**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 Biomedical Patient Biosignals Simulator (BIPBS) is a complete unit which allows the user to simulate the main Biosignals of a patient and to monitor them in a real multi-parameter patient monitor. It includes a patient simulator, which imitates the Biosignals that can be studied by the unit.

The Biomedical Patient Biosignals Simulator (BIPBS) 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 Biomedical Patient Biosignals Simulator (BIPBS) unit allows the students to learn how to interpret and perform the most important biosignal measurements: Electrocardiography (ECG), Pulse oximetry (SpO2), Blood Pressure (BP) and Capnography (etCO2).

The Biomedical Patient Biosignals Simulator (BIPBS) includes:

- Patient simulator, a mannequin which mimics the above-mentioned biological signals (among others) by means of a controller software with different programmable scenarios of healthy and ill patients.

- Real Multi-parameter patient monitor to be connected to the mannequin for the real measurement of the simulated signals.

- Defibrillator, applies a certain amount of energy to the simulated heart whenever the patient simulator presents a fibrillating ECG in order to return to a normal ECG.

This simulator allows the users to change the Biosignals parameters and analyze its consequences, not on a real patient but under similar conditions.
This simulator is composed of:

**Bench top-unit with an anodized aluminum profile structure and painted steel panels, including:**

**Multi-parameter patient monitor:**

- Fully automatic and real-time monitoring of the following biosignals:
  - Electrocardiograph (ECG), range: 1.5-300bpm ± 1%.
  - Oxygen Saturation (SpO₂), range: 0-100% ± 1%.
  - Carbon dioxide partial pressure (etCO₂), range: 0-150mmHg ± 2mmHg.
  - Blood Pressure (BP), range: 0-300mmHg ± 2mmHg.
- Large LCD screen to display the analog and numeric value of each biosignal at the same time.
- Visual and audible alarms. The user can configure alarm for each biosignal.
- 6 buttons to change the display.
- ECG cable. etCO₂ cable. SpO₂ cable.

**Defibrillator:**

- Voltage application to heal a fibrillating heart:
  - Output energy: 150-360 Joules for adult patients; 40-90 Joules for pediatric patients.
  - Energy selection: manually.
- Shockable rhythms: Ventricular fibrillations and rapid ventricular tachycardia.
- Pulse frequency: 25 - 240 ppm.
- ECG monitor with 3-lead patient cable, and heart rate from 15 to 300 bpm.
- Rotation button to select the current provided to the patient.
- Button for discharge on the applicators.

**Mannequin/simulator:**

- Electrotherapy:
  - Defibrillation: 20-360 J (monophasic).
- Air supply (when used):
  - Allowed pressure: 50-120 psi.
- CO₂ supply (when used):
  - Allowed pressure: 30-120 psi.
- Lung specifications:
  - Maximum tidal volume: 1.2 l.
  - Maximum airway pressure: 80 cmH₂O (simulated stomach inflation starts from approximately 40 cmH₂O airway pressure).
  - Cardiac features: pulses from 0-220.
- Software which allows the teacher to modify biosignals, and the students to check that the measured signal (shown in the multi-parameter patient monitor) corresponds to the simulated one; therefore proving the efficiency of the measuring device.

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

**Manuals:**

- This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.
1. Basic principles of biosignals acquisition.
2. Understanding of biosignal measuring devices.
3. Interpretation of the normal pattern of ECG.
4. Analysis of ECG pattern changes.
5. Interpretation of the normal SpO\textsubscript{2} pattern.
6. Analysis of SpO\textsubscript{2} pattern changes.
7. Interpretation of the normal pattern of etCO\textsubscript{2}.
8. Analysis of etCO\textsubscript{2} pattern changes.
9. Interpretation of the normal pattern of arterial blood pressure.
10. Analysis of arterial blood pressure pattern changes.
11. Understanding the reaction that certain drugs have on biopotentials.
12. CPR.
13. Study of defibrillation mechanism.
14. Defibrillation consequences in humans.
15. Basic principles of pacemakers (only if the defibrillator includes a pacemaker).
16. Analysis of the ECG of a patient stimulated by a transcutaneous pacemaker (only if the defibrillator includes a pacemaker).
17. Additional practical possibilities with the optional Defibrillation analyzer:
   - Determination of the charge time of the defibrillator.
   - Study of the cardiac synchronization of the defibrillator.
   - Measurement of the energy discharge of the defibrillator.
   - Analysis of the defibrillator unit with changes in the ECG.

**REQUIRED SERVICES**

- Electrical supply: single-phase, 220V./50Hz or 110V./60Hz.
- Computer (PC).

**DIMENSIONS & WEIGHTS**

**BIPBS:**
- Dimensions: 850 x 500 x 800 mm. approx. (33.46 x 19.68 x 31.50 inches approx.).
- Weight: 40 Kg. approx. (88 pounds approx.)

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

**OPTIONAL ACCESSORIES**

BIPBS/DA. Defibrillator analyzer to check on certain parameters of the defibrillator:
- Load Resistance: 50 Ohms ± 1%.
- Range High: 700 Joules ± 1 Joules.
- Range Low: 1 – 100 Joules ± 0.1 Joules.
- Maximum Voltage: 5200 volts (HI Range).
- Maximum Current: 100 Amp (HI Range).
With no physical connection between unit and computer (PC), this complete software package consists of an Instructor Software (INS/SOF) totally integrated with the Student Software (BIPBS/SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

**INS/SOF. Classroom Management Software (Instructor Software):**

The Instructor can:
- Organize Students by Classes and Groups.
- Create easily new entries or delete them.
- Create data bases with student information.
- Analyze results and make statistical comparisons.
- Generate and print reports.
- Detect student’s progress and difficulties.
...and many other facilities.

This software, working in network configuration, allows controlling all the students in the classroom.

**BIPBS/SOF. Computer Aided Instruction Software (Student Software):**

It explains how to use the unit, run the experiments and what to do at any moment.
- This software contains:
  - **Theory:** gives the student the theoretical background for a total understanding of the studied subject.
  - **Exercises:** divided by thematic areas and chapters to check out that the theory has been understood.
  - **Guided Practices:** presents several practices to be done with the unit, showing how to perform the exercises and practices.
  - **Exams:** set of questions to test the obtained knowledge.

For more information see CAI catalogue. Click on the following link:
BIPBS/CAL. Computer Aided Learning Software (Results Calculation and Analysis):

This Computer Aided Learning Software (Results Calculation and Analysis) “CAL” is a Windows based software, simple and very easy to use, specifically developed by EDIBON. CAL is a class assistant that helps in doing the necessary calculations to extract the right conclusions from data obtained during the experimental practices. With a single click, CAL computes the value of all the variables involved and performs the calculations. Also, CAL allows to plot and print the results. Within the plotting options, any variable can be represented against any other. Available different plotting displays. It has a wide range of information, such as constant values, unit conversion factors and integral and derivative tables.

On a table, we introduce data obtained during the development of the exercise. Above this table, it is shown “Constants” theoretically involved with the field of study. The values of these “Constants” may be modified to our convenience, assigning the appropriate values. Simply, by clicking on “COMPUTE”, CAL performs the calculations of the desired variables. We can save and print the data of the experiment or calculations. Also we can load any data file saved previously.

With the calculated variables, CAL gives the option of plotting the results. It is possible to represent any variable against any other. It has the option of representing the graph with different layouts. Screens below give an example of the multiple choices.

CAL has a wide range of help information. By clicking the button “ADDITIONAL HELP” opens a window where we have information about typical Constants, International System Units, Conversion Factors, and Table of Main Integrals and Derivatives (General), and there is other specific help for the particular unit.

For more information see CAL catalogue. Click on the following link: [www.edibon.com/products/catalogues/en/CAL.pdf](http://www.edibon.com/products/catalogues/en/CAL.pdf)

Specifications subject to change without previous notice, due to the convenience of improvements of the product.