Computer Controlled **Biomedical Human Biosignals and Parameters Teaching Unit,** with SCADA

BIHBPC

EDIBON SCADA System

Configuration example of BIHBPC

② Data Acquisition Board

③ Software for:
- Computer Control
- Data Acquisition
- Data Management

Computer
(not included in the supply)

④ Cables and Accessories

⑤ Manuals

* Minimum supply always includes: 1 + 2 + 3 + 4 + 5 (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

POWERED BY NATIONAL INSTRUMENTS **LabVIEW**

www.edibon.com
➥PRODUCTOS
➥14.-INGENIERÍA BIOMÉDICA

For more information about Key Features, click here

INTRODUCTION

Biosignals are all variables generated by living organisms which can be measured and monitored. The study of Biosignals is of great importance to understand the physicochemical and physiological processes in living systems.

Biosignals are used in clinical medicine for diagnostic purposes and to monitor critically ill patients.

The Computer Controlled Biomedical Human Biosignals and Parameters Teaching Unit "BIHBPC" allows the user to simulate the main human Biosignals and to monitor them in a real Biosignals Patient Monitor (BI-PM). It includes a hardware emulator, which imitates the Biosignals that can be studied by the monitor, so that there is no need to connect any sensors to the students; and the monitor.

The Computer Controlled Biomedical Human Biosignals and Parameters Teaching Unit "BIHBPC" is provided with a set of practical exercises, through which the user will understand the basic principles about the monitoring and interpretation of the most important Biosignals.

GENERAL DESCRIPTION

The Computer Controlled Biomedical Human Biosignals and Parameters Teaching Unit "BIHBPC" allows the students to learn how to interpret and perform the most important biosignal measurements: Electrocardiography (ECG), Pulse oximetry (SpO_2), Blood Pressure (BP) and Capnography ($etCO_2$).

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

The "BIHBPC-UB" includes the following elements:

- BIHBPC-UC. Biomedical Human Biosignals and Parameters Control Unit.
- BIHBPC-ECGT. Electrocardiography and Temperature Biomedical Module.

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

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

Recommended elements to increase the functionality of the "BIHBPC-UB" unit:

- BIHBPC-ETCO2. Capnography Biomedical Module.
- BIHBPC-NIBP. Non-Invasive Blood Pressure Biomedical Module.
- BIHBPC-SPO2. Oxygen Saturation Biomedical Module.

The "BIHBPC" includes the following elements:

- BIHBPC-UB. Biomedical Human Biosignals and Parameters Base Unit.
- BIHBPC-ETCO2. Capnography Biomedical Module.
- BIHBPC-NIBP. Non-Invasive Blood Pressure Biomedical Module.
- BIHBPC-SPO2. Oxygen Saturation Biomedical Module.
- BI-PM. Biosignals Patient Monitor.

This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), and includes: The unit itself + 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

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL
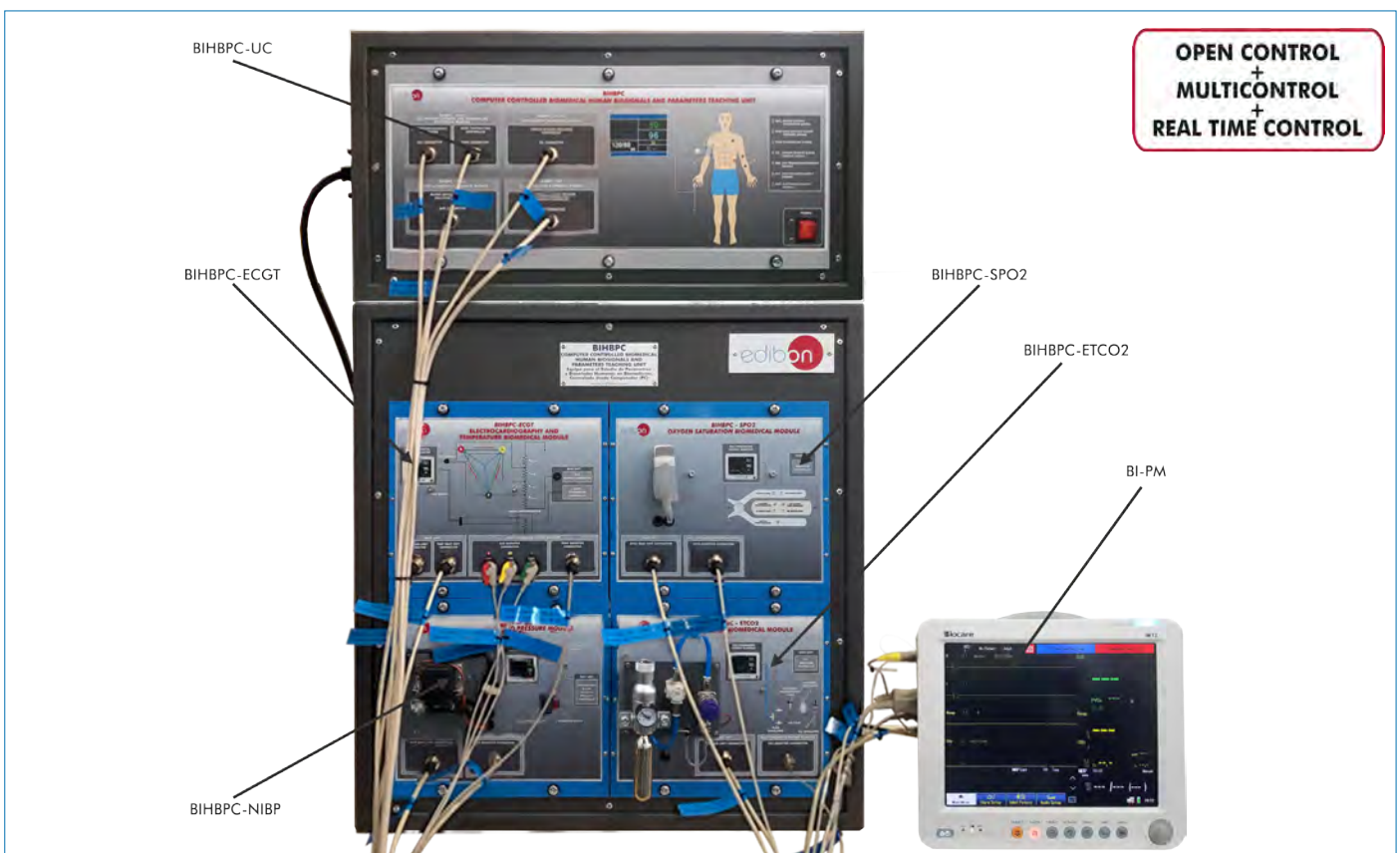
With this unit there are several options and possibilities:

  - Main items: 1, 2, 3 ,4 and 5.

  - Optional items: 6, 7, and 8.

Let us describe first the main items (1 to 5):

① **BIHBPC. Unit:**

  • BIHBPC-UC. **Biomedical Human Biosignals and Parameters Control Unit.**

    The base unit (BIHBPC module) generates the control signals that will regulate the actuators of the rest of modules.

    This module includes:

      Connector for the BIHBPC-ECGT module (ECG).

      Connector for the BIHBPC-ECGT module (Temp).

      Connector for the BIHBPC-SPO2 module.

      Connector for the BIHBPC-ETCO2 module.

      Connector for the BIHBPC-NIBP module.

      ON/OFF switch.

BIHBPC-UC

  • BIHBPC-ECGT. **Electrocardiography and Temperature Biomedical Module.**

    Three-lead EGC 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.

BIHBPC-ECGT

  • BIHBPC-ETCO2. **Capnography Biomedical Module.**

     Proportional valve:

        Power supply: 0 - 10 V.

        Maximum flow rate: 2.7 l/min.

        Working pressure: 50 psi.

     CO_2 bottles:

        Amount of CO_2: 16 g.

BIHBPC-ETCO2

  • BIHBPC-NIBP. **Non-Invasive Blood Pressure Biomedical Module.**

    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.

BIHBPC-NIBP

  • BIHBPC-SPO2. **Oxygen Saturation Biomedical Module.**

    Pulxiometry sensor:

       Red light wavelength: 658 - 664 nm.

       Infrared light wavelength: 897 - 915 nm.

BIHBPC-SPO2

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

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

    12.1" TFT-LCD screen.

    ECG monitoring:

        Three-lead ECG input.

        Selectable leads: I, II, III.

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

    Respiratory monitoring:

        Measuring method: thoracic impedance.

        Selectable leads: I, II.

        Respiratory impedance range: 0.5 - 3 Ω.

        Monitoring range: 0 - 120 rpm (adults) and 0 - 150 rpm (children and newborns).

        Resolution: 1 rpm.

    SpO_2 monitoring:

        Monitoring parameters: SpO_2 and pulse rate.

        SpO_2 range: 1 - 100 %.

        Pulse rate range: 25 - 250 ppm.

        Resolution: 1 %.

        Red light wavelength: 658 - 664 nm.

        Infrared light wavelength: 897 - 915 nm.

    NIBP monitoring:

        Measuring method: automatic oscillometric method.

        Working modes: manual, auto, STAT.

        Monitoring range:

            Systolic pressure: 41 - 270 mmHg (adults), 40 - 200 mmHg (children) and 40 - 135 mmHg (newborns).

            Average pressure: 20 - 230 mmHg (adults), 20 - 165 mmHg (children) and 20 - 110 mmHg (newborns).

            Diastolic pressure: 10 - 210 mmHg (adults), 10 - 150 mmHg (children) and 10 - 100 mmHg (newborns).

        Resolution: 1 mmHg.

    Temperature monitoring:

        Range: 0 - 50 °C.

        Measuring method: thermal resistance method.

        Resolution: 1 °C.

    CO_2 monitoring **(only included if BIHBPC-ETCO2 module is purchased)**:

        Type: lateral flow.

        Measuring method: absorption of infrared radiation.

        Preheating 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, LPDDDR3-1866, 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 **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/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.

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

DAB

③ **BIHBPC/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.

BIHBPC/CCSOF

④ **Cables and Accessories**, for normal operation.

⑤ **Manuals:**

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

∗References 1 to 5 are the main items: BIHBPC + DAB + BIHBPC/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 EEG normal pattern.

4.- Analysis of the EEG pattern changes.

5.- Interpretation of the EMG normal pattern.

6.- Analysis of the EMG pattern changes.

7.- Interpretation of the ECG normal pattern.

8.- Analysis of the ECG pattern changes.

Some practical exercises possibilities with the base unit BIHBPC-UB and BIHBPC-SPO2:

9.- Interpretation of the SpO_2 normal pattern.

10.- Analysis of the SpO_2 pattern changes.

Some practical exercises possibilities with the base unit BIHBPC-UB and BIHBPC-ETCO2:

11.- Interpretation of the $etCO_2$ normal pattern.

12.- Analysis of the $etCO_2$ pattern changes.

Some practical exercises possibilities with the base unit BIHBPC-UB and BIHBPC-NIBP:

13.- Interpretation of the blood pressure normal pattern.

14.- Analysis of the blood pressure pattern changes.

Other possibilities to be done with this Unit:

15.- Many students view results simultaneously.

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

16.- 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.

17.- The Computer Control System with SCADA allows a real industrial simulation.

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

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

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

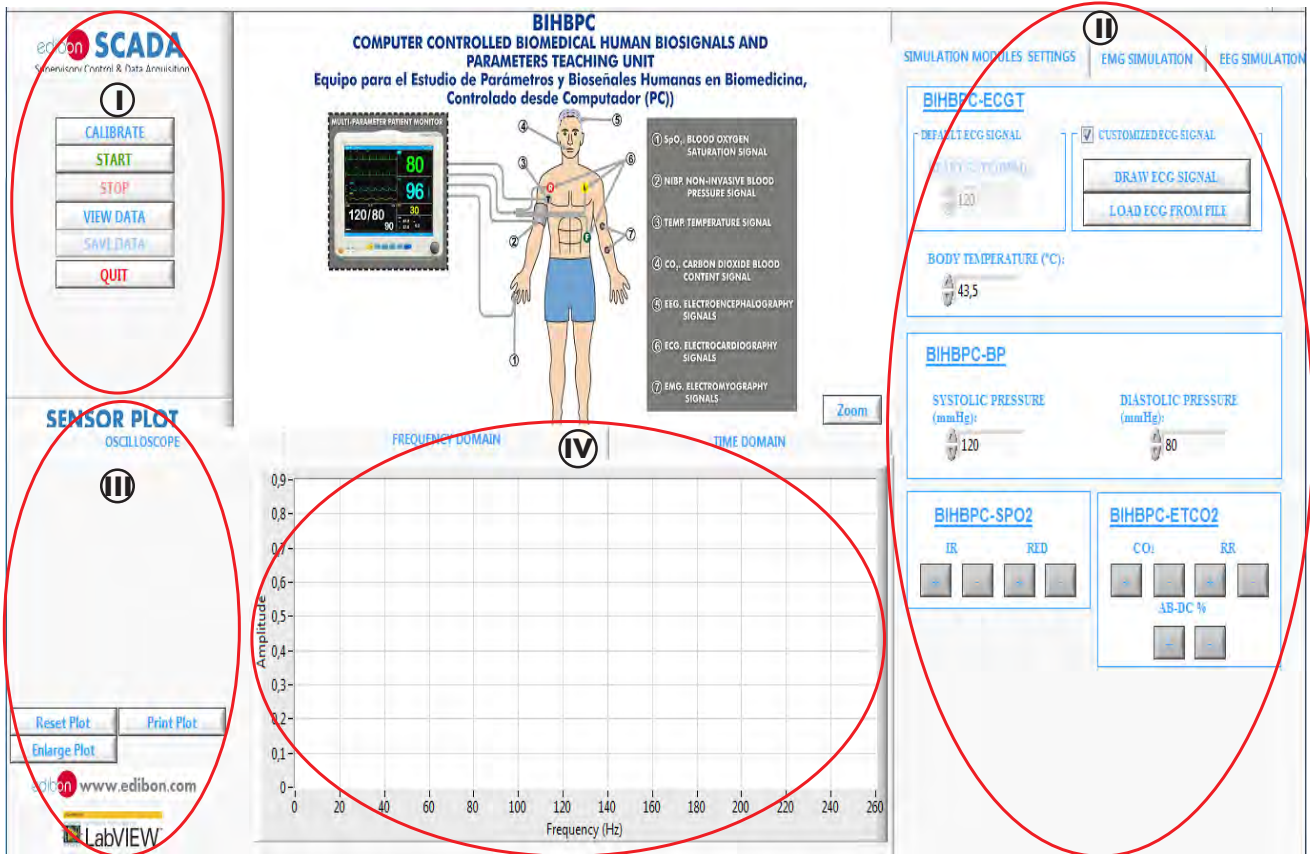- Several other exercises can be done and designed by the user.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

BIHBPC:

- Dimensions: 800 x 660 x 320 mm approx.

(33.46 x 19.68 x 31.50 inches approx.).

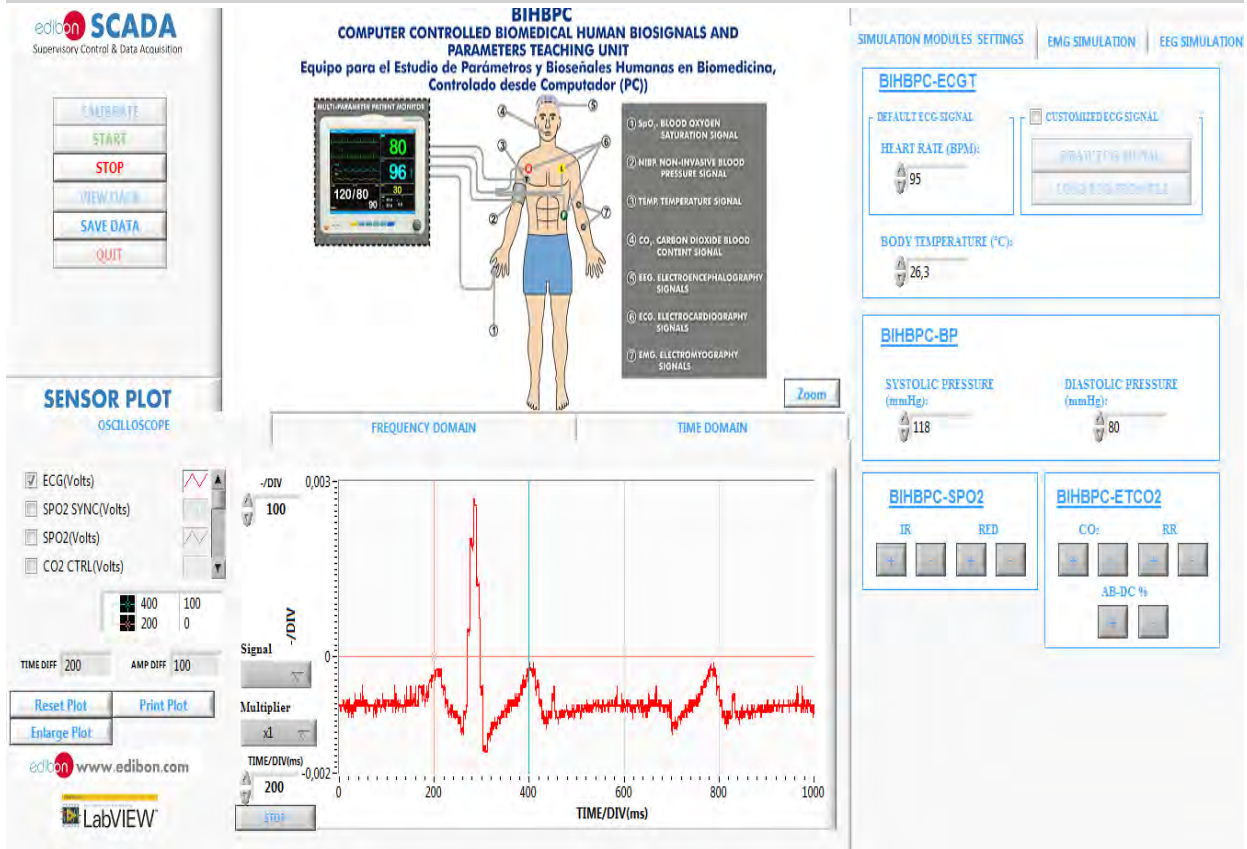- Weight: 15 Kg approx.

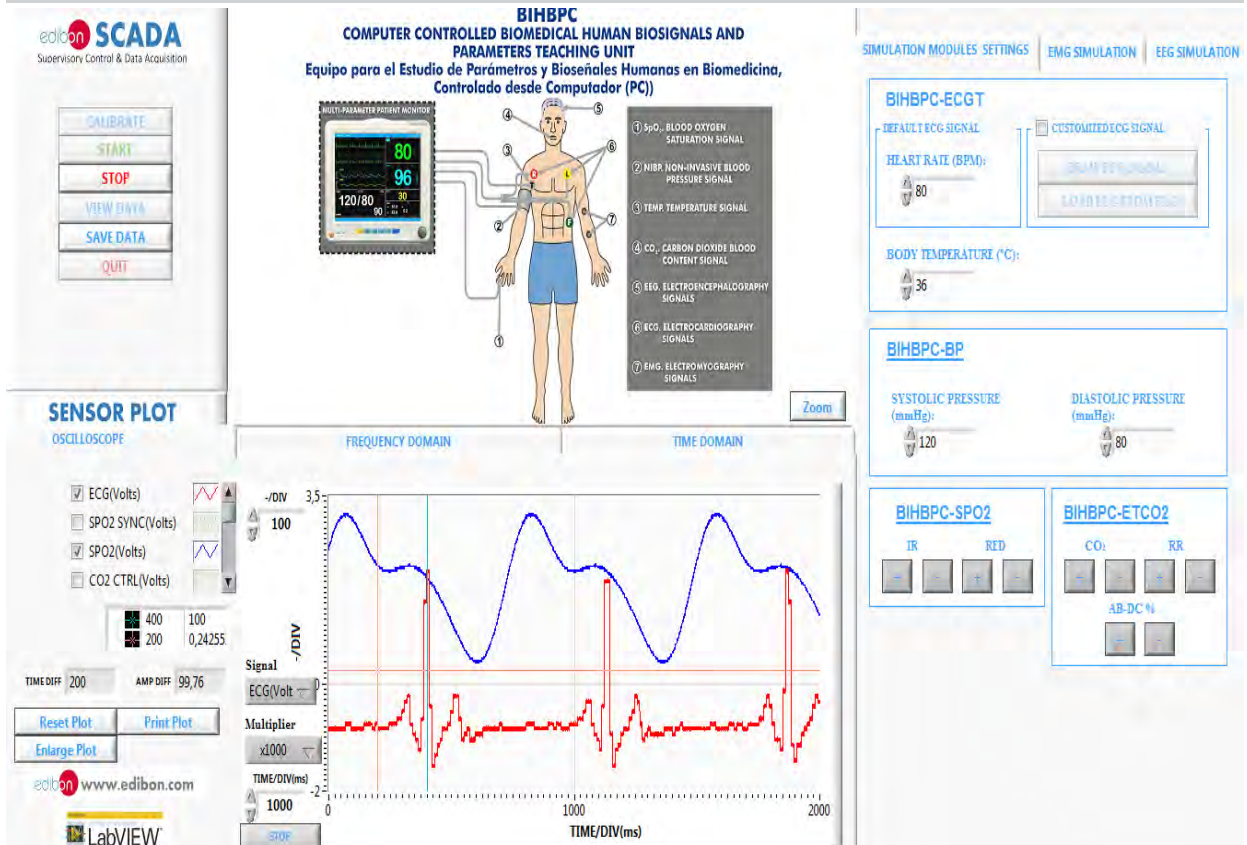(33 pounds approx.).

SCADA
Main screen

(I) Main software operation possibilities.

(II) **Configuration menu:** Modules settings: BIHBPC-ECGT, BIHBPC-NIBP, BIHBPC-SPO2 and BIHBPC-ETCO2.

(III) Channel selection and other plot parameters.

(IV) Real time graphics displays.

95 bpm heart rate ECG signal settings.

80 bpm ECG and SPO2 signals visualization.

120 mmHg systolic and 80 mmHg diastolic blood pressure settings.

SPO2 and SYNC SPO2 signals.

Additionally to the main items (1 to 5) described, we can offer, as optional, other items from 6 to 8.

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

⑥ **BIHBPC/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
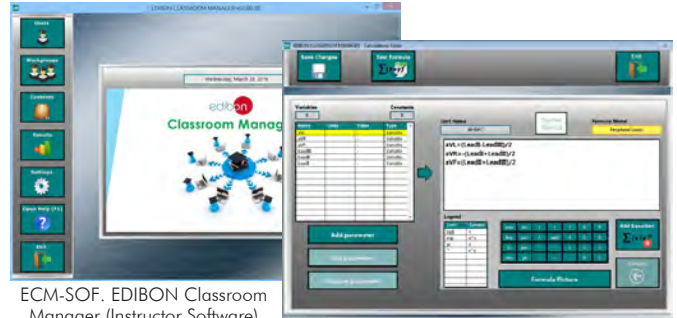
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen

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
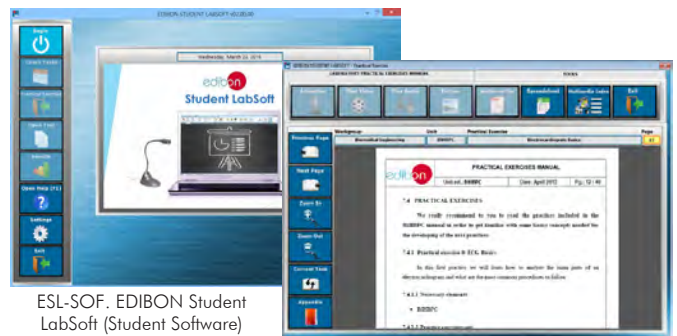
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen

EPE. EDIBON Practical Exercise Program Package Main Screen

ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

b) Multipost Expansions options

⑦ **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

MINI ESN.
EDIBON Mini Scada-Net System

1 UNIT= up to 30 STUDENTS can work simultaneously

Computer Controlled Biomedical Human Biosignals and Parameters Teaching Unit (BIHBPC)

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

Note: The MINI ESN system can be used with any EDIBON computer controlled unit

⑧ **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
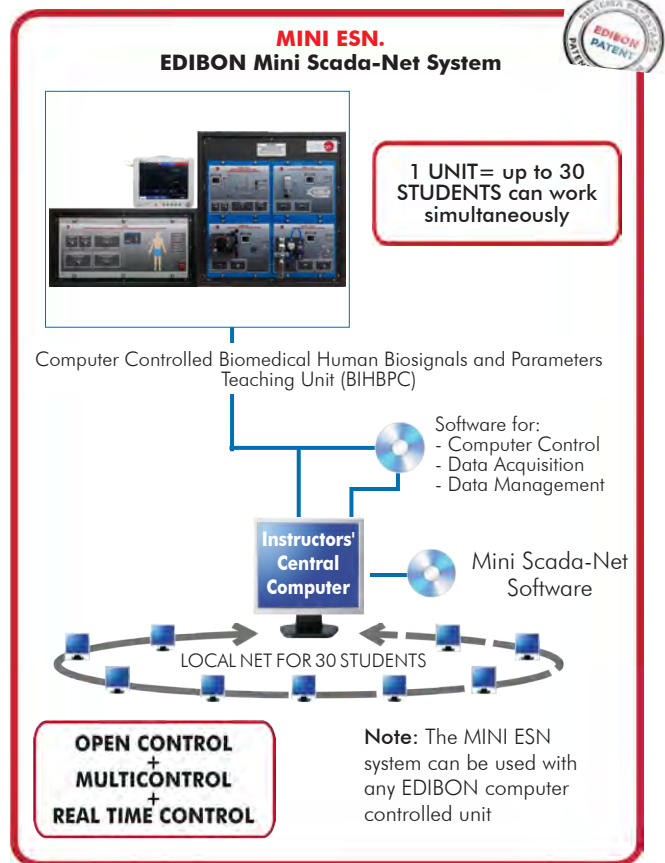
Main items (always included in the supply)

Minimum supply always includes:

① Unit: BIHBPC. Computer Controlled Biomedical Human Biosignals and Parameters Teaching Unit.

② DAB. Data Acquisition Board.

③ BIHBPC/CCSOF. Computer Control + Data Acquisition + Data Management Software.

④ Cables and Accessories, for normal operation.

⑤ Manuals.

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

Optional items (supplied under specific order)

a) Technical and Vocational Education configuration

⑥ BIHBPC/ICAI. Interactive Computer Aided Instruction Software System.

b) Multipost Expansions options

⑦ MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.

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①**BIHBPC. Unit:**
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  - The base unit (BIHBPC module) generates the control signals that will regulate the actuators of the rest of modules.
  - This module includes:
    - Connector for the BIHBPC-ECGT module (ECG).
    - Connector for the BIHBPC-ECGT module (Temp).
    - Connector for the BIHBPC-SPO2 module.
    - Connector for the BIHBPC-ETCO2 module.
    - Connector for the BIHBPC-NIBP module.
    - ON/OFF switch.
- BIHBPC-ECGT. Electrocardiography and Temperature Biomedical Module.
  - Three-lead EGC 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.
- BIHBPC-ETCO2. Capnography Biomedical Module.
  - Proportional valve:
    - Power supply: 0 - 10 V.
    - Maximum flow rate: 2.7 l/min.
    - Working pressure: 50 psi.
  - CO_2 bottles:
    - Amount of CO_2: 16 g.
- BIHBPC-NIBP. Non-Invasive Blood Pressure Biomedical Module.
  - 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.
- BIHBPC-SPO2. Oxygen Saturation Biomedical Module.
  - Pulxiometry sensor:
    - Red light wavelength: 658 - 664 nm.
    - Infrared light wavelength: 897 - 915 nm.
- BI-PM. Biosignals Patient Monitor.
  - Input voltage (CA): 100 - 240 V, 50Hz/60 Hz.
  - 12.1" TFT-LCD screen.
  - ECG monitoring:
    - Three-lead ECG input.
    - Selectable leads: I, II, III.
    - Heart rate range: 15 - 300 ppm (adults) and 15 - 350 ppm (children and newborns).
  - Respiratory monitoring:
    - Measuring method: thoracic impedance.
    - Selectable leads: I, II.
    - Respiratory impedance range: 0.5 - 3 Ω.
    - Monitoring range: 0 - 120 rpm (adults) and 0 - 150 rpm (children and newborns).
    - Resolution: 1 rpm.
  - SpO_2 monitoring:
    - Monitoring parameters: SpO_2 and pulse rate.
    - SpO_2 range: 1 - 100 %.
    - Pulse rate range: 25 - 250 ppm.
    - Resolution: 1 %.
    - Red light wavelength: 658 - 664 nm.
    - Infrared light wavelength: 897 - 915 nm.
  - NIBP monitoring:
    - Measuring method: automatic oscillometric method.
    - Working modes: manual, auto, STAT.
    - Monitoring range:
      - Systolic pressure: 41 - 270 mmHg (adults), 40 - 200 mmHg (children) and 40 - 135 mmHg (newborns).
      - Average pressure: 20 - 230 mmHg (adults), 20 - 165 mmHg (children) and 20 - 110 mmHg (newborns).
      - Diastolic pressure: 10 - 210 mmHg (adults), 10 - 150 mmHg (children) and 10 - 100 mmHg (newborns).
    - Resolution: 1 mmHg.
  - Temperature monitoring:
    - Range: 0 - 50 °C.
    - Measuring method: thermal resistance method.
    - Resolution: 1 °C.
  - CO_2 monitoring (only included if BIHBPC-ETCO2 module is purchased):
    - Type: lateral flow.
    - Measuring method: absorption of infrared radiation.
    - Preheating 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, LPDDDR3-1866, 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.
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  - 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 **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.

③ **BIHBPC/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.

④ **Cables and Accessories**, for normal operation.

⑤ **Manuals:**
  This unit is supplied with 7 manuals: Required Services, Assembly and Installation, 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 EEG normal pattern.

4.- Analysis of the EEG pattern changes.

5.- Interpretation of the EMG normal pattern.

6.- Analysis of the EMG pattern changes.

7.- Interpretation of the ECG normal pattern.

8.- Analysis of the ECG pattern changes.

Some practical exercises possibilities with the base unit BIHBPC-UB and BIHBPC-SPO2:

9.- Interpretation of the SpO_2 normal pattern.

10.- Analysis of the SpO_2 pattern changes.

Some practical exercises possibilities with the base unit BIHBPC-UB and BIHBPC-ETCO2:

11.- Interpretation of the $etCO_2$ normal pattern.

12.- Analysis of the $etCO_2$ pattern changes.

Some practical exercises possibilities with the base unit BIHBPC-UB and BIHBPC-NIBP:

13.- Interpretation of the blood pressure normal pattern.

14.- Analysis of the blood pressure pattern changes.

Other possibilities to be done with this Unit:

15.- Many students view results simultaneously.

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

16.- 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.

17.- The Computer Control System with SCADA allows a real industrial simulation.

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

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

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

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

⑥ **BIHBPC/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

⑦ **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.

REPRESENTATIVE: