Computer Controlled **Cheese Vat,**
with SCADA and PID Control

AEQC

EDIBON **SCADA** System
and **PID Control** included

Teaching Technique used

Control
Interface
included
in the Unit

②

③
Data
Acquisition
Board

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

Computer
(not included in
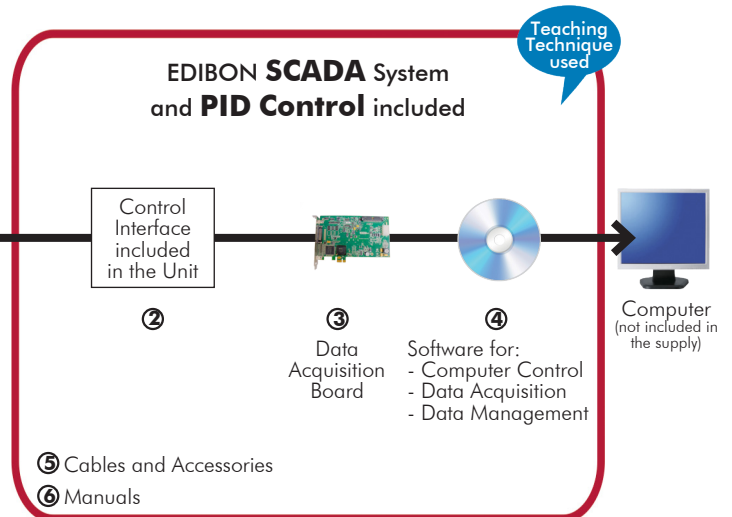the supply)

⑤ Cables and Accessories

⑥ Manuals

① Unit: AEQC. Computer Controlled Cheese Vat

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

Key features:

➤ **Advanced Real-Time SCADA and PID Control.**

➤ **Open Control + Multicontrol + Real-Time Control.**

➤ **Specialized EDIBON Control Software based on LabVIEW.**

➤ **National Instruments Data Acquisition board (250 KS/s, kilo samples per second).**

➤ **Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.**

➤ **Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.**

➤ **Capable of doing applied research, real industrial simulation, training courses, etc.**

➤ **Remote operation and control by the user and remote control for EDIBON technical support, are always included.**

➤ **Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).**

➤ **Designed and manufactured under several quality standards.**

➤ **Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user's knowledge and progress reached.**

➤ **This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.**

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

POWERED BY
NATIONAL INSTRUMENTS
LabVIEW™

www.edibon.com
↳PRODUCTS
↳12.-FOOD & WATER
TECHNOLOGIES

For more information about Key Features, click here

PDF Adobe

You Tube

ISO 9001: Quality Management (for
Design, Manufacturing, Commercialization
and After-sales service)

CE
European Union Certificate
(total safety)

Certificates ISO 14001 and ECO-
Management and Audit Scheme
(environmental management)

"Worlddidac Quality Charter"
and Platinum Member of
Worlddidac

INTRODUCTION

Cheese is a solid food, of animal origin, made from the curdled milk of some ruminant mammals. The curdling process is carried out by the addition of rennet and acidification. The beneficial bacteria are responsible for acidifying the milk and providing flavor.

Nowadays, cheese is widely spread all over the world, being one of the main agricultural products.

Many of the cheese production processes have been industrialized to meet such a huge demand. It was necessary to study and determine parameters in the phases of the transformation of the different types of cheese and adapt the tools to the industry in order to bring this process of traditional origin to the industry

The Computer Controlled Cheese Vat, "AEQC", reproduces a small scale cheese production system to study the whole process in a practical way.

GENERAL DESCRIPTION

The Computer Controlled Cheese Vat, "AEQC", is a small scale unit designed to reproduce industrial cheese making operations.

The main element is a hygienic vat made of stainless steel and mounted on a working frame.

The vat has a jacket through which water heated by a heating element with thermostat flows. The water temperature is selected by a PID control and pumped by a variable speed circulation pump.

There is an agitator, which can be detached for easy cleaning. It consists of a variable speed motor that, by means of a duly protected coupling, drives the paddle agitator. It includes two types of stainless steel paddles.

Perforated stainless steel filter is placed at the outlet of the vat to separate the whey from the curd and drain the vat efficiently.

A temperature and a pH probe are immersed in the vat to monitor the process. The pH probe has a conical membrane that facilitates its introduction into semisolid products and allows a large contact area.

Both the heating jacket and the vat are automatically drained by solenoid valves.
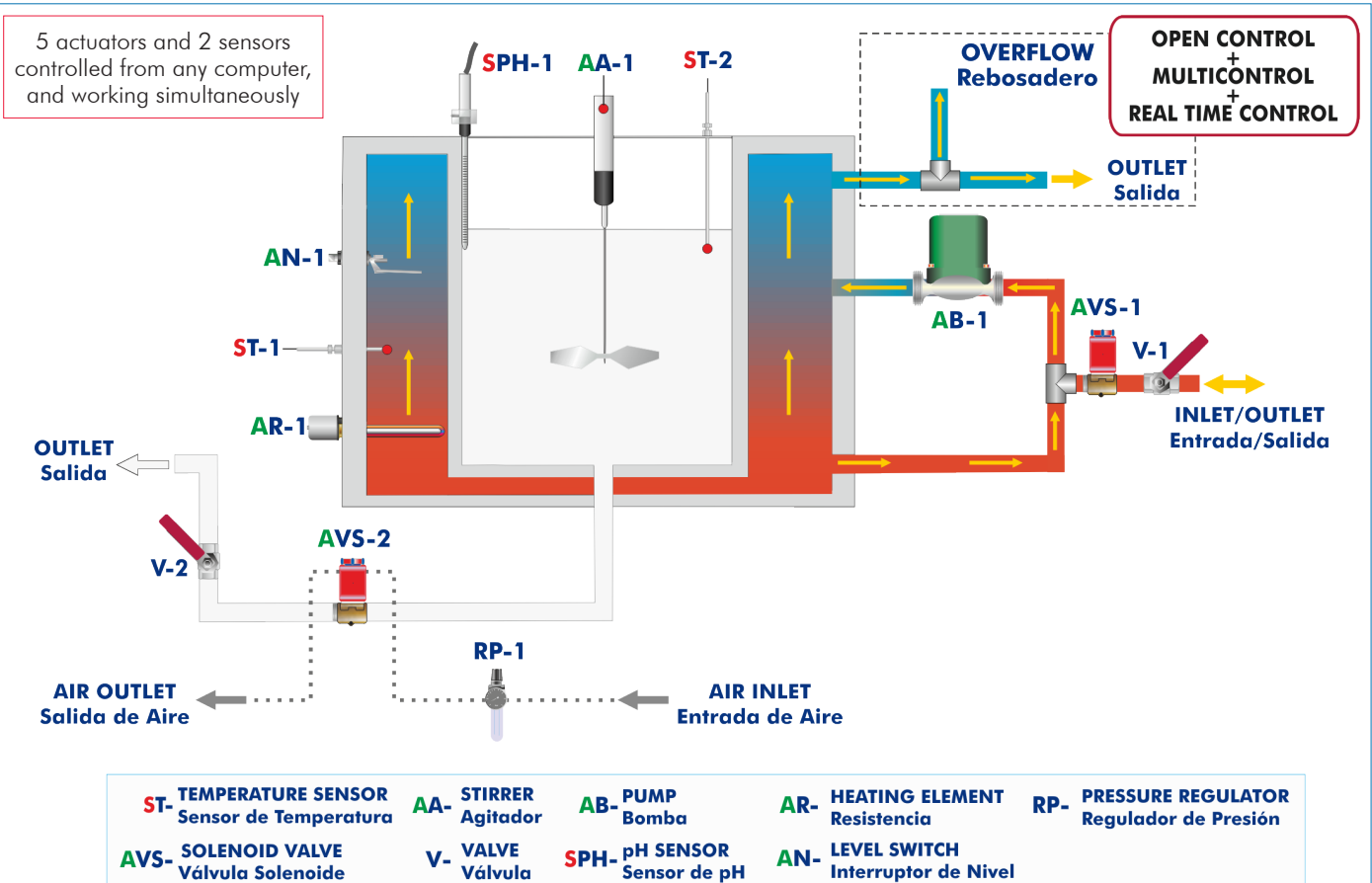
The Computer Controlled Cheese Vat, "AEQC", can be operated in manual or computerized way (performing the control and acquisition of data through the computer). The pump and the agitator speed, as well as the heating water temperature, are controlled. In addition, the pH and the temperature of the vat content and the agitator speed are monitored.

This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), and includes: The unit itself + a Control Interface Box + a Data Acquisition Board + Computer Control, Data Acquisition and Data Management Software Packages, for controlling the process and all parameters involved in the process.

AEQC detail

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

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

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

ST-	TEMPERATURE SENSOR Sensor de Temperatura	AA-	STIRRER Agitador	AB-	PUMP Bomba	AR-	HEATING ELEMENT Resistencia	RP-	PRESSURE REGULATOR Regulador de Presión
AVS-	SOLENOID VALVE Válvula Solenoide	V-	VALVE Válvula	SPH-	pH SENSOR Sensor de pH	AN-	LEVEL SWITCH Interruptor de Nivel		

With this unit there are several options and possibilities:

- Main items: 1, 2, 3, 4, 5 and 6.
- Optional items: 7, 8, 9, 10 and 11.

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

① **AEQC. Unit:**

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

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

Two operation modes: manual or computerized.

Stainless steel vat with jacket. Capacity: 10 l. The jacket includes:

 Heating element with safety thermostat (90 °C). Power: 3000 W.

 Level switch.

 "J" type temperature sensor to measure the temperature of the heating water.

Variable speed circulation pump to impel the heating water in the vat jacket.

Automatic draining of the heating water in the vat by solenoid valve.

Detachable paddle agitator made of stainless steel:

 Variable speed motor to impel the agitator through a duly protected coupling. Range: 0 – 140 rpm.

 Two types of stainless steel paddles.

 Measurement of the agitator speed.

Perforated stainless steel filter to separate the whey from the curd and drain the vat efficiently.

Automatic draining of the whey by a detachable pneumatic solenoid valve for easy cleaning. Compressed air working pressure: 2.5 – 3 bar.

Pressure regulator with manometer to control the air inlet pressure in the pneumatic solenoid valve. Range of the manometer: 0 – 4 bar.

"J" type temperature sensor to measure the content of the vat.

Ladle and spatula made of nylon to collect the curd.

Beaker with capacity of 1000 ml.

pH sensor to measure the product to be made:

 PVDF body; high chemical and mechanical resistance material suitable for food use.

 Conical membrane for easy introduction and wide contact area in semisolid products.

 Silver-free gel electrolyte to avoid contamination.

 Temperature compensation probe to measure pH.

The complete unit includes as well:

 Advanced Real-Time SCADA and PID Control.

 Open Control + Multicontrol + Real-Time Control.

 Specialized EDIBON Control Software based on LabVIEW.

 National Instruments Data Acquisition board (250 KS/s, kilo samples per second).

 Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.

 Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.

 Capable of doing applied research, real industrial simulation, training courses, etc.

 Remote operation and control by the user and remote control for EDIBON technical support, are always included.

 Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).

 Designed and manufactured under several quality standards.

 Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user's knowledge and progress reached.

 This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

Unit: AEQC

Additional recommended elements (Not included):

- AEQC-A. Cheese Making Accesories.

② **AEQC/CIB. Control Interface Box:**

The Control Interface Box is part of the SCADA system.

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

All sensors, with their respective signals, are properly manipulated from -10V. to +10V. computer output. Sensors connectors in the interface have different pines numbers (from 2 to 16), to avoid connection errors.

Single cable between the control interface box and computer.

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

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

Calibration of all sensors involved in the process.

Real time curves representation about system responses.

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

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

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

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

Shield and filtered signals to avoid external interferences.

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

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

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

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

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

Possibility of automatization of the actuators involved in the process.

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

AEQC/CIB

③ **DAB. Data Acquisition Board:**

The Data Acquisition board is part of the SCADA system.

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

Analog input:

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

Analog output:

Number of **channels=2**. **Resolution=16 bits**, 1 in 65536.
Maximum output rate up to: 900 KS/s.
Output range (V)=±10 V. Data transfers=DMA, interrupts, programmed I/0.

Digital Input/Output:

Number of **channels=24 inputs/outputs**. D0 or DI Sample Clock frequency: 0 to 100 MHz.
Timing: Number of **Counter/timers=4**. Resolution: Counter/timers: 32 bits.

The Data Acquisition board model may change at any moment, providing the same or better features than those required for the unit.

DAB

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

The three softwares are part of the SCADA system.

Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen. **Compatible with the industry standards.**

Registration and visualization of all process variables in an automatic and simultaneous way.

Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.

Analog and digital PID control.

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

Management, processing, comparison and storage of data.

Sampling velocity up to 250 KS/s (kilo samples per second).

Calibration system for the sensors involved in the process.

It allows the registration of the alarms state and the graphic representation in real time.

Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

Open software, allowing the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.

This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
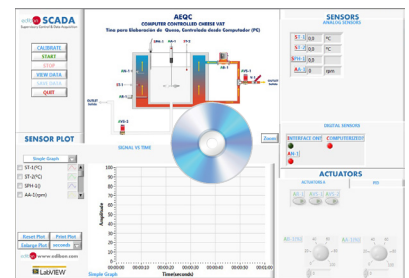
AEQC/CCSOF

⑤ **Cables and Accessories**, for normal operation.

⑥ **Manuals:**

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

✳ References 1 to 6 are the main items: AEQC + AEQC/CIB + DAB + AEQC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply for enabling normal and full operation.

Additional recommended elements (Not included)

AEQC-A. Cheese Making Accesories

Two square cheesecloths (65 x 65 cm).

Curd cutter and knife.

Stainless steel cheese press, with pressure regulator for easy cheese pressing knowing the pressure applied:

    The base of the press has holes for whey draining during the pressing process.

    Compatible with molds up to 19 cm wide and 20 cm high.

Cheese molds:

    Manchego cheese mold with plaited esparto grass band to make a pressed cheese up to 600 g.

    Smooth round mold to make a pressed cheese up to 900 g.

    Two rectangular screen molds to make fresh cheese up to 500 g.

    Four rectangular screen molds to make small fresh cheeses of 50 g.

Acid testing kit. It includes:

    Dornic acidimeter.

    10 ml pipette.

    Dropping bottle.

    100 ml beaker.

EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH THE MAIN ITEMS

1.- Study of the cheese making process:
- Milk heating and agitation.
- Addition of starter culture and rennet.
- Coagulation.
- Curd cutting and heating.
- Precision curd heating and agitation to "scald" the curd.
- Curd settling.
- Whey draining.
- Curd milling.
- Addition of salt.

2.- Hard and soft cheese making.

3.- Study of the pressing process (the additional recommended element AEQC-A is required).

4.- Acid testing (the additional recommended element AEQC-A is required).

Additional practical possibilities:

5.- Sensors calibration.

Other possibilities to be done with this Unit:

6.- Many students view results simultaneously.

To view all results in real time in the classroom by means of a projector or an electronic whiteboard.

7.- Open Control, Multicontrol and Real Time Control.

This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivative parameters; etc, in real time.

8.- The Computer Control System with SCADA and PID Control allow a real industrial simulation.

9.- This unit is totally safe as uses mechanical, electrical/electronic, and software safety devices.

10.-This unit can be used for doing applied research.

11.-This unit can be used for giving training courses to Industries even to other Technical Education Institutions.

12.-Control of the AEQC unit process through the control interface box without the computer.

13.-Visualization of all the sensors values used in the AEQC unit process.

- By using PLC-PI additional 19 more exercises can be done.

- Several other exercises can be done and designed by the user.

REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.
- Supply of compressed air. Service pressure: 2.5 – 3 bar.
- Water supply and drain.
- Computer.

DIMENSIONS AND WEIGHTS

AEQC:
  Unit:
    -Dimensions: 1000 x 650 x 600 mm approx.
                (39.37 x 25.59 x 23.62 inches approx.)
    -Weight: 50 kg approx.
                (110 pounds approx.)

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

- AEQC-A. Cheese Making Accesories.

REQUIRED CONSUMABLES (Not included)

- For the cheese making process:
  Pasteurized fresh whole milk.
  Calcium chloride.
  Natural liquid rennet.
  Lactic ferments.

- For the acidity measurement:
  Phenolphthalein indicator.
  DORNIC caustic soda solution (NaOH 1/9 normal).

- For the pH sensor use and maintenance:
  Pepsin solution suitable for cleaning and maintaining pH probes (suitable for protein contamination).
  pH calibration solutions:
    Calibration solution pH 4.01.
    Calibration solution pH 7.01.

SIMILAR UNITS AVAILABLE

Offered in this catalog:
- AEQC. Computer Controlled Cheese Vat.

Offered in other catalogs:
- DVCP. Dutch Vat for Cheese Production (until 50 l).
- CCDC. Computer Controlled Teaching Curdling Tank.

SCADA and PID Control
Main screen
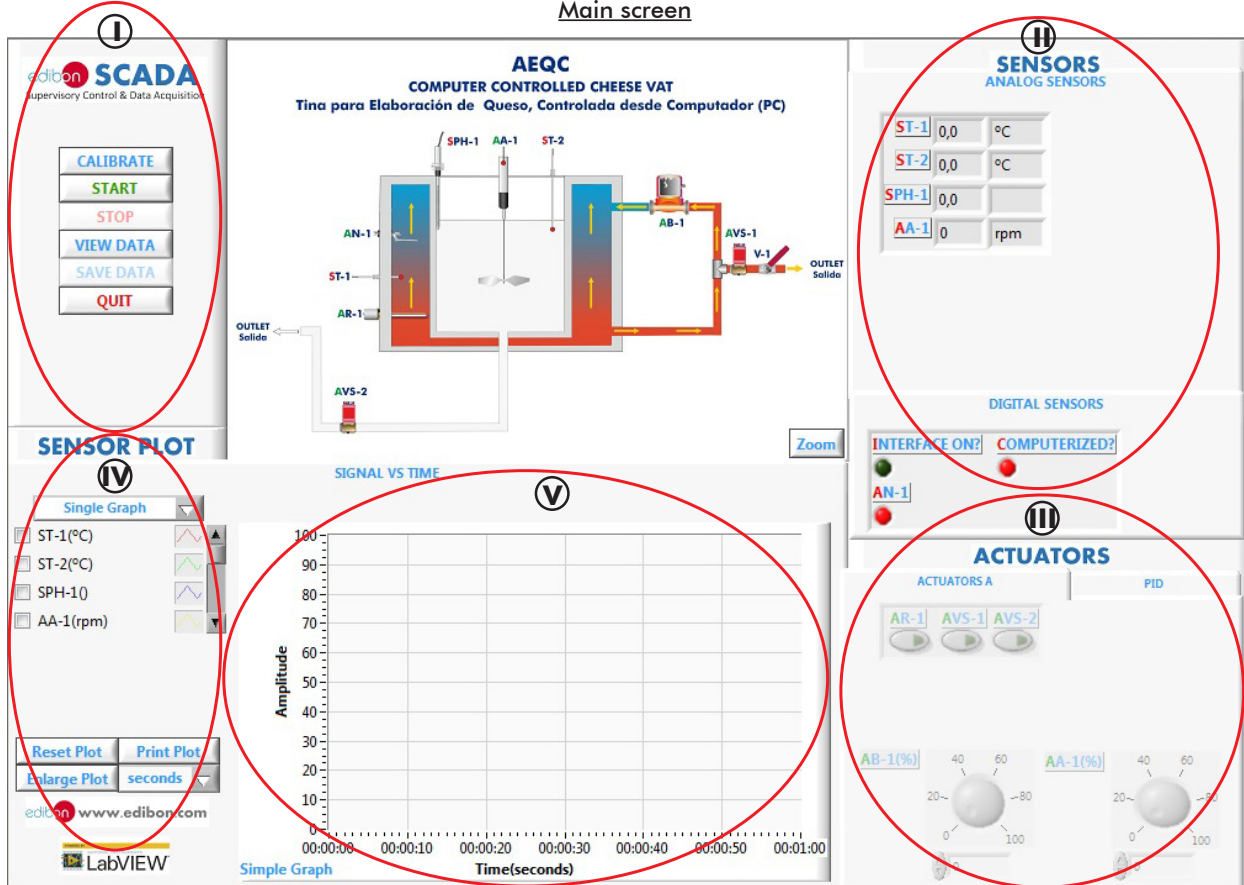
Ⓘ Main software operation possibilities.

Ⓘⓘ Sensors displays, real time values, and extra output parameters. **Sensors:** ST=Temperature sensor. SPH=pH sensor.

Ⓘⓘⓘ Actuators controls. **Actuators:** AA=Stirrer. AB=Pump. AR=Heating element. AN=Level switch. AVS=Solenoid valve.

Ⓘⓥ Channel selection and other plot parameters.

Ⓥ Real time graphics displays.

Software for Sensors Calibration
Example of screen
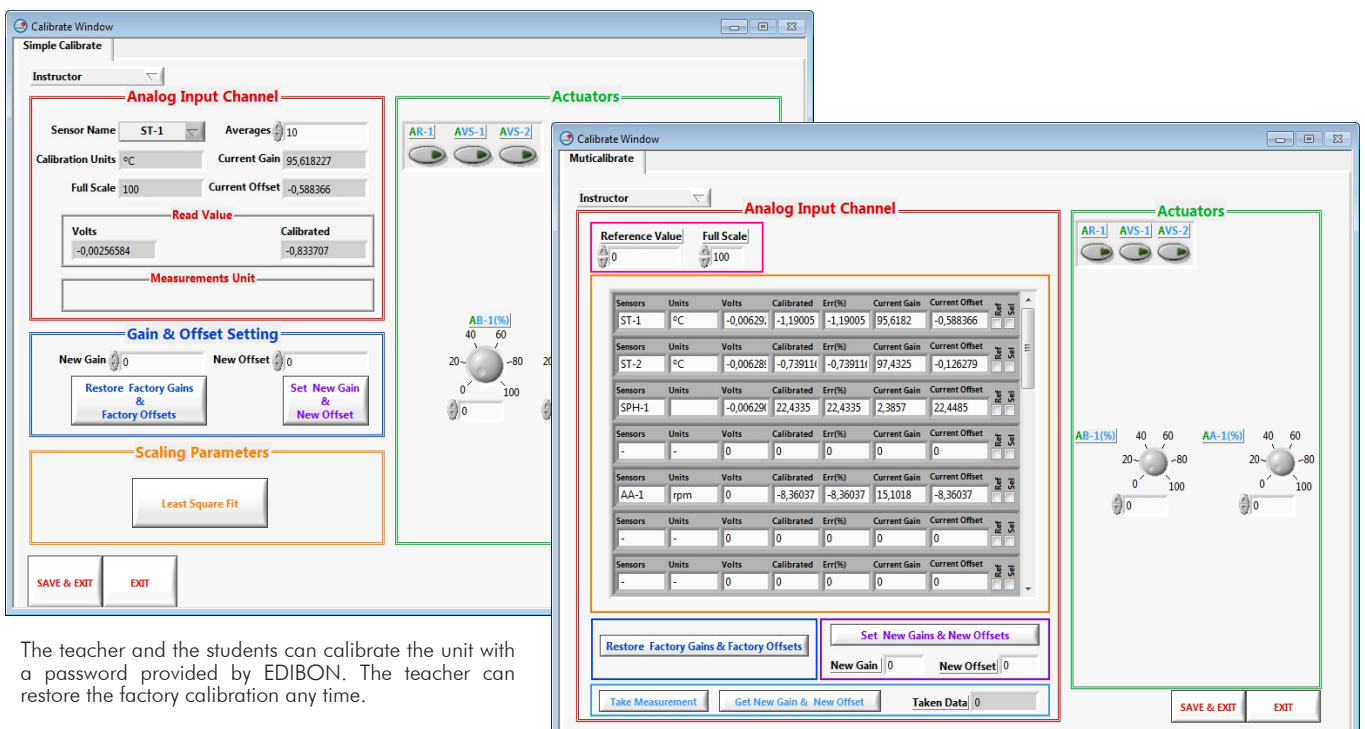
The teacher and the students can calibrate the unit with a password provided by EDIBON. The teacher can restore the factory calibration any time.

SOME **REAL** RESULTS OBTAINED FROM THIS UNIT

Real-time display of the measured magnitudes. Chart of the evolution of the heating jacket and the vat content temperatures versus time.
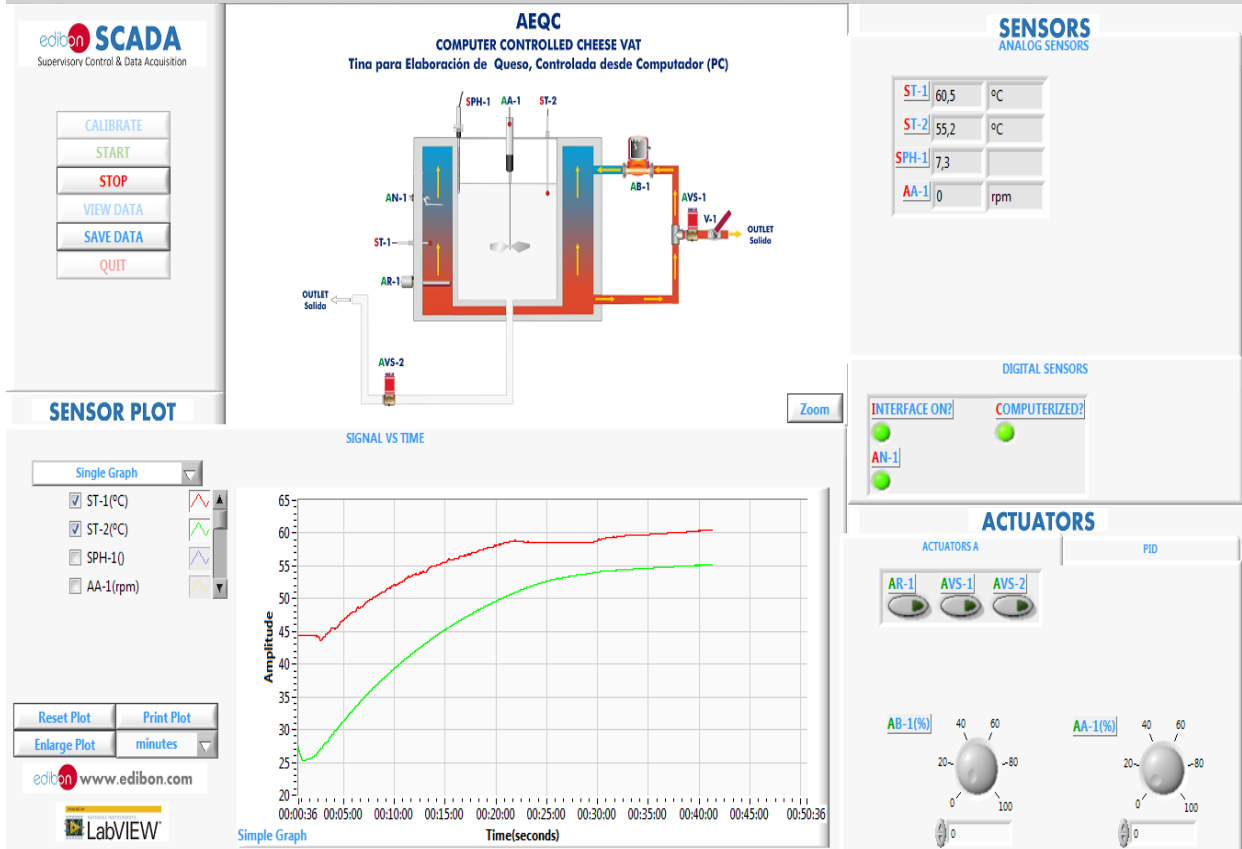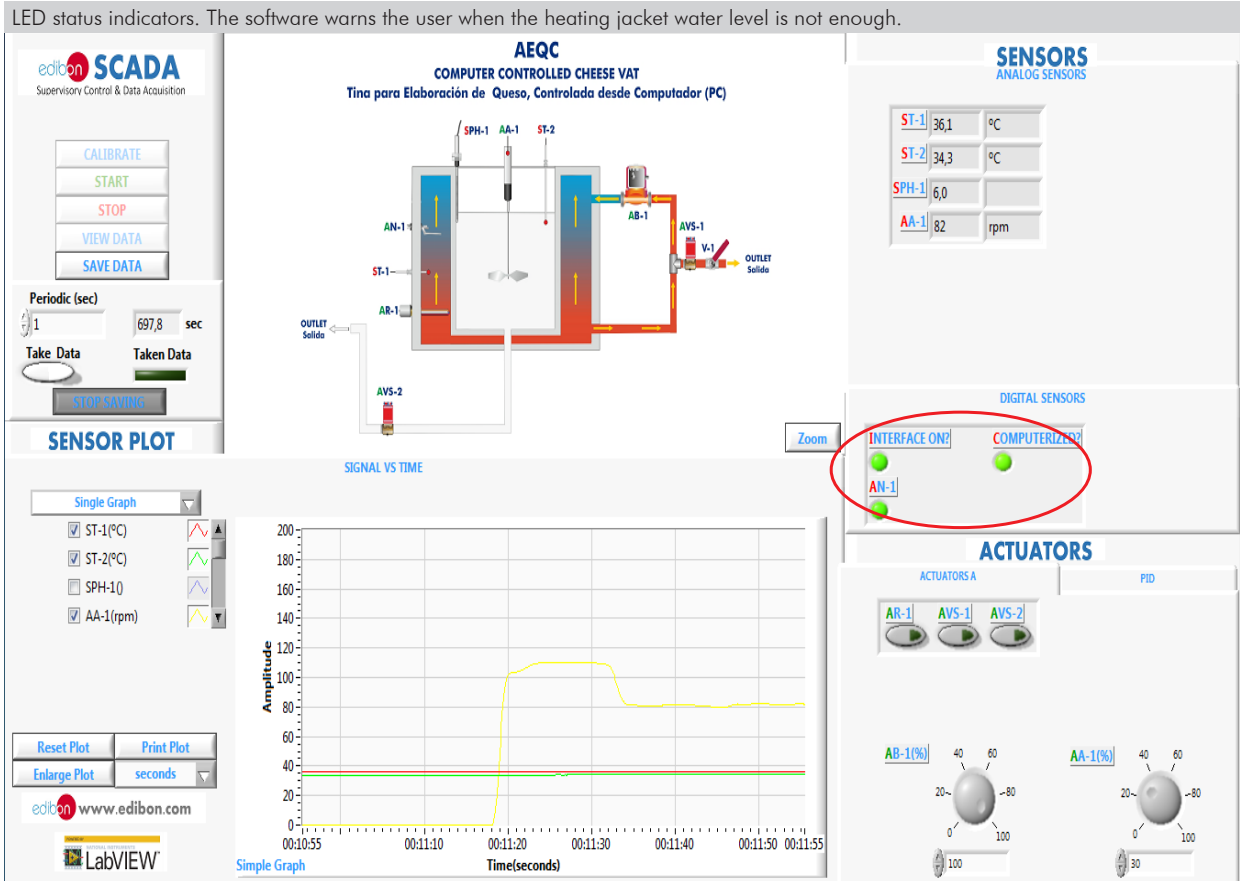
Real-time display of the measured magnitudes. Two charts of the evolution of the temperature and the agitation speed versus time.
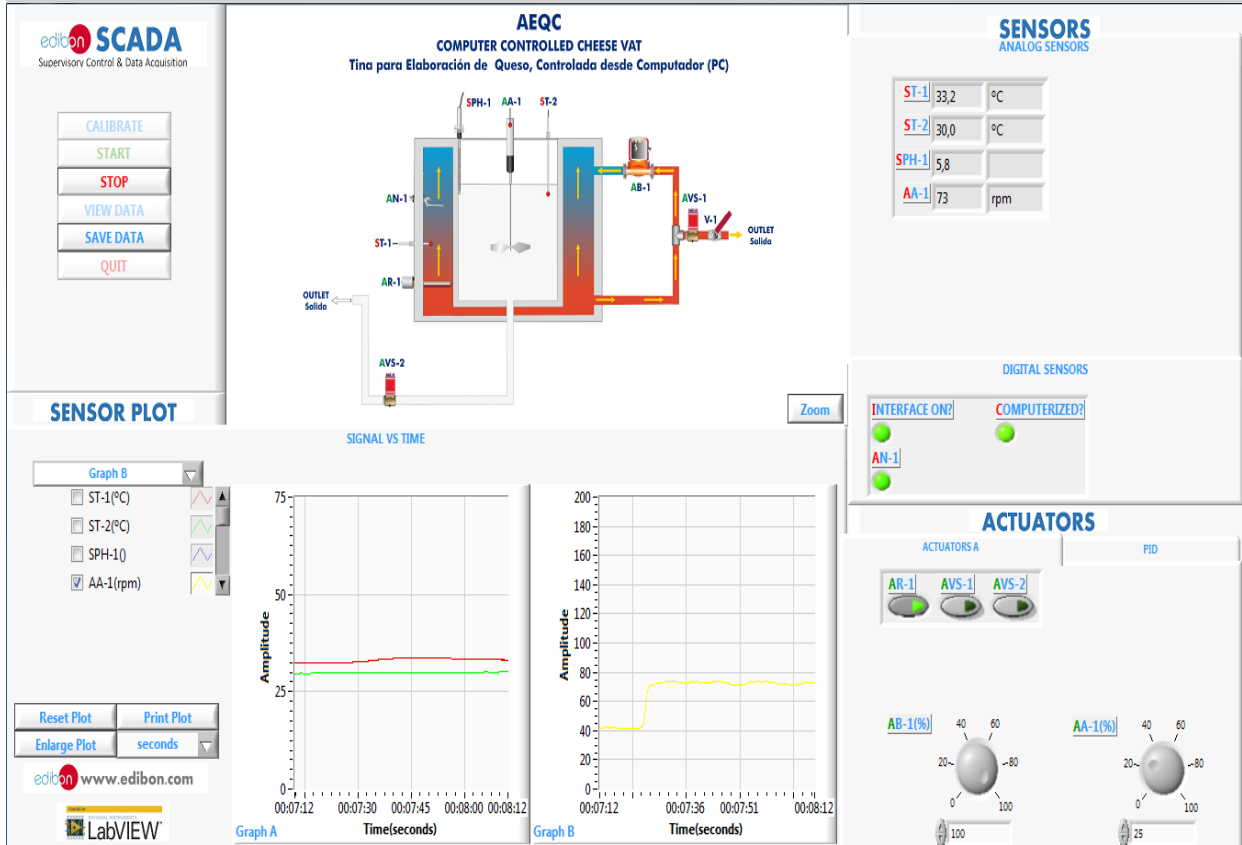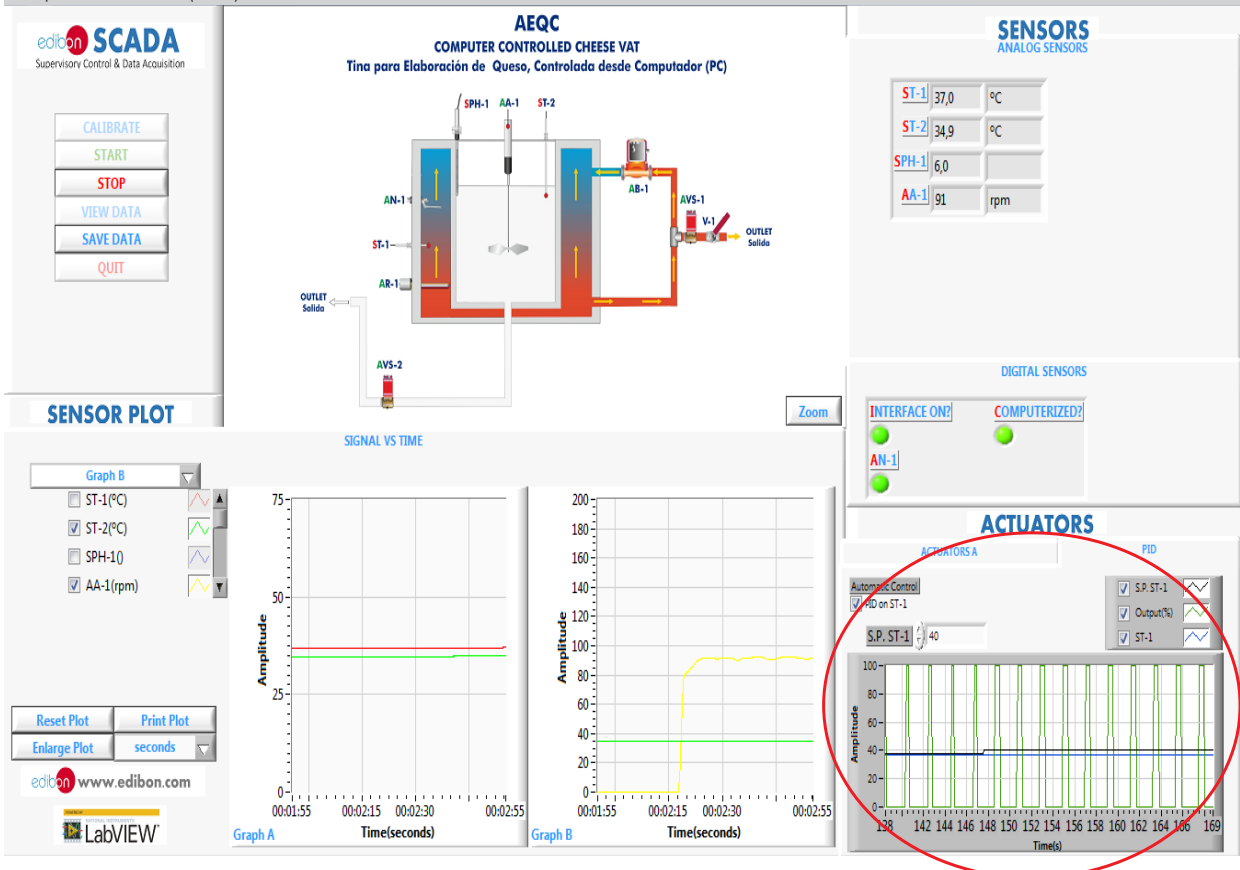
Some **real** results obtained from this Unit

LED status indicators. The software warns the user when the heating jacket water level is not enough.

The heating temperature is controlled by a PID controller. The heating element switches off when the target temperature is reached in the temperature sensor (ST-1).

www.edibon.com

Some **real** results obtained from this Unit

Automatic whey and heating water draining by solenoid valves.

Stored data view and representation.

Additionally to the main items (1 to 6) described, we can offer, as optional, other items from 7 to 11.

All these items try to give more possibilities for:

    a) Industrial configuration. (PLC)

    b) Technical and Vocational Education configuration. (ICAI and FSS)

    c) Multipost Expansions options. (MINI ESN and ESN)

a) Industrial configuration

⑦ PLC. Industrial Control using PLC (it includes PLC-PI Module plus PLC-SOF Control Software):

-PLC-PI. PLC Module:

Metallic box.

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

    Analog outputs block:

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

    Touch screen:

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

Back panel:

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

Inside:

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

    Panasonic PLC:

        High-speed scan of 0.32 μsec. for a basic instruction.

        Program capacity of 32 Ksteps, with a sufficient comment area.

        Power supply input (100 to 240 V AC).

        DC input: 16 (24 V DC).

        Relay output: 14.

        High-speed counter.

        Multi-point PID control.

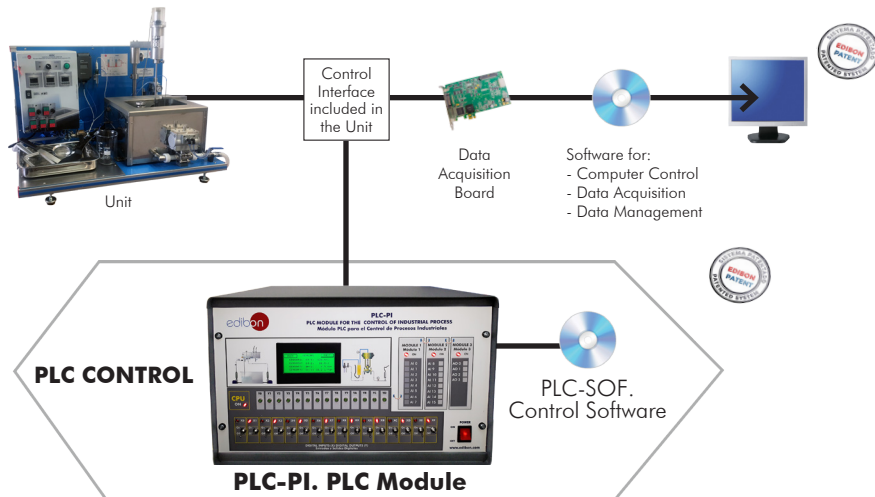   **Digital inputs/outputs and analog inputs/outputs Panasonic modules.**

Communication RS232 wire to computer (PC).

Dimensions: 490 x 330 x 310 mm. approx. (19.29 x 12.99 x 12.20 inches approx.). Weight: 30 Kg. approx. (66 pounds approx.).

-AEQC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

The software has been designed using Labview and it follows the unit operation procedure and linked with the Control Interface Box used in the Computer Controlled Cheese Vat (AEQC).

Unit — Control Interface included in the Unit — Data Acquisition Board — Software for: - Computer Control - Data Acquisition - Data Management

PLC CONTROL — **PLC-PI. PLC Module** — PLC-SOF. Control Software

Practices to be done with PLC-PI:

1.- Control of the particular unit process through the control interface box without the computer.
2.- Visualization of all the sensors values used in the particular unit process.
3.- Calibration of all sensors included in the particular unit process.
4.- Hand on of all the actuators involved in the particular unit process.
5.- Realization of different experiments, in automatic way, without having in front the particular unit. (These experiments can be decided previously).
6.- Simulation of outside actions, in the cases do not exist hardware elements. (Example: test of complementary tanks, complementary industrialenvironment to the process to be studied, etc).
7.- PLC hardware general use.
8.- PLC process application for the particular unit.
9.- PLC structure.
10.-PLC inputs and outputs configuration.
11.-PLC configuration possibilities.
12.-PLC program languages.

13.-PLC different programming standard languages (ladder diagram (LD), structured text (ST), instructions list (IL), sequential function chart (SFC), function block diagram (FBD)).
14.-New configuration and development of new process.
15.-Hand on an established process.
16.-To visualize and see the results and to make comparisons with the particular unit process.
17.-Possibility of creating new process in relation with the particular unit.
18.-PLC Programming Exercises.
19.-Own PLC applications in accordance with teacher and student requirements.

<u>b) Technical and Vocational Education configuration</u>

⑧ **AEQC/ICAI. Interactive Computer Aided Instruction Software.**
This complete software package consists of an Instructor Software (EDIBON Classroom Manager - ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft - ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

This software is optional and can be used additionally to items (1 to 6).

- **ECM-SOF. EDIBON Classroom Manager (Instructor Software).**

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

• User Data Base Management.

• Administration and assignment of Workgroup, Task and Training sessions.

• Creation and Integration of Practical Exercises and Multimedia Resources.

• Custom Design of Evaluation Methods.

• Creation and assignment of Formulas & Equations.

• Equation System Solver Engine.

• Updatable Contents.

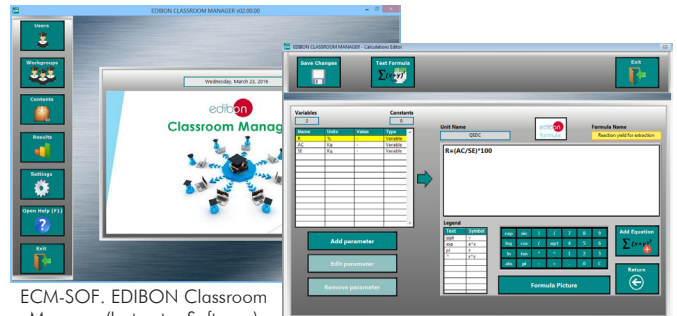• Report generation, User Progression Monitoring and Statistics.

- **ESL-SOF. EDIBON Student Labsoft (Student Software).**

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

• Student Log-In & Self-Registration.

• Existing Tasks checking & Monitoring.

• Default contents & scheduled tasks available to be used from the first session.

• Practical Exercises accomplishment by following the Manual provided by EDIBON.

• Evaluation Methods to prove your knowledge and progression.

• Test self-correction.

• Calculations computing and plotting.

• Equation System Solver Engine.

• User Monitoring Learning & Printable Reports.

• Multimedia-Supported auxiliary resources.

For more information see **ICAI** catalogue. Click on the following link:
www.edibon.com/en/files/expansion/ICAI/catalog

Instructor Software

ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen

ECAL. EDIBON Calculations Program Package - Formula Editor Screen
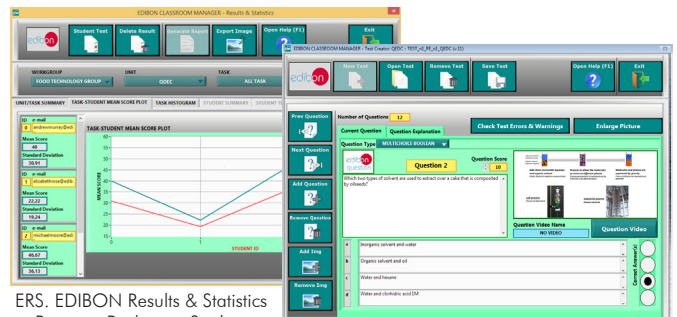
ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

Student Software
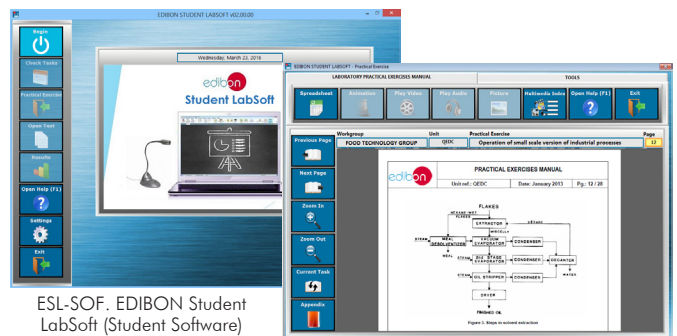
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen

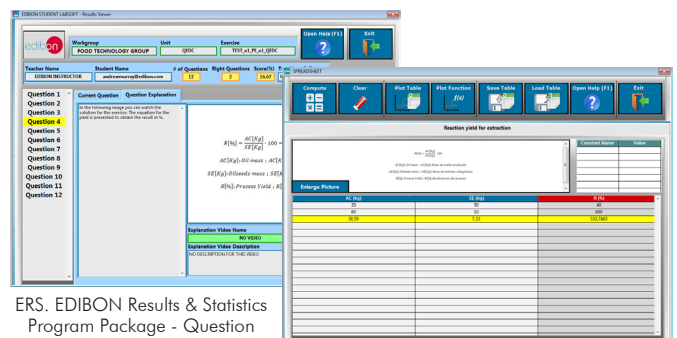EPE. EDIBON Practical Exercise Program Package Main Screen

ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

⑨ **AEQC/FSS. Faults Simulation System.**

Faults Simulation System (FSS) is a Software package that simulates **several faults** in any EDIBON Computer Controlled Unit. It is useful for Technical and Vocational level.

The "FAULTS" mode consists in causing several faults in the unit normal operation. The student must find them and solve them. There are several kinds of faults that can be grouped in the following sections:

Faults affecting the sensors measurement:
- An incorrect calibration is applied to them.
- Non-linearity.

Faults affecting the actuators:
- Actuators channels interchange at any time during the program execution.
- Response reduction of an actuator.

Faults in the controls execution:
- Inversion of the performance in ON/OFF controls.
- Reduction or increase of the calculated total response.
- The action of some controls is annulled.

On/off faults:
- Several on/off faults can be included.

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

www.edibon.com/en/files/expansion/FSS/catalog

Example of some screens
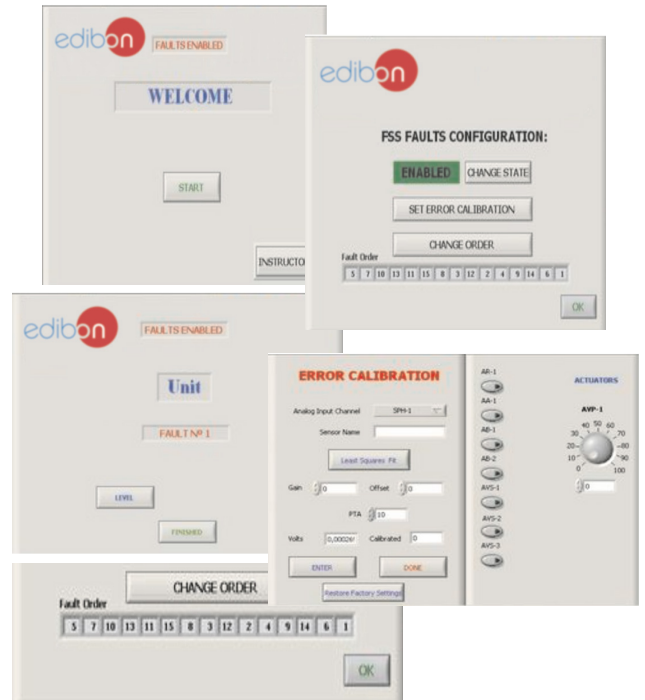
c) Multipost Expansions options

⑩ **MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.**

MINI ESN. EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously. It is useful for both, Higher Education and/or Technical and Vocational Education.

The MINI ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA and PID Control integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit. Then, the number of possible users who can work with the same unit is higher than in an usual way of working (usually only one).

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA and PID Control, connected in a local net.

- Open Control + Multicontrol + Real Time Control + Multi Student Post.

- Instructor controls and explains to all students at the same time.

- Any user/student can work doing "real time" control/multicontrol and visualisation.

- Instructor can see in the computer what any user/student is doing in the unit.

- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.

- This system allows you can save time and cost.

- Future expansions with more EDIBON Units.

For more information see **MINI ESN** catalogue. Click on the following link:

www.edibon.com/en/files/expansion/MINI-ESN/catalog

MINI ESN.
EDIBON Mini Scada-Net System

Computer Controlled Cheese Vat (AEQC)

1 UNIT= up to 30 STUDENTS can work simultaneously

Control Interface included in the Unit

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

Instructors' Central Computer

Mini Scada-Net Software

LOCAL NET FOR 30 STUDENTS

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

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

⑪ **ESN. EDIBON Scada-Net Systems.**

This unit can be integrated, in the future, into a Complete Laboratory with many Units and many Students.

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

www.edibon.com/en/files/expansion/ESN/catalog
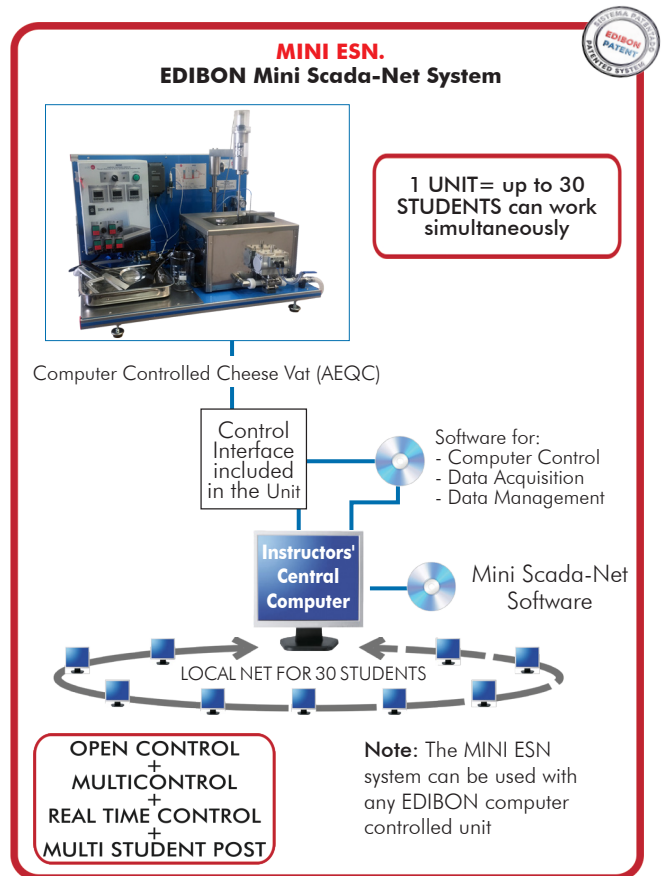
Main items (always included in the supply)

Minimum supply always includes:

① **Unit: AEQC. Computer Controlled Cheese Vat.**

② **AEQC/CIB. Control Interface Box.**

③ **DAB. Data Acquisition Board.**

④ **AEQC/CCSOF. PID Computer Control + Data Acquisition + Data Management Software.**

⑤ **Cables and Accessories**, for normal operation.

⑥ **Manuals.**

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

Optional items (supplied under specific order)

a) Industrial configuration

⑦ PLC. Industrial Control using PLC (it includes PLC-PI Module plus PLC-SOF Control Software):

- PCL-PI. PLC Module.

- AEQC/PLC-SOF. PLC Control Software.

b) Technical and Vocational Education configuration

⑧ AEQC/ICAI. Interactive Computer Aided Instruction Software.

⑨ AEQC/FSS. Faults Simulation System.

c) Multipost Expansions options

⑩ MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.

⑪ ESN. EDIBON Scada-Net Systems.

TENDER SPECIFICATIONS (for main items)

① AEQC. Unit:
Bench-top unit.
Anodized aluminum frame and panels made of painted steel.
Main metallic elements made of stainless steel.
Diagram in the front panel with distribution of the elements similar to the real one.
Two operation modes: manual or computerized.
Stainless steel vat with jacket. Capacity: 10 l. The jacket includes:
   Heating element with safety thermostat (90 °C). Power: 3000 W.
   Level switch.
   "J" type temperature sensor to measure the temperature of the heating water.
Variable speed circulation pump to impel the heating water in the vat jacket.
Automatic draining of the heating water in the vat by solenoid valve.
Detachable paddle agitator made of stainless steel:
   Variable speed motor to impel the agitator through a duly protected coupling. Range: 0 – 140 rpm.
   Two types of stainless steel paddles.
   Measurement of the agitator speed.
Perforated stainless steel filter to separate the whey from the curd and drain the vat efficiently.
Automatic draining of the whey by a detachable pneumatic solenoid valve for easy cleaning. Compressed air working pressure: 2.5 – 3 bar.
Pressure regulator with manometer to control the air inlet pressure in the pneumatic solenoid valve. Range of the manometer: 0 – 4 bar.
"J" type temperature sensor to measure the content of the vat.
Ladle and spatula made of nylon to collect the curd.
Beaker with capacity of 1000 ml.
pH sensor to measure the product to be made:
   PVDF body; high chemical and mechanical resistance material suitable for food use.
   Conical membrane for easy introduction and wide contact area in semisolid products.
   Silver-free gel electrolyte to avoid contamination.
   Temperature compensation probe to measure pH.
The complete unit includes as well:
   Advanced Real-Time SCADA and PID Control.
   Open Control + Multicontrol + Real-Time Control.
   Specialized EDIBON Control Software based on LabVIEW.
   National Instruments Data Acquisition board (250 KS/s, kilo samples per second).
   Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.
   Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.
   Capable of doing applied research, real industrial simulation, training courses, etc.
   Remote operation and control by the user and remote control for EDIBON technical support, are always included.
   Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).
   Designed and manufactured under several quality standards.
   Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user's knowledge and progress reached.
   This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

Additional recommended elements (not included):
   - AEQC-A. Accessories for the Cheese Vat:
Two square cheesecloths (65 x 65 cm).
Curd cutter and knife.
Stainless steel cheese press, with pressure regulator for easy cheese pressing knowing the pressure applied:
   The base of the press has holes for whey draining during the pressing process.
   Compatible with molds up to 19 cm wide and 20 cm high.
Cheese molds:
   Manchego cheese mold with plaited esparto grass band to make a pressed cheese up to 600 g.
   Smooth round mold to make a pressed cheese up to 900 g.
   Two rectangular screen molds to make fresh cheese up to 500 g.
   Four rectangular screen molds to make small fresh cheeses of 50 g.
Acid testing kit. It includes:
   Dornic acidimeter.
   10 ml pipette.
   Dropping bottle.
   100 ml beaker.

② AEQC/CIB. Control Interface Box:
The Control Interface Box is part of the SCADA system.
Control interface box with process diagram in the front panel.
The unit control elements are permanently computer controlled.
Simultaneous visualization in the computer of all parameters involved in the process.
Calibration of all sensors involved in the process.
Real time curves representation about system responses.
All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process.
Shield and filtered signals to avoid external interferences.
Real time PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process.
Real time PID control for parameters involved in the process simultaneously.
Proportional control, integral control and derivative control, based on the real PID mathematical formula, by changing the values, at any time, of the three control constants (proportional, integral and derivative constants).
Open control allowing modifications, at any moment and in real time, of parameters involved in the process simultaneously.
Three safety levels, one mechanical in the unit, another electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
The Data Acquisition board is part of the SCADA system.
PCI Express Data acquisition board (National Instruments) to be placed in a computer slot.
Analog input: Channels= 16 single-ended or 8 differential. Resolution=16 bits, 1 in 65536. Sampling rate up to: 250 KS/s (kilo samples per second).
Analog output: Channels=2. Resolution=16 bits, 1 in 65536.
Digital Input/Output: Channels=24 inputs/outputs.
The Data Acquisition board model may change at any moment, providing the same or better features than those required for the unit.

④ AEQC/CCSOF. PID Computer Control +Data Acquisition+Data Management Software:
The three softwares are part of the SCADA system.
Compatible with the industry standards.
Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
Analog and digital PID control. PID menu and set point selection required in the whole work range.
Management, processing, comparison and storage of data.
Sampling velocity up to 250 KS/s (kilo samples per second).
Calibration system for the sensors involved in the process.
It allows the registration of the alarms state and the graphic representation in real time.
Open software, allowing the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals:
This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Exercises and Practical Possibilities to be done with the Main Items

1.- Study of the cheese making process:

   - Milk heating and agitation.

   - Addition of starter culture and rennet.

   - Coagulation.

   - Curd cutting and heating.

   - Precision curd heating and agitation to "scald" the curd.

   - Curd settling.

   - Whey draining.

   - Curd milling.

   - Addition of salt.

2.- Hard and soft cheese making.

3.- Study of the pressing process (the additional recommended element AEQC-A is required).

4.- Acid testing (the additional recommended element AEQC-A is required).

Additional practical possibilities:

5.- Sensors calibration.

Other possibilities to be done with this Unit:

6.- Many students view results simultaneously.

   To view all results in real time in the classroom by means of a projector or an electronic whiteboard.

7.- Open Control, Multicontrol and Real Time Control.

   This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivative parameters; etc, in real time.

8.- The Computer Control System with SCADA and PID Control allow a real industrial simulation.

9.- This unit is totally safe as uses mechanical, electrical/electronic, and software safety devices.

10.-This unit can be used for doing applied research.

11.-This unit can be used for giving training courses to Industries even to other Technical Education Institutions.

12.-Control of the AEQC unit process through the control interface box without the computer.

13.-Visualization of all the sensors values used in the AEQC unit process.

- By using PLC-PI additional 19 more exercises can be done.

- Several other exercises can be done and designed by the user.

TENDER SPECIFICATIONS (for optional items)

<u>a) Industrial configuration</u>

⑦ **PLC. Industrial Control using PLC** (it includes PLC-PI Module plus PLC-SOF Control Software):

-PLC-PI. PLC Module:

Metallic box.

Circuit diagram in the module front panel.

Digital inputs (X) and Digital outputs (Y) block: 16 Digital inputs. 14 Digital outputs.

Analog inputs block: 16 Analog inputs.

Analog outputs block: 4 Analog outputs.

Touch screen.

Panasonic PLC:

High-speed scan of 0.32 μsec. Program capacity of 32 Ksteps. High-speed counter. Multi-point PID control.

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

-AEQC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

Practices to be done with PLC-PI:

1.- Control of the particular unit process through the control interface box without the computer.
2.- Visualization of all the sensors values used in the particular unit process.
3.- Calibration of all sensors included in the particular unit process.
4.- Hand on of all the actuators involved in the particular unit process.
5.- Realization of different experiments, in automatic way, without having in front the particular unit. (These experiments can be decided previously).
6.- Simulation of outside actions, in the cases do not exist hardware elements. (Example: test of complementary tanks, complementary industrialenvironment to the process to be studied, etc).
7.- PLC hardware general use.
8.- PLC process application for the particular unit.
9.- PLC structure.
10.-PLC inputs and outputs configuration.
11.-PLC configuration possibilities.
12.-PLC program languages.
13.-PLC different programming standard languages (ladder diagram (LD), structured text (ST), instructions list (IL), sequential function chart (SFC), function block diagram (FBD)).
14.-New configuration and development of new process.
15.-Hand on an established process.
16.-To visualize and see the results and to make comparisons with the particular unit process.
17.-Possibility of creating new process in relation with the particular unit.
18.-PLC Programming Exercises.
19.-Own PLC applications in accordance with teacher and student requirements.

<u>b) Technical and Vocational Education configuration</u>

⑧ **AEQC/ICAI. Interactive Computer Aided Instruction Software.**

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

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc...so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

• User Data Base Management.
• Administration and assignment of Workgroup, Task and Training sessions.
• Creation and Integration of Practical Exercises and Multimedia Resources.
• Custom Design of Evaluation Methods.
• Creation and assignment of Formulas & Equations.
• Equation System Solver Engine.
• Updatable Contents.
• Report generation, User Progression Monitoring and Statistics.

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

• Student Log-In & Self-Registration.
• Existing Tasks checking & Monitoring.
• Default contents & scheduled tasks available to be used from the first session.
• Practical Exercises accomplishment by following the Manual provided by EDIBON.
• Evaluation Methods to prove your knowledge and progression.
• Test self-correction.
• Calculations computing and plotting.
• Equation System Solver Engine.
• User Monitoring Learning & Printable Reports.
• Multimedia-Supported auxiliary resources.

⑨ AEQC/FSS. Faults Simulation System.

Faults Simulation System (FSS) is a Software package that simulates several faults in any EDIBON Computer Controlled Unit.

The "FAULTS" mode consists in causing several faults in the unit normal operation. The student must find them and solve them.

There are several kinds of faults that can be grouped in the following sections:

Faults affecting the sensors measurement:

- An incorrect calibration is applied to them.

- Non-linearity.

Faults affecting the actuators:

- Actuators channels interchange at any time during the program execution.

- Response reduction of an actuator.

Faults in the controls execution:

- Inversion of the performance in ON/OFF controls.

- Reduction or increase of the calculated total response.

- The action of some controls is annulled.

On/off faults:

- Several on/off faults can be included.

<u>c) Multipost Expansions options</u>

⑩ MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.

MINI ESN. EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously.

The MINI ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA and PID Control integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit.

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA and PID Control, connected in a local net.

- Open Control + Multicontrol + Real Time Control + Multi Student Post.

- Instructor controls and explains to all students at the same time.

- Any user/student can work doing "real time" control/multicontrol and visualisation.

- Instructor can see in the computer what any user/student is doing in the unit.

- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.

- This system allows you can save time and cost.

- Future expansions with more EDIBON Units.

The system basically will consist of:

This system is used with a Computer Controlled Unit.

- Instructor's computer.

- Students' computers.

- Local Network.

- Unit-Control Interface adaptation.

- Unit Software adaptation.

- Webcam.

- MINI ESN Software to control the whole system.

- Cables and accessories required for a normal operation.

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

REPRESENTATIVE:

edibon
INTERNATIONAL

C/ Julio Cervera, 10-12-14. Móstoles Tecnológico.
28935 MÓSTOLES. (Madrid). ESPAÑA - SPAIN.
Tel.: 34-91-6199363   Fax: 34-91-6198647
E-mail: edibon@edibon.com   Web: **www.edibon.com**

Edition: ED02/20
Date: November/2020