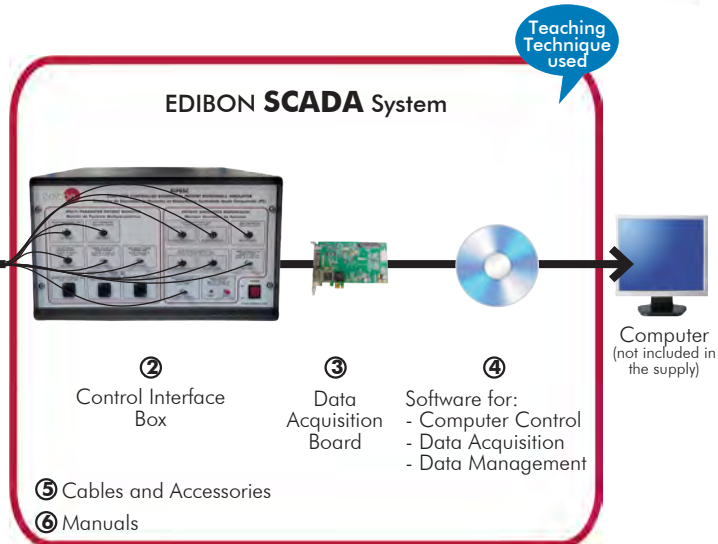


① Unit: BIPBSC. Computer Controlled Biomedical Patient Biosignals Simulator



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

### Key features:

- **Advanced Real-Time SCADA.**
- **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).**
- **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**



[www.edibon.com](http://www.edibon.com)

PRODUCTS  
↳ 14.-BIOMEDICAL  
ENGINEERING

For more information about Key Features, click here



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



European Union Certificate (total safety)



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



"Worlddidac Quality Charter" and Platinum Member of Worlddidac

## INTRODUCTION

The monitoring of a patient carries the most relevant information for a doctor to know how this patient is reacting to a certain treatment. This monitoring consists on the measurement of different biosignals to understand the physicochemical and physiological processes in the patient.

The Computer Controlled Biomedical Patient Biosignals Simulator, "BIPBSC", is a complete unit which allows the user to simulate the main Biosignals of a patient and to monitor them in a real in a real patient monitor. It includes a patient simulator, which imitates the Biosignals that can be studied by the unit.

The Computer Controlled Biomedical Patient Biosignals Simulator, "BIPBSC", unit is provided with a set of practical exercises, through which the user will understand the basic principles about the monitoring of a patient in a realistic clinical environment, as well as interpret the most important Biosignals patterns.

## GENERAL DESCRIPTION

The Computer Controlled Biomedical Patient Biosignals Simulator, "BIPBSC", unit allows the students to learn how to interpret and perform the most important biosignal measurements: Electrocardiography (ECG), Pulse oximetry (SpO<sub>2</sub>), Blood Pressure (BP) and Capnography (etCO<sub>2</sub>). A Patient simulator mimics the above-mentioned biological signals (among others) by means of a software with different programmable scenarios of healthy and ill patients. Also, a real vital signs patient monitor can be connected to the mannequin for the real measurement of the simulated signals.

The "BIPBSC-UB" is the base unit of the "BIPBSC" application.

The "BIPBSC-UB" includes the following elements:

- BIPBSC-UC. Biomedical Patient Biosignals Simulator Control Unit.
- BIPBSC-PS. Patient Simulator.

Required element/s to operate with "BIHBPC-UB" unit:

- BI-PM. Biosignals Patient Monitor.
- AEL-PC. Touch Screen and Computer.

The "BIPBSC" includes the following elements:

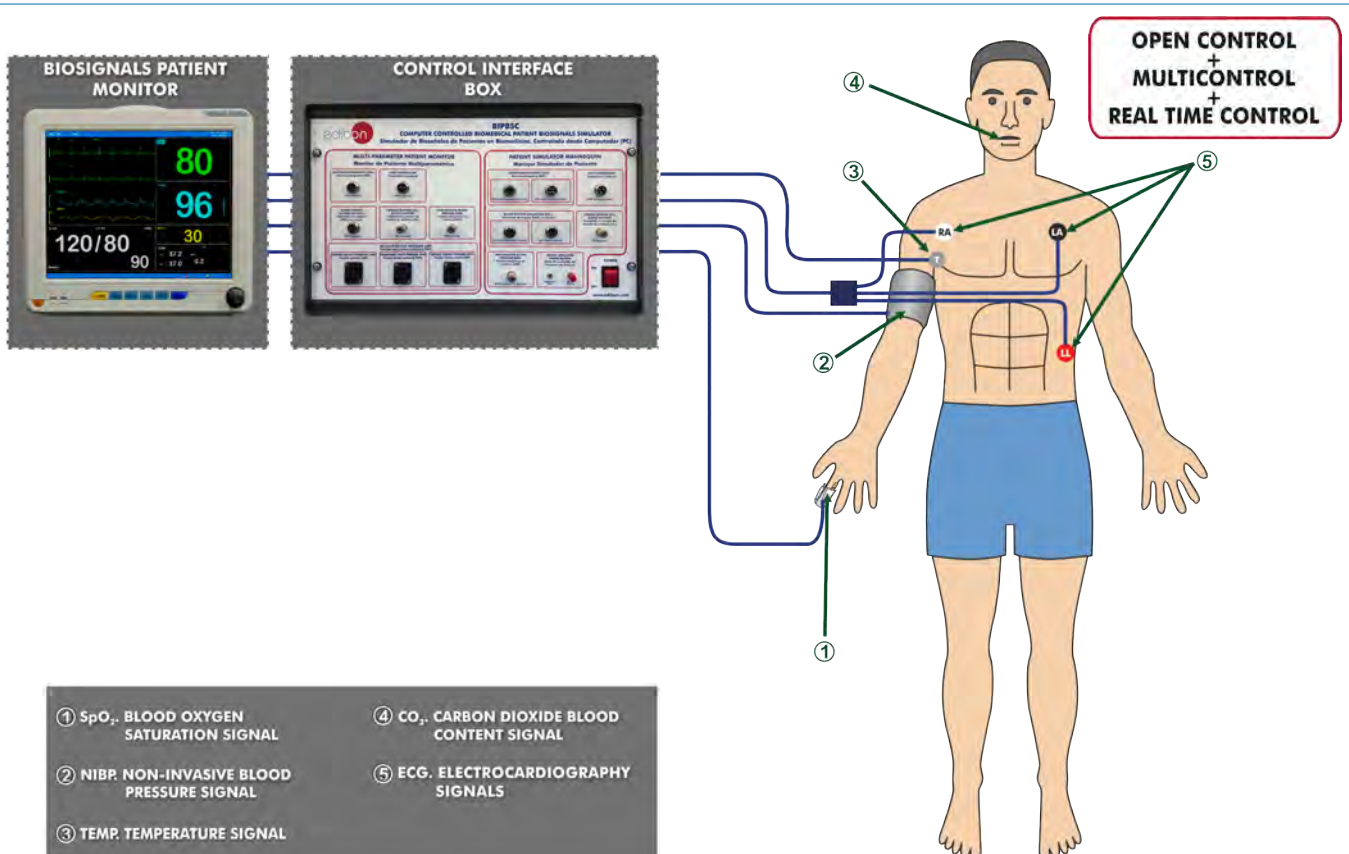
- BIPBSC-UB. Biomedical Patient Biosignals Simulator Base Unit.
- BI-PM. Biosignals Patient Monitor.



BIPBSC detail

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



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 **BIPBSC. Unit:**

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

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

This simulator is composed of:

- **BIPBSC-UC. Biomedical Patient Biosignals Simulator Control Unit.**

Computer controlled biosignals simulator.

The BIPBSC unit can simulate the following biosignals:

Three-lead electrocardiogram (ECG):

Three-lead ECG output.

Heart rate range: 30 - 145 bpm.

Cardiovascular diseases: atrial fibrillation, atrial flutter, asystole, first, second and third degree atrioventricular block, right and left bundle branch block, ectopic heartbeat, hyperkalemia, idioventricular rhythm, left ventricular hypertrophy, pacemakers, ST segment elevation, ischemia, torsades de pointes, ventricular fibrillation, ventricular arrest and ventricular tachycardia.

Temperature range: 25 - 43.5°C.

Oxygen saturation (SpO<sub>2</sub>):

Pulxiometry sensor:

Red light wavelength: 658 - 664 nm.

Infrared light wavelength: 897 - 915 nm.

Capnography (etCO<sub>2</sub>):

Proportional valve:

Power supply: 0 - 10 V.

Maximum flow rate: 2.7 l/min.

Working pressure: 50 psi.

CO<sub>2</sub> bottles:

Amount of CO<sub>2</sub>: 16 g.

Respiratory rate:

Respiratory rate range: 0 to 60 breaths per minute.

Arterial blood pressure (ABP):

Systolic pressure range: 90 - 180 mmHg.

Diastolic pressure range: 50 - 100 mmHg.

Servomotor:

Supply voltage: 4.8 - 7.2 VDC.

Velocity: 0.16s/60°.

Angle of rotation: 180°.

Pressure sensor:

Maximum pressure: 5 psi.

- **BIPBSC-PS. Patient Simulator.**

Real size mannequin.

Mannequin to perform a CPR maneuver:

Realistic chest rise and fall.

Positive pressure ventilation.

Possibility to perform the jaw-thrust and tilt-chin lift maneuvers releasing the airway occlusion.

Manual carotid pulses through a pulse bulb.

Three ECG electrodes located at the real position of the patient.

Latex free unit.



Unit: BIPBSC

• **BI-PM. Biosignals Patient Monitor.**

Input voltage (CA): 100 - 240V, 50Hz/60Hz.

12.1" TFT-LCD screen.

Resolution 800 x 600 pixels.

Alarm sounds:

Prompt tone.

QRS tone.

4 different alarm sounds.

ECG monitoring:

Three-lead ECG input.

Selectable leads: I, II, III.

Heart rate range: 15 - 300 bpm (adults) and 15 - 350 bpm (children and newborns).

Accuracy:  $\pm 1\%$  of range.

Resolution: 1 bpm.

Heart arrhythmia analysis: the monitor analyze different arrhythmia and shows the diagnosis.

Respiratory monitoring:

Measuring method: thoracic impedance.

Heart rate range: 0 - 120 bpm (adults) and 0 - 170 bpm (children and newborns).

Resolution: 1 rpm.

SpO<sub>2</sub> monitoring:

Monitoring parameters: SpO<sub>2</sub> and pulse rate.

SpO<sub>2</sub> range: 0 - 100 %.

Pulse rate range: 30 - 300 bpm.

Resolution: 1 %.

NBP monitoring:

Measuring method: automatic oscillometric method.

Working modes: manual, auto, STAT

Monitoring range:

Mean pressure: 20 - 255 mmHg (adults), 20 - 160 mmHg (children) and 20 - 120 mmHg (newborns).

Systolic pressure: 30 - 270 mmHg (adults), 30 - 180 mmHg (children) and 30 - 130 mmHg (newborns).

Diastolic pressure: 10 - 245 mmHg (adults), 10 - 150 mmHg (children) and 10 - 100 mmHg (newborns).

Accuracy:

Maximum error for mean pressure:  $\pm 5$  mmHg.

Maximum error for systolic or diastolic pressure: 8 mmHg.

Temperature monitoring:

Range: -1 to 45 °C.

Measuring method: thermal resistance method.

Resolution: 0.1 °C.

Capnography (etCO<sub>2</sub>) monitoring:

Measuring method: absorption of infrared radiation.

Warm-up time: 2 min.

Range: 0 - 19.7 % (0 - 150 mmHg).

Resolution: 0.1 mmHg (0 - 69 mmHg), 0.25 mmHg (70 - 150 mmHg).



BI-PM

• **AEL-PC. Touch Screen and Computer.**

Touch Screen:

Energy efficiency class: A.

Screen diagonal: 68.6 cm (27 inch (s)).

Power consumption (operating): 26 watts.

Annual energy consumption: 38 kWh.

Power consumption (standby / off) 0.49 watts.

Screen resolution: 1920 x 1080 pixels.

Computer:

Processor Number: Intel Core i7-6600U Processor (4M Cache, up to 3,40 GHz).

Cache: 4 MB Intel Smart Cache.

Clock speed: 2.6 GHz.

# Of Cores/# of Threads: 2/4.

Max. TDP/Power: 15 W.

Memory Types: DDR4-2133, LPDDR3-1866, DDR3L-1600.

Graphics: Intel HD Graphics 530.

Slot for PCI Express.



AEL-PC

• **All necessary cables to realize the practical exercises are included.**

The complete unit includes as well:

- Advanced Real-Time SCADA.**
- 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).**
- 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.**

② **BIPBSC/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.**
- 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 computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process.**
- Real time computer control for pumps, compressors, heating elements, control valves, etc.
- Real time computer control for parameters involved in the process simultaneously.**
- 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.**



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



DAB

**④ BIPBSC/CCSOF. 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.

**Management, processing, comparison and storage of data.**

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

**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.**



BIPBSC/CCSOF

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

**⑥ Manuals:**

This unit **is supplied with 7 manuals:** Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance & Practices Manuals.

\*References 1 to 6 are the main items: BIPBSC + BIPBSC/CIB + DAB + BIPBSC/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.- Basic principles of biosignals acquisition.
- 2.- Understanding of biosignal measuring devices.
- 3.- Interpretation of the ECG normal pattern.
- 4.- Analysis of ECG pattern changes.
- 5.- Interpretation of the SpO<sub>2</sub> normal pattern.
- 6.- Analysis of SpO<sub>2</sub> pattern changes.
- 7.- Interpretation of the etCO<sub>2</sub> normal pattern.
- 8.- Analysis of etCO<sub>2</sub> pattern changes.
- 9.- Interpretation of the non-invasive blood pressure normal pattern.
- 10.- Analysis of non-invasive blood pressure pattern changes.
- 11.- Interpretation of the invasive blood pressure normal pattern (ABP, PAP and CVP).
- 12.- Analysis of invasive blood pressure (ABP, PAP and CVP) pattern changes.
- 13.- Understanding the reaction that certain drugs have on biopotentials.
- 14.- Cardiopulmonary resuscitation (CPR).
- 15.- Basic principles of pacemakers.
- 16.- Analysis of the patient ECG stimulated by a transcutaneous pacemaker.

Other possibilities to be done with this Unit:

- 17.- Many students view results simultaneously.  
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
  - 18.- 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.
  - 19.- The Computer Control System with SCADA allows a real industrial simulation.
  - 20.- This unit is totally safe as uses mechanical, electrical/electronic, and software safety devices.
  - 21.- This unit can be used for doing applied research.
  - 22.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
  - 23.- Control of the BIPBSC unit process through the control interface box without the computer.
- Several other exercises can be done and designed by the user.

### REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.
- Computer (PC).

### DIMENSIONS AND WEIGHTS

BIPBSC:

Unit:

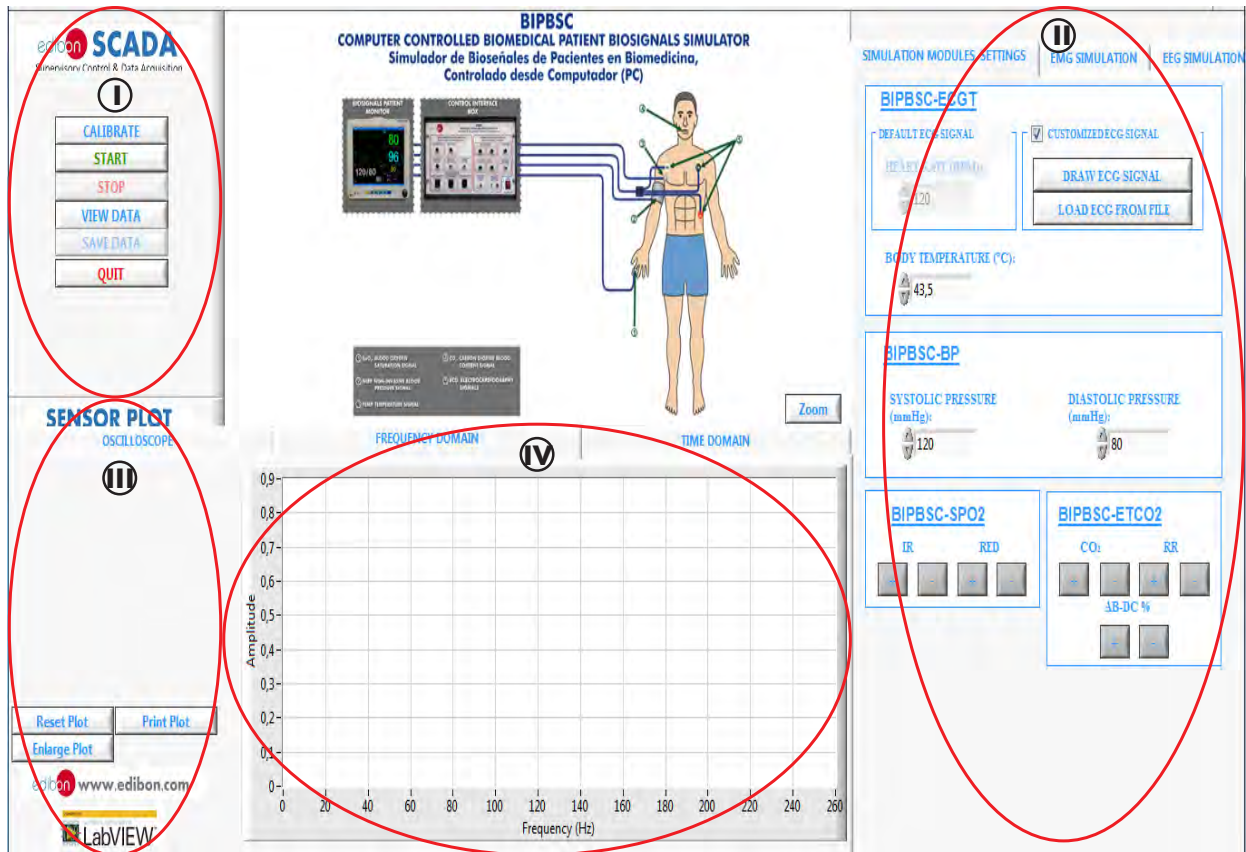
- Dimensions: 1500 x 25.98 x 15.74 mm approx.  
(59.05 x 19.68 x 31.50 inches approx.).
- Weight: 60 Kg approx.  
(132 pounds approx.)

Mannequin:

- Dimensions: 1800 mm x 550 mm approx.  
(70.86x 21.65 inches approx.).
- Weight: 38.5 kg approx.  
(85 pounds approx.)

## SOFTWARE MAIN SCREENS

### SCADA Main screen




- I** Main software operation possibilities.
- II** Configuration menu: Modules settings: BIPBSC-ECGT, BIPBSC-BP, BIPBSC-SPO2 and BIPBSC-ETCO2.
- III** Channel selection and other plot parameters.
- IV** Real time graphics displays.



SOME REAL RESULTS OBTAINED FROM THIS UNIT

120 bpm BP signals visualization.



Supervisory Control & Data Acquisition

CALIBRATE

START

STOP

VIEW DATA

SAVE DATA

QUIT


**SENSOR PLOT**  
OSCILLOSCOPE

Reset Plot

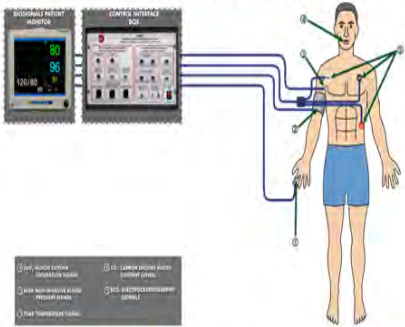
Print Plot

Enlarge Plot

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**BIPBSC**  
COMPUTER CONTROLLED BIOMEDICAL PATIENT BIOSIGNALS SIMULATOR  
Simulador de Bioseñales de Pacientes en Biomedicina,  
Controlado desde Computador (PC)



ECG (Volts)     IR     CO<sub>2</sub> (Volts)  
 SPO<sub>2</sub> SYNC (Volts)     RED     ECG (Electrocardiogram)     RR  
 SPO<sub>2</sub> (Volts)     ECG (Electrocardiogram)     AB-DC %  
 CO<sub>2</sub> CTRL (Volts)

Zoom

SIMULATION MODULES SETTINGS    EMG SIMULATION    EEG SIMULATION

**BIPBSC-ECGT**

DEFAULT ECG SIGNAL     CUSTOMIZED ECG SIGNAL

HEART RATE (BPM): 120

DRAW ECG SIGNAL

LOAD ECG FROM FILE

BODY TEMPERATURE (°C): 43,5

---

**BIPBSC-BP**

SYSTOLIC PRESSURE (mmHg): 120

DIASTOLIC PRESSURE (mmHg): 80

---

**BIPBSC-SPO<sub>2</sub>**

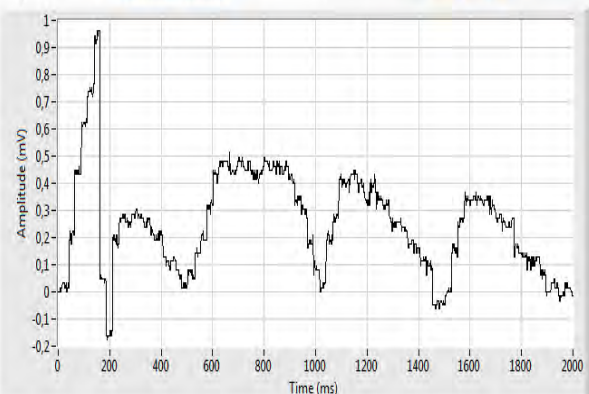
IR    RED

**BIPBSC-ETCO<sub>2</sub>**

CO<sub>2</sub>    RR

AB-DC %


FREQUENCY DOMAIN    TIME DOMAIN



Amplitude (mV)

Time (ms)

80 bpm CO2 signals visualization.



Supervisory Control & Data Acquisition

CALIBRATE

START

STOP

VIEW DATA

SAVE DATA

QUIT


**SENSOR PLOT**  
OSCILLOSCOPE

Reset Plot

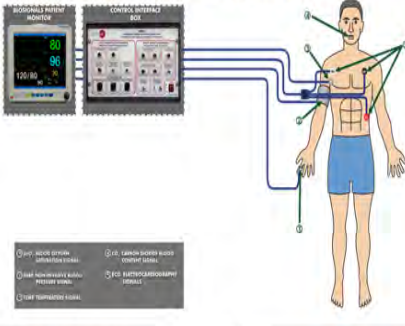
Print Plot

Enlarge Plot

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**BIPBSC**  
COMPUTER CONTROLLED BIOMEDICAL PATIENT BIOSIGNALS SIMULATOR  
Simulador de Bioseñales de Pacientes en Biomedicina,  
Controlado desde Computador (PC)



ECG (Volts)     IR     CO<sub>2</sub> (Volts)  
 SPO<sub>2</sub> SYNC (Volts)     RED     ECG (Electrocardiogram)     RR  
 SPO<sub>2</sub> (Volts)     ECG (Electrocardiogram)     AB-DC %  
 CO<sub>2</sub> CTRL (Volts)

Zoom

SIMULATION MODULES SETTINGS    EMG SIMULATION    EEG SIMULATION

**BIPBSC-ECGT**

DEFAULT ECG SIGNAL     CUSTOMIZED ECG SIGNAL

HEART RATE (BPM): 80

DRAW ECG SIGNAL

LOAD ECG FROM FILE

BODY TEMPERATURE (°C): 43,5

---

**BIPBSC-BP**

SYSTOLIC PRESSURE (mmHg): 120

DIASTOLIC PRESSURE (mmHg): 80

---

**BIPBSC-SPO<sub>2</sub>**

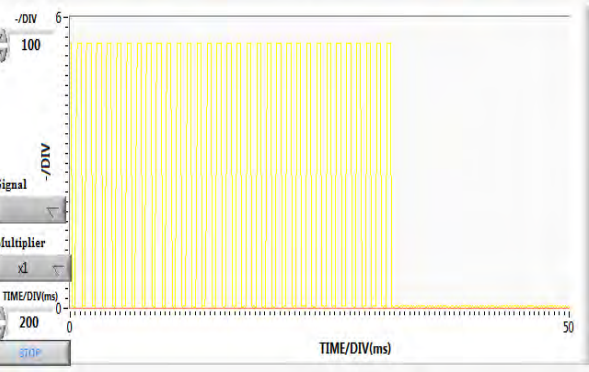
IR    RED

**BIPBSC-ETCO<sub>2</sub>**

CO<sub>2</sub>    RR

AB-DC %

FREQUENCY DOMAIN    TIME DOMAIN



Signal

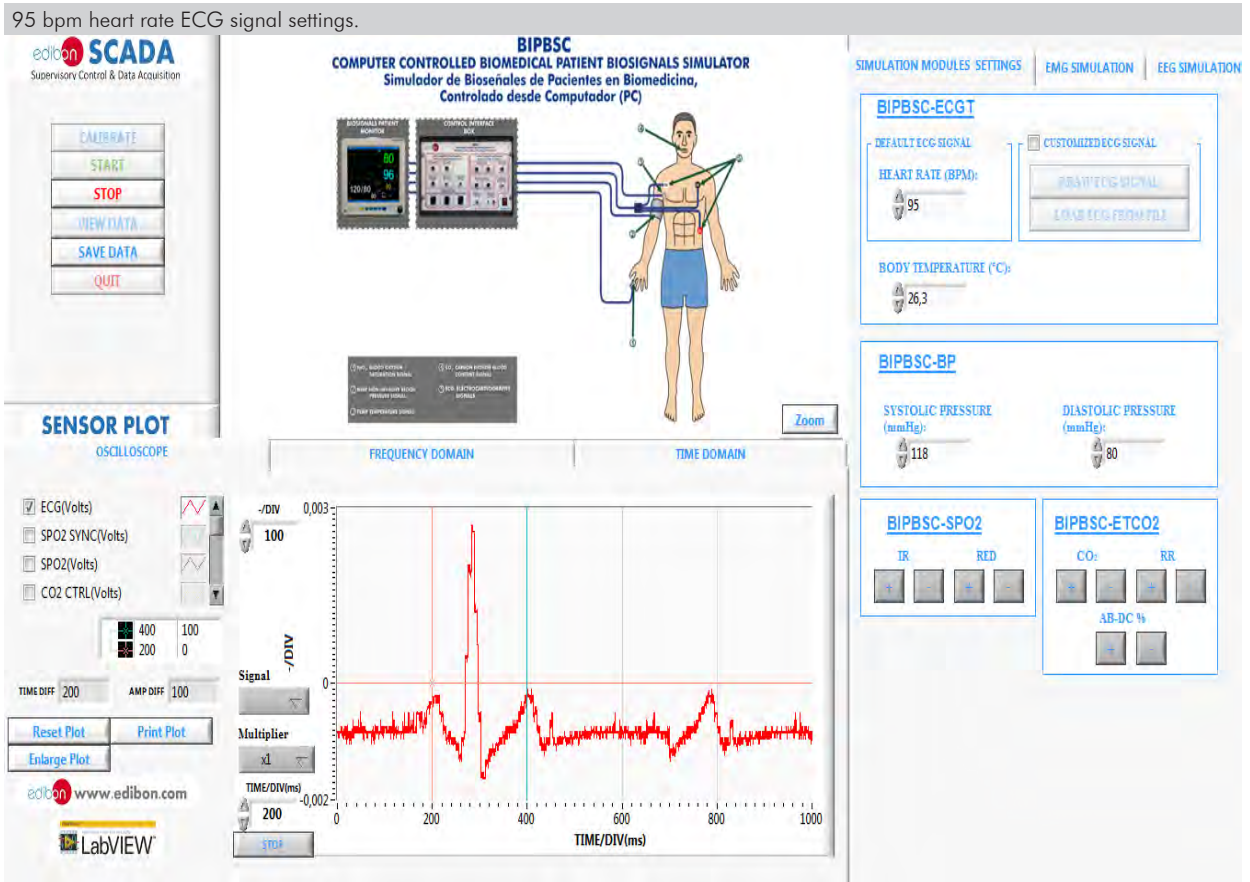
- /DIV 100

Multiplier x1

TIME/DIV(ms) 200

TIME/DIV(ms) 50

Some **real** results obtained from this Unit



## COMPLETE TECHNICAL SPECIFICATIONS (for optional items)

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 BIPBSC/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](http://www.edibon.com/en/files/expansion/ICAI/catalog)

#### Instructor Software



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

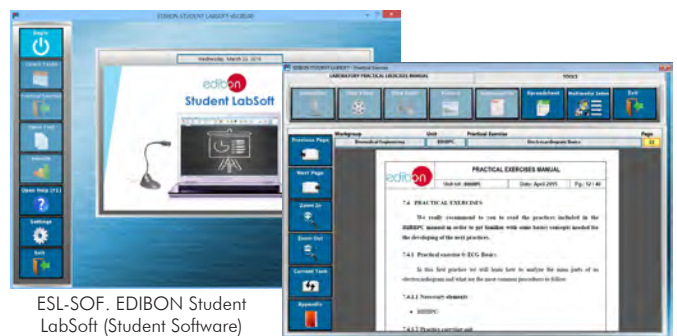
ECAL. EDIBON Calculations Program Package - Formula Editor Screen



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

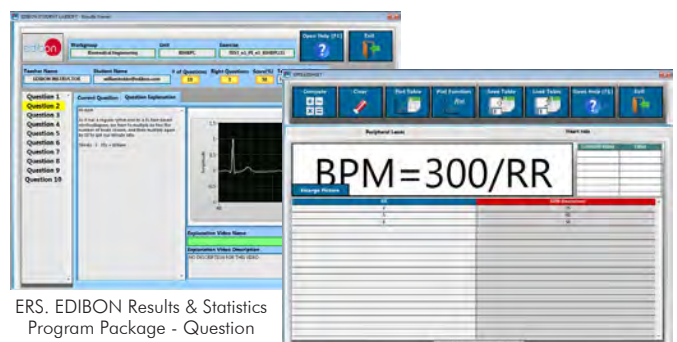
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

#### 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

b) Multipost Expansions options

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

MINI ESN. EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously. 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 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, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing "real time" control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

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

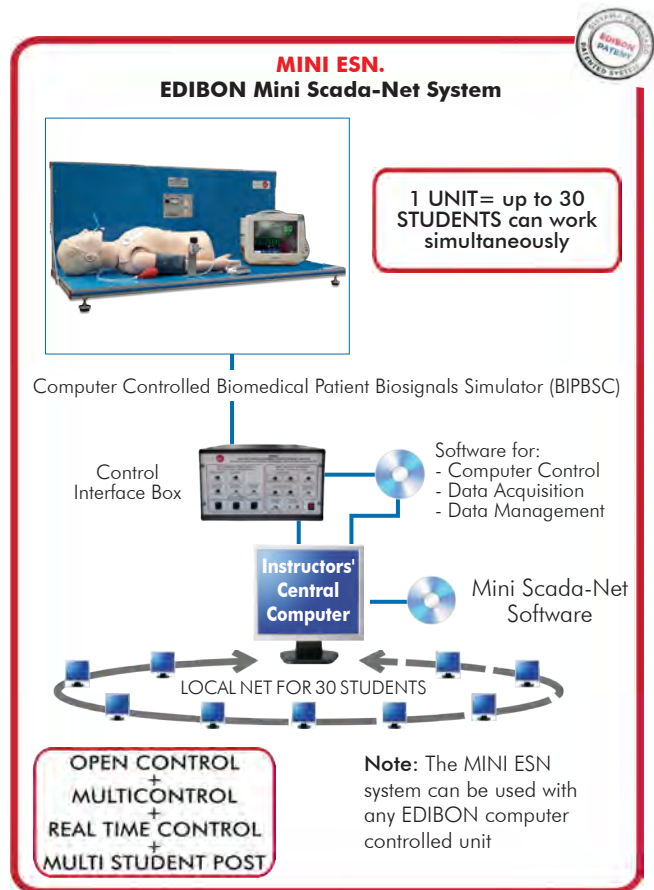
[www.edibon.com/en/files/expansion/MINI-ESN/catalog](http://www.edibon.com/en/files/expansion/MINI-ESN/catalog)

⑨ **ESN. EDIBON Scada-Net Systems.**

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

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

[www.edibon.com/en/files/expansion/ESN/catalog](http://www.edibon.com/en/files/expansion/ESN/catalog)



## ORDER INFORMATION

### **Main items** (always included in the supply)

Minimum supply always includes:

- ① **Unit: BIPBSC. Computer Controlled Biomedical Patient Biosignals Simulator.**
- ② **BIPBSC/CIB. Control Interface Box.**
- ③ **DAB. Data Acquisition Board.**
- ④ **BIPBSC/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
- ⑤ **Cables and Accessories**, for normal operation.
- ⑥ **Manuals.**

\***IMPORTANT:** Under BIPBSC 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 BIPBSC/ICAI. Interactive Computer Aided Instruction Software System.

b) Multipost Expansions options

- ⑧ MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.
- ⑨ ESN. EDIBON Scada-Net Systems.

① **BIPBSC. Unit:**

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

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

This simulator is composed of:

- BIPBSC-UC. Biomedical Patient Biosignals Simulator Control Unit.

Computer controlled biosignals simulator.

The BIPBSC unit can simulate the following biosignals:

Three-lead electrocardiogram (ECG):

Three-lead ECG output.

Heart rate range: 30 - 145 bpm.

Cardiovascular diseases: atrial fibrillation, atrial flutter, asystole, first, second and third degree atrioventricular block, right and left bundle branch block, ectopic heartbeat, hyperkalemia, idioventricular rhythm, left ventricular hypertrophy, pacemakers, ST segment elevation, ischemia, torsades de pointes, ventricular fibrillation, ventricular arrest and ventricular tachycardia.

Temperature range: 25 - 43.5°C.

Oxygen saturation (SpO<sub>2</sub>):

Pulxiometry sensor:

Red light wavelength: 658 - 664 nm.

Infrared light wavelength: 897 - 915 nm.

Capnography (etCO<sub>2</sub>):

Proportional valve:

Power supply: 0 - 10 V.

Maximum flow rate: 2.7 l/min.

Working pressure: 50 psi.

CO<sub>2</sub> bottles:

Amount of CO<sub>2</sub>: 16 g.

Respiratory rate:

Respiratory rate range: 0 to 60 breaths per minute.

Arterial blood pressure (ABP):

Systolic pressure range: 90 - 180 mmHg.

Diastolic pressure range: 50 - 100 mmHg.

Servomotor:

Supply voltage: 4.8 - 7.2 VDC.

Velocity: 0.16s/60°.

Angle of rotation: 180°.

Pressure sensor:

Maximum pressure: 5 psi.

- BIPBSC-PS. Patient Simulator.

Real size mannequin.

Mannequin to perform a CPR maneuver:

Realistic chest rise and fall.

Positive pressure ventilation.

Possibility to perform the jaw-thrust and tilt-chin lift maneuvers releasing the airway occlusion.

Manual carotid pulses through a pulse bulb.

Three ECG electrodes located at the real position of the patient.

Latex free unit.

- BI-PM. Biosignals Patient Monitor.

Input voltage (CA): 100 - 240V, 50Hz/60Hz.

12.1" TFT-LCD screen.

Resolution 800 x 600 pixels.

Alarm sounds:

Prompt tone.

QRS tone.

4 different alarm sounds.

ECG monitoring:

Three-lead ECG input.

Selectable leads: I, II, III.

Heart rate range: 15 - 300 bpm (adults) and 15 - 350 bpm (children and newborns).

Accuracy: ±1% of range.

Resolution: 1 bpm.

Heart arrhythmia analysis: the monitor analyze different arrhythmia and shows the diagnosis.

Respiratory monitoring:

Measuring method: thoracic impedance.

Heart rate range: 0 - 120 bpm (adults) and 0 - 170 bpm (children and newborns).

Resolution: 1 rpm.

SpO<sub>2</sub> monitoring:

Monitoring parameters: SpO<sub>2</sub> and pulse rate.

SpO<sub>2</sub> range: 0 - 100 %.

Pulse rate range: 30 - 300 bpm.

Resolution: 1 %.

NBP monitoring:

Measuring method: automatic oscillometric method.

Working modes: manual, auto, STAT

Monitoring range:

Mean pressure: 20 - 255 mmHg (adults), 20 - 160 mmHg (children) and 20 - 120 mmHg (newborns).

Systolic pressure: 30 - 270 mmHg (adults), 30 - 180 mmHg (children) and 30 - 130 mmHg (newborns).

Diastolic pressure: 10 - 245 mmHg (adults), 10 - 150 mmHg (children) and 10 - 100 mmHg (newborns).

Accuracy:

Maximum error for mean pressure: ±5 mmHg.

Maximum error for systolic or diastolic pressure: 8 mmHg.

## Tender Specifications (for main items)

### Temperature monitoring:

Range: -1 to 45 °C.

Measuring method: thermal resistance method.

Resolution: 0.1 °C.

### Capnography (etCO<sub>2</sub>) monitoring:

Measuring method: absorption of infrared radiation.

Warm-up time: 2 min.

Range: 0 - 19.7 % (0 - 150 mmHg).

Resolution: 0.1 mmHg (0 - 69 mmHg), 0.25 mmHg (70 - 150 mmHg).

### • AEL-PC. Touch Screen and Computer.

#### Touch Screen:

Energy efficiency class: A.

Screen diagonal: 68.6 cm (27 inch (s)).

Power consumption (operating): 26 watts.

Annual energy consumption: 38 kWh.

Power consumption (standby / off) 0.49 watts.

Screen resolution: 1920 x 1080 pixels.

#### Computer:

Processor Number: Intel Core i7-6600U Processor (4M Cache, up to 3,40 GHz).

Cache: 4 MB Intel Smart Cache.

Clock speed: 2.6 GHz.

# Of Cores/# of Threads: 2/4.

Max. TDP/Power: 15 W.

Memory Types: DDR4-2133, LPDDR3-1866, DDR3L-1600.

Graphics: Intel HD Graphics 530.

Slot for PCI Express.

### • All necessary cables to realize the practical exercises are included.

The complete unit includes as well:

Advanced Real-Time SCADA.

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).

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.

### ② BIPBSC/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.

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

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

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

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

### ③ DAB. Data Acquisition Board:

The Data Acquisition board is part of the SCADA system.

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

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

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

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

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

### ④ BIPBSC/CCSOF. 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.

Management, processing, comparison and storage of data.

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

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 7 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance & Practices Manuals.

### Exercises and Practical Possibilities to be done with the Main Items

- 1.- Basic principles of biosignals acquisition.
  - 2.- Understanding of biosignal measuring devices.
  - 3.- Interpretation of the ECG normal pattern.
  - 4.- Analysis of ECG pattern changes.
  - 5.- Interpretation of the SpO<sub>2</sub> normal pattern.
  - 6.- Analysis of SpO<sub>2</sub> pattern changes.
  - 7.- Interpretation of the etCO<sub>2</sub> normal pattern.
  - 8.- Analysis of etCO<sub>2</sub> pattern changes.
  - 9.- Interpretation of the non-invasive blood pressure normal pattern.
  - 10.- Analysis of non-invasive blood pressure pattern changes.
  - 11.- Interpretation of the invasive blood pressure normal pattern (ABP, PAP and CVP).
  - 12.- Analysis of invasive blood pressure (ABP, PAP and CVP) pattern changes.
  - 13.- Understanding the reaction that certain drugs have on biopotentials.
  - 14.- Cardiopulmonary resuscitation (CPR).
  - 15.- Basic principles of pacemakers.
  - 16.- Analysis of the patient ECG stimulated by a transcutaneous pacemaker.
- Other possibilities to be done with this Unit:
- 17.- Many students view results simultaneously.  
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
  - 18.- 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.
  - 19.- The Computer Control System with SCADA allows a real industrial simulation.
  - 20.- This unit is totally safe as uses mechanical, electrical/electronic, and software safety devices.
  - 21.- This unit can be used for doing applied research.
  - 22.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
  - 23.-Control of the BIPBSC unit process through the control interface box without the computer.
- Several other exercises can be done and designed by the user.



## TENDER SPECIFICATIONS (for optional items)

### a) Technical and Vocational Education configuration

#### ⑦ BIPBSC/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.

### b) Multipost Expansions options

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

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

The MINI ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA 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, 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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