



CATALOGUE No. 34-B

**BIOMEDICAL  
EQUIPMENT  
MAINTENANCE  
TECHNICIAN**





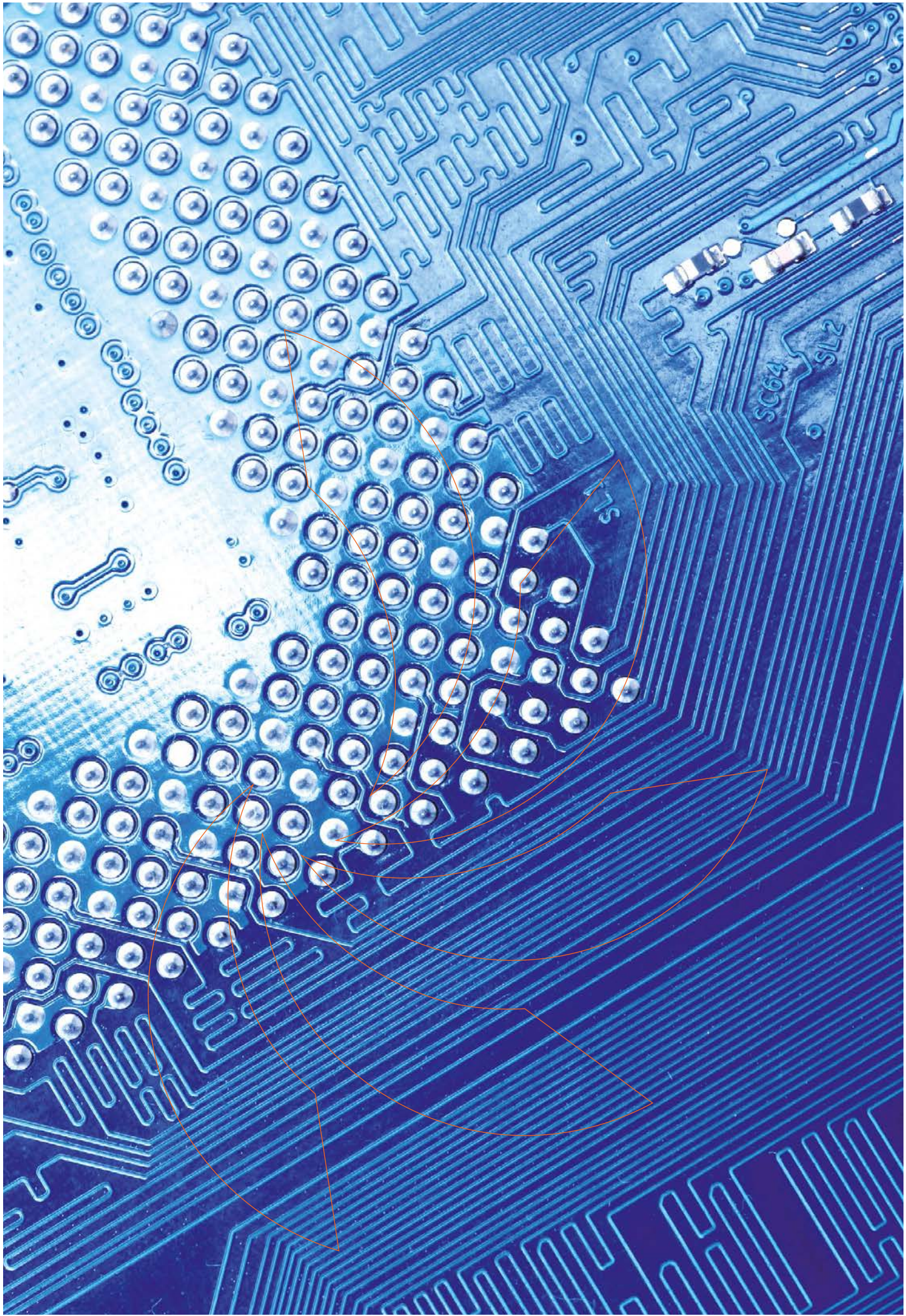
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**BIOMEDICAL  
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MAINTENANCE  
TECHNICIAN**

**Biomedical  
Equipment  
Maintenance  
Technician**

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34B-E  
Rel. M21







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# GENERAL INTRODUCTION

**ELETTRONICA VENETA S.p.A.** has been designing and manufacturing educational equipment since 1963. This equipment, covering the different fields of technology, fulfils two important educational objectives:

- to facilitate the learning process of the student by means of real systems which illustrate practically the important aspects of the theory learned in the classroom.
- to simplify the work of the teacher enabling the demonstration of the real, practical applications of the theory learned.

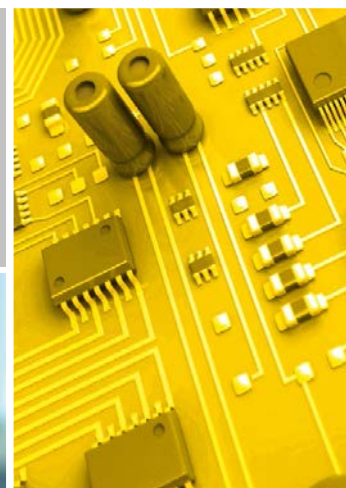
Increasing the efficiency of the didactic process improves and simplifies the integration of young students into the world of employment and justifies the material and human investments made in schools throughout the world.

**ELETTRONICA VENETA S.p.A.** operates on an international level and takes into consideration the training programmes and cultures of each specific country. In order to meet different requirements, we offer flexible systems which ensure maximum compliance with the latest technologies, technological advances and the professional profile requirements of local industry.

The proposed laboratories and training equipment are suitable for regular school education as well as ongoing post-diploma training courses and professional re-qualification.

Our training equipment covers most of the technological sectors included in the training programmes of vocational schools, technical institutes and universities, both national and international.

**ELETTRONICA VENETA S.p.A.** headquarters is located in the green fields of the Veneto region, not far from Venice, and constitute a centre for equipment design and development suited to the training needs of all professional and technical profiles. The modern premises integrates R&D laboratories, a production plant and a fully equipped teacher training centre.



The integration of these efficient training systems into local school structures ensures high-quality, state-of-the-art training programmes which meet the diverse professional expectations of the student and the technological requirements of industry and research within their specific local contexts.

The ISO 9001 (Quality System Certification) obtained in 1998 and updated in application of the latest edition of the International Standard, is further testament to the quality-driven organisation of **ELETTRONICA VENETA S.p.A.** aimed at providing top standard equipment, training and service.

# PRESENTATION

The important technological development of electronics in recent years has led to a large scale diffusion of a new concept of systems including more and more sophisticated electronic components.

Even in the medical field the evolution of technology has introduced various innovations on the equipment used in the treatment methods of different types of pathologies.

At present, more and more sophisticated equipment and techniques are applied in **MEDICINE** to facilitate both diagnosis and therapy. The recording of physiological electrical signals (EEG, ECG, EMG...) or the diagnostic method through images (CAT...) that reproduces body sections of patients with tridimensional graphic processing, detect pathologies that would not be recognized by traditional instruments, showing thus to be a reliable and essential instrument for the doctor.

This situation leads to the need of new professionals with an adequate education in basic electronics and a good knowledge of applications in specific sectors such as biomedical equipment. The in-depth knowledge of a biomedical apparatus is necessary to carry out the correct installation, safety check, control of performance and routine/extraordinary maintenance; consequently this requires a basic theoretical-practical training in the electronic field.

Consequently, the issue of basic training of technicians for the maintenance of biomedical systems has a strategic importance for the medical centres using electromedical equipment.

After a in-depth international survey and thanks to an experience of many years in the fields of electronics and automation, **Elettronica Veneta S.p.A.**, has developed a specific training programme for the "Biomedical" sector to train technicians with an adequate and versatile preparation.

The range of equipment produced by **ELETTRONICA VENETA S.p.A.** for the creation of Laboratories for maintenance technicians of **BIOMEDICAL** equipment is divided into two sections:

- **INTERACTIVE PRACTICAL LABORATORY FOR STUDYING BIOMEDICAL ELECTRONICS**
  - I.P.E.S. system with modules of Electronics and Biomedical Equipment
- **PROFESSIONAL INSTRUMENTS AND ELECTRICAL SAFETY DEVICES FOR MAINTENANCE OF BIOMEDICAL EQUIPMENT**
  - Instruments for Pathophysiology, Analysis and Rehabilitation
  - Equipment to study electrical safety devices

The different topics are organized to build an educational programme including both theoretical introduction and practical experiments:

- study of **BASIC ELECTRONICS** as introduction to biomedical applications (optional preliminary step) and basic training in the **ELECTROMEDICAL Sector**
- **VOCATIONAL TRAINING** with some examples of **instruments** in the sectors of Pathophysiology and Diagnosis, Rehabilitation, Analysis Laboratory for the maintenance of biomedical equipment.

The study of basic electronics and of the biomedical sector is dealt with the setting of an **Electromedical Laboratory** consisting of some stand-alone workstations for students and one for the teacher. The basic parts of the system are indicated here below:

- Individual control unit for managing the interaction between user and automated control system
- Testing modules of electronics and electromedical equipment
- Personal computer used by students for study and guide to exercises, and by teacher to collect and process the results

Vocational training aims at giving a set of knowledges and skills sufficient:

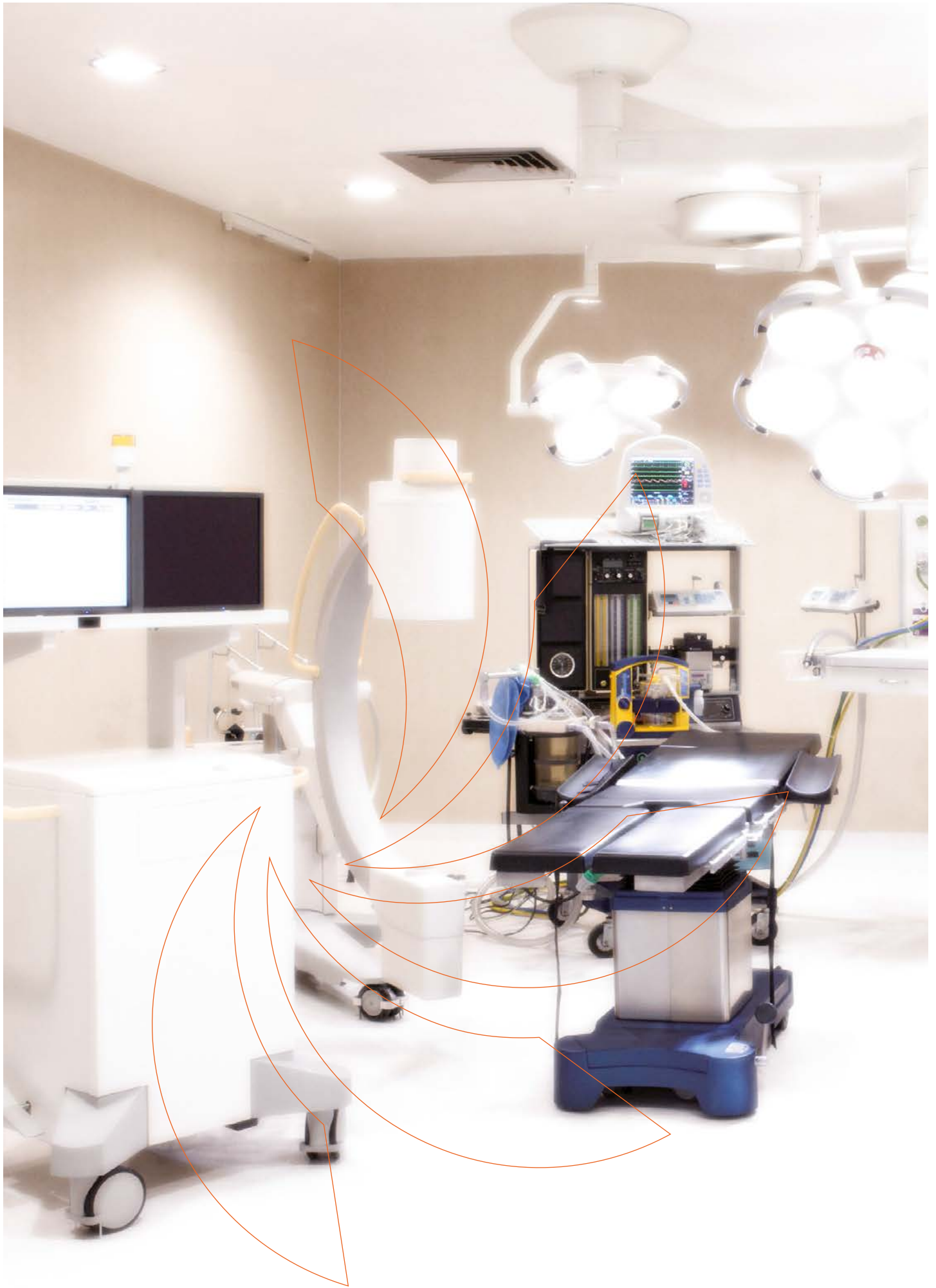
- to know the general operation of existing equipment
- to install, calibrate and repair the instruments that do not require the supplier's intervention
- to maintain and test the electrical safety of the equipment
- to cooperate with medical personnel both in everyday use and in the technical assessment of new required equipment





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# 34-E



## INTERACTIVE PRACTICAL LABORATORY FOR STUDYING BIOMEDICAL ELECTRONICS - I.P.E.S. SYSTEM

PL

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**Objective:**

- Basic training concerning BIOMEDICAL EQUIPMENT

**Equipment:**

- Computerized workstation with Set of Testing Modules
- Teaching with Interactive Multimedia Lessons
- Entering variations of circuit parameters and non destructive faults
- Specific software for Electricity, Electronics and of Biomedical Equipment

# I.P.E.S. SYSTEM

## INTERACTIVE PRACTICAL LABORATORY



### INTRODUCTION

Training skilled engineers being able to solve installation and servicing problems of electronic equipment is a growing demand in training sector. This type of training also enables to meet the requirement of a quick staff retraining and refreshment.

IPES system has been conceived expressly to meet these requirements: in fact it enables to carry out theoretical-practical-experimental courses in very short times, manually or with the aid of a computer. Courses will start from the study of basic electronics and then they will deal with other technological sectors depending on this subject: autotronics, industrial electronics, telecommunications, biomedical, consumer electronics, hydronics, etc...

### THE MAIN FUNCTIONS OF THIS SYSTEM ARE:

- shorter training times
- self-learning via theoretical study and experimental exercises
- updating of technological outlines analyzed with new modules which are under continuous development to keep in step with technological evolution
- exercises using components, devices and electronic circuits corresponding to those used in real industrial world, providing an ideal base for understanding theory
- variation of circuit parameters controlled manually or via computer for an inductive learning method
- insertion of faults into circuits and troubleshooting methods

### MAIN ADVANTAGES ENSURED BY THIS TYPE OF LEARNING:

- learning phases can be carried out individually or in a laboratory environment
- self-assessment of learning level in real time, in both cases, or assessment of the learning level of any user of laboratory, comparing this evaluation with previous results
- training courses with customized contents and duration can be set up extremely quickly and simply, to meet any requirement. These courses can schedule different admittance and final levels depending on students' previous training and the targets to be attained
- using networked PCs enables to extend this system even to users who are not necessarily in the same place (REMOTE TRAINING AND LEARNING)



# I.P.E.S. INTERACTIVE WORKSTATION

**BIOMEDICAL SIGNAL GENERATOR/ACQUISITION  
AND FAULT INSERTION UNIT mod. GAU/EV**

**C.B.T. INTERACTIVE  
MULTIMEDIA SOFTWARE**  
mod. SWD-MCMXX/EV  
mod. SWBB-BX/EV



**POWER SUPPLY**  
mod. PS1-PSU/EV

**EXPERIMENT BOARD**  
mod. MCMXX/EV  
mod. EB-XX/EV

The Laboratory consists of various interactive workstations connected via:

- **LOCAL DATA NETWORK**
- **AUDIO-VIDEO-KEYBOARD-MOUSE EXCHANGE software**
- **CLASS CONTROL Software mod. SW-X/EV**

The specific testing module is connected with Biomedical signal generator/acquisition and fault insertion unit mod. GAU/EV which is linked with Personal Computer via a USB connection.

This module includes the schematic diagrams of circuits, the test points and jumpers for circuit modification, on its upper part, whereas its lower part consists of a rigid box for support and protection.

It is connected with the fault insertion unit and with power supply mod. PS1-PSU/EV which outputs all the necessary voltages for the operation.

A set of interactive lessons that can be taught with the aid of Personal Computer is available in each module. They can guide students either in theoretical section and during the development of the experimental part on module circuits with insertion of faults and functional changes, unit mod. GAU/EV.

The components of this laboratory and a complete list of the modules with the related topics covering all sectors of electronics dealt with in I.P.E.S. system, are indicated here below:

- **INFRASTRUCTURE**
- **MODULES FOR STUDYING BIOMEDICAL EQUIPMENT**



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## 34-B



# INFRASTRUCTURE

<b>POWER SUPPLY</b>	MOD. PS1-PSU/EV	PL 7
<b>MODULE HOLDER BOX</b>	MOD. BOX/EV	PL 7
<b>BIOMEDICAL SIGNAL GENERATOR/ACQUISITION AND FAULT INSERTION UNIT</b>	MOD. GAU/EV	PL 8
<b>C.B.T. INTERACTIVE MULTIMEDIA SOFTWARE</b>	MOD. SW-D-MCMXX/EV MOD. SWBB-BX/EV	PL 10
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<b>EL.VE. EDUCATIONAL AUTHOR SOFTWARE</b>		PL 14



# I.P.E.S. SYSTEM INFRASTRUCTURE



## POWER SUPPLY mod. PS1-PSU/EV



This power supply unit is housed in a case properly designed and it forms an ergonomic assembly with the module holder Box. Terminals and LEDs for extracting and displaying output voltages are available on the silk-screen-printed fore plate. The outputs of these voltages are also available on DIN connectors set on the right side of the power supply.

This power supply is universal because it can power all the types of modules manufactured by Elettronica Veneta S.p.A.

### *The output voltages are:*

#### **OUTPUT S1: +30 Vcc – 4A**

Rectified and filtered voltage, protected by fuse.  
LED for signalling voltage availability.

#### **OUTPUT S2: 24 Vca – 4 A**

Voltage protected by fuse. LED for signalling voltage availability.

#### **OUTPUT S3: +5 Vcc – 2A**

#### **OUTPUT S4: +12 Vcc – 2A, -12 Vcc – 1A**

Regulated voltages, electronically protected against short-circuits and overloads.  
LED for signalling voltage availability.

#### **OUTPUT S5: 1.3 Vcc ÷ 24 Vcc, 1A**

Regulated voltage, electronically protected against short-circuits and overloads.

LED for signalling voltage availability.

#### **OUTPUT ON DIN CONNECTOR: 24 Vca – 0 – 24 Vca, 0.5A**

Voltage protected by fuse.

(Outputs S1 and S2 supply 4 A, individually, and 2 A, when used simultaneously)

**Power supply:** 230 Vca 50 Hz single-phase - 200 VA  
(Other voltage and frequency under request)

**Dimensions:** 415 x 185 x 195 mm

**Weight:** 8 kg

## MODULE HOLDER BOX mod. BOX/EV



Optional box for housing the testing modules. Modules are fixed by a plug-in system.

- **Dimensions and weight: 415x400x110 mm - 3 Kg**

## BIOMEDICAL SIGNAL GENERATOR/ACQUISITION AND FAULT INSERTION UNIT

mod. GAU/EV



The **SIGNAL GENERATOR/ACQUISITION and FAULT INSERTION UNIT mod. GAU/EV** is an essential element enabling to use biomedical modules.

It ensures the following functions:

1. **production of physiological signals such as ECG, EEG and EMG, required by module EB-B1/EV**
2. **Acquisition and display of the signals detected and processed by module EB-B1/EV**
3. **Interface with module EB-B2/EV (Printer)**
4. **USB interface with the Personal Computer**
5. **Fault insertion or circuit variations in biomedical modules**

This unit will output electrical signals with waveforms equivalent to the biological ones (ECG, EMG and EEG) that are properly processed and normalized to replace an actual patient.

The output signals enable to perform the experiments with modules more rapidly; they also solve the problem of the noises appearing during actual signal acquisition (ARTEFACTS), which should otherwise be identified and removed.

### 1. PRODUCTION OF PHYSIOLOGICAL AND CONTROL SIGNALS FOR MODULE EB-B1/EV

This section of unit GAU/EV enables to produce electrical signals with waveforms equivalent to the biological ones (ECG, EMG and EEG) that are properly processed and normalized to replace an actual patient. It is used in tests requiring the production of simulated signals coming from the human body. This section can output the three following types of signals:

- Electrocardiogram ECG signal
- Electroencephalogram EEG signal
- Electromyogram EMG signal

Using a Personal Computer via USB interface enables to load the desired specific biological waveform each time.

This function shows to be flexible and useful for the fact that the biological waveform can be loaded from the Personal Computer, and each waveform can be specifically plotted by a simple text editor. Thus waveforms customized with anomalies (ECG with cardiac anomaly, anomalous tracing...) can be output.

This production function of the unit is used for all exercises with acquisition, processing and display of biomedical signals.

#### SIGNALS:

The biological waveforms that can be selected are: ECG1, ECG2, ECG3, EEG, EMG, US1, US2 and US3 (waveforms created by the user).

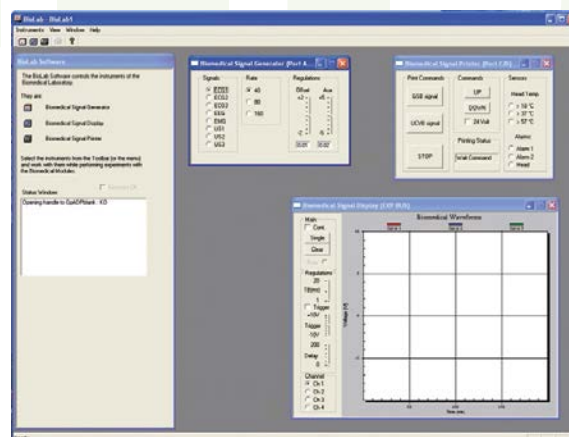
**FREQUENCY:** 40 / 80 / 160 events/min

**AUX:** to adjust the value of AUX input of the generator; each signal can be adjusted between -5V and +5V.

Every waveform other than the three or more main forms can be included in the generator as a file by the mere definition of its graphical form through points at regular intervals (time samples), either for standard waveforms and for those with pathologies.

- EEG signal (output 0.1mV)
- EMG signal (output 0.4mV)
- AUXILIARY signal for adjustment
- Pathological waveforms (output 0.1mV)

#### SIGNAL GENERATOR SOFTWARE



The controls of software instruments are the following:

- **Selection of signal to be output:** ECG1, ECG2, ECG3, EEG, EMG, US1, US2, US3
- **Frequency:** 40,80,160 Hz
- **Offset of displayed waveform**

## 2. ACQUISITION AND DISPLAY OF THE SIGNALS DETECTED BY MODULE EB-B1/EV

This section of unit GAU/EV acquires and displays the biomedical data to perform all experiments requiring to display signals such as ECG/EEG/EMG on a monitor.

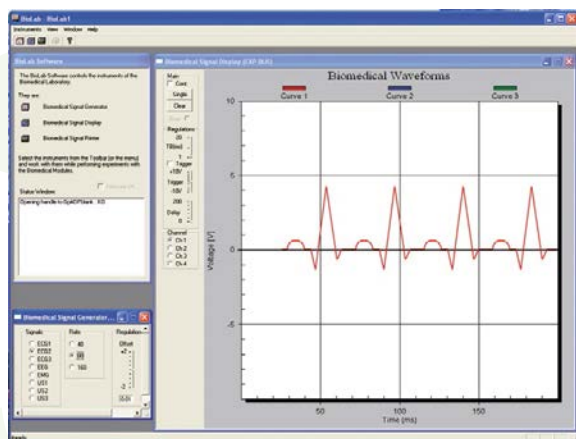
The low frequencies of this type of signals would require a digital oscilloscope with storage.

USB interface with Personal Computer enables to display the biomedical signals acquired from the testing modules after the A/D conversion.

### Main characteristics:

- Analog inputs (-10/10V), conv.12 bit A/D conv.
- Analog outputs (-10/10V), conv.8 bit D/A conv.
- ON/OFF outputs
- ON/OFF inputs

### SOFTWARE FOR DISPLAY OF BIOMEDICAL SIGNALS



The controls of software instruments are the following:

- **CONT:** for continuous display of signal. The signal is acquired and displayed. Every new display replaces the previous one.
- **SING:** to control the display of each signal. The signal is acquired and displayed. The previous signal is not canceled. Different colors are used to distinguish the subsequent displays.
- **CANCEL:** to cancel (eraser icon) the signal displayed by the instrument.
- **TRIG:** to enable or disable the trigger. It is possible to specify a value delay (Del cursor) referred to the trigger moment when acquisition starts.
- **STP:** to set the acquisition start and therefore the duration of the signal having to be displayed.
- **TRG:** to set the trigger value.
- **DEL:** to set a delay after trigger level where the signal acquisition should be made.

Moreover this section includes Analog Outputs and ON/OFF Inputs/Outputs so that unit GAU/EV can also be used in other applications.

(Only analog inputs are used in the experiments with biomedical modules).

## 3. INTERFACE WITH MODULE EB-B2/EV (PRINTER)

This section of unit GAU/EV supplies the interface for the connection of module EB-B2/EV used to print the biomedical signals detected during the experiments (ECG/EEG/EMG).

## 4. USB INTERFACE WITH PERSONAL COMPUTER

The unit is connected to a Personal Computer via USB 2.0 connection.

## 5. FAULT INSERTION OR CIRCUIT VARIATIONS IN BIOMEDICAL MODULES

The testing modules for the study of biomedical signals are connected to the generator/acquisition unit via a 37-pin connector. The connection of this unit to the Personal Computer (via USB connection) enables to interact with all testing modules.

Software SWBB-BX/EV enables the automatic insertion of circuit variations and of fault during the development of computer-assisted lessons.

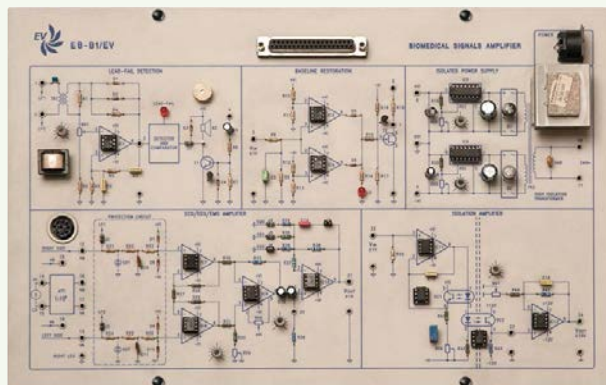


## EXPERIMENT BOARD

Testing modules are the main devices of IPES system; they enable students to carry out all the programmed exercises including the insertion of faults and variations of circuit parameters, for an efficient educational worthiness.

These modules include a set of circuits already assembled and they are connected with the Personal Computer via interface mod. GAU/EV. These testing modules are directly powered by unit mod. PS1-PSU/EV via a unique connector.

Each module is supplied with a handbook which guides students in theoretical study, in practical tests and in troubleshooting.



## C.B.T. INTERACTIVE MULTIMEDIA SOFTWARE Mod. SW-D-MCMXX/EV Mod. SWBB-BX/EV

It consists of a set of lessons for the modules of Electronics MCMXX/EV and for the modules of Biomedical Equipment EB-BX/EV; each set of lessons includes:

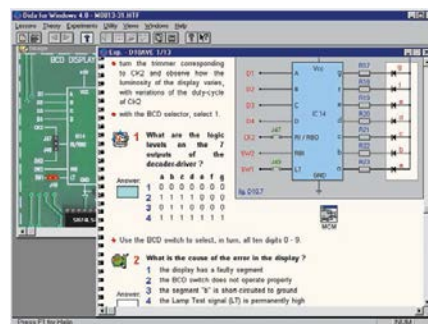
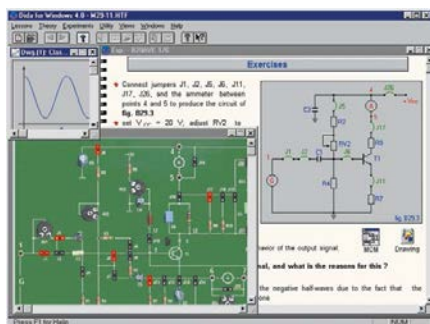
- a series of screens with theoretical explanation of the topic under examination, and a sequence of simulations;
- a guide to exercises that shows circuits, questions, practical exercises, automatic insertion of faults and variations of circuit parameters.

Using this software, students can study and carry out practical tests by themselves, without any additional literature.

The structure of this software, designed for use in Windows environment, is provided with a multimedia graphical interface enabling an easier use of the software, as well as the use of high-definition images and charts with hypertext organization of the topics under examination; before passing to the experimental section students are favoured in understanding concepts by proper simulations included in the theoretical section.

In the subsequent practical section, students will simply select the various functions and answer to the questions appearing in the section concerning exercises, by using the mouse; they can also draw up reports or produce documentary information on laboratory tests that are assessed by the teacher.

All the results are stored in students' PCs, in self-learning mode, and they are automatically sent to teacher's workstation, in laboratory mode.



## LOCAL NETWORK

Data can be exchanged via a Local Area Network.

This network consists of a board installed in each PC, of a connecting cable and of the Control Software. It enables to share teacher's archives and/or programs, to use peripheral units connected with teacher's PC and to gather the data of each student automatically.

The network enables the students:

- to use files and data available in teacher's PC
- to use peripheral units connected with teacher's workstation

Using these devices and DATA ACQUISITION/PROCESSING software mod. SW-X/EV the teacher can select the lessons for students and gather their results automatically at the end.

Each networked PC must be equipped with:

- Ethernet card with connection via coaxial cable
- peer-to-peer connection software for sharing archives and peripheral units. The necessary requirements are the simple sharing of teacher's hard disk for class general archives, either when the various lessons concerning the different modules are distributed to the class, and used by students, and when the results attained by various students belonging to different classes are gathered.

## The characteristics of the system are indicated here below:

- teacher has the full control of students' Personal Computers without leaving his/her desk;
- operations can be selected very easily by both teacher and students via a software with icons;
- store and hardware resources of PCs are not used;
- any type of PC, regardless from resources, can be used.

## General Functions:

- EXCHANGING monitor and audio between: teacher and students, teacher and students' groups (max. 8 groups), teacher and the whole class;
- EXCHANGING monitor, keyboard, mouse and audio from student to Teacher;
- Teacher can correct students via a remote control on the PC of each student;
- possibility of splitting the class into 8 separate groups;
- management of archives of students, class, Teachers, with possibility of shifting and assigning students specifying their name, surname and relevant group, by the Teacher;
- audio-video transmission to individual students, to groups or to the whole class;
- videoconference from Teacher to student, from Teacher to a group of students, from Teacher to the whole class;
- inhibition of students' PCs by teacher at his/her discretion;
- cyclical control of students' videos with time assigned by the Teacher.

## Software

### AUDIO-VIDEO-KEYBOARD-MOUSE EXCHANGE

Laboratory performance can be optimized by MULTIMEDIA CLASSROOM NET CONTROL system.

It consists of an advanced educational multimedia software which ensures a wide flexibility in teaching, monitoring and assisting students, compared with what offered by traditional hardware systems; it can control audio-video-keyboard exchange among the various Personal Computers of a classroom and it only needs the PC connection via a standard LAN.



## Technical characteristics

### FUNCTIONS OF VIDEO-KEYBOARD-MOUSE:

- Transmission of screen, of voice and of other multimedia materials from Teacher's PC to a student, to a group of students or to the whole class, in real time. Integrated graphics pointer for illustrations and explanations;
- Possibility of locking and unlocking students' keyboards and mice;
- Teacher can darken the screen and disable keyboard and mouse of a student, of a group of students or of the whole class in order to draw their attention;
- When Teacher's screen is shown on students' monitor, only a part of students' screens can be used so that they can also carry out an exercise while seeing Teacher's directions. Teacher's directions are displayed only on a square of students' monitor, while students can practise their applications.
- Teacher can supervise a student, a group of students or the whole class (simultaneous display of 8 monitors)
- Teacher can use his/her own keyboard and mouse for remote control of any PC of students in order to check the development of their activities. He/she can select a student to perform a presentation, and send the screen and voice of the selected student to the other students. Teacher can authorize the use of his/her own PC to any student.
- Programs can be sent from CDs, DVDs and video files to selected students, in full-screen or partial-screen modes. This transmission does not affect the speed of standard data network with which all PCs are connected.



## Software

### CLASS CONTROL mod. SW-X/EV

This software includes two sections:

- assignment of lessons and acquisition of results
- control of classes of students, processing and saving the results

The first section of this software deals with the control of data connection network.

It is used with the network software installed with an Ethernet card, for a classroom of networked PCs.

This software enables the teacher:

- to assign a specific lesson or group of lessons having to be carried out by each student. Different lessons or groups of lessons can be assigned to each student according to his/her learning level;
- to assign a lesson to be carried out by the whole class;
- to display the current state of the lessons completed, or having to be carried out, for each student;
- to check the answers of each student, in real time.

The second section of this software is used by the teacher to process the results of students' answers.

Using this software, a teacher can manage various classes and check the learning level of each student constantly, either in a laboratory with microprocessor control unit and in a multimedia laboratory.

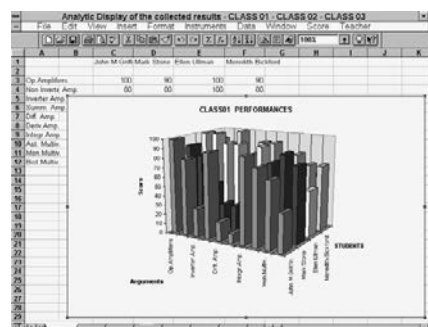
### Main functions:

- Control of 90 classes;
- Control of 32 students per class;
- Entering students' names;
- Automatic data gathering from control units;
- Progressive saving of the results from students' workstations;
- Display of the temporary results concerning previous lesson developments. The teacher can store the last lesson completed as historical result, after a series of previous attempts for completing the same lesson.
- Detailed and summarizing display and printout of students' results. The results of each student or of each class attained for any lesson developed can be displayed and printed.
- Graphic display of the scores for students' answers for an instantaneous overall view of the situation in each class.
- Detailed and summarizing printout of students' results.

Recording the last temporary results as historical record for each student or for each class. Different solutions of the same lesson can be acquired for each student or for each class. Using this option, a teacher can decide when the last result must be saved as the most significant historical result for the student or for the class.

Analysis Display of the collected results - CLASS 01

	Operational Ampl.	Non Inverting Ampl.	Inverting Ampl.	Summer Ampl.	Differential Ampl.
<b>CLASS01</b>					
1	John M. Griffin	100	60	100	30
2	Mark Dione	80	60	70	80
3	Primo Villegas	70	100	80	100
4	Isabella Dickford	40	40	80	100
5	Average	72.5	70	82.5	77.5
<b>CLASS02</b>					
6	Mark Dione	100	80	100	80
7	Conchita Maria	60	60	70	100
8	Julian Dione	70	100	80	100
9	Maria Vargasa	40	40	80	100
10	Carl Long	30	20	40	20
11	Primo Villegas	10	30	30	100
12	Average	55	55	65	85
<b>CLASS03</b>					
13	Angel Toranzo	40	30	50	100
14	Isabella Dickford	60	60	70	80
15	Isabella Dickford	70	100	30	100
16	Isabella Dickford	40	40	10	100
17	Carlos Delacruz	30	20	80	80
18	Isabella Dickford	10	30	30	100
19	Average	42	40	45	75



## EL.VE. EDUCATIONAL AUTHOR SOFTWARE

### AUTHORING SOFTWARE FOR CREATING NEW LESSONS OR MODIFYING THE EXISTING ONES

The software consists of a set of programs that enables to modify the various lessons for modules mod. MCMXX/EV and EB-XX/EV.

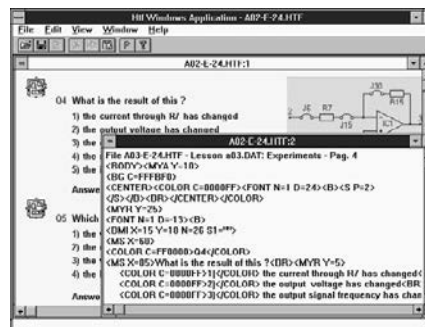
New sections regarding theory and new exercises can also be created.

This software consists of an editor for adding:

- theory pages
- testing pages
- footnotes to these pages

The formatting and general appearance of pages are determined by special markers (tags) that include the information of text layout and style, of the images to be placed in the overall layout of pages, of the content of tables / boxes for data introduction, of links with other pages, of colours of texts and backgrounds.

This program includes a Preview of the page being created or edited. A simple command enables to display the page as it would appear to students during the lesson. This enables to speed up the process of creating educational material considerably.



### EDITOR OF DRAWINGS, DIAGRAMS AND IMAGES

This program is used to plot drawings having to be inserted into the pages of educational material. This tool simplifies the creation of some types of drawings and wiring diagrams; moreover it enables to touch up the images having to be inserted into the pages of the lessons. Images in BMP and JPG format are managed.



# MODULES FOR THE STUDY OF BIOMEDICAL EQUIPMENT

**TESTING MODULE FOR ACQUISITION  
AND PROCESSING OF BIOMEDICAL SIGNALS**

MOD. EB-B1/EV PL 16

**TESTING MODULE FOR PEN RECORDERS**

MOD. EB-B2/EV PL 17

**TESTING MODULE FOR LCD VIDEO MONITOR**

MOD. EB-B3/EV PL 18

**TESTING MODULE FOR PHYSIOTHERAPY  
AND STIMULATION SIGNALS**

MOD. EB-B4/EV PL 19

**TESTING MODULE FOR TRANSDUCERS  
IN MEDICINE**

MOD. EB-B5/EV PL 21

**TESTING MODULE FOR OPTICAL FIBERS  
AND OPTOELECTRONIC COMPONENTS**

MOD. EB-B6/EV PL 22

**TESTING MODULE FOR PHOTOPLETHYSMOMETER  
AND MEASUREMENT OF RESPIRATION FREQUENCY**

MOD. EB-B7/EV PL 23

# TESTING MODULE FOR ACQUISITION AND PROCESSING OF BIOMEDICAL SIGNALS

## Mod. EB-B1/EV

## INTRODUCTION

EB-B1/EV is one of the modules that constitute the Interactive Practical Electronics System – I.P.E.S for the study of Biomedical Equipment.

It consists of a set of components and circuits used in biomedical equipment.

For the lessons development, the module operates in computerized mode, by means of the interactive software version of the handbook SWBB-B1/EV and the Unit mod. GAU/EV. The software inserts circuit variations and faults automatically, enabling the development of the lessons, even without the teacher's assistance.

## EB-B1/EV

The detection and interpretation of signals coming from the human body is certainly one of the most important aspects in the sector of biomedical instruments. These signals are detected by appropriate transducers and enable to diagnose the functioning of the various organs in the human body.

The circuits under examination are parts of equipment used in cardiology, surgery, neurology, medicine and intensive care.

The module enables the basic study and application of biomedical signals and their processing.

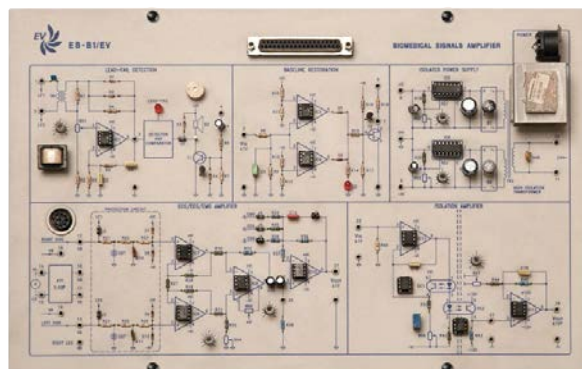
## TRAINING PROGRAM:

- ECG signals
- Electrodes for ECG signals
- Amplification and filtering of ECG signals
- Common-mode noise rejection
- Noise and artefacts
- Safety power supply units and insulation circuits
- Detecting the connection failure of electrodes (Lead-fail detection)
- Electrical protection for the input lines of electrodes
- EEG signals and amplification
- EMG signals and amplification
- Galvanic insulation (photo decoupling) between patient and instruments' references
- Signal calibration before acquisition

## TECHNICAL SPECIFICATIONS:

- High insulation transformer
- Transistor optocoupler
- Lead-fail buzzer
- 3 electrodes for ECG detection
- 2-mm interconnection and test points
- Jumpers for quick circuit modifications
- Fault simulation
- 37-pin connector for Interface Unit GAU/EV
- 8-way connector for Power Supply Unit
- Printed circuit board with protective treatment and silk-screen printed mimic diagram

**Dimensions:** 386 x 248 x 40 mm



## REQUIRED



**POWER SUPPLY  
UNIT  
PS1-PSU/EV**  
- NOT INCLUDED -

## POWER SUPPLY

$\pm 12$  Vcc – 0,5A  
2x24Vca – 0,5A  
+5Vcc – 2A



**BIOMEDICAL SIGNAL GENERATOR/ACQUISITION  
AND FAULT INSERTION UNIT - MOD. GAU/EV**  
**SOFTWARE SWBB-B1/EV**  
- NOT INCLUDED -



**PERSONAL COMPUTER**  
- NOT INCLUDED -

**INSTRUMENTS - NOT INCLUDED -**  
- MULTIMETER  
- OSCILLOSCOPE

## SUPPLIED WITH

**STUDENT HANDBOOK: THEORY AND EXERCISES**  
**TEACHER HANDBOOK: WIRING DIAGRAMS  
AND SOLUTIONS OF EXERCISES**



## OPTIONAL

**MODULE HOLDER - BOX/EV**





# TESTING MODULE FOR PEN RECORDERS

## Mod. EB-B2/EV

### INTRODUCTION

EB-B2/EV is one of the modules that constitute the Interactive Practical Electronics System – I.P.E.S for the study of Biomedical Equipment.

It consists of a set of components and circuits used in biomedical equipment.

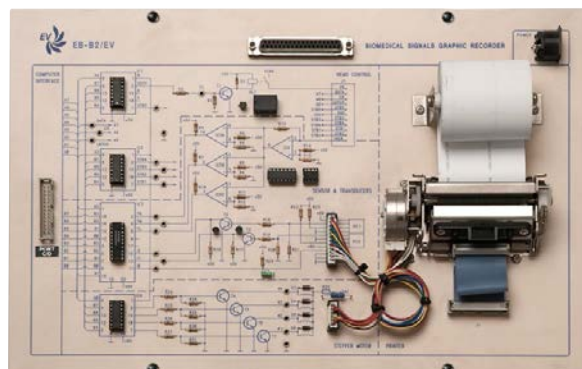
For the lessons development, the module operates in computerized mode, by means of the interactive software version of the handbook SWBB-B2/EV and the Unit mod. GAU/EV. The software inserts circuit variations and faults automatically, enabling the development of the lessons, even without the teacher's assistance.

### EB-B2/EV

Most biomedical instruments include a printing unit to provide users with the data resulting from the detection of physiological parameters or from other measurements carried out on patients. Generally this information consists of the graphic representation concerning electrocardiogram, electroencephalogram, electromyography, etc...

The printing instruments used for this operation are called PEN RECORDERS. But the application of microprocessor units enables a lot of instruments of recent design to use digital recorders almost exclusively, consequently the printing unit is included in most biomedical instruments.

Studying this section is very important to know the operating principles, the signals and the typical electronic equipment used. This module is designed to study and apply the basics of graphic recording used in biomedical equipment.



### TRAINING PROGRAM:

- Printing of biomedical signals
- Pen recorders
- Structure of a thermal printer
- Printing onto roll chart
- Roll feeding unit
- Printing system
- Interface to microprocessor
- Checking signals

### TECHNICAL SPECIFICATIONS:

- 448-dot line head thermal printer
- Printing speed: 400 lines per minute
- Stepper motor: 4 phases
- Head driving voltage: 24 Vdc – max. absorption of 11.7 A
- Printing width: 56 mm
- 2-mm interconnection and test points
- Jumpers for quick circuit modifications
- Fault simulation
- 37-pin connector for Interface Unit GAU/EV
- 8-way connector for Power Supply Unit
- Printed circuit board with protective treatment and silk-screen printed mimic diagram

**Dimensions:** 386 x 248 x 40 mm

#### REQUIRED



**POWER SUPPLY  
UNIT  
PS1-PSU/EV**  
- NOT INCLUDED -

#### POWER SUPPLY

$\pm 12$  Vcc – 0,5A  
+24Vcc – 1A  
+5Vcc – 2A



**BIOMEDICAL SIGNAL GENERATOR/ACQUISITION  
AND FAULT INSERTION UNIT - MOD. GAU/EV**  
SOFTWARE SWBB-B2/EV  
- NOT INCLUDED -



**PERSONAL COMPUTER**  
- NOT INCLUDED -

**INSTRUMENTS - NOT INCLUDED -**  
- MULTIMETER  
- OSCILLOSCOPE

#### SUPPLIED WITH

**STUDENT HANDBOOK: THEORY AND EXERCISES**  
**TEACHER HANDBOOK: WIRING DIAGRAMS  
AND SOLUTIONS OF EXERCISES**



#### OPTIONAL

**MODULE HOLDER - BOX/EV**



# TESTING MODULE FOR LCD VIDEO MONITOR

## Mod. EB-B3/EV

### INTRODUCTION

EB-B3/EV is one of the modules that constitute the Interactive Practical Electronics System – I.P.E.S for the study of Biomedical Equipment.

It consists of a set of components and circuits used in biomedical equipment.

For the lessons development, the module operates in computerized mode, by means of the interactive software version of the handbook SWBB-B3/EV and the Unit mod. GAU/EV. The software inserts circuit variations and faults automatically, enabling the development of the lessons, even without the teacher's assistance.

### EB-B3/EV

Most biomedical instruments include a display unit so that users can see the data resulting from the detection of physiological parameters or from other measurements carried out on patients.

At this purpose, an LCD VIDEO MONITOR is mainly used to display the following signals:

- ECG, EEG and EMG signals
- results of internal inspections coming from ultrasonographies, radiological examinations, etc...
- numerical results of analyses and other information

This equipment is therefore present in most biomedical instruments. The study of this section is very important to learn the operating principles, the signals and the electronic equipment typically used.

The module enables the study and application of the basics of LCD video monitors used in biomedical equipment.

### TRAINING PROGRAM:

- LCD (Liquid Crystal Display) Monitors
- Interfacing with microcontroller
- Acquisition and display of ECG/EEG/EMG signals
- Signal generation
- Maintenance and fault simulation

### TECHNICAL SPECIFICATIONS:

- LCD Monitor 128 x 64 pixels
- N°1 ECG/EEG/EMG signals analog input
  - Voltage range:  $\pm 10V$
  - A/D conversion 12 bit
- N°1 Transducer signals analog input,
  - Voltage range:  $\pm 10V$
  - A/D conversion 12 bit
- N° 2 signal generator outputs
  - Range:  $\pm 10V$
  - D/A conversion 12 bit
- ECG/EEG/EMG Monitor Function
  - Variable Time Base
  - Variable Amplitude
- Generic waveform Oscilloscope Function
  - Variable Time Base
  - Variable Amplitude
- Keyboard to select Functions:
  - Input signals selection
  - Output signals selection
- 2-mm interconnection and test points
- Fault simulation
- 37-pin connector for Interface Unit GAU/EV



- 8-way connector for Power Supply Unit
- Printed circuit board with protective treatment and silk-screen printed mimic diagram

**Dimensions:** 386 x 248 x 40 mm

### REQUIRED



**POWER SUPPLY  
UNIT  
PS1-PSU/EV**  
- NOT INCLUDED -

**POWER SUPPLY**  
 $\pm 12 V_{cc} - 0,5A$   
 $+5V_{cc} - 2A$



**BIOMEDICAL SIGNAL GENERATOR/ACQUISITION  
AND FAULT INSERTION UNIT - MOD. GAU/EV**  
SOFTWARE SWBB-B3/EV  
- NOT INCLUDED -



**PERSONAL COMPUTER**  
- NOT INCLUDED -

**INSTRUMENTS - NOT INCLUDED -**  
- MULTIMETER  
- OSCILLOSCOPE

### SUPPLIED WITH

**STUDENT HANDBOOK: THEORY AND EXERCISES**  
**TEACHER HANDBOOK: WIRING DIAGRAMS  
AND SOLUTIONS OF EXERCISES**



### OPTIONAL

**MODULE HOLDER - BOX/EV**



# TESTING MODULE FOR PHYSIOTHERAPY AND STIMULATION SIGNALS

## Mod. EB-B4/EV

### INTRODUCTION

EB-B4/EV is one of the modules that constitute the Interactive Practical Electronics System – I.P.E.S for the study of Biomedical Equipment.

It consists of a set of components and circuits used in biomedical equipment.

For the lessons development, the module operates in computerized mode, by means of the interactive software version of the handbook SWBB-B4/EV and the Unit mod. GAU/EV. The software inserts circuit variations and faults automatically, enabling the development of the lessons, even without the teacher's assistance.

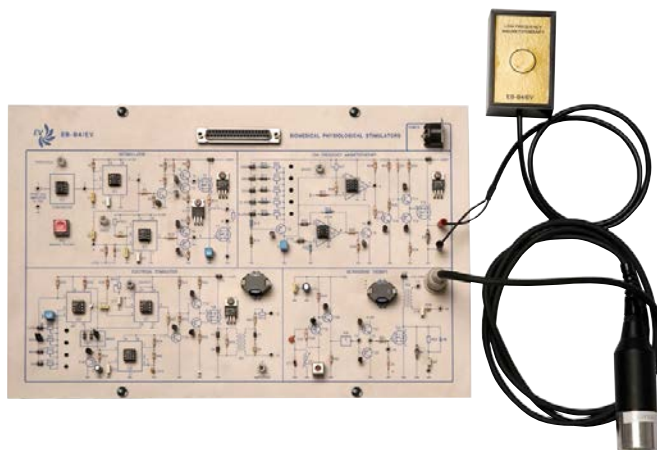
### EB-B4/EV

Aim of this module consists in analyzing the circuits and instruments used when specific organs of the body must be stimulated.

Most apparatuses adopting these techniques are included in the biomedical instruments typically used in the fields of physiotherapeutic medicine and of limbs rehabilitation and reeducation after long immobility periods.

This module examines the following topics:

- Basic circuits of defibrillators (production of special high/ low intensity shocks applied to patients' heart), used also in pathophysiology in case of particular heart dysfunctions to be corrected.
- Instruments for electrostimulation: equipment used for therapeutical treatments based on excitation through electronic stimulation of nervous tissues and muscles, or for anaesthetic effects.
- Instruments of magnetotherapy based on the application of low frequency and intensity signals to obtain therapeutic effects in case of sprains, arthrosis and arthritis, sinusitis, ulcers, lancet wounds, etc...
- Ultrasound instruments: based on ultrasound energy generated by the oscillations of quartz transducers at particular frequencies above audible sounds. The therapeutical effects of ultrasounds regard the temperature increase in tissues and cavities, for example, for the microcirculation of gas bubbles in tissues.



### TRAINING PROGRAM:

#### **Defibrillators**

- Charging/discharging electrical energy
- Storing energy
- Hand check
- Synchronization with ECG
- Electrodes

#### **Electrotherapy**

- Generation of signals
- Control of stimulation parameters
- Output stages
- Anaesthetic and analgesic effects
- Electrodes

#### **Magnetotherapy**

- Generation of signals
- Magnetic field
- Frequency range
- Electrodes

#### **Ultrasound circuits and instruments**

- Oscillators and frequency range
- Electrodes/quartz transducers
- Transmission of ultrasound waves
- Structure and mechanical coupling of transducer

## TECHNICAL SPECIFICATIONS:

- Step-up transformer for electrical stimulation signals
- 1-MHz ultrasonic ceramic transducer
- HARTLEY oscillator
- Step-up transformer for ultrasound stimulation signals
- Low frequency transducer of magnetic field
- 2-mm interconnection and test points
- Jumpers for quick circuit modifications
- Fault simulation
- 37-pin connector for Interface Unit GAU/EV
- 8-way connector for Power Supply Unit
- Printed circuit board with protective treatment and silk-screen printed mimic diagram

**Dimensions:** 386 x 248 x 40 mm

### REQUIRED



**POWER SUPPLY  
UNIT  
PS1-PSU/EV**  
- NOT INCLUDED -

**POWER SUPPLY**  
 $\pm 12 V_{cc} - 0,5A$   
 $+30V_{cc} - 2A$



**BIOMEDICAL SIGNAL GENERATOR/ACQUISITION  
AND FAULT INSERTION UNIT - MOD. GAU/EV**  
SOFTWARE SWBB-B4/EV  
- NOT INCLUDED -



**PERSONAL COMPUTER**  
- NOT INCLUDED -

**INSTRUMENTS - NOT INCLUDED -**  
- MULTIMETER  
- OSCILLOSCOPE

### SUPPLIED WITH

**STUDENT HANDBOOK: THEORY AND EXERCISES**  
**TEACHER HANDBOOK: WIRING DIAGRAMS  
AND SOLUTIONS OF EXERCISES**



### OPTIONAL

**MODULE HOLDER - BOX/EV**





# TESTING MODULE FOR TRANSDUCERS IN MEDICINE

## Mod. EB-B5/EV

### INTRODUCTION

EB-B5/EV is one of the modules that constitute the Interactive Practical Electronics System – I.P.E.S for the study of Biomedical Equipment.

It consists of a set of components and circuits used in biomedical equipment.

For the lessons development, the module operates in computerized mode, by means of the interactive software version of the handbook SWBB-B5/EV and the Unit mod. GAU/EV. The software inserts circuit variations and faults automatically, enabling the development of the lessons, even without the teacher's assistance.

### EB-B5/EV

The measurement of physiological variables is very important in both diagnosis and therapy; this has led to a continuous evolution of sensors and transducers and of the procedures for using recorded information. Among these instruments, sensors and transducers of temperature, flow and of pressure have become particularly important; they provide an analog electric input that indicates the physical variables detected in different physiological instruments.

But the effective use of this electrical information requires some system of electronic interface for connecting transducers with instruments: these circuits are commonly defined "signal conditioners" and they provide an output with voltage variable value in standard ranges not depending on sensor type.

The first part of the circuit enables to measure the different sensors, whereas the second part provides a standard output voltage in a variable range, usually between 0 and +8 Vdc or 10 Vdc, that is the best range to be used by the corresponding process instruments.

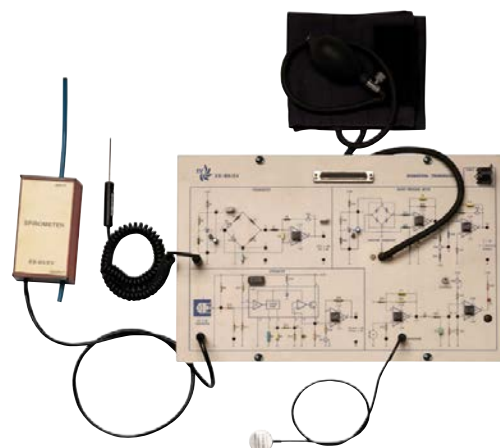
The module enables to study and apply the basics of transducers used in biomedical equipment.

### TRAINING PROGRAM:

- Signal conditioners
- Temperature transducers
  - Measurement and accuracy range
  - Stability
  - Characteristics of temperature / resistance of PTCO
- Pressure transducers
  - Systolic and diastolic blood pressure
  - Measurement of blood pressure
  - Bernoulli effect
  - Piezoelectric sensors
  - Measurement bridges
- Measurement of respiration
  - FVC, PEF, PIF, RV, FEV parameters
  - Volume – flow rate diagram
  - Flow rate sensors
  - Thermistor Sensors
  - Turbine transducers

### TECHNICAL SPECIFICATIONS:

- PTC temperature sensor
- Piezoresistive pressure sensor
- Hall-effect air flow sensor and current pump
- 2-mm interconnection and test points
- Jumpers for quick circuit modifications
- Fault simulation
- 37-pin connector for Interface Unit GAU/EV



- 8-way connector for Power Supply Unit
- Printed circuit board with protective treatment and silk-screen printed mimic diagram

**Dimensions:** 386 x 248 x 40 mm

### REQUIRED



**POWER SUPPLY  
UNIT  
PS1-PSU/EV**  
- NOT INCLUDED -

**POWER SUPPLY**  
 $\pm 12 \text{ Vcc} - 0,5 \text{ A}$



**BIOMEDICAL SIGNAL GENERATOR/ACQUISITION  
AND FAULT INSERTION UNIT - MOD. GAU/EV**  
SOFTWARE SWBB-B5/EV  
- NOT INCLUDED -



**PERSONAL COMPUTER**  
- NOT INCLUDED -

**INSTRUMENTS - NOT INCLUDED -**

- MULTIMETER
- OSCILLOSCOPE

### SUPPLIED WITH

**STUDENT HANDBOOK: THEORY AND EXERCISES**  
**TEACHER HANDBOOK: WIRING DIAGRAMS  
AND SOLUTIONS OF EXERCISES**



### OPTIONAL

**MODULE HOLDER - BOX/EV**



# TESTING MODULE FOR OPTICAL FIBERS AND OPTOELECTRONIC COMPONENTS

## Mod. EB-B6/EV

### INTRODUCTION

EB-B6/EV is one of the modules that constitute the Interactive Practical Electronics System – I.P.E.S for the study of Biomedical Equipment.

It consists of a set of components and circuits used in biomedical equipment.

For the lessons development, the module operates in computerized mode, by means of the interactive software version of the handbook SWBB-B6/EV and the Unit mod. GAU/EV. The software inserts circuit variations and faults automatically, enabling the development of the lessons, even without the teacher's assistance.

### EB-B6/EV

The applications of optoelectronic devices in medicine are very wide. A lot of instruments of analysis laboratory operate on the basis of the different light absorption capacity of an analyzed substance or solution, according to the various constituent substances. It is possible to determine their concentration by induced or automatic procedures. The instruments applying these principles are photometers, colorimeters and spectrophotometers.

Moreover, optical fibers are used in endoscopes, in devices for lighting internal organs and tissues, and in other applications where fibers are used to transfer signals (ECG, EEG, ...) with complete electronic decoupling.

The module enables to study and apply the basics of optical fibers and optoelectronic components used in biomedical equipment.

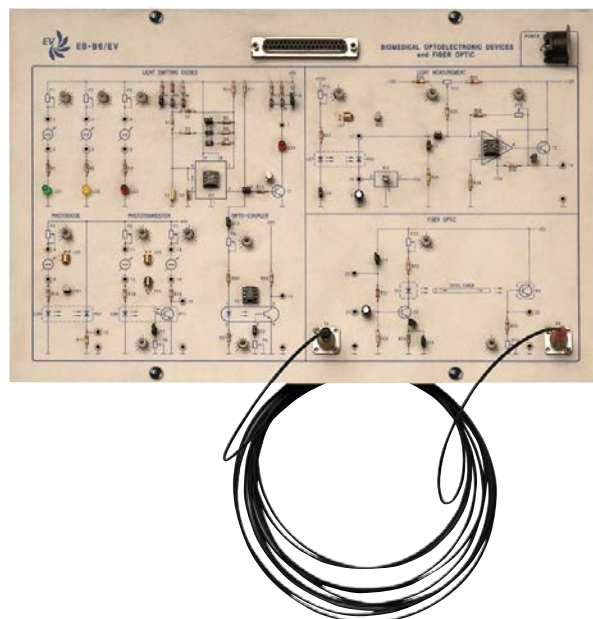
### TRAINING PROGRAM:

- Light radiation and measurement of its intensity
- Optoelectronic devices: LED (Light Emitting Diodes), liquid crystals and laser
- Optoelectronic photodetectors
- Opto-coupling systems
- Light and measurement transducers
- Optical fibers
- Light transmission on optical fibers

### TECHNICAL SPECIFICATIONS:

- Red, green and yellow LEDs
- Photodiodes
- Phototransistors
- Transistor optocouplers
- Optical fiber connectors, snap-in type =660 nm
- Optical fiber Ø 1000µm – 3 m
- 2-mm interconnection and test points
- Jumpers for quick circuit modifications
- Fault simulation
- 37-pin connector for Interface Unit GAU/EV
- 8-way connector for Power Supply Unit
- Printed circuit board with protective treatment and silk-screen printed mimic diagram

**Dimensions:** 386 x 248 x 40 mm



### REQUIRED



**POWER SUPPLY  
UNIT  
PS1-PSU/EV**  
- NOT INCLUDED -

**POWER SUPPLY**  
±12 Vcc – 0,5A  
+5Vcc – 2A



**BIOMEDICAL SIGNAL GENERATOR/ACQUISITION  
AND FAULT INSERTION UNIT - MOD. GAU/EV**  
SOFTWARE SWBB-B6/EV  
- NOT INCLUDED -



**PERSONAL COMPUTER**  
- NOT INCLUDED -

**INSTRUMENTS - NOT INCLUDED -**  
- MULTIMETER  
- OSCILLOSCOPE

### SUPPLIED WITH

**STUDENT HANDBOOK: THEORY AND EXERCISES**  
**TEACHER HANDBOOK: WIRING DIAGRAMS  
AND SOLUTIONS OF EXERCISES**



### OPTIONAL

**MODULE HOLDER - BOX/EV**



# TESTING MODULE FOR PHOTOPLETHYSMOMETER AND MEASUREMENT OF RESPIRATION FREQUENCY

## Mod. EB-B7/EV

### INTRODUCTION

EB-B7/EV is one of the modules that constitute the Interactive Practical Electronics System – I.P.E.S for the study of Biomedical Equipment.

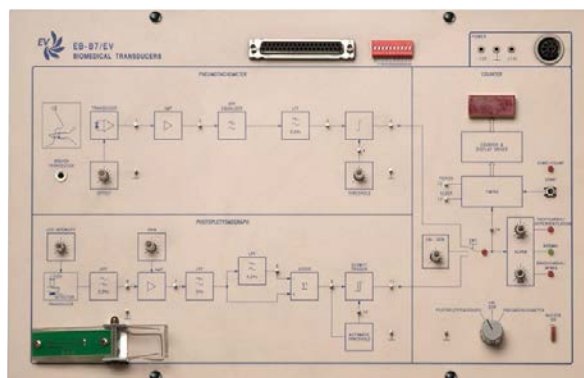
It consists of a set of components and circuits used in biomedical equipment.

For the lessons development, the module operates in computerized mode, by means of the interactive software version of the handbook SWBB-B7/EV and the Unit mod. GAU/EV. The software inserts circuit variations and faults automatically, enabling the development of the lessons, even without the teacher's assistance.

### EB-B7/EV

The module enables to acquire the cardiac rhythm by using a pair of optical transceiver transducers.

As the patient introduces a finger in the optical path, the cardiac rhythm is automatically recorded and displayed on a two-digit screen. It is also possible to record the respiratory rhythm in a non-invasive way by using a temperature transducer placed before the patient's mouth. The minimum and maximum values can be set as parameters in the acquisition section to detect alarm situations (MIN-MAX interval).



### TRAINING PROGRAM:

- The circulatory system
- The respiratory system
- Transducers and actuators
- Immunity to radiative noises
- Event counter with time delays
- Filters and amplification
- Comparing the frequency of measured events (heartbeat and respiratory acts)
- Thresholds, intervals and min./max. limits
- Thresholds and alarms
- Display

### TECHNICAL SPECIFICATIONS:

- Transmission LED / phototransistor for photoplethysmometer reception
- Diode sensor of air flow
- 3-digit / 7-segment display of heart rate
- Calibration of photoplethysmometer / respiratory rate
- 2-mm interconnection and test points
- Jumpers for quick circuit modifications
- Fault simulation
- 37-pin connector for Interface Unit GAU/EV
- 8-way connector for Power Supply Unit
- Printed circuit board with protective treatment and silk-screen printed mimic diagram

**Dimensions:** 386 x 248 x 40 mm

### REQUIRED



**POWER SUPPLY  
UNIT  
PS1-PSU/EV**  
- NOT INCLUDED -

**POWER SUPPLY**  
 $\pm 12 \text{ Vcc} - 0,5\text{A}$



**BIOMEDICAL SIGNAL GENERATOR/ACQUISITION  
AND FAULT INSERTION UNIT - MOD. GAU/EV**  
**SOFTWARE SWBB-B7/EV**  
- NOT INCLUDED -



**PERSONAL COMPUTER**  
- NOT INCLUDED -

**INSTRUMENTS - NOT INCLUDED -**  
- MULTIMETER  
- OSCILLOSCOPE

### SUPPLIED WITH

**STUDENT HANDBOOK: THEORY AND EXERCISES**  
**TEACHER HANDBOOK: WIRING DIAGRAMS  
AND SOLUTIONS OF EXERCISES**



### OPTIONAL

**MODULE HOLDER - BOX/EV**



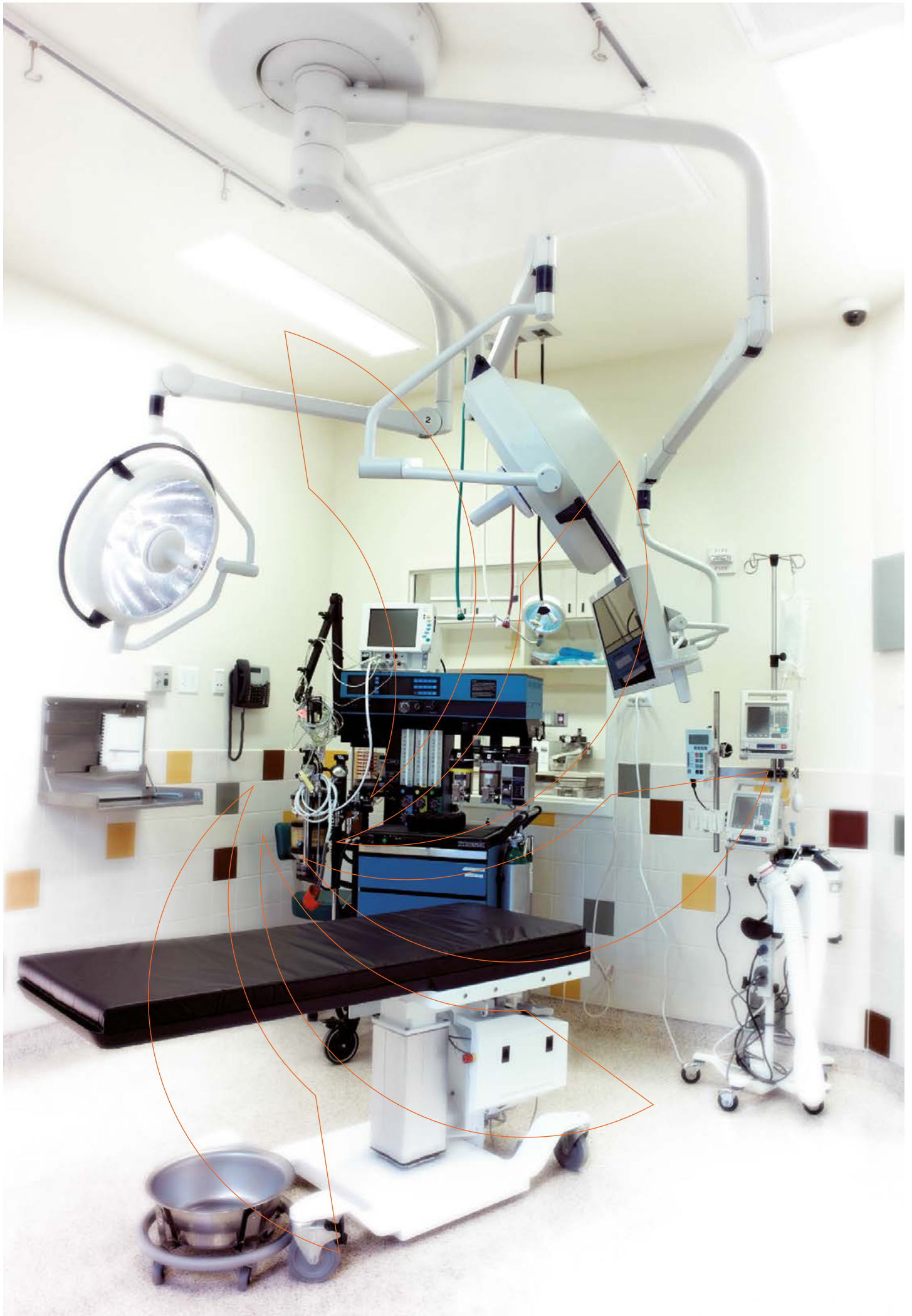
# 34-B

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

BIOMEDICAL EQUIPMENT MAINTENANCE TECHNICIAN

34A-E-PL





# 34-B



## PROFESSIONAL INSTRUMENTS AND ELECTRICAL SAFETY DEVICES

SS  
www.elettronicaveneta.com

### Objective:

- Vocational training for testing safety and performance of biomedical equipment during routine and extraordinary maintenance

### Equipment:

- Instruments for Pathophysiology, Analysis and Rehabilitation
- Equipment for studying electrical safety devices

# INSTRUMENTS FOR VOCATIONAL TRAINING



## INTRODUCTION

The **Biomedical Equipment Maintenance Technician** is an expert in electromechanic and electronic fields; he is learned about objectives, modes and risks of diagnostic and therapeutical use of hospital instruments, and has the technical ability to develop the following functions:

- setting up and calibrating the instruments;
- carrying out routine and preventive maintenance;
- testing the electrical safety of instruments periodically;
- collaborating with medical and paramedical personnel in using the equipment;
- collaborating with health personnel and with the manager of Clinical Engineering Service in keeping in touch with suppliers, acquiring the technical documents concerning the equipment and ensuring a technical advice when purchasing new equipment.

The main aim of **Vocational Training** consists in enabling the technician to test safety and performance of biomedical equipment during routine and extraordinary maintenance.

The training modules deal with the analysis of available instruments, the operating principles and the issues of maintenance and safety. The training modules include some examples of actual biomedical equipment and a multimedia software to explain the operation of the various apparatuses and to analyze the safety rules and the procedures of preventive and periodical maintenance.

The equipment for vocational training includes:

- **Instruments for Pathophysiology, Analysis and Rehabilitation**
- **Equipment for the study electrical safety devices**



# PROFESSIONAL INSTRUMENTS AND ELECTRICAL SAFETY DEVICES

<b>MONITOR FOR ELECTROCARDIOGRAPH</b>	MOD. M501-S/EV	SS 5
<b>APPARATUS FOR ELECTROTHERAPY</b>	MOD. ETR/EV	SS 6
<b>SPECTROPHOTOMETER</b>	MOD. UV-1201/EV	SS 7
<b>SPIROMETER</b>	MOD. SPRM/EV	SS 8
<b>AUDIOMETER</b>	MOD. ADMTR/EV	SS 9
<b>INSTRUMENT FOR MAGNETOTHERAPY</b>	MOD. MGNT/EV	SS 10
<b>INSTRUMENT FOR ULTRASOUND THERAPY</b>	MOD. UTST/EV	SS 11
<b>SYSTEM FOR THE STUDY OF ELECTRICAL SAFETY DEVICES</b>	MOD. VSE/EV	SS 12



# MONITOR FOR ELECTROCARDIOGRAPH

## Mod. M501-S/EV

### INTRODUCTION

This instrument is designed to detect the electrical potentials of heart activity by means of external electrodes and is provided with a graphic Liquid Crystal Display; it also includes a printer for ECG trace.

#### Main characteristics:

- All operations are completely controlled by a microprocessor
- Colour TFT LCD of 10.4"
- ECG, SpO2, Temp1, Temp2
- It can be used on both babies and grown-up people
- Real time display of the last 6 minutes of the trace
- Storage of the trend on 48 hours, in form of graph or chart
- Up to 200 storing sets and retrieving of readings of vital signs
- Printing paper roll for pen recorder included
- QRS filtered and noiseless detection (electrode movements, muscle contractions, pace-maker pulsations)
- Temperature is detected via a self-calibration circuit
- Indication of alarm conditions on every monitored parameter
- Complete handbook

The instrument is connected externally with a box with test points ( $\varnothing$  2 mm) which enable a simple and safe detecting procedure. This enables students to understand also the main functions of the circuit.



#### REQUIRED

INSTRUMENTS - NOT INCLUDED -

- MULTIMETER
- OSCILLOSCOPE

# APPARATUS FOR ELECTROTHERAPY

## Mod. ETR/EV



### Main characteristics:

- This instrument enables to produce electrical signals of variable intensity, frequency and waveform
- It is provided with two separate outputs
- Preselection of treatment time in minutes
- It is possible to combine the different types of current signals selected, with galvanic current (two-phase fixed dynamic current, single-phase current, two-phase pulse train, modulated frequency, pulses, "rectangular current")
- Dynamic current frequency (dya): from 50 Hz to 100 Hz, pulse frequency: from 16 Hz to 400 Hz
- Input: 200 V, 56-60 Hz 30 W

The instrument is connected externally with a box with test points ( $\varnothing$  2 mm) which enable a simple and safe detecting procedure. This enables students to understand also the main functions of the circuit.

### REQUIRED

INSTRUMENTS - NOT INCLUDED -

- MULTIMETER
- OSCILLOSCOPE

# SPECTROPHOTOMETER

## Mod. UV-1201/EV



### Main characteristics:

- This instrument is designed to measure the quantity of light absorbed by the substances under examination.
- It operates in the UV-ray range and in the visible range for a wavelength included between 200 and 1100 nm
- It can be used in all laboratory routine applications by simple changes (all applications of a specific user can be saved and quickly loaded whenever needed)
- It interacts with the screen via a membrane keyboard with function keys; the results can be managed by the operator (serial interface)
- Accuracy: 1 nm, "stray light" 0.05% to 340 nm and 220 nm
- Photometric capacity: from - 0.3 to 3 absorption units (from 0 to 200%)
- Transmission and long-term stability: less than  $\pm 0.001$  Abs/h

The instrument is connected externally with a box with test points ( $\varnothing$  2 mm) which enable a simple and safe detecting procedure. This enables students to understand also the main functions of the circuit.

### REQUIRED

INSTRUMENTS - NOT INCLUDED -  
- MULTIMETER  
- OSCILLOSCOPE

# SPIROMETER

## Mod. SPRM/EV

### INTRODUCTION

Spirometer mod. SPRM/EV is a stand-alone instrument that can be connected with a PC via the specific software included in the equipment. This enables to carry out tests with the spirometer directly connected with a PC, and consequently with the storage unit of patients' records. It enables to store 1500 tests; an alphanumeric keyboard is included for an easier data entry.

### Main characteristics:

- No calibration
- FVC, VC, IVC and MVV
- Software to use PC on-line
- Batteries or electric socket: 220 V/50 Hz
- Colour graphic display: FSTN 240 x 320 pixel
- Integrated thermal printer with 112-mm paper
- Connection for external printer
- Keyboard with 15 specific keys and alphanumeric keys
- Temperature sensor for BTPS conversion: semiconductor sensor 0-45°C
- Measurement of flow and volume:  $\pm 16$  L/s, BPTS
  - volume accuracy:  $\pm 3\%$  or 50 mL
  - flow accuracy:  $\pm 5\%$  or 200 mL/s
- Dynamic resistance:  $<0,8$  cm H<sub>2</sub>O/L/s
- External mouthpiece:  $\varnothing$  30 mm
- Automatic interpretation
- Automatic quality control
- Up to 1500 recordable tests
- F/V curve in real time
- PC interface: series RS-232
- Weight: 1.9 kg
- Selection of different expected values (ERS, Crapo/Bass, Knudson,...)
- 30 parameters: FVC, FEV1, FEV1%, FEV6, FEV6%, FEV1/FEV6%, PEF, FEF25-75%, FEF25%, FEF50%, FEF75%, FET, Vext, PIF, FIVC, FIV1, FIV1%, VC, IVC, ERV, IC, VT, VE, BF, Ti, Te, Ti/Ttot, VT/Ti, MVV

The instrument is connected externally with a box with test points ( $\varnothing$  2 mm) which enable a simple and safe detecting procedure. This enables students to understand also the main functions of the circuit.



### REQUIRED

INSTRUMENTS - NOT INCLUDED -

- MULTIMETER
- OSCILLOSCOPE



# AUDIOMETER

## Mod. ADMTR/EV

### INTRODUCTION

The application of most advanced technologies allows to use more and more updated equipment and integrated functions. Audiometers are extremely compact and light instruments used to measure hearing accuracy. The audiometer carries out a series of tests giving different results which are used to diagnose the state of hearing loss. The results output by an audiometer constitute an audiogram.

#### Main characteristics:

- Aerial conduction, bone conduction and masking
- Storage of various audiograms
- 11 test frequencies from 125 to 8000 Hz
- Quick screening on all frequencies at 20 dB
- Digital adjustment of the instrument
- Serial and parallel port of the instrument
- Printer of audiograms connected with parallel port
- Internal memory for data storage even when the instrument is off
- It is possible to back-up data on personal computer

#### Technical characteristics:

- 3 automatic tests for recognition of hearing threshold
- calibration is possible without opening the instrument case
- direct printing of audiograms on compatible printer
- masking intensity over 100 dB
- it is possible to display audiogram during test
- manual / automatic mode
- hearing thresholds: from -10 dB to 110 dB by 5-dB steps
- frequencies (Hz): 125 250 500 750 1000 1500 3000 4000 6000 8000
- aerial conduction
- bone conduction
- masking dB
- setup: it is possible to fit instrument settings to individual needs: Mode 1 to Mode 11
- programmable for future additional functions.
- power supply unit: 12 Vac (220-240 V)



The instrument is connected externally with a box with test points (Ø 2 mm) which enable a simple and safe detecting procedure. This enables students to understand also the main functions of the circuit.

#### REQUIRED

INSTRUMENTS - NOT INCLUDED -  
 - MULTIMETER  
 - OSCILLOSCOPE

# INSTRUMENT FOR MAGNETOTHERAPY

## Mod. MGNT/EV

### Main characteristics:

The application of the most advanced technologies enables to use more and more updated equipment and integrated functions.

This technology comes from the most recent systems used by personal computers and includes the possibility of updating equipment's functions and programs by using a smart card.

The equipment mod. MGNT/EV outputs magnetic fields of variable frequency from 1 to 100 Hz with intensity up to 200 Gauss. The wide range of available accessories enables the operator to deal with various pathologies that can benefit from magnetotherapy. The smart card memory enables the operator to create individual patient's cards.

A convenient encoder enables a quick selection of current and of the protocol to be issued, and the access to a library of 50 programmes ; furthermore, it enables the operator to create and store up to 50 different, simple or sequential treatment cycles.

### Technical characteristics:

- Graphic TFT LCD of 6"
- Smart card with 64-Kbit memory
- Integrated serial command
- 2 x 16 bit microprocessor
- 50 pre-set protocols
- separate pressure gauge for each section
- 50 protocols for storing
- Exclusive MFC patent that reduces electromagnetic pollution up to <85%
- Solenoids driven with triangular, rectangular and sinusoidal pulse signals
- Option of driving solenoids of various shapes and sizes
- 100 Gauss per output
- Option of modulating the output signal range for the operator
- Absorbed power: 210 W
- Insulation class: II type BF



- Risk class (93/42/EEC): II B
- Available outputs: 1
- Timer
- Supply voltage: 230V 50/60 Hz / 110V 50/60Hz
- Dimensions: 385 x 135 x 300 mm
- Weight: 4 kg

The instrument is connected externally with a box with test points (Ø 2 mm) which enable a simple and safe detecting procedure. This enables students to understand also the main functions of the circuit.

### REQUIRED

#### INSTRUMENTS - NOT INCLUDED -

- MULTIMETER
- OSCILLOSCOPE

# INSTRUMENT FOR ULTRASOUND THERAPY

## Mod. UTST/EV

### INTRODUCTION

The application of the most advanced technologies enables to use more and more updated equipment and integrated functions. This technology comes from the most recent systems used by personal computers and includes the possibility of updating equipment's functions and programs by using a smart card.

The equipment has an operating frequency of 1 – 3 MHz.

#### Main characteristics:

- The equipment prevents the operator from ultrasounds and energy exposure
- The equipment is lightweight, ergonomic and user-friendly
- Power output is the maximum allowed by standard rules: 1 to 3 MHz
- Waterproof to be used both in air and underwater
- When in touch with the part of the body for treatment, the sensor gives off energy according to the specific requirements of that part and informs the operator of this energy output by means of a light indicator.
- The system automatically self-calibrates during the operation thus ensuring the best performance and saving time.

A graphic Liquid Crystal Display shows all necessary information, and a proper encoder enables a quick selection of current and of the protocol to be issued, and the access to a library of 50 programmes; furthermore, it enables the operator to create and store up to 50 different, simple or sequential treatment cycles.

#### Technical characteristics:

- Graphic TFT LCD of 6"
- Smart card with 64-Kbit memory
- Integrated serial command RS-232
- 16 bit microprocessor
- 1/3 MHz function
- 50 pre-set protocols
- 50 protocols for storing
- Contact sensors with light indicator
- Diameter of ultrasound-emitting device: 1 – 3 – 5 and 8 cm, frequency 2 1/3 MHz



- Continuous and alternating function modes
- Low BNR self-calibrating unit
- Water-resistant
- Insulation class: II type BF
- Risk class (93/42/EEC): II B
- Available outputs: 1
- Timer: 1-30 minutes
- Supply voltage: 230V 50/60 Hz / 110V 50/60Hz
- Absorbed power: 80 W
- Dimensions: 385 x 135 x 300 mm
- Weight: 4 kg

The instrument is connected externally with a box with test points (Ø 2 mm) which enable a simple and safe detecting procedure. This enables students to understand also the main functions of the circuit.

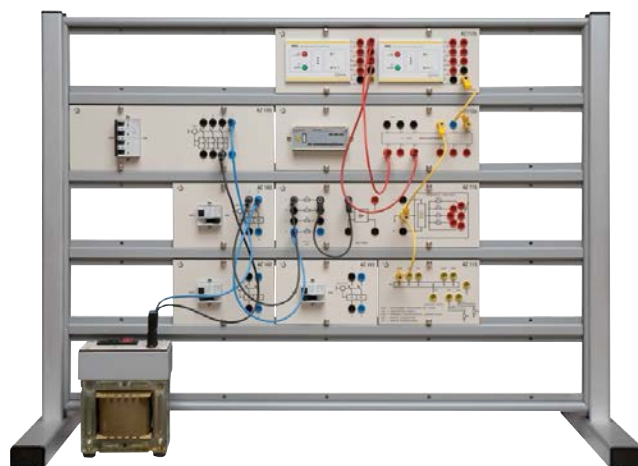
### REQUIRED

#### INSTRUMENTS - NOT INCLUDED -

- MULTIMETER
- OSCILLOSCOPE

# SYSTEM FOR THE STUDY OF ELECTRICAL SAFETY DEVICES

## Mod. VSE/EV



### Main characteristics:

The system enables to study the electrical safety devices of the equipment used in hospitals and clinics according to international standards (IEC).

The system consists of a tabletop unit with a set of modules and instruments enabling to carry out the following tests:

- **Measurement of insulation resistance**
- **Measurement of continuity of protection cables**
- **Measurement of tripping time of protection devices**
- **Measurements of current losses**

The educational panel for the study of electrical protection devices includes the following modules:

- **Module with insulation transformer**
- **Module for differential circuit breakers**
- **Insulation measuring instrument for fault simulation in hospitals**

### The system includes the following instruments:

#### Instrument for insulation measurement

- Battery power supply

#### Test instruments for measurement of differential devices on single-phase or three-phase systems

- Measurement test of current selection TRIP, NO TRIP, FAST TRIP, SLOW TRIP

#### Measurement instrument for current losses

- Interval of 10 mA, high sensitivity
- Measurement interval range: 10mA - 100A
- Power supply: battery or external unit

### SUPPLIED WITH

**HANDBOOK INCLUDING:**  
**THEORETICAL STUDY OF TOPICS AND CIRCUIT DESCRIPTION**  
**STUDENT HANDBOOK: PRACTICAL TESTS AND MEASUREMENTS**  
**WIRING DIAGRAMS AND DESCRIPTION OF OPERATIONS**





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SORTED ALPHABETICALLY BY MODEL

**BIOMEDICAL  
EQUIPMENT  
MAINTENANCE  
TECHNICIAN**  
CATALOGUE N. 34-B

**PL**

## INTERACTIVE PRACTICAL LABORATORY FOR STUDYING BIOMEDICAL ELECTRONICS

**SS**

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