Engineering and Technical Teaching Equipment

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

Teaching Technique used

② Control Interface Box

③ Data Acquisition Board

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

Computer (not included in the supply)

⑤ Cables and Accessories

⑥ Manuals

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

① Unit: AEDC. Computer Controlled Deodorizing Unit

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

INTRODUCTION

Deodorization gradually evolved from a "simple" process to remove off-flavors to an operation with a big impact on the refined oil quality. It is important to remove any undesirable compounds that can affect flavor, odor, stability and/or color.

Deodorization is a vacuum steam distillation process in which steam is passed through of oil at low pressure and high temperature in order to remove any substance still present after the preceding processing stages.

The Computer Controlled Deodorizing Unit, "AEDC", is a unit for teaching/training the deodorization process, which allows stripping undesirable compounds from edible oils through a vacuum steam distillation under low pressure and high temperature with steam.

GENERAL DESCRIPTION

The Computer Controlled Deodorizing Unit, "AEDC", is a batch deodorizing process unit able to perform a vacuum steam distillation under low pressure and high temperature with steam. Several factors that influence the process can be studied. The unit consists of a deodorizing vessel, a vacuum system, a steam line, a discharge pump and a polishing filter.

The deodorizing vessel is equipped with a computer controlled heating element to heat the oil, a steam distributor that allows the steam/oil mixing required, and an immersed cooling water coil to reduce the oil temperature when the process has completed. This vessel is equipped with a sight glass so that the process can be visualized. This vessel includes a security valve, a level switch and a pressure sensor and a manometer to measure the vessel pressure.

The steam line injects steam from the steam generator to the deodorizing vessel with a steam distributor. This line includes a steam trap, a security valve, a check valve, a high pressure switch and two computer controlled solenoid valves.

Vapor from the vessel, with the undesirable compounds, is directed to the condenser of the vacuum system, through which cooling water flows. This system includes a computer controlled liquid ring vacuum pump to achieve the vacuum in the vessel. The condensed compounds pass to be drained with the sealing water of the vacuum pump.

To complete the deodorizing process, the treated oil is pumped out of the deodorizing vessel through a computer controlled pump and a polishing filter.

Pressure, temperature and flow sensors are supplied where is necessary, as well as adequate sampling and drain valves. This unit is protected by a transparent sheet.

The process control is done from the computer using EDIBON control software. This software will allow an automatic control (PID) of the oil temperature with the heating element.

The unit allows two operation modes:

Deodorizing: the oil is heated under vacuum and the steam provides the agitation required. When pressure and temperature conditions are achieved, the steam is adjusted to ensure a good physical contact of the steam with the oil. The undesirable compounds are carried over in the steam and the condensates are blended with the sealing water of the vacuum pump and then discharged to be drained.
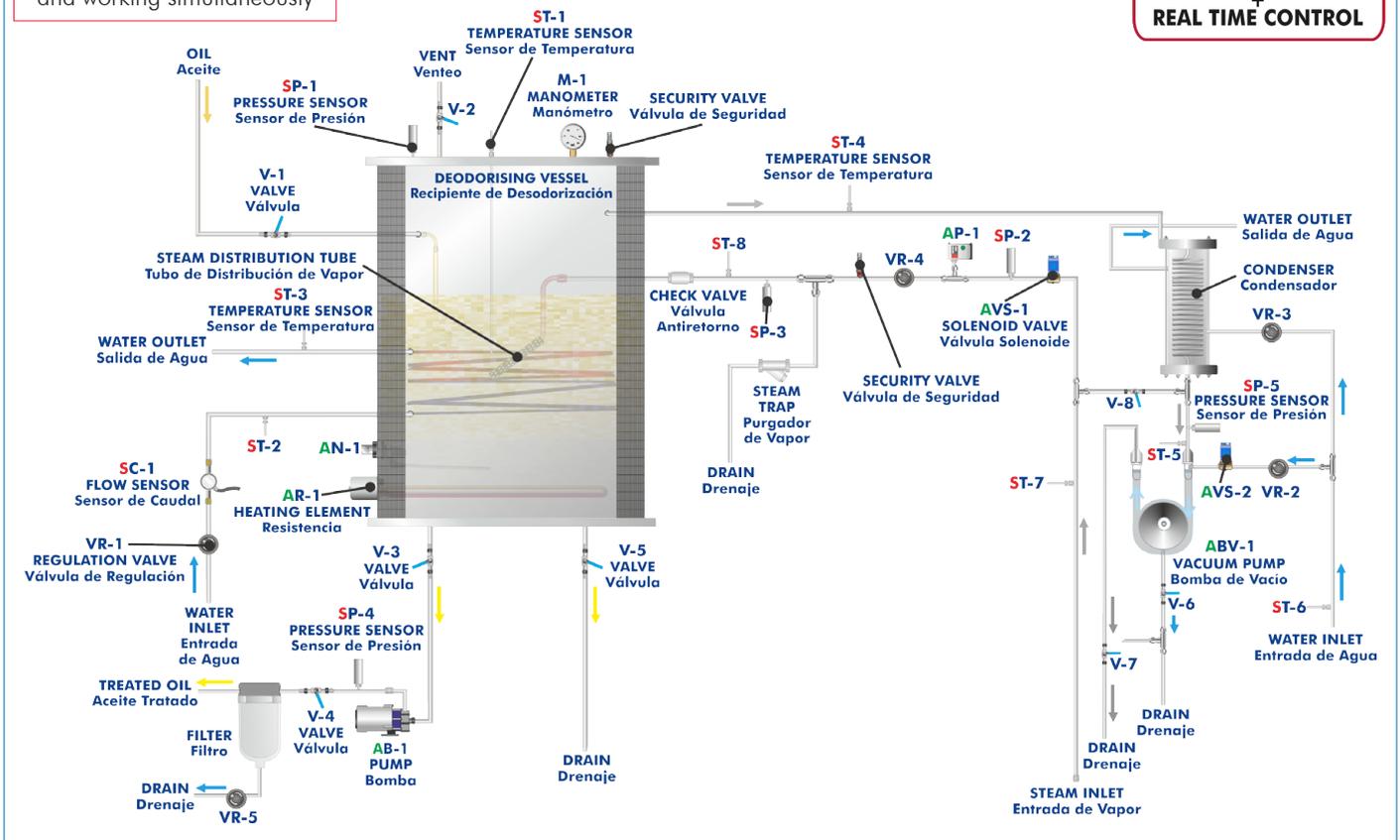
Polishing: after the deodorizing process and the oil refining process is complete. This oil is free of any trace of contaminants. To achieve this, it is pumped through a fine "polishing" filter that removes particles from 5.0 microns on, giving bright oil as product.

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.

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

5 actuators and 14 sensors controlled from any computer, and working simultaneously

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

OIL
Aceite

SP-1
PRESSURE SENSOR
Sensor de Presión

V-1
VALVE
Válvula

STEAM DISTRIBUTION TUBE
Tubo de Distribución de Vapor

ST-3
TEMPERATURE SENSOR
Sensor de Temperatura

WATER OUTLET
Salida de Agua

SC-1
FLOW SENSOR
Sensor de Caudal

VR-1
REGULATION VALVE
Válvula de Regulación

WATER INLET
Entrada de Agua

TREATED OIL
Aceite Tratado

FILTER
Filtro

DRAIN
Drenaje

VR-5

VENT
Venteo

V-2

ST-1
TEMPERATURE SENSOR
Sensor de Temperatura

M-1
MANOMETER
Manómetro

SECURITY VALVE
Válvula de Seguridad

DEODORISING VESSEL
Recipiente de Desodorización

ST-2

AN-1

AR-1
HEATING ELEMENT
Resistencia

V-3
VALVE
Válvula

SP-4
PRESSURE SENSOR
Sensor de Presión

V-4
VALVE
Válvula

AB-1
PUMP
Bomba

V-5
VALVE
Válvula

DRAIN
Drenaje

ST-4
TEMPERATURE SENSOR
Sensor de Temperatura

ST-8

CHECK VALVE
Válvula
Antiretorno

SP-3

STEAM
TRAP
Purgador
de Vapor

DRAIN
Drenaje

VR-4

AP-1 SP-2

AVS-1
SOLENOID VALVE
Válvula Solenoide

SECURITY VALVE
Válvula de Seguridad

V-8

ST-7

V-7

DRAIN
Drenaje

STEAM INLET
Entrada de Vapor

WATER OUTLET
Salida de Agua

CONDENSER
Condensador

VR-3

SP-5
PRESSURE SENSOR
Sensor de Presión

ST-5

AVS-2 VR-2

ABV-1
VACUUM PUMP
Bomba de Vacío

V-6

ST-6

WATER INLET
Entrada de Agua

DRAIN
Drenaje

3

www.edibon.com

With this unit there are several options and possibilities:

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

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

① **AEDC. Unit:**

Anodized aluminum frame and panels made of painted steel.

The unit includes wheels to facilitate its mobility.

Main metallic elements made of stainless steel.

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

Deodorizing vessel:

Cylindrical vessel of stainless steel.

Working volume: 25 l.

Overall volume: 60 l.

It is equipped with a sight glass to visualize the process.

It includes a heating element, computer controlled, to heat the oil to temperatures of up to 200 °C. Power: 3.0 kW.

It includes a jacket to insulate the process and to maintain the temperature inside.

It also contains a steam distributor to provide the steam/oil mixing required.

An immersed cooling water coil reduces the oil temperature to complete the process. Cooling coil area: 0.1 m².

This vessel also includes a security valve to limit the working pressure to 2 bar and a level switch.

Vacuum system. It includes:

Condenser.

Liquid ring vacuum pump, computer controlled, to achieve the vacuum in the deodorizing vessel.

Number of stages: 2. Motor power: 2.2 kW. Sealant: water.

Discharge pump, computer controlled:

This pump allows to impel the treated oil of the vessel through a polishing filter, max. flow: 60 l/min.

Polishing filter:

This filter removes any particles in the finished oil.

It is made of stainless steel and is designed to allow checking the installed cartridge.

Filter type: Replaceable cartridge made of polypropylene.

Filter element size: 5.0 micron.

Steam line. It includes:

Two computer controlled solenoid valves. Security valve to limit the working pressure in the line to 5 bar.

Pressure switch (5 bar). Steam trap. Check valve. Regulation valve.

Pressure sensor and manometer to indicate the pressure in the deodorizing vessel and the vacuum level in the vessel. Pressure sensor range: -1 – 5 bar, manometer range: -1 – 5 bar.

Two pressure sensors to measure the pressure at the steam line, range: -1 – 5 bar.

Pressure sensor to measure the pressure at the outlet of the condenser, range: -1 – 9 bar.

Pressure sensor to measure the pressure at the outlet of the discharge pump, range: 0 – 10 bar.

Eight "J" type temperature sensors.

Flow sensor to measure the coil water flow, range: 1.5 – 30 l/min.

The process control is done from the computer using EDIBON control software. This software will allow an automatic control (PID) of the oil temperature with the heating element.

The unit allows two operation modes: Deodorizing and Polishing.

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: AEDC

② **AEDC/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.

AEDC/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: <u>250 KS/s (kilo samples per second)</u>.
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 **AEDC/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 <u>250 KS/s (kilo samples per second)</u>.**
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.
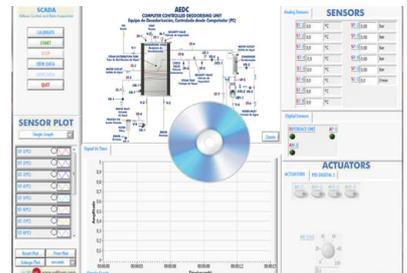
AEDC/CCSOF

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: AEDC + AEDC/CIB + DAB + AEDC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply for enabling normal and full operation.

EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH THE MAIN ITEMS

1.- Study of the operation of small scale version of the deodorizing industrial process.

2.- Study of the variation of deodorizing process temperature.

3.- Study of the variation of deodorizing process pressure.

4.- Study of the variation of quantity of direct steam added to the deodorizing process.

5.- Study of the variation of overall process time in the deodorizing process.

Additional practical possibilities:

6.- Sensors calibration.

7.- Study to determinate the optimum process conditions for different types of oil.

Other possibilities to be done with this unit:

8.- Many students view results simultaneously.

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

9.- 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.

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

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

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

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

14.- Control of the AEDC unit process through the control interface box without the computer.

15.- Visualization of all the sensors values used in the AEDC unit process.

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

REQUIRED SERVICES

- Electrical supply: three-phase, 380 VAC – 400 VAC/50 Hz or 190 VAC – 240 VAC/60 Hz, 5 kW.
- Water supply: Flow: 20.0 l/min, pressure range: 3.0 – 5.0 bar, temperature: 15 °C, approx.
- Drain system.
- Computer.

REQUIRED ELEMENTS (Not included)

- TGV-6KWA. Steam Generator (6 kW) (for high pressures and high temperatures) or steam supply of minimum 4 bar and 10 kg/h.

DIMENSIONS AND WEIGHTS

AEDC:
    Unit:
      - Dimensions: 1400 x 930 x 1800 mm approx.
                (55.11 x 36.61 x 70.86 inches approx.).
      - Weight: 520 Kg approx.
                (1146 pounds approx.).
    Control Interface Box:
      - Dimensions: 490 x 450 x 470 mm approx.
                (19.29 x 17.71 x 18.50 inches approx.)
      - Weight: 20 Kg approx.
                (44 pounds approx.).
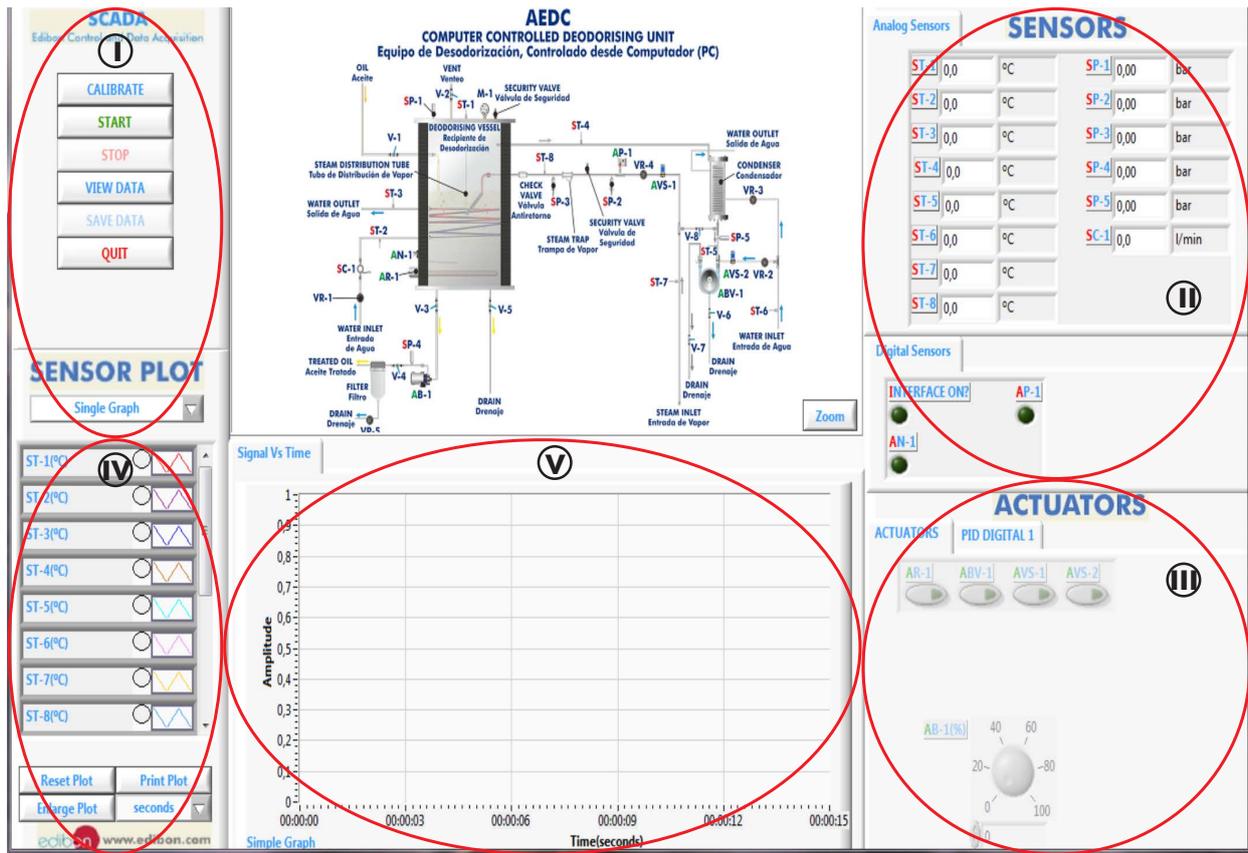
SIMILAR UNITS AVAILABLE

Offered in this catalog:

- AEDC. Computer Controlled Deodorizing Unit.

Offered in other catalog:

- AEDC/A. Advanced Computer Controlled Deodorizing Unit.

SCADA and PID Control
Main screen

Ⓘ Main software operation possibilities.

ⒾⒾ Sensors displays, real time values, and extra output parameters. **Sensors:** ST=Temperature sensor.   SC=Flow sensor.   SP=Pressure sensor.

Ⓘ ⓘ Actuators controls. **Actuators:** AB=Pump.   AR=Heating element.   AVS=Solenoid valve.   ABV=Vacuum pump.   AN=Level switch.   AP=Pressure switch.

ⒾⓋ Channel selection and other plot parameters.

Ⓥ Real time graphics displays.

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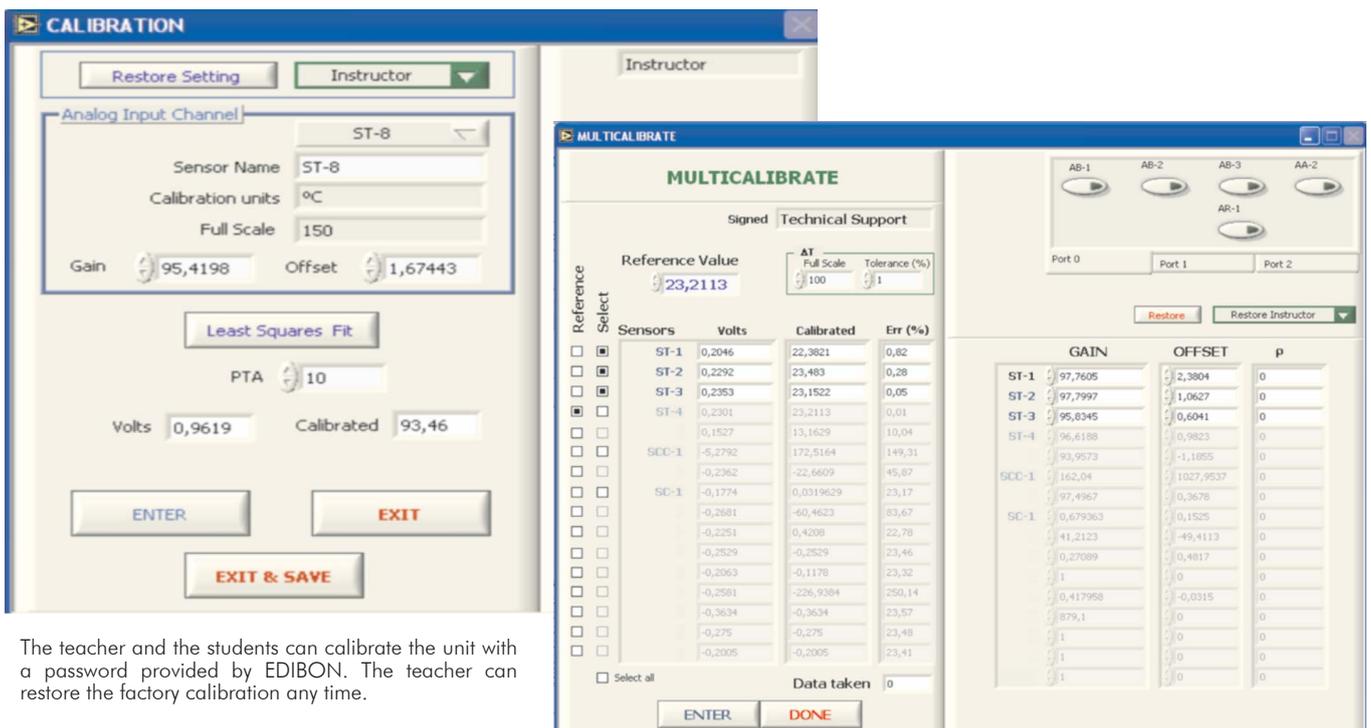
The teacher and the students can calibrate the unit with a password provided by EDIBON. The teacher can restore the factory calibration any time.

# SOME **REAL** RESULTS OBTAINED FROM THIS UNIT

This screen shows how the computer controlled liquid ring vacuum pump (ABV-1) allows to achieve vacuum levels (SP-1 sensor) in the deodorizing vessel.
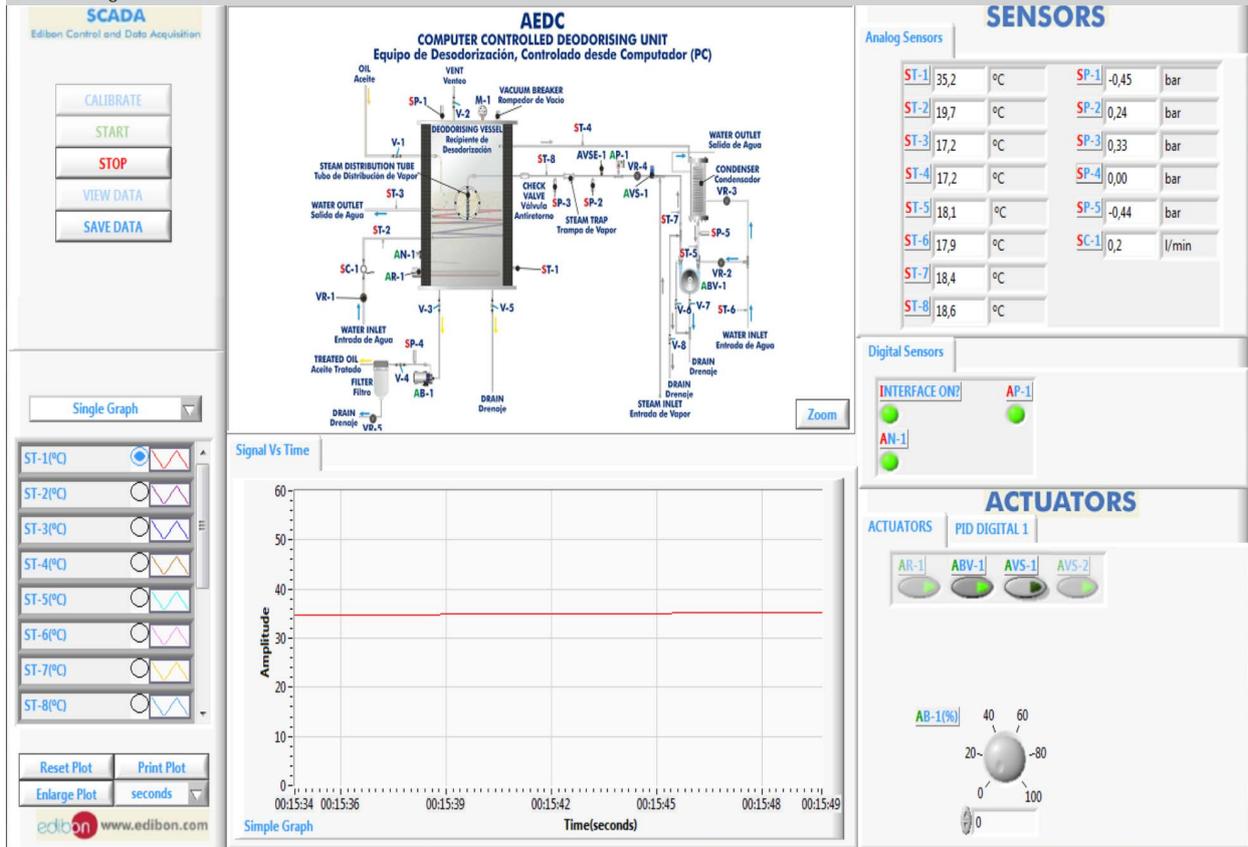

This screen shows the PID controller used to maintain the desired temperature inside the deodorizing vessel during the deodorization process.
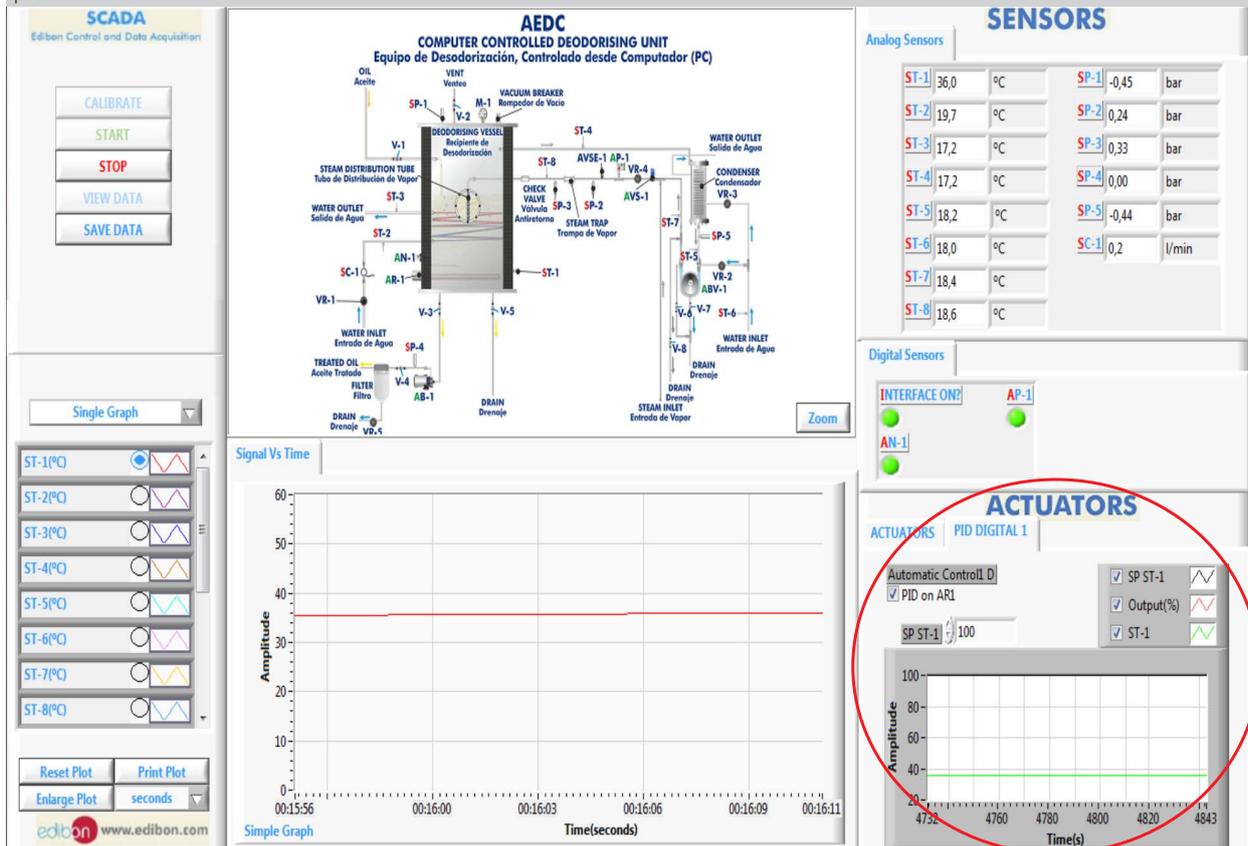
This screen shows how the computer controlled liquid ring vacuum pump (ABV-1) allows to achieve the vacuum in the deodorizing vessel. The steam inlet (AVS-1 is activated) in the deodorizing vessel allows to rise the temperature inside the vessel.
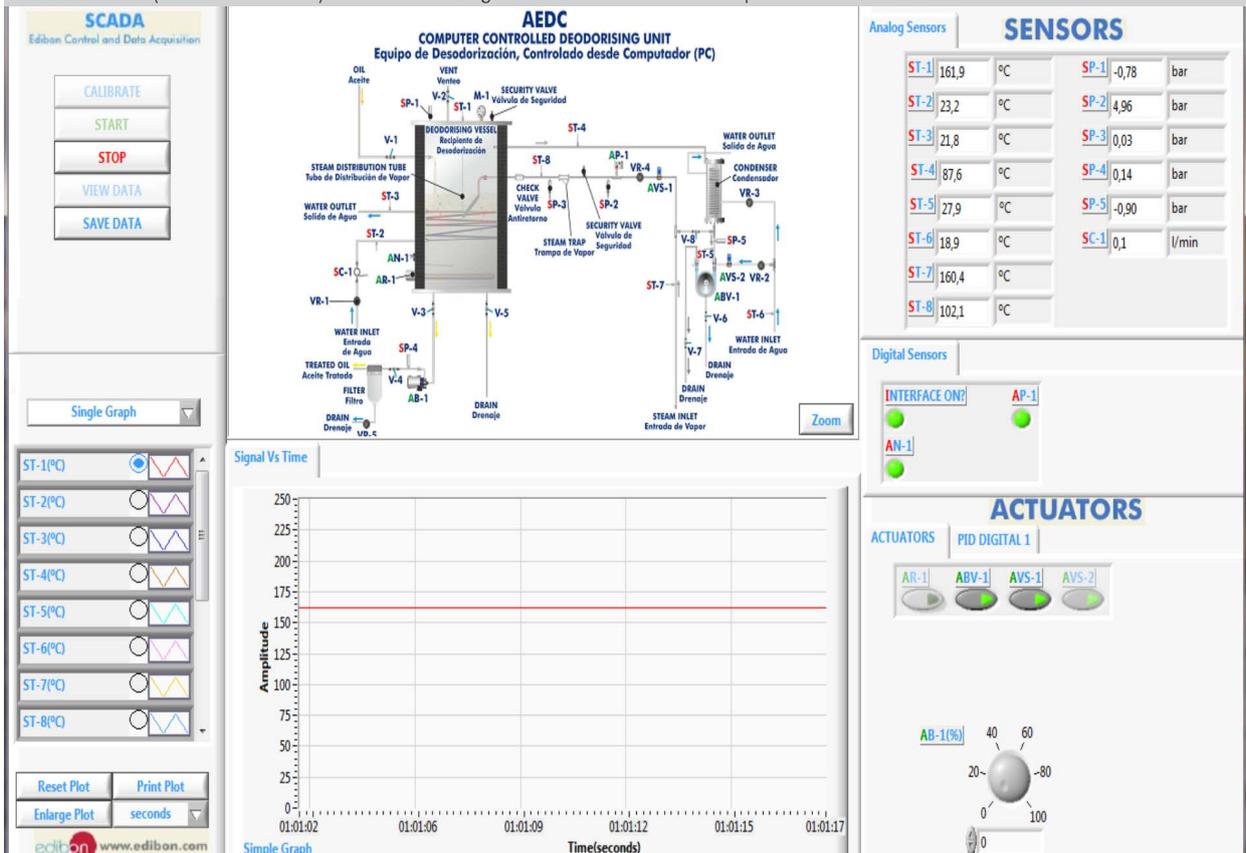
An immersed cooling water coil inside of the deodorizing vessel allow to reduce the oil temperature when the process has completed.
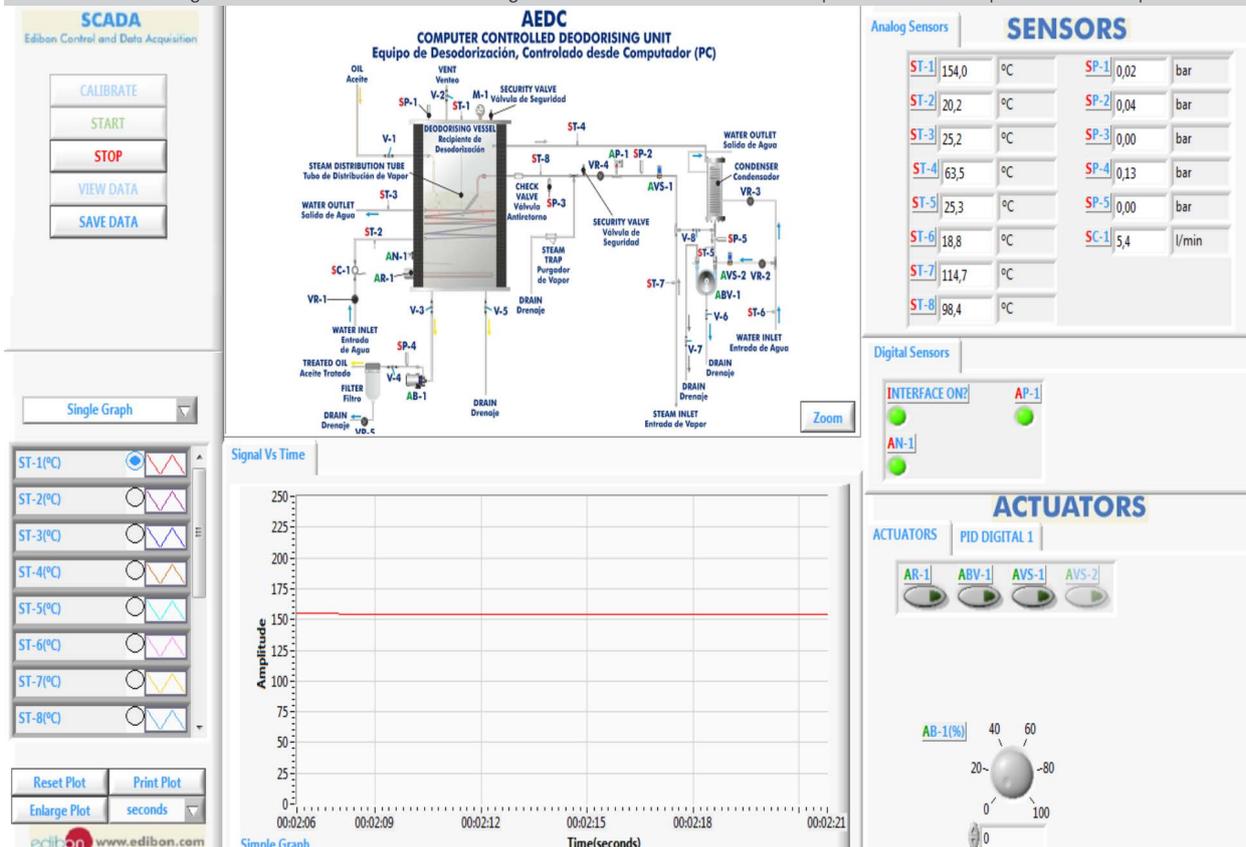
Additionally to the main items (1 to 6) described, we can offer, as optional, other items from 7 to 9.

All these items try to give more possibilities for:

    a) Technical and Vocational Education configuration. (ICAI)

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

a) Technical and Vocational Education configuration

⑦ AEDC/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/interactive-computer-aided-instruction-software

Instructor Software

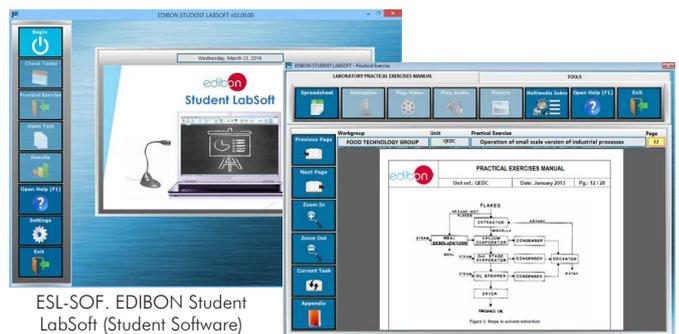ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen

ECAL. EDIBON Calculations Program Package - Formula Editor Screen

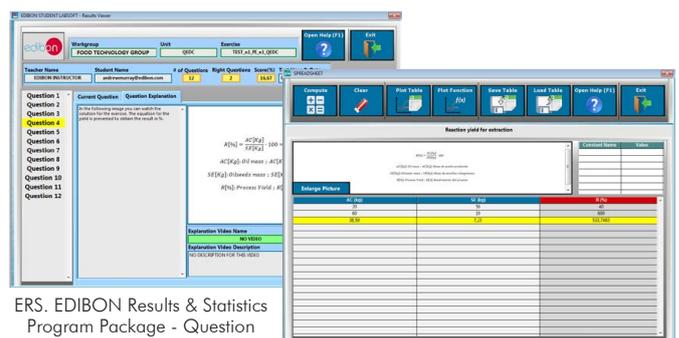ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

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

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

⑧ 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).

<u>Main characteristics:</u>

- 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.

<u>Main advantages:</u>

- 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/edibon-scada-net

MINI ESN.
EDIBON Mini Scada-Net System

1 UNIT= up to 30 STUDENTS can work simultaneously

Computer Controlled Deodorizing Unit (AEDC)

Control Interface Box

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

⑨ 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/edibon-scada-net
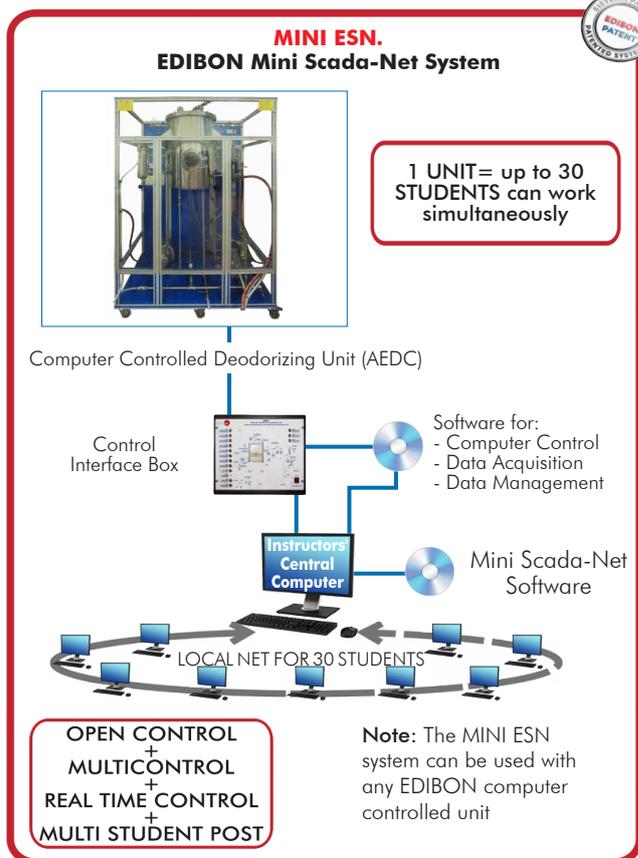
ORDER INFORMATION

Main items (always included in the supply)

Minimum supply always includes:

① **Unit: AEDC. Computer Controlled Deodorizing Unit.**

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

③ **DAB. Data Acquisition Board.**

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

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

⑥ **Manuals.**

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

Optional items (supplied under specific order)

a) Technical and Vocational Education configuration

⑦ AEDC/ICAI. Interactive Computer Aided Instruction Software.

b) Multipost Expansions options

⑧ MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.

⑨ ESN. EDIBON Scada-Net Systems.

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Main metallic elements made of stainless steel.
Diagram in the front panel with distribution of the elements similar to the real one.
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    Working volume: 25 l.
    Overall volume: 60 l.
    It is equipped with a sight glass to visualize the process.
    It includes a heating element, computer controlled, to heat the oil to temperatures of up to 200 °C. Power: 3.0 kW.
    It includes a jacket to insulate the process and to maintain the temperature inside.
    It also contains a steam distributor to provide the steam/oil mixing required.
    An immersed cooling water coil reduces the oil temperature to complete the process. Cooling coil area: 0.1 m².
    This vessel also includes a security valve to limit the working pressure to 2 bar and a level switch.
Vacuum system. It includes:
    Condenser.
    Liquid ring vacuum pump, computer controlled, to achieve the vacuum in the deodorizing vessel.
        Number of stages: 2. Motor power: 2.2 kW. Sealant: water.
Discharge pump, computer controlled:
    This pump allows to impel the treated oil of the vessel through a polishing filter, max. flow: 60 l/min.
Polishing filter:
    This filter removes any particles in the finished oil.
    It is made of stainless steel and is designed to allow checking the installed cartridge.
    Filter type: Replaceable cartridge made of polypropylene.
    Filter element size: 5.0 micron.
Steam line. It includes:
    Two computer controlled solenoid valves. Security valve to limit the working pressure in the line to 5 bar.
    Pressure switch (5 bar). Steam trap. Check valve. Regulation valve.
Pressure sensor and manometer to indicate the pressure in the deodorizing vessel and the vacuum level in the vessel. Pressure sensor range: -1 – 5 bar, manometer range: -1 – 5 bar.
Two pressure sensors to measure the pressure at the steam line, range: -1 – 5 bar.
Pressure sensor to measure the pressure at the outlet of the condenser, range: -1 – 9 bar.
Pressure sensor to measure the pressure at the outlet of the discharge pump, range: 0 – 10 bar.
Eight "J" type temperature sensors.
Flow sensor to measure the coil water flow, range: 1.5 – 30 l/min.
The process control is done from the computer using EDIBON control software. This software will allow an automatic control (PID) of the oil temperature with the heating element.
The unit allows two operation modes: Deodorizing and Polishing.
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.

②AEDC/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.

③DAB. 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.

④AEDC/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.

⑤Cables and Accessories, for normal operation.

⑥Manuals:
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 operation of small scale version of the deodorizing industrial process.

2.- Study of the variation of deodorizing process temperature.

3.- Study of the variation of deodorizing process pressure.

4.- Study of the variation of quantity of direct steam added to the deodorizing process.

5.- Study of the variation of overall process time in the deodorizing process.

Additional practical possibilities:

6.- Sensors calibration.

7.- Study to determinate the optimum process conditions for different types of oil.

Other possibilities to be done with this unit:

8.- Many students view results simultaneously.

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

9.- 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.

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

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

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

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

14.- Control of the AEDC unit process through the control interface box without the computer.

15.- Visualization of all the sensors values used in the AEDC unit process.

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

a) Technical and Vocational Education configuration

⑦ **AEDC/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.

b) Multipost Expansions options

⑧ **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.

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