Computer Controlled **Biomedical Ultrasound Thermal Effects Teaching Unit,** with SCADA

BIUTEC

EDIBON **SCADA** System

② Control Interface Box

③ Data Acquisition Board

④ Software for:
- Data Acquisition
- Data Management

⑤ Cables and Accessories

⑥ Manuals

Computer (not included in the supply)

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

① Unit: BIUTEC. Computer Controlled Biomedical Ultrasound Thermal Effects Teaching Unit

Key features:

➢ **Advanced Real-Time SCADA 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.**

➢ **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.**

For more information about Key Features, click here

www.edibon.com
⤷PRODUCTS
⤷14.-BIOMEDICAL ENGINEERING

INTRODUCTION

Currently, the ultrasound therapy is one of the most commonly used. This type of therapy is based on the use of high frequency sound waves to stimulate the tissue beneath the skin's surface. It is frequently used to ease pain, inflammation and muscular spasms, to quicken the healing process due to its dilator effect, to enhance the cell metabolic activity and for lithotripsy.

The Computer Controlled Biomedical Ultrasound Thermal Effects Teaching Unit, "BIUTEC", has been designed by EDIBON to study, in an experimental way, the ultrasound effects in biological tissues and acquire the necessary knowledge to design and validate therapeutic ultrasound units.

The unit is supplied with a set of practical exercises that will help the student to understand how to configure a therapeutic ultrasound device.
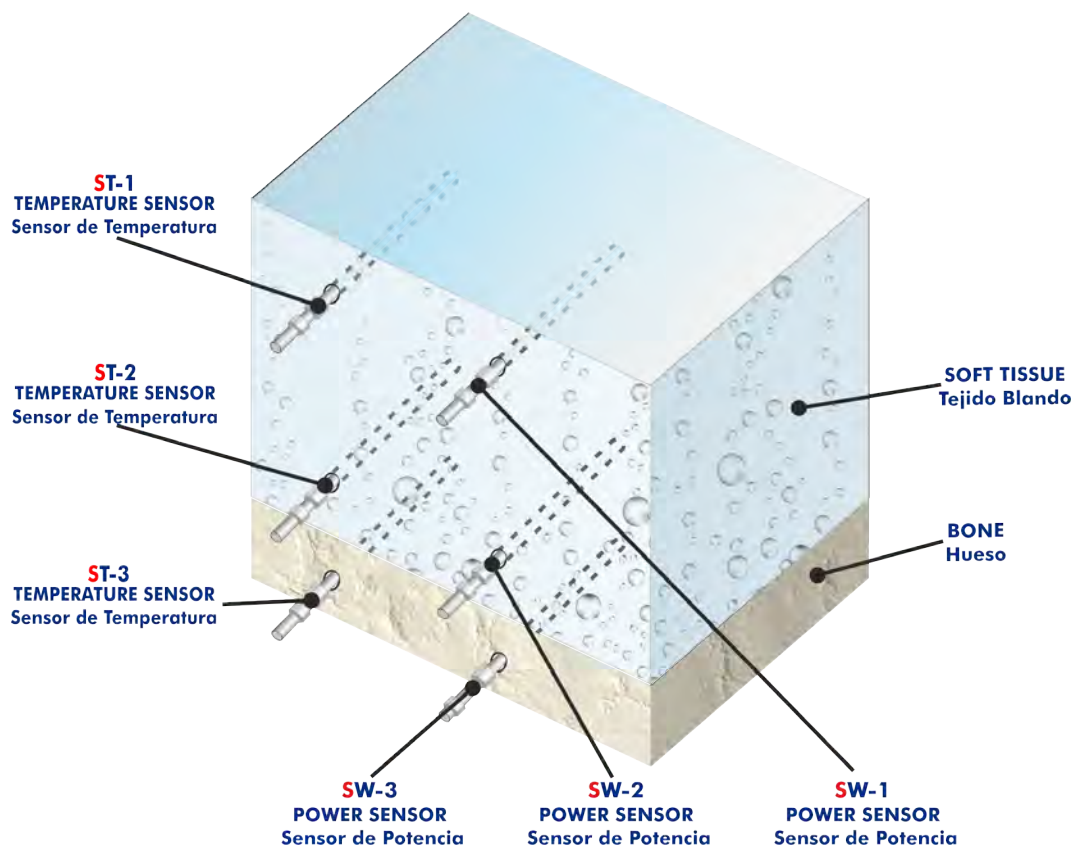
GENERAL DESCRIPTION

The Computer Controlled Biomedical Ultrasound Thermal Effects Teaching Unit, "BIUTEC", consists of a professional therapeutic ultrasound machine and a biological tissue simulator, composed of three different material layers with a thermocouple in each one. The simulator's materials have similar acoustic properties to the human skin, soft tissue and bone with the aim of study the thermal effect produced by ultrasound therapy. Besides, the unit is supplied with different applicators to study the effect of the emitting area.
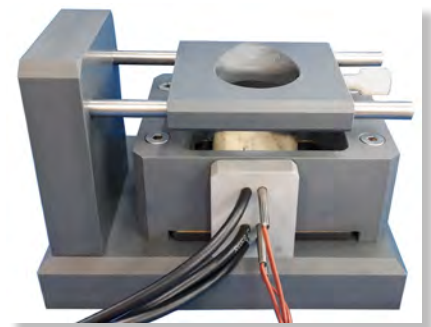
BIUTEC detail

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 + Data Acquisition and Data Management Software Packages, for controlling the process and all parameters involved in the process.

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

ST-1
TEMPERATURE SENSOR
Sensor de Temperatura

ST-2
TEMPERATURE SENSOR
Sensor de Temperatura

ST-3
TEMPERATURE SENSOR
Sensor de Temperatura

SOFT TISSUE
Tejido Blando

BONE
Hueso

SW-3
POWER SENSOR
Sensor de Potencia

SW-2
POWER SENSOR
Sensor de Potencia

SW-1
POWER SENSOR
Sensor de Potencia

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 **BIUTEC. Unit:**

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

Diagram in the front panel with distribution of the elements.

similar to the real one.

The unit includes:

  Therapeutic ultrasound machine:

  Backlit LCD display.

  Adjustable treatment time between 1 and 30 minutes.

  Operation frequency: 1 and 3 MHz.

  Duty cycle: 10 % - 100 %.

  Peak power in continuous mode: 2 W/cm².

  Peak power in pulsed mode: 3 W/cm².

  Risk class (93/42/CEE): IIB.

Four multi-frequency probes of 1 and 3 MHz with different emitting areas: 1, 3, 5 and 8 cm².

  Biological tissues' simulator:

  Three different materials with similar acoustic properties to skin, soft tissue and bone.

  Three thermocouples "type T".

  Three power sensors.

The complete unit includes as well:

  Advanced Real-Time SCADA 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.

  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.

Unit: BIUTEC

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

The Control Interface Box is part of the SCADA system.

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

All sensors, with their respective signals, are properly manipulated from -10V. to +10V. computer output.

Sensors connectors in the interface have different pines numbers (from 2 to 16), to avoid connection errors.

Single cable between the control interface box and computer.

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 sensors values and their responses are displayed on only one screen in the computer.

Shield and filtered signals to avoid external interferences.

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

BIUTEC/CIB

③ **DAB. Data Acquisition Board:**

The Data Acquisition board is part of the SCADA system.

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

Analog input:

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

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

Input range (V)=±10 V. Data transfers=DMA, interrupts, programmed I/0. DMA channels=6.

Analog output:

Number of **channels=2**. **Resolution=16 bits**, 1 in 65536.

Maximum output rate up to: 900 KS/s.

Output range(V)=±10 V. Data transfers=DMA, interrupts, programmed I/0.

Digital Input/Output:

Number of **channels=24 inputs/outputs**. D0 or DI Sample Clock frequency: 0 to 100 MHz.

Timing: Number of **Counter/timers=4**. Resolution: Counter/timers: 32 bits.

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

DAB

④ **BIUTEC/CCSOF. Data Acquisition + Data Management Software:**

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

Management, processing, comparison and storage of data.

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

Calibration system for the sensors involved in the process.

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

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

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

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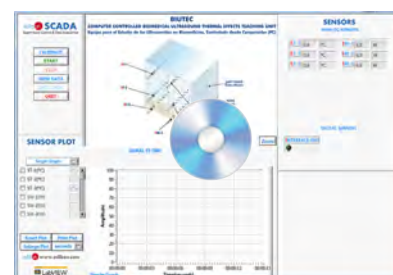
BIUTEC/CCSOF

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: BIUTEC + BIUTEC/CIB + DAB + BIUTEC/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.- Study of ultrasound basic principles and its therapeutic application.

2.- Understanding the different effects of ultrasound waves in the tissues.

3.- Testing the diathermic and mechanic effect of the ultrasound waves according to the different configurable parameters in an ultrasound therapy (frequency, emission type, treatment time, etc.).

4.- Understanding different application examples: cavitation, tendinitis, etc.

Additional practical possibilities:

5.- Sensor calibration.

Other possibilities to be done with this Unit:

6.- Many students view results simultaneously.

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

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

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

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

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

11.-Control of the BIUTEC unit process through the control interface box without the computer.

12.-Visualization of all the sensors values used in the BIUTEC unit process.

- 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.

DIMENSIONS AND WEIGHTS

BIUTEC:
  Unit:
    -Dimensions: 1000 x 700 x 500 mm approx.
                  (39.37 x 27.56 x 16.68 inches approx.)
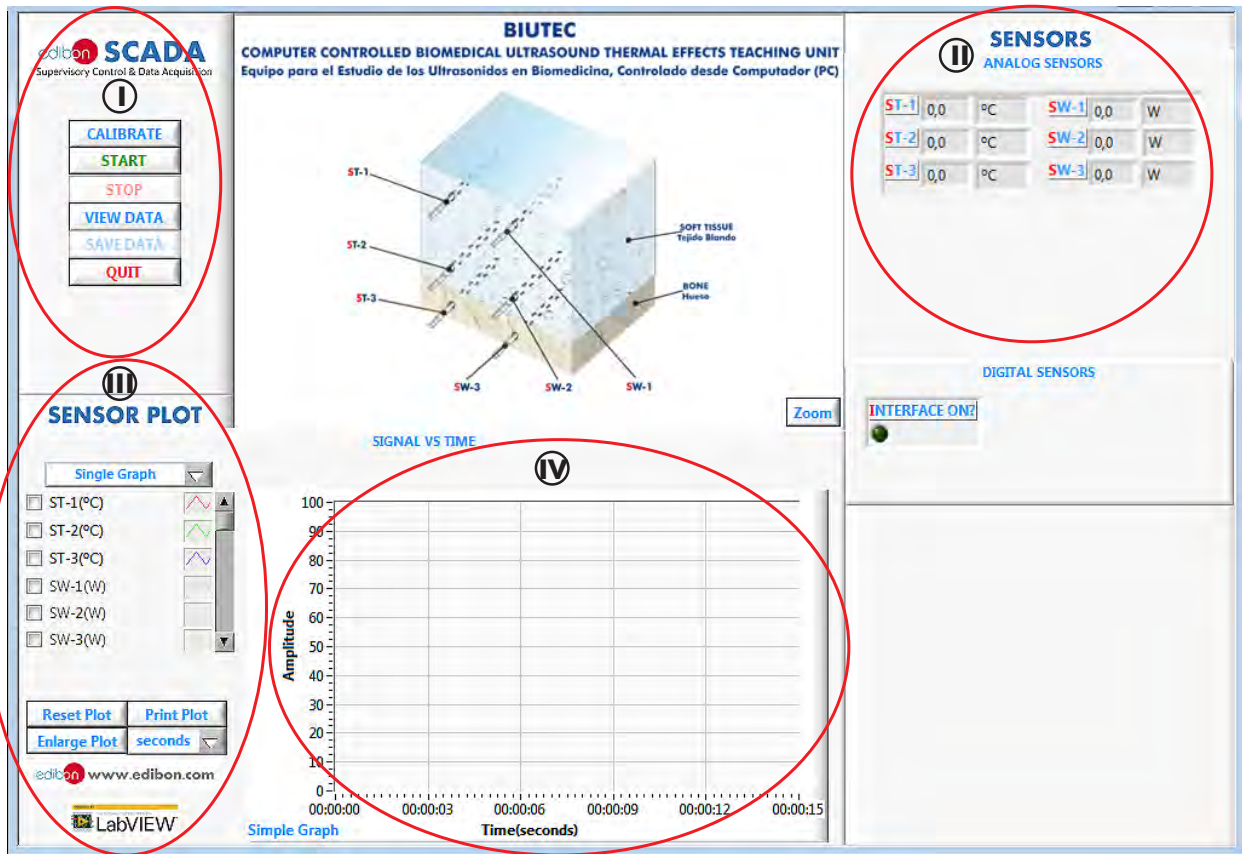   -Weight: 20 Kg approx.
                  (44 pounds approx.)
  Control-Interface Box:
    -Dimensions: 490 x 330 x 310 mm. approx.
                  (19.29 x 12.99 x 12.20 inches approx.)
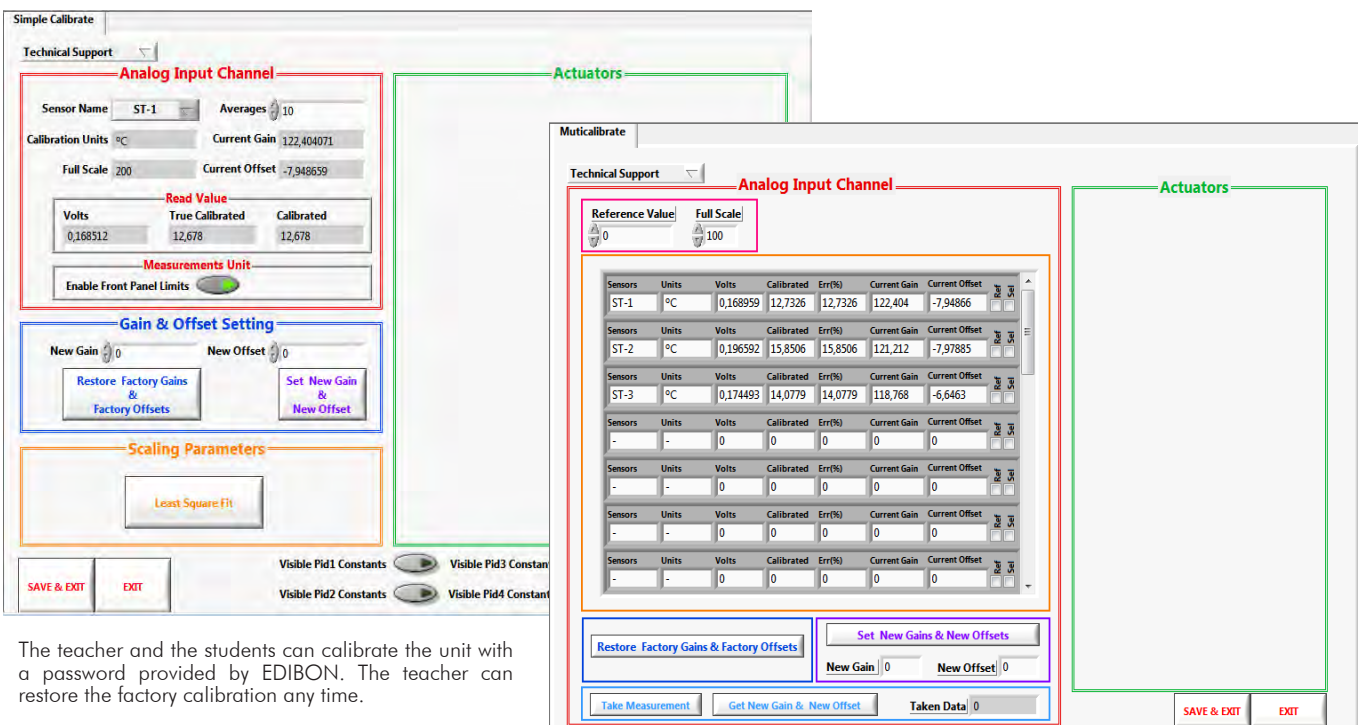   -Weight: 10 Kg. approx.
                  (22 pounds approx.)

SCADA
Main screen

① Main software operation possibilities.

② Sensors displays, real time values, and extra output parameters. **Sensors:** ST=Temperature sensor. SW=Power Sensor.

③ Channel selection and other plot parameters.
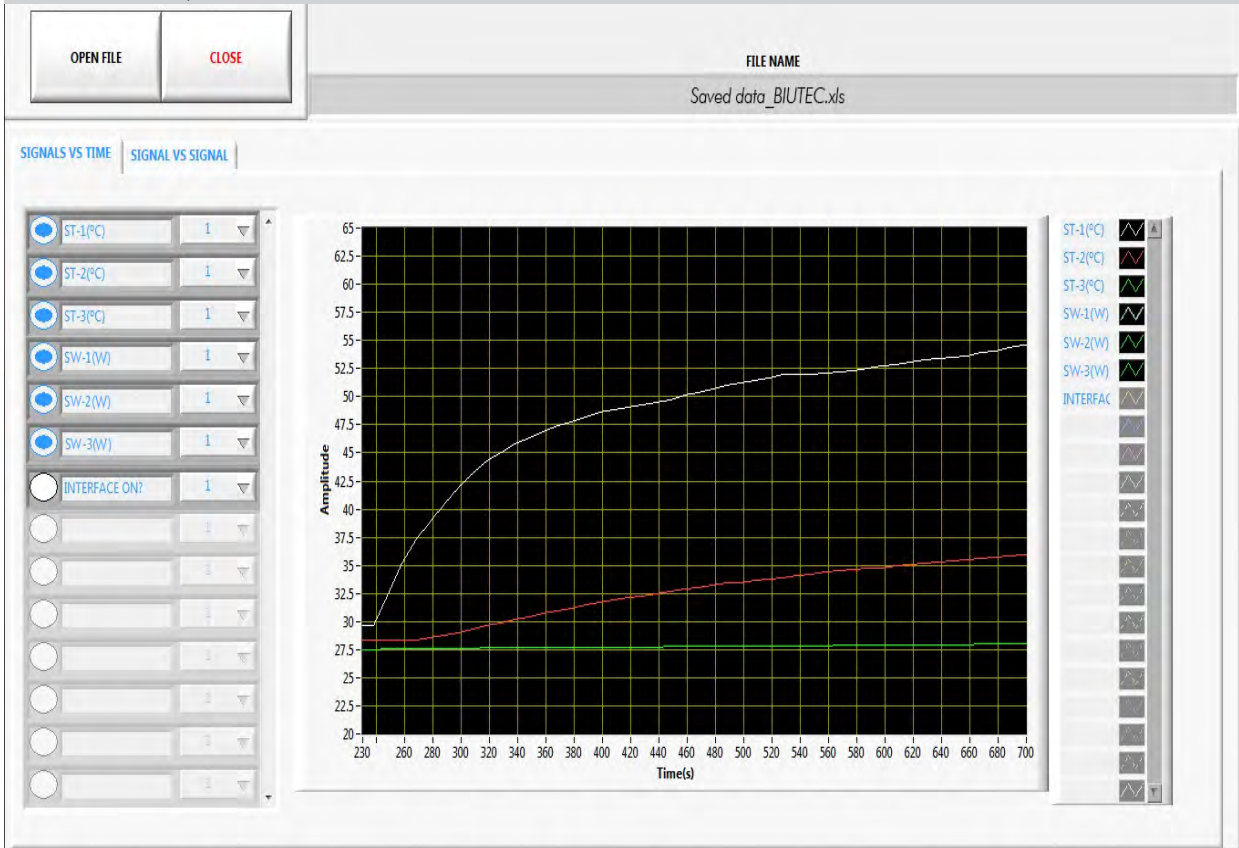
④ Real time graphics displays.

Software for Sensors Calibration
Example of screen

The teacher and the students can calibrate the unit with a password provided by EDIBON. The teacher can restore the factory calibration any time.

Visualization and representation of saved data.

OPEN FILE	CLOSE	FILE NAME
		Saved data_BIUTEC.xls

SIGNALS VS TIME | SIGNAL VS SIGNAL

ST-1(ºC)   1
ST-2(ºC)   1
ST-3(ºC)   1
SW-1(W)   1
SW-2(W)   1
SW-3(W)   1
INTERFACE ON?   1

ST-1(ºC)
ST-2(ºC)
ST-3(ºC)
SW-1(W)
SW-2(W)
SW-3(W)
INTERFAC

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 **BIUTEC/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).

Instructor Software

- 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.

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

ECAL. EDIBON Calculations Program Package - Formula Editor Screen

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.

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

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

- 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.
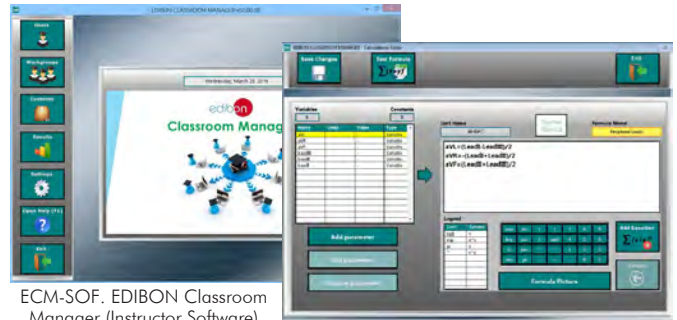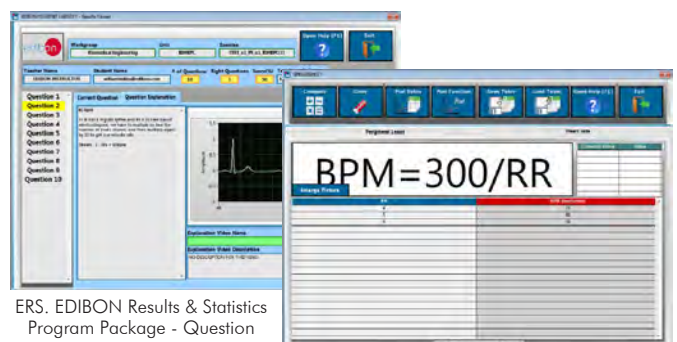
Student Software

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

EPE. EDIBON Practical Exercise Program Package Main Screen

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.

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/en/files/expansion/ICAI/catalog

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

MINI ESN.
EDIBON Mini Scada-Net System

1 UNIT= up to 30 STUDENTS can work simultaneously

Computer Controlled Biomedical Ultrasound Thermal Effects Teaching Unit (BIUTEC)

Control Interface Box

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

Instructors' Central Computer

Mini Scada-Net Software

LOCAL NET FOR 30 STUDENTS

OPEN CONTROL + MULTICONTROL + REAL TIME CONTROL + MULTI STUDENT POST

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

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
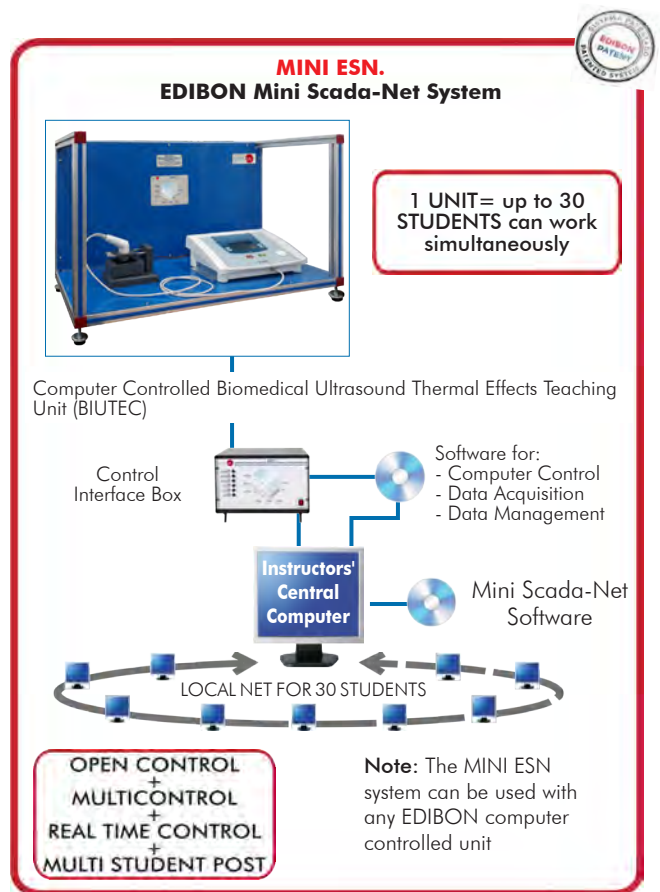
ORDER INFORMATION

Main items (always included in the supply)

Minimum supply always includes:

① Unit: BIUTEC. Computer Controlled Biomedical Ultrasound Thermal Effects Teaching Unit.

② BIUTEC/CIB. Control Interface Box.

③ DAB. Data Acquisition Board.

④ BIUTEC/CCSOF. Data Acquisition + Data Management Software.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals.

*IMPORTANT: Under BIUTEC 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 BIUTEC/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 BIUTEC. Unit:

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

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

The unit includes:

    Therapeutic ultrasound machine:

        Backlit LCD display.

        Adjustable treatment time between 1 and 30 minutes.

        Operation frequency: 1 and 3 MHz.

        Duty cycle: 10 % - 100 %.

        Peak power in continuous mode: 2 W/cm^2.

        Peak power in pulsed mode: 3 W/cm^2.

        Risk class (93/42/CEE): IIB.

    Four multi-frequency probes of 1 and 3 MHz with different emitting areas: 1, 3, 5 and 8 cm^2.

    Biological tissues' simulator:

        Three different materials with similar acoustic properties to skin, soft tissue and bone.

        Three thermocouples "type T".

        Three power sensors.

The complete unit includes as well:

    Advanced Real-Time SCADA based on LabVIEW.

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    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.

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

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    Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user's knowledge and progress reached.

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The Control Interface Box is part of the SCADA system.

Control interface box with process diagram in the front panel.

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.

Shield and filtered signals to avoid external interferences.

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.

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⑤ Cables and Accessories, for normal operation.

⑥ Manuals:

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Exercises and Practical Possibilities to be done with the Main Items

1.- Study of ultrasound basic principles and its therapeutic application.

2.- Understanding the different effects of ultrasound waves in the tissues.

3.- Testing the diathermic and mechanic effect of the ultrasound waves according to the different configurable parameters in an ultrasound therapy (frequency, emission type, treatment time, etc.).

4.- Understanding different application examples: cavitation, tendinitis, etc.

Additional practical possibilities:

5.- Sensor calibration.

Other possibilities to be done with this Unit:

6.- Many students view results simultaneously.

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

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

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

12.- Control of the BIUTEC unit process through the control interface box without the computer.

11.- Visualization of all the sensors values used in the BIUTEC unit process.

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

a) Technical and Vocational Education configuration

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

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- 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.

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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.

REPRESENTATIVE: