank, capacity: 400 l. Water pump: 2500 l./h. The inlet pipe of the tank has an automatic filling system. Drain valve in the water tank.

② CPIC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =

-Main Unit: 5000 x 1500 x 2500 mm. Weight: 1000 Kg.
-Service Module: 2000 x 1500 x 2000 mm. Weight: 200 Kg.
-Control Interface: 490 x 450 x 470 mm. Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/industrial/CPIC.pdf

PRACTICAL POSSIBILITIES

1.- Familiarisation with the different components of the system and their symbolic representation. Identification of components and description of their functions.
2.- The auxiliary systems: air and hot water supply.
3.- Flow sensors calibration.
4.- Temperature sensors calibration.
5.- Level sensor calibration.
6.- I/P converter calibration.
7.- Flow control loop (on/off).
8.- Flow control loop (proportional).
9.- Flow control loop (P+I).
10.- Flow control loop (P+D).
11.- Flow control loop (P+I+D).
12.- Adjust of the flow controller constants (Ziegler-Nichols).
13.- Adjust of the flow controller constants (reaction curves).
14.- Search of simple shortcomings in the loop of flow control.
15.- Temperature control loop (on/off).
16.- Temperature control loop (proportional).
17.- Temperature control loop (P+I).
18.- Temperature control loop (P+D).
19.- Temperature control loop (P+I+D).
20.- Adjust of the temperature controller constants (minimum area or reduction rate).
21.- Adjust of the temperature controller constants (minimum disturbance criterion).
22.- Adjust of the temperature controller constants (minimum width criterion).
23.- Study of the retards for speed/distance, exemplified through the temperature control loop.
24.- Study of the energy lost in the temperature control loop.
25.- Search of simple shortcomings in temperature control loop.
26.- Level control loop (on/off).
27.- Level control loop (proportional).
28.- Level control loop (P+I).
29.- Level control loop (P+D).
30.- Level control loop (P+I+D).
31.- Adjust of the level controller constants (minimum area or reduction rate).
32.- Adjust of the level controller constants (minimum disturbance criterion).
33.- Adjust of the level controller constants (minimum width criterion).
34.- Search of simple shortcomings in level control loop.
35.- Pressure control loop (on/off).
36.- Pressure control loop (proportional).
37.- Pressure control loop (P+I).
38.- Pressure control loop (P+D).
39.- Pressure control loop (P+I+D).
40.- Adjust of the pressure controller constants (minimum area or reduction rate).
41.- Adjust of the pressure controller constants (minimum disturbance criterion).
42.- Adjust of the pressure controller constants (minimum width criterion).
43.- Search of simple shortcomings in the pressure control loop.
44.- The use of the controllers in cascade, exemplified with the level/ flow control loop.
45.- Adjust of cascade control constants (minimum area or reduction rate).
46.- Adjust of cascade control constants (minimum disturbance criterion).
47.- Adjust of cascade control constants (minimum width criterion).
48.- Search of simple shortcomings in cascade control loop.
49.- Practical operation of the control plant to some wanted specific values: transfers without interferences.
50.- Calculation of the fluid flow in function of the differential pressure sensor.
51-69.- Practices with PLC.

Other available Units:

CPIC-C. Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Flow)

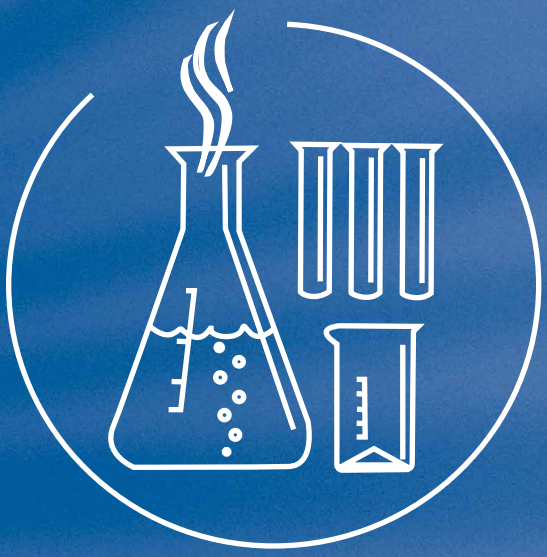
CPIC-T. Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Temperature)

CPIC-N. Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Level)

CPIC-P. Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Pressure)

Summarized
Catalogue

five (5)



11. Chemical Engineering

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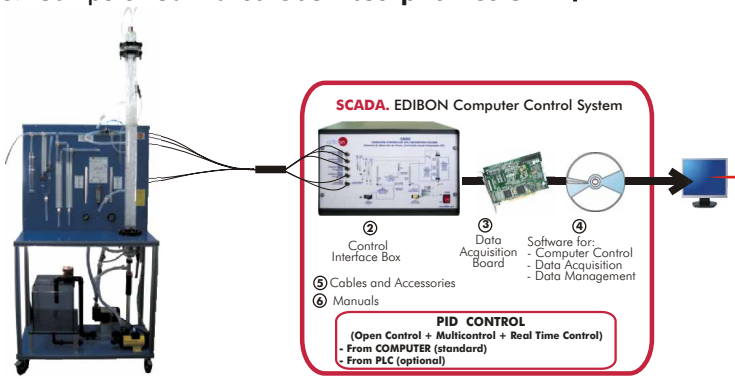
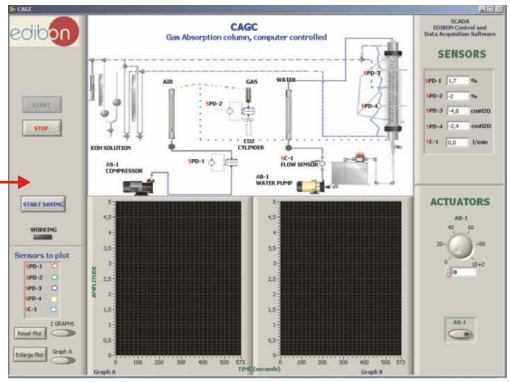
11.- Chemical Engineering

Equipment list

CAGC. Computer Controlled **Gas Absorption Column** ✱



① Unit: CAGC. Gas Absorption Column



SPECIFICATIONS SUMMARY

Items supplied as standard

① CAGC. Unit:
The gas absorption column(CAGC) is an unit designed for studying hydrodynamics and absorption processes in packed columns. The installation absorbs CO_2 from an air mixture into an aqueous solution flowing down the column.
Packed column consists of a glass cylindrical column of 1400 mm of height and 75 mm of internal diameter, filled with Raschig rings of 8mm diameter. Liquid circuit (water) and gas circuit (air and CO_2).
The liquid, that is stored in a PVC glass tank (40 litres capacity), is impelled towards the column with the help of a centrifugal pump, computer controlled. The water flow that arrives in each moment to the column is measured with a flow sensor. Water flow is controlled by PID control. The liquid feeds to the column through its upper end via one glass diffusion shower that assures an uniform distribution in the filler. After crossing the column, the liquid effluent is returned to the storage tank in which there are a control flow valve and one sampler.
Compressor (blower), computer controlled. The gas (CO_2 or ammonia) is supplied by a cylinder, type bottle. The both gas flows are measured by sensors. Differential pressure sensors. Mixing system of 2 gases streams.
A measuring of CO_2 equipment, that allows to determine the concentration of this gas in the currents originating from the upper and cental parts of the column. It is formed by:
A glass syringe dedicated to extract the specific quantities of a sample to be analysed.
Two glass tanks located at different heights and interconnected. They contain an aqueous solution of KOH, in which the contained CO_2 will be absorbed in the sample of gas to analyze.
3 way-valves to direct the gaseous currents during the analysis process. Connection elements.

② CAGC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ CAGC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 1000 x 740 x 2600 mm. Weight: 100 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

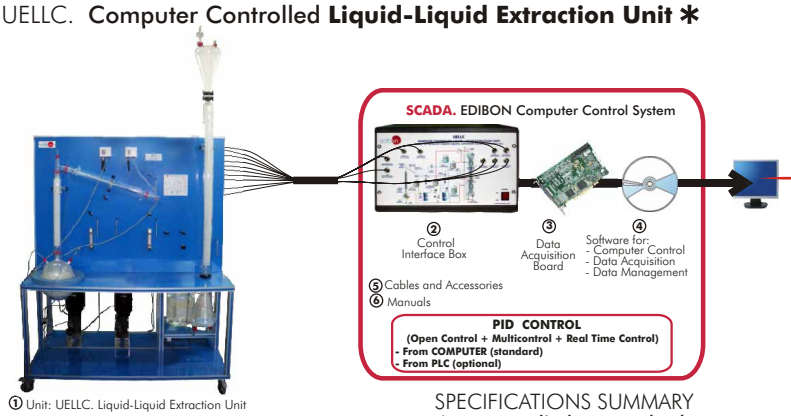
More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringbasic/CAGC.pdf

PRACTICAL POSSIBILITIES

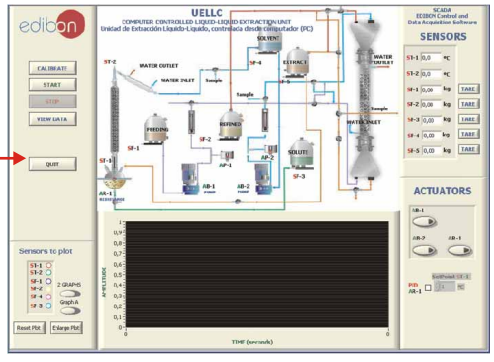
1.- Study of the basic principles of the absorption of a gas into a liquid using a packed column.
2.- Gas stream analysis.
3.- PID control system.
4.- Study of the hydrodynamic characteristics of a packed column.
5.- Study of the hysteresis in the water flow sensor.
6.- Determination of the drag and flooding flows.
7.- Determination of the mass transfer coefficient.
8.- Checking of the mass balances.
9.- Demonstration of methods of gas and liquid quantitative analysis.
10.- Investigations of the variables influencing the effectiveness of the absorption.

Other possible practices:
11.- Sensors calibration.
12.- Determination of the air flow.
13.- Head loss in the column.
14-32.- Practices with PLC.

UELLC. Computer Controlled **Liquid-Liquid Extraction Unit** ✱



① Unit: UELLC. Liquid-Liquid Extraction Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① UELLC. Unit:
The UELLC is an unit, at laboratory scale, designed for studying the separation of liquid mixtures by contact with a solvent. Anodized aluminium and steel structure. Diagram in the front panel. Jacketed glass packed column of 1200 mm of longitude and 50 mm of internal diameter, with two enlargement pieces with 2 l. of capacity at the ends, packed with 9 mm glass Raschig rings; in this column the extraction process is carried out. Jacketed glass packed column of 500 mm of longitude and 25 mm of internal diameter, packed with 3 mm glass Raschig rings; this column is used to the distillation process. Coolant column and elbow. Boiler with 5 l of capacity for the distillation, heated by an adjustable electric heating mantle, with control of the temperature. 5 Pyrex tanks with 10 l. of capacity for the feeding, the refined, the solvent, the extract and the solute. 2 Dosing pumps (computer controlled). Security devices in the pumps. Flow meters to measure of feeding and solvent. 5 Force sensors to measure the mass in the five tanks (feeding, refined, solvent, extract and solute). On this way the level can be calculated. 2 Temperature sensors to measure the temperature in the column head and control of boiler temperature. 2 Pressure switches. 7 Sample takings, distributed between all the circuits of the unit.

② UELLC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, other electronic in the control interface and, the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ UELLC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)=Unit: 1400 x 700 x 1800 mm. Weight: 90 Kg. Control Interface: 490 x 330 x 310 mm Weight: 10 Kg.

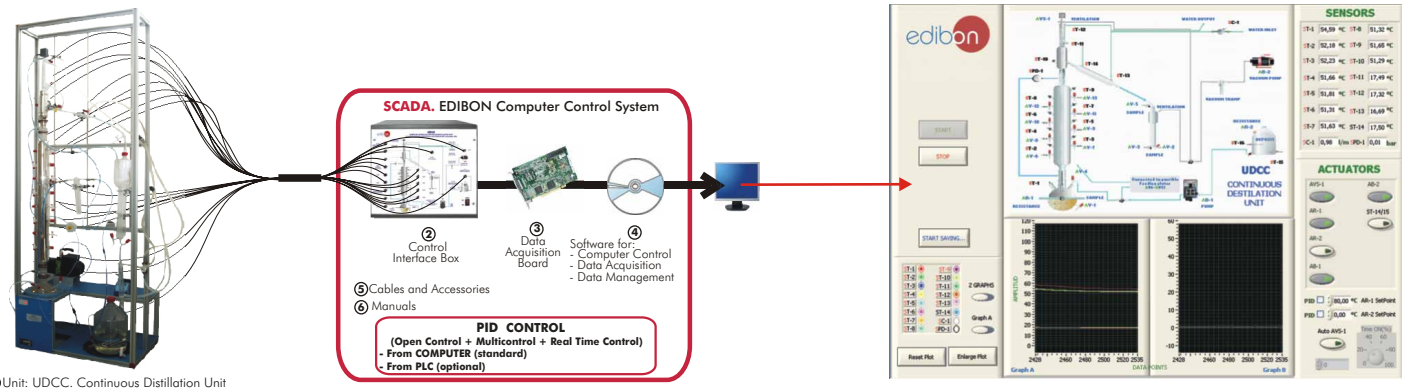
More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringbasic/UELLC.pdf

PRACTICAL POSSIBILITIES

1.- Performance in continuous or discontinuous.
2.- Acid-bases valuation.
3.- Obtaining of the binodal curve.
4.- Material balances.
5.- Flooding velocity calculation of the column.
6.- Height interphase regulation.
7.- Determination of the critical point existence.
8.- Volumetric coefficient of material transfer.
9.- Work in discontinuous regarding the solvent.
10.- Work in discontinuous regarding the supply.
11.- Study of the extraction process for industrial processes.
12.- Analysis of the hydrodynamic liquid-liquid system.
13.- Effect of the temperature in the liquid-liquid extraction process.
14.- Studies of efficiency of the extraction.
15.- Solvent recovery effectiveness calculation.
16.- Distillation process control study.
17.- Use of other combinations.
Other possible practices:
18.- Calibration of the pumps.
19.- Sensors calibration.
20-38.- Practices with PLC.

✱ Non computer controlled version available too.

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



①Unit: UDCC. Continuous Distillation Unit

SPECIFICATIONS SUMMARY

Items supplied as standard

①UDCC. Unit:

EDIBON's distillation unit (UDCC) 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 optima operation point to carry out a big quantity of separations.

Anodized aluminium structure and panels in painted steel.

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

Sieve Plates Column with 8 plates with temperature taking (sensor) and sample in every plate. 50 mm. internal diameter and 1000 mm. length. Vacuumed, silver-plated and double transparent band for vision.

It allows continuous operation and batch operation.

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

Column head with a valve for the steam distribution.

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

2 l. Distillation collector of graduated glass.

Liebig-West coolant.

Feeding system in continuous with preheating (heating resistance, computer controlled) at the specified temperature and a pump (computer controlled).

Feed vessel, 10 l. capacity.

Adjustable vacuum pump (computer controlled).

Temperature measurement system.

Sensors:

15 temperature sensors. Flow sensor. Differential pressure sensor.

Solenoid valve, computer controlled.

The computer control system acts directly on:

The temperature of the heating resistances.

The feeding temperature.

The solenoid valve (reflux ratio).

The vacuum pump.

The feeding pump.

Optional Columns (available other 5 different columns):

- CAR1. Raschig Rings Column.
- C8P1. 8 Plates Type Column (1 Temperature point).
- C10P10. 10 Plates Type Column (10 Temperature points).
- C14P14. 14 Plates Type Column (14 Temperature points).
- C20P20. 20 Plates Type Column (20 Temperature points).

②UDCC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process.

Calibration of all sensors involved in the process. Real time curves representation.

All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences.

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

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

3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data.

Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤Cables and Accessories, for normal operation.

⑥Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 900 x 600 x 2600 mm. Weight: 200 Kg. Control Interface: 490 x 450 x 470 mm. Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringbasic/UDCC.pdf

PRACTICAL POSSIBILITIES

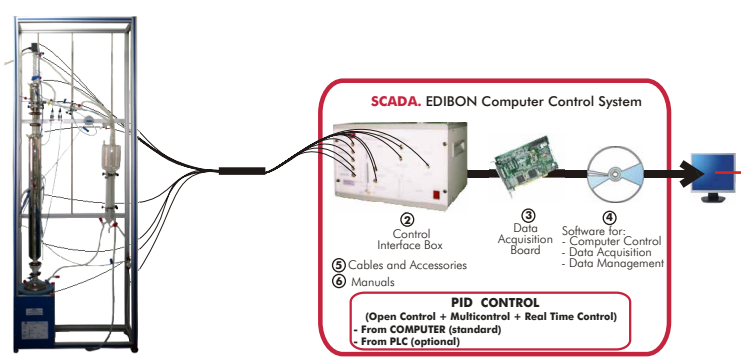
1.- Preparation of solutions.
2.- Analytic valuation techniques.
3.- Filling of the column.
4.- Batch operation. Continuous operation.
5.- Obtaining the McCabe-Thiele diagram. Without reflux.
6.- Obtaining the number of plates. Without reflux.
7.- Efficiency calculations. Without reflux.
8.- Variation 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.- Continuos feeding of the column.
12.- Mass and energy balances across the system.
13.- Plates fluid dynamics studies, including load loss and column flooding.
14.- Study of the feed temperature effect on the continuos processes.
15.- 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.
16.- Pursuit of the temperatures in all plates in the column (Plates columns).
17.- Study of the rectification efficiency at different pressures.
18.- Effect of feed pre-heat.
19.- Effect of feed position.
20.- Demonstration of azeotropic distillation.
21.- Work different heating contribution with regulation by the computer.
22.- Studies of heating interchange in glass refrigerators.

Other possible practices:

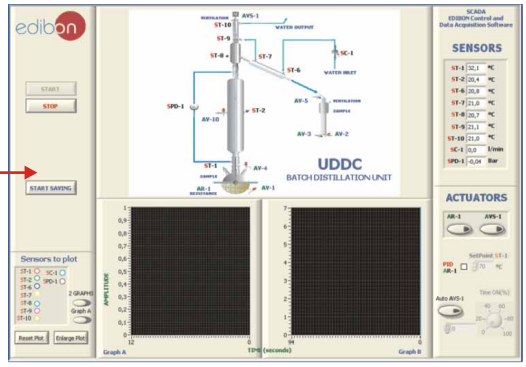
23.- Dosing pump calibration.
24.- Temperature sensors calibration.
25.- Flow sensor calibration.
26.- Pressure sensor calibration.
27.- Study of PID controls.
28-47.- Practices with PLC.

✱ Non computer controlled version available too.

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



① Unit: UDDC. Batch Distillation Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① UDDC. Unit:

Anodized aluminium structure and panels in painted steel.

Diagram in the front panel with similar distribution to 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.

Column head 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.

Sensors:

7 Temperature sensors. 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) and the solenoid valve (reflux ratio).

Optional Columns: (available other 5 different 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).

② UDDC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process.

Calibration of all sensors involved in the process. Real time curves representation.

All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences.

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

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

3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data.

Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 900 x 500 x 2800 mm. Weight: 170 Kg. Control Interface: 490 x 330 x 310 mm Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringbasic/UDDC.pdf

PRACTICAL POSSIBILITIES

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.

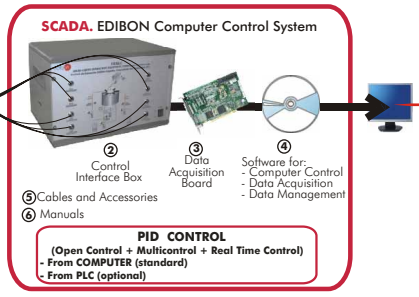
20.- Flow sensor calibration.

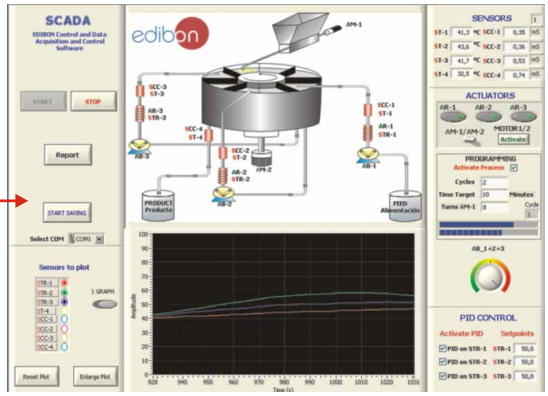
21.- Pressure sensor calibration.

22-40.- Practices with PLC.

✱ Non computer controlled version available too.

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





① Unit: UESLC. Solid-Liquid Extraction Unit

SPECIFICATIONS SUMMARY

Items supplied as standard

① UESLC. Unit:
The "UESLC" is a 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.
Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit. Feed liquid vessel. Product liquid vessel. 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. 3 Decanting filters. 4 Conductivity sensors. 4 Temperature sensors. 3 Heating resistances, computer controlled. 3 Safety thermostats. 3 Peristaltic pumps, computer controlled. Circulation valves.

② UESLC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ UESLC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

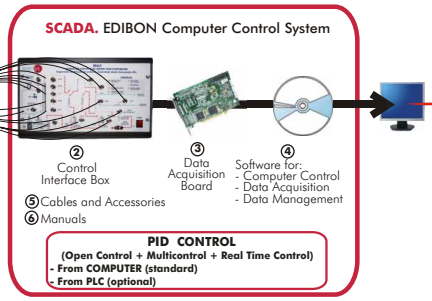
Dimensions (approx.)= Unit: 705 x 570 x 1680 mm. Weight : 120 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

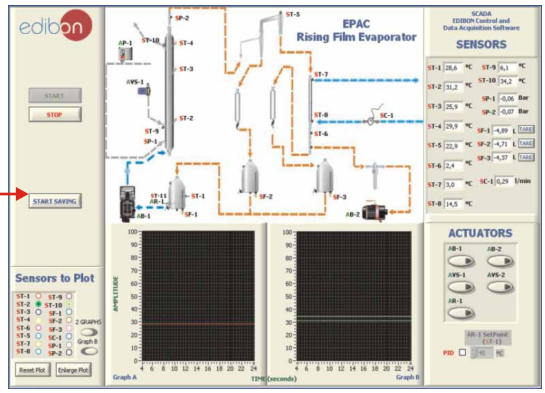
More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringgeneral/UESLC.pdf

PRACTICAL POSSIBILITIES

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.
16-34.- Practices with PLC.

EPAC. Computer Controlled **Rising Film Evaporator**∗





①Unit: EPAC. Rising Film Evaporator

SPECIFICATIONS SUMMARY

Items supplied as standard

① EPAC. Unit:
Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit. Evaporation double jacket column, with a heating surface of 0.122m^3, 30mm of internal dia., 60 mm of external dia. and 1300 mm of length. Membrane dosing pump, computer controlled, with flow control. Single effect vacuum pump, computer controlled. 3 Tanks(10 l) (for feeding, concentrated and evaporated). 2 Graduated vessels (500 ml) for the storage of concentrated and evaporated product. Coil coolant with length of 400 mm. Heating resistance, computer controlled. High safety pressure cut out. Sensors: 10 of temperature, 1 of flow, 3 of force (level) and 2 of pressure. Solenoid valve, computer controlled.
Optional accessory: (not included in the standard supply)
EPDC. Computer Controlled Falling Film Evaporator (for adding to EPAC).

② EPAC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EPAC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 1000 x 805 x 2300 mm. Weight: 115 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

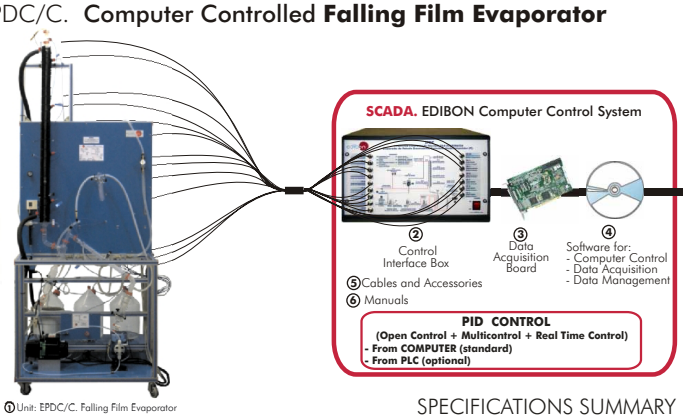
More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringgeneral/EPAC.pdf

PRACTICAL POSSIBILITIES

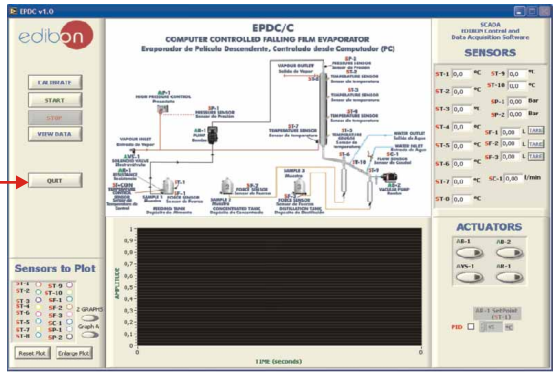
1.- Evaporation velocity calculation.
2.- Study of evaporation velocity in function of the working conditions.
3.- Study of the relation between the condensed product and the evaporated product.
4.- Study of the mass balance for the solute.
5.- Study of the mass balance for the water.
6.- Energy balance in the evaporation unit.
7.- Energy balance in the tubular refrigerator.
8.- Determination of the global heat transfer coefficient.
9.- Determination of the C_i coefficient for a tubular refrigerator.
10.- Investigation of effect of varying process parameters such as: vacuum, flow rate, temperature, recycle rate.
11.- Heat transfer measurements and calculation.
12.- Heating efficiency determination.
13.- Efficiency determination of the steam used in the process.
14.- Steam generator efficiency determination.
Other possible practices:
15.- Temperature sensors calibration.
16.- Force sensors calibration.
17.- Pressure sensors calibration.
18.- Feed pump calibration.
19-37.- Practices with PLC.

∗ Non computer controlled version available too.

EPDC/C. Computer Controlled **Falling Film Evaporator**



①Unit: EPDC/C. Falling Film Evaporator



SPECIFICATIONS SUMMARY

Items supplied as standard

① EPDC/C. Unit:
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit. Evaporation double jacket column, with a heating surface of 0.122 m^3, 30 mm. of internal diameter, 60 mm. of external diameter and 1300 mm. of length. Membrane dosing pump, computer controlled. Single effect vacuum pump, computer controlled. Three 10 l. tanks (for feeding, concentrated and evaporated). Two 500 ml. graduated vessels for the storage of concentrated and evaporated product. Liebing West condenser. Heating resistance, computer controlled, range: 300W. Automatic temperature control. High safety pressure cut out for pressure control in the column. Sensors: 10 temperature sensors, 1 flow sensor, 3 force sensors, 2 pressure sensors. Solenoid valve, computer controlled.

② EPDC/C/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EPDC/C/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 1000 x 805 x 2500 mm. Weight :115 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringgeneral/EPDC-C.pdf

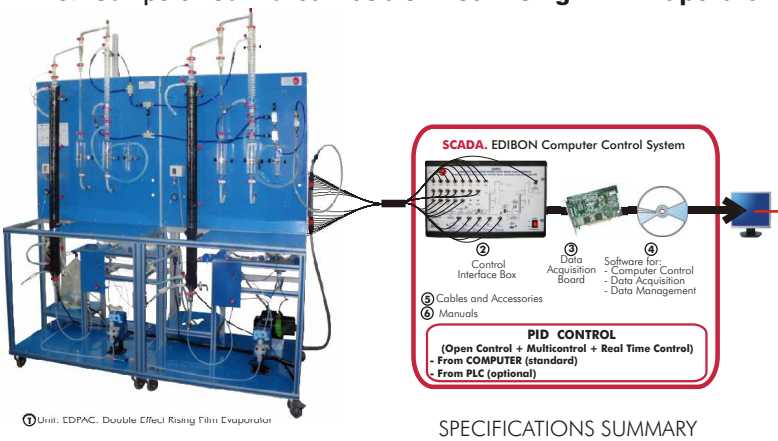
PRACTICAL POSSIBILITIES

1.- Determination of the capacity of the evaporator.
2.- Study of the capacity of the evaporator in function of the work conditions.
3.- Study of the relation between condensed and evaporated product.
4.- Verification of the global mass balance of the system.
5.- Study of the mass balance for the solute.
6.- Verification of the mass balance for the water.
7.- Determination of the concentration of a sugar solution.
8.- Calculation of the enthalpy of the volatile vapours.
9.- Calculation of the mass of steam used by means of an energy balance calculation.
10.- Determination of the economy of the evaporator.
11.- Determination of the efficiency of the steam generator.
12.- Investigation of the effects of varying the process parameters such as: vacuum, flow rate, temperature, etc.
13.- Concentration of fruit juices and vegetable extracts.
14.- Obtaining concentrated milk.

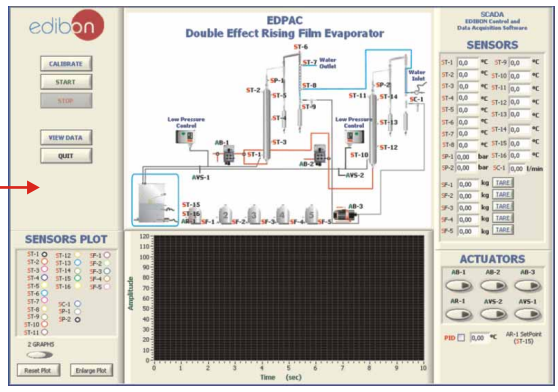
Other possible practices:

15.- Temperature sensors calibration.
16.- Force sensors calibration.
17.- Pressure sensors calibration.
18.- Feeding pump calibration.
19-37.- Practices with PLC.

EDPAC. Computer Controlled **Double Effect Rising Film Evaporator** ✱



①Unit: EDPAC. Double Effect Rising Film Evaporator



SPECIFICATIONS SUMMARY

Items supplied as standard

① EDPAC. Unit:
Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit.
2 Evaporation double jacket columns with a heating area of 0.122 m^2, 30 mm inner dia., 60 mm outer dia. and length of 1300 mm. 2 Membrane dosing pumps, computer controlled. Simple effect vacuum pump, computer controlled. Five 10 litre tanks (feed, concentrated and evaporated). Four 500 ml graduated vessel for collecting concentrated and evaporated product. 2 Coil coolants with length of 400 mm. 2 High safety pressure cut out for pressure control in the columns. Sensors: 16 of temperature, 1 of flow, 2 of pressure and 5 of force (level). 300 W immersion heating resistance, computer controlled. Solenoid valves, computer controlled.
The unit allows to work with several configurations:
a) Columns receive steam from the generator in an independent way.
b) Steam from the first column´s jacket can be used to heat the second column.
OPTIONAL Accessory: (not included in the standard supply)
-EDPDC. Computer Controlled Double Effect Falling Film Evaporator (for adding to EDPAC).

② EDPAC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EDPAC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 2300 x 1000 x 2300 mm. Weight :200 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringgeneral/EDPAC.pdf

✱ Non computer controlled version available too.

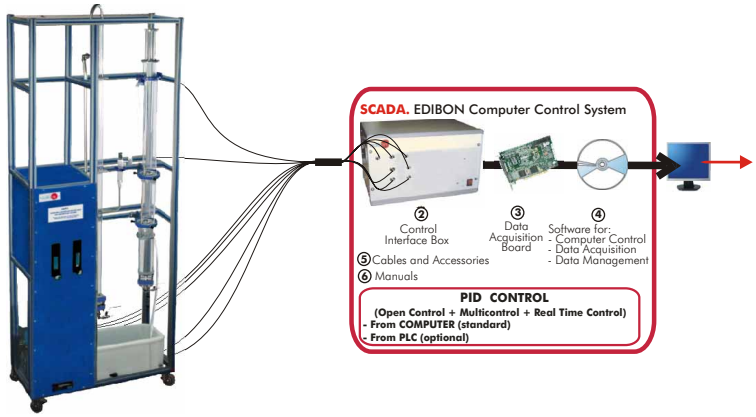
PRACTICAL POSSIBILITIES

1.- Heating efficiency calculation.
2.- Sugared solution concentration.
3.- Evaporation velocity determination.
4.- Study of the evaporation velocity in function of the working conditions.
5.- Study of the relation between condensed and evaporated product.
6.- Study of the mass balance for the solute.
7.- Study of the mass balance for the solvent.
8.- Energy balance in the evaporation unit.
9.- Energy balance in the tubular refrigerator.
10.- Heat transfer global coefficient determination.
11.- Coefficient determination for a tubular refrigerator.
12.- Study of the mass balance for the solute in one column.
13.- Fruit juices and vegetable extracts concentration.
14.- Concentrated milk obtaining.
15.- Efficiency determination of the steam used in the process.
16.- Steam generator efficiency determination.
17.- Investigation of effect of varying process parameters such as: vacuum, flow rate, temperature, recycle rate.
18.- Heat transfer measurements and calculation.

Other possible practices:

19.- Temperature Sensors Calibration.
20.- Force Sensors Calibration.
21.- Pressure Sensors Calibration.
22.- Feed Pumps Calibration.
23-41.- Practices with PLC.

CAPC. Computer Controlled **Wetted Wall Gas Absorption Column**



① Unit: CAPC. Wetted Wall Gas Absorption Column

SPECIFICATIONS SUMMARY

Items supplied as standard

① CAPC. Unit:
Unit used for demonstration and determination of liquid film mass transfer coefficients. This unit examines absorption of oxygen from air into deoxygenated water.
Anodized aluminium structure. Diagram in the front panel. Wetted wall column of glass, with water inlet and outlet sections, height: 900 mm, internal dia.: 32 mm. Feed pump of the absorption column. Air flow sensor. Water flow sensor. Deoxygenating column of transparent acrylic material, height: 1570 mm, internal dia.: 25mm. Deoxygenerator feed pump. Oxygen meter and oxygen analysis probes (saturation, concentration, temperature). Air pump. Water tank, capacity 50 l. approx.

② CAPC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ CAPC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1000 x 500 x 2500 mm. Weight: 200 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringgeneral/CAPC.pdf

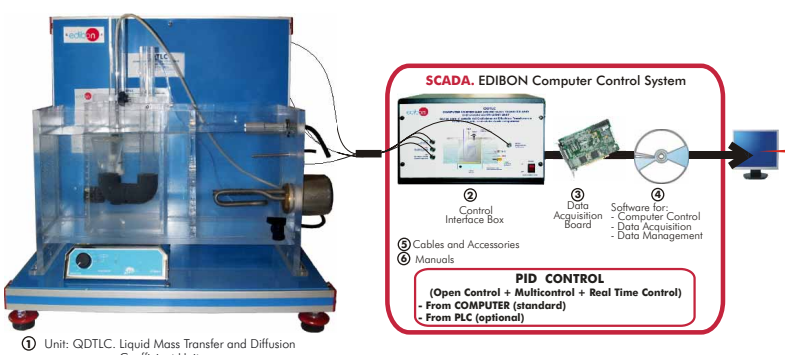
PRACTICAL POSSIBILITIES

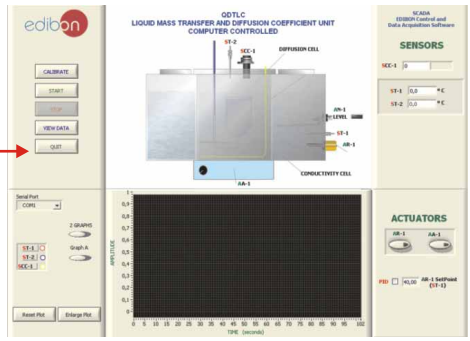
1.- Absorption process study.
2.- Calculation of liquid film mass transfer coefficients.
3.- Variation of coefficient with mass flow rate.
4.- Variation of oxygen flow rate to determine power law relationship.
5.- The system chosen for the experiment is the absorption of oxygen into free water. In this system the solubility and enthalpy of solution are small and by saturating the inlet air with water, humidification effects are eliminated. Thus it is possible to maintain reasonably the isothermal conditions throughout the column.
6.- These experiments allow a power law relationship to be calculated.
7.- Effect of water flow rate.
8.- Effect of oxygen flow rate.

Other possible practices:

9.- Sensors calibration.
10-28.- Practices with PLC.

QDTLC. Computer Controlled **Liquid Mass Transfer and Diffusion Coefficient Unit** ✱





① Unit: QDTLC. Liquid Mass Transfer and Diffusion Coefficient Unit

SPECIFICATIONS SUMMARY

Items supplied as standard

① QDTLC. Unit:
This unit allows to students to familiarise with the notions of mass transfer theory, specially about the diffusion in liquid systems, obtaining experimental data and results which are very useful for a correct practice understanding of the process and consequently, for the technical teaching of the students.
Transparent liquid tank (experimentation vessel), capacity: 2.5 litres.
Magnetic stirrer (computer controlled) (range: 0-300 r.p.m.) and magnet.
Conductivity cell and conductivity sensor. Temperature sensor. Diffusion cell.
Thermostatic bath, including: water bath, capacity: 8 litres; heating resistance (500 W), computer controlled; level switch; temperature sensor.

② QDTLC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. 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. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ QDTLC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 500 x 370 x 500 mm. Weight: 20 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringgeneral/QDTLC.pdf

PRACTICAL POSSIBILITIES

1.- Fick´s law application to calculate the diffusivity.
2.- Direct measurement of mass transfer rates.
3.- Determination of molar density rate.
4.- Effect of concentration of diffusion coefficients.
5.- Simple analysis of a first order unsteady state process.
6.- Concentration and conductivity relation.
7.- Study the effect of the temperature on diffusion coefficients.

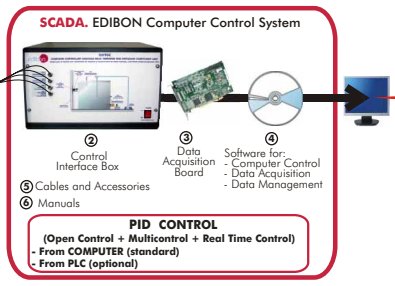
Other possible practices:

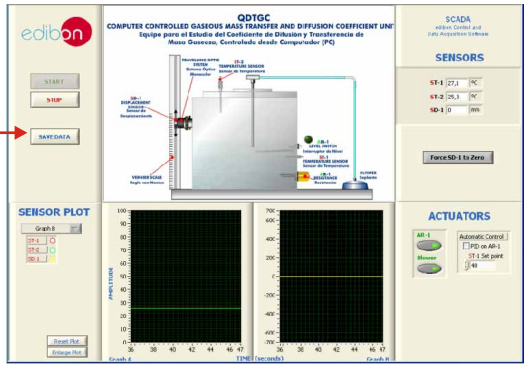
8.- Sensors calibration.
9-27.- Practices with PLC.

✱ Non computer controlled version available too.

QDTGC. Computer Controlled **Gaseous Mass Transfer and Diffusion Coefficient Unit** ✱

① Unit: QDTGC. Gaseous Mass Transfer and Diffusion Coefficient Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① QDTGC. Unit:
The QDTGC is a teaching unit that allows to students familiarise with the notions of mass transfer theory, specifically about the diffusion of a volatile liquid into an inert gas, obtaining experimental data and results which are very useful for a correct practice understanding of the process and, consequently, for the technical teaching of the students.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
A precision glass capillary tube (a narrow vertical tube with a known inside diameter). Air pump with air regulation, computer controlled (range: 1-7 l./min.). Travelling optic system with accurate focus adjustment and mounted for vertical axis movement. Distance measurement by displacement sensor.
A thermostatically controlled water transparent-sided Bath, capacity: 36 litres.
Heating resistance (500 W), computer controlled. 2 Temperature sensors. Level switch.

② QDTGC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. 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. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ QDTGC/CCSOF. PID Computer Control + Data Acquisition + Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 600 x 570 x 570 mm. Weight: 30 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringgeneral/QDTGC.pdf

PRACTICAL POSSIBILITIES

1.- Fick´s law application to calculate the diffusivity.

2.- Direct measurement of mass transfer rates.

3.- Determination of molar density transfer rate.

4.- Study of the effect of temperature on diffusion coefficients.

5.- Use of gas laws to calculate concentration differences in terms of partial pressures.

6.- Graphic representation of concentration profiles.

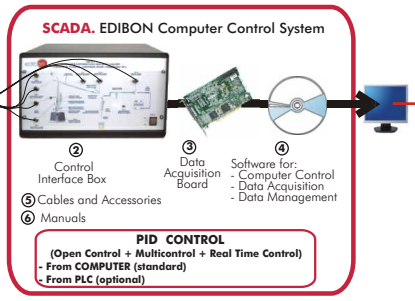
Other possible practices:

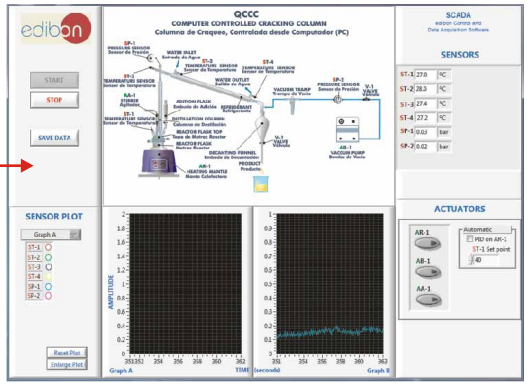
7.- Sensors calibration.

8-26.- Practices with PLC.

QCCC. Computer Controlled **Cracking Column**

① Unit: QCCC. Cracking Column





SPECIFICATIONS SUMMARY

Items supplied as standard

① QCCC. Unit:
The QCCC unit for cracking and distilling oil is a complete lab tool that allows to the students to carry out a cracking reaction, and the study and the control of different variables that condition it. Also, the production cycle will be completed by means of a separation, purification and analysis of the obtained products in that cracking reaction.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel.
Glass elements made of "Pyrex" of high thermal and mechanical resistance. 1 l. Reactor flask, with discharge key. Reactor´s cap, with 4 inlets. Distillation column. Stirring rod with stirring lock , that assures a perfect insulation of the system. Graduated filling funnel. Heating through electrical heating mantle, computer controlled. Maximum working temperature: 300 °C. Liebig-West condenser with interchangeable fittings. Decantation funnel, V=500ml. Vacuum pump, computer controlled. Vacuum trap. Pressure and temperature intakes placed in the main points of the system. 4 Temperature sensors. 2 Pressure sensors.

② QCCC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ QCCC/CCSOF. PID Computer Control + Data Acquisition + Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 1000 x 470 x 1070 mm. Weight: 75 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringgeneral/QCCC.pdf

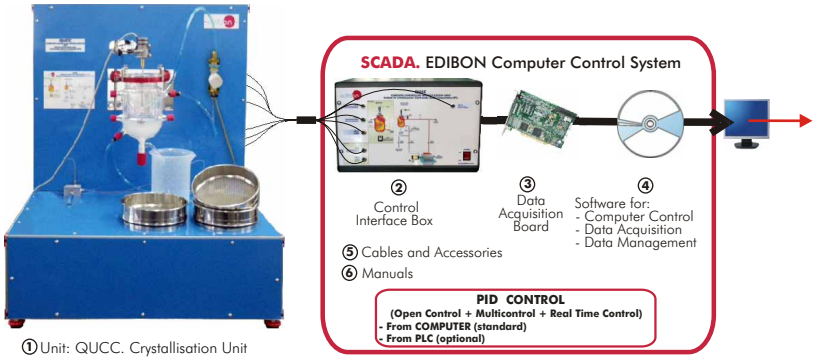
PRACTICAL POSSIBILITIES

1.- Carry out cracking reactions.
2.- Influence of the temperature in the Ricinoleic Acid cracking reaction (gradual increment of temperature).
3.- Influence of the temperature in the Ricinoleic Acid cracking reaction (sudden increment of temperature).
4.- Influence of the pressure in the Ricinoleic Acid pyrolysis reaction (working pressure too low).
5.- Influence of pressure in the Ricinoleic Acid pyrolysis reaction (low working pressure).
6.- Work with different heating gradients, regulated through the computer.
7.- Work with different pressures, regulated through the computer.
8.- Pitch as a catalyst.
9.- Simple distillation. Separation in its components of the product mixture of cracking.
10.- Heptanal purification.
11.- Undecylenic acid purification.
12.- Application of samples on TLC plates.
13.- Thin layer chromatography plates analysis.
14.- Study of several parameters that influence the analysis by thin layer chromatography.
15.- Other simple practices as calibration of instruments, preparation of samples, etc.

Other possible practices:
16.- Sensors calibration.
17.- Cleaning the system.
18.- Monogram of pressure.
19-37.- Practices with PLC.

✱ Non computer controlled version available too.

QUCC. Computer Controlled **Crystallisation Unit** ✱



① Unit: QUCC. Crystallisation Unit

SPECIFICATIONS SUMMARY

Items supplied as standard

① QUCC. Unit:
QUCC is an unit to demonstrate the solution cooling crystallisation. EDIBON has developed this unit to carry out the crystallisation reaction study of those components whose solubility changes with the temperature.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel. Crystallisator composed of jacketed reactor made in glass (1 litre of capacity), which includes temperature sensors and stirrer. Batch operation. Variable speed stirrer, computer controlled. The crystallisation reactor is thermally controlled by means of heated water circulating in the reactor jacket. PID control over the reactor temperature. Thermostatic bath of 600W, with feed water impulsion pump, computer controlled. Water flow sensor. 4 two way valves to allow the water circulation, according to the process. 3 Temperature sensors. Pressure regulation valve to protect the installation. Conductivity cell to measure the solution conductivity (conductivity sensor). 3 sieves of different light size: 0.5 mm/1 mm/2 mm. 2 litres vessel to collect the crystals.
Optional (NOT included in the supply):
- QUCC/C. Continuous Feed Unit.

② QUCC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ QUCC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1000 x 550 x 700 mm. Weight: 50 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringgeneral/QUCC.pdf

PRACTICAL POSSIBILITIES

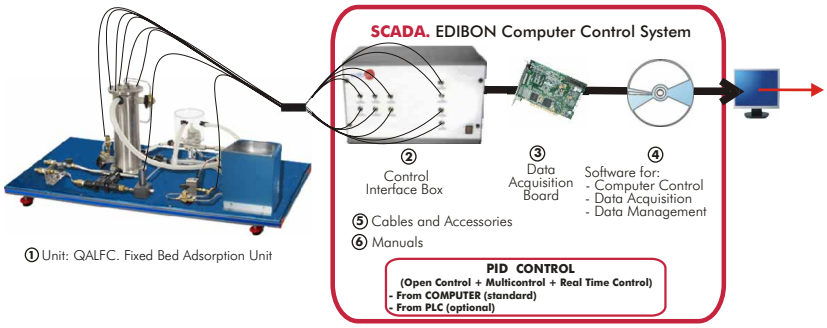
1.- Understanding the principles of solution cooling crystallisation.
2.- Study of crystall size distribution.
3.- Mass and energy balancing.
4.- Batch operation.
5.- Evaluation of crystallisation efficiency and crystallisation kinetics.
6.- Study of the effect of agitation rate.
7.- Study of the effect of cooling rate.
8.- Operation in continuous (optional, if the unit "QUCC/C" is acquired).

Other possible practices:

9.- Sensors calibration.

10-28.- Practices with PLC.

QALFC. Computer Controlled **Fixed Bed Adsorption Unit**



① Unit: QALFC. Fixed Bed Adsorption Unit

SPECIFICATIONS SUMMARY

Items supplied as standard

① QALFC. Unit:
QALFC Unit demonstrates the adsorption of a solute (carbon dioxide) from a binary gas mixture onto the surface of a solid adsorbent (activated carbon). It introduces users to the fundamentals of adsorption and desorption processing using a packed fixed bed adsorption column.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Packed fixed bed adsorption column, in which the adsorbent, activated carbon, is packed: stainless steel jacket for temperature control, bed of glass balls for good gas distribution and steady-state temperature maintenance, temperature sensors sited along the length of the column, gas distribution plate at inlet to the column.
A hot water circulation system, including a temperature sensor, is connected to the column jacket to enable temperature control by a PID temperature control. Valves for flow direction and flow rate control. Pressure relief valve for safety. Flow sensors for measurement of flow rate of both the carrier gas, helium and the adsorbate, carbon dioxide. IR detector for measuring CO_2 concentration. Gas feed flow rate can be controlled.

② QALFC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ QALFC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1000 x 600 x 700 mm. Weight: 50 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalengineeringgeneral/QALFC.pdf

PRACTICAL POSSIBILITIES

1.- Study of Adsorption/Desorption processes under different operational conditions such as: temperature, flow rates, pressure, molar fraction.
2.- Study of the Solute Movement Theory model which describes the adsorption-desorption process.
3.- Breakthrough curves of temperature profiles during the process.
4.- Analysis of the breakthrough curves of CO_2 during the adsorption and desorption/regeneration processes.
5.- Study of the quasi-isothermal regime at low concentrations and pressures. Study of effect of these variables.
6.- Study of the formation of the compressive and dispersive fronts in adsorption processes.
7.- Obtaining of the adsorption equilibrium isotherm of CO_2 from the desorption curve.

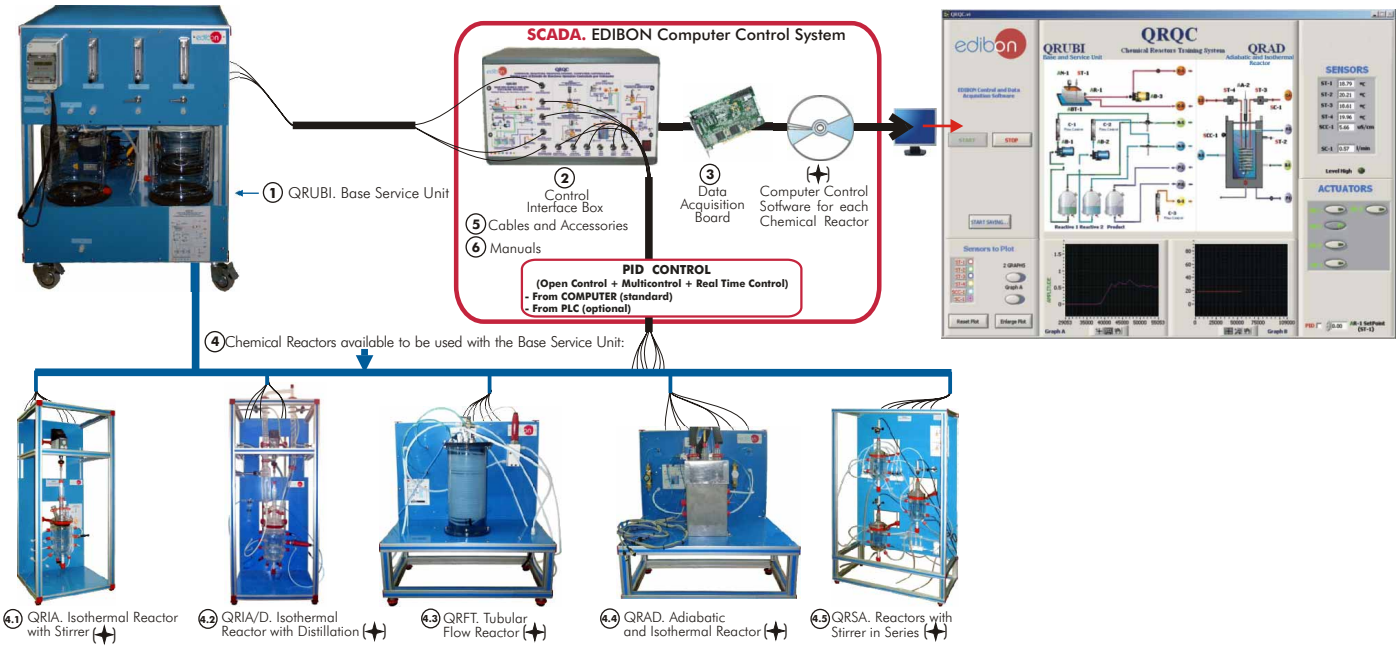
Other possible practices:

8.- Sensors calibration.

9-27.- Practices with PLC.

✱ Non computer controlled version available too.

QRQC. Computer Controlled **Chemical Reactors Training System:**



SPECIFICATIONS SUMMARY

Common items for Chemical Reactors type "QR":

① QRUBI. Base Service Unit:

This unit is common for Chemical Reactors and can work with one or several reactors. It supplies all the services for the operation of each reactor.

2 Dosing pumps. 3 Tanks of 10 l.: two for the reagents and the other for the products. 2 Flow meters for liquids, flow range: 0.7-7 and 0.54-5.4 l/h. Flow meter for gas, max. flow of 1440N l/h and max. pressure of 0.5Kg cm^{-2}. Thermostatic bath of 9 l. that regulates the temperature . Level switch. A pump, computer controlled, to impeller the water that comes from the thermostatic bath and goes to the reactor. Temperature sensor to get the temperature of the reactor in a continuos way. Temperature control thought the computer. Control system of the reaction. Conductivity cell and conductimeter, connected to the control interface.

Dimensions (approx.)= 1100 x 1000 x 980 mm. Weight: 100 Kg.

② QRQC/CIB. Control Interface Box :

This is common for Chemical Reactors and can work with one or several reactors. It has a process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: one mechanical in the unit, electronic in the control interface, and the third one in the control software.

Dimensions (approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ Chemical Reactors:

4.1 QRIA. Isothermal Reactor with Stirrer:

Anodized aluminium structure and panels in painted steel.

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

Reactor insulated made of Pyrex-glass, with a maximum volume of 2 litres.

Inlets of reagents. Outlet of products. Conductivity cell conecction. Water outlet. Water inlet.

Temperature sensor connection. Gas inlet. Gas outlet.

Agitation system with agitation speed control and indication from 0 to 2000 rpm.

Temperature sensor. Conductivity sensor.

Safety, easy and quick connections.

This unit is supplied with 8 manuals.

Computer Control + Data Acquisition + Data Management Software for Isothermal Reactor with Stirrer (QRIA):

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

Dimensions (approx.)= 750 x 500 x 700 mm. Weight: 50 Kg.

Continue...

PRACTICAL POSSIBILITIES

Practices to be done with the Isothermal Reactor with Stirrer (QRIA):

1.- Determination of the ionic conductivities.
2.- Discontinuous operation. Obtaining of the reaction order respect to ethyl-acetate. Initial velocity method.
3.- Discontinuous operation. Obtaining of the reaction order respect to sodium hydroxide. Initial velocity method.
4.- Discontinuous operation. Velocity Constant Computation. Constant sodium hydroxide initial concentration.
5.- Discontinuous Operation. Velocity Constant Computation. Constant ethyl-acetate initial concentration.
6.- Velocity equation formulation.
7.- Discontinuous Operation. Variation of the kinetic constant with temperature. Arrhenius Equation.
8.- Discontinuous Operation. Theoretical and experimental conversion comparative. Deviation from ideality.
9.- Discontinuous Operation. Mixture effects.
10.- Continuous Operation.
11.- Continuous Operation. Mixture effects.
12.- Measurement conductivity system: conductimeter.
13.- Calibration of the temperature sensors.
14.- Calibration of the conductivity cell.
15-33.- Practices with PLC.

Continue...

QRQC. Computer Controlled **Chemical Reactors Training System:**

SPECIFICATIONS SUMMARY

④ Chemical Reactors:

QRIA/D. Isothermal Reactor with Distillation:

Anodized aluminium structure and panels in painted steel.

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

Reactor insulated made of Pyrex-glass, with a maximum volume of 2 litres.

Inlets of reagents. Outlet of products. Conductivity cell connection. Water outlet. Water inlet.

Temperature sensor connection. Gas inlet. Gas outlet.

Agitation system with agitation speed control and indication from 0 to 2000 rpm.

Distillation column. Balls coolant. Coil coolant. Vacuum pump. Vacuum tramp. Graduated funnel.

Temperature sensors. Conductivity sensor.

Safety, easy and quick connections.

This unit is supplied with 8 manuals.

Computer Control + Data Acquisition + Data Management Software for Isothermal Reactor with Distillation (QRIA/D):

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

Dimensions (approx.)= 750 x 500 x 700 mm. Weight: 70 Kg.

QRFT. Tubular Flow Reactor:

Anodized aluminium structure and panels in painted steel.

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

Temperature controlled by a jacket of water, through a temperature sensor "J" type.

Electrical preheater with power of 265 W for both feeding lines.

Reactor with inner coil made of teflon of 6mm of interior diameter, length 14.5 m, volume: 0.393 litres.

Temperature sensor "J" type , that controls the preheating temperature.

Conductivity sensor.

Safety, easy and quick connections.

This unit is supplied with 8 manuals.

Computer Control + Data Acquisition + Data Management Software for Tubular Flow Reactor (QRFT):

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

Dimensions (approx.)= 700 x 500 x 500 mm. Weight: 75 Kg.

QRAD. Adiabatic and Isothermal Reactor:

Anodized aluminium structure and panels in painted steel.

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

Reactor insulated made of Pyrex-glass, with a maximum volume of 2 litres.

Nickel-plated cooper coil of 2500 mm long, outer diameter of 6.7 mm and inner one of 4.1 mm.

Stirrer.

Water flow control of 0-6 l/min.

Outer jacket made of anodised aluminium and inner jacket made of expanded polyurethane foam rubber.

3 Temperature sensors. Conductivity sensor.

Safety, easy and quick connections.

This unit is supplied with 8 manuals.

Computer Control + Data Acquisition + Data Management Software for Adiabatic and Isothermal Reactor (QRAD):

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

Dimensions (approx.)= 1000 x 600 x 400 mm. Weight: 100 Kg.

QRSA. Reactors with Stirrer in Series:

Anodized aluminium structure and panels in painted steel.

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

3 Reactors insulated made of Pyrex-glass, with a maximum volume of 1 litre each one.

Agitation system with agitation speed control and indication from 0 to 2000 rpm. , for each reactor.

3 Temperature sensors.

Conductivity sensors.

Safety, easy and quick connections.

This unit is supplied with 8 manuals.

Computer Control + Data Acquisition + Data Management Software for Reactors with Stirrer in Series (QRSA):

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

Dimensions (approx.) = 1000 x 1000 x 1000 mm. Weight: 100 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/reactors/QRQC.pdf

PRACTICAL POSSIBILITIES

Practices to be done with the Isothermal Reactor with Distillation (QRIA/D):

34.- Determination of the ionic conductivities.
35.- Discontinuous operation. Obtaining of the reaction order respect to ethyl-acetate. Initial velocity method.
36.- Discontinuous operation. Obtaining of the reaction order respect to sodium hydroxide. Initial velocity method.
37.- Discontinuous operation. Velocity Constant Computation. Constant sodium hydroxide initial concentration.
38.- Discontinuous Operation. Velocity Constant Computation. Constant ethyl-acetate initial concentration.
39.- Velocity equation formulation.
40.- Discontinuous Operation. Variation of the kinetic constant with temperature. Arrhenius Equation.
41.- Discontinuous Operation. Theoretical and experimental conversion comparative. Deviation from ideality.
42.- Discontinuous Operation. Mixture effects.
43.- Continuous Operation.
44.- Continuous Operation. Mixture effects.
45.- Measurement conductivity system: conductimeter.
46.- Study of the reactive distillation.
47.- Study of alcohols condensation.
48.- Study of the organic anhydrides.
49.- Synthesis of esters.
50.- Calibration of the temperature sensors.
51.- Calibration of the conductivity cell.
52-70.- Practices with PLC.

Practices to be done with the Tubular Flow Reactor (QRFT):

71.- Analysis of reagents and products.
72.- Ionic conductivities determination.
73.- Theoretical conversion of the tubular reactor.
74.- Experimental determination of the conversion of the tubular reactor.
75.- Dependence in the residence time.
76.- Determination of the reaction order.
77.- Dependence of the speed constant and the conversion with the temperature.
78.- Measurement conductivity system: conductimeter.
79.- Complete emptying of the unit.
80.- Calibration of the temperature sensors.
81-99.- Practices with PLC.

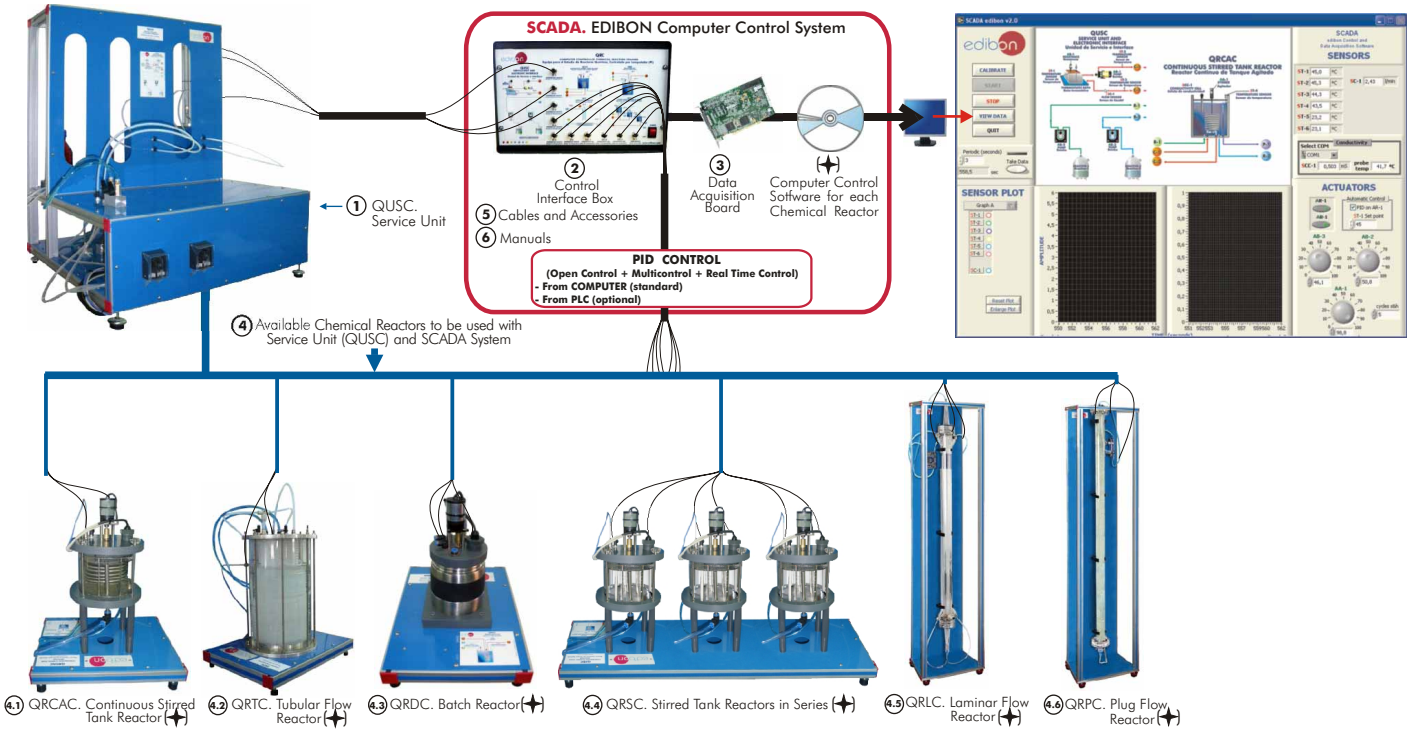
Practices to be done with the Adiabatic and Isothermal Reactor (QRAD):

100.- Determination of the ionic conductivities.
101.- Discontinuous work. Calculation of the order of the reaction referred to the ethyl-acetate. Initial velocity method.
102.- Discontinuous operation. Determination of the order of the reaction referred to the sodium hydroxide. Initial velocity method.
103.- Discontinuous operation. Determination of the speed constant, the initial concentration of the sodium hydroxide is constant.
104.- Discontinuous operation. Determination of the speed constant, the initial concentration of the ethyl acetate is constant.
105.- Formulation of the speed equation.
106.- Discontinuous operation. Variation of the kinetic constant when the temperature is not constant: Arrhenius equation.
107.- Discontinuous operation. Comparison of the theoretical and the experimental conversion: Deviation from the ideality.
108.- Calculation of the heat transference coefficient of the coil.
109.- Calculation of the hydrolysis reaction enthalpy.
110.- Discontinuous operation. Mixture effects.
111.- Continuous operation.
112.- Measurement conductivity system: conductimeter.
113.- Calibration of the temperature sensors.
114.- Calibration of the flow sensor.
115.- Calibration of the conductivity sensor.
116-134.- Practices with PLC.

Practices to be done with the Reactors with Stirrer in Series (QRSA):

135.- Determination of the ionic conductivities.
136.- Work with just one reactor in continuous.
137.- Work with just one reactor in continuous with mixture effects.
138.- Work with 3 reactors in continuous.
139.- Calibration of the temperature sensors.
140.- Calibration of the conductivity cell.
141-159.- Practices with PLC.

QRC. Computer Controlled **Chemical Reactors Trainer:**∗



SPECIFICATIONS SUMMARY

Common items for Chemical Reactors:

① QUSC. Service Unit:

This unit is common for the Chemical Reactors, and can work with one or several reactors.
Accommodation and exchange system of the reactors, quick and easy to handle.
It supplies all the services for the operation of each reactor.
Anodized aluminium structure and panels in painted steel.
Diagram in the front panel with similar distribution to the elements in the real unit.
2 Peristaltic dosing pumps, with variable speed, computer controlled. Flow rate up to 3 l./h. (unit standard disposition). With another disposition, they could reach a flow rate up to 10 l./h.
Thermostatic bath of 9 l. capacity, computer controlled. Temperature PID control of the thermostatic bath.
Pump of 3 l./min., with variable flow, to impel the thermostatization water from the bath to the reactor.
Flow sensor, range: 0-6 l./min.
2 Tanks for the reagents, of 1 liter capacity each one, made in Pyrex glass.
The control of the reaction is carried out by a conductivity sensor, which allows the reaction evolution parametrization in real time.
Three "J" type temperature sensors, one to know the thermostatic bath temperature in a continuous way and two sensors to know the water temperature at the thermostatic bath water inlet and outlet.
Dimensions (approx.): 800 x 800 x 1000 mm. Weight: 50 Kg.

② QRC/CIB. Control Interface Box :

This control interface is common for the Chemical Reactors and can work with one or several reactors. It has a process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: one mechanical in the unit, electronic in the control interface, and the third one in the control software.
Dimensions (approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ Chemical Reactors:

4.1 QRCAC. Continuous Stirred Tank Reactor:

Small scale Continuous Stirred Tank Reactor, computer controlled, designed to demonstrate the behavior of a reactor used for homogeneous reactions liquid-liquid.
Anodized aluminium structure and panels in painted steel.
Diagram in the front panel with similar distribution to the elements in the real unit.
Reactor body made in borosilicate glass, with a maximum capacity of 2 liters, specially designed to work in continuous. It also allows batch operation.
Adjustable volume from 0.4 to 1.5 l.
Stainless steel heat transfer coil and a baffle (removable).
Stirring system with speed control and indication, computer controlled.
Temperature sensor to control the temperature into the reactor.
Conductivity sensor to control the reaction.
Easy and quick assembly on the Service Unit.
This unit is supplied with 8 manuals.
Computer Control + Data Acquisition + Data Management Software for Continuous Stirred Tank Reactor (QRCAC):
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
Dimensions (approx.)= 330 x 330 x 500 mm. Weight: 10 Kg.

Continue...

PRACTICAL POSSIBILITIES

Practices to be done with the Continuous Stirred Tank Reactor (QRCAC):

1.- Determination of the ionic conductivities.
2.- Batch operation. Obtaining of the reaction order respect to ethyl-acetate. Initial velocity method.
3.- Batch operation. Obtaining of the reaction order respect to sodium hydroxide. Initial velocity method.
4.- Batch operation. Velocity Constant Computation. Constant sodium hydroxide initial concentration.
5.- Batch operation. Velocity Constant Computation. Constant ethyl-acetate initial concentration.
6.- Velocity equation formulation.
7.- Batch operation. Variation of the kinetic constant with temperature. Arrhenius Equation.
8.- Batch operation. Theoretical and experimental conversion comparative. Deviation from ideality.
9.- Batch operation. Mixture effects.
10.- Continuous operation.
11.- Continuous operation. Mixture effects.
12.- Measurement conductivity system: conductimeter.
13.- Variation of conversion with residence time.
14.- Residence time distribution.
15.- Determination of reaction rate constant.
16.- Calibration of the temperature sensors.
17.- Calibration of the conductivity sensor.
18-36.- Practices with PLC.

Continue...

∗ Non computer controlled version available too.

QRC. Computer Controlled **Chemical Reactors Trainer:**✱

SPECIFICATIONS SUMMARY

④ Chemical Reactors:

QRTC. Tubular Flow Reactor:

Reactor composed by a continuous tube where the reagents are introduced through the coil end and the products are obtained through the inverse end. Into it, a continuous reagent mix is produced, so the composition will be different at each point. This type of reactors are industrially used for homogeneous reactions liquid-liquid, generally in isothermal conditions.
With this small scale reactor, computer controlled, the behavior of this type of reactors used at industrial level can be observed.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Tubular flow reactor of volume 0.4 l. Coil shaped. Placed into an acrylic vessel through which the cooling or heating medium is circulated.
Electric pre-heater of 12 loops, and loop diameter of 70 mm approx., for the two reagents feed lines.
Temperature controlled by water jacketed. Temperature control by a temperature sensor.
Two temperature sensors to know the reagents outlet temperature from the pre-heater.
Conductivity sensor to control the reaction.
Easy and quick assembly on the Service Unit.
This unit is supplied with 8 manuals.
Computer Control + Data Acquisition + Data Management Software for Tubular Flow Reactor (QRTC):
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
Dimensions (approx.) = 330 x 350 x 500 mm. Weight: 15 Kg.

QRDC. Batch Reactor:

Small scale Bath Reactor, computer controlled, designed for the kinetic study of homogeneous reactions liquid-liquid, both in adiabatic conditions and in isothermal conditions.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
The reactor body is an isolated vessel with a stainless steel external casing. The working volume is 1liter.
Heat transfer coil made in stainless steel and reactor baffle, of 4.5 loops of 76 mm of diameter and 1250 mm length. The tube internal diameter is of 6 mm and the external one is of 8 mm.
Stirring system with speed control and indication, computer controlled.
Temperature sensor to control the temperature into the reactor. Conductivity sensor to control the reaction.
Easy and quick assembly on the Service Unit.
This unit is supplied with 8 manuals.
Computer Control + Data Acquisition + Data Management Software for Batch Reactor (QRDC):
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
Dimensions (approx.) = 330 x 330 x 500 mm. Weight: 10 Kg.

QRSC. Stirred Tank Reactors in Series:

The stirred tank reactors in series are used to increase the reagents conversion referred to an only reactor and so obtain product with higher purity.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
3 Continuous stirred tank reactors connected in series, computer controlled.
Reactors body made in borosilicate glass. Each reactor is fitted with a conductivity sensor.
Each one has a stirrer with variable speed, computer controlled.
The two reagent vessels and the two variable speed doging pumps (at the QUSC Service Unit) feed reagents into the first reactor in line.
A dead-time residence coil can also be attached to the exit of the last reactor in the series. Temperature sensors.
Easy and quick assembly on the Service Unit.
This unit is supplied with 8 manuals.
Computer Control + Data Acquisition + Data Management Software for Stirred Tank Reactors in Series (QRSC):
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
Dimensions (approx.) = 950 x 450 x 500 mm. Weight: 35 Kg.

QRLC. Laminar Flow Reactor:

Small scale Laminar Flow Reactor, computer controlled, designed to demonstrate the flow pattern characterisation and the steady state conversion in a tubular reactor.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit. Working volume: 400 ml. The reactor column is 1300 mm long approx., including 2 diffusers packed with glass balls. At the bottom of the column a premixer provides a complete mixing of the reagents entering the reactor and improves the flow distribution. The reactor refrigeration jacket keeps its contents at constant temperature to keep the laminar flow conditions. The reagents are fed to the reactor by the peristaltic dosing pumps of the Service Unit.
Temperature sensors. Conductivity sensor to control the reaction.
Easy and quick connection with the Service Unit.
This unit is supplied with 8 manuals.
Computer Control + Data Acquisition + Data Management Software for Laminar Flow Reactor (QRLC):
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
Dimensions (approx.) = 330 x 330 x 1490 mm. Weight: 25 Kg.

QRPC. Plug Flow Reactor:

Small scale Plug Flow Reactor, computer controlled, designed to demonstrate the flow pattern characterisation and the steady state conversion in a tubular reactor with axial dispersion. Working volume: 1 litre.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
The reactor column is 1100 mm long approx., packed with 3 mm diameter glass balls.
At the bottom of the column a premixer provides a complete mixing of the reagents entering the reactor and improves the flow distribution. The reagents are fed to the reactor by the 2 peristaltic pumps of the Service Unit. The unit uses a 6 ports injection valve which injects the reagent dose on the reagent carrier at the reactor tube inlet. Temperature sensors. Conductivity sensor to control the reaction. Easy and quick connection with the Service Unit.
This unit is supplied with 8 manuals.
Computer Control + Data Acquisition + Data Management Software for Plug Flow Reactor (QRPC):
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
Dimensions (approx.) = 330 x 330 x 1350 mm. Weight: 25 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/reactors/QRC.pdf

✱ Non computer controlled version available too.

PRACTICAL POSSIBILITIES

Practices to be done with the Tubular Flow Reactor (QRTC):

37.- Analysis of reagents and products.
38.- Ionic conductivities determination.
39.- Theoretical conversion of the tubular reactor.
40.- Experimental determination of the conversion of the tubular reactor.
41.- Dependence in the residence time.
42.- Determination of the reaction order.
43.- Dependence of the speed constant and the conversion with the temperature.
44.- Measurement conductivity system: conductimeter.
45.- Complete emptying of the unit.
46.- Determination of reaction rate constant.
47.- Calibration of the sensors.
48-66.- Practices with PLC.

Practices to be done with the Batch Reactor (QRDC):

67.- Determination of the ionic conductivities.
68.- Batch work. Calculation of the order of the reaction referred to the ethyl-acetate. Initial velocity method.
69.- Batch operation. Determination of the order of the reaction referred to the sodium hydroxide. Initial velocity method.
70.- Batch operation. Determination of the speed constant, the initial concentration of the sodium hydroxide is constant.
71.- Batch operation. Determination of the speed constant, the initial concentration of the ethyl acetate is constant.
72.- Formulation of the speed equation.
73.- Batch operation. Variation of the kinetic constant when the temperature is not constant: Arrhenius equation.
74.- Batch operation. Comparison of the theoretical and the experimental conversion: Deviation from the ideality.
75.- Calculation of the heat transference coefficient of the coil.
76.- Calculation of the hydrolysis reaction enthalpy.
77.- Batch operation. Mixture effects.
78.- Measurement conductivity system: conductimeter.
79.- Calibration of the temperature sensors.
80.- Calibration of the conductivity sensor.
81-99.- Practices with PLC.

Practices to be done with the Stirred Tank Reactors in Series (QRSC):

100.- Investigation of dynamic behaviour of stirred tank reactors in series.
101.- Determination of the ionic conductivities.
102.- Influence of flow rate.
103.- Work with just one reactor in continuous.
104.- Work with just one reactor in continuous with mixture effects.
105.- Work with 3 reactors in continuous.
106.- Effect of step input change.
107.- Response to an impulse change.
108.- Investigation of time constant using dead time coil.
109.- Calibration of the sensors.
110-128.- Practices with PLC.

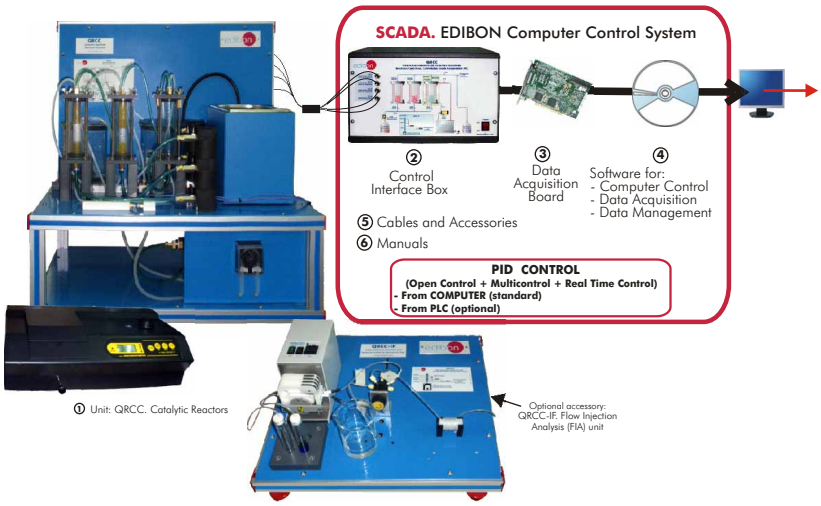
Practices to be done with the Laminar Flow Reactor (QRLC):

129.- Determination of the residence time distribution of the reactor.
130.- Effect of flow rate and feed concentration on the determination of flow pattern.
131.- Steady state conversion for a reaction with laminar flow.
132.- Effect of flow rate and feed concentration on the steady state conversion.
133.- Demonstration of the flow pattern in the reactor and comparison with the theoretical model.
134.- Effect of the temperature on the laminar flow characterisation.
135.- Determination of the steady state conversion of a second order reaction.
136.- Flow pattern characterisation in a laminar flow reactor.
137.- Measurement conductivity system: conductimeter.
138.- Calibration of the temperature sensors.
139.- Calibration of the conductivity sensor.
140-158.- Practices with PLC.

Practices to be done with the Plug Flow Reactor (QRPC):

159.- Determination of the residence time distribution of the reactor.
160.- Effect of flow rate and feed concentration on the determination of flow pattern.
161.- Study of the reactor response to different perturbations: step and pulse change.
162.- Effect of flow rate and feed concentration on the steady state conversion.
163.- Demonstration of the flow pattern in the reactor and comparison with the theoretical model.
164.- Determination of the steady state conversion of a second order reaction.
165.- Understanding the principles of tracer techniques in flow pattern characterisation.
166.- Measurement conductivity system: conductimeter.
167.- Calibration of the temperature sensors.
168.- Calibration of the conductivity sensor.
169-187.- Practices with PLC.

QRCC. Computer Controlled **Catalytic Reactors** ✱



SPECIFICATIONS SUMMARY

Items supplied as standard

① QRCC. Unit:

QRCC unit has been designed to perform the inversion reaction of saccharose, separating its components: glucose and fructose. In order to execute this process, the unit consists of tree fixed-bed reactors that contain different types of catalysts:

Two packed bed reactors for chemical catalysis, composed by acid ion exchange resins.

A biological reactor. (Recommend use with an immobilized enzyme).

Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

2 Glass flacks of 2 litres of capacity, for the initial solution and the final product.

Reactors:

Two packed bed reactors for chemical catalysis, composed by acid ion exchange resins.

An enzymatic packed bed reactor. (Recommended use with an immobilized enzyme).

Reactors diameter: 50 mm. Reactors height: 160 mm. Material: glass, with a methacrylate cover for protection.

Thermostatic bath, with heating resistance of 600W, controlled by a PID from the computer (PC).

A heated water supply to the reactors jackets allows the automatic control of reaction temperature to a set point value.

Peristaltic pump, with speed regulation, computer controlled, that allows to regulate the feed flow from 0 to 32 ml/min.

4 Temperature sensors.

Spectrophotometer, computer controlled, for the final product analysis and absorbance measures:

Wavelength range: 325-1000 nm. Band width: 5 nm. Electrical supply: 230V-50Hz.

All electrical circuits are protected by adequate protection devices.

Optional accessory (not included in the standard supply):

-QRCC-IF. Flow Injection Analysis (FIA) Unit.

② QRCC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 650 x 700 x 800 mm. Weight: 50 Kg.
Spectrophotometer: 470 x 380 x 140 mm. Weight: 10 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/reactors/QRCC.pdf

PRACTICAL POSSIBILITIES

1.- Study of the principles of packed bed catalytic reactors.

2.- Checking the influence on different variables (feed flow, temperature of reaction, reagents concentration) on the obtained final product.

3.- Studies of steady and unsteady state catalysis.

4.- Flow characterisation in a packed bed.

5.- Effect of the variation in the particle´s size in the effectiveness of a fixed-bed reactor.

6.- Mass balancing.

7.- Determination of steady state and unsteady state kinetics of a packed bed catalytic reactor.

8.- Effect of flow rate, temperature and feed concentration on steady state conversion.

9.- Performance comparison of a chemical catalyst (ionic exchange resins) with a biological catalyst (immobilized enzyme).

10.- Comparison of chemical and biological (enzymic) catalysis.

11.- Spectrophotometer calibration.

12.- Using the spectrophotometer and product analysis.

13.- Study of the FIA Flow Injection Analysis technique and principles (with QRCC-IF accessory).

14.- Examination of the reproducibility and sensitivity of the FIA analysis method as a function of the flow rate and sample concentration (with QRCC-IF accessory).

Other possible practices:

15.- Sensors calibration.

16-34.- Practices with PLC.

✱ Non computer controlled version available too.

EMLS. **Liquid/Solid Mixing Unit**

SPECIFICATIONS SUMMARY

The EMLS has been developed to demonstrate the factors affecting mixing using visualization and measurement techniques as appropriate.
This unit permits the study of the agitation process, in order to familiarize the student with the different magnitudes (torque, turning speed, etc) that takes part in the process.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Brake Dynamo Motor: It purpose is generate the turn at some predetermined revolutions of the agitator. Revolutions: from 0 to 3000 rpm.
Torque meter: Its objective is to measure the torque established between the motor and the dissolution Crowbar (load cell): 18.3 cm. Force range: 0 to 39.2 N.
Carry-agitators: It is the element that allows installing different type of agitators. Claws couple them, the diameter of the axis to be place being of 20 mm.
Vertical platform: It allows displacing the brake dynamo motor vertically.
Agitators: They are the elements in charge of the agitation of the fluid, and they can be of very different shapes and sizes:
2 Shovels, diameters: 100 mm. and 50 mm.
2 Turbines, diameters: 100 mm. and 50 mm.
2 Helix, diameters: 100 mm. and 50 mm.
Tanks: they are cylindrical and of transparent material, to facilitate the observation of the stage of agitation in the fluid. They have removable covers to avoid spills and splashes of the fluid:
2 Tanks of 300 mm diameter and 300 mm height, one with deflectors and other without deflectors.
2 Tanks of 150 mm diameter and 300 mm height, one with deflectors and other without deflectors.
The capacity of the tanks is approximately 21 and 5 litres.
The rotation speed of the turbine agitators oscillates between 1000-2500 rpm, and it is possible to obtain 3000 rpm.
The propeller agitators are used for mixing with a viscosity superior to 2000 cp.
Speed controller.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied 8 Manuals.
Dimensions (approx.) = 1940 x 700 x 910 mm. Weight: 95 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocess/EMLS.pdf

PRACTICAL POSSIBILITIES

1.- Visualization of fluid fields.
2.- Power required in the agitation process.
3.- Suspensions of solid in liquids.
4.- Formation of solutions solids liquids.
5.- Emulsion of unmiscible liquids.
6.- Mixing of miscible liquids.
7.- Heating process of liquid masses.
8.- Test with models at scale.
9.- Quality of mixing / mixing time.
10.- Power speed of the different impellers.
11.- Demonstration of the different factors (deposits, deflectors, agitators...) that affect the mixing, using visualization techniques and appropiate measurement.

EEC. **Corrosion Study Unit**

SPECIFICATIONS SUMMARY

The "EEC" unit allows the corrosion simultaneous study of up to 8 corrosion cells, each containing different test specimens.
Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit.
8 Glass cells. Each one consisting on: a 600 ml. vessel (Pyrex) with a cover. Such cover has four orifices: two to adapt the test sheets, one for the reference electrode and another one for the gases diffuser tube.
Number of cells selector. Simultaneous study of corrosion in several cells. Ag/AgCl reference electrode.
A group of test sheets (electrodes): It consists of 40 x 20 mm. sheets of variable thickness depending on the material, and on materials such as stainless steel, carbon steel, zinc, brass, copper, aluminum, graphite, and iron (nails). Connection cables with 4 mm terminals for the reference electrode (Ag/AgCl) and the test sheets.
Digital pH-meter. Air pump for agitation. Air pump switch.
Inert gas inlet. (If the customer wants to work in other kind of atmosphere).
Milliammeter. Millivoltmeter. Milliammeter/Millivoltmeter selector.
Two rotameters (flow meters): One for the air and another one for the gas. Flow rate: 1-7.5 l/min.
Power supply of direct current (D. C.) with 0-30V and 0-3A output, with intensity and voltage indicator.
Control valves for air and gas flow.
Manuals: This unit is supplied 8 Manuals.
Dimensions (approx.)= 1200 x 300 x 500 mm. Weight: 50 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocess/EEC.pdf

PRACTICAL POSSIBILITIES

1.- Galvanic potentials.
2.- Galvanic pairs study.
3.- Iron passivation.
4.- pH influence.
5.- Aluminium anodization.
6.- Cathodic protection.
7.- Galvanic corrosion + oxidation.
8.- Effect of dissolved oxygen concentration.
9.- Electrolytic corrosion.
10.- Chemical inhibition.
11.- Prevention of scaling.
12.- Effect of internal stress.
13.- Simultaneous study of corrosion in several cells.
Other possible practices:
14.- Water treatment studies:
-Calcium carbonate stabilization.
-Oxidation of iron and manganese in ground waters.
-Water softening by chemical precipitation.
-Disinfection of waste water with chlorine solutions.

ESED. **Sedimentation Study Unit**

SPECIFICATIONS SUMMARY

The sedimentation is a process widely used in the classification, water clarification and wastewater treatment.
"ESED" unit provides a facility for studying the basic physical processes involved in sedimentation, which the applications cover fields like chemical engineering, water treatment and other industrial processes.
Five sedimentation graduated cylinders of methacrylate (1m x 50mm approx.) mounted vertically on a panel, illuminated from behind, and with the possibility of being removable for cleaning.
Light diffuser screen and two fluorescent lamps.
Stopwatch.
Three beakers.
Specific gravity bottle.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 550 x 400 x 1300 mm. Weight: 35 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocess/ESED.pdf

PRACTICAL POSSIBILITIES

1.- Variation of the sedimentation characteristics with the concentration and suspension height.
2.- Effect of initial concentration on sedimentation characteristics.
3.- Effect of initial suspension height on sedimentation characteristics.
4.- Construction of settling rate curves against concentration form a single batch test.
5.- Effect of particle size distribution.
6.- Identification of the different sedimentation regimes.
7.- Use of flocculating additives.
8.- Construction of settling rate curves.
9.- Visualization of the retarded sedimentation.
10.- Study of the differences between a clarifier and a classifier.
11.- Study and visualization of the differential sedimentation.
12.- Study of the methods of sinking and floating.

QMS. **Solids Handling Study Unit**

SPECIFICATIONS SUMMARY

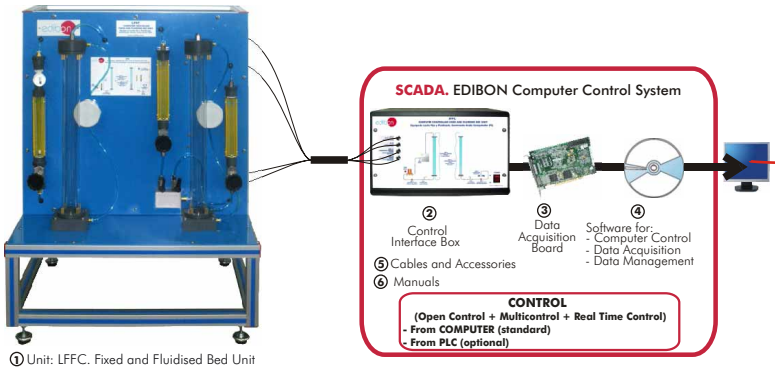
This unit is designed to introduce the students in different aspect of solids behaviour, unit operations as size reduction, mixing, transport, discharge, weighting, etc.
Bench with anodized aluminum structure, metallic panels, and with wheels for mobility. Diagram in the front panel with similar distribution to the elements in the real unit.
Ball mill with variable speed and various sizes of balls. Total volume: 5 l., capacity: 1.25 l.
Motor for the ball mill.
Vibratory shaker and a set of eight sieves with several hole mesh from 2 mm to 0.063 mm.
V-Blender, total volume: 1l.
Motor for the V-Blender, range: 18 rpm, (timer: 60 min.).
Blowing and ejector.
Compressor.
Glass cyclone (inlet diameter: 10 mm.), and pneumatic conveyor.
Transparent horizontal angle of repose rotary cylinder with protractor.
Cylindrical hoppers (capacity: 100 cc.) with different size of exit orifices.
Collecting tray. Balance. Graduated test tube.
Control panel.
Manuals: This unit is supplied 8 manuals.
Dimensions (approx.) = 1020 x 850 x 1700 mm. Weight: 200 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocess/QMS.pdf

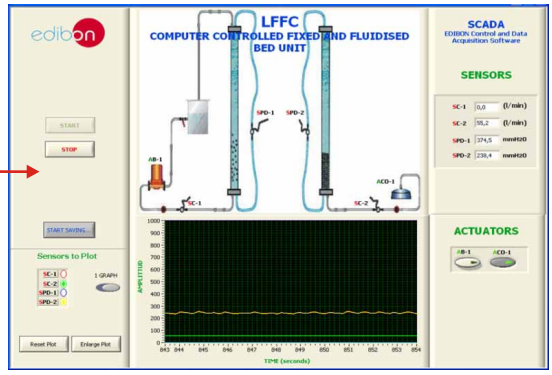
PRACTICAL POSSIBILITIES

1.- Sieving techniques.
2.- To determine the angle of repose.
3.- Study of size reduction.
4.- Classification study according to the size.
5.- To determine bulk solids parameters of density.
6.- To use the hopper to measure solids discharge rates and relate to initial load and hoper exit orifice size.
7.- Cyclone operation. Solids separation.
8.- Pneumatic conveying.
9.- To observe the comminution of granular solids processed through a ball mill.
10.- Study of solids mixing.
11.- Study of the solids properties.
12.- Solids weighing: Balance.
13.- Study of the apparent density.
Other possible practices:
14.- Mixer operation.
15.- Sieves operation.

LFFC. Computer Controlled **Fixed and Fluidised Bed Unit** ✱



① Unit: LFFC. Fixed and Fluidised Bed Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① LFFC. Unit:
Unit for the study of fixed and fluidised beds of solid particles. "LFFC" unit allows a full study about everything concerning the flow of a fluid through a bed, both packed and fluidised. The unit allows the simultaneous study of the water and air flow through the bed.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
2 Transparent cylindrical columns, one for air and one for water. Each column diameter: 50 mm and height: 550 mm, with bed plates.
Two sizes of bed material (glass pearls) are supplied, 170/300 and 250/420 micron ranges.
The columns are demountable in order to remove the particle bed.
Water tank of 10 l. capacity.
Water pump, computer controlled.
Compressor, computer controlled.
Water regulation valve and water flowmeter, range: 0-2 l./min.
Water flow sensor.
2 Air regulation valves and 2 air flowmeters, ranges: 4-22 l./min. and 1-8 l./min.
Air flow sensor.
2 Differential pressure sensors (one for water and other for air).

② LFFC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the PC keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ LFFC/CCSOF. Computer Control + Data Acquisition + Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 700 x 570 x 870 mm. Weight: 50 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocess/LFFC.pdf

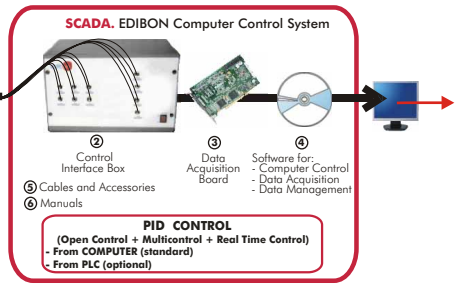
PRACTICAL POSSIBILITIES

1.- Verification of Carman-Kozeny's equation.
2.- Pressure drop through packed and fluidised beds, for air and water systems.
3.- Onset of fluidisation.
4.- Study of differences between particulate and aggregative fluidisation.
5.- Simultaneous study of air and water systems and observation of phenomenon of "bubbling".
6.- Study of the pressure drop in packed and fluidised cakes (Liquid: water and fine cake particle).
7.- Study of the pressure drop in packed and fluidised cakes (Liquid: water and thick cake particle).
8.- Study of the pressure drop in packed and fluidised cakes (Fluid: air and fine cake particle).
9.- Study of the pressure drop in packed and fluidised cakes (Fluid: air and thick cake particle).
Other possible practices:
10.- Sensors calibration.
11-29.- Practices with PLC.

✱ Non computer controlled version available too.

QEDC. Computer Controlled **Batch Solvent Extraction and Desolventising Unit**

①Unit: QEDC. Batch Solvent Extraction and Desolventising Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① QEDC. Unit:
Unit designed to allow instruction/teaching and research into the principle of solid-liquid extraction. It is capable of carrying out a variety of solid/liquid extractions (particularly suitable for edible oils from oil-bearing seeds) and desolventising both the extracted solids and the miscella. Batch process.
Diagram in the front panel with similar distribution to the elements in the real unit. Anodized aluminium and steel structure. Elements in contact with process material are constructed in stainless steel, borosilicate glass, etc.
Extractor vessel. (100 l. total volume which allows a solids working capacity of 25 kg.) Miscella vessel (30 l. volume). Waste water tank (15 l. volume). Solvent condenser. Solvent water separator tank (16 l. volume). Solvent pump (centrifugal type). Vacuum pump (diaphragm type). Temperature, Pressure and Flow sensors.
Flameproof electrical equipment is specified to be compatible with most common solvents.
Modes of operation: extraction by washing with clean solvent, extraction by recirculating miscella, desolventising extracted material and desolventising miscella.

② QEDC/CIB. Control Interface Box
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ QEDC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1800 x 1000 x 1800 mm. Weight: 750 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocess/QEDC.pdf

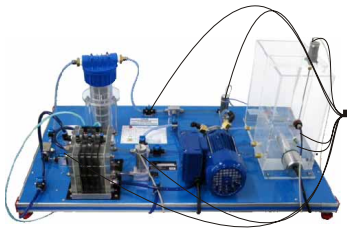
PRACTICAL POSSIBILITIES

1.- Effect of degree of pretreatment of solid material on extraction efficiency.
2.- Effect of extraction time.
3.- Effect of drain time.
4.- Study the effect of solvent type.
5.- Effect of solvent percolation rate.
6.- Effect of process temperature.
7.- Effect of process pressure.
8.- Method of solvent recovery.
9.- Degree of solvent recovery.
10.- Operation of small scale version of industrial processes.

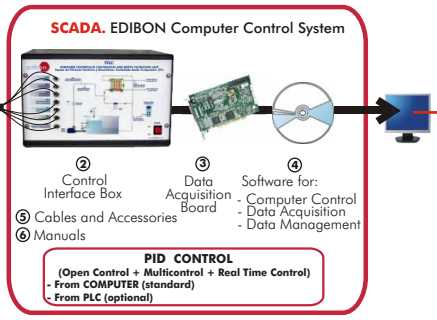
Other possible practices:

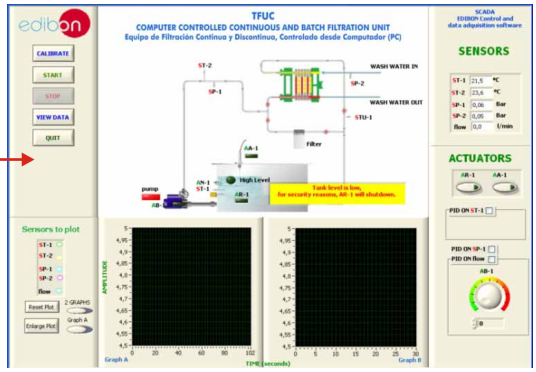
11.- Sensors calibration.
12- 30.- Practices with PLC.

TFUC. Computer Controlled **Continuous and Batch Filtration Unit** ✱



①Unit TFUC. Continuous and Batch Filtration Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① TFUC. Unit:
This filtration unit demonstrates the principles of continuous and batch filtration.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel.
Double tank (capacity: 9 litres), connecting to a centrifugal pump which feeds a slurry to one of the filters depending on the position of the valves. Centrifugal pump, computer controlled. A PID control enables constant flow rate. A PID control enables constant pressure operation by controlling the speed of the pump (from computer).
Heating resistance, computer controlled. Vertical plates filter, composed of 4 sheets of nylon, 5 microns diameter, allowing us to filter the $CaCO_3$ suspension of known concentration. Filter cartridge will filter and "clean" water with small pieces of paper sample. Stirrer, computer controlled.
Sensors: 2 Temperature sensors. 2 Pressure sensors. 1 Differential pressure sensor, for flow measurement.

② TFUC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ TFUC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 750 x 750 x 400 mm. Weight: 30 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocess/TFUC.pdf

PRACTICAL POSSIBILITIES

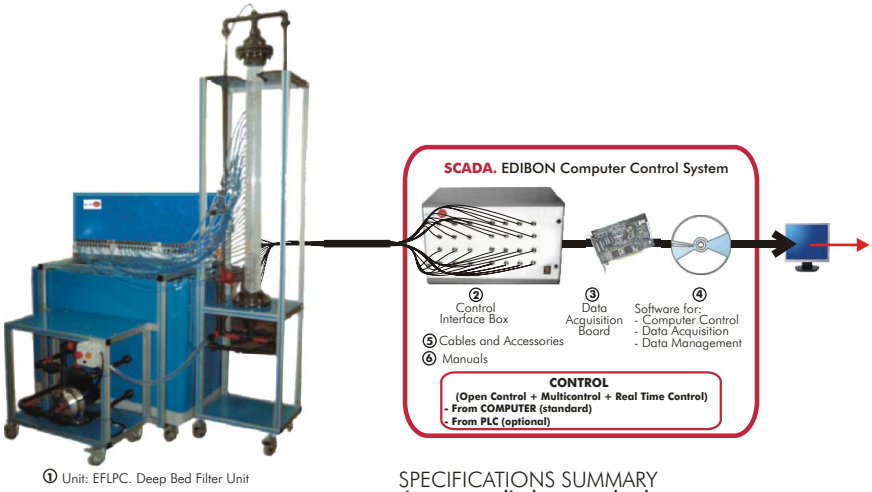
1.- Understanding the principles of continuous and batch filtration using both constant pressure and constant flow operating modes (vertical plates and cartridge filters).
2.- Study of the filter plate at a constant pressure.
3.- Study of the filter plate at a constant flow.
4.- Study of the filter cartridge at constant pressure.
5.- Study of the filter cartridge at constant flow.
6.- Demonstrating filtration through membrane technology.
7.- Mass balancing.
8.- Precoat and body aid filtration.
9.- Demonstration of precoat filtration.
10.- Optimisation of filtration performance using body aid.
11.- Demonstration of Darcy's Law.
12.- Effect of body aid on medium and cake resistances.
13.- Determination of medium and cake resistances.
14.- Filter cake washing and dewatering.
15.- Study of commercial aspects of filtration and optimisation of filtration operations.

Other possible practices:

16.- Sensors calibration.
17-35.- Practices with PLC.

✱ Non computer controlled version available too.

EFLPC. Computer Controlled **Deep Bed Filter Unit** ✱



① Unit: EFLPC. Deep Bed Filter Unit

SPECIFICATIONS SUMMARY

Items supplied as standard

① EFLPC. Unit:
The Deep Bed Filter Unit allows us to filter a fluid in order to eliminate particles in suspension, to have it in more adequate conditions for its subsequent use or consumption. Students can visualize and study with this unit one of the most common treatment processes of water destined to supplying cities and in most industrial uses.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Filter column:
In it the porous media is formed. This includes the following elements:
Transparent filter column of circular section (column height: 1300 mm), with removable top and bottom covers. Support filter of the porous bed. Filtering bed. 30 Pressure takings. 29 Sample capturing takings.
Tanks:
Their objective is to prepare the suspension for being filtered. There is a tank with two reservoirs:
Reservoir 1= 350 litres. Reservoir 2= 350 litres. Total capacity: 700 litres. Both reservoirs have water heigh level and system for agitation with help of the water return.
Pump: Centrifugal pump: 0.6 kW, 2850 r.p.m. In order to take the fluid to the upper part of the filter column (filtering operations), or the bottom part of the column (washing operation of the porous bed).
Pipes and valve system to stablish several circuits and regulate the flows.
Pressure sensors.
Flow sensor.
Mesh filter.
Air purger for eliminating bubbles which are initally in the circuit.

② EFLPC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EFLPC/CCSOF. Computer Control + Data Acquisition + Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)=Unit: 2400 x 1500 x 2700 mm. Weight: 250 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocess/EFLPC.pdf

PRACTICAL POSSIBILITIES

1.- Determination of the initial head loss of a porous bed.
2.- Evolution through time of the head loss of the porous bed.
3.- Measuring how fast total head loss increases with filtration run time.
4.- Measuring pressure drop profiles through the filter bed.
5.- Measuring suspension concentration profiles through the filter bed.
6.- Filtration efficiency. Clarification.
7.- Demonstration of reversed flow fluidisation and backwashing.
8.- Filtering in open and closed circuit.
9.- Washing and filtering circuits.
10.- The column may be readily adapted for absorption and ion exchange studies.

Other possible practices:

11.- Sensors calibration.
12-30.- Practices with PLC.

EII. **Ion Exchange Unit**

SPECIFICATIONS SUMMARY

Self-contained unit either single bed water softening or double bed system for demineralisation.

Anodized aluminium structure and panel in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Exchange capacity of the different materials, as resins and used reagents, as well as the problem water.

Use of simple or double bed for demineralisation.

4 tanks (treated water, demineralized water, hydrochloric acid and sodium hydroxide).

Pump diaphragm type.

Flow meter 5 l./h,resistant to hydrochloric acid.

2 transparent vertical columns for the anionic and cationic resins, volume: 0.16l. 1 spare column.

Valves and pipes circuit.

Conductivity meter (with conductivity cell): scale 0.0 to 19.99 μS.

Typical commercial anionic and cationic resins.

Switch board.

Manuals: This unit is supplied 8 Manuals.

Dimensions (approx.) = 1200 x 500 x 1000 mm. Weight: 50 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocess/EII.pdf

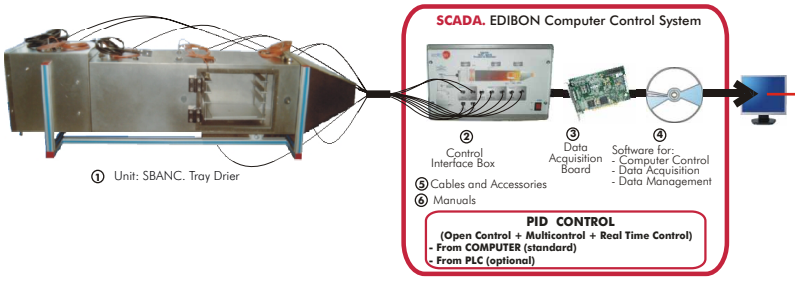
PRACTICAL POSSIBILITIES

1.- Study of general techniques of ion exchange.
2.- Familiarization with the operation modes of column ionic exchange.
3.- The exchange capabilities of different resins materials.
4.- Water softening using a cationic resin.
5.- Hard water softening (H^+).
6.- Hard water softening (OH^-).
7.- Resin regeneration efficiency (H^+).
8.- Demineralisation.
9.- Demineralisation efficiency.
10.- Determination of saline ions concentration.
11.- Separation of Ni^{2+}, Zn^{2+}.
12.- Hard water softening (sodic resin).
13.- Resin regeneration efficiency (Na^+).
14.- How to operate the conductivity meter.
15.- Regeneration efficiency of a softening system.
16.- Demineralisation using two-bed exchange.

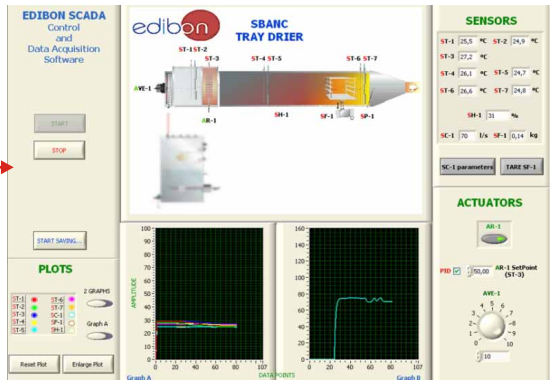
✱ Non computer controlled version available too.

11.5- Chemical Process (Agronomical Industry)

SBANC. Computer Controlled **Tray Drier**



① Unit: SBANC. Tray Drier



SPECIFICATIONS SUMMARY
Items supplied as standard

① SBANC. Unit:
This unit has been designed for studying fluid mechanics, surfaces chemistry, solid structures and substances and energy balances, related to the drying processes. Its size is specially appropriate for laboratories. This tray drier dries solids by passing a stream of hot air over trays of wet material.
Anodized aluminium and steel structure. Diagram in the front panel with similar distribution to the elements in the real unit.
Stainless steel rectangular conduct (1000 x 320 x 300 mm), which includes a support, a drying chamber with a door and a set of four bans, a square nozzle 300 mm long, whose side goes from 315 to 100 mm progressively. Shielded Propeller Fan, with speed control from computer (PC). Weighing system for following the changes in weight of the solid due the evaporation or vaporisation of moisture during operation. Load Cell-force sensor. 7 Temperature sensors: 2 temperature sensors of Dry and Wet Bulb before the electrical resistance, 1 temperature sensor in the electrical resistance, 2 temperature sensors of Dry and Wet Bulb after the electrical resistance, 2 temperature sensors of Dry and Wet Bulb after the drying chamber. Differential pressure sensor. Air flow sensor. Humidity sensor. Electrical heater (resistance 3 KW), computer controlled.

② SBANC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ SBANC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 2000 x 320 x 400 mm. Weight: 190 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/agronomicalindustry/SBANC.pdf

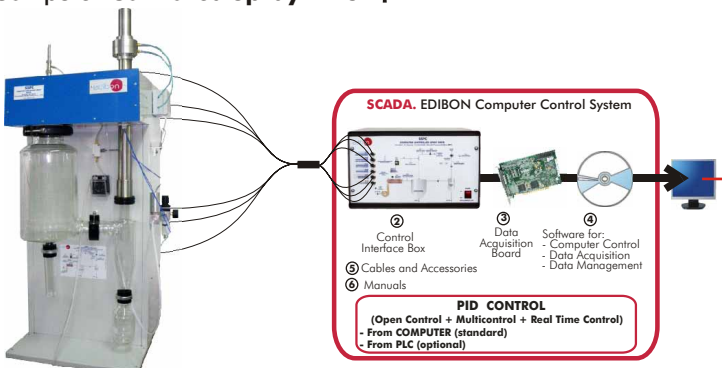
PRACTICAL POSSIBILITIES

1.- Demonstration of drying rate regimes.
2.- Determination of the efficiency of the warm-up resistance.
3.- Effect of the warm-up in an installation.
4.- Heat and mass transfer analogies.
5.- Obtaining of drying curves.
6.- Influence of the particle size.
7.- Influence of the air speed.
8.- Influence of the air temperature.
9.- Application of the psychometric in the drying.

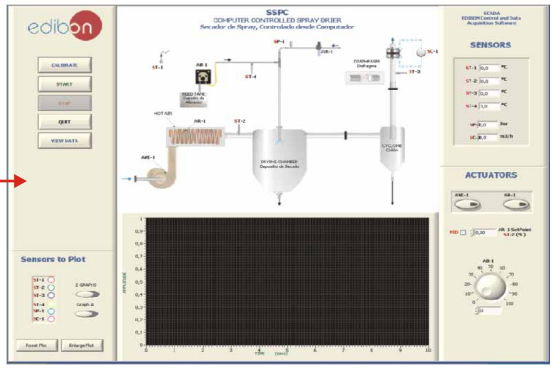
Other possible practices:

10.- Example of the determination of the properties of the air.
11.- Use of a psychometric map.
12.- Determination of the air flow.
13.- Dynamic simulation of the control systems.
14.- Sensors calibration.
15-33.- Practices with PLC.

SSPC. Computer Controlled **Spray Drier** ✱



① Unit: SSPC. Spray Drier



SPECIFICATIONS SUMMARY
Items supplied as standard

① SSPC. Unit:
Bench mounted spray drier for processing aqueous emulsions, solutions, suspensions and colloidal solutions.
Drier fully made with glass. Diagram in the front panel. Downward co-current operation. Glass main chamber. Glass separator cyclone. Sample collection glass bottle. Waste collection glass tube. Exhaust tube. Standard jet of 0.5 mm Ø, it incorporates a de-blocking device. Peristaltic pump, with variable speed, computer controlled. Heater of 3 kW, computer controlled. PID control over the air inlet temperature. Fan (3000 r.p.m.), computer controlled, drying air flow: 70 m^3/h. (fixed) approx.
4 Temperature sensors to measure: environmental temperature, air inlet temperature, exhaust vapour temperature, sampling temperature. 2 Humidity sensors. Flow sensor for exhaust vapour measurement. Pressure sensor for inlet compressed air.

② SSPC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ SSPC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 500 x 500 x 1500 mm. Weight: 80 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/agronomicalindustry/SSPC.pdf

PRACTICAL POSSIBILITIES

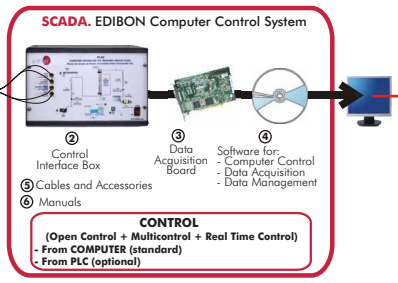
1.- Operation principle of a spray drier.
2.- Effect of the drop size on the drying process.
3.- Effect of the input temperature on the drying process.
4.- Effect of the feed flow of the product on the drying process.
5.- Mass balance of a spray drier.
6.- Energy balance of a spray drier.
7.- Spray drier efficiency.

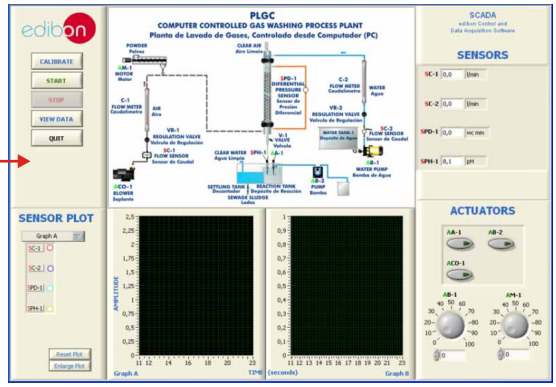
Other possible practices:

8.- Sensors calibration.
9-27.- Practices with PLC.

✱ Non computer controlled version available too.

PLGC. Computer Controlled **Gas Washing Processing Plant**





①Unit: PLGC. Gas Washing Processing Plant

SPECIFICATIONS SUMMARY

Items supplied as standard

① PLGC. Unit:

The Gas Washing Processing Plants are used to eliminate the presence of gases such as carbon dioxide or sulfur dioxide, among others. They also contribute to eliminate fogs or dusts for the environment. Besides, they have other applications such as the products recuperation from process gases, gases desorption and gases condensation and cooling.

PLGC unit, designed by EDIBON, allows to evaluate the operation of a gas washing plant, analyzing its efficiency.

Anodized aluminium structure and panels in painted steel. Diagram in the front panel.

Packed Column: formed by a glass cylindrical tube of 1200 mm. of length and an internal diameter of 100 mm. The column is filled with Raschig rings with a 8 mm. diameter.

Rectangular tank formed by the reaction system and the settler, with a methacrylate structure. Cylindrical feed water tank. Pump, computer controlled, to supply water to the column. Pump, computer controlled, to supply the flocculant to the reaction tank. Solids dosing system to introduce the powders in the air line. Compressor (blower), computer controlled. Stirrer, computer controlled, to mix the water going out the column with the flocculant. Valves to regulate the flow. Ball valve for extracting the sludges.

Sensors: flow sensor to determine the air flow, flow sensor to measure the water flow, two flowmeters, differential pressure sensor. pH sensor.

② PLGC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the PC keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 1500 x 600 x 2400 mm. Weight: 150 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocessspecial/PLGC.pdf

PRACTICAL POSSIBILITIES

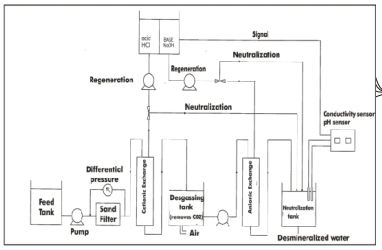
1.- Familiarization with a gas washing plant.
2.- Study of the water flow influence on the gas washing plant efficiency.
3.- Study of the air flow influence on the gas washing plant efficiency.
4.- Study of the introduced dust mass influence on the gas washing plant efficiency.
5.- Determination of the gas washing plant efficiency related to the quantity of solids introduced into the air current with the quantity of sedimented solids.
6.- Best quantity of floculant to produce the dust particles precipitation.
7.- Determination of the best pH for the solid particles sedimentation which go together with the water.
8.- Study of the best pH to obtain biggest purity in settled water.
9.- Study of the floculant presence influence on the pH variation in the reaction-settling tank.
10.- Pressure losses in the gas washing plant.

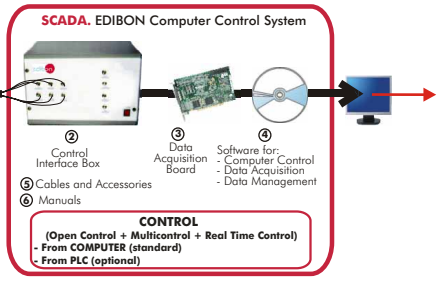
Other possible practices:

11.- Sensors calibration.

12-30- Practices with PLC.

PPDAC. Computer Controlled **Water Demineralization and Processing Plant**





①Unit: PPDAC. Water Demineralization and Processing Plant

SPECIFICATIONS SUMMARY

Items supplied as standard

① PPDAC. Unit:

Main metallic elements in stainless steel. Diagram in the front panel with similar distribution to the elements in the real unit. Basically formed by the following main elements: Feed tank. Feed tank pumping group, computer controlled. Mechanical filter for particles bigger than 30µ. Cationic resins exchanger. Water degasifier tank. Degasifier pumping group, computer controlled. Cationic exchanger. Anionic exchanger. Tank for acid. Tank for base.

Sensors: pH sensor, conductivity sensor, pressure sensors, flow sensors, temperature sensor.

② PPDAC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the PC keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

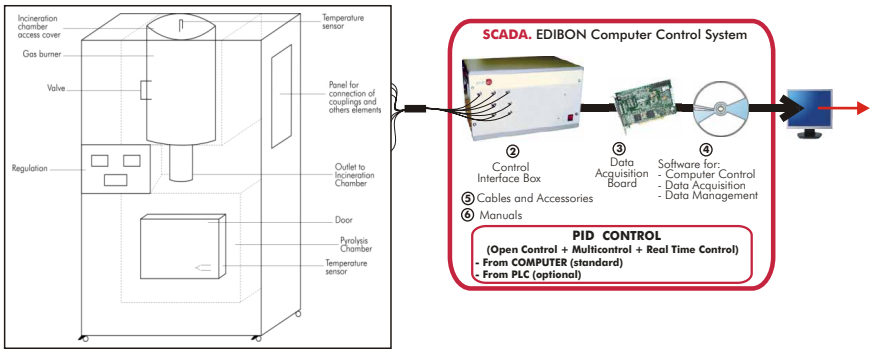
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocessspecial/PPDAC.pdf

EPIRC. Computer Controlled **Pyrolysis Unit**



SPECIFICATIONS SUMMARY

Items supplied as standard

① EPIRC. Unit:

For chemical separation of the elements of a compound through temperature and a tight chamber, heated by an electric resistance with temperature control.

Metallic structure and main metallic elements in stainless steel. Diagram in the front panel with similar distribution to the elements in the real unit.

It will be able to obtain with this unit: to obtain new products by chemical reaction, industrial and urban residues incineration, experiment in the elimination of toxic residues.

The unit includes a combustion chamber, which arrives gases produced in the pyrolysis chamber. This one has a temperature controller which operates the burner. Furnace safety has a pressure sensor.

The furnace has a gas automatic analyser at the gas line and there are sample points and gas input in both chambers.

This unit is supplied with the instrumentation and the suitable sensors for the control and measurement of the most representative parameters.

② EPIRC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

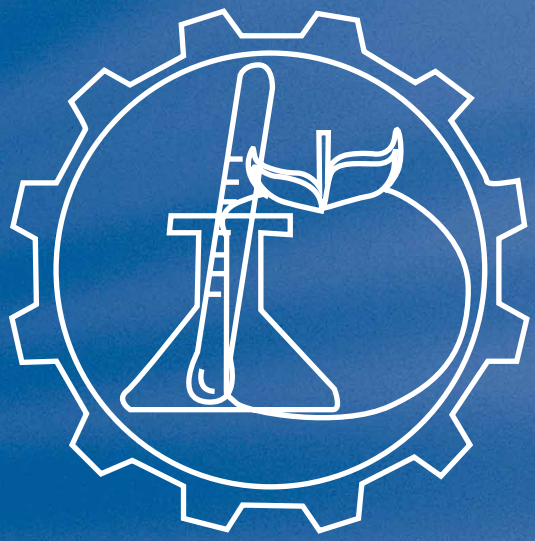
⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/chemicalengineering/chemicalprocessspecial/EPIRC.pdf

Summarized
Catalogue

five (5)



12. Food & Water Technologies

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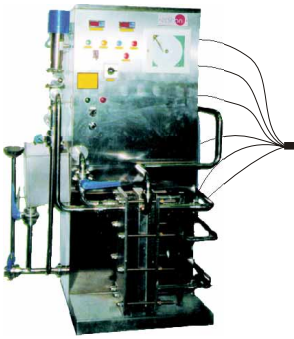
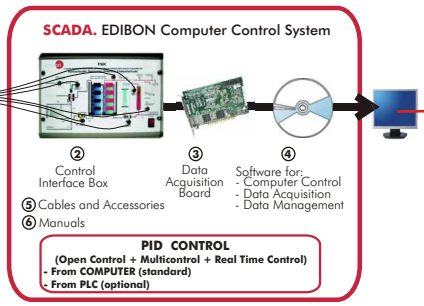
12.- Food & Water Technologies

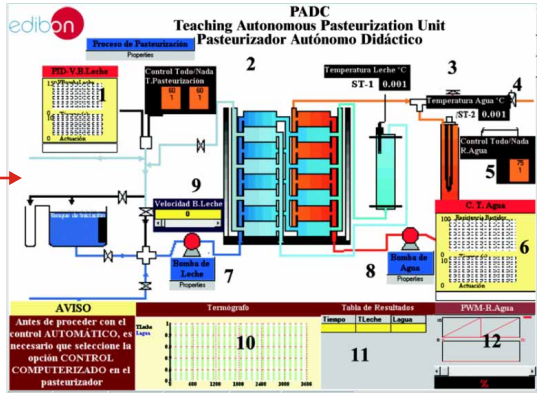
Equipment list

PADC. Computer Controlled **Teaching Autonomous Pasteurization Unit**



① Unit: PADC. Teaching Autonomous Pasteurization Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① PADC. Unit:
Metallic structure. Diagram in the front panel. Pasteurization capacity: 250 l./h. Water flow in the exchange section: 750 l./h. Thermal Cycle: 4-56-72-20 °C. Retention time: 20 seconds at 250 l./h. of milk. Water temperature in the heating section: 79°C. Plates in the regeneration section: 17. Plates in the pasteurization process: 9. Start tank. Heat exchanger. Milk pump. Water pump. Water tank with heating resistance. Retention milk tank. Expansion water tank. Water temperature sensor. Milk temperature sensor. Milk inlet valve. 3 On/Off valves. Defective valve 250/500l. Water fill valve. Purge valve. Safety valve. Pneumatic Valve.

② PADC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ PADC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 1250 x 850 x 1550 mm. Weight: 120 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/PADC.pdf

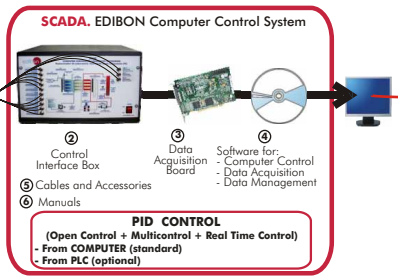
PRACTICAL POSSIBILITIES

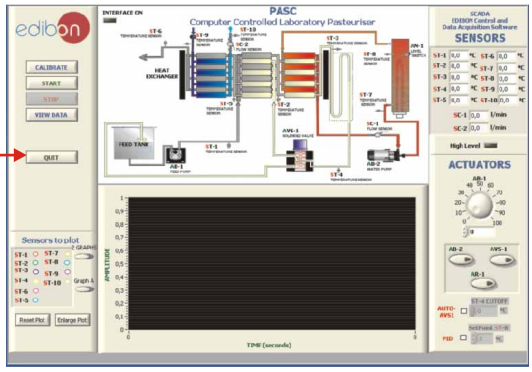
1.- Setting up; filling of the circuit of water.
2.- Set up of the pasteurization plant; operation with water.
3.- Determination of the relation between the heating water temperature in function of the liquid flow to pasteurize.
4.- Determination of the survival curve for the different bacterial floras.
5.- Determination of the threshold temperature for a constant warning time of the milk.
6.- Determination of the necessary time to obtain a desired sterility volume.
7.- Determination of the thermal reduction time curve.
8.- Cleaning of the unit with sodium hydroxide.
9.- Cleaning of the unit with nitric acid.
10.- Manual cleaning of the heat exchanger.

Other possible practices:
11.- Sensors calibration.
12.- Method for direct count with a Microscope.
13.- Method for direct count with Agar plates.
14-32.- Practices with PLC.

PASC. Computer Controlled **Laboratory Pasteuriser**

① Unit: PASC. Laboratory Pasteuriser





SPECIFICATIONS SUMMARY

Items supplied as standard

① PASC. Unit:
The PASC unit is a small scale continuous pasteurizer developed by EDIBON. It utilizes the process known as HTST (High Temperature Short Time) pasteurization, which simulates conditions of a real plant and allows pasteurization of small product quantities in a short time.
Main metallic elements in stainless steel. Diagram in the front panel.
Pasteurisation capacity: 30l./h. Feed tank of 5 litres of capacity. Dosing feed pump, computer controlled.
Water heating system, composed of: centrifugal pump (computer controlled), heating resistance (computer controlled), stainless steel tank, PID control from the computer of the tank water temperature, flow sensor for the hot water.
Plates heat exchanger divided in three sections: N° of plates in the interchanging section: 6, N° of plates in the pasteurisation section: 13, N° of plates in the cooling section: 6. Retention time: 20 seconds at 30 l./h. (approx. for milk).
It also has a product cooling stage for it conservation. Water refrigeration circuit. Flow sensor for the cooling water. Pasteurised Food Production Automatic System, composed of a three-way, solenoid electrovalve, computer controlled, which also makes easier the CIP (Clean In Place) process.
10 Temperature sensors measure the product temperature, hot and cold water, tank water temperature.

② PASC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ PASC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 800 x 800 x 1000 mm. Weight: 100 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

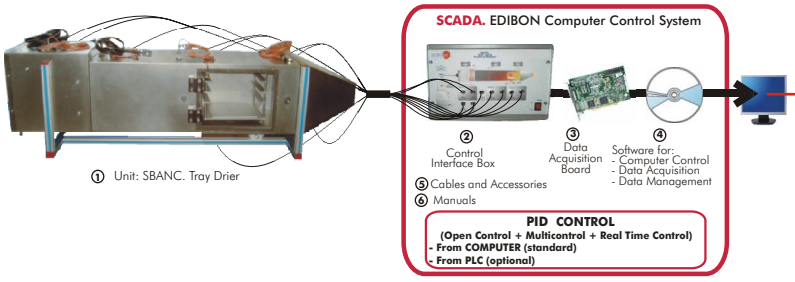
More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/PASC.pdf

PRACTICAL POSSIBILITIES

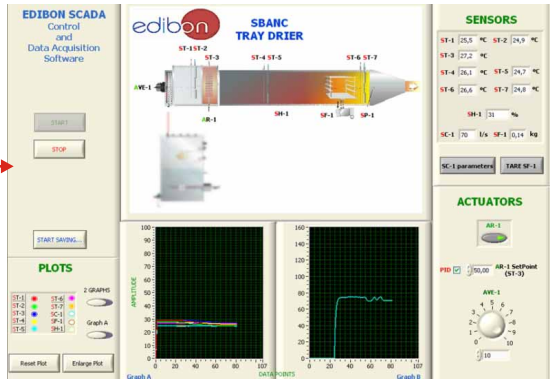
1.- Study of the HTST pasteurisation of alimentary products.
2.- Study of the destruction of damaging organisms.
3.- Calibration of the peristaltic feed pump.
4.- Start of the pasteurisation plant; operation with water.
5.- Determination of the relation between the heating water temperature according to the liquid flow to pasteurise.
6.- Determination of the survival curve for the different bacterial floras.
7.- Determination of the threshold temperature for a constant warming time of the product to treat.
8.- Determination of the necessary time to obtain a desired sterility volume.
9.- Determination of the thermal reduction time curve.
10.- Study and application of the CIP cleaning of the pasteuriser.
11.- Study of different chemical cleaning methods.

Other possible practices:
12.- Sensors calibration.
13-31.- Practices with PLC.

SBANC. Computer Controlled **Tray Drier**



① Unit: SBANC. Tray Drier



SPECIFICATIONS SUMMARY

Items supplied as standard

① SBANC. Unit:

This unit has been designed for studying fluid mechanics, surfaces chemistry, solid structures and substances and energy balances, related to the drying processes. Its size is specially appropriate for laboratories. This tray drier dries solids by passing a stream of hot air over trays of wet material.

Anodized aluminium and steel structure. Diagram in the front panel with similar distribution to the elements in the real unit.

Stainless steel rectangular conduct (1000 x 320 x 300 mm), which includes a support, a drying chamber with a door and a set of four bans, a square nozzle 300 mm long, whose side goes from 315 to 100 mm progressively. Shielded Propeller Fan, with speed control from computer (PC). Weighing system for following the changes in weight of the solid due the evaporation or vaporisation of moisture during operation. Load Cell-force sensor. 7 Temperature sensors: 2 temperature sensors of Dry and Wet Bulb before the electrical resistance, 1 temperature sensor in the electrical resistance, 2 temperature sensors of Dry and Wet Bulb after the electrical resistance, 2 temperature sensors of Dry and Wet Bulb after the drying chamber. Differential pressure sensor. Air flow sensor. Humidity sensor. Electrical heater (resistance 3 KW), computer controlled.

② SBANC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 2000 x 320 x 400 mm. Weight: 190 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/SBANC.pdf

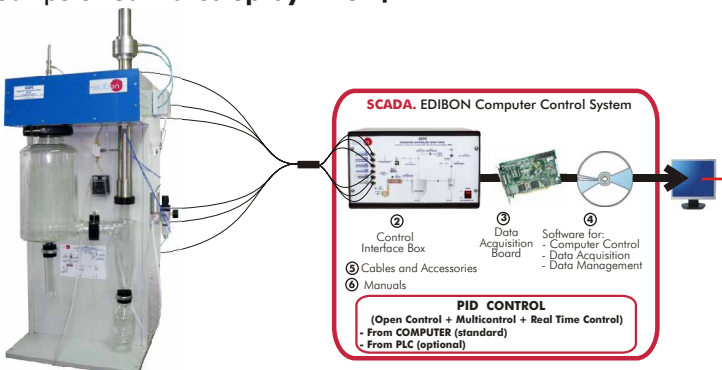
PRACTICAL POSSIBILITIES

1.- Demonstration of drying rate regimes.
2.- Determination of the efficiency of the warm-up resistance.
3.- Effect of the warm-up in an installation.
4.- Heat and mass transfer analogies.
5.- Obtaining of drying curves.
6.- Influence of the particle size.
7.- Influence of the air speed.
8.- Influence of the air temperature.
9.- Application of the psychometric in the drying.

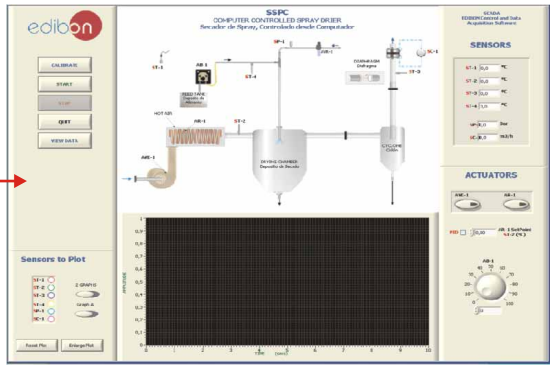
Other possible practices:

10.- Example of the determination of the properties of the air.
11.- Use of a psychometric map.
12.- Determination of the air flow.
13.- Dynamic simulation of the control systems.
14.- Sensors calibration.
15-33.- Practices with PLC.

SSPC. Computer Controlled **Spray Drier** ✱



① Unit: SSPC. Spray Drier



SPECIFICATIONS SUMMARY

Items supplied as standard

① SSPC. Unit:

Bench mounted spray drier for processing aqueous emulsions, solutions, suspensions and colloidal solutions.

Drier fully made with glass. Diagram in the front panel. Downward co-current operation. Glass main chamber. Glass separator cyclone. Sample collection glass bottle. Waste collection glass tube. Exhaust tube. Standard jet of 0.5 mm Ø, it incorporates a de-blocking device. Peristaltic pump, with variable speed, computer controlled. Heater of 3 kW, computer controlled. PID control over the air inlet temperature. Fan (3000 r.p.m.), computer controlled, drying air flow: 70 m^3/h. (fixed) approx.

4 Temperature sensors to measure: environmental temperature, air inlet temperature, exhaust vapour temperature, sampling temperature. 2 Humidity sensors. Flow sensor for exhaust vapour measurement. Pressure sensor for inlet compressed air.

② SSPC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 500 x 500 x 1500 mm. Weight: 80 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/SSPC.pdf

PRACTICAL POSSIBILITIES

1.- Operation principle of a spray drier.
2.- Effect of the drop size on the drying process.
3.- Effect of the input temperature on the drying process.
4.- Effect of the feed flow of the product on the drying process.
5.- Mass balance of a spray drier.
6.- Energy balance of a spray drier.
7.- Spray drier efficiency.

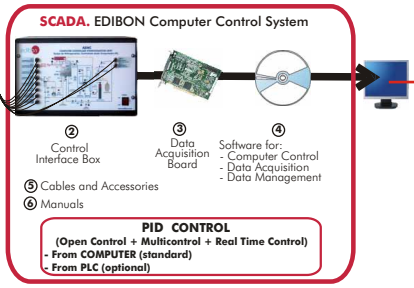
Other possible practices:

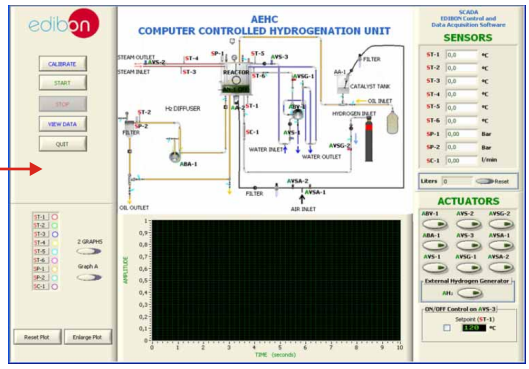
8.- Sensors calibration.
9-27.- Practices with PLC.

✱ Non computer controlled version available too.

AEHC. Computer Controlled **Hydrogenation Unit**

① Unit: AEHC. Hydrogenation Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① AEHC. Unit:
This Hydrogenation Unit is a batch processing vessel, which is used to adjust the degree of saturation of 22 l. batches of edible oils.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel. All equipment in contact with the process fluid in stainless steel.
Stainless steel hydrogenation vessel (reactor): total volume: 30 litres, working volume: 22 litres, minimum working volume: 14 litres, heating coil, cooling coil, stainless steel hydrogen diffuser, exhaust valve, rupture disc.
Variable speed agitator for the hydrogenation vessel. Stainless steel catalyst tank of 6.5 l. Variable speed agitator for the catalyst tank. Liquid ring vacuum pump. Oil pump, centrifugal type. Filter. Security H_2 detector.
Sensors: 6 temperature sensors, 2 pressure sensors, flow sensor. 3 Manometers.
Gas, water and air solenoid valves. Security valves. Flameproof electrical equipment. Safe zone controls. Accurate control of hydrogen addition.

② AEHC/CIB. Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ AEHC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1400 x 1100 x 2000 mm. Weight: 360 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/AEHC.pdf

PRACTICAL POSSIBILITIES

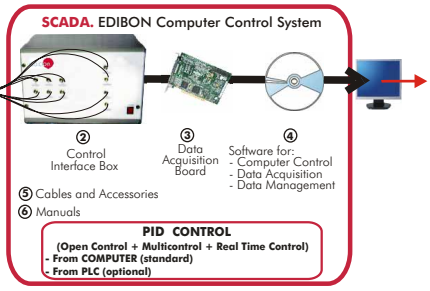
1.- Study of the effect of process temperature.
2.- Study of the effect of degree of agitation.
3.- Study of the effect of hydrogen gas pressure.
4.- Operation of small scale version of the industrial hydrogenation process.
5.- To determine the optimum catalyst dosage.
6.- To demonstrate the operation of the filter for catalyst recovery.
7.- Study of the effect of catalyst type.

Other possible practices:

8.- Sensors calibration.
9-27.- Practices with PLC.

AEDC. Computer Controlled **Deodorising Unit**

① Unit: AEDC. Deodorising Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① AEDC. Unit:
Unit suitable for teaching/training and research into the principles of steam stripping of fatty acids from edible oils. This is a floor-standing batch processing vessel.
Stainless steel and anodized aluminium support structure. Diagram in the front panel.
Deodoriser vessel: 60 litres overall volume, 25 litres working volume, product maximum temperature: 250°C, electrical heating element (electric resistance) (computer controlled), cooling water coil for reducing the oil temperature, steam distribution tube (which allows the steam/oil mixing required).
Multi-stage vacuum system, incorporating: steam ejector, condenser, vacuum pump (computer controlled).
Discharge pump. Polishing filter to remove any remaining particles in the finished oil.
Sensors of: temperature, level and pressure.
Sample collecting.
Modes of operation: Deodorising and polishing.

② AEDC/CIB. Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ AEDC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1300 x 700 x 1600 mm. Weight: 300 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/AEDC.pdf

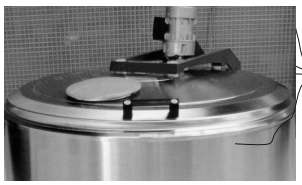
PRACTICAL POSSIBILITIES

1.- Study of the operation of small scale version of the industrial process.
2.- To determinate the optimum process conditions for different oil types.
3.- Effect of variation of process pressure.
4.- Effect of variation process temperature.
5.- Effect of variation of quantity of direct steam added.
6.- Effect of variation of overall process time.

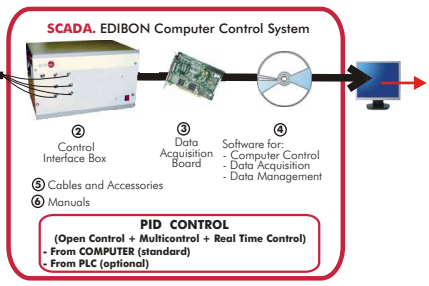
Other possible practices:

7.- Sensors calibration.
8-26.- Practices with PLC.

TFDC. Computer Controlled **Teaching Frigorific Tank**



① Unit: TFDC. Teaching Frigorific Tank



SPECIFICATIONS SUMMARY

Items supplied as standard

① TFDC. Unit:
Tank, covers and lining built in stainless steel. Also all the surfaces in contact with the milk are made of stainless steel, with a degree of refined appropriate polishing. Printed bottom with evaporator that assures the maximum efficiency and minimum consumption (1,5 Kw/100 L, 1, 8 Kw/100L). Effective isolation by means of injected polyurethane to increase, increments of temperature in the milk. Inclination of the bottom to achieve a quick casting. Started anti-air the milk to archive the volume measurement, in the tank. Automatic operation of the cooling group and the stirrer to assure a good homogenization of the milk. Coolant. Adjustable legs. Volume measurement of the milk. Compensated hinge. Frame of stainless steel. Sensors: temperature sensors and level sensor.

② TFDC/CIB. Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

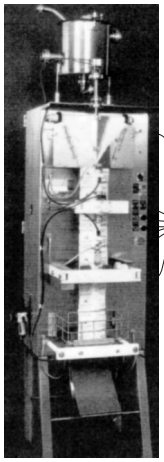
④ TFDC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

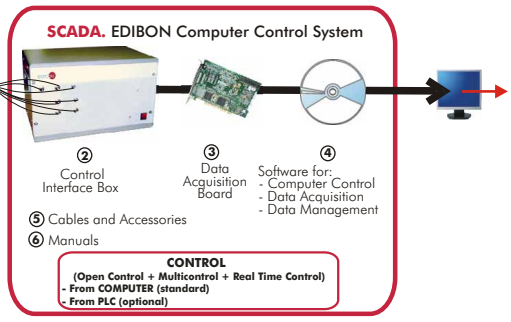
⑥ Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/TFDC.pdf

EDLC. Computer Controlled **Teaching Machine for Putting in Plastic Packing Liquids**



① Unit: EDLC. Teaching Machine for Putting in Plastic Packing Liquids



SPECIFICATIONS SUMMARY

Items supplied as standard

① EDLC. Unit:
Main metallic elements in stainless steel. Diagram in the front panel with similar distribution to the elements in the real unit. Starting from a virgin polyethylene roll the machine give forms, it put in the amount and fill the bags. They are adapted for all type of liquid milk, juices, etc. Fill 1/8 to 1L. All parts in contact with the milk, done by stainless steel. Unroll system with step of the film. Vertical chuck with date engraving. Horizontal chuck. Dosage system for the liquid. Control board. Automatism for the manual control. Heating with two impulse generators. 3 phase + neutral + earth. It needs 100L/h of cooling water. It needs 6 bars compressed air. Power, 1 KW.

② EDLC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the PC keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

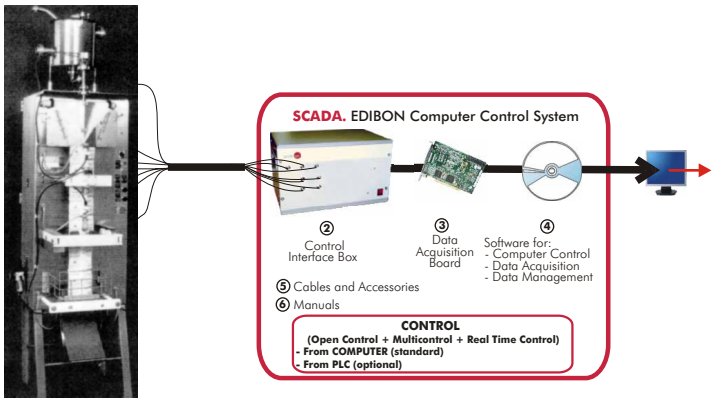
④ EDLC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/EDLC.pdf

EDSC. Computer Controlled **Teaching Machine for Putting into a Container Solids**



① Unit: EDSC. Teaching Machine for Putting into a Container Solids

SPECIFICATIONS SUMMARY

Items supplied as standard

① EDSC. Unit:
Main metallic elements in stainless steel. Diagram in the front panel with similar distribution to the elements in the real unit. Dose time programming. With possibility of creating a small aspiration after each dose, to avoid leakages. Possibility of adjusting the doses directly on the front keyboard. Possibility of working in continuous. Possibility of working in automatic way with regulation of the time of stop among almost dose. Cadence settles down. Possibility of working in manual, by means of switch of button. Possibility of programming certain quantity of dose with systematic counts of the doses. Dose accountant. Capability of 10 memories to establish the parameters of the doses or memorization of the regulations of the doser for 10 products and different volumes. Possibility of dosing liquids, and mash products of different densities, auxiliary coupling and discoupling elements as the product needs (Yoghurt, butter, sauces patés, juices, etc.).

② EDSC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the PC keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

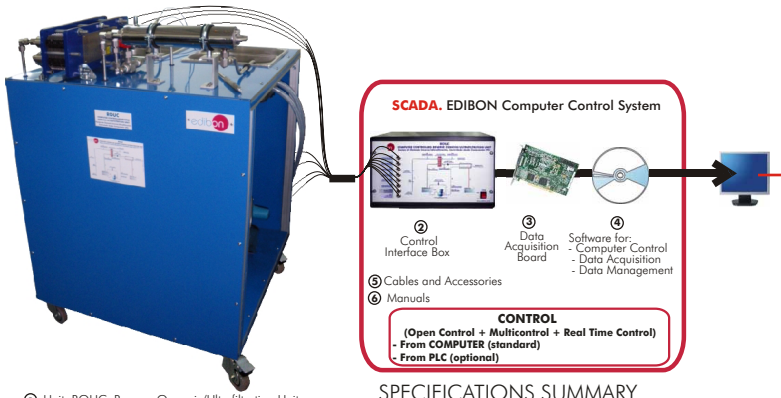
④ EDSC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

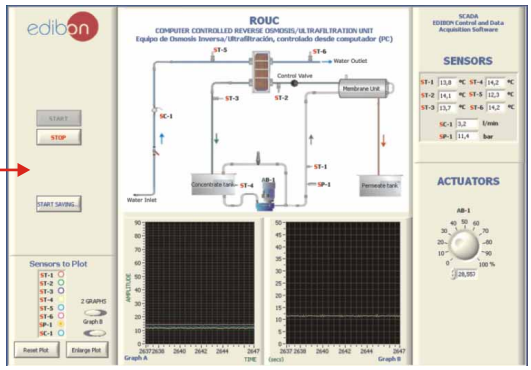
⑥ Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/EDSC.pdf

ROUC. Computer Controlled **Reverse Osmosis/Ultrafiltration Unit**



① Unit: ROUC. Reverse Osmosis/Ultrafiltration Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① ROUC. Unit:
Laboratory Scale Computer Controlled Reverse Osmosis/Ultrafiltration Unit designed to study and to provide practical training in these downstream processing techniques. As well as the processing of the whey, the membranes can be also used to demonstrate, for example: clarification and concentration of fruit juices, potabilization of water, pre-concentration of milk for cheese manufacturing, etc.
Main metallic elements in stainless steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Stainless steel feed tank (15 l. approx. capacity). Three head positive displacement feed pump. Inverter that controls the pump motor. Membrane module: two tubular membranes connected in series. Process control valve. Plates heat exchanger for the concentrate. Permeate stainless steel collecting tank (15 l. approx. capacity).
6 Temperature sensors. Pressure sensor. Flow sensor (water inlet).
Different models of membranes are supplied. Rapid changeover from Reverse Osmosis to Ultrafiltration and back. All elements in contact with the process fluid are constructed from hygienic design materials such as stainless steel, PTFE and silicone rubber.

② ROUC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the PC keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ ROUC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 800 x 800 x 1000 mm. Weight: 180 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/ROUC.pdf

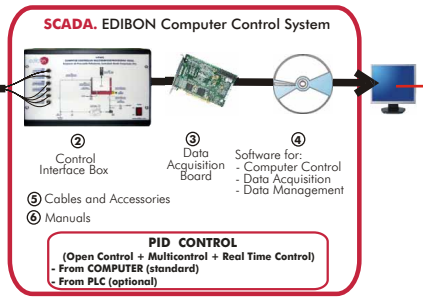
PRACTICAL POSSIBILITIES

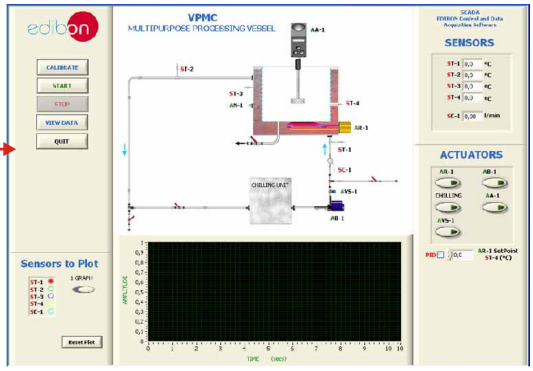
1.- Practical training in ultrafiltration an reverse osmosis processing techniques.
2.- Protein standardisation in the production of fermented milk products such as concentration of skimmed milk for yoghurt production.
3.- Pre-concentration of milk for cheese manufacture.
4.- Concentration of fruit juices.
5.- Clarification of fruit juices.
6.- Water potabilization.
7.- Demonstration of the effect of varying the following process parameters on separation performance:
- Process pressure.
- Product flow rate.
- Process temperature.
8.- Applications of concentration, clarification, fractionation and standardization of milk, fruit juices, vegetables juices, etc.
9.- Treatment of effluent.
10.- Membrane cleaning and maintenance.
11.- Enzime, antibiotics and organic acids recovery in permeate.

Other possible practices:
12.- Sensors calibration.
13-31.- Practices with PLC.

VPMC. Computer Controlled **Multipurpose Processing Vessel**

① Unit:VPMC. Multipurpose Processing Vessel





SPECIFICATIONS SUMMARY

Items supplied as standard

① VPMC. Unit:

The VPMC unit developed by EDIBON is a type batch equipment, suitable to demonstrate the different mixing processes in the alimentary industry. As it is a multiprocess vessel, several mixing tasks will be able to be carried out. Furthermore, it has a temperature control necessary to make easier the mixing tasks which require it, such as the help to carry out the complex emulsion tasks. The VPMC unit has all the necessary to: mix, emulsify, heat, pasteurise, incubate, cool, chill, cure.

As well as the preparation of food products for further processing, it allows to produce finished products in batch sizes from 5 up to 30 liters maximum.

Anodized aluminium structure and panels in painted steel. Diagram in the front panel.

Stainless steel jacketed process vessel, capacity: 30 litres. Batch sizes: from 5 up to 30 litres (depending on the mixture being processed). Maximum vessel contents temperature: 85° C. Heating resistance, computer controlled, of 3000 W. Emulsifier/Mixer unit of high speed with DC motor, this emulsifier is computer controlled; speed range: 0-8000 rpm. 4 Different emulsifier heads are supplied. Chilled water circulation system: chilling unit with 500 W compressor motor and water recirculating centrifugal pump, computer controlled. PID control of the temperature of the product into the process vessel.

4 Temperature sensors to measure: products temperature in the vessel, temperatures for controlling the water temperature.

Flow rate of cold or chilled water is controlled. Level switch in the process vessel to protect the heating resistance.

② VPMC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Manuals: This unit is supplied with 8 manuals.

⑥ Cables and Accessories, for normal operation.

Dimensions (approx.) =Unit: 800 x 800 x 1250 mm. Weight: 150 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/VPMC.pdf

PRACTICAL POSSIBILITIES

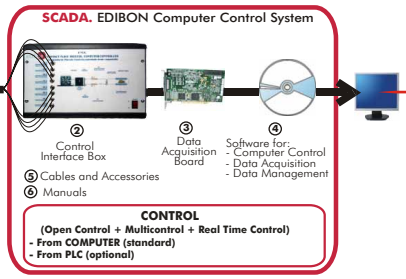
1.- Study of different process, with their adequate instrumentation, using heating and cooling systems.
2.- General emulsion study.
3.- Batch pasteurization of milk.
4.- Processing of fermented milk products.
5.- Yogurt production.
6.- Preparation and curing of ice cream mix.
7.- Preparation of margarine and soft spread emulsions.
8.- Heat transfer measurement.
9.- Heat transfer calculations.
10.- Study of general heating, cooling and chilling.

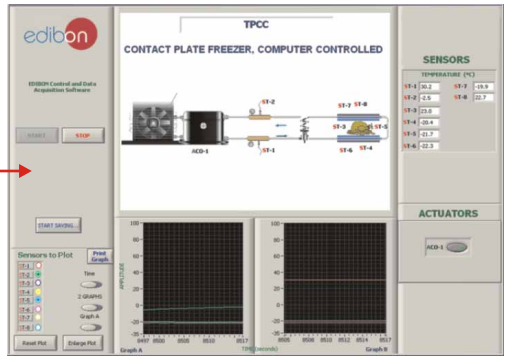
Other possible practices:

11.- Sensors calibration.
12-30.- Practices with PLC.

TPCC. Computer Controlled **Contact Plate Freezer**

①Unit: TPCC. Contact Plate Freezer





SPECIFICATIONS SUMMARY

Items supplied as standard

① TPCC. Unit:

The TPCC unit has as aim to introduce the students to quick freezing processes, to their advantages compared with conventional freezing processes, as well as to proceed to the study of the thermodynamic process, through which such freezing is obtained. Basically, this unit is made up of a refrigeration circuit. The unit has been designed to observe the thermodynamic changes occured during the process, for a given coolant, allowing the study of the refrigeration cycle.

Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit. Coolant compressor. Air condenser. High pressure control. Coolant accumulation tank. Expansion valve. Four-way valve. Evaporator-freezer, with two freezing plates of 180 mm x 280 mm. Plate temperature (both plates): <-35°C.

8 Temperature sensors: 2 temperature sensors (temperature measurement of the coolant) and 6 temperature sensors (temperature measurement of the food). 2 Manometers. Enthalpy diagram of the coolant R404a.

② TPCC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =Unit: 900 x 600 x 500 mm. Weight: 90 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/TPCC.pdf

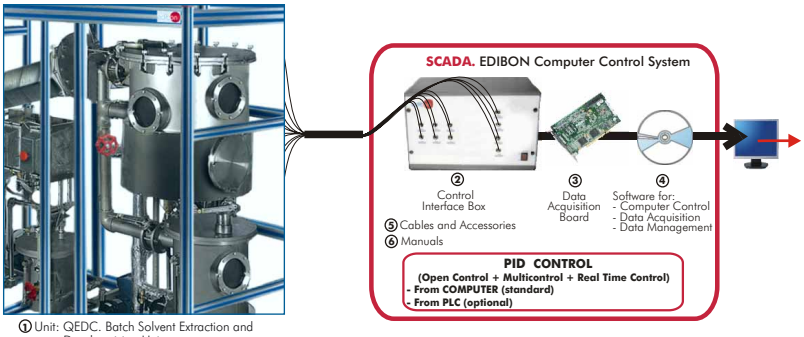
PRACTICAL POSSIBILITIES

1.- Study of industrial freezing process.
2.- Study of food preservation.
3.- Study the effect of freezing on food.
4.- Investigate the effect on the freezing process of parameters such as the shape of the product, portion size, the packaging, etc.
5.- To evaluate the difference between fast freezing and domestic freezing.
6.- Freezing rates.
7.- Study of fast freezing vs slow freezing.
8.- Temperature sensing.
9.- Taste and texture assessments.
10.- Study of the deep-freezing process effect: structural.
11.- Study of the deep-freezing process effect: compositional.
12.- Study of the deep-freezing process effect: sensorial.
13.- Study of the thermal process.
14.- Study the effect of the temperature on bacteria.
15.- Quality control.
16.- Quality assurance.
17.- Freezing curves analysis.
18.- Links with Physics (refrigeration) and with Biology(food structure).

Other possible practices:

19.- Sensors calibration.
20-38.- Practices with PLC.

QEDC. Computer Controlled **Batch Solvent Extraction and Desolventising Unit**



① Unit: QEDC. Batch Solvent Extraction and Desolventising Unit

SPECIFICATIONS SUMMARY

Items supplied as standard

① QEDC. Unit:

Unit designed to allow instruction/teaching and research into the principle of solid-liquid extraction. It is capable of carrying out a variety of solid/liquid extractions (particularly suitable for edible oils from oil-bearing seeds) and desolventising both the extracted solids and the miscella. Batch process.

Diagram in the front panel with similar distribution to the elements in the real unit. Anodized aluminium and steel structure. Elements in contact with process material are constructed in stainless steel, borosilicate glass, etc.

Extractor vessel. (100 l. total volume which allows a solids working capacity of 25 kg.) Miscella vessel (30 l. volume). Waste water tank (15 l. volume). Solvent condenser. Solvent water separator tank (16 l. volume). Solvent pump (centrifugal type). Vacuum pump (diaphragm type). Temperature, Pressure and Flow sensors.

Flameproof electrical equipment is specified to be compatible with most common solvents.

Modes of operation: extraction by washing with clean solvent, extraction by recirculating miscella, desolventising extracted material and desolventising miscella.

② QEDC/CIB. Control Interface Box

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1800 x 1000 x 1800 mm. Weight: 750 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/QEDC.pdf

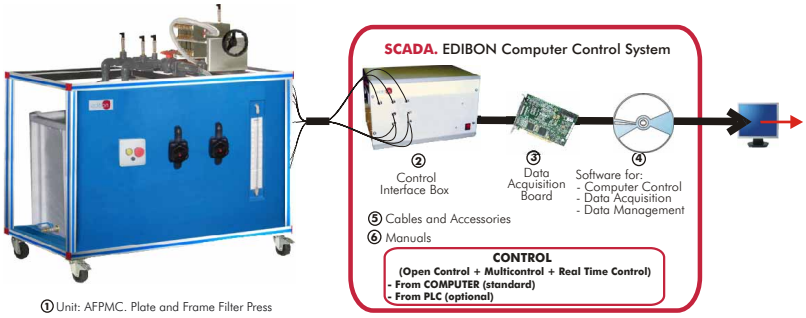
PRACTICAL POSSIBILITIES

1.- Effect of degree of pretreatment of solid material on extraction efficiency.
2.- Effect of extraction time.
3.- Effect of drain time.
4.- Study the effect of solvent type.
5.- Effect of solvent percolation rate.
6.- Effect of process temperature.
7.- Effect of process pressure.
8.- Method of solvent recovery.
9.- Degree of solvent recovery.
10.-Operation of small scale version of industrial processes.

Other possible practices:

11.-Sensors calibration.
12- 30.- Practices with PLC.

AFPMC. Computer Controlled **Plate and Frame Filter Press**



① Unit: AFPMC. Plate and Frame Filter Press

SPECIFICATIONS SUMMARY

Items supplied as standard

① AFPMC. Unit:

This unit has been designed to demonstrate the filtration and clarification processes suitable for chemical, pharmaceutical, food and beverage industries, etc.

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.

The unit includes: A tank to produce the suspension. A pump, computer controlled, to deliver the suspension to the plate and frame filter press. A plate and filter press. (Four plates and four frames). Four grades of filter media are supplied, for: pre-coat filtration, coarse claryfying, polishing and sterilisation. A tank with level scale for filtrate. Pressure sensors. Temperature sensor. Filtrate flow meter. Turbidity sensor.

② AFPMC/CIB. Control Interface Box:

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the PC keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 1650 x 800 x 1550 mm. Weight: 120 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/AFPMC.pdf

PRACTICAL POSSIBILITIES

1.- Learning the fundamental principle and method of operation of a plate and frame filter press.
2.- Study of filtration and clarification processes.
3.- Demonstration of pre-coat filtration.
4.- Production of a suspension.
5.- Fundamentals of cake filtration.
6.- Demonstration of Darcy's Law.
7.- Determination of medium and cake resistance.
8.- Variation in time of filtrate quantity and solid concentration in filtrate.
9.- Mass of filter cake in function of filtrate quantity.

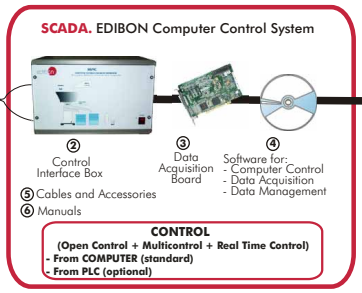
Other possible practices:

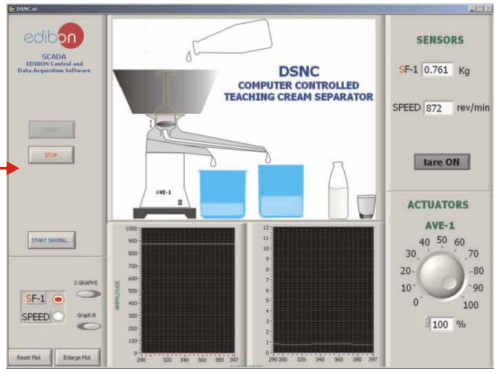
10.- Sensors calibration.
11-29.- Practices with PLC.

12.2- Food Technology (Milk)

DSNC. Computer Controlled **Teaching Cream Separator** ✱

① Unit: DSNC. Teaching Cream Separator





SPECIFICATIONS SUMMARY
Items supplied as standard

① DNSC. Unit:
This unit is designed to provide a practical training in the technique of separation of the different phases present in a liquid, according to the density of each one of the parts. We take the separation of the cream from the milk, reaching efficiency of 125 l/h.
Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit.
Throughputs up to 125 l. per hour can be obtained depending on degree of separation. Feed vessel (10 l. capacity) of anodized aluminium which can be replenished as necessary. Collectors for cream and skimmed milk with exit openings (outlets). Separator bowl incorporates 19 dics (plates). Motor. Speed control from the computer (PC). Speed sensor. Force sensor.
Accessories included: stop clock, glass graduated vessels (for product collecting), allen key, brushes.
The unit can be easily dismantled. Materials in contact with the process fluid are anodised aluminium, stainless steel, rubber and polypropylene.

② DNSC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ DNSC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 500 x 500 x 500 mm. Weight: 40 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologymilk/DSNC.pdf

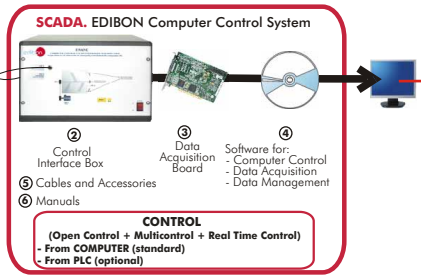
PRACTICAL POSSIBILITIES

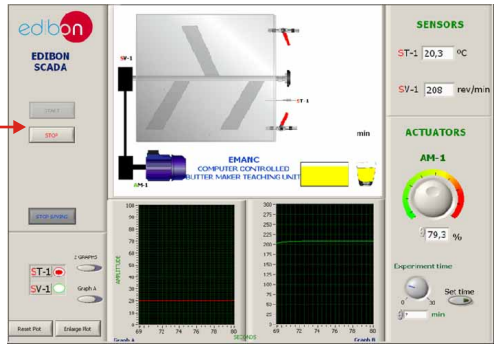
1.- Contribution to a better understanding of the industrial process, by means of operating a scale system.
2.- Study of the separation of different density liquids.
3.- Production of different types of cream by using milks with different greasy matter contents, 11% to 55%.
4.- Production of a range of skimmed milks with different contents of greasy matter.
5.- To demonstrate the effect of the temperature and the speed in the separating process.
6.- To show the importance of cleanness and hygiene in food processing.
7.- Understanding the mode of operation of this type of centrifuge, using instructive diagrams and ease of strip down the component parts.

Other possible practices:
8.- Sensors calibration.
9-27.- Practices with PLC.

EMANC. Computer Controlled **Butter Maker Teaching Unit** ✱

① Unit: EMANC. Butter Maker Teaching Unit





SPECIFICATIONS SUMMARY
Items supplied as standard

①EMANC. Unit:
This unit has been designed to provide practical training in butter making.
The main structure of EMANC is a 25 liter stainless steel tank. On the upper part, a (stainless steel)lid with four braces (two on each side) seals the tank. There is a round window to visualize the state of the inner product. Within the tank, a set of blades churn the product.
The motor is the most important element of the unit, since it makes the blades roll. It is controlled by two switches, a green one to start and the red one to stop. Besides these switches, the process can be controlled by the computer through the interface.
A security system (magnetic sensor) blocks the blades while the lid is not in place. The blades can be removed thanks to a releasing knob, what helps cleaning the interior.
There exist two valves. The upper valve allows the inlet of fresh water for washing the butter. The lower valve has a draining function for both the water and buttermilk.
Up to 13 liters of cream may be used on a single batch. Approx. 0.5 kg of butter produced out of 1.5 kg of cream.
Computer controlled electric motor and agitator. Temperature sensor. Speed sensor.

②EMANC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④EMANC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 550 x 470 x 410 mm. Weight: 30 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologymilk/EMANC.pdf

PRACTICAL POSSIBILITIES

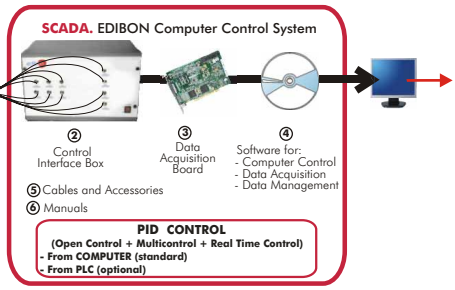
1.- Production of butter from different types of milk.
2.- Production of butter by different methods with analytical and qualitative resolutions.
3.- Temperature study and agitation during the process.
4.- "Phase inversion" of the oil/water emulsion which occurs in churning.
5.- Thermodynamic evolution analysis of the butter production process.
6.- Duration influence study of the final product process.
7.- Influence study of the turning speed in the final product quality.

Other possible practices:
8.- Sensors calibration.
9-27.- Practices with PLC.

✱ Non computer controlled version available too.

AUHTC. Computer Controlled **UHT Unit**

① Unit: AUHTC. UHT Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① AUHTC. Unit:
UHT processing unit employing the direct fluid into steam heating method. This liquid into steam batch process unit will accept feedstock batch sizes up to 0.5 l. Main elements in contact with process fluids in stainless steel. Feed vessel (2 litres capacity). Steam heating vessel with atomiser spray head. Vacuum vessel with vapour/liquid separator. Recessed water bath with cooling coil. Max. Temp.: 150° C. Vacuum pump with variable vacuum. Steam drying and air and steam sterilizing filters. Control valves. Sample size: up to 0.5 litres. Pressure sensors. Temperature sensors. Control and temporization of holding, process and drain times.

② AUHTC/CIB. Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ AUHTC/CCSOF. PID Computer Control + Data Acquisition + Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1000 x 600 x 1700 mm. Weight: 200 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologymilk/AUHTC.pdf

PRACTICAL POSSIBILITIES

1.- To demonstrate the infusion type UHT process.

2.- Study of the effects of the process on quality value of the product.

3.- Study of the effects of the process on nutritional value of the product.

4.- Variation of temperatures and holding times.

5.- Study of the degree of destruction of microorganisms such as mesophilic and thermophilic spores.

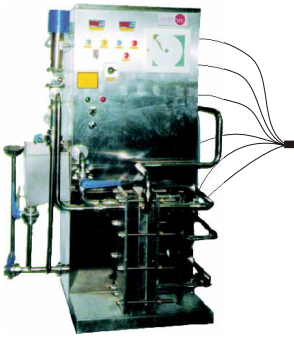
6.- Processing of several small batches consecutively.

Other possible practices:

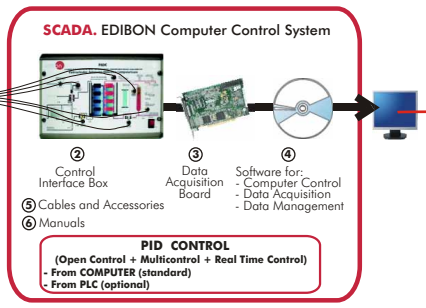
7.- Sensors calibration.

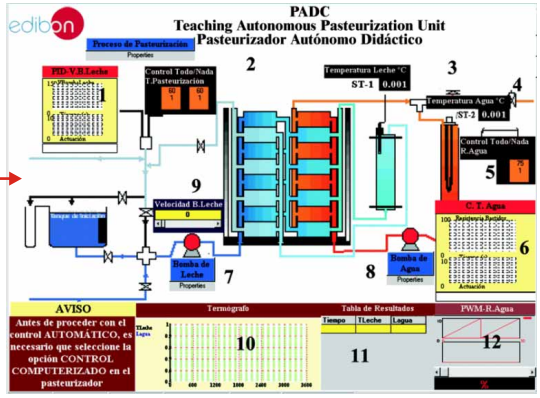
8-26.- Practices with PLC.

PADC. Computer Controlled **Teaching Autonomous Pasteurization Unit**



① Unit: PADC. Teaching Autonomous Pasteurization Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① PADC. Unit:
Metallic structure. Diagram in the front panel. Pasteurization capacity: 250 l./h. Water flow in the exchange section: 750 l./h. Thermal Cycle: 4-56-72-20 °C. Retention time: 20 seconds at 250 l./h. of milk. Water temperature in the heating section: 79°C. Plates in the regeneration section: 17. Plates in the pasteurization process: 9. Start tank. Heat exchanger. Milk pump. Water pump. Water tank with heating resistance. Retention milk tank. Expansion water tank. Water temperature sensor. Milk temperature sensor. Milk inlet valve. 3 On/Off valves. Defective valve 250/500l. Water fill valve. Purge valve. Safety valve. Pneumatic Valve.

② PADC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ PADC/CCSOF. PID Computer Control + Data Acquisition + Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1250 x 850 x 1550 mm. Weight: 120 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologybasic/PADC.pdf

PRACTICAL POSSIBILITIES

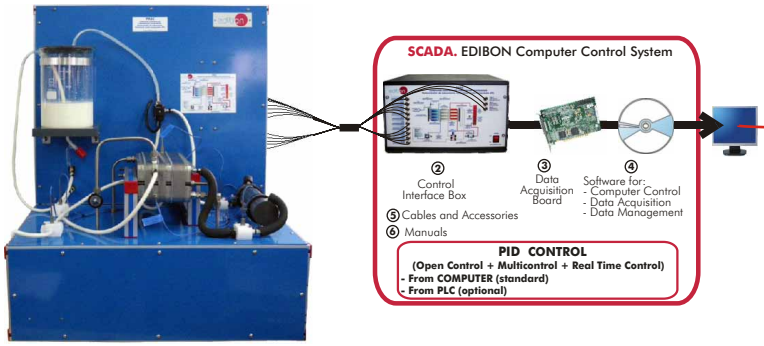
1.- Setting up; filling of the circuit of water.
2.- Set up of the pasteurization plant; operation with water.
3.- Determination of the relation between the heating water temperature in function of the liquid flow to pasteurize.
4.- Determination of the survival curve for the different bacterial floras.
5.- Determination of the threshold temperature for a constant warning time of the milk.
6.- Determination of the necessary time to obtain a desired sterility volume.
7.- Determination of the thermal reduction time curve.
8.- Cleaning of the unit with sodium hydroxide.
9.- Cleaning of the unit with nitric acid.
10.- Manual cleaning of the heat exchanger.

Other possible practices:

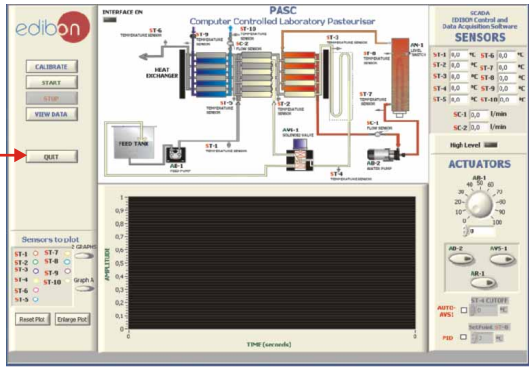
11.- Sensors calibration.
12.- Method for direct count with a Microscope.
13.- Method for direct count with Agar plates.
14-32.- Practices with PLC.

12.2- Food Technology (Milk)

PASC. Computer Controlled **Laboratory Pasteuriser**



① Unit: PASC. Laboratory Pasteuriser



SPECIFICATIONS SUMMARY

Items supplied as standard

① PASC. Unit:

The PASC unit is a small scale continuous pasteurizer developed by EDIBON. It utilizes the process known as HTST (High Temperature Short Time) pasteurization, which simulates conditions of a real plant and allows pasteurization of small product quantities in a short time.

Main metallic elements in stainless steel. Diagram in the front panel.

Pasteurisation capacity: 30l./h. Feed tank of 5 litres of capacity. Dosing feed pump, computer controlled.

Water heating system, composed of: centrifugal pump (computer controlled), heating resistance (computer controlled), stainless steel tank, PID control from the computer of the tank water temperature, flow sensor for the hot water.

Plates heat exchanger divided in three sections: N° of plates in the interchanging section: 6, N° of plates in the pasteurisation section: 13, N° of plates in the cooling section: 6. Retention time: 20 seconds at 30 l./h. (approx. for milk).

It also has a product cooling stage for it conservation. Water refrigeration circuit. Flow sensor for the cooling water. Pasteurised Food Production Automatic System, composed of a three-way, solenoid electrovalve, computer controlled, which also makes easier the CIP (Clean In Place) process.

10 Temperature sensors measure the product temperature, hot and cold water, tank water temperature.

② PASC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 800 x 800 x 1000 mm. Weight: 100 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

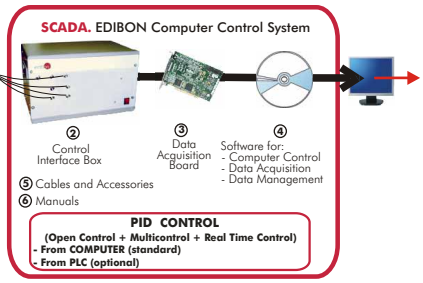
More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologymilk/PASC.pdf

PRACTICAL POSSIBILITIES

1.- Study of the HTST pasteurisation of alimentary products.
2.- Study of the destruction of damaging organisms.
3.- Calibration of the peristaltic feed pump.
4.- Start of the pasteurisation plant; operation with water.
5.- Determination of the relation between the heating water temperature according to the liquid flow to pasteurise.
6.- Determination of the survival curve for the different bacterial floras.
7.- Determination of the threshold temperature for a constant warming time of the product to treat.
8.- Determination of the necessary time to obtain a desired sterility volume.
9.- Determination of the thermal reduction time curve.
10.- Study and application of the CIP cleaning of the pasteuriser.
11.- Study of different chemical cleaning methods.

Other possible practices:
12.- Sensors calibration.
13-31.- Practices with PLC.

CCDC. Computer Controlled **Teaching Curdled Tank**



① Unit: CCDC. Teaching Curdled Tank

SPECIFICATIONS SUMMARY

Items supplied as standard

① CCDC. Unit:

Diagram in the front panel with similar distribution to the elements in the real unit. Dutch model. Rectangular with semicircular ends. Made in stainless steel.

Speed controlled. Temperature control for water and milk. Combined court liras and stirrer. Querflow and prepress bath plates. Coil of stainless steel, for heating the water shirt, using water or steam in closed circuit. Adjustable legs. Capacity: 500 l. Sensors of: temperature and speed.

② CCDC/CIB. Control Interface Box:

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

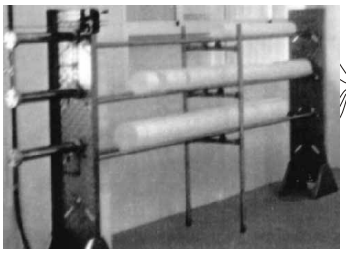
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

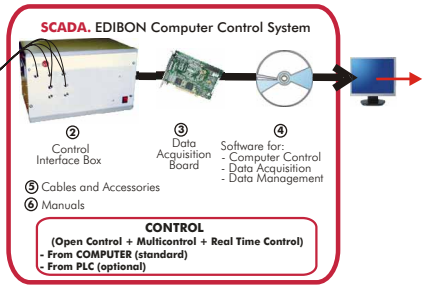
⑥ Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologymilk/CCDC.pdf

PVQC. Computer Controlled **Teaching Cheese Vertical Press**



① Unit: PVQC. Teaching Cheese Vertical Press



SPECIFICATIONS SUMMARY

Items supplied as standard

① PVQC. Unit:

Diagram in the front panel with similar distribution to the elements in the real unit. Built in stainless steel. Compression by spring. 12 molds approximate capacity.

② PVQC/CIB. Control Interface Box:

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the PC keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

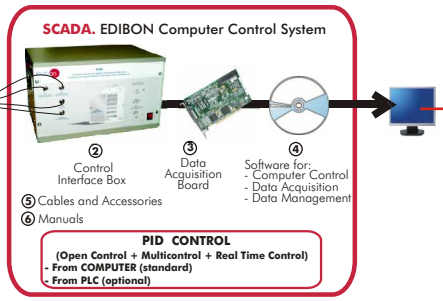
⑤ Cables and Accessories, for normal operation.

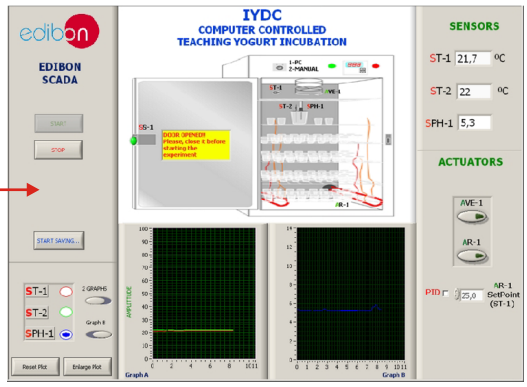
⑥ Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologymilk/PVQC.pdf

IYDC. Computer Controlled **Teaching Yogurt Incubator**

① Unit: IYDC. Teaching Yogurt Incubator





SPECIFICATIONS SUMMARY

Items supplied as standard

① IYDC. Unit:

The objective of this unit is to teach to the students, in the most visual way as possible, the production of yoghurt, as well as the physical parameters that can be measured with this unit. This unit is designed as yogurt maker or yogurt heater. The yogurt maker consists of a series of shelves where the containers, in which the yoghurt will be formed, will placed.

It has a resistance to control the process of heating needed for making yoghurt, an a fan that avoids that the unit overheats. A temperature sensor has been added to the unit, so the temperature of the unit can be computer controlled in any moment through the interface. Also, it has incorporated and electrode connected to the interface to control the proper pH to make yoghurt.

Unit with enameled chassis and with reinforced isolation. Stainless steel AISI 304 main body. 3000W resistance, computer controlled.

2 Temperature sensors. pH sensor with electrolyte solution. Fan, computer controlled, 250 ml vessel. Several mobile grills.

Safety switch (alarm open door). Temperature digital controller with sensor. Manual or Computer Control switch.

Unit on/off switch. Unit on/off indicator led. Safety indicator led (alarm open door). Resistance on/off indicator led.

Sensors connectors and resistance and fan connectors to interface (computer control).

② IYDC/CIB. Control Interface Box:

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 610 x 600 x 1400 mm. Weight: 100 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologymilk/IYDC.pdf

PRACTICAL POSSIBILITIES

1.- Making of yogurt.

2.- Obtained yogurt acidity measurements.

3.- Obtained yogurt viscocity measurements.

4.- Measurement of the two main bacteria used for making yogurt.

5.- Comparison of the results in function of the beaker placement inside of the yogurt incubator.

6.- Viscosity change in function of the yogurt pH.

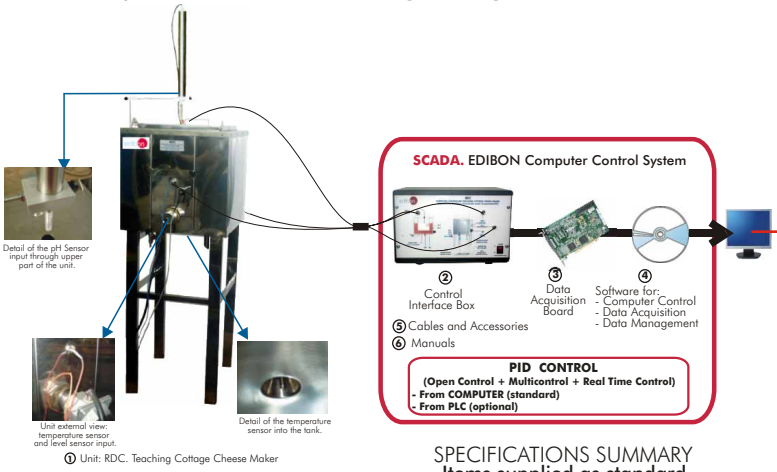
7.- Differences in yoghurt when using whole milk or skim milk.

8.- Control System. temperature sensor calibration.

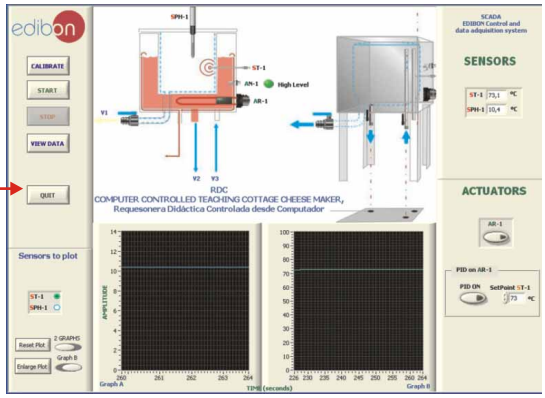
9.- Control System. pH sensor calibration.

10-28.- Practices with PLC.

RDC. Computer Controlled **Teaching Cottage Cheese Maker**



① Unit: RDC. Teaching Cottage Cheese Maker



SPECIFICATIONS SUMMARY
Items supplied as standard

① RDC. Unit:
"RDC" Unit has the objective to introduce student the form more easy in the production of curd-cheese and to study of chemistry parameters.
Structure and main metallic elements in stainless steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Stainless steel tank (45 litres approx.), with water jacket. Electric resistance with protection, 6KW, computer controlled. Temperature PID control from the computer (PC). Whey outlet valve. Water outlet valve. Water inlet valve. Drain pipe and vapour outlet. Required time for the process ≃45 min. Work temperature between 70-90°C. Thermostat. Sensors: pH sensor, level sensor, temperature sensor.

② RDC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ RDC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 700 x 700 x 1700 mm. Weight: 100 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologymilk/RDC.pdf

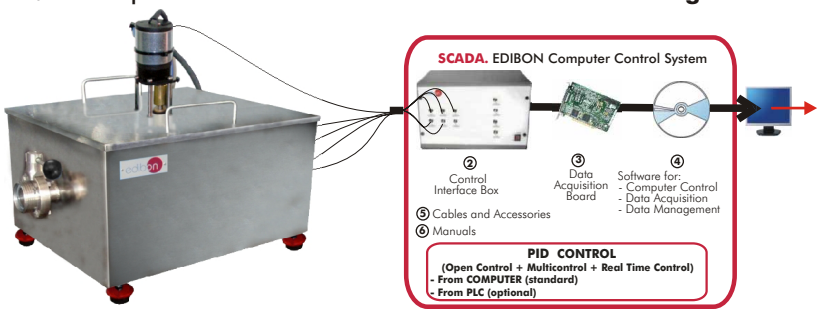
PRACTICAL POSSIBILITIES

1.- Lactowhey obtaining.
2.- Cottage cheese obtaining.
3.- Obtained cottage cheese acidity measurements.
4.- Obtained cottage cheese efficiency determinations.
5.- Cottage cheese by means the traditional process obtaining.
6.- Cottage cheese elaboration (no traditional processes).
7.- Acidity comparative studies in different cottage cheeses.
8.- Proteins concentration determination in function of the temperature.

Other possible practices:

9.- Temperature sensor calibration.
10.- pH sensor calibration.
11-29.- Practices with PLC.

AEQC. Computer Controlled **Cheese Vat and Cheese Making Accesories**



① Unit: AEQC. Cheese Vat

SPECIFICATIONS SUMMARY
Items supplied as standard

① AEQC. Unit:
The Cheese Vat (AEQC) provides practical training in the production of cheese, and it can be an ideal unit for applied research.
The vat is manufactured in stainless steel. Vat working capacity of 10 litres approx. Agitator, computer controlled. Perforated strainer fits into the vat outlet to facilitate efficient draining. Outlet valve. Heating resistance, computer controlled. Water is circulated through a vat jacket. Circulating pump, computer controlled. Over-temperature cut-out device.
Sensors: pH sensor, temperature sensors.
Optional (not included in the standard supply):
AEQC-A. Cheese Making Accessories:
Designed to be used with the Computer Controlled Cheese Vat (AEQC).
All metallic elements in stainless steel.
Using these accessories operations as: curd cutting, cheedaring, pressing and pH determination (chemical) can be carry out.

② AEQC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ AEQC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 600 x 350 x 450 mm. Weight: 55 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologymilk/AEQC.pdf

PRACTICAL POSSIBILITIES

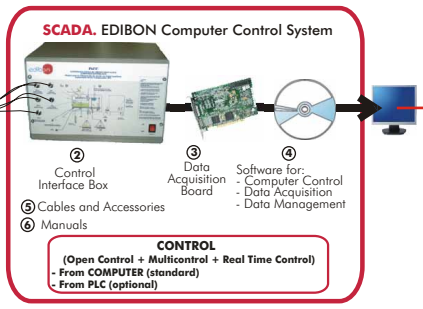
Study and investigation of the processes for the cheese production:
1.- Heating and agitating milk.
2.- Holding milk at exact temperature for addition of starter culture and rennet.
3.- Holding at temperature during coagulation.
4.- Cutting and heating the curd. Heating and agitating accurately to "scald" the curd.
5.- To maintain the higher temperature and agitating during more time.
6.- Settling the curd.
7.- To draw the whey.
8.- Milling.
9.- Addition of salt.
10.- Temperature control.
11.- pH control.
12.- Using the optional accessories: Cheese Making Accessories (AEQC-A), it is possible to carry out these operations: pressing, curd cutting, cheddaring, etc.

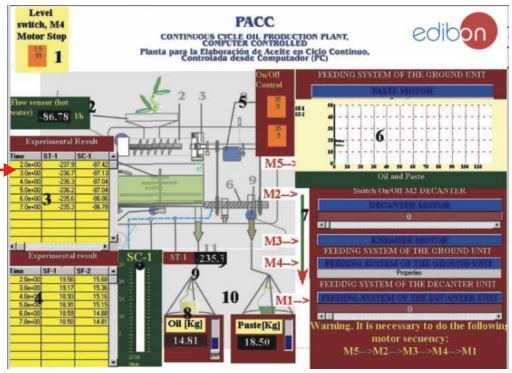
Other possible practices:

13.- Sensors calibration.
14-32.- Practices with PLC.

PACC. Computer Controlled **Continuous Cycle Oil Production Plant**

① Unit: PACC. Continuous Cycle Oil Production Plant





SPECIFICATIONS SUMMARY

Items supplied as standard

① PACC. Unit:
Unit in stainless steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Hopper (200 Kg capacity).
Grinding unit (6000 rpm).
Mixing unit (50 Kg capacity).
Decanter with two phases, one for oil separation and other for water + paste separation. The decanter has double speed: 6000 and 5700 rpm. The decanter has 6 screws to control the quantity of the extracted oil.
Two speed controllers, one for controlling the decanter speed and other for controlling the decanter feed speed.
Sensors: flow sensor, 2 load cells, force sensors and temperature sensor.
Level switch.
Five motors, two of them with speed control.
Fixed protections in all parts with movement for avoiding any contact with the hands. Grille of protection on the hopper with borings. Electric blockage. Electric protection for electric current overload. Control board blockage with IP 54 protection class.
Components in contact with the food product in stainless steel.
Isolated structure.
Vibrations balancing system.
External unit, with anodized aluminium structure, for product collecting, with weighing system (2 Load Cells (50 Kg each one)).
This unit has 2 stainless steel aluminium tanks (capacity 50 l. each one).
Extraction speed: 50 kg/ hour. Power: 3 KW. Oil obtained has a temperature between 22-26°C and an acidity approx. : 0.4°.

② PACC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ PACC/CCSOF. Computer Control + Data Acquisition + Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 1500 x 800 x 1700 mm. Weight: 300 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologyoil/PACC.pdf

PRACTICAL POSSIBILITIES

1.- Obtaining of Oil (olive, avocado, colza, sunflower).

2.- Obtained oil acidity measurement.

3.- Determination of the performance depending on the decanter centrifugation speed.

4.- Determination of performance depending on the type of food product used for oil production.

5.- Study of the influence of the collection time in the performance.

6.- Comparative study of the oil performance depending if the food product for its production has been just recollected or if previously it has been put in the sun to dry.

7.- Practice of cleaning the unit.

8.- Control System. Temperature Sensor Calibration.

9.- Control System. Flow Sensor Calibration.

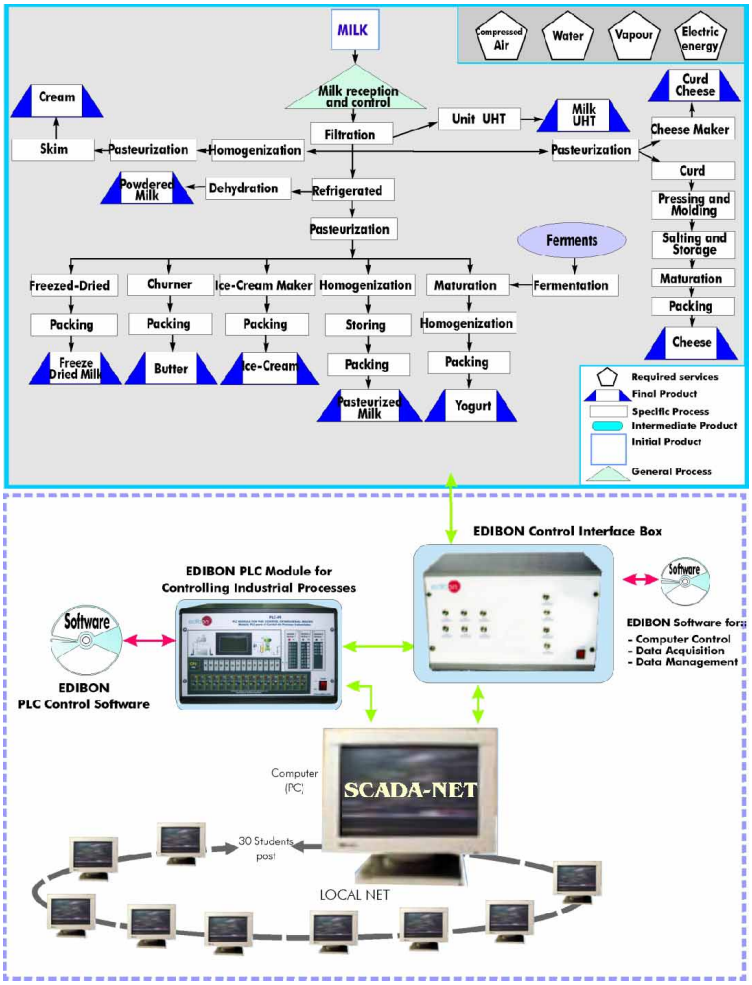
10.-Flow Sensor Hysteresis Study.

11.-Load Cell SF-1 and SF-2 Calibration.

12.-Decanter Supply System Calibration.

13-31.- Practices with PLC.

LE00. **Process Plant for Dairy Products with Scada-Net System "ESN"**



SYSTEM CONFIGURATION

PRACTICAL POSSIBILITIES

Items included in the supply:

① LE00. Process Plant for Dairy Products complete as specifications.
② Control Interface Box.
③ Data Acquisition Board.
④ Software for: Computer Control + Data Acquisition + Data Management.
⑤ EDIBON SCADA-NET Software Package for classroom control and management.
⑥ PLC Module for the Control of Industrial-Processes with all necessary accessories.
⑦ PLC Control Software.
⑧ Computers and local network included.
⑨ Interconnection elements and all accessories included for normal working operation.
⑩ Manuals for:
Practices and Exercises, Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, etc.

SPECIFICATIONS SUMMARY

- Anodized aluminium structure and stainless steel metallic elements. All elements needed are chemical resistant.
- Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process.
- Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
- PLC box for Industrial Control Processes, with front panel process diagram including PLC Control Software.
- Manual, semiautomatic and automatic controlled. All system is connected with a local net with 30 computers in which any student can control any block of the process. When the complete process plant is working synchronized, the control is unique and the rest of the computers in the net works as visualization screens.
- It has been design for a wide range of feed, since 11 to 300 liters, to provide the use for teaching, the production and research.
- The following units have been designed for optimization of all process involved:
Plates Filter (Filtrade).
Refrigerated tank (Refrigeration).
Pasteurization unit (Pasteurization).
Homogenization unit (Homogenization).
Yogurt maker (Obtain yogur).
Cheese maket (Obtain curd).
Ice-cream maker (Obtain ice-cream).
Freeze dryer (Freeze dried).
Dehydratation unit (Dehydration).
Press unit (Obtain cheese).
Butter Maker unit (Obtain butter).
Cream Separator unit (Skim).
Tank to salting, storage and maturation (Salting and maduration).
Packing unit (Packing).
UHT unit(UHT process).
Bottling unit (Bottling).
- Analysis and quality control laboratory.

Dimensions = 14000 x 12000 x 3000 mm. approx. Weight: 3200 Kg. approx.

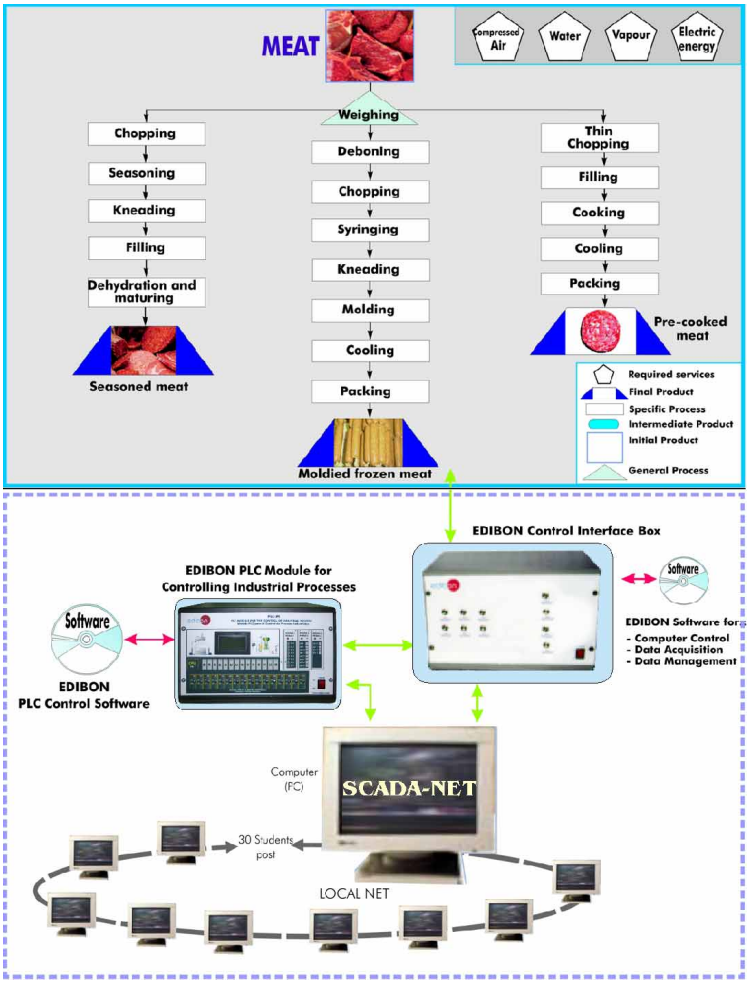
More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologypilotplants/LE00.pdf

This Process Plant has the target of: Research, Teaching, Production and future businessman platform.

It permits the following control and process aspects:

- Analysis of all phases of the product transformation, from reception to packaging.
- Qualitative evaluation of the finished product as function of the productive operations performed.
- Experimentation on the efficiency of the different chemical products used for the preservation process.
- Organization of procedures for continuous quality control of the production operations.
- Execution of procedures for disinfection and sanification of the equipment.
- Evaluation of technical, legal and administrative aspects concerning food adulteration.
- Manual and computer control operation.
- Sensors calibration systems.
- SCADA systems and local net.

CA00. **Process Plant for Meat with Scada-Net System "ESN"**



SYSTEM CONFIGURATION

PRACTICAL POSSIBILITIES

Items included in the supply:

① CA00. Process Plant for Meat complete as specifications.
② Control Interface Box.
③ Data Acquisition Board.
④ Software for: Computer Control + Data Acquisition + Data Management.
⑤ EDIBON SCADA-NET Software Package for classroom control and management.
⑥ PLC Module for the Control of Industrial-Processes with all necessary accessories.
⑦ PLC Control Software.
⑧ Computers and local network included.
⑨ Interconnection elements and all accessories included for normal working operation.
⑩ Manuals for:
Practices and Exercises, Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, etc.

SPECIFICATIONS SUMMARY

- Anodized aluminium structure and stainless steel metallic elements. All elements needed are chemical resistant.
- Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process.
- Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
- PLC box for Industrial Control Processes, with front panel process diagram including PLC Control Software.
- Manual, semiautomatic and automatic controlled. All system is connected with a local net with 30 computers in which any student can control any block of the process. When the complete process plant is working synchronized, the control is unique and the rest of the computers in the net works as visualization screens.
- It has been design for a wide range of feed, since 15 to 200 kg, to provide the use for teaching, the production and research.
- The following units have been designed for optimization of all process involved:
Standard Scale (Weighing).
Cutter (Chopping).
Tank to seasoning (Seasoning).
Kneading unit (Kneading).
Filling/Stuffing unit (Filling/Stuffing).
Dehydration and Maturing unit (Dehydration and maturation).
Deboing unit (Deboing).
Syringing unit (Brine syringing).
Moulding unit (Moulding).
Cooling unit (Cooling).
Packing unit(Packing).
Cooking unit (Cooking).
- Analysis and quality control laboratory.

Dimensions= 12000 x 12000 x 3000 mm. approx. Weight: 3000 Kg. approx.

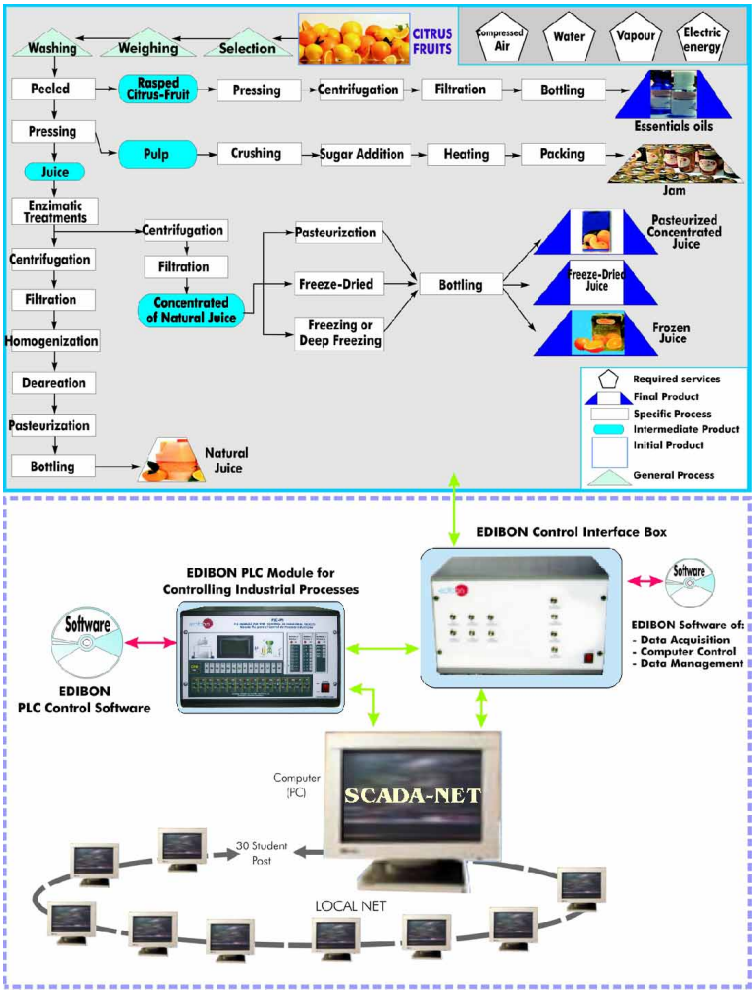
More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologypilotplants/CA00.pdf

This Process Plant has the target of: Research, Teaching, Production and future businessman platform.

It permits the following control and process aspects:

- Analysis of all phases of the product transformation, from reception to packaging.
- Qualitative evaluation of the finished product as function of the productive operations performed.
- Experimentation on the efficiency of the different chemical products used for the preservation process.
- Organization of procedures for continuous quality control of the production operations.
- Execution of procedures for disinfection and sanification of the equipment.
- Evaluation of technical, legal and administrative aspects concerning food adulteration.
- Manual and computer control operation.
- Sensors calibration systems.
- SCADA systems and local net.

CI00. **Process Plant for Citrus Fruits with Scada-Net System "ESN"**



SYSTEM CONFIGURATION

PRACTICAL POSSIBILITIES

Items included in the supply:

① CI00. Process Plant for Citrus Fruits complete as specifications.
② Control Interface Box.
③ Data Acquisition Board.
④ Software for: Computer Control + Data Acquisition + Data Management.
⑤ EDIBON SCADA-NET Software Package for classroom control and management.
⑥ PLC Module for the Control of Industrial-Processes with all necessary accessories.
⑦ PLC Control Software.
⑧ Computers and local network included.
⑨ Interconnection elements and all accessories included for normal working operation.
⑩ Manuals for:
Practices and Exercises, Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, etc.

SPECIFICATIONS SUMMARY

- Anodized aluminium structure and stainless steel metallic elements. All elements needed are chemical resistant.
- Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process.
- Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
- PLC box for Industrial Control Processes, with front panel process diagram including PLC Control Software.
- Manual, semiautomatic and automatic controlled. All system is connected with a local net with 30 computers in which any student can control any block of the process. When the complete process plant is working synchronized, the control is unique and the rest of the computers in the net works as visualization screens.
- It has been design for a wide range of feed, since 15 to 300 kg, to provide the use for teaching , the production and research.
- The following units have been designed for optimization of all process involved:
Selector (Selection).
Standard scale (Weighing).
Washing bath (Washing).
Peeler Unit (Peeled).
Pressed unit (Pressed).
Plates Filter (Filtration).
Centrifugation unit (Centrifugation).
Pasteurization unit (Pasteurization).
Cutter (Size reduction).
Freeze Dryer (Freeze dried).
Stainless steel tank to enzymatic treatment (Enzymatic treatment).
Desaireation tank (Desaireation).
Tank with agitation and resistance (Warming).
Homogenization unit (Homogenization).
Stainless steel tank to sugar addiction (Sugar addiction):
Freezer (Frozen).
Bottling unit (Bottling).
Packing unit (Packing).
- Analysis and quality control laboratory.

Dimensions = 12000 x 12000 x 3000 mm. approx. Weight: 3000 Kg. approx.

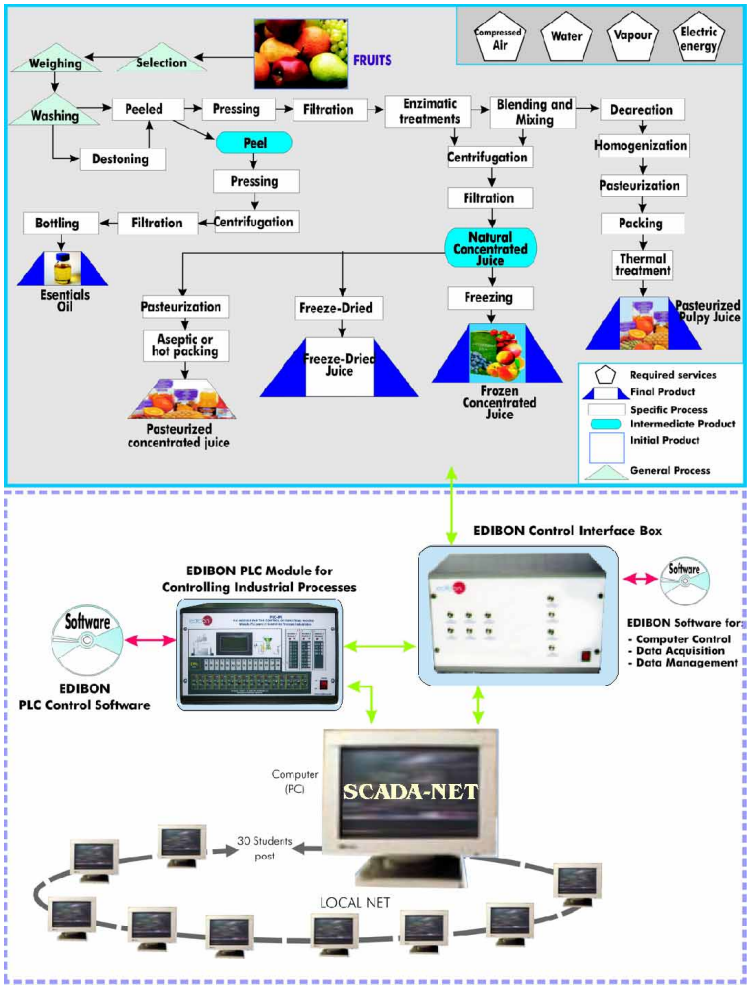
More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologypilotplants/CI00.pdf

This Process Plant has the target of: Research, Teaching, Production and future businessman platform.

It permits the following control and process aspects:

- Analysis of all phases of the product transformation, from reception to packaging.
- Qualitative evaluation of the finished product as function of the productive operations performed.
- Experimentation on the efficiency of the different chemical products used for the preservation process.
- Organization of procedures for continuous quality control of the production operations.
- Execution of procedures for disinfection and sanification of the equipment.
- Analysis of ambient pollution problems caused by the presence of agro-industry.
- Evaluation of technical, legal and administrative aspects concerning food adulteration.
- Manual and computer control operation.
- Sensors calibration systems.
- SCADA systems and local net.

FR00. **Process Plant for Fruits with Scada-Net System "ESN"**



SYSTEM CONFIGURATION

Items included in the supply:

① FR00. Process Plant for Fruits complete as specifications.
② Control Interface Box.
③ Data Acquisition Board.
④ Software for: Computer Control + Data Acquisition + Data Management.
⑤ EDIBON SCADA-NET Software Package for classroom control and management.
⑥ PLC Module for the Control of Industrial-Processes with all necessary accessories.
⑦ PLC Control Software.
⑧ Computers and local network included.
⑨ Interconnection elements and all accessories included for normal working operation.
⑩ Manuals for:
Practices and Exercises, Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, etc.

SPECIFICATIONS SUMMARY

- Anodized aluminium structure and stainless steel metallic elements. All elements needed are chemical resistant.
- Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process.
- Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
- PLC box for Industrial Control Processes, with front panel process diagram including PLC Control Software.
- Manual, semiautomatic and automatic controlled. All system is connected with a local net with 30 computers in which any student can control any block of the process. When the complete process plant is working synchronized, the control is unique and the rest of the computers in the net works as visualization screens.
- It has been design for a wide range of feed, since 15 to 300 kg, to provide the use for teaching , the production and research.
- The following units have been designed for optimization of all process involved:
Selector (Selection).
Standard scale (Weighing).
Washing bath (Washing).
Destoning unit (Destoning).
Peeled unit (Peeled).
Pressed unit (Extraction).
Plates Filter (Filtered).
Tank to Enzymatic Treatments (Enzimatic treatments).
Blending and Mixing unit (Blending and Mixing).
Centrifugation unit (Centrifugation).
Freezer (Frozen).
Freezer-dryer (Freezer dryer).
Pasteurization unit (Pasteurization).
Desaireation unit (Desaireation).
Homogenization unit (Homogenization).
Aseptic packing unit (Aseptic packing).
Bottling unit (Bottling).
Tank with resistance (Thermal treatment).
- Analysis and quality control laboratory.

Dimensions = 12000 x 12000 x 3000 mm. approx. Weight: 3000 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologypilotplants/FR00.pdf

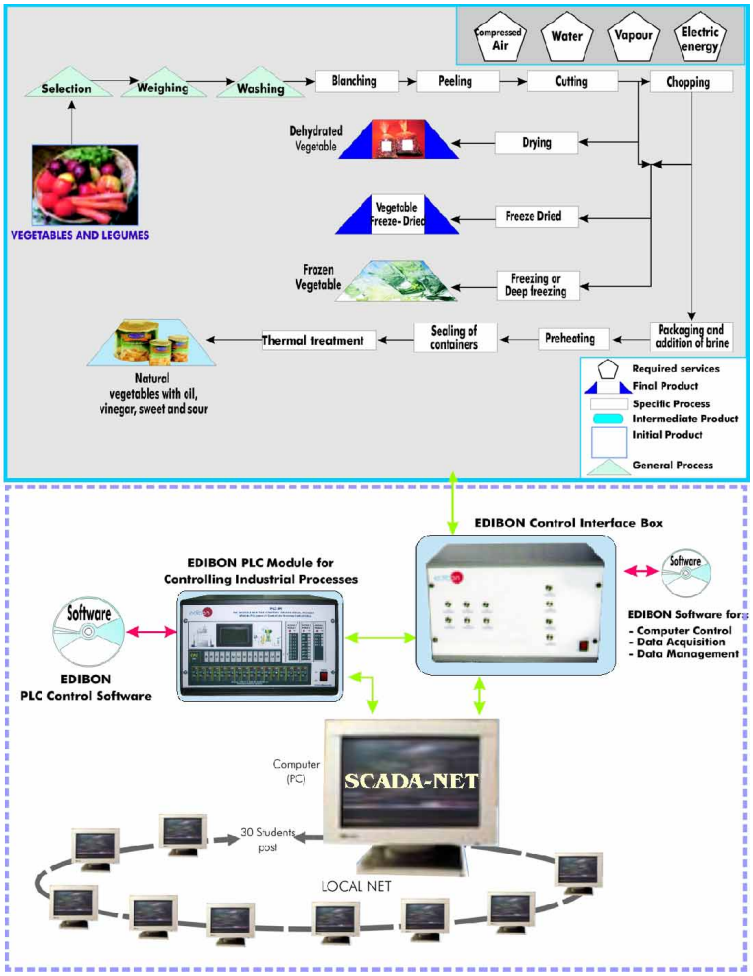
PRACTICAL POSSIBILITIES

This Process Plant has the target of: Research, Teaching, Production and future businessman platform.

It permits the following control and process aspects:

- Analysis of all phases of the product transformation, from reception to packaging.
- Qualitative evaluation of the finished product as function of the productive operations performed.
- Experimentation on the efficiency of the different chemical products used for the preservation process.
- Organization of procedures for continuous quality control of the production operations.
- Execution of procedures for disinfection and sanification of the equipment.
- Evaluation of technical, legal and administrative aspects concerning food adulteration.
- Manual and computer control operation.
- Sensors calibration systems.
- SCADA systems and local net.

VE00. **Process Plant for Vegetables with Scada-Net System "ESN"**



SYSTEM CONFIGURATION

PRACTICAL POSSIBILITIES

Items included in the supply:

① VE00. Process Plant for Vegetables complete as specifications.
② Control Interface Box.
③ Data Acquisition Board.
④ Software for: Computer Control + Data Acquisition + Data Management.
⑤ EDIBON SCADA-NET Software Package for classroom control and management.
⑥ PLC Module for the Control of Industrial-Processes with all necessary accessories.
⑦ PLC Control Software.
⑧ Computers and local network included.
⑨ Interconnection elements and all accessories included for normal working operation.
⑩ Manuals for:
Practices and Exercises, Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, etc.

SPECIFICATIONS SUMMARY

- Anodized aluminium structure and stainless steel metallic elements. All elements needed are chemical resistant.
- Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process.
- Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
- PLC box for Industrial Control Processes, with front panel process diagram including PLC Control Software.
- Manual, semiautomatic and automatic controlled. All system is connected with a local net with 30 computers in which any student can control any block of the process. When the complete process plant is working synchronized, the control is unique and the rest of the computers in the net works as visualization screens.
- It has been design for a wide range of feed, since 15 to 800 kg, to provide the use for teaching , the production and research.
- The following units have been designed for optimization of all process involved:
Selector (Selection).
Standard Scale (Weighing).
Washing Bath (Washing).
Blanched unit (Blanching).
Peeler (Peeled).
Cutter (Cutting).
Dehydrated unit (Dehydration).
Freeze Dryer (Freeze dryed).
Freezer (Frozen).
Packing and adictional brine unit (Packing and brine adicttion).
Stainless steel tank with resistance (Thermal Treatment).
- Analysis and quality control laboratory.

Dimensions = 15000 x 12000 x 3000 mm. approx. Weight: 3500 Kg. approx.

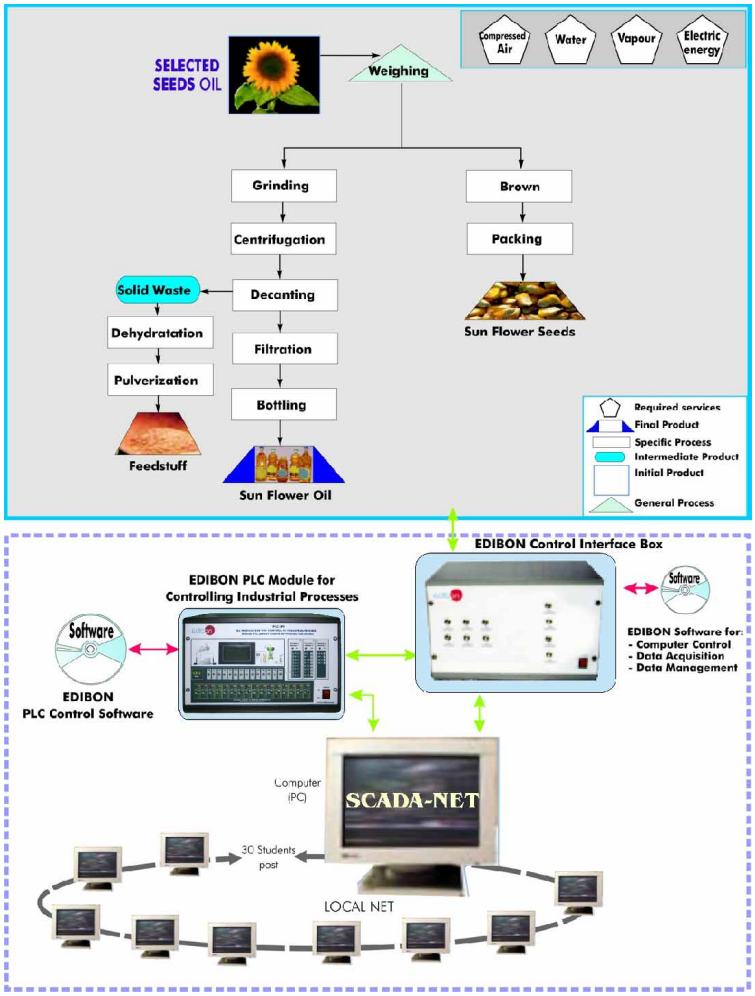
More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologypilotplants/VE00.pdf

This Process Plant has the target of: Research, Teaching, Production and future businessman platform.

It permits the following control and process aspects:

- Analysis of all phases of the product transformation, from reception to packaging.
- Qualitative evaluation of the finished product as function of the productive operations performed.
- Experimentation on the efficiency of the different chemical products used for the preservation process.
- Organization of procedures for continuous quality control of the production operations.
- Execution of procedures for disinfection and sanification of the equipment.
- Evaluation of technical, legal and administrative aspects concerning food adulteration.
- Manual and computer control operation.
- Sensors calibration systems.
- SCADA systems and local net.

AS00. **Process Plant for Seeds Oil with Scada-Net System "ESN"**



SYSTEM CONFIGURATION

Items included in the supply:

① AS00. Process Plant for Seeds Oil complete as specifications.
② Control Interface Box.
③ Data Acquisition Board.
④ Software for: Computer Control + Data Acquisition + Data Management.
⑤ EDIBON SCADA-NET Software Package for classroom control and management.
⑥ PLC Module for the Control of Industrial-Processes with all necessary accessories.
⑦ PLC Control Software.
⑧ Computers and local network included.
⑨ Interconnection elements and all accessories included for normal working operation.
⑩ Manuals for:
Practices and Exercises, Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, etc.

SPECIFICATIONS SUMMARY

- Anodized aluminium structure and stainless steel metallic elements. All elements needed are chemical resistant.
- Control Interface Box:
  With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process.
- Computer Control+Data Acquisition+Data Management Software:
  Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
- PLC box for Industrial Control Processes, with front panel process diagram including PLC Control Software.
- Manual, semiautomatic and automatic controlled. All system is connected with a local net with 30 computers in which any student can control any block of the process. When the complete process plant is working synchronized, the control is unique and the rest of the computers in the net works as visualization screens.
- It has been design for a wide range of feed, since 15 to 380 kg, to provide the use for teaching , the production and research.
- The following units have been designed for optimization of all process involved:
  Standard Scale (Weighing).
  Oven (Brown of sunflower seed).
  Machine to crush, decant and centrifuge (Crushing, Centrifugation and Decantation).
  Dehydrate machine.
  Plates filter.
  Pulverizer.
  Bottling Plant.
  Packaging Machine.
- Analysis and quality control laboratory.

Dimensions = 14000 x 12000 x 3000 mm. approx. Weight: 3200 Kg. approx.

PRACTICAL POSSIBILITIES

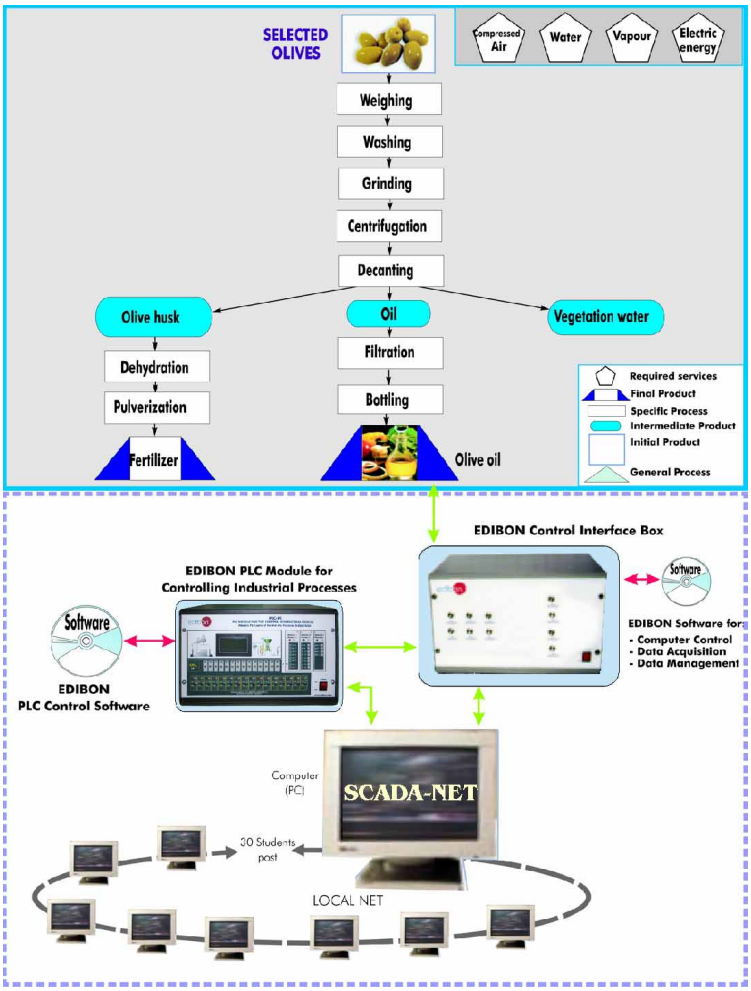
This Process Plant has the target of: Research, Teaching, Production and future businessman platform.

It permits the following control and process aspects:

- Analysis of all phases of the product transformation, from reception to packaging.
- Qualitative evaluation of the finished product as function of the productive operations performed.
- Experimentation on the efficiency of the different chemical products used for the preservation process.
- Organization of procedures for continuous quality control of the production operations.
- Execution of procedures for disinfection and sanification of the equipment.
- Evaluation of technical, legal and administrative aspects concerning food adulteration.
- Manual and computer control operation.
- Sensors calibration systems.
- SCADA systems and local net.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologypilotplants/AS00.pdf

AC00. **Process Plant for Olive Oil with Scada-Net System "ESN"**



SYSTEM CONFIGURATION

PRACTICAL POSSIBILITIES

Items included in the supply:

① AC00. Process Plant for Olive Oil complete as specifications.
② Control Interface Box.
③ Data Acquisition Board.
④ Software for: Computer Control + Data Acquisition + Data Management.
⑤ EDIBON SCADA-NET Software Package for classroom control and management.
⑥ PLC Module for the Control of Industrial-Processes with all necessary accessories.
⑦ PLC Control Software.
⑧ Computers and local network included.
⑨ Interconnection elements and all accessories included for normal working operation.
⑩ Manuals for:
Practices and Exercises, Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, etc.

SPECIFICATIONS SUMMARY

- Anodized aluminium structure and stainless steel metallic elements. All elements needed are chemical resistant.
- Control Interface Box:
  With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process.
- Computer Control+Data Acquisition+Data Management Software:
  Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
- PLC box for Industrial Control Processes, with front panel process diagram including PLC Control Software.
- Manual, semiautomatic and automatic controlled. All system is connected with a local net with 30 computers in which any student can control any block of the process. When the complete process plant is working synchronized, the control is unique and the rest of the computers in the net works as visualization screens.
- It has been design for a wide range of feed, since 15 to 200 kg, to provide the use for teaching , the production and research.
- The following units have been designed for optimization of all process involved:
  Standard Scale (Weighing).
  Washing bath to olives (Washing).
  Unit to crush, decant and centrifuge (Crushing, Centrifugation and Decanting).
  Dehydration unit (Dehydration).
  Pulverization unit (Pulverization).
  Plates filter (Filtration).
  Bottling unit (Bottling).
- Analysis and quality control laboratory.

Dimensions = 14000 x 12000 x 3000 mm. approx. Weight: 3200 Kg. approx.

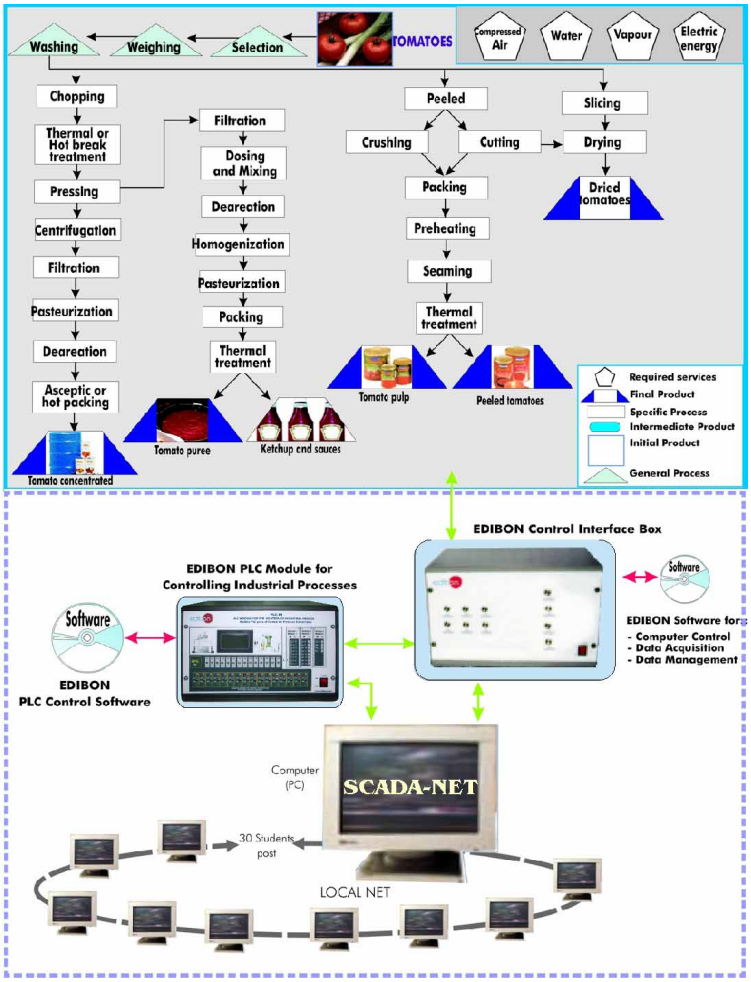
This Process Plant has the target of: Research, Teaching, Production and future businessman platform.

It permits the following control and process aspects:

- Analysis of all phases of the product transformation, from reception to packaging.
- Qualitative evaluation of the finished product as function of the productive operations performed.
- Experimentation on the efficiency of the different chemical products used for the preservation process.
- Organization of procedures for continuous quality control of the production operations.
- Execution of procedures for disinfection and sanification of the equipment.
- Evaluation of technical, legal and administrative aspects concerning food adulteration.
- Manual and computer control operation.
- Sensors calibration systems.
- SCADA systems and local net.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologypilotplants/AC00.pdf

TO00. **Process Plant for Tomatoes with Scada-Net System "ESN"**



SYSTEM CONFIGURATION

Items included in the supply:

① TO00. Process Plant for Tomatoes complete as specifications.
② Control Interface Box.
③ Data Acquisition Board.
④ Software for: Computer Control + Data Acquisition + Data Management.
⑤ EDIBON SCADA-NET Software Package for classroom control and management.
⑥ PLC Module for the Control of Industrial-Processes with all necessary accessories.
⑦ PLC Control Software.
⑧ Computers and local network included.
⑨ Interconnection elements and all accessories included for normal working operation.
⑩ Manuals for:
Practices and Exercises, Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, etc.

SPECIFICATIONS SUMMARY

- Anodized aluminium structure and stainless steel metallic elements. All elements needed are chemical resistant.
- Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process.
- Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
- PLC box for Industrial Control Processes, with front panel process diagram including PLC Control Software.
- Manual, semiautomatic and automatic controlled. All system is connected with a local net with 30 computers in which any student can control any block of the process. When the complete process plant is working synchronized, the control is unique and the rest of the computers in the net works as visualization screens.
- It has been design for a wide range of feed, since 15 to 300 kg, to provide the use for teaching , the production and research.
- The following units have been designed for optimization of all process involved:
Selector (Selection).
Standard scale (Weighing).
Washing Bath (Washing).
Peeler unit (Peeled).
Crusher (Crusher).
Packing unit (Packing).
Seaming unit (Seaming).
Stainless steel tank to thermal treatment (Thermal treatment).
Plates Filter (Filtered).
Centrifugation unit (Centrifugation).
Pasteurization unit (Pasteurization).
Homogenization unit (Homogenization).
Drying unit (Drying).Aseptic packing unit (Aseptic packing)
Desaireation tank (Desaireation).
Press unit (Pressed).
Tank with resistance (Thermal treatment).
Packing unit (Bottling).
Mixing and Dosing unit (Mixing and Dosing).
Scalded unit (Scalded).
- Analysis and quality control laboratory.

Dimensions = 15000 x 12000 x 3000 mm. approx. Weight: 3500 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologypilotplants/TO00.pdf

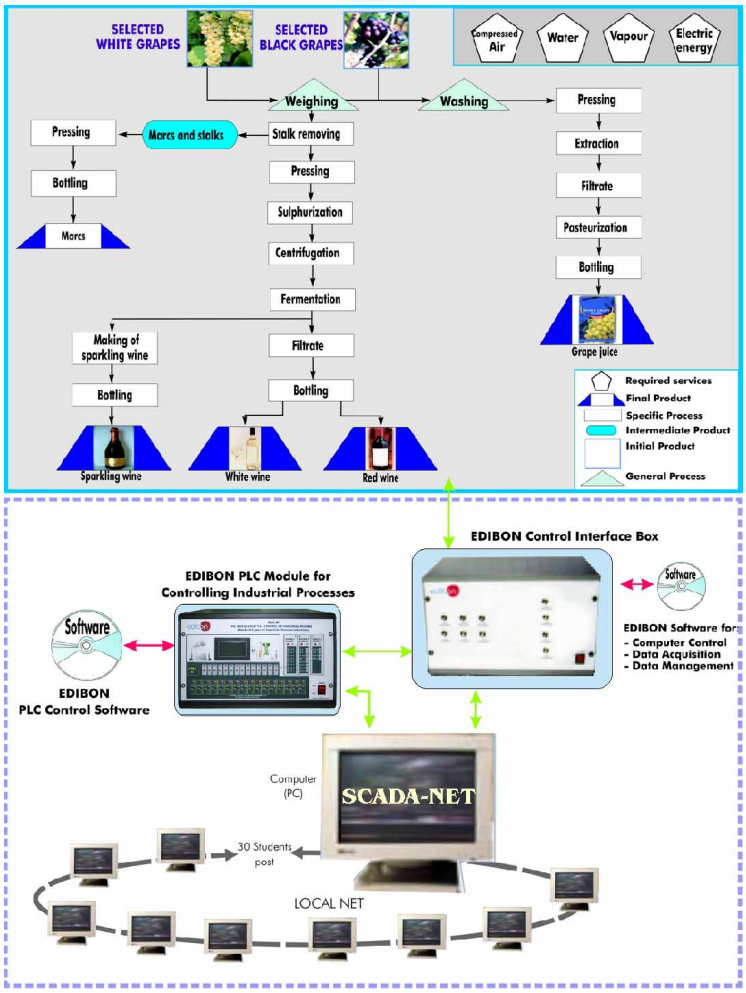
PRACTICAL POSSIBILITIES

This Process Plant has the target of: Research, Teaching, Production and future businessman platform.

It permits the following control and process aspects:

- Analysis of all phases of the product transformation, from reception to packaging.
- Qualitative evaluation of the finished product as function of the productive operations performed.
- Experimentation on the efficiency of the different chemical products used for the preservation process.
- Organization of procedures for continuous quality control of the production operations.
- Execution of procedures for disinfection and sanification of the equipment.
- Evaluation of technical, legal and administrative aspects concerning food adulteration.
- Manual and computer control operation.
- Sensors calibration systems.
- SCADA systems and local net.

UV00. **Process Plant for Grapes with Scada-Net System "ESN"**



SYSTEM CONFIGURATION

PRACTICAL POSSIBILITIES

Items included in the supply:

① UV00. Process Plant for Grapes complete as specifications.
② Control Interface Box.
③ Data Acquisition Board.
④ Software for: Computer Control + Data Acquisition + Data Management.
⑤ EDIBON SCADA-NET Software Package for classroom control and management.
⑥ PLC Module for the Control of Industrial-Processes with all necessary accessories.
⑦ PLC Control Software.
⑧ Computers and local network included.
⑨ Interconnection elements and all accessories included for normal working operation.
⑩ Manuals for:
Practices and Exercises, Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, etc.

SPECIFICATIONS SUMMARY

- Anodized aluminium structure and stainless steel metallic elements. All elements needed are chemical resistant.
- Control Interface Box:
  With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process.
- Computer Control+Data Acquisition+Data Management Software:
  Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
- PLC box for Industrial Control Processes, with front panel process diagram including PLC Control Software.
- Manual, semiautomatic and automatic controlled. All system is connected with a local net with 30 computers in which any student can control any block of the process. When the complete process plant is working synchronized,the control is unique and the rest of the computers in the net works as visualization screens.
- It has been design for a wide range of feed, since 5 to 300 kg, to provide the use for teaching , the production and research.
- The following units have been designed for optimization of all process involved:
  Standard Scale (Weighing).
  Extractor unit (Extraction).
  Plates Filter (Filtrate).
  Pasteurized unit (Pasteurization).
  Stalk removing unit (Stalk removing and sulphured).
  Centrifuge (Centrifugation).
  Fermentation unit (Wine fermentation).
  Bottling unit (Bottling).
- Analysis and quality control laboratory.

Dimensions= 12000 x 12000 x 3000 mm. approx. Weight: 3000 Kg. approx.

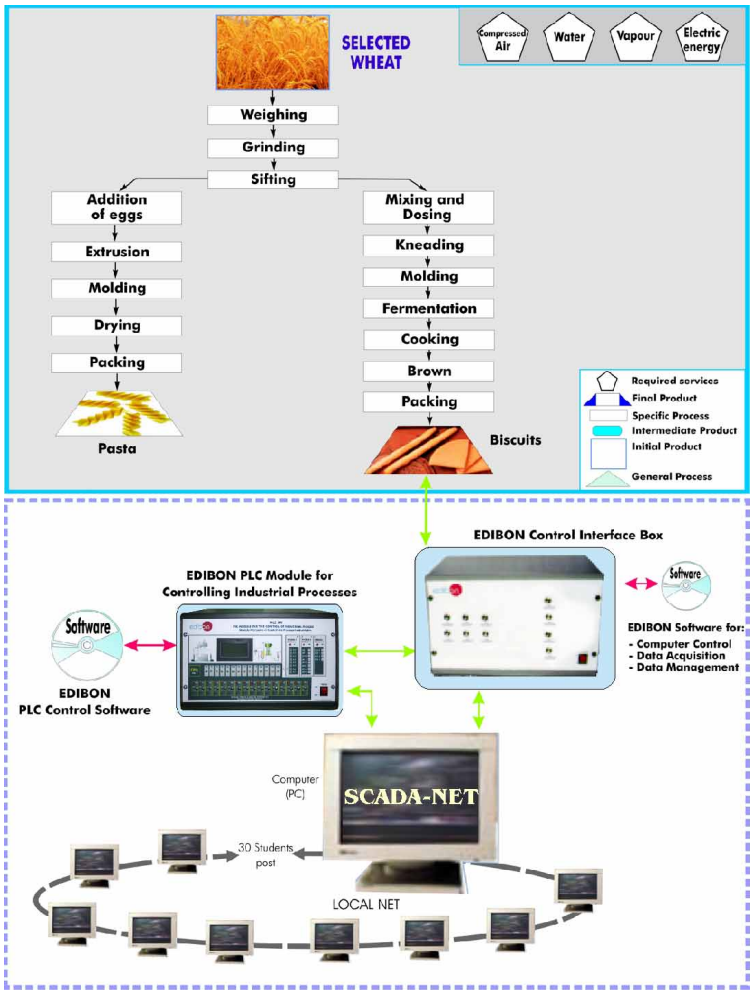
This Process Plant has the target of: Research, Teaching, Production and future businessman platform.

It permits the following control and process aspects:

- Analysis of all phases of the product transformation, from reception to packaging.
- Qualitative evaluation of the finished product as function of the productive operations performed.
- Experimentation on the efficiency of the different chemical products used for the preservation process.
- Organization of procedures for continuous quality control of the production operations.
- Execution of procedures for disinfection and sanification of the equipment.
- Evaluation of technical, legal and administrative aspects concerning food adulteration.
- Manual and computer control operation.
- Sensors calibration systems.
- SCADA systems and local net.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologypilotplants/UV00.pdf

CE00. **Process Plant for Cereals with Scada-Net System "ESN"**



SYSTEM CONFIGURATION

Items included in the supply:

① CE00. Process Plant for Cereals complete as specifications.
② Control Interface Box.
③ Data Acquisition Board.
④ Software for: Computer Control + Data Acquisition + Data Management.
⑤ EDIBON SCADA-NET Software Package for classroom control and management.
⑥ PLC Module for the Control of Industrial-Processes with all necessary accessories.
⑦ PLC Control Software.
⑧ Computers and local network included.
⑨ Interconnection elements and all accessories included for normal working operation.
⑩ Manuals for:
Practices and Exercises, Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, etc.

SPECIFICATIONS SUMMARY

- Anodized aluminium structure and stainless steel metallic elements. All elements needed are chemical resistant.
- Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process.
- Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.
- PLC box for Industrial Control Processes, with front panel process diagram including PLC Control Software.
- Manual, semiautomatic and automatic controlled. All system is connected with a local net with 30 computers in which any student can control any block of the process. When the complete process plant is working synchronized, the control is unique and the rest of the computers in the net works as visualization screens.
- It has been design for a wide range of feed, since 15 to 180 kg, to provide the use for teaching , the production and research.
- The following units have been designed for optimization of all process involved:
Standard Scale (Weighing).
Press unit (Pressed).
Sifting unit (Sifting).
Mixer unit (Mixed).
Tank to addition of eggs (Egges addiction).
Extrusion unit (Extrusion).
Moulding unit (Moulding).
Cooking unit (Cooking).
Packing unit (Packing).
Kneading unit (Kneading).
Fermentation unit (Fermentation).
- Analysis and quality control laboratory.

Dimensions= 12000 x 12000 x 3000 mm. approx. Weight: 3000 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/foodwatertechnologies/foodtechnologypilotplants/CE00.pdf

PRACTICAL POSSIBILITIES

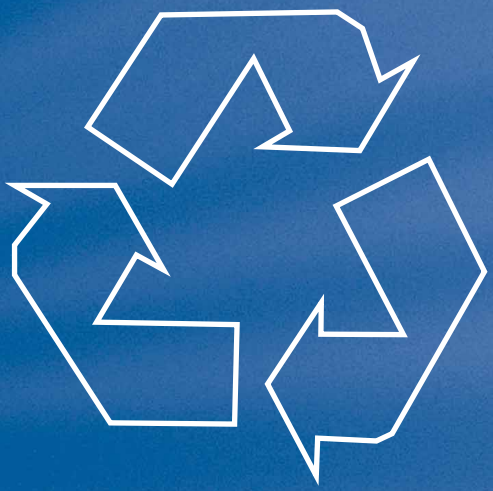
This Process Plant has the target of: Research, Teaching, Production and future businessman platform.

It permits the following control and process aspects:

- Analysis of all phases of the product transformation, from reception to packaging.
- Qualitative evaluation of the finished product as function of the productive operations performed.
- Experimentation on the efficiency of the different chemical products used for the preservation process.
- Organization of procedures for continuous quality control of the production operations.
- Execution of procedures for disinfection and sanification of the equipment.
- Evaluation of technical, legal and administrative aspects concerning food adulteration.
- Manual and computer control operation.
- Sensors calibration systems.
- SCADA systems and local net.

Summarized
Catalogue

five (5)



13. Environment

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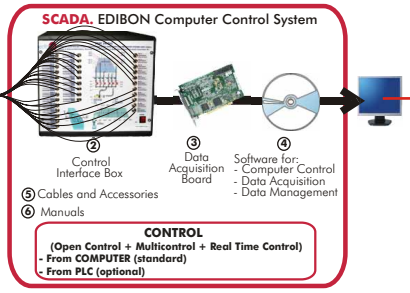
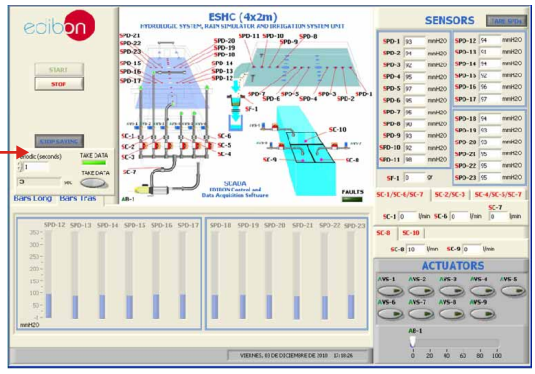
13.1- Water Handling

13.2- Water Treatment

ESHC. Computer Controlled **Hydrologic Systems, Rain Simulator and Irrigation Systems Unit** ✱





① Unit: ESHC. Hydrologic Systems, Rain Simulator and Irrigation Systems Unit.
Versions available:
- ESHC (2x1m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (2x1m).
- ESHC (4x2m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (4x2m).

SPECIFICATIONS SUMMARY

Items supplied as standard

① ESHC. Unit:

This Unit demonstrates some of the major physical process found in hydrology and fluvial geomorphology, including: rainfall hydrographs for catchment areas of varying permeability, the formation of river features and effects of sediment transport, the abstraction of ground water by wells, both with and without surface recharge from rainfall, etc.

Moreover it is capable of demonstrating , on a small scale, the hydrological principles of ground water flow, and the applications of the principles to some engineering constructions.

It is possible to study the use of wells for water abstraction, de-watering and drainage of lakes, and demonstration of flood risks associated with land drainage works.

There are two versions:

ESHC (2x1m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (2x1m).

ESHC (4x2m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (4x2m).

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

Test tank, which is a large sized tank that provides a large working surface:

For ESHC (2x1m): tank dimensions: L=2m, W=1m.

For ESHC (4x2m): tank dimensions: L=4m, W=2m.

Storage tanks, that supply the water required:

For ESHC (2x1m)= two 400 litres tanks.

For ESHC (4x2m)= four 400 litres tanks.

Porous "well" tubes. Drain. Water outlet river simulation. Over flow outlet pipes. Filter. Rain simulator comprised of spray nozzles and showers. Outlet tanks for the flow measurement in the drains and wells. Water inlet valves (auxiliary inlets, rain inlet, river inlet, french wells inlets). Independent flexible pipes. 34 Pressure sensors. 27 Sample capturing takings. Flow sensors (orifice plate). Load Cell.

② ESHC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = ESHC (2x1m) Unit: 2700 x 1500 x 1800 mm. Weight: 950 Kg.
ESHC (4x2m) Unit: 4600 x 2250 x 1800 mm. Weight: 1990 Kg.
Control Interface: 490 x 450 x 470 mm. Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/ESHC(2x1m).pdf

PRACTICAL POSSIBILITIES

1.- Determination of the superficial dragging.
2.- Hydrograph curve, strong storm.
3.- Calculation of concentration time for a short storm.
4.- Storm hydrographs from single or multiple storms.
5.- Storm hydrograph from a previously saturated catchment.
6.- Storm runoff from an impermeable catchment.
7.- Drainage density determination
8.- Effect of a moving storm flood hydrograph.
9.- Effect of a reservoir storage on flood hydrograph.
10.- Effect of land drains on flood hydrograph.
11.- Reservoir filling and flooding.
12.- Gravity force of water.
13.- Fluvial-mechanical experiments.
14.- Model stream flow in alluvial material.
15.- Sediment transport in river models.
16.- Formation and development of river features over time.
17.- Meandering river.
18.- Erosion on river beds and current speed.
19.- Sediment transport, bedload motion, scour and erosion.
20.- Underground water capture studies.
21.- Well depression cone.
22.- Interaction of depression cones by two adjoining wells.
23.- Well in the centre of a circular island.
24.- Draw-down curves for one well and two wells systems.

Other possible practices:

25.- Sensors calibration.
26-44.- Practices with PLC.

EFAS. **Ground Water Flow Unit**

SPECIFICATIONS SUMMARY

Unit for demonstrating the hydrological principles of groundwater flow and the applications of these to different engineering constructions. It allows the investigation of ground water flows, the drainage processes and the effect of the permeability. It is possible to study the use of wells, de-watering and drainage of lakes, and demonstration of ground drainage works, among others. This unit allows a quick configuration of any easy situation of tridimensional flow and to measurement the piezometric levels at different and appropriate places within the model, making possible to obtain realistic experimental results.

Unit mounted on anodized aluminium profiles and painted steel panels.

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

A test tank, made in fibreglass reinforced polyester, 1000 mm of length x 500 mm of width and 240 mm of depth.

Two membrane valves to regulate water inlet flows to the test tank.

Two wells simmetrically located in the test tank.

Two membrane valves to regulate water outlet flows from the wells.

19 tappings to measure the hydraulic gradients, connected to column water manometers of 300 mm. long. The manometers have individual ball valves to purge the tubes.

Air manual pump connected to the manometers.

Three accessories that make it easy the construction of the different models object of study: rectangular model for a lake construction, rectangular model for an excavation construction, cylindrical model for a confined aquifer construction.

Flexible pipes and quick connectors.

Cables and Accessories, for normal operation.

Manual: This unit is supplied 8 Manuals.

Dimensions (approx.) = 1100 x 650 x 1400 mm. Weight: 100 Kg.

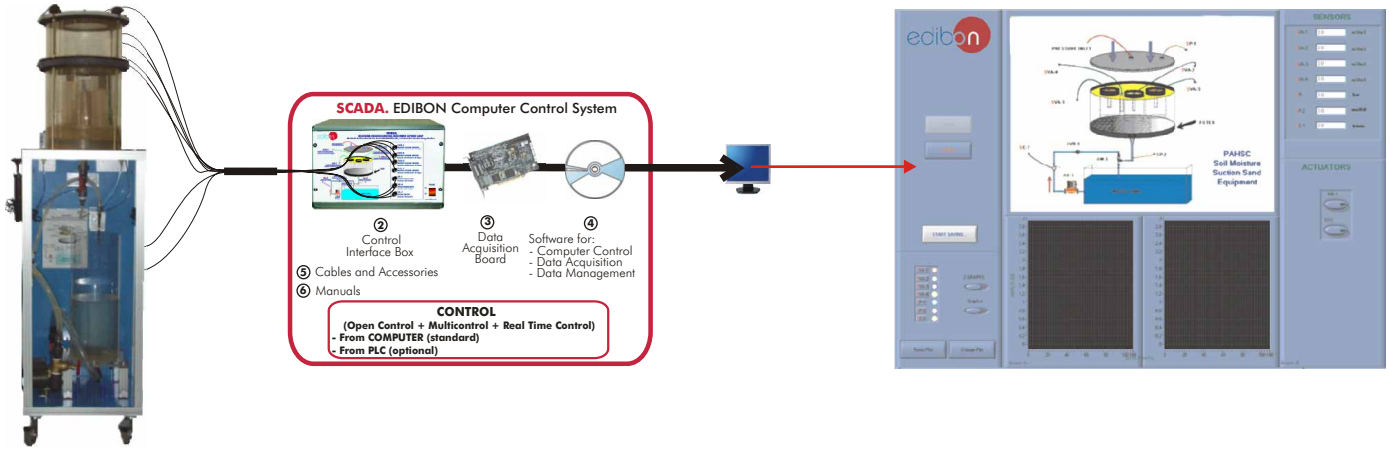
More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/EFAS.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of hydraulic gradients in ground water flow, including the effect of permeability.
2.- Investigation of hydraulic gradients for different models built on the test tank.
3.- Determination of the ground water level between inlet and outlet.
4.- Demonstration of the Darcy's Law.
5.- Study of the cone of depression for a well in a confined aquifer.
6.- Study of the cone of depression for a well in a free aquifer.
7.- Study of the cone of depression cone for two wells.
8.- Experiment to obtain hydraulic gradients for a model with two wells. Compare it with the result of only one well by the superposition method.
9.- Draining of or lake model.
10.- De-watering of an excavation model under freatic level.
11.- De-watering of an excavation model using two wells.
12.- Interaction of cones of depression by two adjoining wells.
13.- Draw-down curves for one well and two wells systems.
14.- Comparison of different profiles, combinations.
15.- How to fill the manometer tubes.

✱ Non computer controlled version available too.

PAHSC. Computer Controlled **Soil Moisture Suction Sand Unit** ✱



①Unit: PAHSC. Soil Moisture Suction Sand Unit

SPECIFICATIONS SUMMARY

Items supplied as standard

① PAHSC. Unit:

Unit, computer controlled, designed to study and understand the water retentivity principles, in terms of soil suction, as well as for the derivation of characteristic curves of the ground´s humidity.

Anodized aluminium structure a nd panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Suction system, including: water circuit, water tank (capacity: 5 l.), water pump (range: 3 l/min.), water jet pump, pressure sensor, flow sensor.

Soil container, including: filter, transparent circular tank for filling with sand (capacity: 15 l.), 4 soil sample retaining rings (capacity of each one: 0.3 l.), 4 water volume sensors (humidity), pressure sensor, air inlet (pressure inlet).

② PAHSC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 400 x 500 x 1200 mm. Weight: 90 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/PAHSC.pdf

PRACTICAL POSSIBILITIES

1.- To understand the relationship between water retentivity and soil.

2.- To understand the basic principles of water retentivity in terms of soil suction.

3.- Derive soil moisture characteristic curves for several soils.

4.- Effect of the atmospheric pressure.

Other possible practices:

5.- Sensors calibration.

6-24.- Practices with PLC.

PL. **Demonstration Lysimeter**

SPECIFICATIONS SUMMARY

Unit designed for the measurement of evapotranspiration by water-balance method. The Demonstration Lysimeter (PL) consists of containers in which may be placed any soil type and several crop types grown.

Anodized aluminium structure and panels in painted steel.

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

2 Bases and 2 inner discs to support soil filled recipients and plants.

2 Hydraulic sensing devices located in the bases, connected to the graduated water columns.

2 Graduated water columns , mounted above the lysimeters.

Two 300 mm. approx. diameter containers. Each container can then in turn be placed on a hydraulically mounted plate which is used to monitor system weight changes arising for evapotranspiration.

Set of calibration weights (2 of 2.5 Kg., 1 of 0.5 Kg., 2 of 200 gr., and 2 of 100 gr.).

Cables and Accessories, for normal operation.

Manual: This unit is supplied 8 Manuals.

Dimensions (approx.) = 1000 x 700 x 1300 mm. Weight: 60 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/PL.pdf

PRACTICAL POSSIBILITIES

1.- Study of the measurement of evapotranspiration by water-balance method.

2.- To use lysimeter unit.

3.- To determine plant water usage.

4.- To understand the relationship between reference maximum and actual transpiration.

✱ Non computer controlled version available too.

PPD. **Drain Permeameter**

SPECIFICATIONS SUMMARY

Unit designed for the study and laboratory investigation of field drain filter materials. This drain permeameter is suited for use both as a teaching and demonstration unit and for laboratory testing and research.

Anodized aluminium structure and panels in painted steel.

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

Transparent acrylic column of 100 mm. diameter, supported on a stand, which may be filled with any soil type.

Removable test section at the base of the column to house the filter medium to be tested.

3 different metallic filters.

Constant head supply device. This is an adjustable water input tank, which allows to regulate the pressure.

Feed tank, capacity: 20 l. approx.

Permeating water and soil collected tank. Capacity: 20 l. approx.

Water centrifugal pump.

Cables and Accessories, for normal operation.

Manual: This unit is supplied 8 Manuals.

Dimensions (approx.) = 500 x 700 x 1500 mm. Weight: 40 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/PPD.pdf

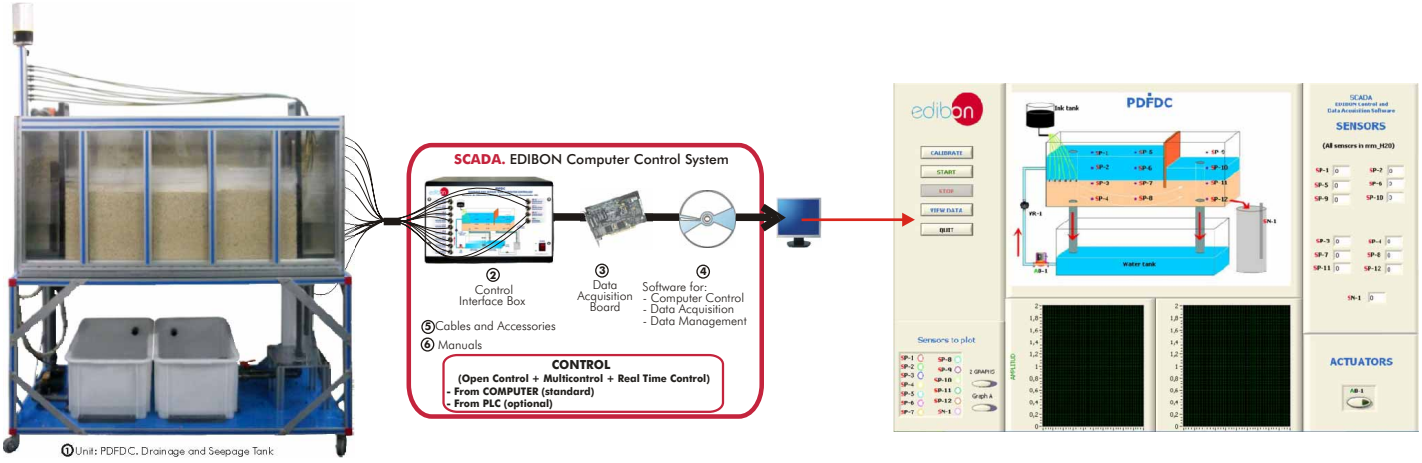
PRACTICAL POSSIBILITIES

1.- Investigation of drain filter materials.

2.- To select optimum filter/soil combinations.

3.- To determine relative efficiencies of drain filter materials.

PDFDC. Computer Controlled **Drainage and Seepage Tank** ✱



SPECIFICATIONS SUMMARY

Items supplied as standard

① PDFDC. Unit:

This unit has been designed for the practical demonstration, visualization and experimental study of the flow through permeable media and flows in subsoil.

Mobile bench. Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Rectangular tank (soils container), with front side in methacrylate and back side in aluminium, to contain the sand. (Sand not included). 2 Overflow pipes in the tank. 12 Pressure sensors.

Feed water tank (capacity: 75 litres). Water pump, computer controlled. Control valve to regulate the water flow. Water collection tank (capacity: 75 litres); this tank is connected to the feed water tank. Samples collection tank; it includes a level sensor and a valve to control the emptying process.

Dye injection system: with dye vessel, with 8 dye injection needles and regulation valve.

Set of typical models:

1 Sheet pile wall. 2 Mesh gates. 1 Mobile accessory for pressure measurement.

② PDFDC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1500 x 700 x 2000 mm. Weight: 200 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/PDFDC.pdf

PRACTICAL POSSIBILITIES

1.- Flow net construction.

2.- Flow line visualisation.

3.- Verification of Darcy´s Law.

4.- Comparison of experimental results with analytical solutions.

5.- To determine seepage rates.

6.- Seepage through an earth dam.

7.- Seepage underneath a sheet pile wall.

8.- Control of seepage through permeable soils by sub-soil drainage.

9.- To reduce uplift pressure and lateral thrust by drainage.

10.- Distribution of uplift pressure on hydraulic structures.

11.- Behaviour and formation of "quicksands".

12.- To drain an excavation site using wells.

13.- Stability of an earth dam.

14.- Comparison of permeability according to the grain size.

15.- Sheet pile wall:

- Study of the soil permeability.
- Flow lines visualization.
- Calculation of the equipotential lines.
- Pressures distribution.

16.- Permeability of the phreatic layer:

- Study of the soil permeability.
- Flow lines visualization.
- Calculation of the equipotential lines.
- Measurement of the infiltration speed.
- Verification of the Law of Darcy.

17.- Flow through an earth dam:

- Study of the soil permeability.
- Flow lines visualization.
- Calculation of the equipotential lines.
- Pressures distribution.
- Effects of the layer inclination.

Other possible practices:

18.- Sensors calibration.

19-37.- Practices with PLC.

✱ Non computer controlled version available too.

PEIF. **Filterability Index Unit**

SPECIFICATIONS SUMMARY

The PEIF is an unit for demonstrating the filtering process through a porous media. It enables a water quality test to be made on a suspension to be filtered through sand or similar granular media.

This unit utilises a bed of granular material, normally sand, which can be chosen by the student to suit his own purposes. The measurements taken with this unit enable a filterability index to be calculated which has significance in deep bed filter performance.

Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Feeding tank of 1 litre capacity.

Filtration unit, with porous bed filter, removable:

Height of the filter: 70 mm. Test filter cell diameter: 44 mm. The filter unit can be dismounted to change the sand.

A regulation valve controls the flow, which is observed on a flow meter.

Water flow meter, range: 0-550 cc/min.

Differential manometer of 500 mm, to measure the head loss.

Accessories included with the unit:

Thermometer. Stopwatch. 1 litre graduated test tube. 0.6 litres glass beaker (to collect filtrate). Air pump for purging the manometer.

Cables and Accessories, for normal operation.

Manual: This unit is supplied 8 Manuals.

Dimensions (approx.) = 600 x 400 x 800 mm. Weight: 25 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/PEIF.pdf

PRACTICAL POSSIBILITIES

1.- Study of the filtration operation principles.
2.- Filtration procedure.
3.- Flowmeter calibration.
4.- Calculation of Filterability Index from measurements taken.
5.- Flow through permeable layers.
6.- Deep bed filtration of suspensions with different particle layers.
7.- Practice of sand filter cleaning.

ESED. **Sedimentation Study Unit**

SPECIFICATIONS SUMMARY

The sedimentation is a process widely used in the classification, water clarification and wastewater treatment.

"ESED" unit provides a facility for studying the basic physical processess involved in sedimentation, which the applications cover fields like chemical engineering, water treatment and other industrial processes.

Five sedimentation graduated cylinders of methacrylate (1m x 50mm approx.) mounted vertically on a panel, illuminated from behind, and with the possibility of being removable for cleaning.

Light diffuser screen and two fluorescent lamps.

Stopwatch.

Three beakers.

Specific gravity bottle.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = 550 x 400 x 1300 mm. Weight: 35 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/ESED.pdf

PRACTICAL POSSIBILITIES

1.- Variation of the sedimentation characteristics with the concentration and suspension height.
2.- Effect of initial concentration on sedimentation characteristics.
3.- Effect of initial suspension height on sedimentation characteristics.
4.- Construction of settling rate curves against concentration form a single batch test.
5.- Effect of particle size distribution.
6.- Identification of the different sedimentation regimes.
7.- Use of flocculating additives.
8.- Construction of settling rate curves.
9.- Visualization of the retarded sedimentation.
10.- Study of the differences between a clarifier and a classifier.
11.- Study and visualization of the differential sedimentation.
12.- Study of the methods of sinking and floating.

PEDI. **Demonstration Infiltration Unit**

SPECIFICATIONS SUMMARY

This unit has been developed for the demonstration of the infiltration processes. This demonstration infiltration unit is suited for use both as a teaching and demonstration unit and for laboratory testing and research.

The unit is mounted in an anodized aluminium and painted steel panels and comprises three transparent graduated cylinders in which soil samples are placed. The cylinders have an air breather and at the bottom a perforated plate which retains the material while allowing the water to drain through.

Water is poured onto the soil surface into each cylinder and its progress through the samples can be observed.

Tank for water.

Cables and Accessories, for normal operation.

Manual: This unit is supplied 8 Manuals.

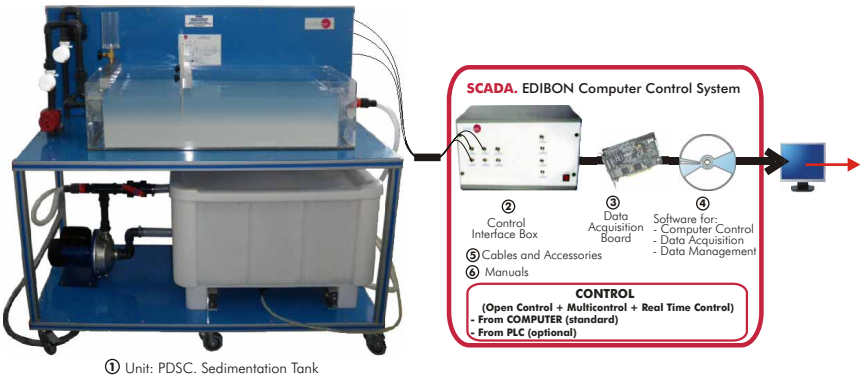
Dimensions (approx.) = 550 x 450 x 950 mm. Weight: 50 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/PEDI.pdf

PRACTICAL POSSIBILITIES

1.- Understand the effects of existing soil moisture conditions on infiltration.
2.- Understand the effects of soil texture and structure on infiltration.
3.- Comparison of the rates of infiltration in different types of soil.
4.- Determination of surface effects on infiltration.

PDSC. Computer Controlled **Sedimentation Tank** ✱



① Unit: PDSC. Sedimentation Tank

SPECIFICATIONS SUMMARY

Items supplied as standard

① PDSC. Unit:

PDSC is a teaching unit designed by EDIBON to demonstrate the sedimentation process and to familiarize with the settling principle of discrete or floculated particles settling into a tank. It will also allow to study the hydraulic characteristics of a rectangular sedimentation tank which works in continuous.

Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Sedimentation tank, made in transparent methacrylate. Length: 1000 mm; width: 400 mm; height: 250 mm.

Suspended solids installation, composed of: suspended solids tank of 140 litres, centrifugal pump, computer controlled, flow regulation valve, flow sensor.

Clean water installation, composed of: flow regulation valve, flow sensor.

Dye injection and tracer system, which allows to study the fluid current lines into the sedimentation tank.

2 Baffle plates, adjustable in height, what makes easier for the student the possibility of changing the flow lines direction and its study.

Sensor for measuring the inlet water temperature.

Accessories included: 2 Imhoff cones of 1000 ml., to measure the solids concentrations, graduated test tube of 1 litre.

② PDSC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1400 x 700 x 1300 mm. Weight: 150 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/PDSC.pdf

PRACTICAL POSSIBILITIES

1.- Study of the basic principles of solids in suspension separation.

2.- Efficiency of the separation by sedimentation process.

3.- Study of the current lines.

4.- Study of the effect of flow rate, inlet water temperature and baffle position on dispersion.

5.- Measuring sediment removal efficiencies and relating these to the hydraulic characteristics.

6.- To measure the flow short-circuiting and dead space using a tracer.

7.- Comparison of real flow regimes with idealised flow models.

Other possible practices:

8.- Sensors calibration.

9-27.- Practices with PLC.

PEFP. **Permeability/Fluidisation Studies Unit**

SPECIFICATIONS SUMMARY

The EDIBON Permeability/ Fluidisation Studies Unit is designed for student to measure and understand the characteristics of flow through a bed of particles. Such flows occur both naturally and in process plant designs. This unit can also be used for a part of the studying of media for water and wastewater filtration. This unit verifies Darcy's Law, examines Kozeny's equation and observes liquid fluidisation behaviour of a granular bed.

Anodized aluminium structure and panel in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Permeameter: transparent acrylic cylinder of 50 mm. diameter, 500 mm. length.

2 Filter metallic disks.

4 Piezometer taps located along the vertical axis of the cylinder.

Piezometric taking collector.

Piezometer or Manometer of water: 500 mm. length.

2 Manometers, Bourdon type, of 0-1000 mm H_2O.

Constant head supply device: max. height variation: 500 mm.

Flowmeter: 2 l/min. max.

Cables and Accessories, for normal operation.

Manual: This unit is supplied 8 Manuals.

Dimensions (approx.) = 850 x 400 x 1200 mm. Weight: 70 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/PEFP.pdf

PRACTICAL POSSIBILITIES

1.- Pressure drop measurements and correlations for flow through packed beds.

2.- To calculate the density of each specimen.

3.- To calculate the relative density of specimen mixing.

4.- Study and verification of Carman-Kozeny´s equation.

5.- Calculation the void ratio.

6.- To determine the permeability constant (Darcy´s Law).

7.- Observation of a liquid fluidised bed.

8.- Characteristic of a liquid fluidised bed.

9.- Attrition test.

10.- Measurement of permeability of selected solids.

✱ Non computer controlled version available too.

HVFLM. **Mobile Bed and Flow Visualisation Unit**

SPECIFICATIONS SUMMARY

This unit has been designed to allow investigations of mobile bed situations both in relation to water courses or structures of engineering and to perform practices and tests involving two dimensional flow visualization by means of dust indicator technique or by other methods of flow visualisation.

Three are 2 Versions:

- HVFLM-2. Mobile Bed and Flow Visualisation Unit (working section: 2000 x 610 mm).
- HVFLM-4. Mobile Bed and Flow Visualisation Unit (working section: 4000 x 610 mm).

Metallic structure and supports. Diagram in the from panel with similar distribution to the elements in the real unit.

Self contained recirculating water tank for flow visualisation and mobile bed studies and practices. Tank composed of inlet tank, working section and discharge reservoir tank.

Dimensions of the working section:

For HVFLM-2 Version: 2000 x 610 mm.

For HVFLM-4 Version: 4000 x 610 mm.

Max. water depth: 120 mm.

Sump capacity: 300 l.

An adjustable overshot weir with upstream sand trap is located within the discharge tank.

Depth gauge for measuring the water level and for mapping the sand bed contours. Hook and point and Vernier scale to determine levels accurately.

Centrifugal pump.

Sheet of coloured glass to allow quick changeover from mobile bed to flow visualisation mode.

Console with all controls, with motor starter and digital meter.

Set of accessories and models, made of corrosion proof material are included.

Cables and Accessories, for normal operation.

Manual: This unit is supplied 8 Manuals.

Dimensions (approx.) = HVFLM-2: 3800 x 750 x 1700 mm.
Weight: 500 Kg.
HVFLM-4: 5800 x 750 x 1700 mm.
Weight: 650 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/waterhandling/HVFLM.pdf

PRACTICAL POSSIBILITIES

1.- Flow around model engineering structures.

2.- Mobile bed experiments.

3.- Meandering water courses characteristics.

4.- Visualisation of the behaviour of boundary layers.

5.- Demonstration of boundary layer suction.

6.- Experiments of erosion.

7.- Experiments of deposition.

8.- Velocity distribution in duct flow.

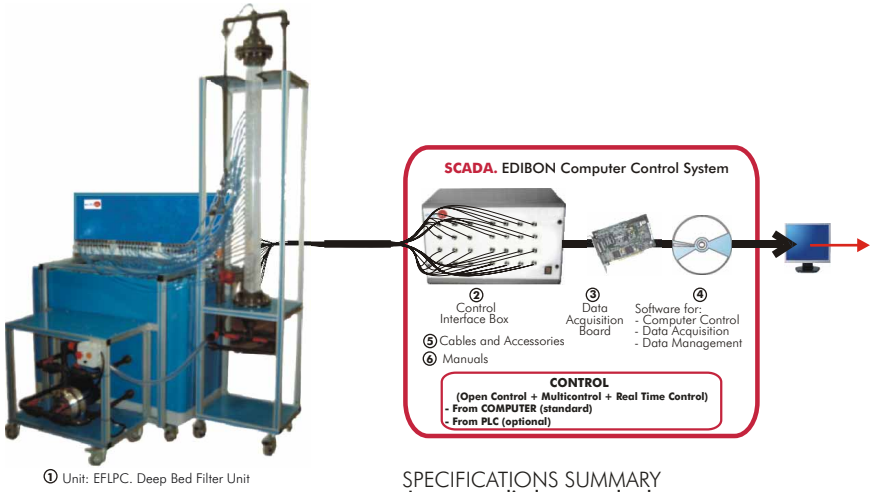
9.- Practices and tests with models for engineering.

10.- Two dimensional flow visualization by the Ahlborn technique.

11.- Hydraulic analogy to compressible flow.

12.- Sediment erosion and deposits.

EFLPC. Computer Controlled **Deep Bed Filter Unit** ✱



① Unit: EFLPC. Deep Bed Filter Unit

SPECIFICATIONS SUMMARY
Items supplied as standard

① EFLPC. Unit:
The Deep Bed Filter Unit allows us to filter a fluid in order to eliminate particles in suspension, to have it in more adequate conditions for its subsequent use or consumption. Students can visualize and study with this unit one of the most common treatment processes of water destined to supplying cities and in most industrial uses.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Filter column:
In it the porous media is formed. This includes the following elements:
Transparent filter column of circular section (column height: 1300 mm), with removable top and bottom covers. Support filter of the porous bed. Filtering bed. 30 Pressure takings. 29 Sample capturing takings.
Tanks:
Their objective is to prepare the suspension for being filtered. There is a tank with two reservoirs:
Reservoir 1 = 350 litres. Reservoir 2 = 350 litres. Total capacity: 700 litres. Both reservoirs have water heigh level and system for agitation with help of the water return.
Pump: Centrifugal pump: 0.6 kW, 2850 r.p.m. In order to take the fluid to the upper part of the filter column (filtering operations), or the bottom part of the column (washing operation of the porous bed).
Pipes and valve system to stablish several circuits and regulate the flows.
Pressure sensors.
Flow sensor.
Mesh filter.
Air purger for eliminating bubbles which are initally in the circuit.

② EFLPC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EFLPC/CCSOF. Computer Control + Data Acquisition + Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 2400 x 1500 x 2700 mm. Weight: 250 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/watertreatment/EFLPC.pdf

PRACTICAL POSSIBILITIES

1.- Determination of the initial head loss of a porous bed.
2.- Evolution through time of the head loss of the porous bed.
3.- Measuring how fast total head loss increases with filtration run time.
4.- Measuring pressure drop profiles through the filter bed.
5.- Measuring suspension concentration profiles through the filter bed.
6.- Filtration efficiency. Clarification.
7.- Demonstration of reversed flow fluidisation and backwashing.
8.- Filtering in open and closed circuit.
9.- Washing and filtering circuits.
10.- The column may be readily adapted for absorption and ion exchange studies.

Other possible practices:

11.- Sensors calibration.
12-30.- Practices with PLC.

EII. **Ion Exchange Unit**

SPECIFICATIONS SUMMARY

Self-contained unit either single bed water softening or double bed system for demineralisation.

Anodized aluminium structure and panel in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Exchange capacity of the different materials, as resins and used reagents, as well as the problem water.

Use of simple or double bed for demineralisation.

4 tanks (treated water, demineralized water, hydrochloric acid and sodium hydroxide).

Pump diaphragm type.

Flow meter 5 l./h, resistant to hydrochloric acid.

2 transparent vertical columns for the anionic and cationic resins, volume: 0.16l. 1 spare column.

Valves and pipes circuit.

Conductivity meter (with conductivity cell): scale 0.0 to 19.99 μS.

Typical commercial anionic and cationic resins.

Switch board.

Manuals: This unit is supplied 8 Manuals.

Dimensions (approx.) = 1200 x 500 x 1000 mm. Weight: 50 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/watertreatment/EII.pdf

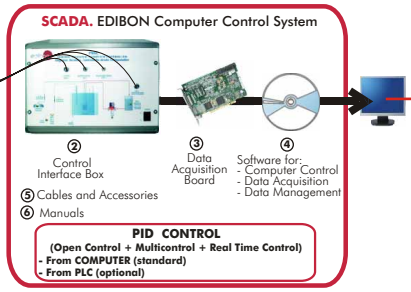
PRACTICAL POSSIBILITIES

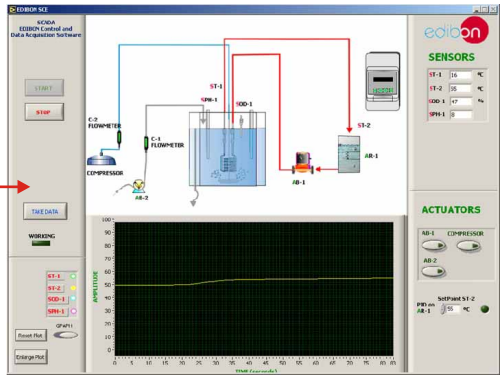
1.- Study of general techniques of ion exchange.
2.- Familiarization with the operation modes of column ionic exchange.
3.- The exchange capabilities of different resins materials.
4.- Water softening using a cationic resin.
5.- Hard water softening (H^+).
6.- Hard water softening (OH^-).
7.- Resin regeneration efficiency (H^+).
8.- Demineralisation.
9.- Demineralisation efficiency.
10.- Determination of saline ions concentration.
11.- Separation of Ni^{2+}, Zn^{2+}.
12.- Hard water softening (sodic resin).
13.- Resin regeneration efficiency (Na^+).
14.- How to operate the conductivity meter.
15.- Regeneration efficiency of a softening system.
16.- Demineralisation using two-bed exchange.

✱ Non computer controlled version available too.

PDAC. Computer Controlled **Aerobic Digester** ✱

① Unit: PDAC. Aerobic Digester





SPECIFICATIONS SUMMARY

Items supplied as standard

① PDAC. Unit:
The aim of this unit is to allow the study and the comprehension of the aerobic digestion processes. Such digestion is a biological process in which the parcial oxidation of primary mud, active muds or a mixing of different types of mud take place, through the constant aireation.
Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit. 20 litres reactor vessel with a tubular membrane inside. Lid for the reactor with a manual valve and the respective holes. Sensors: 2 temperature sensors, pH sensor and dissolved oxygen sensor. Thermostatic bath (until 60°C). Pump, computer controlled, for water circulation of the thermostatic bath. Heating or cooling coil, computer controlled. Peristaltic pump, computer controlled. Water flow meter. Air compressor. Diffusing sheet for the air inlet. Air flow meter. Membrane, muds separation. Overflow for the outlet of filtered water. Valve on the bottom for mud extraction.

② PDAC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ PDAC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 800 x 600 x 700 mm. Weight: 50 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/watertreatment/PDAC.pdf

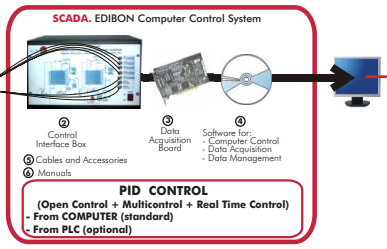
PRACTICAL POSSIBILITIES

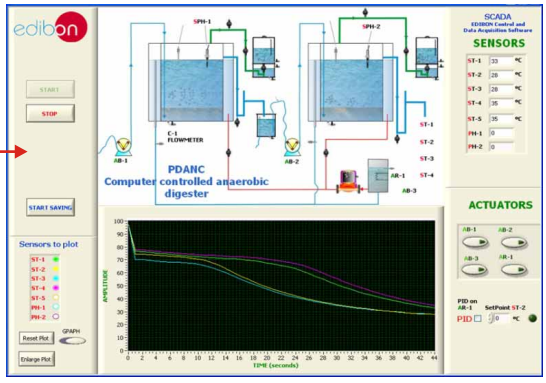
1.- Gas/liquid mass transfer.
2.- Measurement of MLSS and COD changes as criteria of performance.
3.- Residence time distributions.
4.- Acclimation of biological samples.
5.- Study of the temperature effect on the effluent quality.
6.- Study of the detention time effect on the effluent quality.
7.- Study of the aireation effect on the effluent quality.
8.- Study of the pH effect on the effluent quality.
9.- Study of the mass load effect on the effluent quality.
10.- Study of the nutrients effect on the effluent quality.
11.- Study of the recirculation effect on the effluent quality.
12.- Establishing the stoichiometry of aerobic processes.
13.- Establishing the kinetics of aerobic processes.

Other possible practices:
14.- Sensors calibration.
15-33.- Practices with PLC.

PDANC. Computer Controlled **Anaerobic Digester** ✱

①Unit: PDANC. Anaerobic Digester





SPECIFICATIONS SUMMARY

Items supplied as standard

① PDANC. Unit:
The aim of this unit is to allow the survey and the comprehension of the anaerobic digestion process. Anaerobic Digestion (AD) is a biological process that happens naturally in which micro-organisms break down biodegradable material (organic matter) in environments with no oxygen.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
2 Packed reactors (anaerobic digesters) that may be operated in series or parallel flow arrangement. Each reactor has 5 litres capacity. Reactor packing: 25 mm diameter Bio-balls. For each reactor: heating jacket with PID control. 2 Feed pumps, computer controlled. 2 Volumetric tanks, for collecting and measurement of the volume of gas produced. Temperature control. 5 Temperature sensors. 2 pH sensors. 2 Water flow meters. Thermostatic bath (heating resistance, computer controlled), up to 90°C. Water circulation pump, computer controlled, for the thermostatic bath. Buffer vessel (1 litre capacity).

② PDANC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ PDANC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1000 x 800 x 1000 mm. Weight: 80 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/watertreatment/PDANC.pdf

✱ Non computer controlled version available too.

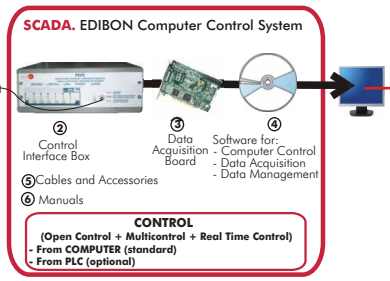
PRACTICAL POSSIBILITIES

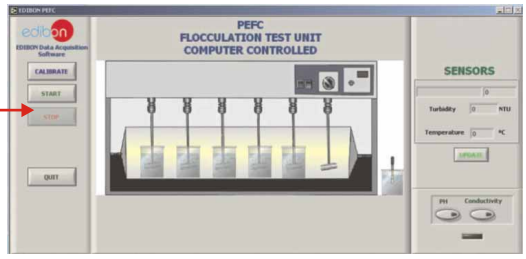
1.- Stabilization process study.
2.- Effect of temperature in the purification.
3.- Effect of the effluent pH in the digestion.
4.- Survey of the feeding rate in the purification.
5.- Study of the effluent strength.
6.- Study of the relation between the nutrient concentration in the effluent and purification.
7.- Study of the effect of the hydraulic charge in the purification.
8.- Study of the influence of the inhibitors to the anaerobic digestion.
9.- Comparison between mesophilic and thermophilic anaerobic digestion.
10.- Determination of the optimal working temperature.
11.- Determination of the optimal feeding rate.
12.- Determination of the optimal solids/water ratio.
13.- Determination of the optimal degradable/ non-degradable solids ratio.
14.- Demonstration of the multistage nature of anaerobic digestion.
15.- Kinematics determination.
16.- Carbon balance.
17.- Solids Balance.
18.- Biogas Balance.
19.- Study of the effect of pH.
20.- Influent nutrient concentration.
21.- Preparation, warming and acclimation of an anaerobic reactor.
22.- Effluent treatability studies, including solids, carbon and biogas balances for determining the purification (COD-BOD).
23.- Study of the effects on purification performance of:
Feed ratios.
Hydraulic loading.
Temperature.
Influent strength.
Nutrient deficiency.

Other possible practices:
24.- Sensors calibration.
25-43.- Practices with PLC.

PEFC. Computer Controlled **Flocculation Test Unit** ∗

① Unit: PEFC. Flocculation Test Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① PEFC. Unit:
Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit.
Flocculation test unit illuminated in the base or in back part. Six stirrers with stainless steel paddles. Agitation speed regulation. Six flocculating graduated vessels. Sample volume of each vessel: 1l. Timer. Lamp switch. R.p.m. regulator and r.p.m. display. pH sensor. Conductivity sensor. Temperature sensor. Turbidity meter.

② PEFC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ PEFC/CCSOF. Computer Control + Data Acquisition + Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1000 x 250 x 520 mm. Weight: 40 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/watertreatment/PEFC.pdf

PRACTICAL POSSIBILITIES

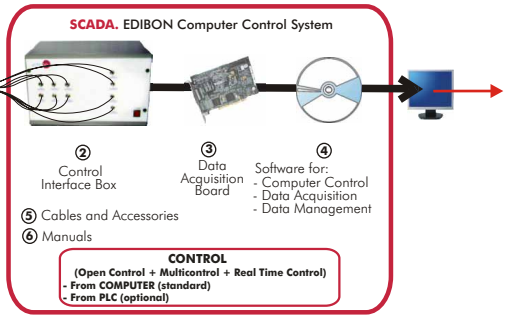
1.- Determination of optimum coagulant dosage.
2.- Study of coagula formation regarding to the mixing time and the agitation speed.
3.- Determination of optimum pH.
4.- Coagulation tests in conjunction with activated carbon.

Other possible practices:

5.- Sensors calibration.
6-24.- Practices with PLC.

PEAIC. Computer Controlled **Aeration Unit** ∗

① Unit: PEAIC. Aeration Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① PEAIC. Unit:
This unit permits the study of the oxygen transfer characteristics of diffused air systems, and to study the physical and chemical parameters which influence their oxygenation capacity.
The "PEAIC" unit demonstrates the water aeration process which, mainly, eliminates smell and taste from water.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Open tank of 28 l. capacity. Air injection pipe. Air injection control. Flow sensor. Paddle stirrer with variable speed control. Air pump. Oxygen sensor and oxygen probe (300 mm. length). Three diffusers: sparger tube, disk airstone and single airstone. Temperature sensor.

② PEAIC/CIB. 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. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s (Kilo samples per second). 2 Analog outputs. 24 Digital Inputs/Outputs.

④ PEAIC/CCSOF. Computer Control + Data Acquisition + Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 600 x 700 x 850 mm. Weight: 50 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/watertreatment/PEAIC.pdf

PRACTICAL POSSIBILITIES

1.- Aeration necessity determination.
2.- To measure the absorption coefficient K_s and the oxygenation capacity R.
3.- Influence of the injected oxygen volume.
4.- Study of the effect on K_s and R of:
- Water temperature.
- Degree of fluid mixing.
- Gas flow rate.
- Diffuser arrangement.
- Depth of water.
- Water composition.

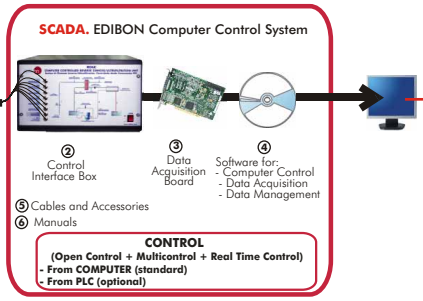
5.- Influence of the stirrer turn speed.
6.- Aeration with air injection and agitation.
7.- Influence of the temperature in the process.
8.- Influence of liquid level in the tank.
9.- Effects of oxygen transfer under non-steady state conditions.

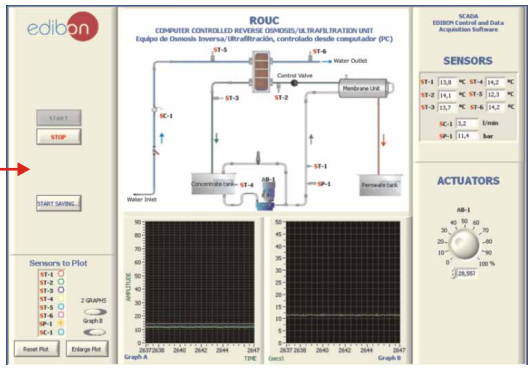
Other possible practices:
10.- Sensors calibration.
11-29.- Practices with PLC.

∗ Non computer controlled version available too.

ROUC. Computer Controlled **Reverse Osmosis/Ultrafiltration Unit**

① Unit: ROUC. Reverse Osmosis/Ultrafiltration Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① ROUC. Unit:
Laboratory Scale Computer Controlled Reverse Osmosis/Ultrafiltration Unit designed to study and to provide practical training in these downstream processing techniques. As well as the processing of the whey, the membranes can be also used to demonstrate, for example: clarification and concentration of fruit juices, potabilization of water, pre-concentration of milk for cheese manufacturing, etc.
Main metallic elements in stainless steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Stainless steel feed tank (15 l. approx. capacity). Three head positive displacement feed pump. Inverter that controls the pump motor. Membrane module: two tubular membranes connected in series. Process control valve. Plates heat exchanger for the concentrate. Permeate stainless steel collecting tank (15 l. approx. capacity).
6 Temperature sensors. Pressure sensor. Flow sensor (water inlet).
Different models of membranes are supplied. Rapid changeover from Reverse Osmosis to Ultrafiltration and back. All elements in contact with the process fluid are constructed from hygienic design materials such as stainless steel, PTFE and silicone rubber.

② ROUC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the PC keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ ROUC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =Unit: 800 x 800 x 1000 mm. Weight: 180 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/environment/watertreatment/ROUC.pdf

PRACTICAL POSSIBILITIES

1.- Practical training in ultrafiltration an reverse osmosis processing techniques.
2.- Protein standardisation in the production of fermented milk products such as concentration of skimmed milk for yoghurt production.
3.- Pre-concentration of milk for cheese manufacture.
4.- Concentration of fruit juices.
5.- Clarification of fruit juices.
6.- Water potabilization.
7.- Demonstration of the effect of varying the following process parameters on separation performance:
- Process pressure.
- Product flow rate.
- Process temperature.
8.- Applications of concentration, clarification, fractionation and standardization of milk, fruit juices, vegetables juices, etc.
9.- Treatment of effluent.
10.- Membrane cleaning and maintenance.
11.- Enzime, antibiotics and organic acids recovery in permeate.

Other possible practices:
12.- Sensors calibration.
13-31.- Practices with PLC.

PPTAC. Computer Controlled **Water Treatment Plant**

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

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REPRESENTATIVE:

ISO 9000: Quality Management
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(total safety)

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

Worlddidac Quality Charter Certificate
(Worlddidac Member)