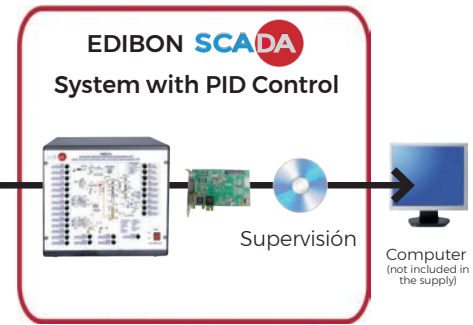


12.- FOOD & WATER TECHNOLOGY



- Study and research of the **continuous and discontinuous deodorization** operation.
- Research units, **modular and expandable**.
- **Custom design**.
- **Own manufacturing**.
- Column with **structured filling and trays** capable of perform a **vacuum and high temperature distillation** with steam.
- Recording of the most relevant parameters and **process control**.

EXPANSIONS

The main reference could be expanded adding:



ECR
EDIBON Industrial Modular System with NI CompactRIO



PLCHMI
IIoT local/remote Control and Monitoring with HMI



ICAI
Interactive Computer Aided Instruction Software System



ESN
EDIBON Scada-Net Systems



ECL
EDIBON Cloud Learning

INNOVATE SYSTEMS

- 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.

WARRANTIES



CONTACT US:

+34 91.619.93.63

edibon@edibon.com



For detailed product information, visit:

www.edibon.com



INTRODUCTION

After the extraction process, crude oil or oil mixed with solvent is obtained, which usually requires prior refining to be fit for consumption. The processing to which the oils are subjected after extraction will depend on the source from which they come, their quality and their end use. Refining is a series of operations aimed at eliminating the defects in oils and fats (excessive acidity, unpleasant taste and smell, inadequate colouring, turbidity, etc.).

Within the refining process, a critical process (last stage of general refining) in terms of the key quality parameters of the final oil is deodorization.

Deodorisation aims to eliminate various compounds responsible for undesirable aromas in oils, or to achieve odourless and flavourless oils for use in margarine production. These compounds are mainly aldehydes, ketones, carotenoids, tocopherols, short chain free fatty acids (such as butyric, isovaleric or caproic) and sterols, and some sulphur compounds.



GENERAL DESCRIPTION

The Advanced Computer Controlled Deodorizing Unit, "AEDC/A", designed by EDIBON is a unit that allows the study and research of the continuous deodorization operation capable of performing a vacuum and high temperature distillation with steam.

In the deodorization process, natural fatty acids (GFA) are removed from different types of vegetable oils, allowing the study of the main factors that influence the process.



The main element is the column that has structured filling and trays, to carry out the separation of fatty acids (stripping), also to wash the gases generated (scrubbing) has another structured filling fraction. After each operation, two demisters separate the liquids in the form of small particles contained in vapors and gases by coalescence.

The feed to the column is distributed evenly through collectors. To improve the exchange of material, superheated steam is injected into the column. The extracted fatty acids are recirculated through the head of the column to avoid cooling and therefore solidification and the possibility of clogging the ducts. Thermal oil

circulates through the column's coil, providing the necessary energy to keep the vegetable oil warm for the necessary residence time until the deodorization stage is completed. Along the column there are sensors that record the temperature and pressure at the different heights of the column.

Heat exchangers are used to provide the necessary thermal jump to the typical deodorisation temperature of the specific vegetable oil.

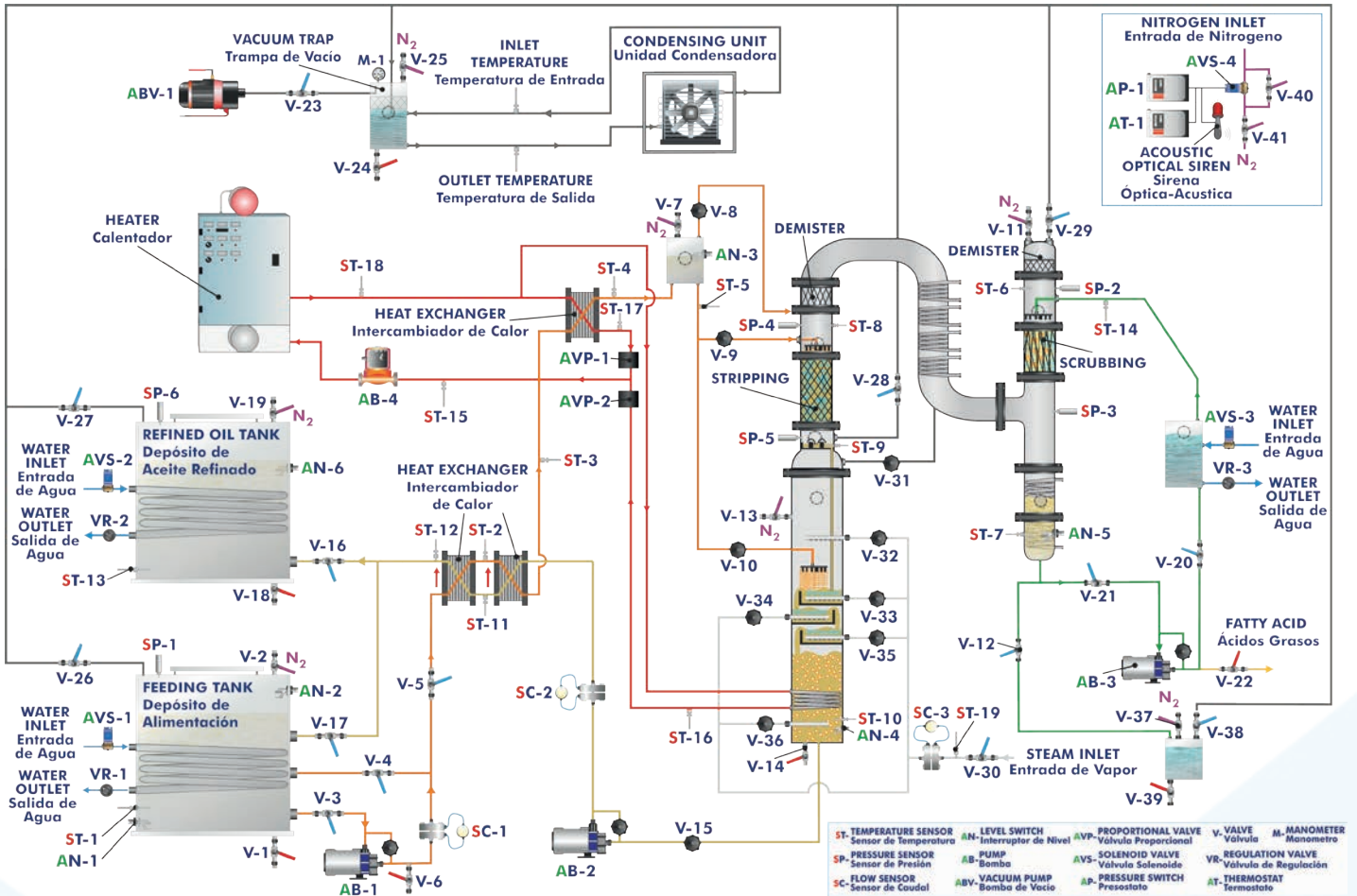
The feed tank allows the oil to be deodorised to be stored as well as being de-aerated and heated to suit the process conditions.

The refined oil tank stores the oil that has been deodorised for subsequent analysis.

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



EXERCISES AND PRACTICAL POSSIBILITIES

Guided practical exercises included in this unit:

- 1.- Study of the operation of a small-scale model of the industrial continuous deodorization process.
- 2.- Study of the operation of a small-scale model of the industrial discontinuous deodorization process.
- 3.- Study of a structured packing column.
- 4.- Study of the fatty acid removal process of various vegetable oils.
- 5.- Study of the variation in temperature of the deodorization process.
- 6.- Study of the variation in pressure of the deodorization process.
- 7.- Study of the variation in the amount of direct steam added to the deodorization process.
- 8.- Study of the variation in the total processing time of the deodorization process.
- 9.- Study of the effect of the recirculation of the fatty acids obtained in the process.

Additional practical possibilities:

- 10.- Sensor calibration.
- 11.- Study of the impact of the type of packing in the fatty acid removal process.

Other possibilities to be done with this Unit:

- 12.- Many students view results simultaneously.

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

- 13.- 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.

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

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

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

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

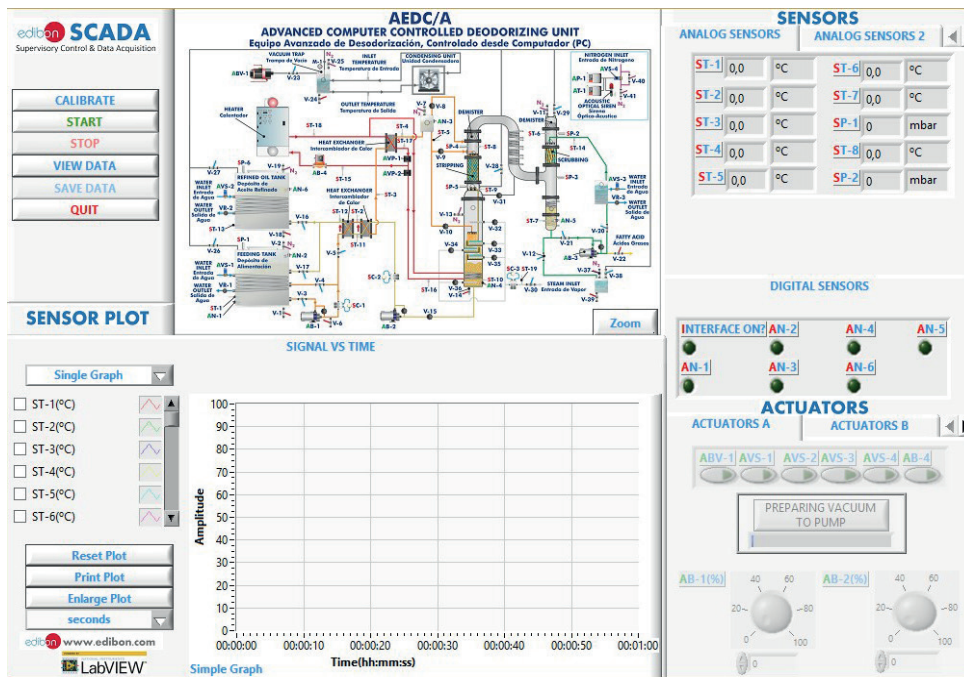
18.- Control of the AEDC/A unit process through the control interface box without the computer.

19.- Visualization of all the sensors values used in the AEDC/A unit process.

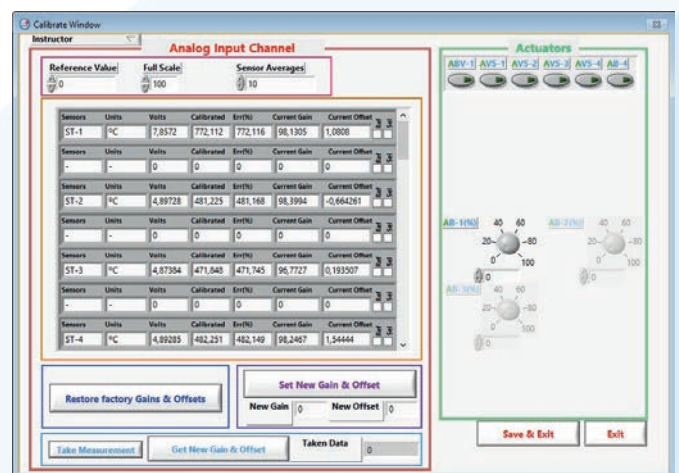
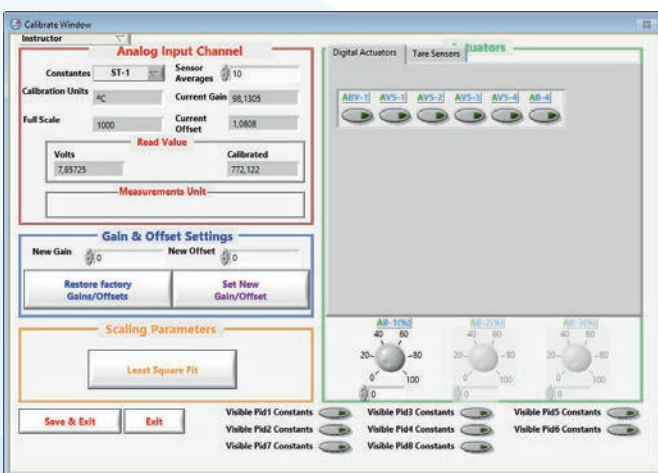
20.- Several other exercises can be done and designed by the user.

RESULTS

SOFTWARE MAIN SCREEN



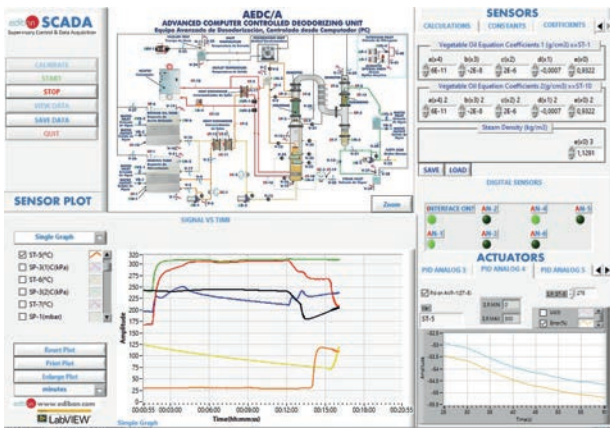
- Main software operation possibilities.
- Sensors displays, real time values, and extra output parameters. Sensors: ST=Temperature sensor. SP=Pressure sensor. SC=Flow sensor.
- Actuators controls. Actuators: AN=Level switch. AB=Pump. ABV=Vacuum pump. AP=Pressure switch. AVS=Solenoid valve. AVP=Proportional valve. AT=Thermostat.
- Channel selection and other plot parameters.
- Real time graphics displays.



The teacher and the students can calibrate the unit with a password provided by EDIBON. The teacher can restore the factory calibration any time.

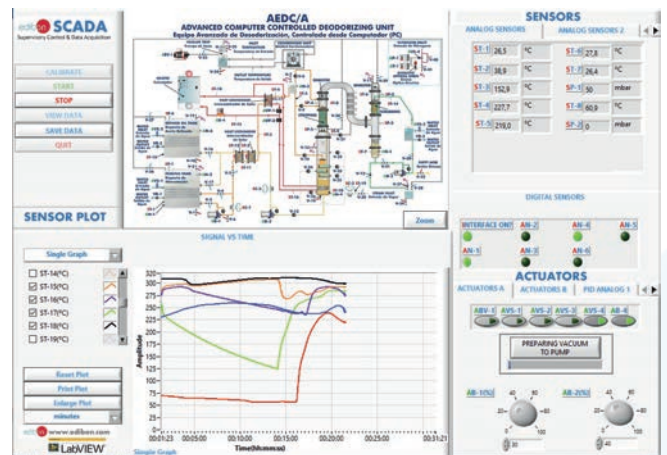
RESULTS

RESULTS

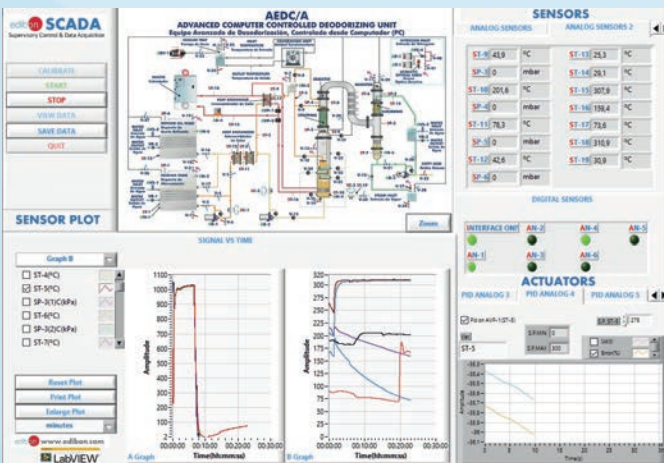


PID control of main temperatures.

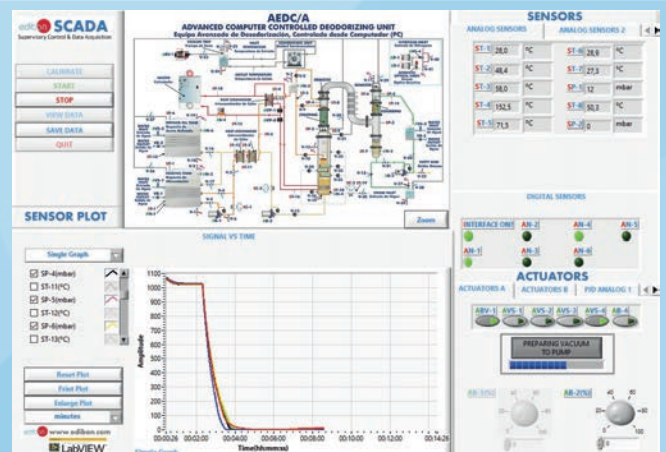
Real time representation of any measured variable.



Real time representation of any measured variable.



Vacuum pressure adjustment.



COMPLETE TECHNICAL SPECIFICATIONS

1. AEDC/A 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.
- All metal elements are made of s316 stainless steel, including the supports.
- Seals are suitable for food and can be used at temperatures of up to 300°C.
- Feeding tank with vacuum connection for oil de-aeration.
- Coil in the feeding tank, for preheating the oil, thus facilitating de-aeration.
- Domestic hot water heater for exchange in the feeding tank coil. Water supply regulation valve to the coil, according to the desired temperature.
- Feed pump to the de-aerated oil system with flow rate control, range: 8 - 20 kg/h.



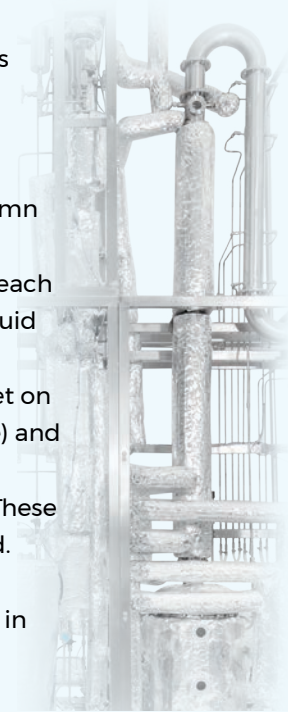
THREE PLATE HEAT EXCHANGERS FOR HEATING THE VEGETABLE OIL TO BE TREATED:

- Two counterflow exchangers with pre-deodorized oil.
- Exchanger for counterflow heating the oil to be treated with thermal oil.
- 20 plates.
- SiO₂-coated, suitable for food.



DISTILLATION/DESATURATION COLUMN BASED ON A COLUMN WITH STRUCTURED PACKING, HEAT INSULATION, VACUUM CONNECTION AND EQUIPPED WITH:

- Oil inlet distributor placed in the edible oil inlet to the column from the top. It ensures an even oil distribution when introduced into the column.
- Three-tiered plate trays to promote contact between the liquid and vapor phases and to improve distillation performance.
- Four hoods are the base of the stripping and allow the steam to rise through the column and a central hole, through which the oil falls to the surface of the first or upper plate.
- Flexipac 500Y column packing. It is distributed in plates positioned at a 90° angle to each other, so that no preferential paths are ever formed and the even distribution of the fluid along the column is guaranteed.
- Steam distributor, used as a carrier gas: five inlets for the carrier steam. There is an inlet on top of the contact plates, three others located inside the plates (one inside each plate) and the last one at the bottom of the column below the contact plates.
- There are also 4 coils at the column head to help condense the extracted fatty acids. These coils can be connected the mains water so that a constant temperature is maintained.
- Two demisters.
- Coil at the bottom of the thermal oil circulation column to maintain the temperature in the column.



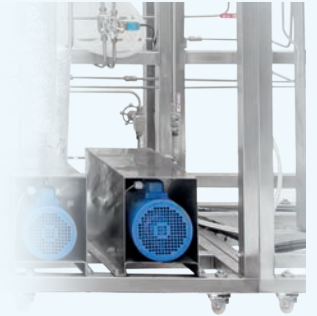
- Pump with an adjustable outlet flow rate from the deodorizer.
- Cooling tank for the treated oil, consisting of a cooling water coil with a transparent cover.

THERMAL OIL CIRCUIT:

- Edible thermal oil boiler providing the energy needed to heat the oil entering the column.
- Maximum thermal oil temperature: 300 °C.
- Edible thermal oil.
- Pump with thermal oil flow control.
- Two proportional valves to control the thermal oil flow rates to the heat exchangers and/or the deodorizing column coil.

**FATTY ACID RECIRCULATION CIRCUIT:**

- Fatty acid recirculation pump, to prevent them from solidifying and to maintain the temperature at the column head.
- Direct extraction via manual valve or redirecting to a cooling tank up to 60 °C: Cooling tank for cooling water coil to prevent fatty acids from condensing and thickening.
- Auxiliary tank with Nitrogen intake to collect samples at any time.

**VACUUM CIRCUIT:**

- Vacuum pump.
- Vacuum trap, which ensures that the vapors from the column do not reach the pump.
- It includes a coil that is part of a condensing unit, and allows water vapor from the column to be condensed, reducing its volume and enabling the vacuum pump to keep the vacuum in the system constantly.
- Condensing unit filled with R-404 refrigerant.
- Carrier steam generator. 3kW power.
- Nitrogen circuit.
- Temperature and pressure sensors at key points in the system.
- Vegetable oil flow sensors.
- Level switch.
- Relief solenoid valves and all necessary measurements, such as alarms, thermostat, and pressure switch, etc., to work safely.



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.**
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- **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.**

2. AEDC/A/CIB. Control Interface Box

- A high performance and reliability control box providing a controlled environment for all devices responsible of the electrical functionality of the unit (power supplying, data signal conditioning, control, electrical protection, etc.) and also for quick and easy connection between the unit and PC.



BOX

- **Industrial standard size** with normalized dimensions, handles and rubber feet for easy installation.
- Metallic box for grounding and shielding for safety and noise reduction.
- **Differential magneto-thermic switch** and fuses for electrical protection.
- Standardized power supply requirements.
- Power isolation transformer to provide isolation and protection.
- **Shielded wiring to minimize** and prevent electromagnetic interferences.
- Data signal converters and conditioners to amplify, filter and convert sensor signals to standardized analog input ranges: 4-20mA, 0-5V, +/-10V, etc.
- **Industrial controllers and drivers** to perform different control algorithms: open loop control, closed loop control, etc.

FRONT PANEL

- Detailed process diagram of the unit for an easy understanding.
- Easy, quick and secure sensor connections using identifiers and keyed connectors to prevent accidental bad connections.
- Main power bipolar switch with light indicator to show unit status.

BACK PANEL

- High density signal connector to minimize connections between the unit and PC.
- Fuse holders and connectors location diagram for an easy identification and quick connection.

3. DAB. Data Acquisition Board: PCIe 6 321

- The multifunction acquisition board is part of the SCADA System which offers a wide range of feature:



- National Instruments high-speed multifunction board: **250 KS /s sampling rate.**
- High performance interface with dedicated bandwidth: 250MB/s.
- Signal Streaming technology to guarantee low data latencies.
- **High-speed bidirectional data transfer.**
- Advanced timing, triggering and synchronizing functions, both analogical and digital.
- Highly accurate measurements. 16 bits for Analogical inputs resolution.
- 16 differential or single-ended type analogical channels.
- 24 bidirectional digital I/O lines, programmable and multipurpose.
- 2 multimodal analogical outputs to generate non-periodic, periodic and arbitrary waveforms with 900ks/s sampling rate and 16bits of resolution.

4. AEDC/A/CCSOF. Supervision Software + Control Software + Data acquisition Software + Data Management Software.

SCADA System is composed of four Software Package with the following features:

- **The Supervision Software** is in charge of monitoring in real time start and stop elements, unexpected conditions and process evolution. In case of being necessary, it actuates on the system and notifies the user the incorrect operations.
- **The Control Software** allows to manage multiple process and variables in real time either a manual way or automatic way. Several type of algorithms of control such PID CONTROL are implemented depending on the field of study.
- **The Data acquisition Software** focus on measuring and processing signals from the process with very high accuracy getting a synchronized and fast response of the system. A Calibration System is part of this software to adjust the sensor measurements.
- **The Data Management Software** stores and represents, alarms, variables and process evolution in real time both in a graphic format and in a numeric format such Time Charts or Process Diagram. Printable reports can be generated or Historian Data can be loaded to study the experiments in detail.

The Software is open and flexible architecture that facilities to access different work levels both Instructors and Students. It is supported by current Windows Operating System and Industrial Standards. The graphical user interface is intuitive and user- friendly.

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 from 1 to 6 are always included in the minimum supply:

- AEDC/A.
- AEDC/A/CIB.
- DAB.
- AEDC/A/CCSOF.
- Cables and Accessories.
- 8 Manuals for enabling normal and full operation.

REQUIRED SERVICES

- Electrical supply: three-phase, 380 VAC – 400 VAC/50 Hz or 190 VAC – 240 VAC/60 Hz, 20 kW.
- Water supply and drain.
- Computer.

REQUIRED ELEMENTS (Not included)

- TGV. Steam Generator (3 kW).

REQUIRED CONSUMABLES (Not included)

- N₂ cylinder.
- Vegetable oil to be treated with a high content of fatty acids.
- Edible thermal oil.

SIMILAR UNITS AVAILABLE

Offered in this catalog:

- AEDC/A. Advanced Computer Controlled Deodorizing Unit.

Offered in other catalog:

- AEDC. Computer Controlled Deodorizing Unit.

DIMENSIONS AND WEIGHTS

• Unit AEDC/A

- Dimensions: 7000 x 1000 x 4000 mm aprox.
(275.58 x 39.36 x 157.47 inches approx.)
- Weight: 500 Kg aprox.
(1102 pounds approx.)

• Control-Interface Box

- Dimensions: 490 x 450 x 470 mm aprox.
(19.29 x 17.71 x 18.50 inches approx.)
- Weight: 20 Kg aprox.
(44 pounds)

ORDER INFORMATION

Main items (always included in the supply) Minimum supply always includes:

1. **Unit: AEDC/A. Advanced Computer Controlled Deodorizing Unit.**
2. **AEDC/A/CIB. Control Interface Box.**
3. **DAB. Data Acquisition Board.**
4. **AEDC/A/CCSOF. PID Computer Control + Data Acquisition + Data Management Software.**
5. **Cables and Accessories**, for normal operation.
6. **Manuals.**

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

Optional items (supplied under specific order)

• **EXPANSIONS**

- ECR. EDIBON Industrial Modular System with NI CompactRIO.
- PLCHMI. IIoT local/remote Control and Monitoring with HMI.
- ICAI. Interactive Computer Aided Instruction Software.
- ESN. EDIBON Scada-Net Systems.
- ECL. EDIBON Cloud Learning.

• **REQUIRED ELEMENTS**

- TGV. Steam Generator (3 kW).

QUALITY CERTIFICATES



WARRANTIES



C/ Julio Cervera, 10-12-14. Móstoles Tecnológico.
28935 MÓSTOLES. (Madrid). ESPAÑA - SPAIN.

Telf.: 34-91-6199363

Fax: 34-91-6198647

e-mail: edibon@edibon.com

Web: www.edibon.com

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