Basic Electronics and Electricity Laboratory

LIEBA

edibon

Engineering and Technical Teaching Equipment

Laboratory structure

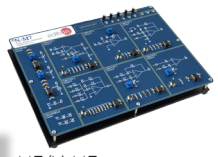
② Modules

N-M1

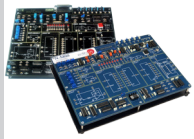
M16/N-M16

M17/N-M17

M18/N-M18

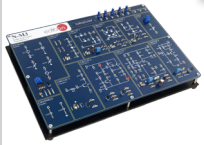


M7/N-M7

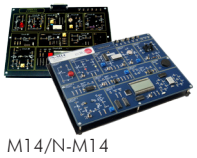


M60/N-M60

M12/N-M12



N-M3



M14/N-M14

Other Modules

① Power Supply

FACO

or

EBC100

③ ICAI. Interactive Computer Aided Instruction Software

Teaching Technique used

EDIBON Classroom Manager (Instructor Software)

+

EDIBON Student Labsoft (Student Software)

+

EDIBON E-Learning Content (Unit Software)

PC required for

④ EDAS/VIS. EDIBON Data Acquisition System and Virtual Instrumentation

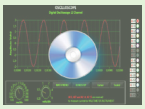
Teaching Technique used

Data Acquisition Interface Box

+

Data Acquisition Board

+

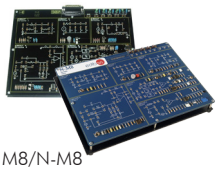


Data Acquisition and Virtual Instrumentation Software

② Modules

M41

M46

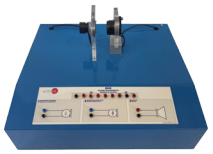


M8/N-M8

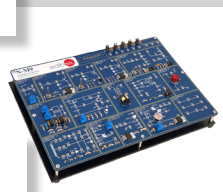
M44

M45

M47



M48



N-M9

M5/N-M5

Other Modules

www.edibon.com
PRODUCTS
2.- ELECTRONICS AND 14.- BIOMEDICAL ENGINEERING

The complete laboratory includes parts①to④and any part can be supplied individually or additionally. (Power supply + Module/s are the minimum supply):① + ②.

Available Modules

➤ Basic Electrical Laws Concpets
-N-M1. Direct Current (DC) Circuits Module.
-N-M2. Alternating Current (AC) Circuits Module.
-N-M16. Electric Networks Module.
-N-M17. Electromagnetism Module.
-N-M18. Three-phase Circuits Module.

➤ Analog Electronics
-N-M6. Oscillators Module.
-N-M7. Operational Amplifiers Module.
-N-M8. Filters Module.

➤ Digital Electronics
-N-M60. Analog/Digital Converters Module.
-N-M61. Digital/Analog Converters Module.
-N-M10. Digital Systems & Converters Module.
-N-M11. Digital Electronics Fundamentals Module.
-N-M12. Basic Combinational Circuits Module.
-N-M13. Basic Sequential Circuits Module.
-N-M15. Own Development Module.

➤ Semiconductors
-N-M3. Semiconductors I Module.
-N-M4. Semiconductors II Module.
-N-M14. Optoelectronics Module.

➤ Instrumentation & Control
-M41. Resistance Transducers.
-M44. Applications of Light.
-M45. Linear Position and Force.
-M46. Environmental Measurements.
-M47. Rotational Speed & Position Control.
-M48. Sound Measurements.
-N-M49. Applications of Temperature and Pressure Module

➤ Power Electronics (Fundamentals)
-N-M9. Power Electronics Module.
-N-M5. Power Supplies Module.

LRQA CERTIFIED ISO 9001
Certificate of Approval of the Quality Management System

CE
European Union Certificate (total safety)

UL CSA
UL and CSA Regulations (All our products are manufactured according to current UL and CSA regulations)

LRQA CERTIFIED ISO 14001
Certificate of Approval of the Environmental Management System

WQC worlddidac
Worlddidac Association Certificate of Membership

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

EDIBON 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:
-FACO. Power Supply. Using this power supply, training and practices can be done conventionally. This is the most common power supply used with modules.
-EBC100. 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.
Each Module has its own manuals (8 manuals are normally supplied), that gives the theoretical background and explains everything the student needs to carry out the exercises/experiments.
Connectors and cables for completing the exercises and practices are supplied.

③ **ICAI. Interactive Computer Aided Instruction Software:**
The best help in classroom for both teacher and students.
It includes:

3.1) ECM-SOF. EDIBON CLASSROOM MANAGER (INSTRUCTOR SOFTWARE):
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

3.2) ESL-SOF. EDIBON STUDENT LABSOFT (STUDENT SOFTWARE):
ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

3.3) ESL-*UNIT*-SOF. EDIBON E-LEARNING CONTENT FOR EACH UNIT. (UNIT SOFTWARE):
ESL-*UNIT*-SOF, is a set of digital resources created by EDIBON that accompanies each Technical Teaching Unit. The resources can be edited or enriched by the instructor adding others if deems it convenient. The content provided by EDIBON includes a practical manual, evaluation exercises, equations and multimedia support material to assimilate the concepts studied with the units.

④ **EDAS/VIS. EDIBON Data Acquisition System and Virtual Instrumentation:**
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

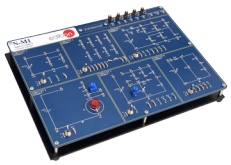
Minimum supply: ① Power Supply + ② Module/s (every module needs power supply).

Optionally, the modules offered in this catalog can be supplied together with the Electrical Workbench (Rail), "AEL-WBC", in order to install the modules on it and to have workstations to work with the modules in a more comfortable way.

A) ICAI + EDAS/VIS working possibility (complete EDIBON system)

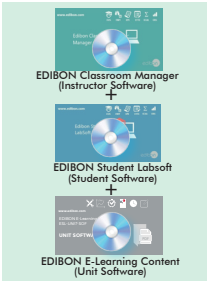
Power supply:
FACO. Power Supply
or
EBC100. Base Unit, with built-in power supply

+



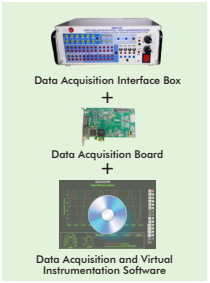
Module/s

+



ICAI.
Interactive Computer Aided
Instruction Software

+



EDAS/VIS.
EDIBON Data Acquisition System
and Virtual Instrumentation

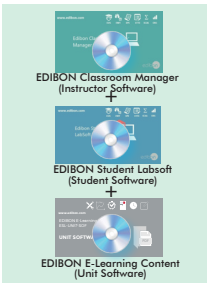
B) ICAI working possibility

Power supply:
FACO. Power Supply
or
EBC100. Base Unit, with built-in power supply

+

Module/s

+



ICAI.
Interactive Computer Aided
Instruction Software

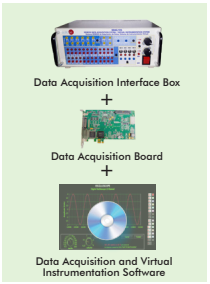
C) EDAS/VIS working possibility

Power supply:
FACO. Power Supply
or
EBC100. Base Unit, with built-in power supply

+

Module/s

+

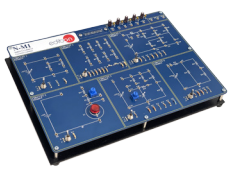


EDAS/VIS.
EDIBON Data Acquisition System
and Virtual Instrumentation

D) Simplest working possibility

Power supply:
FACO. Power Supply
or
EBC100. Base Unit, with built-in power supply

+



Module/s

FACO. **Power Supply**

SPECIFICATIONS

DC Fixed outputs: + 5 V, ± 12 V, 1 A.

DC Variable outputs: ± 12 V, 0.5 A.

AC Outputs: 12 V or 24 V.

Outputs through 2 mm terminals, or connectors Sub-D of 25 pins (2 outputs).

Voltage LED indicators.

Robust construction.

Power: 110/220 VAC

Frequency: 50/60 Hz.

DIMENSIONS AND WEIGHTS

Dimensions: 225 x 205 x 100 mm approx.
(8.85 x 8.07 x 3.93 inches approx.)

Weight: 2 kg approx.
(4.4 pounds approx.)

EBC100. **Base Unit, with built-in power supply**

SPECIFICATIONS

Hardware support and power supply.

Modules supporting unit.

DC Fixed outputs: + 5 V, + 12 V, -12 V.

DC Variable outputs: ± 12 V.

AC Outputs: 12 V or 24 V.

Outputs through either 2 mm contact terminals, or through 25 pins Sub-D connector.

Voltage LED indicators.

Robust construction.

Power: 110/220 VAC.

Frequency: 50/60 Hz.

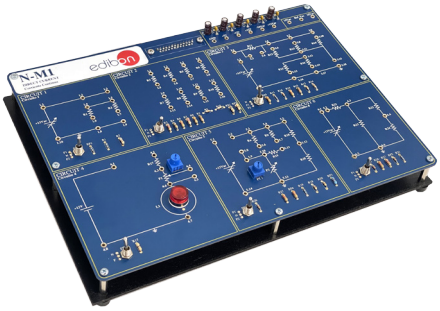
DIMENSIONS AND WEIGHTS

Dimensions: 410 x 298 x 107 mm approx.
(16.14 x 11.73 x 4.21 inches approx.)

Weight: 2 kg approx.
(4.4 pounds approx.)

➤ **Basic Electrical Laws Concepts**

N-M1. Direct Current (DC) Circuits Module



GENERAL DESCRIPTION

For the correct understanding of electronics it is necessary to know some fundamental laws and theorems such as Ohm's Law, Kirchhoff's Laws and other simple theorems of initiation to DC circuits.

With the Direct Current (DC) Circuits Module, "N-M1", designed by EDIBON, you can start to study the basic principles of direct current, such as:

-Handling of measuring and testing instruments (ammeter, voltmeter, ohmmeter and multimeter).

-Study of Ohm's law and its practical testing.

-Study of the different resistors: electrical resistance, characteristics of resistors, study of the concept of resistivity, conductivity, conductance and how to measure resistors.

-Association of resistors (series, parallel, mixed circuit) and Wheatstone bridge.

-Study of Kirchhoff's laws.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Measurement managing and checking instruments:
1.- Electronic instrumentation operation. Use of multimeter.
2.- Faults study of F1 in resistance circuit.
3.- Faults study of 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.- Faults study of F1 in resistors circuit.
10.-Faults study of 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.-Parallel configuration study.
14.-The Wheatstone bridge.
15.-Faults study of F1 in series resistors circuit.
16.-Faults study of F2 in parallel resistors circuit.
17.-Faults study of F1 in Wheatstone bridge circuit.
18.-Faults study of 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 practical possibilities:
24.-Voltage/current dividers.
25.-Batteries and switches.
26.-Power source in series and parallel.
27.-The rheostat and potentiometer.
-Several other exercises can be done and designed by the user.

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 AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

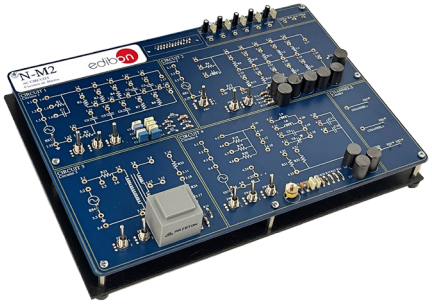
Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Basic Electrical Laws Concepts**

N-M2. **Alternating Current (AC) Circuits Module**



GENERAL DESCRIPTION

In contrast to DC, which always has the same direction and sense, in AC the flow of electrons changes direction periodically with a frequency of 50 or 60 Hz (depending on the country).

With the Alternating Current (AC) Circuits Module, "N-M2", designed by EDIBON, you can start to study the basic principles in alternating current, such as:

-Characteristics of alternating signals: study of the different AC waveforms, relations between peak and RMS values for seinodal waves, series and parallel resistors.

-Characteristics of capacitors and coils in AC: variation of reactance, capacitance and inductance, series/parallel capacitances, study of reactive reactance, etc.

-Study of basic theorems and capacitive and inductive circuits (impedance and Ohm's Law, RC series/parallel circuits, RL parallel circuit, etc.).

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Alternating signal characteristics. Instruments:
1.- Waveforms study in AC.
2.- Faults study of F1 in the circuit#1 (Waveform circuit).
3.- Faults study of F2 in the circuit#1 (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.-Theoretical/practical 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, Xc, variations with the frequency.
14.-Faults study 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.-Theoretical/practical 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-nductor circuits in series.
26.-Study of Fault 1 in the circuit#3 (Reactive mixed circuits).
27.-Study of Fault 2 in the circuit#3 (Reactive mixed circuits).
28.-AC resistor-inductor circuits in parallel.
29.-Theoretical/practical exercises.
RLC Circuits:
30.-Resistance-capacitance filters.
31.-Filters inductive resistance.
32.-Theoretical/practical exercises.
Resonance:
33.-AC L-C circuits in parallel with low impedance source.
34.-Faults study of F1 in the resonance circuit.
35.-Faults study of F2 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.- Theoretical/practical exercises.
The transformer:
40.-Intermediate frequency transformers.
41.-Transformer with load.
42.-Current measurement in the secondary transformer with charge.
43.-Theoretical/practical exercises.
-Several other exercises can be done and designed by the user.

SPECIFICATIONS

Circuit blocks:
Waveforms. (Circuit#1).
Transformers. (Circuit#2).
Reactive mixed circuits. (Circuit#3).
Channels.

DIMENSIONS AND WEIGHTS

Dimensions: 300 x 210 x 45 mm approx.
(11.81 x 8.26 x 1.77 inches approx.)
Weight: 300 g approx. (0.66 pounds approx.)

REQUIRED ELEMENTS (Not included)

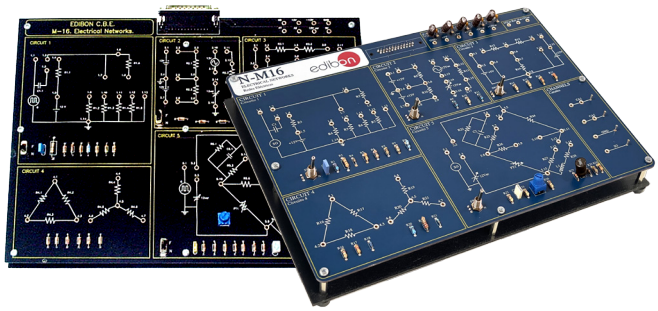
Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Basic Electrical Laws Concepts**

M16/N-M16. **Electric Networks Module**



GENERAL DESCRIPTION

After studying the basic knowledge of electrical networks, we must understand and investigate the dependence between current and voltage applied to different electrical devices.

With the Electric Networks Module, "N-M16", designed by EDIBON, it is possible to understand the principles of Ohm's Law, Norton's and Thévenin's Theorems, Wheatstone bridge operation, superposition theorems or star/triangle transformation and vice versa.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Ohm's law:

1.- Calculation of the internal resistance of a continuous source.
2.- Faults 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+AC assembly.
9.- Error study in the circuit, DC assembly.
10.-DC+AC assembly.
11.-Theoretical/practical exercises.

Thèvenin's and Norton's theorems:

12.-Thèvenin and Norton equivalent circuits.
13.-Theoretical/practical exercises.

Superposition theorem:

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

Star/triangle transformation:

17.-Resistance measurement between terminals.
18.-Theoretical/practical exercises.

Wheatstone bridge:

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

Additional practical possibilities:

23.-Millman's theorem.
-Several other exercises can be done and designed by the user.

SPECIFICATIONS

Circuit blocks:
- Series/Parallel connections. (Circuit#1).
- AC/DC. (Circuit#2).
- Superposition. (Circuit#3).
- Triangle/Star (Δ|Y). (Circuit#4).
- Bridges. (Circuit#5).
- Channels.

DIMENSIONS AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

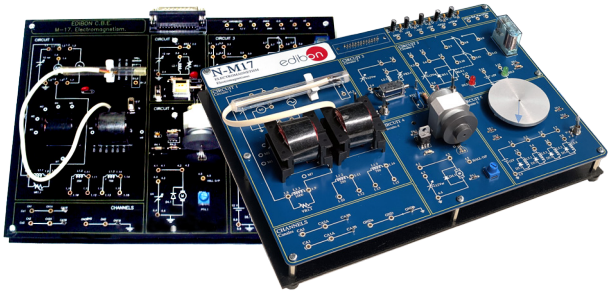
Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Basic Electrical Laws Concepts**

M17/N-M17. **Electromagnetism Module**



GENERAL DESCRIPTION

Electromagnetism is the interaction between electric charges. It is described in terms of charges interacting between electric and magnetic fields.

With the Electromagnetism Module, "N-M17", designed by EDIBON, the operation of electromagnetic applications such as transformer, solenoid, relay, stepper motor operation or DC motors can be studied.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Magnetic fields:

1.- Magnetic fields measurement.
2.- Armature electromotive force. Coil reactance calculation.
3.- Theoretical/practical exercises.

Electromagnetic applications:

4.- Mutual Inductance.
5.- Basic operation of the transformer.
6.- Core effect in a transformer response.
7.- Failure 1. Fault study in circuit#1 (Coils. Hall effect probe. Materials).
8.- Basic operation of the solenoid.
9.- Failure 2. Faults study in the circuit#2 (Solenoid).
10.-Basic operation of a relay.
11.-Contacts position self-holding.
12.-Failure 3. Faults study in the circuit#3 (Excitation. Relays).
13.-Theoretical/practical exercises.

Direct current motor:

14.-Characteristic Speed/Voltage of a direct current motor.
15.-Motor used as DC generator.
16.-Counter-EMF.
17.-Theoretical/practical exercises.

Stepping motor:

18.-Stepping motor working.
19.-Failure 4. Faults study in circuit#5 (Stepping motor).
20.-Theoretical/practical exercises.
-Several other exercises can be done and designed by the user.

SPECIFICATIONS

Circuit blocks:

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

DIMENSIONS AND WEIGHTS

Dimensions: 300 x 210 x 45 mm approx.
(11.81 x 8.26 x 1.77 inches approx.)
Weight: 300 g approx.
(0.66 pounds approx.)

REQUIRED ELEMENTS (Not included)

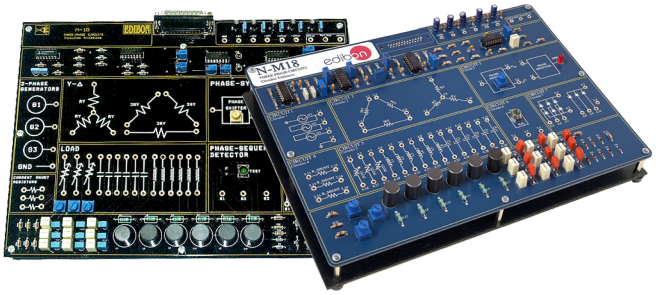
Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Basic Electrical Laws Concepts**

M18/N-M18. **Three-phase Circuits Module**



GENERAL DESCRIPTION

Three-phase voltage is essentially a system of three alternating voltages, coupled (all 3 are produced simultaneously in a generator) and 120° out of phase with each other (i.e. one third of the period).

The Three-phase Circuits Module, "N-M18", designed by EDIBON, is used to study the generation of three-phase systems, load balancing between phases, operation of three-phase rectifiers, etc.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Generation of a three-phase system:

1.- Checking of the three-phase system.

2.- Calculation of the voltage values.

Three-phase load in star and triangle:

3.- Triangle/star 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.

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

SPECIFICATIONS

Circuit blocks:

- Three-phase generator.
- Triangle/Star. (Δ|Y).
- Phase-synchronism detector.
- Current resistors.
- Loads.
- Phase-sequence detector.
- Three-phase rectifiers:
  - -Full wave three-phase rectifier.
  - -Half wave three-phase rectifier.

DIMENSIONS AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

Required (only one):

- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):

- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Analog Electronics**

M6/N-M6. **Oscillators Module**

GENERAL DESCRIPTION

Oscillators operation is usually very similar in all of them: the oscillating circuit produces an oscillation, then the amplifier increases it and finally the feedback network takes a part of the energy from the oscillating circuit and introduces it back into the input producing a positive feedback.

In short, the oscillator is an electronic stage which, being supplied with a DC voltage, produces at its output a periodic signal, which may be roughly sinusoidal, or square, or sawtooth, or triangular, etc. The essence of the oscillator is to "create" a periodic signal by itself, without any signal having to be applied to the input.

With the Oscillators Module, "N-M6", designed by EDIBON, the different oscillators can be studied: RC and LC network oscillators, Wein bridge, Colpitts, Hartley and the astable multivibrator.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

RC and LC nets oscillators:

1.- RC net oscillator.
2.- LC net oscillator.
3.- Faults study with RC anad LC net oscillators.
4.- Theoretical/practical exercises.

Wien bridge oscillator:

5.- Wien bridge.
6.- Faults study on the Wien bridge oscillator.
7.- Theoretical/practical exercises.

Colpitts oscillator. Hartley oscillator:

8.- Colpitts oscillator.
9.- Hartley oscillator.
10.-Faults study with the Colpitts oscillator.
11.-Theoretical/practical exercises.

Astable multivibrator:

12.-Astable multivibrator.
13.-Faults study with an astable multivibrator.
14.-Theoretical/practical exercises.

555 Timer:

15.-Astable multivibrator.
16.-Faults study of 555 timer.
17.-Theoretical/practical exercises.

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

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 AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

Required (only one):

- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

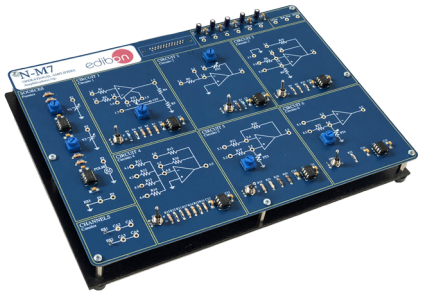
ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):

- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Analog Electronics**

M7/N-M7. **Operational Amplifiers Module**



GENERAL DESCRIPTION

Operational amplifiers are compact, active and linear high-gain devices designed to provide the desired transfer function. An operational amplifier consists of an electronic circuit having two inputs and one output. The output is the difference between the two inputs multiplied by a gain factor.

In short, the operational amplifier also called OpAmp or Op-Amp is an integrated circuit. Its main function is to amplify the voltage with a differential type input in order to have an amplified and ground-referenced output.

Operational amplifiers enable a wide variety of useful electronic circuits from a voltage comparator, a signal amplifier, arithmetic operations and filtering signals, etc. Operational amplifiers are made up of a large number of internal transistors that allow them to control currents and voltages, to give them their electrical characteristics.

With the Operational Amplifiers Module, "N-M7", designed by EDIBON, the different amplifiers can be studied: inverting, non-inverting, additive, differential and comparators.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Operational amplifier characteristics:
1.- Operational amplifier study.
2.- Closed-loop output compensation voltage.
3.- Operational amplifier fault study.
4.- Theoretical/practical exercises.

The inverting amplifier:
5.- Inverting amplifier study.
6.- Inverting amplifier fault study.
7.- Theoretical/practical exercises.

The non-inverting amplifier:
8.- Study of the non-inverting amplifier.
9.- Voltage follower.
10.-Fault study in the non-inverting amplifier.
11.-Theoretical/practical exercises.

The adder amplifier:
12.-Adding amplifier study.
13.-Faults study in the adding amplifier.
14.-Theoretical/practical exercises.

The differential amplifier:
15.-Differential amplifier study.
16.-Differential amplifier fault study.
17.-Theoretical/practical exercises.

Comparators:
18.-Comparator study.
19.-Comparators fault study.
20.-Theoretical/practical exercises.

Additional practical possibilities:
21.-Attenuator.
22.-Voltage divider.
23.-Open-loop operation.
-Several other exercises can be done and designed by the user.

SPECIFICATIONS

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

DIMENSIONS AND WEIGHTS

Dimensions: 300 x 210 x 45 mm approx.
(11.81 x 8.26 x 1.77 inches approx.)
Weight: 300 g approx.
(0.66 pounds approx.)

REQUIRED ELEMENTS (Not included)

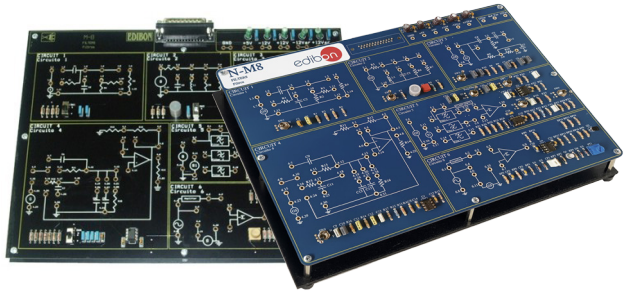
Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Analog Electronics**

M8/N-M8. **Filters Module**



GENERAL DESCRIPTION

An electronic filter is an element that allows electrical signals to pass through it, at an specific frequency or frequency ranges while preventing the passage of others, being able to modify both, their amplitude and phase. It is a device that separates, passes or suppresses a group of signals from a mixture of signals.

Filters are two-port systems, one input and one output, operating in the frequency domain. Their operation is based on blocking signals in terms of their spectral content, letting through signals whose frequency is within a certain range known as the pass band and rejecting those signals outside this range, known as the rejection band. A filter works on input signals to produce an output signal whose spectral content depends on the type of filter.

A frequency filter is a circuit that uses electrical and/or electronic components to attenuate, correct or reject a range of frequencies within any type of signal. This range can be different from time to time as filters are very flexible and different types exist.

With the Filters Module, "N-M8", designed by EDIBON, the different types of filters can be studied: RC and LC, in "T" type configuration, active filters and also study associations of one and others in order to be able to practice with more complex filters, to obtain other filters with certain desired characteristics (low-pass filter, high-pass, band-pass and eliminated band).

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

RC and LC filter responses:
1.- Frequency response.
2.- Low-pass filter.
3.- High-pass filter.
4.- LC Circuit.
5.- Faults study in low-pass filter.
6.- Faults study in high-pass filter.
7.- Theoretical/practical exercises.
T-shaped filter:
8.- Filter with double T link.
9.- Signal generator circuit.
10.-Faults study in RC filters with double T.
11.-Theoretical/practical exercises.
Active filters:
12.-Low-pass filter with load.
13.-Low-pass filter with an operational amplifier.
14.-High-pass filter with load.
15.-High-pass filter with an operational amplifier.
16.-The attenuation is cumulative.
17.-Use of operational amplifier.
18.-Faults study in active filters.
19.-Theoretical/practical exercises.
Association of filters:
20.-Behaviour of the filter.
21.-Filtering of a distorted signal.
22.-Filter in cascade, low pass filter and high pass filter.
23.-Filter in parallel.
24.-Faults study in filters.
25.-Theoretical/practical exercises.
Additional practical possibilities:
26.-Band-pass and band-stop filters.
-Several other exercises can be done and designed by the user.

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 AND WEIGHTS

Dimensions: 300 x 210 x 45 mm approx.
(11.81 x 8.26 x 1.77 inches approx.)
Weight: 300 g approx.
(0.66 pounds approx.)

REQUIRED ELEMENTS (Not included)

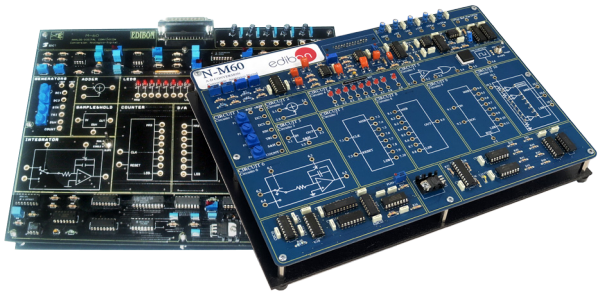
Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Digital Electronics**

M60/N-M60. **Analog/Digital Converters Module**



GENERAL DESCRIPTION

Most of the "information" generated in the world by different physical phenomena has a strong analogical character. This means that the information undergoes a continuous variation within certain limits determined over time. Of course, there is also information of a digital character, but its number is considerably smaller than that mentioned above.

When you need to process information, an analog signal, it is usually better to convert the signal to digital form so you can process it digitally. The reason is that the automatic processing of digital information involves great technological simplicity.

With the Analog/Digital Converters Module, "N-M60", designed by EDIBON, the different types of analog/digital conversion can be studied.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

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.

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

SPECIFICATIONS

Circuit blocks:

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

DIMENSIONS AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

Required (only one):

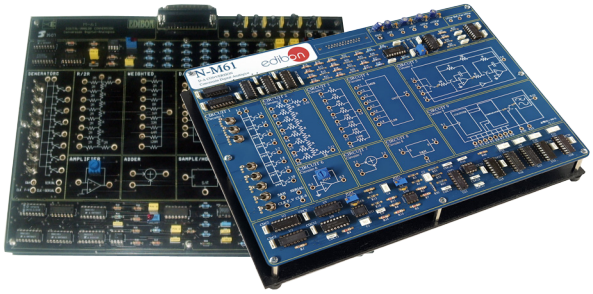
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):

- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

M61/N-M61. Digital/Analog Converters Module



GENERAL DESCRIPTION

Digital/analog conversion happens when we want to recover or re-obtain a digital signal that has been processed and we want to regenerate it. A signal that has been sampled, for example, a temperature signal and we want to return it to the continuous medium, or it may be that we do not need to recover such a signal but we want to generate an analog signal from a digital signal. The process we can describe for returning or obtaining a signal from digital to analogue is called reconstruction. Each discrete value of ones and zeros must be directly related to the previously defined value of an analogue signal.

With the Digital/Analog Converters Module, "N-M61", designed by EDIBON, the different direct and indirect digital to analog converters can be studied.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

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.

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

SPECIFICATIONS

Circuit blocks:

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

DIMENSIONS AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

Required (only one):

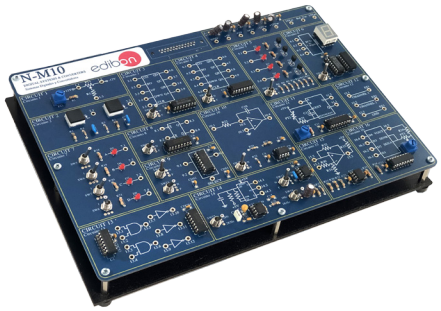
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):

- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

M10/N-M10. **Digital Systems & Converters Module**



GENERAL DESCRIPTION

Generally, an analog to digital converter is an electronic device that converts an analog voltage input to a digital number. The digital output can use different coding schemes, such as binary, although some non-electrical or partially electrical devices can be considered as analog to digital converters.

The resolution of a converter indicates the number of discrete values it can produce over a range of voltage values (usually expressed in bits). For the implementation of digital circuits, logic gates (AND, OR and NOT) and transistors are used.

With the Digital Systems & Converters Module, "N-M10", designed by EDIBON, the behaviour of BCD/Binary counters, comparators and analog integrators can be studied, as well as analogue/digital conversion and vice versa.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Analog switching. Bistable, astable and monostable family:

1.- Characteristics of an analog switch chip.
2.- Faults study of F1 in the analog multiplexer.
3.- Faults study of F3 in the analog multiplexer.
4.- Characteristics of a Latch integrated circuit type S-R.
5.- Faults study of F2 in the bistable.
6.- Characteristics of an astable integrated circuit.
7.- Faults study of F8 in the astable.
8.- Characteristics of a monostable integrated circuit.
9.- Theoretical/practical exercises.

Binary/BCD counters & 7-segments displays:

10.-Characteristics of a 74ALS193 binary up/down counter and a 7-segment display.
11.-Faults study of F6 in the binary counter.
12.-Characteristics of the BCD up/down counter and 7-segment display.
13.-Faults study in the BCD counter.
14.-Theoretical/practical exercises.

Comparators and analog integrators:

15.-Characteristics of an analog comparator.
16.-Analog integrator.
17.-Faults study of F7 in the analog integrator.
18.-Triangular wave generation.
19.-Theoretical/practical exercises.

A/D and D/A conversion:

20.-D/A converter.
21.-A/D converter.
22.-Theoretical/practical exercises.

Applications:

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

Additional practical possibilities:

26.-Synchronous/asynchronous counter.
-Several other exercises can be done and designed by the user.

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 AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

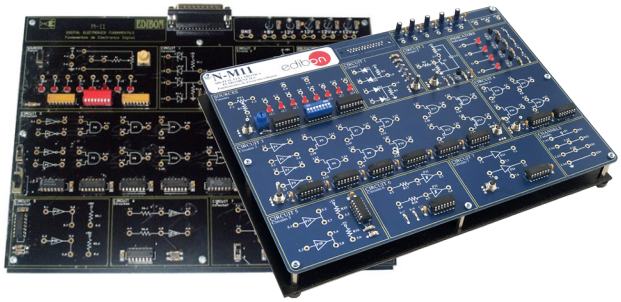
Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Digital Electronics**

M11/N-M11. **Digital Electronics Fundamentals Module**



GENERAL DESCRIPTION

Digital systems are systems for processing, treatment or transmission of information, in which the information is limited to taking values in a discrete set. These signals (whose magnitude can only take one value from a discrete set of values) are digital signals. Unlike analogue systems, in digital systems the devices that constitute them will function as switches.

With the Digital Electronics Fundamentals Module, "N-M11", designed by EDIBON, numbering systems, logic circuits, TTL gates, CMOS, Boolean algebra, etc. can be studied.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Numbers systems:
1.- Voltage measurement in a circuit of sources.
2.- Faults study in the source circuit.
3.- Theoretical/practical exercises.

Logical circuits:
4.- Logical diode.
5.- Fault study in sources.
6.- Logic with transistor and diodes.
7.- Faults study in transistor/diode circuit.
8.- Theoretical/practical exercises.

TTL gates:
9.- Basic function gates.
10.-Faults study in TTL circuit.
11.-Faults study in logic gates.
12.-Theoretical/practical exercises.

CMOS gates:
13.-Basic function gates.
14.-Faults study in CMOS circuit.
15.-Theoretical/practical exercises.

Boolean algebra and logical functions:
16.-Study of use of circuit#3 (TTL logical gates).
17.-Theoretical/practical exercises.

Open collector gates:
18.-Study of the use of circuit#5 (Open collector gates).
19.-Theoretical/practical 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 (Three-states).
23.-Theoretical/practical exercises.

Additional practical possibilities:
24.-JK Flip-Flop.
25.-Control of data bus.
-Several other exercises can be done and designed by the user.

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 AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Digital Electronics**

M12/N-M12. **Basic Combinational Circuits Module**

GENERAL DESCRIPTION

A combinational circuit is an electronic circuit in which the value of its outputs at a given instant, depends on the value of the inputs at the same instant. In other words, it is a circuit that has no memory. Combinational circuits work with numbers and with the technology with which these numbers are made (represented in binary).

With the Basic Combinational Circuits Module, "N-M12", designed by EDIBON, encoders, decoders, multiplexers, demultiplexers, digital comparators and arithmetic and logical operations can be studied.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Encoders:
1.- Study of an encoder.
2.- Faults study in the encoder.
3.- Theoretical/practical exercises.
Decoders:
4.- Study of a decoder.
5.- Faults study in the decoder.
6.- Theoretical/practical exercises.
Multiplexers:
7.- Study of a multiplexer.
8.- Faults study in the multiplexers.
9.- Theoretical/practical exercises.
Demultiplexers:
10.-Study of a demultiplexer.
11.-Faults study in demultiplexers.
12.-Theoretical/practical exercises.
Digital comparators:
13.-Study of a comparator.
14.-Faults study in a comparator.
15.-Theoretical/practical exercises.
Arithmetic and logic operations:
16.-Study of an adder.
17.-Faults study in the arithmetic and logic operations.
18.-Study of a parity generator.
19.-Faults study in the parity generator.
20.-Theoretical/practical exercises.
-Several other exercises can be done and designed by the user.

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 AND WEIGHTS

Dimensions: 300 x 210 x 45 mm approx.
(11.81 x 8.26 x 1.77 inches approx.)
Weight: 300 g approx.
(0.66 pounds approx.)

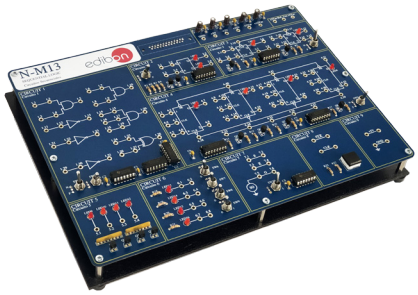
REQUIRED ELEMENTS (Not included)

Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

M13/N-M13. **Basic Sequential Circuits Module**



GENERAL DESCRIPTION

Logic gates and the circuits created with them constitute combinational logic, so called because the output only depends on the combination of the input variables present.

There is a second group of logic circuits called sequential logic, so called because the output depends, in addition to the input variables, on the value previously present at the output. This means that these circuits are equipped with memory. In addition, a large proportion of sequential circuits are only activated by a cyclic or clock signal and are called synchronous sequential circuits.

The edge trigger time can last for the duration of the clock signal (pulse trigger) or the instant of change from 0 to 1 (edge trigger).

In the elements activated by edge, a small triangle is drawn on the clock connection, which is completed with a circle to specify that the edge is falling (this is the most frequent activation).

For the study of sequential circuits, use is made of the chronogram, the graphic representation of how both the inputs and the output of the circuit evolve over time.

Basic sequential circuits are called bistables, scales or flip-flops.

With the Basic Sequential Circuits Module, "N-M13", designed by EDIBON, all types of bistables, counters, flip-flops, synchronous sequential circuits and the operation of memories can be studied.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Bistables:

1.- Bistables.
2.- Bistable S-R using NAND gates.
3.- Practical performance.
4.- Faults study in the bistables.
5.- Theoretical/practical exercises.

Shift registers:

6.- Shift registers.
7.- Faults study of the shift registers.
8.- Theoretical/practical exercises.

Counters:

9.- Steps to be followed for the assembly of a counter.
10.-Faults study of the counters.
11.-Theoretical/practical exercises.

Synchronous sequential circuits:

12.-Practice of the synchronised.
13.-Faults study of the synchronised sequential circuits.
14.-Theoretical/practical exercises.

Memories:

15.-Theoretical/practical exercises.

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

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 AND WEIGHTS

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

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

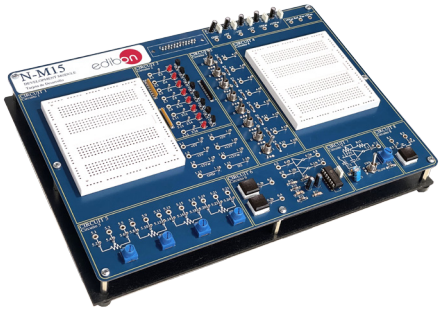
REQUIRED ELEMENTS (Not included)

Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

N-M15. **Own Development Module**



GENERAL DESCRIPTION

The Own Development Module "N-M15", designed by EDIBON, consists of a circuit board that will allow the realization of a set of assemblies on the mentioned board, allowing the study of the basic concepts of direct current circuits.

The circuits can be made using real elements such as resistors, capacitors, integrated circuits, etc.

For those circuits in which we wish to see a specific digital input or output, the development board incorporates a circuit to visualise when a signal is a logical 1 or 0. It also allows us to generate logic ones and zeros by switching switches.

Four potentiometers of various values are provided on the board, to be used in the circuits to be designed.

To generate pulses, there is a circuit with two pushbuttons, which when pressed introduce a logic 1 at the output. In addition, a small circuit provides a clock signal whose frequency depends on the position of the switch in its circuit.

SPECIFICATIONS

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

DIMENSIONS AND WEIGHTS

Dimensions: 300 x 210 x 45 mm approx.
(11.81 x 8.26 x 1.77 inches approx.)
Weight: 300 g approx.
(0.66 pounds approx.)

REQUIRED ELEMENTS (Not included)

Required (only one):
- FACO. Power Supply.

or

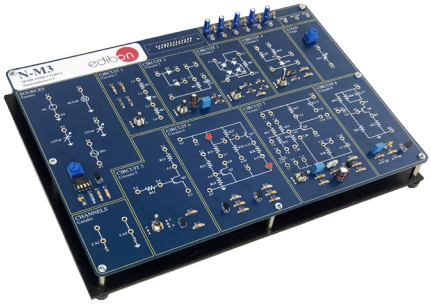
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (NOT INCLUDED)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Semiconductors**

N-M3. **Semiconductors I Module**



GENERAL DESCRIPTION

Semiconductors are materials characterized by a resistivity lower than an insulator and higher than a conductor. There are different types of semiconductors among which we could highlight diodes as extrinsic semiconductors (formed by more than one atom).

With the Semiconductors I Module, "N-M3", designed by EDIBON, the basic concepts of diodes can be studied, at the same time as the student will be asked to carry out a series of assemblies on the practice board to consolidate his knowledge of PN-type junctions, uses of the diode as a rectifier, Zéner diodes, etc.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Characteristics of the PN junction:
1.- Study of the diode.
2.- Faults study in diodes.
3.- Theoretical/practical exercises.
The diode as a rectifier element:
4.- Half wave rectifier.
5.- Faults study in rectifier circuit.
6.- Bridge rectifier.
7.- Faults study in bridge rectifier.
8.- Theoretical/practical exercises.
The Zener diode:
9.- Voltage regulator with a Zener diode.
10.-Faults study in Zener circuit.
11.-Theoretical/practical exercises.
Study and characteristics of the transistor:
12.-Study of the transistor.
13.-Faults study in the transistor.
14.-Theoretical/practical exercises.
Transistor characteristics operating as a switch:
15.-Study of the transistor as a switch.
16.-Theoretical/practical exercises.
Common emitter amplifier:
17.-Study of the common emitter NPN amplifier.
18.-Faults study in amplifier circuit.
19.-Study of the common emitter PNP amplifier.
20.-Theoretical/practical exercises.
Additional practical possibilities:
21.-Voltage doubler.
22.-Power supply filtering.
-Several other exercises can be done and designed by the user.

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 AND WEIGHTS

Dimensions: 300 x 210 x 45 mm approx.
(11.81 x 8.26 x 1.77 inches approx.)
Weight: 300 g approx.
(0.66 pounds approx.)

REQUIRED ELEMENTS (Not included)

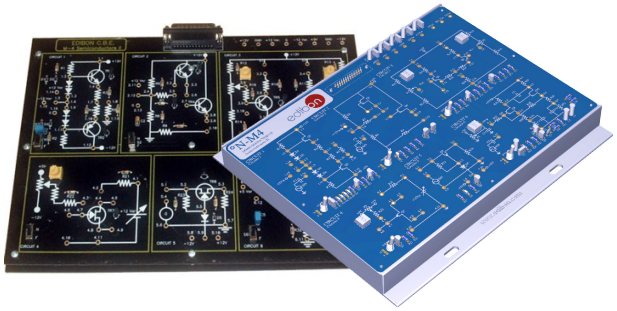
Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Semiconductors**

M4/N-M4. **Semiconductors II Module**



GENERAL DESCRIPTION

To improve and extend the characteristics of the input signals it is possible to use two or more transistors. Thus, you may want to build an amplifier in which you want to increase the input impedance without decreasing the gain. The solution to this lies in the combined use of two or more transistors. Thus, it is common to find structures that improve the characteristics of the individual transistors.

With the Semiconductors II Module, "N-M4", designed by EDIBON, semiconductors can be studied by extending the knowledge acquired in the basic module "N-M3".

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Complementary transistors pair:

1.- Complementary transistors pair.
2.- Transistors pair with alternating signal.
3.- Faults study of the complementary transistors pair.
4.- Theoretical/practical exercises.

Darlington configuration:

5.- Darlington configuration.
6.- Faults study of the Darlington configuration.
7.- Theoretical/practical exercises.

Differential amplifier:

8.- Differential amplifier.
9.- Faults study in the differential amplifier.
10.-Theoretical/practical exercises.

Study and characteristics of the JFET transistor:

11.-JFET characteristics.
12.-Faults study with the JFET transistor.
13.-Theoretical/practical exercises.

Analog switch:

14.-Analog switch.
15.-Theoretical/practical exercises.

Direct coupled amplifier:

16.-Direct coupled amplifier.
17.-Faults study in an amplifier coupled directly.
18.-Theoretical/practical exercises.

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

SPECIFICATIONS

Circuit blocks:

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

DIMENSIONS AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

Required (only one):

- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):

- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Semiconductors**

M14/N-M14. **Optoelectronics Module**

GENERAL DESCRIPTION

Optoelectronics is the link between optical systems and electronic systems. Optoelectronic components are those whose operation is directly related to light.

They are semiconductor devices capable of producing light radiation within the human visible spectrum or outside the human visible spectrum (infrared). Also included are components which are sensitive to light and whose operation is governed by light.

Among the optoelectronic components are: LEDs, photodiodes, luminescent displays, optocouplers, phototransistors, liquid crystal displays, fluorescent displays.

With the Optoelectronics Module, "N-M14", designed by EDIBON, the main light emitters and liquid crystal displays (LCD), photoconductive cells, fibre optics, infrared, etc. can be studied.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

Light transmitters and liquid crystal display (LCD):

1.- Light transmitters.
2.- Bargraph.
3.- LCD display and 7-segment display.
4.- Faults study in light transmitters and liquid crystal display.
5.- Theoretical/practical exercises.

Photo-conducting cells:

6.- Light dependent resistors.
7.- Alarm.
8.- Faults study on the photo-conducting cell.
9.- Theoretical/practical exercises.

Fiber optics:

10.-Fiber optics practice.
11.-Faults study using fiber optics.
12.-Theoretical/practical exercises.

Infrared:

13.-Circuit with infrared diodes.
14.-Faults study of the infrared diodes.
15.-Theoretical/practical exercises.

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

SPECIFICATIONS

Circuit blocks:
- Lamp. (Circuit#1).
- Sources. (Circuit#2).
- Bargraph. (Circuit#3).
- LDR. (Circuit#4).
- Photodiodes, optic fiber. (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 AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Instrumentation & Control**

M41. **Resistance Transducers**

GENERAL DESCRIPTION

This unit allows different practices related to resistance transducers to be carried out. The unit has five different types of transducers: PTC, NTC, LDR, strain gauge and RTD.

The operation of thermistors is based on the principle that the resistance of some materials varies as their temperature changes. When the temperature of the material changes, its resistance varies and can be simply measured and calibrated according to the input quantity. The most commonly used thermistors are made of ceramic semiconductor materials, such as manganese, nickel and cobalt oxides. Thermistors can be used for temperature measurement, as electrical power sensing devices and also as control for various processes.

With the Resistance Transducers unit, "M41", designed by EDIBON, we can study techniques for the measurement of various physical quantities, such as temperature, light intensity, displacement, force, etc., using 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.

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

DIMENSIONS AND WEIGHTS

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.)

REQUIRED ELEMENTS (Not included)

- FACO. Power Supply.

SPECIFICATIONS

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

Heater resistor:
- -Voltage: 12 Vdc.
- -Power dissipation: 4 W 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: 250 mW max.
- -Peak wavelength: 550 nm.

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

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

M44. Applications of Light

GENERAL DESCRIPTION

This unit allows different practices related to the measurement of light intensity to be carried out. Photodiodes are semiconductor light sensors that generate a current or voltage when the P-N junction in the semiconductor is illuminated with light.

With the Applications of Light unit, "M44", designed by EDIBON, different practices related to the measurement of light intensity are carried out.

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

By studying the different sensors, it is possible to compare their mode of operation and determine their advantages and disadvantages.

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.
8.- Study of a real application for controlling the light intensity using PID control elements.
-Several other exercises can be done and designed by the user.

DIMENSIONS AND WEIGHTS

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.)

REQUIRED ELEMENTS (Not included)

- FACO. Power Supply.

SPECIFICATIONS

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

Elements included:

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

Photodiode:
-Power dissipation: 250 mW max.
-Sensibility: 0.34 A/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.

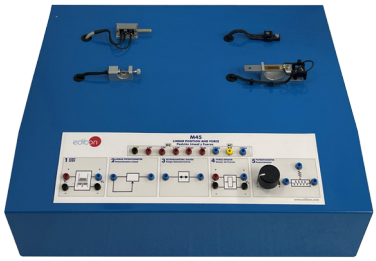
Photovoltaic cell:
-Power dissipation: 250 mW max.
-Peak wavelength: 550 nm.

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 unit front panel, with diagrams describing their functions.

M45. **Linear Position and Force**



GENERAL DESCRIPTION

Linear Variable Displacement Transducers (LVDT) provide a certain amount of voltage output relative to the parameters being measured, for example force, for signal conditioning.

With the Linear Position and Force unit, "M45", designed by EDIBON, it is possible to study the use and applications of transducers, sensors and measurement systems. That is to say, it shows the techniques to measure several physical magnitudes, such as position, displacement, force, etc., using linear position transducers. This unit allows to perform different practices related to linear position and force sensors.

PRACTICAL POSSIBILITIES

1.- Force sensor.
2.- Linear position sensor.
3.- Displacement measurement by LVDT.
4.- Strain measurement by strain gauges.
5.- Potentiometer.
-Several other exercises can be done and designed by the user.

DIMENSIONS AND WEIGHTS

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.)

REQUIRED ELEMENTS (Not included)

- FACO. Power Supply.

SPECIFICATIONS

Force sensor:
-Voltage: 5 Vdc.
-Current: 1.6 mA max.
-Power dissipation: 19.2 mW max.
-Operating force: 0 – 1500 g.
-Sensitivity: 24 mV/g.
Linear position sensor:
-Resistance range: 500 Ohms – 10 K.
Ohms:
-Tolerance: +/- 20%.
-Temperature characteristic: 0 – 200 ppm/°C max.
-Operating temperature max.: -40 °C – +130 °C.
LVDT:
-Voltage input: 15 Vac.
-Current input: 10 – 13 mA.
-Length of work: +/- 1 mm.
-Operating temperature max.: -40 °C – +80 °C.
Strain gauge:
-Resistance: 120 Ohm.
-Power dissipation: 100 mW max.
-Factor: 2.1.
-Length: 5 mm.
Potentiometer:
-Resistance: 10 K.
-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 unit front panel, with diagrams describing their functions.

M46. Environmental Measurements

GENERAL DESCRIPTION

Environmental measurement is a data collection process. In other words, it is a continuous and systematic follow-up study of environmental variables (air quality and speed, humidity, pressure, etc.). The aim is to identify and evaluate qualitatively and quantitatively the conditions of natural resources in order to verify whether certain environmental impacts are occurring, measure changes, introduce mitigating measures if necessary, etc.

With the Environmental Measurement unit, "M46", designed by EDIBON, it is possible to study the different techniques used in the measurement of physical magnitudes, such as humidity, air pressure, air flow, temperature, etc., using different types of sensors.

This unit allows to carry out different practices related to environmental transducers. The unit has different types of sensors: humidity sensor, pressure transducer, air velocity sensor and temperature sensor.

PRACTICAL POSSIBILITIES

1.- Temperature sensor characteristics.

2.- Air speed sensor characteristics.

3.- Differential pressure sensor characteristics.

4.- Humidity sensor characteristics.

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

DIMENSIONS AND WEIGHTS

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.)

REQUIRED ELEMENTS (Not included)

- FACO. Power Supply.

SPECIFICATIONS

Heater resistor:

-Voltage: 12 Vdc.

-Power dissipation: 4 W max.

Temperature sensor:

-Voltage supply: 4 – 30 Vdc.

-Sensibility: 10 mV/°C.

Humidity sensor:

-Voltage supply: 4 – 5.8 Vdc.

-Current supply: 500 mA.

-Operating temperature: -40 – 85 °C.

Differential pressure sensor:

-Voltage supply: 10 – 16 Vdc.

-Pressure range: 0 – 30 psi.

-Sensibility: 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.

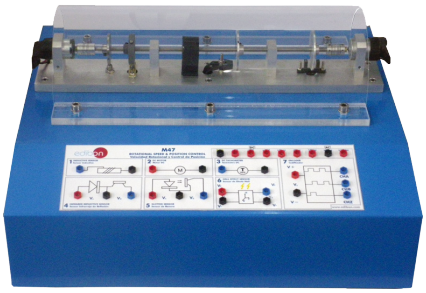
Manometer.

Air compressor.

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

➤ **Instrumentation & Control**

M47. **Rotational Speed & Position Control**



GENERAL DESCRIPTION

The unit is equipped with a DC motor whose rotation speed can be controlled by the supply voltage. The following sensors are arranged along the motor shaft: optical slot sensor, inductive sensor, infrared reflection sensor, Hall effect sensor, encoder.

With the Rotational Speed and Position Control unit, "M47", designed by EDIBON, it is possible, using the tachometer, to study the different techniques for measuring both linear and angular velocities.

The unit has a DC motor whose rotation speed can be controlled by the supply voltage. Along the motor shaft there are different sensors: optical slot sensor, inductive sensor, infrared reflection sensor, Hall effect sensor and encoder.

PRACTICAL POSSIBILITIES

1.- DC Motor.
2.- DC Tachometer.
3.- Inductive sensor.
4.- Infrared Reflective sensor.
5.- Slot sensor.
6.- Hall-Effect.
7.- Encoder.
-Several other exercises can be done and designed by the user.

DIMENSIONS AND WEIGHTS

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.)

REQUIRED ELEMENTS (Not included)

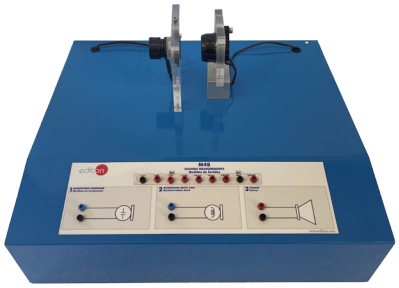
- FACO. Power Supply.

SPECIFICATIONS

DC motor:
-Nominal voltage: 12 Vdc.
-Maximum load speed: 3500 rpm approx.
-EFM: 1401 mV/rpm.
DC tachometer:
-Power: 1.21 W.
-Velocity: 7800 rpm.
-Voltage/Velocity relationship: 0.214 mV/rpm.
Inductive sensor:
-Output voltage: up to 10 Vpp.
-Body-housing material: Steel.
-Operating temperature range: -40°C – +60°C.
-Inductance: 12 mH +/- 10%.
-Coil resistance: 130 Ω +/- 10%.
Slot optical sensor:
Diode:
-V_F max: 1.7 V, I_r max: 100 μA.
-V_r : 2 V. Po max: 100 mW.
Photodetector:
-V_{CEO} max: 30 V. V_{ECO} max: 5 V.
-Dissipated power: 100 mW (max).
-Maximum operation frequency:100 kHz.
-V_O in output bornes of M47: 0.0 – 5 V to V_S=5 VDC.
Infrared reflective sensor:
Diode:
-V_F max: 1.6 V, V_r max: 3V.
-Po max: 70 mW.
Photodetector:
-V_{CEO} max: 30V, V_{ECO} max: 5V.
-Po max: 70 mW.
-V_O in output bornes of M47: 0.0 – 400 mV for V_S = 12 VDC.
-Detection distance: 4 – 6 mm.
Hall effect sensor:
-Supply voltage: 4 to 10 V. Supply current: 3.5 mA.
-Output type: Differential.
-Output voltage: 0.25 V – 2 V.
-Sensitivity: -130 – 130 gauss, 0.75 – 1.06 mV/gauss.
-V_O in output bornes of M47: 0.0 – 1V for V_S =5 VDC.
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 – 7 V.
-Output current: -1 – 5 mA.
-Output voltage V_O: -0.5 – V_{CC}.
-Velocity: 30000 rpm.

➤ **Instrumentation & Control**

M48. **Sound Measurements**



GENERAL DESCRIPTION

With the Sound Measurement unit, "M48", designed by EDIBON, different practices related to sound measurements can be carried out. The unit has three different types of components: two types of microphones and a loudspeaker.

PRACTICAL POSSIBILITIES

1.- Characteristics of a loudspeaker.

2.- Characteristics of a coil microphone.

3.- Characteristics of an Electret condenser microphone.

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

DIMENSIONS AND WEIGHTS

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.)

REQUIRED ELEMENTS (Not included)

- FACO. Power Supply.

SPECIFICATIONS

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 1000 Hz).

-Sensitivity: -75dB +/- 3dB.

Condenser microphone:

-Directional characteristics: Uni-directional.

-Frequency: 50 Hz – 16000 Hz.

-Impedance: < 2.2 K Ohm.

-Sensitivity: -47dB +/- 3dB.

-Standard operation voltage: 2 Vdc.

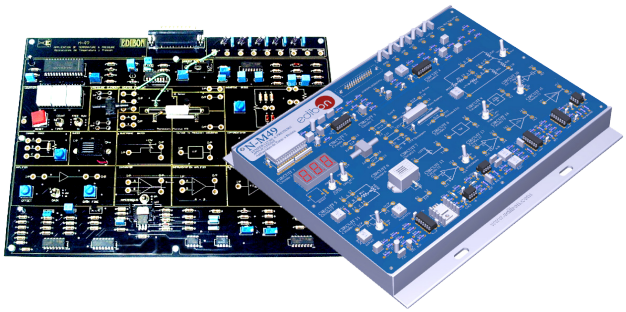
-Maximum operation voltage: 10 Vdc.

-Maximum current: 0.5 mA.

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

➤ **Instrumentation & Control**

M49/N-M49. **Applications of Temperature and Pressure Module**



GENERAL DESCRIPTION

A transducer is a device that is capable of transforming or converting a certain type of input energy into a different one at the output. Depending on the application they have, the name itself will indicate the type of conversion it performs, for example, an electromechanical transducer transforms a certain electrical signal into a mechanical one and vice versa, a mechanical one into an electrical one, etc.

Transducers have diverse applications and we can find them in industry, agriculture, internal medicine, robotics, railway industry, etc. They are used to transform information and data in chemical and/or physical contexts, and from these to obtain electrical impulses or signals or vice versa.

Temperature transducers can be: thermocouples, thermistors, IC sensors and resistance thermometers.

Pressure transducers allow us to convert pressure into an analog electrical signal.

The Applications of Temperature and Pressure module, "N-M49", designed by EDIBON, allows the study of these temperature and pressure transducers: operation, characteristics, etc.

PRACTICAL POSSIBILITIES

The integrated circuit temperature transducer:

1.- Characteristics of an integrated temperature circuit.

2.- Assembly of a digital thermometer.

The platinum transducer, RTD (Resistance Temperature Detector):

3.- Characteristics of a resistance temperature transducer (RTD).

The NTC (Negative Temperature Coefficient) thermistor:

4.- Characteristics of a NTC thermistor.

5.- NTC 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.

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

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 AND WEIGHTS

Dimensions: 300 x 210 x 45 mm approx.
(11.81 x 8.26 x 1.77 inches approx.)
Weight: 300 g approx. (0.66 pounds approx.)

REQUIRED ELEMENTS (Not included)

Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Power Electronics (Fundamentals)**

N-M9. **Power Electronics Module**

GENERAL DESCRIPTION

Semiconductors used in power electronics operate as switches and therefore it is interesting to know the conduction characteristics, switching and control methods.

With the Power Electronics Module, "N-M9", designed by EDIBON, the operation of MOSFET transistors, thyristors, TRIACs, etc. can be studied.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

PRACTICAL POSSIBILITIES

The bipolar power transistor:

1.- Study of the power transistor.

2.- Faults study in the power transistor.

3.- Theoretical/practical exercises.

The MOSFET transistor:

4.- Study of the MOSFET transistor.

5.- Faults study in the MOSFET transistor.

6.- Theoretical/practical exercises.

The thyristor:

7.- Study of the thyristor.

8.- Faults study of the thyristor.

9.- Theoretical/practical 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.-Theoretical/practical exercises.

The TRIAC:

13.-Study of the TRIAC.

14.-Practical assembly of the TRIAC.

15.-Theoretical/practical exercises.

Additional practical possibilities:

16.-Half/Full wave control.

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

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 AND WEIGHTS

Dimensions: 300 x 210 x 45 mm approx.
(11.81 x 8.26 x 1.77 inches approx.)
Weight: 300 g approx. (0.66 pounds approx.)

REQUIRED ELEMENTS (Not included)

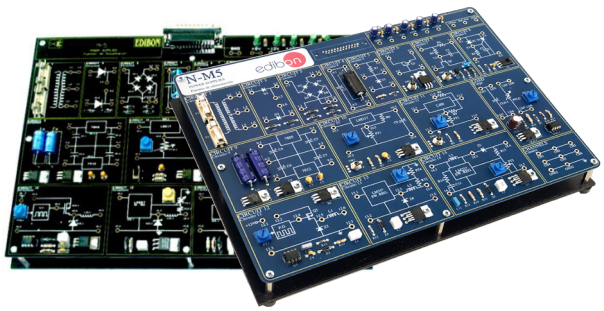
Required (only one):
- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):
- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

➤ **Power Electronics (Fundamentals)**

M5/N-M5. **Power Supplies Module**



GENERAL DESCRIPTION

With the Power Supplies Module "N-M5", designed by EDIBON, symmetrical voltage regulators, operation of fixed, symmetrical and switched-mode power supplies as well as rectification (conversion of an AC voltage to a DC voltage) can be studied.

In addition, faults can be simulated in most of the circuits under study. The student must investigate what is happening in the circuit and why it is not working properly. These faults simulations can be of several types from damage components to a hypothetical incorrect circuit assembly.

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.- Faults study in "Stabilization through Zener and Transistor".

7.- Protection against overcurrents.

8.- Protection against overvoltages.

9.- Faults study of "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.-Faults study in adjustable LM317 regulator.

16.-Adjustable L200 regulator.

17.-Faults 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 practical possibilities:

23.-Voltage Feedback.

24.-DC-DC converter.

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

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 AND WEIGHTS

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

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

REQUIRED ELEMENTS (Not included)

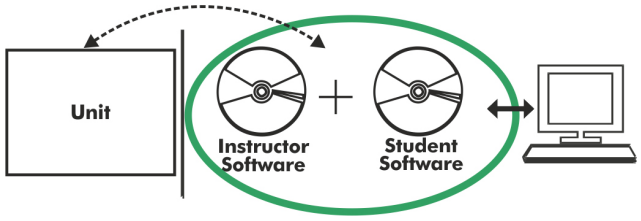
Required (only one):

- FACO. Power Supply. *or*
- EBC100. Base Unit, with built-in power supply.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):

- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s). *or*
- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).



With no physical connection between unit and computer (PC), **this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF).** Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

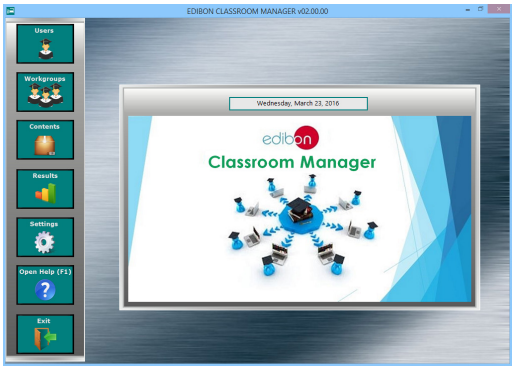
Instructor Software

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

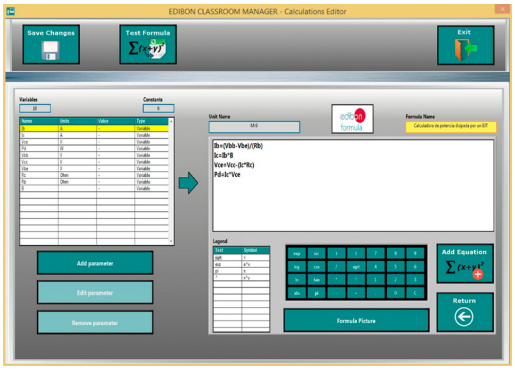
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

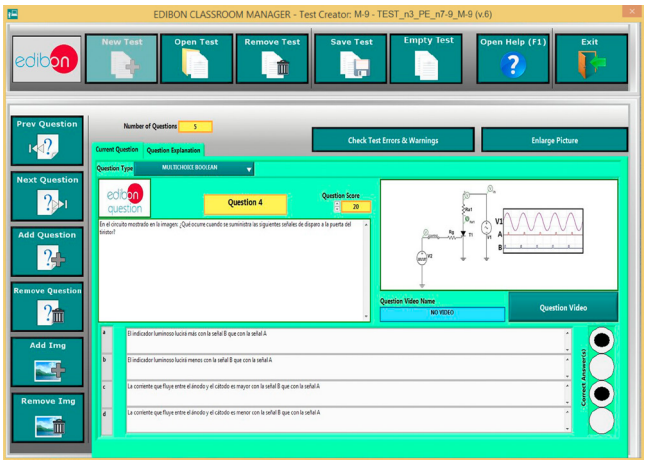
- **User Data Base Management.**
- **Administration and assignment of Workgroup, Task and Training sessions.**
- **Creation and Integration of Practical Exercises and Multimedia Resources.**
- **Custom Design of Evaluation Methods.**
- **Creation and assignment of Formulas & Equations.**
- **Equation System Solver Engine.**
- **Updatable Contents.**
- **Report generation, User Progression Monitoring and Statistics.**



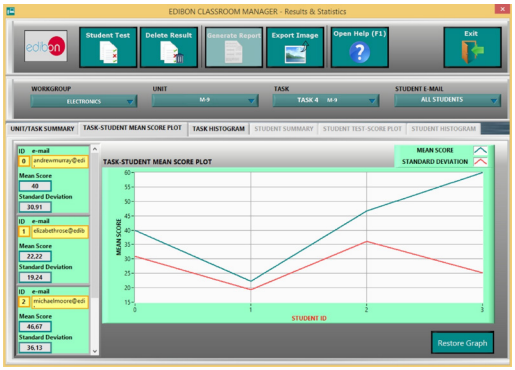
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



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



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

Student Software

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

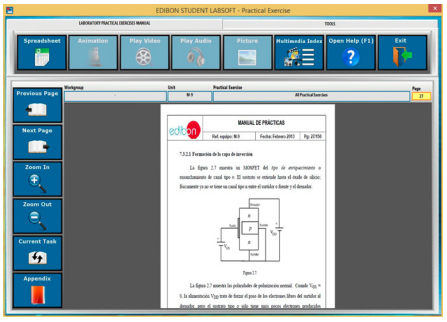
Innovative features:

- **Student Log-In & Self-Registration.**
- **Existing Tasks checking & Monitoring.**
- **Default contents & scheduled tasks available to be used from the first session.**
- **Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- **Evaluation Methods to prove your knowledge and progression.**
- **Test self-correction.**
- **Calculations computing and plotting.**
- **Equation System Solver Engine.**
- **User Monitoring Learning & Printable Reports.**
- **Multimedia-Supported auxiliary resources.**

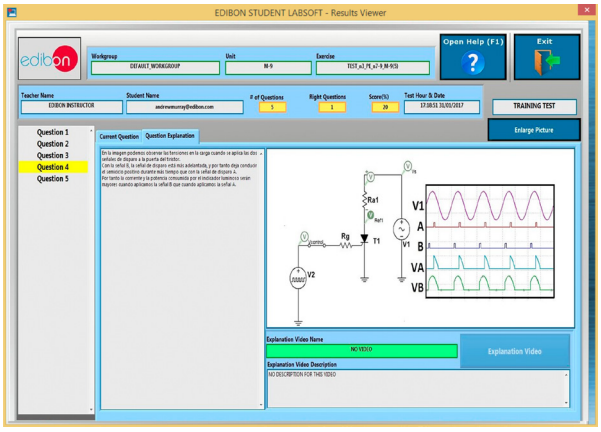
For more information see **ICAI** catalogue. Click on the following link:

www.edibon.com/en/interactive-computer-aided-instruction-software

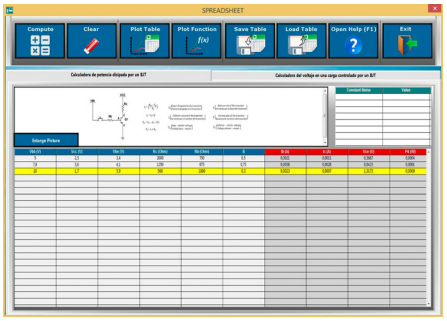
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

Available Student/Module Softwares

➤ Basic Electrical Laws Concpets

-ESL-N-M1-SOF. EDIBON E-Learning Content for N-M1.
-ESL-N-M2-SOF. EDIBON E-Learning Content for N-M2.
-ESL-N-M16-SOF. EDIBON E-Learning Content for N-M16.
-ESL-N-M17-SOF. EDIBON E-Learning Content for N-M17.
-ESL-N-M18-SOF. EDIBON E-Learning Content for N-M18.

➤ Analog Electronics

-ESL-N-M6-SOF. EDIBON E-Learning Content for N-M6.
-ESL-N-M7-SOF. EDIBON E-Learning Content for N-M7.
-ESL-N-M8-SOF. EDIBON E-Learning Content for N-M8.

➤ Digital Electronics

-ESL-N-M60-SOF. EDIBON E-Learning Content for N-M60.
-ESL-N-M61-SOF. EDIBON E-Learning Content for N-M61.
-ESL-N-M10-SOF. EDIBON E-Learning Content for N-M10.
-ESL-N-M11-SOF. EDIBON E-Learning Content for N-M11.
-ESL-N-M12-SOF. EDIBON E-Learning Content for N-M12.
-ESL-N-M13-SOF. EDIBON E-Learning Content for N-M13.

➤ Semiconductors

-ESL-N-M3-SOF. EDIBON E-Learning Content for N-M3.
-ESL-N-M4-SOF. EDIBON E-Learning Content for N-M4.
-ESL-N-M14-SOF. EDIBON E-Learning Content for N-M14.

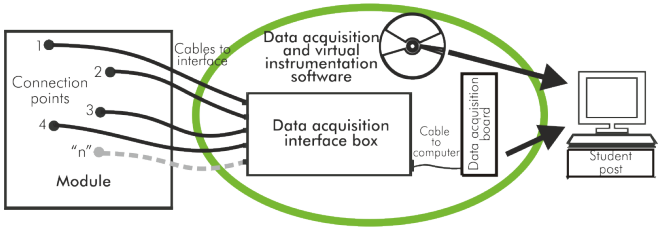
➤ Instrumentation & Control

-ESL-M41-SOF. EDIBON E-Learning Content for M41.
-ESL-M44-SOF. EDIBON E-Learning Content for M44.
-ESL-M45-SOF. EDIBON E-Learning Content for M45.
-ESL-M46-SOF. EDIBON E-Learning Content for M46.
-ESL-M47-SOF. EDIBON E-Learning Content for M47.
-ESL-M48-SOF. EDIBON E-Learning Content for M48.
-ESL-N-M49-SOF. EDIBON E-Learning Content for N-M49.

➤ Power Electronics (Fundamentals)

-ESL-N-M9-SOF. EDIBON E-Learning Content for N-M9.
-ESL-N-M5-SOF. EDIBON E-Learning Content for N-M5.

④ EDAS/VIS. EDIBON Data Acquisition System and Virtual Instrumentation



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)).

EDAS/VIS-0.25, sampling velocity 250,000 samples per second.

EDAS/VIS-1.25, sampling velocity 1,250,000 samples per second.

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 - 5 V.

2 analog signal potentiometers 12 V.

Main ON/OFF switch.

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

DAIB

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

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

Connecting cables.

- DAB. Data Acquisition Board:

The Data Acquisition board is part of the SCADA system.

<u>For EDAS/VIS-1.25 Version EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s):</u>

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

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)= ±10V.

Data transfers=DMA, interrupts, programmed I/0. Number of DMA channels=6.

Analog output:

Number of **channels=2**. **Resolution=16 bits**, 1 in 65536. **Max. output rate up to: 900 KS/s.**

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

Digital Input/Output: Number of **channels=24 inputs/outputs**. **Port 0 up to 8 MHz.**

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

<u>For EDAS/VIS-0.25 Version EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s):</u>

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 1 MHz.**

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

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

DAB

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

EDAS/VIS-SOF

Compatible with actual Windows operating systems. Amicable graphical frame.

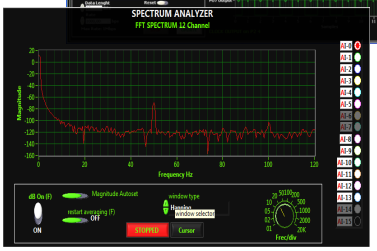
Configurable software allowing the temporal/frequency representation of the different inputs and outputs. Visualization of a voltage of the circuits on the computer screen.

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: 10 V.
  All 12 input channels could be scaled to compare signal with different voltage levels.
  Maximum sampling velocity: 1000 samples per second.
  "Math Menu" with operations as add, rest, multiplication and division, between any of the 12 oscilloscope channels.
- **Function generator:**
  Two independent signal generators, for sinusoidal, triangular, sawtooth and square.
  Channels: 2 (allowing working simultaneously). Maximum output voltage: 10 V.
  Maximum output rate: 1000 samples per second.
  It includes a graph where an output signal for each channel is shown.
- **Spectrum analyzer:**
  Channels: 12 (simultaneous). Maximum voltage: 10 V. Digital spectrum analyzer: based on the FFT.
  Maximum sampling velocity: 1000 samples per second.
- **Multimeter:**
  Voltmeter, channels: 12 (simultaneous). Maximum voltage: 10 V RMS.
  Ammeter, channels: 2 (simultaneous). Maximum ampere: 500 mA RMS per channel.
- **Transient analyzer**.
- **Logic analyzer:**
  Number of Input channels: 8. TTL Voltage Level.
  Clock source: **2 different sources.**
  This instrument allows receiving as far as 8 digital signal simultaneously.
- **Logic generator:**
  Number of transmission channels: 8. TTL voltage level.
  This instrument allows generating up to 8 digital simultaneous signals.



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 unit **is supplied whit the following manuals:** Required services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices manuals.

For more information see **EDAS/VIS** catalogue. Click on the following link:

www.edibon.com/en/edibon-data-acquisition-system-and-virtual-instrumentation

IMPORTANT!

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

✱ Specifications subject to change without previous notice, due to the convenience of improvement of the product. The physical appearance of the units may be modified without previous notice.

C/ Julio Cervera, 10. Móstoles Tecnológico.
28935 MÓSTOLES. (Madrid). ESPAÑA - SPAIN.
Tel.: 34-91-6199363 Fax: 34-91-6198647
E-mail: edibon@edibon.com Web: **www.edibon.com**

Edition: ED02/24
Date: October/2024

REPRESENTATIVE: