ElettronicaVeneta

CATALOGUE No. 20-B

ELECTRONICS AND SYSTEMS

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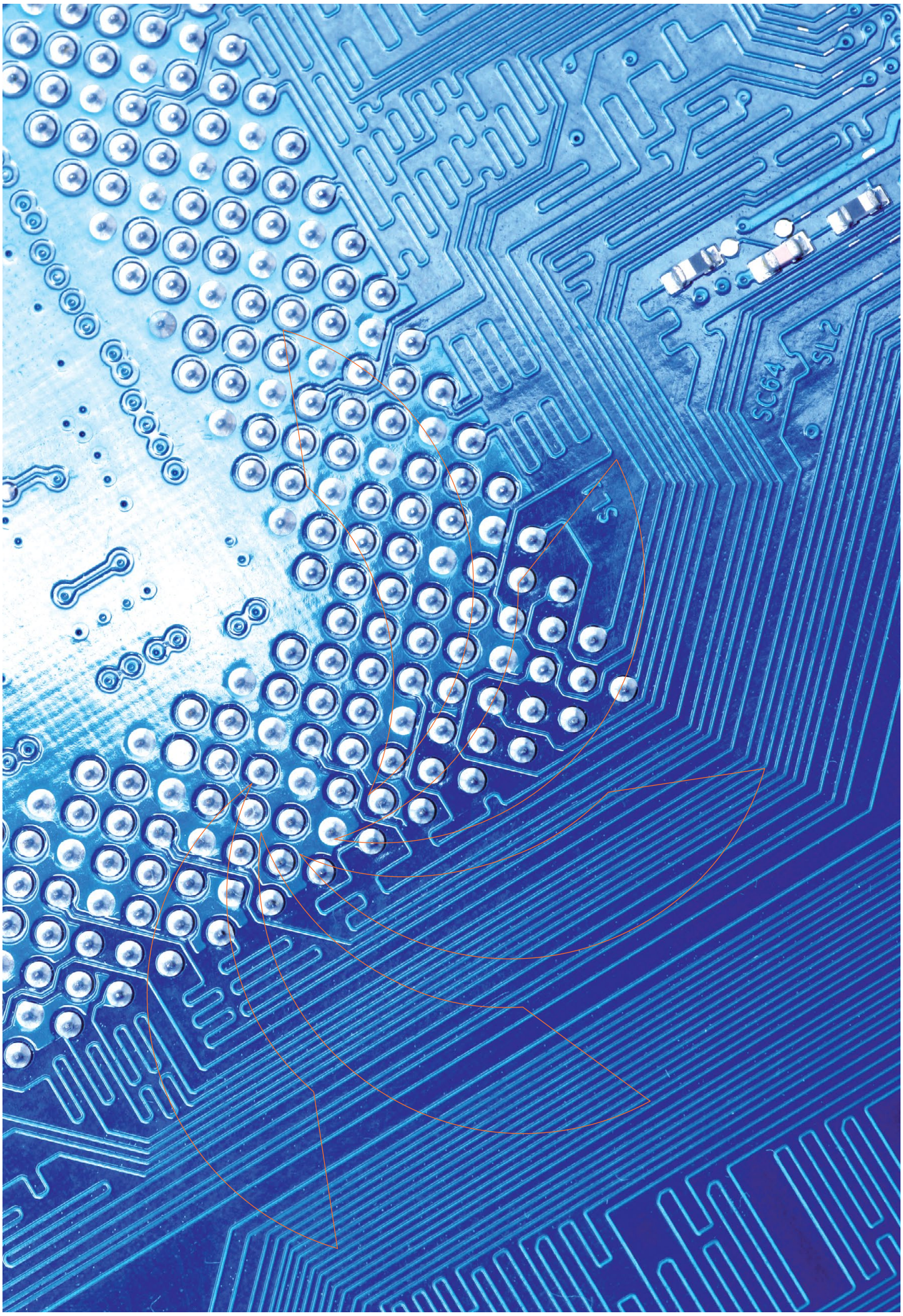
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ELECTRONICS AND SYSTEMS
CATALOGUE No. 20-B

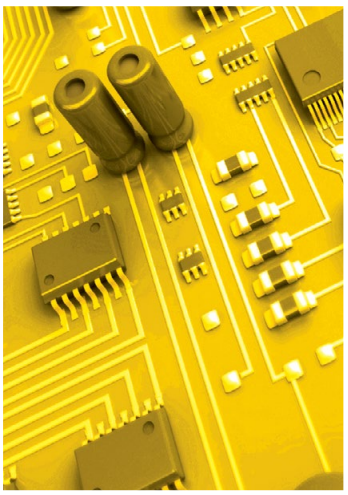
INDEX

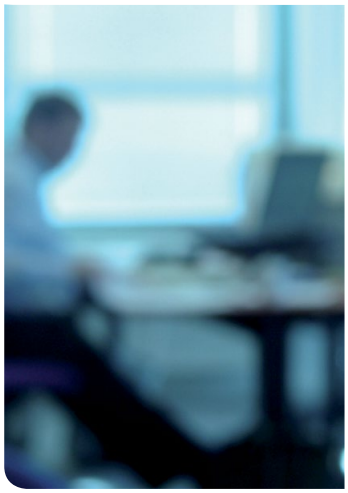
PROFESSIONAL/ADVANCED ELECTRONICS M.P.T. SYSTEM — PE

PROJECT'S DEVELOPMENT **PD**

Note: The catalog is constantly updated. Please send any suggestion you have to export@elettronicaveneta.com. We would also like to remind you that, due to the continuous technological upgrades, the described products may be subjected to design and/or technical modifications. Nevertheless, we guarantee that the educational content of our equipment remains unchanged.

GENERAL INTRODUCTION

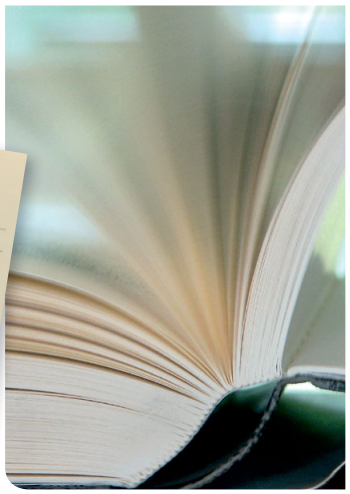




ELETTRONICA VENETA S.p.A. has been designing and manufacturing educational equipment since 1963. This equipment, covering the different fields of technology, fulfils two important educational objectives:

- 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

Major technological developments in electronics in recent years have lead to a large scale deployment of equipment containing evermore sophisticated electronic circuits.

From this reality stems the need to create skilled professionals adequately trained in the basics of electronic technology as well as in its more advanced applications. In view of the technological advancements and the evolution of electronic components, ongoing theoretical, experimental and practical upgrading of skilled workers is essential.

For training purposes, access to modular and flexible systems which can be adapted to diverse and continuously varying needs is necessary in order to meet these demands.

ELETTRONICA VENETA S.p.A. has developed tailor made systems and solutions for training and research purposes, by designing a range of equipment for the theoretical and practical analysis of all topics related to electronics, from the basic concepts through to more complex applications.

The various topics are covered extensively and constitute a complete training program which includes both a theoretical introduction and practical experiments starting from **BASIC ELECTRONICS** and progressing on to the more advanced technologies of **INDUSTRIAL ELECTRONICS.**

At the end, a further experimental section is included covering **EDUCATIONAL AND DEVELOPMENT SOFTWARE, SIMULATION** and **ASSEMBLY OF ELECTRONIC CIRCUITS** employing various technologies and which can be updated to meet current developments and trends.

This section is arranged so as to implement a modular and flexible training program which is continuously enriched by innovative circuit solutions and which ensures a technically updated training course.

The equipment proposed by ELETTRONICA VENETA S.p.A. for setting up ELECTRONICS Laboratories is divided into three product ranges:

- INTERACTIVE PRACTICAL LABORATORY FOR THE STUDY OF GENERAL ELECTRONICS
  I.P.E.S. SYSTEM
- WORKSTATION FOR THE ADVANCED EXPERIMENTATION IN ELECTRONICS
  M.P.T. SYSTEM
- SOFTWARE and INSTRUMENTS for PROJECTS' DEVELOPMENT
  SOFTWARE
  KIT FOR CIRCUITS CONSTRUCTION AND ASSEMBLY
  INSTRUMENTS, COMPONENTS, PROGRAMMING AND CODE DOWNLOADING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BE

20-B

BASIC ELECTRONICS

I.P.E.S. System

BE

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INTERACTIVE PRACTICAL LABORATORY FOR THE STUDY OF GENERAL ELECTRONICS I.P.E.S. SYSTEM

Aim:

- Basic training on Electricity, Electronics and Industrial Electronics

Equipment:

- Computerised workstation with Sets of Experiments' Board
- Computer Based Training with multimedia Lessons
- Insertion of circuits parameters' variations and faults

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I.P.E.S. SYSTEM
INTERACTIVE PRACTICAL LABORATORY

INTRODUCTION

Qualified, skilled technicians capable of solving the installation and maintenance problems of electronic equipment are in ever-increasing demand and their associated training is a growing requirement in educational establishments. This type of training is also suited for personnel re-qualification and updating courses.

The I.P.E.S. system was designed with these needs in mind and enables the set up of both theoretical and practical courses where time is limited. The exercises can be performed in manual mode or with the aid of a computer. Courses begin with the study of basic electronics and progress through to advanced technologies which depend on electronics: industrial electronics, telecommunications, biomedical electronics, autotronics, consumer electronics, hydronics, etc...

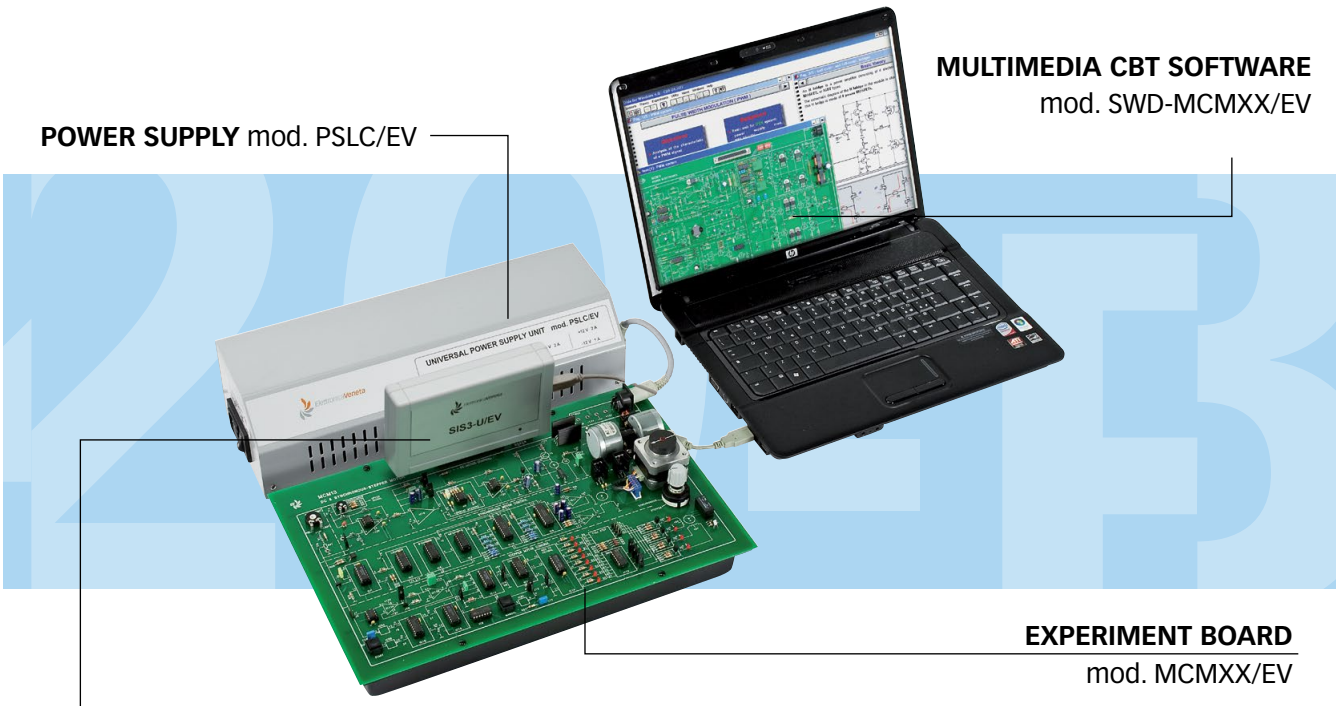
THE MAIN FEATURES OF THE SYSTEM ARE:

- shorter training times
- self-learning through both theoretical study and practical exercises
- updating courses in various technological fields, supported 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 the real industrial world, providing an ideal base for understanding the theory
- circuit configurations that can be changed, either manually or under computer control in order to encourage an inductive learning method
- insertion of faults into circuits and troubleshooting methods

THE MAIN ADVANTAGES OF THIS TYPE OF LEARNING ARE:

- it can be carried out individually (self learning) or in a laboratory environment (guided by a teacher).
- self-assessment of the level of learning, or assessment by the lecturer, can be achieved in real time - in the laboratory, comparing the outcome with previous results
- tailor - made training courses, in content and duration, can be set up extremely quickly and simply, to meet any requirement. These courses may have different starting and finishing levels depending on the students' previous training and the objectives to be reached
- the use of networked computers allows this system to be extended to users who are not necessarily in the same place, but who may be at other locations. (REMOTE TRAINING AND LEARNING)

I.P.E.S. INTERACTIVE WORKSTATION



MULTIMEDIA CBT SOFTWARE
mod. SWD-MCMXX/EV

POWER SUPPLY mod. PSLC/EV

EXPERIMENT BOARD
mod. MCMXX/EV

INTERACTIVE CONTROL UNIT mod. SIS3-U/EV
connected to PERSONAL COMPUTER

The laboratory consists of a set of student workstations connected to the teacher workstation via:

- **LOCAL DATA NETWORK**
- **VIDEO-KEYBOARD-MOUSE EXCHANGE SOFTWARE**
- **CLASSROOM MANAGEMENT SOFTWARE mod. SW-X/EV**

The specific experiment board is connected to the Interactive Control Unit mod. SIS3-U/EV which is interfaced to the PC via a USB connection.

The front surface of the experiment board shows the screen-printed circuit diagrams, the measurement points and the jumper connections for circuit modifications while the hard cover on the rear surface acts as component and circuit protection and tabletop support. The experiment board is connected to the Interactive Control Unit mod. SIS3-U/EV and to the Power Supply mod. PSLC/EV which supplies all the voltages required for its operation.

Each board is supplied with a set of interactive lessons, which can be carried out with a specific software and PC and which guide the student through the theory and the practical experiments, including fault insertion and circuit variation by means of the Interactive Control Unit mod. SIS3-U/EV.

Below is a list of the components which make up the structure of the I.P.E.S. Lab and of all the topics covered by the experiment boards of the I.P.E.S. system for the study of Electronics:

- INFRASTRUCTURE
- BASIC ELECTRICITY EXPERIMENT BOARDS
- LINEAR ELECTRONICS EXPERIMENT BOARDS
- DIGITAL ELECTRONICS EXPERIMENT BOARDS
- MICROPROCESSOR AND MICROCONTROLLER EXPERIMENT BOARDS
- INDUSTRIAL ELECTRONICS EXPERIMENT BOARDS

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I.P.E.S. LABORATORY SET-UP

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I.P.E.S. SYSTEM
INFRASTRUCTURE

POWER SUPPLY mod. PSLC/EV

It supplies the voltages necessary for the power supply of the experiment boards.
The supplied voltage and current values are screen printed on the front side. These voltages are available on a DIN connector located on the right hand side of the unit and are supplied directly to the experiment board by means of a standard cable.

The supplied voltages are:

OUTPUT 1: +1.3 Vdc ÷ +24 Vdc, 1A
Stabilized voltage, electronically protected against short-circuits and overloads. Rotating switch on the left hand side to select the variable voltage

OUTPUT 2: 24 Vac – 0 – 24 Vac, 0.5A
Fuse protected

OUTPUT 3: +5 Vdc – 2 A

OUTPUT 4: +12 Vdc – 2 A
Stabilized voltage, electronically protected against short-circuits and overloads.

OUTPUT 5: -12 Vdc – 1A
Stabilized voltage, electronically protected against short-circuits and overloads.

Main supply: 115/230 Vac, ±10%, 50/60 Hz.
Maximum power: 150 VA
Dimensions: 385 x 105 x 130 mm

INTERACTIVE CONTROL UNIT mod. SIS3-U/EV

The Interactive Control Unit mod. SIS3-U/EV has a USB connection to the PC and a multipin connection to the experiment board.

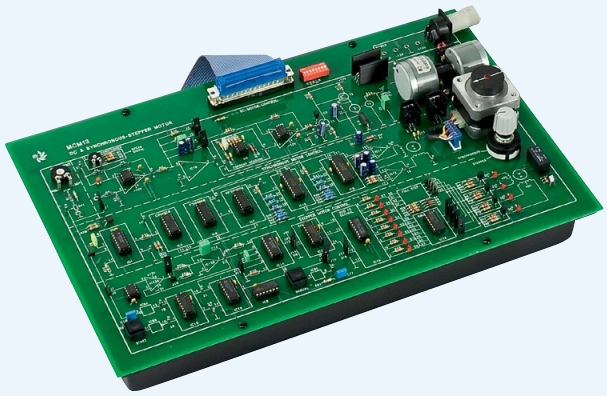
It constitutes the interface between the PC and the experiment board, enabling the insertion of 24 faults or circuit parameter variations. The power is supplied directly by the PC to which it is connected.

ELECTRONICS EXPERIMENT BOARDS

The experiment boards are the fundamental units of the I.P.E.S. system, enabling the student to perform all the exercises and experiments contained in the courseware, including the insertion of faults and circuit parameter variations.

The boards contain a set of pre-assembled components which are divided into functional circuit blocks. The experiments and circuits are set up using bridging plugs and connection cables. The interactive experiments can be performed either in manual mode, by means of the on-board DIP-switches and a printed manual, or in computerised mode, with the Interface Control Unit mod. SIS3-U/EV, a PC and course software.

All boards are powered directly by the Power Supply Unit mod. PSLC/EV and are supplied with their specific courseware which guides the student through the theory, the practical experiments and troubleshooting.



INTERACTIVE MULTIMEDIA CBT SOFTWARE mod. SW-D-MCMXX/EV

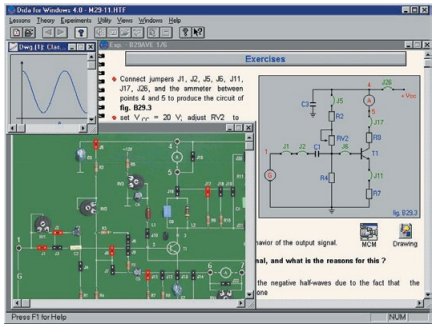
The software consists of a number of lessons for each MCMXX/EV experiment board and includes:

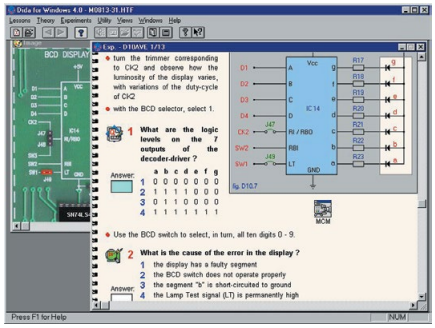
- The theoretical explanation of the relevant topic and a series of simulations
- A guide to the exercises with circuit illustrations, questions, practical experiments, automatic fault insertion and circuit parameter variation.

This software allows the student to study the specific topic and to perform the experiments autonomously, without the need of additional documentation.
The software structure, designed to run under a Windows environment, is a multimedia graphic interface with a hypertextual organisation of the relevant topics and high definition images and graphics.
The simulations included in the first section help to understand the theoretical concepts before progressing to the practical experiments.

During the practical experiment stage, the student simply selects the various functions with the mouse and answers the questions in the associated exercise section. The student can also create reports or document laboratory tests which will subsequently be evaluated by the teacher.

In self-learning mode, all the results are filed on the student PC while in laboratory mode (Classroom Management Software mod. SW-X/EV is required) they are automatically sent to the teacher's workstation.





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LOCAL NETWORK

Data can be exchanged through a Local Area Network.
This network consists of an interface card installed in each PC, a connection cable and the management software.
It enables file sharing between teacher and student workstations.

The network enables the students to:

- use files and data stored on the teacher's PC.
- use peripheral units connected to the teacher's workstation.

Using the classroom management software mod. SW-X/EV, the teacher can select the student assignments and automatically collect the final results.

Each network connected PC must be equipped with:

- Ethernet network card with UTP cable connection
- Peer-to-peer software for sharing files and peripheral units. The only requirement is the sharing of the teacher's hard disk for the class database, both for the distribution to the class and use of the various lessons associated with the different experiment boards as well as for the collection of the students' results.

Software
VIDEO-KEYBOARD-MOUSE EXCHANGE

The laboratory performance can be optimised by adding the MULTIMEDIA CLASSROOM NET CONTROL system. This consists of an advanced multimedia educational software which provides greater flexibility in teaching, monitoring and assisting students than traditional hardware systems. It manages the video and keyboard exchange between classroom computers and requires only that the PC's be connected to each other by means of a standard LAN network.

The characteristics of the system are the following:

- The teacher has total control of the student PC's without having to leave his desk.
- Very simple, user-friendly operation for both teacher and students by means of an icon-based software.
- Does not use the PC memory and hard disc resources.
- Has no minimum PC requirements (any PC can be used).

General Functions:

- Monitor EXCHANGE between:
  - Teacher and student
  - Teacher and groups of students (max. 8 groups)
  - Teacher and the whole classroom
- Monitor, keyboard and mouse EXCHANGE from student to teacher.
- The teacher can correct the students by remote control of each student's PC.
- File management: students, classes, teachers with possibility of moving and allocating students by name, surname and group as decided by the teacher.
- Video transmission to single students, groups or the whole class.
- Disablement of the student PC's, at the discretion of the teacher.
- Periodic control of the students' screen at time intervals determined by the teacher.

Technical specifications

VIDEO - KEYBOARD - MOUSE FUNCTIONS:

- Real time transmission of the screen from the teacher's PC to a student, a group or to the whole class. Integrated graphic pointer for illustrations and explanations.
- Disable/Enable student keyboard and mouse.
- The teacher can shut down the screen and disable the keyboard and mouse of a single student, a group or the whole class in order to get their attention.
- The teacher's screen can be transmitted to only a portion of the student's screen thus allowing the teacher to give instructions at the same time that the student is performing the exercises. One frame shows the teacher's instructions while the rest of the screen is dedicated to the specific student experiment application.
- The teacher can monitor a single screen, a group of screens or all the students' screens (simultaneous screening of 8 monitors).
- The teacher can use his/her keyboard and mouse to remotely control any student PC in order to assist them in their work. The teacher can select a student to give a presentation and transmit his/her screen to the other students. The teacher can authorise any student to access his/her PC.
- CD/DVD programmes can be transmitted to selected students in full or partial screen mode. Transmission does not effect the speed of the standard data network via which all the PC's are connected.

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CLASSROOM MANAGEMENT SOFTWARE mod. SW-X/EV

The software is divided into two parts:

- Lesson assignment and result collection
- Management of student classrooms, processing and filing of results

The first part of this software deals with data network connection management.
It is used with the network software installed with the Ethernet card in a classroom of networked PC's.

Using this software, the teacher can:

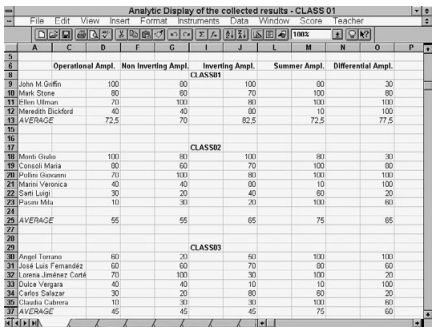
- Assign each student the specific lesson or set of lessons to be completed. Each student can be assigned a different lesson or set of lessons based on their specific level of preparation.
- Assign a lesson to the whole class
- Display the current stage of the lessons completed and those yet to be executed by each student
- Monitor the results of each student in real time

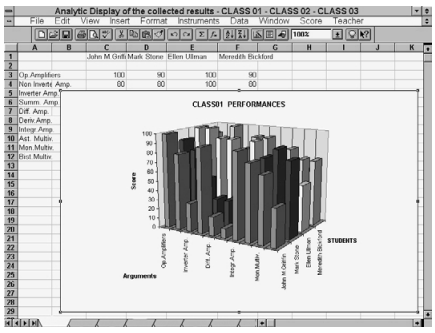
The second part of this software is used by the teacher for processing the results of the students' answers.

It allows the teacher to manage various classes and to constantly monitor the students' progress, either in a microprocessor-controlled laboratory set up or a multimedia one.

The main features are:

- Management of 90 classes.
- Management of 32 students per class.
- Entry of students' names.
- Automatic data collection from the control units.
- Progressive storage of results collected from the student workstations.
- Display of the temporary results of the progress of previous lessons. The teacher can save the reference results of the last of a series of previous attempts at executing the same lesson.
- Detailed and summarised display and printout of the students' results: the results of each student or of each class achieved for each completed lesson.
- Graphic display of the marks obtained by the students, providing an instantaneous, comprehensive evaluation of each class.
- Recording of the last temporary results obtained as reference for each student or for each class. Different results obtained for the same lesson can be collected. The teacher can then decide which result to save as the most significant reference for the student and the class.





EL.VE. SOFTWARE
EDUCATIONAL EDITING SOFTWARE

EDITING SOFTWARE FOR CREATING NEW LESSONS OR MODIFYING EXISTING ONES

This software includes a set of programmes for modifying the various lessons for the experiment boards mod. MCMXX/EV and ATXX/EV. New theoretical or practical sections can either be added or created.

It includes an editor for inserting:

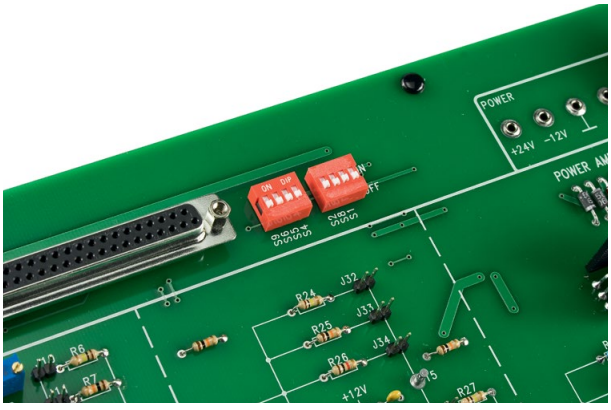
- the theory pages
- the experiment pages
- the notes to the theory and experiment pages

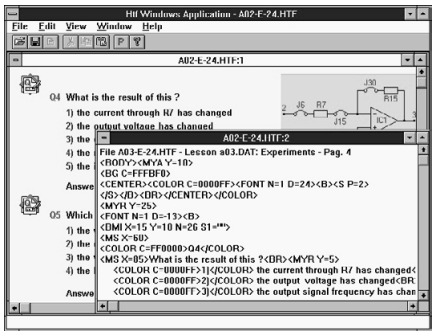
The page is formatted and the general appearance is determined by means of special marker commands (tags) which contain indications on the layout and style of the text, on the images to be placed in the overall page layout, on the content of the tables for data insertion and links with other pages, on the text and background colour.

The program contains a Pre-View of the page being created or modified. With a single command, it is possible to view the page as it would appear to the student during the lesson, thus considerably accelerating the creation of teaching material.

MANUAL MODE

All MCMXX/EV and ATXX/EV boards include a number of on-board micro-switches for circuit parameter variation and fault insertion, enabling the same lessons to be conducted without the need of the CBT software and interface control unit. In this case, the boards are supplied with a comprehensive, printed theoretical and experimental manual.





DRAWING, DIAGRAMME AND IMAGE EDITING

This program is used to create drawings which can be added to the pages of the training manuals. It simplifies the creation of some types of drawings and circuit diagrams and also enables modification of the images which are added to the lesson pages. The program can read images in BMP and JPG format.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BASIC ELECTRICITY EXPERIMENT BOARDS

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MCM1/EV

(DC CIRCUITS AND SYSTEMS)

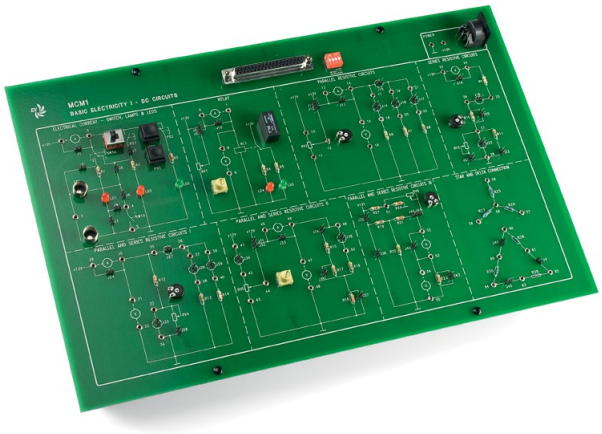
INTRODUCTION

MCM1/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM1/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM1/EV

Experiment Board for the study of the basic concepts related to DC circuits. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Electricity, units and symbols;
- The e.m.f. and the difference of potential;
- The effects of the electrical current on the human body, safety;
- Measurements;
- DC current, switches and relays;
- Power supplies and measuring instruments: voltmeter, ammeter, ohmmeter, the multimeter;
- Ohm's Law;
- Series and parallel resistive circuits: current, voltage and resistance measurements;
- Kirchhoff's Laws: voltage, current and resistance circuit calculation;
- Thevenin's Theorem: equivalent e.m.f. and series resistance calculation;
- Norton's Theorem: equivalent current and parallel resistance calculation;
- Superposition Theorem;
- Rheostats and potentiometers;
- Power in DC; Power transfer.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc - 0.5A
1.3÷24 Vdc - 0÷2A var

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM1/EV

MCM2/EV

(AC CIRCUITS AND SYSTEMS)

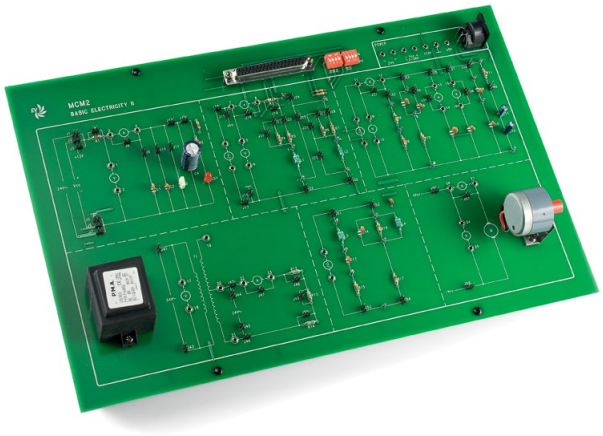
INTRODUCTION

MCM2/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM2/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM2/EV

Experiment Board for analysis of the application of various electronic components in AC circuits and the use of DC motors. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Magnetic fields;
- Electrical and electromagnetic fields;
- The capacitive effect and the capacitors: the energy storage, the current as a function of the voltage applied to a capacitor;
- The inductive effect and the inductors: internal resistance measurement and experimental test of an inductor;
- AC resistive and capacitive circuits: the impedance as a function of the frequency. Verifying the voltage and current phase shift in a condenser;
- AC inductive circuits: the voltage and current phase shift in an inductance, voltage and current with sinusoidal input and the reactance calculation of a coil;
- The RLC circuit: the concept of circuit impedance, current and voltage measurement in RC, RL and RLC circuits;
- Series and parallel resonance: the resonant frequency measurement in parallel and series circuits, the Q factor of a series resonant circuit;
- AC power: active, reactive and apparent power;
  The transformer: no-load and under load tests and transformer ratio measurement;
- The autotransformer;
- DC electrical motors: the speed as a function of the applied armature voltage, and the current as a function of the applied load;
- The electrical motor as an electrical generator.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc - 0,5A
1,3÷24 Vdc - 0÷2A var.
+5 Vdc - 2A
2x24 Vac - 0,5A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM2/EV

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MCM2T/EV

(THREE-PHASE CIRCUITS AND SYSTEMS)

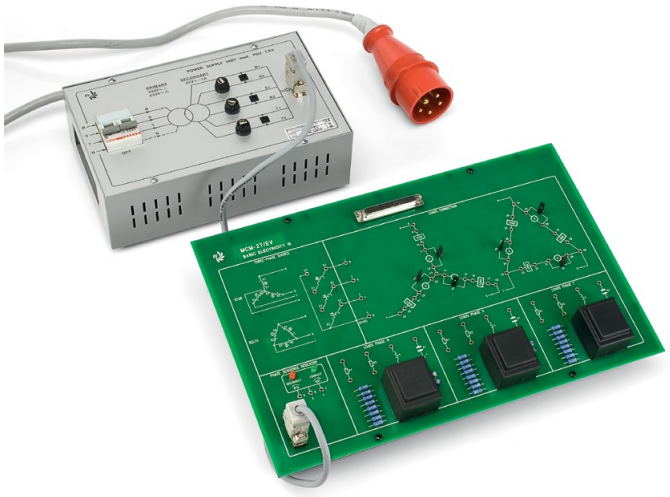
INTRODUCTION

MCM2T/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM2T/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM2T/EV

Experiment Board for the study of three-phase systems, their connections (delta/star) and three-phase power. It is powered by an external three-phase transformer supplying 3 x 42V AC. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Three-phase system;
- Three-phase power supply;
- Transport of three-phase current;
- Vector representation of the quantities;
- Star connection;
- Delta connection;
- Sequence of generator phases;
- Three phase load: star and delta connection;
- Three-phase star and delta resistive load;
- Star and Delta connection comparison;
- Three phase power systems;
- Three phase system with unbalanced load;
- Power supply with single and three-phase load;
- Inductive loads;
- Capacitive loads;
- Power factor.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 9-pole connector for Power Supply Unit
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED POWER SUPPLY:

- 9-wire connector to the power supply unit mod. PSU-T/EV
- Safety connectors for the connection of the power supply
- Three-phase low-voltage power supply from independent transformer: 3x24Vac – 1A

SUPPLIED WITH

STUDENT HANDBOOK: THEORY AND EXERCISES

TEACHER HANDBOOK: WIRING DIAGRAMS AND SOLUTIONS OF EXERCISES

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM2T/EV

MCM2A/EV
(ELECTROMAGNETISM)

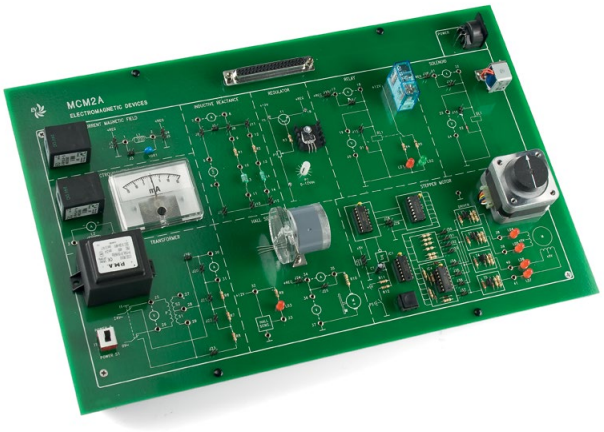
INTRODUCTION

MCM2A/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM2A/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM2A/EV

Experiment Board for analysis of the magnetic effects of current and testing of the effects of electromagnetic induction. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Permanent magnets and ferromagnetic metals;
- Curie point;
- Magnetic field and spectrum;
- Magnetic permeability;
- Induced flux and measurement units;
- Electromagnetic induction, self-induced electromagnetic force;
- VDR suppressor of interference generated by CEMF (counter electromotive force);
- Inductive reactance factor, phase angle;
- Mutual inductance in transformers, radio coils;
- Solenoids and magnets for relays, pick-up, drop-out;
- Transformer;
- DC motors, voltage, current, speed, direction;
- Hall effect sensors as a speed measurement;
- Step by step motor: full and half-step driving with unipolar current, step number measurement;
- Step by step motor application example.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM2A/EV

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LINEAR ELECTRONICS EXPERIMENT BOARDS

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MCM3/EV
(SEMICONDUCTORS)

INTRODUCTION

MCM3/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM3/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM3/EV

Experiment Board for analysis of semiconductor devices and their most common applications. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.

TRAINING PROGRAM:

- Introduction to semiconductors: Current conduction mechanism, semiconductors doping, minor and major electrical carriers;
- PN junction: diffusion and field current and potential barrier;
- P-N junction; direct and inverse polarization;
- Avalanche effect;
- Zener effect;
- Diode characteristics: direct and inverse conduction, diode conduction according to the applied voltage, volt amperometric characteristic tracing;
- Rectifier: transformer central tap, full wave, Graetz's bridge;
- Ripple filters: capacitive filter, inductive, LC, CLC and CRC;
- Voltage-doubler;
- Clipping and clamping circuits: load and no-load test;
- Zener diodes, differential resistance, voltage stabilisation with changing load and output;
- UJT transistors: triangular and square wave generator
- PUT: application, frequency splitter circuit;
- SCR: holding current, triggering and cut-off. Anodo-gate and anode-cathode connections. Triggering characterics;
- DIAC and TRIAC: DIAC characteristic, impulse generator, TRIAC bidirectional conduction.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc - 0.5A
1,3÷24Vdc - 0÷2A var.
2x24Vac - 0,5A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM3/EV

MCM4/EV

(FEATURES AND BIASING OF TRANSISTORS)

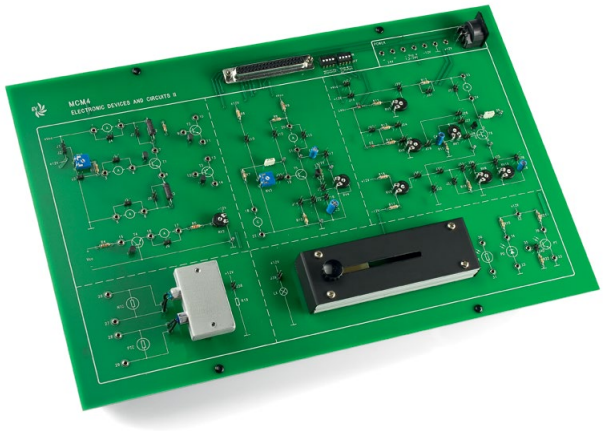
INTRODUCTION

MCM4/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM4/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM4/EV

Experiment Board for the study of the parameters and biasing methods of semiconductor devices. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- NPN and PNP transistors: operation and fundamental equations;
- Transistor static gain;
- Emitter collector characteristic curves;
- Field effect transistors: J-FET characteristic transconductance curves;
- MOSFET: MOSFET Depletion, MOSFET Enhancement, MOSFET and JFET comparison;
- JFET circuit amplifier, voltage generator and signal amplifier;
- Optoelectronic components: photo-resistance, photo-diode, photo-transistor, resistance-brightness and voltage-brightness;
- Temperature transducers: resistance-temperature characteristic;
- Transistor connections: CE, CB and CC configuration;
- Transistor biasing: output circuit and characteristic, bias determination with graphical and analytical method;
- Transistor working zones;
- Bias circuits with one power supply;
- Working classes: A, B, C;
- Bias stabilization: thermal effect, CE and CB stabilization;
- Stability parameters, VBE influence, gain influence,
- stabilization effect on signal components.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc - 0.5A
1,3÷24Vdc - 0÷2A var.
2x24Vac - 0,5A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM4/EV

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MCM5/EV

(VOLTAGE AND POWER AMPLIFIER CIRCUITS)

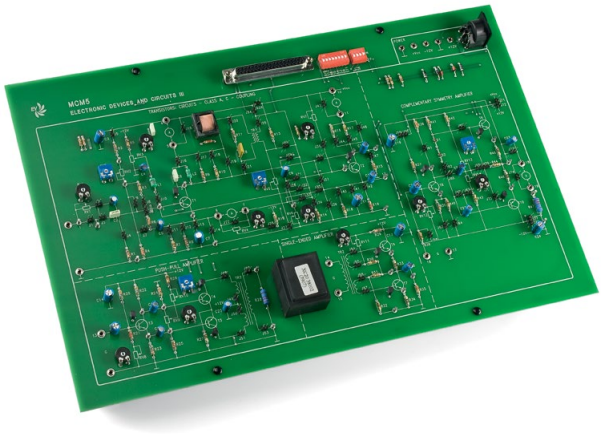
INTRODUCTION

MCM5/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM5/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM5/EV

Experiment Board for analysis of all the main types of transistor amplifier circuits. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Small signal parameters: transistor's equivalent circuit with CE, "h" parameters definition and variation;
- Emitter characteristic according to "h" parameters;
- Bias parameters measurement;
- Amplifier measurement and input capacity effect;
- Input and output resistance measurement;
- Emitter followers;
- Double load amplifier: characteristic according to "h" parameters, voltage and offset gains, input resistance measurement;
- RC coupling: number of stages, and modes;
- Transformer coupling: bias, characteristic according to "h" parameters;
- Direct coupling: characteristic according to "h" parameters;
- Darlington connection: characteristic according to "h" parameters, saturation voltage;
- Cascade and Bootstrap connections: characteristic according to "h" parameters;
- Differential amplifier: bias, common mode rejection ratio (CMRR), differential gain;
- Class A amplifiers: power, output efficiency;
- Class B amplifiers: Single-Ended with double and single power supply, Push-Pull, energy balance, cross-distortion;
- Complementary symmetry amplifiers: single and double power supply;
- Class C amplifiers: resistive and tuned load.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
1,3÷24Vdc - 0÷2A var.

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM5/EV

MCM6/EV
(OSCILLATOR CIRCUITS)

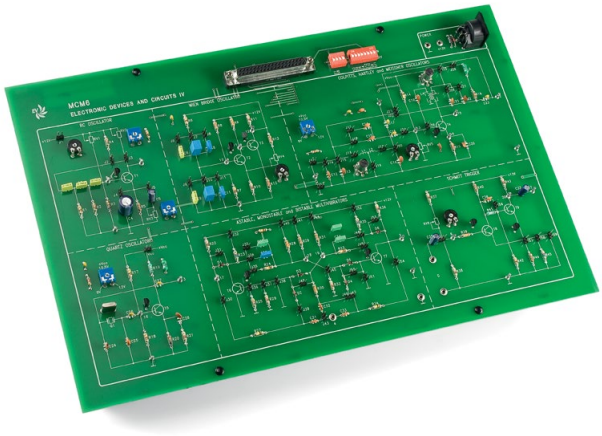
INTRODUCTION

MCM6/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM6/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM6/EV

Experiment Board for investigating oscillating circuits, monostable, bistable and astable multivibrators. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- RC and Wien bridge oscillators: RC or offset oscillator, resistance collector variation;
- Colpitts oscillator: frequency oscillator according to L and C and to the supply voltage;
- Hartley oscillator;
- Meissner oscillator;
- Crystal oscillator: frequency stability, equivalent crystal circuit, JBT crystal oscillator, voltage variation;
- Astable multivibrators;
- Monostable multivibrators: control circuit, square wave input functioning, synchronisation frequency, output pulse duration;
- Bistable multivibrators: control circuit and propagation duration, frequency splitter, maximum commutation frequency;
- Schmitt trigger: parameters determination, output voltages, VTH and VTL voltages, circuit feedback with triangular and sine waves, commutation speed.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
1,3÷24Vdc - 0÷2A var.

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM6/EV

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MCM7/EV

(OPERATIONAL AMPLIFIERS)

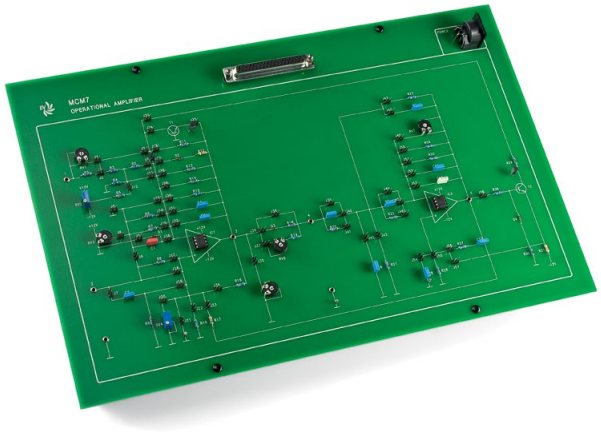
INTRODUCTION

MCM7/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM7/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM7/EV

Experiment Board for analysis of the parameters and numerous possible configurations of operational amplifiers. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Typical parameters: amplification, output voltage, common mode rejection ratio (CMRR), input/output impedance, slew-rate, band width for unitary gain;
- Inverting amplifier;
- Non-inverting amplifier;
- Adder amplifier;
- Difference amplifier;
- Integrator amplifier;
- Differentiator amplifier;
- Comparator amplifier;
- Logarithmic amplifier;
- Monostable multivibrator;
- Astable multivibrator;
- Sinewave oscillator;
- Waveform generator;
- V/I Voltage/frequency converter;
- Low-pass filter;
- High-pass filter;
- Band-pass filter.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM7/EV

MCM7A/EV

(V/I, I/V, V/F, F/V CONVERTERS)

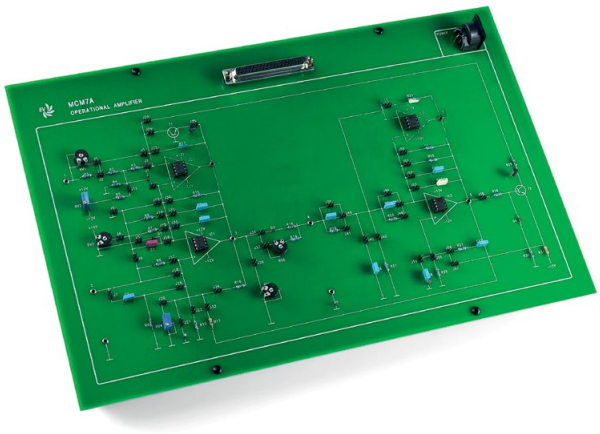
INTRODUCTION

MCM7A/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM7A/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM7A/EV

Experiment Board for investigating V/I and I/V, V/F and F/V converter circuits. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- V/I and I/V converters;
- Use of the operational amplifier to increase the entry impedance;
- Input current and output voltage dynamic range;
- F/V and V/F converters;
- Output Buffer;
- Linearity.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM7A/EV

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20-B

DIGITAL ELECTRONICS EXPERIMENT BOARDS

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MCM8/EV

(SEQUENTIAL AND COMBINATIONAL LOGIC)

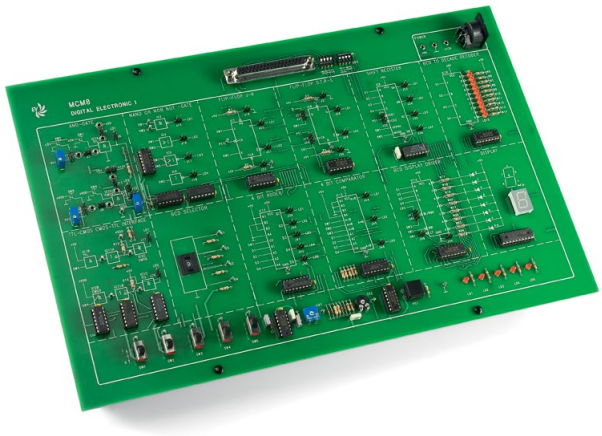
INTRODUCTION

MCM8/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM8/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM8/EV

Experiment Board for the study of digital circuits, starting from basic logic and progressing through to sequential and combinational logic networks. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Logic families - typical parameters: voltage characteristic, current, dissipated power from a logic device, input load (FAN-IN), output load (FAN-OUT), noise margin, transition and propagation time;
- TTL logic family: electrical characteristic, status ON/OFF, commutation, subfamily ECL;
- CMOS logic family: complementary output status, CMOS, HC and HCT series;
- TTL-CMOS and CMOS-TTL interface;
- Boolean algebra: class, logic statement, postulate and theorems, logic functions;
- Combinational logic circuits: function minimization, Karnaugh map;
- Flip-Flops, sequential circuits: flip-flop (latch)R-S, flip-flop with clock R¬S, flip-flop J-K, flip-flop Master-Slave J-K, flip flop D, flip-flop T, clock generator with logic ports
- Shift registers: integrated circuit SN 74LS95;
- Encoders and decoders: decimal encoder/decoder BCD;
- Display driver and 7-segment display BCD, LED visualization;
- Adders, comparators and BCD selectors: binary adder, cascade connection for adders, 1-4 bit comparator, BCD pre-selector.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
+5Vdc – 2 A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM8/EV

MCM8A/EV

(A/D AND D/A CONVERTERS)

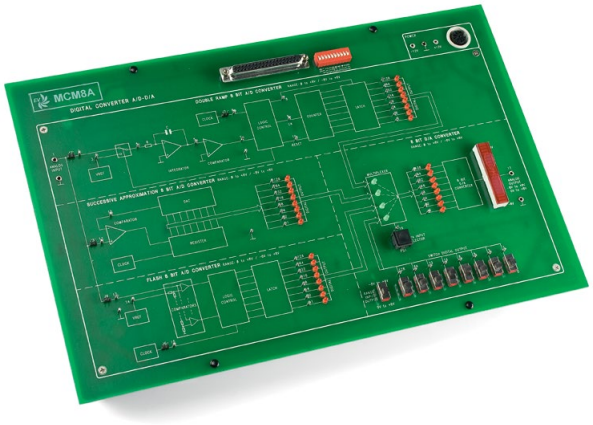
INTRODUCTION

MCM8A/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM8A/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM8A/EV

Experiment Board for the study of analog to digital and digital to analog conversion circuits. Apart from the digital component related to the two types of conversion, the analog component present in the conversion processes is also analysed. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Characteristics of analog-to-digital conversion: Sampling, Quantization, sample & hold, conversion time, errors, signal-to-noise ratio;
- A/D converters with double-ramp: input signal integration for a constant time, impulse number count proportional to the input voltage;
- A/D converters: chronometer signal generator, sequential logic device at n output lines, analog/digital converter at "n" bit;
- A/D FLASH converters: comparison between input analog value and fixed ones, control logic, analog digital converter at "n" bit;
- D/A converter;
- Comparison between different A/D converters based on the input frequency signal;
- Selection of the conversion type according to the application.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- Input range: switchable between 0 – 8V and -8V – +8V
- Output range: switchable between 0 – 8V and -8V – +8V
- LED display for digital signals
- Digital values configuration by means of switches
- Bar LED display for analog signals
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pin connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
+5 Vdc – 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM8A/EV

 ELETTRONICA VENETA S.P.A. - 31045 Motta di Livenza (TV) Italy - Via Postumia 16 - Tel. +39 0422 765 802 - Fax +39 0422 861 901 - E-mail: export@elettronicaveneta.com

MCM9/EV

(ADVANCED LOGIC APPLICATIONS)

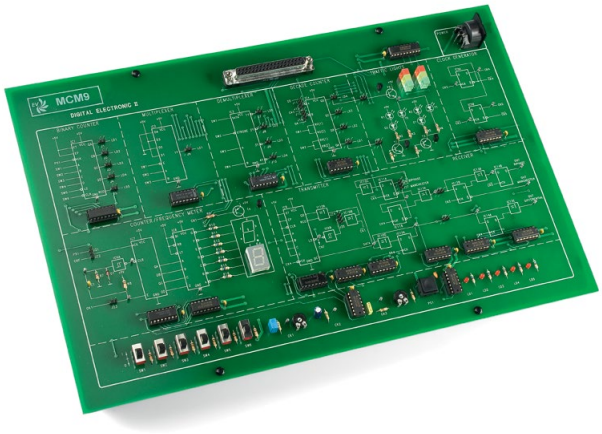
INTRODUCTION

MCM9/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM9/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM9/EV

Experiment Board for investigating several typical applications of digital circuits. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Multiplexer: applications, integrated circuit SN 74LS153;
- Demultiplexer: IN/OUT circuit, integrated circuit SN 74LS155, binary-decimal decoder;
- Asynchronous and synchronous counters: BCD 10 module counters, 7490 counter;
- Traffic light simulator: 74LS90 counter, LED interface;
- Counter/frequency meter;
- Digital transmission/reception systems: NRZ code;
- Encoder/decoder Manchester code;
- Encoder/decoder double phase code;
- Encoder/decoder 1 bit differential code.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
+5Vdc – 2A

SUPPLIED WITH

STUDENT HANDBOOK: THEORY AND EXERCISES

TEACHER HANDBOOK: WIRING DIAGRAMS AND SOLUTIONS OF EXERCISES

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM9/EV

MCM9A/EV

(FPGA - FIELD PROGRAMMABLE GATE ARRAY)

INTRODUCTION

MCM9A/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

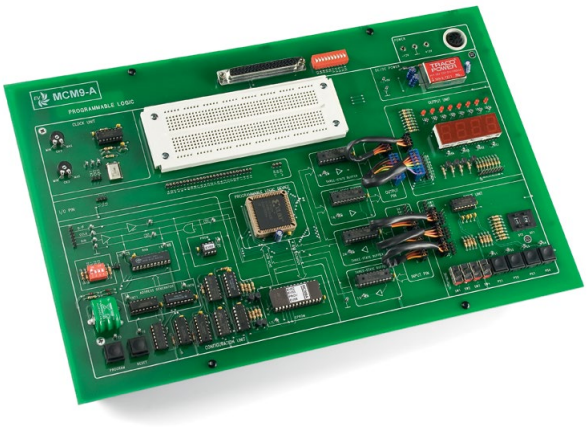
The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM9A/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM9A/EV

Experiment Board for the study and use of a high level development system for latest generation programmable logic and the creation of circuit examples using these types of devices.
Digital integrated circuits can be divided into two big families: standard integrated circuits and Application Specific Integrated Circuits (ASIC).
Among the sub-families of the ASIC, the most well-known is the Programmable Logic Device (PLD) which includes:

- PAL: consisting in a programmable AND matrix and a fixed OR matrix
- PLA: consisting in programmable AND and OR structures
- LCA and FPGA: deriving from the PLA and containing numerous completely programmable blocks

MCM9A/EV contemplates the LCA components in a non-permanent way (RAM memory). This simplifies the program and erase operations which become quicker and more immediate and enables instant modification of the implemented circuit while storing the previous configuration in an external permanent memory device.



TRAINING PROGRAM:

- View of the programmable logic devices and detailed description of the used device;
- Description of the different programming modes of the PLD;
- Analysis of the software development instruments available and guided creation of projects with general characteristics and problems;
- FPGA logic configuration: directly from PC, PROM, EPROM, RAM supplied with buffer battery;
- Project creation: circuit design and editing, simulation, compilation, transfer from PC to FPGA;
- Johnson counter project 6 module bit and 4 bit chronometer.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- LCA programmable device (FPGA)
- RAM, EPROM, PROM memories with pre-programmed examples
- Clock generators, pushbuttons, switches, LED's, display
- Breadboard for creating circuits to be connected to the programmable device
- PC interface
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pin connector for Power Supply Unit PSLC/EV
- Simulation of 10 faults

Dimensions: 386 x 248 x 40 mm

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DEVELOPMENT SOFTWARE:

The software tool required to process, minimise, simulate and implement the circuit in the programmable device. The function that the circuit has to perform can be inputted as an:

- electrical diagram,
- a Boolean equation,
- a Karnaugh map or
- a truth table.

Two types of simulation can be performed: a logic simulation and a sequential simulation to check the delays introduced into the logic device.

The output of the development software which consists of a FPGA configuration file, can be downloaded from the PC to the device or via a programmer to a PROM or EPROM or directly from the PC to a RAM powered by a buffer battery.

The device is not permanently programmed and can be re-used for other projects. Device used with variable pin-out in different formats starting from 55 I/O lines and 64 configurable inner blocks.

Minimum configuration of the Personal Computer for the Development software:

- **PC IBM Compatibile**
- **500 MB RAM**
- **VGA, SUPER VGA graphics**
- **Mouse**
- **CD-ROM Unit**
- **Parallel interface**
- **Windows XP or W7**

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
+5 Vdc – 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM9A/EV

MCM9B/EV

(FPGA - ADVANCED PROGRAMMABLE LOGIC WITH SPI MEMORY CONFIGURATION AND VHDL PROGRAMMING)

INTRODUCTION

MCM9B/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM9B/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM9B/EV

Experiment Board based on a non-permanent programmable FPGA with the set-up program stored in the SPI memory (Serial Protocol Interface).
This feature simplifies and speeds up the program and erase operations, which are safe and do not require external, non-permanent programmers or erasers.

The FPGA (Field Programmable Gates Array) are flexible components introduced to replace parts of circuits with obsolete traditional IC and to satisfy requirements of high volumes at low cost applications.

These components are an alternative of higher level to the ASIC (Application Specific Integrated Circuit), which have very high development costs and almost no flexibility.

They consist of a chip including an array of configurable logic blocks and some routing channels. Each logic block includes a Lookup Table LUT with 4 inputs and a flip-flop: the only output can be registered (or not) by the LUT.

To develop any digital circuit simply interconnect all these logical blocks. The interconnection can be codified as a bit sequence (bit stream) to be serially introduced after the reset and it programs the switches that are included in the device.

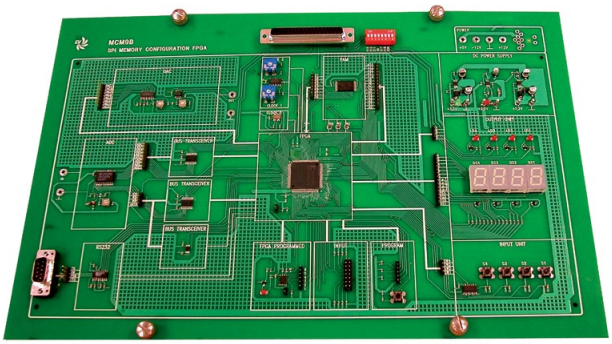
Each time the FPGA host circuit is started up, the bit sequence (and therefore, its functionality) is loaded from a SPI memory and keeps active up to the next memory programming (4Mb) or using the JTAG cable connected to the Personal Computer; in this case the code is active until the board is turned off.
The FPGA can be re-programmed or updated directly in the device that uses it without any component substitution.

The IN/OUT relation (the logic function) is set by the programmer during the project implementation of the programmable circuit.

This feature, added to the master circuit simplification and higher working frequences, has become the reasons of a fast development of these new logic circuits that are replacing the traditional Ics.

The FPGA associated electronic circuit is designed in VHDL (Hardware description Language), or directly through a SCHEMATIC ENTRY program by which the programmer graphically connects the components and therefore specifies the circuit function that will be connected to the component using a CAD program.

This last program ming mode is seldom used as it is specific for each component; instead, the VHDL language has become a standard for all the FPGA families.



For the practical educational training, the FPGA programming is carried out via a cable directly connected to the development Personal Computer.

TRAINING PROGRAM:

- Overview of logic programmable devices
- Detailed description of the used device
- Description of the FPGA programming modes
- Operation under different power supply values and adjustment between different components with transceiver devices
- Management of the specific sections:
  - A/D Converters
  - D/A Converters
  - RS232 serial line with PC interface
  - 7 segment LED and Display
  - Pushbuttons
  - RAM Memories
- VHDL programming language
- Simulation of specific circuits

The above subjects can lead to a complete project of a specific application.

The theoretical-practical manuals supplied with the module explain the operating principles of the devices, the proper use of the software and the development of circuits. Complete developed examples are supplied.

TECHNICAL SPECIFICATIONS:

FPGA:

The used FPGA has 100.000 gates density, equivalent to 2.160 logic cells and a max. 108 I/O lines. The used tecnology is 90 nm. The FPGA architecture is based over 5 programmable functional elements:

- CLB (Configurable Logic Blocks) including the LookUp (LUT) tables to implement logic and memory functions.
- IOBs (Input Output Blocks) to control de data flow from the external pins to the internal logics. Different signal standards are managed, including the DDR (Double Data Rate)
- 18-Kbit Block Ram for data memorizing
- Multiplier Blocks for the multiplication of two 18 bit numbers
- Digital Clock manager Blocks (DCM) for the clock signals management: distribution, delays, multiplication, division and phase difference.
- 100K Gates system
- Equivalent logic cells: 2160 including optional shift register or distributed RAM support.
- CLB (Configurable Logic Blocks): 240
- 15 Kbits distributed RAM
- 72 Kbits Block Ram
- 4 dedicated multipliers
- 2 DCM (Digital Clock Manager)
- 108 I/O USER max
- 40 I/O max differential pairs
- Max Operation frequency: 500 MHz
- Module frequency: 10MHz
- N° 2 variable frequency generators
- JTAG programming port
- N° 3 on-board pwr supplies: +1,2Vdc, +2,5Vdc, +3,3Vdc
- SPI programming memory: 4Mbit Flash Memory (512K x 8 pages - 3,3Vdc)
- 8 bit D/A converter
- 8 bit A/D converter
- N° 3 Octal Bus Transceiver.3-V / 5-V shifter with 3-state outputs
- N° 1 low power line receiver/transmitter RS-232 3,3Vdc
- N° 4 - 7 segments display
- N° 4 pushbuttons and 4 KEDs for circuits arrangements
- Management of a static CMOS RAM 3,3Vdc memory, 256K (32K x 8) bit
- Management of RS-232 serial communication line for PC interface.
- JTAG connector for the SPI memory saving or direct memorization to the FPGA from the PC

Dimensions: 386 x 248 x 40 mm

DEVELOPMENT SOFTWARE:

The software tool required to process, minimise, simulate and implement the circuit in the programmable device. The function to be performed by the circuit is inputed in the following sequence:

- Development of the new project
- Development of the VHDL descriptive file of the circuit (It is possible to insert the circuit function by using a graphic editor of digital networks, or defining a finite states machine of synthesis of the circuit to be developed).
- Defining the pins file to assign the IN/OUT of the theoretical circuit and the real FPGA pins.
- Circuit simulation for optimizing the times and the sequences.
- Transferring from the development Personal Computer to the module FPGA.
- Test of the developed function

The output of the development system is a configuration file that includes the data for programming the device.

The programmable device is normally used in different configurations, all of them can be developed by the proposed system:

- The configuration file is loaded from the PC on the device.
- The configuration file is loaded on a flash SPI memory and the content of this memory is loaded on the FPGA

It is worth noting that at every start the FPGA device is programmed with the data of the SPI serial flash memory or directly transmitted from the Personal Computer. As the FPGA is not permanently programmed, it is possible to reuse the same FPGA for different projects.

Minimum configuration of the Personal Computer for the Development software:

- **PC IBM Compatibile**
- **500 MB RAM**
- **VGA, SUPER VGA graphics**
- **Mouse**
- **CD-ROM Unit**
- **Parallel interface**
- **Windows XP or W7**

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
+5 Vdc – 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM9B/EV

20-B

MICROPROCESSOR AND MICROCONTROLLER EXPERIMENT BOARDS

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Z1/EV

(8 BIT MICROPROCESSORS)

INTRODUCTION

Z1/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-Z1/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

Z1/EV

The Z1/EV 8-bit microprocessor board is an educational system based on the Z80 version of a microprocessor. It is designed for an introductory study of microprocessor and of 8-bit systems in particular.

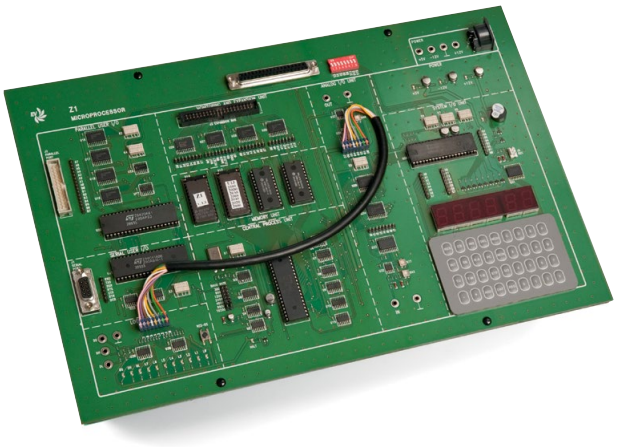
The module includes all the components characteristic of this kind of system (Z80 microprocessor, RAM and E²PROM, keyboard and display, serial and parallel interfaces, analog inputs and outputs and a fault control system).

The system is equipped with a considerable number of digital and analog interfaces, thus enabling its application to different sectors.

The machine code instructions, representing the program to be developed, are usually inserted from the keyboard and shown on the module display.

When the applications to be developed are too complex to be performed with the on board peripherals, the system can be connected to a Personal Computer by creating a Development system with the following phases:

- Program writing into the PC in Assembler using a text Editor;
- Program compiling and linking for the machine code transformation made by microprocessor;
- Program downloading, via serial or parallel interface, into the RAM of the microprocessor system;
- Program debugging directly on the microprocessor module with the module hardware interfaces;
- Transfer of the perfectly operating and completely PC tested program to an E²PROM programmer for the definitive programming of the E²PROM and its insertion into the proper base of the microprocessor system.



TRAINING PROGRAM:

- Programming 8-bit microprocessor systems;
- Instructions and controls from Monitor program;
- Analysis of hardware structure;
- Memory devices (RAM-E²PROM);
- BUS signals expansion: interface and programming;
- BUS signals monitoring;
- Interface with serial external devices: Z80-PIO, structure and programming, 2 bidirectional parallel programming ports;
- 7 segments display management keyboard;
- Analogue-to-digital and digital-to-analog converters;
- Troubleshooting in microprocessor system;
- Pre-programmed routine available;
- Program examples.

TECHNICAL SPECIFICATIONS:

- Z80 microprocessor, 2.5 MHz;
- 4-KB E²PROM system;
- 4-KB E²PROM user;
- 2-KB RAM (expandable to 4 KB);
- Keyboard with 20 function and 16 hexadecimal keys;
- 6-digit display (7-segments);
- Buzzer;
- Tape-recorder interface;
- PIO interface (2 ports, 8 bits);
- SIO interface (RS-232);
- Expansion BUS interface;
- Analogue output: 8-bit D/A converter;
- Analogue input: 8-bit A/D converter;
- Device for fault insertion (8-fault insertion system with switch);
- 6 logic probes for troubleshooting;
- Monitor program in E²PROM with the following commands:
  - viewing and editing the content of the registers and memory;
  - introduction of breakpoints in the programs;
  - loading and saving programs in assembler via PC;
- Fault simulation;
- Test and interconnection points, Ø 2 mm;
- Jumpers for rapid circuit modification;
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-wire connector to the power supply unit.

Dimensions: 386 x 248 x 40 mm

GENERAL FEATURES:

- Printed circuit board with protective treatment and silk screen mimic diagram;
- Additional modules (optional boards) are available for other applications.

DEVELOPMENT SOFTWARE:

Editing, compiling, linking and serial transmission program from Personal Computer to Z1/EV board.

SOFTWARE SW-D-Z1/EV:

This includes a series of lessons covering the topics required for the practical circuits of this board.
The development of theoretical, experimental and practical learning, including variations to the circuit and the automatic insertion of faults are performed through a multimedia graphical interface.

It's possible to connect and to experience the following mod. F04/EV application modules:

F04-0/EV
F04-1/EV
F04-2/EV
F04-3/EV
F04-4/EV
F04-5/EV
F04-6/EV
F04-7/EV
(see details from pag. EB53)

REQUIRED

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

POWER SUPPLY
±12 Vdc – 0.5A
+5 Vdc – 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-Z1/EV

PROTOTYPING UNIT Z1A/EV

E²PROM PROGRAMMER

Z2/EV

(16-BIT MICROPROCESSOR SYSTEM)

INTRODUCTION

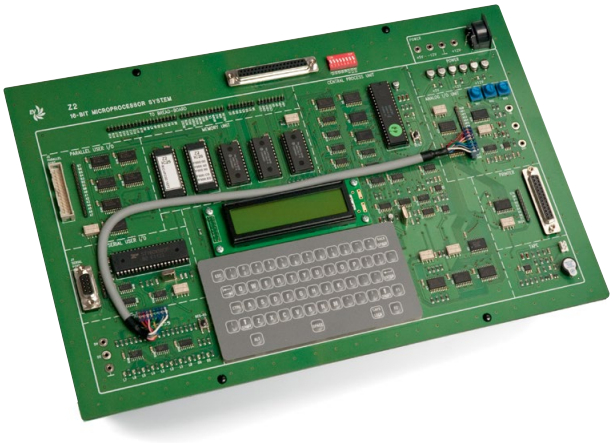
Z2/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-Z2/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

The 16-bit microprocessor unit is based on the 8088 and enables the study of systems using this class of CPU.
The choice of the INTEL 8088 microprocessor, the same used on the first Personal Computers, makes it an indispensable educational tool for the study of the hardware and software structure of the Personal Computer.
The instructions of the program are usually digitized from the keyboard and shown on the module display directly in Assembler language thanks to an interpreter program in line.

As the complexity of the applications which are to be developed increases, the system can be connected to a Personal Computer creating a Development System with the following phases:

- Insertion of the program into the PC in Assembler using a text Editor;
- Compiling and linking of the program for the transformation into machine code which can be obtained from the microprocessor;
- Program transfer via serial interface into the RAM of the microprocessor system;
- Debug phase of the program directly on the microprocessor module with the hardware of the same module;
- Transfer of the perfectly operating program which is completely tested by the PC to an E²PROM programmer for the last programming of the memory and its insertion into the proper base of the microprocessor system.



16-BIT MICROPROCESSOR SYSTEM mod. Z2/EV

The basic version of the module includes all typical components of this kind of system: 8088 microprocessor; RAM and E²PROM; QWERTY keyboard and liquid crystal display; serial and parallel interface; analog inputs and outputs; trouble-shooting section; monitor program in E²PROM with assembler and disassembler.

TRAINING PROGRAM:

- Programming of 16-bit microprocessor systems;
- Hardware structure of 16-bit systems;
- Data, control and address bus;
- Instructions and addressing modes;
- Interfacing of RAM and E²PROM;
- Keyboard and LCD display control;
- Parallel and serial interface;
- A/D and D/A conversion;
- Troubleshooting;
- The sources available in the system enables to deal with the problems related to the study of the microprocessor in a simple way. In particular, an inner line assembler working directly in Mnemonic code (Assembler), avoids Machine Code programming.

SOFTWARE:

Program for editing, compiling, linking and transmission from PC to board mod. Z2/EV: SW-Z2/EV.

TECHNICAL SPECIFICATIONS:

- 8088 microprocessor, 4.77 MHz;
- 32-Kbyte system E²PROM;
- 32-Kbyte user E²PROM;
- 6-Kbyte RAM;
- QWERTY keyboard with 59 keys;
- Liquid crystal display with 2 lines of 20 characters each;
- Buzzer;
- I/O parallel interface (2 ports, 8 bits);
- Centronics parallel interface;
- Serial interface (standard RS-232);
- Analog output: 8-bit D/A converter;
- Analog input: 8-bit A/D converter;
- 8-fault insertion system with switch;
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 10 Logic probes for troubleshooting;
- Monitor Program in E²PROM with controls for:
  - display and change register contents;
  - display and change memory contents;
  - assembler and de-assembler;

  continuous and step by step execution, break-point management.

Dimensions: 386 x 372 x 40 mm

It's possible to connect and to experience the following mod. F04/EV application modules:

F04-0/EV
F04-1/EV
F04-2/EV
F04-3/EV
F04-4/EV
F04-5/EV
F04-6/EV
F04-7/EV

(see details from pag. EB53)

REQUIRED

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

POWER SUPPLY
5 Vdc / 0.5A
±12 Vdc / 0.5A

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-Z2/EV

E²PROM PROGRAMMER

STAND-ALONE VERSION
The 16-bit microprocessor system can be provided in stand-alone version (mod. Z2/EV), which can be directly connected to 220 Vac with inner power supply unit.

Z3/EV

(32 BIT MICROPROCESSORS)

INTRODUCTION

Z3/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-Z3/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

Z3/EV

The Z3/EV 32-bit microprocessor board is a system developed for studying the most advanced microprocessors, and their most important applications.

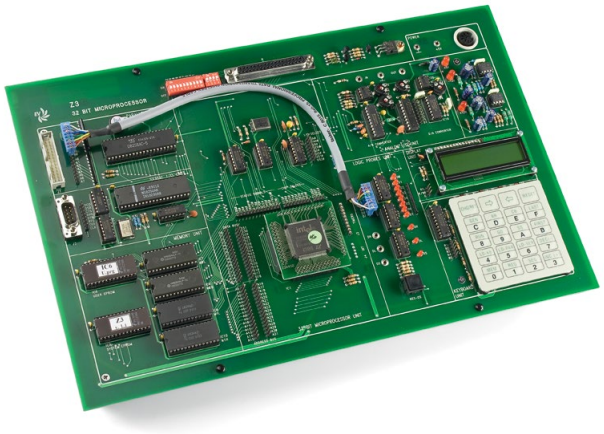
It contains all typical components of microprocessor systems: the microprocessor, RAM, EPROM, digital and analog I/O devices, etc.

The choice of the microprocessor used also on Personal Computers makes it a necessary educational equipment for studying the hardware and software structure of the Personal Computer.

The instructions of the program to be carried out are usually entered from the keyboard and displayed on the module display.

When the complexity of the applications to be developed increases, the system can be connected to a Personal Computer creating a Development System with the following phases:
- Programs insertion into the PC in Assembler using a Text editor;
- Program compiling and linking for machine code transformation by the microprocessor;
- Program transfer via serial or parallel interface into the RAM of the microprocessor;
- Program debug phase directly on the microprocessor module with the same module hardware;
- Transfer of the perfectly operating and completely PC tested program to an EPROM programmer for the definitive programming of the EPROM and its insertion into the proper base of the microprocessor system

The EPROM monitor contains all commands for programs execution and testing, and the control software for peripherals. The system is provided with test points for checking the signals and fault insertion possibility.



TRAINING PROGRAM:

- Programming of 32-bit microprocessor systems: programming introduction, machine code and assembler language programming, advanced programming;
- 80386EX microprocessor;
- Management control;
- Data and address bus;
- Control bus;
- Instructions and address modes;
- Maskable and not-maskable interruptions;
- RAM and EPROM interfacing;
- Keyboard and LCD display control
- Parallel interface
- Serial interface
- A/D and D/A conversion
- PC communication

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TECHNICAL SPECIFICATIONS:

- 32-bit microprocessor
- 32-KB static RAM
- 16-KB EPROM
- 8-bit parallel interface
- RS-232 serial interface
- Keyboard with hexadecimal and function keys
- LCD Display
- Test points for Data Bus, Address Bus and Control Bus
- Analog-to-Digital converter
- Digital-to-analog converter
- Monitor program in EPROM with commands for:
  - Data insertion/change in RAM
  - Register content display/change
  - I/O ports control
  - Continuous, stepper programs execution
  - Breakpoint control
- Fault simulation
- Test and interconnection points, Ø 2 mm
- Jumpers for rapid circuit modification
- 37-pin connector to the control unit
- 8-wire connector to the power supply unit

Dimensions: 386 x 248 x 40 mm

It's possible to connect and to experience the following mod. F04/EV application modules:

F04-0/EV
F04-1/EV
F04-2/EV
F04-3/EV
F04-4/EV
F04-5/EV
F04-6/EV
F04-7/EV

(see details from pag. EB53)

GENERAL FEATURES:

- Printed circuit with protective treatment and silk screen mimic diagram
- Additional modules (optional boards) are available for other applications

DEVELOPMENT SOFTWARE

Program for editing, compiling, linking and parallel transmission from Personal Computer to board mod. Z3/EV.

REQUIRED

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

POWER SUPPLY
±12 Vdc – 0.5A
+5 Vdc – 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-Z3/EV

EPROM PROGRAMMER

EPROM ERASER

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Z10/EV

(ST62E25 MICROCONTROLLER)

INTRODUCTION

Z10/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

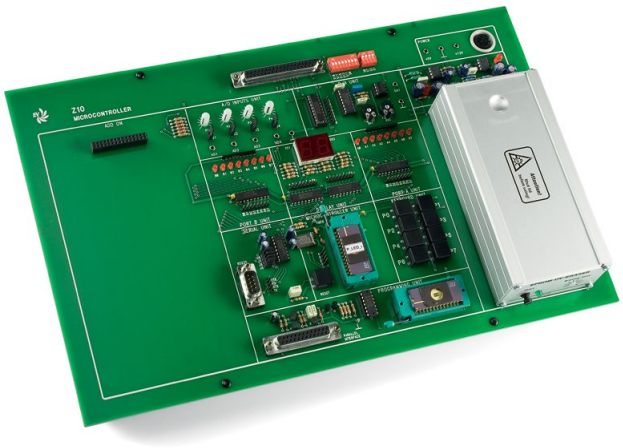
The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-Z10/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

Z10/EV

The Z10/EV microcontroller board is a microprocessor containing all devices (CPU, EPROM, RAM, I/O devices) necessary to a complete system. This feature enables the building of whole systems with minimum hardware and makes convenient their use in low cost and mass production electronic boards (remote controls, controls systems, etc.).

The ST Microelectronics microcontroller device used in this training system counts with an EPROM where the user code is recorded and is very suitable for developing applications because the memory EPROM can be reprogrammed many times. After having developed and tuned the software with a in system EPROM, in the industry, it is common practice to use OTP (ONCE TIME PROGRAMMABLE) devices for mass production. The module implements all typical development operations, with special care to the educational aspects.

The microcontroller applications can be developed as follows:
- Programs insertion into the PC in Assembler using a Text editor;
- Program compiling and linking for machine code transformation by the microcontroller;
- Program debug phase directly on the microprocessor module with the same module hardware;
- Program erasing in a second microcontroller in use (EPROM erasing device of the module) to avail of a ready component to be reprogrammed with the changes and corrections detected in the debug phase.



TRAINING PROGRAM:

- System programming with microcontrollers;
- ST62E25 microcontroller: block diagram;
- Program: records, stack, EPROM and RAM memory
- Data addressing: inherent, direct, indirect, immediate, related to Program Counter, extended, bit direct and test;
- Instruction set;
- Software development: edit, assembler, linker;
- Input/output ports: characteristic, OPTIONAL, IN/OUT programming direction, applications;
- A/D converter;
- Reset control:
  - Power-on reset;
  - Watchdog reset;
- Control of the wait and stop state;
- Use of timers;
- Serial communication: RS232 standard transmission and reception, interface and programming.

TECHNICAL SPECIFICATIONS:

- Microcontroller: ST62E25
- Maximum clock frequency: 8MHz
- User EPROM: 3876 bytes
- User RAM: 64 bytes
- Interface for PC programming
- Digital input line
- Digital output lines
- Analog input lines (8-bit A/D converter with 16 inputs)
- Analog output line with D/A converter
- Display, LED and keys
- RS-232 serial interface
- 10 faults
- Software: Assembler for microcontroller and transfer program
- Fault simulation
- Test and interconnection points, Ø 2 mm
- Jumpers for rapid circuit modification
- 37-pin connector to the control unit
- 8-wire connector to the power supply unit

Dimensions: 386 x 248 x 40 mm

It's possible to connect and to experience the following mod. F04/EV application modules:

F04-0/EV
F04-1/EV
F04-2/EV
F04-3/EV
F04-4/EV
F04-5/EV
F04-6/EV
F04-7/EV
(see details from pag. EB53)

GENERAL FEATURES:

- Printed circuit with protective treatment and silk screen mimic diagram
- Additional modules (optional boards) are available for other applications

DEVELOPMENT SOFTWARE

Program for editing, compiling, linking and parallel transmission from Personal Computer to board mod. Z10/EV.

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
+5 Vdc – 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-Z10/EV

EPROM PROGRAMMER

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Z11/EV

(PIC 16F84 MICROCONTROLLER)

INTRODUCTION

Z11/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-Z11/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

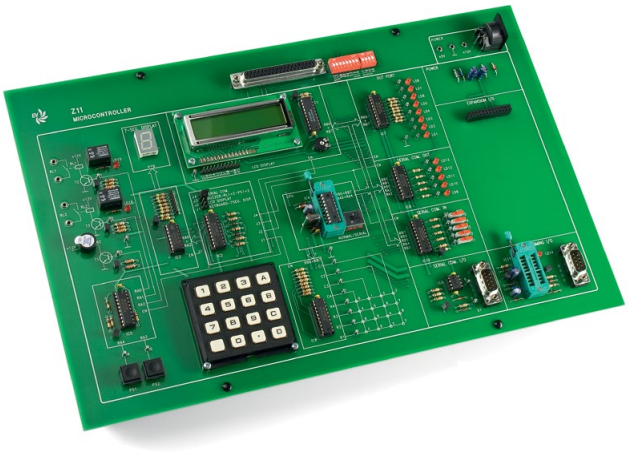
Z11/EV

The Z11/EV microcontroller board studies one of the most used microcontrollers in industry and can be programmed directly via an integrated Flash Memory and EEPROM so that the programming and testing process is considerably simplified. Thanks to the possibility to electrically programming and erasing of the flash RAM memory (the component is guaranteed for 1.000.000 writing and reading operations), fast code writing, in-system programming and testing is allowed. The 8-bit microcontroller has an RISC architecture with 35 instructions in total.

The module using this microcontroller allows study the device programming and interfacing techniques with components typical of the different applications: display, keyboards, sensors and actuators.

The microcontroller applications related to the different topics of the module can be developed as follows:

- Programs insertion into the PC in Assembler using a Text editor
- Program compiling and linking for machine code transformation by the microcontroller
- Transfer via serial interface of the program into the E^2PROM of the microprocessor system
- Program debug phase directly on the microprocessor module with the same hardware of the module



TRAINING PROGRAM:

- System programming with microcontrollers;
- PIC microcontrollers: block diagram;
- Software development: edit, assembler, linker;
- Internal architecture: program area and Register File, ALU, W recorder, program counter and stack;
- A and B ports: input/output functioning, i/o hardware structure;
- Counter and pre-scaler;
- Interrupt: event type and enable, interrupt vector, handler and flag;
- Power-down ad watchdog time: sleep function, prescaler use;
- Sleep mode re-activation management;
- LCD display interface: Enable and Register Select lines;
- Serial communication: RS232 standard transmission and reception, interface and programming.

TECHNICAL SPECIFICATIONS:

- Microcontroller: PIC16F84;
- Input digital lines;
- Output digital lines;
- SLEEP operation;
- 1K inner E^2PROM for the program;
- Erasing/writing operations in the data memory E^2PROM;
- Duration if not powered with voltage >40 years;
- 13 I/O with individual control of direction;
- 8-bit inner counter;
- Program protection in reading;
- In-circuit serial programming;
- 8-level stack;
- LCD display, 2 lines x16 characters;
- 7-segment display;
- Led bar;
- 4x4-matrix keyboard;
- 2 free pushbutton;
- 2 relays;
- Piezoelectric buzzer;
- Serial interface RS-232;
- Separation buffer for the tri-state functions to use the microcontroller separately in more fields of the board according to the different programs;
- Microcontroller programming section with interface for PC;
- Programming;
- 10 faults;
- Software: Microcontroller Assembler and transfer program;
- Fault simulation;
- Test and interconnection points, Ø 2 mm;
- Jumpers for rapid circuit modification;
- 37-pin connector to the control unit;
- 8-wire connector to the power supply unit.

Dimensions: 386 x 248 x 40 mm

GENERAL FEATURES:

- Printed circuit with protective treatment and silk screen mimic diagram
- Additional modules (optional boards) are available for other applications

DEVELOPMENT SOFTWARE

Program for editing, compiling, linking and parallel transmission from Personal Computer to board mod. Z11/EV.

It's possible to connect and to experience the following mod. F04/EV application modules:

F04-0/EV
F04-1/EV
F04-2/EV
F04-5/EV
F04-6/EV
(see details from pag. EB53)

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc - 0.5A
+5 Vdc - 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-Z11/EV

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Z12/EV

(8051 MICROCONTROLLER)

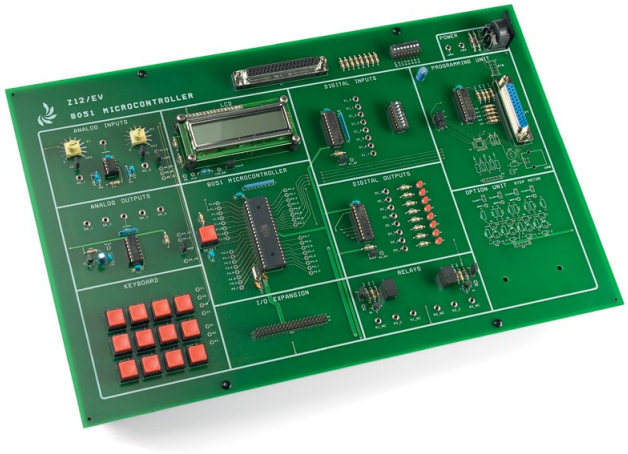
INTRODUCTION

Z12/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-Z12/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

Z12/EV

The Z12/EV microcontroller board studies one of the most used microcontrollers in industry and integrates a FLASH memory. Thanks to the flash memory the in-system' (ISP) programming and debugging is allowed, really simplifying the programming and development process.



The chosen microcontroller is one of the most used in the industry 8051 and integrates a FLASH memory. Thanks to the flash memory the in-system' (ISP) programming and debugging is allowed, really simplifying the programming and development process.
Board using such kind of microcontroller allows to learn programming and interfacing techniques with the use of typical components: display, keyboards, sensors and actuators.
For developing the applications related to the board circuital fields it is necessary to proceed as follows:

- Program PC insertion in assembler language, using an editing text;
- Program compilation and linking for the transformation of the machine code with the microcontroller;
- Transfer via USB parallel interface of the program on FLASH memory, included in the microcontroller;
- Program debug directly on microcontroller board with the same hardware sources.

TRAINING PROGRAM:

- System programming with microcontrollers;
- 8051 microcontrollers: block scheme;
- Software development: edit, assembler, linker;
- 8051 Internal architecture;
- A and B ports: input/output functioning, i/o hardware structure;
- Counter and timers;
- Interrupt: event type and enable, interrupt vector, handler and flag;
- Power-off ad watchdog time: sleep function, prescaler use;
- LCD display interface: Enable and Register Select lines;
- Analogue signal acquisition;
- Analogue signal generator.

TECHNICAL SPECIFICATIONS:

- Microcontroller 8051, 80C51 compatible, instruction set and pinout;
- Clock: 24 MHz;
- Programmable memory In-System Programmable (ISP), Flash: 4KB;
- Memory: 128x8-bit SRAM;
- N.4 ports I/O 8-bit;
- Expansion connector of the system ports I/O;
- Alphanumeric LCD Display;
- Keyboard - 12 keys;
- 8 bit A/D Converter with N.2 channels;
- 8 bit D/A Converter with N.2 channels;
- N.8 LED;
- N.8 DIP switches;
- N.2 Relays;
- PC interface through Parallel/USB ports;
- N.8 faults to be inserted in the system;
- Software for Windows PC with Edit, Assembler and programs Downloading;
- Fault simulation;
- Test and interconnection points, Ø 2 mm;
- Jumpers for rapid circuit modification;
- 37-pin connector to the control unit;
- 8-wire connector to the power supply unit.

Dimensions: 386 x 248 x 40 mm

It's possible to connect and to experience the following mod. F04/EV application modules:

F04-0/EV
F04-1/EV
F04-2/EV
F04-3/EV
F04-4/EV
F04-5/EV
F04-6/EV
F04-7/EV
(see details from pag. EB53)

GENERAL FEATURES:

- Printed circuit with protective treatment and silk screen mimic diagram
- Additional modules (optional boards) are available for other applications

DEVELOPMENT SOFTWARE

Program for editing, compiling, linking and parallel transmission from Personal Computer to board mod. Z12/EV.

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
+5 Vdc – 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-Z12/EV

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Z50/EV

MICROCONTROLLERS AND APPLICATIONS

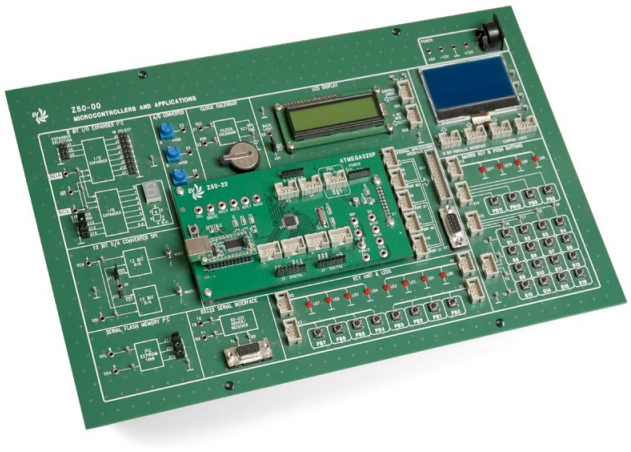
Z50/EV

The MICROCONTROLLERS AND APPLICATIONS module is a system for the study and testing of various applications that are normally found in “embedded” systems and uses a series of different microcontrollers.

As the use of the microcontroller systems is enormously grown not only in the digital applications, but also in the interface solutions to the analog world with A/D-D/A converters and the PWM technique, the industrial environment continuously requires the presence of qualified technicians, trained on the development of applications with these components: hardware design and software programming.
This implies to know the instruments to perform these activities, especially as regards the programming: IDE development environments, compatibility, libraries, compilation, transferring the programs in the memories of the devices, debug...
Each microcontroller contains a microprocessor (CPU) and a high number of peripherals that let you interact with the outside world: internal Flash memory, I/O lines, A/D converters, PWM modules, communication USB, CAN, SPI, I2C, USART buses, Timers, Real Time Clock, Dials, Capture ...
Not all the microcontrollers provide all these peripherals as their features increase with the cost and a variable number of pins for the external connection. So, it is important to progressively learn to know the families of the components to be able to select from time to time the most suitable microcontroller.

The MICROCONTROLLERS AND APPLICATIONS module consists of:

- a base board, mod. Z50-00/EV, with different applications (memories, converters, LCD display, USB and serial interfaces ...).
- a sub-module with a specific microcontroller, selectable from a series of sub-modules with different types of microcontrollers in order to cover a wide range of such components as regards the 8 / 16 / 32 bit structures as well as the internal organizations and the I/O resources. The sub-module must be inserted in the central area of the application board and, after the connection of its various I/O lines with the applications, it automatically becomes the manager and controller. Based on the required resources, the computing and I/O capacity of the microcontroller, it is possible to control more applications simultaneously.



Overall, the module provides a set of applications for specific devices involved in the study of different typical topics in the microcontroller systems:

- Data entry
- Displaying the data using LEDs and LCD display
- Acquisition and generation of A/D and D/A waveforms
- Data storage: flash memories with different communication protocols
- Interface with the PC or with other external systems such specific application boards, smart sensors, different actuators ...

TRAINING PROGRAM:

The module allows the theoretical analysis and testing of the following main topics:

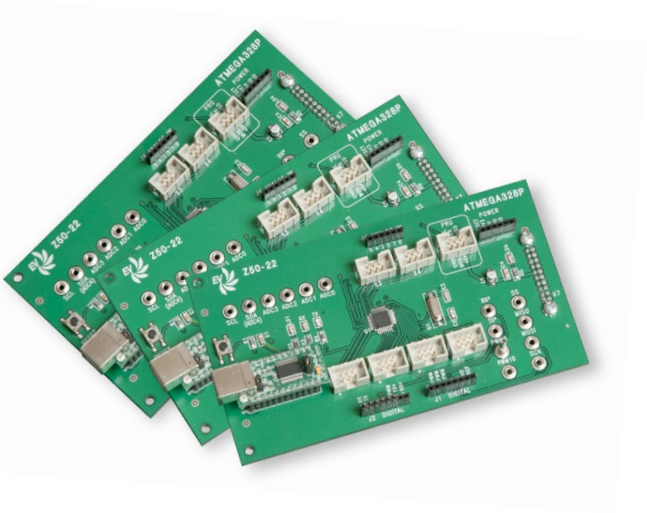
- Expansion of 8-bit I/O ports via an I2C Bus
- 12-bit D/A converters via a SPI Bus
- Reading/Writing of FLASH memory via an I2C Bus
- RTC management via an I2C Bus
- Serial RS232 and USB interface
- Management of LCD displays
- Management of GRAPHIC displays
- Management of LEDs and keys
- Management of 4 x 4 KEYS Matrix Keyboard
- Management of external applications via 2 I/O ports

TECHNICAL SPECIFICATIONS BASE BOARD, Mod. Z50-00/EV:

- I/O Expander PCF8574 with selectable address, used as 8 inputs
- I/O Expander PCF8574 with selectable address, used as 8 Outputs
- 7-segment common anode display connected to the output of the Expander PCF8574
- #2 12-bit DACs with SPI interface and selectable address
- Serial EEPROM 16K x 8bit 24LC128 memory with serial interface via an I2C bus
- RS232 interface using MAX232C with RS-232 DB9 connector; interface for 5Vdc/3.3 Vdc
- Clock and calendar with 240 x 8-bit RAM with serial interface via an I2C bus and 32.768 kHz external crystal oscillator
- alphanumeric 2 lines x 16 characters LCD; interface for 5Vdc/3.3 Vdc
- Graphic 128 x 64 pixels LCD; interface for 5Vdc/3.3 Vdc
- 4 x 4 keys matrix keyboard
- Line of 8 keys for the bytes inlet port
- Line of 8 LEDs for bytes outlet port
- Line of 4 keys with pull-up for the semibyte inlet port
- Line of 4 LEDs for the semibyte outlet port
- Connector for 26-pin external applications interface
- Connector for power supply of external RS-232 DB9 applications
- Ansley 3x2 female connectors and bushings for the connections with the sub- modules
- ICSP programmer for microchip microcontrollers
- ISP programmer for ATMEL microcontrollers

Dimensions: 386 x 248 x 40 mm

SUB MODULES MICROCONTROLLERS



MICROCHIP Microcontrollers

Unlike the general-purpose microprocessors, their inside is provided with all that is needed to the digital and analog interface, that is, for example, ADC and DAC converters, comparators, RS232 and USB interfaces.
The PIC microcontrollers adopt the Harvard architecture: they use different memories for storing data and instructions. In contrast, the Von Neumann architecture uses the same memory for data and programs. This architecture uses fewer lines, but does not exploit the parallelism and is therefore less efficient and fast.
The PICs are RISC (Reduced Instruction Set Computer) microcontrollers: they have a set of few instructions, 33 to 77, and 12 to 16-bit. However, it is commonly assumed that the RISC microcontrollers are more efficient and fast, even if the programming is a bit more difficult and the instructions are simpler. The inside of the PICs, like all the modern microcontrollers, is provided with an internal watchdog that provides for an automatic reset when an internal control counter (independent of the Program Counter) reaches its maximum: if the program is stalled or is not activated for a certain time, the watchdog activates the reset. If the program works correctly, it prevents the counter to reach the maximum, resetting it periodically. Currently a microcontroller without the watchdog is no longer feasible for the industrial applications. Even the presence of A/D converters is practically essential.
In the PIC18s, all the non- jumping instructions are executed in one machine cycle, equal to 4 clock periods, namely those of the 2-jumping phases. Therefore, if the clock is 4 MHz, an instruction lasts 1 microsecond, if the clock is 40 MHz, 10 million instructions per second are performed.

The PICs can be placed into the following families:

- Medium-and high-level PICs (8-bit) where the level is given by the number of instructions
- PIC24 (16-bit)
- PIC32 (32-bit)

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
+5 Vdc – 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

ICPS PROGRAMMER FOR MICROCHIP MICROCONTROLLERS

ISP PROGRAMMER FOR ATMEL MICROCONTROLLERS

8-bit MICROCHIP:

Z50-01/EV: PIC16F628A
Clock 20 MHz, 2K x14 bit words ROM, 224 x 8 bytes RAM, 128 x 8 bytes EEPROM, 3 timers, 10 interrupts, 2 Buy, 2 Compares, 1 Capture / Compare / PWM, 1 Usart, 16 I/Os: 8-bit PortA, 8-bit PortB complete with an internal clock, 4 A/D converters + 1 D/A converter on the external PCF8591 component, power supply: 2.0-5.5Vdc, ICSP programming.

Z50-02/EV: PIC16F877A
Clock 20/4 MHz, 8K x14 bit words ROM, 368 x 8 bytes RAM, 256 x 8 bytes EEPROM, 3 timers, 14 interrupts, 2 Compares / Captures / PWMs, 1 Usart, SSP, SPI, I2C, Parallel Slave Port, PortA, PortB, PortC, PortD, PortE, Power supply: 2.0-5.5 Vdc, ICSP programming.

Z50-03/EV: PIC1 8F2550
Clock 20 MHz, 32K bytes ROM, 2048 bytes RAM, 256 bytes EEPROM, 4 timers, 19 interrupts, 2 Compares / Captures / PWMs, 1 EAUSART, SPI, I2C, Parallel Slave Port, 10 10-bit A/Ds, 2 Comparators, 1 USB v2.0, PortA, PortB, PortC, Power supply: 2.0-5.5 Vdc, ICSP programming.

Z50-04/EV: PIC18F4580
Clock 20 MHz, 32K bytes ROM, 1536 bytes SRAM, 256 bytes EEPROM, 4 timers, 20 interrupts, 1 Compare / Capture / PWM, 1 Enh.Compare / Enh.Capture / Enh.PWM, 1 ECAN module, 1 EAUSART, 1 MSSP, 1 Enh. MSSP, SPI, I2C, 1 PMP/PSP, 1 RTCC, CTMU 1, 2 Comparators, 10 10-bit A/Ds, 1 USB v2.0 On-The Go, PortA, PortB, PortC, PortD, PortE, Power supply: 2.0-5.5 Vdc, ICSP programming.

Z50-05/EV: PIC18F4550
Clock 20 MHz,32K bytes ROM, 2048 bytes RAM, 256 bytes EEPROM, 4 timers, 19 Interrupts, 2 Compares / Captures / PWMs,1 EAUSART, SSP, SPI, I2C, Parallel Slave Port, 13 10-bit A/Ds, 2 Comparators, 1 USB v2.0, PortA, PortB, PortC, PortD, PortE, Power supply: 2.0-5.5 Vdc, ICSP programming.

16-bit MICROCHIP:

Z50-10/EV: PIC24FJ64GB002
Clock 20 MHz, 64K bytes ROM, 8Kbytes SRAM, 15 Remapps, Pins, 5 16 bit timers, 20 Interrupts, 5 Compares / PWMs, 2 Uarts/IrDAs,2 SPIs,2 I2Cs, 1 Parallel PMP/PSP, 3 Comparators, 9 10-bit A/Ds, 1 USB OTG, 1 RTCC, 1 CTMU, PortA-5bit, PortB -16bit, Power supply: 2.0-3.6Vdc, 5.5V tolerant digital input, ICSP programming.

32-bit MICROCHIP:

Z50-15/EV: PIC32MX220F032D
Clock 20MHz, 32+3Kbytes ROM, 8KBytes RAM, 31 Remapps, Pins, 5/5/5 Timers/Captures/Compares, 2 UARTs, 2 SPIs/I2Cs, 5 Ext. Interrupts, 3 Analog comparators, USB-On-The-Go, 2 I2Cs, PMP, 4/2 DMA Channels, 13 10-bit A/Ds, 1 RTCC, 1 CTMTU, Power supply: 2.0-3.6Vdc, JTAG programming.

ATMEL AVR microcontrollers

ATMEL low-level 8–bit microcontrollers
In the eight-bit AVR structure each processor has 32 registers of eight bytes each on which you can work through a set of 133 instructions. The 32 registers are directly connected to the ALU RISC architecture, allowing two independent registers to be managed in a single instruction lasting one clock cycle. Most of these instructions is executed in a single cycle of the processor, thereby allowing a high flow of operations. The code runs with efficiency 10 times greater than that obtained with the normal CISC microcontrollers.
These components use the Harvard architecture to optimize the performance and parallel structure: separate program and data memories and different buses. An instruction in the program memory is performed with the technique of the pipeline in two stages: while an instruction is executed, at the same time, it is analyzed and decoded for the next execution. In this way, the instructions can be executed in every clock cycle. The Flash program memory is divided into two sections: the Boot Program section and that of the application, both provided with bits for the protection of the reading/writing. The Boot program is executed by the CPU and can use any interface to download the application program in the Flash memory for the (USB, SERIAL ...) application. The program in the Flash memory Boot is executed while you update the application section of the flash memory using the Read-While-Write feature of the memory.
The Flash memory can be reprogrammed directly on the component soldered on the circuit, through a serial SPI interface, using a generic programmer of SPI memories.
The Flash program memory is 8KBytes, the EEPROM is 256 Bytes and the RAM memory is 1K Bytes.
The main peripherals include:
- Two 8-bit timers/counters with prescaler, comparators and capture
- A 16-bit timer with prescaler, comparators and capture
- 6 channels modulated in the PWM with resolution ranging from 2 to 16 bits
- 8 10-bit ADC converters each
- Serial SPI and I2C port
- Serial two-line interface
- Bidirectional USART
- Watchdog Timer
- Analog comparator

ATMEL high-level 8–bit microcontrollers
The Flash program memory is 32KBytes, the EEPROM is 1 Kbyte and the RAM memory is 2K Bytes
The main peripherals include:
- Two 8-bit timers/counters with prescaler, comparators and capture
- A 16-bit timer with prescaler, comparators and capture
- 6 channels modulated in the PWM with resolution ranging from 2 to 16 bits
- 8 10-bit ADC converters each
- Serial SPI and I2C port
- Serial two-line interface
- Bidirectional USART
- Watchdog Timer
- Analog comparator

8-bit ATMEL:

Z50-21/EV: ATMEGA88P
Clock 20MHz, 8Kbytes ROM, 1Kbytes RAM, 512 Bytes EEPROM, 2 8-bit timers, 1 16-bit timer, RealTimeCounter with separate oscillator, internal/external interrupt, 6 PWMs, 8 10-bit A/Ds, serial USART, SPI, I2C, 1 analog Comparator, 6 PWM channels, power supply: 2.7-5.5 Vdc, ISP interface programming.

Z50-22/EV: ATMEGA328P
Clock 20MHz, 32Kbytes ROM, 2Kbytes RAM, 1K Bytes EEPROM, 2 8-bit timers, 1 16-bit timer, RealTimeCounter with separate oscillator, internal/external interrupt, 6 PWMs, 8 10-bit A/Ds, serial USART, SPI, I2C, 1 analog Comparator, 6 PWM channels, power supply: 2.7-5.5 Vdc, ISP interface programming.

Z20-A/EV

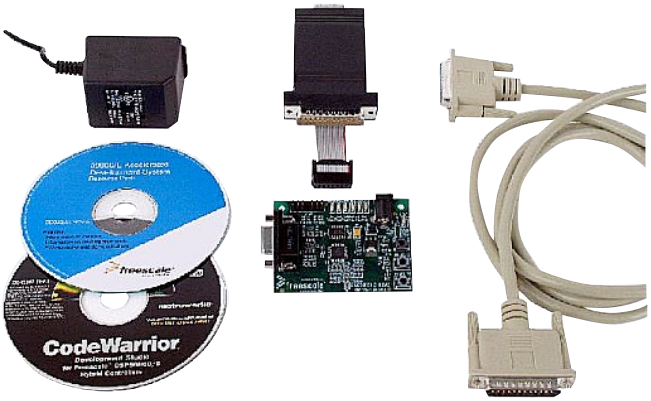
(DSP DEVELOPMENT SYSTEM)

INTRODUCTION

The Demonstration Board is used to demonstrate the abilities of the 56F8014 digital signal controller and to provide a hardware to l allowing the development of applications.
It includes a 56F8014 part, RS-232 interface, user LEDs, user pushbutton switches and a daughter card connector. The daughter card connector allows signal monitoring and expandability of user features.

The Demonstration Board is designed for the following purposes:

- Allowing new users to become familiar with the features of the 56800E architecture. The tools and examples provided with the 56F8014 Demonstration Board facilitate evaluation of the feature set and the benefits of the family.
- Serving as a platform for real-time software development. The tool suite enables the user to develop and simulate routines, download the software to on-chip memory, run it, and debug it using a debugger via the JTAG/Enhanced OnCE (EOnCE)prt. The breakpoint features f the EOnCE port enable the user to easily specify complex break conditions and to execute user-developed software at full speed until the break conditions are satisfied. The ability to examine and modify all user-accessible registers, memory and peripherals through the EOnCE port greatly facilitates the task of the developer.
- Serving as a platform for hardware development. The hardware platform enables the user to connect external hardware peripherals. The on-board peripherals can be disabled, providing the user with the ability to reassign any and all of the processor's peripherals. The EOnCE port's unobtrusive design means that all memory on the board and on the processor is available to the user.



FEATURES:

- Up to 32 MIPS at 32MHz core frequency
- DSP and MCU functionality in a unified, C-efficient architecture
- 16KB Program Flash
- 4KB Unified Data/Program RAM
- One 5-channel PWM module
- Two 4-channel 12-bit ADCs
- One Serial Communication Interface (SCI) with LIN slave functionality
- One Serial Peripheral Interface (SPI)
- One 16-bit Quad Timer
- One Inter-Integrated Circuit (I 2 C) Port
- Computer Operating Properly (COP)/Watchdog
- On-Chip Relaxation Oscillator
- Integrated Power-On Reset and Low-Voltage Interrupt Module
- JTAG/Enhanced On-Chip Emulation (OnCE™) for unobtrusive, real-time debugging
- Up to 26 GPIO lines
- 32-pin LQFP Package

DSP DEVELOPMENT SYSTEM SET

The kit includes:

- 56F8014 Demonstration Board
- Parallel cable
- +9V DC power supply
- JTAG adapter
- 56F8014 Demonstration Board Kit installation Guide
- CODE WARRIOR for DSP 56800/E, 64K Compiler Edition, Software and 1 Year Support, Nodelock License.

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MICROPROCESSORS AND MICROCONTROLLERS APPLICATIONS BOARDS

Mod. F04/EV

INTRODUCTION

This system, in combination with a microprocessor experiment board (not supplied), allows the study of several applications, as detailed below.

The system consists of a base board, of the same dimensions as a standard I.P.E.S system experiment board, and the connections for the power supplies, the Interactive Control Unit SIS3-U/EV and the specific application board being used.

These applications can be used with the following microprocessor and microcontroller experiment boards: Z1/EV (8-bit), Z2/EV (16-bit), Z3/EV (32-bit), Z10/EV (ST62E25), Z11/EV (PIC16F84), Z12/EV (8051).
They are supplied complete with assembler language software for the specific application and microprocessor or microcontroller used.

TRAINING PROGRAM:

- Digital Input/output;
- 8 bit A/D e D/A converter;
- Stepper motor control;
- DC motor control step by step;
- Strain gauge;
- Temperature sensor;
- Audio unit with variable gain;
- Ultrasonic transmitter / Ultrasonic receiver;
- Traffic light and light control

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A

OPTIONAL

PERSONAL COMPUTER

TECHNICAL SPECIFICATIONS:

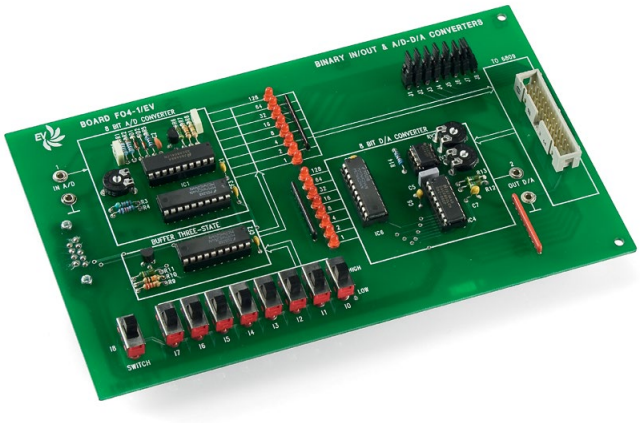
BASE BOARD mod. F04-0/EV

Includes 3 x Ø 2 mm power supply sockets (+12Vdc, -12Vdc, GND), one DIN connector for direct supply by means of a cable connected to the Power Supply PS1-PSU/EV, one 9-pole connector for connection of the application boards to the base board and one 37-pin connector for the Interface Control Unit SIS3-U/EV (not supplied).

Dimensions: 386 x 248 x 40 mm

The base board is indispensable for using the application boards.

APPLICATION BOARD F04-1/EV:
Binary In/Out signals and A/D & D/A converters



Including:

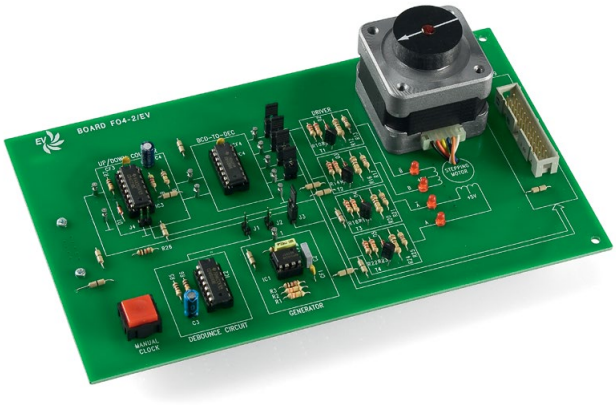
- 8-bit A/D converter and 8-bits D/A converter;
- 8 switches for the on-board generated binary inputs;
- 16 LEDs for the on-board binary outputs;
- Possibility to enter an external analog signal (to be applied to the A/D converter), through 2 mm connectors;
- Possibility to get an output analog signal from the D/A converter, through 2 mm connectors.

The application board allows to combine the different external-internal input/output possibilities.

Software Examples:

- Input reading and LED display;
- Variable input reading through A/D converter and LED display;
- Manifold generation through D/A converter;
- Variable voltage manifold generation through D/A converter.

APPLICATION BOARD F04-2/EV:
Stepper motor



Including:

- Stepper motor, full step, 200 steps/rev
- Automatic stepper motor pulse generation (100 Hz) or pushbutton manual clock with debouncing circuit
- BCD to DEC converter
- UP / DOWN control
- External control from PC

Software Examples:

- Full step motor control with clock generated by a program – clock and anti-clockwise rotation control;
- Direct full step motor control through program - clock and anti-clockwise rotation control;
- Direct half step motor control through program – clock and anti-clockwise rotation control.

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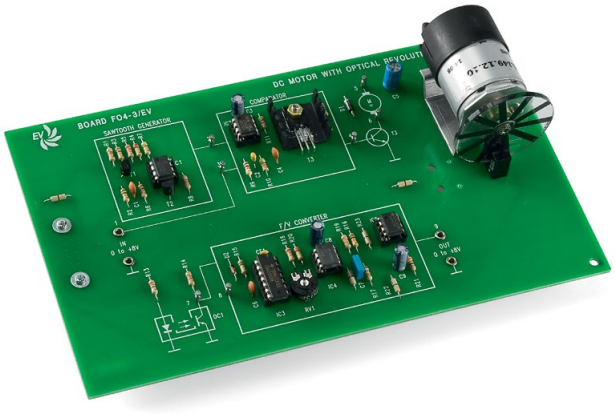
APPLICATION BOARD F04-3/EV:
DC Motor



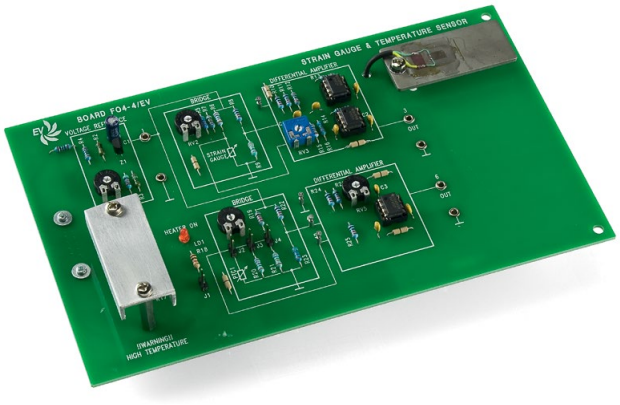
Including:

- Permanent DC motor speed control; Motor speed externally controlled via 0-8 V reference signal, or via the microprocessor D/A converter output;
- Coaxial motor speed optical sensor, "U" type;
- PWM control by means of the external 0 ÷ 8V reference signal compared with a saw-tooth signal. Power amplifier by means of a power transistor;
- F/V converter for an 0-8 V output signal proportional to the motor speed.

Software Examples:

- DC motor control – pushing two buttons on the keyboard of the used microprocessor board (Z1/EV, Z2/EV, Z3/EV…) the motor speed increases/decreases and the value is displayed;
- Proportional control of the speed with closed ring: fixed value setup by means of two buttons on used microprocessor board's keyboard (Z1/EV, Z2/EV, Z3/EV…), control output towards DC motor, speed reading and fault measurement related to set-point during motor control.

APPLICATION BOARD F04-4/EV:
Force and Temperature transducers



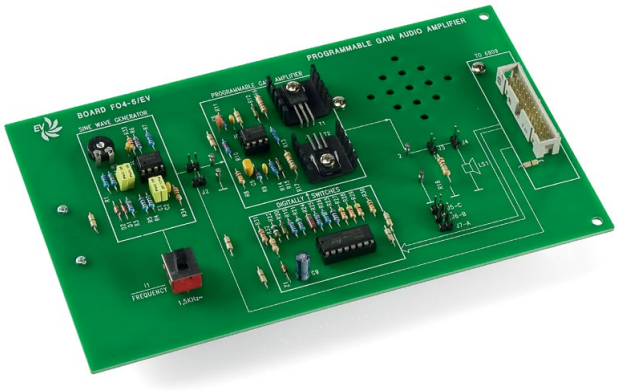
Including:

- A strain gauge as force sensor and a PTC as temperature sensor;
- Both force and temperature control includes: the sensor, a constant reference voltage for the sensors, a bridge circuit and a differential amplifier;
- Both analog outputs can be applied to the microprocessor A/D unit.

Software Examples:

- Temperature reading and display through data chart;
- Weight reading and display through data chart.

APPLICATION BOARD F04-5/EV:
Programmable gain audio amplifier



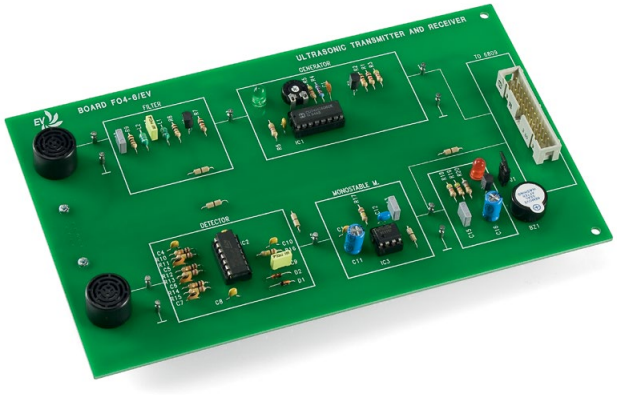
Including:

- On-board 1.5 and 3 kHz generators (Wien bridge oscillator);
- The gain of the amplifier is digitally controlled in 8 steps (GAIN Factors: 1 -1,5 – 3 – 6 – 12 – 25 – 50 – 100) from the microprocessor board;
- Complementary symmetry amplifier with power transistors;
- On-board 0.25 W, 50 mm dia. speaker.

Software Examples:

- Audio amplification selection pushing two buttons on the keyboard of the used microprocessor board (Z1 EV, Z2/EV, Z3/EV…); frequency remains fixed;
- Audio signal frequency pushing two buttons on the keyboard of the used microprocessor board (Z1/EV, Z2/EV, Z3/EV…); the gain remains fixed.

APPLICATION BOARD F04-6/EV:
Ultrasonic Tx/Rx system



Including:

- Tx section: 40 kHz sine wave generator with filter section;
- 640 kHz reference clock signal divided by 16 to obtain the transmission frequency;
- Ultrasound ceramic transmission transducer;
- Rx section: amplitude detector section;
- Trigger stage with monostable circuit and section with buzzer;
- The microprocessor can switch the transmission signal Tx ON and OFF and can display the presence of obstacles in the Rx/Tx course.

Software Examples:

- ON/OFF transmission enable pushing two buttons on the keyboard of the used microprocessor board (Z1 EV, Z2/EV, Z3/EV…);
- ON/OFF Rx activity display.

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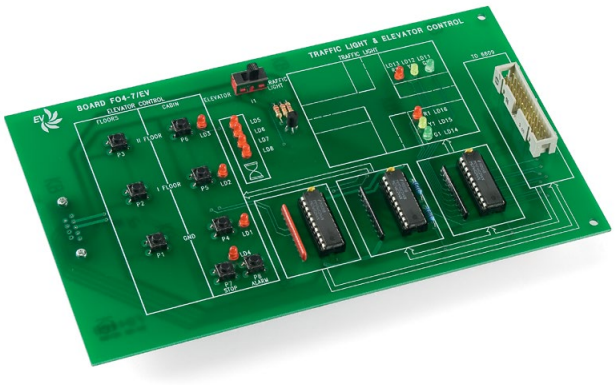
APPLICATION BOARD F04-7/EV:
Traffic Light & Elevator Control



Including:

Traffic Light:

- 1 x Red, yellow and green lights at both cross roads;
- Switches to modify the day and night operation (yellow flashing)

Lift Control:

- 3 floors (G + I° + II° FLOORS)
- Push-buttons to select the target floor
- LED to indicate the actual floor
- Bargraph to indicate the reaching of the floors

Software Examples:

- Software management: standard daytime operation and nighttime flashing operation with selection by means of two buttons;
- Lift control: 3 floor management with standard operation in cabin and floor, STOP and ALARM button selection, display of the time between the floors.

Software examples for the various application boards:

- Module F04/EV is supplied with a set of specific application examples which are installed and run on the microprocessor board used (Z1/EV, Z2/EV, Z3/EV …)
- The programmes are edited, compiled and linked in the corresponding assembler language of the microprocessor used. They are then transferred to the RAM memory of the microprocessor board to then be run in conjunction with the various application boards.
- The examples are provided as models for developing other applications with the boards. They enable immediate access to the software resources (SUBROUTINES, INTERRUPT …) for using the hardware available on the application boards.

THEORETICAL-EXPERIMENTAL MANUALS

The application boards are supplied with manuals including:

- *A section explaining the theoretical aspects of the topics and a description of the circuits*
- *A series of practical experiments with detailed instructions which reinforce the theory learned and which offer the student the opportunity to get familiarised with the measurements, controls and adjustments of electronic circuits.*
- *The lists of the suggested programmes in assembler with notes on operation and programming included in the most important points*

20-B

INDUSTRIAL ELECTRONICS EXPERIMENT BOARDS

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MCM10/EV

(INDUSTRIAL ELECTRONICS)

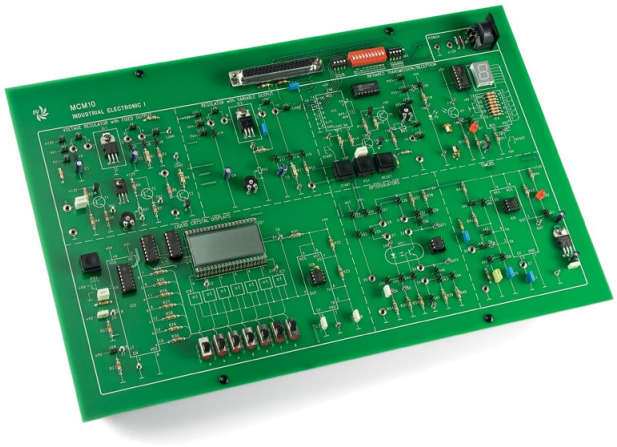
INTRODUCTION

MCM10/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM10/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM10/EV

Experiment Board for analysis of the components generally used in industrial applications: timers, regulators, optic and display components. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Fixed voltage regulation: characteristic parameters, charge variation, voltage input variation, input voltage ripple rejection, current absorption from the voltage regulation with variable load, output voltage variation when changing load current;
- Variable voltage regulation: relation between output and reference voltage, input voltage ripple rejection, current absorption from the voltage regulation with variable load;
- Integrated Timer 555: monostable and astable configuration, PWM modulator;
- LCD display characteristic;
- LCD display piloting;
- Optocouplers: correspondence factor, optical coupling system parameters;
- Infrared reception/transmission: circuit solutions

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
+5 Vdc – 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM10/EV

MCM11/EV
(POWER ELECTRONICS)

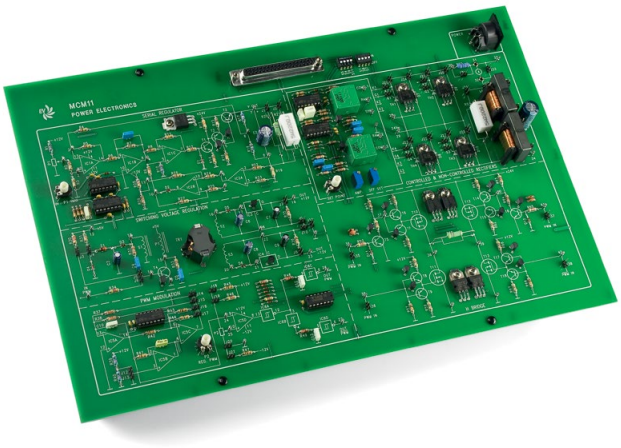
INTRODUCTION

MCM11/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM11/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM11/EV

Experiment Board for the study of power rectifiers and voltage regulators. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Diode rectifying: resistive, RC, RL load fuctioning, rectified output voltage and current, rippling;
- SCR controlled rectifying: breakdown circuit, Zener diode, resistive and RL load functioning;
- PWM system: circuit solutions;
- MOS-Fet H bridge: N and P channelMOS-Fet driver;
- Voltage variation with series regulation: circuit solutions;
- Switching-type voltage regulator: Flyback, Forward types, circuit solutions.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
1.3÷24 Vdc – 0÷2A var

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM11/EV

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MCM12/EV

(TEMPERATURE AND LIGHT CONTROL)

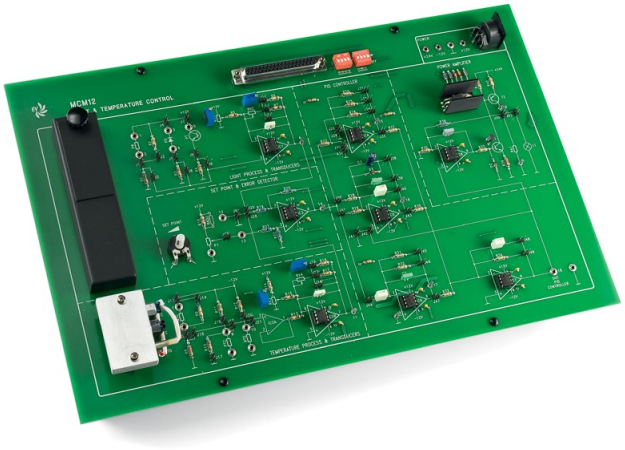
INTRODUCTION

MCM12/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM12/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM12/EV

Experiment Board for investigating the various types of sensors and PID control systems. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Light sensors: photoresistor, photodiode, phototransistor;
- Conditioning circuits for photoresistance, photodiode, phototransistor;
- Temperature sensors: NTC thermistor, PTC thermistor and thermal resistance;
- Conditioning circuits for NTC thermistor, PTC thermistor and thermal resistance;
- Automatic control: reference, adder node, controller, transducer and feedback signal;
- PID controller: proportional, integration, diversion and combined action;
- ON/OFF controller;
- Automatic control: block schemes, open/closed chain, sensitivity, precision, answer time, stability, design;
- Automatic light control: open/closed chain regulation with PID controller;
- Automatic temperature control: open/closed chain regulation with PID controller.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
1.3÷24 Vdc – 0÷2A var

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM12/EV

OPTIONALS ON REQUEST:

HARDWARE-SOFTWARE KIT for data acquisition, supervision and process control.

Includes:
- USB interface card mod. MFI-LC/EV
- Supervision and control software SW-S-MCMPRO/EV

MCM12A/EV

(SPEED AND POSITION CONTROL)

INTRODUCTION

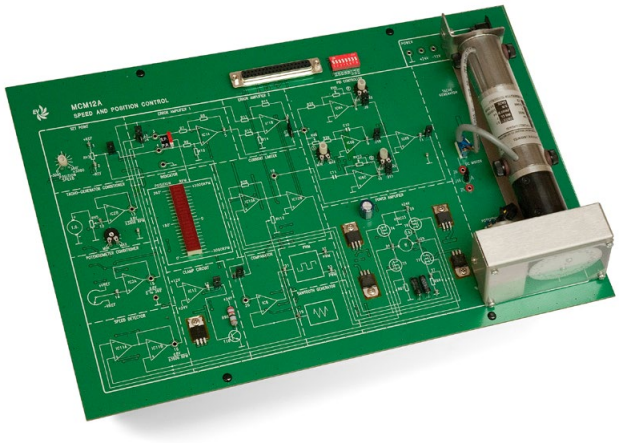
MCM12A/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM12A/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM12A/EV

Experiment Board for the development of a series of lessons on the following topics:

- DC motor
- Sensor signal conditioning circuits
- Automatic speed and position control



The main on board blocks are:

- Speed and position set points;
- Error Amplifier;
- Tacho generator signal conditioner;
- PWM "H" bidirectional power bridge;
- Adjustable P - I - D controller via potentiometers;
- Bar-graph to display the rotational speed;
- DC Motor set with tacho generator and angular position dial.

TRAINING PROGRAM:

- DC motor with permanent magnets;
- Tacho generator;
- Proportional, integral and derivative control;
- DC motor speed control;
- DC motor position control;
- Bidirectional rotation MOSFET "H" bridge;
- PWM modulation;
- Armature current control;
- Fault insertion and troubleshooting

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 13W electric motor
- Torque reducer
- Tachogenerator 3V/1000 rpm
- Manual brake
- Set up for PC control and supervision
- 2 mm sockets for test points and connections Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pin connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
+ 24V-1A
+12V-2A
-12V-0,5A

SUPPLIED WITH

STUDENT HANDBOOK: THEORY AND EXERCISES

TEACHER HANDBOOK: WIRING DIAGRAMS AND SOLUTIONS OF EXERCISES

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM12A/EV

KIT HARDWARE-SOFTWARE FOR DATA ACQUISITION, SUPERVISION AND PROCESS CONTROL. INCLUDES:

- **USB INTERFACE CARD MOD. MFI-LC/EV**
- **SUPERVISION AND CONTROL SOFTWARE SW-S-MCMPRO/EV**

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MCM12B/EV
(PRESSURE CONTROL)

INTRODUCTION

MCM12B/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM12B/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

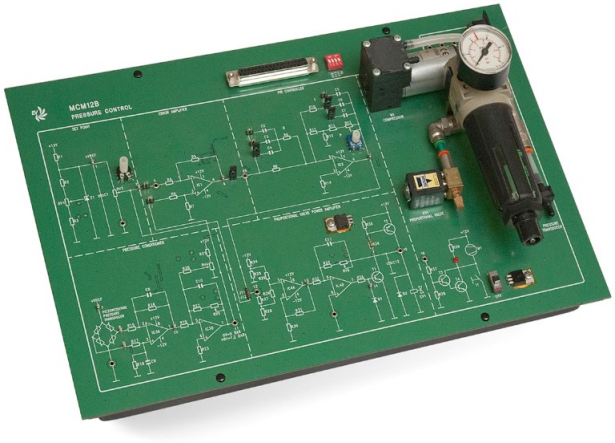
MCM12B/EV

Experiment Board for the study of the following topics:

- Air compression
- Proportional valves
- Piezoresistive pressure transducers
- Pressure regulation

The main circuit blocks of the board include:

- Pressure set-point
- Error amplifier
- Pressure sensor conditioning
- Proportional regulation valve control
- Configurable PID controller
- Manometer
- Compressor, air tank, proportional valve group



TRAINING PROGRAM:

- Compressor
- Proportional valve
- Proportional control
- Integral and derivative control
- Pressure control with possibility of load variation
- Piezoresistive sensor
- Proportional valve control
- Fault insertion

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- Compressor 12V – 1 bar
- Load variation device
- Manometer (1.2 bar)
- Proportional valve 12V
- Set up for PC control and supervision
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pin connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
+12V-2A
-12V-0,5A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM12B/EV

KIT HARDWARE-SOFTWARE FOR DATA ACQUISITION, SUPERVISION AND PROCESS CONTROL. INCLUDES:
- **USB INTERFACE CARD MOD. MFI-LC/EV**
- **SUPERVISION AND CONTROL SOFTWARE SW-S-MCMPRO/EV**

MCM12C/EV

(LEVEL & FLOW CONTROL)

INTRODUCTION

MCM12C/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM12C/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM12C/EV

Experiment Board for the development of a series of lessons on the following topics:

- Flow transducer for water
- Level/pressure transducer
- Flow and level control

The main on board blocks are:

- Set point for level and flow
- Error amplifier
- Signal conditioning for the flow and level/pressure sensors.
- Variable PID controller
- Power amplifier
- Bar-graph for signal visualization
- External unit with graduated tank (2000 cc) and electrical pump.
- Discharge cock

TRAINING PROGRAM:

- Flow and level/pressure transducers.
- Signal conditioning circuits for the transducers.
- F/V & V/F conversions
- PID control

TECHNICAL SPECIFICATIONS:

- 12V immersed electric pump
- Level sensor with signal conditioner. Measurement of the water column pressure
- Flow transducer 0.1 – 2.5 l/min
- Level/pressure conditioning signal output range: 0 – 8V DC
- Set up for PC control and supervision
- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pin connector for Power Supply Unit PSLC/EV
- Fault simulation

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
+12V - 2A
-12V - 0,5A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM12C/EV

KIT HARDWARE-SOFTWARE FOR DATA ACQUISITION, SUPERVISION AND PROCESS CONTROL. INCLUDES:
- **USB INTERFACE CARD MOD. MFI-LC/EV**
- **SUPERVISION AND CONTROL SOFTWARE SW-S-MCMPRO/EV**

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MCM13/EV

(DC, SYNCHRONOUS AND STEPPER MOTOR)

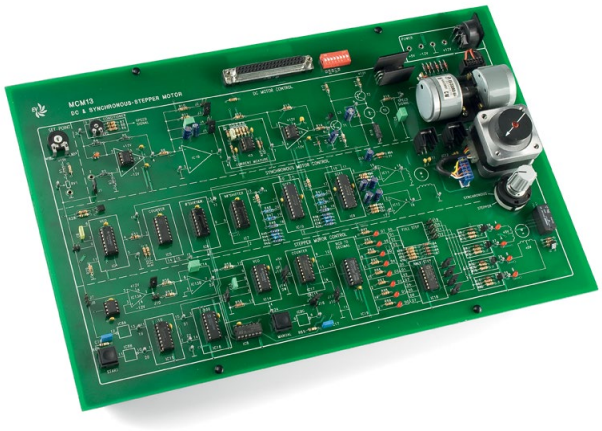
INTRODUCTION

MCM13/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM13/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM13/EV

Experiment Board for analysis of DC, synchronous and stepper motors. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- DC permanent magnet motor: torque, speed and power, tacho-generator, driving and power circuitry;
- Control and drive systems: tacho signal conditioner, set point, fault signal, PI control, amplifier, voltage control;
- Synchronous AC motor: circuit solutions;
- Stepper motor: full/half step unipolar control;
- Step sequence generator, BDC decimal decoder, control amplifier of motor winding.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
+5 Vdc – 2A

SUPPLIED WITH

STUDENT HANDBOOK: THEORY AND EXERCISES

TEACHER HANDBOOK: WIRING DIAGRAMS AND SOLUTIONS OF EXERCISES

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM13/EV

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MCM14/EV
(TRANSDUCERS)

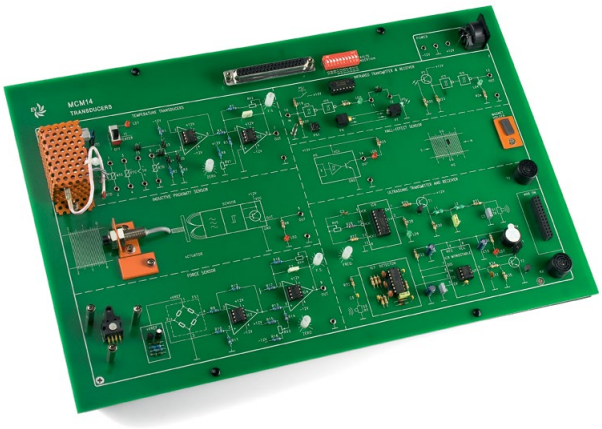
INTRODUCTION

MCM14/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM14/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM14/EV

Experiment Board for analysis of the various sensors and conditioning circuits typically used in control circuits. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Temperature sensors: RDT, thermoresistor, NTC and PTC, thermocouple;
- Hall effect position sensors;
- Infrared sensors: infrared components description, TX diode voltage, pulse signal transmission;
- Proximity sensor: self-amplified inductive sensor;
- Power sensor: piezoelectricity, characteristic parameters, power measurement signal conditioner;
- Ultrasound transmitters and receivers: ultrasound characteristic, transmission time, distance from the source.

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
±12 Vdc – 0.5A
+5 Vdc – 2A

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM14/EV

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MCM15/EV

(SINGLE PHASE INVERTER- UPS)

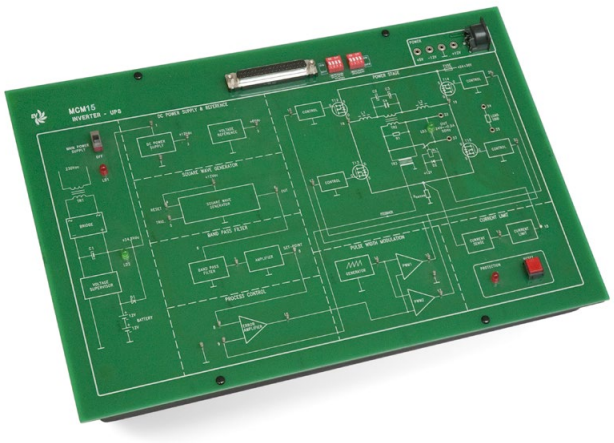
INTRODUCTION

MCM15/EV is one of the experiment boards that constitute the Interactive Practical Electronics System – I.P.E.S.
It consists of a set of components and circuits for performing experiments.

The lessons included in this module can be developed in:
- **Standard mode**: using the switches of the equipment and consulting the handbook;
-**Computerized mode:** the interactive software version of the handbook - SW-D-MCM15/EV - interfaced to the module via Control Unit SIS3-U/EV, is used. This software inserts circuit variations and faults automatically enabling the development of lessons even without teacher's assistance.

MCM15/EV

A quality mains power supply must be supported by a UPS (uninterrupted Power Supply).
This Experiment Board investigates the DC-AC conversion process typical of UPS systems, for the generation of a single-phase AC voltage. It contains all the pre-assembled electronic components needed to construct the experiment circuits and divided into functional circuit blocks which can be interconnected and modified by means of supplied jumpers and connection cables.



TRAINING PROGRAM:

- Generation of the reference signal at fixed frequency
- PWM generator control signals
- PWM (Pulse With Modulation) generator
- PWM MOSFET power amplifier
- L-C filtering and output transformer matching circuitry for output voltage conditioning
- Sinewave output voltage generation
- Automatic amplitude control of the output voltage
- Operation with R, L, C loads
- Introduction of anomalies in the circuit for the study of maintenance techniques
- Analysis of the automatic control system of the output voltage wavefrom

TECHNICAL SPECIFICATIONS:

- Printed circuit board with protective treatment and mimic diagram
- 2 mm sockets for test points and connections
- Jumpers for quick circuit modification
- 37-pin connector for Interface Control Unit SIS3-U/EV
- 8-pole female DIN connector for Power Supply Unit PSLC/EV
- Fault simulation

Dimensions: 386 x 248 x 40 mm

REQUIRED

PSLC/EV
POWER SUPPLY UNIT
- NOT INCLUDED -

POWER SUPPLY
+ 30 Vdc
+ 12 Vdc

SUPPLIED WITH

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

OPTIONAL

PERSONAL COMPUTER

FAULT INSERTION UNIT SIS3-U/EV AND MULTIMEDIA SOFTWARE SW-D-MCM15/EV

MFI-LC/EV

(USB INTERFACE FOR PERSONAL COMPUTER)

INTRODUCTION

The MFI-LC/EV is an interface board integrating A/D and D/A converters and direct input output of digital signals, enabling the use of Personal Computer to acquire and generate analog and digital signals with external applications.
The board is connected to the Personal Computer using a standard USB port. The unit is powered directly from the USB port (absorbed current < 100mA) and doesn't require empty PC slots which makes it also suitable for portable PC. With this interface unit it is possible to acquire and send data on the experimental boards, especially related to sensor and process control study.

This board is supplied bundled with a software for I/O management and is designed as a LabView software compatible tool.

TECHNICAL SPECIFICATIONS:

Analogue Inputs:
- 8 Single-ended inputs / converter AD 10-bit
- Voltage gap: 0 ± 10Vdc

Analogue Inputs:
- 2 Single-ended outputs AD 8-bit
- Voltage gap: 0 ± 10Vdc

Digital Inputs:
- 4 TTL input channels with pull-up resistance

Digital Outputs:
- 4 TTL output channels; reset (0 VDC) line at start-up

USB Interface:
- USB power supply, absorbed current < 100 mA
- USB 2.0 Full Speed 12 Mps

Supplied accessories:
- USB connection cable
- USB driver

Software:
- Supervision software I/O
- LabView Interface

PE

20-B

PROFESSIONAL ADVANCED ELECTRONICS M.P.T. System

PE

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WORK STATIONS FOR ADVANCED EXPERIMENTS M.P.T. SYSTEM

Aim:

- Specialised training on specific Electronics fields such as: Industrial Electronics, Transducers, Process Control and Servomechanisms

Equipment:

- Computerised Workstations with a Set of Industrial Electronics, Transducer and Process Control boards
- Data acquisition systems; Software for process control and signal display
- Measuring instruments

20B-E-PE

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M.P.T. SYSTEM
WORKSTATIONS FOR ADVANCED EXPERIMENTATION

INTRODUCTION

The M.P.T. computerised workstation for Advances Experiments on Electronics allows the theoretical and experimental study of microprocessors, industrial electronics, process control and servomechanisms.

The experiment boards and equipment of the M.P.T. system constitute real applications of circuits analysed in previous basic electronics courses which are now integrated in complex, electronic systems typical of real, industrial applications.

The proposed educational equipment and systems enable the creation of modular study programmes capable of meeting specific and advanced training requirements in the following main technological fields:

Microprocessors
Industrial Electronics
Process Control
Computer Interface
Servomechanisms

The proposed systems are significant examples of typical professional equipment used in this field. They employ the same technologies and devices used in industrial systems: the only difference is the advantage of being specifically designed for training purposes.

The use of this technologically advanced, industrial design equipment ensures the indispensable link between the world of education and industrial reality.

The following features distinguish all the experiment boards and equipment:

- **Flexibility**: different training programmes, specifically designed for different study levels, can be created with the same equipment which can also be upgraded and extended with subsequent modules, in keeping with the latest advancements in technology
- **High technological and didactic content**: modern technology is translated into clear and functional didactic concepts
- **Courseware:** comprehensive manuals guide the student through the theoretical and practical course
- **Software:** SCADA, CBT and multimedia CAI software is available for most of the M.P.T. training programmes and complete the teaching/learning process.

The computerised workstation for Professional Electronics consists of:

Power Supply Unit
Module Holder Box
Experiment Boards
Theoretical/Experimental Manuals
Data Acquisition System
(A/D and D/A card with software)

The front surface of the experiment boards show the circuit diagram, the block diagram of the circuit being examined and the measurement points. The components are mounted on the back, protected by a transparent cover allowing visual inspection of the devices and circuits. Some boards include external units which contain devices or specific circuits, such as transducers, actuators, power circuits, systems for generating physical quantities, etc… The board are supplied with connection cables for carrying out the experiments.

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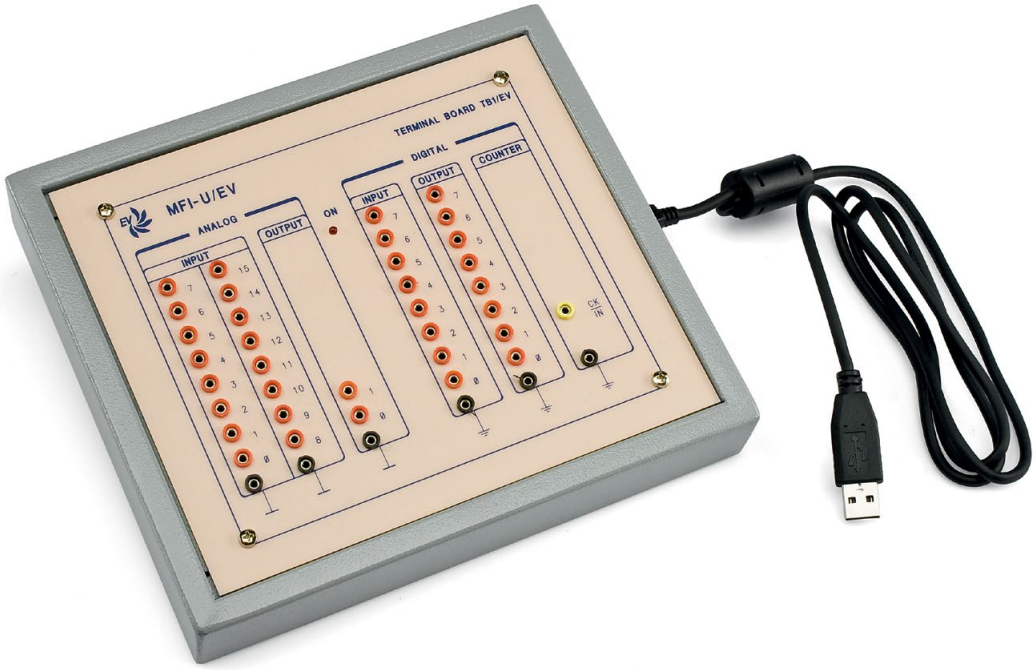
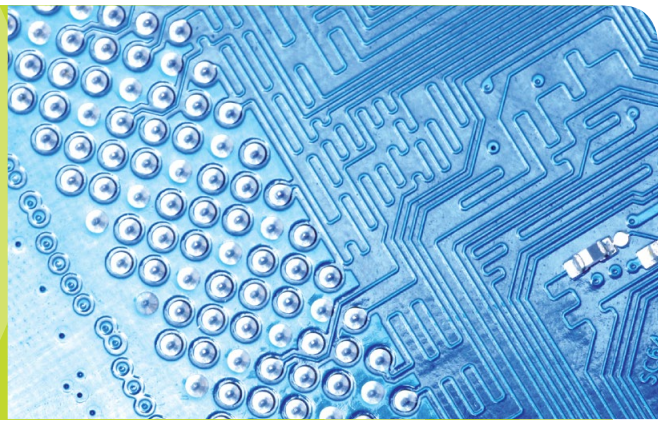


The USB industrial interface unit mod. MFI-U/EV connected to a Personal Computer allows the link with the various experiment boards for acquisition of the analysed variables, supervision and process control.

The experiments can be run with the pre-written software or new programmes can be created for achieving the optimal interface with the boards being used.



The components of the M.P.T. system and the complete list of the experiment boards with related topics are as follows:

- INFRASTRUCTURE
- DIGITAL ELECTRONICS AND MICROPROCESSORS
- INDUSTRIAL ELECTRONICS
- PROCESS CONTROL
- DATA ACQUISITION, CONTROL AND SUPERVISION SYSTEM FOR M.P.T. SYSTEM
- SERVOMECHANISMS

20-B

M.P.T. LABORATORY COMPOSITION

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M.P.T. SYSTEM WORKSTATIONS FOR ADVANCED EXPERIMENTATION INFRASTRUCTURE

POWER SUPPLY UNIT
MOD. PS1-PSU/EV

The power supply is enclosed within a metal housing and together with the module holder box creates an ergonomic tabletop unit. On the front panel are sockets for voltage output and LED voltage indicators. The voltages are also available on DIN connectors located on the right hand side of the unit. This power supply unit is universal as it supplies the voltages necessary for the entire range of experiment boards manufactured by Elettronica Veneta S.p.A..

The supplied voltages are:

OUTPUT S1: +30 Vdc – 4A
Rectified, filtered fuse protected voltage.
Voltage indicator LED.

OUTPUT S2: 24 Vac – 4A
Fuse protected . Voltage indicator LED.

OUTPUT S3: +5 Vdc – 2A

OUTPUT S4: +12 Vdc – 2A, -12 Vdc – 1A
Stabilized voltage, electronically protected from short-circuits and overloads. Voltage indicator LED.

OUTPUT S5: 1.3 Vdc ÷ 24 Vdc, 1A
Stabilized voltage, electronically protected from short-circuits and overloads. Voltage indicator LED.

OUTPUT ON DIN CONNECTOR: 24 Vac – 0 – 24 Vac, 0.5A
Fuse protected voltage.

(Outputs S1 and S2 supply 4A separately and 2A if used simultaneously)

Power supply:	230 Vac 50 Hz single-phase - 200 VA (Other voltage and frequency on request)
Dimensions:	415 x 185 x 195 mm
Weight:	8 kg

MODULE HOLDER BOX
MOD. BOX/EV

Support for housing the experiment boards which are fixed to the frame by means of a “Plug-in” system.
Dimensions and weight: 415 x 400 x 110 mm – 1 kg.

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PERSONAL COMPUTER INTERFACE MOD. MFI-U/EV

Industrial interface units transform any PC into an industrial-type device for applications related to data acquisition, analysis, monitoring and control.

The industrial system obtained becomes a powerful unit for data acquisition, tests, measurements and applications.

USB INTERFACE MOD. MFI-U/EV

This interface expands the PC's architecture providing a set of analog and digital interfaces, counters and timers.

It is connected to the PC via a standard USB cable and is powered directly from the computer USB port (current absorption <100mA).
There is no need for empty slots in the PC hence it can also be used with portable computers.

The experiment boards and electronic devices are thus interfaced to the PC for data acquisition and process supervision and control.

Interface MFI-U/EV is supplied with a USB driver DLL library compatible with LabView software. This enables the user to develop personalised applications for data acquisition and supervision and control of the processes under study.

TECHNICAL SPECIFICATIONS

Analogue inputs:
- 16 Single-ended / AD 12-bit converter
- Voltage range: ±10Vdc
- Protection against over-voltages

Analogue outputs:
- 2 Single-ended / AD 8-bit converter
- Voltage range: ±10Vdc ±1,5%

Digital I/O:
- 8 TTL input channels
- 8 TTL output channels

Counters:
- 1 TTL channel

USB-powered, current absorption < 100 mA, auto-calibration and initial auto-reset
Maximum conversion frequency: 10 kHz

Accessories:
- USB Connection cable
- USB Driver, microcontroller firmware, DLL with API components for the development of interface software for specific applications

DEVELOPMENT SOFTWARE (INCLUDED WITH THE BOARD)
The software mod. MFIDEV/EV enables data acquisition which can be displayed graphically and filed for use with the boards of training devices.

20-B

BOARDS FOR THE STUDY OF DIGITAL ELECTRONICS AND MICROPROCESSORS

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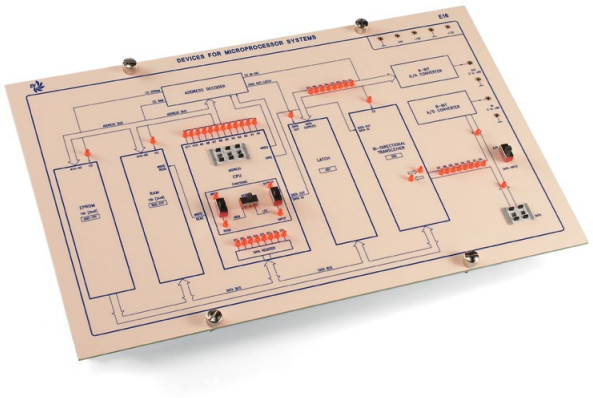
DEVICES FOR µP SYSTEMS
Mod. E16/EV



Before dealing directly with the study of a microprocessor system, it is useful to analyse the devices which constitute a system of this kind and their interfacing to the central unit to learn in detail the real structure which will be analysed next.
The system constitutes an effective introduction to the devices employed in microprocessor systems, starting from their theoretical and practical characteristics up to the control of the peripherals of common use in industrial applications such as A/D and D/A converters.

DEVICES FOR µP SYSTEMS mod. E16/EV
Experiment board consisting of a screen-printed block diagram. The devices constituting a microprocessor system are mounted on the rear side of the front panel and can be interfaced by means of a BUS system. Appropriate operation of the module consists in the simulation of the most important functions of the microprocessor CPU.

TRAINING PROGRAM:

- Data Bus and addresses
- Address decoding
- Data reading and writing on RAM memory
- Data reading from E²PROM
- Data input/output (latch and bidirectional transceiver)
- 8-bit analog/digital conversion
- 8-bit digital/analog conversion
- Data transfer between digital and analog environment via A/D and D/A converters

TECHNICAL SPECIFICATIONS:

- RAM
- EPROM
- Address decoder
- A/D & D/A 8-bit converter
- Latch
- I/O buffer
- Bi-directional transceiver
- Thumbwheel switches

Dimensions: 386 x 248 x 30 mm

REQUIRED

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

POWER SUPPLY
5 Vdc / 0.5A
±12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS: MULTIMETER - NOT INCLUDED -

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

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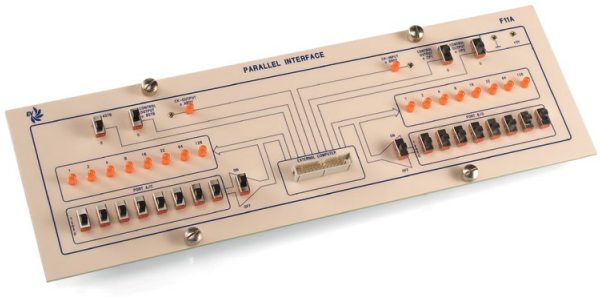
PARALLEL INTERFACE
Mod. F11A/EV



Experiment board for the study of the parallel interface standard signals of mod. Z1/EV, Z2/EV and Z3/EV and protocol and the analysis of the inputs and outputs.
The input data are set with switches and the output data are displayed through LEDs.

TRAINING PROGRAM:

- Data and address Bus and control signals;
- Interfacing of the devices by means of a parallel port;
- Study of the downloading of microprocessor systems' code.

TECHNICAL SPECIFICATIONS:

- Control switches;
- 8+8 Input switches;
- 8+8 Display leds.

Dimensions: 386 x 123 x 40 mm

SOFTWARE:

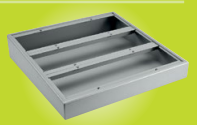
Interfacing program with boards mod. Z1/EV, Z2/EV and Z3/EV: SW-F11A/EV.

REQUIRED

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

POWER SUPPLY
5 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



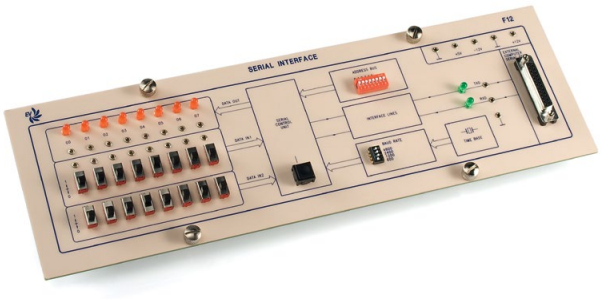
INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

 ELETTRONICA VENETA S.P.A. - 31045 Motta di Livenza (TV) Italy - Via Postumia 16 - Tel. +39 0422 765 802 - Fax +39 0422 861 901 - E-mail: export@elettronicaveneta.com

SERIAL INTERFACE
Mod. F12/EV



Experiment board for the study of serial interface. It contains a programmable processor which transforms serial information in parallel and vice versa.
Serially transmitted data are used in parallel on module's leds. It is possible to study all the problems related to serial communication and related protocols.
It is also possible to connect more modules in cascade with different addresses in order to simulate multi-drop connection.

TRAINING PROGRAM:

- Interfacing of the devices through serial ports;
- Study of the downloading of microprocessor systems' code

TECHNICAL SPECIFICATIONS:

- Control switches;
- 8+8 Input switches;
- 8+8 Display leds.

Dimensions: 386 x 123 x 40 mm

SOFTWARE:

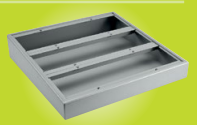
Interfacing program SW-F12/EV (PC with serial output)

REQUIRED

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

POWER SUPPLY
+5 Vdc / 0.5A
±12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

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PERSONAL COMPUTER MAINTENANCE AND TROUBLESHOOTING

Mod. PCTS/EV

During the installation of a Personal Computer or during its normal use, different kinds of anomalies can appear with different levels of solution.
Learning to solve these kinds of problems, from more simple to more complex ones, and thanks to the hardware as well as the software section of the Personal Computer, you can learn the maintenance and troubleshooting procedures of this kind of equipment.
Besides, in this way, the structure and operation of a Personal Computer can be studied in detail, up to the microprocessor and the different peripheral devices.

FEATURES

The system consists of:

- Personal Computer with diagnostic card for detection of the POST codes;
- External fault simulation and test point unit for measurement of the most important signals for the diagnostic analysis of the PC motherboard;
- Software instruments for total analysis of the operation of the different sections.

TRAINING PROGRAM:

- Personal computers;
- Microprocessor systems;
- PC applications in control systems with industrial interface cards;
- Troubleshooting;
- POST and solution codes;
- Analysis of the power supplies;
- Analysis of the BUS signals;
- Analysis of the motherboard signals;
- Analysis of the clock signals;
- Test and maintenance procedures of Personal Computers;
- Evaluation of the performances of a Personal Computer;
- Mouse and joystick;
- Audio;
- Video;
- BURN-IN controls

DIAGNOSTIC SOFTWARE:

- System Test: configuration and ratio
- Advanced diagnostic tests
- Processor
- Mother plate
- Memory
- Floppy disk and Hard Disk
- CD-ROM, LS-FLOPPY, ZIP, SCSI devices
- Serial and parallel ports
- Modem
- Printers

TECHNICAL SPECIFICATIONS:

Personal Computer:

- IBM-compatible PC;
- 32 MB RAM;
- VGA, SUPER VGA graphic card;
- Mouse;
- CD-ROM;
- Serial interface;
- Parallel interface;
- Windows 95/98/2000/XP.

Power supply: 230 Vac 50 Hz single-phase - 350 VA
(Other voltage and frequency on request)
Dimensions: 386 x 123 x 40 mm
Weight: 22 kg

Detection card for POST and SOLUTION codes

- Plug-in ISA and PCI card;
- Autonomous CPU integrated into the card;
- POST address selection;
- Test sequence indicator;
- Switch for code/reset display;
- 3-digit display POST codes and solution codes;
- 3-led indicator for logic probe;
- Logic probe.

Fault simulation unit

- Membrane-switch keyboard;
- LCD display;
- Insertion of 12 faults (cut-off or short-circuit) into the PC

REQUIRED

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

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20-B

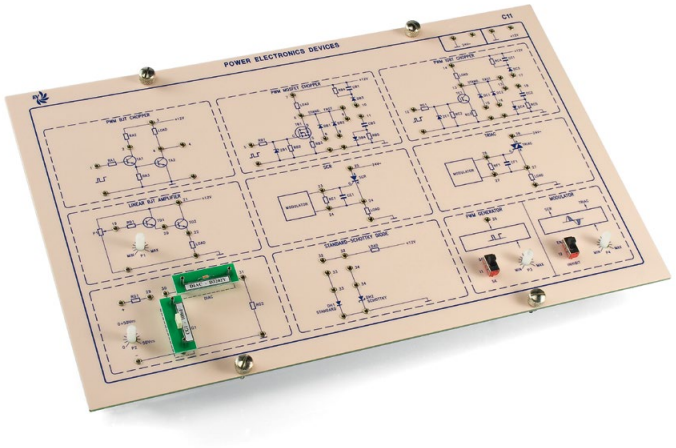
20-B

BOARDS FOR THE STUDY OF POWER ELECTRONICS

 ELETTRONICA VENETA S.P.A. - 31045 Motta di Livenza (TV) Italy - Via Postumia 16 - Tel. +39 0422 765 802 - Fax +39 0422 861 901 - E-mail: export@elettronicaveneta.com

POWER DEVICES AND REGULATION

Mod. C11/EV



DC and AC power control is a key topic of Industrial Electronics. In this contest the experiment board mod. C11/EV, is a milestone of this technology, especially as concerns the driving of actuators for motions and machining.
The **board mod. C11/EV** enables the student to carry out an exhaustive study, first on semiconductor devices employed in the industrial field and, then, on their most common applications.

POWER DEVICES AND REGULATION mod. C11/EV

The possibility to carry out a serious and in-depth experimentation on the theoretical notions concerning the electrical power regulation is provided by experiment board mod. C11/EV.

The last analyzes power control philosophies such as:

- Linear control
- Non-linear control

In both cases, semiconductor devices are used in modern industrial technology as standard fast recovery, Schottky, power BJT, DIAC, TRIAC, SCR, MOSFET and IGBT diodes.

As concerns, the non-linear control techniques these are:

- Phase control
- PWM modulation

The student can compare the different possible approaches and evaluate the performances getting closer to the professional daily practice.
The experiment board is provided with a panel reporting the silk screen representations of the carried out circuit configurations. Each of them shows the inputs, the outputs and the other significant points for measurements with the oscilloscope or multimeter.
The exercises can be performed with the guide of the theoretical- experimental handbooks available with the module.

TRAINING PROGRAM:

Analysis of the operation of the most used power devices:

- Standard diodes, fast recovery, Schottky;
- SCR, TRIAC, DIAC;
- Bipolar power transistors (BJT);
- MOSFET power transistors;
- Insulated gate bipolar transistor: IGBT;
- Driver for power devices;
- PWM generator;
- Detection of the waveforms in circuits with standard and Schottky diodes;
- Detection of the waveforms in switching circuits with fast recovery diodes;
- Detection of the waveforms of a phase control amplifier, an SCR and TRIAC amplifier, and with resistive load;
- Detection of the waveforms in a DIAC circuit;
- Detection of the waveforms of a BJT power linear amplifier with load on the emitter;
- Detection of the waveforms of a PWM amplifier with bipolar transistors and with resistive load;
- Detection of the waveforms of a PWM amplifier with MOSFET transistor and with resistive load;
- Detection of the waveforms of a PWM amplifier with IGBT transistor and with resistive load.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Integrated PWM power amplifier with high switching frequency;
- BJT Darlington driver with resistive load and PWM modulation; load on the collector;
- BJT linear amplifier with adjustable gain for driving the resistive load, in the Emitter Follower configuration
- IGBT driver for control of the resistive load with PWM modulation;
- Potentiometer for duty-cycle regulation;
- Phase control amplifiers with SCR, TRIAC for resistive load control;
- Potentiometer for the firing angle setting of the SCR, TRIAC.

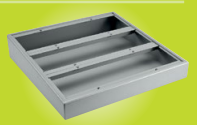
Dimensions: 386 x 123 x 40 mm

REQUIRED

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

POWER SUPPLY
+12 Vdc / 2A
24 Vac / 4A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

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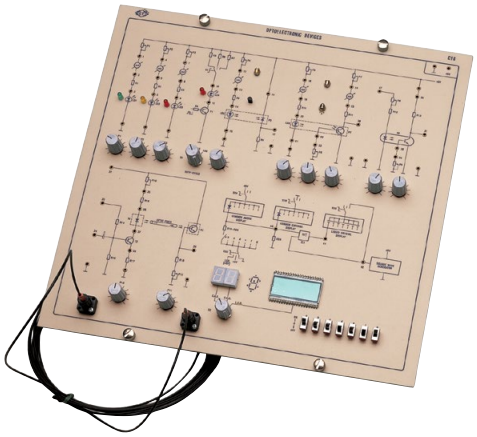
OPTOELECTRONIC DEVICES
Mod. C16/EV



The use of optoelectronic devices in Industrial Electronics covers a wide range of applications: optocouplers for circuit galvanic separation, graphic and light displays, optical fiber transmission of information.
Experiment board C16/EV provides the student with the necessary instrument for experimentation on a large number of topics related to optoelectronic device technologies.

OPTOELECTRONIC DEVICES mod. C16/EV
Board mod. C16/EV is designed to be included in an Industrial Electronics Training laboratory. It enables the implementation of a training program allowing the student to develop experiments related to optoelectronic technologies, employed in the real industrial world.
Starting from exercises on the physical laws governing light radiation, experiment board C16/EV enables a vast range of experiments right up to sinusoidal signal transmission across optical fibres.
The variation of the characteristic parameters of the existing circuits can be easily carried out by means of 10 rotary potentiometers and micro-switches.
The inclusion of a square wave generator on the experiment board reduces the need for external instruments. It not only offers the possibility of performing qualitative and quantitative measurements on the most important points of the circuit, but also allows the student to directly compare the experiment results with those obtained analytically.
Each circuit block is represented in a screen-printed diagram on the front panel made of insulating material.
Finally, the theoretical-experimental manuals supplied with the experiment board guide the student through the exercises and experiments.

TRAINING PROGRAM:

- Light radiation;
- Coherent and non-coherent light sources;
- Photo-conductivity, photoelectric effect, photovoltaic effect;
- Photodiode, phototransistor, photocoupler;
- LED diode;
- LED diode polarization;
- Pulse operation;
- Frequency response;
- Different wave-length Leds: red, green, yellow;
- 7-segment display with common anode and cathode;
- Liquid crystals;
- Liquid crystal 7-segment display;
- Optical fibers;
- Refraction indexes: step-index optical fibers;
- Dispersion and attenuation;
- Sine signal transmission via single-mode optical fiber

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the board and electrical diagram of each circuit
- Terminals for the connections and measurements
- 4 LED diodes: red, green, yellow
- 2 7-segment displays with common cathode and anode for 2-digit coding
- Liquid crystal display on the module
- Regulation of the parameters via 10 rotary potentiometers
- Characteristics of the optical fiber supplied with the board:
  - Type: step-index
  - Single-mode
  - 250 dB/Km attenuation
  - Diameter: 2.2 mm
  - External PVC sheath
- Square-wave generator: inner f=10 kHz

REQUIRED

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

POWER SUPPLY
+5 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

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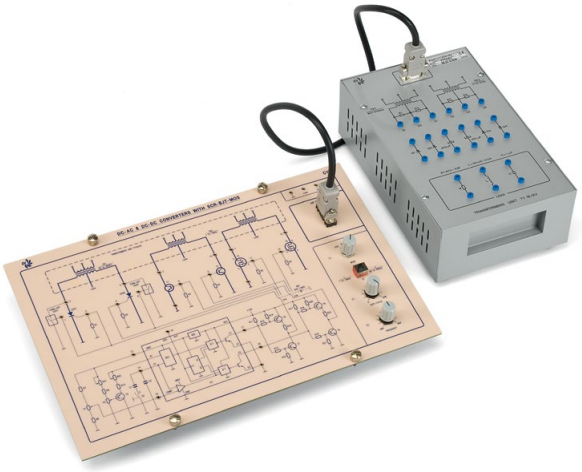
DC-AC AND DC-DC CONVERTERS WITH SCR-BJT-MOS

Mod. C18/EV



The static conversion of DC/AC and DC/DC electrical power is very important in Industrial Electronics as it involves many applications at different levels.
In this context, experiment board mod. C18/EV is used to carry out chopper-type conversion techniques, using discreet and integrated components employed in specific industrial sectors.

DC/AC AND DC/DC CONVERTERS WITH SCR-BJT-MOS mod. C18/EV

Experiment board mod. C18/EV is a complete set (Control circuits, power devices, transformers and RLC loads) that enables the development of a solid training program on DC/AC and DC/DC conversion with SCR, BJT and MOS semiconductor devices used as electronic switches in "chopper" mode.
The student can analyze the performances of the components in different circuit configurations and carry out comparisons so that he can get acquainted with real professional practice.
Inside the board mod. C18/EV, there are two control signal generators, with variable frequency, for the electronic switches: one for the SCR and the other for the BJT and MOS.
Qualitative and quantitative measurements can be carried out with an oscilloscope and multimeter (not included) in many points accessible directly on the module.
The operation of the converters with R-L-C loads and transformers can be analyzed via the connection of the module to the external unit mod. TY18/EV, which is used to fit the above loads and transformers.
The board mod. C18/EV represents on the front silk screen panel made in insulating material all circuit and functional configurations. An effective guide to the exercises is provided by the theoretical- experimental handbooks supplied with the module.

TRAINING PROGRAM:

- Double-chopper DC/AC converter (push-pull inverter);
- Frequency behaviour of the transformers in push-pull configurations;
- Thyristor chopper (SCR);
- Bipolar transistor chopper (BJT) and MOSFET;
- Choice of the configuration according to the application;
- SCR firing;
- Driving signal generator for SCR chopper, with frequency ranging between 50 and 400 Hz;
- Control of two-pole (BJT) and MOSFET transistors;
- Driving signal generator for BJT and MOSFET transistor chopper with switching frequency ranging between 1 KHz and 10KHz;
- Operation of the DC/AC converter with R, RL, RC, RLC loads:
  - Variable frequency behaviour
  - Filtering
- DC/DC converter;
- Integrated circuits for the control of the push-pull inverter.

TECHNICAL SPECIFICATIONS:

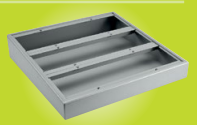
- 3 Push-pulls : SCR, BJT, MOS
- Switching between the push-pulls with rotary switch
- DC/AC converter push-pull outputs:
  - Voltage: 24 Vac / Current: 1 Aac / Power: 24 VA
- Toroidal and ferrite transformers for high frequency applications
- SCR switching frequency: 50 ÷ 400 Hz
- BJT and MOSFET switching frequency: 1 ÷ 10 KHz
- Frequencies adjustable with rotary potentiometer
- Duty-cycle adjustable with rotary potentiometer in the range of
- 0% ÷ 50%, to prevent the saturation of the magnetic cores in the transformers
- External unit (mod. TY18/EV) for fitting the R, C, L, loads and the two output transformers
- Output transformers:
  - 1 For frequencies ≤ 1 kHz / 1 For frequencies ≤ 1 kHz

REQUIRED

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

POWER SUPPLY
+12 Vdc / 0.5A
+30 Vdc / 1A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

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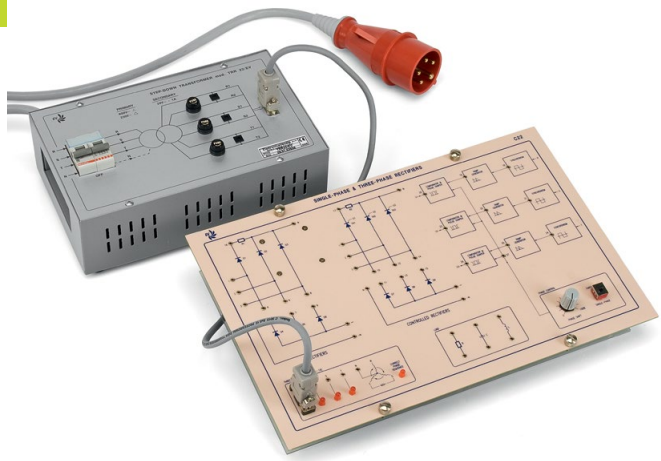
SINGLE PHASE AND THREE PHASES RECTIFIERS

Mod. C22/EV



In Industrial Electronics, AC to DC rectifying systems enable the conversion of electrical power as single-phase and three-phase AC current, into electrical power as DC current with power characteristics matching the specific application.
The most used and modern conversion techniques are carried out by the experiment board mod. C22/EV enabling the student to easily develop a valuable experimentation completing its theoretical training.

SINGLE-PHASE AND THREE-PHASE RECTIFIERS mod. C22/EV

All AC/DC conversion techniques are implemented in the experiment board mod. C22/EV, enabling the student to carry out a solid and exhaustive set of experiments, analyzing different specific circuit configurations.

First of all, traditional non-controlled conversion techniques with rectifier filters are considered and, secondly, the SCR controlled conversion techniques are investigated. Each experiment is developed for single- phase as well as three-phase systems, with R-L-C loads. The loads are provided with the module and can be connected in all their configurations via jumpers.

The external unit mod. TRR22/EV, also supplied with the module, contains 3 transformers and is connectable to the C22/EV board. It supplies power to the board for performing the exercises related to AC/DC conversion with three-phase AC source.

The evaluation of the typical waveforms, produced by the circuits, can be easily performed through T. P. terminals on the module allowing fast connections with oscilloscope and multimeter.

In this way, a direct comparison can be carried out with the data obtained during the theoretical lesson.

Experiment board mod. C22/EV is enriched with a silk screen printed diagram of all circuit blocks on the front panel made in insulating material.

During the experiments, the student is guided by the theoretical-experimental handbooks supplied with the module.

TRAINING PROGRAM:

- Semi-conductor devices used in rectification systems: power rectifier diodes, SCR;
- Half-wave single-phase rectifier;
- Full-wave single-phase rectifier, with central tap transformer;
- Graetz bridge single-phase rectifier;
- Half-wave three-phase rectifier;
- Full-wave three-phase rectifier;
- Wave-form analysis;
- Not-controlled diode rectifier for single-phase and three phase systems;
- SCR controlled rectifier for single-phase and three phase systems;
- Phase control SCR regulation;
- Output voltage as function of the firing angle;
- Operation analysis with R, RL, RC, RLC loads;
- Shift between load voltage and current;
- Firing circuits of the SCR.

Three-phase transformer system experiences:
For three-phase transformer system exercises, the power supply is obtained directly from the external unit mod. TRR22/EV containing a three-phase transformer system with primary: 230/400 Vac, secondary: 3X24 Vac.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Connection cables;
- Power diodes: 400 W;
- Variable SCR firing angle with potentiometer;
- R,L,C loads on the module;
- Power supply for three-phase rectification experiences via external unit mod. TRR22/EV containing 3 single phase transformers;
- Three-phase power cable for unit mod. TRR22/EV with CEE- type connector;
- Characteristics of the transformers:
  Primary: 3x230 / 400 Vac – ±10% – 50/60 Hz
  Secondary: 3x24 Vac / 1 A

MOD. C22/EV

Power supply: Three-phase: 3x24 Vac / 1A supplied by unit mod. TRR22/EV

Dimensions: 386 x 248 x 50 mm

MOD. TRR22/EV

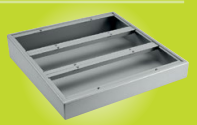
Dimensions: 260 x 160 x 90 mm

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- TRR22/EV External unit power supply:
  Three-phase 400 Vac 50 Hz
  (Other voltage and frequency on request)

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

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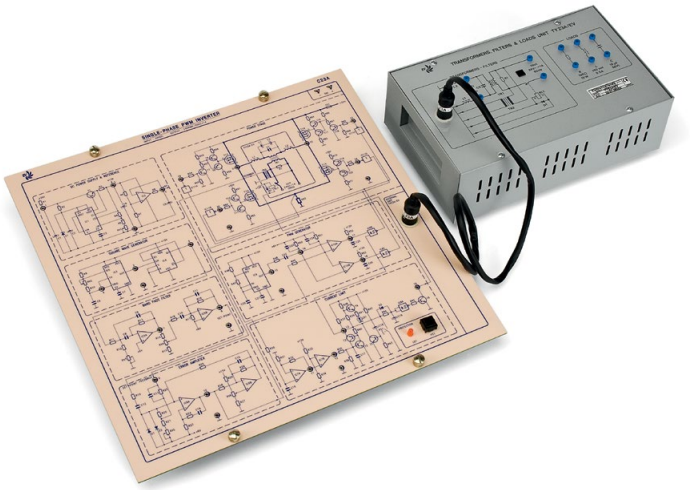
SINGLE-PHASE PWM INVERTER
Mod. C23A/EV



The use of inverters in Industrial Electronics involves several special technical issues to be considered: switching power supply, electrical operations, UPS, active filtering to reduce the current harmonics absorbed in the network.
The experiment board mod. C23A/EV has been designed to enable the student to carry out experiments on the control techniques of a single-phase inverter, with sine PWM modulation.

SINGLE-PHASE PWM INVERTER mod. C23A/EV

A single-phase inverter, controlled with PWM sine technique, is carried out by the board mod. C23A/EV.
Using it the student can experiment and understand the circuit structure of the inverter and analyse the control strategies. The inverter circuitry integrated in the board mod. C23A/EV is carried out using 4 power MOSFETs in "H-bridge" configuration as power switches.
The sine PWM modulation is totally generated on the module. This enables the student to follow all steps of PWM control, from the generation of the sine modulating signal to the generation of the start up and turn off times of the MOSFETs. The insertion of RLC loads across the inverter output enables the filtering of the modulated waveform and so the extraction of the main sine component at the frequency of 50 Hz. The RLC filtering components with a load transformer are housed on the external unit mod. TY23A/EV which can be connected to the module. Inputs, outputs and other significant points of the circuit blocks present on the board mod. C23A/EV, are accessible to measurements with oscilloscope and multimeter. The front panel of the experiment board is enriched with the silk screen mimic diagram of each circuit which is very helpful in learning. Fast connections between the blocks of the circuitry are possible via jumpers and guided through the THEORETICAL-EXPERIMENTAL MANUALS supplied with the module helping the student in carrying out the exercises of the training program.

20B-E-PE-C23A-0

TRAINING PROGRAM:

- Single-phase inverter in "H-bridge" configuration;
- Control strategies of the power MOSFETs (channel P and channel N);
- Insertion of the dead times into the controls;
- Generation of the set-point sine signal with fixed frequency;
- PWM sine modulation (Pulse Width Modulation);
- Control signals for PWM generator;
- PWM generator;
- MOSFET PWM amplifier;
- Filtering and matching of the output voltage via L-C filter and output transformer;
- Restraints on the switching and modulation frequency to obtain a good filtering;
- Output voltage with sine wave-form;
- Ripple analysis at the switching frequency;
- Automatic control of the output voltage waveform;
- Limitation of the load current;
- Analysis of the automatic control system of the output voltage waveform;
- Operation with R ohmic load;
- Operation with mixed RL , RC, RLC, LC loads;
- Analysis of the voltage/current shift with reactive loads;
- Function of the recirculation diodes in parallel to the MOSFETs of the inverter;
- Distorting effect of the dead times on the output wave form;
- Operation with load transformer.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- MOSFET: 2 MOS channels N and 2 MOS channels P;
- Output voltage: sine 24 Vac / 1 A;
- Output voltage frequency: 50 Hz;
- Switching frequency of the PWM generator: 20 kHz;
- External unit mod. TY23A/EV for housing the output transformer, the filters and the R-L-C loads .

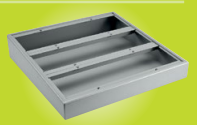
Dimensions mod. C23A/EV: 386 x 372 x 50 mm
Dimensions mod. TY23A/EV: 260 x 160 x 90 mm

REQUIRED

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

POWER SUPPLY
+30 Vdc / 2A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



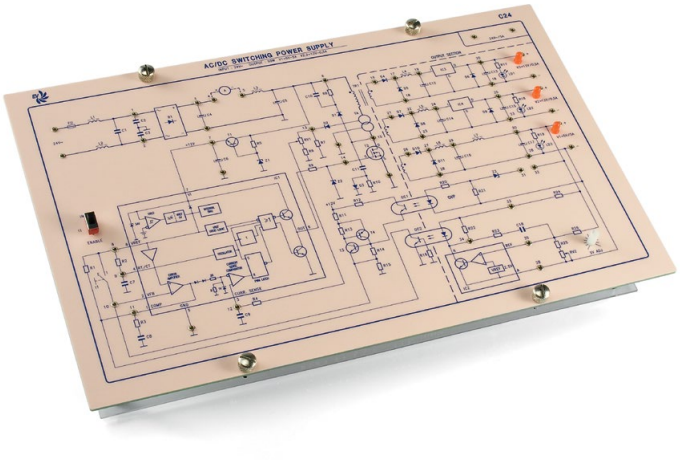
INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

 ELETTRONICA VENETA S.P.A. - 31045 Motta di Livenza (TV) Italy - Via Postumia 16 - Tel. +39 0422 765 802 - Fax +39 0422 861 901 - E-mail: export@elettronicaveneta.com

AC/DC SWITCHING POWER SUPPLY
Mod. C24/EV



The static conversion of AC/DC electrical power of switching kind is particularly important in Industrial Electronics. This approach enables to obtain higher efficiencies in respect to the traditional linear conversion techniques.
The experiment board mod. C24/EV has been designed to develop a wide and solid training program in the field of switching conversion techniques and with the aim to face the student with real, complex problems occurring in the daily professional practice.

AC/DC SWITCHING POWER SUPPLY mod. C24/EV

The electronic technology implemented by modern AC/DC switching power supplies is reported in the board mod. C24/EV in a way to enable the student to acquire a top level knowledge, through experimentation, on the state of the art of Power Electronics and switching techniques.
The wide and gradual training program which can be obtained with the board mod. C24/EV, enables the student to easily switch from the analytic phase of the subject to the practice phase, considering the operation of a professional switching power supply on the whole. In this context, we can analyze the components used and the control techniques taken from the modern Theory of the Systems.
The front panel, made in insulating material, is enriched with a detailed silk screen printed diagrams of the power supply functional and circuit blocks. Among these, the inputs, the outputs and other points that are particularly significant from an educational point of view are accessible to measurements.
The student can qualitatively and quantitatively analyze, in this way, the waveforms present in the circuit getting near the insidious technical problems of industrial routine.

TRAINING PROGRAM:

- Analysis of the input voltages of an SMPS (Switching Mode Power Supply);
- Rectification of the AC input voltage;
- Switching pulse generation;
- PWM modulation with under-oscillation;
- PWM signal spectrum;
- Filtering of the PWM signal: good filtering condition;
- Control techniques of the output voltage width;
- Optocouplers feedback;
- Current-mode control techniques;
- Switching control integrated circuits;
- Ripple of the output voltage;
- MOS transistor as electronic switch;
- Power absorbed and power given: efficiency η;
- The transformer: characteristics for switching applications;
- Behavior of the transformer at high switching frequencies;
- Rectifier systems for the output voltages.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Rectification of the 24-Vac input voltage with Graetz bridge and LC filtering cell;
- Protection fuse on the network side;
- 2 inductances on the network side for the reduction of the current harmonics produced by the Graetz bridge;
- DC/DC converter configuration type: FORWARD with transformer;
- Regulation carried out via dedicated integrated circuit with double loop regulation: voltage and current;
- Current-mode peak current regulation with current sensing on the primary of the transformer;
- Voltage feedback via optical coupling;
- Regulation of the output voltage value via potentiometer;
- Output transformer with 3 secondaries consisting of cores for high frequency applications;
- 3 output voltages:
  - v1: +5 Vdc/5 A adjusted with switching controller
  - v2: +12 Vdc/0,5 A adjusted with 3-terminals linear post-regulator
  - v3: +12 Vdc/5 A adjusted with 3-terminals linear post-regulator

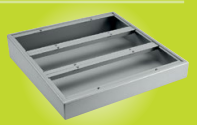
Dimensions: 386 x 248 x 50 mm

REQUIRED

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

POWER SUPPLY
24 Vac / 4A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

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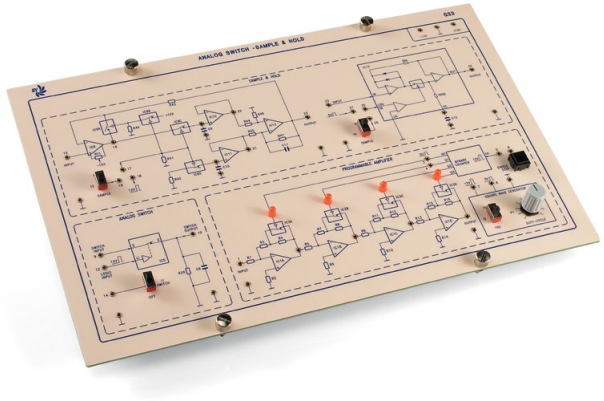
ANALOG SWITCH AND SAMPLE & HOLD
Mod. G33/EV



The analog switches, consisting in electronic semiconductor devices, enable to change the topology of a circuit through electrical control. In the context of Industrial Electronics, these devices are used especially inside Sample & Hold circuitry, for the acquisition of analog, continuous and time variable signals.

ANALOG SWITCH AND SAMPLE & HOLD mod. G33/EV

The experiment board mod. G33/EV has been designed with the aim to allow a valid and deep experimentation on the subjects concerning JFET and MOSFET analog switches, and the Sample & Hold modules. The student finds here the basic elements to understand the process of sampling of external signals to be converted into numerical format. The circuits built on the board mod. G33/EV are those really employed by the industry. In this way, the student can approach the professional practice enriching his analytical background.

TECHNICAL SPECIFICATIONS:

- Front panel built with insulating material complete of silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for connections and measurements;
- Square-wave generator with fixed frequency and variable duty-cycle with rotary potentiometer;
- Programmable amplifier.

Dimensions: 386 x 248 x 50 mm

TRAINING PROGRAM:

- JFET electronic analog switches;
- CMOS electronic analog switches;
- Operative analysis of the analog switch: programmable gain amplifiers;
- Industrial uses of the Sample & Hold;
- Sampling and acquisition times.

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0,5A

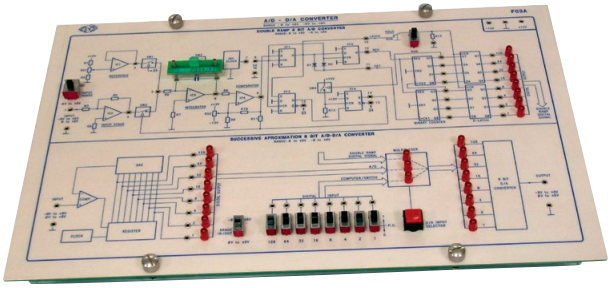
MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- OSCILLOSCOPE
- FUNCTION GENERATOR

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

A/D AND D/A CONVERTERS
Mod. F03A/EV



The A/D and D/A conversions enable the digital control systems normally used in Industrial Electronics to treat signals of analog nature as signals in numerical format and reconvert them into the original analog format at the end.

A/D AND D/A CONVERTERS mod. F03A/EV

The experiment board mod. F03A/EV enables the experiments of many exercises on the subjects concerning A/D and D/A conversions using components really employed by the industry. The student can improve its theoretical knowledge, validating it with many practical experiences. The inputs and outputs of each block of the board mod. F03A/EV are available for the measurements with traditional instruments and, thanks to an interface card and SCADA software available and supplied separately, through the PC.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Input range: ranging between 0 ÷ 8 V and -8 ÷ +8 V;
- Output range: ranging between 0 ÷ 8 V and -8 ÷ +8 V;
- Led display of the digital signals;
- Bar display of analog signals;
- Digital values though switches configuration;
- Fault simulation;
- Test and interconnection points, Ø 2 mm;
- Jumpers for rapid circuit modification.

Dimensions: 386 x 248 x 50 mm

OPTIONAL NOT INCLUDED:

SUPERVISION AND CONTROL SOFTWARE

The software packet mod. **MFIDEV/EV** enables the process supervision and control from PC, via multifunction "plug-in" card mod. MFI-I/EV, for interfacing to the board mod. F03A/EV.

TRAINING PROGRAM:

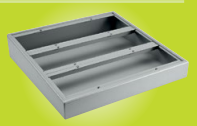
- Analytical aspects of analog/digital conversion, quantisation of a sampled signal, sample & hold, conversion time, errors, relation between signal and noise;
- A/D converters with double ramp: integration of input signal for a constant period, pulse measurement proportional to input voltage;
- A/D converters with approximations: chronometer signal generator, "n" input lines logic sequential device, "n" bit digital/analog converter;
- A/D FLASH converters: comparison between input analog value and prefixed one, control logic, "n" bit digital/analog converter;
- A/D converter;
- Comparison between different A/D converters according to input frequency;
- Selection of the conversion type according to the application.

REQUIRED

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

POWER SUPPLY
+5 Vdc / 0.5A
±12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



INSTRUMENTS: MULTIMETER - NOT INCLUDED -

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

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20-B

20-B

BOARDS FOR THE STUDY OF PROCESS CONTROL

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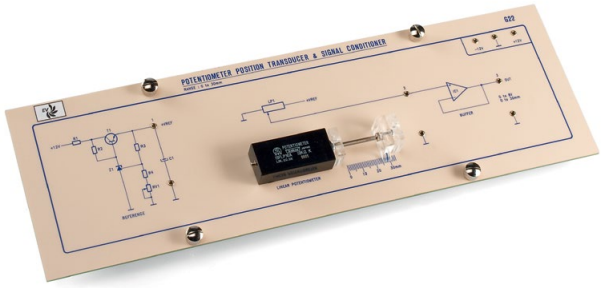
POTENTIOMETRIC POSITION TRANSDUCER AND SIGNAL CONDITIONER

Mod. G22/EV



The use of position transducers, in the process control field, has a wide range of applications converting mechanical displacements into electrical signals that are suitable to process and control the position of an object.

POTENTIOMETRIC POSITION TRANSDUCER AND SIGNAL CONDITIONER mod. G22/EV

The experiment board mod. G22/EV, using components really employed in industry, enables a solid and deep experimentation on potentiometric position transducers and on the consequent signal conditioning. Concepts such as linearity, resolution, sensitivity are directly applied by the student through practical exercises enriching his theoretical background. Each functional and circuit block is provided with inputs and outputs accessible to measurements with a simple multi-meter.

On the board mod. G22/EV, the data acquisition on a PC is possible through a dedicated software and data acquisition card supplied separately.

TRAINING PROGRAM:

- Characteristics of linear position transducers;
- Linear potentiometer;
- Signal conditioner;
- Detection of the characteristic curve;
- Plotting of the best straight line of the transducer;
- Detection of the transduction linearity;
- Analysis and use of the supervision software with Personal Computer.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Signal conditioning circuit with operational amplifier in follower configuration;
- Linear potentiometer position transducer;
- Transducer shift range: 0 ÷ 30 mm;
- Transducer linearity: 0.5%;
- Output voltage range: 0 ÷ 8 V.

Dimensions: 386 x 123 x 40 mm

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- CENTESIMAL CALIPER

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

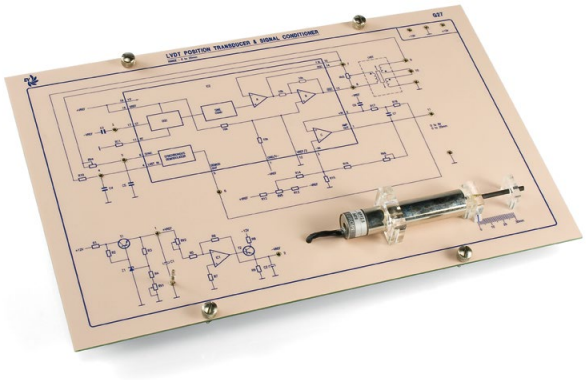
OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
MFIDEV/EV DATA ACQUISITION SOFTWARE

POSITION TRANSDUCER WITH LVDT AND SIGNAL CONDITIONER

Mod. G27/EV



The LVDT position transducers are the answer to the need of very strong performances, in terms of accuracy, in the field of industrial process controls.

POSITION TRANSDUCER WITH LVDT AND SIGNAL CONDITIONER mod. G27/EV

The experiment board mod. G27/EV has been designed to offer the student the possibility to develop a solid and deep experimentation on LVDT position transducers and their conditioning circuits, using components and techniques really employed in the professional field.

The PC data acquisition with the board mod. G27/EV is possible by using a data acquisition software and a dedicated software, both supplied separately.

TRAINING PROGRAM:

- Characteristics of linear position transducers
- Sensitivity, resolution, linearity
- Linear Variable Differential Transformer (LVDT)
- Signal conditioner
- Detection of the "shift-voltage" characteristic curve
- Plotting of the best straight line of the transducer
- Calibration of the conditioner
- Detection of the transducer/conditioner linearity
- Analysis and use of the supervision software with Personal Computer

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- LVDT position transducer;
- Signal conditioner;
- Transducer shift range: 0 ÷ 30 mm;
- Transducer linearity: 0.2%;
- Output voltage range: 0 ÷ 8.

Dimensions: 386 x 248 x 40 mm

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS: MULTIMETER - NOT INCLUDED -

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
MFIDEV/EV DATA ACQUISITION SOFTWARE

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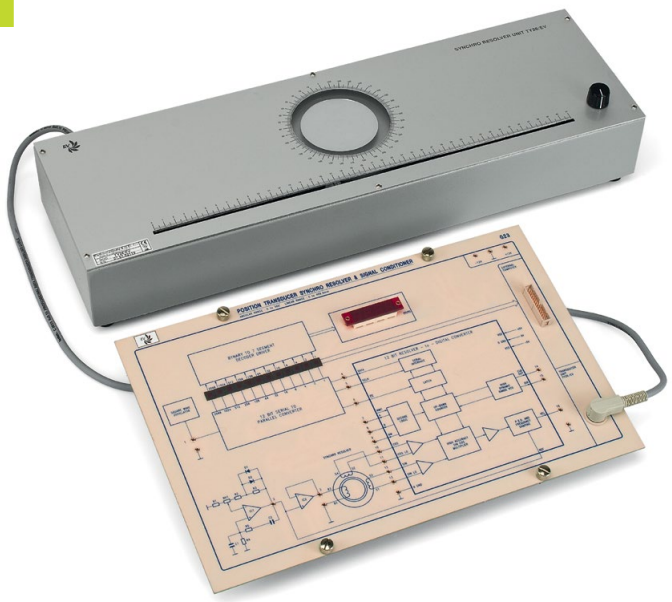
POSITION TRANSDUCER WITH SYNCHRO RESOLVER AND SIGNAL CONDITIONER

Mod. G23/EV



The use of digital controllers in the regulation of industrial processes implies the need to use transducers providing digital output data. Among these transducers, or sensors, much used is the synchro-resolver, providing two sine analog and isofrequential outputs shifted between them of 90° with amplitude as function of position.

POSITION TRANSDUCER WITH SYNCHRO-RESOLVER AND SIGNAL CONDITIONER mod. G23/EV

The experiment board mod. G23/EV has been designed to offer the student the possibility to carry out a solid and deep experimentation on the problems concerning position transducer with synchro-resolver.

The components and the circuits of the board mod. G23/EV are the same used in the industry. In this way the student will be acquainted wth the articulated problems of top level design. The external unit mod. TY26/EV, included with the board mod. G23/EV, to which is connected via an 8-pole DIN cable, includes:

- **A Mechanism for setting the angular or linear position**
- **A Synchro-resolver transducer**

The unit mod. TY26/EV is used for the generation of the physical quantity (position) which is transduced and converted by the synchro-resolver. The transduced signal, coming from the synchro- resolver, is conditioned by the circuits of mod. G23/EV and next displayed on a 4-digit display.

On the board mod. G23/EV, it is possible to carry out measurements and connections via the terminals accessible on the front panel on that the silk screen mimic diagram of the circuit and functional blocks is included.

The training program is completed by the use of software to control and supervision of the process wit the PC .

TRAINING PROGRAM:

- Characteristics of position transducers;
- Position transducers with synchro-resolver;
- Resolution power, sensitivity, linearity of the synchro resolvers;
- Transformation ratio;
- Signal conditioner;
- Electrical zero;
- 12-bit analog-to-digital conversion;
- Detection of the "shift/output digital signal" characteristic;
- Plotting of the best curve of the "entrainment mechanics, transducer, conditioner" unit;
- Detection of the linearity of the "entrainment mechanics, transducer, conditioner" unit;
- Detection of the conversion factor between digital output signal (decimal) and the angular shift of the synchro resolver;
- Analysis and use of the supervision software with Personal Computer.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Measurement and connection terminals;
- The unit mod. TY26/EV for the generation of the physical variable (position) consists of:
- Metal container,
- Synchro-resolver,
- Angular (from 0 to 360°) and linear (from 0 to 410 mm) position indicators,
  - Knob for position set-up,
  - Transformer mechanism of the motion from linear to angular type "belt transmission",
- Synchro-resolver characteristics:
  - Frequency = 10 kHz
  - Transformation ratio = 0.480
  - Shift = 1°
  - Accuracy = ±10 minutes
  - Weight = 115 g
- 12-bit integrated signal conditioner
- Inner clock generator
- Characteristics of transduction:
  - Input range: 0 ÷ 409.66 mm
  - Decimal reading: 0 ÷ 4096 unit
- Display of reading with a 4-digit display;
- Connection cable of the module to an 8-pole external unit type DIN 270.

Dimensions mod. G23/EV: 386 x 248 x 40 mm
Dimensions mod. TY26/EV: 550 x 170 x 100 mm

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS: MULTIMETER - NOT INCLUDED -

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
MFIDEV/EV DATA ACQUISITION SOFTWARE

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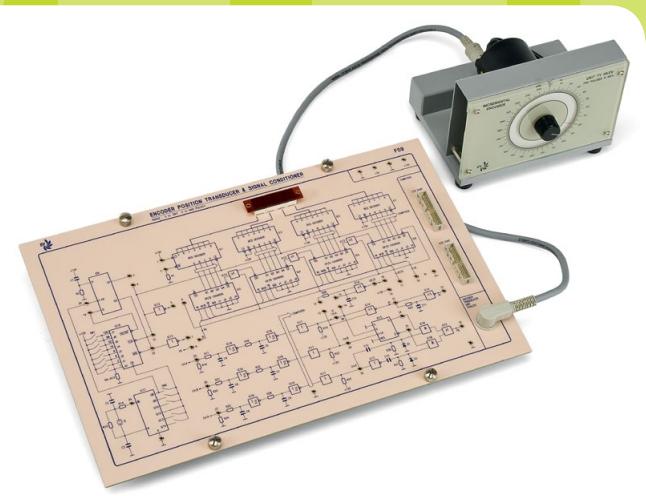
POSITION TRANSDUCER WITH ENCODER AND SIGNAL CONDITIONER

Mod. F09/EV



The wide use of digital control systems produced a great development in numerical transducers. In particular, nowadays, numerical position transducers are available providing a numerical representation of angular rotations and linear motions. Both types, Incremental and absolute, are studied with the mod. F09/EV.

POSITION TRANSDUCER WITH ENCODER AND SIGNAL CONDITIONER mod. F09/EV

The experiment board mod. F09/EV is a valuable piece of instruments for the Process Controls' technology. In fact this special transducer is a basic device for the conversion of linear and angular movements into numeric quantities. The circuits used for F09/EV is designed and built using components and circuits really employed in the professional field. The incremental encoder is assembled on the external unit mod. TY09/EV, which can be connected to the board mod. F09/EV through an 8-pole DIN cable. The same unit enables to fix a reference position (set point) with a rotary knob, which rotation will be detected by the encoder, conditioned by proper circuits on the board and displayed in a 4-digit display. The mimic diagram of the functional and circuit blocks of the board are silk screen printed on the front panel made of insulating material. In this way, qualitative and quantitative measurements can be carried out directly on the input and output terminals of each block. The training program is completed by the use of the data acquisition software from PC, for monitoring the electrical variables involved in board mod. F09/EV. A comprehensive theoretical-experimental manual, provided with the module, effectively guide the student in carrying out the exercises.

TRAINING PROGRAM:

- Characteristics of position transducers;
- Numerical position transducers;
- Photoelectrical transducers;
- Coding of numerical position transducers;
- Absolute Encoders;
- Incremental Encoders;
- Control and display circuits;
- Signal conditioner: detailed analysis of the circuits;
- Position and speed detections;
- Use of the conditioner as frequency-meter;
- Checking the measurement accuracy;
- Resolution;
- Analysis and use of the supervision software with Personal Computer and dedicated card.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Integrated circuits for treating the signal;
- 4-digit display for the position reading;
- Encoder transducer: 250 pulses, 2 channels + zero channel;
- Unit mod. TY09/EV for the generation of the angular position consisting of:
  - Metal support
  - Goniometric indicator for the angular position
  - Rotary handle for the angular position variation
  - Transducer
- 8-pole connection cable of the module to the external unit DIN 270.

Dimensions mod. F09/EV: 386 x 248 x 40 mm
Dimensions mod. TY09/EV: 160 x 120 x 120 mm

REQUIRED

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

POWER SUPPLY
+5 Vdc / 1A
+12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS: OSCILLOSCOPE - NOT INCLUDED -

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
MFIDEV/EV DATA ACQUISITION SOFTWARE

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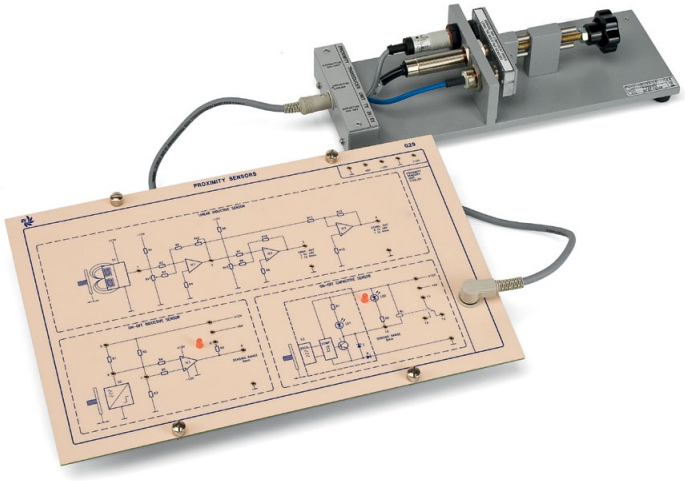
PROXIMITY TRANSDUCER AND SIGNAL CONDITIONER

Mod. G29/EV



The need of equipment with high reliability, operating in very difficult conditions in the field of Process Control, encouraged the development of a new kind of position indicator (limit switch) without mechanical contact between actuator and sensor.
The experiment board mod. G29/EV has been designed to enable the student to develop experiments on subjects concerning proximity transducers and the conditioning of the signal supplied by the same transducers.

PROXIMITY TRANSDUCER AND SIGNAL CONDITIONER mod. G29/EV

Experiment board mod. G29/EV has been designed and manufactured with industrial components, circuits and techniques employed in the field of Process Control. It represents a necessary tool for the analytical-experimental study of the subjects concerning proximity transducers and signal conditioning circuits. The training program includes a wide range of exercises completing the theoretical background of the student and getting him acquainted with problems concerning industrial design.
The external unit mod. TY29/EV, coming with the board mod. G29/EV to which is connected via 8-pole DIN cable, includes inside a solid metal support:

- **3 sensors: inductive, linear inductive, capacitive**
- **1 motion system adjustable with handle**

The electrical signal, coming from unit mod. TY29/EV, is processed by the conditioning circuits integrated in the board mod. G29/EV. The result of the processing is the generation of a voltage depending on the distance between sensors and the moving mechanism. Measurements of key parameters in the circuits of board mod. G29/EV, can be carried through test points accessible from the front panel of the board.
Thanks to a data acquisition card and SCADA software (supplied separately), the training program can be completed with experiments of signals acquisition and recording with a PC.

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TRAINING PROGRAM:

- Characteristics of proximity transducers;
- Linear inductive proximity sensors;
- ON-OFF inductive proximity sensors;
- ON-OFF capacitive proximity sensors
- Signal conditioners for proximity sensors;
- Calibration of the signal conditioner;
- Detection of the "distance/voltage (sensor)" characteristic curve;
- Detection of the "distance/voltage (sensor + conditioner)" characteristic curve;
- Plotting of the best straight line of the sensor;
- Detection of the sensor-conditioner linearity;
- Detection of the current with and without actuator;
- Detection of the intervention distance;
- Analysis and use of the supervision software with Personal Computer.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- 2 signaling LEDs for ON-OFF sensors;
- Unit mod. TY29/EV for the generation of the physical variable (position) consisting of:
  - Metal container
  - Linear inductive sensor
  - ON-OFF inductive sensor
  - ON-OFF capacitive sensor
  - Motion system adjustable with rotary switch
- Linear inductive sensor: standard output 0 ÷ 8 V for a motion of 1 ÷ 4 mm; prop. output 0 ÷ 4 V for a motion of 1 ÷ 4 mm;
- ON-OFF inductive sensor: detection range 5 mm;
- ON-OFF capacitive sensor: detection range 5 mm;
- Connection cable of the module to the 8-pole external unit type DIN 270.

Dimensions mod. G29/EV: 386 x 248 x 40 mm
Dimensions mod. TY29/EV: 330 x 120 x 75 mm

REQUIRED

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

POWER SUPPLY
+5 Vdc / 2A
+12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS: MULTIMETER - NOT INCLUDED -

SUPPLIED WITH

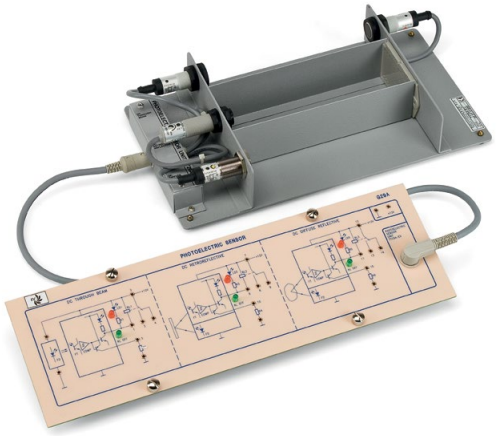
THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
MFIDEV/EV DATA ACQUISITION SOFTWARE

PHOTOELECTRIC SENSORS
Mod. G29A/EV



Electronic measurements and controls try to reproduce the human model: they sense the environment and transform the information into electrical signals that are processed by intelligent electronic units. The electronic and automation world follows this process, transforming, via sensors and transducers, the values of the physical parameters into electrical signals, further processed by intelligent electronic units, such as PLC and IN/OUT data acquisition systems. There is a strong need for high reliability industrial devices, able to operate under highly severe electrical and environmental conditions. This need boosted the use of a class of optical transducers, working with electromagnetic radiation in the optical band, but also in the UV (ultraviolet) and IR (infra red) bands.

Experiment board G29A/EV has been designed to allow the student to perform at a glance the experiments on subjects related to photoelectric transducers and the signal conditioning circuits that process the signals generated by the sensors. It has been built using industrial components normally used in process control. It is an indispensable tool for the experimental study of subjects related to photoelectric sensors, signal conditioning circuits and the actuators that control the processes that include the photoelectric sensors.

The photoelectric transducers are based on photosensitive elements that modify their electrical characteristics according to the light intensity that reach them. The variation of the light intensity, caused by the presence/absence of the object to be sensed, generates and electrical signal that, appropriately processed, activates a final amplification stage able to drive an external load. The IR transmitted beam allows to work with environmental light levels up to 10000/5000 LUX and to have long activation ranges with low energy consumption.

PHOTOELECTRIC SENSORS
MOD. G29A/EV

The unit TY29A/EV, included with the board G29A/EV and connected via an 8-poles DIN cable, includes three different photoelectric sensors.

- through beam photoelectric sensors
- retro reflective photoelectric sensors with reflector
- diffuse reflective photoelectric sensors

The incoming signals from the TY29A/EV unit are processed by the conditioning circuits and later connected to the actuators included in the board G29A/EV.

TRAINING PROGRAM:

- Features of the photoelectric sensors
- Through beam photoelectric sensors:
  - emitter sensor
  - receiver sensor
- Retro reflective photoelectric sensors
- Diffuse reflective sensors
- Signal conditioning circuits

TECHNICAL SPECIFICATIONS:

- Frontal panel made of isolating material with silk screen diagram of the circuits blocks of the module and the electrical diagram of each circuit;
- Measuring and connecting terminals

Dimensions mod. G29A/EV: 386 x 123 x 40 mm
Dimensions mod. TY29A/EV: 330 x 180 x 75 mm

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS: MULTIMETER - NOT INCLUDED -

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS. INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
MFIDEV/EV DATA ACQUISITION SOFTWARE

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ULTRASONIC SENSORS
Mod. G40/EV

The ultrasonic sensors, made with piezoelectric components, generate waves of frequencies over 20.000 Hz and simultaneously can detect signals of the same type. Their wide field of application is mainly related with the distance measurement and presence detection of objects.

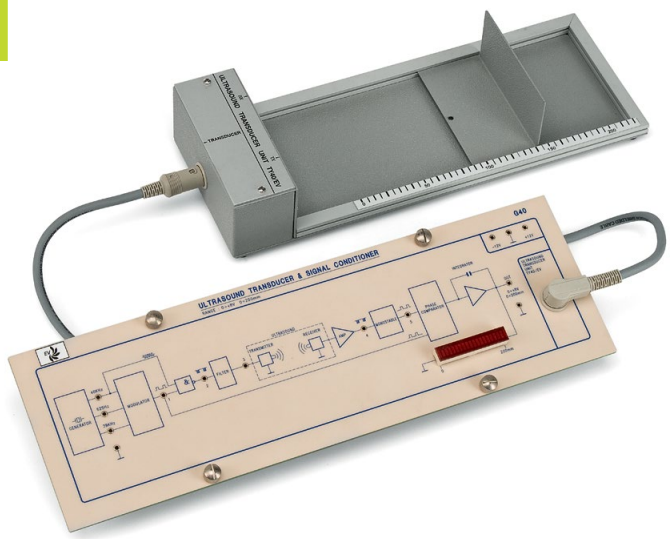
The study of these sensors is devoted to its most frequent application, the ultrasonic radar, that can use signals of different frequencies and power, but always based on the physical phenomenon of the ECHO.

The operation of this radar is based on the principle of the emitter station that sends the ultrasonic impulses and the receiver station for detecting the same signals reflected by the obstacles found in their path.

The aim of this radar is then to detect the presence and determine the position of a solid object.

The radar transmitter generates a very short and powerful ultrasonic impulse through a directional transducer. When the impulse finds objects with different characteristics from the environment, it is reflected back and then is detected by the receiver equivalent sensor.

At the typical ultrasonic radar frequencies (40000Hz), the emitter transducer concentrates the irradiated energy in a narrow beam or spatial cone. After emitting the impulse, the transmitter makes a short pause, allowing the receiver to "hear" eventual echoes of the just emitted impulse. The equipment registers the reception time of each echo. The time difference between the pulse emission and the echo return is translated into distance from the object. The echo power is weaker than the sent impulse, thus very sensitive receivers are required.



ULTRASONIC SENSOR mod. G40/EV

Experiment board G40/EV has been designed to allow the Student experiences on subjects related with ultrasonic transducers and the relative signal conditioning circuits in the context of the ultrasonic radar.

It has been designed and made using industrial components of the process control sector.

It is an indispensable instrument for the experimental study of the subjects regarding ultrasonic sensors, the signal conditioning circuits and the actuators that control the processes, where the transducers themselves are used.

The unit TY40/EV included with the board G40/EV and connected to it via an 8-poles DIN cable, includes two ultrasonic sensors and an obstacle simulation system:

- transmission ultrasonic sensor
- reception ultrasonic sensor
- obstacle simulation system: barrier positionable from 0 to 200 mm.

The reflected signal coming from the obstacle and the transmitted signal in the TY40/EV unit, are processed by the signal conditioning circuits and interface placed in the board G40/EV.

TRAINING PROGRAM:

- Piezoelectric materials: mechanical and electrical properties;
- Characteristics of the ultrasonic sensors;
- Signal Conditioning circuits;
- Sensors sensitivity calibration;
- Generation and modulation of the transmitted signals;
- Demodulation and conditioning of the received signals;
- Comparation of the emitted and received signals;
- Conversion of the signals for the interface;
- Visualization;
- Analysis of the obstacles reflectant characteristics;
- Analysis and use of the supervision software with the Personal Computer.

TECHNICAL SPECIFICATIONS:

- Front panel made in isolating material with the silk screen diagram of the electrical circuital blocks;
- Measurement and connection terminals;
- Unit mod. TY40/EV for the generation of the physical parameter (interruption of the light beam) including:
  - Metallic support
  - Ultrasonic transmitter sensor
  - Ultrasonic receiver sensor
  - Obstacle simulation: barrier positionable from 0 to 200mm
  - Piezoelectric transmitter sensor, max. irradiated power at 40000Hz;
  - Piezoelectric receiver sensor, max. sensitivity at 40000Hz;
- Standard output: 0 – 8Vdc for a obstacle distance from 0 to 200mm;
- 20 LEDs bargraph for visualising the obstacle distance (1 LED per 10 mm);
- Visualisation, via oscilloscope, of the phase difference between the transmitted and received signals for a better accuracy in the measurement distance;
- 8-poles DIN 270 connection cable between module and the external unit.

Dimensions mod. G40/EV: 386 x 123 x 40 mm
Dimensions mod. TY40/EV: 330 x 120 x 60 mm

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
MFIDEV/EV DATA ACQUISITION SOFTWARE

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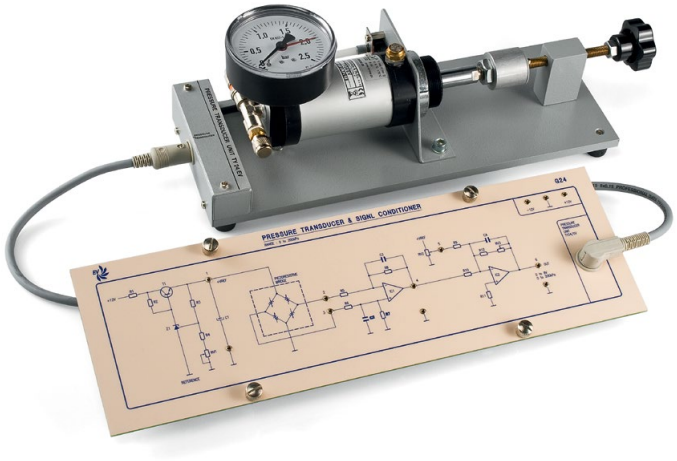
PRESSURE TRANSDUCER AND SIGNAL CONDITIONER

Mod. G24/EV



Among the transducers or sensors, used in the industrial field, the pressure transducer is getting more and more important as it provides an electrical analog output indicating the gas pressure or the liquid set under test. In this context, the board mod. G24/EV represents a complete and innovative system for direct experimentation on pressure sensors.

PRESSURE TRANSDUCER AND SIGNAL CONDITIONER mod. G24/EV

Experiment board mod. G24/EV enables the development of a wide range of experiments on subjects concerning pressure transducers and signal conditioners used in industrial Process Controls.

The components and circuits present on the board mod. G24/EV are the same used in the professional field. The student, in this way, can complete what acquired from a theoretical point of view, getting near complex problems concerning the design of control systems. The external unit mod. TY24/EV, supplied with the board mod. G24/EV, to which is connected via an 8-pole DIN cable, contains:

- The device for manual generation, via handle, of the sample pressure;
- Pressure transducer;
- Indication pressure gauge.

The signal transduced by the unit mod. TY24/EV is conditioned by the matching and filtering circuits present on the board mod. G24/EV, which provide a voltage reading proportional to the set pressure.

Measurement with multimeter and connection via jumpers can be carried out in many significant points to enable the student to perform a direct testing of his theoretical training.

The training program is completed by the use of an acquisition software (offered separately) to record and display the signals coming from the board mod. G24/EV, with the aid of a PC.

TRAINING PROGRAM:

- Characteristics of pressure transducers;
- Pressure-shift transducers;
- Piezoresistive transducer;
- Signal conditioner;
- Calibration of the signal conditioner;
- Detection of the "Pressure/Output voltage" characteristic curve of the transducer-conditioner;
- Plotting of the best curve of the transducer-conditioner;
- Calculation of the linearity of the transducer-conditioner;
- Detection of the measurement variation at the transducer temperature variation;
- Detection of the measurement variation at the conditioner temperature variation;
- Analysis and use of the supervision software with Personal Computer.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Signal conditioning with bridge and operational amplifiers for matching-filtering;
- Voltage reference for the bridge: linear, inner;
- Pressure transducer:
  - Input pressure range: 0 ÷ 2 bar
  - Output voltage range: 0 ÷ 8 V
  - Linearity: 0.15%
- The unit mod. TY24/EV for the generation of the physical variable (pressure) consists of:
  - Metal container with cylinder
  - Adjustment handle
  - Pressure gauge for pressure indication
- Connection cable of the module to an 8-pole external unit type DIN 270

Dimensions mod. G24/EV: 386 x 123 x 40 mm
Dimensions mod. TY24/EV: 330 x 120 x 120 mm

REQUIRED

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

POWER SUPPLY
±12Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS: MULTIMETER - NOT INCLUDED -

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
MFIDEV/EV DATA ACQUISITION SOFTWARE

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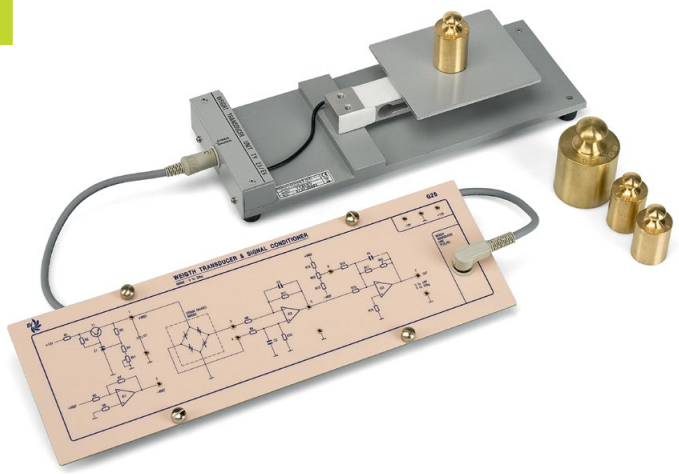
FORCE TRANSDUCER AND SIGNAL CONDITIONER

Mod. G25/EV



The development of automatic weighting, packaging and dosing systems made the force sensor one of the most used transducers in the industrial field. In this context, the experiment board mod. G25/EV, has been designed to enable the development of experiments on subjects concerning force transducers and conditioning systems of the signal supplied by the same transducers.

FORCE TRANSDUCER AND SIGNAL CONDITIONER mod. G25/EV

The experiments on the subjects concerning force transducers and signal conditioners, are enabled by the use of the same board mod. G25/EV, in a wide range of exercises constituting the training program.

The design of board mod. G25/EV involved the use of industrial circuits and techniques. In this way, the exercises which can be developed get the student acquainted with the articulated problems of design. The external unit mod. TY25/EV, included with the board mod. G25/EV, to which is connected via an 8-pole DIN cable, and includes:

- Device for manual generation of force with sample weights
- Load cell
- Sample weights

The signal transduced by the unit mod. TY25/EV is conditioned by the matching and filtering circuits present on the board mod. G25/EV, which provide a voltage reading proportional to the force set with the sample weights.

Measurements on the electrical variables present in the circuits of the board mod. G25/EV can be carried out in many points accessible to terminals located on the front panel of the module. The training program is completed by the use of the PC acquisition software of signals coming from the board mod. G25/EV.

TRAINING PROGRAM:

- Characteristics of force transducers;
- Transducers based on elastic reaction;
- Sensors using resistive strain gages;
- Sensors using semiconductor strain gages;
- Load cells;
- Transducers based on piezoelectricity;
- Signal conditioners used as force transducers;
- Calibration of the signal conditioner;
- Detection of the "force/output voltage" characteristic curve;
- Plotting of the best curve of the transducer-conditioner;
- Detection of the measurement variation at the load cell temperature variation;
- Detection of the measurement variation at the conditioner temperature variation;
- Analysis and use of the supervision software with PersonalComputer;

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Signal conditioning with bridge and operational amplifiers for matching-filtering;
- Voltage reference for the bridge: linear, inner;
- Force transducer:
  - Input force range: 0 ÷ 20 Kg
  - Output voltage range: 0 ÷ 8 V
  - Linearity: 0.3%
- The unit mod. TY25/EV for the generation of the physical variable (force) consists of:
  - Metal container
  - Load cell
  - Sample weights
- Connection cable of the module to an 8-pole external unit type DIN 270.

Dimensions mod. G25/EV: 386 x 123 x 40 mm
Dimensions mod. TY25/EV: 330 x 120 x 120 mm

REQUIRED

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

POWER SUPPLY
±12Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS: MULTIMETER - NOT INCLUDED -

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
MFIDEV/EV DATA ACQUISITION SOFTWARE

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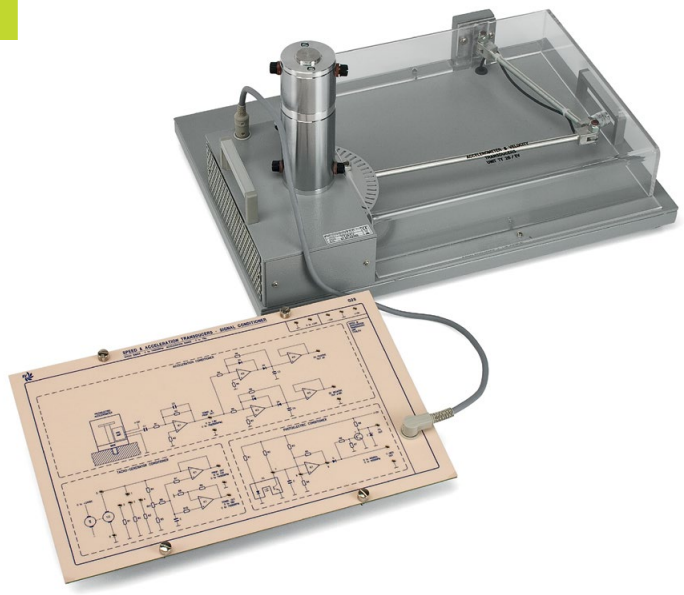
SPEED AND ACCELERATION TRANSDUCER AND SIGNAL CONDITIONER

Mod. G28/EV



The need to measure and analyze the vibrations producing in the most different structures recently brought to the development of proper transducers transforming the mechanical accelerations into electrical signals.
The module mod. G28/EV has been designed to enable the student to develop the experiments on the subjects concerning speed and acceleration transducers and the related circuits for signal conditioning.

SPEED AND ACCELERATION TRANSDUCER AND SIGNAL CONDITIONERS mod. G28/EV

Experiment board mod. G28/EV has been designed with components and circuits really employed in Industrial Process Controls. With it, the student can carry out experiments including a wide range of subjects concerning "speed" and "acceleration" transducers. The experimentation completes the theoretical background of the student and gets him acquainted with the problems of professional practice. The external unit mod. TY28/EV, coming with the board mod. G28/EV and connectable to it via an 8-pole DIN cable, includes:

- **Variable speed DC motor**
- **Connecting rod-crank system**
- **Speed and acceleration transducers**

The transduced signal, coming from unit mod. TY28/EV, is conditioned by the matching and filtering circuits present in the board mod. G28/EV which supply a voltage reading proportional to the speed and/or acceleration of the connecting rod-crank system of the external unit. Measurements of the quantities present in the circuits of board mod. G28/EV, can be carried out in many points accessible in terminals set on the front panel of the module. The training program is completed by the use of the acquisition software from Personal Computer of the binary signals coming from board mod. G28/EV.

TRAINING PROGRAM:

- Characteristics of speed and acceleration transducers;
- Sensitivity;
- Dynamic range;
- Piezo-electric accelerometer;
- Signal conditioner;
- Detection of the "acceleration/voltage" characteristic curve;
- Plotting of the best straight line of the transducer;
- Detection of the transducer-conditioner linearity;
- Tachymetric transducer;
- Detection of the tachymetric constant;
- Detection of the "speed/voltage" characteristic curve;
- Plotting of the best straight line of the tachogenerator;
- Detection of the tachogenerator linearity;
- Calibration of the signal conditioner;
- Detection of the characteristic curve of the "voltage as function of speed for different values of the mechanical load";
- Detection of the "frequency as function of speed"
- characteristic curve;
- Analysis and use of the supervision software with Personal Computer.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Unit mod. TY28/EV for the generation of the physical variable (speed and acceleration) consisting of:
  - Metal support;
  - DC motor; control voltage: –24 V – +24 V;
  - Perforated disk;
  - Rotating arm for connecting rod-crank system;
  - Transducers;
- 3 Different signal conditioners:
  - Conditioner for tachogenerator
  - Conditioner for piezoelectric accelerometer
  - Photoelectric conditioner for "speed/frequency" transducer
- Input range of the tachogenerator: from 0 to ±4000 RPM;
- 1 (standard) voltage output of conditioner from 0 to ± 8 V;
- 1 (proportional) voltage output of conditioner from 0 to ± 4 V;
- Input range of the piezoelectric accelerometer: from 0 to 78 g;
- 2 (positive and negative) outputs with voltage from 0 to ± 8 V
- Output range of the photoelectric conditioner from 0 to 4000 Hz;
- 2 TTL and CMOS compatible outputs;
- Connection cable of the module to 8-pole external unit DIN 270.

Dimensions mod. G28/EV: 386 x 248 x 40 mm
Dimensions mod. TY28/EV: 500 x 350 x 250 mm

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A
30 Vdc / 2A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

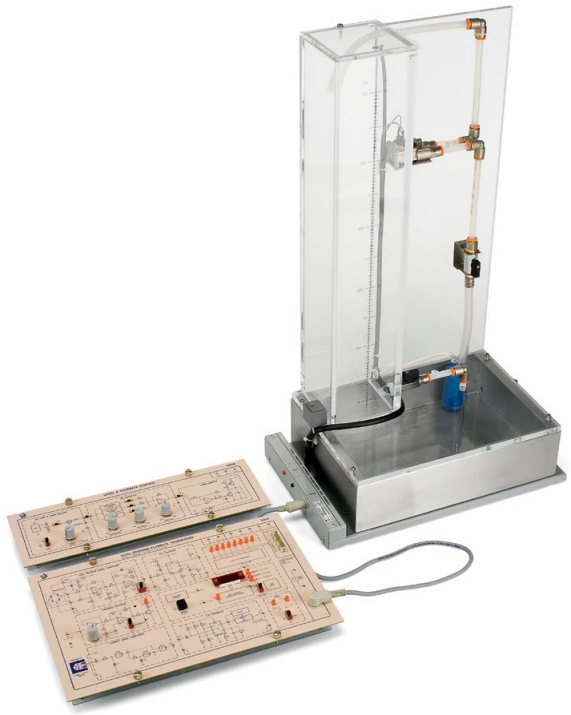
OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
MFIDEV/EV DATA ACQUISITION SOFTWARE

FLOW AND LEVEL TRANSDUCERS AND CONTROL

Mod. G30A/EV
Mod. G30B/EV



In hydraulic plants of different kinds, there is often the need to control the flow values of a pipe or the level of the liquid in a tank or in the same pipe. Usually, the regulation implemented by these controls is PID and these are designed to obtain the best characteristics in terms of stability, response speed and steady state error.

The modules mod. G30A/EV and mod. G30B/EV together with the external unit mod. TY30/EV enable the:

- **Analysis of level, pressure and flow transducers**
- **Automatic control of flow and level with variable coefficient PID regulator**

The circuits and techniques employed on this aim are the same used in the professional field. In this way, the student directly approaches the problems concerning the design of signal conditioning systems.

The experiment board mod. G30A/EV is divided into 8 parts, each of which develops a different action. Each part is limited by a dotted line including the electrical diagram of the same block which inputs and outputs are accessible to measurements, with oscilloscope or multimeter.
The main circuits present in the board mod. G30A/EV are:

- **Signal conditioner for flow transducer;**
- **Signal conditioner for level/pressure transducer;**
- **F/V and V/F converter;**
- **3-digit display for the measured quantity;**
- **8-bit A/D converter and 8-LED display for the converted value;**
- **Threshold detector.**

The connection between the module and the external unit mod. TY30A/EV is made via two terminals and 1 8-pole DIN socket. The water pump of the external unit is powered across two terminals. The DIN socket, instead, is used for the connection of the transducer signals to the module.

The training program is completed by the use of the supervision and process control from Personal Computer.

TRAINING PROGRAM:

- General characteristics of transducers
- Flow transducers: windmill flowmeter
- Signal conditioner for windmill flowmeter with flow display in l/min on 7-segment (3 digit) display
- Detection of the characteristic curve and determination of the linearity of the windmill flowmeter
- Level transducers: use for level and pressure measurements and relation between the two measurements
- Detection of the characteristic curve and determination of the level transducer linearity
- Use of the voltage/frequency converter to show the level directly on the display
- Use of the frequency/voltage converter to obtain an analog signal proportional to the flow
- Calibrations of the conditioners
- Main subjects on automatic control theory for linear and continuous- in-time systems
- Types of regulators: PID regulators (Proportional Integrative- Derivative)
- Response of the PID regulators to the typical signals (step, square, triangular wave)

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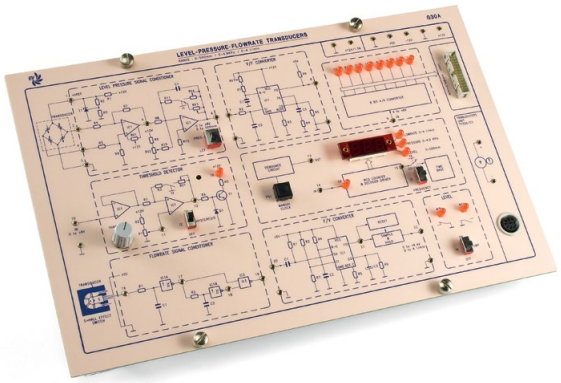
- Project of a PID regulator with Bode diagrams
- Choice of the P I D parameters with the Ziegler-Nichols method
- Open-loop and closed-loop control: dynamic and static differences between the two
- Total process response with independent and separately variable P-I-D actions
- Checking the level and flow automatic control at variation of the disturbing actions
- Stability, steady state error, overshoot, response time with variation of the P-I-D actions
- Analysis and use of the supervision software with Personal Computer.



TECHNICAL SPECIFICATIONS Mod. G30A/EV:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Transduction range:
  - Level: 0 ÷ 500 mm
  - Pressure: 0 ÷ 4.9 kPa
  - Flow: 0 ÷ 4 l/min
- Conditioner for Wheatstone bridge-type level/pressure transducer: 0 ÷ 8 V;
- 3 1/2 digit display for direct reading of the level/flow values;
- Variable-threshold detector. Hysteresis variable with potentiometer and connectable/disconnectable via small switch;

Dimensions Mod. G30A/EV: 386 x 248 x 40 mm

TECHNICAL SPECIFICATIONS Mod. TY30A/EV:

The external unit mod. TY30A/EV is composed of two transparent tanks. In the lower one, there is an electrical pump which purpose is to transfer the liquid from this tank to the vertical one for the generation of flow and level quantities.

On the concerned unit there are two transducers: flow and level.
The flow transducer is a "blade or turbine flowmeter". This provides the output with a pulse voltage which frequency is proportional to the liquid flow.
The level transducer exploits the pressure exerted by the water column to generate an elementary deformation on the in-built Strain Gages.

A signal conditioner provides a voltage proportional to the pressure and so the liquid level.

- Unit mod. TY30A/EV for generation of the physical variables (flow and level) consisting of:
  - Metal container
  - 2 Plexiglass tanks: inferior and superior (vertical)
  - Electrical pump
  - Throttle valve
  - Flow windmill or blade transducer
  - Level/pressure transducer of strain gage kind
- Connection cable to external unit type 8-pole DIN.

Dimensions Mod. TY30A/EV: 420 x 710 x 260 mm

TECHNICAL SPECIFICATIONS Mod. G30B/EV:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Set-point adjustable via present rotary potentiometer;
- Set-point (flow/ level) switching with switch:
  - Flow Set-point range: 0 – 4 l/min
  - Level Set-point range: 0 – 500 mm
- PID controller with separately insertable actions;
- Time constants of the integrative and derivative controller variable via 2 rotary potentiometers;
- Proportionality constant of the proportional controller variable via 1 rotary potentiometer;
- Hybrid power amplifier (op-amp + bipolar transistors).

Dimensions Mod. G30B/EV: 386 x 123 x 40 mm

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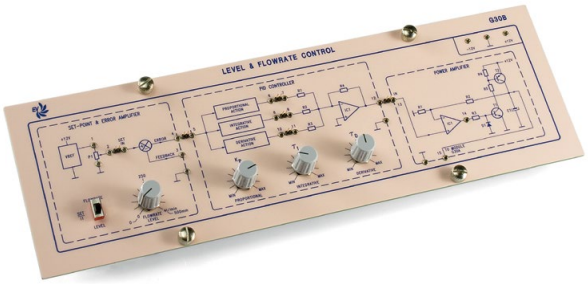
The board mod. G30B/EV is composed by 3 blocks:

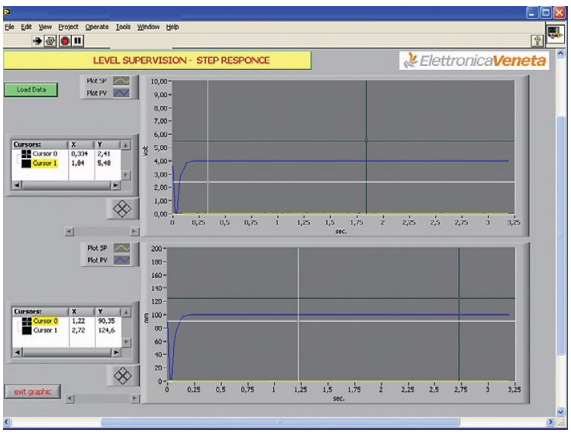
SET POINT & ERROR AMPLIFIER: setting of the set-point value, via rotary potentiometer, and comparison with the effective value taken by the output.

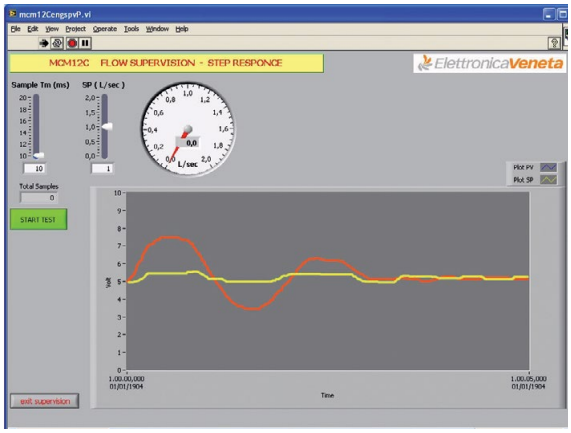
PID CONTROLLER: processing of the error signal coming from the last block so that the output takes the wished value. The values of the P I D gains are variable independently via 3 rotary potentiometers.

POWER AMPLIFIER: "dosing" of the electrical power provided by the power supply to the actuator (pump) to change the value of the output variable. Each block is shown in a silk screen printed diagram on the front panel of the module



Connections between the 3 blocks can be easily carried out via jumpers, while those with the board mod. G30A/EV and the external unit mod. TY30A/EV are achieved with cables of different length available with the modules. Qualitative and quantitative measures, with oscilloscope and multimeter, can be carried out in any accessible point of the terminals.
The training program is completed by the use of the supervision and process control from Personal Computer.





REQUIRED MOD. G30A/EV AND MOD. G30B/EV

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

POWER SUPPLY
G30A/EV: +5 Vdc / 2A
±12 Vdc / 2A
G30B/EV: ±12 Vdc / 2A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

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

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

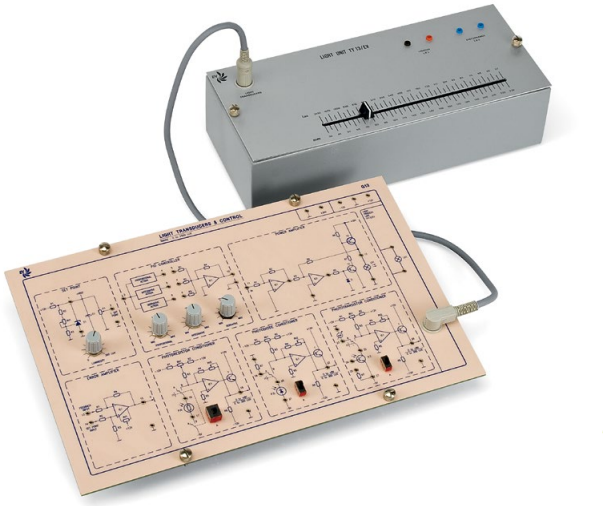
PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARDS

SUPERVISION AND CONTROL SOFTWARE MFIDEV/EV

BESIDES THE ON-BOARD PID, THE TRAINER CAN ALSO BE CONTROLLED BY:
- **FOUR LOOPS PID DIGITAL CONTROLLER MOD. PID-S1/EV**

LUMINOSITY TRANSDUCERS AND CONTROL
Mod. G13/EV



The automatic control of luminosity is widely applied not only in the industrial field (e.g. technologies of semiconductors), but also in other fields such as electrical plant engineering (luminosity control of a domestic ambient), agriculture (luminosity control of a greenhouse).
The type of regulator employed in these controls is a PID controller, designed in a way to obtain the best characteristics in terms of stability, response speed and steady state error.
The board mod. G13/EV together with the external unit mod. TY13/EV enables the:

- Analysis of the luminosity transducers and the related conditioning circuits;
- Automatic control of luminosity with PID regulator.

LUMINOSITY TRANSDUCER AND CONTROL mod. G13/EV

Experiment board mod. G13/EV has been designed and built with the same components, circuits and techniques used in the professional field. In an educational laboratory for Process Control, the board mod. G13/EV represents the instrument necessary to the top level training on theoretical-experimental problems concerning:

- **Luminosity transducers and related signal conditioners;**
- **Luminosity control with PID regulator.**

The experiments are carried out together with the external unit mod. TY13/EV, employed for the generation of the physical variable (luminosity).
The board mod. G13/EV consists of 7 separate functional blocks that can be interconnected for the lay-out of the control circuit configuration. Each block is limited by a dotted line including the electrical diagram reported in the silk screen printed diagram on the front panel of the module. This wide silk screen representation enables a clear vision of the system on the whole and in detail, easing the development of the large set of exercises composing the training program.

- **Set-point;**
- **Error amplifier;**
- **Signal conditioners for the transducers;**
- **PID controller with independent actions;**
- **Power amplifier.**

The Set-point (luminosity) is setted up via a rotary potentiometer connected with a voltage reference. With other three rotary potentiometers the calibration and tuning of the PID controller can carried out through the independent set up of the P, I and D parameters. The signal conditioners are 3, one for each transducer used.
The luminosity transducers are mounted into the external unit mod. TY13/EV and are:

- **Photoresistance**
- **Photodiode**
- **Phototransistor**

Qualitative and quantitative measurements, on the variables present in the circuits of the board mod. G13/EV can be carried out across the outputs and inputs of each signal functional block, in terminals used also for the connections via jumpers.
The connection between the module and the external unit mod. TY13/EV occurs via two terminals and an 8-pole DIN socket. The incandescent lamp is powered across the two terminals. The signals of the transducers are connected to the module via the DIN socket.
The training program is completed by the use of the software for supervision and process control from PC.

TRAINING PROGRAM:

- Detection of the typical characteristics of a photoresistive luminosity transducer;
- Detection of the typical characteristics of a phototransistor;
- Detection of the typical characteristics of the photodiode used as photovoltaic cell;
- Study and calibration of signal conditioners for:
  - Photoresistor
  - Photodiode
  - Phototransistor
- Theoretical/experimental analysis of the main subjects treated by the automatic control systems;
- Open loop and closed loop control: differences;
- Process response using a controller with independent actions:
  - Proportional (P)
  - Integrative (I)
  - Derivative (D)

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- hecking the automatic control of luminosity at variation of the distance between the source and transducer;
- System response to the introduction of a luminosity source (disturbance) not controlled by the module mod.G13/EV;
- Reaction of the controller to sudden or continuous variations of the intensity of the disturbing source;
- Detection of the most significant waveforms;
- Analysis and use of the software for supervision and process control experiences from PC.
  - Silicon NPN phototransistorting;
- Error amplifier;
- Feedback power amplifier with operational amplifiers and final with bipolar transistor, for control of the luminosity actuator;

TECHNICAL SPECIFICATIONS mod. G13/EV:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Conditioners for transducers of these kinds:
  - Cadmium sulphide photoresistance
  - Silicon photodiode
  - Silicon NPN phototransistor
- Set-point voltage generator with integrated stabilizer;
- Rotary potentiometer for luminosity set-point setting;
- Error amplifier;
- Feedback power amplifier with operational amplifiers and final with bipolar transistor, for control of the luminosity actuator;

Luminosity actuator consisting in a tungsten incandescent lamp (5 W) with possibility to move away from the transducer to enable the variation of the incident intensity and with possibility to introduce a light source into the disturbance.

Characteristics of the transducers and conditioners:
Luminosity input range: 0-300 Lux;
Output voltage range: 0÷8 V;

- PID controller with independent P, I, D actions;
- 3 Potentiometers for independent setting of the P, I, and D parameters, with wide regulation margins;
- 2 Output terminals for control of the actuator in the external unit mod. TY13/EV;
- 8-pole DIN socket for connection to the external unit mod. TY13/EV;
- 8-pole DIN connection cable.

EXTERNAL UNIT FOR THE PHYSICAL VARIABLE GENERATION mod. TY13/EV
The generation of the process physical variable is made by the external unit mod. TY13/EV provided with:

- **1 Process actuator consisting in a tungsten incandescent lamp;**
- **1 Actuator of the disturbance signal;**
- **3 Luminosity transducers.**

The process actuator is set on a sliding guide so that the distance from the sensors can be regulated. The signals coming from the sensors reach the board mod. G13/EV via an 8-pole DIN cable, where they are properly processed by the conditioning circuits for the control needs.
The solid envelope of the external unit mod. TY13/EV is in aluminum sheet, painted in black inside to prevent reflection phenomena.

TECHNICAL SPECIFICATIONS mod. TY13/EV:

- The external unit mod. TY13/EV is composed by:
  - Sheet steel light unit painted in black inside to avoid reflections;
  - 3 Different luminosity transducers fixed on printed electronic circuit set internally;
  - Incandescent lamp mounted on sliding guide to adjust the distance from the sensors.
- Actuator for disturbance signal;
- 1 8-pole DIN socket for transducers;
- 2 Terminals for control of the actuator by board mod. G13/EV;
- 2 Terminals for control of the disturbance lamp;
- Maximum control voltage for lamp: 30 V.

Dimensions mod. G13/EV: 386 x 248 x 40 mm
Dimensions mod. TY13/EV: 330 x 140 x 100 mm

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A
30 Vdc / 1A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- **MULTIMETER**
- **OSCILLOSCOPE**
- **FUNCTION GENERATOR**

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
SUPERVISION AND CONTROL SOFTWARE MFIDEV/EV

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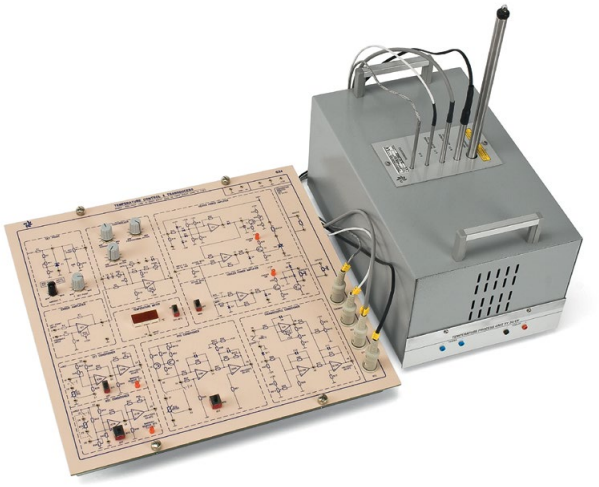
TEMPERATURE TRANSDUCERS AND CONTROL

Mod. G34/EV



The need to automatically control the temperature of a material or an ambient, is a typical application of industrial and domestic real life. The first kind of control which can be carried out to satisfy this need is ON/OFF. This control although robust and practically insensitive to the parametric variations of the system, does not fit all those applications needing a fine temperature control. This is why temperature controls are carried out with PID controllers which can be "shaped" by the user so that the process takes a particular dynamic evolution according to the specific application.
In this context, the board mod. G34/EV together with the external process unit mod. TY34/EV, enables the development of a wide set of exercises on subjects concerning the:

- **Analysis of the temperature transducers and related conditioning circuits;**
- **Automatic temperature control with PID regulator.**

TEMPERATURE TRANSDUCERS AND CONTROL mod. G34/EV

Experiment board mod. G34/EV has been designed and carried out with the same components, circuits and techniques used in the professional field. In an educational laboratory for Process Control, it represents the necessary instrument for high level training on the theoretical-experimental themes concerning:

- **Temperature transducers and related signal conditioners;**
- **Temperature control with PID regulators.**

The exercises are developed together with the external unit mod. TY34/EV which houses the real temperature process and the transducers.
The board mod. G34/EV consists in 10 functional block, each of which develops a separate function. Each block is limited by a dotted line including the electrical diagram of the same block which outputs and inputs are accessible to measurements, with oscilloscope or multimeter.

The main circuits of the board mod. G34/EV are:

- **Set point;**
- **Error amplifier;**
- **Signal conditioner of the transducer;**
- **PID controller;**
- **TRIAC power amplifiers to power the heating elements;**
- **BJT bipolar transistor amplifier to power the cooling fan.**

The Set-point (temperature) is fixed with 1 rotary potentiometer and an inner voltage set-point.
With two rotary potentiometers, you can independently fix the values of the parameters P and D for the calibration of the PID controller.
The signal conditioners are 3, one for each transducer used.
The temperature transducers are located on the external unit mod. TY34/EV and are:

- **Industrial semiconductor transducer (PTC);**
- **Thermoresistance NTC;**
- **Industrial RTD Pt-100;**
- **Thermocouple type J.**

The connection between the module and the external unit mod. TY34/EV is made via four terminals and three 8-pole DIN sockets. The 4 terminals are used to power the heating resistive elements and the cooling fan. The DIN sockets, instead, are used for the connection of the transducers signal to the module.

The training program is completed by the use of the supervision and process control from Personal Computer.

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EXTERNAL UNIT FOR GENERATION OF THE PHYSICAL VARIABLE mod. TY34/EV

The temperature process consists of unit mod. TY34/EV provided with:

- **4 Temperature transducers (thermocouple, RTD, PTC, NTC)**
- **Heating resistive elements**
- **Cooling fan**
- **Mercury thermometer for process temperature indication**

The environment of the process consists in an aluminum plate, heated by resistive elements powered by the power amplifier, with phase partialization and TRIAC, present on the board mod. G34/EV. Three 8-pole DIN cables carry the signals from the sensors to the board where they are properly processed by the conditioning circuits in order to be used in the control circuitry. A mercury thermometer set on the upper side of the unit mod. TY34/EV, enables the direct reading of the temperature reached by the process.
The solid covering of the external unit mod. TY34/EV is metal type with thermo-insulating hollow space.

TRAINING PROGRAM:

- General characteristics of transducers;
- Signal conditioner;
- Industrial semiconductive temperature transducer (PTC);
- Detection of the characteristics of an industrial PTC;
- Determination of the linearity of an industrial PTC;
- NTC thermoresistor;
- Detection of the characteristics of an NTC;
- Determination of the linearity of an NTC;
- Industrial thermoresistance;
- Detection of the characteristics of an industrial thermoresistance;
- Determination of the linearity of a thermoresistance;
- Industrial thermocouple;
- Detection of the characteristics of an industrial thermocouple;
- Determination of the linearity of a thermocouple.

Study and calibration of signal conditioner for PTC, NTC, Thermoresistances, Thermocouples:

- Detection of the characteristics of the temperature process;
- Process response using a controller with independent actions:
  - Proportional
  - Integrative
  - Derivative
- Process control stabilization;
- Checking the intervention of the closed loop control in presence of disturbance;
- Study of the phase partialization amplifier with TRIAC;
- Detection of significant voltages, currents and waveforms in different points of the circuit;
- Analysis and use of the supervision software with Personal Computer.

TECHNICAL SPECIFICATIONS mod. G34/EV:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Conditioner for Pt-100 RTD with constant current generator and removal of the line influence with the three wire method;
- Conditioner for PTC transducer with linearization of the characteristics
- Conditioner for NTC transducer with linearization of the characteristics
- Conditioner for thermocouple type J with cold joint compensation;
- Set-point voltage generator with integrated stabilizer;
- 1 Rotary potentiometer to set the temperature Set-point;
- 1 Error amplifier;
- 1 Power amplifier, with TRIAC phase partialization, powered at low voltage, to power the heating element;
- 1 power amplifier at bipolar transistor for the cooling fan piloting;
- Heating elements consisting in resistors (24 Vac, 100 W).

Characteristics of the transducers and conditioners:

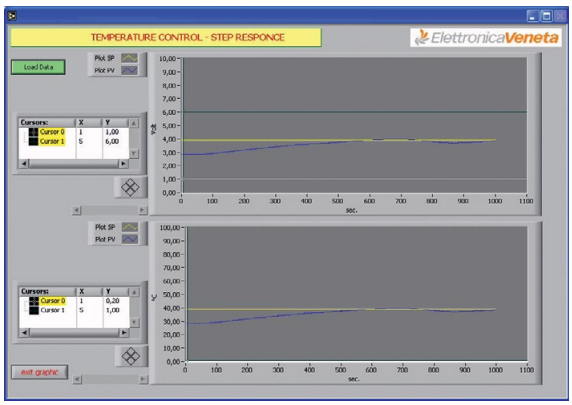
Input temperature range: Tamb-250° C
Output voltage range: 0 ÷ 8 V

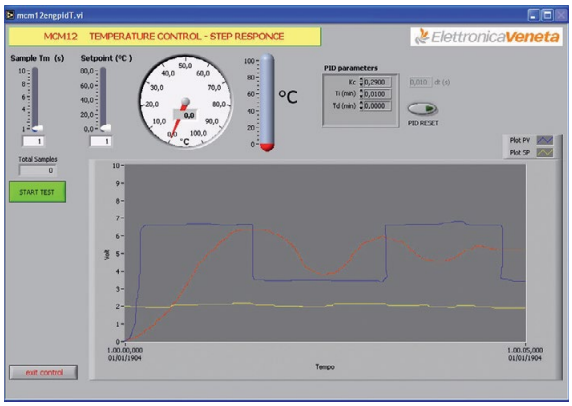
- 1 Digital thermometer with temperature indication on 7-segment and 3-digit display;
- PID controller with P, I, D independent actions;
- Rotary potentiometers to independently set the P and D parameters, with wide regulation margins;
- 2 TRIAC amplifier output terminals to power the heating element in the external unit mod. TY34/EV;
- 2 Power amplifier output terminals for control of the cooling fan in the external unit mod. TY34/EV;
- 8-pole DIN cable socket for connection to the external unit mod. TY34/EV;
- 8-pole DIN connection cables.

TECHNICAL SPECIFICATIONS mod. TY34/EV:

- The external unit mod. TY34/EV is composed of:
  - Metal container with thermoinsulating hollow space
  - 1 Temperature transducer PTC
  - 1 Thermistor NTC
  - 1 Thermocouple type J
  - 1 RTD Pt-100
  - Aluminum plate which is the seat of the process
  - Cooling fan
  - Mercury thermometer
- 2 Terminals for control of the heating resistors by the board mod. G34/EV;
- 2 Terminals for control of the fan by the board mod. G34 EV;
- 2 Side re-entering handles for easy transport.

Dimensions mod. G34/EV: 386 x 372 x 40 mm
Dimensions mod. TY34/EV: 330 x 210 x 210 mm





REQUIRED

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

POWER SUPPLY
±12 Vdc - 0.5A
24 Vac - 4A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

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

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
SUPERVISION AND CONTROL SOFTWARE MFIDEV/EV

BESIDES THE ON-BOARD PID, THE TRAINER CAN ALSO BE CONTROLLED BY:
- **FOUR LOOPS PID DIGITAL CONTROLLER MOD. PID-S1/EV**

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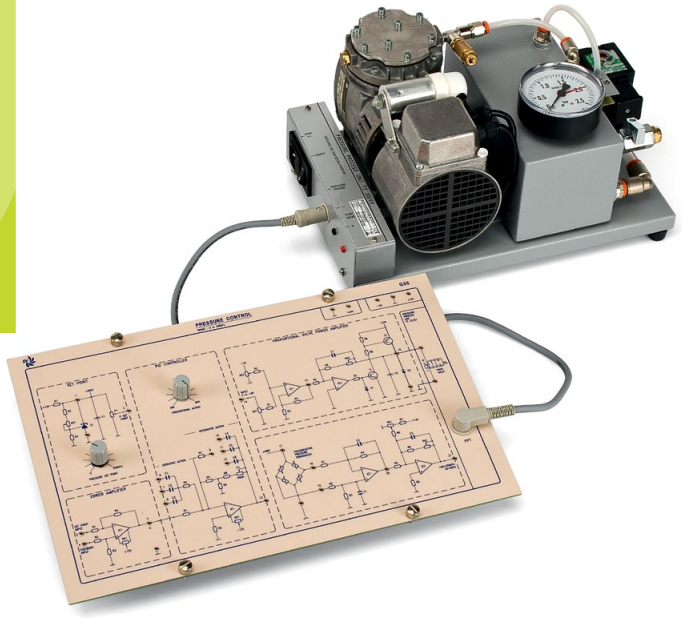
PRESSURE TRANSDUCER AND CONTROL
Mod. G35/EV



The automatic pressure control is much used in industry and its basic structure is the same of an automatic control of other physical variables such as temperature, speed, luminosity, etc. Usually, the kind of regulation implemented by these controls is PID, designed in a way to obtain best characteristics in terms of stability, response speed and steady state error.
The board mod. G35/EV together with the external unit mod. TY35/EV enables the:

- **Analysis of pressure transducers and related conditioning circuits;**
- **Automatic pressure control with PID regulator with variable coefficients.**

PRESSURE TRANSDUCER AND CONTROL mod. G35/EV
Experiment board mod. G35/EV has been designed to be the necessary instrument to the development of a training program including a large number of exercises concerning:

- **Pressure transducers and signal conditioners;**
- **Automatic pressure control with PID regulators.**

The exercises are developed using the external unit mod. TY35/EV, too, which houses the real pressure process and the transducer. The circuits, the components and the techniques employed in this process control are the same used in the industrial field, in this way getting the student acquainted with the complex problems of top level design. The board mod. G35/EV consists of 5 parts which develop separate functions. Each part is limited by a dotted line including the electrical diagram of the same block which outputs and inputs are accessible to measurements (with oscilloscope or multimeter).

The main circuits of board mod. G35/EV are:

- **Set-point;**
- **Error amplifier;**
- **Signal conditioner of the transducer;**
- **PID controller;**
- **Power amplifier for proportional valve.**

Two rotary potentiometers enable respectively the setting of the pressure set-point and the variation of the level of proportional gain of the PID controller.
The connection between the module and the external unit mod. TY35/EV is made via two terminals and an 8-pole DIN socket. The pneumatic pump of the external unit is powered across two terminals. The DIN socket, instead, is used for the connection to the module of the signal coming from the transducer.

The training program is completed by the use of the supervision and data acquisition software from Personal Computer.

EXTERNAL UNIT FOR PHYSICAL VARIABLE GENERATION mod. TY35/EV
The pressure process consists of unit mod. TY35/EV provided with:

- **Compressor with air tank;**
- **Proportional valve;**
- **Piezoresistive transducer;**
- **Indication pressure gauge;**
- **Load variation device.**

This unit is the pressure source for detection of the characteristic curve of the sensor and for the analysis of the signal conditioner. The used industrial pressure transducer is piezoresistive and its basic element is the Strain Gauge. The signal of the transducer, via 8-pole DIN cable, reaches the board mod. G35/EV, where it is conditioned and filtered with proper circuits. On the unit mod. TY35/EV, there are two terminals for control of the proportional solenoid valve made by the control system.
The solid structure of the external unit mod. TY35/EV is metal kind and includes, beside the above components, also a filter for the air of the compressor.

TRAINING PROGRAM:

- General characteristics of transducers;
- Determination of the linearity of a transducer;
- Signal conditioners;
- Detection of the piezoresistive pressure transducer characteristics;
- Study and calibration of the signal conditioner for piezoresistive transducer;
- Automatic pressure control: general description;
- Analogue PID controllers;
- Detection of the process response employing a controller with the following actions:
  - Proportional
  - Proportional + Integrative
  - Proportional + Integrative + Derivative
- Study of the pressure process response at variation of the load, the power supply voltage and the disturbance signals inserted into different points of the control chain;
- Study of the transistor amplifier for control of a proportional valve;
- Detection of significant voltages, currents and waveforms in different points of the circuit;
- Analysis and use of the supervision software with Personal Computer.

Characteristics of the transducer and conditioner:

Input pressure range: 0 ÷ 200 kPa
Output voltage range: 0 ÷ 8 Vdc

- Reference voltage generator with inner stabilizer;
- PID controller with P, I, D independent actions;
- Transistor power amplifier and operational amplifiers for proportional valve.

Characteristics:

Input voltage of the amplifier: 0 ÷ 8 Vdc
Output voltage of the amplifier: 0 ÷ 24 Vdc

- Filtering of all circuit parts to diminish the influence of the disturbance from and to the ambient;
- Plexiglas protection on the rear for the visual inspection of the components;
- Connection cable and socket for external unit type 8-pole DIN.

TECHNICAL SPECIFICATIONS mod. TY35/EV:

- The external unit mod. TY35/EV is composed of:
  - Metal support base
  - Air compressor mounted on vibration damping base
  - Silencer
  - Tank with safety valve
  - Proportional solenoid valve with variable control voltage
  - Industrial Wheatstone bridge pressure transducer
  - Throttle valve
  - Pressure gauge
- Range of the produced pressure: 0-2 bar
- Power supply cable

TECHNICAL SPECIFICATIONS mod. G35/EV:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Industrial piezoresistive pressure transducer with Wheatstone bridge and its signal conditioner.

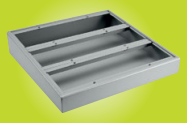
Dimensions mod. G35/EV: 386 x 248 x 40 mm
Dimensions mod. TY35/EV: 330 x 210 x 190 mm

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A
+30 Vdc / 1A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



INSTRUMENTS - NOT INCLUDED -
- **MULTIMETER**
- **OSCILLOSCOPE**
- **FUNCTION GENERATOR**

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD

SUPERVISION AND CONTROL SOFTWARE MFIDEV/EV

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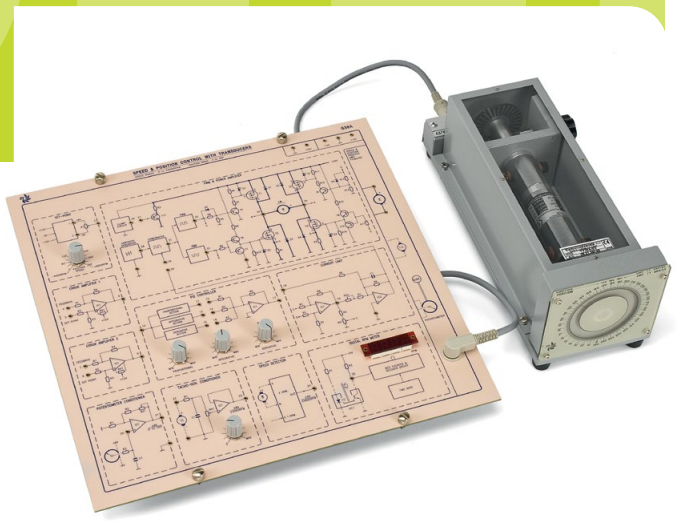
SPEED AND POSITION TRANSDUCER AND CONTROL

Mod. G36A/EV



The electrical servomechanisms for DC motors are widely used nowadays in several different applications. Versatile as concerns the position controls, e.g., they are employed mostly in machine tools, where high precision relative motions between the tool and the piece to be machined are required. The board mod. G36A/EV has been designed and carried out to be an instrument necessary to the training of technicians with a high level of knowledge on DC motor controls. Together with the external unit mod.

TY36A/EV, the board mod. G36A/EV enables the development of a training theoretical-experimental program concerning the:

- **Analysis of speed and position transducers;**
- **Analysis of the conditioning circuits;**
- **Study of DC motors;**
- **Study of electrical servomechanisms for DC motors.**

SPEED AND POSITION TRANSDUCER AND CONTROL mod. G36A/EV

The board mod. G36A/EV has been carried out with industrial components, circuits and techniques. It enables the development of a rich set of exercises on subjects concerning:

- **The general characteristics of DC motors;**
- **The speed and position control of a DC motor.**

The experiments are carried out together with the external unit mod. TY36A/EV consisting mainly in a DC motor and the speed and position transducers.

The board mod. G36A/EV consists of the different separate functional blocks which can be connected for the lay-out of control circuit configurations. Each block is limited by a dotted line including the silk screen printed electrical diagram on the front panel of the module. This wide silk screen representation enables a clear vision of the system on the whole and in detail, facilitating the development of a rich set of exercises.

The main circuit blocks of board mod. G36A/EV are:

- **Set-point;**
- **Error amplifier;**
- **Signal conditioners for transducer;**
- **PID control with independent actions;**
- **Armature current limit;**
- **"H"-bridge DC/DC converter.**

The Set-point (speed and position) fixing is made via a rotary potentiometer and inner voltage reference. Always using 3 rotary potentiometers, you can independently set the values of the P, I and D parameters for the calibration of the PID controller. The control of the MOS DC/DC converter, in "H-bridge" topology, is carried out with PWM modulation techniques and enables the 4- quadrant motor control. The instant speed of the motor, transduced by the optoelectronic device is displayed in a 7-segment and 4-digit display.

Measurements of the wave-forms present in the circuits can be carried out at the inputs and outputs of each functional block, in the terminals used also for connections via jumpers.

The connection between module and the external unit mod. TY36A/EV is made via two terminals and an 8-pole DIN socket. The motor is controlled via the two terminals. The DIN socket, instead, is used for the connection of the signals coming from the speed and position transducers to the module.

The training program is completed by the use of the supervision and data acquisition software from Personal Computer.

TRAINING PROGRAM:

- DC permanent magnets motor: general notions and mathematical modelization;
- Electrical and mechanical characteristics;
- Detection of the characteristics of the armature reaction of a DC motor;
- Detection of the characteristics of an optoelectronic speed transducers;
- Detection of the characteristics of a tachogenerator of industrial kind;
- Detection of the characteristics of a potentiometric transducer of industrial kind;
- Study and calibration of the signal conditioners for:
  - Tachogenerator
  - Armature feedback
  - Optoelectronic transducer
  - Potentiometric transducer
- Study of the response of Proportional, Integrative and Derivative controllers at different input signals;
- Speed servomechanisms with DC motor;
- Position servomechanism with DC motor;
- DC/DC MOSFET converter for 4-quadrant operation;
- Driver for the MOSFETs of the DC/DC converter;
- PWM modulation for driving the DC/DC converter;
- Process response using a controller with independent actions:
  - Proportional
  - Integrative
  - Derivative
- Control of the maximum armature current;
- System response at variation of the braking load;
- Analysis and use of the supervision software with Personal Computer.

TECHNICAL SPECIFICATIONS mod. G36A/EV:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Tachimetric transducer fitted to the motor axis;
- Signal conditioner for matching the voltage levels;
- Signal conditioner for armature reaction.

Characteristics of the speed and conditioner transducer

- Speed input range: ±4000 r.p.m.
  - Output voltage range: ±8 V
- Optoelectronic transducer;
- Signal conditioner with indication on 7-segment and 4-digit display of the rotation speed (r.p.m.);
- Potentiometric transducer;
- Signal conditioner for potentiometric transducer.

Characteristics of the position and conditioner transducer

Position input range: 0 – 360°
Output voltage range: ±8 V

- Reference voltage generator (Set-point) with integrated stabilizer;
- 2 Error amplifiers for double loop controls (position + speed);
- 1 Rotary potentiometer for setting the speed and position set- points;
- PID controller with P, I, D independent actions;
- 3 Potentiometers for independent setting of the P, I, and D parameters, with wide regulation margins;
- Limit circuit for the armature current;
- DC/DC converter, 4-MOSFET "H-bridge" configuration;
- 4 Drivers for the MOSFET;
- 8-pole DIN cable with socket for the connection to an external unit mod. TY36A/EV;
- 8-pole DIN cable.

EXTERNAL UNIT FOR SPEED AND POSITION mod. TY36A/EV

The external unit mod. TY36A/EV is composed by:

- **DC permanent magnets motor**
- **Potentiometric position transducer**
- **Tachimetric and optoelectronic speed transducers**
- **Devices for load variation**

This unit enables the generation of speed and position physical quantities with the rotation of the DC permanent magnets motor. Via the 8-pole DIN cable, the signals of the transducers reach board mod. G36A/EV where they are properly processed by the conditioning and filtering circuits.
The instant position indication of the rotor, can be read with accuracy on an angular position indicator ranging between 0° and 360°. For safety reasons, all parts in rotation of the motor are protected by a metal and plexiglas cover.

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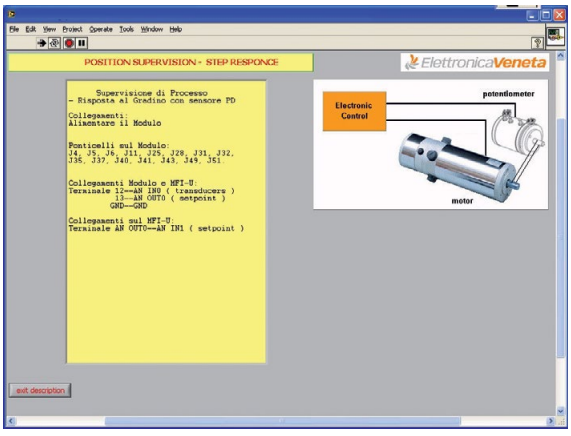
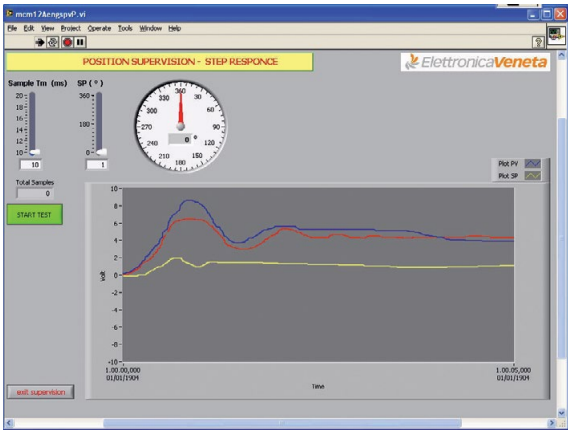
TECHNICAL SPECIFICATIONS mod. TY36A/EV:

- **The external unit mod. TY36A/EV is composed of:**
  - Metal support base;
  - DC permanent magnet motor;
  - Epicycloidal planetary gearing;
  - Tachogenerator fixed to the motor axis;
  - Optoelectronic transmission sensor;
  - Transparent and opaque disk for fork optoelectronic transducer;
  - Potentiometric transducer;
  - Angular position indicator for the angular position;
  - Braking device.

- **Characteristics of the DC permanent magnet motor:**
  - Rotation speed: 4000 RPM;
  - Nominal voltage: 24 V;
  - Armature resistance Ra: 5.5 Ohm;
  - Armature inductance La: 2.8 mH;
  - Constructional form: B14;
  - Permanent magnets: ferrites;
  - Insulation: class F;
  - Weight: 5 kg.

Dimensions mod. G36A/EV: 386 x 372 x 40 mm
Dimensions mod. TY36A/EV: 330 x 120 x 120 mm





REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A
30 Vdc / 2A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- **MULTIMETER**
- **OSCILLOSCOPE**
- **FUNCTION GENERATOR**

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

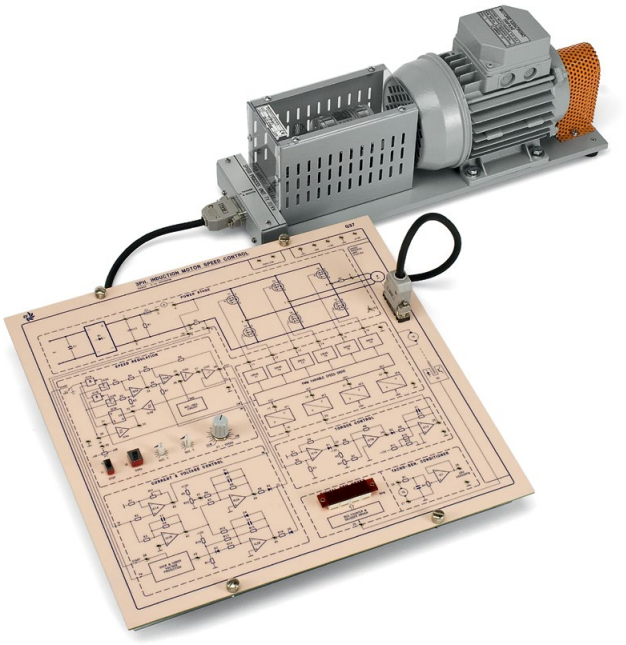
MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD

SUPERVISION AND CONTROL SOFTWARE MFIDEV/EV

BESIDES THE ON-BOARD PID, THE TRAINER CAN ALSO BE CONTROLLED BY:
- **FOUR LOOPS PID DIGITAL CONTROLLER MOD. PID-S1/EV**

SPEED CONTROL FOR THREE-PHASE MOTOR

Mod. G37/EV



Nowadays, asynchronous three-phase motors are used more and more frequently, not only for strictly industrial applications but also in the field of electrical appliances (air-conditioners, fans, washing machines) and of electrical traction (locomotive, industrial vehicles, electrical car). This tendency stimulated the research to theorize and experiment on more and more sophisticated electronic control techniques, which realization also profits of the calculation power of modern microprocessors. From simple scalar V/Hz servomechanisms up to the implementation of sophisticated vectorial controls for the optimization of the motor performances. In this context the board mod. G37/EV together with the external unit mod. TY37/EV, enables the:

- **Study of angular speed transducers (optoelectronic transducer);**
- **Study of asynchronous three-phase motors;**
- **Study of electrical servomechanisms for asynchronous three-phase motors.**

SPEED CONTROL FOR THREE-PHASE MOTOR mod. G37/EV

Inside a teaching laboratory for Process Control, the experiment board mod. G37/EV enables the development of high level experiments on the subjects concerning:

- **The general characteristics of three-phase asynchronous motors;**
- **The speed control of a three-phase asynchronous motor.**

The experiments are carried out together with the external unit mod. TY37/EV consisting in a three-phase asynchronous motor and the speed transducers. The speed control implemented by the board mod. G37/EV is V/Hz scalar and has been designed and manufactured with industrial components, circuits and techniques. The board mod. G37/EV consists in separate functional blocks which can be connected for the creation of the control chain. A silk screen diagram of all circuits is reported on the front panel of the module. In this way, the student is offered the possibility of a clear vision of the system on the whole and in detail, facilitating the development of a wide range of exercises.

The main blocks of board mod. G37/EV are:

- **Speed regulator;**
- **Power stage with three-phase impressed voltage inverter (VSI);**
- **Torque control circuit;**
- **Voltage and current control circuit.**

Using the 3 rotary potentiometers, you can fix the speed set-point, the acceleration and deceleration ramp grade. The motor instant speed transduced by the optoelectronic device is also displayed on a 7-segment and 4-digit display.
Measurements on the waveforms present in the circuits can be carried out by the student, across the inputs and outputs of each functional block.
The connection between the module mod. G37/EV and the external unit mod. TY37/EV is made via a 15-pole connector, which is not only crossed by the signals of the speed transducers but also by the signals of the inverter which drive the motor.
The training program is completed by the use of the supervision and data acquisition software from Personal Computer.

EXTERNAL SPEED UNIT mod. TY37/EV

The external speed unit mod. TY37/EV mainly consists of:

- **Metal base;**
- **Asynchronous three-phase motor;**
- **Optoelectronic transducer;**
- **Tachogenerator.**

This unit enables the speed generation via rotation of the asynchronous three-phase motor.
Via 15-pole DIN cable, the transducer signals reach the board mod. G37/EV where they are properly processed by the conditioning and filtering circuits. The same cable is crossed by the signals coming from the inverter for the motor driving. For safety reasons, the parts of the motor in rotation are protected by a metal and plexiglas cover.

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TRAINING PROGRAM:

General characteristics of transducers

- Speed transducers: optical encoder;
- Detection of the characteristics of an optoelectronic speed transducer (encoder);
- Study and calibration of the signal conditioner for optoelectronic transducer;
- The automatic control: general notions;
- Part of a general automatic control system: set-point, error amplifier, controller, power amplifier, transducer;
- The asynchronous three-phase motor: electrical and mechanical characteristics;
- Scalar servomechanism for asynchronous three-phase motor type V/Hz;
- Impressed voltage inverter (VSI);
- Protections of the servomechanism:
  - Mean current
  - Peak current
  - Overvoltage
  - Undervoltage
- Study of the servomechanism, with MOSFET three phase inverter, for three-phase asynchronous motor;
- PWM (Pulse Width Modulation) modulation for control of the inverter;
- AC input voltage rectification via diode bridge and filter capacitors;
- Accelerations and decelerations:
  - Via set-point signal variations
  - Independent and separately adjustable by the user
- Detection of the most significant waveforms;
- Analysis and use of the supervision software with Personal Computer.

TECHNICAL SPECIFICATIONS mod. G37/EV:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- Signal conditioner for optoelectronic transducer (encoder);
- Tachometric transducer:
  - Input range: ±6000 r.p.m.;
  - Output range: ±8 V;
- 7-segment and 4-digit display indication of the rotation speed (r.p.m.);
- Set-point voltage generator with integrated stabilizer;
- 3 Rotary potentiometers for respective setting of the speed, acceleration ramp, deceleration ramp set-points;
- Torque control circuit;
- Current and voltage control circuit;
- AC voltage rectifier for inverter power supply;
- 6-MOS impressed voltage three-phase inverter (VSI);
- 6 Drivers for MOS driving
- Socket for 15-pole connector for connection to external mod. TY37/EV;
- 15-pole connection cable.

TECHNICAL SPECIFICATIONS mod. TY37/EV:

- The external unit mod. TY37/EV is composed of:
  - Metal support base;
  - Asynchronous three-phase motor;
  - Optoelectronic transmission sensor;
  - Tachometric speed transducer;
  - Optical disk for optoelectronic transducer;
  - Inertial mass;
- Squirrel cage asynchronous three-phase motor characteristics:
  - Power: 100W;
  - No. of poles: 2;
  - Rotation speed: 3000 r.p.m. / 6000 r.p.m.;
  - Voltage: 14/24 V;
  - Constructional shape B3;
- Transmission optoelectronic transducer with 30 opaque sectors and 30 transparent sectors (30 pulses for revolution);
- 15-pole connector for connection to the board mod. G37 EV.

Dimensions mod. G37/EV: 386 x 372 x 40 mm

Dimensions mod. TY37/EV: 420 x 120 x 120 mm

REQUIRED

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

POWER SUPPLY
5 Vdc / 0.5A
+24 Vac / 4A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- **MULTIMETER**
- **OSCILLOSCOPE**
- **FUNCTION GENERATOR**

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

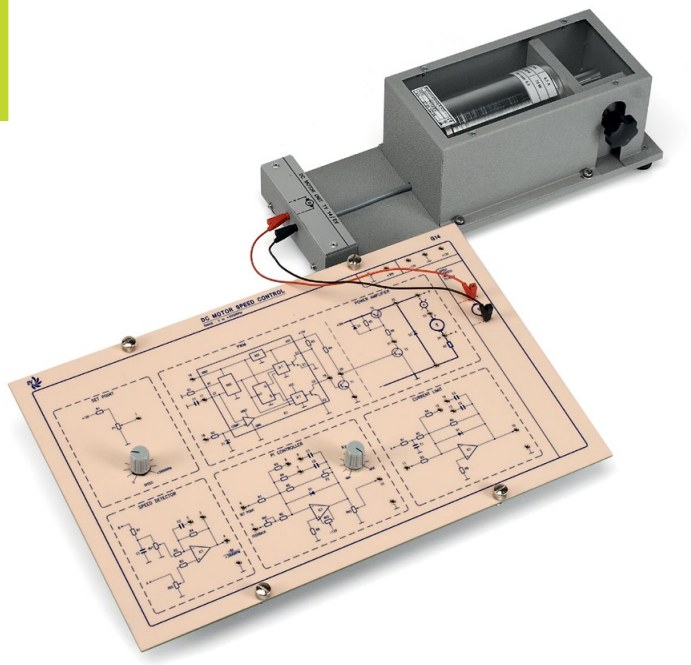
OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD

SUPERVISION SOFTWARE MFIDEV/EV

PWM SPEED CONTROL FOR DC MOTOR
Mod. G14/EV



The PWM speed control technology for DC motors enables to obtain significantly higher efficiencies in respect to standard linear control systems. Based on the ON-OFF operation of semiconductor devices, at least theoretically, the PWM control ensures a near zero control power. Moreover the evolution of modern technologies of semiconductor devices allows the use higher and higher switching frequencies also for high powers.

The experiment board mod. G14/EV has been designed for top level educational experiments of PWM control techniques of DC current motors, using the same discreet and integrated components employed in the professional field.

PWM SPEED CONTROL FOR DC MOTOR mod. G14/EV

The training program enabled by board mod. G14/EV, includes a large set of exercises concerning the DC motor control with PWM techniques.

The DC motor used is a permanent magnets and is mounted on the external unit mod. TY14/EV where also the manual brake is mounted. The motor is connected to the board via the 8-pole DIN cable.

The signal (feedback reaction) proportional to the motor speed is processed by the control circuits on the board mod. G14/EV. In this way, fixing the speed set-point with the potentiometer, the PI controller adjusts the motor speed.

The PWM signal generation, for control of the power transistor, is carried out by a properly controlled dedicated integrated circuit. Besides, the speed control enables:

- **The limitation of the maximum armature current**
- **The variation of the PI controller parameters with rotary potentiometer.**

Experiment board mod. G14/EV enables measurement and connections, via jumpers, to terminals accessible on the front panel on that a mimic diagram of the circuit and functional blocks is included.

The training program is completed by the use of the control supervision software of the PC, for monitoring the behavior of the electrical quantities involved in the circuits of board mod. G14/EV.

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TRAINING PROGRAM:

- DC permanent magnet motor;
- Equivalent circuit of the DC motor;
- PWM control of a DC motor, with bipolar power transistors (BJT);
- Integrated circuit PWM generator;
- Driving circuit for the regulator transistor;
- Speed transduction of the DC motor from the armature feedback detection;
- Speed and current controller with P.I. controllers with adjustable parameters;
- Calibration of the P.I. controller;
- Calibration of the maximum current;
- Calibration of the SPEED DETECTOR and the maximum speed;
- Detection of the open-loop speed;
- Detection of the open-loop current;
- Detection of the closed-loop speed;
- Detection of the closed-loop current;
- Gain variation of the speed regulator;
- Gain variation of the current regulator;
- Variation of the time constants of the regulation unit;
- 0Analysis and use of the supervision software with Personal Computer.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- The unit mod. TY14/EV consists of:
  - Metal container
  - DC permanent magnet motor
  - Mechanical brake
- DC motor characteristics:
  - Nominal voltage: 24Vdc
  - Power: 50 W
  - Armature resistance Ra: 8 Ω
  - Maximum rotation speed: 3500 RPM
- Set-point fixed with rotary potentiometer;
- Adjustable PI analog regulator;
- Circuit for limiting the armature current;
- Inner clock generator;
- PWM signal frequency: 14 kHz;
- 8-pole connection cable for the module to the external unit type DIN 270.

Dimensions mod. G14/EV: 386 x 248 x 40 mm

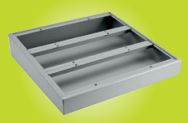
Dimensions mod. TY14/EV: 330 x 120 x 100 mm

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A
30 Vdc / 1.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



INSTRUMENTS - NOT INCLUDED -
- **MULTIMETER**
- **OSCILLOSCOPE**
- **FUNCTION GENERATOR**

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

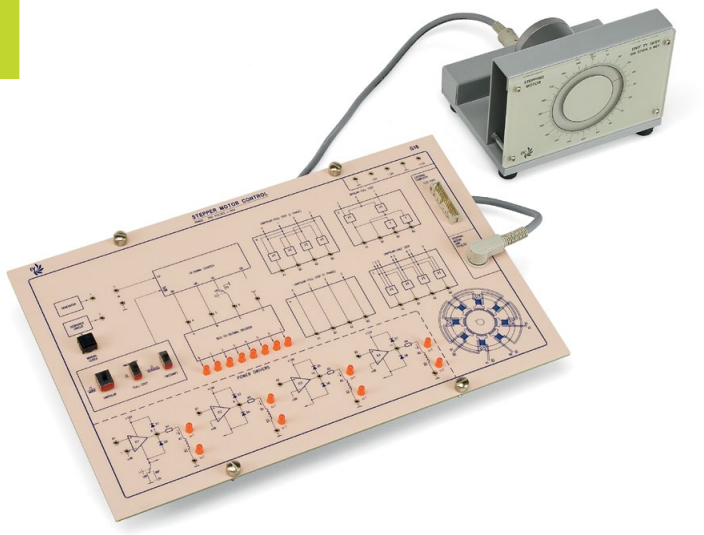
MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD

SUPERVISION AND CONTROL SOFTWARE MFIDEV/EV

BESIDES THE ON-BOARD PID, THE TRAINER CAN ALSO BE CONTROLLED BY:
- **FOUR LOOPS PID DIGITAL CONTROLLER MOD. PID-S1/EV**

STEPPER MOTOR CONTROL
Mod. G16/EV

A stepper motor is an electromechanical device which shaft rotates at discrete steps, following the control pulses in number and speed. It is very good for applications using a digital control. Its easy use, especially due to the fact it does not need feedback, the accuracy and the fast positioning determined its wide use in: process controls, control of printers, readers/perforators, plotters, machine tools, etc.



STEPPER MOTOR CONTROL mod. G16/EV

Experiment board mod. G16/EV is manufactured with industrial component and circuits, for the theoretical and practical study of subjects concerning stepper motors.
The external unit mod. TY16/EV, included with board mod. G16/EV, to which is connected via 8-pole DIN cable, includes:

- **4-phase stepper motor**
- **Goniometric indicator of the angular position**

The control circuitry for the stepping motor is assembled in the board mod. G16/EV. The student can experiment the different operating modes of the motor and change the speed also manually checking the structure and format of the pulse train. The counting of the number of steps carried out by the motor is displayed also by 8 LED diodes controlled by a decoding integrated circuit. The 4 phases of the motor are driven by separate power circuits, with current protection and indication of the direction via 2 LED diodes.

The training program is completed by the use of the PC and a software allowing the control of the motor and supervision of the process.

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TRAINING PROGRAM:

- Operating principles, terminology and technical characteristics of stepper motors;
- Waveforms of the phase current;
- Unipolar and bipolar driving;
- Full step operation;
- Half step operation;
- Single step and constant speed progress;
- Driving sequence creation;
- Power circuits for phase driving;
- Analysis and use of the supervision software with Personal Computer.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- The unit mod. TY16/EV consists of:
  - Metal container
  - Stepper motor
  - Goniometric indicator with marks for the angular position
- Stepper motor characteristics:
  - Number of phases: 4
  - Steps: 200 steps/rev
  - Angle: 1.8° – 0.9°
  - Max. torque: 850 g·cm
- Manual clock operation with pushbutton;
- Inner clock generator;
- Unipolar/bipolar, half step/ full step switching with microswitches;
- 4 Power drivers with LED indication of the current direction in the phases;
- 8-LED display of the number of steps performed by the motor, in decimal noting;
- Connection cable of the module to the external unit type 8-pole DIN 270.

Dimensions mod. G16/EV: 386 x 248 x 40 mm

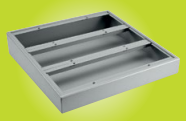
Dimensions mod. TY16/EV: 160 x 120 x 120 mm

REQUIRED

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

POWER SUPPLY
±12 Vdc / 2A
5 Vdc / 1A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -



INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

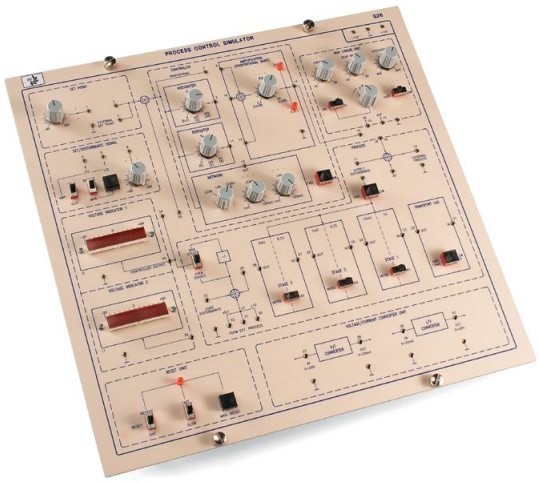
OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD

SUPERVISION AND DRIVING SOFTWARE MFIDEV/EV

PROCESS SIMULATOR
Mod. G26/EV



An important chapter in the science of automation consists in the topic called automatic controls. It refers to the study of devices (called regulators, controllers or control devices), which are used to automatically change the variables of a system (a controlled system) which can be freely manipulated, so that it undergoes the evolution in the best time and way possible.
It is obvious that the knowledge of the theory of automatic controls has become, nowadays, an indispensable requirement for all technicians operating in the field of Industrial Electronics and Process Controls.
The Simulator mod. G26/EV represents, in this context, the necessary tool for a deep study of the subjects of the theory of Automatic Controls, through the practical experimentation and the analysis of the wide range of exercises included in the complete and detailed training program.

PROCESS SIMULATOR mod. G26/EV

The salient peculiarity of the process simulator mod. G26/EV is to constitute a completely autonomous instrument for the development of a high level training program on the subjects concerning the Automatic Control of Systems.
The components, the circuits and control techniques of the simulator mod. G26/EV are the same used in industrial Process Controls. The implemented controls are analog, i.e., in general, the involved signals are continuous in time and amplitude. The control techniques, instead, include linear and non linear processing of the signals, for the simulation and control of open- and closed-loop processes, pointing out the influence of the characteristic parameters on the process responses and evaluating the errors performed in transient and permanent state.
The simulator mod. G26/EV is composed by different blocks each of which develops a separate function, but which can be connected for the lay-out of the control configuration.

Each block is limited by a dotted line which includes the silk screen printed functional diagram on the front panel of the simulator. This wide silk screen representation enables a clear vision of the system on the whole and in details, facilitating the development of the many exercises composing the training program.

The main functional linear blocks present on the simulator mod. G26/EV are:

- **Set-point;**
- **Error amplifier;**
- **P-I-D regulator with independent actions;**
- **"LEAD" & "LAG" networks;**
- **Simulated Process.**

The Set-point is fixed via 1 rotary potentiometer and inner voltage reference. Always with rotary potentiometers, it is possible to set the parameters of the PID regulator and the "LEAD" & " LAG" networks. In particular, on the PID regulator you can connect/disconnect the three P, I and D actions, independently.
The non-linear functional blocks present on the simulator mod. G26/EV are:

- **Saturation;**
- **Dead band;**
- **Hysteresis.**

Even as concerns the non-linear actions, these can be adjusted via rotary potentiometers according to the needs of the process. Continuous and repetitive disturbances can be inserted in any point of the control chain for evaluation of the rejection capacity of the system. Besides, a specific unit enables the manual and automatic reset of the system in case of repetitive experiences. Furthermore, terminals at the input and output of each functional block enable qualitative and quantitative measurements of the variables in the control chain.
In line with the modern technologies of Process Control, the PC connection is possible via cards and dedicated software, for supervision and control of the system.

The PID controls from PC anticipates the student the subjects of Digital Process Controls enriching the training program which can be developed with the simulator mod. G26/EV.

TRAINING PROGRAM:

- Physical description of the processes;
- Determination of the mathematical model;
- Block diagram representation of the system;
- Analysis of the influence of the disturbances introduced across different points;
- Linear systems: integral-differential equations;
- Input-output ratios: transfer functions;
- Feedback systems;
- Basic structures of regulators;

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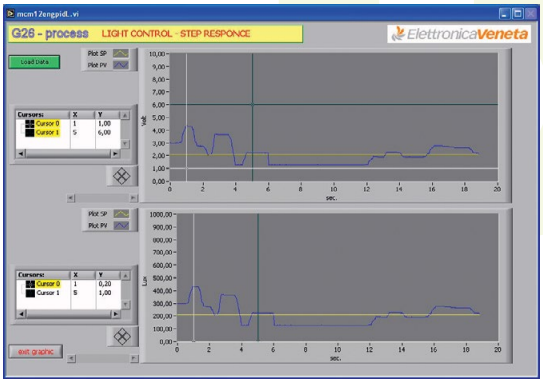
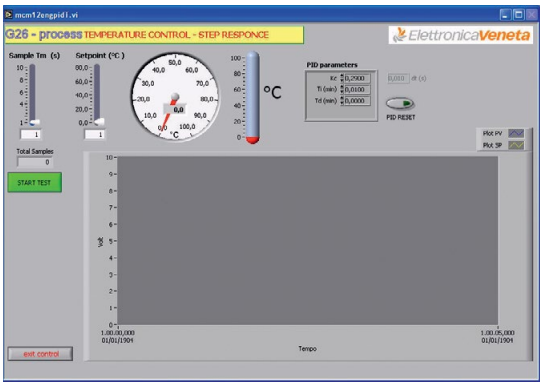
- Actions: Proportional, Integral, Derivative,Lead, Lag
- Process control: influence of characteristic parameters;
- Simulation of a heat exchanger (process of the 1st order type 0);
- Simulation of a DC motor current (process of the 2nd order type 0);
- Simulation of an adiabatic thermostatic chamber (process of the 2nd order type 1);
- Simulation of the positioner controlled by a DC motor (process of the 3rd order type 1);
- Set up of the PID controller according to the procedures of:
  - Ziegler-Nichols
  - Janssen-Offereins
  - Step response of the open-loop system
- Non-linear process simulation:
  - Saturation, Dead band, Hysteresis
- Analysis of open and closed loop systems in time and frequency domain;
- Analysis and use of the supervision and control software.

TECHNICAL SPECIFICATIONS:

- Front panel in insulating material, with silk screen printed diagram of the different circuit blocks of the module and electrical diagram of each circuit;
- Terminals for the connections and measurements;
- **Set-point (reference) and comparison block:**
  - DC: voltage variable from -8 V to +8 V
  - Pulse generator:
    Ton=30 ms, toff=10 ms (slow)
    Ton=3 ms, toff=1 ms (fast)
  - Manual pulse using pushbuttons
  - Analog comparison block using operational amplifiers
- **PID controller:**
  - Integral action range:
    4 ms ÷ 400 ms (fast)
    0.4 s ÷ 40 s (slow)
  - Derivative action range:
    0 ms ÷ 40 ms (fast)
    0 s ÷ 4 s (slow)
  - Proportional band range:
    2.5% ÷ 250% (amplification 0.4 – 40)
- Rotary potentiometers for regulation of the PID controller parameters
- **"Lead" & "lag" compensating networks:**
  - "Lead" working range: 1 ms – 100 ms
  - "Lag" working range: 1 ms – 100 ms
- 1 Switch with handle for "lead" & "lag" network selection
- 2 Rotary potentiometers for the choice of the action times of the "lead" & "lag" networks
- **Non linear unit:**
  - Limits adjustable from 0 V to +8 Vdc
  - Dead band adjustable from 0 V to +8 Vdc
  - Hysteresis adjustable over the whole range of the signal
  - Two ranges for the backlash according to the operating speed
- Potentiometers for non-linearity parameters regulation potentiometers
- **Process**
  - 1 Lag/integrator with time constant: 10 ms (fast),1 s (slow)
  - 2 Lag/integrator with time constant: 7 ms (fast), 0.7 s (slow)
  - 1 Transport delay unit (speed-distance) with useful frequency range: 0 ÷ 30 Hz (speed) or 0 ÷ 3 Hz
- **Converters:**
  Voltage/current and current/voltage converter:
  Voltage range: ±8 V
  Current range: 4 ÷ 20 mA
- 2 LED indication diodes for controller saturation;
- 2 Analog indicators for the controlled variable and for any other variable of the simulator;
- Automatic reset system for repetitive experiences.

Dimensions mod. G26A/EV: 386 x 372 x 40 mm





REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- **MULTIMETER**
- **OSCILLOSCOPE**
- **FUNCTION GENERATOR**

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

OPTIONAL

PERSONAL COMPUTER

MFI-U/EV USB INDUSTRIAL INTERFACE - FOR INTERFACING TO THE BOARD
SUPERVISION SOFTWARE MFIDEV/EV

BESIDES THE ON-BOARD PID, THE TRAINER CAN ALSO BE CONTROLLED BY:
- **FOUR LOOPS PID DIGITAL CONTROLLER MOD. PID-S1/EV**

FOUR LOOPS PID DIGITAL CONTROLLER
Mod. PID-S1/EV

As with the present generation of PID controllers, the Four Loops PID Digital Controller mod. PID-S1/EV has a structure based on a high performance microcontroller, analog inputs and outputs, programming of the regulation functions and serial interface for the communication with Personal Computers.
The programming of the main parameters of the process control is carried out locally through the touch screen display.
The controller can find immediate application to the control of various processes (temperature, pressure, flow rate and level) since it is designed to interface with those modules.
It is provided with an Ethernet interface in order to be connected to a Personal Computer for data visualization and control.
The main function of the regulator is to control and monitor the process continuously according to the programmed regulation algorithm. The regulator controls 4 auto-tuning regulation loops.
The parameters for the P- proportional, D- derivative and I- integrative regulation are set via the touch screen display or via the PC.
The high resolution display shows the numerical or graphic trend of the variables during the regulation (Set point, Regulated quantity, Error…).

TRAINING PROGRAM:

The equipment allows a wide range of educational applications such as:

- Analyzing the structure of a digital process regulator
- Programming the functions of the regulator;
- Analyzing the parameters: proportional, derivative and integrative coefficient;
- Analyzing the analog I/O signals and the connections with the process regulation;
- Applying algorithms to the functional programming of a digital process control;

TECHNICAL SPECIFICATIONS:

- Front screen in isolating material with screen-printed diagrams and internal components
- Power supply unit 24 Vdc / 2 A with electronic protection against overload and short circuit
- Power supply unit 10 Vdc / 0.5 A with electronic protection against overload and short circuit
- 4 different regulation techniques:
  - Multi Loops (1 to 4 loops)
  - Ratio
  - Cascade
  - Override

When selecting a technique, the system automatically sets the corresponding parameters and gives some I/O specific functions.

- Color graphic TFT touch 4.3" display (480 x 272 pixels / colors: 16 M)
- Auto-tuning
- Alarm configuration page
- Alarm history
- Parameter page of the selected loop
- Trend page of the selected loop
- Parameter page of the analog inputs
- Parameter page of the analog outputs
- Parameter page of the digital I/O
- Status and forcing of I/O
- Time register
- Ethernet switch: on board
- Ø 2 mm jacks for instruments for connecting inputs and outputs to external devices.

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Analog inputs
- 6 Voltage / current sortable analog inputs
- Voltage range: 0÷1 V / 0÷5 V / 1÷5 V / 0÷10 V
- Current Range: 0÷20 mA / 4÷20 mA

Digital inputs
- 8 optocoupled Auxiliary ON/OFF inputs (0-24 Vdc)

Set Point
- Local setting via the touch screen display

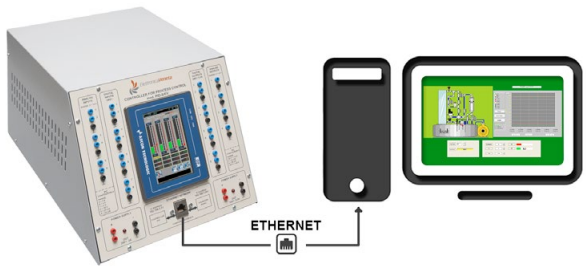
Analog outputs
- 4 voltage / current sortable analog outputs
- Voltage range: -10 V÷ +10 V / -20 V÷ +20 V / 0÷10 V
- Current Range: 4÷20 mA

Digital outputs
- 8 digital outputs 24 Vdc - 0.5 A

Communication
- 1 Ethernet interface for parameterization / supervision via PC of the regulator with Modbus TCP/IP protocol.

On board characteristics / functions
- High resolution color display
- Pages organized in a menu
- Visualizing the regulated figures in real-time
- Managing bar graphs, trends, alarms
- Optional use of password

Power supply: 110/230 Vac 50 Hz single-phase
Dimensions: 245 x 197 x 355 mm



Supervision and data acquisition is carried out via the optional software mod. SV-1/EV with Modbus TCP/IP protocol.

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK WITH GUIDE TO THE PROCESS CONTROL APPLICATIONS

INSTALLATION, USE AND MAINTENANCE HANDBOOK

OPTIONAL

PROCESS SUPERVISION AND DATA ACQUISITION SOFTWARE - Mod. SV-1/EV

Powerful software with graphic pages enabling process control supervision and data acquisition from a PC station connected to the PID controller.

20-B

SERVOMECHANISMS

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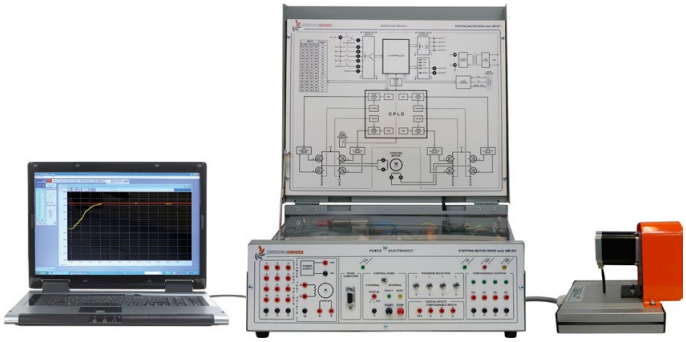
SERVOMECHANISM FOR STEPPER MOTOR
Mod. SM1/EV



Stepper motors are largely used for position controls, like for example: computer peripherals, textile industry, integrated circuit manufacturing industries, robotics, etc. A stepper motor can be considered as a digital electromechanical device, where each input pulse corresponds to a motion of the rotor of a discrete angle, called step angle.

So, the stepper motor is used in open-loop position controls, by simply counting the number of pulses sent to the stator. In this context, the proposed equipment mod. SM1/EV, enables the high level analytical/experimental study of stepper motors. The power of the servomechanism, the circuit solutions and the used components allow developing the Educational program on a completely industrial product and not only on a reduced dimension system.

SERVOMECHANISM FOR STEPPER MOTOR mod. SM1/EV
The system mod. SM1/EV mainly consists of:

- **An industrial bipolar-chopper servomechanism for stepper motor;**
- **An external unit consisting of a stepper motor.**

The servomechanism is mounted on the EDUBOX structure, an innovative system for teaching explanation combining the demonstration efficacy with the operative functionality. The compact unit includes:

- **The electronic circuit of the equipment;**
- **A silk-screen printed diagram with detailed block diagram;**
- **A panel with controls, signaling, test points;**
- **A non-destructive fault simulator.**

The servomechanism is connected to the external unit via an 8-pole cable. A dedicated card provided with the equipment mod. SM1/EV, enables the PC interfacing, via USB, during control experiences.
A faults simulation system allows the insertion of 8 different non-destructive faults through hidden switches; the faults simulated are the most common occurring in the real world. In this way, the experimentation is completed by experiences concerning the maintenance of servomechanisms for industrial stepper motors, enriching the professional background of the student.

TRAINING PROGRAM:

- Stepper motor: electrical and mechanical characteristics;
- Equivalent circuits;
- Position control;
- Structure of the bipolar-chopper servomechanims;
- Application range;
- Analysis of the MOSFET transistor power stage;
- Phase currents;
- Full-, half-, quarter-step excitation;
- Current reduction;
- Dynamics of the system;
- Analysis and use of the supervision software from PC;
- Troubleshooting experiences in the servomechanism.

TECHNICAL SPECIFICATIONS:

- EDUBOX mounting structure;
- Silk screen printed diagram with the different circuit blocks of the system;
- Measurement test-points;
- External control panel with switches and rotary potentiometer;
- Non-destructive fault simulator: possibility of insertion of 8 faults at max with the same number of switches.

Power supply: 230 Vac 50 Hz single-phase - 300 VA
(Other voltage and frequency on request)
Dimensions: 380 x 330 x 130 mm
Weight: about 10 Kg

SERVOMECHANISM CHARACTERISTICS:

- Set-points which can be fixed inside or via PC;
- Output current: variable from 4 to 10 A;
- Operative mode: bipolar;
- "H"-bridge power stage with 4 MOSFET power transistors;
- High switching frequency;
- Control: bidirectional;
- Protections: max./min. voltage, temperature, short-circuit;
- Diagnostics with signaling LED diodes;
- Single-phase rectifier bridge from network.

SOFTWARE:

Data acquisition and supervision:

- Interface card inside the equipment, complete with SRAM memory;
- Connection to PC USB port (PC not included);
- Software running on Windows 7/8 or higher.

MOTOR UNIT CHARACTERISTICS:

- Metal base;
- 2-phase stepper motor;
- Step angle: 1.8°;
- Bipolar nominal angle: 4 A;
- Bipolar torque: 110 N·cm.

Dimensions: 160 x 120 x 140 mm
Weight: about 5 kg

REQUIRED

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE
- FUNCTION GENERATOR

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
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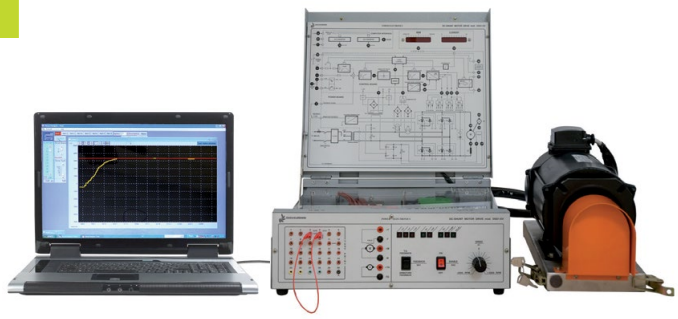
SERVOMECHANISM FOR DC-SHUNT MOTOR

Mod. DSD1/EV



The **DC-SHUNT** motor is a direct current motor in which the rotor field is generated by an external excitation circuit, in a way to obtain a constant or variable field. The DC-SHUNT motor drive proposed in the equipment **mod. DSD1/EV** is of the AC/DC type with thyristors (SCR).

This drive has been historically, the first one among the DC drives. Nevertheless, it is by no means obsolete; in fact, its robustness, its low cost in relation to the controlled power and the application fields make this mechanism an indispensable product for the industry. The system mod. DSD1/EV is, inside a laboratory of servomechanisms, the instrument necessary to the high level theoretical-practical study on the subjects concerning the thyristor AC/DC servomechanisms for DC-SHUNT motors. The power of the servomechanism, the circuit solutions and the employed components enable the development of the training program on a **totally industrial product and not on a simulator.**

SERVOMECHANISM FOR DC-SHUNT MOTOR mod. DSD1/EV

The system mod. DSD1/EV mainly consists of:

- **A bidirectional industrial servomechanism for DC SHUNT motor with separate excitation;**
- **An external unit consisting of a DC-SHUNT motor with separate excitation.**

The servomechanism is mounted on the EDUBOX structure, an innovative teaching presentation system combining the demonstration efficiency with the operative functionality. The compact unit includes:

- **An electronic circuit of the equipment;**
- **A silk-screen printed diagram with detailed block diagram;**
- **A panel with controls, indicators, test points;**
- **A non-destructive fault simulator.**

A tachogenerator directly mounted on the external unit together with the DC-SHUNT motor is providing the system's feedback. The servomechanism is connected to the external unit via an 8-pole cable. A dedicated electronic board, provided with the equipment mod. DSD1/EV, enables the PC interfacing, via USB/Bluetooth, during data acquisition and process supervision experiences. A fault simulation system enables the insertion of 8 different non-destructive faults by means of hidden switches; the inserted faults are the most common as concern the industrial use of the system. In this way, several exercises concerning the maintenance of the servomechanisms for industrial DC-SHUNT motor are allowed, enriching the professional background of the student.

TRAINING PROGRAM:

- DC-SHUNT motor with separated excitation: electrical and mechanical characteristics;
- Structure of the bidirectional SCR servomechanism;
- Application range;
- Current and voltage waveforms of the motor;
- Speed control with tachogenerator;
- Speed control with inner current loop;
- PI regulators;
- Proportional action-speed controller calibration;
- Proportional action-current controller calibration;
- Integrative action;
- Set-point/ignition angle/SCR/speed ratio;
- Acceleration and deceleration ramps;
- Synchronism signal;
- Signal produced by the modulator;
- Dynamic response of the system;
- Analysis and use of the supervision software from PC in operations of speed setting / reading and speed/current graph plotting;
- Troubleshooting experiences in the servomechanism.

SOFTWARE:

Data acquisition and supervision:

- Interface card inside the equipment, complete with A/D and D/A converters;
- Connection to PC: USB/Bluetooth (PC not included);
- Graphic software running on Windows 7/8 or higher.

TECHNICAL SPECIFICATIONS:

- EDUBOX mounting structure;
- Silk screen printed diagram with the different circuit blocks of the system;
- Measurement test-points;
- 2 bar-graph indicators for speed and current;
- External control panel with switches and rotary potentiometer;
- Non-destructive fault simulator: possibility of insertion of 8 faults at max. with the same number of switches.

Power supply: 230 Vac 50 Hz single-phase - 1,5 kVA (Other voltage and frequency on request)
Dimensions: 380 x 330 x 130 mm
Weight: about 10 Kg

SERVOMECHANISM CHARACTERISTICS:

- Speed set-point which can be fixed via potentiometer or PC;
- Speed regulation range: ±3000 rpm;
- Field voltage obtained inside and equal to 190 V;
- Single-phase controlled rectified power stage with 8 thyristors
- Ramp time: 5 s at max;
- Control: 4 Q bidirectional;
- LED diode diagnostics: power supply, current limit.

MOTOR UNIT CHARACTERISTICS:

- Metal base;
- Wounded rotor DC motor with separate excitation;
- Tachogenerator splined to the motor shaft;
- Nominal armature voltage: 160 V;
- Nominal power: 700 VA;
- Nominal speed: ±3000 rpm.

Dimensions: 400 x 120 x 170 mm
Weight: ca. 11 kg

REQUIRED

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE
- FUNCTION GENERATOR

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

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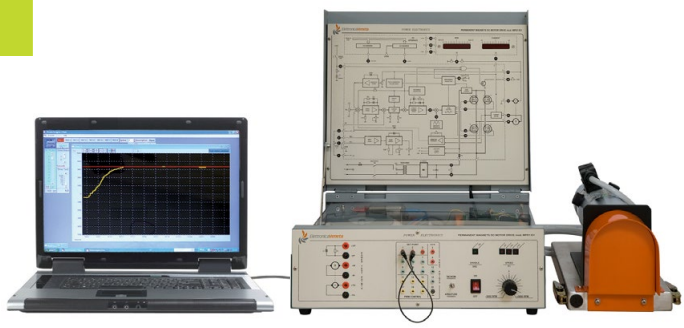
SERVOMECHANISM FOR PERMANENT MAGNETS DC MOTOR

Mod. MPD1/EV



Traditionally, the servomechanisms for permanent magnets DC motors have been employed in applications concerning speed and position control. Although recently the use of AC servomechanisms in these applications is greatly increased, DC servomechanisms are still used for their low starting cost and the excellent performances.

In this context, the suggested equipment **mod. MPD1/EV** represents the necessary instrument for the high level analytical-experimental study of subjects concerning **permanent magnets DC motors bidirectional servomechanisms, with PWM control techniques**. The power of the servomechanism, the circuit solutions, the used components cause the training program to be developed on **a totally industrial product and not on a reduced dimensions system**.

SERVOMECHANISM FOR PERMANENT MAGNETS DC MOTOR mod. MPD1/EV

The system mod. MPD1/EV mainly consists of:

- **A 4-quadrant industrial bidirectional servomechanism for permanent magnet DC motor;**
- **An external unit consisting of a permanent magnet DC motor.**

The servomechanism is mounted on the EDUBOX, structure, an innovative system for teaching presentation combining the demonstration effect with the operative functionality. The compact unit includes:

- **An electronic circuit of the equipment;**
- **A silk-screen printed diagram with detailed block diagram;**
- **A panel with controls, signaling, test points;**
- **A non-destructive fault simulator.**

Besides the DC motor, the external unit contains a tachogenerator for generating the feedback. The servomechanism is connected to the external unit via an 8-pole cable. A dedicated card, provided with the equipment mod. MPD1/EV, enables the PC interfacing, via USB/Bluetooth, for data acquisition and process supervision experiences. The training system is completed with a faults' simulation system allowing the insertion of 8 different non-destructive faults through hidden switches; the faults simulated are the most common ones occuring in the industrial use of the system. In this way, the experimentation is completed with exercises concerning the maintenance of DC industrial servomechanisms, enriching the professional background of the student.

TRAINING PROGRAM:

- Permanent magnet DC motor: electrical and mechanical characteristics;
- One-loop speed control with tachogenerator and armature feedback;
- Speed control with inner current loop;
- Structure of the 4-quadrant bidirectional servomechanism;
- Application range;
- Analysis of the power stage with bridge in "H" configuration;
- Zero adjustment;
- Maximum speed adjustment;
- PID controllers;
- Proportional-integrative gain regulation;
- Derivative action regulation;
- Set-point/duty-cycle/speed ratio;
- Dynamic response of the system;
- Analysis and use of the supervision software from PC in operations of speed setting/reading and speed/current graph plotting;
- Troubleshooting experiences in the servomechanism.

TECHNICAL SPECIFICATIONS:

- EDUBOX mounting structure;
- Silk-screen printed diagram with the different circuit blocks of the system;
- Measurement test-points;
- 2 bar-graph indicators for speed and current;
- External control panel with switches and rotary potentiometer;
- Non-destructive fault simulator: possibility of insertion of 8 faults at max with the same number of switches.

Power supply: 230 Vac 50 Hz single-phase - 1 kVA
(Other voltage and frequency on request)
Dimensions: 380 x 330 x 130 mm
Weight: about 10 kg

SERVOMECHANISM CHARACTERISTICS:

- Speed set-point which can be fixed via potentiometer or PC;
- Speed regulation range: ± 3000 rpm;
- Auxiliary voltages obtained with DC/DC converter inside the drive;
- "H" bridge power stage with 4 MOSFET power transistors;
- PWM modulation at high switching frequency;
- Control: 4-quadrant bidirectional;
- Reversible protection for over/under voltages;
- Irreversible protections for over temperature, short circuit, tachometric breaking;
- Single-phase rectifier bridge from network.

SOFTWARE:

Data acquisition and supervision:

- Interface card inside the equipment, complete with A/D and D/A converters;
- Connection to PC: USB/Bluetooth (PC not included);
- Graphic software running on Windows 7/8 or higher.

MOTOR UNIT CHARACTERISTICS:

- Metal base;
- Permanent magnet DC motor;
- Tachogenerator splined to the motor shaft;
- Nominal armature voltage: 80 Vac;
- Nominal armature current: 8Aac;
- Nominal speed: ± 3000 rpm

Dimensions: 400 x 120 x 170 mm
Weight: about 11 kg

REQUIRED

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE
- FUNCTION GENERATOR

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
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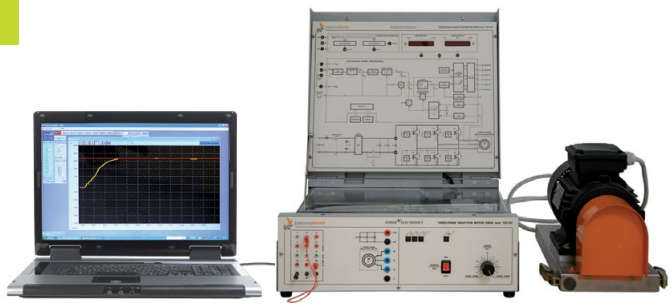
INVERTER FOR THREE-PHASE ASYNCHRONOUS MOTOR

Mod. TID1/EV



The scalar V/Hz servomechanism for three-phase asynchronous motors is the most widely used in low and medium power range applications, due to their reduced price and good performances. The applications of such a servomechanism, for example, are: speed control of fans, compressors, pumps, electrical drilling machines.

In this context, the proposed equipment mod. TID1/EV, has been designed and carried out to enable deep theoretical/experimental study on **V/Hz scalar servomechanisms for three-phase asynchronous motors with sinusoidal PWM control.** The power of the servomechanism, the circuit solutions and the used components allow developing the educational program based on **a fully industrial product and not only on a reduced dimensions system.**

INVERTER FOR THREE-PHASE ASYNCHRONOUS MOTOR mod. TID1/EV

The system mod. TID1/EV mainly consists of:

- **A V/Hz industrial inverter for three-phase asynchronous motor;**
- **An external unit consisting of a three-phase asynchronous motor.**

The servomechanism is mounted on the EDUBOX structure, an innovative system for teaching presentation combining the demonstration effect with the operative functionality. The compact unit includes:

- **An electronic circuit of the equipment;**
- **A silk-screen printed diagram with detailed block diagram;**
- **A panel with controls, signaling, test points;**
- **A non-destructive fault simulator.**

The servomechanism is connected to the external unit via an 8-pole cable. A dedicated A/D & D/A card provided with the equipment mod. TID1/EV, enables the PC interfacing, via USB/Bluetooth, during data acquisition and process supervision experiences. A faults simulation system enables the insertion of 8 different non-destructive faults through hidden switches; the inserted faults are the most common accurring in the real world. In this way, the experimentation is completed with exercises concerning the maintenance of inverters for industrial three-phase asynchronous motors, enriching the professional background of the student.

TRAINING PROGRAM:

- Asynchronous three-phase motor: electrical and mechanical characteristics;
- Equivalent circuits;
- Structure of the scalar V/Hz bidirectional servomechanism;
- Application range;
- Analysis of the IGBT three-phase inverter;
- Sine three-phase PWM modulation;
- Voltage wave-forms on the motor phases;
- Current wave-forms on the motor phases;
- Variation of the control frequency;
- Set-point/frequency/speed ratio;
- Acceleration/deceleration ramp;
- Dynamic response of the system;
- Analysis and use of the supervision software from PC in operations of speed setting / reading;
- Speed/current graph plotting;
- Troubleshooting experiences in the servomechanism.

SOFTWARE:

Data acquisition and supervision:

- Interface card inside the equipment, complete with A/D and D/A converters;
- Connection to PC: USB/Bluetooth (PC not included);
- Graphic software running on Windows 7/8 or higher.

TECHNICAL SPECIFICATIONS:

- EDUBOX mounting structure;
- Silk screen printed diagram with the different circuit blocks of the system;
- Measurement test-points;
- 2 bar-graph indicators for speed and current;
- External control panel with switches and rotary potentiometer;
- Non-destructive fault simulator: possibility of insertion of 8 faults at max with the same number of switches.

Power supply: 230 Vac 50 Hz single-phase - 0,5 kVA
(Other voltage and frequency on request)
Dimensions: 380 x 330 x 130 mm
Weight: about 10 kg

SERVOMECHANISM CHARACTERISTICS:

- Speed set-point which can be fixed via potentiometer or PC;
- Speed regulation range: ± 3000 rpm;
- Auxiliary voltages obtained with DC/DC converter inside the drive;
- Three-phase inverter with 6 IGBT transistors;
- Sine three-phase PWM modulation with programmable switching frequency;
- Rotation frequency programmable in the range: 0.1 ÷ 480 Hz;
- Control: bidirectional;
- Starting automatic Boost;
- Accel./decel. times, programmable from 0.00 s to 99.99 s;
- Protections: over/under voltage, overcurrent, temperature, short-circuit;
- Single-phase rectifier bridge from network.

MOTOR UNIT CHARACTERISTICS:

- Metal base;
- Nominal phase voltages: 3x230 Vac;
- Three-phase asynchronous motor with squirrel cage rotor;
- Nominal speed: ± 3000 rpm.

Dimensions: 400 x 120 x 170 mm
Weight: about 10 kg

REQUIRED

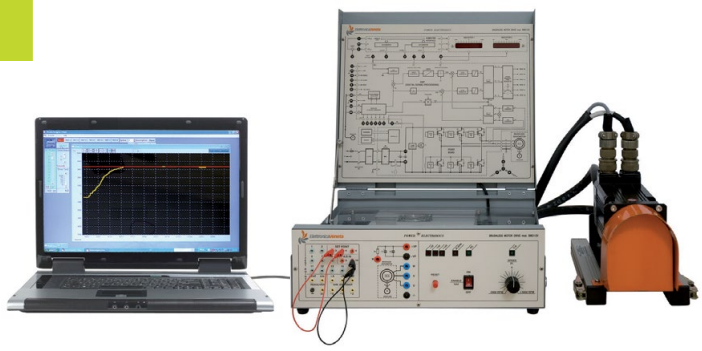
INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE
- FUNCTION GENERATOR

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE APPLICATIONS.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

SERVOMECHANISM FOR BRUSHLESS MOTOR

Mod. BMD1/EV



Brushless motors are synchronous machines with rotor consisting in a permanent magnet and consequently without brushes. The mechanical and electrical characteristics of these motors are superior to those of traditional DC and AC motors.

Brushless motors are typically employed in power applications up to some kW such as: the control of computer peripherals, industrial automation, robots and variable speed servomechanisms for heat pumps. In this context, the suggested equipment mod. BMD1/EV, is the necessary instrument for a high level analytical-experimental study of the subjects concerning **electrical servomechanisms for brushless motors.** The power of the servomechanism, the circuit solutions, the used components, make the training program to be developed on a **totally industrial product and not on a symulated system**.

SERVOMECHANISM FOR BRUSHLESS MOTOR mod. BMD1/EV

The system mod. BMD1/EV essentially consists of:

- **An industrial bidirectional drive for AC brushless motor;**
- **An external unit consisting of an AC brushless motor.**

The servomechanism is mounted on the EDUBOX structure, an innovative system for teaching presentation combining the demonstration effect with the operative functionality.

The compact unit includes:

- **An electronic circuit of the equipment;**
- **A silk-screen printed diagram with detailed block diagram;**
- **A panel with controls, signaling, test points;**
- **A non-destructive fault simulator.**

Besides the brushless motor, the external unit contains a resolver-type position transducer. The servomechanism is connected to the external unit via an 8-pole cable. Besides, a dedicated card provided with the equipment mod. BMD1/EV, enables the PC interfacing, via USB/Bluetooth, during data acquisition and process supervision experiences. Then a simulation system enables the insertion of 8 different non-destructive faults via the same number of switches; the inserted faults are the most used as concern the industrial use of the system. In this way, the experimentation is completed with exercises concerning the maintenance of brushless industrial servomechanisms, enriching the professional background of the student.

TRAINING PROGRAM:

- AC brushless motor: electrical and mechanical characteristics
- Position transducers: resolver
- Double-loop speed-current control
- Structure of the servomechanism
- Application range
- Analysis of the power stage with IGBT transistor
- Microcontroller architecture
- Acceleration and deceleration ramps
- Detection of the voltage and current wave-forms on the motor phases
- Changing of the control parameters
- Dynamic response of the system
- Analysis and use of the supervision software from PC in exercises of speed setting/reading
- Speed/current graph plotting
- Troubleshooting experiences in the servomechanism

SOFTWARE:

Data acquisition and supervision:

- Interface card inside the equipment, complete with A/D and D/A converters;
- Connection to PC: USB/Bluetooth (PC not included);
- Graphic software running on Windows 7/8 or higher.

TECHNICAL SPECIFICATIONS:

- EDUBOX mounting structure
- Silk screen printed diagram with the different circuit blocks of the system
- Measurement test-points
- 2 Bar-graph indicators for speed and current
- External control panel with switches and rotary potentiometer
- Non-destructive fault simulator: possibility of insertion of 8 faults at max with the same number of switches.

Power supply: 230 Vac 50 Hz single-phase - 2 kVA (Other voltage and frequency on request)
Dimensions: 380 x 330 x 130 mm
Weight: about 6 kg

SERVOMECHANISM CHARACTERISTICS:

- Speed set-point which can be fixed via potentiometer or PC;
- Speed regulation range: ± 3000 rpm;
- Auxiliary voltages obtained with DC/DC converter inside the drive;
- 6 IGBT transistor power stage;
- Feedback with resolver;
- Control: 4-quadrant bidirectional with double speed-current loop;
- Accel./decel. times, programmable from 0.00 s to 99.99 s;
- Protection for over/under voltages;
- Single-phase rectifier bridge from network.

MOTOR UNIT CHARACTERISTICS:

- Metal base;
- Permanent magnet brushless motor in neodymium-iron boron;
- Resolver splined to the motor shaft;
- Nominal armature voltage: 3x200 Vrms;
- Nominal armature current: 3x3.3 Arms;
- Nominal speed: ± 3000 rpm;
- Torque: 7.8 N·m.

Dimensions: 350 x 120 x 150 mm
Weight: about 5 kg

REQUIRED

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE
- FUNCTION GENERATOR

SUPPLIED WITH

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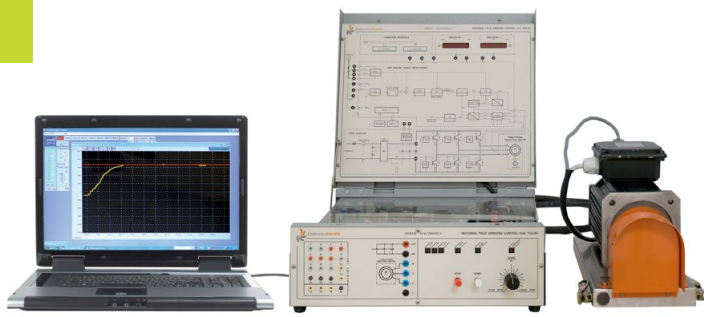
VECTORIAL FIELD-ORIENTED CONTROL SERVOMECHANISM FOR THREE-PHASES ASYNCHRONOUS MOTOR

Mod. FOC/EV



In AC servomechanisms of the last years, **the vectorial F.O.C. field- oriented control technology** is dominating. Used with three-phase asynchronous motors, they allow to reach torque and speed performances, superior to those obtained with traditional scalar technology.

The vectorial field-oriented control servomechanism for asynchronous three-phase motor mod. FOC/EV enables the student to learn, demonstrate and experiment the main concepts of field oriented control, enriching the personal theoretical background with the practical aspects of industrial design and maintenance. The power of the servomechanism, the circuit solutions, the used components, make the training program to be developed on a **totally industrial product and not on a simulator.**

VECTORIAL FIELD-ORIENTED CONTROL SERVOMECHANISM FOR ASYNCHRONOUS THREE-PHASE MOTOR mod. FOC/EV

Mainly consists of:

- **An industrial vectorial inverter for asynchronous three-phase bidirectional motor;**
- **An external unit consisting of a three-phase asynchronous motor.**

The available control modes are:

- **Field orientation with speed sensor;**
- **Field orientation without speed sensor (Sensorless);**
- **V/Hz control.**

The servomechanism is mounted on the EDUBOX structure, an innovative system for teaching presentation combining the demonstration effect with the operative functionality.

The compact unit includes:

- **An electronic circuit of the equipment;**
- **A silk-screen printed diagram with detailed block diagram;**
- **A panel with controls, signaling, test points;**
- **A non-destructive fault simulator.**

The servomechanism is connected to the external motor via an 8-pole cable. A dedicated electronic board, provided with the equipment mod. FOC/EV, enables the PC interfacing for data acquisition and process supervision experiences. The parametrization of the servomechanism is made with a keyboard with LCD display or via PC with dedicated software supplied with the system.

A faults' simulation system enables the insertion of 8 different non-destructive faults through switches; the faults simulated are typical cases verified in the industrial use of the system.

TRAINING PROGRAM:

- Asynchronous three-phase motor: electrical and mechanical characteristics;
- Vectorial field-oriented control (F.O.C.);
- Speed and torque control;
- Analysis of the IGBT three-phase inverter;
- "Space vector" vectorial modulation;
- Voltage/current wave-forms on the motor phases;
- Dynamic response of the system;
- Programming the servomechanism via keyboard or PC with dedicated software;
- Analysis and use of the data acquisition software from PC;
- Troubleshooting experiences in the servomechanism.

TECHNICAL SPECIFICATIONS:

- EDUBOX mounting structure;
- Silk screen printed diagram with the different circuit blocks of the system;
- Measurement test-points;
- External control panel with switches and rotary potentiometer;
- Non-destructive fault simulator: possibility of insertion of 8 faults at max with the same number of switches.

Power supply: 230 Vac 50 Hz single-phase - 1,5 kVA (Other voltage and frequency on request)
Dimensions: 380 x 330 x 130 mm
Weight: about 10 kg

SERVOMECHANISM CHARACTERISTICS:

- Speed set-point which can be fixed via potentiometer or PC;
- Speed regulation range: ± 3000 rpm;
- Auxiliary voltages obtained with DC/DC converter inside the drive;
- 6 IGBT transistor three-phase inverter;
- SVM (Space Vector Modulation) to keep the noise level to the minimum;
- Possibility of controls: sensorless, with encoder and V/Hz;
- Inverter programming via keyboard with back-lighted LCD display or PC with dedicated software and serial interface;
- Controls: speed and torque;
- Autotuning procedure for current, flow and range regulators;
- 8 inner speed references and 4 inner linear or "S" ramps;
- Digital inputs for encoder analog differentials;
- Outputs protected against the accidental grounding and phase short-circuit across the output and overload control;
- Alarm signaling on the keyboard display.

SOFTWARE:

Data acquisition and supervision:

- Interface card inside the equipment, complete with A/D and D/A converters;
- Connection to PC using the above mentioned interface (PC not included);
- Graphic software running on Windows 7/8 or higher.

MOTOR UNIT CHARACTERISTICS:

- Metal base;
- Nominal phase voltages: 3x230 V;
- Three-phase asynchronous motor with squirrel cage rotor;
- Nominal speed: ± 3000 rpm.

Dimensions: 400 x 120 x 170 mm
Weight: about 10 kg

REQUIRED

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE
- FUNCTION GENERATOR

SUPPLIED WITH

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MINI-ROBOT CONTROLLED BY STEPPER MOTORS

Mod. MRB-4/EV

From an electronic point of view, Robotics represents the more complete application of all control, regulation and digital techniques of Personal Computers for machine control. The suggested equipment constitutes a first approach to the performances and uses of the robot.

MINI-ROBOT CONTROLLED BY STEPPER MOTORS mod.MRB-4/EV

The robot has a contained size and performances, in order to respect the educational needs. But it enables the maximum interaction with the user; practically, it is an open "machine".
The Robot mod. MRB-4/EV has 6 degrees of freedom, controlled by 5 stepper motors, moving the base, the shoulder, the arm, the wrist and the grip constituting the hand; the wrist can move vertically or rotate using the same two motors.
The equipment comes with a control program, enabling to move the Robot from the keyboard, in order to create a sequence of motions and record it on disk, and to carry out a sequence recorded before.

TRAINING PROGRAM:

Using the provided handbooks the main subjects dealt are:

- Analysis of the basic philosophy of a robot;
- Structure of a robot;
- Analysis of the motion techniques (use of stepper motors);
- Analysis of the interface problems to the computer and driving techniques;
- Analysis of the control software with particular reference to:
  - Motion algorithms of stepper motors;
  - Motion with self-learning;
- Robot application in small industrial experiences.

TECHNICAL SPECIFICATIONS:

The Robot has 5 motion axes and a grip. These are described hereinafter:

- **BASE:** it is mounted on the main structure for the robot support which contains the whole electronic part in motion; it can be rotated up to 300° clockwise and counter-clockwise
- **SHOULDER:** it moves vertically on the base, it supports the motors and gears of the other axes and enables to lift / lower of 90°;
- **ARM:** it is hinged around an horizontal axis with the shoulder enabling to lift / lower of 90°;
- **WRIST/LIFTING:** grip vertical movement of 180°;
- **WRIST/ROTATION**: grip rotation of 120°;
- **GRIP:** it constitutes the effective grasp unit and can be opened or closed with a motor.

ON LINE / OFF LINE operation:

- ON LINE: movement of axes and simultaneous graphic simulation
- OFF LINE: only graphic simulation without any robot movement

Movement in WORLD COORDINATES:
ORIGIN in the central point of the BASE and 3 coordinates X, Y and Z describing the GRIPPER position in the space

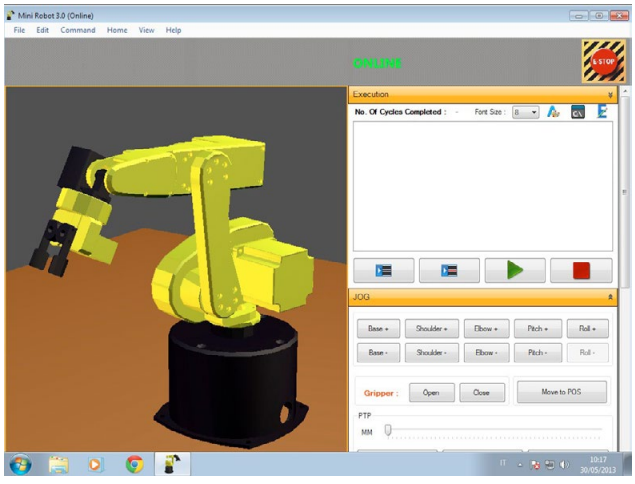
Movement in AXIAL COORDINATES:
5 coordinates describing the position of every axis separately (AXIS 1, 2, 3, 4, 5) without common ORIGIN.

PROGRAMMING software:
Select JOG mode and then WORLD or AXIAL COORDINATES for the acquisition of movement points. Pressing +/- buttons concerning the 3 AXES: X, Y, Z, or the 5 AXES: 1, 2, 3, 4, 5, will enable to move the robot to a desired position. Selecting JOINT or PTP will store the position, and entering the EXECUTION mode enables to display the corresponding instruction automatically added to the program list. As regards the ARITHMETIC instructions and those of FLOW MANAGEMENT, use some graphic Templates by entering "Command Panel" and inserting the desired parameters, or writing the instructions directly in "Editor". This position also enables to check the correctness of program syntax (Debug).
Once inserted a correct program, execute it entering the "Execution" mode.

Other characteristics of the equipment are:

- Axes no.: 5;
- Resolution: 1 mm;
- Load capacity: 250 grams;
- Repeatability: 1mm;
- Parallel gripper;
- DC gripper motor;
- Joint clamp stepper motors;
- Position control: opened ring.

Power supply: 230 Vac 50 Hz single-phase - 350 VA
Robot Dimensions: Max vertical extension: 425 mm
Max horizontal extension: 330 mm
Controller Dimensions: 300 x 200 x 150 mm
Robot Weight: 8 kg
Controller Weight: 3 kg



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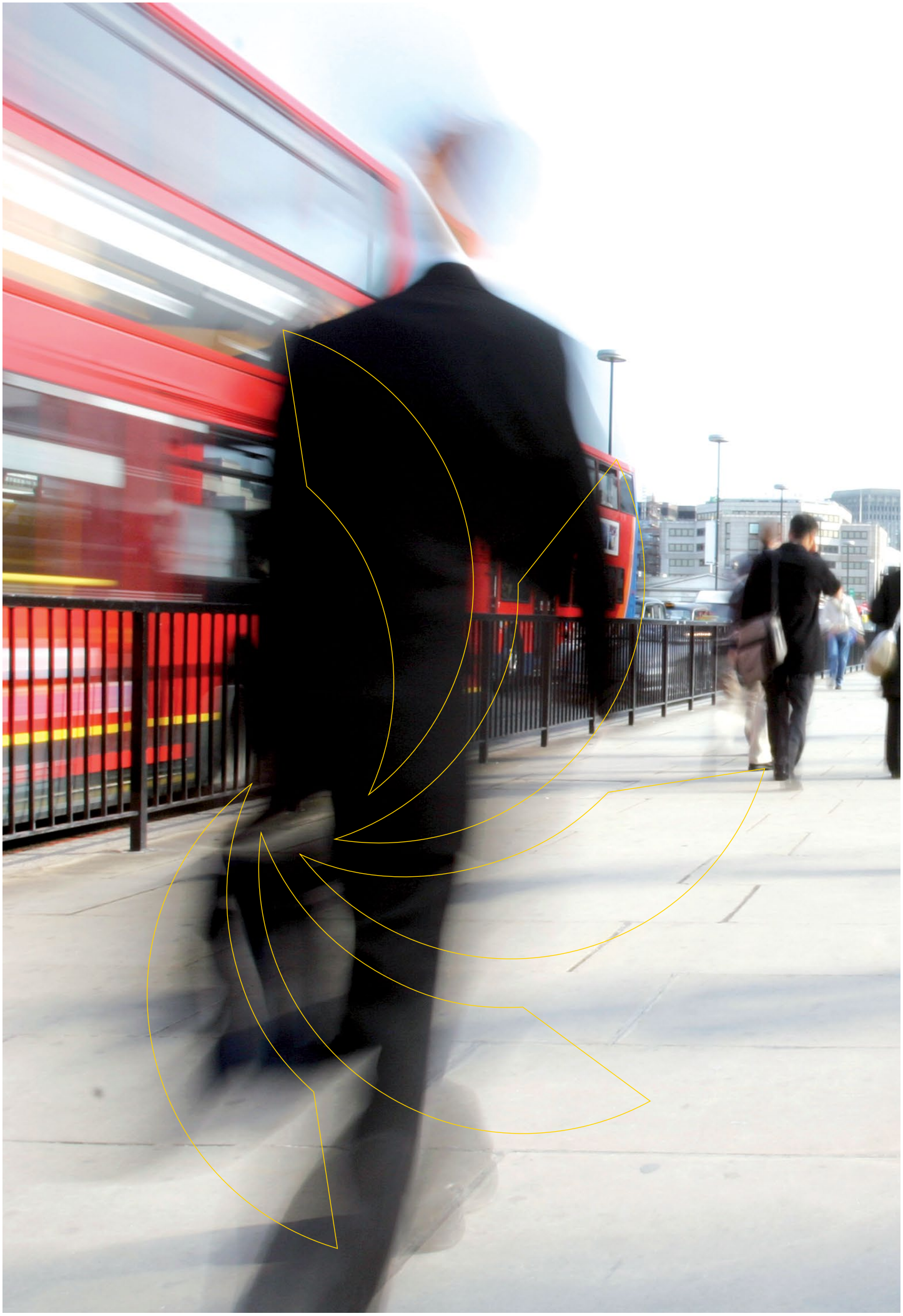

PD

20-B

PROJECT'S DEVELOPMENT

PD

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SOFTWARE AND TOOLS FOR PROJECTS' DEVELOPMENT

Aim:

- Using educational and development software packages (circuit design simulation and PCB processing applications)
- Designing, assembling and analysing different kind of circuits;
- Using signal generators and measuring instruments for the analysis of circuits.

Equipment:

- Educational Software;
- Modules for the assembly of analogs and digital circuits with pre-mounted components and breadboards;
- Software CAD-CAE for the electronics circuit development: design, simulation, devices placement and electronic boards' assembly
- Rapid prototyping with dedicated Milling machine for PCB production.

20B-E-PD

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20-B

ELECTRONICS AND SYSTEMS

SOFTWARE AND INSTRUMENTS FOR PROJECTS' DEVELOPMENT

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20-B

MULTIMEDIA EDUCATIONAL SOFTWARE

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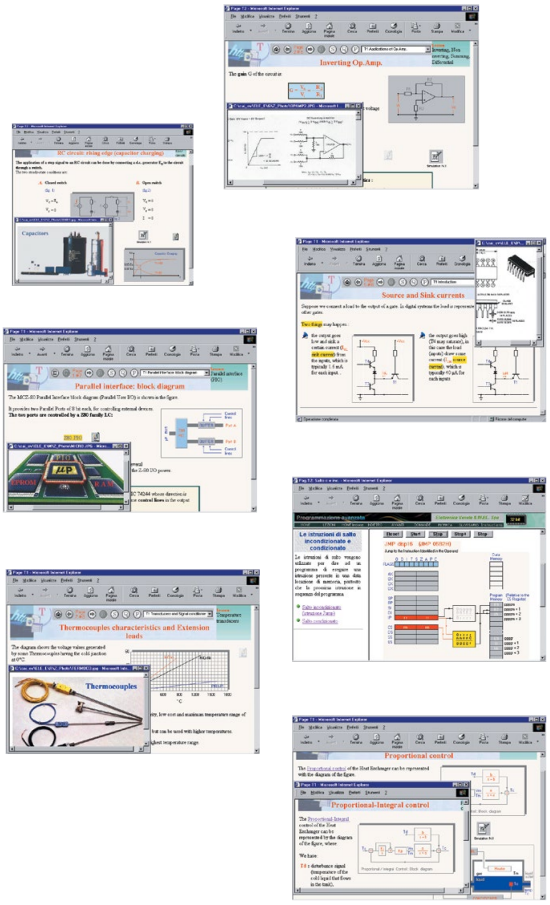

INTRODUCTION

A new way of learning electronics, unique of this kind: computer science technologies combined with traditional educational equipment.

This Multimedia Educational Software forms a complete system for the THEORETICAL/PRATICAL/ EXPERIMENTAL study of general and digital electronics, automatic control systems, microprocessor and telecommunications.

The Multimedia Educational Software for Electronics uses the World Wide Web technology applied to education to make teaching and learning simple as Internet navigation.

Multimedia contents, ipertexts, simulations and animations, questions with immediate control of learning, make this product a unique instrument of its kind for the training in all fields of electronics.

It can be used by the Teacher to explain the lesson, directly with a Personal Computer or by using a Computerised Overhead Projector to explain the video screens and the simulations of the Software to the whole class.

The software is divided into sections which enable the Teacher to:

- Explain the lesson with the theory inserted into the Computer;
- Simulate the physical phenomena or the circuit under test;
- Help with the realisation of practical experiences with experimental verification. The Software can be used by the student for self-learning courses, for checking the learning level and for the experimental exercises.

The following packages are available featuring:

- Basic electricity “E”;
- General electronics “G”;
- Digital electronics “D”;
- Microprocessors “M” and “P”;
- Sensors and transducers “R”;
- Process control “S”.

STRUCTURE OF THE PACKAGES

Each package is composed of a set of lessons divided into 4 main parts:

- THEORY
- SIMULATIONS
- QUESTIONS
- EXPERIMENTS

THEORY: the subject of the lesson is introduced by pointing out the general theoretical grounding, with texts, graphs, drawings and images. The software uses an ipertext method to select different lessons.

SIMULATIONS: the phenomenon or the circuit under test are simulated under different operating conditions. Electronic instruments are used which are simulated on the computer monitor.

QUESTIONS: the computer presents the student some questions and exercises and controls the answers. The learning level is immediately checked, in this way.

EXPERIMENTS: the computer helps the student to carry out the practical laboratory exercises on the experiment modules.

Measurements are suggested with immediate testing of their correctness.

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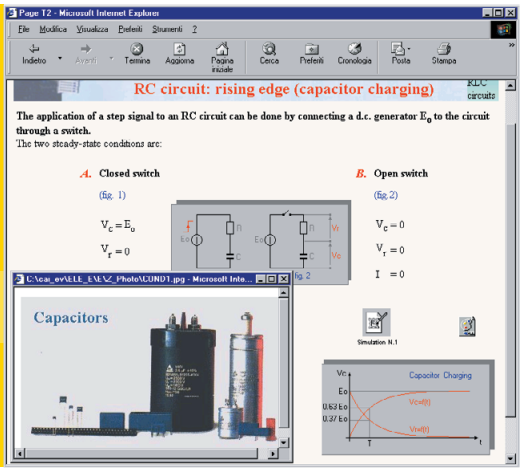

PD

BASE ELECTRICITY
mod. E-WIN/EV

This package of programs provides the User with all the necessary background knowledge concerning the laws and circuits relative to direct and alternating current, which are introductory to the next subjects.
The user needs to know only the principles of Physics and the elementary concepts of mathematics.

First, the electrical variables are introduced, then the fundamental theorems for the solution of DC networks are illustrated.
The study of the capacity and inductance, together with the electrical and magnetic field, allows circuits to be studied in transient conditions. Then, AC electrical units and circuits are studied.

The complete list of lessons is the following:

Direct current
- Electrical variables and Ohm's laws;
- Kirchoff's laws;
- Thevenin's and Norton's theorems;
- Capacitance and inductance;
- Circuits in transitory state.

Alternated current
- Alternated electrical variables;
- Resonant and coupled circuits.

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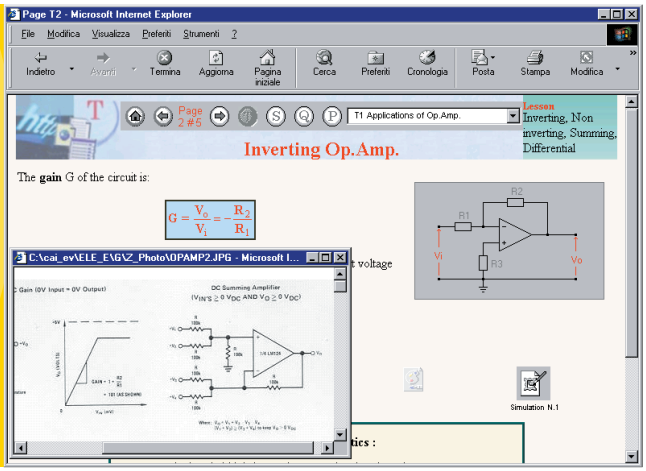

GENERAL ELECTRONICS
mod. G-WIN/EV

This package of programs gives an overview on general electronics from the study of basic devices to their most common applications, to end up with the analysis of the operational amplifiers.

The study of discrete components and of basic circuits is important for a better understanding of complex applications and integrated monolithic circuits. This is why emphasis is given to the characteristics and basic applications of all the main semiconductor devices.

For a better understanding of the subjects treated, the user must know the fundamentals of basic electricity, from the Ohm's law to the main theorems of electrical networks.

The complete list of lessons is the following:

Electronic components
- Diode;
- Zener Diode, varicap;
- UJT, PUT;
- SCR, DIAC, TRIAC;
- Transistors: main concepts;
- Transistor biasing;
- Transistor equivalent circuit;
- Small signals amplifiers (1);
- Small signals amplifiers (2);
- J-FET;
- MOS-FET.

Power supply circuits
- Stabilization;
- Protection.

Amplifiers
- Differential amplifier;
- The reaction: static study;
- The reaction: dynamic study;
- Amplifiers for large signals in class A;
- Amplifiers for large signals in class B.

Oscillators
- Main concepts on oscillators;
- RC, Colpitts, Hartley, Meissner, quartz oscillator;

Switching circuits
- Astable, monostable and bistable multivibrator,
- Schmitt trigger.

Operational amplifiers
- General characteristics and measurement of the parameters;
- Inverter and non-inverter, adder and subtractor;
- Differentiator and integrator;
- Waveform generators;
- Active filters.

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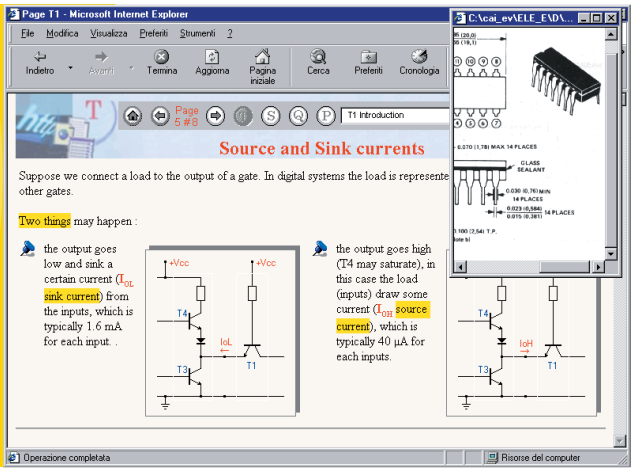

DIGITAL ELECTRONICS
mod. D-WIN/EV

This package of programs deals with all subjects concerning the study of Digital Circuits, starting from the Fundamentals of Logics to Medium Scale Integrated circuits (MSI).

First the fundamentals of logics are dealt with, starting from Boolean Algebra up to the introduction of logic functions and the related problems concerned with minimization.
Then, logic circuits and families are studied, dealing with the fundamental electrical circuits and the performances of the main TTL and CMOS logic families.

Furthermore, combinational logic networks and sequential networks are taken into consideration.
For combinational logic networks, some typical circuits, such as coders and decoders, adders, comparators, etc, are analyzed.
For sequential logic networks, the different types of Flip-Flops and then counters and the shift-registers are analyzed.

At last, several MSI circuits are examined, taking into consideration the same functions used in the previous lessons (comparators, counters, shift registers, multiplexer and demultiplexer) but performed with integrated circuits.

The complete list of lessons is the following:

Fundamentals of Logics
- Boolean Algebra;
- Logic functions;
- Minimization of logic functions.

Logic families
- Logic circuits and logic families;
- TTL logic family;
- CMOS logic family.

Combinational logics
- Fundamentals of combinational logics;
- Combinational circuits I;
- Combinational circuits II;

Sequential logics
- Sequential circuits and Flip-Flop;
- Shift registers;
- Counters.

MSI circuits
- Decoders and comparators;
- Shift register, Multi/Demultiplexer;
- Integrated binary and decade counters;

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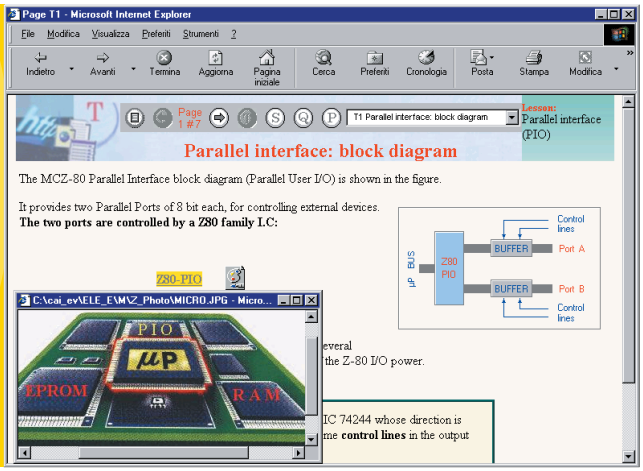


8-BIT MICROPROCESSOR
mod. M-WIN/EV

This package of programs deals with microprocessors.
The user only needs some knowledge of digital electronics, without any specific knowledge about microprocessors. Then, he is guided to understand all aspects related to the study of this component. The complete program is divided into three sections.
The first section starts by analyzing the numerical systems used and, generally, the inner structure of the microprocessor without specific references.
Then, the Microprocessor Z80 and microprocessor system mod. Z1/EV are studied: the last one is used for all the experiments included in the package.
The second package concerns the programming of a microprocessor and, in particular, the Z80. Various types of instructions, with their specific functions will be analyzed through practical examples. The third section concerns the study of Hardware devices present in a microprocessor system (serial, parallel, analog interface) with many application examples.

The complete list of lessons is the following:

8-bit microprocessor

- Microprocessor and microcomputer;
- Numerical systems and arithmetics;
- Inside the microprocessor (part I);
- Inside the microprocessor (part II);
- The microprocessor Z80;
- The module Z1/EV.

Programming

- Introduction to programming;
- Data transfer instructions;
- Arithmetical and logical instructions;
- Jump and call instructions;
- I/O, polling, interrupt and others.

Hardware, Interfaces and Applications

- Decoder, Latch, Buffer, Clock;
- Memory devices;
- Parallel and serial interface;
- Analog interfaces (D/A and A/D);
- Applications: Stepper motor and Encoder.

The program package is integrated by the presence of a simulator for the instructions of the microprocessor Z80. The 150 instructions of the microprocessor have been reduced to 70 (the most important and significant ones) and a simulation has been developed for each of these showing their complete operation.

The main characteristics of this package of lessons are as follows:

- No basic knowledge is required;
- The basic principles of microprocessors and its components are explained in details;
- The microprocessor Z80 and its components are explained in details;
- The general principles of microprocessor programming are explained;
- The Z80 is examined analyzing the most important instructions;
- For each instruction, there is a specific video simulation, together with a set of programs for each group of instructions;
- 30 complete programs have been developed and completely illustrated.

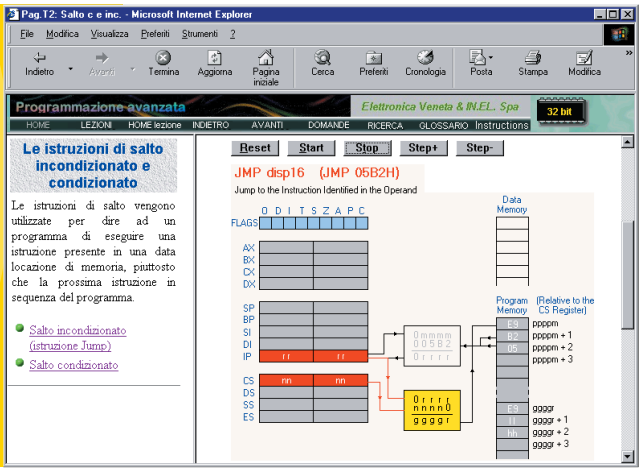
Module mod. Z1/EV is used as support to the experiments.

The module mod. Z1/EV can be connected to the Personal Computer and is supplied complete with the software to:

- Assemble the programs;
- Transfer the programs to the mod. Z1 /EV for direct verification.

This creates a complete system for microprocessor software development.
After the 8-bit microprocessor, microprocessors with more complex structure (32-bit INTEL present in the Personal Computer) can be analyzed.

MULTIMEDIA EDUCATIONAL SOFTWARE



32-BIT MICROPROCESSOR
mod. P-WIN/EV

The complete list of lessons is the following:

- Microcomputer and microprocessors;
- Introduction to programming;
- Machine code programming;
- Programming in Assembler;
- The 32-bit microprocessor 80386;
- The microprocessor 80386EX;
- The 32-bit Microprocessor Trainer mod. Z3/EV;
- Advanced programming;
- Control of the interruptions;
- RAM and EPROM memories and interfacing to microprocessor;
- Parallel and serial interface;
- D/A and A/D conversion.

Module mod. Z3/EV is used as support to the experiments.

The module mod. Z3/EV can be connected to the Personal Computer and is supplied complete with the software to:

- Assemble the programs;
- Transfer the programs to the mod. Z3 /EV for direct verification.

This creates a complete system for microprocessor software development.

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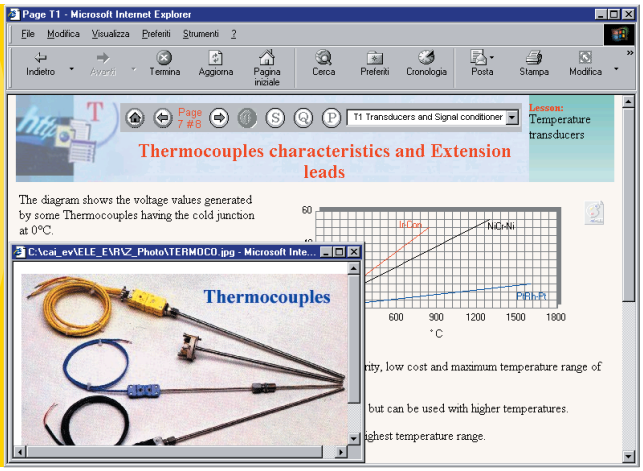
MULTIMEDIA EDUCATIONAL SOFTWARE



SENSORS AND TRANSDUCERS
mod. R-WIN/EV

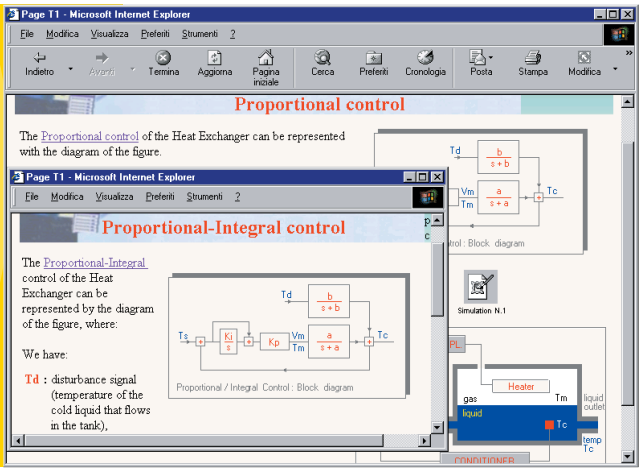
This package of programs for Industrial Electronics, is intended to offer a complete picture of all subjects of the devices and techniques used to transform physical variables into electrical signals. Transducers, in fact, are devices transforming a physical variable (acceleration, speed…) into a different variable, generally of electrical kind (voltage).
The powers involved are very small and the transformation law is mostly linear.

Transducers are used in control systems to measure the controlled physical variable and to produce an electrical signal. Thus, transducers are classified according to the input, which may be: position, speed, acceleration, pressure, temperature, level, flow… The main characteristics of transducers are: linearity, accuracy, stability, sensitivity, response speed, resolution and the range between the minimum and maximum measurable quantities.

The complete list of lessons is the following:

- Temperature transducers;
- Light transducers;
- Angular position transducers (synchro);
- Linear position transducers;
- Pressure transducers;
- Force transducers;
- Angular position transducers (encoder);
- Speed transducers (tacho-generator);
- Acceleration transducers;
- Proximity transducers;
- Flow transducers;
- Level transducers of magnetic kind.

MULTIMEDIA EDUCATIONAL SOFTWARE



PROCESS CONTROL
mod. S-WIN/EV

This section of the program package examines all aspects of Process Control. The fundamental subjects for Industrial Electronics, concerning Transducers and Sensors, are covered in a separate packet. The program is divided into three sections.

The first section deals with power regulation, i.e. it describes the components (SCR and TRIAC) and circuits normally used for driving devices which need high power.
Then, process simulation is analyzed by studying the mathematical techniques used for representing and simulating any type of process. Aspects of process regulation, with particular attention to open-loop and closed-loop are fully described.

The third section describes real physical processes, such as:

- Luminosity control;
- Temperature control;
- Control of a DC motor.

This section illustrates the stepping motor, a device often used in industrial processes.

The complete list of lessons is the following:

Power regulation

- Phase control power regulation;
- Zero-voltage power regulation.

Process simulation

- Control systems;
- Process regulation;
- Description of the process simulator;
- Open-loop control;
- Closed-loop control;
- Non linear processes.

Process Control

- Luminosity control;
- Temperature control;
- D.c. motor speed control (I);
- D.c. motor speed control (II);
- Stepper motor control.

20-B

PD

ELECTRONICS AND SYSTEMS

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20B-E-PD

20-B

INSTRUMENTS FOR PROJECTS' DEVELOPMENT

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TINA Simulation software

Software for Analog, Digital, Symbolic, RF, VHDL, MCU and Mixed Mode Circuit Simulation and PCB Design

TINA is a powerful yet affordable software for analyzing, designing, simulating and real time testing analog, digital, VHDL, MCU, and mixed electronic circuits and their PCB layouts.

It is possible also to analyze RF, communication, optoelectronic circuits, test & debug microcontroller applications.
The simulation software works simultaneously with the hardware unit through an USB connection and this transforms the PC in a powerful multifunction instrument of measurement and control/excitation.

A **"schematic entry"** software is used in order to graphically insert the circuit. Diagram can be enriched adding text and graphical elements such as lines, arks, bows and various forms. Components can be chosen in a wide library containing more than 20,000 manufacturer models. The schematic-editor supports the insertion of hierarchical design.

Circuit analysis instruments with more than 20 analysis modes and 10 different virtual instruments. Results can be presented on the main window of the package, through virtual instruments, where it is possible to modify a circuit also during its functioning, execute simulation, evaluate the functioning and eventually modify again.

Advanced presentation instruments for producing relations and presentation of the diagrams, with notes and formulas required in the symbolical analysis. It is possible using Bode and Nyquist diagrams, poles and zero, transitory answers, digital wave shapes.
It is possible to import **Spice models** to create new component for sub circuits. TINA represents automatically these sub-circuits as rectangular blocks or other shapes that are possible to define with "Schematic Symbol Editor".

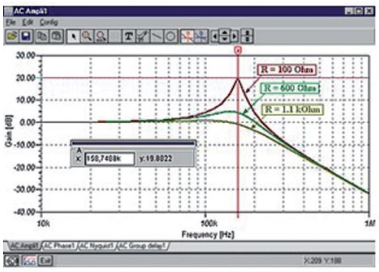
The program includes instruments for analysing the student's knowledge and monitoring the progress and techniques of fault searching.

Virtual Instruments: Oscilloscope, Function generator, Multimeter, Answer analysing with Bode, Net and Spectrum analyser, Logic Analyser, Signal logic generator, Data recorder.

Real Time measurement for simulation software with virtual instruments.

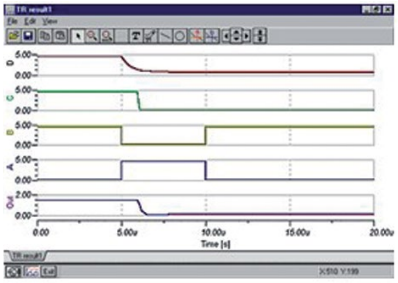
With TINALab II Real Time T&M hardware unit and the virtual instruments, the Teacher can create a powerful, multifucntion teaching instruments. All the instruments such as multimeter, oscilloscope, spectrum analyser, logic analyser, arbitrary function generation or signal generator can be used.

ANALOGUE SIMULATION



DC Analysis calculates the operative point and the characteristic of the non-linear analog circuits transfer.
AC Analysis calculates the voltage, current, impedance and power and the Bode and Nyquist diagrams.
Transient Analysis display the transient answer of analog and digital/analog circuits.

DIGITAL SIMULATION

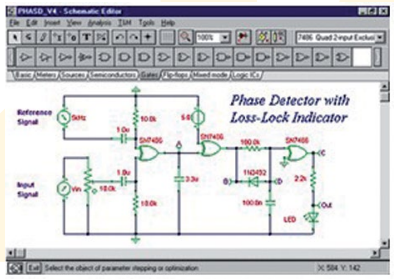


The analysis includes digital circuits and a powerful simulator. The equation of the logical status is solved in each node and the result is displayed.

MIXED SIMULATION

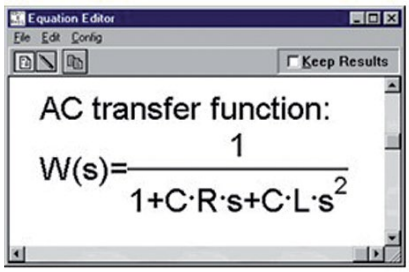
The analysis includes also the circuits composed of analog and digital sections.

DIAGRAM EDITOR



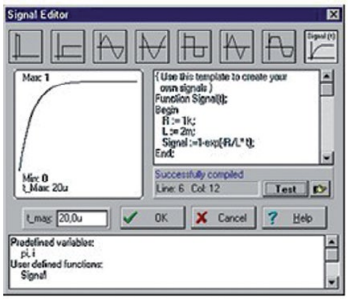
Components are selected from a wide and updating library and then graphically wired for the assembly of every kind of circuit.

EQUATION EDITOR



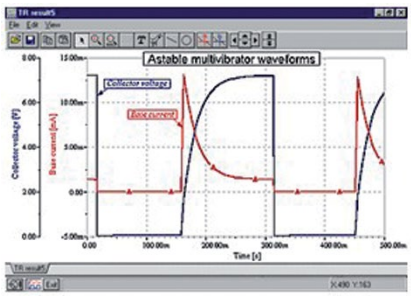
The program includes a text and equation editor in order to integrate the theoretical notes, calculations, input/output graphics and measurement results.

EXCITATION SIGNAL EDITOR



It is possible to define arbitrary wave shapes for analog and digital circuits. It is possible to use all arithmetic standard functions and define variables procedures. Digital wave shapes can be created as a sequence of time and logic associated level. Once defined, the excitation signal can be displayed, verified and saved.

PROGRAM EDITOR

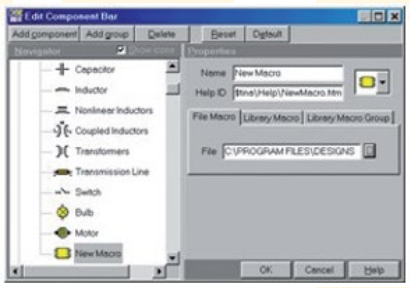


It is possible to create Bode and Nyquist diagram presentations, transient answers, wave shapes answers to transient and other data using linear or logarithm scale.
Personalised presentation can be printed directly, trimmed and inserted in external documents of presentation.

SUB CIRCUITS

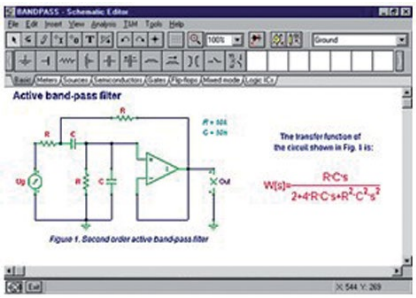
The diagrams can be simplified concentrating parts of the circuit in sub-circuits. Automatically the program represents these sub-circuits like a rectangular block on the main scheme. They can be created from Spice elements, such as new ones or supplied from the manufacturer through a CD.

COMPONENTS EDITOR



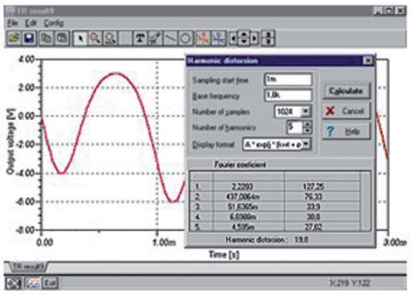
Groups of tailor-made components can be added and associated into homogeneous families.

SYMBOLIC ANALYSIS



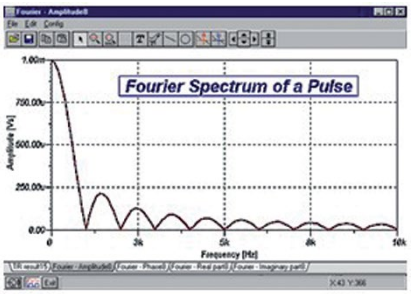
The symbolic analysis produces the nearest form to the transfer function, to the resistance or equivalent impedance and to the analog linear net. Linear circuit's poles and zeros can be calculated and displayed in diagrams.

FOURIER ANALYSIS



Beside the calculation and display of the answer in time, it is possible to calculate Fourier series coefficients and harmonic distortion of periodical signals using the Fast Fourier Transform.

SPECTRUM WITH FOURIER ANALYSIS



Fourier series are presented both in exponential and trigonometrical form.

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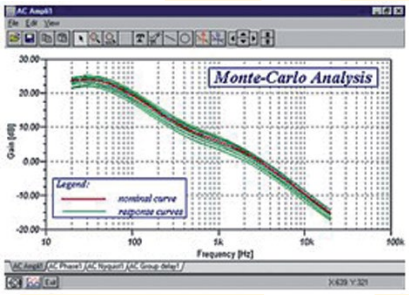
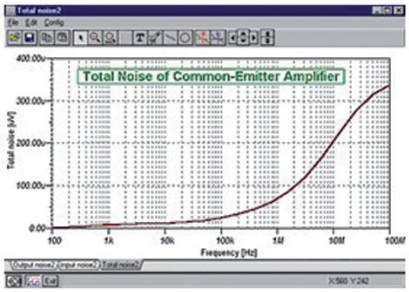
TOLERANCE ANALYSIS



It is possible to assign the circuit components tolerance in order to calculate the analysis on the worst-case situation. The result can be elaborated also statistically using the expected average, standard deviation…

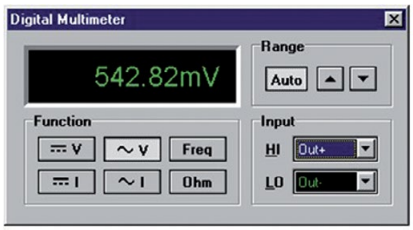
NOISE ANALYSIS



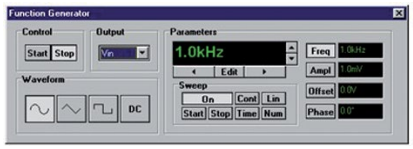
Determination of the circuit noise spectrum referred to the input and output.
Power and signal/disturb relation can be calculated.

VIRTUAL INSTRUMENTS

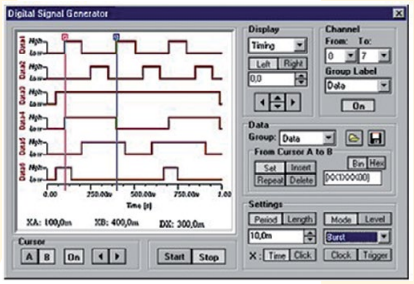
DIGITAL MULTIMETER



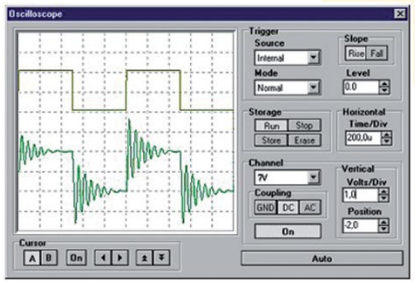
FUNCTION GENERATOR



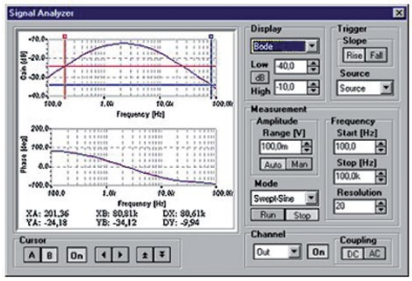
Digital signal generator



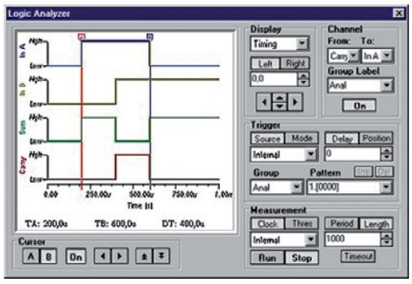
OSCILLOSCOPE WITH MEMORY



SIGNAL ANALYSER



LOGIC ANALYSER

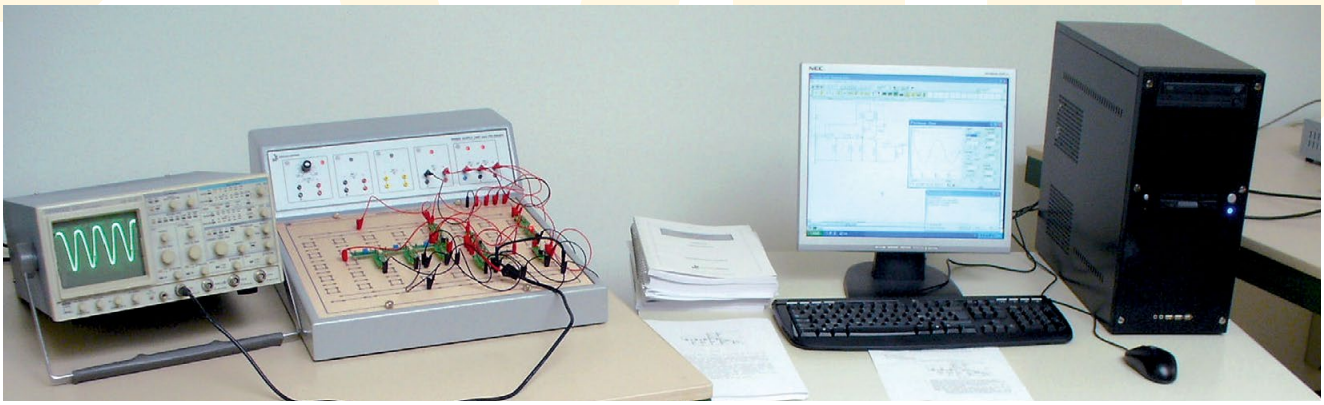


OPTIONAL

INTEGRATED PCB DESIGN

Multilayer PCB's with split power plane layers, powerful autoplacement & autorouting, rip-up and reroute, manual and "follow-me" trace placement, pin and gate swapping, keep-in and keep-out areas, 3D view of your PCB design, Gerber file output, Flexible PCB layout and much more.

IN ORDER TO COMPLETE THE FUNCTIONALITY AND USE OF THE SOFTWARE FOR DESIGN AND SIMULATION (CAD/CAE SOFTWARE), THE MODULES C20/EV, C30/EV AND E18/EV ARE OFFERED AS TOOLS FOR THE EXPERIMENTAL VERIFICATION OF THE DESIGNED CIRCUITS, PREVIOUSLY SIMULATED WITH THE SOFTWARE.



The development modules permits to quickly carry out some experimental circuits to check the functionality of a new design and to crosscheck the simulation result with a real bench testing of the designed circuits).

The proposed modules consist of a kit of active, passive and IC electronics components with a patching board, allowing a wide range of circuits, both analog and digital, assembly.

The practical handbooks included with the modules offer a wide collection of electrical circuits according to the educational contents with progressive increasing difficulties.

In order to optimise, from an educational point of view, the theoretical comprehension of the topics and the practical feedback on the realisation and analysis of the circuit functioning, with the use of the handbooks the following approach is allowed:

1. Theoretical analysis of the circuit with the main functioning equations;
2. Circuit capture and simulation with a CAD/CAE program;
3. Circuit realisation with module C20/EV or C30/EV;
4. Electrical quantities measurement on the real circuit;
5. Comparison between electrical quantities of the circuits and of the data from simulator.

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MODULE FOR PROJECTS CONSTRUCTION

Mod. C20/EV

The experiment module mod. C20/EV is the perfect tool for constructing the exercises included in the Laboratory of General Electronics. It allows a wide range of experiments which topics are divided into three main parts:

- Basic electricity;
- Electronic circuits and devices;
- Linear microelectronics.

The exercises relative to the program of Basic Electricity enable students to acquire general knowledge of electricity and AC/DC circuits, and on the use of the electrical instrumentation. While those related to the program for Electronic Circuits and Devices include the detection of the semiconductor components characteristics and their use in the basic electronic circuits.
The development of the Linear Microelectronics program enables the student to learn the operations and applications typical of linear integrated circuits. This subject includes Operational Amplifiers and their different connections, the voltage regulators, the timers and the integrated audio amplifiers.

EXPERIMENT MODULE mod. C20/EV
The system consists in patching board and a wide range of components welded on terminal boards with standard D. 2mm pins for a proper insertion into the board. In this way, it is possible to assemble any kind of circuit by inserting the selected components. The power supplies and connections between components are carried out via cables.

TRAINING PROGRAM

Basic electricity:
- Electricity, measurement units and symbols;
- DC electrical supplies, switches and relays;
- Use of power supplies and measurement instruments;
- Ohm's law;
- Series and parallel resistive circuits, voltage dividers, attenuators;
- Kirchoff's laws;
- Superimposition theorem;
- Thevenin's and Norton's theorem;
- DC power;
- Power transfer;
- Capacitance and capacitors;
- Inductance and inductors;
- Alternating signals: waveform, mean value, root mean square (rms) value, period and frequency;
- Use of function generator and oscilloscope;
- AC resistive, inductive, capacitive circuits;
- Active and reactive power;
- Transformers;
- Series and parallel resonance.

Electronics circuits and devices:

- Introduction to semiconductors;
- PN junction, diode;
- Half-wave, full-wave, Graetz bridge rectifiers;
- Smoothing and filtering circuits;
- Clipping circuits, voltage doublers, clamping circuits;
- Zener and Varicap diodes;
- Optoelectronic components;
- NTC and PTC thermistors;
- NPN and PNP transistors;
- J-FET, MOS-FET, UJT, PUT, DIAC, SCR, TRIAC;
- Transistor connections: common emitter, common collector, common base;
- Bias stabilization;
- Small signal parameters;
- Dual load amplifier;
- Multistage amplifier: RC, transformer, direct coupling;
- Differential amplifier;
- Darlington, Cascode, Bootstrap circuit;
- Class A and class B amplifiers;
- Push-pull, complementary symmetry, single-ended configuration;
- Oscillators: RC, Wien bridge, Colpitts, Hartley, Meissner, quartz;
- Monostable, bistable, astable, Schmitt trigger multivibrators.

Linear microelectronics:

- Integrated operational amplifier: typical parameters
- Applications of the operational amplifier: inverting and non-inverting, summing, subtractor, integrator, differentiator, comparator, logarithmic;
- Monostable and astable multivibrator;
- Voltage-frequency converter;
- Sine, rectangular, triangular, ramp wave-form generator;
- Low pass, high pass, band pass active filter;
- Monolithic voltage regulators; output stabilization at variations of the load and the power supply;
- Integrated timer: characteristics and applications;
- Audio power amplifier: typical parameters.

TECHNICAL SPECIFICATIONS:

- Various types of connector jacks for quick assembly of the circuits;
- Panel with silk-screen printing of the connections between terminals;
- Components mounted on support with metal terminals and silk- screen printing of the component.

Board dimensions: 386 x 248 x 50 mm

ACCESSORIES:

- Set of 140 components (resistors, capacitors, inductances, potentiometers, transformers, diodes, transistors, integrated circuits, etc.) necessary to the development of all exercises suggested in the handbook;
- Case for the components;
- Set of connector cables.

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A
+5 Vdc / 2A
24 Vac

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE
- FUNCTION GENERATOR

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE EXERCISES.
INSTALLATION, USE AND MAINTENANCE HANDBOOK. (*)

(*) The manuals included with the modules offer a wide collection of electrical diagrams of the various circuits ranked according to the content of progressive increasing difficulty.
In order to optimise, from an educational point of view, the theoretical comprehension of the topics and the practical feedback on the realisation and analysis of the circuit functioning, the following approach to the matters is carried out:

1. *Theoretical analysis of the circuit with the main functioning equations;*
2. *Circuit simulation with a simulation program;*
3. *Circuit realisation with module C20/EV or C30/EV;*
4. *Electrical quantities measurement on the real circuit;*
5. *Comparison between electrical quantities of the circuits and of the simulator.*

DEVELOPMENT MODULE
Mod. C30/EV

The development module mod. C30/EV permits to carry out and check a wide range of linear and digital electronic circuits; it also enables the ready handiness for cabling and testing the circuits.

DEVELOPMENT MODULE mod. C30/EV

The module is developed into many parts, each of which carries out a specific function. Particularly, the following blocks are present:

- VOLTAGE: enabling the connection of the module to the necessary voltages coming from an external power supply (STANDARD version) or generated internally (STAND ALONE version);
- FUNCTION GENERATOR: it is a function generator with variable frequency and sine, triangle, square, pulse waveform; all these signals can be obtained simultaneously. The amplitude and the DC component of the signal can be adjusted separately for each output waveform;
- TTL GENERATOR: it is a generator with output voltage at TTL level and frequency ranging between 1 Hz and 1 MHz;
- LOGIC INPUTS: they consist in a set of 8 lever switches and 2 pushbuttons;
- HEXADECIMAL KEYBOARD: the unit consists in a 16-key keyboard and 4 terminals from which the signals corresponding to the key pressed can be taken, and 4 leds which hexadecimal decoding identifies which key has been pressed;
- ANALOG INPUTS: consisting in 4 potentiometers of different value with three terminals available: thus they can be used with circuits via the breadboards;
- DISPLAY: it consists in a 4-digit display. The coding for each digit of the display is in BCD logic and each digit has four terminals available to introduce the value to be displayed;
- LOGIC INDICATORS: they consist of leds accessed via terminals. The logical levels are TTL and if the logical level is high, the corresponding led turns on;
- BREADBOARD: 4 breadboards are inserted into the module which permit to insert the electronic components to carry out the different circuits. The BREADBOARDs can be extracted from the module to preserve the carried out circuit.

TRAINING PROGRAM:

- Half- and full-wave rectifiers;
- Regulated power supplies with discrete components and integrated circuits;
- Amplifiers: differential, wide-band, selective, in class C, with complementary symmetry;
- Meissner, Hartley and Colpitts oscillators;
- Astable, monostable and bistable multivibrators and Schmitt trigger;
- Voltage regulators with UJT, SCR, DIAC and TRIAC;
- Circuits with operational amplifiers;
- Multivibrators, oscillators, active filters by means of operationals;
- Waveform generators;
- OR-AND-NOR-NAND-NOT ports with discrete components, integrated circuits and combinatory logic networks;
- Sequential logic networks with flip-flop RS, D, JK, JK Master Slave and Latch;
- 4-bit shift registers;
- Binary and decade counters;
- Decoder and driver for 7-segment display or multiplexer and demultiplexer.

TECHNICAL SPECIFICATIONS:

- Mounting plate which can be inserted or extracted via breadboards with 2200 connection points;
- Function generator with:
  - waveform: sine, square, triangle, pulse with independent outputs which can also be used contemporarily
  - frequency: 0.1 Hz-100 KHz
  - amplitude: ranging between 0 and 16 Vpp (for the pulse output variable between 0 and 8 V)
  - offset: variable between ± 8 V
  - amplitude and offset with separate control
  - pulse duration: adjustable independently from frequency
- TTL generator: 1 Hz ÷ 1 MHz;
- Hexadecimal keyboard;
- 4-Digit display with BCD coding;
- 8 Switches and 2 pushbuttons with antibounce circuit;
- 8 Led diodes with driver;
- 1 Loudspeaker: 8 Ohm, 0.5 W;
- 4 Potentiometers: 2 KOhm, 5 KOhm, 10 KOhm and 100 Kohm.

Dimensions: 386 x 372 x 40 mm

ACCESSORIES:

- Set of 240 components including: resistors, capacitors, trimmers, diodes, transistors, SCR, Triac, integrated circuits, leds, display, etc.

REQUIRED

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

POWER SUPPLY
±12 Vdc / 0.5A
+5 Vdc / 2A
24 Vac

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

OPTIONAL

STAND ALONE VERSION
(REPLACES THE PS1-PSU/EV POWER SUPPLY UNIT)

The module is fixed to the module holder box containing the power supply with the following output voltages:

- +5 Vdc / 2A, ±12 Vdc / 1A, +30 Vdc / 4A, 24 Vac / 4A;
- 1 3-digit digital voltmeter with bias indication and possibility to measure DC and AC voltages;
- mains power voltage, 220 V / 50Hz;

SUPPLIED WITH

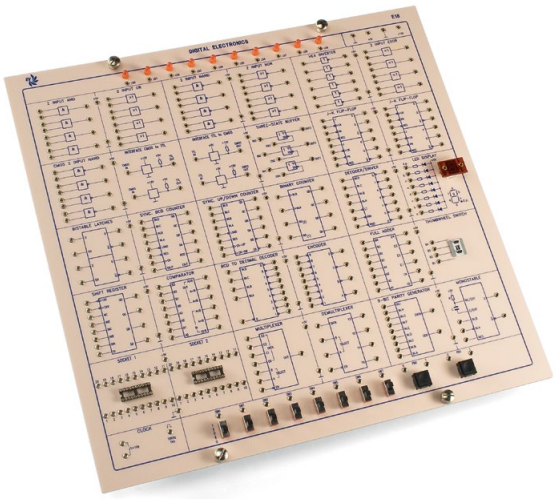
THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE EXERCISES.
INSTALLATION, USE AND MAINTENANCE HANDBOOK. (*)

(*) The manuals included with the modules offer a wide collection of electrical diagrams of the various circuits ranked according to the content of progressive increasing difficulty.
In order to optimise, from an educational point of view, the theoretical comprehension of the topics and the practical feedback on the realisation and analysis of the circuit functioning, the following approach to the matters is carried out:

1. *Theoretical analysis of the circuit with the main functioning equations;*
2. *Circuit simulation with a simulation program;*
3. *Circuit realisation with module C30/EV;*
4. *Electrical quantities measurement on the real circuit;*
5. *Comparison between electrical quantities of the circuits and of the simulator.*

MODULE FOR ANALYSIS AND REALISATION OF EXPERIMENTS OF DIGITAL ELECTRONICS

Mod. E18/EV



The module enables the analysis and realization of a wide range of digital electronic circuits. The necessary components are already present in the module and are mounted so that the experiments are very easy, especially as concerns the more complex logical circuits.

MODULE FOR THE ANALYSIS AND REALIZATION OF EXPERIMENTS OF DIGITAL ELECTRONICS mod. E18/EV

The connections between the terminals of the logical devices, connected directly to those of assembled integrated circuits, are carried out via electrical cables. The logical diagram, the functions related to the terminals (Pin-Out) and other indications, which can be useful during the exercise, are silk screen printed in correspondence of each integrated circuit.

TRAINING PROGRAM:

- AND, OR, NAND, NOR, XOR logic ports with two inputs;
- INVERTER;
- TTL and CMOS logic families;
- TTL-CMOS and CMOS-TTL interface;
- Three-state buffer;
- Flip-flop;
- Latch;
- BCD, binary, forward/reverse counters;
- Shift registers;
- 4-bit comparators;
- 4-bit complete adder;
- Multiplexer and demultiplexer;
- Monostable;
- 9-bit parity generator;
- BCD-decimal decoder;
- BCD/7-segment decoder/driver and 7-segment led display;
- Decimal-BCD coder;
- BCD selector.

TECHNICAL SPECIFICATIONS:

- Front panel with silk screen printed diagram of the blocks composing the module and the terminals for the access to the input and output points of the circuits;
- Electronic protection in case of application of wrong voltage which can damage the module; the protection automatically disconnects when the proper voltages are restored;
- Presence of 10 leds with related access terminals to display the logic level present across the input/output points;
- Presence of 10 switches with related terminals to take the wished logic level to be used as input for the different circuits;
- 2 Pushbuttons to take positive as well as negative pulses to be applied as inputs to the different circuits;
- Presence of two 20-pin bases, each to insert and analyze other integrated circuits which are not present on the module;
- In-built clock generator with output frequency selectable between two values (1 Hz and 10 KHz).

Dimensions: 386 x 372 x 40 mm

REQUIRED

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

POWER SUPPLY
+5 Vdc / 2A
+12 Vdc / 0.5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE EXERCISES.
INSTALLATION, USE AND MAINTENANCE HANDBOOK. (*)

(*) The manuals included with the modules offer a wide collection of electrical diagrams of the various circuits ranked according to the content of progressive increasing difficulty.
In order to optimise, from an educational point of view, the theoretical comprehension of the topics and the practical feedback on the realisation and analysis of the circuit functioning, the following approach to the matters is carried out:

1. *Theoretical analysis of the circuit with the main functioning equations;*
2. *Circuit simulation with a simulation program;*
3. *Circuit realisation with module E18/EV;*
4. *Electrical quantities measurement on the real circuit;*
5. *Comparison between electrical quantities of the circuits and of the simulator.*

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DEVELOPMENT MODULE
Mod. C30-1/EV

The development module mod. C30-1/EV allows to carry out and check a wide range of linear and digital electronic circuits; it is perfectly suitable for practical hands-on cabling and circuit testing.

The module is divided in several parts, each of which carries out a specific function. Particularly, the following blocks are present:

- **VOLTAGE:** enables the module connection to the necessary voltages from an external power supply (STANDARD version) or an internal power supply (STAND-ALONE version);
- **FUNCTION GENERATOR:** the following waveforms are available: pulse, sine, triangle square over 3 outputs: one for pulse (adjustable amplitude and pulse width), the second for sine/triangle and square (adjustable amplitude and DC offset) and the third for TTL. For all the 3 outputs, the frequency range is 0.1 to 100 kHz. There are 6 steps: 0,1 Hz, 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz; with a fine frequency control that extends the ranges.
- **TTL GENERATOR:** a TTL level voltage generator output; frequency range: 1 Hz to 100 kHz.
- **LOGIC INPUTS:** a set of 8 lever switches and 2 pushbuttons;
- **HEXADECIMAL KEYBOARD:** a 16-key keyboard and 4 terminals from which the signals can be taken and 4+1 LEDS with hexadecimal decoding that identifies the key that has been pressed. It includes a 16 key encoder IC;
- **ANALOG INPUTS:** 4 potentiometers of different values with 3 available terminals. The terminals can be used in the breadboards;
- **DISPLAY:** a 4-digit display. The coding of each digit is in BCD and each digit has four available terminals.
- **LOGIC INDICATORS:** 10 LEDS available to be connected. The logical levels are TTL.
- **THUMBWHEEL SWITCHES:** 4 Decimal BCD switches (0000 – 9999)
- **LOUDSPEAKER:** 8 Ohm, 0,5 W
- **BREADBOARD:** 4 breadboards, 2200 total connection points to carry out the different circuits. The breadboards can be extracted from the module to preserve the developed circuit.

TRAINING PROGRAM:

- Half and full-wave rectifiers
- Regulated power supplies with discrete components and integrated circuits
- Amplifiers: differential, wide-band, selective, in class C, with complementary symmetry
- Meissner, Hartley and Colpitts oscillators
- Astable, monostable and bistable multivibrators and Schmitt trigger
- Voltage regulators with UJT, SCR, DIAC and TRIAC
- Circuits with operational amplifiers
- Multivibrators, oscillators, active filters by means of operationals
- Waveform generators
- OR-AND-NOR-NAND-NOT ports with discrete components, integrated circuits and combinatory logic networks
- Sequential logic networks with flip-flop RS, D, JK, JK Master Slave and Latch
- 4-bit shift registers
- Binary and decade counters
- Decoder and driver for 7-segment display or multiplexer and demultiplexer

TECHNICAL SPECIFICATIONS:

- Mounting plate which can be inserted or extracted via breadboards with 2200 connection points;
- Function generator with:
  - Waveform output: Pulse with Width and Amplitude adjustment
  - Waveform output: Sine /square / triangle with Offset and Amplitude adjustment
  - Waveform output: TTL signal
  - Common waveforms frequency: 0.1 Hz-100 KHz in 6 ranges: 0,1 Hz, 1 Hz, 10 Hz, 100 Hz, 1 kHz,10 kHz
  - Amplitude: ranging between 0 and 20 Vpp (for the pulse output variable between 0 and 12V)
  - Offset: variable between ± 10 V
  - Amplitude and offset of Sine /square / triangle waveforms with separate control
  - Pulse duration: adjustable independently from frequency
- Hexadecimal keyboard including a 16 key encoder
- 4-Digit display with BCD coding
- 8 Switches and 2 pushbuttons with antibounce circuit
- 10 Led diodes with driver
- 1 Loudspeaker: 8 Ohm, 0.5 W
- 4 Potentiometers: 2 KOhm, 5 KOhm, 10 KOhm and 100 KOhm
- 4 Decimal BCD switches (0000 – 9999) Thumbwheel switches
- 6 Led indicators for power supply

Dimensions: 386 x 248 x 40 mm

To facilitate the assembly of the branches of electrical circuits the potentiometers, power supplies, loudspeaker, function generator, display, hexadecimal keyboard, thumbwheel switches, logic indicators, switches and pushbuttons can be connected to the bread boards through a double female socket connector. The power supplies, potentiometers and switches can also be connected through a Ø 2mm female socket connector.

ACCESSORIES:

Set of 240 components including: resistors, capacitors, trimmers, diodes, transistors, SCR, Triac, integrated circuits, LEDs, display, etc.

REQUIRED

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

INSTRUMENTS - NOT INCLUDED -
- MULTIMETER
- OSCILLOSCOPE

OPTIONAL

STAND ALONE VERSION
(REPLACES THE PS1-PSU/EV POWER SUPPLY UNIT)

The module is fixed to the module holder box containing the power supply with the following output voltages:

- 1,3÷24 Vdc / 1A, ±12 Vdc / 1 A, +5 Vdc / 2 A, 2 x 24 Vac / 0,5A.
- 1 3-digit digital voltmeter with bias indication and possibility to measure DC and AC voltages;
- mains power voltage, 220 V / 50Hz;

SUPPLIED WITH

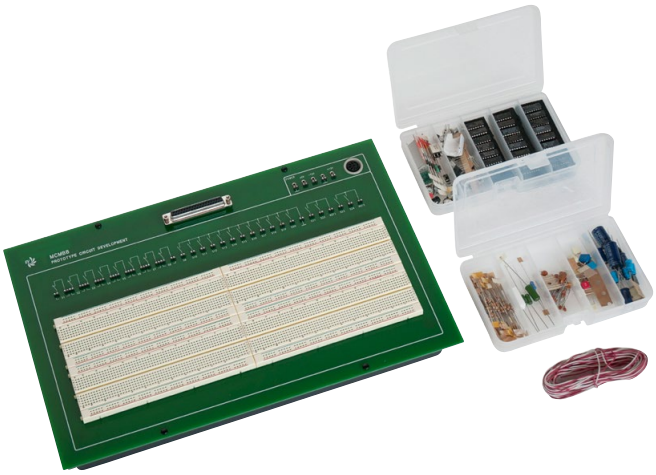
THEORETICAL-APPLICATION HANDBOOK OF THE MODULE WITH GUIDE TO THE EXERCISES
INSTALLATION, USE AND MAINTENANCE HANDBOOK (*)

(*) The manuals included with the modules offer a wide collection of electrical diagrams of the various circuits ranked according to the content of progressive increasing difficulty.
In order to optimise, from an educational point of view, the theoretical comprehension of the topics and the practical feedback on the realisation and analysis of the circuit functioning, the following approach to the matters is carried out:

1. *Theoretical analysis of the circuit with the main functioning equations;*
2. *Circuit simulation with a simulation program;*
3. *Circuit realisation with module C30-1/EV;*
4. *Electrical quantities measurement on the real circuit;*
5. *Comparison between electrical quantities of the circuits and of the simulator.*

PROTOTYPE CIRCUIT DEVELOPMENT

Mod. MCMBB/EV



Mod. MCMBB/EV is one of the experiment modules in the Interactive Practical Electronics System – I.P.E.S..
It enable to assembly a wide number of circuits using 4 Bread-Board as support and a variety of components.

MODULE MOD. MCMBB/EV

This module allows the lecturer or the users to build prototype circuits or sections of circuits, starting with familiar topics and progressing on to new ones.

The circuits are assembled directly in the breadboards according to the specific requirements, as well as the connections relating to the variations of the circuit or the insertion of faults.
We supply the manuals containing electrical diagrams of various circuits already tested and to be directly assembled. All the exercises are introduced from a theoretical section which enables to verify the characteristics and the values of the electrical measurement quantities on functioning circuits.

Using the EDUCATIONAL AUTHOR SOFTWARE EL.VE. SOFTWARE, lessons can be created made up of a theoretical and an experimental part involving variations of the circuit and the insertion of faults.

GENERAL FEATURES:

- Printed circuit with protective treatment;
- 4 breadboards for creating prototypes and circuits;
- Set of electronic components;
- Set of 140 components (resistance, condenser, inductance, potentiometer, transformers, diode, transistor, integrated circuits, etc..) necessary for the development of all the suggested exercises on the manual;
- Case containing the components;
- Set of connecting cables.

Dimensions: 386 x 248 x 50 mm

TRAINING PROGRAM:

- One/double-semiwave rectifiers;
- Stabilised power supply at discrete component and integrated circuits;
- Amplifiers: differentials, at large band, selective, in C class, at complimentary symmetry;
- Meissner, Hartley and Colpitts oscillator;
- A-stable, monostable e bistable multivibrator;
- Currency regulators with UJT, SCR, DIAC and TRIAC;
- Operational amplifiers circuits;
- Multivibrators, oscillators, active and operational filters;
- Wave-shapes generators;
- OR-AND-NOR-NAND-NOT ports at discrete components, integrated circuits and logic combinatory nets;
- Sequential logic net with flip-flop RS, D, JK, JK Master-Slave and Latch;
- 4 bit sliding registers;
- Binary and decade counters;
- Decoders and drivers for display at 7 segments or multiplexer and demultiplexer.

REQUIRED

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

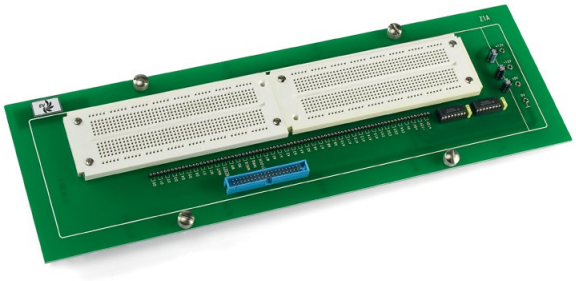
POWER SUPPLY
±12 Vdc – 0.5A
1.3÷24 Vdc – 0÷2A Var

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL MANUALS OF THE MODULE WITH GUIDE TO THE EXERCISES.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

EXPANSION BOARD FOR Z1/EV MICROPROCESSOR SYSTEM

Mod. Z1A/EV



PROTOTYPE REELING UNIT mod. Z1A/EV

This unit enable to develop easily, through the integrated Breadboard, some specific application, of particular interest for the user, related to Z80 microprocessor (Module mod. Z1/EV). It is directly connectable to the expansion Bus of the module mod. Z1/EV and presents also an addresses' circuit decoder section in order to simplify their use.

TRAINING PROGRAM:

- Data, addresses and control signal Bus;
- Devices interface;
- 8 bit system programming microprocessor study.

TECHNICAL SPECIFICATIONS:

- 2 Breadboards;
- Data and addresses buffer.

Dimensions: 386 x 123 x 40 mm

REQUIRED

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

POWER SUPPLY
+5 Vdc / 1A
±12 Vdc / -0,5A

MODULE HOLDER BOX - BOX/EV
- NOT INCLUDED -

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL MANUALS OF THE MODULE WITH GUIDE TO THE EXERCISES.
INSTALLATION, USE AND MAINTENANCE HANDBOOK.

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TRAINER FOR DIGITAL LABORATORY

Mod. IDL-800A

The development module mod. IDL-800A allows to carry out and check a wide range of electronic circuits.
It also enables the quick cabling and testing of the circuits. A signal generator unit and a digital multimeter is provided too.

The module includes a set of components to carry out and check a wide range of digital electronic circuits.

The following blocks are integrated into the trainer:

BREADBOARD
Nickel plated contacts with a total of 1896 tie points, fitting all DIP sizes and components with lead and solid wire AWG#22-30. It can be changed and replaced for different purpose and can be connected with demonstration panel.

DC POWER SUPPLY
Variable DC Power:
- Positive Output Voltage 0 ÷ +15V
- Negative Output Voltage 0 ÷ -15V
- Maximum Output Current 300mA
- Line Regulation <0.05%/V (at 25°C)
- Load Regulation <30mV

Fixed Power Supply:
- Positive Output Voltage 5V ±0.25V;
- Maximum Output Current 1 Amp;
- Line Regulation <50mV;
- Load Regulation <100mV;
- Negative Output Voltage -5 ±0.25V;
- Maximum Output Current 100mA;
- Line Regulation <25mV;
- Load Regulation <30mV;

All DC Power Supplies Equipped with Short Circuit Protection.

FUNCTION GENERATOR
Frequency Ranges:
- 1Hz ÷ 10Hz
- 10Hz ÷ 100Hz
- 100Hz ÷ 1KHz
- 1KHz ÷ 10KHz
- 10KHz ÷ 100KHz

- Sine Wave Output: 0 to 8 Vp-p Variable
- Triangle Wave Output: 6Vp-p Fixed
- Square Wave Output: 8 Vp-p Fixed

DIGITAL VOLTMETER (DVM)
- 3-1/2 Digits LED Display;
- 4 Ranges:
- 0-199.9V Full Scale;
- 0-19.99V Full Scale;
- 0-1.999V Full Scale;
- 0-199.9mV Full Scale.

Input Impedance: 10 Meg ohm for any Range

TWO DIGITS OF 7 SEGMENT LED DISPLAY
Common Cathode Operation

FOUR POINT TIP/BANANA SOCKET/BNC SOCKET EXCHANGE ADAPTERS

EIGHT BUFFERED LED DISPLAYS

EIGHT DATA SWITCHES

TWO FUNCTION SWITCHES

TWO PULSE SWITCHES

Set of components to carry out digital circuits:
flip-flops, AND-NAND-OR-NOR-NOT gates, shift registers, counters, coders and decoders, 7-segment display, comparators, multiplexers, demultiplexers…

Dimensions: 480 x 360 x 200 mm
Weight: 4.2 kg

POWER SUPPLY UNIT
Mod. PS1-PSU/EV

The power supply unit consists in a container that creates an ergonomic unit with the module holder box. On the silk screen front plate, there are the terminals and the LEDs for taking and display the output voltages. These are available on DIN connectors set on the rear side of the power supply. The power supply unit is universal, as it is proper to power all kinds of modules produced by Elettronica Veneta S.p.A..

The supplied voltages are:

- **Output S1:** +30 Vdc – 4A. Rectified, filtered voltage protected with fuse. Voltage indicator LED.
- **Output S2:** 24 Vac – 4A. Protection with fuse. Voltage indicator LED.
- **Output S3:** +5 Vdc – 2A
- **Output S4:** +12 Vdc – 2A, -12 Vdc – 1A. Stabilized voltages, electronically protected against short-circuits and overloads. Voltage indicator LEDs.
- **Output S5:** 1.3 Vdc – 24 Vdc, 1A. Stabilized voltage, electronically protected against short-circuits and overloads. Voltage indicator LED.
- **Output on DIN connector:** 24 Vac – 0 – 24 Vac, 0.5A. Voltage protected with fuse.

(The outputs S1 and S2 provide 4A singularly and 2A if used simultaneously)

Power supply:	230 Vac 50 Hz single-phase - 200 VA (Other voltage and frequency on request)
Dimensions:	415 x 185 x 195 mm
Weight:	8 kg

MODULE HOLDER BOX
Mod. BOX/EV

Support for housing the experiment modules. The modules can be fixed to the frame by using a “Plug-in” system.

Dimensions:	415 x 400 x 110 mm
Weight:	3 kg

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COMPACT POWER SUPPLY

Mod. PS3-C/EV

It provides the DC voltage necessary to power the experiment modules.
It consists in a container that creates a compact and ergonomic unit with the educational modules of the I.P.E.S. series.
It uses a proprietary cable for interconnection to the experiment boards of the I.P.E.S. series. The use of a cable with proprietary connector avoids faults created by a wrong connection.
The power supply unit is fully compliance with more modules produced by Elettronica Veneta S.p.A. that require the following voltage values: +5Vdc and ±12Vdc.

TECHNICAL SPECIFICATIONS:

- Universal AC input: from 90 to 264 Vac
- Protections:
  Short circuit / Overload / Over voltage/Over Temp
- Fully enclosed plastic case
- LED indicator for power on
- Supplied Voltage

OUTPUT 1: +12 Vdc, 0.8A
Stabilised voltage, protected from short circuits and overloads.

OUTPUT 2: -12 Vdc, 0.3A
Stabilised voltage, protected from short circuits and overloads.

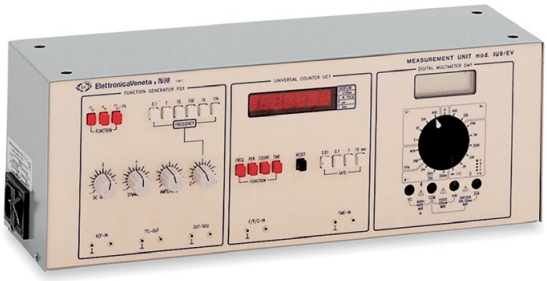
OUTPUT 3: +5 Vdc, 2.5A

- Available power: 25W (max)
- Standard output cable: 150cm of AWM 2464 Standard output plug: fully compliance with the I.P.E.S. series modules
- Power cord: included

Dimensions: 108 x 67 x 36 mm

INSTRUMENTS UNIT

Mod. IU9/EV



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The instrument unit mod. IU9/EV includes a function generator, a multimeter and a frequency meter.

The unit is usually placed over the power supply, so to make easy connections over the module.

TECHNICAL CHARACTERISTICS:

Function generator

- Wave-form: sine, triangle, square
- Frequency: variable from 0.1 Hz to 100 kHz
- Amplitude: variable from 0 to 16 Vpp
- Offset: ±10 Vdc
- Output impedance: 50 Ohm.

Frequencymeter

- Functions: frequency, period, time, pulse counter
- Range: from 10 Hz to 10 MHz
- Input impedance: 1 Mohm
- Sensitivity: 100 Mv
- Indication: via 7-digit led display
- Time base: 0.01 – 0.1 - 1 – 10 sec.

Multimeter

- Measurement of:
  - DC and AC voltages
  - Resistors
  - DC and AC currents
- 3 1/2 digit display
- 4 Ranges for DC voltage: 200 mV, 2 V, 20 V, 200 V
- 4 Range for AC voltage: 2 V, 20 V, 200 V, 750 V
- 4 Ranges for resistance: 2 KOhm, 20 KOhm, 200 KOhm, 2 MOhm
- 2 Ranges for current: 200 mA, 10 A.

Power supply: 230 Vac 50 Hz single-phase - 10 VA
(Other voltage and frequency on request)

Dimensions: 410 x 125 x 150 mm

Weight: 3 kg

THE UNIT MOD. IU9/EV CAN BE SET OVER THE POWER SUPPLY MOD. PS1-PSU/EV.

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INTERACTIVE MULTIMEDIA SYSTEM WITH VIRTUAL INSTRUMENTS AND CONTROL UNIT

Mod. SIS4-P/EV

The unit mod. SIS4-P/EV is connected via a USB port to the Personal Computer. It includes a set of virtual instruments for the electronics work.
The unit also allows the insertion of non-destructive faults and the parameters modifications on the experimental modules MCMxx/EV.

The unit is placed over the power supply, so to make easy connections over the module. The unit has a front plate including the connecting terminals, the BNC connectors for the instruments and the signal generators and the faults insertion connector to the module. On the right side is placed the feeding connector and the USB type B connector.

The unit includes the following circuits measuring and control devices of the MCMxx/EV modules:

- N° 2 Multimeters, 3 ¾ digits
- N° 1 Signal Generator
- N° 1 Frequency meter
- N° 1 Digital Dual channel Oscilloscope with Spectrum Analyzer.
- N° 1 Digital Pattern Generator
- N° 1 Digital Logic States Analyzer

The instruments and the faults insertion section include a hardware/firmware acquisition section.
The signal processing, the measuring parameters, the faults insertion and the data and graphs visualization are managed by the Personal Computer connected via the USB port.

GENERAL CHARACTERISTICS:

FAULTS INSERTION:
- N. 24 faults / 24 relays

PC INTERFACE:
- USB 12 MHz

Power supply:	230 Vac 50 Hz single-phase - 20 VA (Other voltage and frequency on request)
Dimensions:	386 x 90 x 100 mm
Weight:	3 kg

TECHNICAL SPECIFICATIONS:

N° 2 Multimeters:
- 3-3/4 digits
- DC /AC Voltages & Currents as follows:
- Voltage Ranges: 400mV /4V / 40V / 80V
- Currents Ranges: 200mA,8A
- Resistance ranges: 400, 4k, 40k, 400k, 4M, 40MOhm

N° 1 Signal Generator:
- Waveforms: Sinus, Square, Triangle, Continuous
- Frequency range: 0,1 Hz – 1MHz
- Output: ± 10Vpp & TTL
- Amplite, Offset and Frequency control.

N° 1 Frequency meter:
- Measures: frequency, period, events count, time interval
- Frequency Range: 0.1Hz – 1 MHz
- Analog input: 1 MHz, TTL inputs

N° 1 Digital Dual channel Oscilloscope:
- 2 Channels, AC/DC
- Input Amplitude: 20/50/100/200/500mV, 1/2/5V per division.
- Sampling frequency: 100Hz – 40 MHz per track
- Trigger: internal / external

N° 1 Digital Pattern Generator:
- N. 8 TTL channels and Clock signal
- Output Frequency: 100 Hz – 1MHz
- Pattern Length: 1024 bytes

N° 1 Digital Logic States Analyzer:
- N. 8 TTL channels, Clock inputs
- Sampling frequency: 100Hz – 1 MHz
- Memory: 1024 bytes

PC BASED 2-CHANNEL OSCILLOSCOPE

Mod. IU11-A/EV

PD

ELECTRONICS AND SYSTEMS

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20B-E-PD-IU11A-0

Digital Oscilloscope mod. IU11A/EV uses the calculation capability of the PC in order to display the electrical signals. It presents an high graphical resolution up to 0,15 mV, a wide band and a sampling frequency up to 1 GHz.

USB connection allows to the virtual instrument, simply connectable and operative and therefore suitable particularly at the jointed use with a Lap Top in order to effectuate measurement on field. The dimensions are particularly reduced and vertically developed in order to constitute a compact working station also in case of use with a normal desk Personal Computer.

The software included is very flexible and powerful in order to integrate hardware section of the external interface.
A DLL library is supplied in order to integrate the oscilloscope functionality in every specific software program.

TECHNICAL CHARACTERISTICS:

Oscilloscope:

- Time base: 20ns to 100ms for division
- Trigger source: CH1, CH2, EXT or free
- Trigger level: up/down front
- Level of Trigger level: adjustable at whole screen
- Interpolation: linear or smoothed
- Markers for: current and frequency
- Input gap: from 5mV to 2V/division
- Input sensitivity: 0.15mV graphical resolution
- Auto-configuration function and X10 option
- Pre-trigger function
- Graphical indication on the screen: True RMS, dBV, dBm, peak to peak, Duty cycle, Frequency…
- Memorisation length: 4K sample / channels
- Real time sampling frequency: from 25kHz to 50MHz
- Repetitive signal sampling frequency: 1GHz

Spectrum analyser:

- Frequency gap: from 0...1.2kHz to 25MHz
- Time scale: linear or logarithmic
- Functioning: FFT (Fast Fourier Transform)
- FFT resolution: 2048 lines
- Input channel FFT: CH1 o CH2
- Zoom function
- Frequency and amplitude markers

Transient registration:

- Time base: from 20ms/div to 2000s/div
- Maximum recording time: 9.4 hr/paginate display
- Data automatic memorisation
- Automatic memorisation for more than 1 year
- Max. number of samples: 100/s
- Min. number of samples: 1 sample / 20s
- Time and amplitude markers
- Recording and displaying of the paginate.

TECHNICAL SPECIFICATIONS:

General information:

- Inputs: 2 channels, 1 external trigger input
- Input impedance: 1Mohm // 30pF
- Passing band: from DC to 60 MHz ±3dB
- Input maximum current: 30V (AC + DC)
- Input: DC, AC and GND
- USB port (500mA) direct power supply

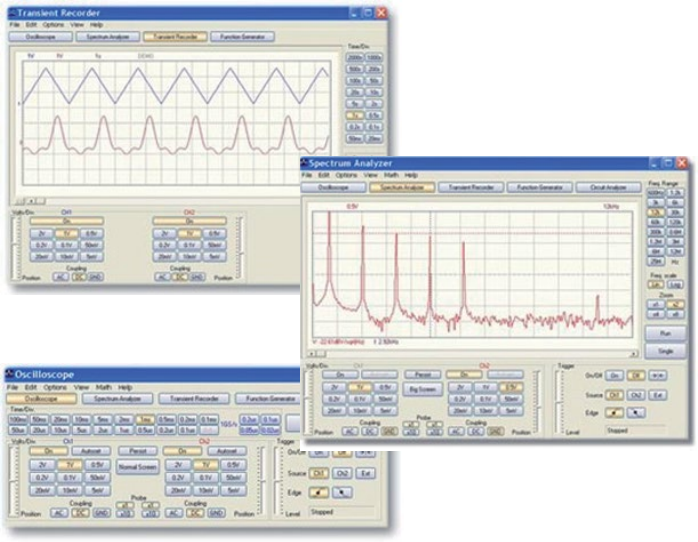
Minimum required PC characteristics:

- PC IBM compatible;
- Operative system: Win98SE or more
- Graphical card SVGA (recommended min. 800x600, 1024x768)
- mouse
- 1.1 or 2.0 USB compatible port
- CD Rom Reader.

Includes:

- Oscilloscope with USB connection
- 2 x 60MHz oscilloscope probes (PROBE60S)
- USB cable
- CD with software
- Manuals

Dimensions: 55 x 190 x 200 mm



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PC BASED FUNCTION GENERATOR

Mod. IU12-A/EV

The IU12A/EV is a digital function generator which can be connected with a PC via USB.
Standard signal waves like e.g. sine, triangle and rectangle are available; other sine waves can be easily created.
The signal waves are created in the PC and produced by the function generator via DDS (Direct Digital wave Synthesis).

Frequencies up to 2MHz.
Features 2 equal outputs and a TTL Sync output.
Output voltage of 1mVpp up to 10Vpp at 600 ohms.

All outputs are galvanically separated from the PC in order to avoid measuring problems. Power adapter is included.

TECHNICAL CHARACTERISTICS:

- Frequency range: from 0.01 Hz to 2MHz;
- Crystal-based stability;
- Outputs are galvanically isolated from the PC;
- Low sine wave distortion;
- Two parallel output connectors for waveforms;
- TTL-level synchronisation output;
- Stores up to 8192 of waveform points;
- Standard waveforms: sine, square and triangle;
- Predefined library waveforms included: noise, sweep,…;
- You can create your own waveforms with the integrated signal wave editor;
- Sweep frequency range 0.0001Hz to 25MHz;
- Sweep time 1ms to 10 hours;
- Noise mode bandwidth 25MHz;
- Extended bode plot option together with PC scope;
- Automated wave sequence generation, using file or computer RS232 input;
- available DLL library for custom software development.

TECHNICAL SPECIFICATIONS:

- Amplitude range: 100mVpp to 10Vpp @ 1KHz// 600ohm load / 0V offset
- Frequency setting resolution: 0.01%
- Internal 40 dB attenuator (output divided by 100)
- Direct digital wave synthesis (DDS), stores up to 8192 of waveform points
- Amplitude resolution: 0.4% of full scale
- Offset: from 0 to -5Vdc or +5Vdc max. (resolution 0.4% of full scale)
- Vertical resolution: 8 bits (0.4% of full scale)
- Sample rate: 50MHz
- Typical sine wave distortion (THD): < 0.08%
- Output impedance: 2 x 50ohm
- Power supply: standard 9V DC adapter, 600mA (included)

Dimensions: 55 x 190 x 200 mm

Minimum system requirements:
- IBM compatible PC
- Windows™ 98SE, ME, 2000, XP, Vista
- SVGA display card (min. 800x600)
- Mouse
- USB port
- CD Rom player.

Includes:
- USB PC function generator
- USB cable
- Getting started manual
- Software on CD.

PERSONAL LOGIC ANALYSER
Mod. IU13/EV

Personal Logic Analyzer (40 MS/s, 16 Channels, 256 KB, Adv. Trigger):

- 40 MSample/s
- 16 Channels
- 128K Samples per Channel
- Timing/State Mode
- Advanced Triggers
- Serial Analysis (RS-232, SPI, I2C-Bus)
- Windows 9x/Me/2000/NT/XP User Interface

OVERVIEW

The Logic State Analyzer, in combination with a standard personal computer, provides a full-featured, high-performance tool for the troubleshooting and performance verification of digital circuits.

A logic analyzer is the digital counterpart of an analog oscilloscope. It allows a number of digital input signals to be sampled and stored sequentially in a high-speed memory or buffer.

A logic analyzer can also recognize a condition, or sequence of conditions, on the input data and use that combination of events to trigger data storage.

The information acquired is displayed as oscilloscope-like waveforms or as list of numbers representing a sequence of logic states. The Logic State Analyzers is very compact and communicates with the PC through the parallel port.

DEEP ACQUISITION MEMORY

With its 128K Samples of acquisition memory per channel, the Logic State Analyzers is the best choice where large amount of data need to be acquired and analyzed.

Data Acquisition Modes

The Logic State Analyzer can work in two different operation modes: Timing mode and State mode. Timing mode is useful when recording the input data at a constant rate determined by a fixed timebase. As a result, the waveform display represents time in linear form on the X-axis and logical state on the Y-axis.

In State mode, instead, an external sample clock is provided, thus synchronizing sampled data with state transitions that occur in the circuit under test.

Advanced Trigger Conditions

The Logic State Analyzer features powerful triggering conditions, such as edge trigger, pattern trigger and advanced trigger specification, in order to trigger data storage at the very specific event needed to properly debug the circuit under test.

In addition, storage filters control input data storage.

It works both in Timing mode and State mode and can be used to control under which condition sampled data is effectively stored into the acquisition memory.

When one or both of the storage filters is enabled, data will be stored by the analyzer only if the signal connected to the enabled filter is logically true.

The Logic State Analyzer provides a feature that helps extend its triggering capabilities and allows you to use it with other instruments: the Trigger Output.

The Trigger Output signal (available on the BNC on the frontal panel) is generated when the analyzer's trigger condition is satisfied; thus, it can be used to trigger an external measurement system or other device. For example, you may want to use the Trigger Output signal to trigger an oscilloscope.

Bus Grouping

The Logic State Analyzer allows you to group input channels into bus items. The user interface will display the acquired data by grouping the input channels as specified. The order with which the input channels build a bus is used to determine the numeric value of bus at each sampling, which is also displayed by the analyzer.

Serial Analysis

The Logic State Analyzer, additionally, features a series of serial data analysis--sets of algorithms that perform a special analysis on the raw acquired data. By defining an item as one of the three available serial analysis functions (Asynchronous Serial Channel, Generic Synchronous Serial Channel, I2C-Bus), the user interface will automatically display the appropriate serial character or packet characteristics. RS-232, RS-485 and SPI communication lines are just examples of what can be analyzed.

Glitch Detection

To avoid missing fast events or short pulses, the Logic State Analyzer features a glitch capture logic, which is capable to detect signal transitions finer than the sampling rate (down to a minimum time resolution of 50 ns).

Powerful User Interface

All this features are accessible from a user-friendly yet powerful user interface running under Windows 9x/Me/2000/NT/XP. A Waveform window displays the acquired data in a graphical fashion. Input channels are grouped up into customizable items for meaningful representation. Additionally, a Listing window provides an alternate presentation for sampled data. The sampled data is displayed as a list of numerical logic values instead that as a waveform graphical representation. An interface library (DLL) is also provided (as option) so that you can interface your own programs directly with the analyzer.

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EPROM ERASER
Mod. EC-80

The EPROM Eraser is housed in anodized aluminium case and is quick and easy to use.

The case is divided into two parts: in the lower part it's assembled the the electronic and display section, in the upper part the EPROM to be erased are lodged using a sliding cover with safety switch.

Up to 5 EPROMS can be erased.

On the front panel the ON/OFF switch and the LED and the timer are positioned.
The EPROM eraser is fed by an external 12 Vdc power supply.

TECHNICAL SPECIFICATIONS:

Power absorption:	4 W
UV lamps (UV4W12V):	1 x 4 W
UV ray wavelength:	253,7 nm
Starter	
Programmable timer	
Power supply (W-800) :	12 V DC

Dimensions: 150 x 75 x 42 mm

UNIVERSAL EPROM PROGRAMMER

Mod. EP-80

PD

The UNIVERSAL PROGRAMMER supports device programming for a variety of device types covering EPROM, E²PROM, Serial PROM, FLASH, PLD/CPLD/FPGA, MPU/MCU, etc.
Most of programmable devices in DIP, SDIP, SOP, SSOP, TSOP, PLCC, QFP, or BGA package types can be programmed on a default DIP40 socket or through an appropriate ADAPTER / CONVERTER.

High speed parallel port is provided to connect to the majority of notebook or desktop PC running on Windows 95/98/NT/2000/XP.

Derive from CPU upgrading, the UNIVERSAL PROGRAMMER provides 5 times faster programming speeds compared with the previous programmers.
The UNIVERSAL PROGRAMMER features modular pin drivers to provide excellent programming capabilities at high speed, high reliability and high expansion flexibility.
All pin drivers of the UNIVERSAL PROGRAMMER are fully programmable to meet modern programming / testing needs including new released low voltage devices in the market.
The UNIVERSAL PROGRAMMER utilises dedicated pin drivers to get accurate waveforms, high programming speed plus over current protection, reverse insertion detection, self diagnostic etc.

Wide IC Coverage
Over 7,000 programmable devices can be programmed covering EPROM, E²PROM, Serial PROM, FLASH, PLD/CPLD/FPGA, MPU/MCU, etc. in DIP, SDIP, SOP, SSOP, TSOP, PLCC, QFP, or BGA etc. package types.

Easy to Use - Runs on Windows
After master read or file download from PC, user only needs to select (Blank check, Program, Auto) function from Menu and then hit" YES" key on programmer to start program function. Operation is very easy.

High Reliability – Using proven technology, the programming quality is getting perfect.

High Expansion Flexibility – Over 800 ADAPTERS, 150 CONVERTERS available for future expansion to ensure a great expansion and flexibility.

Ideal for Engineering Environment – Wide device covering range, flexible future expansion capability help engineers to achieve challenging time-to-market goal.

- **Device Contact:** Default - DIP40, Textool;
- **Device Contact:** Others - SDIP, SOP, SSOP, PLCC, MLF etc. through optional CONVERTERS or ADAPTERS;
- **Programming Site:** Single site;
- **Control:** Controller, Single chip controller, YES Key- Hit for operation, Indicators - GOOD LED, BUSY LED;
- **Interface Port:** Parallel Port;
- **Functions:** Load file, Read Master, Program, Verify, Auto, ID Check. Checksum, Blank Check, Erase, Secure, Protect/Unprotect, Edit, File Transfer,Function Configuration, Self Test;

Host Computer Requirements:
- An Intel Pentium or compatible processor with 32MB of RAM
- One parallel port needed, 5 MB free hard disk space with Windows 95/98/NT/2000/XP operating system.
- CD-R drive.

- **Power By external power supply:**
  - AC input voltage : 100 - 240 Vac / 50-60 Hz
  - DC output voltage : 5Vdc /1,5A , 12Vdc /1.5A
- **Dimensions:** 245 x 220 x 50 mm
- **Weight:** 2 kg.
- **Operating Temperature:** 0-40 °C
- **Safety Standards:** CE Approved

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UNIVERSAL PROGRAMMER
Mod. UP-80

Professional pocket-sized Universal Programmer with 48-Pin socket and USB connection 2.0. Ideal instrument for the development laboratory that can be used in all the movable applications and consequently near the apparatus that can be programmed (field programmer).

- Universal 48-pin DIL socket
- it can program most active components, from EPROM to Microcontroller
- USB connection 2.0
- Powered via USB connection
- CPU 200 MIPS ARM-9
- Internal RAM of 64 MB
- Very short programming times
- 3 programming voltages up to 25 V
- Low voltage programming up to 1.3
- Linux 2.6 installed

It can support EPROMs, EEPROMs, FLASH EPROMs, series EEPROMs, NV-RAM, LPC,FPGA, EPLD, GAL, PALCE, Microcontrollers, up to DIP48 without the need of any adapter nor additional circuits.

Technology
High-Speed programming. Programming algorithms are included in the processor 200 MIPS ARM-9, developed in Linux environment. This processor directly controls the necessary pin drivers and algorithms for programming the component, via an FPGA. The FPGA enables to realize State-Machine, UARTs, etc..., besides assisting the programming of critical components that cannot be implemented with simple software solutions.
Programming times reach the minimum values allowed by the same components. The internal RAM of 64 MB enables to store also the data of big components, so that, in case of multiple programming, they must not be reloaded.
The signals indicated here below are available for each pin of the programming socket:

- logic output: High level from 1.3 V to 5.0 V (adjustable)
- logic input: adjustable change threshold from 0.5 V to 5.0 V
- three separate programming voltages up to 25 V
- ground
- three different loads that can be connected for Pull-up and Pull-down
- adjustable cycles

In-System Programming (ISP)
The signals for In-System Programming can be extracted with the use of a specific adapter, or they can come directly from the 48-pin ZIF socket of the programmer. The software supplies useful information for the connection of all the supported components.

JTAG support
It is possible to clear, program and check components with JTAG port (Joint Test Action Group, IEEE Std. 1149.1). The following formats: SVF-Script file in XSVF (Xilinx) and JAMByte-Code Player (ALTERA), are supported.

Safety characteristics
The current absorption, the correct positioning, as well as the connection of each pin with the component, are checked for every action. Thus any wrong use of the component or of the instrument is completely excluded.

Software
The software will run in all 32-bit Windows versions. Besides the basic functions such as writing, programming, comparing and clearing, other special functions too can be set for the selected component. This software also includes an editor offering multiple possibilities for using the program of the component, that can be opened or saved in Binary, Intel-Hex, Motorola-S format or in Jedec format. The programming phases in production are supported by statistical functions and by programming with serial numbers.
The software is continuously upgraded to support new components and upgrades are available at no cost on our web site.

Using the programmer without power supply unit
This programmer is powered directly from the USB port of the PC and it needs batteries or the power supply unit only in specific cases. This instrument is certified for the use with USB and it needs 500 mA, at the most. A limitation is set only for the old NMOS components or for some complex microcontrollers needing high programming voltages. These components are specified in the Software of use. Although these components are USB certified, it is better to use the power supply unit included, or the batteries (6xAAA, not included) for external applications.

TECHNICAL CHARACTERISTICS

- 48-pin ZIF socket
- 48 universal pin drivers
- Processor 200 MIPS ARM-9 RISC
- 64-MB RAM
- 8-MB Flash
- FPGA (50K Gatter, 64-kb RAM)
- USB connection 2.0 High-Speed Device
- 3 linear regulators for internal power supply
- 4 regulators for programming voltages and for internal power supply
- 2 linear regulators for output logic levels and input logic comparators
- Microcontroller for the control of internal supply voltages
- Microcontroller for the control of programming voltages
- 8-channel Digital-to-Analog converter
- 16-channel Analog-to-Digital converter

Dimensions: 80x115x33mm (+7mm of socket)
Weight: approx. 185g

Accessories included:

- Power supply unit
- USB cable
- CD with Software and Handbooks

20-B

PCB CIRCUIT LABORATORY

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CAD-CAE VIRTUAL INSTRUMENT SYSTEM & PCB DRILLING

Mod. VTD/EV

There are different steps between the ideation and the marketing of an electronic device, and these are the circuit design, the simulation, the realization of the printed circuit, the realization of the first prototype and its testing.
These activities require the availability of a set of high accuracy equipment and instruments and the use of effective and well documented procedures which can be employed in a second time for the development of analog products (approach required by the standard ISO9000, too).
The system enables the creation of a standard application by using industrial procedures and equipment.

CIRCUIT DESIGN

CAD-CAE software for development of electronic design

- Design of the electrical diagram;
- Simulation;
- Design of the circuit layout;
- Positioning and connection between automatic components;
- Post-processing.

PRINTED CIRCUIT EXECUTION

Desk top dedicated milling machine for printed circuit etching connected to Personal Computer:

- 3 axes: X, Y and Z;
- Driving range X / Y / Z (mm): 290 x 335 x 70;
- Passage High in mm: 105;
- Table dimension: 500 x 600 mm;
- 900 W Hybrid Motor that are brushless motors equipped with high grade ball bearing. Rotational speed stability even under load variations. Highest torque in thr lower speed range;
- Rotation speed: 8000 – 26000 rev/min;
- Repetition accuracy: ±1/100 mm;
- 3 end/reference switch, accuracy <1/100 mm;
- Teflon coated rubber seal to protect the spindles;
- Serial / Ethernet interface, 2 digital inputs and 2 digital outputs;
- Input file type GERBER;
- 20 tools engraving kit – 25 tools drilling kit;
- Vacuum cleaner adapter to remove produced dust.

FUNCTIONAL CHECKING AND TESTING THE CIRCUIT

A set of virtual instruments is used for stimulation and acquisition and are installed on Personal Computer and connectable directly to the card:

- 2-Channel oscilloscope with memory and sampling frequency of 50 Ms/s;
- 2-Channel programmable frequencymeter/counter with frequency range of 10 Hz ÷ 100 MHz and events counting from 0 to 9999999999;
- Function generator (sine, square, triangle wave) programmable from 10 Hz to 10 MHz and amplitude from 0 to 5 Vpp;
- 8-Channel programmable analog outputs with ±9 Vdc selectable voltages and 10 mA output current;
- 2-Channel programmable voltameter with measurement ranges from 4 to 200 V and mathematical function of sum, difference, product and ratio;
- Capacimeter with measurement range form 10 pF to 100 pF;
- Power supplies:
  - Fixed output voltage: ±5 Vdc / 5A
  - Variable voltage 0 ÷ +15 Vdc / 200 mA
  - Variable voltage 0 ÷ -15 Vdc / 200 mA
- Test sequence generator with indication texts of the operations, automatic programming controls of the stimulation and memorization instruments for the carried out measurements;
- Data logger for memorization of the data coming from the frequencymeter/counter, programmable voltmeters, variable power supplies.

STANDARD APPLICATIONS

Application of analog kind including:

- Amplification section;
- Oscillation section;
- Fault insertion section

Application of digital kind including:

- Combinatory/sequential logic section;
- Display section;
- Fault insertion section.

CNC MILLING MACHINE FOR PRINTED CIRCUITS

Mod. CR-PCB/EV

The CNC milling machine for printed circuits mod. CR-PCB/EV is ideal for educational use, and features:

- Simplicity of use
- Accuracy
- Innovative design
- Structure in rigid steel
- Milling surface: 160 mm – Z axis

TECHNICAL SPECIFICATIONS:

General characteristics:

- Performance and dynamics of the millings
- Rigid structure
- Easy, fast and reliable tool change (manual or automatic), and point-zero pickup thanks to the tool sensor for automatic Z axis reference
- XYZ stroke: 310 x 220 x 160 mm
- Visibility: 180°
- Illumination: high-luminosity LEDs
- Immediate installation and commissioning
- Complies with the European security standards
- 3D milling

Electrical characteristics:

- Micro-step digital control of the axes
- 3 axes with electronic interpolation
- Communication: RS232C (USB - RS232C converter)
- Power supply: 230V, single phase
- Power: approx. 2 kW

Drive:

- Stepper motors with micro-step technology
- Ball screw ø 12mm with 5mm threading on each axis
- Double guiding by prismatic rails in grinded steel with re-circulating ball bearings on X and Y axes
- Each axis protected by a hermetic cover
- Integrated greaser on each axis

Safety devices:

- Complete safety guard in polycarbonate and galvanized steel sheet, with 180° visibility
- Guard opening sensor
- Electromagnetic closing of the guard controlled by the spindle
- Compliance with the European safety standards “machines No. 98/37/CE”
- Emergency stop button

Mechanical characteristics:

- X axis stroke: 310 mm
- Y axis stroke: 220 mm
- Z axis stroke: 160 mm
- Surface dimensions: 375 x 320 mm
- Architecture: fixed gantry with mobile table in the Y axis
- Structure: welded steel
- Passage between columns: 450 mm
- Passage under gantry: 115 mm
- Passage under spindle: 165 mm
- Max. speed: 100 mm/s
- Max. feed: 100 mm/s
- Standard motors: 90Ncm stepper motors
- Resolution: 0,003 mm
- Repeatability: 0,02mm
- Electro-spindle HF series, 800W, with manual tool change
- Spindle rotational speed: 4000 ÷ 24000 RPM, air-cooled

Power supply:	230 Vac 50 Hz single-phase (Other voltage and frequency on request)
Dimensions:	620 x 850 x 730 mm
Weight:	81 kg

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ACCESSORIES:

- Set of tools: 17 engraving and piercing tools for printed circuits
- Fixing brackets for boards
- Keys to fix tools

SOFTWARE:

Interface driver G-PILOTE

G-PILOTE software is a machine control program, directly interfaced to the numeric control. With this software it is possible to import ISO files previously processed by a CAM software and control all the machine movements, price zeroing and tool zeroing. Through some cursors it is furthermore possible to modify milling speed, spindle RPM and visualize the remaining milling time.

OPTIONAL

PERCIVAL SOFTWARE FOR PRINTED CIRCUITS

Software to convert Gerber and Excellon files transmitted by a CAD electronic program, in a tool path to isolate the tracks. It sets the insulation and drilling tool paths starting from an existing circuit. It calculates the outlines, the points where components must be linked and fixed, and the bores of the holes where component terminals will be inserted.

SOFTWARE FOR EDITING, AUTO-ROUTING AND PCB LAYOUT:

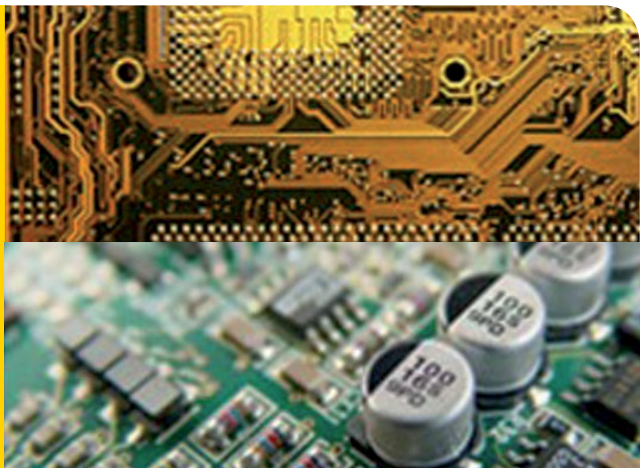
ORCAD: to draw electric diagrams, simulate and auto-route printed circuits, or

EAGLE: electronic CAD to draw electric diagrams, PCB layout and path auto-routing

SUPPLIED WITH

USE AND MAINTENANCE HANDBOOK

20 PCB CIRCUIT LABORATORY



SHEAR PRESS BRAKE AND SLIP ROLL mod. 600

- Bed length: 610 mm
- Max shearing, bending and rolling thickness: 0,8 mm
- Bending angle: 90°
- Min. rolling Ø: 43 mm
- Overall sizes: 960 x 410 x 610 mm
- Weight: 130 kg

DOUBLE FACE BROMOGRAPH mod. DF 2080

Designed for double face PCB manufacturing. The UV photo etching method is used. It includes a high performance internal vacuum pump for an optimum resolution of the details. With programming timer, microprocessor controlled. It allows to memorize up to 32 preset exposition times, even with no power supply. All functions are easily set by keyboard and visualized on the display. For safety reasons, no visual contact among the UV tubes and the operator is allowed.

- Exposure area: 500 x 375 mm;
- 12 UV tubes, 20 W;
- Possibility to single face operation;
- External dimensions: 635 x 600 x 290 mm
  Weight: 35 kg approx.;
- Power supply: 220/240 Vac-400 W.

ETCHING MACHINE mod. GA 1300

Compact etching machine, for single and double face PCBs. Totally made in PVC, has an upper transparent cover for controlling the etching process. A high performance pump makes the foam that takes out the copper. A thermostat allows the optimum temperature for the ferric chloride.

- Useful area: 220 x 280 mm;
- Tank cap: 2 lt;
- Pump included;
- Thermostat 100 W;
- Power supply: 230 Vac+/- 10%-50 Hz.

ILLUMINATED TABLE mod. PL40

- Working area: 400 x 330 x 80 mm
- Back light: 2 tubes, 8W
- Power supply: 230Vac +/- 10 %- 50Hz

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TEMPERATURE CONTROLLED WELDING STATION mod. SSD-3

Power supply: 230 Vac - 40W – Temperature range: 160 - 400°C - with welder support

RIVET PRESS FOR METALIZED HOLES mod. RPR

Mechanical press to insert the rivets on PCBs.
To carry out the conductivity on the PCB holes between the two faces of a double sided
circuit. It includes a tool for each different rivet diameter and 1000 rivets. Good contacts without welding too.
Available rivets: 0,6 to 0,8 mm.

Standard: Tubular Rivets according to DIN 7340, Form A.
Material: Copper, blank.

BENCH TYPE DRILL mod. TBM 220

Working area: 220 x 120 mm approx.
Chrome-steel column: 20 x 280 mm.
Electrical motor tested VDE 220 – 240 V (85 W).
Low noise.
3 pulleys.
Speeds: 1800, 4700 and 8500 RPM.
Stroke: 30 mm. With depth indicator.
Distance from center column to center mandrel: 140 mm.

TRAYS

Different size.

20-B

WORKING AND TESTING BENCHES

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POWER SUPPLY AND INSTRUMENT CONSOLE
Mod. 1444-A/EV

CONSOLE 1444-A/EV

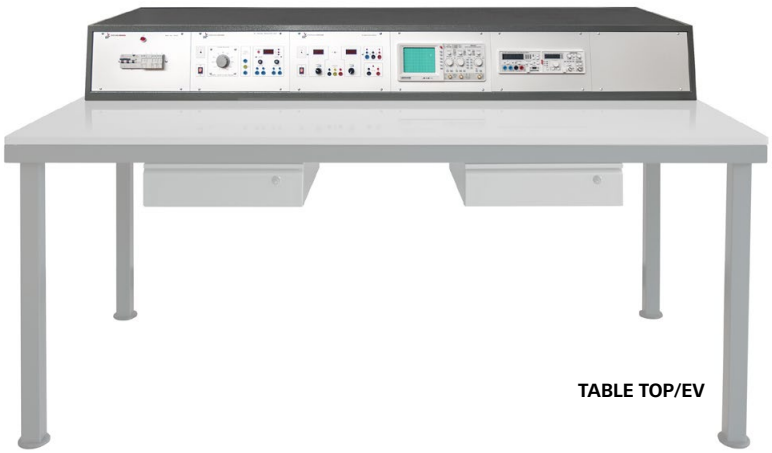


TABLE TOP/EV

Three stabilized power supplies, a function generator, a digital multimeter and a dual trace oscilloscope are mounted on the console mod. 1444-A/EV. Other instruments (frequencymeter, RF generator, etc...) can be inserted upon request. The console can be mechanically locked to the table mod. TOP/EV (or to any other laboratory table).

Power supply: 230 Vac 50 Hz single-phase - 500 VA (Other voltage and frequency on request)
Dimensions: 2000 x 450 x 250 mm
Weight: 60 kg

Table TOP/EV dimensions: 2000 x 1000 x 860 mm

TECHNICAL SPECIFICATIONS:

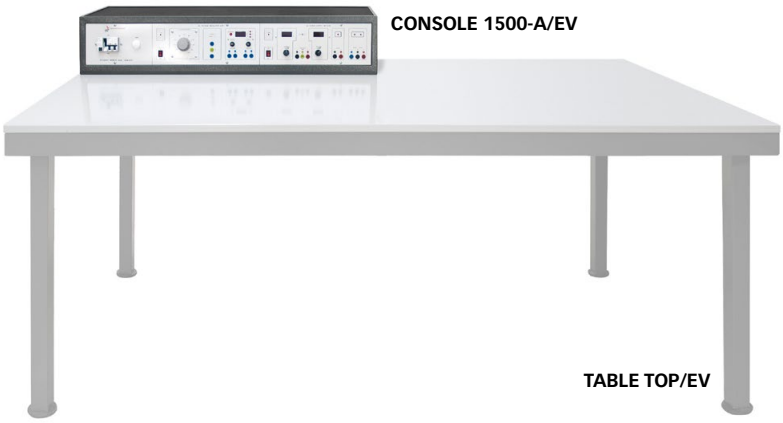
- 1 DC stabilized power supply (0 ÷ 30 V, 0 ÷ 2A), with electronic current protection and voltage and current digital indicators;
- 1 DC stabilized power supply (+12 Vdc 2A, -12 Vdc 1A), with electronic current protection;
- 1 AC power supply (0 – 250 Vac, 1A), (2 x 24 V, 5A), with digital voltage indication;
- 1 Sine, square and triangular voltage generator (range: 50 mHz ÷ 10 MHz), with adjustable output voltage and offset;
- 1 Digital multimeter (measurement of V, A, DC/AC, Ohm), with 4 3/4 digit display;
- 1 Dual-trace oscilloscope (40 MHz):
  - input impedance: 1 Mohm, 30 pF;
  - sensitivity: 5mV/div (1mV/div);
  - attenuator: from 5 mV/div to 20 V/div, sequence 1-2-5;
  - scan times: 0.1 µs – 0.5 s/cm;
- Protection on the power supply with high sensitivity E.L.C.B (30 mA).

We supply laboratory benches on request with the mobile console mod. 1444-A/EV.

This solution enables to:

- Lower the console and block it to make all the table surface available;
- Lift the console to proceed with the experimental exercises with the power supplies and instruments available in the console mod. 1444-A/EV.

POWER SUPPLY CONSOLE
Mod. 1500-A/EV



A set of power supplies is mounted on the console mod. 1500- A/EV with professional characteristics and general use; DC and AC voltages are available, which are fixed and variable, protected against overloads and short-circuits.
The console can be mechanically locked to the table mod. TOP/EV (or to any laboratory table).

On the rear side of the console, there are 4 sockets to connect any instrument which can be laid on the upper part covered with a rubber carpet.

TECHNICAL SPECIFICATIONS:

- DC power supplies
  - Output 1: + 5Vdc, 2A;
  - Output 2: +12Vdc 2A, -12Vdc 1A.

Stabilized voltages electronically protected against short-circuits and overloads.
  - Output 3: 0 ÷ 30 Vdc / 0 ÷ 2A.

Voltage and current adjustable with multi-rev potentiometer for the voltage , one rev. for the current.

- AC power supply
  - Output 4: 2x0 ÷ 24Vac - 4A (insulated);
  - Output 5: 0 ÷ 250 Vac - 1A (not insulated) T.M.C.B..

General magneto-differential power supply switch

Power supply: 230 Vac 50 Hz single-phase - 500 VA
(Other voltage and frequency on request)
Dimensions: 1000 x 340 x 185 mm
Weight: 30 kg

Table TOP/EV dimensions: 2000 x 1000 x 860 mm

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PRODUCTS INDEX
SORTED ALPHABETICALLY BY MODEL

BE BASIC ELECTRONICS I.P.E.S. SYSTEM

PE PROFESSIONAL/ADVANCED ELECTRONICS - M.P.T. SYSTEM

PD PROJECT DEVELOPMENT

ElettronicaVeneta

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