Advanced Computer Controlled
Biomass Process Unit,
with SCADA and PID Control

EBMC/A

EDIBON PATENT

Teaching Technique used

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

② Control Interface Box

③ Data Acquisition Board

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

Computer
(not included in the supply)

① Unit: EBMC/A. Advanced Computer Controlled Biomass Process Unit

⑤ Cables and Accessories
⑥ Manuals

* 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
  ↳50.- ENERGY

For more information about Key Features, click here

PDF Adobe

You Tube

INTRODUCTION

Energy is a limited natural resource whose generation in form of heat has economic costs and environmental impact of certain significance.

Biomass is that organic matter from vegetal or animal origin, including organic waste and residues, susceptible of being well exploited.

Plants transform the sun's radiant energy into chemical energy through photosynthesis, and part of this energy is stored as organic matter.

The knowledge and study of the characteristics and operation of the biomass systems, in such a way that facilitates the users to know these aspects in depth, allows to improve a responsible use and contributes to the wellbeing of everyone.

The Advanced Computer Controlled Biomass Process Unit, "EBMC/A", designed by EDIBON, is a unit that allows the user to study heating systems and how to obtain domestic hot water with a biomass boiler.

GENERAL DESCRIPTION

The main element of the unit is the biomass boiler, which will heat the water that will flow through the other components transfering its heat.

The boiler is a biomass boiler of 16 kW that works with pellet and other granulated fuels. The body of the boiler is made of steel with a thickness of 5 mm that guarantees a long operating life. It includes a burner made of high temperature stainless steel with self-cleaning system, which allows the use of several granulated fuels apart from Pellet.

The boiler has ashes extraction boxes; besides it facilitates the access to cleaning and maintenance areas.

The boiler heats water that is impelled by a computer controlled circulating pump through the circuit.

The unit also includes a computer controlled three-ways solenoid valve that distributes the water heated by the biomass boiler towards two primary circuits: one towards the double jacket of the storage tank to obtain domestic hot water and the other towards the unit heater to generate heating.

This valve, when activated, allows the passage of water towards both directions. On the other hand, when deactivated, it closes the water passage towards the unit heater and increases the water flow towards the hot water storage tank.

The capacity of the storage tank is 60 l and it is made of AISI 316 Ti stainless steel. This material has an excellent behavior against corrosion and high temperatures. It has a double jacket through which the water previously heated in the boiler flows, constituting the primary circuit. There is a computer controlled solenoid valve, located in the tap water inlet line towards the storage tank to be heated, that will be opened or closed according to the requirements.

The part of the unit where the heating generation is studied is formed by a computer controlled unit heater, located inside a PMMA box.

It allows the student to control the time required to heat the box up to the required temperature. The temperature control of that box is possible thanks to a PID control via software that acts on the three-ways solenoid valve.

The primary circuit is closed with the recycling of both the water from the circuit that has already given its heat in the storage tank and the water leaving the unit heater. Both lines are joined and enter the boiler again, thus closing the primary circuit.

The "EBMC/A" unit is an advanced version with all mentioned instruments and accessories and enough power and flow to work together with the "TORC/A" unit. It includes advanced ashes removal and supply.

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

www.edibon.com
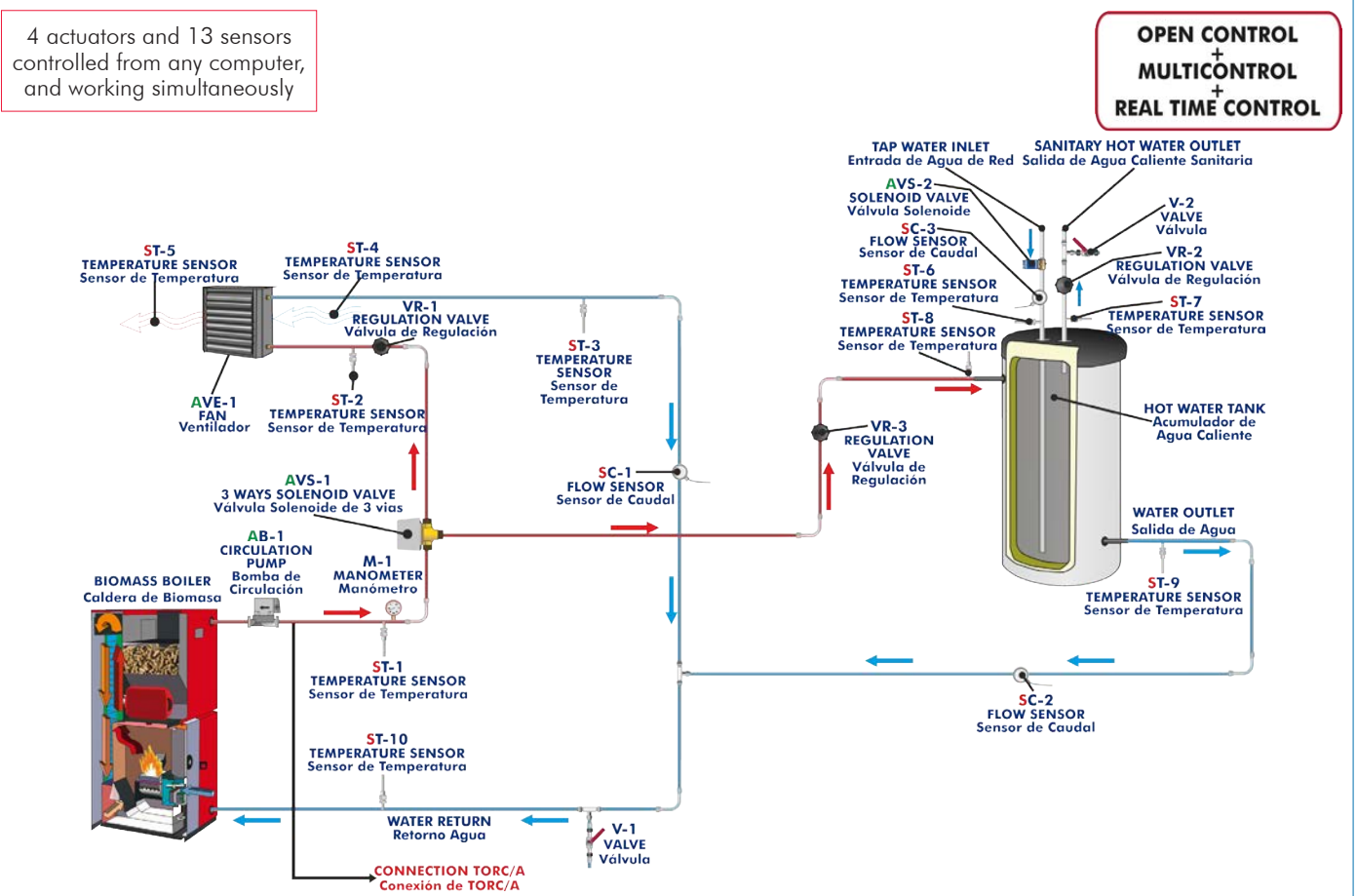
With this unit there are several options and possibilities:
- Main items: 1, 2, 3, 4, 5 and 6.
- Optional items: 7, 8, 9 and 10.

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

① **EBMC/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.

Biomass boiler of 16 Kw. It works with pellets and other granulated fuels:

    Computer controlled hot water circulating pump.

    AISI 310 stainless steel burner.

    Expansion tank of 8 l.

    Safety valve (2.5 Bar).

    Water content in the boiler: 45 l.

    Safety thermostat.

    Drain valve.

    Biomass boiler with a capacity of 97 Kg.

    Regulation of the temperature in the boiler: from 60 °C to 87 °C.

    Automatic cleaning system for the burner and ashes.

    It includes boxes for separation and removal of ashes (burner, furnace and fumes passing chamber).

    Fumes temperature to minimum thermal power: 90 °C.

    Connection to the smokestack: 80 mm of diameter.

Double jacket storage tank made of stainless steel of 50 l for the DHW.

Computer controlled unit heater:

    Power: 14 900 Kcal/h.

    Air flow (at maximum speed of the fan): 1550 m³/h.

Box made of PMMA where the unit heater is located. PID control of the box temperature.

Computer controlled three-ways electronic valve.

Computer controlled solenoid valve located at the storage tank tap water inlet line.

Three regulation valves of the hot water through the different circuits.

Manometer, range: 0 - 4 Bar.

Ten "J" type temperature sensors.

Three water flow sensors, range: 1.5 - 30 l/min.

Unit: EBMC/A

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).

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    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.

② **EBMC/A/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.

EBMC/A/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.

DAB

④ **EBMC/A/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.
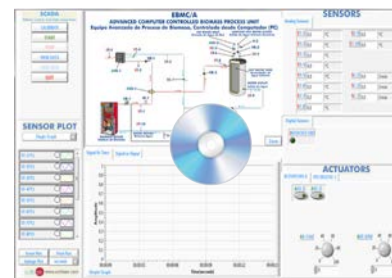
EBMC/A/CCSOF

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: EBMC/A + EBMC/A/CIB + DAB + EBMC/A/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.- Familiarization with the operation of a heating and DHW system with biomass boilers.

2.- Start-up of a biomass boiler.

3.- Determining the inlet and outlet temperature of the heating water.

4.- Determining the temperature of the domestic hot water.

5.- Measurement of the heat transfer of different biomass fuels to the heating water.

6.- Energy balance in the heating circuit (unit heater) with different types of biomass fuels.

7.- Energy balance in the sanitary water circuit with different types of biomass fuels.

8.- Influence of the heating water flow variation in the heat transfer.

Additional practical possibilities:

9.- Sensors calibration.

Other possibilities to be done with this Unit:

10.-Many students view results simultaneously.

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

11.-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.

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

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

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

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

16.-Control of the EBMC/A unit process through the control interface box without the computer.

17.-Visualization of all the sensors values used in the EBMC/A unit process.

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

REQUIRED SERVICES

- Electrical supply: single-phase, 220 V/50 Hz or 110 V/60 Hz.
- Water supply and drainage.
- Computer.
- Exhaust gases external exit.
- Wood pellets - EN plus A1.

DIMENSIONS AND WEIGHTS

EBMC/A:
  Unit:
    -Dimensions: 2500 x 750 x 1500 mm approx.
                 (98.42 x 29.52 x 59.05 inches approx.)
    -Weight: 250 Kg approx.
                 (551 pounds approx.)
  Control-Interface Box:
    -Dimensions: 490 x 330 x 310 mm approx.
                 (19.29 x12.99 x12.20 inches approx.)
   -Weight: 10 Kg approx.
                 (22 pounds approx.)

SCADA and PID Control
Main screen
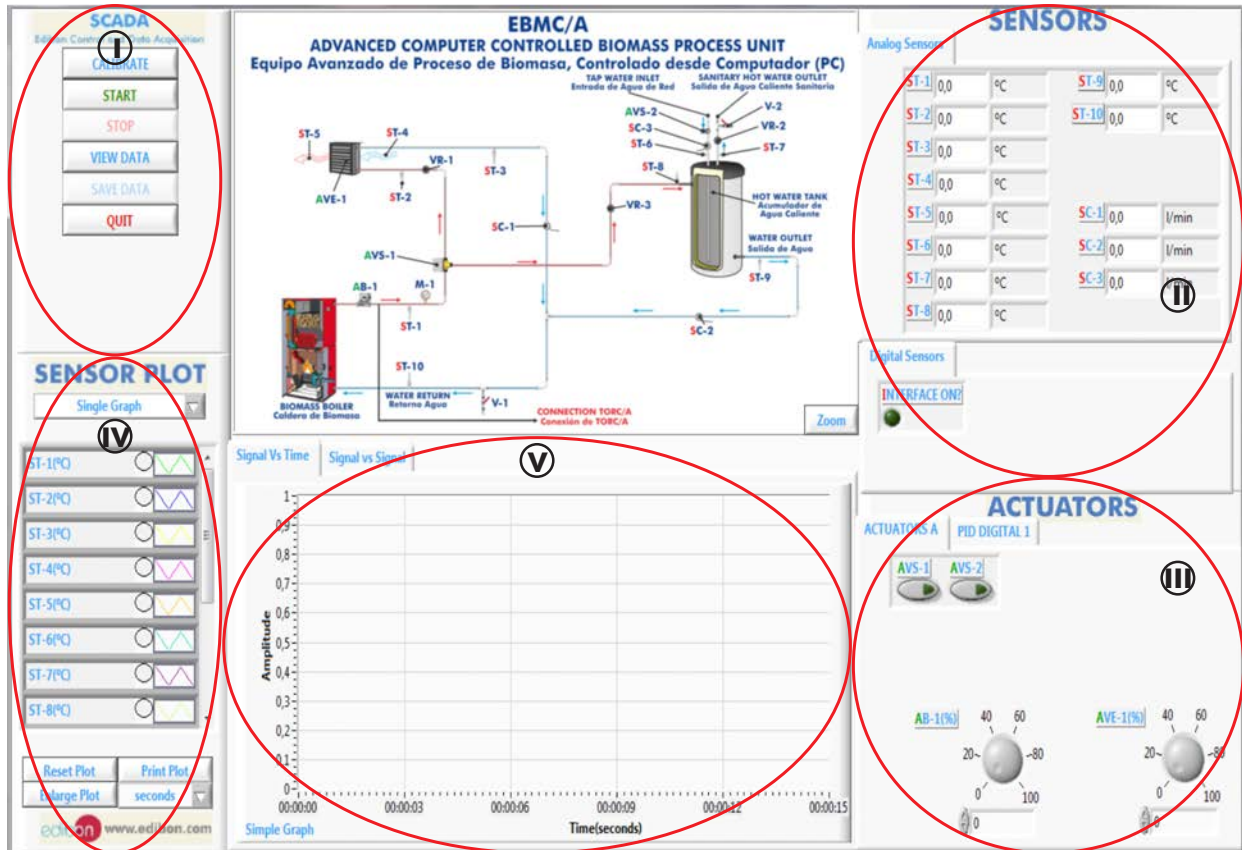
① Main software operation possibilities.

② Sensors displays, real time values, and extra output parameters. **Sensors:** ST=Temperature sensor. SC=Flow sensor.

③ Actuators controls. **Actuators:** AVS=Solenoid valve. AB=Circulation pump. AVE=Fan.

④ Channel selection and other plot parameters.

⑤ Real time graphics displays.

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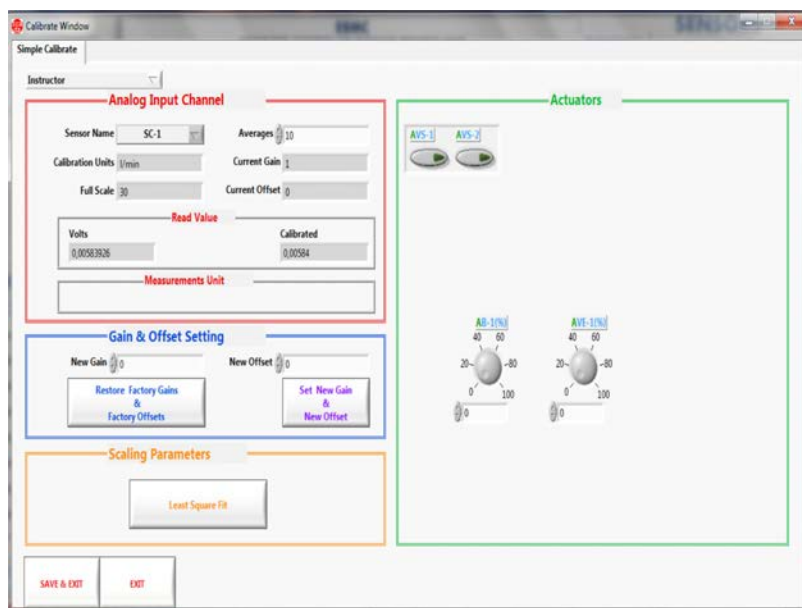
The teacher and the students can calibrate the unit with a password provided by EDIBON.
The teacher can restore the factory calibration any time.

When the solenoid valve (AVS-1) is deactivated, the heating water passage towards the unit heater (SC-1 flow sensor) is closed, so that water passes through the storage tank (SC-2 flow sensor).
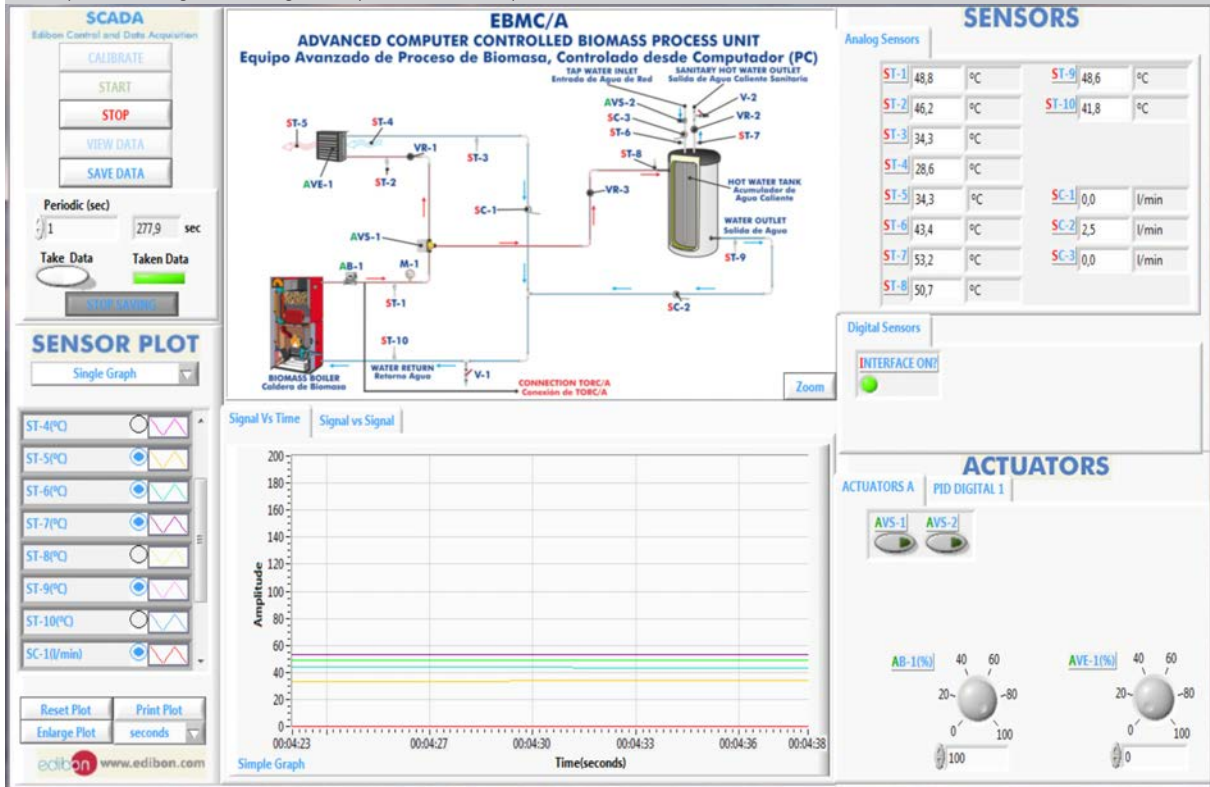
When the solenoid valve (AVS-1) is activated, the heating water can go towards both primary circuits and the flow can be regulated from 0 to 100% (AB-1 pump).
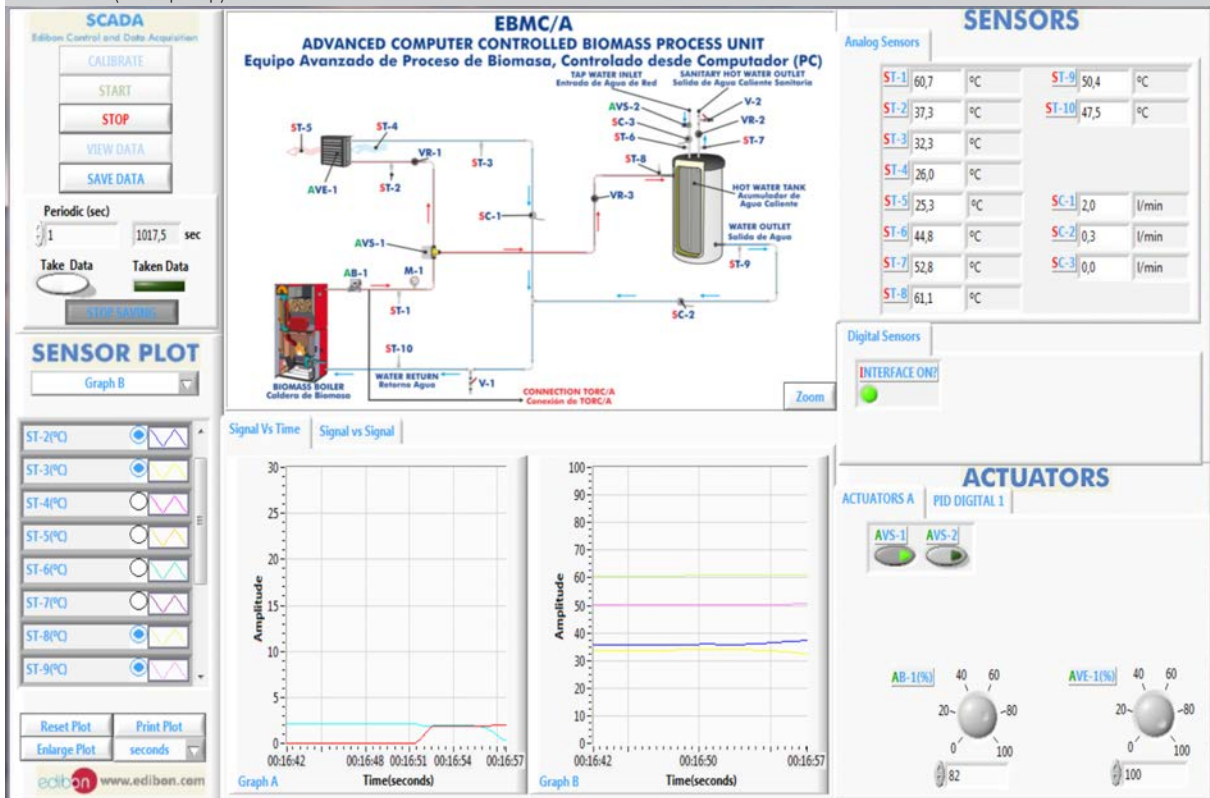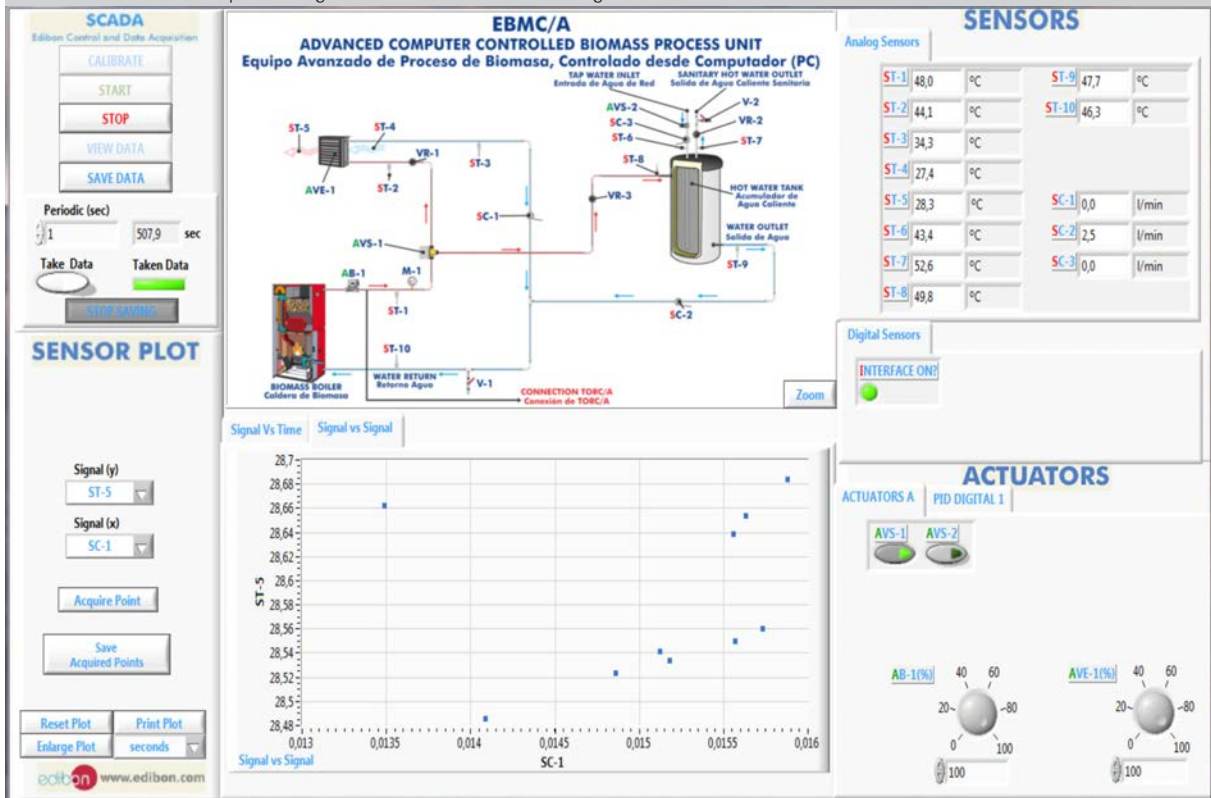
Some **real** results obtained from this Unit

A PID control acts on the three-ways solenoid valve (AVS-1) when the target temperature is reached in the box (ST-5 temperature sensor).
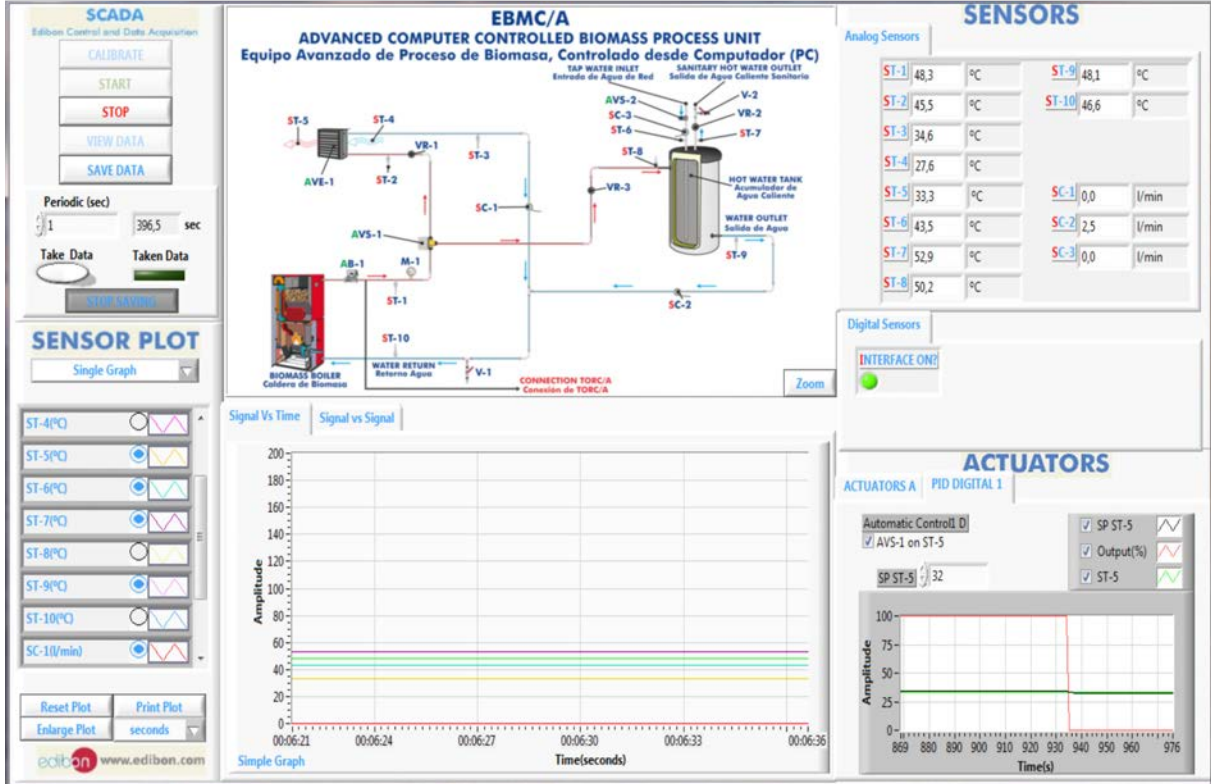
The software enables to plot the signal of one sensor versus the signal of another sensor.

The software enables to plot the sensors measurement evolution versus time.

Additionally to the main items (1 to 6) described, we can offer, as optional, other items from 7 to 10.

All these items try to give more possibilities for:

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

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

a) Technical and Vocational Education configuration

⑦ **EBMC/A/ICAI. Interactive Computer Aided Instruction Software System.**
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.**

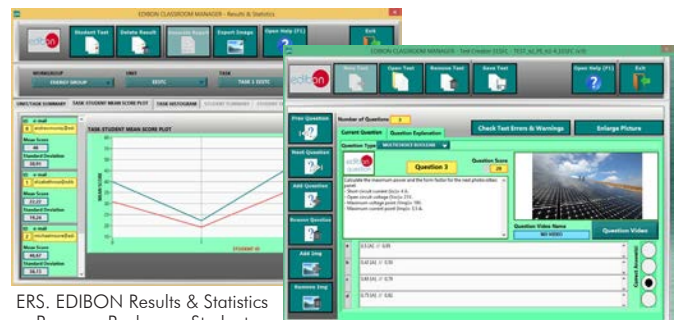For more information see **ICAI** catalogue. Click on the following link:

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

Instructor Software

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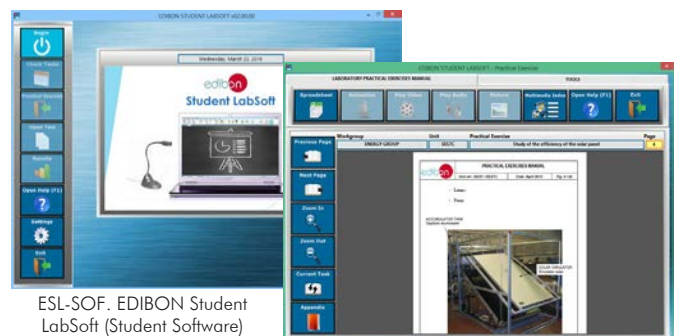

ECAL. EDIBON Calculations Program Package - Formula Editor Screen

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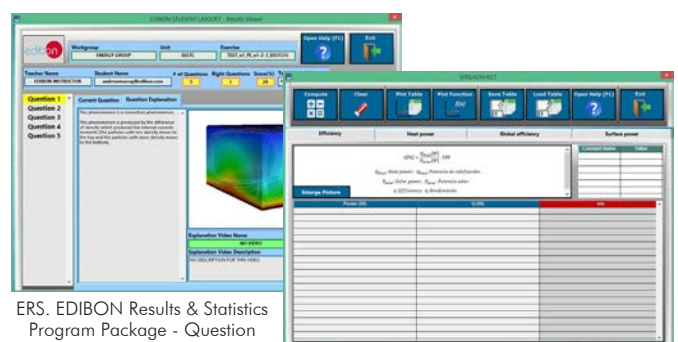

ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

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

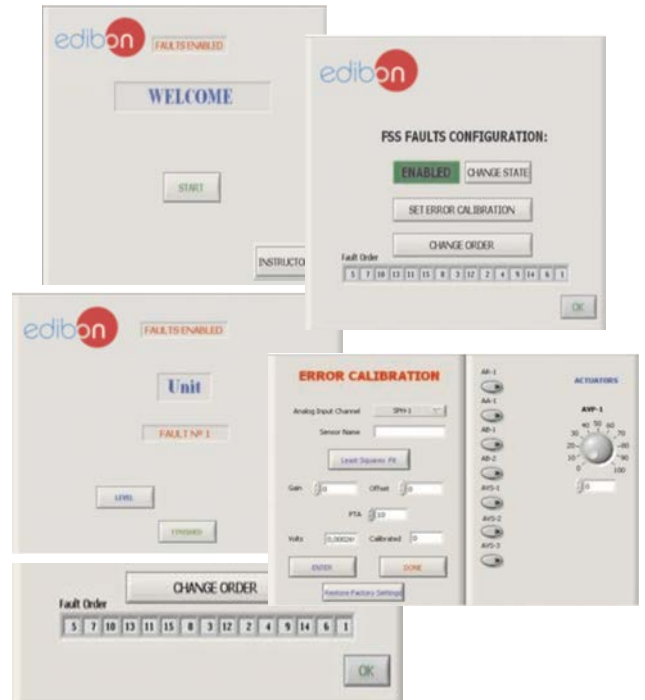ECAL. EDIBON Calculations Program Package Main Screen

⑨ **EBMC/A/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

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b) Multipost Expansions options

⑩ **Mini ESN. EDIBON Mini Scada-Net System.**

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/products/catalogues/en/Mini-ESN.pdf

Mini ESN.
EDIBON Mini Scada-Net System

1 UNIT= up to 30 STUDENTS can work simultaneously

Advanced Computer Controlled Biomass Process Unit (EBMC/A)

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

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⑪ **EBM. EDIBON Scada-Net System.**

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/products/catalogues/en/units/energy/esn-alternativeenergies/ESN-ALTERNATIVE_ENERGIES.pdf
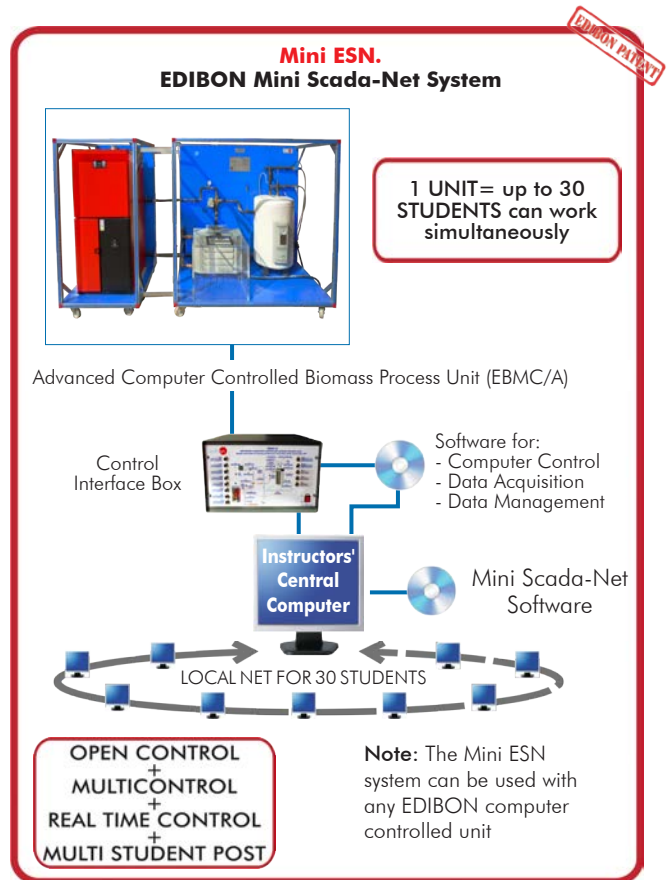
Main items (always included in the supply)

Minimum supply always includes:

① Unit: EBMC/A. Advanced Computer Controlled Biomass Process Unit.

② EBMC/A/CIB. Control Interface Box.

③ DAB. Data Acquisition Board.

④ EBMC/A/CCSOF. PID Computer Control + Data Acquisition + Data Management Software.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals.

*IMPORTANT: Under EBMC/A 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 EBMC/A/ICAI. Interactive Computer Aided Instruction Software System.

⑧ EBMC/A/FSS. Faults Simulation System.

b) Multipost Expansions options

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②EBMC/A/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.

④EBMC/A/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.- Familiarization with the operation of a heating and DHW system with biomass boilers.

2.- Start-up of a biomass boiler.

3.- Determining the inlet and outlet temperature of the heating water.

4.- Determining the temperature of the domestic hot water.

5.- Measurement of the heat transfer of different biomass fuels to the heating water.

6.- Energy balance in the heating circuit (unit heater) with different types of biomass fuels.

7.- Energy balance in the sanitary water circuit with different types of biomass fuels.

8.- Influence of the heating water flow variation in the heat transfer.

Additional practical possibilities:

9.- Sensors calibration.

Other possibilities to be done with this Unit:

10.-Many students view results simultaneously.

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

11.-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.

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

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

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

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

16.-Control of the EBMC/A unit process through the control interface box without the computer.

17.-Visualization of all the sensors values used in the EBMC/A unit process.

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

⑦ EBMC/A/ICAI. Interactive Computer Aided Instruction Software System.

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.

⑧ EBMC/A/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.

b) Multipost Expansions options

⑨ **Mini ESN. EDIBON Mini Scada-Net System.**

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: