

The complete laboratory includes parts 1 to 5 and any part can be supplied individually or additionally. (Power supply + Module/s is the minimum supply).

Available Modules:

Basic Electronics concepts

- . M3. Semiconductors I.
- . M4. Semiconductors II.
- . M6. Oscillators.
- . M7. Operational Amplifiers.
- . M8. Filters.
- . M9. Power Electronics.
- . M60. Analog/Digital Converters.
- . M61. Digital/Analog Converters.
- . M99. Expansion Unit:

Modules included:

- . M99-1. Analog Multiplexer module.
- . M99-2. Analog Multiplier module.
- . M99-3. Function Generator module.
- . M99-4. AM Modulator module.

- . M99-5. AM Demodulator module.
- . M99-6. Motors, Generators and Controls Unit.

Digital Electronics

- . M10. Digital Systems & Converters.
- . M11. Digital Electronics Fundamentals.
- . M12. Basic Combinational Circuits.
- . M13. Basic Sequential Circuits.
- . M14. Optoelectronics.
- . M41. Resistance Transducers.

Basic Electricity concepts

- . M5. Power Supplies.
- . M1. Direct Current (D.C.) Circuits.
- . M2. Alternating Current (A.C.) Circuits.
- . M16. Electric Networks.
- . M17. Electromagnetism.

- . M18. Three-phase Circuits.

Electronics Applications

- . M43. Applications of Temperature.
- . M49. Applications of Temperature and Pressure.
- . M44. Applications of Light.
- . M45. Linear Position and Force.
- . M46. Environmental Measurements.
- . M15. Development Module.
- . M48. Sounds Measurements.

Control

- . RYC/B. Basic Teaching Unit for the Study of Regulation and Control.
- . M47. Rotational Speed & Position Control.



ISO 9001:2000
Certificate of Approval



European Union Certificate



Certificates ISO 14001: 2004 and
EMAS (environmental management)



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INTRODUCTION

Present technology requires necessary knowledge of ELECTRONICS and ELECTRICITY in most fields.

Avionics, Autotronics, Domotics, Agrotronics, Physics, Process Chemistry, Health Services, etc., already employ components or even whole systems based on Electronics and Electricity. Thus there is an increasing number of professionals in these and many other fields who need adequate knowledge and training.

Taken this into account, EDIBON has developed the Basic Electronics and Electricity Integrated Laboratory, capable of covering different levels of difficulty. It is based on a series of self-taught modules, each one referring to a specific area of Electricity and Electronics.

GENERAL DESCRIPTION

We present a flexible and modular-based system for learning basic electronics, basic electricity and circuit theory.

The advantage given by this learning and teaching system is that the student establishes his own rhythm, thus rendering unnecessary to keep pace with the rest of the class.

Any desired configuration can be chosen (see next page), according to working mode, areas of study and number of working posts.

Being a modular and open system, it is very economical and may be enlarged depending on required needs; all previously acquired systems are fully compatible and valid.

What are the parts included in the laboratory?:

① Power supply:

There are two choices for supplying the modules:

FA-CO. Power Supply:

Using this system training and practices can be done conventionally. This is the most common power supply used.

EBC-100. Base Unit, with built-in power supply:

This unit is self-complete, it includes hardware, power supply and the necessary connections for supplying power and allocating the available modules.

② Modules:

They consist on modules which allow the student to do the exercises/practices corresponding to the target subject.

On these modules the circuits to be designed are serigraphed. Real components are displayed to familiarize the student with them. There are many points where measures can be taken (voltage, current intensity, resistance, etc.).

Moreover, circuit and electronic components **faults can be simulated too**.

Every Module has its own manuals, that gives the theoretical knowledge and explains everything the student needs to carry out the exercise/practice.

We provide eight manuals per module.

Connectors and cables for completing the exercises and practices are included.

③ CAI. Computer Aided Instruction Software System:

The best help in classroom for both teacher and students.

It includes:

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

Only one software is needed per classroom.

Helps creating databases, reports and statistical comparisons among many more features.

- STUDENT SOFTWARE: **M../SOF.** Computer Aided Instruction Softwares (Student/Module Software).

Each module has its own software.

Gives the students the proper assistance on theoretical knowledge as well as in practice, presenting exercises and questions.

④ LIEBA/CAL. Computer Aided Learning Software (Results Calculation and Analysis):

Windows based software, simple and easy to use.

Thought for Results Calculation and Analysis, this software computes, displays and plots obtained data.

⑤ EDAS/VIS. EDIBON Data Acquisition System/Virtual Instrumentation System:

EDIBON has developed this unique data acquisition interface, link between modules and PC, for an adequate visualization of the results yielded by the modules.

The components together (hardware + software) makes the computer work as virtual instruments: Oscilloscope, Functions Generator, Spectrum Analyzer, Transient Analyzer, Multimeter, Logic Analyzer and Logic Generator, with all their features and applications.

It includes:

- Hardware: DAIB. Data Acquisition Interface Box + DAB. Data Acquisition Board.

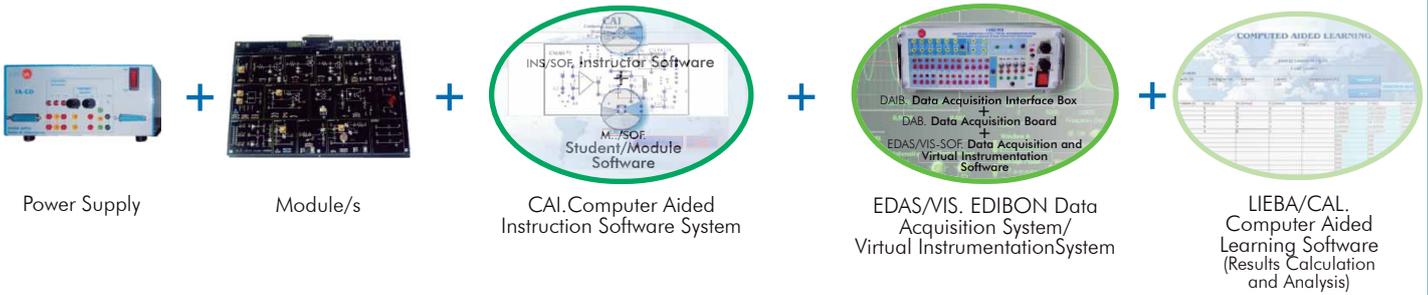
- Software: EDAS/VIS-SOF. Data Acquisition and Virtual Instrumentation Software.

Complete LIEBA LABORATORY includes: ① + ② + ③ + ④ + ⑤

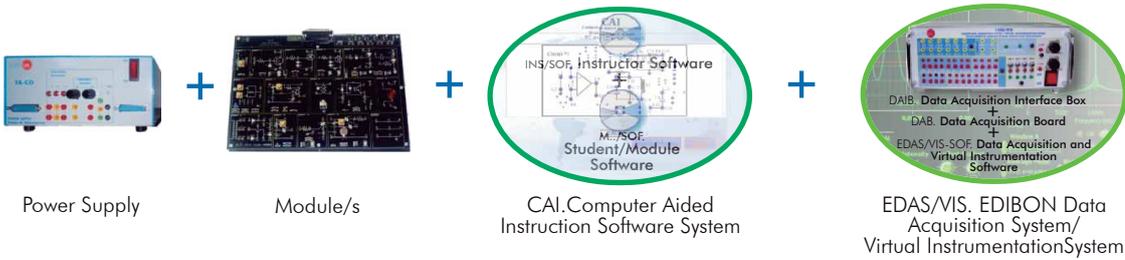
Minimum configuration: ① Power supply + ② Modules (Every module needs power supply).

Some Working possibilities:

A) CAI + EDAS/VIS + LIEBA/CAL working possibility (complete EDIBON system)



B) CAI + EDAS/VIS working possibility



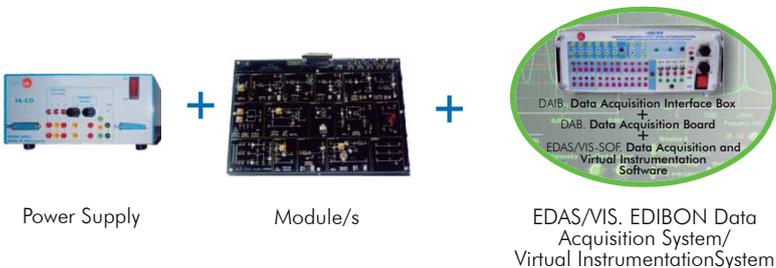
C) CAI working possibility



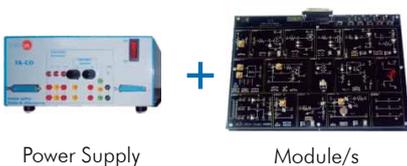
D) LIEBA/CAL working possibility



E) EDAS/VIS working possibility



F) Simplest working possibility



① Power Supply

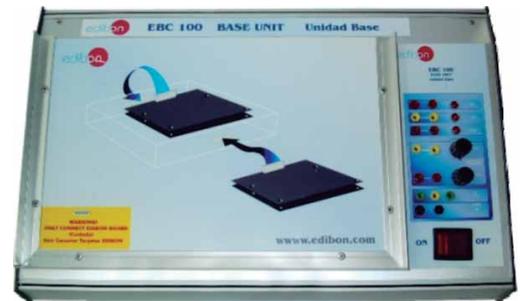
FA-CO. Power Supply

Fixed outputs DC: + 5V, $\pm 12V$, 1 A.
Variable outputs DC: $\pm 12V$, 0.5 A.
AC output: 12V. or 24 V.
Outputs through either 2mm. contact terminals, or through 25 pin Sub-D connectors (2 outputs).
LED's voltage indicators.
Robust construction.
Supply: 110/220V A.C.
Frequency: 50/60 Hz.
FA-CO includes all the requirements for full working with any module from M1 to M99.
Dimensions: 225 x 205 x 100 mm. approx. (8.9 x 8 x 3.9 inches approx.).
Weight: 2 Kg. approx. (4.4 pounds approx.).



EBC-100. Base Unit, with built-in power supply.

Hardware support and power supply.
Modules supporting unit.
Fixed outputs DC: + 5V, + 12V, -12V.
Variable outputs DC: $\pm 12V$.
AC output: 12 V. or 24 V.
Outputs through either 2mm. contact terminals, or through 25 pin Sub-D connector.
LED's voltage indicators.
Robust construction.
Supply: 110/220 V. AC.
Frequency: 50/60 Hz.
EBC-100 includes all the requirements for full working with any module from M1 to M99.
Dimensions: 410 x 298 x 107 mm. approx. (16.1 x 11.7 x 4.2 inches approx.).
Weight: 2 Kg. approx. (4.4 pounds approx.).



② Modules

► Basic Electronics concepts

M3. Semiconductors I

Practical possibilities:

Characteristics of the PN junction:

- 1.- Study of the diode.
- 2.- Fault Study in diodes.
- 3.- Exercises.

The diode as a rectifier element:

- 4.- Half wave rectifier.
- 5.- Study of faults in Rectifier circuit.
- 6.- Bridge rectifier.
- 7.- Study of faults in bridge rectifier.
- 8.- Exercises.

The Zener diode:

- 9.- Voltage regulator with a Zener diode.
- 10.- Study of faults in Zener circuit.
- 11.- Exercises.

Study and characteristics of the transistor:

- 12.- Study of the transistor.
- 13.- Study of the fault in the transistor.
- 14.- Exercises.

Transistor characteristics operating as a switch:

- 15.- Study of the transistor.
- 16.- Exercises.

Common emitter amplifier:

- 17.- Study of the common emitter NPN amplifier.
- 18.- Fault Study in Amplifier circuit.
- 19.- Study of the common emitter PNP amplifier.
- 20.- Exercises.

Additional Possibilities:

- Voltage Doubler.
- Power Supply filtering.

Specifications:

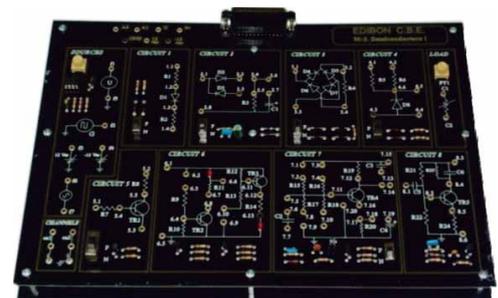
Circuit blocks:

- Diode. (Circuit#1).
- Signal filtration. (Circuit#2).
- Diodes bridge. (Circuit#3).
- Zener diode. (Circuit#4).
- BJT transistor. (Circuit#5).
- NPN and PNP as switch. (Circuit#6).
- NPN amplification. (Circuit#7).
- PNP amplification. (Circuit#8).
- Sources.
- Load.
- Channels.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M4. Semiconductors II

Practical possibilities:

Complementary transistors pair:

- 1.- Complementary transistors pair.
- 2.- Transistors pair with alternating signal.
- 3.- Fault study of the complementary Transistor pair.
- 4.- Exercises.

Darlington configuration:

- 5.- Darlington configuration.
- 6.- Fault study of the Darlington configuration.
- 7.- Exercises.

Differential amplifier:

- 8.- Differential amplifier.
- 9.- Fault study in the differential amplifier.
- 10.- Exercises.

Study and characteristics of the JFET transistor:

- 11.- JFET characteristics.
- 12.- Fault study with the JFET transistor.
- 13.- Exercises.

Analog switch:

- 14.- Analog switch.
- 15.- Exercises.

Multistage Amplifier. Direct coupling:

- 16.- Amplifier coupled directly.
- 17.- Fault study of an amplifier coupled directly.
- 18.- Exercises.

Specifications:

Circuit blocks:

- Complementary transistors. (Circuit#1).
- Darlington configuration. (Circuit#2).
- Differential configuration. (Circuit#3).
- JFET field-effect transistors. (Circuit#4).
- Analog switch. (Circuit#5).
- Direct coupling. (Circuit#6).

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M6. Oscillators

Practical possibilities:

Oscillators. RC and LC Nets:

- 1.- RC net oscillator.
- 2.- LC net oscillator.
- 3.- Faults study with RC and LC Net oscillators.
- 4.- Exercises.

Wien bridge oscillator:

- 5.- Wien Bridge.
- 6.- Fault study in the Wien bridge oscillator.
- 7.- Exercises.

Colpitts oscillator. Hartley oscillator:

- 8.- Colpitts oscillator.
- 9.- Hartley oscillator.
- 10.- Faults study with the Colpitts oscillator.
- 11.- Exercises.

Astable multivibrator:

- 12.- Astable multivibrator.
- 13.- Fault study with an Astable multivibrator.
- 14.- Exercises.

555 Timer:

- 15.- 555 timer.
- 16.- 555 timer fault study.
- 17.- Exercises.

Specifications:

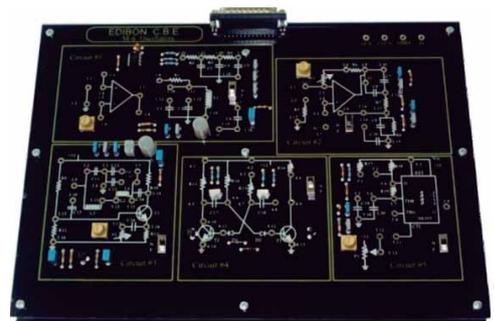
Circuit blocks:

- RC and LC oscillators. (Circuit#1).
- Wien bridge. (Circuit#2).
- Colpitts, Hartley oscillators. (Circuit#3).
- Astable multivibrator. (Circuit#4).
- 555 Timer. (Circuit#5).

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M7. Operational Amplifiers

Practical possibilities:

Operational amplifier characteristics:

- 1.- Operational amplifier study.
- 2.- Closed-loop output compensation voltage.
- 3.- Operational amplifier fault study.
- 4.- Exercises.

The inverting amplifier:

- 5.- Inverting amplifier study.
- 6.- Inverting amplifier fault study.
- 7.- Exercises.

The non-inverting amplifier:

- 8.- Study of the non-inverting amplifier.
- 9.- Voltage follower.
- 10.- Fault study in the non-inverting amplifier.
- 11.- Exercises.

The adder amplifier:

- 12.- Adding amplifier study.
- 13.- Fault study in the adding amplifier.
- 14.- Exercises.

The differential amplifier:

- 15.- Differential amplifier study.
- 16.- Differential amplifier fault study.
- 17.- Exercises.

Comparators:

- 18.- Comparator study.
- 19.- Comparators fault study.
- 20.- Exercises.

Additional Possibilities:

- Attenuator.
- Voltage Divider.
- Open-loop operation.

Specifications:

Circuit blocks:

- Operational amplifier.
- Inverting amplifier.
- Non-inverting amplifier.
- Adder.
- Differential amplifier.
- Comparator.
- Channels.
- Sources.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M8. Filters

Practical possibilities:

RC and LC filter responses:

- 1.- Frequency response.
- 2.- Low-pass filter.
- 3.- High-pass filter.
- 4.- LC Circuit.
- 5.- Study of Error in Low-pass filter.
- 6.- Study of Error in High-pass filter.
- 7.- Exercises theoretical/practical.

T-shaped Filter:

- 8.- Filter with double T link.
- 9.- Generator circuit of the signal.
- 10.- Study of Error in RC filter with double T.
- 11.- Exercises theoretical/practical.

Active filters:

- 12.- Low-pass filter.
- 13.- Low-pass filter with load and operational amplifier.
- 14.- High-pass filter.
- 15.- High-pass filter with load and operational amplifier.
- 16.- The attenuation is cumulative.
- 17.- Use of Operational Amplifier.
- 18.- Study of Faults in filters.
- 19.- Exercises theoretical/practical.

Association of filters:

- 20.- Behaviour of the filter.
- 21.- Filter of distorted signal.
- 22.- Filter in cascade; low pass filter and high pass filter.
- 23.- Filter in parallel.
- 24.- Study of Error in filters.
- 25.- Exercises theoretical/practical.

Additional Possibilities:

- Band-Pass and Band-Stop Filters.

Specifications:

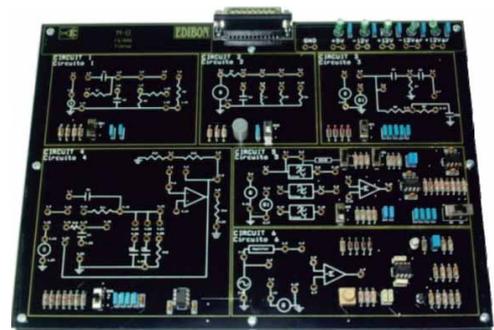
Circuit blocks:

- RC filters. (Circuit#1).
- LC filter. (Circuit#2).
- T-shaped filter. (Circuit#3).
- Active filters. (Circuit#4).
- Association of filters. Distorted signal filters. (Circuit#5 and Circuit#6).

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M9. Power Electronics

Practical possibilities:

The bipolar power transistor:

- 1.- Study of the power transistor.
- 2.- Study of faults in the power transistor.
- 3.- Exercises.

The MOSFET transistor:

- 4.- Study of the MOSFET transistor.
- 5.- Study of faults in the MOSFET transistor.
- 6.- Exercises.

The thyristor:

- 7.- Study of the thyristor.
- 8.- Study of the error of the thyristor.
- 9.- Exercises.

The UJT transistor and trigger circuits of the thyristor:

- 10.- Study of the trigger circuits of the thyristor.
- 11.- Study of insulation circuits.
- 12.- Exercises.

The TRIAC:

- 13.- Study of the TRIAC.
- 14.- Practical assembly of the TRIAC.
- 15.- Exercises.

Additional Possibilities:

Half/Full wave control.

Specifications:

Circuit blocks:

- Variable source. (Circuit#1).
- Power transistors. (Circuit#2).
- MOSFET N. (Circuit#3).
- MOSFET P. (Circuit#4).
- Thyristores. (Circuit#5).
- Pulse generator. (Circuit#6).
- UJT. (Circuit#7).
- Transformer. (Circuit#8).
- Photodiode. (Circuit#9).
- Lamp. (Circuit#10).
- Rectification. (Circuit#11).
- DIAC. (Circuit#12).
- TRIAC. (Circuit#13).
- DIAC tripping TRIAC. (Circuit#14).
- Channels.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M60. Analog/Digital Converters

Practical possibilities:

- 1.- Sampling theorem.
- 2.- Monopolar simple ramp converter.
- 3.- Monopolar double ramp converter.
- 4.- Monopolar binary ramp converter.
- 5.- A/D integrated converter. Monopolar assembly.
- 6.- A/D integrated converter. Bipolar assembly.
- 7.- Flash converter.

Specifications:

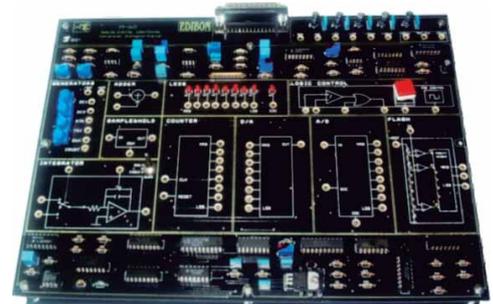
Circuit blocks:

- Generators.
- D/A converter.
- A/D converter.
- Adder.
- Sample & Hold.
- Leds.
- Logic control.
- Integrator.
- Counter.
- Flash converter.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M61. Digital/Analog Converters

Practical possibilities:

- 1.- D/A converter of weighted divider resistors.
- 2.- Analog switches errors.
- 3.- D/A converter of R-2R ladder.
- 4.- Current division in R-2R ladder converter.
- 5.- D/A converter of inverted ladder.
- 6.- D/A integrated converter.
- 7.- Serial data input D/A converter.
- 8.- D/A converter of pulse width modulation.

Specifications:

Circuit blocks:

- Generators.
- R-2R converter.
- Weighted converter.
- D/A converter.
- Serial converter.
- Amplifier.
- Adder.
- Sample/Hold.
- Frequency-voltage converter.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M99. Expansion Unit

Practical possibilities:

- 1.- TDM (Time Division Multiplexing).
- 2.- Analog Multiplication.
- 3.- AM modulation/demodulation.
- 4.- FM modulation/demodulation.
- 5.- PWM modulation/demodulation.

Specifications:

M99 unit enables to carry out different practices related with basic electronics.

Modules included in M99 unit:

M99-1. Analog Multiplexer module:

This module allows us to select between two analog signals. There is a digital control signal for selecting the input signal.

- Two input signals.
- Input Voltage: $\pm 10V$ max.
- TTL compatible control signal.

M99-2. Analog Multiplier module:

This module is an analog multiplier. There is also a potentiometer to control the gain of the multiplier.

- Two input signals.
- Input Voltage: $\pm 10V$ max.

M99-3. Function Generator module:

This module allows us to generate three different signals types: sinusoidal, square and sawtooth. The frequency and amplitude of the signals can be adjusted using the potentiometers.

- Sine, square and sawtooth signals.
- Amplitude: $\pm 10V$.
- Frequency: 0Hz to 100Hz.

M99-4. AM modulator module:

This module allows us to generate an AM signal. The frequency of the carrier signal can be selected by using a potentiometer.

- AM-DSB modulator.
- Carrier frequency: 1000Hz max.

M99-5. AM demodulator module:

This module allows us to demodulate an AM signal. The demodulator is divided in different blocks: mixer, IF amplifier, envelope detector and audio filter. The frequency of the local oscillator generated for the tuning can be selected by using a potentiometer. All outputs of these blocks can be observed using the output terminals.

- Tuning circuit.
- IF amplifier (455Hz).
- Envelope detector.
- Audio signal filter.

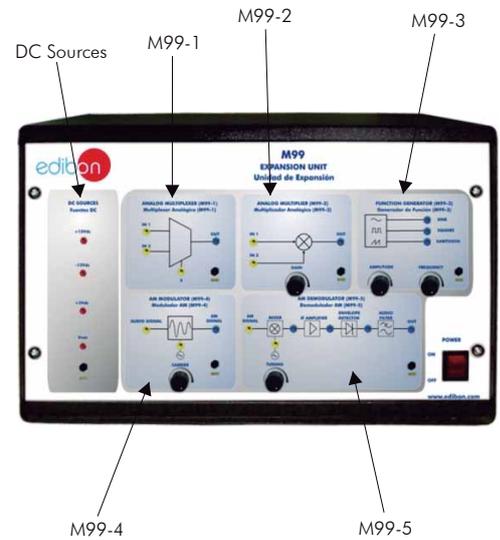
DC source module:

- $\pm 12Vdc$.
- $\pm 5Vdc$.

Dimensions: 490 x 330 x 310 mm. approx.
(19.3 x 13 x 12.2 inches approx.).

Weight: 6 Kg. approx.
(13.22 pounds approx.).

Power supply required:
single-phase, 220V / 50Hz. or 110V/
60Hz.



M99-6. Motors, Generators and Controls Unit

Practical possibilities:

- 1.- DC Motor.
- 2.- AC Motor.
- 3.- DC Generator.
- 4.- AC Generator.
- 5.- Stepper motor.

Specifications:

M99-6 unit enables to carry out different practices related with motors and generators. The unit is divided in three different modules: DC motor, AC motor and Stepper Motor.

DC Motor:

This module contains a DC motor.

There is a potentiometer to control the speed of the motor.

There is a switch to enable the motor to run.

The voltage internally applied to the motor or generated can be observe using the "M+" and "M-" terminals.

- Power supply: 5Vdc, 1W.
- Speed: 800 rpm.

AC Motor:

This module contains an AC synchronous motor.

There is a switch to enable the motor to run.

The voltage internally applied to the motor or generated can be observe using the "AC1" and "AC2" terminals.

- Power supply: 24Vac, 50Hz, 0.9W.
- Torque: 0.9Ncm max.
- Speed: 600 rpm.

Stepper Motor:

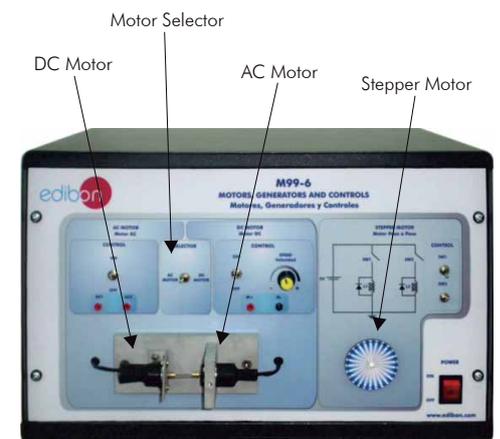
This module contains a stepper motor. There are two switches to control the rotation of the motor.

Power supply: 5 Vdc, 1.25 W.

Dimensions: 490 x 330 x 310 mm. approx.
(19.3 x 13 x 12.2 inches approx.).

Weight: 6 Kg. approx.
(13.22 pounds approx.).

Power supply required:
single-phase, 220V / 50Hz. or 110V/
60Hz.



M10. Digital Systems and Converters

Practical possibilities:

Analog switching. The bistable, astable and monostable family:

- 1.- Characteristics of an analog switch.
- 2.- Study of the errors in the Analog Multiplexer.
- 3.- Characteristics of an S-R type Latch circuit.
- 4.- Error Study in the bistable.
- 5.- Characteristics of an astable circuit.
- 6.- Error study in the astable.
- 7.- Characteristics of a monostable circuit.
- 8.- Theoretical/practical exercises.

Binary/BCD Counters & 7-segments Displays:

- 9.- Characteristics of Binary UP/DOWN Counter and 7-Segment Display.
- 10.- Error Study in the binary counter.
- 11.- Characteristics of the BCD UP/DOWN counter and 7-Segment Display.
- 12.- Error Study in the BCD counter.
- 13.- Theoretical/practical exercises.

Comparators and analog integrators:

- 14.- Characteristics of an analog comparator.
- 15.- Analog integrator.
- 16.- Error Study in the analog integrator.
- 17.- Triangular wave generation.
- 18.- Theoretical/practical exercises.

A/D and D/A conversion:

- 19.- D/A Converter.
- 20.- A/D Converter.
- 21.- Theoretical/practical exercises.

Applications:

- 22.- Random number generator.
- 23.- Measuring the time between two events.
- 24.- Theoretical/practical exercises.

Additional Possibilities:

Synchronous/Asynchronous Counter.

Specifications:

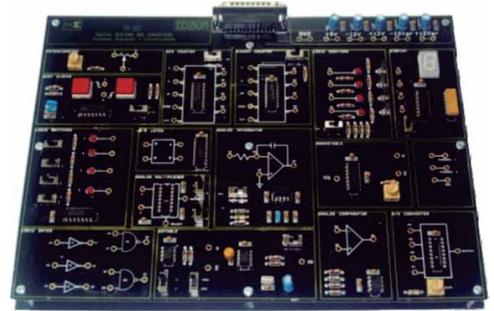
Circuit blocks:

- Potentiometer.
- BCD counter.
- Binary counter.
- Logic monitors.
- Display.
- Shot Clocks.
- Logic switches.
- Flip Flop RS.
- Analog multiplexer.
- Analog integrator.
- Monostable.
- Logic gates.
- Astable.
- Analog comparator.
- D/A converter.
- Channels.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M11. Digital Electronics Fundamentals

Practical possibilities:

Numbers systems:

- 1.- Voltage measurement in a circuit of sources.
- 2.- Fault study in the source circuit.
- 3.- Exercises.

Logical circuits:

- 4.- Logical Diode.
- 5.- Fault study in Sources.
- 6.- Logic with transistor and diodes.
- 7.- Fault study in transistor/diode circuit.
- 8.- Exercises.

TTL gates:

- 9.- Basic function gates.
- 10.- Fault study in TTL circuit.
- 11.- Fault study in Logic Gates.
- 12.- Exercises.

CMOS gates:

- 13.- Basic function gates.
- 14.- Fault study in CMOS circuit.
- 15.- Exercises.

Boolean Algebra and logical functions:

- 16.- Study of use of Circuit #3.
- 17.- Exercises.

Open collector gates:

- 18.- Study of the use of Circuit #5.
- 19.- Exercises.

Others types of integrated gates:

- 20.- Study of simple operations with a Schmitt Trigger inverter.
- 21.- Operation study of a three-state buffer.
- 22.- Study of the fault in the Circuit #7.
- 23.- Exercises.

Additional Possibilities:

JK Flip-Flop.
Control of Data Bus.

Specifications:

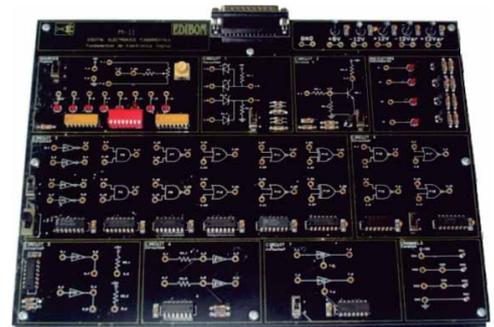
Circuit blocks:

- Logical source. (Circuit#1).
- Sources. (Circuit#2).
- TTL logical gates. (Circuit#3).
- CMOS logical gates. (Circuit#4).
- Open collector gates. (Circuit#5).
- Schmitt trigger. (Circuit#6).
- Three-states. (Circuit#7).
- Channels.
- Sources.
- Indicators.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M12. Basic Combinational Circuits

Practical possibilities:

Encoders:

- 1.- Study of an encoder.
- 2.- Fault study in the encoder.
- 3.- Exercises.

Decoders:

- 4.- Study of a decoder.
- 5.- Fault study in the decoder.
- 6.- Exercises.

Multiplexers:

- 7.- Study of a multiplexer.
- 8.- Study of the errors in the multiplexers.
- 9.- Exercises.

Demultiplexers:

- 10.- Study of a demultiplexer.
- 11.- Study of the errors in demultiplexers.
- 12.- Exercises.

Digital Comparators:

- 13.- Study of a comparator.
- 14.- Study of the errors in a comparator.
- 15.- Exercises.

Arithmetic and logic operations:

- 16.- Study of an adder.
- 17.- Study of the error in the arithmetic and logic operations.
- 18.- Study of a parity generator.
- 19.- Study of the error in the Parity generator.
- 20.- Exercises.

Specifications:

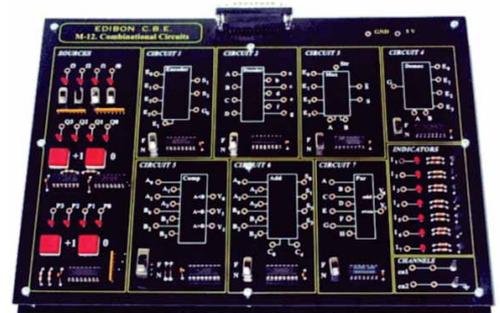
Circuit blocks:

- Encoder. (Circuit#1).
- Decoder. (Circuit#2).
- Multiplexer. (Circuit#3).
- Demultiplexer. (Circuit#4).
- Comparator. (Circuit#5).
- Adder. (Circuit#6).
- Parity. (Circuit#7).
- Indicators.
- Channels.
- Sources.

Dimensions: 300 x 210 x 45 mm. approx.
 (11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
 (0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M13. Basic Sequential Circuits

Practical possibilities:

Bistables:

- 1.- Bistables.
- 2.- Bistable S-R using NAND gates.
- 3.- Practical performance.
- 4.- Study of error in the Bistables.
- 5.- Exercises.

Shift registers:

- 6.- Shift registers.
- 7.- Study of faults of the Shift registers.
- 8.- Exercises.

Counters:

- 9.- Practice of the Counters.
- 10.- Study of faults of the Counters.
- 11.- Exercises.

Synchronised sequential circuits:

- 12.- Practice of the Synchronised.
- 13.- Study of errors of the Synchronised sequential circuits.
- 14.- Exercises.

Memories:

- 15.- Exercises.

Specifications:

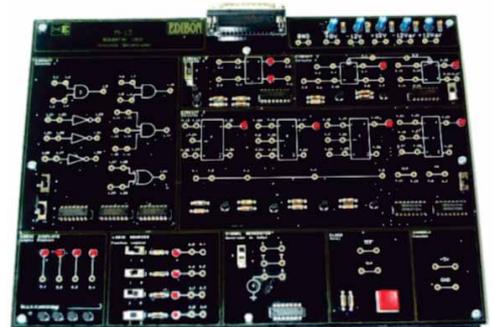
Circuit blocks:

- Logic gates. (Circuit#1).
- RS Bistable. (Circuit#2).
- Shift registers. (Circuit#3).
- Counters. (Circuit#4).
- Logic displays.
- Sources.
- Signal generator.
- Clock.

Dimensions: 300 x 210 x 45 mm. approx.
 (11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
 (0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M14. Optoelectronics

Practical possibilities:

Light transmitters and liquid crystal display (LCD):

- 1.- Light transmitters.
- 2.- Bar graph.
- 3.- LCD display and 7-segment display.
- 4.- Fault Study in light transmitters and liquid crystal display.
- 5.- Exercises.

Photo-conducting cells:

- 6.- Light dependent resistors.
- 7.- Alarm.
- 8.- Fault study on the photo-conducting cell.
- 9.- Exercises.

Fibre optics:

- 10.- Fibre optics practice.
- 11.- Fault study using fibre optics.
- 12.- Exercises.

Infrared:

- 13.- Circuit with infrared diodes.
- 14.- Fault study of the infrared diodes.
- 15.- Exercises.

Specifications:

Circuit blocks:

- Lamp. (Circuit#1).
- Sources. (Circuit#2).
- Bar graph. (Circuit#3).
- LDR. (Circuit#4).
- Photodiodes, optic fibre. (Circuit#5).
- Converter. (Circuit#6).
- Amplifier. (Circuit#7).
- Differential amplifier. (Circuit#8).
- Infrared Photodiodes. (Circuit#9).
- LCD Display, 7 segment BCD. (Circuit#10).
- Buzzer.

Dimensions: 300 x 210 x 45 mm. approx.
 (11.81x8.26x1.77 inches approx.).

Weight: 300 gr. approx.
 (0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M41. Resistance Transducers

Practical possibilities:

- 1.- Study of the properties of NTC for the measurement of temperature.
- 2.- Study of the properties of PTC for the measurement of temperature.
- 3.- Study of the properties of LDR for the measurement of light intensity.
- 4.- Study of the properties of RTD for the measurement of temperature.
- 5.- Study of the properties of Strain Gauge for the measurement of deformation.

Specifications:

This module enables to carry out different practices related with variable resistance transducers. The module has five different types of transducers: PTC, NTC, LDR, strain gauge and RTD.

On the chassis there are a lamp, a heater and the sensors. The lamp is used to control the illumination incident. The module also include a dark cover box whose aim is to avoid the environmental light noise. The heater is used to control the temperature.

Elements included:

Lamp:

- Voltage: 12Vdc.
- Illumination intensity: 200 lumens.
- Power dissipation: 5W max.

Heater resistor:

- Voltage: 12Vdc.
- Power dissipation: 4W max.

PTC:

- Resistance @ 25°C: 100 Ohm.
- Operating temperature max: +70°C.

NTC:

- Resistance @25°C: 150 Ohm.
- Temperature coefficient: -3.9%/°C.
- Temperature sensing range: -55 to +150°C.

RTD:

- Resistance @ 0°C: 100 Ohm.
- Sensibility: +0.3851 Ohm/°C.
- Temperature sensing range: -220°C to +650°C.

LDR:

- Resistance: 5.4K min., 12.6K max.
- Power dissipation: 250mW max.
- Peak wavelength: 550nm.

Strain gauge:

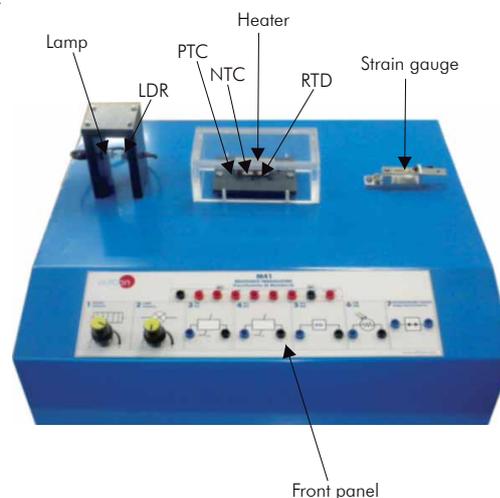
- Resistance: 120 Ohm.
- Power dissipation: 100mW max.
- Factor: 2.1
- Length: 5mm.

All the connections of the different sensors and lamp are done using the 2mm terminals available on the module front panel, with diagrams describing their functions.

Dimensions: 405 x 300 x 350 mm. approx.
 (15.9x11.8x13.7 inches approx.).

Weight: 6 Kg. approx.
 (13.22 pounds approx.).

Note: FA-CO Unit gives all the supplies required for this module.



M5. Power Supplies

Practical possibilities:

Rectification:

- 1.- Rectification.
- 2.- Bridge rectifier.
- 3.- Theoretical/practical exercises.

Fixed voltage sources:

- 4.- Power supply with the Zener diode.
- 5.- Stabilization through Zener and Transistor.
- 6.- Fault study in "Stabilization through Zener and Transistor".
- 7.- Protection against overcurrents.
- 8.- Protection against overvoltages.
- 9.- Study of the fault "Protection against overcurrents".
- 10.- Theoretical/practical exercises.

Symmetrical voltage power sources:

- 11.- Symmetrical source; 78XX regulator.
- 12.- Symmetrical source; 79XX regulator.
- 13.- Theoretical/practical exercises.

Voltage regulators with integrated circuits:

- 14.- Adjustable regulator; LM317.
- 15.- Study of the fault in adjustable LM317 regulator.
- 16.- Adjustable L200 regulator.
- 17.- Fault Study in adjustable L200 regulator.
- 18.- Theoretical/practical exercises.

Introduction to switched power supplies:

- 19.- Switching technique.
- 20.- Switching technique. PWM.
- 21.- Switching technique. Boost.
- 22.- Theoretical/practical exercises.

Additional Possibilities:

- Voltage Feedback.
DC-DC converter.

Specifications:

Circuit blocks:

- Transformer. (Circuit#1).
Half wave rectifier. Full wave rectifier, center tap. (Circuit#2).
Full wave rectifier. (Circuit#3).
Filtering. (Circuit#4).
Zener limiting.(Circuit#5).
Regulation. (Circuit#6).
Overcurrent protection. (Circuit#7).
Overvoltage protection. (Circuit#8).
Voltage regulators. (Circuit#9).
LM317 adjustable Regulator. (Circuit#10).
L200 adjustable Regulator. (Circuit#11).
Switched source. (Circuit#12).
PWM switched source. (Circuit#13).
Boost switched source. (Circuit#14).
Load.
Channels.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M1. Direct Current (D.C.) Circuits

Practical possibilities:

Measurement managing and checking instruments:

- 1.- Electronic instrumentation operation. Use of multimeter.
- 2.- Study of fault F1 in Resistance circuit.
- 3.- Study of fault F2 in Resistance circuit.
- 4.- Theoretical/practical exercises.

Ohm's Law:

- 5.- Ohm's Law verification.
- 6.- Power calculation.
- 7.- Theoretical/practical exercises.

Resistors: characteristics and types:

- 8.- Resistor measurements.
- 9.- Study of Fault F1 in Resistors circuit.
- 10.- Study of Fault F2 in Resistors circuit.
- 11.- Theoretical/practical exercises.

Resistors association and the Wheatstone Bridge:

- 12.- Voltage and current measurement in a circuit with resistors connected in series.
- 13.- Series/Parallel configuration study.
- 14.- The Wheatstone Bridge.
- 15.- Study of Fault in Series Resistors circuit.
- 16.- Study of Fault in Parallel Resistors circuit.
- 17.- Study of Fault F1 in Wheatstone Bridge circuit.
- 18.- Study of Fault F2 in Wheatstone Bridge circuit.
- 19.- Theoretical/practical exercises.

Kirchoff's laws:

- 20.- Kirchoff's first law.
- 21.- Kirchoff's second law.
- 22.- Fault study using Kirchoff's law.
- 23.- Theoretical/practical exercises.

Additional Possibilities:

- Voltage/Current dividers.
Batteries and Switches.
Power source in series and parallel.
The Rheostat and Potentiometer.

Specifications:

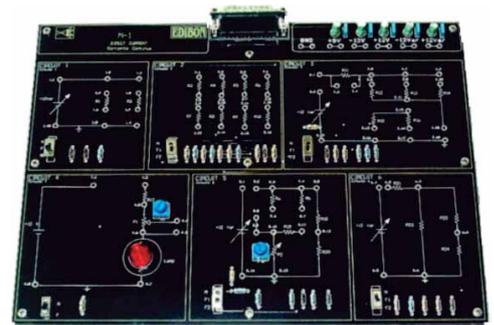
Circuit blocks:

- Resistance Circuit.(Circuit #1).
Series/Parallel Resistors. (Circuit #2).
Series/Parallel Resistors Circuit with source. (Circuit #3).
Intensity regulation. (Circuit #4).
Wheatstone bridge. (Circuit #5).
Faults study. (Circuit #6).

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M2. Alternating Current (A.C.) Circuits

Practical possibilities:

Alternating signal characteristics. Instruments:

- 1.- Waveforms study in AC.
- 2.- Introduction of anomalies in the Wave form circuit.
- 3.- Study of Faults in the Waveform circuit.
- 4.- Relation between peak values and RMS for sinusoidal waves.
- 5.- Resistance in a sinusoidal alternating current.
- 6.- Measurements using the oscilloscope.
- 7.- Voltage and current phase angles for resistors in sinusoidal alternating current.
- 8.- Sinusoidal AC. resistors in series.
- 9.- Sinusoidal AC. resistors in parallel.
- 10.- Exercises.

Behaviour of AC. capacitors and inductors:

- 11.- Capacitance with square waveform and sinusoidal input current.
- 12.- Inductance with square waveform and a sinusoidal input voltage.
- 13.- Reactive reactance, X_c , variations with the frequency.
- 14.- Study of faults in capacitors.
- 15.- Reactive capacitance variations with the capacitance.
- 16.- AC. capacitors in parallel.
- 17.- AC. capacitors in series.
- 18.- AC. capacitors as voltage dividers.
- 19.- Inductance in an AC circuit.
- 20.- Inductive reactance variations with the inductance.
- 21.- Inductors in series in an AC. circuit.
- 22.- Exercises.

Basic theorems and capacitance and inductance circuits:

- 23.- AC. Resistor-Capacitor circuits in series.
- 24.- AC. Resistor-Capacitor circuits in parallel.
- 25.- AC. Resistor-Inductor circuits in series.
- 26.- Study of Fault 1 in the Circuit #3.
- 27.- Study of Fault 2 in the Circuit #3.
- 28.- AC. Resistor-Inductor circuits in parallel.
- 29.- Exercises.

RLC Circuits:

- 30.- Resistance-Capacitance Filters.
- 31.- Filters inductive resistance. Low-Pass and High-Pass filters.
- 32.- Exercises.

Resonance:

- 33.- AC. L-C Circuits in parallel with low impedance source.
- 34.- Study of Fault 1 in the resonance circuit.
- 35.- Study of Fault 2 in the resonance circuit.
- 36.- AC. L-C Circuits in parallel with high impedance source.
- 37.- Circuit frequency response and bandwidth.
- 38.- AC. R-L-C Circuits in series.
- 39.- Exercises.

The transformer:

- 40.- The transformer.
- 41.- The transformer with load.
- 42.- Current measurement in the secondary Transformer with charge.
- 43.- Exercises.



Specifications:

Circuit blocks:

- Wave forms. (Circuit #1).
- Transformers. (Circuit #2).
- Reactive mixed circuits. (Circuit #3).
- Channels.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.

M16. Electric Networks

Practical possibilities:

Ohm's law:

- 1.- Calculation of the internal resistance of a continuous source.
- 2.- Error study in an internal resistance.
- 3.- Internal resistance calculation of an alternating source.
- 4.- Theoretical/practical exercises.

Electrical power:

- 5.- Power transferred by a DC source to load.
- 6.- Power transferred to a load by an AC source.
- 7.- Theoretical/practical exercises.

Power supplies combination:

- 8.- DC+DC assembly.
- 9.- Error study in the circuit, DC assembly.
- 10.- DC+AC assembly.
- 11.- Theoretical/practical exercises.

Thévenin's and Norton's theorems:

- 12.- Thévenin and Norton equivalent circuits. Conversion. Kirchoff's laws.
- 13.- Theoretical/practical exercises.

Superposition theorem:

- 14.- Application of the Superposition theorem.
- 15.- Error study in the Superposition circuit.
- 16.- Theoretical/practical exercises.

Star-triangle transformation:

- 17.- Resistance measurement between terminals. Delta | Y configurations.
- 18.- Theoretical/practical exercises.

Wheatstone bridge:

- 19.- Calibration of a Wheatstone bridge fed by a DC source.
- 20.- Error study in the Wheatstone bridge circuit.
- 21.- Wheatstone bridge calibration fed by an AC source.
- 22.- Theoretical/practical exercises.

Additional Possibilities:

Millman's Theorem.

Specifications:

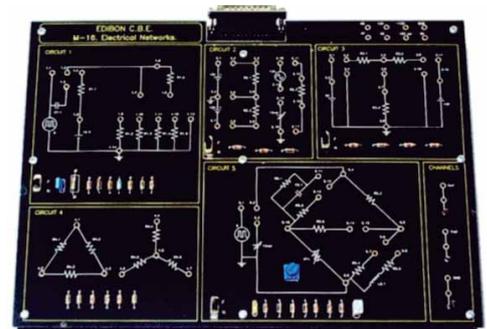
Circuit blocks:

- Series/Parallel Connections. (Circuit #1).
- AC/DC. (Circuit #2).
- Superposition. (Circuit #3).
- Triangle .Star. (Delta | Y)(Circuit #4).
- Bridges. (Circuit #5).
- Channels.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M17. Electromagnetism

Practical possibilities:

Magnetic fields:

- 1.- Magnetic fields measurement.
- 2.- Induced electromotive force. Coil Reactance calculation.
- 3.- Exercises.

Electromagnetic applications:

- 4.- Mutual Inductance.
- 5.- Basic operation of the transformer.
- 6.- Core effect in a transformer response.
- 7.- Fault study in the transformer.
- 8.- Basic operation of the solenoid.
- 9.- Fault study in the solenoid circuit.
- 10.- Basic operation of a relay.
- 11.- Self-holding of the position of the contacts.
- 12.- Fault study in the relay circuit.
- 13.- Exercises.

Direct current motor:

- 14.- Characteristic Speed/Voltage of a continuous current motor.
- 15.- Motor used as DC generator.
- 16.- Cemf.
- 17.- Exercises.

Stepper Motor:

- 18.- Stepper motor working.
- 19.- Fault study in Stepping motor circuit.
- 20.- Exercises.

Specifications:

Circuit blocks:

- Coils. Hall effect probe. Materials. (Circuit#1).
- Solenoid. (Circuit#2).
- Excitation. Relays. (Circuit#3).
- Hall effect probe. DC Motor. (Circuit#4).
- Stepper motor. (Circuit#5).
- Channels.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M18. Three-phase Circuits

Practical possibilities:

Generation of a three-phase system:

- 1.- Checking of the three-phase system.
- 2.- Calculation of the voltage values.

Three-phase loads in star and delta:

- 3.- Star-delta equivalence.
- 4.- Decompensation of the star.
- 5.- Out-phase between voltage and current (reactance).
- 6.- Measurement of the power factor.
- 7.- Correction of the power factor.

Synchronism detector:

- 8.- Out-phase generation between waves.
- 9.- Detection of out-phase between waves.

Phase-sequence detector:

- 10.- Waves in direct sequence.
- 11.- Waves in inverse sequence.

Three-phase rectifier:

- 12.- Half-wave three-phase rectifier.
- 13.- Full-wave three-phase rectifier.

Specifications:

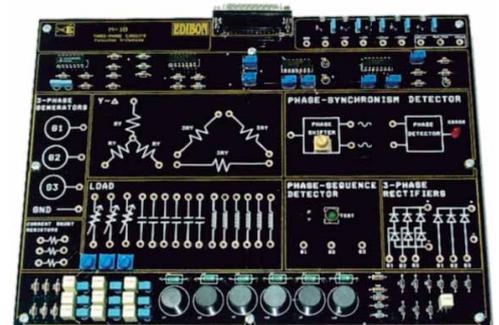
Circuit blocks:

- Three-phase generator.
- Star-Delta ($Y-\Delta$).
- Phase-synchronism detector.
- Current resistors.
- Loads.
- Phase-sequence detector.
- Three-phase rectifiers:
 - Full wave three-phase rectifier.
 - Half wave three-phase rectifier.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M43. Applications of Temperature

Practical possibilities:

The integrated circuit temperature transducer:

- 1.- Characteristics of an integrated temperature circuit.
- 2.- Construction of a digital thermometer.

The (T.D.R.) Platinum transducer:

- 3.- Characteristics of a platinum Temperature Dependent Resistance (T.D.R) transducer.

The N.T.C (Negative Temperature Coefficient) thermistor:

- 4.- Characteristics of an N.T.C thermistor.
- 5.- N.T.C Characteristics. Thermistor used in an alarm circuit (double thermistor).

The "K" type thermocouple temperature thermistor:

- 6.- Characteristics of a 'K' type thermocouple.

Specifications:

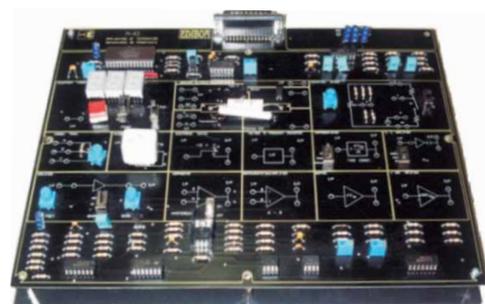
Circuit blocks:

- Counter/Timer.
- Thermometric probes (Type 'K', IC, Thermistor, Platinum RTD).
- Wheatstone bridge.
- Carbon track.
- Buzzer.
- Electronic switch.
- Voltage to frequency converter.
- Differentiator.
- AC Amplifier.
- Amplifier (Adjust offset. Gain).
- Comparator. Hyteresis.
- Instrumental amplifier.
- Buffer.
- x100 amplifier.

Dimensions: 300 x 210 x 45 mm. approx.
 (11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
 (0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M49. Applications of Temperature and Pressure

Practical possibilities:

The integrated circuit temperature transducer:

- 1.- Characteristics of an integrated temperature circuit.
- 2.- Construction of a digital thermometer.

The (T.D.R.) Platinum transducer:

- 3.- Characteristics of a platinum Temperature Dependent Resistance (T.D.R) transducer.

The N.T.C (Negative Temperature Coefficient) thermistor:

- 4.- Characteristics of an N.T.C thermistor.
- 5.- N.T.C Characteristics. Thermistor used in an alarm circuit (double thermistor).

The "K" type thermocouple temperature thermistor:

- 6.- Characteristics of a 'K' type thermocouple.

The Pressure transducer:

- 7.- Characteristic of a pressure transducer.

Specifications:

Circuit blocks:

- Counter/Timer.
- Thermometric probes (Type 'K', IC, Thermistor, Platinum RTD).
- Wheatstone bridge.
- Carbon track.
- Buzzer.
- Pressure transducer.
- Electronic switch.
- Voltage to frequency converter.
- Differentiator.
- AC Amplifier.
- Amplifier (Adjust offset. Gain).
- Comparator. Hyteresis.
- Instrumental amplifier.
- Buffer.
- x100 amplifier.

Dimensions: 300 x 210 x 45 mm. approx.
 (11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
 (0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M44. Applications of Light

Practical possibilities:

- 1.- Study of the equivalent electrical circuit of a photodiode.
- 2.- Study of the V-I characteristic of a photodiode.
- 3.- Study of the photovoltaic and photoconductive modes of a photodiode.
- 4.- Study the "ON/OFF" operation mode of a phototransistor.
- 5.- Measurement of light intensity using a photovoltaic cell.
- 6.- Study of the properties of light dependent resistors (LDR)
- 7.- Study of different applications using IR sensors.

Specifications:

This module enables to carry out different practices related with the light intensity measurement.

The module has five different types of light sensors: photodiode, phototransistor, photovoltaic cell, light dependent resistor and infrared sensor.

Studying the different sensors is possible to compare their operation and determine their corresponding strengths and weaknesses.

On the chassis there are two holders with a lamp and the sensors. The lamp is used to control the illumination incident. The module also includes a dark cover box whose aim is to avoid the environmental light noise.

Elements included:

Lamp:

- Voltage: 12Vdc.
- Power dissipation: 5W max.
- Illumination intensity: 200 lumens.

Photodiode:

- Power dissipation: 250 mW max.

- Sensitivity: 0.34A/W.
- Dark current: 200 nA.
- Peak wavelength: 550 nm.
- Reverse voltage: 10V max.

Phototransistor:

- Current collector max.: 20 mA.
- Peak wavelength: 570 nm.

LDR:

- Power dissipation: 250 mW max.
- Peak wavelength: 550 nm.

Photovoltaic cell:

- Power dissipation: 250 mW max.
- Peak wavelength: 550 nm.

IR Emitter:

- Power dissipation: 470 mW max.
- Current max.: 200 mA.
- Peak wavelength: 880 nm.

IR Receiver:

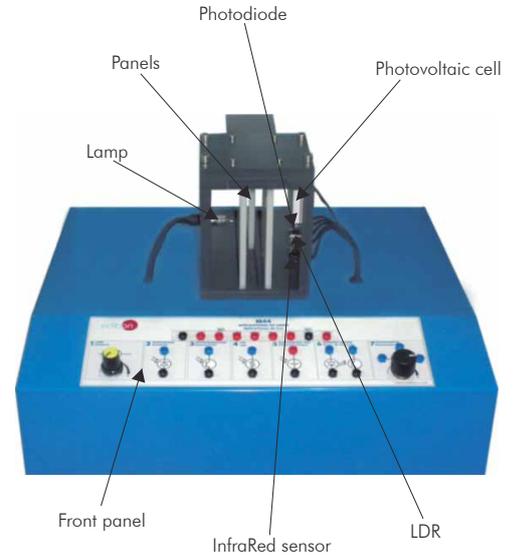
- Power dissipation: 470 mW max.
- Current max.: 200 mA.
- Peak wavelength: 880 nm.

All the connections of the different sensors and lamp are done using the 2 mm. terminals available on the module front panel, with diagrams describing their functions.

Dimensions: 405 x 300 x 350 mm. approx.
(15.9 x 11.8 x 13.7 inches approx.).

Weight: 6 Kg. approx.
(13.22 pounds approx.).

Note: FA-CO Unit gives all the supplies required for this module.



M45. Linear Position and Force

Practical possibilities:

- 1.- Characteristics of a Linear Variable Differential Transformer (LVDT).
- 2.- Displacement measurement by means of a LVDT.
- 3.- Characteristics of a variable resistance.
- 4.- Characteristics of a strain gauge.
- 5.- Deformation measurement by means of strain gauges.
- 6.- Characteristic of a force sensor.
- 7.- Characteristic of a Lineal Position Sensor.

Specifications:

This module enables to carry out different practices related with linear position and force sensors.

Elements included:

Force sensor:

- Voltage: 5 Vdc.
- Current: 1.6 mA max.
- Power dissipation: 19.2 mW max.
- Operating force: 0-1500 gram.
- Sensitivity: 24 mV/gram.

Linear Position Sensor:

- Resistance range: 500 Ohms to 10 K Ohms.
- Tolerance: +/- 20%.
- Temperature characteristic: 0 to 200 ppm/°C max.
- Operating temperature max.: -40°C to +130°C.

LVDT:

- Voltage input: 15 Vac.
- Current input: 10-13 mA.
- Length of work: +/- 1 mm.
- Operating temperature max.: -40 to +80°C.

Strain gauge:

- Resistance: 120 Ohm.
- Power dissipation: 100 mW max.
- Factor: 2.1.
- Length: 5 mm.

Potentiometer:

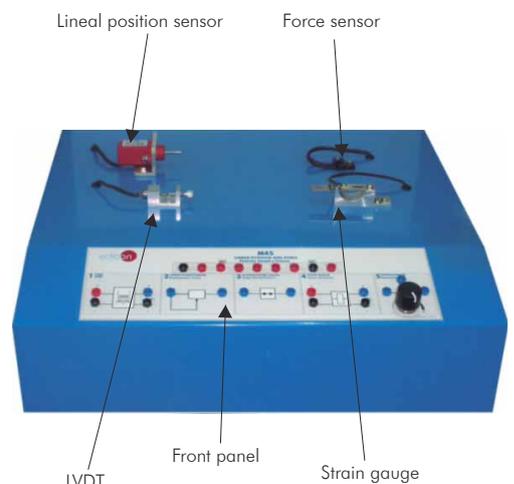
- Resistance: 10K.
- Power dissipation: 470 mW max.
- Current max.: 200 mA.

All the connections of the different sensors and elements are done using the 2 mm. terminals available on the module front panel, with diagrams describing their functions.

Dimensions: 405 x 300 x 350 mm. approx.
(15.9 x 11.8 x 13.7 inches approx.).

Weight: 6 Kg. approx.
(13.22 pounds approx.).

Note: FA-CO Units gives all the supplies required for this module.



M46. Environmental Measurements

Practical possibilities:

- 1.- Characteristics of the temperature sensor.
- 2.- Characteristics of air speed sensor.
- 3.- Characteristics of differential pressure sensor.
- 4.- Characteristics of the humidity sensor.

- Current supply: 500 mA.
- Operating temperature: -40 to 85°C.

- Differential pressure sensor:
- Voltage supply: 10-16 Vdc.
 - Pressure range: 0-30 psi.
 - Sensitivity: 3.33 mV/psi.

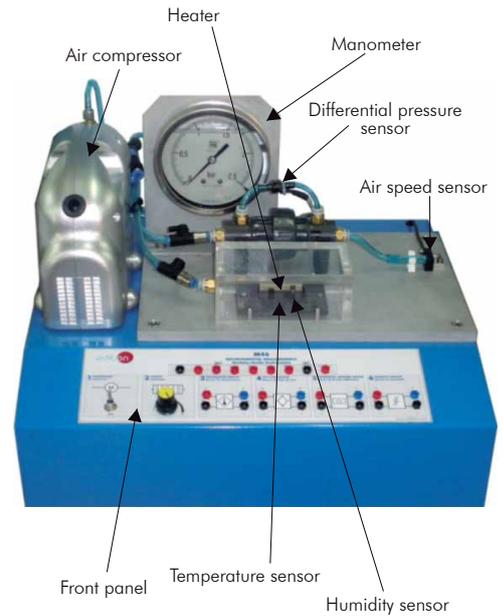
- Air speed sensor:
- Voltage supply: 3.15 - 3.45 Vdc.
 - Analog output: 0.5 - 2 Vdc.
 - Flow range: 0 - 3 m/s.

- Manometer.
Air compressor.

All the connections of the different sensors and elements are done using the 2 mm. terminals available on the module front panel, with diagrams describing their functions.

Dimensions: 405 x 330 x 350 mm. approx.
(15.9 x 13 x 13.7 inches approx.).

Weight: 6 Kg. approx.
(13.22 pounds approx.).



Note: FA-CO Unit gives all the supplies required for this module.

M15. Development Module

This is a module to build and implement student's own circuits, it consists on:

- Development board.
- Power supply connector.
- Digital visual display unit.
- Logical source.
- Set of potentiometers.
- Pulse generator and inverters.
- Interrupter.
- Clock.

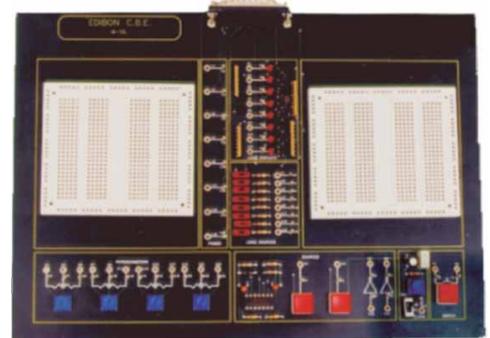
Specifications:

- Circuit blocks:
- Power.
 - Logic sources.
 - Logic displays.
 - Potentiometers.
 - Sources.
 - Clock.
 - Switch.

Dimensions: 300 x 210 x 45 mm. approx.
(11.81 x 8.26 x 1.77 inches approx.).

Weight: 300 gr. approx.
(0.66 pounds approx.).

Note: FA-CO or EBC-100 Units give all the supplies required for this module.



M48. Sounds Measurements

Practical possibilities:

- 1.- Characteristics of a dynamic microphone.
- 2.- Characteristics of a condenser microphone.
- 3.- Characteristics of a loudspeaker.

- Frequency: 50 Hz - 16000 Hz.
- Impedance: < 2.2K Ohm.
- Sensitivity: -47dB +/- 3dB.
- Standard operation voltage: 2Vdc.
- Maximum operation voltage: 10Vdc.
- Maximum current: 0.5 mA.

Specifications:

This module enables to carry out different practices related with variable sound measures. The module has three different types of components: two kind of microphones and a loudspeaker.

Elements included:

- Loudspeaker:
- Impedance: 8 Ohm.
 - Power max.: 0.2 W.

- Dynamic moving coil microphone:
- Directional characteristics: Uni-Directional.
 - Frequency: 70 Hz - 14000 Hz.
 - Impedance: 500 Ohm +/- 30% (at 1000Hz).
 - Sensitivity: -75dB +/- 3dB.

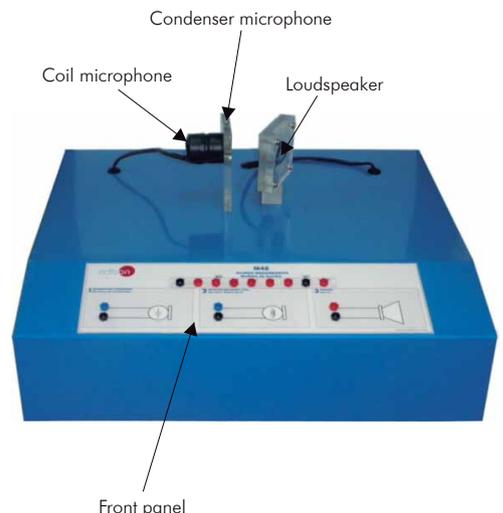
- Condenser microphone:
- Directional characteristics: Uni-Directional.

All the connections of the different sensors and elements are done using the 2 mm. terminals available on the module front panel, with diagrams describing their functions.

Dimensions: 405 x 300 x 350 mm. approx.
(15.9 x 11.8 x 13.7 inches approx.).

Weight: 6 Kg. approx.
(13.22 pounds approx.).

Note: FA-CO Unit gives all the supplies required for this module.



RYC/B. Basic Teaching Unit for the Study of Regulation and Control

Practical possibilities:

- 1.- Response of a first order system in time domain. (Step-response).
- 2.- Response of a first order system in time domain. (Ramp-response).
- 3.- Response of a first order system in time domain. (Sinusoidal-response).
- 4.- Response of a first order system in frequency domain (Sinusoidal-response).
- 5.- Response of a second order system in time domain (Step-response).
- 6.- Response of a second order system in time domain. (Ramp-response).
- 7.- Response of a second order system in time domain. (Sinusoidal-response).
- 8.- Response of a second order system in frequency domain (Sinusoidal-response).
- 9.- Structure of a PID controller (Proportional-Integrative-Derivative blocks).
- 10.- PID control of a first order system in open-loop.
- 11.- PID control of a second order system in open-loop.
- 12.- PID control of a first order system in closed-loop. (Mathematical tuning).
- 13.- PID control of a first order system in closed-loop. (Experimental tuning)
- 14.- PID control of a first order system in closed-loop. (Ziegler-Nichols tuning).
- 15.- PID control of a second order system in closed-loop. (Mathematical tuning).
- 16.- PID control of a second order system in closed-loop. (Experimental tuning).
- 17.- PID control of a second order system in closed-loop. (Ziegler-Nichols tuning).

Specifications:

RYC/B allows the user to learn the basics about regulation and control of first and second order systems.

This unit enables to carry a set of practices related with basic regulation and control, through which the user will understand how to characterize first and second order systems and how a PID controller works.

Elements included:

Power Supply. Protection fuse. Block diagrams in the front panel.

Modules:

Reference signals:

Step: Amplitude: ± 10 V. Frequency: 0Hz to 1000Hz.

Ramp: Amplitude: ± 10 V. Frequency: 0Hz to 1000Hz.

Sine: Amplitude: ± 10 V. Frequency: 0Hz to 1000Hz.

PID controller:

P controller: K_p : 0 to 10.

I controller: T_i : 1 ms to 10 ms.

D controller: T_d : 1 ms to 10 ms.

Systems:

First Order System:

Time constant (T): 1 ms to 100 ms.

Second Order System:

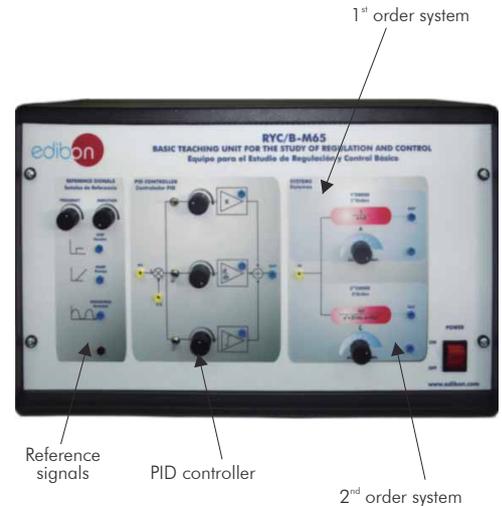
Damping coefficient (ξ): 0 to 1.5

Natural frequency (ω_n): $2 \cdot \pi \cdot 100$ rad/s (100Hz).

Electrical supply required: single-phase, 220V/50Hz or 110V/60Hz.

Dimensions: 490 x 330 x 310 mm. approx.
(19.3 x 13 x 12.2 inches approx.).

Weight: 10 Kg. approx.
(22 pounds approx.).



M47. Rotational Speed and Position Control

Practical possibilities:

- 1.- DC Motor
- 2.- DC Tachometer.
- 3.- Inductive sensor.
- 4.- Infrared Reflective sensor
- 5.- Slot sensor.
- 6.- Hall-Effect.
- 7.- Encoder.

Specifications:

This module has a DC motor. The motor speed can be changed adjusting the voltage delivered to the actuator motor.

The available sensors on the module are:

- Slot optical sensor.
- Inductive sensor.
- Infrared Reflective sensor.
- Hall effect sensor.
- Encoder sensor.

All the connections of the different transducers and of the motor will have an outlet through a group of 2 mm. terminals. These are placed on the front panel of the module with a drawing representing their functions.

Elements included:

DC Motor:

- Nominal voltage: 12Vdc.
- Maximum load speed: 3500 r.p.m. approx.
- EFM: 1401 mV/r.p.m.

DC Tachometer:

- Power: 1.21W.
- Velocity: 7800 r.p.m.
- Voltage/Velocity Relationship: 0.214 mV/r.p.m.

Inductive sensor:

- Output voltage: up to 10 Vpp.
- Body-housing material: Steel.
- Operating temperature range: -40°C to +60°C.
- Inductance: 12 mH +/- 10%.
- Coil Resistance: 130 Ω +/- 10%.

Slot Optical Sensor:

Diode:

- V_f max.: 1.7V., I_r max.: 100 μ A.
- V_r : 2V.. P_o : 100 mW (max.).

Photodetector:

- V_{CE0} : 30V (max.). V_{ECO} : 5V (max.).
- Dissipated power: 100 mW (max).
- Maximum operation frequency: 100 KHz.
- V_o in output bornes of M47: 0.0 - 5V to $V_s = 5VDC$.

Infrared Reflective sensor:

Diode:

- V_f max.: 1.6V., V_r max.: 3V.
- P_o max.: 70 mW.

Phototransmitter:

- V_{CE0} max.: 30V., V_{ECO} max.: 5V.
- P_o max.: 70 mW.
- V_o in output bornes of M47: 0.0-400mV for $V_s = 12VDC$.
- Detection distance: 4-6 mm.

Hall Effect Sensor:

- Supply voltage: 4 to 10V.
- Supply current: 3.5 mA.
- Output type: Differential.
- Output voltage: 0.25V to 2V.
- Sensitivity: -130 a + 130 gauss, 0.75 to 1.06 mV/gauss.
- V_o in output bornes of M47: 0.0-1V for $V_s = 5VDC$.

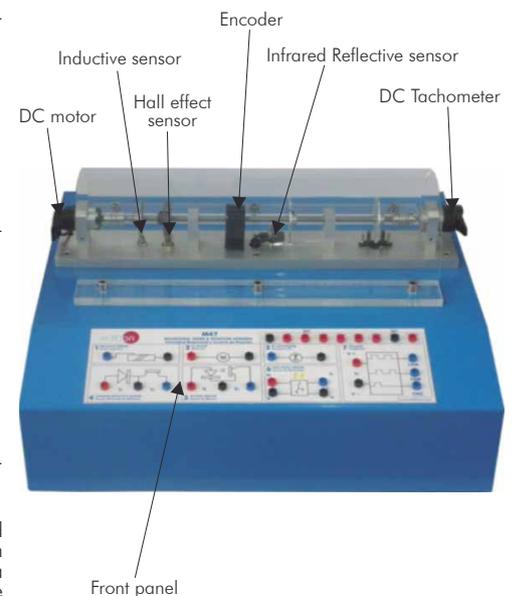
Encoder:

- This optical encoder contains a lensed LED source, an integrated circuit with detectors and output circuitry, and a codewheel which rotates between the emitter and the detector IC.
- Supply voltage V_{CC} : -0.5 to 7V.
- Output current: -1 to 5 mA.
- Output voltage V_O : -0.5 to V_{CC} .
- Velocity: 30000 r.p.m.

Dimensions: 405 x 300 x 350mm. approx.
(15.9 x 11.8 x 13.7 inches approx.).

Weight: 6 Kg. approx.
(13.22 pounds approx.).

Note: FA-CO Unit gives all the supplies required for this module.



M30. 16 Bits Microprocessor (EDILAB)

Main features:

It operates on either stand-alone keyboard and LCD or with host PC through its RS-232-C/RS 485 interface in serial mode.

It works with either 8086 or 8088 CPU in Max Mode at a frequency of 8 MHz.

Provision for on-board 8087 NDP.

Provision for on-board memory of 1M bytes.

Provision for on-board 12 bit ADC.

Keyboard and serial monitor programs support the entry of user program, editing and debugging facilities like breakpoint, single-step and full speed execution of user program.

Built-in One Line Assembler, Disassembler in both serial and stand-alone modes of operation.

48 I/O lines and three 16-bit programmable interval timers.

On-board parallel printer port.

On-board 8 bit DAC.

On-board Interrupt controller handles eight external interrupt sources. Provision for cascading through expansion connector.

Provision for system bus expansion through ribbon cable connectors.

Driver Software for file upload/ download to/from host PC.



M31. Z80 Microprocessor (EDILAB)

Main features:

It is a Microprocessor Trainer based on the Z80 CPU, supported by a monitor program and a variety of interfaces.

It can be operated either from on-board keyboard or from a PC compatible system through its RS 232 C Port.

User can enter programs, debug them through Single Step, Breakpoint facilities and also run them at full speed.

Facilities to edit programs through INSERT, DELETE, and BLOCK MOVE commands.

3 on-board ribbon cable connectors for system expansion.

On-board audio cassette interface.

On-board general purpose PCB, for user expansion.

Provision for battery backup to RAM.

Provision for on-board ADC 0809.



M-EB. Practical Expansion Boards (EDILAB)

Main features:

- 16-Channel 8-bit ADC interface.
- 4-Digit, 7-Segment, LED Display interface.
- 6-Digit, 7-Segment Display with calculator.
- 4x4 Matrix Hex keypad interface.
- 8-Channel, 12-bit ADC interface with MUX.
- Microprinter.
- Calculator type keyboard interface.
- Crystal Clock Divider interface.
- DAC for ADC & Temp. Sensor interface.
- Dual DAC interface.
- Dual Slope ADC interface.
- EPROM programmer interface.
- LCD (16 x 2) interface.
- Logic Controller interface.
- Musical Tone Generator interface.
- Opto Isolated input interface.
- Opto Isolated output interface.
- Relay output interface.
- Real-time Clock interface.
- DC motor Interface with DC motor (12 Vdc/14W) & feedback circuit for speed measurement.
- Stepper motor interface.
- Traffic Lights interface.
- TXDR Interface using PT100 with ADC.
- Elevator interface.



M32. 8051 Microcontroller (EDILAB)

Main features:

It operates on either in stand-alone mode using computer (PC) keyboard and LCD or with host PC through its RS-232-C/RS-485 interface in serial mode.

User friendly Windows, Linux and DOS driver software for file upload/download to/from host PC.

Line assembler and disassembler in both modes: stand-alone and serial modes.

On-board parallel printer port.

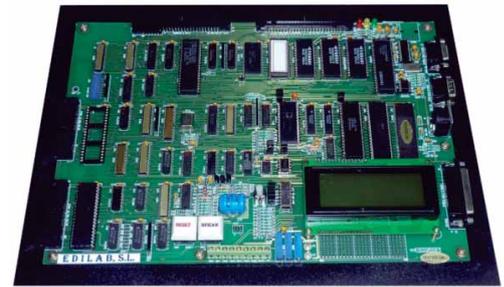
On-board 8 bit DAC.

Keyboard and serial monitor programs support the entry of user programs, editing and debugging facilities like breakpoints (128K),single stepping and full speed execution of user programs.

Total memory on-board is 128K bytes.

13 port lines of the MCU are brought out to the connector including INT1, RXD & TXD pins.

Buffered bus signals are available through ribbon cable connector for system expansion.



M33. 68000 Microprocessor (EDILAB)

Main features:

It operates on single + 5V power supply with a PC compatible system through its RS 232 C serial communication interface.

Interrupt system.

Supported by a variety of interface modules.

Built-in one line assembler and disassembler.

Hardware debugging through Read loop, Write loop and Test memory commands.

Centronics printer driver included in the monitor program.

System monitor permits entry of programs, debugging through breakpoint, trace and instruction step facilities.

Interfacing with PC compatibles, with file upload/download capability.

Provision for multi-master design expansion.

ABORT facility to recover gracefully from "STUCK" programs.



M34. DSP Microprocessor (EDILAB)

Main features:

It comes with a full compliment of on-board devices that suit a wide variety of application environments.

-JTAG emulation through on-board JTAG emulator with USB host interface or external emulator.

Main features include:

-Single voltage power supply (+5V).

-DSP operating at 1 Gigahertz.

-16 Mbytes of synchronous DRAM.

-512 Kbytes of non-volatile Flash memory.

-AIC23 stereo codec.

-Software board configuration through registers implemented in CPLD.

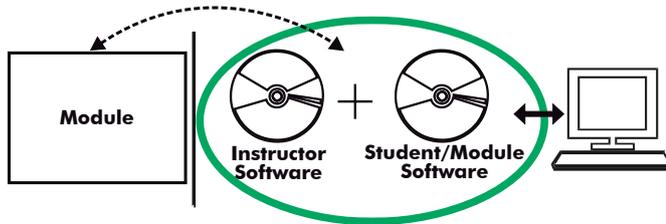
-4 user accessible LEDs and DIP switches.

-Configured boot options and clock input selection.

-Standard expansion connectors for daughter card use.



③ CAI. Computer Aided Instruction Software System



With no physical connection between module and computer (PC), this complete software package consists on an Instructor Software (INS/SOF) totally integrated with the Student/Module Software (M../SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

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

The Instructor can:

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

The Instructor Software is the same for all the modules, and working in network configuration allows controlling all the students in the classroom.

Instructor Software



-M../SOF. Computer Aided Instruction Softwares (Student/Module Software).

It explains how to use the module, run the experiments and what to do at any moment.

Each module has its own Student Software.

- The options are presented by pull-down menus and pop-up windows.
- Each Software contains:

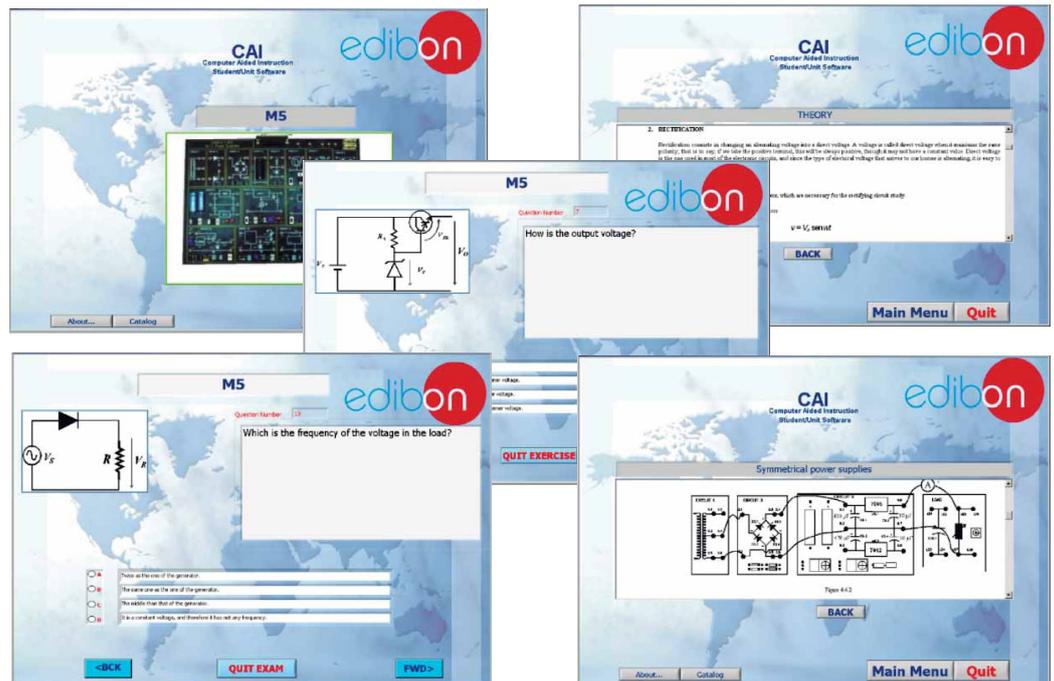
Theory: gives the student the theoretical background for a total understanding of the studied subject.

Exercises: divided by thematic areas and chapters to check out that the theory has been understood.

Guided Practices: presents several practices to be done with the module, showing how to perform the exercises and practices.

Exams: set of questions to test the obtained knowledge.

Student/Module Software



For more information see CAI catalogue. Click on the following link: www.edibon.com/products/catalogues/en/CAI.pdf

Available Student/Module Softwares:

Basic Electronics concepts

- . M3/SOF. Semiconductors I.
- . M4/SOF. Semiconductors II.
- . M6/SOF. Oscillators.
- . M7/SOF. Operational Amplifiers.
- . M8/SOF. Filters.
- . M9/SOF. Power Electronics.
- . M60/SOF. Analog/Digital Converters.
- . M61/SOF. Digital/Analog Converters.
- . M99/SOF. Expansion Unit.
- . M99-6/SOF. Motors, Generators and Controls.

Digital Electronics

- . M10/SOF. Digital Systems & Converters.
- . M11/SOF. Digital Electronics Fundamentals.

- . M12/SOF. Basic Combinational Circuits.
- . M13/SOF. Basic Sequential Circuits.
- . M14/SOF. Optoelectronics.
- . M41/SOF. Resistance Transducers.

Basic Electricity concepts

- . M5/SOF. Power Supplies.
- . M1/SOF. Direct Current (D.C.) Circuits.
- . M2/SOF. Alternating Current (A.C.) Circuits.
- . M16/SOF. Electric Networks.
- . M17/SOF. Electromagnetism.
- . M18/SOF. Three-phase Circuits.

Electronics Applications

- . M43/SOF. Applications of Temperature.
- . M49/SOF. Applications of Temperature and Pressure.

- . M44/SOF. Applications of Light.
- . M45/SOF. Linear Position and Force.
- . M46/SOF. Environmental Measurements.
- . M48/SOF. Sounds Measurements.

Control

- . RYC/B/SOF. Study of Regulation and Control.
- . M47/SOF. Rotational Speed & Position Control.

④ LIEBA/CAL. Computer Aided Learning Software (Results Calculation and Analysis)

This Computer Aided Learning Software (Results Calculation and Analysis) "CAL" is a Windows based software, simple and very easy to use, specifically developed by EDIBON.

CAL is a class assistant that helps in doing the necessary calculations to extract the right conclusions from data obtained during the experimental practices. With a single click, CAL computes the value of all the variables involved and performs the calculations.

Also, CAL allows to plot and print the results. Within the plotting options, any variable can be represented against any other.

Available different plotting displays.

It has a wide range of information, such as constant values, unit conversion factors and integral and derivative tables.

The screenshot shows the 'COMPUTER AIDED LEARNING' software interface. At the top, there's a title bar with the 'edibon' logo. Below it, a 'Constants' section contains input fields for 'g (m/s²)', 'DisDia (m)', 'AdmDia (m)', 'DeltaZ (m)', and 'SpWeight (kg/(ms))'. To the right of these fields are buttons for 'COMPUTE', 'LOAD FILE', 'PLOT', 'SAVE', 'CLEAR TABLE', 'MAIN MENU', 'ADDITIONAL HELP', and 'QUIT CAL'. Below the constants is a data table with columns: Torque (Nm), Speed (rpm), Flow (l/min), Pdm (bar), Pds (bar), Ht (m), Nt (Watts), Nm (Watts), and Ef (%). The table contains several rows of numerical data.

Torque (Nm)	Speed (rpm)	Flow (l/min)	Pdm (bar)	Pds (bar)	Ht (m)	Nt (Watts)	Nm (Watts)	Ef (%)
50	280	80	1	10	91,854735	1199,935145	1466,075333	81,846759
40	250	70	1	9	81,650653	933,805858	1047,196667	89,171966
30	240	60	1	8	71,446571	700,176396	753,981600	92,863857
25	235	50	1	7	61,242490	499,946943	615,228042	81,262054
20	230	45	1	6	51,038408	375,132299	481,710467	77,875057

On a table, we introduce data obtained during the development of the exercise.

Above this table, it is shown "Constants" theoretically involved with the field of study. The values of these "Constants" may be modified to our convenience, assigning the appropriate values.

Simply, by clicking on "COMPUTE", CAL performs the calculations of the desired variables.

We can save and print the data of the experiment or calculations.

Also we can load any data file saved previously.

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

The screenshots show the plotting interface of the CAL software. The top screenshot shows the 'COMPUTER AIDED LEARNING' interface with 'Flow (l/min)' selected for the X-axis and 'Ef (%)' for the Y-axis. Below this, there are two more screenshots. The middle one shows a 'Color' dialog box with options for 'Color', 'Line Style', 'Line Width', and 'Area-Around'. The bottom screenshot shows a 3D surface plot of the data, with a green surface representing the relationship between Flow and Ef. The plot has axes for Flow (l/min) and Ef (%).

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

The screenshot shows the 'ADDITIONAL HELP' window. It has tabs for 'CONSTANTS', 'I.S. UNITS', 'CONV. FACTORS', 'MAIN INTEGRALS', and 'DERIVATES'. The 'I.S. UNITS' tab is selected, showing a table of SI base units and SI Prefixes.

SI base units		
Name	Symbol	Quantity
metre	m	Length
kilogram	kg	Mass
second	s	Time
ampere	A	Electrical current
kelvin	K	Thermodynamic temperature
mole	mol	Amount of substance
candela	cd	Luminous intensity

SI Prefixes										
Name	Symbol	Quantity								
yotta	Y	10 ²⁴								
zetta	Z	10 ²¹								
exa	E	10 ¹⁸								
peta	P	10 ¹⁵								
tera	T	10 ¹²								
giga	G	10 ⁹								
mega	M	10 ⁶								
kilo	k	10 ³								
hecto	h	10 ²								
deca	da	10 ¹								
Symbol	Y	Z	E	P	T	G	M	k	h	da
Factor	10 ²⁴	10 ²¹	10 ¹⁸	10 ¹⁵	10 ¹²	10 ⁹	10 ⁶	10 ³	10 ²	10 ¹
Name	deci	centi	milli	micro	nano	pico	femto	atto	zepto	yocto

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

Available Softwares:

Basic Electronics concepts

- . M3/CAL. Semiconductors I.
- . M4/CAL. Semiconductors II.
- . M6/CAL. Oscillators.
- . M7/CAL. Operational Amplifiers.
- . M8/CAL. Filters.
- . M9/CAL. Power Electronics.
- . M60/CAL. Analog/Digital Converters.
- . M61/CAL. Digital/Analog Converters.
- . M99/CAL. Expansion Unit.
- . M99-6/CAL. Motors, Generators and Controls.

Digital Electronics

- . M10/CAL. Digital Systems & Converters.
- . M11/CAL. Digital Electronics Fundamentals.
- . M12/CAL. Basic Combinational Circuits.

Basic Electricity concepts

- . M5/CAL. Power Supplies.
- . M1/CAL. Direct Current (D.C.) Circuits.
- . M2/CAL. Alternating Current (A.C.) Circuits.
- . M16/CAL. Electric Networks.
- . M17/CAL. Electromagnetism.
- . M18/CAL. Three-phase Circuits.

Electronics Applications

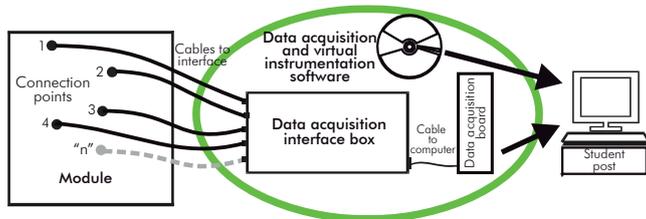
- . M43/CAL. Applications of Temperature.
- . M49/CAL. Applications of Temperature and Pressure.
- . M44/CAL. Applications of Light.

- . M45/CAL. Linear Position and Force.
- . M46/CAL. Environmental Measurements.
- . M48/CAL. Sounds Measurements.

Control

- . RYC/B/CAL. Study of Regulation and Control.
- . M47/CAL. Rotational Speed & Position Control.

⑤ EDAS/VIS. EDIBON Data Acquisition System/Virtual Instrumentation System



EDAS/VIS is the perfect link between the modules and the PC. With the EDAS/VIS system, information from the modules is sent to the computer. There, it can be analyzed and represented.

We easily connect the Data Acquisition Interface Box (DAIB) to the modules with the supplied cables (connection points are placed in the modules). Like any other hardware, the DAIB is connected to the PC through the Data Acquisition Board (DAB), and by using the Data Acquisition and Virtual Instrumentation Software the student can get the results from the undertaken experiment/practice, see them on the screen and work with them.

This EDAS/VIS System includes DAIB + DAB + EDAS/VIS-SOF:

- DAIB. Data Acquisition Interface Box:

Metallic box. Dimensions: 310 x 220 x 145 mm. approx. (12.2 x 8.6 x 5.7 inches approx.)

Front panel:

16 Analog inputs (1 block with 12 voltage channels and 1 block with 2 current channels (4 connections)).

Sampling velocity **1,250,000 samples per second** for EDAS/VIS 1.25 Version.

Sampling velocity **250,000 samples per second** for EDAS/VIS 0.25 Version.

2 Analog outputs.

24 Digital inputs/outputs, configurable as inputs or outputs, with 24 state led indicators.

These digital inputs/outputs are grouped in three ports of eight channels (P0, P1 and P3).

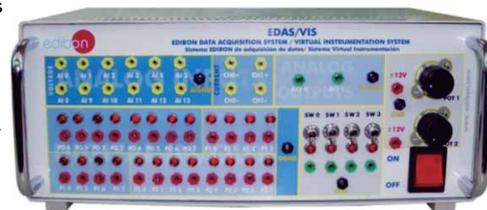
4 Digital signal switches 0-5V. 2 Analog signal potentiometers $\pm 12V$.

Main ON/OFF switch.

Inside: Internal power supply of 12 and 5 V. Potentiometer.

Back panel: Power supply connector. SCSI connector (for data acquisition board).

Connecting cables.



DAIB

- DAB. Data Acquisition Board:

For EDAS/VIS 1.25 Version:

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

Analog input:

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

Sampling rate up to: 1,250,000 S/s (samples per second). Input range (V) = $\pm 10V$.

Data transfers = DMA, interrupts, programmed I/O. Number of DMA channels = 6.

Analog output:

Number channels = **2**. **Resolution = 16 bits**, 1 in 65536. **Max. output rate up to: 833KS/s**.

Output range (V) = $\pm 10V$. Data transfers = DMA, interrupts, programmed I/O.

Digital Input/Output: Numbers of channels = 24 inputs/outputs. Port 0 up to 8 Mhz.

Timing: **Counter/timers = 2**. Resolution: Counter/timers: 32 bits.

For EDAS/VIS 0.25 Version:

Sampling rate up to: 250,000 S/s (samples per second).

Analog output: Max. output rate up to: 10 KS/s.

Digital Input/Output: Number of channels = 24 inputs/outputs. Port 0 up to 1 Mhz.

Rest of characteristics are the same than EDAS/VIS 1.25 Version.



DAB

- EDAS/VIS-SOF. Data Acquisition and Virtual Instrumentation Software:

Compatible with actual Windows operating systems. Amicable graphical frame.

Configurable software allowing the temporal/frequency representation of the different inputs and outputs. Visualization of a voltage of the circuits on the computer screen.

It allows data store in a file, print screens and reports of the signals at any time.

Measurement, analysis, visualization, representation and report of results.

Set of Virtual Instruments:

- Oscilloscope:

Channels: 12 simultaneous. Maximum input voltage: $\pm 10V$.

All 12 input channels could be scaled to compare signal with different voltage levels.

"Math Menu" with operations as Addition, Subtraction, Multiplication and Division, between any of the 12 oscilloscope channels.

- Function Generator:

Two independent signal generators, for sinusoidal, triangular, saw tooth and square.

Channels: 2 (allowing working simultaneously). Maximum output voltage: $\pm 10V$.

It includes a graph where an output signal for each channel is shown.

- Spectrum Analyzer:

Channels: 12 (simultaneous). Max. voltage: $\pm 10V$. Spectrum analyzer: based on the FFT.

- Multimeter:

Voltmeter (Channels: 12 (simultaneous). Max. voltage: $\pm 10V$ RMS).

Ammeter (Channels: 2 (simultaneous). Max. Ampere: 500 mA rms per channel).

- Transient Analyzer:

- Logic Analyzer:

Number of Input channels: 8. TTL Voltage Level.

Clock Source: 3 different sources.

This instrument allows receiving as far as 8 digital signal simultaneously at 1 or 8 Mbps (depending the version).

- Logic Generator:

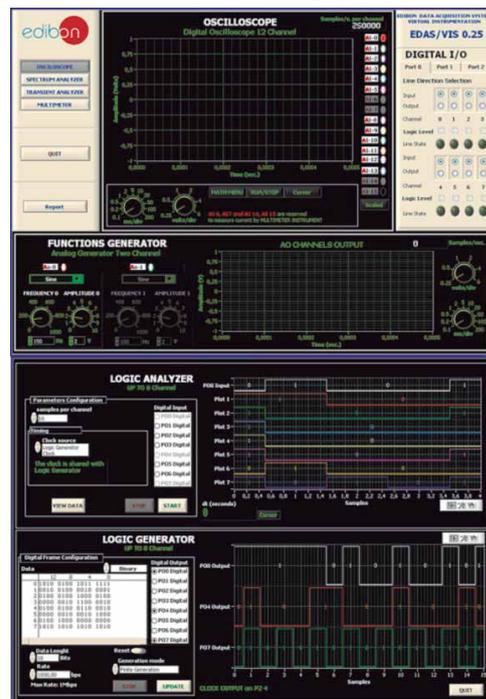
Number of transmission channels: 8. TTL voltage level.

This instrument allows generating up to 8 digital simultaneous signals of 1 or 8 Mbps (depending of the version).

Sampling velocity 1,250,000 samples per second for EDAS/VIS 1.25 Version.

Sampling velocity 250,000 samples per second for EDAS/VIS 0.25 Version.

Manuals: This system is supplied with the following manuals: Required Services, Assembly and Installation, Interface and Software, Starting-up, Safety, Maintenance & Practices Manuals.



EDAS/VIS-SOF

Important! Only one EDAS/VIS is needed for all electronic boards or modules. One EDAS/VIS is needed for each student work post. The EDAS/VIS allows to work with several electronic boards or modules simultaneously.

Note: for more information see EDAS/VIS specific Catalogue: www.edibon.com/products/catalogues/en/units/electronics/basic/EDAS-VIS.pdf

REQUIRED SERVICES

- Electrical power supply needed for FA-CO and EBC-100: single-phase, 220V/50Hz or 110V/60 Hz.
- For using EDAS/VIS, CAI and LIEBA/CAL a Computer (PC) is required.

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



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