

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

① Unit: EBGC. Computer Controlled Biogas Process 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 CAL software helps the user perform calculations and comprehend the results.**
- **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.**



For more information about Key Features, click here



INTRODUCTION

Anaerobic digestion (also known as methane fermentation) is a biological process that takes place naturally. In this process certain microorganisms break biodegradable material in the absence of oxygen. Biogas obtained in this process is a new energy source used in as a useful means of decontamination and as an alternate source of renewable energy.

Biogas generation through anaerobic breakdown is considered useful when treating biodegradable residues, since it generates valuable fuel, as well as an effluent that can be applied as a soil conditioning substance or generic fertilizer.

This gas can be used to generate electrical energy by means of turbines or power plants working with gas, in ovens, heaters, driers, boilers or other combustion systems working with gas, properly adapted to such application.

The Computer Controlled Biogas Process Unit "EBGC" is designed to study and understand the different processes given during the biogas generation through anaerobic breakdown, as well as the study of the different parameters that affect the anaerobic digestion itself and the value of the obtained biogas.

GENERAL DESCRIPTION

The Computer Controlled Biogas Process Unit "EBGC" is supplied with two packed anaerobic digesters. In this way, the user can work either in only one stage or in two stages, separating the different phases of the digestion process (the processes of hydrolysis, acidogenesis and acetogenesis would take place in the first digester, and the methanogenesis in the second digester).

Both digesters have a heating blanket that allows to regulate (PID Control) both the appropriate temperature for each part of the process and the operation with different ranges depending on the used microorganisms. Thus, it can operate at the psychrophilic range (room temperature), mesophilic range (temperatures around 35°C) or thermophilic range (temperatures around 55°C).

The unit has four computer controlled peristaltic pumps which enable the propelling of both the supply to be introduced in the digester and the acid and the base (introduced in two vessels located at the rear side) in order to adjust and control thoroughly the pH in each stage of the process. In case of working in an anaerobic digestion in two stages, one of the pumps carries the product from one of the digesters to the other, passing through a buffer tank which collects the excess of flow from the first reactor. The control of these pumps allows to know the different flows with which the unit is working.

Two volumetric tanks are also included for the storage and volume measurement of the generated biogas. The generated biogas flows through a pipe from the upper side of the digesters to these tanks, where the biogas volume is measured by means of a water displacement.

Such tanks have two parts: the upper side is where the generated biogas is collected and the second part, smaller than the first one and located below it, is used to collect the displaced water.

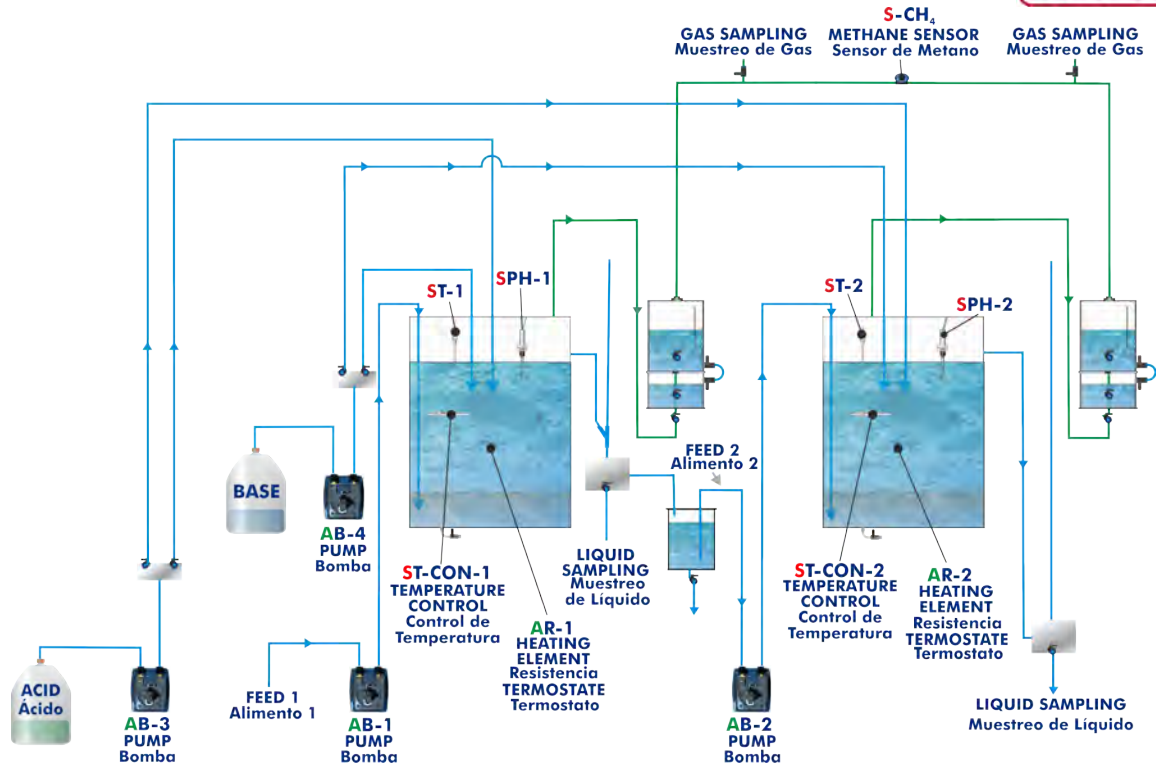
Each digester has a temperature sensor and a pH sensor. Their function is to follow the whole process and study the influence of the different controlling parameters in the anaerobic digestion.

Finally, the volumetric tanks, by their upper side, enable the flowing of the collected biogas through a pipe and its passing through a methane (CH₄) sensor. This sensor allows to know the methane concentration in such current. This way, the biogas quality depending on 4 the physical-chemical conditions under which the anaerobic digestion is developed can be determined, as well as its value as a renewable energy source.

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.

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

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL



Unit's front side

Unit's back side



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 **EBGC. Unit:**

Anodized aluminum structure and panels in painted steel.

Main metallic elements in stainless steel.

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

2 Packed anaerobic digesters of 5 l. Reactors packing: 25 mm. diameter bactoballs.

2 Computer controlled heating blankets of 120W, with PID control and with a thermostat . Temperature range: 0-90°C.

4 Computer controlled peristaltic pumps.

Feeding flows measurement by the pumps calibration.

2 Volumetric tanks for the storage and volume measurement of the generated biogas.

Buffer vessel, of 1 l. of capacity.

2 Pyrex vessels, of 1 l. of capacity, for the acid and the base.

Methane sensor to measure its concentration in the generated biogas, 0-100%.

2 pH sensors.

2 Temperature sensors, "J" type.

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.

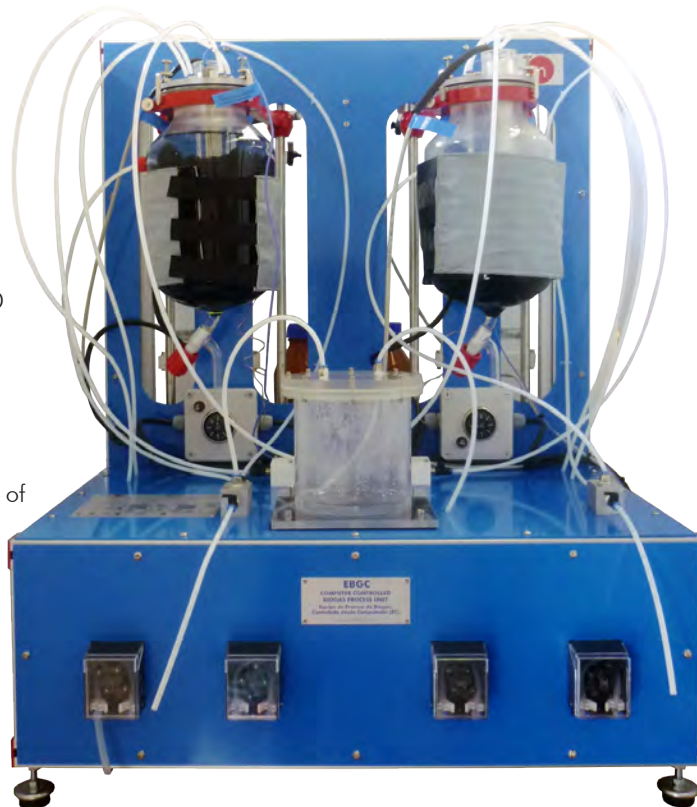
Remote operation and control by the user and remote control for EDIBON technical support, are always included.

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

Designed and manufactured under several quality standards.

Optional CAL software helps the user perform calculations and comprehend the results.

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: EBGC

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

The Control Interface Box is part of the SCADA system.

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

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

Single cable between the control interface box and computer.

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

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.



EBGC/CIB

③ **DAB. Data Acquisition Board:**

The Data Acquisition board is part of the SCADA system.

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

Analog input:

Number of channels= 16 single-ended or 8 differential. Resolution=16 bits, 1 in 65536.

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

Input range (V)= ±10 V. Data transfers=DMA, interrupts, programmed I/O. 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/O.

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

The three softwares are part of the SCADA system.

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

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

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

Analog and digital PID control.

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

Management, processing, comparison and storage of data.

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

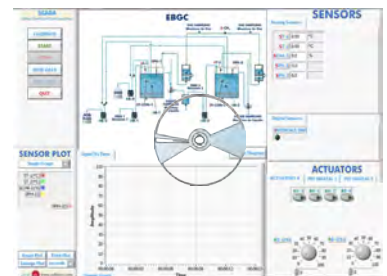
Calibration system for the sensors involved in the process.

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

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

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

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



EBGC/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: EBGC + EBGC/CIB + DAB + EBGC/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

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| <ol style="list-style-type: none"> 1.- Study of the stabilization process. 2.- Study of the effect of temperature in the anaerobic digestion, purification and quality of the obtained biogas. 3.- Study of the pH effect of the feeding waste water in the anaerobic digestion, purification and quality of the obtained biogas. 4.- Study of the influence of the feeding rate in the anaerobic digestion, purification and quality of the obtained biogas. 5.- Study of the influence of the type of the feeding waste water in the anaerobic digestion, purification and quality of the obtained biogas. 6.- Study of the concentration of nutrients influence of the feeding waste water in the anaerobic digestion, purification and quality of the obtained biogas. 7.- Study of the hydraulic load effect in the anaerobic digestion, purification and quality of the obtained biogas. 8.- Study of the inhibitors influence in the anaerobic digestion, purification and quality of the obtained biogas. 9.- Comparison between the mesophilic and thermophilic anaerobic digestion and their influence in the biogas obtention. 10.-Determination of the optimum operation temperature. 11.-Determination of the optimum feeding rate. 12.-Determination of the optimum solids/water relation. 13.-Determination of the optimum degradable/non degradable solids relation. 14.-Determination of the multistage nature in the anaerobic digestion. 15.-Determination of the kinetics. | <ol style="list-style-type: none"> 16.- Carbon balance. 17.- Solids balance. 18.- Biogas balance. <p>Additional practical possibilities:</p> <ol style="list-style-type: none"> 19.- Sensors calibration. <p>Other possibilities to be done with this Unit:</p> <ol style="list-style-type: none"> 20.- Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard. 21.- Open Control, Multicontrol and Real Time Control.
This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivate parameters; etc, in real time. 22.- The Computer Control System with SCADA and PID Control allow a real industrial simulation. 23.- This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices. 24.- This unit can be used for doing applied research. 25.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions. 26.- Control of the EBGC unit process through the control interface box without the computer. 27.- Visualization of all the sensors values used in the EBGC unit process. <p>- Several other exercises can be done and designed by the user.</p> |
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REQUIRED SERVICES

- Electrical supply: single phase, 220 V./50 Hz. or 110 V./60 Hz.
- Computer.
- Waste and feeding tank.
- Anaerobic sludge.
- Supply waste water.

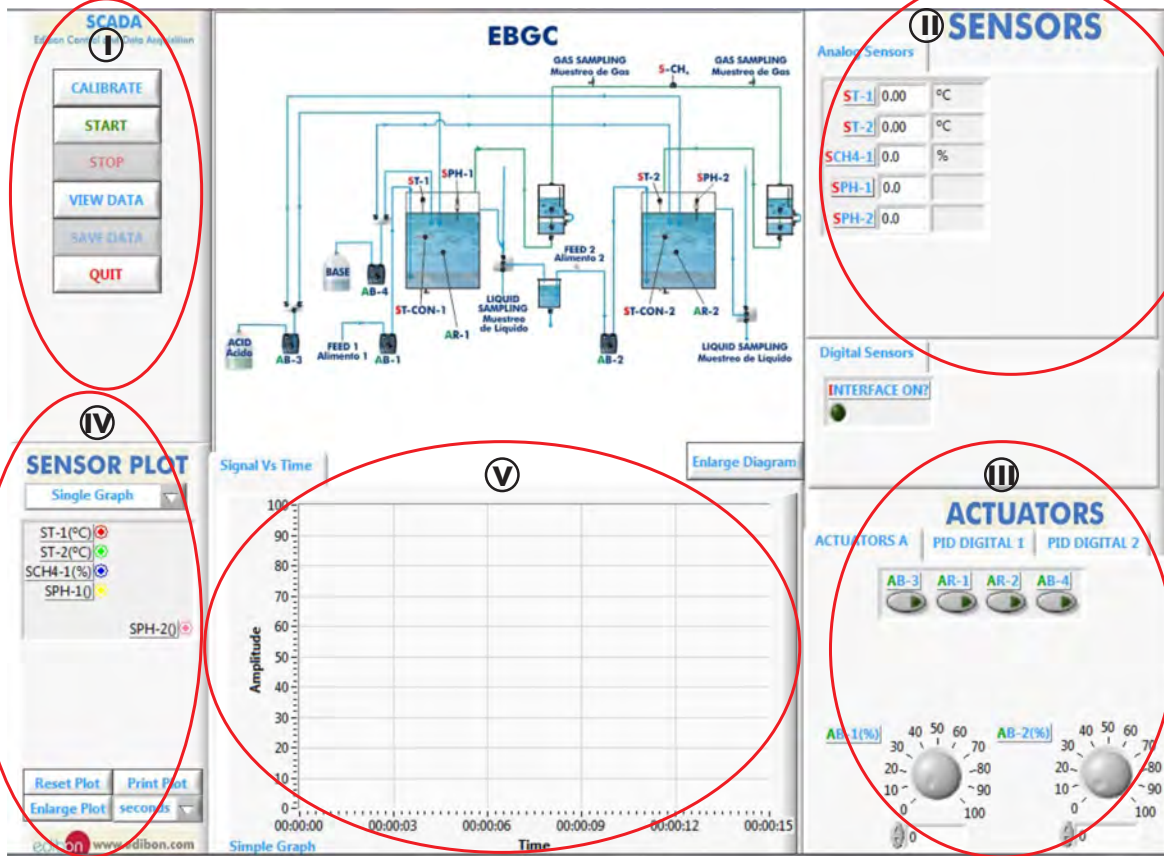
DIMENSIONS AND WEIGHTS

- EBGC:
- Unit:
- Dimensions: 1000 x 800 x 1000 mm. approx.
(39.37 x 31.49 x 39.37 inches approx.)
 - Weight: 70 Kg. approx.
(154.32 pounds approx.)
- Control Interface Box:
- Dimensions: 490 x 330 x 310mm. approx.
(19.29 x 12.99 x 12.20 inches approx.)
 - Weight: 10 Kg. approx.
(22 pounds approx.)

AVAILABLE VERSIONS

- Offered in this catalogue:
- EBGC. Computer Controlled Biogas Process Unit.
- Offered in other catalogue:
- EBGB. Biogas Process Unit.

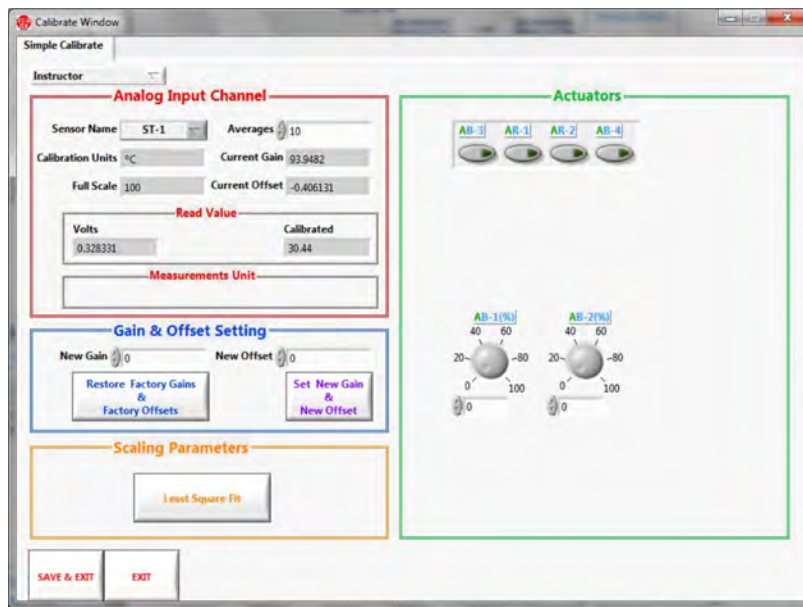
SCADA and PID Control
Main screen



- ❶ Main software operation possibilities.
- ❷ Sensors displays, real time values, and extra output parameters. Sensors: ST=Temperature sensor. SCH=Methane sensor. SPH=pH sensor.
- ❸ Actuators controls. Actuators: AB=Pump. AR=Heating element.
- ❹ Channel selection and other plot parameters.
- ❺ Real time graphics displays.

Software for Sensors Calibration

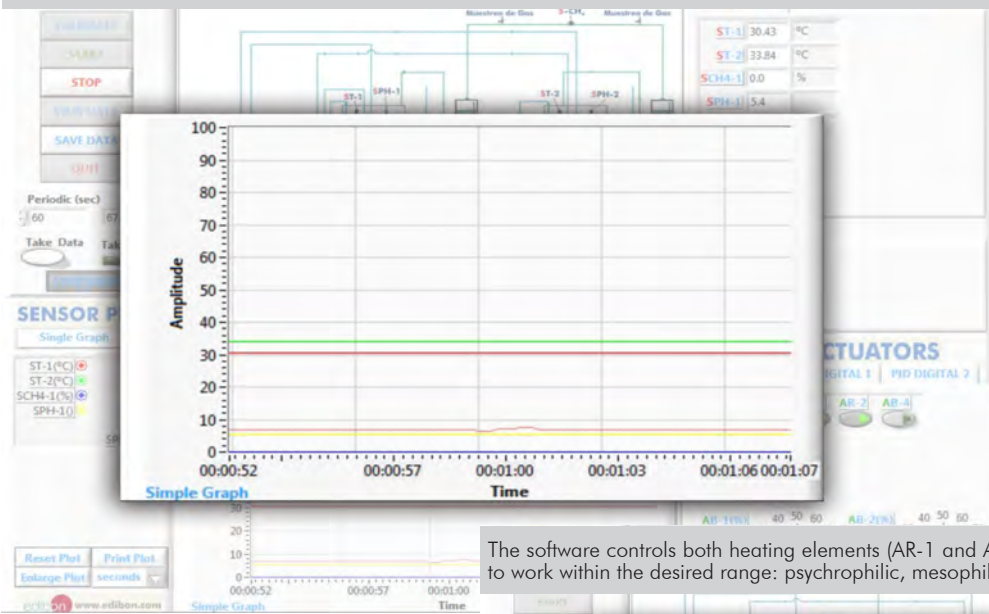
Example of screen



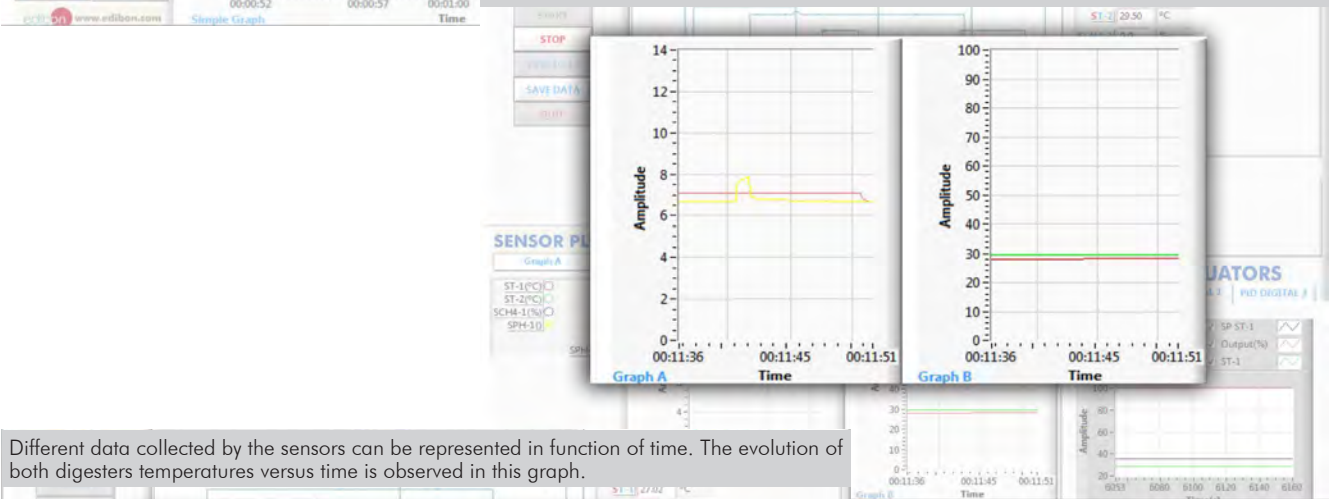
By using a free of charge code, the teacher and the students can calibrate the unit.
The teacher can recover his/her own calibration by using the EDIBON code that we give free of charge.

SOME REAL RESULTS OBTAINED FROM THIS UNIT

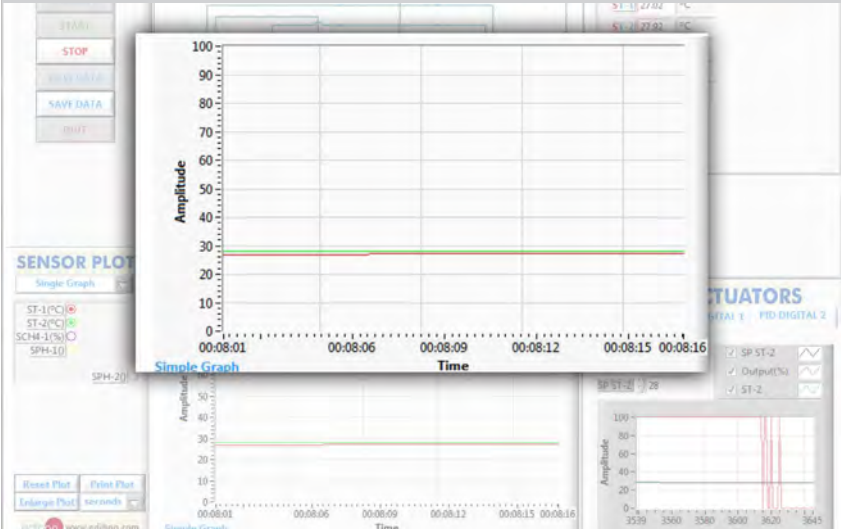
The software controls from 0 to 100% the supply flow to any of the two digesters (pump AB-1) when working in parallel and the supply flow to the second digester (pump AB-2) when working in series.



The software controls both heating elements (AR-1 and AR-2) through a PID control, enabling to work within the desired range: psychrophilic, mesophilic or thermophilic.



Different data collected by the sensors can be represented in function of time. The evolution of both digesters temperatures versus time is observed in this graph.



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 **EBGC/ICAI. Interactive Computer Aided Instruction Software System.**

This complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM) totally integrated with the Student Software (EDIBON Student Labsoft -ESL). 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).

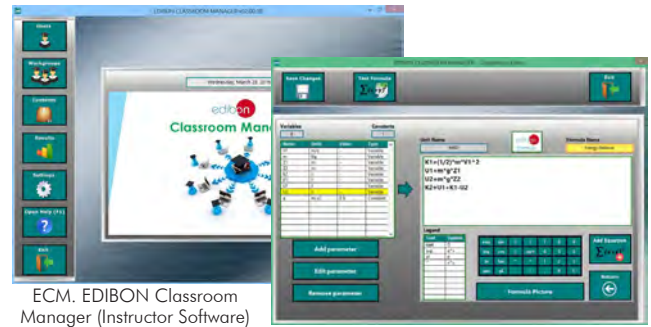
-ECM. EDIBON Classroom Manager (Instructor Software).

ECM 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.**

Instructor Software



ECM. 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

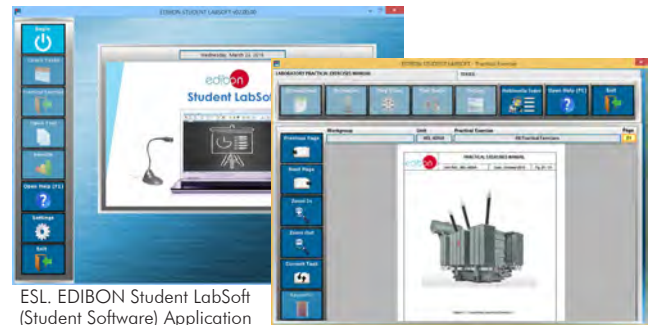
-ESL. EDIBON Student Labsoft (Student Software).

ESL 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:

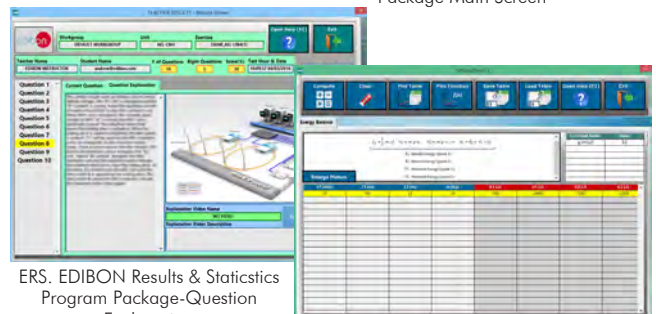
- Student Log-In & Self-Registration.**
- Existing Tasks checking & Monitoring.**
- Default contents & scheduled tasks available to be used from the first session.**
- Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- Evaluation Methods to prove your knowledge and progression.**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

Student Software



ESL. 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

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

www.edibon.com/products/catalogues/en/ICAI.pdf

b) Multipost Expansions options

⑧ **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:

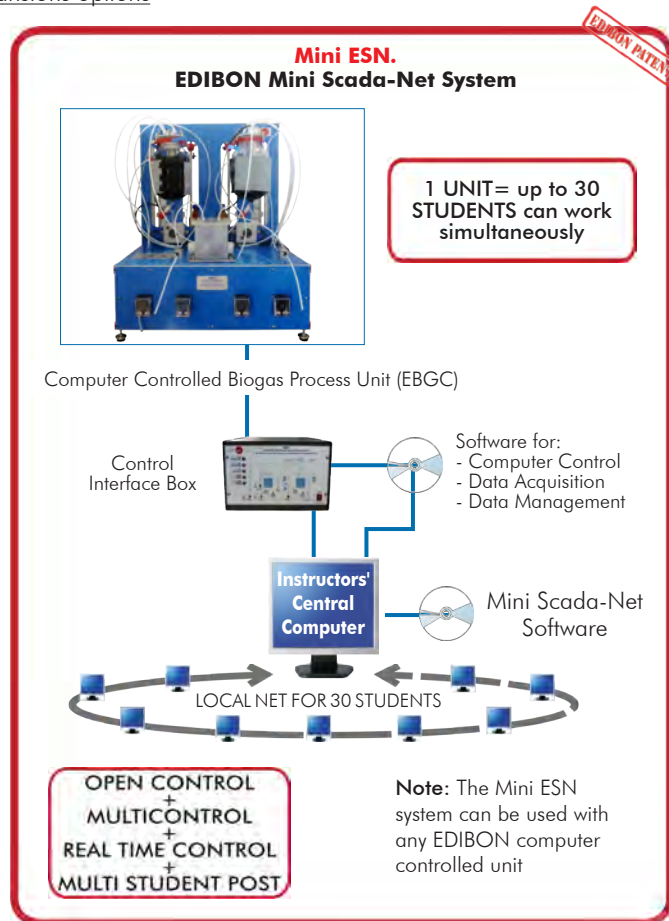
www.edibon.com/products/catalogues/en/Mini-ESN.pdf

⑨ **ESN. 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



ORDER INFORMATION

Main items (always included in the supply)

Minimum supply always includes:

- ① Unit: EBG. Computer Controlled Biogas Process Unit.
- ② EBG/CIB. Control Interface Box.
- ③ DAB. Data Acquisition Board.
- ④ EBG/CCSOF. PID Computer Control + Data Acquisition + Data Management Software.
- ⑤ Cables and Accessories, for normal operation.
- ⑥ Manuals.

***IMPORTANT:** Under EBG 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 configuration

- ⑦ EBG/ICAI. Interactive Computer Aided Instruction Software System.

b) Multipost Expansions options

- ⑧ Mini ESN. EDIBON Mini Scada-Net System.
- ⑨ ESN. EDIBON Scada-Net System.

① EBGC. Unit:

Anodized aluminum structure and panels in painted steel.

Main metallic elements in stainless steel.

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

2 Packed anaerobic digesters of 5 l. Reactors packing: 25 mm. diameter bactoballs.

2 Computer controlled heating blankets of 120W, with PID control and with a thermostat . Temperature range: 0-90°C.

4 Computer controlled peristaltic pumps.

Feeding flows measurement by the pumps calibration.

2 Volumetric tanks for the storage and volume measurement of the generated biogas.

Buffer vessel, of 1 l. of capacity.

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Methane sensor to measure its concentration in the generated biogas, 0-100%.

2 pH sensors.

2 Temperature sensors, "J" type.

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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 CAL software helps the user perform calculations and comprehend the results.

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.

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The Control Interface Box is part of the SCADA system.

Control interface box with process diagram in the front panel.

The unit control elements are permanently computer controlled.

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

Calibration of all sensors involved in the process.

Real time curves representation about system responses.

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

Shield and filtered signals to avoid external interferences.

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

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

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

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

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

③ DAB. Data Acquisition Board:

The Data Acquisition board is part of the SCADA system.

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

Analog input: Channels= 16 single-ended or 8 differential. Resolution=16 bits, 1 in 65536. Sampling rate up to: 250 KS/s (kilo samples per second).

Analog output: Channels=2. Resolution=16 bits, 1 in 65536.

Digital Input/Output: Channels=24 inputs/outputs.

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

The three softwares are part of the SCADA system.

Compatible with the industry standards.

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

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

Management, processing, comparison and storage of data.

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

Calibration system for the sensors involved in the process.

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

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

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

⑤ Cables and Accessories, for normal operation.**⑥ Manuals:**

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

Exercises and Practical Possibilities to be done with the Main Items

- 1.- Study of the stabilization process.
 - 2.- Study of the effect of temperature in the anaerobic digestion, purification and quality of the obtained biogas.
 - 3.- Study of the pH effect of the feeding waste water in the anaerobic digestion, purification and quality of the obtained biogas.
 - 4.- Study of the influence of the feeding rate in the anaerobic digestion, purification and quality of the obtained biogas.
 - 5.- Study of the influence of the type of the feeding waste water in the anaerobic digestion, purification and quality of the obtained biogas.
 - 6.- Study of the concentration of nutrients influence of the feeding waste water in the anaerobic digestion, purification and quality of the obtained biogas.
 - 7.- Study of the hydraulic load effect in the anaerobic digestion, purification and quality of the obtained biogas.
 - 8.- Study of the inhibitors influence in the anaerobic digestion, purification and quality of the obtained biogas.
 - 9.- Comparison between the mesophilic and thermophilic anaerobic digestion and their influence in the biogas obtention.
 - 10.- Determination of the optimum operation temperature.
 - 11.- Determination of the optimum feeding rate.
 - 12.- Determination of the optimum solids/water relation.
 - 13.- Determination of the optimum degradable/non degradable solids relation.
 - 14.- Determination of the multistage nature in the anaerobic digestion.
 - 15.- Determination of the kinetics.
 - 16.- Carbon balance.
 - 17.- Solids balance.
 - 18.- Biogas balance.
- Additional practical possibilities:
- 19.- Sensors calibration.
- Other possibilities to be done with this Unit:
- 20.- Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
 - 21.- Open Control, Multicontrol and Real Time Control.
This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivate parameters; etc, in real time.
 - 22.- The Computer Control System with SCADA and PID Control allow a real industrial simulation.
 - 23.- This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
 - 24.- This unit can be used for doing applied research.
 - 25.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
 - 26.- Control of the EBGC unit process through the control interface box without the computer.
 - 27.- Visualization of all the sensors values used in the EBGC unit process.
- Several other exercises can be done and designed by the user.

a) Technical and Vocational Education configuration

⑦ **EBGC/ICAI. Interactive Computer Aided Instruction Software System.**

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

-ECM. EDIBON Classroom Manager (Instructor Software).

ECM 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. EDIBON Student Labsoft (Student Software).

ESL 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.**

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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Edition: ED01/16
Date: August/2016

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