Computer Controlled **Gas Absorption Column**

CAGC

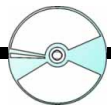
Technical Teaching Equipment

Always included in the supply:

EDIBON PATENT

Teaching Technique used

SCADA. EDIBON Computer Control System



Computer (not included in the supply)

② Control Interface Box

③ Data Acquisition Board

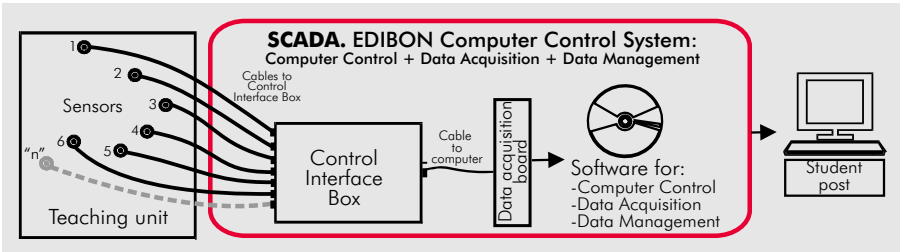
④ Software for:
- Computer Control
- Data Acquisition
- Data Management

⑤ Cables and Accessories

⑥ Manuals

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

① Unit: CAGC. Gas Absorption Column



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Products
Products range
Units
11.-Chemical Engineering

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

European Union Certificate
(total safety)

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

Worlddidac Quality Charter Certificate
(Worlddidac Member)

DESCRIPTION

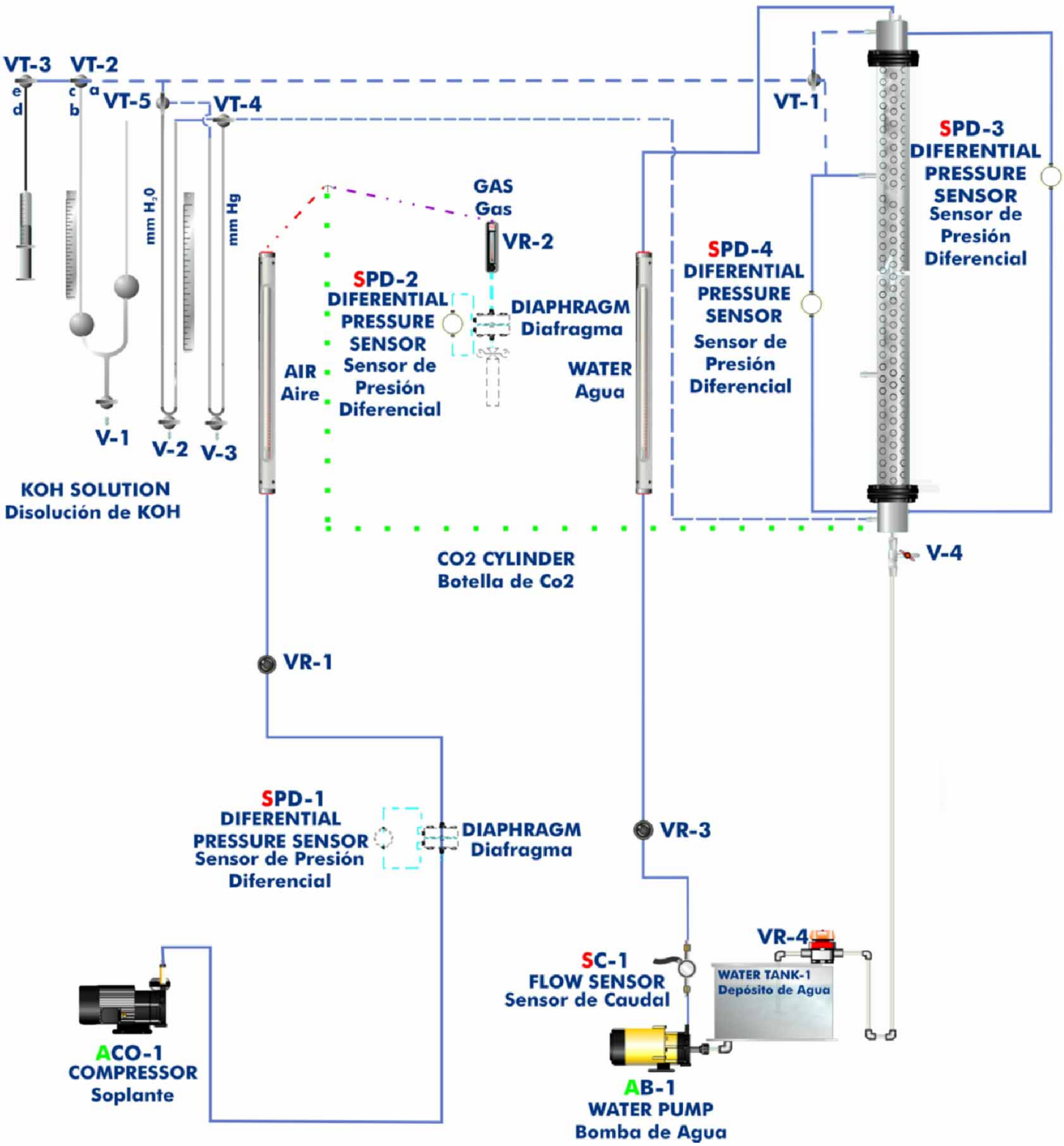
The gas absorption column(CAGC) is an unit designed for studying hydrodynamics and absorption processes in packed columns. The installation absorbs CO_2 from an air mixture into a aqueous solution flowing down the column.

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

PROCESS DIAGRAM AND ELEMENTS ALLOCATION

2 actuators and 5 sensors controlled from any computer, and working simultaneously

OPEN CONTROL + MULTICONTROL + REAL TIME CONTROL



Items supplied as standard

① CAGC. Unit:

This unit is mounted on an anodized aluminium rigid structure, with panels in painted steel (epoxy paint). This unit has wheels for its mobility.

Main metallic elements in stainless steel.

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

Packed column consists of a glass cylindrical column of 1400 mm of height and 75 mm of internal diameter. This column is filled with Raschig rings of 8mm diameter. It includes glass ends for inlet and outlet of gases and liquids and for sample points.

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, (maximum flow rate: 540 l./h.).

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 through a PVC conduit with hydraulic seal (to avoid possible gas leaks) in which there are a control flow valve and one sampler.

Compressor (blower), computer controlled, provides a maximum flow of 6 m^3/h and a maximum pressure of 1bar.

The gas (CO_2 or ammonia) is supplied by a cylinder, type bottle. (Not supplied with the unit).

The both gas flows are measured by sensors.

Differential pressure sensors. The pressure can be measured in different parts of the column.

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 of 100 ml capacity, 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.

Rapidity and facility to replace parts of the unit, in case of failure or braking.

There are transparent elements allowing better visualization of the process.

CAGC Unit

② CAGC/CIB. Control Interface Box:

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

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

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

Single cable between the control interface box and computer.

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

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

Calibration of all sensors involved in the process.

Real time curves representation about system responses.

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

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

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

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

Shield and filtered signals to avoid external interferences.

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

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

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

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

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

Possibility of automatization of the actuators involved in the process.

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

CAGC/CIB

Continue...

Items supplied as standard (continuation)

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot.
Bus PCI.

Analog input:

Number of **channels= 16** single-ended or 8 differential.
Resolution=16 bits, 1 in 65536.
Sampling rate up to: 250 KSPS (Kilo samples per second).
Input range (V)=±10V.
Data transfers=DMA, interrupts, programmed I/0.
Number of DMA channels=6.

DAB

Analog output:

Number of **channels=2**.
Resolution=16 bits, 1 in 65536.
Maximum output rate up to: 833 KSPS.
Output range(V)=±10V.
Data transfers=DMA, interrupts, programmed I/0.

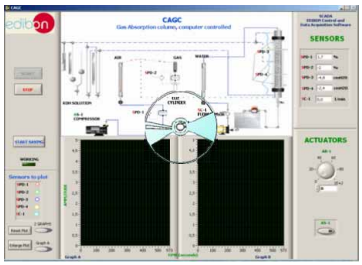
Digital Input/Output:

Number of **Channels=24 inputs/outputs**.
D0 or DI Sample Clock frequency: 0 to 1 MHz.

Timing: **Counter/timers=2**.
Resolution: Counter/timers: 32 bits.

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

Compatible with actual Windows operating systems.
Graphic and intuitive simulation of the process in screen.
Compatible with the industry standards.
Registration and visualization of all process variables in an automatic and simultaneously way.
Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
Analog and digital PID control.
Menu for PID and set point selection required in the whole work range.
Management, processing, comparison and storage of data.
Sampling velocity up to 250,000 data per second guaranteed.
Calibration system for the sensors involved in the process.
It allows the registration of the alarms state and the graphic representation in real time.
Comparative analysis of the obtained data, after the process and modification of the conditions during the process.
Open software, allowing to the teacher to modify texts, instructions.
Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access at different work levels.
This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.



CAGC/SOF

⑤ Cables and Accessories, for normal operation.

⑥ Manuals:

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

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

Continue...

Additional and optional items to the standard supply

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

⑦ PLC-PI. PLC Module:

Circuit diagram in the front panel.

Front panel:

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

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

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

Analog inputs block:

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

Analog outputs block:

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

Touch screen:

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

Back panel:

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

Inside:

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

Panasonic PLC:

High-speed scan of 0.32 μsec. for a basic instruction.
Program capacity of 32 Ksteps, with a sufficient comment area.
Free input AC voltage(100 to 240 V AC).
DC input:16 (24 V DC).
Relay output: 14 (250 V A AC/2 A).
High-speed counter.
Multi-point PID control.

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

Communication RS232 wire, to computer (PC).

PLC-PI

⑧ CAGC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

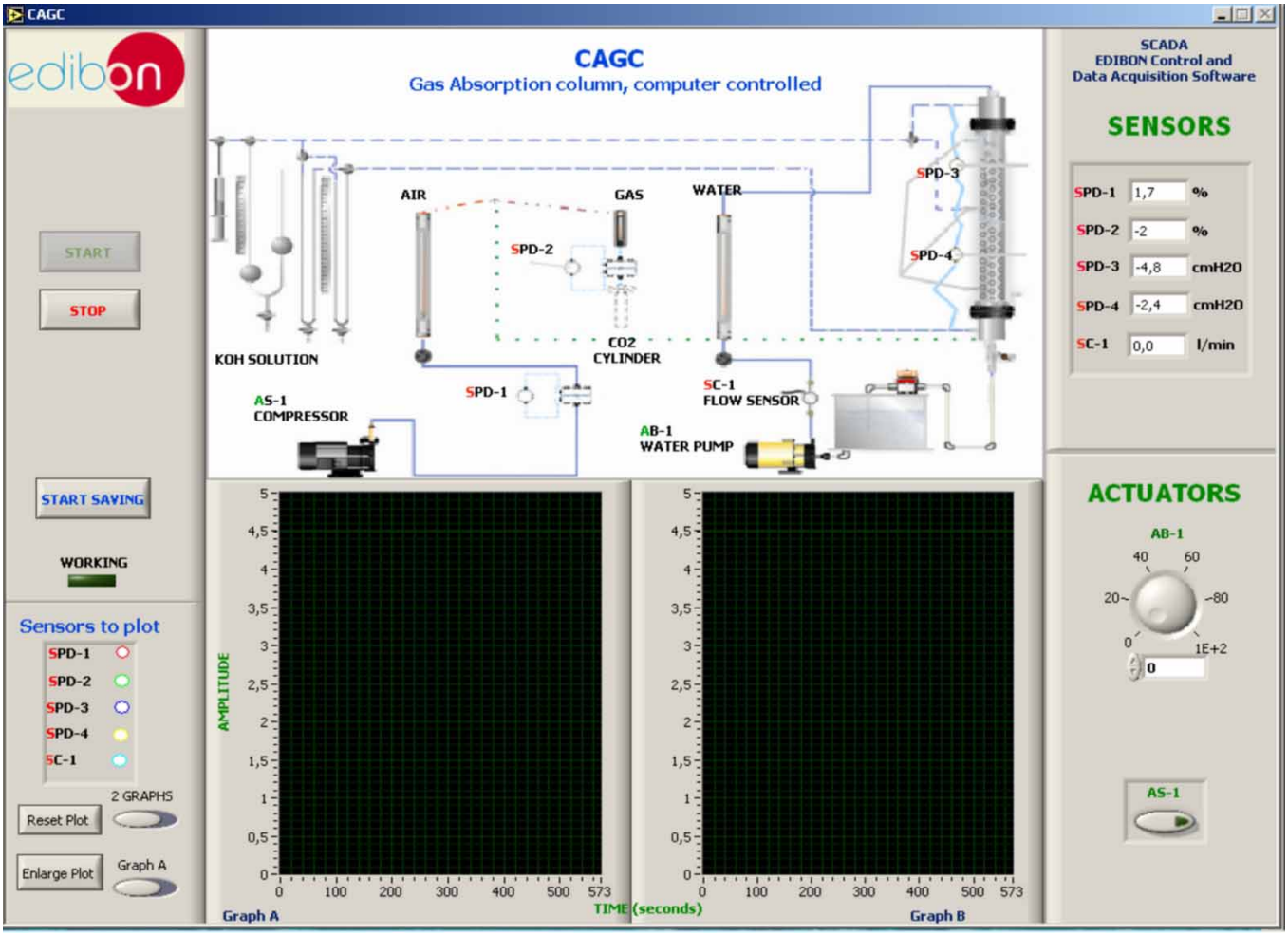
Items available on request

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

⑩ CAGC/FSS. Faults Simulation System.

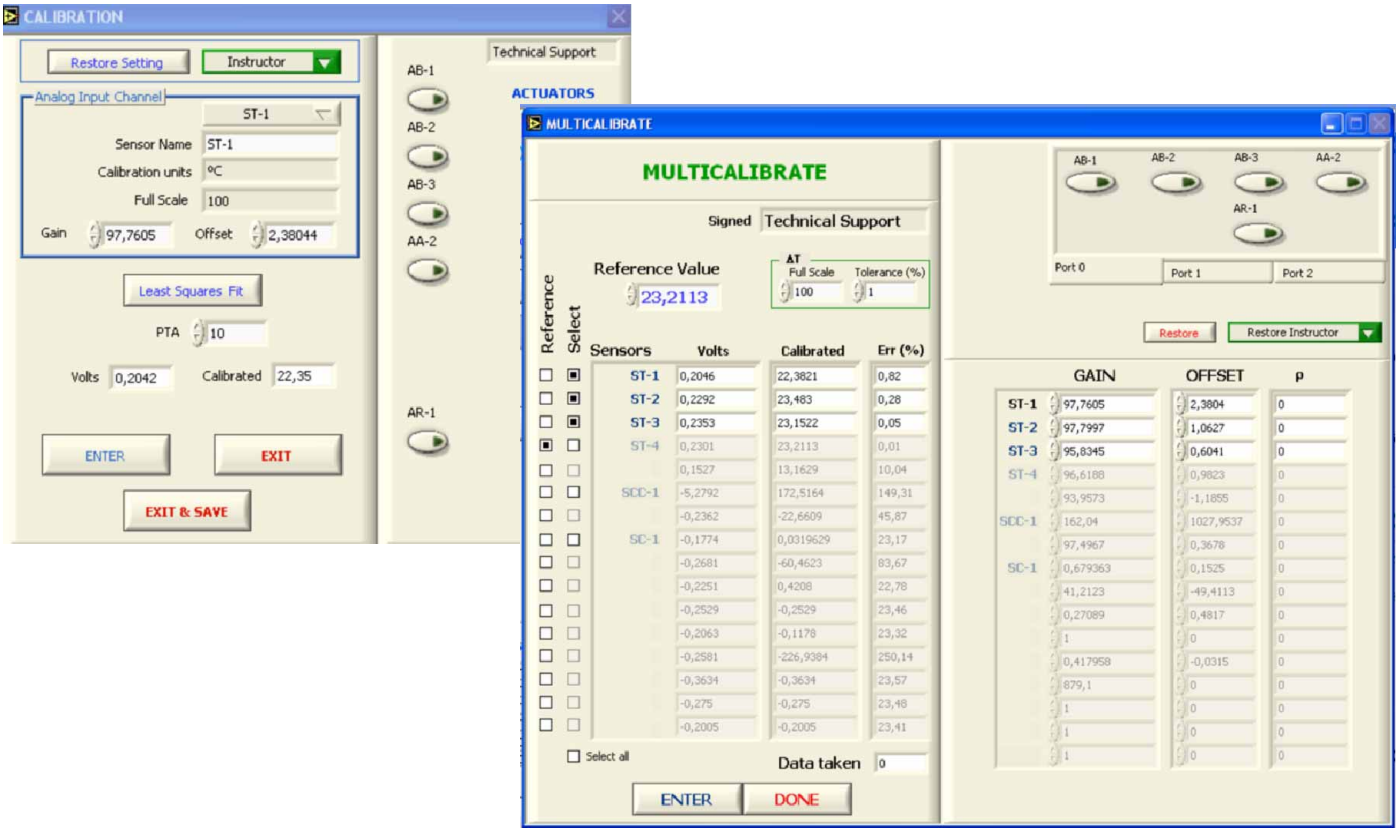
Software Main Screens

Main screen



Note: SPD= Differential pressure sensor. SC= Flow sensor. AB= Pump. AS= Compressor.

Examples of Sensors Calibration screens



EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

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.

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

14.- Control of the CAGC unit process through the control interface box without the computer.
15.- Visualization of all the sensors values used in the CAGC unit process.
16.- Calibration of all sensors included in the CAGC unit process.
17.- Hand on of all the actuators involved in the CAGC unit process.
18.- Realization of different experiments, in automatic way, without having in front the unit.(This experiment can be decided previously).
19.- Simulation of outside actions, in the cases do not exist hardware elements. (Example: test of complementary tanks, complementary industrial environment to the process to be studied, etc).
20.- PLC hardware general use and manipulation.
21.- PLC process application for CAGC unit.
22.- PLC structure.
23.- PLC inputs and outputs configuration.
24.- PLC configuration possibilities.
25.- PLC program languages.
26.- PLC different programming standard languages.
27.- New configuration and development of new process.
28.- Hand on an established process.
29.- To visualize and see the results and to make comparisons with the CAGC unit process.
30.- Possibility of creating new process in relation with the CAGC unit.
31. PLC Programming Exercises.
32.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS

Expansion 1:

EDIBON PATENT

Teaching Technique used

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

1 UNIT = 30 STUDENTS can work simultaneously

Gas Absorption Column (CAGC)

Control Interface Box

Computer Control Software: Computer Control + Data Acquisition + Data Management

Teacher's Central Computer

Mini Scada-Net Software

30 Student Post

LOCAL NET

OPEN CONTROL + MULTICONTROL + REAL TIME CONTROL + MULTI STUDENT POST

Note: The Mini ESN system can be used with any EDIBON computer controlled unit.

Expansion 2:

EDIBON PATENT

Teaching Technique used

⑫ **ESN.** Multipost EDIBON Scada-Net System

OPEN CONTROL + MULTICONTROL + REAL TIME CONTROL + MULTI STUDENT POST

Note: The ESN system can use any EDIBON computer controlled unit.

ORDER INFORMATION

Items supplied as standard

Minimum configuration for normal operation includes:

① **Unit: CAGC. Gas Absorption Column.**
② **CAGC/CIB. Control Interface Box.**
③ **DAB. Data Acquisition Board.**
④ **CAGC/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
⑤ **Cables and Accessories,** for normal operation.
⑥ **Manuals.**

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

Additional and optional items to the standard supply

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

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

Expansions

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

REQUIRED SERVICES

-Electrical supply: single-phase, 220V./50Hz or 110V./60Hz.

-Water supply and drainage.

-Computer (PC).

DIMENSIONS & WEIGHTS

CAGC Unit:	-Dimensions: 1000x740x2600 mm. approx. -Weight: 100 Kg. approx.
Control Interface Box:	-Dimensions: 490x330x310 mm. approx. -Weight: 10 Kg. approx.
PLC Module (PLC-PI):	-Dimensions: 490x330x310 mm. approx. -Weight: 30 Kg. approx.

REQUIRED ACCESSORIES

-Gas bottle: CO_2 or ammonia.

RECOMMENDED ACCESSORIES

-Vent piping to outside laboratory.

-General instrument for liquid titration.

-Draining tank for treatment of effluents.

AVAILABLE VERSIONS

Offered in this catalogue:

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

Offered in other catalogue:

- CAG. **Gas Absorption Column.**

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

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