Technical Teaching Equipment

Summarized
Catalogue

two (2)

Electronics

Communications

Electricity

Energy

Mechatronics & Automation

Process Control

Edition: ED01/12
Date: December/2012

edibon

www.edibon.com

edibon

complete range

INDEX

Summarized
Catalogue
two(2)

2. Electronics page 4

Basic Electronics:
- 2.1. Basic Electronics. 6-19
- 2.2. Electronics Kits. 20-25
- 2.3. Transducers and Sensors. 26-32

Advanced Electronics:
- 2.4. Control Electronics (Advanced). 33-34
- 2.5. Digital Electronics (Advanced). 35
- 2.6. Industrial Electronics (Advanced). 36-38

3. Communications page 39

Basic Communications:
- 3.1. Analog Communications &
- 3.2. Digital Communications. 41-48

Advanced Communications:
- 3.3. Telephony. 48
- 3.4. Applied Communications. 49

4. Electricity page 50

Basic Electricity:
- 4.1. Basic Electricity. 53-79
- 4.2. Electricity Demonstration. 79
- 4.3. Electrical Installations Workshop.

Advanced Electricity:
- 4.4. Electrical Machines. 80-101
- 4.5. Electrical Machines Kits. 102

5. Energy page 103

- 5.1. Energy Simulation.
- 5.2. Energy Power Plants. 105-120
- 5.3. Renewable (Alternative) Energies. 121-133
- 5.4. Relays Units. 134-137
- 5.5. Smart Grid. 138-145

6. Mechatronics & Automation page 146

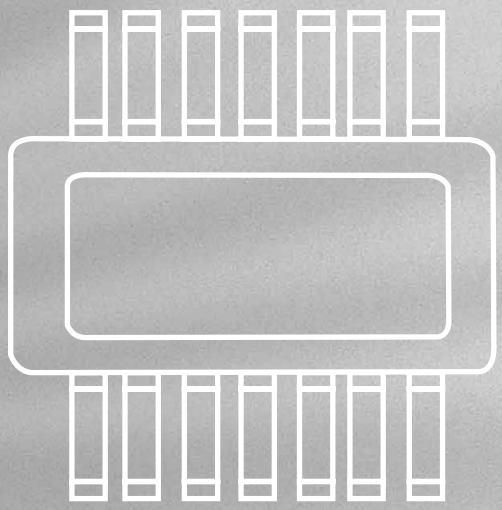
- 6.1. Automation (PLC Process Emulation). 148-158
- 6.2. Automation (PLC Small Scale Real Applications). 159-163
- 6.3. Automation (Industrial PLC Applications). 164
- 6.4. Automation (PLC Unit Operations Control). 165
- 6.5. Automation (Regulation and Control). 166
- 6.6. Automation (Control). 167-168
- 6.7. Systems. 169

10. Process Control page 170

- 10.1. Process Control. Fundamentals. 172-176
- 10.2. Industrial Process Control. 177

Summarized
Catalogue

two(2)



2. Electronics

	page
Basic Electronics:	
2.1. Basic Electronics.	6-19
2.2. Electronics Kits.	20-25
2.3. Transducers and Sensors.	26-32
Advanced Electronics:	
2.4. Control Electronics (Advanced).	33-34
2.5. Digital Electronics (Advanced).	35
2.6. Industrial Electronics (Advanced).	36-38

edibon

www.edibon.com

page

2.1- Basic Electronics

-LIEBA **Basic Electronics and Electricity Integrated Laboratory:** 6-19

Power Supplies
(one power supply required)
- •FA-CO **Power Supply.**
- •EBC-100 **Base Unit,** with built-in power supply.

Modules

Basic Electronics concepts
- •M3 **Semiconductors I.**
- •M4 **Semiconductors II.**
- •M6 **Oscillators.**
- •M7 **Operational Amplifiers.**
- •M8 **Filters.**
- •M9 **Power Electronics.**
- •M60 **Analog/Digital Converters.**
- •M61 **Digital/Analog Converters.**
- •M99 **Expansion Unit**:
  Modules included:
  - •M99-1 **Analog Multiplexer module.**
  - •M99-2 **Analog Multiplier module.**
  - •M99-3 **Function Generator module.**
  - •M99-4 **AM Modulator module.**
  - •M99-5 **AM Demodulator module.**
- •M99-6 **Motors, Generators and Controls Unit.**

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

Basic Electricity concepts
- •M5 **Power Supplies.**
- •M1 **Direct Current (D.C.) Circuits.**
- •M2 **Alternating Current (A.C) Circuits.**
- •M16 **Electric Networks.**
- •M17 **Electromagnetism.**
- •M18 **Three-phase Circuits.**

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

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

Software
- -CAI **Computer Aided Instruction Software System,** additional and optional to the Modules type "M".
- -LIEBA/CAL **Computer Aided Learning Software (Results Calculation and Analysis),** additional and optional to the Modules type "M".

Data Acquisition and Virtual Instrumentation
- -EDAS/VIS 0.25 **EDIBON Data Acquisition System + Virtual Instrumentation System,** for being used with the Modules type "M".
- -EDAS/VIS 1.25 **EDIBON Data Acquisition System + Virtual Instrumentation System,** for being used with the Modules type "M".

2.2- Electronics Kits

-M-KITS **Basic Electronics and Electricity Assembly Kits:** 20-25

Required elements by any Kits
- •FA-CO **Power Supply.**
- •M15 **Development Module.**

Assembly Kits

Basic Electronics concepts
- •M3-KIT **Semiconductors I.**
- •M4-KIT **Semiconductors II.**
- •M6-KIT **Oscillators.**
- •M7-KIT **Operational Amplifiers.**
- •M8-KIT **Filters.**
- •M9-KIT **Power Electronics.**

Digital Electronics
- •M10-KIT **Digital Systems & Converters.**
- •M11-KIT **Digital Electronics Fundamentals.**
- •M12-KIT **Basic Combinational Circuits.**
- •M13-KIT **Basic Sequential Circuits.**
- •M14-KIT **Optoelectronics.**

Basic Electricity concepts
- •M5-KIT **Power Supplies.**
- •M1-KIT **Direct Current (D.C.) Circuits.**
- •M2-KIT **Alternating Current (A.C.) Circuits.**
- •M16-KIT **Electric Networks.**

page

Software
- -CAI **Computer Aided Instruction Software System,** additional and optional to the Kits type "M-KIT".
- -CAL **Computer Aided Learning Software (Results Calculation and Analysis),** additional and optional to the Kits type "M-KIT".

Data Acquisition and Virtual Instrumentation
- -EDAS/VIS 0.25 **EDIBON Data Acquisition System + Virtual Instrumentation System,** for being used with the Kits type "M-KIT".
- -EDAS/VIS 1.25 **EDIBON Data Acquisition System + Virtual Instrumentation System,** for being used with the Kits type "M-KIT".

2.3- Transducers and Sensors

-BS **Modular System for the Study of Sensors:** 26-30

Base Units
(one base unit is required)
- •BSPC Computer Controlled **Base Unit.**
- •BSUB **Base Unit** (no computer controlled).

Modules
- •BS-1 **Vibration and/or Deformation Test Module.**
- •BS-2 **Temperature Test Module.**
- •BS-3 **Pressure Test Module.**
- •BS-4 **Flow Test Module.**
- •BS-5 **Ovens Test Module.**
- •BS-6 **Liquid Level Test Module.**
- •BS-7 **Tachometers Test Module.**
- •BS-8 **Proximity Test Module.**
- •BS-9 **Pneumatic Test Module.**
- •BS-10 **Light Test Module.**

-SAIT **Transducers and Instrumentation Trainer.** 31

-SPC Computer Controlled **Weighing System.** 32

-SCSP **Pressure Sensors Calibration System.** 32

2.4- Control Electronics (Advanced)

-RYC Computer Controlled **Teaching Unit for the Study of Regulation and Control.** 33

-RYC/B **Basic Teaching Unit for the Study of Regulation and Control.** 34

-CADDA Computer Controlled **Teaching Unit for the Study of Analog/Digital and Digital/Analog Converters.** 34

2.5- Digital Electronics (Advanced)

-TDS Computer Controlled **Teaching Unit for the Study of Digital Signal Processing.** 35

2.6- Industrial Electronics (Advanced)

-TECNEL Computer Controlled **Teaching Unit for the Study of Power Electronics** (with IGBTS). (Converters: DC/AC + AC/DC + DC/DC + AC/AC). 36

-TECNEL/B Computer Controlled **Basic Teaching Unit for the Study of Power Electronics** (no IGBTS). (Converters: AC/DC + AC/AC). 36

-PECADS **Power Electronics Computer Aided Design and Simulation Software.** (Converters: DC/AC, AC/DC, DC/DC, AC/AC).

-SERIN/CA Computer Controlled **Advanced Industrial Servosystems Trainer (AC motors).** 37

-SERIN/CC Computer Controlled **Advanced Industrial Servosystems Trainer (DC motors).** 37

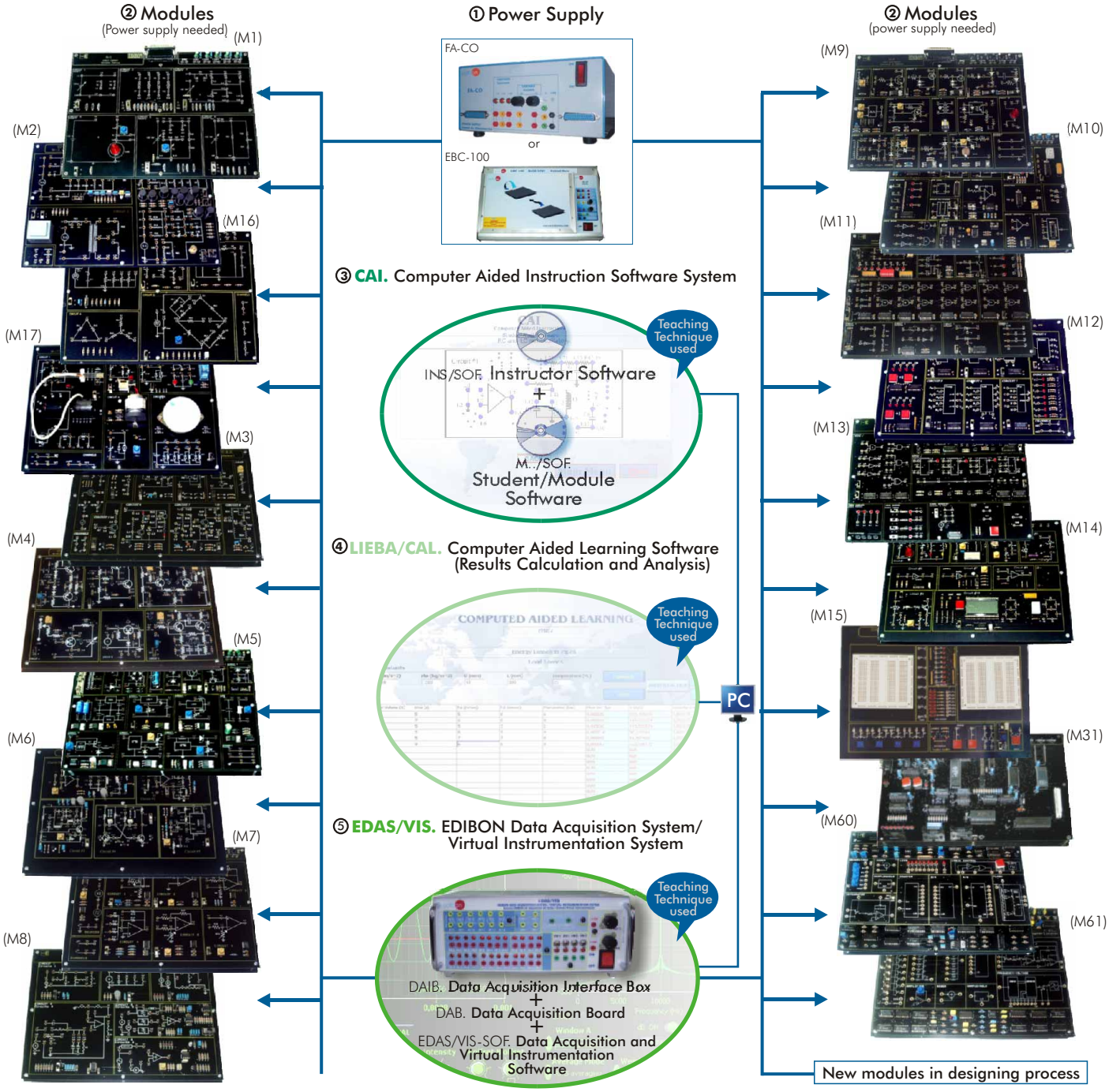
-SERIN/CCB **Basic Servosystems Trainer (DC motors).** 38

-SERIN/CACC Computer Controlled **Advanced Industrial Servosystems Trainer (AC and DC motors).** 38

-SERIN/CAB **Basic Servosystems Trainer (AC motors).** 38

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

Laboratory structure



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

Available Modules:

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

  Modules included:
  - .M99-1. Analog Multiplexer module.
  - .M99-2. Analog Multiplier module.
  - .M99-3. Function Generator module.
  - .M99-4. AM Modulator module.
  - .M99-5. AM Demodulator module.
  - .M99-6. Motors, Generators and Controls Unit.

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

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

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

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

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

① Power Supply

There are two choices for suppling the modules:

FA-CO. **Power Supply**

or

SPECIFICATIONS SUMMARY

Fixed outputs: + 5 V, ± 12 V, 1 A. Variable outputs: ± 12 V, 0.5 A. AC output: 12V. or 24 V. Outputs through either 2mm. contact terminals, or through 25 pin CENTRONICS connectors (2 outputs). LED's voltage indicators. Robust construction. Supply: 110/220V A.C. Frequency: 50/60 Hz.

FA-CO includes all the requirements for full working with any module from M1 to M99.

Dimensions (approx.): 225 x 205 x 100 mm. Weight: 2 Kg.

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

SPECIFICATIONS SUMMARY

Hardware support and power supply. Modules supporting unit.

Fixed outputs + 5V, + 12V, -12V. Variable outputs ± 12 V. AC output: 12 V. or 24 V. Outputs through either 2mm. contact terminals, or through 25 pin CENTRONICS connector. LED's voltage indicators. Robust construction. Supply: 110/220 V. A.C. Frequency: 50/60 Hz.

EBC-100 includes all the requirements for full working with any module from M1 to M99.

Dimensions: 410 x 298 x 107 mm. approx. Weight: 2 Kg. approx.

② Modules

They consist on electronic boards or 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 component faults can be simulated too.
Every Module has its own manuals, that gives the theoretical knowledge and explains everything the student needs to carry out the exercise/practice. We provide eight manuals per module.
Connectors and cables for completing the exercises and practices are included.

➤Basic Electronics concepts

M3. **Semiconductors I**

SPECIFICATIONS SUMMARY

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 (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

Characteristics of the PN junction:
1.- Study of the diode.
2.- Fault Study in Diodes.
3.- Exercises.

The diode as a rectifier element:
4.- Half wave rectifier.
5.- Study of faults in Rectifier circuit.
6.- Bridge rectifier.
7.- Study of faults in bridge rectifier.
8.- Exercises.

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

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

Transistor characteristics operating as a switch:
15.- Study of the transistor as a switch.
16.- Exercises.

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

Additional Possibilities:
Voltage Doubler.
Power Supply filtering.

M4. **Semiconductors II**

SPECIFICATIONS SUMMARY

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

Dimensions (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

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

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

Study and characteristics of the JFET transistor:
11.- JFET characteristics.
12.- Fault study with the JFET transistor.
13.- Exercises.

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

Multistage Amplifier. Direct coupling:
16.- Amplifier coupled directly.
17.- Fault study of an amplifier coupled directly.
18.- Exercises.

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

② Modules

➤ **Basic Electronics concepts**

M6. **Oscillators**

SPECIFICATIONS SUMMARY

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 (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

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

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

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

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

M7. **Operational Amplifiers**

SPECIFICATIONS SUMMARY

Circuit blocks:
- Non-inverting amplifier. (Circuit#1).
- Amplifier. (Circuit#2).
- Voltage follower. (Circuit#3).
- Adder. (Circuit#4).
- Differential amplifier. (Circuit#5).
- Comparator. (Circuit#6).
- Channels.
- Sources.

Dimensions (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

The inverting amplifier:
5.- Inverting amplifier study.
6.- Inverting amplifier fault study.
7.- Exercises.

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

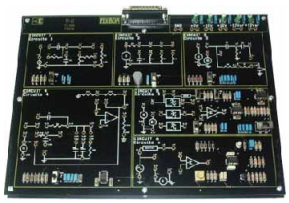
The adder amplifier:
12.- Adding amplifier study.
13.- Fault study in the adding amplifier.
14.- Exercises.

The differential amplifier:
15.- Differential amplifier study.
16.- Differential amplifier fault study.
17.- Exercises.

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

Additional Possibilities:
Attenuator.
Voltage Divider.
Open-loop operation.

M8. **Filters**



SPECIFICATIONS SUMMARY

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 (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

T-shaped Filter:
8.- Filter with double T link.
9.- Generator circuit of the signal S1.
10.- Study of Error in RC filter with double T.
11.- Exercises theoretical/practical.

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

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

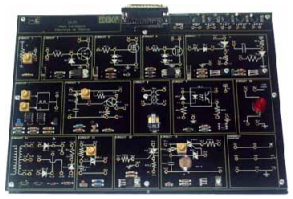
Additional Possibilities:
Band-Pass and Band-Stop Filters.

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

② Modules

➤**Basic Electronics concepts**

M9. **Power Electronics**



SPECIFICATIONS SUMMARY

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 (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

The bipolar power transistor:

1.- Study of the power transistor.

2.- Study of faults in the power transistor.

3.- Exercises.

The MOSFET transistor:

4.- Study of the MOSFET transistor.

5.- Study of faults in the MOSFET transistor.

6.- Exercises.

The thyristor:

7.- Study of the thyristor.

8.- Study of the error of the thyristor.

9.- Exercises.

The UJT transistor and trigger circuits of the thyristor:

10.- Study of the trigger circuits of the thyristor.

11.- Study of insulation circuits.

12.- Exercises.

The TRIAC:

13.- Study of the TRIAC.

14.- Practical assembly of the TRIAC.

15.- Exercises.

Additional Possibilities:

Half/Full wave control.

M60. **Analog/Digital Converters**

SPECIFICATIONS SUMMARY

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

Dimensions (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

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.

M61. **Digital/Analog Converters**

SPECIFICATIONS SUMMARY

Circuit blocks:
- Generators.
- R/2R converter.
- Weighled converter.
- D/A converter.
- Serial converter.
- Amplifier.
- Adder.
- Sample/Hold.
- Frequency-voltage converter.

Dimensions (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

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.

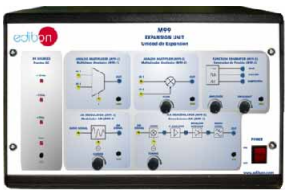
8.- D/A converter of pulse width modulation.

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

② Modules

➤**Basic Electronics concepts**

M99. **Expansion Unit**



SPECIFICATIONS SUMMARY

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

Modules included in M99 unit:

M99-1. Analog Multiplexer module:

This module allows us to select between two analog signals IN1 and IN2. There is a digital control signal S for selecting the input signal.

M99-2. Analog Multiplier module:

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

M99-3. Function Generator module:

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

M99-4. AM modulator module:

This module allows us to generate an AM signal. The frequency of the carrier signal can be selected by using a potentiometer. The carrier signal can be observed using the outout terminal. AM-DSB modulator.

M99-5. AM demodulator module:

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

DC source module.

Dimensions (approx.)= 490 x 330 x 310 mm.

Weight: 6 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

1.- TDM (Time Division Multiplexing).

2.- Analog Multiplication.

3.- AM modulation/demodulation.

4.- FM modulation/demodulation.

5.- PWM modulation/demodulation.

M99-6. **Motors, Generators and Controls Unit**

SPECIFICATIONS SUMMARY

M99-6 unit enables to carry out different practices related with motors and generators.

The unit is divided in three different modules: DC motor, AC motor and Stepper Motor.

DC Motor:

This module contains a DC motor. There is a potentiometer to control the speed of the motor. There is a switch to enable the motor to run. The voltage internally applied to the motor or generated can be observe using the "M+" and "M-" terminals.

AC Motor:

This module contains an AC synchronous motor. There is a switch to enable the motor to run. The voltage internally applied to the motor or generated can be observe using the "AC1" and "AC2" terminals.

Stepper motor:

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

Dimensions (approx.)= 490 x 330 x 310 mm.

Weight: 6 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

1.- DC motor.

2.- AC Motor.

3.- DC Generator.

4.- AC Generator.

5.- Stepper Motor.

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

➤ **Digital Electronics**

② Modules

M10. **Digital Systems & Converters**

SPECIFICATIONS SUMMARY

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 (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

Analog switching. The bistable, astable and monostable family:
1.- Characteristics of an analog switch chip.
2.- Study of the error F1 in the Analog Multiplexer.
3.- Study of the errors in the Analog Multiplexer.
4.- Characteristics of an S-R type Latch Integrated circuit.
5.- Error Study in the bistable.
6.- Characteristics of an integrated astable circuit.
7.- Error Study in the astable.
8.- Characteristics of an integrated Monostable circuit.
9.- Theoretical/practical exercises.

Behaviour of Binary/BCD Counters & 7-segments Displays:
10.- Characteristics of Binary UP/DOWN Counter 74LS193 and 7-Segment Display.
11.- Error Study in the binary counter.
12.- Characteristics of the BCD UP/DOWN counter and 7-Segment Display.
13.- Error Study in the BCD counter.
14.- Theoretical/practical exercises.

Comparators and analog integrators:
15.- Characteristics of an analog comparator.
16.- Analog integrator.
17.- Error Study 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 Possibilities:
Synchronous/Asynchronous Counter.

M11. **Digital Electronics Fundamentals**

SPECIFICATIONS SUMMARY

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 (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

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

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

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

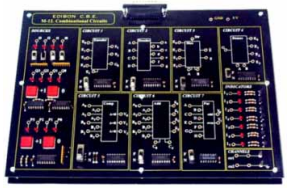
Boolean Algebra and logical functions:
16.- Study of use of Circuit #3.
17.- Exercises.

Open collector gates:
18.- Study of the use of Circuit #5.
19.- Exercises.

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

Additional Possibilities:
JK Flip-Flop.
Control of Data Bus.

M12. **Basic Combinational Circuits**



SPECIFICATIONS SUMMARY

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 (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

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

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

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

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

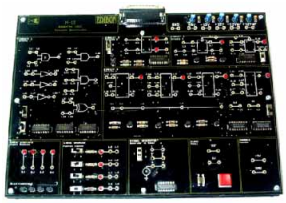
Arithmetic and logic operations:
16.- Study of an adder.
17.- Study of the error in the arithmetic and logic operations.
18.- Study of a parity generator.
19.- Study of the error in the Parity generator.
20.- Exercises.

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

② Modules

➤**Digital Electronics**

M13. Basic Sequential Circuits



SPECIFICATIONS SUMMARY

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

Dimensions (approx.)= 300 x 210 x 45 mm.

Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

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

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

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

Memories:
15.- Exercises.

M14. Optoelectronics

SPECIFICATIONS SUMMARY

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

Dimensions (approx.)= 300 x 210 x 45 mm.

Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

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

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

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

M41. Resistance Transducers

SPECIFICATIONS SUMMARY

This module enables to carry out different practices related with variable resistance transducers.

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

Elements included:
- Lamp.
- Heater resistor.
- PTC.
- NTC.
- RTD.
- LDR.
- Extensiometric gauge.

Dimensions (approx.)= 405 x 300 x 350 mm.

Weight: 6 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

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 Extensiometric Gauge for the measurement of deformation.

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

② Modules

➤ **Basic Electricity concepts**

M5. **Power Supplies**

SPECIFICATIONS SUMMARY

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 Regulators. (Circuit#10).
- L200 adjustable Regulator. (Circuit#11).
- Switched source. (Circuit#12).
- PWM switched source. (Circuit#13).
- Boost switched source. (Circuit#14).
- Load.
- Channels.

Dimensions (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

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

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

Voltage regulators with integrated circuits:
14.- Adjustable regulator; LM317.
15.- Study of the fault in adjustable LM317 regulator.
16.- Adjustable L200 regulator.
17.- Fault Study in adjustable L200 Regulator.
18.- Theoretical/practical exercises.

Introduction to switched power supplies:
19.- Switching technique.
20.- Switching technique. PWM.
21.- Switching technique. Boost.
22.- Theoretical/practical exercises.

Additional Possibilities:
Voltage Feedback.
DC-DC converter.

M1. **Direct Current (D.C.) Circuits**

SPECIFICATIONS SUMMARY

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 (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

Measurement managing and checking instruments:
1.- Electronic instrumentation operation. Use of multimeter.
2.- Study of fault F1 in Resistance circuit.
3.- Study of fault F2 in Resistance circuit.
4.- Theoretical/practical exercises.

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

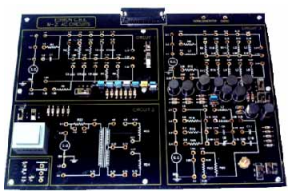
Resistors: characteristics and types:
8.- Resistor measurements. Color code. Ohmmeter.
9.- Study of Fault F1 in Resistors circuit.
10.- Study of Fault F2 in Resistors circuit.
11.- Theoretical/practical exercises.

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

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

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

M2. **Alternating Current (A.C.) Circuits**



SPECIFICATIONS SUMMARY

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

Dimensions (approx.)= 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

Behaviour of A.C. 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.- Study of faults in capacitors.
15.- Reactive capacitance variations with the capacitance.
16.- A.C. capacitors in parallel.
17.- A.C. capacitors in series.
18.- A.C. capacitors as voltage dividers.
19.- Inductance in an A.C circuit.
20.- Inductive reactance variations with the inductance.
21.- Inductors in series in an A.C. circuit.
22.- Exercises.

Basic theorems and capacitance and inductance circuits:
23.- A.C. Resistor-Capacitor circuits in series.
24.- A.C. Resistor-Capacitor circuits in parallel.
25.- A.C. Resistor-Inductor circuits in series.
26.- Study of Fault 1 in the Circuit #3.
27.- Study of Fault 2 in the Circuit #3.
28.- A.C. Resistor-Inductor circuits in parallel.
29.- Exercises.

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

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

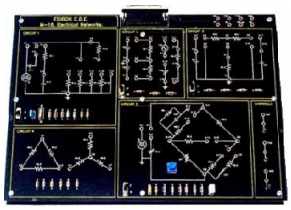
The transformer:
41.- The transformer.
42.- The transformer with load.
43.- Current measurement in the secondary Transformer with charge.
44.- Exercises.

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

② Modules

➤**Basic Electricity concepts**

M16. **Electric Networks**



SPECIFICATIONS SUMMARY

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

Dimensions (approx.) = 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

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

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

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

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

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

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

Additional Possibilities:
Millman's Theorem.

M17. **Electromagnetism**

SPECIFICATIONS SUMMARY

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

Dimensions (approx.) = 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

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

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

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

M18. **Three-phase Circuits**

SPECIFICATIONS SUMMARY

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

Dimensions (approx.) = 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

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

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

Phase-sequence detector:
10.- Waves in direct sequence.
11.- Waves in inverse sequence.

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

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

② Modules

➤**Electronics Applications**

M43. **Applications of Temperature**

SPECIFICATIONS SUMMARY

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

Dimensions (approx.) = 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

The integrated circuit temperature transducer:

1.- Characteristics of an integrated temperature circuit.

2.- Construction of a digital thermometer.

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

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

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

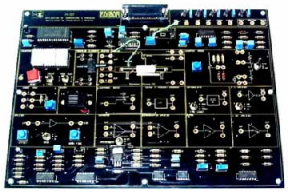
4.- Characteristics of an N.T.C thermistor.

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

The "K" type thermocouple temperature thermistor:

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

M49. **Applications of Temperature and Pressure**



SPECIFICATIONS SUMMARY

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 (approx.) = 300 x 210 x 45 mm.
Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

The integrated circuit temperature transducer:

1.- Characteristics of an integrated temperature circuit.

2.- Construction of a digital thermometer.

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

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

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

4.- Characteristics of an N.T.C thermistor.

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

The "K" type thermocouple temperature thermistor:

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

The Pressure transducer:

7.- Characteristic of a pressure transducer.

M44. **Applications of Light**

SPECIFICATIONS SUMMARY

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

The module has five different types of light sensors.

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

Elements included:
- Lamp.
- Photodiode.
- Phototransistor.
- LDR.
- Photovoltaic cell.
- IR Emitter.
- IR Receiver.

Dimensions (approx.) = 405 x 300 x 350 mm.
Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

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 real applications using IR sensors.

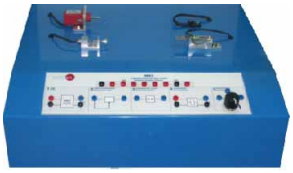
8.- Study of a real application for controlling the light intensity using PID control elements.

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

② Modules

➤**Electronics Applications**

M45. **Linear Position and Force**



SPECIFICATIONS SUMMARY

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

Elements included:

- Force sensor.
- Linear Position Sensor.
- LVDT.
- Extensiometric gauge.
- Potentiometer.

Dimensions (approx.)= 405 x 300 x 350 mm.

Weight: 6 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

M46. **Environmental Measurements**

SPECIFICATIONS SUMMARY

This module enables to carry out different practices related with variable environmental transducers. The module has different types of sensors.

On the chassis there are the sensors. The heater is used to control the temperature.

Elements included:

- Heater resistor.
- Temperature sensor.
- Humidity sensor.
- Differential pressure sensor.
- Air speed sensor.
- Manometer.
- Air compressor.

Dimensions (approx.)= 405 x 330 x 350 mm.

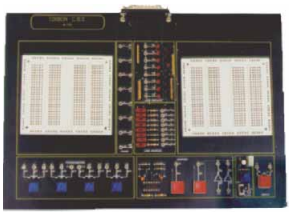
Weight: 6 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

M15. **Development Module**



SPECIFICATIONS SUMMARY

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

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

Dimensions (approx.)= 300 x 210 x 45 mm.

Weight: 300 gr.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

M48. **Sounds Measurements**

SPECIFICATIONS SUMMARY

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

Elements included:

- Loudspeaker.
- Dynamic moving coil microphone.
- Condenser microphone.

Dimensions (approx.)= 405 x 300 x 350 mm.

Weight: 6 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

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

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

➤**Control**

② Modules

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

SPECIFICATIONS SUMMARY

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

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

Elements included:

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

Modules:

- Reference signals:
  - Step.
  - Ramp.
  - Sine.
- PID controller:
  - P controller.
  - I controller.
  - D controller.
- Systems:
  - First Order System.
  - Second Order System.

Dimensions (approx.) = 490 x 330 x 310 mm.

Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

1.- Response of a first order system in time domain. (Step-response).

2.- Response of a first order system in time domain. (Ramp-response).

3.- Response of a first order system in time domain. (Sinusoidal-response).

4.- Response of a first order system in frequency domain (Sinusoidal-response).

5.- Response of a second order system in time domain (Step-response).

6.- Response of a second order system in time domain. (Ramp-response).

7.- Response of a second order system in time domain. (Sinusoidal-response).

8.- Response of a second order system in frequency domain (Sinusoidal-response).

9.- Structure of a PID controller (Proportional-Integrative-Derivative blocks).

10.- PID control of a first order system in open-loop.

11.- PID control of a second order system in open-loop.

12.- PID control of a first order system in closed- loop. (Mathematical tuning).

13.- PID control of a first order system in closed- loop. (Experimental tuning)

14.- PID control of a first order system in closed- loop. (Ziegler-Nichols tuning).

15.- PID control of a second order system in closed- loop. (Mathematical tuning).

16.- PID control of a second order system in closed- loop. (Experimental tuning).

17.- PID control of a second order system in closed- loop. (Ziegler-Nichols tuning).

M47. **Rotational Speed & Position Control**

SPECIFICATIONS SUMMARY

On the module, mounted on its upper part, there is a miniature motor used to move the axle. The motor speed can be changed adjusting the voltage delivered to the actuator motor. The rotation speed can be measured using the different measurement transducers placed on the axle.

Elements included:

- DC Motor.
- DC Tachometer.
- Inductive sensor.
- Slot Optical Sensor.
- Refractive Infrared Sensor.
- Hall Effect Sensor.
- Encoder.

Dimensions (approx.) = 405x300x300 mm.

Weight: 6 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

PRACTICAL POSSIBILITIES

1.- DC Motor

2.- DC Tachometer.

3.- Inductive sensor.

4.- Reflexive Infrared Sensor

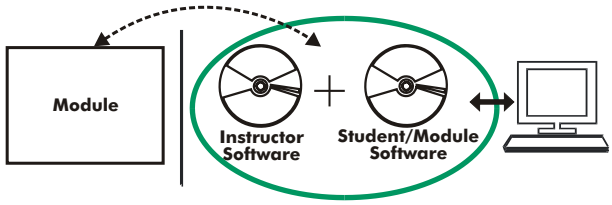
5.- Slot sensor.

6.- Hall-Effect.

7.- Encoder.

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

③ CAI. Computer Aided Instruction Software System



With no physical connection between module and computer, this complete package consists on an Instructor Software (INS/SOF) totally integrated with the Student/Module Software (M../SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students. These, on the other hand, get a virtual instructor who helps them to deal with all the information on the subject of study.

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

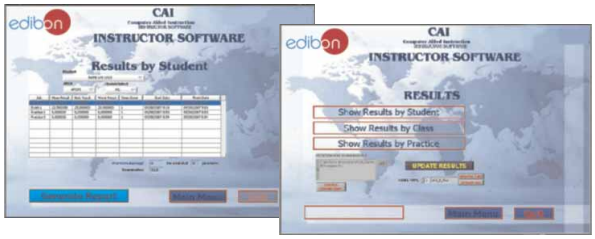
The Instructor can:

- Organize Students by Classes and Groups.
- Create easily new entries or delete them.
- Create data bases with student information.
- Analyze results and make statistical comparisons.
- Print reports.
- Develop own examinations.
- Detect student's progress and difficulties.

...and many other facilities.

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

Instructor Software



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

It explains how to use the module, run the experiments and what to do at any moment. Each module has its own Student Software.

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

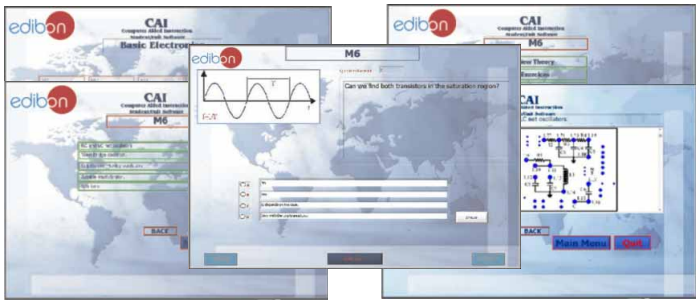
  Theory: that gives the student the theoretical background for a total understanding of the studied subject.

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

  Guided Practices: presents several practices to be done with the module, showing how to complete the circuits and get the right information from them.

  Exams: set of questions presented to test the obtained knowledge.

Student/Module Software



Available Student/Module Softwares:

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

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

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

➤Electronics Applications
- . M43/SOF. Applications of Temperature.
- . M49/SOF. Applications of Temperature and Pressure.
- . M44/SOF. Applications of Light.
- . M45/SOF. Linear Position and Force.
- . M46/SOF. Environmental Measurements.
- . M48/SOF. Sounds Measurements.

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

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

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

CAL is a class assistant that helps in making the necessary calculations to extract the right conclusions from data obtained during the experimental practices.

CAL will perform the calculations.

CAL computes the value of all the variables involved.

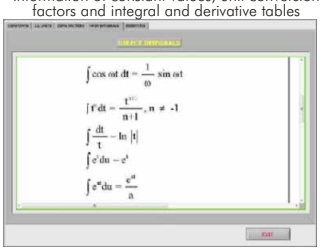
It allows to plot and print the results. Between the plotting options, any variable can be represented against any other.

Different plotting displays.

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

Calculations

Information of constant values, unit conversion factors and integral and derivative tables



Plotting options

Available Softwares:

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

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

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

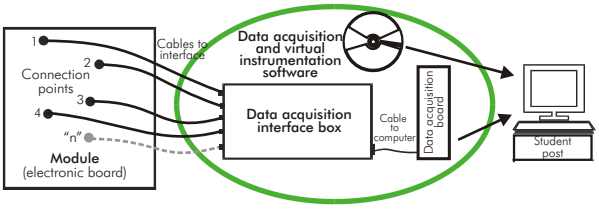
➤Electronics Applications
- . M43/CAL. Applications of Temperature.
- . M49/CAL. Applications of Temperature and Pressure.
- . M44/CAL. Applications of Light.
- . M45/CAL. Linear Position and Force.
- . M46/CAL. Environmental Measurements.
- . M48/CAL. Sounds Measurements.

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

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

LIEBA. **Basic Electronics and Electricity Integrated Laboratory:**

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



EDAS/VIS is the perfect link between the modules and the PC. With the EDAS/VIS system, information from the modules is sent to the computer. There, it can be analyzed and represented.
We easily connect the Data Acquisition Interface Box (DAIB) to the modules with the supplied cables (connection points are placed in the modules). Like any other hardware, the DAIB is connected to the PC through the Data Acquisition Board (DAB), and by using the Data Acquisition and Virtual Instrumentation Software the student can get the results from the undertaken experiment/practice, see them on the screen and work with them.

The EDAS/VIS System includes a Hardware: DAIB Data Acquisition Interface Box + DAB. Data Acquisition Board and a Software: EDAS/VIS-SOF. Data Acquisition and Virtual Instrumentation Software:

1) DAIB. **Data Acquisition Interface Box:**
Metallic box. Dimensions: 310 x 220 x 145 mm. approx.
Front panel:
16 Analog inputs.
Sampling velocity 1,250,000 samples per second for EDAS/VIS 1.25 Version.
Sampling velocity 250,000 samples per second for EDAS/VIS 0.25 Version.
2 Analog outputs. 24 Digital inputs/outputs, configurable as inputs or outputs.
4 Digital signal switches 0-5 V. 2 Analog signal potentiometers ±12 V.
Inside: Internal power supply of 12 and 5 V. Potentiometer.
Back panel: Power supply connector. SCSI connector (for connecting with the data acquisition board).
Connecting cables.

DAIB

+

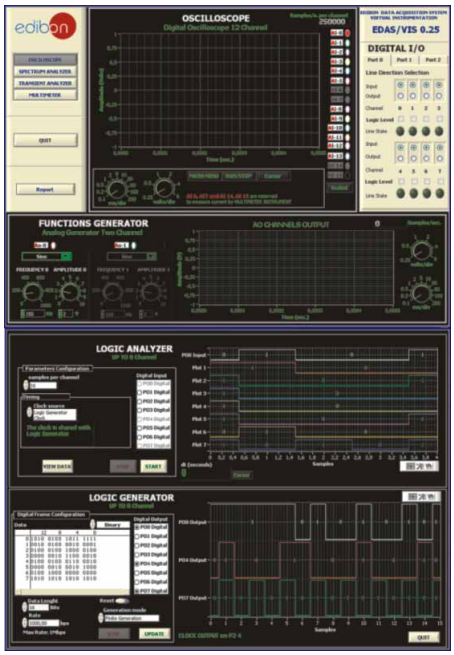
2) DAB. **Data Acquisition Board:**
PCI Data acquisition board (National Instruments) to be placed in a computer slot.
For EDAS/VIS 1.25 Version:
Analog input: Number of channels= 16. Sampling rate up to: 1,250,000 S/s (samples per second).
Analog output: Number of channels= 2. Max. output rate up to: 833 KS/s.
Digital Input/Output: Number of channels= 24 inputs/outputs.

For EDAS/VIS 0.25 Version:
This is a similar version to the 1.25, with the following differences:
Sampling rate up to: 250,000 S/s (samples per second).
Analog output: Max. output rate up to: 10 KS/s.


DAB

+

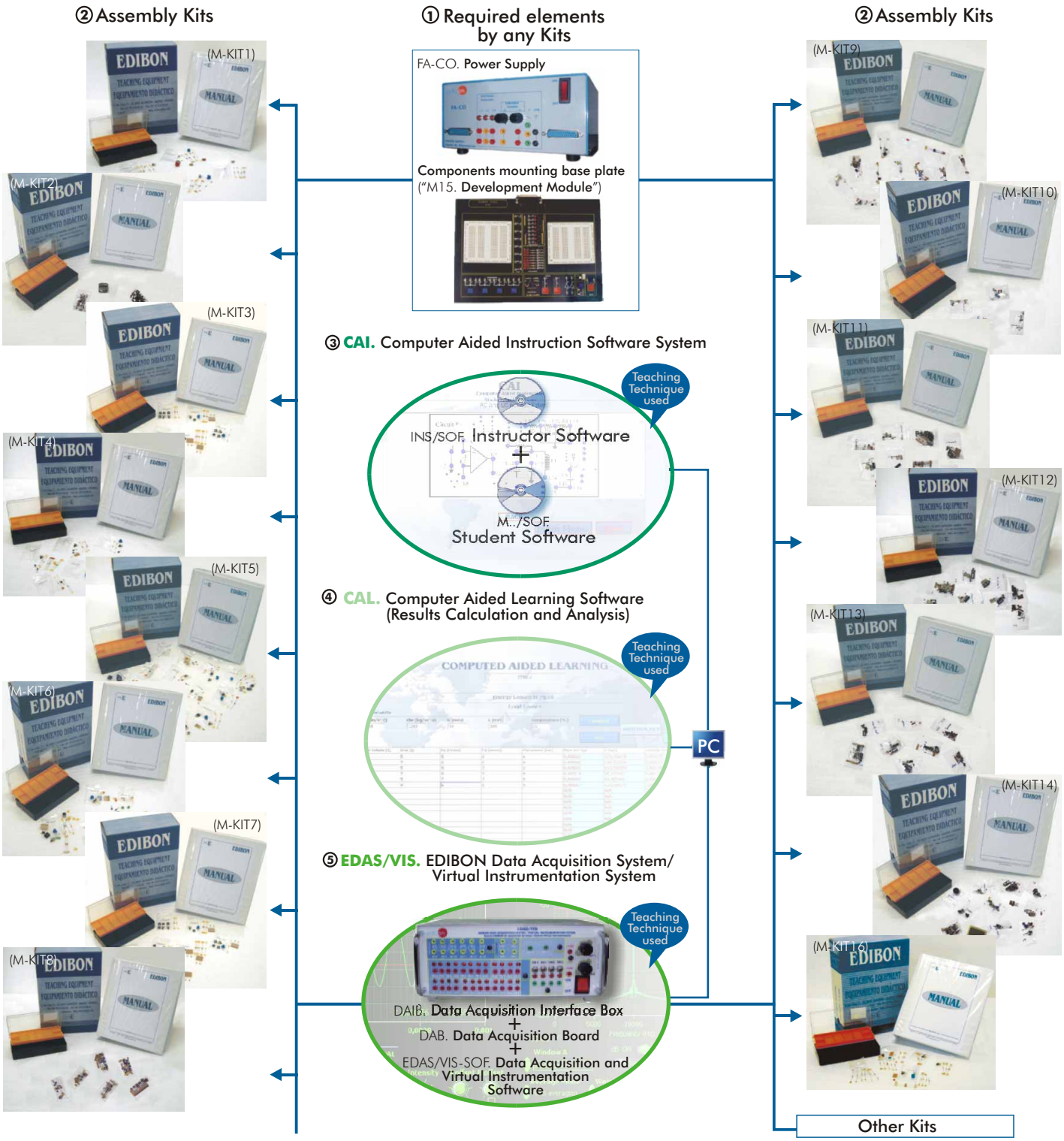
3) EDAS/VIS-SOF. **Data Acquisition and Virtual Instrumentation Software:**
Compatible with actual Windows operating systems. Friendly graphical frame.
Configurable software allowing the temporal/frequency representation of the different inputs and outputs. Visualization of a voltage of the circuits 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.
-**Function Generator:**
Two independent signal generators, for sinusoidal, triangular, saw tooth and square. Channels: 2.
-**Spectrum Analyzer:**
Channels: 12 (simultaneous).
-**Multimeter:**
Voltmeter (Channels: 12 (simultaneous)). Ammeter (Channels: 2 (simultaneous)).
-**Transient Analyzer.**
-**Logic Analyzer:**
Number of Input channels: 8.
Clock Source: 3 different sources.
This instrument allows receiving as far as 8 digital signal simultaneously at 1 or 8 Mbps (depending of the version).
-**Logic Generator:**
Number of transmission channels: 8.
This instrument allows generating up to 8 digital simultaneous signals of 1 or 8 Mbps (depending of the version).
Sampling velocity 1,250,000 samples per second for EDAS/VIS 1.25 Version.
Sampling velocity 250,000 samples per second for EDAS/VIS 0.25 Version.



EDAS/VIS-SOF

More information in: www.edibon.com/products/catalogues/en/units/electronics/basic/LIEBA.pdf

M-KITS. **Basic Electronics and Electricity Assembly Kits:**



The complete system includes parts 1 to 5 and any part can be supplied individually or additionally. (Power supply + Module (M15) + Kit/s, is the minimum supply).

Available Assembly Kits:

➤Basic Electronics concepts
- .M3-KIT. Semiconductors I.
- .M4-KIT. Semiconductors II.
- .M6-KIT. Oscillators.
- .M7-KIT. Operational Amplifiers.
- .M8-KIT. Filters.
- .M9-KIT. Power Electronics.

➤Digital Electronics
- .M10-KIT. Digital Systems & Converters.
- .M11-KIT. Digital Electronics Fundamentals.
- .M12-KIT. Basic Combinational Circuits.
- .M13-KIT. Basic Sequential Circuits.
- .M14-KIT. Optoelectronics.

➤Basic Electricity concepts
- .M5-KIT. Power Supplies.
- .M1-KIT. Direct Current (D.C.) Circuits.
- .M2-KIT. Alternating Current (A.C.) Circuits.
- .M16-KIT. Electric Networks.

More information in: www.edibon.com/products/catalogues/en/units/electronics/electronickits/M-KITS.pdf

M-KITS. **Basic Electronics and Electricity Assembly Kits:**

① Required elements by any Kits

FA-CO. **Power Supply**

SPECIFICATIONS SUMMARY

Fixed outputs: + 5 V, ± 12 V, 1 A. Variable outputs: ± 12 V, 0.5 A. AC output: 12V. or 24 V. Outputs through either 2mm. contact terminals, or through 25 pin CENTRONICS connectors (2 outputs). LED's voltage indicators. Robust construction. Supply: 110/220V A.C. Frequency: 50/60 Hz.

FA-CO includes all the requirements for full working with any kit from M1-KIT to M16-KIT.

Dimensions: 225 x 205 x 100 mm. approx. Weight: 2 Kg. approx.

M15. **Development Module**

SPECIFICATIONS SUMMARY

Components mounting baseplate.

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

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

Dimensions: 300 x 210 x 45 mm. approx. Weight: 300 gr. approx.

② Assembly Kits

KITS, containing each one:

Assembly and practice manuals (8 manuals supplied). Set of components and wires necessary for mounting the corresponding practice. After the first assembly, all the elements are recoverable.

➤Basic Electronics concepts

M3-KIT. **Semiconductors I**

PRACTICAL POSSIBILITIES

Characteristics of the PN junction:
1.- Study of the diode.
2.- Fault Study in Diodes.

The diode as a rectifier element:
3.- Half wave rectifier.
4.- Study of faults in Rectifier circuit.
5.- Bridge rectifier.
6.- Study of faults in bridge rectifier.

The Zener diode:
7.- Voltage regulator with a Zener diode.
8.- Study of faults in Zener circuit.

Study and characteristics of the transistor:
9.- Study of the transistor.
10.- Study of the fault in the transistor.

Transistor characteristics operating as a switch:
11.- Study of the transistor as a switch.

Common emitter amplifier:
12.- Study of the common emitter NPN amplifier.
13.- Fault Study in Amplifier circuit.
14.- Study of the common emitter PNP amplifier.

M4-KIT. **Semiconductors II**

PRACTICAL POSSIBILITIES

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

Darlington configuration:
4.- Darlington configuration.
5.- Fault study of the Darlington configuration.

Differential amplifier:
6.- Differential amplifier.
7.- Fault study in the differential amplifier.

Study and characteristics of the JFET transistor:
8.- JFET characteristics.
9.- Fault study with the JFET transistor.

Analog switch:
10.- Analog switch.

Multistage Amplifier. Direct coupling:
11.- Amplifier coupled directly.
12.- Fault study of an amplifier coupled directly.

M6-KIT. **Oscillators**

PRACTICAL POSSIBILITIES

Oscillators. RC and LC Nets:
1.- RC net oscillator.
2.- LC net oscillator.
3.- Faults study with RC and LC Net oscillators.

Wien bridge oscillator:
4.- Wien Bridge.
5.- Fault study in the Wien bridge oscillator.

Colpitts oscillator. Hartley oscillator:
6.- Colpitts oscillator.
7.- Hartley oscillator.
8.- Faults study with the Colpitts oscillator.

Astable multivibrator:
9.- Astable multivibrator.
10.- Fault study with an Astable multivibrator.

555 TIMER:
11.- 555 timer.
12.- 555 timer fault study.

More information in: www.edibon.com/products/catalogues/en/units/electronics/electronickits/M-KITS.pdf

M-KITS. **Basic Electronics and Electricity Assembly Kits:**

② Assembly Kits

➤**Basic Electronics concepts**

M7-KIT. **Operational Amplifiers**

PRACTICAL POSSIBILITIES

Operational amplifier characteristics:
1.- Operational amplifier study.
2.- Closed-loop output compensation voltage.
3.- Operational amplifier fault study.
The inverting amplifier:
4.- Inverting amplifier study.
5.- Inverting amplifier fault study.
The non-inverting amplifier:
6.- Study of the non-inverting amplifier.
7.- Voltage follower.
8.- Fault study in the non-inverting amplifier.
The adder amplifier:
9.- Adding amplifier study.
10.- Fault study in the adding amplifier.
The differential amplifier:
11.- Differential amplifier study.
12.- Differential amplifier fault study.
Comparators:
13.- Comparator study.
14.- Comparators fault study.

M8-KIT. **Filters**

PRACTICAL POSSIBILITIES

RC and LC filter responses:
1.- Frequency response.
2.- Low-pass filter.
3.- High-pass filter.
4.- LC Circuit.
5.- Study of Error in Low-pass filter.
6.- Study of Error in High-pass filter.
T-shaped Filter:
7.- Filter with double T link.
8.- Generator circuit of the signal S1.
9.- Study of Error in RC filter with double T.
Active filters:
10.- Low-pass filter.
11.- Low-pass filter with load and operational amplifier.
12.- High-pass filter.
13.- High-pass filter with load and operational amplifier.
14.- The attenuation is cumulative.
15.- Use of Operational Amplifier.
16.- Study of Faults in filters.
Association of filters:
17.- Behaviour of the filter.
18.- Filter of distorted signal.
19.- Filter in cascade; low pass filter and high pass filter.
20.- Filter in parallel.
21.- Study of Error in filters.

M9-KIT. **Power Electronics**

PRACTICAL POSSIBILITIES

The bipolar power transistor:
1.- Study of the power transistor.
2.- Study of faults in the power transistor.
The MOSFET transistor:
3.- Study of the MOSFET transistor.
4.- Study of faults in the MOSFET transistor.
The thyristor:
5.- Study of the thyristor.
6.- Study of error of the thyristor.
The UJT transistor and trigger circuits of the thyristor:
7.- Study of the trigger circuits of the thyristor.
8.- Study of insulation circuits.
The TRIAC:
9.- Study of the TRIAC.
10.- Practical assembly of the TRIAC.

➤**Digital Electronics**

M10-KIT. **Digital Systems & Converters**

PRACTICAL POSSIBILITIES

Analog switching. The bistable, astable and monostable family:
1.- Characteristics of an analog switch chip.
2.- Study of errors in the Analog Multiplexer.
3.- Study of errors in the Analog Multiplexer.
4.- Characteristics of an S-R type Latch Integrated circuit.
5.- Error study in the bistable.
6.- Characteristics of an integrated astable circuit.
7.- Error study in the astable.
8.- Characteristics of an integrated Monostable circuit.
Behaviour of Binary/BCD Counters & 7-segments Displays:
9.- Characteristics of Binary UP/DOWN Counter 74LS193 and 7-Segment Display.
10.- Error study in the binary counter.
11.- Characteristics of the BCD UP/DOWN counter and 7-Segment Display.
12.- Error study in the BCD counter.
Comparators and analog integrators:
13.- Characteristics of an analog comparator.
14.- Analog integrator.
15.- Error study in the analog integrator.
16.- Triangular wave generation.
A/D and D/A conversion:
17.- D/A Converter.
18.- A/D Converter.
Applications:
19.- Random number generator.
20.- Measuring the time between two events.

M11-KIT. **Digital Electronics Fundamentals**

PRACTICAL POSSIBILITIES

Numbers systems:
1.- Voltage measurement in a circuit of SOURCES.
2.- Fault study in the circuit.
Logical circuits:
3.- Logical Diode.
4.- Fault study in sources.
5.- Logic with transistor and diodes.
6.- Fault study in transistor/diode circuit.
TTL gates:
7.- Basic function gates.
8.- Study of faults in TTL circuit.
9.- Study of faults in Logic Gates.
CMOS gates:
10.- Basic function gates.
11.- Study of faults in CMOS circuit.
Boolean Algebra and logical functions:
12.- Study of use of the circuit.
Open collector gates:
13.- Study of the use of the circuit.
Others types of integrated gates:
14.- Study of simple operations with a Schmitt Trigger inverter.
15.- Operation study of a three-state buffer.
16.- Study of the fault in the circuit.

M12-KIT. **Basic Combinational Circuits**

PRACTICAL POSSIBILITIES

Encoders:
1.- Study of an encoder.
2.- Fault study in the encoder.
Decoders:
3.- Study of a decoder.
4.- Fault study in the decoder.
Multiplexers:
5.- Study of a multiplexer.
6.- Study of errors in the multiplexers.
Demultiplexers:
7.- Study of a demultiplexer.
8.- Study of errors in demultiplexers.
Digital Comparators:
9.- Study of a comparator.
10.- Study of errors in a comparator.
Arithmetic and logic operations:
11.- Study of an adder.
12.- Study of error of the arithmetic and logic operations.
13.- Study of a parity generator.
14.- Study of error in the Parity generator.

More information in: www.edibon.com/products/catalogues/en/units/electronics/electronickits/M-KITS.pdf

M-KITS. **Basic Electronics and Electricity Assembly Kits:**

②Assembly Kits

➤Digital Electronics

M13-KIT. **Basic Sequential Circuits**

PRACTICAL POSSIBILITIES

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

Shift registers:
5.- Shift registers.
6.- Study of faults of the Shift registers.

Counters:
7.- Practice of the Counters.
8.- Study of faults of the Counters.

Synchronised sequential circuits:
9.- Practice of the Synchronised.
10.- Study of errors of the Synchronised sequential circuits.

Memories:
11.- Exercises

M14-KIT. **Optoelectronics**

PRACTICAL POSSIBILITIES

Light transmitters and liquid crystal display (LCD):
1.- Light transmitters.
2.- Bar graph.
3.- LCD display and 7-segment display.
4.- Fault study in light transmitters and liquid crystal display.

Photo-conducting cells:
5.- Light dependent resistors.
6.- Alarm.
7.- Fault study on the photo-conducting cell.

Fibre optics:
8.- Fibre optics practice.
9.- Fault study using fibre optics.

Infrared:
10.- Circuit with infrared diodes.
11.- Fault study of the infrared diodes.

➤Basic Electricity concepts

M5-KIT. **Power Supplies**

PRACTICAL POSSIBILITIES

Rectification:
1.- Rectification.
2.- Bridge rectifier.

Fixed voltage sources:
3.- Power supply with the Zener diode.
4.- Stabilization through Zener and Transistor.
5.- Fault study in "Stabilization through Zener and Transistor".
6.- Protection against overcurrents.
7.- Protection against overvoltages.
8.- Study of fault "Protection against overcurrents".

Symmetrical voltage power sources:
9.- Symmetrical source; 78XX regulator.
10.- Symmetrical source; 79XX regulator.

Voltage regulators with integrated circuits:
11.- Adjustable regulator; LM317.
12.- Study of fault in adjustable LM317 regulator.
13.- Adjustable L200 regulator.
14.- Fault study in adjustable L200 Regulator.

Introduction to switched power supplies:
15.- Switching technique.
16.- Switching technique. PWM.
17.- Switching technique. Boost.

M1-KIT. **Direct Current (D.C.) Circuits**

PRACTICAL POSSIBILITIES

Measurement managing and checking instruments:
1.- Electronic instrumentation operation. Use of multimeter.
2.- Study of faults in Resistance circuit.

Ohm's Law:
3.- Ohm's Law verification.
4.- Power calculation.

Resistors: characteristics and types:
5.- Resistor measurements. Color code. Ohmmeter.
6.- Study of Faults in Resistors circuit .

Resistors association and the Wheatstone Bridge:
7.- Voltage and current measurement in a circuit with resistors connected in series.
8.- Series/Parallel configuration study.
9.- The Wheatstone Bridge.
10.- Study of Fault in Series Resistors circuit.
11.- Study of Fault in Parallel Resistors circuit.
12.- Study of Faults in Wheatstone Bridge circuit.

Kirchoff's laws:
13.- Kirchoff's first law.
14.- Kirchoff's second law.
15.- Fault study using Kirchoff's law.

M2-KIT. **Alternating Current (A.C.) Circuits**

PRACTICAL POSSIBILITIES

Alternating signal characteristics. Instruments:
1.- Waveforms study in A.C.
2.- Introduction of anomalies in the Wave form circuit.
3.- Study of Faults in the Wave form 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 A.C. resistors in series.
9.- Sinusoidal A.C. resistors in parallel.

Behaviour of A.C. capacitors and inductors:
10.- Capacitance with square waveform and a sinusoidal input current.
11.- Inductance with square waveform and a sinusoidal input voltage.
12.- Reactive reactance, Xc, variations with the frequency.
13.- Study of faults in capacitors.
14.- Reactive capacitance variations with capacitance.
15.- A.C. capacitors in parallel.
16.- A.C. capacitors in series.
17.- A.C. capacitors as voltage dividers.
18.- Inductance in an A.C circuit.
19.- Inductive reactance variations with the inductance.
20.- Inductors in series in an A.C. circuit.

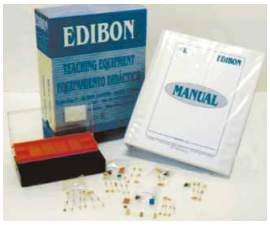
Basic theorems and capacitance and inductance circuits:
21.- A.C. Resistor-Capacitor circuits in series.
22.- A.C. Resistor-Capacitor circuits in parallel.
23.- A.C. Resistor-Inductor circuits in series.
24.- Study of Faults in the Circuit.
25.- A.C. Resistor-Inductor circuits in parallel.

RLC Circuits:
26.- Resistance-Capacitance Filters.
27.- Filters inductive resistance. Low-Pass and High-Pass filters.

Resonance:
28.- A.C. L-C Circuits in parallel with low Impedance source.
29.- Study of Faults in the resonance circuit.
30.- A.C. L-C Circuits in parallel with high impedance source.
31.- Circuit frequency response and bandwidth.
32.- A.C. R-L-C Circuits in series.
33.- Study of Faults in the resonance circuit.

The transformer:
34.- The transformer.
35.- The transformer with load.
36.- Current measurement in the secondary transformer with charge.

M16-KIT. **Electric Networks**



PRACTICAL POSSIBILITIES

Ohm's law:
1.- Calculation of the internal resistance of a continuous source.
2.- Error study in an internal resistance.
3.- Internal resistance calculation of an alternating source.

Electrical power:
4.- Power transferred by a DC source to load.
5.- Power transferred to a load by an AC source.

Power supplies combination:
6.- DC+DC assembly.
7.- Error study in the circuit, DC assembly.
8.- DC+AC assembly.

Thévenin's and Norton's theorems:
9.- Thévenin and Norton equivalent circuits. Conversion. Kirchoff's laws.

Superposition theorem:
10.- Application of the Superposition theorem.
11.- Error study in the Superposition circuit.
Component values modifications.

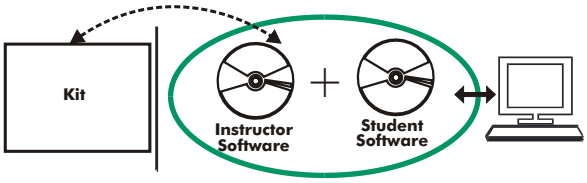
Star-triangle transformation:
12.- Resistance measurement between terminals. Delta | Y configurations.

Wheatstone bridge:
13.- Calibration of a Wheatstone bridge fed by a DC source.
14.- Error study in the Wheatstone bridge circuit.
15.- Wheatstone bridge calibration fed by an AC source.

More information in: www.edibon.com/products/catalogues/en/units/electronics/electronickits/M-KITS.pdf

M-KITS. **Basic Electronics and Electricity Assembly Kits:**

③ CAI. Computer Aided Instruction Software System



With no physical connection between the kit and the computer, this complete package consists on an Instructor Software (INS/SOF) totally integrated with the Student/Kit Software (M../SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students. These, on the other hand, get a virtual instructor who helps them to deal with all the information on the subject of study.

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

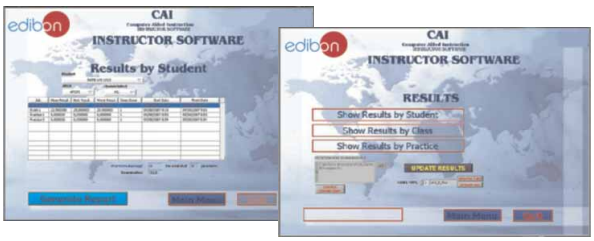
The Instructor can:

- Organize Students by Classes and Groups.
- Create easily new entries or delete them.
- Create data bases with student information.
- Analyze results and make statistical comparisons.
- Print reports.
- Develop own examinations.
- Detect student's progress and difficulties.

...and many other facilities.

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

Instructor Software



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

It explains how to use the module, run the experiments and what to do at any moment. Each kit has its own Student Software.

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

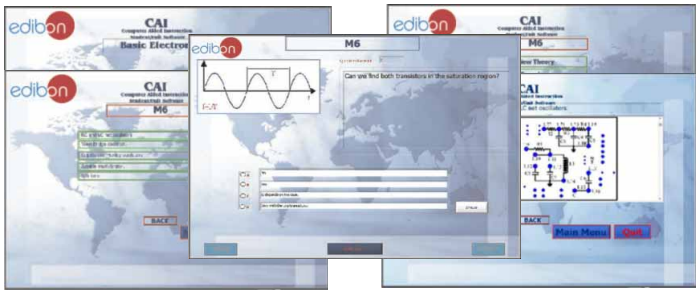
  Theory: that gives the student the theoretical background for a total understanding of the studied subject.

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

  Guided Practices: presents several practices to be done with the kit, showing how to complete the circuits and get the right information from them.

  Exams: set of questions presented to test the obtained knowledge.

Student/Kit Software



Available Student/Kit Softwares:

➤Basic Electronics concepts
- M3/SOF. Semiconductors I.
- M4/SOF. Semiconductors II.
- M6/SOF. Oscillators.
- M7/SOF. Operational Amplifiers.
- M8/SOF. Filters.

- M9/SOF. Power Electronics.

➤Digital Electronics
- M10/SOF. Digital Systems & Converters.
- M11/SOF. Digital Electronics Fundamentals.
- M12/SOF. Basic Combinational Circuits.
- M13/SOF. Basic Sequential Circuits.

- M14/SOF. Optoelectronics.

➤Basic Electricity concepts
- M5/SOF. Power Supplies.
- M1/SOF. Direct Current (D.C.) Circuits.
- M2/SOF. Alternating Current (A.C.) Circuits.
- M16/SOF. Electric Networks.

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

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

CAL is a class assistant that helps in making the necessary calculations to extract the right conclusions from data obtained during the experimental practices.

CAL will perform the calculations.

CAL computes the value of all the variables involved.

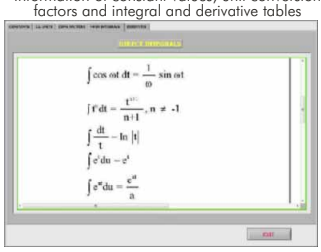
It allows to plot and print the results. Between the plotting options, any variable can be represented against any other.

Different plotting displays.

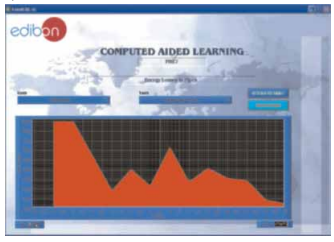
It has a wide range of information, such as constant values, unit conversion factors and integral and derivative tables.

Calculations

Information of constant values, unit conversion factors and integral and derivative tables



Plotting options



Available Softwares:

➤Basic Electronics concepts
- M3/CAL. Semiconductors I.
- M4/CAL. Semiconductors II.
- M6/CAL. Oscillators.
- M7/CAL. Operational Amplifiers.
- M8/CAL. Filters.

- M9/CAL. Power Electronics.

➤Digital Electronics
- M10/CAL. Digital Systems & Converters.
- M11/CAL. Digital Electronics Fundamentals.
- M12/CAL. Basic Combinational Circuits.
- M13/CAL. Basic Sequential Circuits.

- M14/CAL. Optoelectronics.

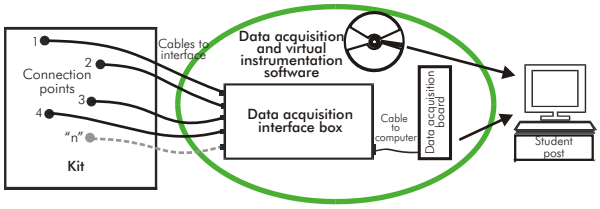
➤Basic Electricity concepts
- M5/CAL. Power Supplies.
- M1/CAL. Direct Current (D.C.) Circuits.
- M2/CAL. Alternating Current (A.C.) Circuits.
- M16/CAL. Electric Networks.

More information in: www.edibon.com/products/catalogues/en/units/electronics/electronickits/M-KITS.pdf

2.2- Electronics Kits

M-KITS. **Basic Electronics and Electricity Assembly Kits:**

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



EDAS/VIS is the perfect link between the modules and the PC. With the EDAS/VIS system, information from the modules is sent to the computer. There, it can be analyzed and represented.
We easily connect the Data Acquisition Interface Box (DAIB) to the modules with the supplied cables (connection points are placed in the modules). Like any other hardware, the DAIB is connected to the PC through the Data Acquisition Board (DAB), and by using the Data Acquisition and Virtual Instrumentation Software the student can get the results from the undertaken experiment/practice, see them on the screen and work with them.

The EDAS/VIS System includes a Hardware: DAIB Data Acquisition Interface Box + DAB. Data Acquisition Board and a Software: EDAS/VIS-SOF. Data Acquisition and Virtual Instrumentation Software:

1) DAIB. **Data Acquisition Interface Box:**
Metallic box. Dimensions: 310 x 220 x 145 mm. approx.
Front panel:
16 Analog inputs.
Sampling velocity 1,250,000 samples per second for EDAS/VIS 1.25 Version.
Sampling velocity 250,000 samples per second for EDAS/VIS 0.25 Version.
2 Analog outputs. 24 Digital inputs/outputs, configurable as inputs or outputs.
4 Digital signal switches 0-5 V. 2 Analog signal potentiometers ±12 V.
Inside: Internal power supply of 12 and 5 V. Potentiometer.
Back panel: Power supply connector. SCSI connector (for connecting with the data acquisition board).
Connecting cables.

DAIB

+

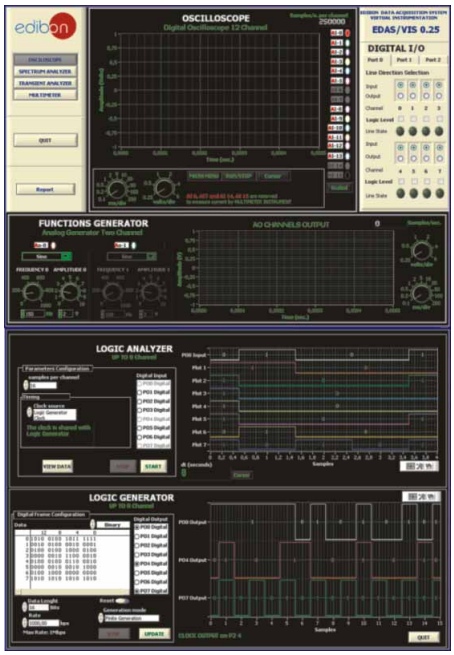
2) DAB. **Data Acquisition Board:**
PCI Data acquisition board (National Instruments) to be placed in a computer slot.
For EDAS/VIS 1.25 Version:
Analog input: Number of channels= 16. Sampling rate up to: 1,250,000 S/s (samples per second).
Analog output: Number of channels= 2. Max. output rate up to: 833 KS/s.
Digital Input/Output: Number of channels= 24 inputs/outputs.

For EDAS/VIS 0.25 Version:
This is a similar version to the 1.25, with the following differences:
Sampling rate up to: 250,000 S/s (samples per second).
Analog output: Max. output rate up to: 10 KS/s.


DAB

+

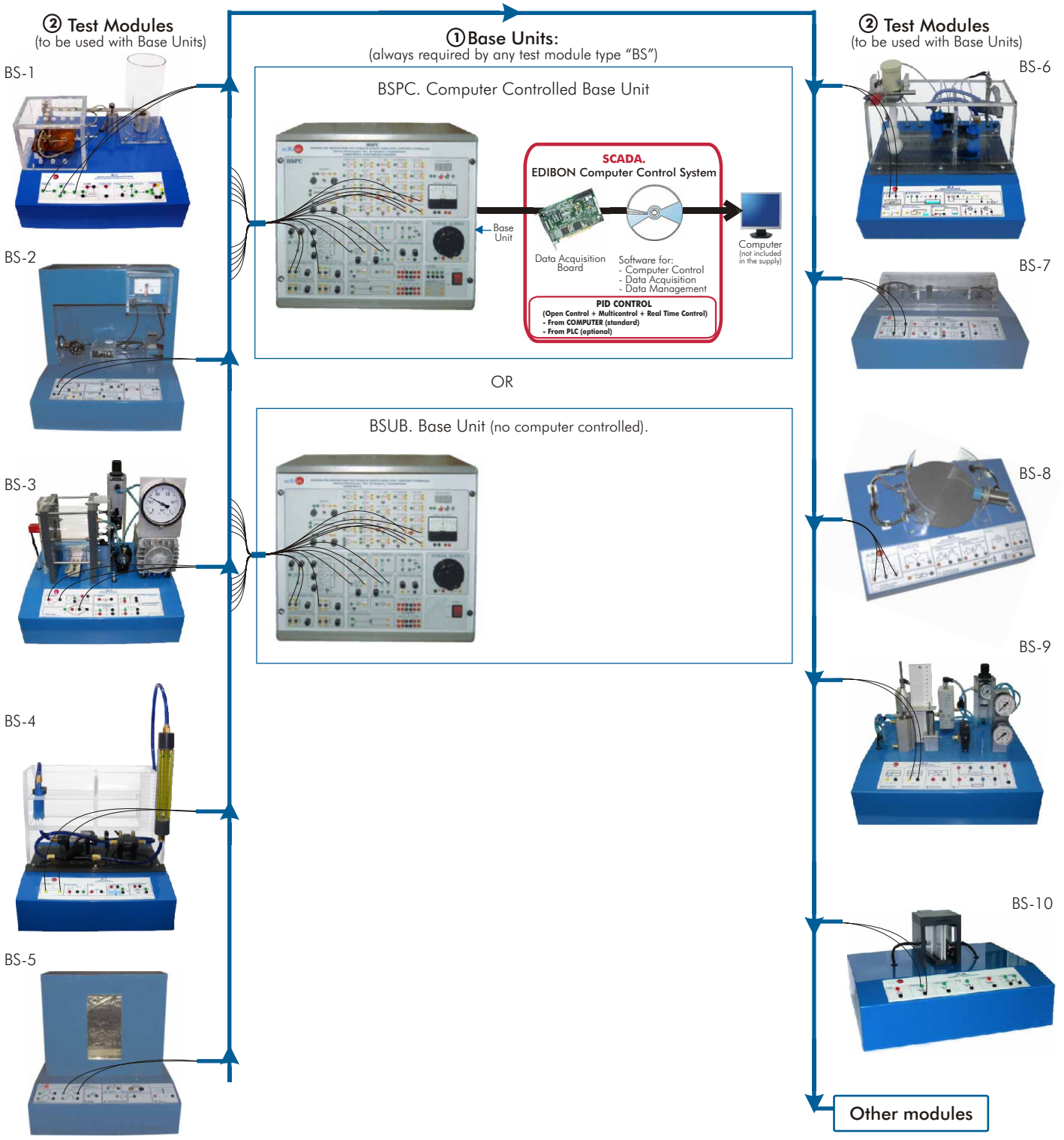
3) EDAS/VIS-SOF. **Data Acquisition and Virtual Instrumentation Software:**
Compatible with actual Windows operating systems. Friendly graphical frame.
Configurable software allowing the temporal/frequency representation of the different inputs and outputs.
Visualization of a voltage of the circuits 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.
-**Function Generator:**
Two independent signal generators, for sinusoidal, triangular, saw tooth and square. Channels: 2.
-**Spectrum Analyzer:**
Channels: 12 (simultaneous).
-**Multimeter:**
Voltmeter (Channels: 12 (simultaneous)). Ammeter (Channels: 2 (simultaneous)).
-**Transient Analyzer.**
-**Logic Analyzer:**
Number of Input channels: 8.
Clock Source: 3 different sources.
This instrument allows receiving as far as 8 digital signal simultaneously at 1 or 8 Mbps (depending of the version).
-**Logic Generator:**
Number of transmission channels: 8.
This instrument allows generating up to 8 digital simultaneous signals of 1 or 8 Mbps (depending of the version).
Sampling velocity 1,250,000 samples per second for EDAS/VIS 1.25 Version.
Sampling velocity 250,000 samples per second for EDAS/VIS 0.25 Version.



EDAS/VIS-SOF

More information in: www.edibon.com/products/catalogues/en/units/electronics/electronickits/M-KITS.pdf

BS. **Modular System for the Study of Sensors:**



"BS" System includes a set of electronic components with a twofold purpose: to control the signal produced by the transducers, and to evaluate and quantify it. Sensors or transducers are common elements in the state of our technology. Therefore this SYSTEM has been developed to show the basic principles of different types of sensors and their way of processing signals.

This system consists of:

① Base Unit, to control the system:

BSPC. Computer Controlled Base Unit, including EDIBON Computer Control System. OR

BSUB. Base Unit (no computer controlled).

② Test Modules:

BS-1. Vibration and/or Deformation Test Module.
BS-2. Temperature Test Module.
BS-3. Pressure Test Module.
BS-4. Flow Test Module.
BS-5. Ovens Test Module.
BS-6. Liquid Level Test Module.
BS-7. Tachometers Test Module.
BS-8. Proximity Test Module.
BS-9. Pneumatic Test Module.
BS-10. Light Test Module.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

BS. **Modular System for the Study of Sensors:**

①Base Units

BSPC. **Computer Controlled Base Unit**

SPECIFICATIONS SUMMARY

Unit to control the system. Common for the different test modules type "BS". Elements of the unit are included in a metallic box. In the back panel of the box, we can find the outlet and the general switch of the unit for its operation. In the front panel there are two masks with all type of signal conditioners, and even an analogical voltmeter.

Amplifiers: Several amplifier circuits of DC are included in the Base Unit, but only three are used specifically for the amplifiers applications: Amplifier 1, Amplifier 2, Amplifier 3. AC amplifier. Power amplifier. Current amplifier. Two buffer amplifiers. Inverter amplifier. Two circuits of differential amplifiers are supplied.

Signal Converters Circuits: Converter from Voltage to Current. Converter from Current to Voltage. Converter from Voltage to Frequency. Converter of Frequency to Voltage (F/V). Full-Wave Rectifier. Phase rectifier. Phase shifter. Semiconductor detector of temperature.

Comparators, Generators, Oscillators and Filters: Comparator. Alarm oscillator. Electronic switch. Oscillator. Filters. Integrator. The differentiator. Circuit "Sample and Hold". Pulse generator. Pulse Receiver. PID Control. Power Control. Low Frequency Oscillator. Current generator.

Others:Supply Sources of Direct Current (1A). Power source (4A). 4 Potentiometers of 1K, 5K, 10K and 20K.

SCADA. EDIBON Computer Control System:

Control Interface integrated in the unit box (BSPC). Data acquisition board to be installed in a computer slot.

Computer Control Software.

Cables and Accessories, for normal operation. It is supplied with 8 manuals.

Dimensions (approx.)= 490 x 450 x 470 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

BSUB. **Base Unit** (no computer controlled)

SPECIFICATIONS SUMMARY

Unit to control the system. Common for the different test modules type "BS". Elements of the unit are included in a stainless steel box. In the back panel of the box, we can find the outlet and the general switch of the unit for its operation. In the front panel there are two masks with all type of signal conditioners, and even an analogical voltmeter.

Amplifiers: Several amplifier circuits of DC are included in the Base Unit, but only three are used specifically for the amplifiers applications: Amplifier 1, Amplifier 2, Amplifier 3. AC amplifier. Power amplifier. Current amplifier. Two buffer amplifiers. Inverter amplifier. Two circuits of differential amplifiers are supplied.

Signal Converters Circuits: Converter from Voltage to Current. Converter from Current to Voltage. Converter from Voltage to Frequency. Converter of Frequency to Voltage (F/V). Full-Wave Rectifier. Phase rectifier. Phase shifter. Semiconductor detector of temperature.

Comparators, Generators, Oscillators and Filters: Comparator. Alarm oscillator. Electronic switch. Oscillator. Filters. Integrator. The differentiator. Circuit "Sample and Hold". Pulse generator. Pulse Receiver. PID Control. Power Control. Low Frequency Oscillator. Current generator.

Others:Supply Sources of Direct Current (1A). Power source (4A). 4 Potentiometers of 1K, 5K, 10K and 20K.

Cables and Accessories, for normal operation. It is supplied with 8 manuals.

Dimensions (approx.)= 490 x 450 x 470 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

②Modules

BS-1. **Vibration and/or Deformation Test Module**

SPECIFICATIONS SUMMARY

This Test Module has been designed to teach mechanical vibration and displacement variable measurement techniques.

Painted steel box. Connection diagrams for each transducer are represented graphically.

Extensiometric gauges:

Characteristics: Resistance at 24°C: 120 Ω. Gauge factor at 24°C: 2.120.

Heating resistance and thermocouple:

Resistance used to produce temperature variations in the vibrant bar and to see how situation affects the extensiometric gauges. Thermocouple type "K". Temperature range: -50°C to 350°C.

LVDT Sensor: Input Voltage range: 10 to 24 VDC.

Sensor connections with the Base Unit (BSPC or BSUB) and with power supplies is through 2 mm. terminals located in the front panel of the Test Module.

Manuals: It is supplied with 8 manuals.

Each module may operate independently of another.

Dimensions (approx.)= 405 x 300 x 350 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

PRACTICAL POSSIBILITIES

1.- To measure the vibration of a vibrant girder using extensiometric gauges.

2.- To use a heating resistance to rise the girder temperature in order to study the effect on the sensors. (Thermocouple and heating resistance).

3.- To detect the displacement of the BS-1 system vibrant girder using a LVDT sensor.

4.- Effect of temperature variation on an extensiometric beam.

5.- Effect of deformation on the resistance of a beam.

6.- Measure of the three deformation dimensions or deformation of spherical or cylindrical systems.

7.- Linear variable differential transformer (LVDT) for measuring displacements.

8.- Analysis of how to compensate the variation of resistance of a gauge due to temperature variations, using shorted circuits with compensating gauges.

9.- Linear variable differential transformers (LVDT) as a weighing system.

10.- Effect on the vibration of a beam with different masses.

BS. **Modular System for the Study of Sensors:**

②Modules

BS-2. **Temperature Test Module**

SPECIFICATIONS SUMMARY

The Temperature Test Module has been designed to teach the use and applications of sensors of temperature as a measure, and its control.
Painted steel box. Connection diagrams for each transducer are represented graphically.
Bimetallic switch sensor:
Opening temperature: 50°C. Closing temp.: 30°C.
Adjustable bimetallic thermostat, with heater resistor:
Temperature range: 0°C to 30°C.
Relay AC:
Voltage and current (nominal): 250V-10A. 3 sockets. Switching voltage: 12 V.
Capillary thermostat: Temperature range: 0°C-90°C. Max. bulb temperature: 150°C. Socket current: 15A, 250V AC.
Thermocouples:
3 Cromel-Alumel thermocouples type K. Temperature range: -50°C to 250°C.
Sensor connections with the Base Unit (BSPC or BSUB) and with power supplies is through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with 8 manuals.
Each module may operate independently of another.
Dimensions (approx.) = 405 x 280 x 335 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

PRACTICAL POSSIBILITIES

1.- How to use the Curie effect as application of a high temperature thermostatic controller.
2.- Adjustable bimetallic thermostat. To use the bimetallic thermostat as a temperature control, calculating its hysteresis.
3.- Adjustable bimetallic thermostat. How we can reduce the hysteresis by adding a resistor to the heating circuit.
4.- To use the thermostat based on a bimetallic sensor to control the temperature.
5.- Capillary thermostatic controller.

BS-3. **Pressure Test Module**

SPECIFICATIONS SUMMARY

The Pressure Test Module has been designed to teach the use and applications of this kind of sensors measurement systems. It shows the different pressure measurement techniques.
Painted steel box. Connection diagrams for each transducer are represented graphically.
Linear positioning sensor (Potentiometer):
Resistor range: 500 Ω to 5 KΩ. Operation force: 200-750 g.
LVDT sensor: Sensibility: 780mV/mm. Power voltage: 10 to 24 Vdc.
Differential pressure sensor:
Measurement range: 0 to 30 psi. Sensibility: 3.33mV/psi. Overpressure: 60 psi.
Extensiometric gauges:
Nominal resistor @ 25°C: 120 Ω. Gauge factor: 2.00 to 2.1 typical.
Manometric pressure sensor:
Measurement range: 0 to 30 psi. Overpressure: 60 psi.
Absolute pressure sensor:
Measurement range: 2 to 30 psi. Overpressure: 60 psi.
Air Compressor:
Air flow: 10 l/min. Pressure: 1.83 Kg/cm^2.
Sensor connections with the Base Unit (BSPC or BSUB) and with power supplies is through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with 8 manuals.
Each module may operate independently of another.
Dimensions (approx.) = 400 x 270 x 320 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

PRACTICAL POSSIBILITIES

1.- Use of linear positioning sensor (potentiometer) to detect the displacement produced by a diaphragm expansion caused by the air pressure.
2.- Use of a LVDT as an element to measure the diaphragm distortion that is consequence of the pressure inside the pressure chamber.
3.- Differential pressure sensor with hole-board system. Use of a differential pressure sensor of the semiconductor type to measure the pressure fall in a hole-board system.
4.- Extensiometric Gauges. To detect objects using an infrared sensor by light beam interruption.
5.- Measure the pressure in the chamber, using two different types of sensors (manometric and absolute pressure sensor).
6.- Extensiometric gauges for measuring deformations: their resistance changes as the diaphragm expands due to the pressure coming from the pressure container.

BS-4. **Flow Test Module**

SPECIFICATIONS SUMMARY

The objective this module is to show techniques to measure changeable fluids.
Painted steel box. Connection diagrams for each transducer are represented graphically.
Flow optical sensor:
Power supply: 4.5 to 24 Vdc. Standard flow range: 0.5 to 5 GPM.
High resolution optical flow sensor: Measurement range: 0.25 to 6.5 l/min.
Underwater pump.
Level sensor by pressure:
It is a differential pressure sensor. Pressure range: 0 to 1psi. Overpressure: 20 psi.
Differential pressure sensor (Hole board system):
Measurement range: 0 to 30 psi. Overpressure: 60 psi.
Changeable flow meter: Range:0 -2 l/min.
V narrowing.
Main and secondary tanks.
Sensor connections with the Base Unit (BSPC or BSUB) and with power supplies is through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with 8 manuals.
Each module may operate independently of another.
Dimensions (approx.) = 405 x 280 x 400 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

PRACTICAL POSSIBILITIES

1.- To measure the water volume produced by an underwater pump in the module using an optical flow sensor.
2.- To use a high-resolution optical flow sensor to measure low volumes.
3.- Level sensor by pressure. To use a differential pressure sensor to measure the liquid level in one of the tanks.
4.- Differential pressure sensor. To measure the pressure-fall in the module hole board system, as a necessary parameter to determine volume.
5.- To measure the flow volume generated by the underwater pump using a flow meter of changeable area.
6.- To obtain the flow-volume value in the secondary tank using the V narrowing weir.

BS. **Modular System for the Study of Sensors:**

②Modules

BS-5. **Ovens Test Module**

SPECIFICATIONS SUMMARY

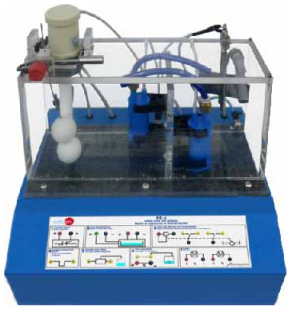
With "BS-5" Test Module it is possible to study temperature measurement techniques using several kinds of sensors placed inside the sealed place that is used as oven.
Painted steel box. Connection diagrams for each transducer are represented graphically.
Oven chamber.
Heating resistance: Maximum dissipation power of 500 W.
Fan: Maximum air flow: 2.5 l/s.
Thermocouples:
4 thermocouples placed inside the oven, each one of them at a different height. Temperature range: -184°C to 400°C.
Platinum resistance thermometer:
Temperature range: -70°C to 600°C.
Thermistor:
NTC thermistor. Resistence at 25°C: 5.8 KΩ. Temperature range: -40°C to 125°C.
Semiconductor temperature sensor: Reverse polarized diode.
Sensor connections with the Base Unit (BSPC or BSUB) and with power supplies is through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with 8 manuals.
Each module may operate independently of another.
Dimensions (approx.) = 405 x 300 x 470 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

PRACTICAL POSSIBILITIES

1.- Heating resistance. Raise the oven internal temperature over the environmental temperature using a heating resistance to make tests and practices related with temperature measurement.
2.- To use a fan as refrigerating element of the oven.
3.- To use thermocouples as temperature sensors elements inside the oven. Temperature measurement using a thermocouple.
4.- To measure temperature inside the oven using a platinum resistance thermometer.
5.- To measure temperature inside the oven using a thermistor temperature sensor.
6.- Temperature measurement using a thermistor, based on its negative temperature coefficient.
7.- To obtain the temperature value inside the oven, using a semiconductor sensor (diode).
8.- PID control.

BS-6. **Liquid Level Test Module**



SPECIFICATIONS SUMMARY

The Liquid Level Test Module "BS-6" has been designed to teach the use and applications of level sensors and their measurement systems. This module teaches techniques to measure and control the liquid level in a tank.
Painted steel box. Connection diagrams for each transducer are represented graphically.
Water tanks.
Capacitative level sensor.
Pressure level sensor: Pressure range: 0-1psi.
Level gauge changeable resistance with path end and beginning switches.
Conduction sensor.
Magnetic float level sensor.
Optical level sensor.
2 Minipumps:
Power supply: 12Vdc (max. voltage). Nominal current: 1 A DC.
Sensor connections with the Base Unit (BSPC or BSUB) and with power supplies is through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with 8 manuals.
Each module may operate independently of another.
Dimensions (approx.) = 400 x 300 x 400 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

PRACTICAL POSSIBILITIES

1.- To use a capacitative sensor to measure the liquid level in the tank.
2.- To use the differential pressure sensor as an element to determine the water level in a tank.
3.- To use a changeable resistance fixed to a float system as a liquid level measurement element.
4.- Conduction Sensor. Use of a sensor made up of to steel electrodes to measure the water level of a tank.
5.- Magnetic float level sensor. Detect a precise tank liquid level with a magnetic switch sensor.
6.- Control the BS-6 system left tank liquid level using an optical level sensor.

BS-7. **Tachometers Test Module**

SPECIFICATIONS SUMMARY

This module has been designed to teach linear and angular speed measurement techniques.
Painted steel box. Connection diagrams for each transducer are represented graphically.
Inductive Sensor: Output voltage: up to 10 Vpp.
DC Motor:
Nominal voltage: 12V. Resistance: 9,7 Oh. Max. vacuum speed: 8500 r.p.m. Max. load speed: approx. 3500 r.p.m. Start voltage: 210 mV.
DC Tachometer.
Refractive Infrared Sensor.
Slot Sensor:
Slotted optical switch where an input LED and an output phototransistor are capsulated.
Hall Effect position sensor.
Encoder.
Sensor connections with the Base Unit (BSPC or BSUB) and with power supplies is through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with 8 manuals.
Each module may operate independently of another.
Dimensions (approx.) = 300 x 200 x 200 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

PRACTICAL POSSIBILITIES

1.- DC Motor. Provide the group of sensors of the BS-7 system fixed to the central axle of the equipment with movement power.
2.- DC Tachometer. To use a DC motor as a tachometer to measure the revolutions of the BS-7 system central axle.
3.- Inductive Sensor.
4.- Refractive Infrared Sensor. To measure the central axle revolutions of the BS-7 system using a light reflection optical sensor.
5.- To obtain the central axle speed value using a slotted optical sensor through light interruption.
6.- To obtain the central axle speed value using a Hall-effect position sensor.
7.- To measure the central axle revolutions of the BS-7 system using the encoder.

BS. **Modular System for the Study of Sensors:**

②Modules

BS-8. **Proximity Test Module**

SPECIFICATIONS SUMMARY

This Module has been designed to teach techniques to detect the proximity of objects, focusing on the distance at which each sensor is able to detect the object and the type of material it can detect.
Painted steel box. Connection diagrams for each transducer are represented graphically.
DC Motor: Nominal power supply: 12 Vdc.
Proximity capacitative sensor: Detection distance: 10 mm.
Hall effect sensor.
Infrared sensor by reflection:
Emission narrow beam GaAs IR Emitter. Detection narrow beam IR Photodetector.
Transmission infrared sensor:
Emission narrow beam GaAs IR Emitter. Detection narrow beam IR Photodetector.
Conduction sensor.
Inductive sensor: Detection distance: 2 mm.
Ultrasound sensor:
Transmitter sensibility: 106 dB. Receiver sensibility: -65 dB. Resonance frequency: 40kHz.
Sensor connections with the Base Unit (BSPC or BSUB) and with power supplies is through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with 8 manuals.
Each module may operate independently of another.
Dimensions (approx.) = 400 x 270 x 200 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

PRACTICAL POSSIBILITIES

1.- How to use a capacitative sensor to detect metal objects as the pass in front of the sensor.
2.- To use a Hall effect sensor as an element to detect the presence of magnetic objects.
3.- Reflection infrared sensor. To use an optical sensor that works through infrared light reflection.
4.- Infrared sensor by transmission. To detect objects using an infrared sensor by light beam interruption.
5.- Conduction sensor. To detect magnetic objects using a REED switch sensor.
6.- To detect the presence of ferrous object using an inductive sensor.
7.- Ultrasound sensor. To detect metallic and non-metallic object using high frequency sounds.

BS-9. **Pneumatic Test Module**

SPECIFICATIONS SUMMARY

The Pneumatics Test Module "BS-9" has been designed to teach techniques of control and handling of a pneumatic piston.
Painted steel box. Connection diagrams for each transducer are represented graphically.
Proportional valve 1 and 2:
Nominal voltage: 24Vdc. Pressure range: 8 bar max., 0 to 6 bar control.
Differential pressure sensor: Measurement range: 0 to 30 psi.
Pneumatic switch: Max. pressure: 6 bars.
LVDT Sensor.
Regulation filter: Manual drainage. Max. input pressure: 8 bars.
Sensor connections with the Base Unit (BSPC or BSUB) and with power supplies is through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with 8 manuals.
Each module may operate independently of another.
Dimensions (approx.) = 300 x 300 x 300 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

PRACTICAL POSSIBILITIES

1.- Proportional valves. To control electronically the vertical displacement of a double effect pneumatic piston using proportional valves.
2.- Differential pressure sensor. To use a pressure sensor for measuring the pressure difference between both pneumatic piston air inlets.
3.- Pneumatic switch. To deflect the air flow in the BS-9 system using a pneumatic switch.
4.- LVDT Linear Displacement Sensor. To measure pneumatic piston displacement using an excitation and DC output LVDT.

BS-10. **Light Test Module**

SPECIFICATIONS SUMMARY

The objective of this module is to show some of the techniques used to measure light or illumination intensity.
Painted steel box. Connection diagrams for each transducer are represented graphically.
Photodiode.
Phototransistor.
Light Dependent Resistor.
Photovoltaic Cell.
Infrared emitter-receiver.
Sensor connections with the Base Unit (BSPC or BSUB) and with power supplies is through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with 8 manuals.
Each module may operate independently of another.
Dimensions (approx.) = 405 x 300 x 350 mm. Weight: 10 Kg.

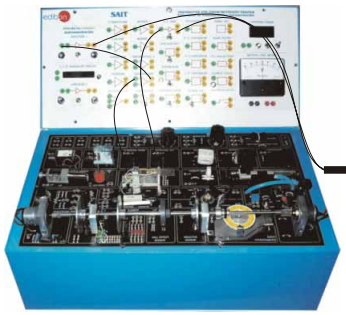
More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/BS.pdf

PRACTICAL POSSIBILITIES

1.- Study of the equivalent electrical circuit of a photodiode. Study the V-I characteristic of a photodiode.
2.- Study of the normal operation mode of a photodiode. Study the "ON/OFF" operation (light switch) of a phototransistor.
3.- Measurement of light intensity using a solar cell.
4.- Study of the properties of light dependent resistors (LDR).
5.- Study of the operation of IR sensors.
6.- Study of a real application for controlling the light intensity using PID control elements.

2.3- Transducers and Sensors

SAIT. **Transducers and Instrumentation Trainer**



SAIT. Trainer

SPECIFICATIONS SUMMARY

The SAIT trainer shows didactically the function principles of the transducers most used in industry. It is divided into two parts: the lower part, in which all the input and output transducers are found, while in the upper part, the system of signal conditioning and those of instrumentation are found; the electrical and pneumatic power supplies are housed in its interior.

Input Transducers:

Resistance Transducers for applications in angular or linear position:

Linearly sliding potentiometer. Rotary carbon-track potentiometer. Rotary coil potentiometer. Precision servo- potentiometer. The Wheatstone Bridge circuit.

Applications of temperature:

NTC (Negative Temperature Coefficient) Thermistors. RTD Sensor (Platinum Transducer with Temperature dependent Resistance). Temperature sensor IC "Integrated Circuit LM 335". Type "K" Thermocouples.

Applications of light:

Photovoltaic Cell. Phototransistor. Photodiode PIN. Photoconductive Cell.

Linear position and force:

Linear Variable Differential Transformer LVDT. Extensiometric Transducer.

Environmental measurements:

Air flow Sensor. Air pressure Sensor. Humidity sensor.

Rotational speed and position control:

Slotted optoelectronic Sensor. Opto-reflective Sensor. Inductive sensor. Hall effect Sensor. Permanent D.C. magnet tachogenerator.

Sound measurements:

Dynamical microphone. Ultrasonic receiver.

Visualization Devices:

Timing device/ counter with LED display. Graphic bar visualizer. Mobile coil voltmeter.

Output Transducers:

Electrical Resistance. Incandescent Lamp.

Applications for the sound output:

Buzzing (Buzzer). Mobile coil loud speaker. Ultrasonic transmitter.

Applications of linear or angular motion:

D.C. Soleinod. D.C. Relay. Solenoid Valve. Permanent Magnet D.C. Motor.

Signal Conditioners:

D.C. Amplifiers. A.C. Amplifier. Power Amplifier. Current Amplifier. Buffers. Inverting Amplifier. Differential amplifier. V/F and F/V Converters. V/I and I/V Converters. Full Wave Rectifier. Hysteresis convertible Comparator. Electronic switch. Oscillator 40 kHz. Filter 40 kHz. Time-constant convertible Low Pass Filter.

Circuit with Mathematical Operation: Adding amplifier. Integrator with different time constants. Differentiator with different time constants. Instrumentation Amplifier. Circuit SAMPLE & HOLD. Amplifiers with gain control and offset.

Furthermore it contains a linearly mounted system of a D.C. motor, tachodynamo, reflective, slotted opto-sensors to detect the absolute and incremental position.

Cables.

Manuals: 8 manuals supplied.

Dimensions (approx.): 400 x 400 x 300 mm.

Weight: 10 Kg.

More information in:
www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/SAIT.pdf

PRACTICAL POSSIBILITIES

1.- Basic Control Systems description.

Characteristics of the Control System:

2.- Characteristics of an ON/OFF temperature control System.
3.- Characteristics of an ON/ OFF Lighting System.
4.- Investigation of the Characteristics of a Positional Control System.
5. - Proportional Control.
6.- Proportional+Integral Control.
7. - Proportional+Derivate Control.
8. - Proportional+Integral+Derivate Control.
9. - Characteristics of a Speed Control System.
10.- Operation in Open Loop.
11.- Operation in Closed Loop, Proportional Control.
12.- Proportional+Integral Control.
13.- Proportional+Integral+Derivate Control.

Display devices:

14.- Application of the Timer/Counter as a meter of time.
15.- Application of the Timer/Counter as a simple counter.
16.- Application of the Timer/Counter as rev-counter or frequency-meter.
17.- Characteristics of an L.E.D. bargraph display unit.
18.- Characteristic of a Mobile Coil Meter.
19.- Comparison of Digital, Bargraph and Mobile Coil meters.
20.- To widen the voltage index of the B. M. meter.

Variable Resistance transducers in angle or linear arrangement:

21.- Variation of the Output Voltage for a Potentiometer used as a Position transducer.
22.- The Buffer as compensator for the effect of the load on the output voltage of a potentiometer.
23.- Servo potentiometer. Variation of the output voltage with respect to its position.
24.- Measuring the Resistance using a Wheatstone Bridge Circuit.
25.- Measuring the Voltage using "Null Balance" Procedures (Method1).
26.- Measuring Voltages using "Null Balance" Procedures (Method 2).Measuring voltages smaller than the normal available voltage.
27.- Measuring Voltages using "Null Balance" Procedures (Method 2).Measuring voltages greater than the normal voltage.

Transducers for Applications of Temperature Measurement:

28.- Characteristics of an Integrated Temperature Circuit.
29.- Construction of a Digital Thermometer using the facilities of the TRANSDUCER TRAINER.
30.- Characteristics of a Platinum Temperature Dependent Resistance (T.D.R.) Transducer.
31.- The N.T.C. (Negative Temperature coefficient)Thermistor.
32.- Characteristics of an N.T.C. Thermistor (Resistance measuring method).
33.- Characteristics of the N.T.C. Thermistor used in an alarm circuit (double thermistor).
34.- Characteristics of a Type "K" Thermocouple.

Transducers for Light Measuring Applications:

35.- Characteristics of a photovoltaic cell.
36.- Characteristics of a photo-transistor.
37.- Luminous intensity detector.
38.-The P.I.N. Photodiode.
39.- Characteristics of a P.I.N. Photodiode.

Linear Position transducers.

40.- Characteristics of a Linear Variable Differential Transformer (LVDT).
41.- Characteristics of a Variable Resistance.
42.- Characteristics of a Strain gauge Transducer.

Transducers for Environmental Measurement Applications:

43.- Characteristics of a air flow transducer.
44.- Characteristics of a pressure sensor.
45.- Characteristics of a humidity sensor.

Rotational Velocity Transducers or Position Measuring Applications:

46.- Characteristics of a slotted opto-transducers and its applications for counting and speed measurement.
47.- Characteristics of the reflective optotransducers and Gray code disk.
48.- Characteristics of an inductive transducer.
49.- Characteristics of a Hall effect transducer.
50.- Characteristics of a D.C. Permanent magnet Tachogenerator.

Transducers for Measuring Sound:

51.- Characteristics of a Dynamic Microphone.
52.- Characteristics of an ultrasonic receiver.

Transducers for Sound Output:

53.- Characteristics of the mobile coil loudspeaker.
54.- Characteristics of a Buzzer.

Output Transducer for Linear or Angular Movement:

55.- Characteristics of a D.C. Solenoid.
56.- Characteristics of a D.C. Relay.
57.- Characteristics of a Solenoid air valve.
58.- Characteristics of a Permanent Magnet Motor.

Signal Conditioning Circuits:

59.- Characteristics of the Direct Current amplifiers 1, 2 and x100.
60.- Characteristics of a current amplifier and application of a buffer amplifier.
61.- Characteristics of Power and Buffer Amplifiers.
62.- Characteristics of an Inverter Amplifier.
63.- Characteristics of a Differential Amplifier.

Signal Converter Circuits:

64.- Characteristics of a Voltage to Current Converter.
65.- Characteristics of a Current to Voltage Converter.
66.- Characteristics of a Voltage to Frequency Converter.
67.- Characteristics of a Frequency to Voltage Converter.
68.- Characteristics of a Full Wave Rectifier.

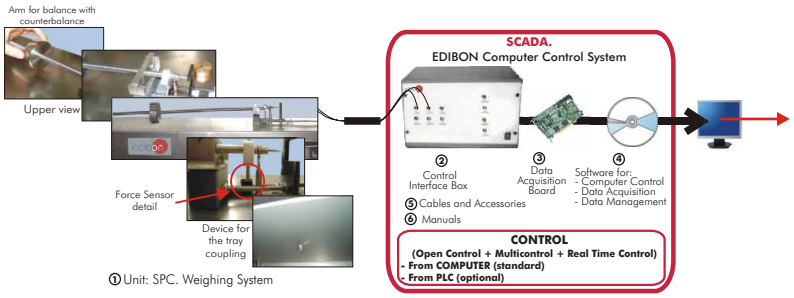
Comparators, Oscillator and Filters:

69.- Characteristics of a Comparator.
70.- Characteristics of an Alarm Oscillator circuit.
71.- Characteristics of an Electronic Switch.
72.- Characteristics of the Oscillator of 40 kHz.
73.- Characteristics of Filters.

Circuits that carry out Mathematical Operations:

74.- Characteristics of a Adding Amplifier.
75.- Characteristics of an Integrator.
76.- Characteristics of a Differentiator Circuit.
77.- Characteristics of a Sample and Hold Circuit.

SPC. Computer Controlled **Weighing System**



① Unit: SPC. Weighing System

SPECIFICATIONS SUMMARY

Items supplied as standard

① SPC Unit:

Anodized aluminium structure.

Stainless steel arm for balance. Counterbalance of 0.5 and 1 Kg. Anodized aluminium tray. High precision force sensor of 0-10N.

② SPC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ SPC/CCSOF. Computer Control + Data Acquisition + Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 700 x 400 x 400 mm. Weight: 20 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/SPC.pdf

PRACTICAL POSSIBILITIES

1.- Sensor Calibration.
2.- Hysteresis study.
3.- Weight high precission measurement.

SCSP. **Pressure Sensors Calibration System**

SPECIFICATIONS SUMMARY

Bench-top unit.

Anodized aluminium structure and panel in painted steel.

Diagram in the front panel.

Vacuum-meter of range (-9800 [mmH_2O] to 0).

Vacuum-meter of range (-1000 [mmH_2O] to 0).

Manometer of range (0 to 1000 [mmH_2O]).

Manometer of range (0 to 2,5 [bars]).

Mobile Piston (syringe).

8 valves.

Non-return valve.

Polyurethane tubes.

This system is supplied with atm, bares, psi, mmHg, mmH_2O, conversion tables.

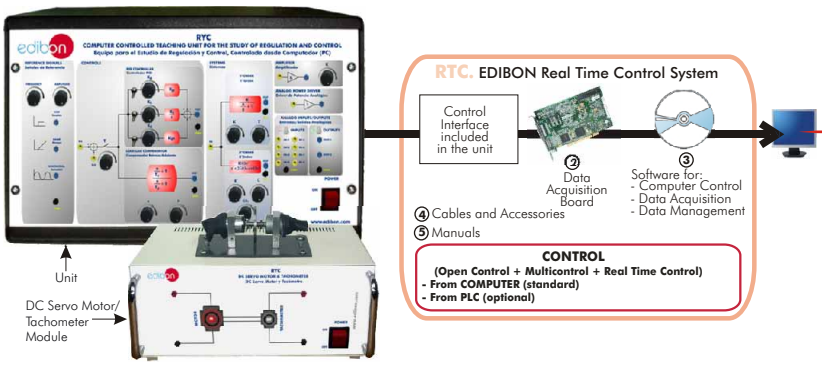
This system allows the calibration of 6 sensors (same type) simultaneously.

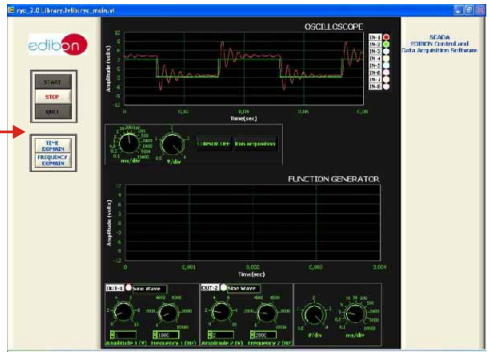
Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = 720 x 300 x 570 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/transducerssensors/SCSP.pdf

RYC. Computer Controlled **Teaching Unit for the Study of Regulation and Control**





① Unit: RYC. Teaching Unit for the Study of Regulation and Control

SPECIFICATIONS SUMMARY

Items supplied as standard

① RYC. Unit:

The RYC is a Regulation and Control training unit designed by EDIBON. It allows students to learn the most important concepts about Regulation and Control in an easy and quick way.

The unit is provided with a set of practices, through which the user will understand how to characterize first and second order systems and how a PID controller works.

Unit:

Metallic box.

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

This unit includes the following modules:

Reference signals module: It allows to generate three different types: step, ramp and sinusoidal. The frequency and amplitude of the signals can be adjusted using the potentiometers.

PID controller module: It is subdivided into proportional, integrative and derivative blocks. Each block has its own potentiometer to adjust each parameter independently.

Lead / Lag Compensator: It represents a compensator system in the Laplace domain. The system has a potentiometer z to modify the zero, p to modify the pole and K to modify the gain of the compensator.

First Order System: It represents a first order system in the Laplace domain. The system has a potentiometer T to modify the time constant of the system. The gain can be also adjusted using the K potentiometer.

Second Order System: It represents a second order system in Laplace domain. The system has three potentiometers to modify the three parameters of the system: gain K, damping coefficient and the natural frequency.

Amplifier module: It can be used for signal amplification. There is a potentiometer, K, to adjust the gain of the amplifier.

Analog Power Driver: It consists of a power amplifier that can be used as the last stage when a application requires high power supply (for example a DC Motor, pump, etc).

Analog I/O: It is provided with 8 analog inputs and 2 analog outputs. The inputs are used to visualize different signals in the computer. The analog outputs are for signal generation.

Control Interface included.

DC Servo Motor/Tachometer Module:

Metallic box.

DC Servo Motor (speed: 3600 rpm max.).

Tachometer (speed: 3600 rpm max.).

② DAB. Data Acquisition Board:

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

16 Analog inputs. Sampling rate up to: 250 KS/s.

2 Analog outputs. 24 Digital Inputs/Outputs.

③ RYC/CCSOF. Computer Control+Data Acquisition+Data Management Software:

Registration and visualization of all process variables in an automatic and simultaneously way.

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

Management, processing, comparison and storage of data.

Sampling velocity up to 250 KS/s (kilo samples per second).

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

④ Cables and Accessories, for normal operation.

⑤ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 490 x 330 x 310 mm. Weight: 10 Kg.

DC Servo Motor/Tachometer Module: 310 x 220 x 145 mm. Weight: 10 Kg.

PRACTICAL POSSIBILITIES

1.- Response of a first order system in time domain. (Step-response).

2.- Response of a first order system in time domain. (Ramp-response).

3.- Response of a first order system in time domain. (Sinusoidal-response).

4.- Response of a first order system in frequency domain. (Sinusoidal-response).

5.- Response of a second order system in time domain. (Step-response).

6.- Response of a second order system in time domain. (Ramp-response).

7.- Response of a second order system in time domain. (Sinusoidal-response).

8.- Response of a second order system in frequency domain. (Sinusoidal-response).

9.- Phase Lead Compensator experiment.

10.- Phase Lag Compensator experiment.

11.- Structure of a PID controller (Proportional-Integrative-Derivative blocks).

12.- PID control of a first order system in open-loop.

13.- PID control of a second order system in open-loop.

14.- PID control of a first order system in closed- loop. (Mathematical tuning)

15.- PID control of a first order system in closed- loop. (Experimental tuning)

16.- PID control of a first order system in closed- loop. (Ziegler -Nichols tuning).

17.- PID control of a second order system in closed- loop. (Mathematical tuning).

18.- PID control of a second order system in closed- loop. (Experimental tuning).

19.- PID control of a second order system in closed- loop. (Ziegler -Nichols tuning).

20.- Characterization of a DC motor.

21.- DC motor speed control with a PID controller.

More information in: www.edibon.com/products/catalogues/en/units/electronics/control/RYC.pdf

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

SPECIFICATIONS SUMMARY

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

Metallic enclosure, including all the modules and elements.

Power Supply.

Protection fuse.

Block diagrams in the front panel.

The unit includes the following modules:

Reference signals:

Step, Ramp and Sine.

PID controller:

P controller, I controller and D controller.

Systems:

First Order System.

Second Order System.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 490 x 330 x 310 mm.

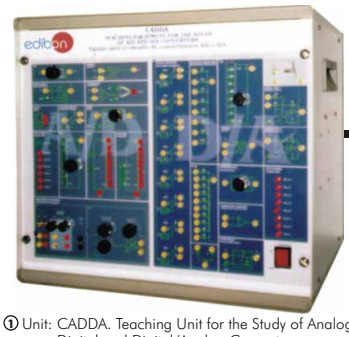
Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/control/RYC-B.pdf

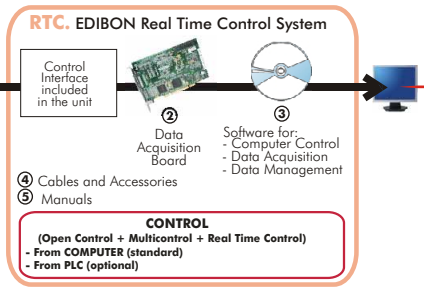
PRACTICAL POSSIBILITIES

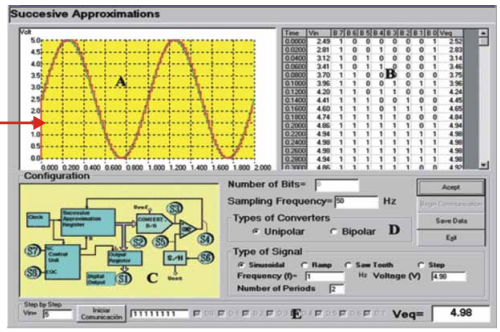
1.- Response of a first order system in time domain. (Step-response).
2.- Response of a first order system in time domain. (Ramp-response).
3.- Response of a first order system in time domain. (Sinusoidal-response).
4.- Response of a first order system in frequency domain (Sinusoidal-response).
5.- Response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

CADDA. Computer Controlled **Teaching Unit for the Study of Analog/Digital and Digital/Analog Converters**



① Unit: CADDA. Teaching Unit for the Study of Analog/ Digital and Digital/Analog Converters.





SPECIFICATIONS SUMMARY

Items supplied as standard

① CADDA. Unit:

Metallic box. Diagram in the front panel with similar distribution to the elements in the real unit.

In this unit, the elements are separated in two parts: lefthand part for analog to digital conversions, and right hand part for digital to analog conversions.

Analog/Digital converter board. Digital/Analog converter board.

Signal generator board, with 100 to 330 µF capacitors, 10 to 50K potentiometers and 1 to 100K resistors. Female and male connectors, interconnections. Power supply.

LPF-Low Pass Filter: 2nd order low pass filter, needed to convert analog signals to digital. Sample/Hold module. Comparator module. Clock module. Analog switch. Ramp module. A/D control module. D/A module, this module includes an integrated digital to analog converter. A/D module, this module includes an integrated analog to digital converter. Counter module. Waveform generator. 8 analog switches, all are managed by a PC.

Weighted resistors: 8 resistances are connected to a common point. D/A module: same module than described before "D/A". Analog input and output for PC. Serial lock 1 module. Adding module: same module as previously described "Adding". Serial lock 2 module: same module than serial lock 1, but based only on an inverter. R/2R: stair of resistance R/2R. Potentiometer. D/A control module. Operational amplifier. Two capacities of 100nF with common connection. Sample/Hold module: same module as previously described "Sample/Hold". Control Interface.

② DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

③ CADDA/CCSOF. Computer Control + Data Acquisition + Data Management Software:

Registration and visualization of all process variables in an automatic and simultaneously way. Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

④ Cables and Accessories, for normal operation.

⑤ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 490 x 450 x 470 mm. Weight: 40 Kg.

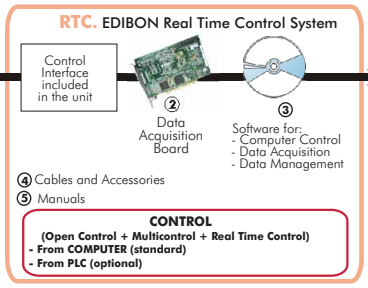
More information in: www.edibon.com/products/catalogues/en/units/electronics/control/CADDA.pdf

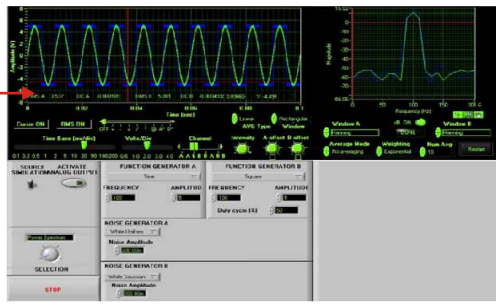
PRACTICAL POSSIBILITIES

1.- Sampling theorem.
2.- Analog/Digital integrated converter. Monopolar assembly.
3.- Analog/Digital integrated converter. Bipolar assembly.
4.- Monopolar binary ramp converter.
5.- Quantification effects.
6.- Bipolar binary ramp converter.
7.- Binary ramp converter with continuous monopolar counting.
8.- Binary ramp converter with bipolar continuous counting.
9.- Monopolar simple ramp.
10.- Bipolar simple ramp converter.
11.- Monopolar double ramp converter.
12.- Double bipolar ramp converter.
13.- Monopolar converter of successive approximations.
14.- Bipolar converter of successive approximations.
15.- Integrated Digital/Analog converter. Monopolar assembly.
16.- Digital/Analog integrated converter. Bipolar assembly.
17.- Digitalization and reconstruction of monopolar signals.
18.- Digitalization and reconstruction of bipolar signals.
19.- Digital/Analog monopolar converter of weighted resistance.
20.- Digital/Analog bipolar converter of weighted resistance.
21.- Analog switches errors.
22.- R/2R monopolar stair converter.
23.- R/2R bipolar stair converter.
24.- Current division in R/2R stairs.
25.- Digital/Analog converter of monopolar inverted stair.
26.- Digital/Analog bipolar converter of inverted stair.
27.- Digital/Analog monopolar converter of series blocking.
28.- Digital/Analog bipolar converter of series blocking.
29.- Digital/Analog converter of load balance.
30.- Bipolar Digital/Analog converter of load balance.
31.- Monopolar Digital/Analog converter of pulse width modulation.
32.- Digital/Analog bipolar converter of pulse width modulation.

TDS. Computer Controlled **Teaching Unit for the Study of Digital Signal Processing**

① Unit: TDS. Teaching Unit for the Study of Digital Signal Processing





SPECIFICATIONS SUMMARY

Items supplied as standard

① TDS Unit:

Metallic box.

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

Front Panel:

2 Function generators modules, that can generate 3 different signals: sinusoidal, square and triangular.

Each one includes: wave forms selector, frequency selector, amplitude selector.

Duty cycle selector.

Signal output.

Noise generator module, that can generate two noise type.

Including: 2 noise outputs, attenuator selector per each noise type.

Microphone pre-amplifier module, including: input (microphone), outputs (2 connectors).

Power amplifier module, including: inputs (2 connectors), output (1 connector), volume selector.

Speaker module.

PC input/output module, including: 2 inputs. 2 outputs.

Power On/Off switch.

Lateral panel:

SCSI connector for connecting with the data acquisition board (DAB) to be placed in the computer.

Back panel:

Power supply connector.

Safety fuse.

Inside:

Power supply. 2 Signal generation boards (PBC).

White and pink noise generation board (PBC).

Power amplifier board (PBC).

Pre-amplifier board (PBC).

Control interface.

Possibility of working simultaneously with two external signals, thanks to its inputs, facilitating operations that required more than one signal.

Moreover it is possible to generate signals directly by the software and send them to the unit outputs and then visualizing by an external oscilloscope or listening by the speaker.

② DAB. Data Acquisition Board:

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

16 Analog inputs. Sampling rate up to: 250 KS/s.

2 Analog outputs. 24 Digital Inputs/Outputs.

③ TDS/CCSOF. Computer Control + Data Acquisition + Data Management Software:

Registration and visualization of signals in an automatic and simultaneously way.

2 signals can be visualized simultaneously.

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

Management, processing and comparison of data.

Sampling velocity up to 250 KS/s (kilo samples per second).

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

④ Cables and Accessories, for normal operation.

⑤ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 490 x 330 x 310 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/digital/TDS.pdf

PRACTICAL POSSIBILITIES

1.- Continuous wave form generation, with the possibility of varying the frequency and amplitude of signals, besides of duty cycle.

2.- Characterization of signals. To analyze the nature of the signals: sinusoidal, square, triangular and sawtooth.

3.- Possibility of working simultaneously with two external signals.

4.- Possibility of generating signals directly by the software and send them to the unit outputs and then visualizing or listening by the speaker or an external oscilloscope.

5.- Signal digitalization, permitting the most suitable sampling time, avoiding "aliasing".

6.- Digitalization of signals with the possibility of adjusting the sampling frequency.

7.- Fast Fourier Transforms (Power Spectrum).

8.- Addition, subtraction, multiplication, convolution and auto-convolution of signals.

9.- Study of "aliasing".

10.- Application of the frequency convolution theorem.

11.- Study of different noise types: White Uniform noise. White Gaussian noise. 1/f noise. Poisson noise. Random noise. Gamma noise.

12.- Representation of the Bode diagram and Nyquist diagram of any transfer function, and phase information.

13.- Study and use of filters:

-Possibility of filtration of any signal.

-Reconstructions of signals through the application of filters.

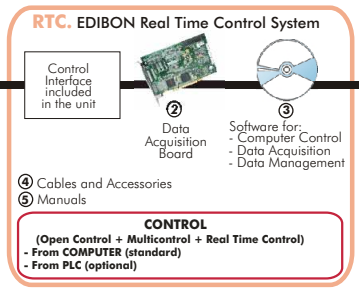
-Finite Impulse Response (FIR) Filters.

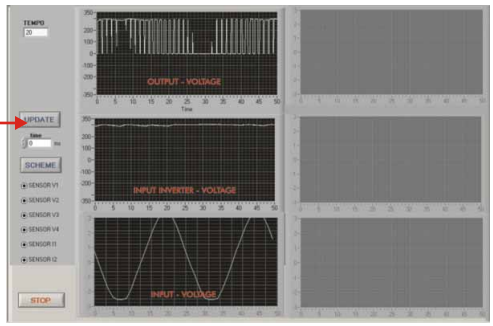
-Infinite Impulse Response (IIR) Filters.

-Possibility to use Bartlett, Hanning, Hamming, Kaiser, Parzen, etc. windows for applying on the signal.

TECNEL. **Computer Controlled Teaching Unit for the Study of Power Electronics** (with IGBTS)
(Converters: DC/AC+AC/DC+DC/DC+AC/AC)

① Unit: TECNEL. Teaching Unit for the Study of Power Electronics (with IGBTS), including Control Interface. (Converters: DC/AC+ AC/DC+DC/DC+AC/AC).





SPECIFICATIONS SUMMARY
Items supplied as standard

①TECNEL. Unit:
Unit with Computer Control and Data Acquisition System designed to study the basis of Power Electronics. It allows students to study AC/DC, DC/AC, DC/DC, AC/AC converters.
Metallic box. Diagram in the front panel with similar distribution to the elements in the real unit.
Front panel: Diodes module: 6 diodes. Thyristors module: 6 thyristors. IGBTS Module: 6 IGBTS. Snubber net. Sensors module: 4 voltage sensors, 2 current sensors. Power supply connections for Vr, Vs, Vt, Neutral and Ground. Practices schemes.
Back panel: Data Acquisition Board Connector (SCSI connector). Tachodynamo connector. Main fuses (Vr, Vs, Vt) and LEDs. Circuit breaker (main switch).
Single-phase driver. Three-phase driver. IGBT driver. TSI board. PIC board. SKHI61 board. Four relays board. 2 Three-phase relays. Commuted power supply. Three-phase magnetothermal.
Control interface.

② DAB. Data Acquisition Board:
PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

③ TECNEL/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Registration and visualization of all process variables in an automatic and simultaneously way. Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

④ Cables and Accessories, for normal operation.

⑤ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =Unit: 490 x 330 x 310 mm. Weight: 40 Kg.

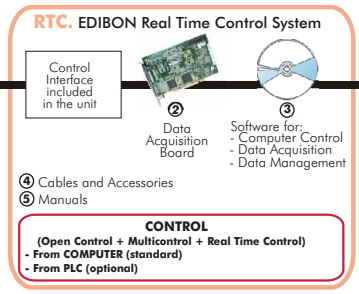
More information in: www.edibon.com/products/catalogues/en/units/electronics/industrial/TECNEL.pdf

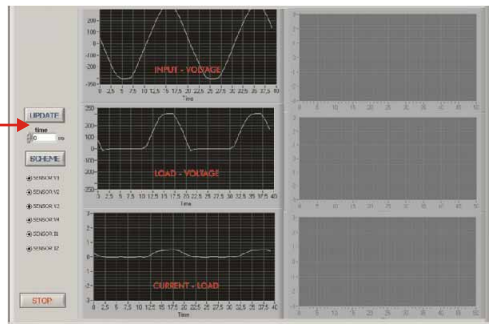
PRACTICAL POSSIBILITIES

1.- Single phase half-wave rectifier with load R.
2.- Single phase half-wave rectifier with load R-L.
3.- Single-phase half-wave rectifier with R-L load with free wheeling diode (FWD).
4.- Single-phase full-wave rectifier.
5.- Three-phase half-wave uncontrolled rectifier.
6.- Three-phase full-wave uncontrolled rectifier.
7.- Single-phase half-wave controlled rectifier.
8.- Single-phase full-wave controlled rectifier.
9.- Single-phase full-wave controlled rectifier with a DC motor.
10.- Three-phase full-wave completely controlled.
11.- Single-phase semi controlled rectifier.
12.- Three-phase full-wave semi-controlled rectifier.
13.- Chopper.
14.- Single-phase square-wave inverter.
15.- Single-phase displaced phase inverter.
16.- Single-phase inverter. PWM control.
17.- Three-phase inverter. PWM control with R load and R-L load.
18.- Three-phase inverter. PWM control with AC motor.
19.- Alternating regulators: R and R-L load.
20.- Asynchronous three-motor with rotor in short circuit (squirrel cage).

TECNEL/B. **Computer Controlled Basic Teaching Unit for the Study of Power Electronics** (no IGBTS)
(Converters: AC/DC+AC/AC)

① Unit: TECNEL/B. Basic Teaching Unit for the Study of Power Electronics (no IGBTS), including Control Interface. (Converters: AC/DC+AC/AC).





SPECIFICATIONS SUMMARY
Items supplied as standard

①TECNEL/B. Unit:
Unit with Computer Control and Data Acquisition System designed to study the basis of Power Electrics. It allows students to study AC/DC, AC/AC converters.
Metallic box. Diagram in the front panel with similar distribution to the elements in the real unit.
Front panel: Diodes module: 6 diodes. Thyristors module: 6 thyristors. Snubber net. Sensors module: 4 voltage sensors, 2 current sensors. Power supply connections for Vr, Vs, Vt, Neutral and Ground. Practices schemes.
Back panel: Data Acquisition Board connector (SCSI connector). Tachodynamo connector. Main fuses (Vr, Vs, Vt) and LEDs. Circuit breaker (main switch).
Single-phase driver. Three-phase driver. TSI board. Four relays board. 2 Three-phase relays. Commuted power supply. Three-phase magnetothermal. Control Interface.

② DAB. Data Acquisition Board:
PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

③ TECNEL/B/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Registration and visualization of all process variables in an automatic and simultaneously way. Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

④ Cables and Accessories, for normal operation.

⑤ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =Unit: 490 x 330 x 310 mm. Weight: 35 Kg.

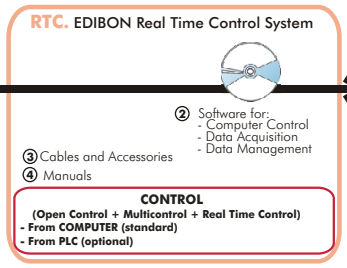
More information in: www.edibon.com/products/catalogues/en/units/electronics/industrial/TECNEL-B.pdf

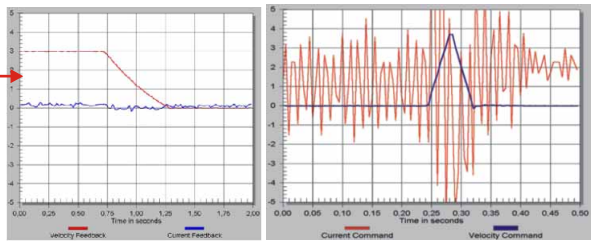
PRACTICAL POSSIBILITIES

1.- Single phase half-wave rectifier with load R.
2.- Single phase half-wave rectifier with load R-L.
3.- Single-phase half-wave rectifier with R-L load with free wheeling diode (FWD).
4.- Single-phase full-wave rectifier.
5.- Three-phase half-wave uncontrolled rectifier.
6.- Three-phase full-wave uncontrolled rectifier.
7.- Single-phase half-wave controlled rectifier.
8.- Single-phase full-wave controlled rectifier.
9.- Single-phase full-wave controlled rectifier with a DC motor.
10.- Three-phase full-wave completely controlled.
11.- Single-phase semi-controlled rectifier.
12.- Three-phase full-wave semi-controlled rectifier.
13.- Alternating regulators: R and R-L load.

SERIN/CA. Computer Controlled **Advanced Industrial Servosystems Trainer (AC motors)**

①Unit: SERIN/CA. Advanced Industrial Servosystems Trainer (AC motors)





SPECIFICATIONS SUMMARY
Items supplied as standard

① SERIN/CA Unit:

The SERIN/CA trainer consists on an Control Interface Box connected to a three-phase motor and to a PC. The control interface has a resolver for three-phase motors that controls the speed, position and current of the motor. The communication between the control interface and the PC provides the SERIN/CA the possibility of commanding the motor from the PC and visualize the most important signals of the motor. Velocity, Position and Torque Control. It allows predefined moves and programming.

Control Interface Box:

Front panel:

3 Digital outputs: They have a green LED that indicates if the output is active or not. Emulative encoder outputs: two pair of outputs (CH A Out, CH B Out and their respective denied outputs) that are TTL signals of incremental position generated by the resolver feedback, and one pair of outputs (CH S Out and their denied) that TTL works as marker of pulses. Analog output 4 (relay). Analog_outputs of the DAC monitor: these analog outputs are monitored points of general character. 6 digital inputs for those signals that are introduced to enable the different available functions in the software. 6 buttons to enable the digital inputs. 6 switches, with the same function as the buttons, but with the only difference that they are switches. Switch outfitter of digital inputs: there is a switch that enables the digital inputs. Analog input: this input allows an analog use directly of the user. It is an A/D input. Voltage supply: 3 sources of D.C. in the unit (+24 V. , +12V., and -12V. DC.) 2 Potentiometers.

Back panel:

Voltage supply (220 V A.C.). Three-phase output when solving: it is a three-phase output that feeds when you are solving and, therefore, allows their movement. Connection port in series: to connect the unit with the PC by the port in series. Connection with the feedback: it is a connection with the motor feedback. It allows the encoder to manage the motor.

Motor: AC motor, 0.7kW, 2.8A ac, 4200 rpm, 320V dc. Sensor RESOLVER :1 Speed, 1X/RX, 3 phase.

② SERIN/CA/CCSOF.Computer Control+Data Acquisition+Data Management Software:

Registration and visualization of signals in an automatic and simultaneously way. Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Comparative analysis of the obtained data, after to the process and modification of the conditions during the process.

③ Cables and Accessories, for normal operation.

④ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =Unit: 490 x 330 x 310 mm. Weight: 40 Kg. Motor:410 x 170 x 150 mm. Weight: 5 Kg.

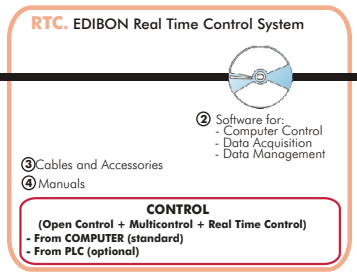
More information in: www.edibon.com/products/catalogues/en/units/electronics/industrial/SERIN-CA.pdf

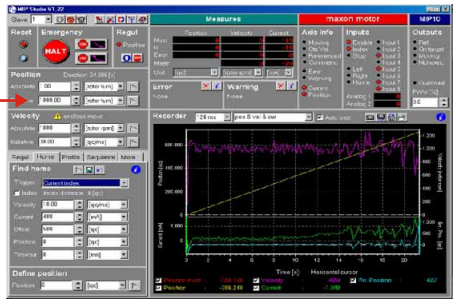
PRACTICAL POSSIBILITIES

1.- Homing.
2.- Clutch/Control.
3.- Turn movement (w/correction phase).
4.- Registration movements.
5.- Dry movements.
6.- Stop and blockade. Transitory states.
7.- Stop and blockade. Influence on the filtered velocity.
8.- Transitory velocity study.
9.- Feedback gain manage.
10.- Modification of Feedback Parameters and Phases U, V and W.
11.- Use and modification of the feedback filters.
12.- Phase voltages U, V and W showing.

SERIN/CC. Computer Controlled **Advanced Industrial Servosystems Trainer (DC motors)**

①Unit: SERIN/CC. Advanced Industrial Servosystems Trainer (DC motors)





SPECIFICATIONS SUMMARY
Items supplied as standard

① SERIN/CC Unit:

It is formed by a Control Interface Box and a Direct Current Motor and Encoder Module. The Control Interface Box has a 4-quadrants servo amplifier for DC motors that controls the motor speed, position and current of the motor. In order to do this control the feedback is done thanks to an encoder. The communication between the Control Interface Box and the computer (PC) provides the possibility of commanding the motor from the PC and to visualize the most important signals of the motor. The 4-quadrant servo amplifier controls the motor operation and the braking operation in both rotation directions clockwise and counterclockwise. Velocity, Position and Torque Control. It allows predefined moves and programming.

Control Interface Box:

Front panel: Diagram in the front panel with similar distribution to the elements in the real unit.

7 Digital outputs. 13 Digital inputs. 2 Analog inputs with voltages in the range of 0-5V. 2 Potentiometers to select the value of the analog inputs (0-5 V DC).

Back panel:

Voltage supply that feeds the unit with 220 V of alternating current. Motor power supply: it is a 24 V DC motor power supply. Connection plug to connect the Control Interface with the PC by the RS-232 port, in order to allow the software to manage the motor. Connection with the motor Feedback, it is a connection with the motor Feedback, it allows the encoder to manage the motor.

Direct Current Motor and Encoder Module:

DC Motor, 90W, position, speed and current are controlled by the Control Interface. Digital encoder, 500 pulses per revolution, with RS232 communication port.

2 Power supply wires. 2 Communication RS232 wires.

② SERIN/CC/CCSOF.Computer Control+Data Acquisition+Data Management Software:

Registration and visualization of signals in an automatic and simultaneously way. Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Comparative analysis of the obtained data, after to the process and modification of the conditions during the process.

③ Cables and Accessories, for normal operation.

④ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)=Unit: 490 x 330 x 310 mm. Weight: 40 Kg. Motor+Esconder Module: 300 x 300 x 120 mm. Weight: 5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/industrial/SERIN-CC.pdf

PRACTICAL POSSIBILITIES

1.- Autotuning.
2.- Manual tuning of the position regulator.
3.- Motion commands in MPBUS RS232 mode.
4.- Signals Graph, Transient Analysis.
5.- Batch Commands.
6.- User´s parameters, Position Val., velocity Val., Acceleration Val.
7.- Digital inputs and outputs in I/O mode.
8.- Load and braking simulation.
9.- Searching reference.
10.- Input/Output functions.
11.- State commands and Exception.
12.- Velocity, Position and Torque control.

SERIN/CCB. **Basic Servosystems Trainer (DC motors)**

SPECIFICATIONS SUMMARY

"SERIN/CCB" is an unit whose goal is studing low power servo systems. It is a low power DC motor speed control trainer that has a breakdown simulator.

This trainer is a basic version of the Advanced and Computerised "SERIN/CC" Trainer, being advisable for an introductory study of closed and open loop control systems.

The trainer includes:

Base Unit:

Metallic box. Diagram in the front panel with similar distribution to the elements in the real unit.

Electromechanic unit. Tachometric adaptor. Generation and control of set point. Ramp generator, as well as of sinusoidal, triangular and square wave generator. PWM modulator.

Open loop control.

Close loop control:

Proportional Control (P). Integrative Proportional Control (PI). Proportional derivative Control (PD). Proportional Integrative derivative (PID).

Current limiter. Turn inversion control. Stop/starting control. Power stage and excitation of the power stage. Brake control.

Fault simulator that allows the entries of a considerable amount of disfunctions in order to the students diagnose its nature and find out the components that cause them.

Direct current motor (DC) and tachometric generator.

Computer Control Software.

Cables and Accessories, necessary for its correct operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = 400 x 330 x 310 mm.

Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electronics/industrial/SERIN-CCB.pdf

PRACTICAL POSSIBILITIES

1.- Open loop control response.

2.- Demonstration of a bracking ramp functioning.

3.- Functioning of a PWM modulator and the response of the system.

4.- Closed loop or feedback control through a Proportional control (P).

5.- Closed loop or feedback control through a Derivative control (D).

6.- Closed loop or feedback control through a Proportional-Integral controller (PI).

7.- Closed loop or feedback control through a Proportional Derivative controller (PD).

8.- Achievement of an over damped system using a closed loop system.

9.- Achievement of a critically damped system using a closed loop PID.

10.- Instability, a characteristic of closed loop systems.

11.- Stabilisation of an unstable system.

12.- Faults simulation:

Type of faults including on the unit:

Fault 1: The absolute value of the feedback signal from the tachogenerator is not calculated for its subtraction from the reference, thus, for one of the turning senses, the error is wrong.

Fault 2: The value of the Proportional constant of the PID is divided by ten with the user unable to detect it but its effect.

Fault 3: The value of the Integral constant of the PID is divided by ten with the user unable to detect it but its effect.

Fault 4: The value of the Derivative constant of the PID is divided by ten with the user unable to detect it but its effect.

Fault 5: The signal from the tachogenerator is modified, making the PID control to believe that the speed is ten times lower to the real one.

None of these faults are exclusive, being possible to combine them.

SERIN/CACC. Computer Controlled **Advanced Industrial Servosystems Trainer (AC and DC motors)**

SERIN/CAB. **Basic Servosystems Trainer (AC motors)**

Summarized
Catalogue
two(2)

3. Communications

	page
Basic Communications:	
3.1. Analog Communications &	
3.2. Digital Communications.	41-48
Advanced Communications:	
3.3. Telephony.	48
3.4. Applied Communications.	49

edibon

www.edibon.com

3.- Communications

Equipment list

page

3.1- Analog Communications/ 3.2- Digital Communications

-LICOMBA **Communications Integrated Laboratory:** 41-46

Power Supplies
(one power supply required)

- FA-CO **Power Supply.**
- EBC-100 **Base Unit**, with built-in power supply.

Analog Communications

Modules

- ED-CAM **AM Communications.**
- ED-CFM **FM Communications.**

Digital Communications

Modules

- EDICOM1 **Signals Sampling and Reconstruction.**
- EDICOM2 **Time Division Multiplex (TDM). PAM Transmitter and Receiver.**
- EDICOM3 **MIC-TDM Transmission/Reception.**
- EDICOM4 **Delta Modulation and Demodulation.**
- EDICOM5 **Line codes. Signal Modulation and Demodulation.**
- EDICOM6 **Optical Fibre Transmission and Reception.**

Software

-CAI **Computer Aided Instruction Software System,** additional and optional to the Modules type "ED-CAM, ED-CFM and EDICOM".

-LICOMBA/CAL **Computer Aided Learning Software (Results Calculation and Analysis),** additional and optional to the Modules type "ED-CAM, ED-CFM and EDICOM".

Data Acquisition and Virtual Instrumentation

-EDAS/VIS 0.25 **EDIBON Data Acquisition System + Virtual Instrumentation System,** for being used with the Modules type "ED-CAM, ED-CFM and EDICOM".

-EDAS/VIS 1.25 **EDIBON Data Acquisition System + Virtual Instrumentation System,** for being used with the Modules type "ED-CAM, ED-CFM and EDICOM".

-EMDA/A **Analog Modulations Trainer.** 47

-EMDA/D **Digital Modulations Trainer.** 47

-EMDA/P **Pulse Modulations Trainer.** 48

page

3.3- Telephony

-CODITEL **Telephony Systems Trainer.** 48

3.4- Applied Communications

-EGPS **GPS Trainer.** 49

-EAN **Antenna Trainer.**

-ESA **Satellite Trainer.**

-EMI **Microwave Trainer.**

-EBL **Bluetooth Trainer.**

-ETM **Celular Mobile Trainer.**

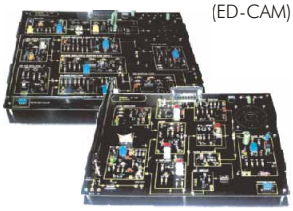
-ERA **Radar Trainer.**

LICOMBA. **Communications Integrated Laboratory:**

Laboratory structure

② Modules
(power supply needed)
Available analog communications modules:

(ED-CAM)



(ED-CFM)

① Power Supply

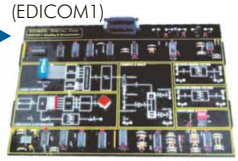
FA-CO

or

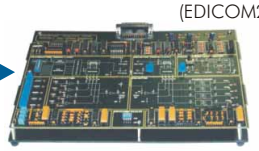
EBC-100

② Modules
(power supply needed)
Available digital communications modules:

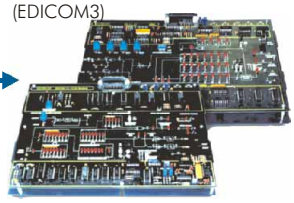
(EDICOM1)



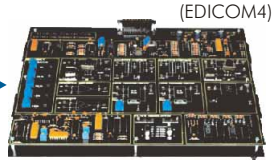
(EDICOM2)



(EDICOM3)

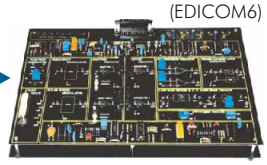


(EDICOM4)

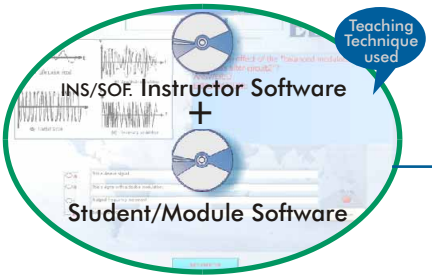


(EDICOM5)

(EDICOM6)



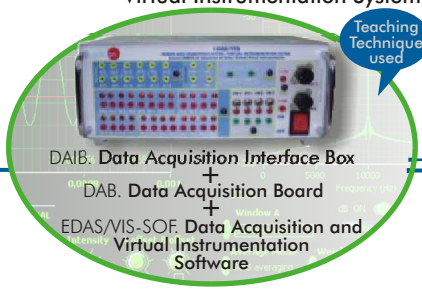
③ **CAI.** Computer Aided Instruction Software System



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

PC

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



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

Available Modules:

➤Analog Communications
- ED-CAM. **AM Communications.**
- ED-CFM. **FM Communications.**

➤Digital Communications
- EDICOM 1. **Signals Sampling and Reconstruction.**
- EDICOM 2. **Time Division Multiplex (TDM). PAM Transmitter and Receiver.**
- EDICOM 3. **MIC-TDM Transmission/Reception.**
- EDICOM 4. **Delta Modulation and Demodulation.**
- EDICOM 5. **Line codes. Signal Modulation and Demodulation.**
- EDICOM 6. **Optical Fibre Transmission and Reception.**

More information in: www.edibon.com/products/catalogues/en/units/communications/analog/LICOMBA.pdf

LICOMBA. **Communications Integrated Laboratory:**

① Power Supply

There are two choices for suppling the modules:

FA-CO. **Power Supply**

SPECIFICATIONS SUMMARY

Fixed outputs: + 5 V, ± 12 V, 1 A. Variable outputs: ± 12 V, 0.5 A. AC output: 12V. or 24 V. Outputs through either 2mm. contact terminals, or through 25 pin CENTRONICS connectors (2 outputs). LED's voltage indicators. Robust construction. Supply: 110/220V A.C. Frequency: 50/60 Hz.
FA-CO includes all the requirements for full working with any module from ED-CAM, ED-CFM and EDICOM type.
Dimensions: 225 x 205 x 100 mm. approx. Weight: 2 Kg. approx.

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

SPECIFICATIONS SUMMARY

Hardware support and power supply. Modules supporting unit.
Fixed outputs + 5V, + 12V, -12V. Variable outputs ± 12 V. AC output: 12 V. or 24 V. Outputs through either 2mm. contact terminals, or through 25 pin CENTRONICS connector. LED's voltage indicators. Robust construction. Supply: 110/220 V. A.C. Frequency: 50/60 Hz.
EBC-100 includes all the requirements for full working with any module from ED-CAM, ED-CFM and EDICOM type.
Dimensions: 410 x 298 x 107 mm. approx. Weight: 2 Kg. approx.

② Modules

They consist on electronic boards which permit 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 component faults can be simulated too. Every Module has its own manual, that gives the theoretical knowledge and explains everything the student needs to carry out the exercise /practice. We provide eight manuals per module. Connectors and cables for completing the exercises and practices are included.
Power supply needeed (FA-CO or EBC-100).
Dimensions (approx.) of each board = 300 x 210 x 45 mm. Weight: 300 gr.

➤Analog Communications

ED-CAM. **AM Communications**

SPECIFICATIONS SUMMARY

The module consist of two different boards:
One is the transmitter, the other one the receiver.
Communication between them may be through connecting cables or by antennas.
Modulation study:
D.S.B.: Double Sideband.
S.S.B.: Single Sideband.
DSB-SC: Double Sideband with Suppressed Carrier.
Also contains an audio amplifier and a loudspeaker. Adjustable audio volume through the amplifier.
Output signal selector through loudspeaker or headphones.
Sixteen error commuter switches (eight per board).
Telescopic antenna.
Numbered testing points for measurements using an oscilloscope.
Transmitter specifications:
DSB output frequency: 1 Mhz. SSB output frequency: 1.4 MHz.
DSB MODULATOR, consisting of: a crystal oscillator (1 MHz.); a balanced modulator and a band-pass filter N.1; and a ceramic pass-band filter.
SSB MODULATOR, consisting of: an oscillator of 455 kHz.; a balanced modulator; a ceramic pass-band filter; and a balanced modulator and pass-band filter N.2
Receiver specifications:
Type: Superheterodyne.
Two Detectors:
Detector diode for demodulation of AM-DSB.
Product detector for demodulation of AM-SSB.
Frequency range: 525 Hz. to 1605 KHz.
Intermediate frequency: 455 KHz.
Blocks: Local oscillator; BFO; Product detector; Radio-frequency amplifier; mixer; two intermediate-frequency amplifiers; AGC (automatic gain control); and an audio amplifier.

More information in: www.edibon.com/products/catalogues/en/units/communications/analog/LICOMBA.pdf

PRACTICAL POSSIBILITIES

1.- Analysis of the main features of the transmitter and the receiver.
2.- Analysis of modulation:
D.S.B.: Double Sideband.
S.S.B.: Single Sideband.
3.- Signal modulation using AM-DSB :
Carrier modulation.
Amplitude modulation.
Frequency modulation.
Analysis of DSB modulation.
Diode detector operation.
Superheterodyne receiver operation.
AM-DSB signal reception and demodulation.
Generation of DSB modulated signals.
4.- Signal modulation using AM- SSB :
Analysis of SSB modulation.
Analysis of the AM-SSB demodulator.
Analysis of BFO (heterodyne oscillator).
AM-SSB signal reception and demodulation.
5.- Analysis of the Image Frequency.
6.- Adjustment of Tuning Circuits.
7.- Error Generator.

ED-CFM. **FM Communications**

SPECIFICATIONS SUMMARY

The module consists of a single board for studying FM communications, including transmission and reception, and also noise effects existing in communication.
The board includes two frequency modulators and five discriminator circuits.
Alternatively it is possible to modulate the amplitude of the FM signal using an external noise input signal.
Transmitter:
Modulator circuits: Reactor and Varactor.
Output frequency: 455 KHz.
Frequency range of the audio oscillator: 300 Hz. to 3.4 KHz.
Receiver:
Demodulator circuits: Tuner resonator, square-law detector, ratio discriminator, synchronous detector, and a Foster-Seeley discriminator.
Low-pass filter/Amplifiers.
Filter cutoff frequency: 3.4 KHz.
Eight commuter switches.
Testing points for measurements using an oscilloscope.

More information in: www.edibon.com/products/catalogues/en/units/communications/analog/LICOMBA.pdf

PRACTICAL POSSIBILITIES

1.- Introduction:
Main features of the FM transmitter-receiver board.
2.- FM Modulation:
Analysis of the reactor modulator.
Analysis of the varactor modulator.
3.- Frequency Demodulation Techniques:
Analysis of the Untuned Resonant Circuit.
Analysis of the Quadratic Detector.
Analysis of the Foster-Seeley Detector.
Analysis of the Ratio Detector.
Analysis of the Closed-Loop Phase Detector Circuit.
4.- Adjustment of Tuning Circuits.
5.- Error Generator.

LICOMBA. **Communications Integrated Laboratory:**

② Modules

➤ **Digital Communications**

EDICOM1. **Signals Sampling and Reconstruction**

SPECIFICATIONS SUMMARY

The module consists of a board for studying the principles of Sampling Theorem.

Internally the board generates a 1 KHz. signal which shall be used as the transmitted signal, as well as five different sampling frequency signals. The board also contains a circuit for calculating the time percentage used in each sampling period when the signal is sampled.

Sampling frequencies: 2,4,8,16, and 32 KHz.

Sampling utilization factor: variable 0-90% using 10% stepping.

Two low-pass filters; cutoff frequency: 3.4 KHz., of 2nd. and 4th. order, for receiving, as the filter's order increases its gradient is stronger, allowing a better reconstruction.

There is an output for the sampled signal, and another for the sampling and maintenance of the signal.

There exists the possibility of introducing a sampled or pure signal, external to the board.

Allows faults simulation.

More information in: www.edibon.com/products/catalogues/en/units/communications/digital/LICOMBA.pdf

PRACTICAL POSSIBILITIES

1.- Description of the principles of signal sampling and reconstructions.

2.- Visualization of the main signals involved in a sampling process.

3.- Analysis of the whole signal sampling and reconstruction cycle.

4.- Comparison of the use of a 2nd. against 4th. order filter in the recovery process of a signal.

5.- Faults simulation.

EDICOM2. **Time Division Multiplex (TDM). PAM Transmitter and Receiver**

SPECIFICATIONS SUMMARY

This module consists of a board for studying Pulse Amplitude Modulation and Demodulation (PAM), and Time Division Multiplex (TDM).

Sampling and time division multiplex are analyzed for each channel.

It includes analog tetrapolar switches installed both in the transmitter and the receiver for channel multiplexing and demultiplexing.

Input channels: 4 TDM and PAM.

Analog channels: 250 Hz., 500 Hz, 1 KHz, and 2 KHz.

Sampling frequency: 16 KHz per channel.

Sampling utilization factor: variable with transmission from 0 to 90% using 10% steps per channel.

Analog channels: 250 Hz., 500 Hz, 1 KHz, and 2 KHz, variable amplitude with potentiometer.

Low-pass filter cutoff frequency: 3.4 KHz.

Three operation modes, allowing verification of the receiver's complexity and channel usage, depending on the transmitted information.

Possibility of transmitting externally supplied signals.

The board permits introducing faults simulation using a switchboard, thus enabling the student to study in depth the board's operation and localization of faults.

More information in: www.edibon.com/products/catalogues/en/units/communications/digital/LICOMBA.pdf

PRACTICAL POSSIBILITIES

1.- Analysis of the principles of Time Division Multiplex (TDM).

2.- Analysis of the features of the Transmitter, the Receiver and all the other circuits.

3.- Comparison between different operation modes, varying with their connections.

4.- Faults simulation.

EDICOM3. **MIC-TDM Transmission/Reception**

SPECIFICATIONS SUMMARY

This module consists of two boards for studying the modulation of a two-channel MIC-TDM system:

Transmission board (EDICOM 3.1).

Reception board (EDICOM 3.2).

Here is analyzed analog signal transmission using two-channel sampling, multiplexing, and coding, thus generating a lay transmitted to the receiver which recovers the two analog signals.

The module also allows checking error codes.

Input channels: two PCM channels.

Codes generated by the transmitter: pseudo random for the synchronizing signal.

Error checking: even and odd parity, and Hamming code.

Includes two continuos signal generators of 1 and 2 KHz, and another two direct current signal generators, all of them of variable amplitude using potentiometer.

Possibility of faults simulation.

More information in: www.edibon.com/products/catalogues/en/units/communications/digital/LICOMBA.pdf

PRACTICAL POSSIBILITIES

1.- Analysis of transmission in a two-channel MIC-TDM system.

2.- Study of the transmitter characteristic codes.

3.- Analysis of receiver operation varying the transmitter output signal.

4.- Use of synchronizing code sequences for data transmission.

5.- Use of the clock generation circuit for reducing connections between transmitter and receiver to a single one.

6.- Faults simulation.

LICOMBA. **Communications Integrated Laboratory:**

② Modules

➤**Digital Communications**

EDICOM4. **Delta Modulation and Demodulation**

SPECIFICATIONS SUMMARY

This module consists of a board for studying Delta, Adaptive Delta and Delta/Sigma Modulation.

Delta modulation transforms an analog signal into a stream of digital data, transmitting one bit every time the analog signal is sampled.

This modulation has some drawbacks depending on various parameters, for example the variation slope of the analog signal to be transmitted at the sampling frequency. Due to this there are different types of delta modulation.

This module allows to show the three main deltas: Delta modulation. Adaptive-delta modulation. Sigma-delta modulation.

This allows the study of the parameters: sampling frequency, sampling step size, and analog input signal frequency and amplitude.

Sampling frequencies: 32, 64, 128, and 256 KHz.

Low-pass "Butterworth" filter with cutoff frequency at 3.4 KHz.

Transmitter and receiver in-built integrators enabling selection of four different gains using switches or automatic gain variation.

Includes four input signals at 250 Hz, 500 Hz, 1 KHz, and 2 KHz, and also a direct current signal, all of them of variable amplitude and potentiometer, as well as the possibility of introducing an external signal.

More information in: www.edibon.com/products/catalogues/en/units/communications/digital/LICOMBA.pdf

PRACTICAL POSSIBILITIES

1.- Analysis of Delta, Adaptive Delta, and Delta Sigma Modulation.

2.- Construction of a Delta Modulator/Demodulator system.

3.- Construction of an Adaptive Delta Modulator/Demodulator system.

4.- Construction of a Sigma-Delta Modulator/Demodulator system.

EDICOM5. **Line codes. Signal Modulation and Demodulation**

SPECIFICATIONS SUMMARY

This module consists of two boards for studying data conditioning:

Transmission board (EDICOM 5.1): for data coding and signal modulation.

Reception board (EDICOM 5.2): for signal demodulation and data decoding.

The aim is to study carrier modulation/demodulation techniques: ASK, PSK, FSK, and QPSK.

Also to study data coding formats: NRZ(L), NRZ(M), RZ, Two-phase (Manchester), and Two-phase (Mark).

Carrier wave frequency: 1.44 MHz, (I) 960 KHz, (Q) 960 KHz.

It Includes two carrier modulators and two unipolar-bipolar converters.

Elements: a data inverter, an amplifier-adder, and bit decoder installed in the receiver.

For completing the practices, it is necessary to use the boards of Module EDICOM 3.

The EDICOM 5.2 board contains all the demodulators and circuitry needed for recovering the signal.

Faults simulation.

More information in: www.edibon.com/products/catalogues/en/units/communications/digital/LICOMBA.pdf

PRACTICAL POSSIBILITIES

1.- Analysis of line codes used for short-distance digital trans-mission: NRZ(L), NRZ(M), RZ, AMI, RB, Two-phase (Manchester), and Two-phase (Mark).

2.- Relationship between binary mode and modulation rate.

3.- Analysis of digital modulation techniques: ASK, PSK, FSK, and QPSK, studying their features at the transmitter and the demodulation at the receiver.

4.- Faults simulation.

5.- Requires "EDICOM 3" module.

EDICOM6. **Optical Fibre Transmission and Reception**

SPECIFICATIONS SUMMARY

This module consists of one board for studying optical fibre transmission and reception.

Different methods comprising the modulation of a light source are described: amplitude modulation, frequency modulation, signal pulse-width modulation; as well as their subsequent recovery and reconstruction.

Transmission medium: optical fibre cable.

Sources: analog and digital.

Two optical fibre transmission and reception circuits. Maximum transmitter frequency: 300 KHz. 4th order low-pass filter with cutoff frequency at 3.4 KHz.

This module may be used together with EDICOM 4 to enable its better use, though it may also be used independently.

Faults simulation.

More information in: www.edibon.com/products/catalogues/en/units/communications/digital/LICOMBA.pdf

PRACTICAL POSSIBILITIES

1.- Analysis of optical fibre transmission and reception.

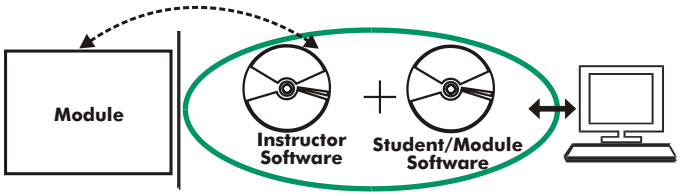
2.- Analysis of the various methods used for modulating a beam of light: amplitude modulation and pulse-width modulation.

3.- Analysis of the transmission of digital signals using optical fibre.

4.- Faults simulation.

LICOMBA. **Communications Integrated Laboratory:**

③ CAI. Computer Aided Instruction Software System



With no physical connection between module and computer, this complete package consists on an Instructor Software (INS/SOF) totally integrated with the Student/Module Software. Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students. These, on the other hand, get a virtual instructor who helps them to deal with all the information on the subject of study.

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

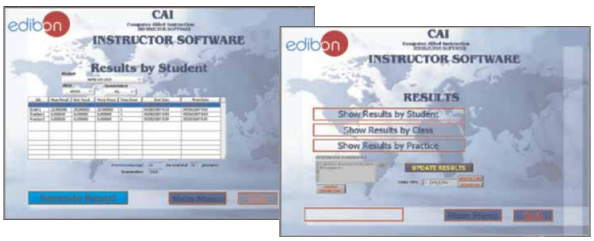
The Instructor can:

- Organize Students by Classes and Groups.
- Create easily new entries or delete them.
- Create data bases with student information.
- Analyze results and make statistical comparisons.
- Print reports.
- Develop own examinations.
- Detect student's progress and difficulties.

...and many other facilities.

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

Instructor Software



- Computer Aided Instruction Softwares (Student/Module Software):

It explains how to use the module, run the experiments and what to do at any moment. Each module has its own Student Software.

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

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

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

  Guided Practices: presents several practices to be done with the module, showing how to complete the circuits and get the right information from them.

  Exams: set of questions presented to test the obtained knowledge.

Student/Module Software

Available Student/Module Softwares:

➤Analog Communications
- ED-CAM/SOF. AM Communications.
- ED-CFM/SOF. FM Communications.

➤Digital Communications
- EDICOM 1/SOF. Signals Sampling and Reconstruction.
- EDICOM 2/SOF. Time Division Multiplex(TDM). PAM Transmitter and Receiver.
- EDICOM 3/SOF. MIC-TDM Transmission/Reception.
- EDICOM 4/SOF. Delta Modulation and Demodulation.
- EDICOM 5/SOF. Line codes. Signal Modulation and Demodulation.
- EDICOM 6/SOF. Optical Fibre Transmission/Reception.

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

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

CAL is a class assistant that helps in making the necessary calculations to extract the right conclusions from data obtained during the experimental practices.

CAL will perform the calculations.

CAL computes the value of all the variables involved.

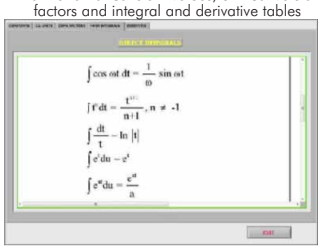
It allows to plot and print the results. Between the plotting options, any variable can be represented against any other.

Different plotting displays.

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

Calculations

Information of constant values, unit conversion factors and integral and derivative tables



Plotting options

Available Softwares:

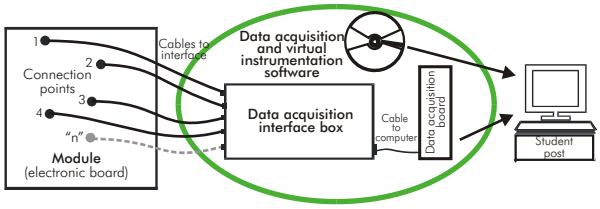
➤Analog Communications
- ED-CAM/CAL. AM Communications.
- ED-CFM/CAL. FM Communications.

➤Digital Communications
- EDICOM 1/CAL. Signals Sampling and Reconstruction.
- EDICOM 2/CAL. Time Division Multiplex(TDM). PAM Transmitter and Receiver.
- EDICOM 3/CAL. MIC-TDM Transmission/Reception.
- EDICOM 4/CAL. Delta Modulation and Demodulation.
- EDICOM 5/CAL. Line codes. Signal Modulation and Demodulation.
- EDICOM 6/CAL. Optical Fibre Transmission/Reception.

More information in: www.edibon.com/products/catalogues/en/units/communications/digital/LICOMBA.pdf

LICOMBA. **Communications Integrated Laboratory:**

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



EDAS/VIS is the perfect link between the modules and the PC. With the EDAS/VIS system, information from the modules is sent to the computer. There, it can be analyzed and represented.
We easily connect the Data Acquisition Interface Box (DAIB) to the modules with the supplied cables (connection points are placed in the modules). Like any other hardware, the DAIB is connected to the PC through the Data Acquisition Board (DAB), and by using the Data Acquisition and Virtual Instrumentation Software the student can get the results from the undertaken experiment/practice, see them on the screen and work with them.

The EDAS/VIS System includes a Hardware: DAIB Data Acquisition Interface Box + DAB. Data Acquisition Board and a Software: EDAS/VIS-SOF. Data Acquisition and Virtual Instrumentation Software:

1) DAIB. **Data Acquisition Interface Box:**
Metallic box. Dimensions: 310 x 220 x 145 mm. approx.
Front panel:
16 Analog inputs.
Sampling velocity 1,250,000 samples per second for EDAS/VIS 1.25 Version.
Sampling velocity 250,000 samples per second for EDAS/VIS 0.25 Version.
2 Analog outputs. 24 Digital inputs/outputs, configurable as inputs or outputs.
4 Digital signal switches 0-5 V. 2 Analog signal potentiometers ±12 V.
Inside: Internal power supply of 12 and 5 V. Potentiometer.
Back panel: Power supply connector. SCSI connector (for connecting with the data acquisition board).
Connecting cables.

DAIB

+

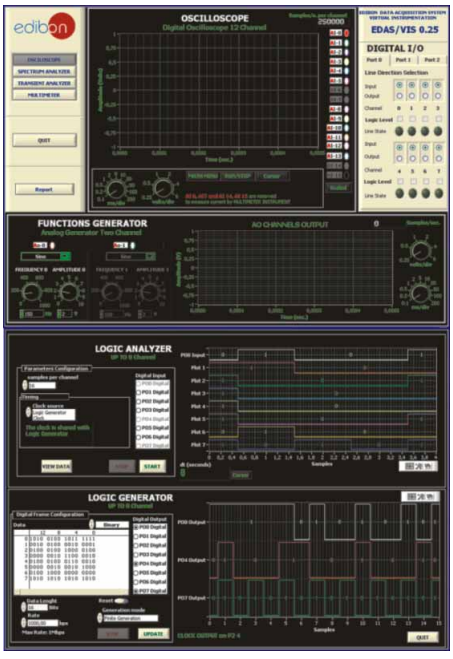
2) DAB. **Data Acquisition Board:**
PCI Data acquisition board (National Instruments) to be placed in a computer slot.
For EDAS/VIS 1.25 Version:
Analog input: Number of channels= 16. Sampling rate up to: 1,250,000 S/s (samples per second).
Analog output: Number of channels= 2. Max. output rate up to: 833 KS/s.
Digital Input/Output: Number of channels= 24 inputs/outputs.

For EDAS/VIS 0.25 Version:
This is a similar version to the 1.25, with the following differences:
Sampling rate up to: 250,000 S/s (samples per second).
Analog output: Max. output rate up to: 10 KS/s.


DAB

+

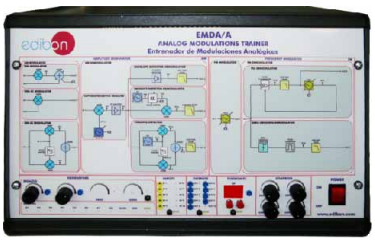
3) EDAS/VIS-SOF. **Data Acquisition and Virtual Instrumentation Software:**
Compatible with actual Windows operating systems. Friendly graphical frame.
Configurable software allowing the temporal/frequency representation of the different inputs and outputs. Visualization of a voltage of the circuits 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.
-**Function Generator:**
Two independent signal generators, for sinusoidal, triangular, saw tooth and square. Channels: 2.
-**Spectrum Analyzer:**
Channels: 12 (simultaneous).
-**Multimeter:**
Voltmeter (Channels: 12 (simultaneous)). Ammeter (Channels: 2 (simultaneous)).
-**Transient Analyzer.**
-**Logic Analyzer:**
Number of Input channels: 8.
Clock Source: 3 different sources.
This instrument allows receiving as far as 8 digital signal simultaneously at 1 or 8 Mbps (depending of the version).
-**Logic Generator:**
Number of transmission channels: 8.
This instrument allows generating up to 8 digital simultaneous signals of 1 or 8 Mbps (depending of the version).
Sampling velocity 1,250,000 samples per second for EDAS/VIS 1.25 Version.
Sampling velocity 250,000 samples per second for EDAS/VIS 0.25 Version.



EDAS/VIS-SOF

More information in: www.edibon.com/products/catalogues/en/units/communications/digital/LICOMBA.pdf

EMDA/A. **Analog Modulations Trainer**



SPECIFICATIONS SUMMARY

EMDA/A is a complete analog communications trainer designed to explain the basic concepts of analog modulation. It covers the principles of many of the modulation and demodulation techniques used in modern analog communication systems.
It provides a basic understanding of the concepts behind analog techniques: Dual Side Band (DSB), Dual Side Band Suppressed Carrier (DSB-SC) and Single Side Band Suppressed Carrier (SSB-SC).
All elements are mounted in a metallic box, with power supply and block diagram.
Functional blocks:
- Modulators and demodulators:
  - Amplitude Modulation (AM):
    - Double Side Band modulator (DSB). Double Side Band Suppressed Carrier modulator (DSB-SC). Single Side Band Suppressed Carrier AM modulator (SSB-SC). Radio-Frequency Tuning. Intermediate-Frequency (I.F) Mixer. I.F Amplifier. Envelope detector. Product detector.
  - Frequency Modulation (FM):
    - Voltage Controlled Oscillator (VCO). Phase-Locked Loop detector (PLL).
- Analog Generators:
  - Carrier and audio signals.
- 5 Analog Inputs. 9 Analog Outputs.
- 18 Test points. 2 Controls.

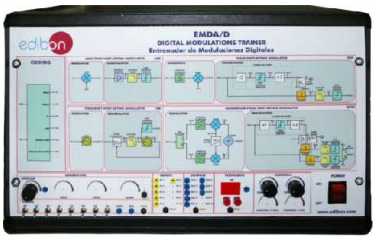
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/communications/analog/EMDA-A.pdf

PRACTICAL POSSIBILITIES

1.- Study of basic principles of AM modulation and demodulation technique.
2.- Basic principles of DSB modulation and demodulation.
3.- Basic principles of DSBSC modulation and demodulation.
4.- Basic principles of SSBSC modulation and demodulation.
5.- Comparison of the spectrum of AM, SSBSC and DSBSC signals.
6.- Basic principles of FM modulation and demodulation.
7.- Introduction to the PLL operation.

EMDA/D. **Digital Modulations Trainer**



SPECIFICATIONS SUMMARY

EMDA/D is a complete digital communications trainer designed to explain the basic concepts of digital modulation. It covers the principles of many of the modulation and demodulation techniques used in modern digital communication systems.
The trainer provides a basic understanding of the concepts behind digital communications techniques: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK) and Quadrature Phase Shift Keying (QPSK). It allows students to study some of the line coding techniques like NRZ(L), NRZ(M), RZ, RB, etc.
All elements are mounted in a metallic box, with power supply and block diagram.
Functional blocks:
- Line Coding:
  - Non Return to Zero Level line coding circuit (NRZL). Non Return to Zero Mark line coding circuit (NRZM). Biphase Manchester line coding circuit. Biphase Mark circuit line coding circuit. Return to Zero line coding circuit (RZ). Return to Bias line coding circuit (RB). Alternate Mark Inversion line coding circuit (AMI).
- Modulators and demodulators:
  - Amplitude-Shift Keying (ASK): Mixer. Filter.
  - Frequency-Shift Keying (FSK):
    - Phase-Locked Loop detector (PLL).
  - Phase-Shift Keying (PSK):
    - Unipolar to Bipolar converter. Mixers.
    - Carrier recovery circuit:
      - Multiplier and divider circuits. Squarer circuit. Voltage Controlled Oscillator (VCO).
    - Sampler. Filter. Level-Crossing detector.
  - Quadrature Phase-Shift Keying (QPSK):
    - Dbit encoder circuit. Unipolar to Bipolar converters. Mixers.
    - Carrier recovery circuit:
      - Multiplier and divider circuits. Squarer circuit. Voltage Controlled Oscillator (VCO).
    - Samplers circuits. Filter. Level-Crossing detectors. Dbit decoder circuit.
- Analog Generators:
  - Carrier signal.
- Digital Generators:
  - 1 byte (8 bits, serial).
- 6 Analog Inputs. 8 Analog Outputs.
- 28 Test points. 2 Controls.

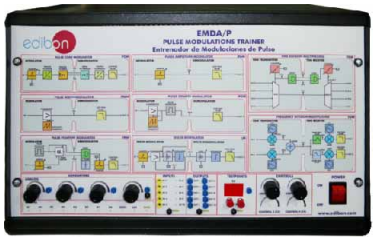
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/communications/digital/EMDA-D.pdf

PRACTICAL POSSIBILITIES

1.- Study of the data coding techniques.
2.- Study of basic principles of ASK modulation and demodulation technique.
3.- Study of basic principles of FSK modulation and demodulation technique.
4.- Study of basic principles of PSK modulation and demodulation technique.
5.- Study of basic principles of QSK modulation and demodulation technique.

EMDA/P. **Pulse Modulations Trainer**



SPECIFICATIONS SUMMARY

The EMDA/P is a complete modulations trainer designed to explain the basic concepts of pulse modulation. It covers the principles of many of the modulation and demodulation techniques used in modern communication systems.
The trainer provides a basic understanding of the concepts behind pulse communications techniques: Pulse Code Modulation (PCM), Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Density Modulation (PDM), Pulse Position Modulation (PPM). Finally, it allows students to study the basic principles of Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM) are introduced.
All elements are mounted in a metallic box, with power supply and block diagram.
Functional blocks:
- Modulators and demodulators:
  - Pulse Code Modulation (PCM):
    Sample & Hold circuit. Analog to Digital Converter (ADC). Parallel to Serial circuit. Serial to Parallel circuit. Digital to Analog Converter (DAC). Filter.
  - Pulse Amplitude Modulation (PAM): Sampler circuit. Filter.
  - Pulse Width Modulation (PWM):
    Sawtooth Generator circuit. Comparator circuit. Filter.
  - Pulse Density Modulation (PDM):
    Sawtooth Generator circuit. Comparator circuit. Filter.
  - Pulse-Position Modulation (PPM):
    Pulse Generator circuit. Samplers circuits. Phase Shifter. Filters.
  - Delta Modulation (ΔM):
    Sample Generator circuit. Comparator circuit. Integrators circuit. Amplifiers. Filters.
- Time Division Multiplexing (TDM):
  Multiplexer and Demultiplexer. Synchronization circuits.
- Frequency Division Multiplexing (FDM):
  Local Oscillators. Mixers. Adder circuit. Band-Pass Filters. Low Pass Filters.
- Analog Generators: 2 Audio signals. 2 Carrier signals.
- 5 Analog Inputs. 10 Analog Outputs. 28 Test points. 2 Controls.

Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.)= 490 x 330 x 310 mm. Weight: 20 Kg.

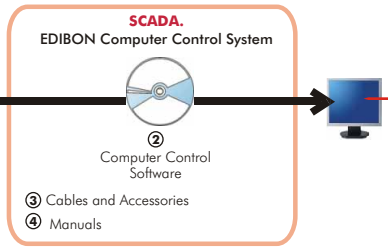
More information in: www.edibon.com/products/catalogues/en/units/communications/digital/EMDA-P.pdf

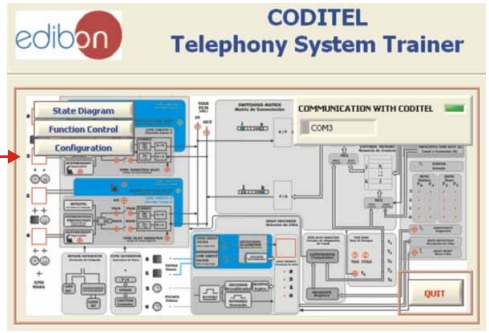
PRACTICAL POSSIBILITIES

1.- Basic principles of PCM modulation and demodulation.
2.- Basic principles of PAM modulation and demodulation.
3.- Basic principles of PWM modulation and demodulation.
4.- Basic principles of PPM modulation and demodulation.
5.- Basic principles of PDM modulation and demodulation.
6.- Basic principles of Delta modulation and demodulation.
7.- Introduction to the work principle of TDM.
8.- Introduction to the work principle of FDM.

CODITEL. **Telephony Systems Trainer**

① Unit: CODITEL. Telephony Systems Trainer





SPECIFICATIONS SUMMARY

Items supplied as standard

① CODITEL. Trainer:
CODITEL is a digital circuit commutation unit for didactic purposes. Its structure is like a temporal commutator structure with two MIC ways, one inlet way and one outlet way. Basically, it follows the recommendation of the CCITT and of Telephony.
System is mounted on a desktop box. Diagram in the front panel of the unit with the same structure as the real hardware. Provides access to all main signals. Follows all the recommendations of CCITT (Cosultive Comitte International Telephony and Telegraphy). Structure is based on the standard for digital commutation systems. *Time division multiplexing(TDM)* and Pulse code Modulation (PCM) principles.
Communication based on a temporal commutator that supports up to fifteen complete internal communications with two MIC ways, one inlet way and one outlet way. Standard MIC system of 32 channels with dynamic assignament and frame synchronization. 30 channels used for voice transmission and 2 used for signalling and synchronism. Internal hardware consists of two electronics boards: an analog board with all integrated and discrete analog elements and a digital board. Structure integrated with all the internal common elements in a telephone system: subscriber´s line, tone generator, base of times, filtering stage, switching matrix, number decoders and control memory. Functions as battery feed, overvoltage protection, ringing, coding and decoding, supervision, signalling, 2-4 wires conversion and test(BORSCHT functions) covered, in each line. High precision digital tone synthetizer 400 Hz using *Direct Digital Synthetizer* (DDS).
Four commercial receptors (telephones), two used for signaling by pulses and other two for tones.
Switching memory matrix, control memory and base of times implemented with FPGA technology with high stability and fiability. Standard protocol for communication between the PC and the trainer.

② CODITEL/CCSOF. Computer Control and Graphic Visualization Software:
Compatible with actual Windows operating systems. Compatible with the industry standards. In combination with the hardware, Coditel Software is supplied with the system. Coditel software has a user friendly graphical interface that provides totally control and visualization of the telephone system.

③ Cables and Accessories, for normal operation.
④ Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 20 Kg.

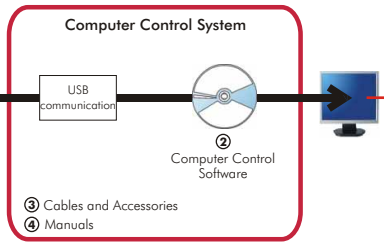
More information in: www.edibon.com/products/catalogues/en/units/communications/telephony/CODITEL.pdf

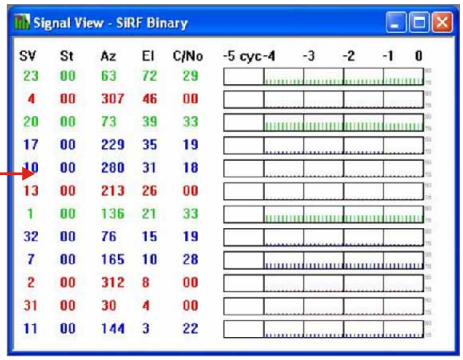
PRACTICAL POSSIBILITIES

1.- To study the main actions and signals involved in a digital commutation.
2.- To study the dynamic channel assignment and temporal switching.
3.- To study the standards for audio conversion.
4.- To establish of a communication between some channels step by step.
5.- Visual monitoring of the main states that a line goes through during a call.
6.- To configure lines as only receiver, transmitter, receiver / transmitter.
7.- To test of the conversion from 2 to 4 wires.
8.- To study the electric stages when the user makes actions over the telephone.
9.- To study the signals involved when dialing by pulses.
10.- To study the signals involved when dialing by tones.
11.- To study the tone signal.

EGPS. **GPS Trainer**

①Unit: EGPS. GPS Trainer





SPECIFICATIONS SUMMARY

Items supplied as standard

① EGPS. Trainer:

The EGPS unit is the GPS trainer designed by EDIBON to study the basic concepts about global positioning.

This unit allows to acquire solid formation about the operation mode of a GPS receiver without any previous knowledge.

The EGPS unit allows the student to learn, in a simple and practical way, the basic terms and concepts used in global positioning systems such as trilateration, GPS starting modes, geographic Azimuth, etc.

The unit mainly consists of two elements: the unit-interface, which includes the GPS receiver element with a series of status indicators and the antenna in charge of the satellites signals reception.

Metallic box with handles.

The communication between the unit and the PC is through a USB communication connector.

The EGPS has a set of LEDs to indicate the unit status:

Switch and indicator of the unit status.

Tracking and positioning status indicators.

Active antenna with amplifier incorporated and magnetic base to be fixed to metallic elements.

Technical data:

Receptor 20 channels L1 Band (1575,42MHz).

RF sensibility reception:

Adquistion (cold start): 144 dBm.

Adquistion (hot start): 155 dBm.

Navigation: 157 dBm.

Tracking: 159 dBm.

Acquisition times:

Hot<1 sec.

Warm<36 sec.

Cold<38 sec.

Reacquisition<1 sec.

Precision:

Horizontal CEP<2.5 m.

Horizontal (2dRMS)<5.5 m.

Vertical VEP<2m.

Speed < 0.01 m/s.

Antenna RF with magnetic base.

USB communication connector.

② EGPS/CCSOF. Computer Control Software:

Compatible with the current Windows operative systems. Intuitive and friendly environment.

Easy to use software to control and monitor the EGPS receiver. It uses the serial protocol of the National Marine Electronics Association (NMEA) version 1.83 to communicate with the unit.

③ Cables and Accessories, for normal operation.

④ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = 310 x 220 x 180 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/communications/appliedcommunications/EGPS.pdf

PRACTICAL POSSIBILITIES

1.- Study the operation principle of a GPS receiver.

2.- Determination of the GPS state.

3.- Configuration of the communication parameters.

4.- Study of the signal-to-noise ratio (SNR).

5.- Study of NMEA sentences.

6.- Study of geographic Azimuth.

7.- Basic concepts about navigation.

8.- Measurement of longitude, latitude and altitude.

9.- Study of the time.

10.- Study of the DOP effect.

11.- Advanced concepts about the GPS receiver.

Others units:

EAN. **Antenna Trainer**

ESA. **Satellite Trainer**

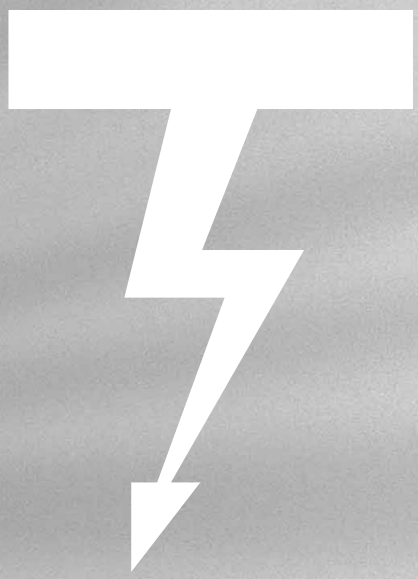
EMI. **Microwave Trainer**

EBL. **Bluetooth Trainer**

ETM. **Cellular Mobile Trainer**

ERA. **Radar Trainer**

Summarized
Catalogue
two(2)



4. Electricity

	page
Basic Electricity:	
4.1. Basic Electricity.	53-79
4.2. Electricity Demonstration.	79
4.3. Electrical Installations Workshop.	
Advanced Electricity:	
4.4. Electrical Machines.	80-101
4.5. Electrical Machines Kits.	102

edibon

www.edibon.com

page

4.1- Basic Electricity

-LIELBA **Electrical Installations Integrated Laboratory:** 53-68

APPLICATIONS:

Domestic Electrical Installations

General
- •AD1A **Robbery Alarm Station.**
- •AD3A **Fire Alarm Station.**
- •AD5 **Stair Lights Timing.**
- •AD13 **Audio Door entry System.**
- •AD14 **Audio and Video Door entry System.**

Industrial Control
- •AD6A **Luminosity Control Station.**
- •AD9A **Heating Control Station.**
- •AD15A **Position Control Station.**
- •AD17A **Photoelectric Control Position Station.**
- •AD22 **Flooding Control Station.**
- •AD23 **Wireless Basic Control Station (RF).**
- •AD24 **Position Switch.**
- •AD25A **Control Station for Domestic Electric Services through the Telephone.**
- •AD28A **Integral Control Station of Domestic Electric Systems.**
- •AD30 **Gas Control Station.**

Sound
- •AD19A **Sound Station.**
- •AD31 **Movement and Sound Detection and Control.**

Instruments
- •AD8 **Blinds Activator.**
- •AD11A **Network Analyzer.**
- •AD32 **24 Vac/12 Vdc Circuits Analyzer.**
- •AD33 **Installations Faults Simulator.**

Industrial Electrical Installations

Starters and Motors
- •AI1 **Star-Delta Starter.**
- •AI2 **Starter through Auto-Transformer.**
- •AI4 **Starter-Inverter.**
- •AI5 **AC Wound Rotor Motor Starter.**
- •AI6 **DC Motor Starter.**
- •AI12 **Modular Trainer (AC Motors).**

Speed Control
- •AI3 **Speed Commutator for Dahlander Motor.**
- •AI7 **Automatic Change of Speed of a Dahlander Motor with Change of Direction.**

Electrotecnics
- •AI8 **Reactive Power Compensation (Power Factor Correction).**
- •A13 **Modular Trainer for Electrotecnics.**
- •AI13-A **Modular Trainer for Electrotecnics (RLC Circuits).**
- •AI13-B **Modular Trainer for Electrotecnics (Electrostatic Kit).**
- •AI13-C **Modular Trainer for Electrotecnics (Motors).**
- •AI13-D **Modular Trainer for Electrotecnics (Transformers).**
- •AI13-E **Modular Trainer for Electrotecnics (Lighting).**

Safety
- •AI9 **People Safety Against Indirect Electrical Contacts in TT Neutral Regimen.**
- •AI10 **People Safety Against Indirect Electrical Contacts in TN Neutral Regimen.**
- •AI11 **People Safety Against Indirect Electrical Contacts in IT Neutral Regimen.**

Energy Installations

Protection and Relays
- •AE3 **Test Unit for Magneto-Thermal Automatic Switches.**
- •AE4 **Test Unit for Differential Automatic Switches.**
- •AE5 **Relay Control Station.**
- •AE7 **Multi-Functional Electrical Protection Station.**
- •AE9 **Directional Relay:** Earth Fault Detection. Directional Power Flow Detection. Reactive Power Flow Detection.

Measurements and Control
- •AE2 **Reactive Energy Control and Compensation.**
- •AE6 **Energy Counters Control Station.**
- •AE8 **Power & Torque Measurements of Electrical Motors.**

Lines
- •AE1A **Aerial Line Model.**

Software

-CAI **Computer Aided Instruction Software System,** additional and optional to the LIELBA Applications type "A".

-CAL **Computer Aided Learning Software (Results Calculation and Analysis),** additional and optional to the LIELBA Applications type "A".

Data Acquisition

-MUAD **Electric Power Data Acquisition System,** for being used with the LIELBA Applications type "A".

page

-ELE-KITS **Electrical Installations Assembly Kits:** 69-78

- •BAS-K **Installation Cubicle.**

KITS:

Domestic Electrical Installations

General
- •KD1A **Robbery Alarm Station Kit.**
- •KD3A **Fire Alarm Station Kit.**
- •KD5 **Stair Lights Timing Kit.**
- •KD13 **Audio Door entry System Kit.**
- •KD14 **Audio and Video Door entry System Kit.**

Industrial Control
- •KD6A **Luminosity Control Station Kit.**
- •KD9A **Heating Control Station Kit.**
- •KD15A **Position Control Station Kit.**
- •KD17A **Photoelectric Control Position Station Kit.**
- •KD22 **Flooding Control Station Kit.**
- •KD23 **Wireless Basic Control Station (RF) Kit.**
- •KD24 **Position Switch Kit.**
- •KD25A **Kit of Control Station for Domestic Electric Services through the Telephone.**
- •KD28A **Kit of Integral Control Station of Domestic Electric Systems.**
- •KD30 **Gas Control Station Kit.**

Sound
- •KD19A **Sound Station Kit.**
- •KD31 **Movement and Sound Detection and Control Kit.**

Instruments
- •KD8 **Blinds Activator Kit.**
- •KD11A **Network Analyzer Kit.**
- •KD32 **24 Vac / 12 Vdc Circuits Analyzer Kit.**
- •KD33 **Installations Faults Simulator Kit.**

Industrial Electrical Installations

Starters and Motors
- •KI1 **Star-Delta Starter Kit.**
- •KI2 **Starter through Auto-Transformer Kit.**
- •KI4 **Starter-Inverter Kit.**
- •KI5 **AC Wound Rotor Motor Starter Kit.**
- •KI6 **DC Motor Starter Kit.**

Speed Control
- •KI3 **Speed Commutator for Dahlander Motor Kit.**
- •KI7 **Kit of Automatic Change of Speed of a Dahlander Motor with Change of Direction.**

Electrotecnics
- •KI8 **Kit of Reactive Power Compensation (Power Factor Correction).**

Safety
- •KI9 **Kit of People Safety Against Indirect Electrical Contacts in TT Neutral Regimen.**
- •KI10 **Kit of People Safety Against Indirect Electrical Contacts in TN Neutral Regimen.**
- •KI11 **Kit of People Safety Against Indirect Electrical Contacts in IT Neutral Regimen.**

Energy Installations

Protection and Relays
- •KE3 **Kit of Test Unit for Magneto-Thermal Automatic Switches.**
- •KE4 **Kit of Test Unit for Differential Automatic Switches.**
- •KE5 **Relay Control Station Kit.**
- •KE7 **Multi-Functional Electrical Protection Station Kit.**
- •KE9 **Kit of Directional Relay:** Earth Fault Detection. Directional Power Flow Detection. Reactive Power Flow Detection.

Measurements and Control
- •KE2 **Kit of Reactive Energy Control and Compensation.**
- •KE6 **Energy Counters Control Station Kit.**
- •KE8 **Kit of Power & Torque Measurements of Electrical Motors.**

Lines
- •KE1 **Aerial Line Model Kit.**

Software

-CAI **Computer Aided Instruction Software System,** additional and optional to the Kits type "K".

-CAL **Computer Aided Learning Software (Results Calculation and Analysis),** additional and optional to the Kits type "K".

Data Acquisition

-MUAD **Electric Power Data Acquisition System,** for being used with the Kits type "K".

-EIV2 **Home Automation Installations Trainer.** 79

-EIV6 **Home Automation Installations Trainer.** 79

page

4.2- Electricity Demonstration

-PDL **Lamps Demonstration Panel.** 79

-PDCE-P **Electric Cables Demonstration Panel (Power).** 79

-PDCE-S **Electric Cables Demonstration Panel (Signalling).** 79

-PDF **Fuses Demonstration Panel.** 79

4.3- Electrical Installations Workshop

-EIWS **Including furniture, tools, components, etc.**

4.4- Electrical Machines

-LIMEL **Integrated Laboratory for Electrical Machines:** 80-95

Electrical Machines Units

-EME **Electrical Machines Unit** (Advanced option).
-EME/M **Electrical Machines Unit** (Intermediate option).
-EME/B **Electrical Machines Unit** (Basic option).

Measurement Units

-MULT **Digital Multimeter.**
-EAL **Network Analyzer Unit (AC).**
-EALD **Network Analyzer Unit, with Computer Data Acquisition.**
-EALDG **Network Analyzer Unit, with Computer Data Acquisition+Oscilloscope Display.**
-EAL-DC **Network Analyzer Unit (DC).**
-EAM-VA **Analog Measurement Unit.**
-MUAD **Electric Power Data Acquisition System.**

Loads

-RCL3R **Resistive, Inductive and Capacitive Loads Module.**
-Individual elements:
-IND. **Inductance Module.**
-CON. **Capacitors Module.**
-REV. **Variable Resistance Module.**
-REV-T. **Three-phase Variable Resistance Module.**
-REF. **Fixed Resistance Module.**

Motors

Motors (D.C.)
-EMT1 **D.C. Independent excitation motor-generator.**
-EMT2 **D.C. Series excitation motor-generator.**
-EMT3 **D.C. Shunt excitation motor-generator.**
-EMT4 **D.C. Compound excitation motor-generator.**
-EMT5 **D.C. Shunt-series compound excitation motor.**
-EMT12 **Universal motor (single-phase).**
-EMT15 **D.C. Permanent magnet motor.**
-EMT18 **D.C. Brushless motor.**
-EMT19 **Stepper motor.**
Motors (A.C.)
-EMT6 **A.C. Synchronous three-phase motor alternator.**
-EMT6B **Permanent magnets synchronous three-phase generator (24 Vac).**
-EMT7 **Asynchronous three-phase motor of squirrel cage.**
-EMT7B **Asynchronous three-phase motor of squirrel cage (4 poles).**
-EMT7C **Asynchronous three-phase motor of squirrel cage (8 poles).**
-EMT8 **Asynchronous three-phase motor with wound rotor.**
-EMT9 **Dahlander three-phase (two-speeds).**
-EMT10 **Asynchronous three-phase motor of two independent speeds.**
-EMT11 **Asynchronous single-phase motor with starting capacitor.**
-EMT12 **Universal motor (single-phase).**
-EMT14 **Repulsion motor, single-phase with short-circuited brushes.**
-EMT16 **Asynchronous single-phase motor with starting and running capacitor.**
-EMT17 **Three-phase motor of squirrel cage with "Y" connection.**
-EMT20 **Asynchronous single-phase motor with split phase.**
-EMT21 **Three-phase reluctance motor.**
-EMT22 **Single-phase shaded pole motor.**

page

Brakes

-FRE-FE **Electronic Brake.**
-DI-FRE **Pendular Dynamo Brake.**
-EMCC **Load Cell Module.**
-FREND **Dynamo Brake.**
-FRENP **Magnetic Powder Brake.**
-FREPR **Prony Brake.**
-FRECP **Eddy Current Brake.**

Transformers

-ETT **Three-phase and single-phase Transformers Unit.**
-TPPT **Three- phase Power Transformer Unit.**
-EMPTA **Auxiliary Transformer and Protection Module.**
-AUTR **Variable Auto-transformer.**
-Individual elements:
-TRANS **Single-phase Transformer.**
-TRANS/3 **Three-phase Transformer.**

DC Motor Speed Control

-VVCC **DC Motor Speed Controller.**
-VVCC/M **DC Motor Speed Controller** (intermediate option).
-VVPP **Velocity Control for Stepper Motor** (Manual Control and Automatic Control).
-VVPP/B **Velocity Control for Stepper Motor** (Manual Control).
-Individual elements:
-VVCC/B **DC Motor Speed Controller,** with no other elements.

AC Motor Speed Control

-VVCA **AC Motor Speed Controller.**
-VVCA/M **AC Motor Speed Controller** (intermediate option).
-Individual elements:
-VVCA/B **AC Motor Speed Controller,** with no other elements.

PLC (Programmable Logic Controller)

-PLC-PI **PLC Module for the Control of Industrial Processes.**
-Individual elements:
-EDIBON FP-X-CPU **PLC,** with no other elements.

Tachogenerator

-TECNEL/T **Tachogenerator.**
-TECNEL/TM **Hand Tachometer.**

Software

-CAI **Computer Aided Instruction Software System.**
-CAL **Computer Aided Learning Software (Results Calculation and Analysis).**

Data Acquisition

-MUAD **Electric Power Data Acquisition System.**

-EMT-E **Motors** (available different type of motors). 96

-EMT-S **Cut Away Motors** (available different type of motors). 96

-ESAM **Faults Simulation Trainer in Electrical Motors.** 96

-ESAE **Electrical Faults Simulation Trainer.** 97

-EEA **Alternators Study Unit.** 97

-EGMG24 **Motor-Generator Group,** three-phase 24 Vac, no excitation required (permanent magnets). 97

-ERP **Protection Relays Test:** 98-101
• ERP-UB **Protection Relays Test Unit** (common for the relays modules type "ERP").

Relays Modules

• ERP-SFT **Overcurrent and Earth Fault Protection Relay Module.**
• ERP-SDND **Directional/Non Directional Overcurrent Protection Relay Module.**
• ERP-PDF **Differential Protection Relay Module.**
• ERP-MA **Feeders Management Relay Module.**
• ERP-PD **Distance Protection Relay Module.**

4.5- Electrical Machines Kits

-EMT-KIT **Disassembly Machines Kit.** 102

LIELBA. **Electrical Installations Integrated Laboratory:**

Domestic Electrical Installations

➤**General**

AD1A. **Robbery Alarm Station**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24 Vac and 24 Vdc adjustable.
DET27. Glass Break Detector.
INT32. Intrusion Switch/Detector. (2 units)
SEL03. 3 Pilot-Lights.
SEL21. Indoor Siren.
VAR07. Kit: Burglar Alarm Central + infrared ele. + battery.
Two-pole automatic differential switch and two-pole automatic thermal-magnetic switch for the security of the elements.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 490 x 450 x 470 mm. approx. Weight: 25 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AD1A.pdf

PRACTICAL POSSIBILITIES

1.- Identification of the elements of the main power supply.
2.- Checking the main power supply.
3.- Checking the auxiliary power supply.
4.- Checking the lamps and the alarm.
5.- Checking the alarm.
6.- Checking the glass break detector.
7.- Checking the infrared sensors.
8.- Checking the Burglar Alarm Central and tests.
9.- Real application, acoustic and luminous signal activation by means of detection the presence.

AD3A. **Fire Alarm Station**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
ALA02. Fire Alarm Station (with battery).
DET06. Smoke Detector for domestic control.
DET21. Fire Detector through Ionization for Central.
SEL21. Indoor Siren.
DET10. Water Electro-valve.
DET22. Fire Thermal Detector.
SEL17. Fire Indicators, Bell type.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 490 x 450 x 470 mm. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AD3A.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the station with fire detector, smoke detector and alarm.
2.- Test of the station with fire detector.
3.- Test of the station with smoke detector.
4.- Test of the station with detection of fire by the thermal detector.
5.- Activation of the electro-valve following the detection of the fire.

AD5. **Stair Lights Timing**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI02. Main Power Supply.
CTI10. Automatic of Stairs.
INT21. Switch+Commutator Group+Bell Push-Button. (2 units)
LAM08. 2 Lamp-holders + Incandescent Lamps 40W. (2 units)
LAM13. 2 Low Consumption Fluorescent Lamps. (2 units)
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 490 x 450 x 470 mm. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AD5.pdf

PRACTICAL POSSIBILITIES

1.- Identification of the elements of the main power supply.
2.- Checking the main power supply.
3.- Test of the set from two points with incandescent lamps.
4.- Test of the set from two points with fluorescent lamps.

AD13. **Audio Door entry System**

SPECIFICATIONS SUMMARY

Included modules:
ALI02. Main Power Supply.
POR01. Phones Power Supply.
POR02. Phone.
POR03. Interphone.
POR06. Lock.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the system.
2.- To check the interphone operation.

AD14. **Audio and Video Door entry System**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI02. Main Power Supply.
POR04. Video Camera.
POR05. Phone/Monitor and POR07.Digital Station.
POR06. Lock.
POR08. Video-Interphone Power Supply.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 490 x 450 x 470 mm. approx. Weight: 25 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AD14.pdf

PRACTICAL POSSIBILITIES

1.- Checking the main power supply (ALI02).
2.- Checking the Video-interphone power supply (POR08).
3.- Communication between Video camera (POR04) and Phone/monitor (POR05) / Digital station (POR07).
4.- Real application of an audio and video entry system.

LIELBA. **Electrical Installations Integrated Laboratory:**

Domestic Electrical Installations

➤**Industrial Control**

AD6A. **Luminosity Control Station**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI02. Main Power Supply.
COM14. 2 Commutators.
LAM08. 2 Lamp-holders + Incandescent Lamps (40W).
REG06. Voltage Electronic Regulator (Switch) 40 to 300W/230Vac.
INT18. 1-pole Switch + 1-pole Switch with Light.
LAM10. 2 Halogen Lamps.
LAM09. Fluorescent Lamp.
SEN26. Presence and Movement Sensor (Wall).
Two-pole automatic differential switch and two-pole automatic thermal-magnetic switch for the security of the elements.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 490 x 450 x 470 mm. approx. Weight: 40 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AD6A.pdf

PRACTICAL POSSIBILITIES

1.- Control of luminosity of an halogen lamp.
2.- Control of luminosity of an incandescent lamp.
3.- Light point from a switch.
4.- Light point from two devices.
5.- Fluorescent tube.
6.- Test of the station by movement sensor.
7.- Variation of the luminous intensity.
8.- Control of the lamp using a movement sensor.
9.- Luminosity control.
10.- Station complete control.

AD9A. **Heating Control Station**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI02. Main Power Supply.
TIM01. 2 Bell 70dB, 230V. (2 units)
SEL09. Double Luminous Signalling red-green 230Vac. (2 units)
MED76. Thermostat for Heating.
MED77. Thermostat for Heating and Refrigeration.
Two-pole automatic differential switch and two-pole automatic thermal-magnetic switch for the security of the elements.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 490 x 450 x 470 mm. approx. Weight: 20 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AD9A.pdf

PRACTICAL POSSIBILITIES

1.- Identification of the elements of the main power supply.
2.- Checking the main power supply.
3.- Checking relays.
4.- Checking the thermostat for heating and tests.
5.- Checking the thermostat for heating and refrigeration, and tests.
6.- Test with several temperatures and green light.
7.- Test with several temperatures and red light.
8.- Test with several temperatures and the siren.
9.- Test with several temperatures, red light and the siren.
10.- Test with several temperatures, green light and the siren.

AD15A. **Position Control Station**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24 Vac and 24 Vdc adjustable.
INT14. One-Pole 2 Switches.
SEL01. Light Signalling Beacons (lamps).
SEN04. Inductive Proximity Sensor type PNP.
SEN14. Cylindrical Capacitive Proximity Sensor.
SEN29. Cylindrical Inductive Proximity Sensor.
SEN01. Instantaneous Micro-switch.
SEN26. Presence and Movement Sensor (Wall).
Two-pole automatic differential switch and two-pole automatic thermal-magnetic switch for the security of the elements.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 490 x 450 x 470 mm. approx. Weight: 25 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AD15A.pdf

PRACTICAL POSSIBILITIES

1.- Identification of the elements of the main power supply.
2.- Checking the main power supply.
3.- Checking the auxiliary power supply.
4.- Checking the operation of the inductive sensor (DC).
5.- Checking the operation of the capacitive sensor.
6.- Checking the operation of the inductive sensor (AC).
7.- Bodies detection tests with inductive sensors.
8.- Bodies detection tests with capacitive sensor.
9.- Test check the movement detection of a body.
10.- Real application of a detection system.

AD17A. **Photoelectric Control Position Station**

SPECIFICATIONS SUMMARY

Included modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
LAM04. 3 Push-buttons and Lamps (24Vac). (2 units).
SEN18. Cylindrical Photoelectric Sensor.
SEN19. Miniature Photoelectric Sensor.
SEN20. Compact Photoelectric Sensor.
SEN21. Barrier Photoelectric Sensor (Emitter).
SEN22. Barrier Photoelectric Sensor (Receptor).
SEN23. Reflecting Photoelectric Sensor (Emitter).
SEN24. Reflecting Photoelectric Sensor (Receptor).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the control station.
2.- Test of the detection with cylindrical sensor.
3.- Test of the detection with miniature sensor.
4.- Test of the detection with compact sensor.
5.- Assembly of the control station with battery and sensors.
6.- Test of the detection with emitters and receivers.
7.- Test with only emitters and receptors.

LIELBA. **Electrical Installations Integrated Laboratory:**

Domestic Electrical Installations

➤**Industrial Control**

AD22. **Flooding Control Station**

SPECIFICATIONS SUMMARY

The complete application is formed by Unit 1 and Unit 2:
Unit 1, in metallic box, including the following modules:
ALI02. Main Power Supply.
ALI03/B. Auxiliary Power Supply 24 Vac and 24 Vdc adjustable.
DET03. Fitted Power Supply for the flooding detector.
DET04. Flooding Detector.
SEL03. 3 Pilot-Lights.
SEL21. Indoor Siren.
Two-pole automatic differential switch and two-pole automatic thermal-magnetic switch for the security of the elements.
Unit 2, including:
DET10. Water Electro-valve.
Pump and two transparent tanks.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions:
Unit 1: 490 x 450 x 470 mm. approx. Weight: 6 Kg. approx.
Unit 2: 400 x 350 x 370 mm. approx. Weight: 3 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AD22.pdf

PRACTICAL POSSIBILITIES

1.- Identification of the elements of the main power supply.
2.- Checking the main power supply.
3.- Checking the auxiliary power supply.
4.- Demonstration of the flooding detector operation.
5.- Assembly of the flooding control with a probe.
6.- Test of the flooding control.
7.- Test of the flooding control acting on the electro-valve.
8.- Test of the control acting on the siren.
9.- Demonstration of the detection system operation in a real application.

AD23. **Wireless Basic Control Station (RF)**

SPECIFICATIONS SUMMARY

Included modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
DET13. Wireless Intrusion Detector RF.
DET14. Wireless Panic Push-button RF.
DET15. Wireless 1-channel Receptor RF.
DET15. Wireless 1-channel Receptor RF.
SEL01. Light Signalling Beacons.
TIM05. Bell + Buzzer.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Wireless intrusion detection and alarm.
2.- Wireless panic button alarm.

AD24. **Position Switch**

SPECIFICATIONS SUMMARY

Included modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
LAM03. 3 Push-buttons and Lamps (220Vac).
SEN01. Instantaneous Micro-switch.
SEN02. MBB Micro-switch.
SEN03. BBM Micro-switch.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Instantaneous Micro-switch.
2.- MBB Micro-switch.
3.- BBM Micro-switch.

AD25A. **Control Station for Domestic Electric Services through the Telephone**

SPECIFICATIONS SUMMARY

Included modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CTR01. Basic Control Module.
DET01. Flooding Detector.
DET03. Fitted Power Supply (gas and flooding detector). (3units)
DET04. Flooding Detector (with probe).
DET05. Gas Detector for domestic control.
DET06. Smoke Detector for domestic control.
DET10. Water Electro-valve.
DET12. Gas Electro-valve.
DET13. Wireless Intrusion Detector RF.
DET14. Wireless Panic Push-button RF.
DET15. Wireless 1-channel Receptor RF.
VAR05. Tones Dialling Telephone.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Smoke detection.
2.- Gas detection and electro-valve control.
3.- Flooding detection and electro-valve control.
4.- Temperature and Battery.
5.- Intrusion detection.
6.- Wireless detection.
7.- Complete control of home electric services through the telephone.

LIELBA. **Electrical Installations Integrated Laboratory:**

Domestic Electrical Installations

➤**Industrial Control**

AD28A. **Integral Control Station of Domestic Electric Systems**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CTR02. Advanced Control Module.
CTR05. Power Module 72W.
CTR07. Timers Module.
CTR08. Inputs Module 24V.
CTR11. Outputs Module 24V.
CTR17. Infrared Remote Control for Control Modules.
CTR18. Infrared Receptor.
DET04. Flooding Detector (with probe).
DET05. Gas Detector for domestic control.
DET06. Smoke Detector for domestic control.
DET09. Intrusion Detector for domestic control.
DET10. Water Electro-valve.
DET12. Gas Electro-valve.
VAR08. Monitor.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AD28A.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the complete system with the smoke, flooding and gas detectors.
2.- Test of the station with smoke, flooding and gas detectors.
3.- To set the temporization and monitoring the results.
4.- Assembly of the complete system with infrared and instrusion detectors.
5.- Test of the station with infrared and instrusion detectors.
6.- Electro-valves activation.
7.- Wireless assembly of the sensor through infrared control

AD30. **Gas Control Station**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
DET02. Gas Detector.
DET03. Fitted Power Supply.
DET12. Gas Electro-valve.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 490 x 450 x 470 mm. approx. Weight: 25 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AD30.pdf

PRACTICAL POSSIBILITIES

1.- Checking the main power supply (ALI02).
2.- Checking the auxiliary power supply (ALI03).
3.- Checking the fitted power supply (DET03).
4.- Gas detection.
5.- Real application of the gas control station.

➤**Sound**

AD19A. **Sound Station**

SPECIFICATIONS SUMMARY

Included modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
AUD01. Analog Sound Regulator.
AUD04. Speaker of 2", 2W, 8 ohm. (3 units)
AUD06. Basic Audio Central.
AUD20. Analog Sound Regulator (mono-stereo).
AUD02. Digital Sound Regulator.
AUD05. Speaker of 4", 7W, 8 ohm. (3 units)
AUD03. Warnings Emitter Module.
AUD08. Background Music Regulator 3W.
AUD10. Double Background Music Regulator.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Mono-stereo system installation.
2.- Mono system with warnings reception.
3.- Mono-stereo system installation with warnings reception.
4.- Stereo system installation with warnings reception.
5.- Background music installation.

AD31. **Movement and Sound Detection and Control**

SPECIFICATIONS SUMMARY

Included modules:
ALI02. Main Power Supply.
INT15. 2 Switches with Light.
LAM08. 2 Lamp-holders + Incandescent Lamps 40W.
INT31. Intrusion Switch/Detector from 40 to 300W.
LAM10. 2 Halogen Lamps.
PUL22. 2 Light Push-Buttons.
TIM05. Bell + Buzzer.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Movement and sound detection controlled by switches.
2.- Movement and sound detection controlled by push-buttons.

LIELBA. **Electrical Installations Integrated Laboratory:**

Domestic Electrical Installations

➤**Instruments**

AD8. **Blinds Activator**

SPECIFICATIONS SUMMARY

Included modules:
ALI02. Main Power Supply.
INT22. 2 Switches for Blinds.
DET19. Twilight Detector.
DET20. Light Detector.
VAR01. Motor for Blinds / Curtains.
PUL29. 2 Push-Buttons Group for Blinds (without Interlock).
PUL30. 2 Push-Buttons Group for Blinds (with Interlock).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the activator (motor, detectors and switches).
2.- Blind activation by push-buttons.
3.- Blind activation by sensors.

AD11A. **Network Analyzer**

SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
MED11. AC Ammeter (0-10A).
MED25. Pointer Frequency Meter(45-65Hz).
MED32. 1-Phase Wattmeter 230V.
MED21. AC Voltmeter (0-250V).
MED30. 1-Phase Phasemeter 230V.
MED38. 1-Phase Varmeter 230V.
MED12. AC Ammeter (custom made). (3 units)
MED22. AC Voltmeter (0-400V). (3 units)
MED31. 3-Phase Phasemeter 400V. (3 units)
MED39. 3-Phase Balanced Varmeter 440V.
MED33. 3-Phase Balanced Wattmeter 440V.
MED63. Synchronoscope.
MED64. Phase Sequence Indicator.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the analyzer to measure current, voltage, frequency, active power, reactive power, sequence of phases of a 220V single-phase circuit.
2.- Assembly of the analyzer to measure current, voltage, frequency, active power, reactive power, sequence of phases of a 380V three-phase circuit.

AD32. **24 Vac/12 Vdc Circuits Analyzer**

SPECIFICATIONS SUMMARY

Included modules:
ALI02. Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
ALI04. DC Auxiliary Power Supply (+12, 0, -12 Vdc).
MED04. DC Milliammeter (0-600 mA).
MED05. DC Ammeter (0-1.5A).
MED08. AC Milliammeter (0-600mA).
MED09. AC Ammeter (0-2.5A).
MED15. DC Voltmeter (0-5V).
MED16. DC Voltmeter (0-50V).
MED19. AC Voltmeter (0-10V).
MED20. AC Voltmeter (0-60V).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- AC circuits analyzer (2 ranges).
2.- DC circuits analyzer (2 ranges).

AD33. **Installations Faults Simulator**

SPECIFICATIONS SUMMARY

Included modules:
ALI02. Main Power Supply.
COM14.2 Commutators. (2 units)
ENC09. 2-pole European Socket with Safety Device. (2 units)
COM21.Inverter + Group of 2 Commutators. (2 units)
LAM01. Lamps.
LAM08. 2 Lamp-holders + Incandescent Lamps 40W. (2 units)
LAM09. Fluorescent Lamp.
MED65. Digital Multimeter.
FUS04. 3 Fuse-holders 10A, 230Vac (include 2, 4,6,10A). Fault box.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Ground fault simulation of a plug base.
2.- Fault simulation between phases of a plug base.
3.- Ground fault simulation of an incandescent lamp base.
4.- Ground fault simulation of a fluorescent lamp base.
5.- Fault simulation between phases of an incandescent lamp base.
6.- To simulate fault of power-supply contact in the lamp base.
7.- To simulate fault of contact of the switch.
8.- To simulate fault of contact of the fuse.
9.- To simulate fault of contact of the fluorescent base.

LIELBA. **Electrical Installations Integrated Laboratory:**

Industrial Electrical Installations

➤**Starters and Motors**

AI1. **Star-Delta Starter**

SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CON01. 3-pole Contactor (24Vac). (3 units)
IAM20. 3-pole Magneto-thermal Automatic Switch, 4A, Curve C.
MED60. Network Analyzer.
PUL04. Push-Buttons with Light (24Vac).
REL02. Thermal Relay (1.6-2.5A).
REL11. Time Relay (0.6-60 sec.).
VAR02. Motor (EMT7) (squirrel cage).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the starter.
2.- Test of the starter with a squirrel cage motor.
3.- Measurement of the star current and delta current.
4.- Direct start of the motor. Measurement of the starting current.

AI2. **Starter through Auto-Transformer**

SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CON01. 3-pole Contactor (24Vac). (3 units)
IAM20. 3-pole Magneto-thermal Automatic Switch, 4A, Curve C.
MED60. Network Analyzer.
PUL04. Push-Buttons with Light (24Vac).
REL02. Thermal Relay (1.6-2.5A).
REL11. Time Relay (0.6-60 sec.).
TRA14. 3-Phase Auto-transformer.
VAR02. Motor (EMT7) (squirrel cage).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the starter.
2.- Test of the starter with a squirrel cage motor.
3.- Measurement of both the star and delta current.

AI4. **Starter-Inverter**

SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CON02. 3-pole Contactor (220Vac).
CON11. 3-pole Contactor- Inverter (220Vac).
MED60. Network Analyzer.
PUL03. Push-Buttons with Light (220Vac). (2 units)
REL05. Thermal Relay/3-pole Phase fault (0.8-1.2A).
VAR02. Motor (EMT7) (squirrel cage).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the starter.
2.- To test of the direct start of a squirrel cage motor.
3.- To invert the rotation direction of the motor.

AI5. **AC Wound Rotor Motor Starter**

SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
VAR06. Motor (EMT8) (wound rotor).
CAR22. AC Starting Rheostat.
IAM20. 3-pole Magneto-thermal Automatic Switch, 4A, Curve C.
CON01. 3-pole Contactor (24Vac).
PUL04. Push-Buttons with Light (24Vac).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the starter.
2.- To test the starter changing the resistances step by step.

LIELBA. **Electrical Installations Integrated Laboratory:**

Industrial Electrical Installations

➤**Starters and Motors**

AI6. **DC Motor Starter**

SPECIFICATIONS SUMMARY

Included modules:

ALI01. Industrial Main Power Supply.
ALI04. DC Auxiliary Power Supply (+12, 0, -12 Vdc).
VAR04. Motor (EMT5) (DC motor).
CAR23. DC Starting Rheostat.
IAM20. 3-pole Magneto-thermal Automatic Switch, 4A, Curve C.
CON03. 3-pole Contactor (12Vdc).
PUL04. Push-Buttons with Light (24Vac).
CAR20. Diodes and Thyristors.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Direct starter.
2.- Starter rheostat.

AI12. **Modular Trainer (AC Motors)**

SPECIFICATIONS SUMMARY

Included modules:

ALI01. Industrial Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
PUL48. 3 Double Chamber Push-buttons. (2 units)
LAM02. Auxiliary Lamps(3 lamps).
CON01. 3-pole Contactor (24Vac). (4 units)
VAR09. Frequency variator.
REL30. Synchronization Relay (variable delay).
REL47. Thermal Relay Module (2 units)
REL45. Module with disjunctor.
IAM31. 4-pole Magneto-thermal Automatic Switch, 4A, Curve C.
FUS10. Module with 3 Fuse-holders and Power Fuses.
TRA06. 3-Phase Power Transformer (custom made).
CAR10. Capacitive Load (custom made).
VAR02. Motor (EMT7) (squirrel cage).
VAR03. Motor (EMT9) (Dahlander motor).
VAR15. Single-phase Capacitor Motor (EMT16).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AI12.pdf

PRACTICAL POSSIBILITIES

1.- Identification of the main power supply elements.
2.- Study of the elements in the control of AC motors.
3.- Study of the protection elements for AC motors.
4.- Direct starting of a three-phase motor through contactor, with some stop and start push-buttons.
5.- Configuration of a magnetic protection system, with stop mush room button.
6.- Direct starting of a three-phase motor with thermal relay with control coil.
7.- Direct starting of a three-phase motor through impulses contactor.
8.- Direct starting of a three-phase motor with thermal relay and with push-buttons and signalling.
9.- Turning inverted starter of a three-phase motor stopping before turning in the opposite direction.
10.- Turning inverted starter of a three-phase motor without stopping before turning in the opposite direction.
11.- Turning inverted starter of a three-phase motor with microswitch and push-buttons box.
12.- Star-delta starting with an turn inverter of a three-phase motor.
13.- Automatic star-delta starting of a three-phase motor.
14.- Turning inverted starter of a three-phase motor with micro switch, with start push-buttons, stop and function cycle. (Direct).
15.- Manual star-delta starting of a three-phase motor.
16.- Control of a single phase motor direct and, with time-delay connection and disconnection.
17.- Starting of a three-phase motor with single- phase voltage.
18.- Motor speed control with a frequency variator.
19.- Parameters of the motor.
20.- Starting and control of a two-speed Dahlander motor.

LIELBA. **Electrical Installations Integrated Laboratory:**

Industrial Electrical Installations

➤Speed Control

AI3. **Speed Commutator for Dahlander Motor**

SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CON01. 3-pole Contactor (24Vac). (3 units)
IAM20. 3-pole Magneto-thermal Automatic Switch, 4A, Curve C.
MED60. Network Analyzer.
PUL04. Push-Buttons with Light (24Vac).
REL02. Thermal Relay (1.6-2.5A).
REL11. Time Relay (0.6-60 sec.).
VAR03. Motor (EMT9) (Dahlander motor).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the commutator.
2.- Test of the commutator changing the speed of a Dahlander motor.
3.- Measurement of the voltage and current.

AI7. **Automatic Change of Speed of a Dahlander Motor with Change of Direction**

SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
IAM24. 3-pole+neutral Magneto-thermal Automatic Switch, 6A, Curve C.
CON01. 3-pole Contactor (24Vac). (5 units)
REL05. Thermal Relay/3-pole Phase fault (0.8-1.2A). (2 units)
PUL16. Push-Button for Industrial use (NC Contacts). (5 units)
PUL16. Push-Button for Industrial use (NO Contacts). (5 units)
VAR03. Motor (EMT9) (Dahlander motor).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the set.
2.- Motor starting with right turning direction at high speed. R.p.m and consumption measurements.
3.- Motor stop and change to left the turning direction at high speed.
4.- Change to low speed.
5.- Motor stop and change to right the turning direction.
6.- Change to high speed. R.p.m and consumption measurements.

➤Electrotecnics

AI8. **Reactive Power Compensation (Power Factor Correction)**

SPECIFICATIONS SUMMARY

This application includes:
AI8 unit, in metallic box, including:
Three-phase AC power supply.
Variable resistive load (variable resistance), 500 W, variable up to 150 Ω by a rheostat.
Two coils with inductive loads of 33, 78, 140, 193 and 236 mH, each one.
Three banks of of 4 capacitors of 7 mF, each one.
Ground connection.
Protection fuses (3.15A).
EAL. Network Analyzer Unit.
This unit shows the main electric parameters on the electric network through the interface and an parameter selection.
Metallic box.
3 current inputs, for series intensity.
3 voltage terminals, for each phase (R,S,T) measure and another one for the connection.
Control and visualization digital display.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.):
AI8. Unit: 490 x 330 x 310 mm. Weight: 30 Kg.
EAL. Unit: 300 x 180 x 120 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AI8.pdf

PRACTICAL POSSIBILITIES

1.- Measurement of active power consumed by a receiver (resistive circuit).
2.- Measurement of the inductance of a coil.
3.- Measurement of the reactance XL considering RL.
4.- Measurement of reactive power consumed by a receiver (inductive circuit).
5.- Measurement of reactive power consumed by a receiver (capacitive circuit).
6.- Measurement of apparent power consumed by a receiver.
7.- Measurement of power factor of a receiver.
8.- Measurement of active energy consumed by a receiver.
9.- Measurement of reactive energy consumed by a receiver.
10.- Compensation of reactive energy (improvement of the power factor).
11.- Comparison of the active energy consumed after the compensation.
12.- Comparison of the reactive energy consumed after the compensation.
13.- Measurement of power factor after the compensation.

LIELBA. **Electrical Installations Integrated Laboratory:**

Industrial Electrical Installations

➤**Electrotecnics**

AI13. **Modular Trainer for Electrotecnics**

SPECIFICATIONS SUMMARY

Included modules:

ALI01. Industrial Main Power Supply.
ALI10. Power Supply Module.
CAR30. Inductances Module.
CAR31. Capacitors Module.
CAR32. Rectifier Diodes Module.
CAR33. Resistive Components Module.
LAM26. Lighting Module.
LAM09. Fluorescent Lamp.
MED65. Digital Multimeter.
REL50. Relays Module.
TRA28. Three-phase Transformer.
VAR17. Dismantled Transformer Kit.
VAR15. Single-phase Capacitor Motor (EMT16).
VAR02. Motor (EMT7) (squirrel cage).
VAR25. Open Universal Motor (EMT12).
VAR16. Electromagnetism Kit with Group of Motor/ Generator.
VAR18. Electrostatic Kit.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AI13.pdf

PRACTICAL POSSIBILITIES

Static Electricity:
1.-Electrostatic demonstration on several materials.
2.-The Electroscope.
3.-The Acetate.
4.-Sign of the charge.
5.-Static electricity checking, with an electroscope and an electrometer.
6.-Static electricity experiments.

Magnetism, Electromagnetism and Electromagnetic Induction:
7.-Electromagnetic induction.
8.-Electromagnet: Oersted´s experiment.
9.-The electromagnetic field (Electromagnets).

Direct current (DC) and Alternating Current (AC):
10.- Ohm´s law verification.
11.- Resistance measurement.
12.- Resistors in series association.
13.- Resistors in parallel association.
14.- Power measurement of a resistive circuit.
15.- Analysis of the variable resistances response curve.
16.- Voltage divider analysis.
17.- Simplification systems; Application of Kirchhoff´s first law. Application of Kirchhoff´s second law. Thevenin´s and Norton´s Theorem.
18.- Application of the superposition theorem.
19.- Coils in series association.
20.- Coils in parallel association.
21.- Measurement and visualization of the alternating current.
22.- Measurement of the phase angle among voltages (AC).
23.- Resistive circuits in delta.
24.- Resistive circuits in star.
25.- Star/delta transformation.
26.- Delta/star transformation.
27.- Lamp with variable lighting.
28.- Connection of lamps in series.
29.- Connection of lamps in parallel.

Electric capacity:
30.- Capacity measurement of a capacitor.
31.- Capacitors series association.
32.- Capacitors parallel association.
33.- Charge analysis of a capacitor.
34.- Dischange analysis of a capacitor.

Dynamic Electricity:
35.- Identification of the components of the trainer.
36.- Preparation of the power supply and of the measurement instruments.

Motors:
37.- Electric motors.
38.- Generators.
39.- Single-phase motor.
40.- Universal motor.
41.- Squirrel-cage three-phase motor.
42.- Identification, coils measurement and starting-up of a single-phase motor.
43.- Identification, measurement and starting-up of an universal motor.
44.- Identification, coils measurement and starting-up of a three phase motor.
45.- Electric energy into mechanic energy conversion.
46.- Mechanic energy into electric energy conversion.
47.- Electric energy into magnetic energy conversion.
48.- Magnetic induction: Lenz´s Law.

Transformers:
49.- Assembling the transformer.
50.- Back transformer.
51.- Boost transformer.
52.- Auto-transformer.
53.- Experiments and practices with a dismantled transformer.
54.- Identification of the three-phase transformer.
55.- Connection as single-phase transformer.
56.- Star/star three-phase connection.
57.- Reverse star/star three-phase connection.
58.- Direct delta/delta three-phase connection.
59.- Star/delta three-phase connection.
60.- Three-phase/six-phase connection.
61.- Transformer with coils in series in phase.

RL, RC and RCL Circuits:
62.- Time constant.
63.- Analysis of a RL circuit in series.
64.- Analysis of a RL circuit in parallel.
65.- Analysis of a RC circuit in series.
66.- Analysis of a RC circuit in parallel.
67.- Analysis of a RCL circuit in series.
68.- Analysis of a RCL circuit in parallel.

Rectification and filtrate:
69.- Low-pass filter.
70.- High-pass filter.
71.- Analysis of the rectifier diode response curve.
72.- Half wave rectification.
73.- Full wave rectification.
74.- Rectification to feed the universal motor.
75.- Double wave rectification with two windings.
76.- Double wave rectification with a Graezt's bridge.
77.- Half wave three-phase rectification.
78.- Three-phase rectification in bridge.

Electric circuits of application:
79.- Basic electric installation with lamps.
80.- Lamps controlled by a switch or a push button.
81.- Lamps controlled from two points
82.- Lamps controlled from three points.
83.- Lamps control by a switch relay.
84.- Lamps control by a commutator relay.
85.- Acoustic circuit.
86.- Fluorescent tube.

LIELBA. **Electrical Installations Integrated Laboratory:**

Industrial Electrical Installations

➤**Electrotecnics**

AI13-A. **Modular Trainer for Electrotecnics (RLC Circuits)**

SPECIFICATIONS SUMMARY

Included modules:

ALI01. Industrial Main Power Supply.

ALI10. Power Pupply Module.

CAR30. Inductances Module.

CAR31. Capacitors Module.

CAR32. Rectifier Diodes Module.

CAR33. Resistive Components Module.

MED65. Digital Multimeter.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions: 490 x 450 x 470 mm. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AI13-A.pdf

PRACTICAL POSSIBILITIES

Direct current (DC) and Alternating Current (AC):

1.- Ohm´s law verification.
2.- Resistance measurement.
3.- Resistors in series association.
4.- Resistors in parallel association.
5.- Power measurement of a resistive circuit.
6.- Analysis of the variable resistances response curve.
7.- Voltage divider analysis.
8.- Simplification systems: Application of Kirchhoff´s first law. Application of Kirchhoff´s second law. Thevenin´s and Norton´s Theorem.
9.- Application of the superposition theorem.
10.- Coils in series association.
11.- Coils in parallel association.
12.- Measurement and visualization of the alternating current.
13.- Measurement of the phase angle among voltages (AC).
14.- Resistive circuits in delta.
15.- Resistive circuits in star.
16.- Star/delta transformation.
17.- Delta/star transformation.

Electric capacity:

18.- Capacity measurement of a capacitor.
19.- Capacitors series association.
20.- Capacitors parallel association.
21.- Charge analysis of a capacitor.
22.- Discharge analysis of a capacitor.

RL, RC and RCL Circuits:

23.- Time constant.
24.- Analysis of a RL circuit in series.
25.- Analysis of a RL circuit in parallel.
26.- Analysis of a RC circuit in series.
27.- Analysis of a RC circuit in parallel.
28.- Analysis of a RLC circuit in series.
29.- Analysis of a RLC circuit in parallel.

Rectification and filtrate:

30.- Low-pass filter.
31.- High-pass filter.
32.- Analysis of the rectifier diode response curve.
33.- Half wave rectification.
34.- Full wave rectification.
35.- Rectification to feed the universal motor.
36.- Double wave rectification with two windings.
37.- Double wave rectification with a Graezt's bridge.
38.- Half wave three-phase rectification.
39.- Three-phase rectification in bridge.

AI13-B. **Modular Trainer for Electrotecnics (Electrostatic Kit)**

SPECIFICATIONS SUMMARY

VAR18. Electrostatic Kit:

Case containing:

- PVC bar.
- PVC tube.
- Nylon bar.
- Aluminium bar.
- Acetate sheets. (2 units)
- Electroscope (vertical base and hook, aluminium sheets, aluminium ball).
- Rabbit skin.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AI13-B.pdf

PRACTICAL POSSIBILITIES

1.- Electrostatic demonstration on several materials.
2.- The Electroscope.
3.- The Acetate.
4.- Sign of the charge.
5.- Static electricity checking, with an electroscope and an electrometer.
6.- Static electricity experiments.

LIELBA. **Electrical Installations Integrated Laboratory:**

Industrial Electrical Installations

➤**Electrotecnics**

AI13-C. **Modular Trainer for Electrotecnics (Motors)**

SPECIFICATIONS SUMMARY

Included modules:

ALI01. Industrial Main Power Supply.
ALI10. Power Supply Module.
VAR15. Single-phase Capacitor Motor (EMT16).
VAR25. Open Universal Motor (EMT12).
VAR02. Motor (EMT17) (squirrel cage).
VAR16. Electromagnetism Kit with Group of Motor/Generator.
MED65. Digital Multimeter.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AI13-C.pdf

PRACTICAL POSSIBILITIES

1.- Electric motors.
2.- Generators.
3.- Single-phase motor.
4.- Universal motor.
5.- Squirrel-cage three-phase motor.
6.- Identification, coils measurement and starting-up of a single-phase motor.
7.- Identification, measurement and starting-up of an universal motor.
8.- Identification, coils measuremt and starting-up of a three-phase motor.
9.- Electric energy into mechanic energy conversion.
10.- Mechanic energy into electric energy conversion.
11.- Electric energy into magnetic energy conversion.
12.- Magnetic induction: Lenz´s Law.
13.- Electromagnetic induction.
14.- Electromagnet: Oersted's experiment.
15.- The electromagnetic field (Electromagnets).

AI13-D. **Modular Trainer for Electrotecnics (Transformers)**

SPECIFICATIONS SUMMARY

Included modules:

EME/B. Electrical Machines Unit.
VAR17. Dismantled Transformer Kit.
TRA28. Three-phase Transformer.
MED65. Digital Multimeter.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AI13-D.pdf

PRACTICAL POSSIBILITIES

1.- Assembling the transformer.
2.- Back transformer.
3.- Boost transformer.
4.- Auto-transformer.
5.- Experiments and practices with a dismantled transformer.
6.- Identification of the three-phase transformer.
7.- Connection as single-phase transformer.
8.- Star/star three-phase connection.
9.- Reverse star/star three-phase connection.
10.- Direct delta/delta three-phase connection.
11.- Star/delta three-phase connection.
12.- Three-phase/six-phase connection.
13.- Transformer with coils in series in phase.

AI13-E. **Modular Trainer for Electrotecnics (Lighting)**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:

ALI02. Main Power Supply.
ALI10. Power Supply Module.
LAM09. Fluorescent Lamp.
MED65. Digital Multimeter.
REL50. Relays Module.
LAM26. Lighting Module.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 490 x 450 x 470 mm. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AI13-E.pdf

PRACTICAL POSSIBILITIES

1.- Connection of lamps in series.
2.- Connection of lamps in parallel.
3.- Lamp with variable lighting.
4.- Basic electric installation with lamps.
5.- Lamps controlled by a switch or a push button.
6.- Lamps controlled from two points.
7.- Lamps controlled from three points.
8.- Lamps control by a switch relay.
9.- Lamps control by a commutator relay.
10.- Acoustic circuit.
11.- Fluorescent tube.

LIELBA. **Electrical Installations Integrated Laboratory:**

Industrial Electrical Installations

➤**Safety**

AI9. **People Safety Against Indirect Electrical Contacts in TT Neutral Regimen**

SPECIFICATIONS SUMMARY

Included modules:

ALI01. Industrial Main Power Supply.

CAR05. Double Variable Resistive Load, 150 ohm, 500 W. Resistance 1600 Ω.

COM12. Commutator/Switch.

PUL11. 2 Double Push-Buttons (230Vac).

TRA12. 3-Phase Current Transformer.

IAD13. 3-pole + neutral Differential Automatic Switch, 25A, 300mA, class AC, instantaneous.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Study of an isolation fault in TT neutral regimen.

2.- Structure of a differential switch. Necessity to use a differential switch.

3.- Study of the selectivity among differential switches.

AI10. **People Safety Against Indirect Electrical Contacts in TN Neutral Regimen**

SPECIFICATIONS SUMMARY

Included modules:

ALI01. Industrial Main Power Supply.

COM12. Commutator/Switch. (2 units).

TRA12. 3-Phase Current Transformer.

IAD01. 1-pole+neutral Differential Automatic Switch, 6A, 30mA, class A.

Resistance 200 W.

Resistance 100 Ω, 72W.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Study of an isolation fault in TN neutral regimen.

2.- Measurement of the ground loop impedances.

3.- Indirect contact with defect mass.

4.- The case in which the automatic switches are not suitable in TN-C conditions.

5.- The case in which the automatic switches are not suitable in TN-S conditions.

AI11. **People Safety Against Indirect Electrical Contacts in IT Neutral Regimen**

SPECIFICATIONS SUMMARY

Included modules:

ALI01. Industrial Main Power Supply.

INT01. 1-pole Load Switch. (2 units)

INT02. 2-pole Load Switch. (2 units)

CPA. Isolation Permanent Controller.

Capacitor 300V. 200 nF .(2 units)

Resistance 100 Ω.

Resistance 10 Ω.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Study of an isolation simple fault.

2.- Study of an isolation double fault (only with one mass).

3.- Study with several masses.

4.- Operation of the isolation controller.

5.- Study of the ground loop impedance.

LIELBA. **Electrical Installations Integrated Laboratory:**

Energy Installations

➤**Protection and Relays**

AE3. **Test Unit for Magneto-Thermal Automatic Switches**

SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
CAR04. Variable Resistive Load.
IAM13. 2-pole Magneto-thermal Automatic Switch, 1A, Curve C.
TRA19. Transformer for Experiments (custom made).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- To connect the set.
2.- To simulate a high current (thermal) and to test if the automatic switch breaks.
3.- To measure the current and to check the tripping.

AE4. **Test Unit for Differential Automatic Switches**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI02. Main Power Supply.
IAD01. 1-pole+neutral Differential Automatic Switch, 6A, 30mA, class A.
CAR04. Variable Resistive Load.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 490 x 330 x 310 mm. approx. Weight: 5 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AE4.pdf

PRACTICAL POSSIBILITIES

1.- To simulate a fault to earth and to test if the differential breaks.
2.- To calculate the current earth fault.
3.- Study of fault circuit.

AE5. **Relay Control Station**

SPECIFICATIONS SUMMARY

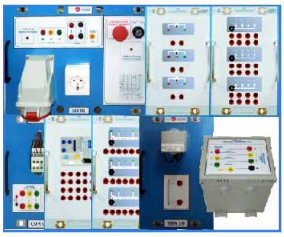
Application, in metallic box, including the following modules:
ALI01. Industrial Main Power Supply.
REL23/A. Earth Leakage Relay.
REL23/B. Over Current Relay.
CON01. 3-pole Contactor (24 Vac).
TRA03. Single-phase Voltage Transformer 220 Vac/24 Vac.
TRA10. Current Transformer 25/5A.
CAR18/A. Rheostat for Equivalent Circuit of an Electric Line.
CAR18/B. Inductance for Equivalent Circuit of an Electric Line.
CAR18/C. Capacitor for Equivalent Circuit of an Electric Line.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AE5.pdf

PRACTICAL POSSIBILITIES

1.- To connect the transformers to a line.
2.- To connect the protection relay.
3.- To simulate a line fault and the relay will trip the circuit breaker.
4.- Start up of a three-phase contactor.
5.- Calculation of the transformation ratio of a toroid.
6.- Calculation of the parameters of a line.
7.- Start up of an over current relay.
8.- Start up of an earth leakage relay.

AE7. **Multi-Functional Electrical Protection Station**



SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
CAR08. 3-phase Variable Resistive Load (custom made).
CAR11. 3-phase Capacitive Load.
CON01. 3-pole Contactor (24Vac).
REL22. Multi-function Protection Relay (software included).
TRA04. 3-Phase Power Transformer 380/220V, 630VA.
CAR14. 3-Phase Inductive Load.
TRA10. Current Transformer 25/5A.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the station with the relay.
2.- To simulate faults in the line.
3.- To simulate under and/or overvoltage, changing the line parameters.
4.- To check if the relay trips the contactor.

AE9. **Directional Relay:** Earth Fault Detection. Directional Power Flow Detection. Reactive Power Flow Detection

SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
CAR08. 3-Phase Variable Resistive Load (custom made).
CON01. 3-Pole Contactor (24Vac).
CAR11. 3-Phase Capacitive Load.
TRA04. 3-Phase Power Transformer 380/220V, 630VA.
REL20. 1-Phase Directional Relay.
CAR14. 3-Phase Inductive Load.
TRA10. Current Transformer 25/5A.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the set.
2.- Directional relay tripping test, in a case of an earth fault.
3.- To test the tripping when power flows in the opposite direction.
4.- To test the tripping when the reactive power is over or under certain limit.

LIELBA. **Electrical Installations Integrated Laboratory:**

Energy Installations

➤Measurements and Control

AE2. **Reactive Energy Control and Compensation**

SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI01. Industrial Main Power Supply.
CAR08. 3-phase Variable Resistive Load (custom made).
CAR11. 3-phase Capacitive Load.
CAR14. 3-phase Inductive Load.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AE2.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the set with inductive load.
2.- Power Factor (cos φ) measurement.
3.- To calculate the necessary capacitors to get cos φ= 1.
4.- Capacitors connection and power factor measurement.

AE6. **Energy Counters Control Station**

SPECIFICATIONS SUMMARY

This complete application includes:
Unit, in a metallic box, including the following modules:
ALI01. Industrial Main Power Supply.
CAR01. Fixed Resistive Load, 150 ohms, 500 W.
MED72. Energy Counter.
TRA04. Three-phase Power Transformer: 1 KVA. 380/220 Vac.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.):
AE6. Unit: 490 x 330 x 310 mm. Weight: 15 Kg.
Transformer TRA04: 195 x 152 x 215 mm. Weight: 6 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AE6.pdf

PRACTICAL POSSIBILITIES

1.- Indentification of the elements of the main power supply.
2.- Checking the main power supply.
3.- To measure the energy consumed by the load with the energy counter.
4.- Checking the three-phase power transformer.

AE8. **Power & Torque Measurements of Electrical Motors**

SPECIFICATIONS SUMMARY

Included modules:
ALI01. Industrial Main Power Supply.
ALI03. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CON02. 3-pole Contactor (220Vac).
PUL11. 2 Double Push-Buttons (230Vac).
REL08. Time Electronic Relay against Overcurrents (0.3-1.5A).
MED60. Network Analyzer.
VAR02. Motor (EMT7) (squirrel cage).
FREND. Dynamo Brake.
TECNEL/T. Tachodynamo.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

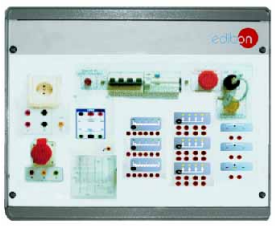
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the set and to start the motor and dynamo.
2.- To change the dynamo current and to measure both the power and the torque of the motor.
3.- To obtain the efficiency curve.

➤Lines

AE1A **Aerial Line Model**



SPECIFICATIONS SUMMARY

Application, in metallic box, including the following modules:
ALI01. Industrial Main Power Supply.
CAR08. 3-phase Variable Resistive Load (custom made).
CAR11. 3-phase Capacitive Load.
CAR14. 3-phase Inductive Load.
TRA05. 3-Phase Power Transformer 220/127V, 1000VA.
CAR18. Aerial Line Model.
TRA18. Petersen Coil.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

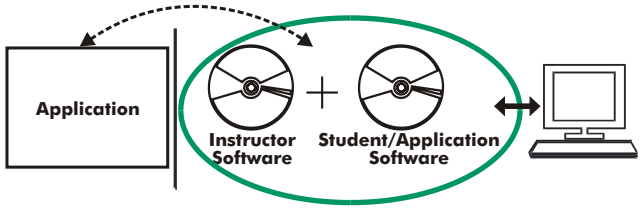
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/AE1.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the set.
2.- Measurement of the voltage without loads.
3.- Measurement of the voltage with loads.
4.- Power Factor (cos φ) measurement.
5.- Fault to earth and measurement of the current through the Petersen coil.

LIELBA. **Electrical Installations Integrated Laboratory:**

CAI. Computer Aided Instruction Software System



With no physical connection between application and computer (PC), this complete package consists on an Instructor Software (INS/SOF) totally integrated with the Student/Application Software (A.../SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students. These, on the other hand, get a virtual instructor who helps them to deal with all the information on the subject of study.

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

The Instructor can:

- Organize Students by Classes and Groups.
- Create easily new entries or delete them.
- Create data bases with student information.
- Analyze results and make statistical comparisons.
- Print reports.
- Develop own examinations.
- Detect student's progress and difficulties.

...and many other facilities.

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

Instructor Software

- A.../SOF. Computer Aided Instruction Softwares (Student/Application Software):

It explains how to use the application, run the experiments and what to do at any moment. Each application has its own Student Software.

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

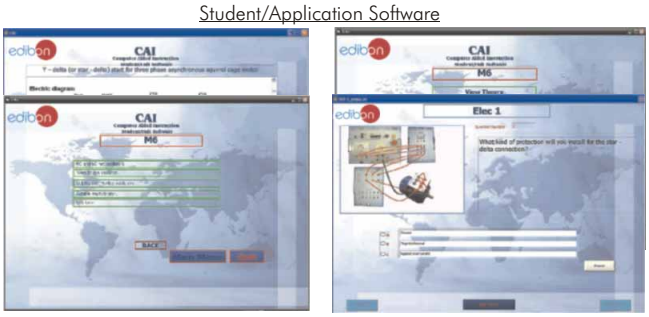
  Theory: that gives the student the theoretical background for a total understanding of the studied subject.

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

  Guided Practices: presents several practices to be done with the application, showing how to complete the circuits and get the right information from them.

  Exams: set of questions presented to test the obtained knowledge.

Student/Application Software



Available Student/Application Softwares:

Domestic Electrical Installations

➤General

AD1A/SOF. Robbery Alarm Station.
AD3A/SOF. Fire Alarm Station.
AD5/SOF. Stair Lights Timing.
AD13/SOF. Audio Door entry System.
AD14/SOF. Audio and Video Door entry System.

➤Industrial Control

AD6A/SOF. Luminosity Control Station.
AD9A/SOF. Heating Control Station.
AD15A/SOF. Position Control Station.
AD17A/SOF. Photoelectric Control Position Station.
AD22/SOF. Flooding Control Station.
AD23/SOF. Wireless Basic Control Station (RF).
AD24/SOF. Position Switch.
AD25A/SOF. Control Station for Domestic Electric Services through the Telephone.
AD28A/SOF. Integral Control Station of Domestic Electric Systems.
AD30/SOF. Gas Control Station.

➤Sound

AD19A/SOF. Sound Station.
AD31/SOF. Movement and Sound Detection and Control.

➤Instruments

AD8/SOF. Blinds Activator.
AD11A/SOF. Network Analyzer.
AD32/SOF. 24 Vac /12 Vdc Circuits Analyzer.
AD33/SOF. Installations Faults Simulator.

Industrial Electrical Installations:

➤Starter and Motors

AI1/SOF. Star-Delta Starter.
AI2/SOF. Starter through Auto-Transformer.
AI4/SOF. Starter-Inverter.
AI5/SOF. AC Wound Rotor Motor Starter.
AI6/SOF. DC Motor Starter.
AI12/SOF. Modular Trainer (AC Motors).

➤Speed Control

AI3/SOF. Speed Commutator for Dahlander Motor.
AI7/SOF. Automatic Change of Speed of a Dahlander Motor with Change of Direction.

➤Electrotecnins

AI8/SOF. Reactive Power Compensation (Power Factor Correction).
AI13/SOF. Modular Trainer for Electrotecnics.
AI13-A/SOF. Modular Trainer for Electrotecnics (RLC circuits).
AI13-B/SOF. Modular Trainer for Electrotecnics (Electrostatic Kit).
AI13-C/SOF. Modular Trainer for Electrotecnics (Motors).
AI13-D/SOF. Modular Trainer for Electrotecnics (Transformers).
AI13-E/SOF. Modular Trainer for Electrotecnics (Lighting).

➤Safety

AI9/SOF. People Safety Against Indirect Electrical Contacts in TT Neutral Regimen.
AI10/SOF. People Safety Against Indirect Electrical Contacts in TN Neutral Regimen.
AI11/SOF. People Safety Against Indirect Electrical Contacts in IT Neutral Regimen.

Energy Installations:

➤Protection and Relays

AE3/SOF. Test Unit for Magneto-Thermal Automatic Switches.
AE4/SOF. Test Unit for Differential Automatic Switches.
AE5/SOF. Relay Control Station.
AE7/SOF. Multi-Functional Electrical Protection Station.
AE9/SOF. Directional Relay: Earth Fault Detection. Directional Power Flow Detection. Reactive Power Flow Detection.

➤Measurements and Control

AE2/SOF. Reactive Energy Control and Compensation.
AE6/SOF. Energy Counters Control Station.
AE8/SOF. Power & Torque Measurements of Electrical Motors.

➤Lines

AE1/SOF. Aerial Line Model.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

LIELBA. **Electrical Installations Integrated Laboratory:**

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

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

CAL is a class assistant that helps in making the necessary calculations to extract the right conclusions from data obtained during the experimental practices.

CAL will perform the calculations.

CAL computes the value of all the variables involved.

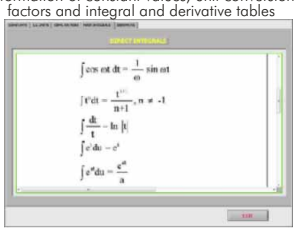
It allows to plot and print the results. Between the plotting options, any variable can be represented against any other.

Different plotting displays.

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

Calculations

Information of constant values, unit conversion factors and integral and derivative tables



Plotting options

Available Softwares:

Domestic Electrical Installations

➤General

AD1A/CAL. Robbery Alarm Station.
AD3A/CAL. Fire Alarm Station.
AD5/CAL. Stair Lights Timing.
AD13/CAL. Audio Door entry System.
AD14/CAL. Audio and Video Door entry System.

➤Industrial Control

AD6A/CAL. Luminosity Control Station.
AD9A/CAL. Heating Control Station.
AD15A/CAL. Position Control Station.
AD17A/CAL. Photoelectric Control Position Station.
AD22/CAL. Flooding Control Station.
AD23/CAL. Wireless Basic Control Station (RF).
AD24/CAL. Position Switch.
AD25A/CAL. Control Station for Domestic Electric Services through the Telephone.
AD28A/CAL. Integral Control Station of Domestic Electric Systems.
AD30/CAL. Gas Control Station.

➤Sound

AD19A/CAL. Sound Station.
AD31/CAL. Movement and Sound Detection and Control.

➤Instruments

AD8/CAL. Blinds Activator.
AD11A/CAL. Network Analyzer.
AD32/CAL. 24 Vac /12 Vdc Circuits Analyzer.
AD33/CAL. Installations Faults Simulator.

Industrial Electrical Installations:

➤Starter and Motors

AI1/CAL. Star-Delta Starter.
AI2/CAL. Starter through Auto-Transformer.
AI4/CAL. Starter-Inverter.
AI5/CAL. AC Wound Rotor Motor Starter.
AI6/CAL. DC Motor Starter.
AI12/CAL. Modular Trainer (AC Motors).

➤Speed Control

AI3/CAL. Speed Commutator for Dahlander Motor.
AI7/CAL. Automatic Change of Speed of a Dahlander Motor with Change of Direction.

➤Electrotecnins

AI8/CAL. Reactive Power Compensation (Power Factor Correction).
AI13/CAL. Modular Trainer for Electrotecnics.
AI13-A/CAL. Modular Trainer for Electrotecnics (RLC circuits).
AI13-B/CAL. Modular Trainer for Electrotecnics (Electrostatic Kit).
AI13-C/CAL. Modular Trainer for Electrotecnics (Motors).
AI13-D/CAL. Modular Trainer for Electrotecnics (Transformers).
AI13-E/CAL. Modular Trainer for Electrotecnics (Lighting).

➤Safety

AI9/CAL. People Safety Against Indirect Electrical Contacts in TT Neutral Regimen.
AI10/CAL. People Safety Against Indirect Electrical Contacts in TN Neutral Regimen.
AI11/CAL. People Safety Against Indirect Electrical Contacts in IT Neutral Regimen.

Energy Installations:

➤Protection and Relays

AE3/CAL. Test Unit for Magneto-Thermal Automatic Switches.
AE4/CAL. Test Unit for Differential Automatic Switches.
AE5/CAL. Relay Control Station.
AE7/CAL. Multi-Functional Electrical Protection Station.
AE9/CAL. Directional Relay: Earth Fault Detection. Directional Power Flow Detection. Reactive Power Flow Detection.

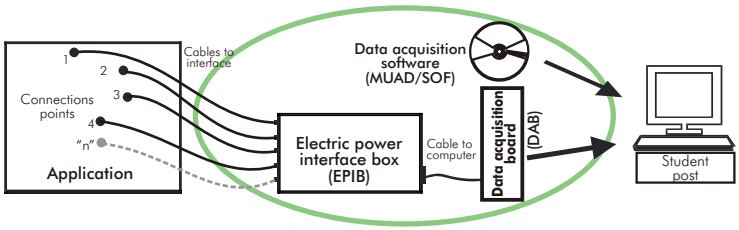
➤Measurements and Control

AE2/CAL. Reactive Energy Control and Compensation.
AE6/CAL. Energy Counters Control Station.
AE8/CAL. Power & Torque Measurements of Electrical Motors.

➤Lines

AE1/CAL. Aerial Line Model.

MUAD. Electric Power Data Acquisition System



MUAD is the perfect link between the application and the PC. MUAD is a continuous data acquisition system with virtual instrumentation, that measures, analyzes and represents the parameters involved in the process.
MUAD allows voltage and current acquisition and measurement, data processing, frequency spectrum and all the functions of a digital oscilloscope.
We easily connect the Electric Power Interface Box (EPIB) to the application with the supplied cables (there are several connection points placed for it). The EPIB is connected to the PC through the Data Acquisition Board (DAB), and by using the Data Acquisition with Virtual Instrumentation Software, the student can get results from the undertaken experiment/practice, see them on the screen and work with them.

This MUAD System includes EPIB + DAB + MUAD/SOF:

1) EPIB. **Electric Power Interface Box** (dimensions: 300 x 120 x 180 mm. approx.):
Interface that carries out the conditioning of the diverse signals that can be acquired in a process, for their later treatment and visualisation.
In the front panel, the elements are separated in two parts: left-hand part to VOLTAGE sensors, and right-hand part corresponds with CURRENT sensors.
Analog Input Channels:
8 analog input channels. Sampling range: 250 KSPS (Kilo samples per second).
4 Tension sensors AC/DC, 400V. 4 Current sensors.

EPIB

+

DAB

+

2) DAB. **Data Acquisition Board :**
PCI Data acquisition board (National Instruments) to be placed in a computer slot.
Analog input:
Number of channels= 16 single-ended or 8 differential.
Resolution=16 bits, 1 in 65536.
Sampling rate up to: 250 KSPS (Kilo samples per second).
Analog output:
Number of channels=2.
Resolution=16 bits, 1 in 65536.
Digital Input/Output:
Number channels=24inputs/outputs.
Timing: Counter/timers=2.

3) MUAD/SOF. **Data Acquisition Software** :
Data Acquisition Software with Graphic Representation:
Friendly graphical frame.
Compatible with actual Windows operating systems.
Configurable software allowing the representation of temporal evolution of the different signals.
Visualization of a tension of the circuits on the computer screen.
Sampling velocity up to 250 KSPS. (Kilo samples per second).

MUAD/SOF

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/LIELBA.pdf

ELE-KITS. **Electrical Installations Assembly Kits:**

BAS-K. **Installation Cubicle**

SPECIFICATIONS SUMMARY

All sides panel with rear and side walls and roof.
Standard dimensions: 1200 x 1000 x 2000 mm.
Other dimensions available on request.

Domestic Electrical Installations

➤**General**

KD1A. **Robbery Alarm Station Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
DET27-K. Glass Break Detector.
INT32-K. Intrusion Switch/Detector. (2 units)
SEL03-K. 3 Pilot-Lights.
SEL21-K. Indoor Siren.
VAR07-K. Kit: Burglar Alarm Central + infrared ele. + battery.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the station with intrusion detector and alarm.
2.- Assembly of the station with glass breaking detector and alarm.
3.- Assembly of the station with both types of detectors and alarm.
4.- Assembly of the station with infrared detectors.

KD3A. **Fire Alarm Station Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
ALA02-K. Fire Alarm Station (with battery).
DET06-K. Smoke Detector for domestic control.
DET21-K. Fire Detector through Ionization for Central.
SEL21-K. Indoor Siren.
DET10-K. Water Electro-valve.
DET22-K. Fire Thermal Detector.
SEL17-K. Fire Indicators, Bell type.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the station with fire detector, smoke detector and alarm.
2.- Test of the station with fire detector.
3.- Test of the station with smoke detector.
4.- Test of the station with detection of fire by the thermal detector.
5.- Activation of the electro-valve following the detection of the fire.

KD5. **Stair Lights Timing Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
CTI10-K. Automatic of Stairs.
INT21-K. Switch+Commutator Group+Bell Push-Button. (2 units)
LAM08-K. 2 Lamp-holders + Incandescent Lamps 40W.(2 units)
LAM13-K. 2 Low Consumption Fluorescent Lamps.(2 units)
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the basic set of temporization.
2.- Test of the set from two points with incandescent lamps.
3.- Test of the set from two points with fluorescent lamps.

KD13. **Audio Door entry System Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
POR01-K. Phones Power Supply.
POR02-K. Phone.
POR03-K. Interphone.
POR06-K. Lock.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the system.
2.- To check the interphone operation.

KD14. **Audio and Video Door entry System Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
POR04-K. Video Camera.
POR05-K. Phone/Monitor.
POR06-K. Lock.
POR07-K. Digital Station.
POR08. Video-Interphone Power Supply.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the system.
2.- To check of the video and audio operation.

ELE-KITS. **Electrical Installations Assembly Kits:**

Domestic Electrical Installations

➤**Industrial Control**

KD6A. **Luminosity Control Station Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
COM14-K. 2 Commutators.
LAM08-K. 2 Lamp-holders + Incandescent Lamps 40W.
REG06-K. Voltage Electronic Regulator (Switch) 40 to 300W/ 230Vac.
INT18-K. 1-pole Switch + 1-pole Switch with Light.
LAM10-K. 2 Halogen Lamps.
LAM09-K. Fluorescent Lamp.
SEN26-K. Presence and Movement Sensor (Wall).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the control station.
2.- Control of luminosity of an halogen lamp.
3.- Control of luminosity of an incandescent lamp.
4.- Test of the station by movement sensor.
5.- Luminosity control.
6.- Complete control.

KD9A. **Heating Control Station Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
TIM01-K. 2 Bell 70dB, 230V. (2 units)
SEL09-K. Double Luminous Signalling red-green 230Vac. (2 units)
MED76-K. Thermostat for Heating.
MED77-K. Thermostat for Heating and Refrigeration.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the heating control station.
2.- Assembly of the heating and refrigeration control.
3.- Test with several temperatures.

KD15A. **Position Control Station Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
INT14-K. One-pole 2 Switches.
SEL01-K. Light Signalling Beacons (lamps).
SEN04-K. Inductive Proximity Sensor type PNP.
SEN14-K. Cylindrical Capacitive Proximity Sensor.
SEN29-K. Cylindrical Inductive Proximity Sensor.
SEN01-K. Instantaneous Micro-Switch.
SEN26-K. Presence and Movement Sensor (Wall).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the station with sensors.
2.- Test of the capacitive detection of a body.
3.- Test of the inductive position detection of a body.
4.- Assembly of the station with presence and movement wall sensor.
5.- To check the movement detection of a body.

KD17A. **Photoelectric Control Position Station Kit**

SPECIFICATIONS SUMMARY

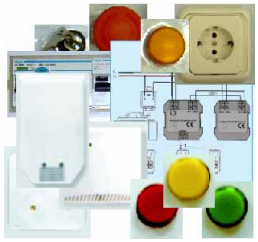
Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
LAM04-K. 3 Push-buttons and Lamps (24Vac). (2 units)
SEN18-K. Cylindrical Photoelectric Sensor.
SEN19-K. Miniature Photoelectric Sensor.
SEN20-K. Compact Photoelectric Sensor.
SEN21-K. Barrier Photoelectric Sensor (Emitter).
SEN22-K. Barrier Photoelectric Sensor (Receptor).
SEN23-K. Reflecting Photoelectric Sensor (Emitter).
SEN24-K. Reflecting Photoelectric Sensor (Receptor).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the control station.
2.- Test of the detection with cylindrical sensor.
3.- Test of the detection with miniature sensor.
4.- Test of the detection with compact sensor.
5.- Assembly of the control station with battery and sensors.
6.- Test of the detection with emitters and receivers.
7.- Test with only emitters and receptors.

KD22. **Flooding Control Station Kit**



SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
DET03-K. Fitted Power Supply for the flooding detector.
DET04-K. Flooding Detector.
SEL03-K. 3 Pilot-Lights.
SEL21-K. Indoor Siren.
DET10-K. Water Electro-valve.
DET11-K. Probe for Water Electro-valve. (2 units)
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the flooding control with a probe.
2.- Test of the flooding control.
3.- Test of the flooding control acting on an eletro-valve.

ELE-KITS. **Electrical Installations Assembly Kits:**

Domestic Electrical Installations

➤**Industrial Control**

KD23. **Wireless Basic Control Station (RF) Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
DET13-K. Wireless Intrusion Detector RF.
DET14-K. Wireless Panic Push- button RF.
DET15-K. Wireless 1-channel Receptor RF.
SEL01-K. Light Signalling Beacons.
TIM05-K. Bell + Buzzer.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Wireless intrusion detection and alarm.
2.- Wireless panic button alarm.

KD24. **Position Switch Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
LAM03-K. 3 Push-buttons and Lamps (220Vac).
SEN01-K. Instantaneous Micro- switch.
SEN02-K. MBB Micro-switch.
SEN03-K. BBM Micro-switch.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Instantaneous Micro-switch.
2.- MBB Micro-switch.
3.- BBM Micro-switch.

KD25A. **Kit of Control Station for Domestic Electric Services through the Telephone**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CTR01-K. Basic Control Element.
DET01-K. Flooding Detector.
DET03-K. Fitted Power Supply (gas and flooding detector). (3units)
DET04-K. Flooding Detector (with probe).
DET05-K. Gas Detector for domestic control.
DET06-K. Smoke Detector for domestic control.
DET10-K. Water Electro-valve.
DET12-K. Gas Electro-valve.
DET13-K. Wireless Intrusion Detector RF.
DET14-K. Wireless Panic Push- button RF.
DET15-K. Wireless 1-channel Receptor RF.
VAR05-K. Tones Dialling Telephone.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Smoke detection.
2.- Gas detection and electro-valve control.
3.- Flooding detection and electro-valve control.
4.- Temperature and Battery.
5.- Intrusion detection.
6.- Wireless detection.
7.- Complete control of home electric services through the telephone.

KD28A. **Kit of Integral Control Station of Domestic Electric Systems**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CTR02-K. Advanced Control Element.
CTR05-K. Power Element 72W.
CTR07-K. Timers Element.
CTR08-K. Inputs Element 24V.
CTR11-K. Outputs Element 24V.
CTR17-K. Infrared Remote Control for Control Elements.
CTR18-K. Infrared Receptor.
DET04-K. Flooding Detector (with probe).
DET05-K. Gas Detector for domestic control.
DET06-K. Smoke Detector for domestic control.
DET09-K. Intrusion Detector for domestic control.
DET10-K. Water Electro-valve.
DET12-K. Gas Electro-valve.
VAR08-K. Monitor.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the complete system with the smoke, flooding and gas detectors.
2.- Test of the station with smoke, flooding and gas detectors.
3.- To set the temporization and monitoring the results.
4.- Assembly of the complete system with infrared and instrusion detectors.
5.- Test of the station with infrared and instrusion detectors.
6.- Electro-valves activation.
7.- Wireless assembly of the sensor through infrared control.

KD30. **Gas Control Station Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
DET12-K. Gas Electro-valve.
DET03-K. Fitted Power Supply (gas and flooding detector).
DET02-K. Gas Detector.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Gas detection.
2.- Electro-valve activation.

ELE-KITS. **Electrical Installations Assembly Kits:**

Domestic Electrical Installations

➤Sound

KD19A. **Sound Station Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
AUD01-K. Analog Sound Regulator.
AUD04-K. Speaker of 2", 2W, 8 ohm. (3 units)
AUD06-K. Basic Audio Central.
AUD20-K. Analog Sound Regulator (mono-stereo).
AUD02-K. Digital Sound Regulator.
AUD05-K. Speaker of 4", 7W, 8 ohm. (3 units)
AUD03-K. Warnings Emitter Module.
AUD08-K. Background Music Regulator 3W.
AUD10-K. Double Background Music Regulator.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Mono-stereo system installation.
2.- Mono system with warnings reception.
3.- Mono-stereo system installation with warnings reception.
4.- Stereo system installation with warnings reception.
5.- Background music installation.

KD31. **Movement and Sound Detection and Control Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
INT15-K. 2 Switches with Light.
LAM08-K. 2 Lamp-holders + Incandescent Lamps 40W.
INT31-K. Intrusion Switch/Detector from 40 to 300W.
LAM10-K. 2 Halogen Lamps.
PUL22-K 2 Light Push-Buttons.
TIM05-K. Bell + Buzzer.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Movement and sound detection controlled by switches.
2.- Movement and sound detection controlled by push-buttons.

➤Instruments

KD8. **Blinds Activator Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
INT22-K. 2 Switches for Blinds.
DET19-K. Twilight Detector.
DET20-K. Light Detector.
VAR01-K. Motor for Blinds/Curtains.
PUL29-K. 2 Push-Buttons Group for Blinds (without Interlock).
PUL30-K. 2 Push-Buttons Group for Blinds (with Interlock).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the activator (motor, detectors and switches).
2.- Blind activation by push-buttons.
3.- Blind activation by sensors.

KD11A. **Network Analyzer Kit**

SPECIFICATIONS SUMMARY

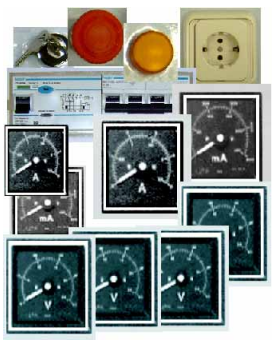
Included elements:
ALI01-K. Industrial Main Power Supply.
MED11-K. AC Ammeter (0-10A).
MED25-K. Pointer Frequency Meter (45-65Hz).
MED32-K. 1-Phase Wattmeter 230V.
MED21-K. AC Voltmeter (0-250V).
MED30-K. 1-Phase Phasemeter 230V.
MED38-K. 1-Phase Varmeter 230V.
MED12-K. AC Ammeter (custom made). (3 units)
MED22-K. AC Voltmeter (0-400V). (3 units)
MED31-K. 3-Phase Phasemeter 400V. (3 units)
MED39-K. 3-Phase Balanced Varmeter 440V.
MED33-K. 3-Phase Balanced Wattmeter 440V.
MED63-K. Synchronoscope.
MED64-K. Phase Sequence Indicator.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the analyzer to measure current, voltage, frequency, active power, reactive power, sequence of phases of a 220V single-phase circuit.
2.- Assembly of the analyzer to measure current, voltage, frequency, active power, reactive power, sequence of phases of a 380V three-phase circuit.

KD32. **24 Vac/12 Vdc Circuits Analyzer Kit**



SPECIFICATIONS SUMMARY

Included elements
ALI02-K. Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
ALI04-K. DC Auxiliary Power Supply (+12, 0, -12 Vdc).
MED04-K. DC Milliammeter (0-600 mA).
MED05-K. DC Ammeter (0-1.5A).
MED08-K. AC Milliammeter (0-600mA).
MED09-K. AC Ammeter (0-2.5A).
MED15-K. DC Voltmeter (0-5V).
MED16-K. DC Voltmeter (0-50V).
MED19-K. AC Voltmeter (0-10V).
MED20-K. AC Voltmeter (0-60V).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

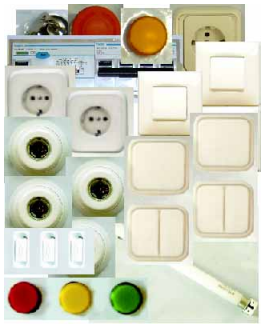
1.- AC circuits analyzer (2 ranges).
2.- DC circuits analyzer (2 ranges).

ELE-KITS. **Electrical Installations Assembly Kits:**

Domestic Electrical Installations

➤**Instruments**

KD33. **Installations Faults Simulator Kit**



SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
COM14-K. 2 Commutators. (2 units)
ENC09-K. 2-pole European Socket with Safety Device. (2 units)
COM21-K. Inverter + Group of 2 Commutators. (2 units)
LAM01-K. Lamps.
LAM08-K. 2 Lamp-holders + Incandescent Lamps 40W. (2 units)
LAM09-K. Fluorescent Lamp.
MED65-K. Digital Multimeter.
FUS04-K. 3 Fuse-holders 10A, 230Vac (include 2, 4,6,10A).
Faults Box.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Ground fault simulation of a plug base.
2.- Fault simulation between phases of a plug base.
3.- Ground fault simulation of an incandescent lamp base.
4.- Ground fault simulation of a fluorescent lamp base.
5.- Fault simulation between phases of an incandescent lamp base.
6.- To simulate fault of power-supply contact in the lamp base.
7.- To simulate fault of contact of the switch.
8.- To simulate fault of contact of the fuse.
9.- To simulate fault of contact of the fluorescent base.

Industrial Electrical Installations

➤**Starters and Motors**

KI1. **Star-Delta Starter Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CON01-K. 3-pole Contactor (24Vac). (3 units)
IAM20-K. 3-pole Magneto-thermal Automatic Switch, 4A, Curve C.
MED60-K. Network Analyzer.
PUL04-K. Push-Buttons with Light (24Vac).
REL02-K. Thermal Relay (1.6-2.5A).
REL11-K. Time Relay (0.6-60 sec.).
VAR02-K. Motor (EMT7) (squirrel cage).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the starter.
2.- Test of the starter with a squirrel cage motor.
3.- Measurement of the star current and delta current.
4.- Direct start of the motor. Measurement of the starting current.

KI2. **Starter through Auto-Transformer Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CON01-K. 3-pole Contactor (24Vac). (3 units).
IAM20-K. 3-pole Magneto-thermal Automatic Switch, 4A, Curve C.
MED60-K. Network Analyzer.
PUL04-K. Push-Buttons with Light (24Vac).
REL02-K. Thermal Relay (1.6-2.5A).
REL11-K. Time Relay (0.6-60 sec.).
TRA14-K. 3-Phase Auto-transformer.
VAR02-K. Motor (EMT7) (squirrel cage).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the starter.
2.- Test of the starter with a squirrel cage motor.
3.- Measurement of both the star and delta current.

KI4. **Starter-Inverter Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CON02-K. 3-pole Contactor (220Vac).
CON11-K. 3-pole Contactor- Inverter (220Vac).
MED60-K. Network Analyzer.
PUL03-K. Push-Buttons with Light (220Vac). (2 units)
REL05-K. Thermal Relay/3-pole Phase fault (0.8-1.2A).
VAR02-K. Motor (EMT7) (squirrel cage).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the starter.
2.- To test of the direct start of a squirrel cage motor.
3.- To invert the rotation direction of the motor.

KI5. **AC Wound Rotor Motor Starter Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
VAR06-K. Motor (EMT8) (wound rotor).
CAR22-K. AC Starting Rheostat.
IAM20-K. 3-pole Magneto-thermal Automatic Switch, 4A, Curve C.
CON01-K. 3-pole Contactor (24Vac).
PUL04-K. Push-Buttons with Light (24Vac).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the starter.
2.- To test the starter changing the resistances step by step.

ELE-KITS. **Electrical Installations Assembly Kits:**

Industrial Electrical Installations

➤Starters and Motors

KI6. **DC Motor Starter Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
ALI04-K. DC Auxiliary Power Supply (+12, 0, -12 Vdc).
VAR04-K. Motor (EMT5) (DC motor).
CAR23-K. DC Starting Rheostat.
IAM20-K. 3-pole Magneto-thermal Automatic Switch, 4A, Curve C.
CON03-K. 3-pole Contactor (12Vdc).
PUL04-K. Push-Buttons with Light (24Vac).
CAR20-K. Diodes and Thyristors.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Direct starter.
2.- Starter rheostat.

➤Speed Control

KI3. **Speed Commutator for Dahlander Motor Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CON01-K. 3-pole Contactor (24Vac). (3 units)
IAM20-K. 3-pole Magneto-thermal Automatic Switch, 4A, Curve C.
MED60-K. Network Analyzer.
PUL04-K. Push-Buttons with Light (24Vac).
REL02-K. Thermal Relay (1.6-2.5A).
REL11-K. Time Relay (0.6-60 sec.).
VAR03-K. Motor (EMT9) (Dahlander motor).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the commutator.
2.- Test of the commutator changing the speed of a Dahlander motor.
3.- Measurement of the voltage and current.

KI7. **Kit of Automatic Change of Speed of a Dahlander Motor with Change of Direction**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
IAM24-K. 3-pole+neutral Magneto- thermal Automatic Switch, 6A, Curve C.
CON01-K. 3-pole Contactor (24Vac). (5 units)
REL05-K. Thermal Relay/3-pole Phase fault (0.8-1.2A). (2 units)
PUL16-K. Push-Button for Industrial use (NC Contacts). (5 units)
PUL16-K. Push-Button for Industrial use (NO Contacts). (5 units)
VAR03-K. Motor (EMT9) (Dahlander motor).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the set.
2.- Motor starting with right turning direction at high speed. R.p.m and consumption measurements.
3.- Motor stop and change to left the turning direction at high speed.
4.- Change to low speed.
5.- Motor stop and change to right the turning direction.
6.- Change to high speed. R.p.m and consumption measurements.

➤Electrotecnics

KI8. **Kit of Reactive Power Compensation (Power Factor Correction)**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
CAR04-K. Variable Resistive Load, 150 ohm, 500W.
CAR09-K. Capacitive Load 4 x 7 µF.
CAR12-K. Inductive Load 0-33-78- 140-193-236 mH. (2 units)
MED60B-K. Network Analyzer with active and reactive energy counters.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Measurement of active power consumed by a receiver.
2.- Measurement of reactive power consumed by a receiver.
3.- Measurement of apparent power consumed by a receiver.
4.- Measurement of power factor of a receiver.
5.- Measurement of active energy consumed by a receiver.
6.- Measurement of reactive energy consumed by a receiver.
7.- Compensation of reactive energy (improvement of the power factor).
8.- Comparison of the active energy consumed after the compensation.
9.- Comparison of the reactive energy consumed after the compensation.
10.- Measurement of power factor after the compensation.

➤Safety

KI9. **Kit of People Safety Against Indirect Electrical Contacts in TT Neutral Regimen**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
CAR05-K. Double Variable Resistive Load , 150 ohm, 500 W . Resistance 1600 Ω.
COM12-K. Commutator/Switch.
PUL11-K. 2 Double Push-Buttons (230Vac).
TRA12-K. 3-Phase Current Transformer.
AD13-K. 3-pole + neutral Differential Automatic Switch, 25A, 300mA, class AC, instantaneous.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

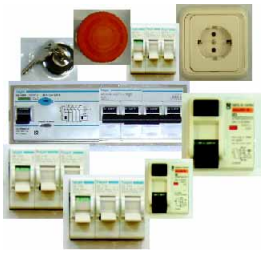
1.- Study of an isolation fault in TT neutral regimen.
2.- Structure of a differential switch. Necessity to use a differential switch.
3.- Study of the selectivity among differential switches.

ELE-KITS. **Electrical Installations Assembly Kits:**

Industrial Electrical Installations

➤**Safety**

KI10. **Kit of People Safety Against Indirect Electrical Contacts in TN Neutral Regimen**



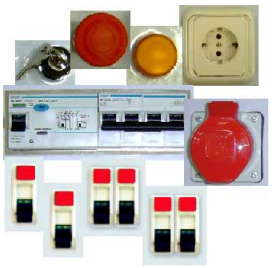
SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
COM12-K. Commutator/Switch. (2 units)
TRA12-K. 3-Phase Current Transformer.
IAD01-K. 1-pole+neutral Differential Automatic Switch, 6A, 30mA, class A.
Resistance 200 W.
Resistance 100 Ω, 72W.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Study of an isolation fault in TN neutral regimen.
2.- Measurement of the ground loop impedances.
3.- Indirect contact with defect mass.
4.- The case in which the automatic switches are not suitable in TN-C conditions.
5.- The case in which the automatic switches are not suitable in TN-S conditions.

KI11. **Kit of People Safety Against Indirect Electrical Contacts in IT Neutral Regimen**



SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
INT01-K. 1-pole Load Switch. (2 units)
INT02-K. 2-pole Load Switch .(2 units)
CPA-K. Isolation Permanent Controller.
Capacitor 300V. 200 nF. (2 units)
Resistance 100 Ω.
Resistance 10 Ω.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Study of an isolation simple fault.
2.- Study of an isolation double fault (only with one mass).
3.- Study with several masses.
4.- Operation of the isolation controller.
5.- Study of the ground loop impedance.

Energy Installations

➤**Protection and Relays**

KE3. **Kit of Test Unit for Magneto-Thermal Automatic Switches**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
CAR04-K. Variable Resistive Load.
IAM13-K. 2-pole Magneto-thermal Automatic Switch, 1A, Curve C.
TRA19-K. Transformer for Experiments (custom made).
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- To connect the set.
2.- To simulate a high current (thermal) and to test if the automatic switch breaks.
3.- To measure the current and to check the tripping.

KE4. **Kit of Test Unit for Differential Automatic Switches**

SPECIFICATIONS SUMMARY

Included elements:
ALI02-K. Main Power Supply.
IAD01-K. 1-pole+neutral Differential Automatic Switch, 6A, 30mA, class A.
CAR04-K. Variable Resistive Load.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- To simulate a fault to earth and to test if the differential breaks.
2.- To calculate the current earth fault.
3.- Study of fault circuit.

KE5. **Relay Control Station Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
REL23-K. Overcurrent Relay and Fault to Earth.
CON01-K. 3-pole Contactor (24Vac).
TRA10-K. Current Transformer 25/5A.
CAR18-K. Aerial Line Model.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- To connect the transformers to line.
2.- To connect the protection relay.
3.- To simulate a line fault and the relay will trip the circuit breaker.

KE7. **Multi-Functional Electrical Protection Station Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
CAR08-K. 3-phase Variable Resistive Load (custom made).
CAR11-K. 3-phase Capacitive Load.
CON01-K. 3-pole Contactor (24Vac).
REL22-K. Multi-function Protection Relay (software included).
TRA04-K. 3-Phase Power Transformer 380/220V, 630VA.
CAR14-K. 3-phase Inductive Load.
TRA10-K. Current Transformer 25/5A.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the station with the relay.
2.- To simulate faults in the line.
3.- To simulate under and/or overvoltage, changing the line parameters.
4.- To check if the relay trips the contactor.

ELE-KITS. **Electrical Installations Assembly Kits:**

Energy Installations

➤Protection and Relays

KE9. **Kit of Directional Relay:** Earth Fault Detection. Directional Power Flow Detection. Reactive Power Flow Detection

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
CAR08-K. 3-phase Variable Resistive Load (custom made).
CON01-K. 3-pole Contactor (24Vac).
CAR11-K. 3-phase Capacitive Load.
TRA04-K. 3-Phase Power Transformer 380/220V, 630VA.
REL20-K. 1-Phase Directional Relay.
CAR14-K. 3-phase Inductive Load.
TRA10-K. Current Transformer 25/5A.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the set.
2.- Directional relay tripping test, in a case of an earth fault.
3.- To test the tripping when power flows in the opposite direction.
4.- To test the tripping when the reactive power is over or under certain limit.

➤Measurements and Control

KE2. **Kit of Reactive Energy Control and Compensation**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
CAR08-K. 3-phase Variable Resistive Load (custom made).
CAR11-K. 3-phase Capacitive Load.
CAR14-K. 3-phase Inductive Load.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the set with inductive load.
2.- Power Factor (cos φ) measurement.
3.- To calculate the necessary capacitors to get cos φ = 1.
4.- Capacitors connection and power factor measurement.

KE6. **Energy Counters Control Station Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
CAR01-K. Fixed Resistive Load, 150 ohm, 500 W.
MED72-K. Energy Counter.
TRA04-K. Three-Phase Power Transformer.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- To measure the energy consumed by the load with the energy counter.
2.- Checking the three-phase power transformer.

KE8. **Kit of Power & Torque Measurements of Electrical Motors**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
ALI03-K. Auxiliary Power Supply 24Vac and 24Vdc adjustable.
CON02-K. 3-pole Contactor (220Vac).
PUL11-K. 2 Double Push-Buttons (230Vac).
REL08-K. Time Electronic Relay against Overcurrents 0.3-1.5A).
MED60-K. Network Analyzer.
VAR02-K. Motor (EMT7) (squirrel cage).
FREND. Dynamo Brake.
TECNEL/T. Tachodynamo.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the set and to start the motor and dynamo.
2.- To change the dynamo current and to measure both the power and the torque of the motor.
3.- To obtain the efficiency curve.

➤Lines

KE1. **Aerial Line Model Kit**

SPECIFICATIONS SUMMARY

Included elements:
ALI01-K. Industrial Main Power Supply.
CAR08-K. 3-phase Variable Resistive Load (custom made).
CAR11-K. 3-phase Capacitive Load.
CAR14-K. 3-phase Inductive Load.
TRA05-K. 3-Phase Power Transformer 220/127V, 1000VA.
CAR18-K. Aerial Line Model.
TRA18-K. Petersen Coil.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

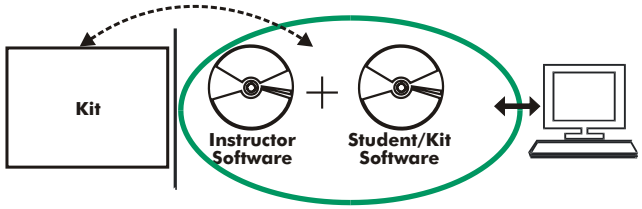
More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

PRACTICAL POSSIBILITIES

1.- Assembly of the set.
2.- Measurement of the voltage without loads.
3.- Measurement of the voltage with loads.
4.- Power Factor (cos φ) measurement.
5.- Fault to earth and measurement of the current through the Petersen coil.

ELE-KITS. **Electrical Installations Assembly Kits:**

CAI. Computer Aided Instruction Software System



With no physical connection between Kit and computer (PC), this complete package consists on an Instructor Software (INS/SOF) totally integrated with the Student/Kit Software (K.../SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students. These, on the other hand, get a virtual instructor who helps them to deal with all the information on the subject of study.

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

The Instructor can:

- Organize Students by Classes and Groups.
- Create easily new entries or delete them.
- Create data bases with student information.
- Analyze results and make statistical comparisons.
- Print reports.
- Develop own examinations.
- Detect student's progress and difficulties.

...and many other facilities.

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

Instructor Software

- K.../SOF. Computer Aided Instruction Softwares (Student/Kit Software):

It explains how to use the kit, run the experiments and what to do at any moment.
Each kit has its own Student Software.

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

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

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

  Guided Practices: presents several practices to be done with the kit, showing how to complete the circuits and get the right information from them.

  Exams: set of questions presented to test the obtained knowledge.

Student/Kit Software

Available Student/Kit Softwares:

Domestic Electrical Installations

➤General

KD1A/SOF. Robbery Alarm Station Kit.
KD3A/SOF. Fire Alarm Station Kit.
KD5/SOF. Stair Lights Timing Kit.
KD13/SOF. Audio Door entry System Kit.
KD14/SOF. Audio and Video Door entry System Kit.

➤Industrial Control

KD6A/SOF. Luminosity Control Station Kit.
KD9A/SOF. Heating Control Station Kit.
KD15A/SOF. Position Control Station Kit.
KD17A/SOF. Photoelectric Control Position Station Kit.
KD22/SOF. Flooding Control Station Kit.
KD23/SOF. Wireless Basic Control Station (RF) Kit.
KD24/SOF. Position Switch Kit.
KD25A/SOF. Control Station for Domestic Electric Services through the Telephone Kit.
KD28A/SOF. Integral Control Station of Domestic Electric Systems Kit.
KD30/SOF. Gas Control Station Kit.

➤Sound

KD19A/SOF. Sound Station Kit.
KD31/SOF. Movement and Sound Detection and Control Kit.

➤Instruments

KD8/SOF. Blinds Activator Kit.
KD11A/SOF. Network Analyzer Kit.
KD32/SOF. 24 Vac / 12 Vdc Circuits Analyzer Kit.
KD33/SOF. Installations Faults Simulator Kit.

Industrial Electrical Installations:

➤Starter and Motors

KI1/SOF. Star-Delta Starter Kit.
KI2/SOF. Starter through Auto-Transformer Kit.
KI4/SOF. Starter-Inverter Kit.
KI5/SOF. AC Wound Rotor Motor Starter Kit.
KI6/SOF. DC Motor Starter Kit.

➤Speed Control

KI3/SOF. Speed Commutator for Dahlander Motor Kit.
KI7/SOF. Automatic Change of Speed of a Dahlander Motor with Change of Direction Kit.

➤Electrotecnins

KI8/SOF. Reactive Power Compensation (Power Factor Correction) Kit.

➤Safety

KI9/SOF. People Safety Against Indirect Electrical Contacts in TT Neutral Regimen Kit.
KI10/SOF. People Safety Against Indirect Electrical Contacts in TN Neutral Regimen Kit.
KI11/SOF. People Safety Against Indirect Electrical Contacts in IT Neutral Regimen Kit.

Energy Installations:

➤Protection and Relays

KE3/SOF. Test Unit for Magneto-Thermal Automatic Switches Kit.
KE4/SOF. Test Unit for Differential Automatic Switches Kit.
KE5/SOF. Relay Control Station Kit.
KE7/SOF. Multi-Functional Electrical Protection Station Kit.
KE9/SOF. Directional Relay: Earth Fault Detection. Directional Power Flow Detection. Reactive Power Flow Detection Kit.

➤Measurements and Control

KE2/SOF. Reactive Energy Control and Compensation Kit.
KE6/SOF. Energy Counters Control Station Kit.
KE8/SOF. Power & Torque Measurements of Electrical Motors Kit.

➤Lines

KE1/SOF. Aerial Line Model Kit.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

ELE-KITS. **Electrical Installations Assembly Kits:**

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

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

CAL is a class assistant that helps in making the necessary calculations to extract the right conclusions from data obtained during the experimental practices.

CAL will perform the calculations.

CAL computes the value of all the variables involved.

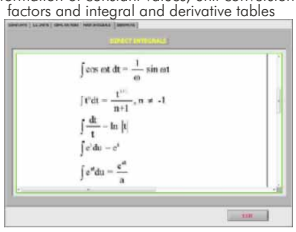
It allows to plot and print the results. Between the plotting options, any variable can be represented against any other.

Different plotting displays.

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

Calculations

Information of constant values, unit conversion factors and integral and derivative tables



Plotting options

Available Softwares:

Domestic Electrical Installations

➤General
- KD1A/CAL. Robbery Alarm Station Kit.
- KD3A/CAL. Fire Alarm Station Kit.
- KD5/CAL. Stair Lights Timing Kit.
- KD13/CAL. Audio Door entry System Kit.
- KD14/CAL. Audio and Video Door entry System Kit.

➤Industrial Control
- KD6A/CAL. Luminosity Control Station Kit.
- KD9A/CAL. Heating Control Station Kit.
- KD15A/CAL. Position Control Station Kit.
- KD17A/CAL. Photoelectric Control Position Station Kit.
- KD22/CAL. Flooding Control Station Kit.
- KD23/CAL. Wireless Basic Control Station (RF) Kit.
- KD24/CAL. Position Switch Kit.
- KD25A/CAL. Control Station for Domestic Electric Services through the Telephone Kit.
- KD28A/CAL. Integral Control Station of Domestic Electric Systems Kit.
- KD30/CAL. Gas Control Station Kit.

➤Sound
- KD19A/CAL. Sound Station Kit.
- KD31/CAL . Movement and Sound Detection and Control Kit.

➤Instruments
- KD8/CAL. Blinds Activator Kit.
- KD11A/CAL. Network Analyzer Kit.
- KD32/CAL. 24 Vac / 12 Vdc Circuits Analyzer Kit.
- KD33/CAL. Installations Faults Simulator Kit.

Industrial Electrical Installations:

➤Starter and Motors
- KI1/CAL. Star-Delta Starter Kit.
- KI2/CAL. Starter through Auto-Transformer Kit.
- KI4/CAL. Starter-Inverter Kit.
- KI5/CAL. AC Wound Rotor Motor Starter Kit.
- KI6/CAL. DC Motor Starter Kit.

➤Speed Control
- KI3/CAL. Speed Commutator for Dahlander Motor Kit.
- KI7/CAL. Automatic Change of Speed of a Dahlander Motor with Change of Direction Kit.

➤Electrotecnins
- KI8/CAL. Reactive Power Compensation (Power Factor Correction) Kit.

➤Safety
- KI9/CAL. People Safety Against Indirect Electrical Contacts in TT Neutral Regimen Kit.
- KI10/CAL. People Safety Against Indirect Electrical Contacts in TN Neutral Regimen Kit.
- KI11/CAL. People Safety Against Indirect Electrical Contacts in IT Neutral Regimen Kit.

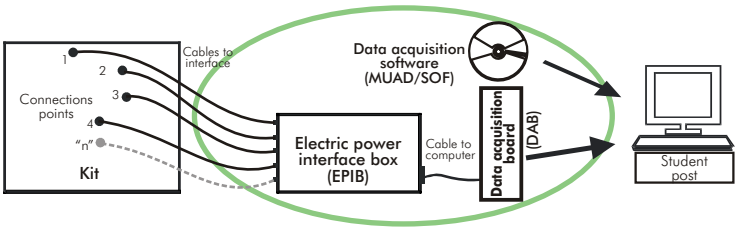
Energy Installations:

➤Protection and Relays
- KE3/CAL. Test Unit for Magneto-Thermal Automatic Switches Kit.
- KE4/CAL. Test Unit for Differential Automatic Switches Kit.
- KE5/CAL. Relay Control Station Kit.
- KE7/CAL. Multi-Functional Electrical Protection Station Kit.
- KE9/CAL. Directional Relay: Earth Fault Detection. Directional Power Flow Detection. Reactive Power Flow Detection Kit.

➤Measurements and Control
- KE2/CAL. Reactive Energy Control and Compensation Kit.
- KE6/CAL. Energy Counters Control Station Kit.
- KE8/CAL. Power & Torque Measurements of Electrical Motors Kit.

➤Lines
- KE1/CAL. Aerial Line Model Kit.

MUAD. Electric Power Data Acquisition System



MUAD is the perfect link between the kit/application and the PC. MUAD is a continuous data acquisition system with virtual instrumentation, that measures, analyzes and represents the parameters involved in the process.
MUAD allows voltage and current acquisition and measurement, data processing, frequency spectrum and all the functions of a digital oscilloscope.
We easily connect the Electric Power Interface Box (EPIB) to the kit/application with the supplied cables (there are several connection points placed for it). The EPIB is connected to the PC through the Data Acquisition Board (DAB), and by using the Data Acquisition with Virtual Instrumentation Software, the student can get results from the undertaken experiment/practice, see them on the screen and work with them.

This MUAD System includes EPIB + DAB + MUAD/SOF:

1) EPIB. **Electric Power Interface Box** (dimensions: 300 x 120 x 180 mm. approx.):
   Interface that carries out the conditioning of the diverse signals that can be acquired in a process, for their later treatment and visualisation.
   In the front panel, the elements are separated in two parts: left-hand part to VOLTAGE sensors, and right-hand part corresponds with CURRENT sensors.
   Analog Input Channels:
   8 analog input channels. Sampling range: 250 KSPS (Kilo samples per second).
   4 Tension sensors AC/DC, 400V. 4 Current sensors.

EPIB

+

DAB

+

2) DAB. **Data Acquisition Board :**
   PCI Data acquisition board (National Instruments) to be placed in a computer slot.
   Analog input:
   Number of channels= 16 single-ended or 8 differential.
   Resolution=16 bits, 1 in 65536.
   Sampling rate up to: 250 KSPS (Kilo samples per second).
   Analog output:
   Number of channels=2.
   Resolution=16 bits, 1 in 65536.
   Digital Input/Output:
   Number channels=24inputs/outputs.
   Timing: Counter/timers=2.

3) MUAD/SOF. **Data Acquisition Software** :
   Data Acquisition Software with Graphic Representation:
   Friendly graphical frame.
   Compatible with actual Windows operating systems.
   Configurable software allowing the representation of temporal evolution of the different signals.
   Visualization of a tension of the circuits on the computer screen.
   Sampling velocity up to 250 KSPS. (Kilo samples per second).

MUAD/SOF

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/ELE-KITS.pdf

4.1- Basic Electricity

EIV2. **Home Automation Installations Trainer**

SPECIFICATIONS SUMMARY

Trainer designed for the study of automation electrical installations in home and buildings. It allows the study of the security, the energy management, the comfort, the communications, etc.
Frame with anodized aluminium structure, on which the modules of domotic elements have to be fitted.
Modules allowing a quick, easy and secure installation of the domotic elements , without having electric risks.
Use of the EIB (european bus " instabus") installation system.
If foresees the use of a programmable logical controller, integrable on the EIB bus.
Connection between the different modules through some connections ready for such purpose.
Programming software for the programmable logical controller, and instabus.
Modules included:

- Power supply module, coil and data interface.
- Lamp-holder module. (2 units).
- Binary entry module.
- Binary output module.
- Switch-pushbutton module.
- Dimmer module.
- Module: thermostat, quadruple push-button and presence detector. (Multifunction module).
- Logical module and scenes.
- Blind module.
- Tactile vision module.
- Telecontrol module.
- Programmable logical controller module and EIB module.
- Double push-button module, infrared detector and display/actuator.

Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/EIV2.pdf

EIV6. **Home Automation Installations Trainer**

SPECIFICATIONS SUMMARY

Trainer designed for the study of automation electrical installations in home and buildings. It allows the study of the security, the energy management, the comfort, the communications, etc.
Frame with anodized aluminium structure, on which the modules of domotic elements have to be fitted.
Modules allowing a quick, easy and secure installation of the domotic elements, without electric risks.
Use of the EIB (european bus "instabus") installation system.
Connection between the different modules through connections ready for such purpose.
Modules included:

- Power supply module, coil and data interface.
- Lamp-holder module. (2 units).
- Binary entry module.
- Binary output module.
- Switch-pushbutton module.
- Dimmer module.
- Module: thermostat, quadruple push-button and presence detector. (Multifunction module).
- Logical module and scenes.

Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/basic/EIV6.pdf

4.2- Electricity Demonstration

PDL. **Lamps Demonstration Panel**

PDCE-P. **Electric Cables Demonstration Panel (Power)**

PDCE-S. **Electric Cables Demonstration Panel (Signalling)**

PDF. **Fuses Demonstration Panel**

4.3- Electrical Installations Workshop

LIMEL. **Integrated Laboratory for Electrical Machines:**

Laboratory structure

① Electrical Machines Units

EME. Electrical Machines Unit
(Advanced option)

EME/M. Electrical Machines Unit
(Intermediate option)

EME/B. Electrical Machines Unit
(Basic option)

② Measurement Units

MULT. Digital Multimeter

EAL. Network Analyzer Unit (AC)

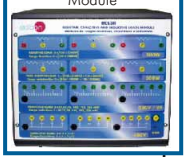
or

Other Network Analyzers:
-EALD. with Computer Data Acquisition.
-EALDG. with Computer Data Acquisition + Oscilloscope Display.
-EAL-DC. Network Analyzer Unit (DC).

-EAM-VA. Analog Measurement Unit.
-MUAD. Electric Power Data Acquisition System.

③ Loads:

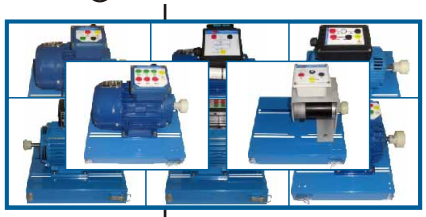
RCL3R. Resistive, Inductive and Capacitive Loads Module



or

Individual elements:
-IND. Inductance Module.
-CON. Capacitors Module.
-REV. Variable Resistance Module.
-REV-T. Three-phase Variable Resistance Module.
-REF. Fixed Resistance Module.

④ Motors:



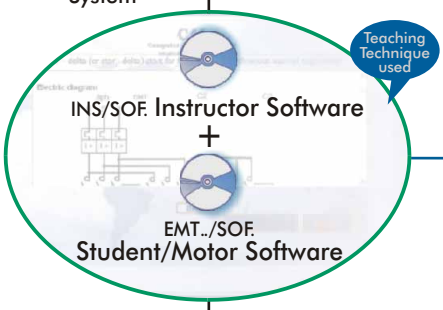
⑤ Brakes:

FRE-FE. Electronic Brake

or

-DI-FRE. Pendular Dynamo Brake.
-FREND. Dynamo Brake.
-FRENP. Magnetic Powder Brake.
-FREPR. Prony Brake.
-FRECP. Eddy Current Brake.

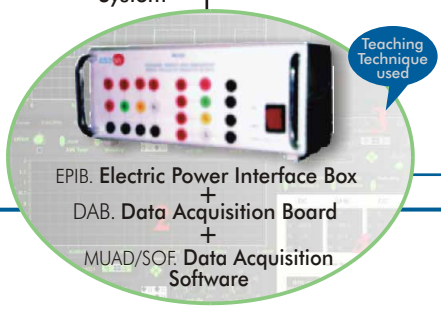
⑪ CAI. Computer Aided Instruction Software System



⑫ CAL. Computer Aided Learning Software (Results Calculation and Analysis)

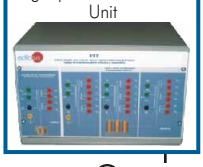
PC

⑬ MUAD. Electric Power Data Acquisition System



⑥ Transformers:

ETT. Three-phase and single-phase Transformers Unit



or

-TPPT. Three-phase Power Transformer Unit.
-EMPTA. Auxiliary Transformer and Protection Module.
-AUTR. Variable Auto-Transformer.
Individual elements:
-TRANS. Single-phase Transformer.
-TRANS/3. Three-phase Transformer.

⑦ DC Motor Speed Control

WCC. DC Motor Speed Controller

or

- WCC/M. DC Motor Speed Controller (intermediate option).
Individual elements:
- WCC/B. DC Motor Speed Controller, with no other elements.

⑧ AC Motor Speed Control

WCA. AC Motor Speed Controller

or

- WCA/M. AC Motor Speed Controller (intermediate option).
Individual elements:
- WCA/B. AC Motor Speed Controller, with no other elements.

⑨ PLC

PLC-PI. PLC Module for the Control of Industrial Processes

or

Individual elements:
- EDIBON FP-X-CPU. PLC, with no other elements.

⑩ Tachogenerator

TECNEL/T. Tachogenerator

or

- TECNEL/TM. Hand Tachometer.

Complete configuration

Main units:
① Electrical Machines Units.
② Measurement Units.
③ Loads.
④ Motors.
⑤ Brakes.

Additional possibilities:
⑪ CAI. Computer Aided Instruction Software System.
⑫ CAL. Computer Aided Learning Software (Results Calculation and Analysis).
⑬ MUAD. Electric Power Data Acquisition System.

* MINIMUM CONFIGURATION: ① + ②

Additional elements:
⑥ Transformers.
⑦ DC Motor Speed Control.
⑧ AC Motor Speed Control.
⑨ PLC (Programmable Logic Contoller).
⑩ Tachogenerator.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

LIMEL. **Integrated Laboratory for Electrical Machines:**

① Electrical Machines Units

EDIBON presents three alternatives with increasing complexity and practical possibilities.
- EME. Electrical Machines Unit. It is a compact unit including the main electrical functions. It is EDIBON's most advanced option.
- EME/M. Electrical Machines Unit (intermediate option). Students can get a good grasp on the subject.
- EME/B. Electrical Machines Unit (basic option). It includes the most basic functions.

EME. **Electrical Machines Unit** (Advanced option)

SPECIFICATIONS SUMMARY

The Electrical Machines Unit (EME) is a compact and robust box for the study of the main electrical functions. In its front side, you find standard electrical functions, divided in sections, for a better visualization of the different applications. In EME, you have all the main panels you need for analyzing an electrical machine, as measuring devices, supply systems, management systems, protection systems, synchronism and rectification systems, etc.

This unit is prepared for working to a maximum power of 1 KW and all the components are located within a compact box.

Metallic box. Diagram in the front panel.

Different modules included in the EME unit:

-Connection terminals module:

Connection terminals of three-phase: R, S and T and supply neutral with the corresponding signaling lamps which indicate the voltage. There are 4 terminals in each phase.

Signaling lamp which will light up when the three-phase sequence is correct.

This module also has a signaling lamp and fuse, corresponding to the internal supply of the unit.

Two 24 Vac terminals.

-Operation module:

3 Running switches.

3 Stop switches.

3 Three-pole contactors, power A, B and C, with control circuit in alternating current. Each contactor has 2 auxiliary terminals (NC) and 3 auxiliary terminals (NO).

3 Lamps that will light when the contactors are started.

2 Timing realys.

Indicating lamps.

-Protection module:

Thermal Magnetic Circuit Breaker.

Thermal relay.

3 Power contacts.

2 Auxiliary contacts (NO and NC).

Signaling lamp.

-Synchronizing and rectification module:

3 lamps, as well as the inlet terminals for the three-phases with signaling for indicating its correct sequence.

Single-phase bridge rectifier, with 2 fuses with their corresponding fusion lamps.

-Contactors module:

3 Power takes, and the selected position closes the corresponding contact in the three phases.

-Possibility of assemblies of control circuits with delay.

* Minimum recommended measurement units:

2 Digital multimeters.

Recommended measurement unit:

EAL. Network Analyzer Unit.

Electrical supply required: Three-phase with neutral and ground, 380V.

Dimensions (approx.): 490 x 450 x 470 mm.

Weight: 50 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

PRACTICAL POSSIBILITIES

The D.C.Machine (with motors EMT1/2/3/4/5/15)

1.- Preparation, regulation and inversion in a dynamo with independent excitation.
2.- The dynamo characteristic curve without load.
3.- Dynamos with series and shunt excitation.
4.- Dynamo external characteristic curve.
5.- Dynamo characteristic regulation curve.
6.- Speed variation, inversion and stop of D.C. motor with independent excitation.
7.- Speed-armature current characteristic curves in a D.C. motor with shunt or independent excitation.
8.- Torque-current characteristic curve in a D.C. motor with shunt or independent excitation.
9.- Torque-speed characteristic curve in a D.C. motor with shunt or independent excitation.
10.- Speed-excitation current characteristic curves in a D.C. motor with independent or shunt excitation. Operation in constant power.
11.- Speed control at constant torque.
12.- Series D.C. motor: starting, speed variation, inversion and braking.
13.- Speed-intensity characteristic curve in a D.C. motor with series excitation.
14.- Torque-current characteristic curve in a D.C. motor with series excitation.
15.- The D.C. motor with series excitation as universal motor.

The Synchronous Machine (with motor EMT6)

16.- Starting, voltage and frequency regulation in a three-phase alternator.
17.- Net coupling of a three-phase alternator.
18.- Characteristic curve of an alternator without load.
19.- Characteristic curve of an alternator in short circuit.
20.- Characteristic curve of an alternator with load.
21.- Synchronous motor starting.

The Asynchronous Machine (with motors EMT7/8/9/10/11/16/17)

22.- Mordey's diagrams.
23.- Starting process of a three-phase asynchronous motor with rotor in short circuit.
24.- Test without load of an asynchronous motor with rotor in short circuit.
25.- Test with load of a three-phase asynchronous motor with rotor in short circuit.
26.- Starting of a three-phase asynchronous motor with the wound rotor.
27.- Test without load of a three-phase asynchronous motor with the wound rotor.
28.- Test with load of a three-phase asynchronous motor with wound rotor.
29.- Starting of a single-phase motor with capacitor.
30.- Test without load of a single-phase asynchronous motor.
31.- Test in load of the single-phase motor.

The Universal motor (with motor EMT12)

32.- The Universal motor with D.C. supply.
33.- Speed-current characteristic of an Universal motor with D.C. supply.
34.- Torque-intensity characteristic in the D.C. Universal motor.
35.- The universal motor with A.C. supply.

The Repulsion motor (with motor EMT14)

36.- Starting and inversion of a single-phase repulsion motor.
37.- Test of a single-phase repulsion motor without load.
38.- Test of a single-phase asynchronous repulsion motor in A.C.

The Brushless motor (with motor EMT18)

39.- Brushless motor starting.
40.- Speed control and change of the turn sense.

The Dahlander motor (with motor EMT9)

41.- Dahlander motor starting.
42.- Different working speeds.
43.- Changing the different speeds of Dahlander motor while working.

The Stepper motor (with motor EMT19)

44.- Stepper motor starting.
45.- Steps control.
46.- Rotation sense change.

The Reluctance motor (with motor EMT21)

47.- Star connection of the reluctance motor.
48.- Delta connection of the reluctance motor.
49.- Revolution sense and inversion of rotation.

LIMEL. **Integrated Laboratory for Electrical Machines:**

① Electrical Machines Units

EME/M. **Electrical Machines Unit** (Intermediate option)

SPECIFICATIONS SUMMARY

Metallic box.

Diagram in the front panel.

Thermal Magnetic Circuit Breaker.

Two double switches (1 NO + 1 NC in each one)

Push Button (1 NC + 1 NO).

Three contactors with 2 NO and 1 NC.

DC supply 200 V dc with fuses.

Connection Key

Emergency stop push button.

* Minimum recommended measurement units:

2 Digital multimeters.

Recommended measurement unit:

EAL. Network Analyzer Unit.

Electrical supply required: Three-phase with neutral and ground, 380V.

Dimensions (approx.): 490 x 330 x 310 mm.

Weight: 25 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

PRACTICAL POSSIBILITIES

The D.C.Machine:

1.- Preparation, regulation and inversion in a dynamo with independent excitation.
2.- The dynamo characteristic curve without load.
3.- Dynamos with series and shunt excitation.
4.- Dynamo external characteristics curve.
5.- Characteristic regulation curve of a dynamo.
6.- Speed control at constant torque.
7.- Series D.C. motor: starting, speed variation, inversion and braking.

The Synchronous Machine:

8.- Starting, voltage and frequency regulation in a three-phase alternator.
9.- Characteristic curve of an alternator without load.
10.- Characteristic curve of an alternator in short circuit.
11.- Characteristic curve of an alternator with load.
12.- Synchronous motor starting.

The Asynchronous Machine:

13.- Mordey's diagrams.
14.- Starting process of a three-phase asynchronous motor with rotor in short circuit.
15.- Test without load of an asynchronous motor with rotor in short circuit.
16.- Test with load of a three-phase asynchronous motor with rotor in short circuit.
17.- Starting and turn sense inversion of a three-phase motor.
18.- Test without load of a single-phase motor.
19.- Test in load of the single-phase motor.

The Universal motor:

20.- The universal motor with D.C. supply.
21.- Speed-current characteristic of an Universal motor with D.C. supply.
22.- Torque-intensity characteristic in the D.C. Universal motor.
23.- The Universal motor with A.C. supply.

The Repulsion motor:

24.- Starting and inversion of a single-phase repulsion motor.
25.- Test of a single-phase repulsion motor without load.
26.- Test of a single-phase asynchronous repulsion motor in A.C.

The Brushless motor:

27.- Brushless motor starting.
28.- Speed control and change of the turn sense.

The Dahlander motor:

29.- Dahlander motor starting.
30.- Different working speeds.

The Reluctance motor:

31.- Star connection of the reluctance motor.
32.- Delta connection of the reluctance motor.
33.- Revolution sense and inversion of rotation.

EME/B. **Electrical Machines Unit** (Basic option)

SPECIFICATIONS SUMMARY

Metallic box.
Diagram in the front panel.
Thermal Magnetic Circuit Breaker.
DC supply 200 Vdc with fuses.
Connection Key.
Emergency stop push button.
Two push buttons (1NO + 1NC).
One contactor, with three power connections, one control connection and supply control.
* Minimum recommended measurement units:
2 Digital Multimeters.
Recommended measurement unit:
EAL. Network Analyzer Unit.
Electrical supply required: Three-phase with neutral and ground, 380V.
Dimensions (approx.): 300 x 190 x 120 mm.
Weight: 5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

PRACTICAL POSSIBILITIES

The D.C.Machine:

1.- Preparation, regulation in a dynamo with independent excitation.
2.- Dynamos with series and shunt excitation.
3.- Speed control at constant torque.
4.- Series D.C. Motor: starting, speed variation, inversion and braking.

The Asynchronous Machine:

5.- Starting process of a three-phase asynchronous motor with rotor in short circuit.
6.- Test without load of an asynchronous motor with rotor in short circuit.

The Universal motor:

7.- The Universal motor with D.C. supply.

LIMEL. **Integrated Laboratory for Electrical Machines:**

② Measurement Units

The measurement units let us extract information from the experimental units (EMEs), thus allowing further process of the data. We can get values of currents, voltages, resistance, etc. for further analysis.

MULT. **Digital Multimeter**

SPECIFICATIONS SUMMARY

Digital multimeter.
Voltage and current meter.
Resistances and capacitors.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

EAL. **Network Analyzer Unit (AC)**

SPECIFICATIONS SUMMARY

This unit shows the main electric parameters on the electric network through the interface and an easy parameter selection.
Metallic box. Diagram in the front panel.
Measurements of current, voltage, power, power factor, frequency, energy, TRMS measurement of distorted waves (voltage, current) for each phase and average.
Display for instantaneous variables: 3 x 3 digits.
Display for energies: 8+1 digits.
Voltage: V_{L-N} = 185 V to 460 V. V_{L-L} = 320 V to 800 V.
Current: Phase current : 0.03 to 5A.
Frequency: 48 to 62 Hz ± 0.1 Hz.
Power: Active, Reactive and Apparent.
Power Factor: Power factor for resistive, inductive and capacitive load types.
Dimensions (approx.): 300 x 190 x 120 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

EALD. **Network Analyzer Unit, with Computer Data Acquisition**

SPECIFICATIONS SUMMARY

This unit shows the main electric parameters on the electric network through the interface and an easy parameter selection.
Metallic box. Diagram in the front panel.
Measurements of current, voltage, power, power factor, frequency, energy, TRMS measurement of distorted waves (voltage, current) for each phase and average.
Display for instantaneous variables: 3 x 3 digits.
Voltage: V_{L-N} = 185 V to 460 V. V_{L-L} = 320 V to 800 V.
Current: Phase current : 0.03 to 5A.
Frequency: 48 to 62 Hz ± 0.1 Hz.
Power: Active, Reactive and Apparent.
Power Factor: Power factor for resistive, inductive and capacitive load types.
Connection RS232 to computer (PC) and Data Acquisition Software.
Dimensions (approx.): 300 x 190 x 120 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

EALDG. **Network Analyzer Unit, with Computer Data Acquisition + Oscilloscope Display**

SPECIFICATIONS SUMMARY

This unit shows the main electric parameters on the electric network through the interface and a parameter selection.
Metallic box. Diagram in the front panel.
3 Current inputs, for series intensity.
3 Voltage terminals for each phase measure (R, S, T) and another one for the neutral connection.
Control and visualization digital display and oscilloscope display.
Voltage: Range 0 - 750 Vrms. Prec.: ±0.5%. Phase to phase - Phase to neutral.
Current: Range 0.01 - 5 Arms. Prec.: ±0.5%.
Frequency: Range 48 to 62 Hz. ±0.1Hz.
Power: Active, Reactive and Apparent. Range 0.01 to 9900 kW. Prec.: ±1%.
Power Factor: Power Factor for each phase and average. Range -0.5 to + 0.5. Prec.: ±1%.
Operating temperature 0 to +50°C.
Connection RS232 to computer (PC).
Data Acquisition Software.
Dimensions (approx.): 300 x 190 x 120 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

LIMEL. **Integrated Laboratory for Electrical Machines:**

②Measurement Units

EAL-DC. **Network Analyzer Unit (DC)**

SPECIFICATIONS SUMMARY

This unit shows the main electric parameters on the electric loads throught the interface and a parameters selection.
Metallic box. Diagram in the front panel.
1 Current input.
1 Terminal voltage.
Visualization digital display:
Voltage: Range 0 - 450 Vdc without transformer.
Current: Range 0 - 5 A.
Power.
Power supply connection: 38 - 265 Vac/dc.
Resolution: 0.1 V; 0.01 A; 0.01 KW.
Energy total: 6 DGT (0.1 KWh).
Dimensions (approx.): 300 x 190 x 120 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

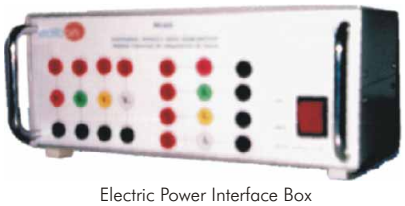
EAM-VA. **Analog Measurement Unit**

SPECIFICATIONS SUMMARY

This unit allows to analyze the different voltages and currents involved in a circuit through a simple frontal panel that includes analog measurement instruments.
Metallic box.
4 Voltmeters.
A.C. Measuring Instruments with moving iron.
Voltmeter with measuring range from 0 to 500Vac.
Horizontal scale with precision grade of 1.5.
2 Ammeters.
A.C. Measuring Instruments with moving iron.
Ammeter with measuring range of 0 to 5A.
Horizontal scale with precision grade of 1.5.
2 Analog inputs for each meter.
Dimensions (approx.): 490 x 330 x 310 mm. Weight: 40 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

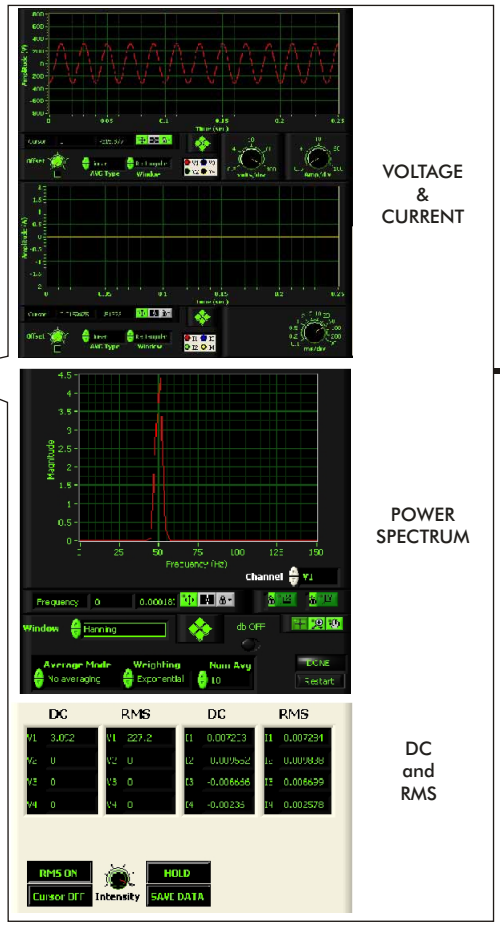
MUAD. **Electric Power Data Acquisition System** (see "Section 13" in page 91)



Electric Power Interface Box

Data Acquisition Board

Data Acquisition Software



Computer (not included in the supply)

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

LIMEL. **Integrated Laboratory for Electrical Machines:**

③ Loads

RLC3R. **Resistive, Inductive and Capacitive Loads Module**

SPECIFICATIONS SUMMARY

When you brake an electrical machine, the electrical energy has to be dissipated. Loads provide this function, the dissipation of energy. Depending on the experiment, the dissipating load has to be resistive, inductive or capacitive. EDIBON recommends having the three kinds, if a good understanding on the subject is pursued.

Our Resistive, Capacitive and Inductive Loads Module (RCL3R) offers:

- Single and Three-phase fixed resistances.
- Single and Three-phase variable resistances.
- Single and Three-phase inductances.
- Single and Three-phase capacitors.

Metallic box. Diagram in the front panel.

Variable resistive loads: 3 x [150 Ω (500 W)].

Fixed resistive loads: 3 x [150 Ω (500 W) + 150 Ω (500 W)].

Inductive loads: 3 x [0, 33, 78, 140, 193, 236 mH].(230V /2 A)

Capacitive loads: 3 x [4 x 7 μF]. (400V)

Dimensions (approx.): 490 x 450 x 470 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

Individual Elements

SPECIFICATIONS SUMMARY

When a simpler and cheaper option is preferred when studying the use of loads in electrical machines, EDIBON gives the choice of acquiring single modules.

IND

IND. **Inductance Module**

Metallic box. Diagram in the front panel.

Inductance load: [0, 33, 78, 140, 193, 236 mH].

Dimensions (approx.): 300 x 190 x 120 mm.

CON

CON. **Capacitors Module**

Metallic box. Diagram in the front panel.

Capacitive load: [4 x 7 μF].

Dimensions (approx.): 300 x 190 x 120 mm.

REV

REV. **Variable Resistance Module**

Metallic box. Diagram in the front panel.

Variable resistive load of 0-150Ω (500W).

Dimensions (approx.): 300 x 190 x 120 mm.

REV-T

REV-T. **Three-phase Variable Resistance Module**

Metallic box. Diagram in the front panel.

3 Variable resistive loads of 150Ω (500W).

Dimensions (approx.): 490 x 330 x 310 mm.

REF

REF. **Fixed Resistance Module**

Metallic box. Diagram in the front panel.

Resistive load of 150Ω (500W).

Dimensions (approx.): 300 x 190 x 120 mm.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

LIMEL. **Integrated Laboratory for Electrical Machines:**

④ Motors

EDIBON has a wide range of electric motors. The motors supplied include connectors, couplings and motor support.

➤Motors (D.C.)


EMT1


EMT2


EMT3


EMT4


EMT5


EMT12


EMT15


EMT18


EMT19


VVPP


VVPP/B

SPECIFICATIONS SUMMARY

EMT1. **D.C. Independent excitation motor-generator.**
Power: 250W. Speed: 3400 r.p.m. V.excitation: 200 V.D.C. I.Excitation: 0.3A. V.Armature.: 200V D.C. I.Armature: 1.5A.

EMT2. **D.C. Series excitation motor-generator.**
Power: 250W. Speed: 7500 r.p.m. V.Armature: 200V.D.C. I.Armature: 1.5A.

EMT3. **D.C. Shunt excitation motor-generator.**
Power: 250W. Speed: 3400 r.p.m. V.Armature: 200V.D.C. I.Armature: 1.5A.

EMT4. **D.C. Compound excitation motor-generator.**
Power: 250W. Speed: 3400 r.p.m. I.Excitation:0.4A. V.Armature: 200V. I.Armature: 1.5A.

EMT5. **D.C. Shunt-series compound excitation motor.**
Power: 250W. Speed: 3400/7500 r.p.m. V.excitation: 230 V.D.C. I.Excitation: 0.4A. V.Armature.: 200V. D.C. I.Armature: 1.5A.

EMT12. **Universal motor (single-phase).**
Power: 230W. Speed: 9000 r.p.m. Frequency: 50/60Hz. V.Armature.: 230V. I.Armature: 1A.

EMT15. **D.C. Permanent magnet motor.**
Power: 100W. Speed: 3000 r.p.m. V.Armature: 200V. I.Armature: 0.5A.

EMT18. **D.C. Brushless motor.**
Power: 80W. Speed: 3250 r.p.m. V.Armature: 24V.D.C. I.Armature:3.3 A.

EMT19. **Stepper motor.**
Power: 2W. V.Armature: 12V. I.Armature: 0.16 A.

OPTIONAL for working with EMT19. Stepper motor:

VVPP. **Velocity Control for Stepper Motor** (Manual Control and Automatic Control).

VVPP/B. **Velocity Control for Stepper Motor** (Manual Control).

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

PRACTICAL POSSIBILITIES

The D.C. Machine (with motors EMT1/2/3/4/5/15)

1.- Preparation, regulation and inversion in a dynamo with independent excitation.
2.- The dynamo characteristic curve without load.
3.- Dynamos with series and shunt excitation.
4.- Dynamo external characteristic curve.
5.- Dynamo characteristic regulation curve.
6.- Speed variation, inversion and stop of D.C. motor with independent excitation.
7.- Speed-armature current characteristic curve in a D.C. motor with shunt or independent excitation.
8.- Torque-current characteristic curve in a D.C. motor with shunt or independent excitation.
9.- Torque-speed characteristic curve in a D.C. motor with shunt or independent excitation.
10.- Speed-excitation current characteristic curve in a D.C. motor with independent or shunt excitation. Operation in constant power.
11.- Speed control at constant torque.
12.- Series D.C. motor: starting, speed variation, inversion and braking.
13.- Speed-intensity characteristic curve in a D.C. motor with series excitation.
14.- Torque-current characteristic curve in a D.C. motor with series excitation.
15.- The D.C. motor with series excitation as universal motor.

The Synchronous Machine (with motor EMT6)

16.- Starting, voltage and frequency regulation in a three-phase alternator.
17.- Net coupling of a three-phase alternator.
18.- Characteristic curve of an alternator without load.
19.- Characteristic curve of an alternator in short circuit.
20.- Characteristic curve of an alternator with load.
21.- Synchronous motor starting.

The Asynchronous Machine (with motors EMT7/8/9/10/11/16/17)

22.- Mordey's diagrams.
23.- Starting process of a three-phase asynchronous motor with rotor in short circuit.
24.- Test without load of an asynchronous motor with rotor in short circuit.
25.- Test with load of a three-phase asynchronous motor with rotor in short circuit.

Continue...

➤Motors (A.C.)


EMT6


EMT6B


EMT7


EMT7B

SPECIFICATIONS SUMMARY

EMT6. **A.C. Synchronous three-phase motor alternator.**
Power: 200W. Speed: 3000 r.p.m. Frequency: 50Hz. V.excitation: 200V. I.Excitation: 0.7A. V.Armature: 220V. I.Armature: 1A.

EMT6B. **Permanent magnets synchronous three-phase generator (24 Vac).**
Power: 450W. Speed: 750 r.p.m. Frequency: 50Hz. V.Armature: 3 x 24 (Vac). I.Armature: 11A.

EMT7. **Asynchronous three-phase motor of squirrel cage.**
Power: 370W. Speed: 2730 r.p.m. Frequency: 50/60Hz. V.Armature: 230/400V. I.Armature: 1.67/0.97A. Connections: Star/triangle.

EMT7B. **Asynchronous three-phase motor of squirrel cage (4 poles).**
Power: 370W. Speed: 1370 r.p.m. V.Armature: 230/400V. I.Armature: 1.92/1.11A. Frequency: 50/60Hz. Connections: Star/triangle.

Continue...

LIMEL. **Integrated Laboratory for Electrical Machines:**

④ Motors

➤ **Motors (A.C.)**


EMT7C


EMT8


EMT9


EMT10


EMT11


EMT12


EMT14


EMT16


EMT17


EMT20


EMT21


EMT22

SPECIFICATIONS SUMMARY

EMT7C. **Asynchronous three-phase motor of squirrel cage (8 poles).**
Power: 550W. Speed: 750 r.p.m. V.Armature: 230/400V. I.Armature: 3.6/2A. Frequency: 50/60Hz. Connections: Star/triangle.

EMT8. **Asynchronous three-phase motor with wound rotor.**
Power: 200W. Speed: 3000 r.p.m. Frequency: 50Hz. V.Armature: 230/400V. I.Armature: 1/0.5 A. Connections: Star/triangle.

EMT9. **Dahlander three-phase (two-speeds).**
Power: 250/500W. Speed: 1400/2800 r.p.m. Frequency: 50/60Hz. V.Armature: 400V. I.Armature: 1.20/1.55 A.

EMT10. **Asynchronous three-phase motor of two independent speeds.**
Power: 240/370W. Speed: 900/1420 r.p.m. Frequency: 50/60Hz. V.Armature: 400V. I.Armature: 1/1.2 A.

EMT11. **Asynchronous single-phase motor with starting capacitor.**
Power: 370W. Speed: 2780 r.p.m. Frequency: 50/60Hz. V.Armature: 230V. I.Armature: 2.53A.

EMT12. **Universal motor (single-phase).**
Power: 230W. Speed: 9000 r.p.m. Frequency: 50/60Hz. V.Armature.: 230V. I.Armature: 1A.

EMT14. **Repulsion motor, single-phase with short-circuited brushes.**
Power: 350W. Speed: 1500 r.p.m. Frequency: 50/60Hz. V.Excitation: 230V. I.Excitation: 1.5 A.

EMT16. **Asynchronous single-phase motor with starting and running capacitor.**
Power: 370W. Speed: 2780 r.p.m. Frequency: 50/60Hz. V.Armature: 230V. I.Armature: 2.53 A.

EMT17. **Three-phase motor of squirrel cage with "Y" connection.**
Power: 370W. Speed: 2730 r.p.m. Frequency: 50/60 Hz. V.Armature: 400 V. I.Armature nominal: 0.97A.

EMT20. **Asynchronous single-phase motor with split phase.**
Power: 370W. Speed: 2780 r.p.m. Frequency: 50/60 Hz. V.Armature: 230V. I.Armature: 2.53 A.

EMT21. **Three-phase reluctance motor.**
Power: 300W. Speed: 3000 r.p.m. Frequency: 50/60 Hz. V.Armature: 400V. I.Armature: 1.4 A.

EMT22. **Single-phase shaded pole motor.**
Power: 16W. Speed: 1550 r.p.m. Frequency: 50/60Hz. V. Armature: 230/240V. I.Armature: 0.42 A.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

PRACTICAL POSSIBILITIES

26.- Starting of a three-phase asynchronous motor with the wound rotor.
27.- Test without load of a three-phase asynchronous motor with the wound rotor.
28.- Test with load of a three-phase asynchronous motor with wound rotor.
29.- Starting and turn sense inversion of a single-phase motor with capacitor.
30.- Test without load of a single-phase motor.
31.- Test in load of the single-phase motor.

The Universal motor (with motor EMT12)

32.- The universal motor with D.C. supply.
33.- Speed-current characteristic of an Universal motor with D.C. supply.
34.- Torque-intensity characteristic in the D.C. Universal motor.
35.- The universal motor with A.C. supply.

The repulsion motor (with motor EMT14)

36.- Starting and inversion of a single-phase repulsion motor.
37.- Test of a single-phase repulsion without load.
38.- Test of a single-phase asynchronous repulsion motor with A.C.

The Brushless motor (with motor EMT18)

39.- Brushless motor starting.
40.- Speed control and change of the turn sense.

The Dahlander motor (with motor EMT9)

41.- Dahlander motor starting.
42.- Different working speeds.
43.- Changing the different speeds of Dahlander motor while working.

The Stepper motor (with motor EMT19)

44.- Stepper motor starting.
45.- Steps control.
46.- Rotation sense change.

The Reluctance motor (with motor EMT21)

47.- Star connection of the reluctance motor.
48.- Delta connection of the reluctance motor.
49.- Revolution sense and inversion of rotation.

LIMEL. **Integrated Laboratory for Electrical Machines:**

⑤ Brakes

The importance of Brakes comes when we want to adjust the motor speed, measure the torque given, or stop the motor.

FRE-FE. **Electronic Brake**

SPECIFICATIONS SUMMARY

The electronic brake FRE-FE is an unit that allows to regulate the braking torque of a motor.
The FRE-FE is constituted as a set of two elements:
- Control module:
  - Front panel:
    - Braking torque control.
    - ON/OFF switch.
    - Electrical parameters indicator.
    - Display manipulation: Key "FUNC/DATA". Keys "RUN" / "STOP".
    - Forward / Reverse switch.
- Braking motor mounted on a bench-support.

Cable to connect the two elements.
Power: 370W. V. Armature: 220/240V.
The control of the braking torque is carried out by means of a control potentiometer placed on the front side of the control module.
The direction of the braking motor is controlled by a switch placed on the front panel of the control module.
Furthermore, the user will be able to visualize in a display different electrical parameters (as for example: current, frequency, active power...), as well as checking the voltage in the resistor that is used to produce the braking of the motor.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

DI-FRE. **Pendular Dynamo Brake**

SPECIFICATIONS SUMMARY

Power: 300W.
Speed: 3000 rpm.
V.Excitation: 190 V.D.C. I.Excitation: 0.3A.
V.Armature: 200 V.D.C. I.Armature: 1.5A.
Torque measured with lever and weights, by combining the mechanical torque and electrical torque.
Security connectors.
Bench-support.
Variable power resistance (REV) required.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

EMCC. **Load Cell Module**

SPECIFICATIONS SUMMARY

Accessory for DI-FRE. Pendular Dynamo Brake.
Metallic box.
Front panel:
- Connector for cable to the load cell.
- ON/OFF switch.
- Digital display/Force N.

Load cell.
Dimensions (approx.): 300 x 190 x 120 mm. Weight: 2 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

FREND. **Dynamo Brake**

SPECIFICATIONS SUMMARY

Power: 300W.
Speed: 3400 rpm.
I.Excitation: 0.4A.
V.Armature: 200 V.D.C. I.Armature: 1.5A.
Connectors.
Bench - support.
Variable power resistance (REV) required.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

LIMEL. **Integrated Laboratory for Electrical Machines:**

⑤ Brakes

FRENP. **Magnetic Powder Brake**

SPECIFICATIONS SUMMARY

The FRENP is a unit designed for the study of a magnetic powder brake.
The unit consists of a magnetic powder brake and a control module.
The control module allows setting the nominal torque of the brake through a potentiometer. It has two terminals to measure a voltage in direct proportion to the current supplied to the brake, therefore, to the exerted torque.
The unit also includes a fuse and a thermal relay to avoid eventual damages due to a over-intensity and/or to a over-temperature.
Power: 400 W.
V.Armature: 110/220V.
It is equipped with temperature probe to stop the braking action (the motor would stay free).
Bench-support.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

FREPR. **Prony Brake**

SPECIFICATIONS SUMMARY

Prony brake with resistant ribbon.
Mechanical braking action and dynamometer.
Power: 500 W.
Speed.: 3000 rpm.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

FRECP. **Eddy Current Brake**

SPECIFICATIONS SUMMARY

FRECP is an unit designed to work as a magnetic brake by means of the induction of Foucault's parasitic currents.
The FRECP is similar to an electrical motor, since it has a stator winding, the inductor, that we will feed with a DC voltage. We will change the braking torque by means of this direct voltage.
The braking torque is proportional to the current injected.
Nominal current: 1.67 A.
Maximum current: 1.8 A.
Maximum braking torque: 1.4 Nm.
Bench - support.
DC power supply.
Required service: WCC/M. DC Motor Speed Controller (intermediate option).

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

LIMEL. **Integrated Laboratory for Electrical Machines:**

⑥ Transformers

ETT. Three-phase and single-phase Transformers Unit

SPECIFICATIONS SUMMARY

Metallic box. Diagram in the front panel.
Single-phase transformer:
Nominal power: 500 VA. Transformation ratio: 400 / 230 V.
Inlets: 400 V and 230 V (in the primary). Number of secondary coils: 2.
Output voltage in the secondary: 115 (each one).
Maximum current in the primary: 1.5 A (for each voltage of 400 V). 3 A (for each voltage of 230 V).
Three-phase transformer in pillars:
Nominal power: 1000 VA. Transformation ratio: 380/3 x 127 V.
Inlets: 220 V and 380 V (in the primary).
Outlet voltage in the secondary: 3 x 127 V (each phase).
Maximum current in the primary: 2 A (for a voltage of 380 V). 2 A (for a voltage of 220 V).
Connection modes: Primary: Star, triangle. Secondary: Star, triangle, zig-zag, six-phase and triple star.
Electrical supply:
For single-phase transformer: 400-230 V / 50 Hz. or 60 Hz.
For three-phase transformer: 380-220 V / 50 Hz. or 60 Hz.
Dimensions (approx.): 490 x 330 x 310 mm. Weight: 40 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

PRACTICAL POSSIBILITIES

1.- Measurement of the transformation ratio.
2.- Rehearsal of a single-phase transformer in open circuit.
3.- Rehearsal of a single-phase transformer in short circuit.
4.- Rehearsal of a single-phase transformer in load.
5.- Rehearsal of a three-phase transformer in open circuit.
6.- Rehearsal of a three-phase transformer in short circuit.
7.- Autotransformer tests.
8.- Connection modes tests: Start/delta/Zig-Zag/6-phase/triple star.
9.- Transformer ratio variation tests.

TPPT. Three-phase Power Transformer Unit

SPECIFICATIONS SUMMARY

The "TPPT" unit is formed by a metallic box, which contains a three-phase power transformer. In the front panel of the box are located the terminals for both primary and secondary terminals for different power supply inputs and outputs. In the backside are located the fuses to protect the transformer.
Power: 1000 VA.
Module 1: Primary winding
It includes a three-phase winding which can be connected externally in either star or triangle, each phase winding has a neutral terminal, a 146V a.c. intermediate terminal and 220V a.c. terminal.
Module 2: Secondary winding
It includes a three-phase winding which can be connected externally in either star of triangle. Each phase winding has a neutral terminal, a 127V a.c. intermediate terminal and a 220V a.c. terminal.
This unit can be used to make 6 different a.c. connection types:

-Star (380V). - Triangle (380V).	-Triangle (220V). - Triangle (380V).
-Star (380V). - Star (220V).	-Triangle (220V). - Star (220V).
-Star (380V). - Triangle (127V).	-Triangle (220V). - Triangle (127V).

Electrical supply: 380-220 V.
Dimensions (approx.): 490 x 330 x 310 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

EMPTA. Auxiliary Transformer and Protection Module

SPECIFICATIONS SUMMARY

Metallic Box.
Input and output connectors.
Thermal magnetic unit 16 A., 2 poles.
Differential 25 A., 30 mV., 230 V.
Reversible auto-transformer 125-220 (1000 VA).
Conversion from 127V. 60Hz to 220V. 50Hz.
Conversion from 220V. 50Hz to 127V. 60Hz.
Differential electrical protection.
Thermal magnetic protection.
Required services: Input: 220Vac - 127Vac.
Dimensions (approx.): 300 x 190 x 120 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

PRACTICAL POSSIBILITIES

1.- Conversion from 127V/60Hz to 220V/50Hz.
2.- Conversion from 220V/50Hz to 127V/60Hz.
3.- Differential electrical protection.
4.- Thermal magnetic protection.

AUTR. Variable Auto-transformer

SPECIFICATIONS SUMMARY

This unit enables to carry out different practices related with variable auto-transformers.
The objective of the AUTR unit is to show techniques to measure the variable output and how the auto-transformer can be used with a load.
Metallic box. Diagram in the front panel.
It has two protection fuses in back part for controlling the output current is lower than 2A.
Input voltage: 240Vac, 50/60 Hz.
Output voltage: 0-240Vac, 50/60 Hz.
Maximum output current: 2 A.
Dimensions (approx.): 300 x 190 x 120 mm.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

Individual Elements:

TRANS

TRANS/3

SPECIFICATIONS SUMMARY

TRANS. **Single-phase Transformer**
Input and output connectors.
Single phase transformer, 400 V a.c. - 230 V a.c., 400 VA.
Ground connector.
TRANS/3. **Three-phase Transformer**
Input and output connectors.
Three phase transformer, 400 V a.c. - 230 V a.c., 1000 VA

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

LIMEL. **Integrated Laboratory for Electrical Machines:**

⑦ DC Motor Speed Control

VVCC. **DC Motor Speed Controller**

SPECIFICATIONS SUMMARY

Metallic box.
Front panel including:
- Excitation terminals:
  - Connection with the excitation of the DC Motor.
  - Red Terminal / Positive Polarity. Black Terminal / Negative Polarity.
- Rotor terminals:
  - Connection with the rotor of the DC Motor.
  - Red Terminal / Positive Polarity. Black Terminal / Negative Polarity.
- Tachodynamo terminals:
  - Connection with an external DC Tachogenerator.
  - Red Terminal / Positive Polarity. Black Terminal / Negative Polarity.
- Torque control: Control of the mechanical torque of the motor.
- Speed control: Control of the speed of the motor.
- Start/Stop switch to run or stop the motor. On/Off switch to turn the unit on.
- Feedback switch: switch to control the feedback source (tachodynamo or internal).
- LED indicators of the status of the unit.

Maximum power: 550W. Maximum torque: 2.6 Nm. Speed range: 130-2000 r.p.m.
Besides the motor speed controller, all the indicators, connecting cables and additional components are included.
Dimensions (approx.): 300 x 190 x 120 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

PRACTICAL POSSIBILITIES

1.- Motor parameters adjustment
2.- Working at a certain frequency.
3.- Starting carrying out by defined ramp.
4.- Braking possibility until a certain speed and recovery.

VVCC/M. **DC Motor Speed Controller** (intermediate option)

SPECIFICATIONS SUMMARY

This unit consists in a variable transformer followed by a rectifier bridge and an anti-ripple capacitor with a resistor to get discharged.
Metallic box.
Adjustable voltage: up to 320 Vdc. Maximum current: 2 A.
At the top of the unit there is a knob to adjust the DC voltage.
Front panel including:
- Positive, negative and ground connections. ON/OFF switch.

Dimensions (approx.): 300 x 190 x 120 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

VVPP. **Velocity Control for Stepper Motor** (Manual Control and Automatic Control)

SPECIFICATIONS SUMMARY

The VVPP is the stepper motor controller training module designed by EDIBON.
It has a PLC which programmed for controlling the stepper motor and includes a software to program the PLC.
Technical data:
- Number of inputs: 8.
- Voltage: 230 Vac.
- Number outputs: 4.
- Output type: Relay.
- Output capacity: 2 A.
- Single-phase: 220 V; 6.3 VA.

Dimensions (approx.): 300 x 190 x 120 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

VVPP/B. **Velocity Control for Stepper Motor** (Manual Control)

SPECIFICATIONS SUMMARY

Front panel:
- DC input + ground connection. ON/OFF switch.
- A, A', B, B' connections with 4 fuses.
- Direction: clockwise/anticlockwise.
- Manual control with 4 switches.

Dimensions (approx.): 300 x 190 x 120 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

Individual Elements:

SPECIFICATIONS SUMMARY

VVCC/B. **DC Motor Speed Controller**, with no other elements
- Maximum power: 550W.
- Maximum torque: 2.6 N.m.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

LIMEL. **Integrated Laboratory for Electrical Machines:**

⑧ AC Motor Speed Control

VVCA. **AC Motor Speed Controller**

SPECIFICATIONS SUMMARY

This is a unit for varying the speed of an AC motor for control applications.
This unit enables to change the speed of an asynchronous motor, obtaining features which characterize a direct current motor. It consists basically on a rectifying phase coupled to another inverter phase, with a capacitor in parallel between them. By varying the shooting frequency of the IGBT, we obtain an alternating output at a variable frequency which is applied to the asynchronous motor.
Metallic box.
Circuit diagram in front panel.
It has a control panel in order to introduce the parameters of the motor that is going to be used and the output frequency. In addition, through it, we can carry out several programming. The unit also has a series of terminals where we connect the digital and analog inputs and the relay and transistor outputs.
Maximum power: 750 W.
Parameter self adjustment.
Analog/digital parameter inlets through panel.
Turn inversion while running.
Analog parameter visualization.
Voltage Input:
Frequency set according to external command: up to 50Hz. Reversible operation using +/- signal: 0 to +/-10 V. PID control. Input resistance: 22 KΩ.
Current input:
Frequency set according to the analog input current command: up to 50 Hz. Reversible operation: 20 to 4mA. PID control. Input resistance: 250 Ohms.
5 Digital inputs that can be configured by the user.
1 Outlet to alarm relay.
2 Transistor internal outlets:
Maximum load current: 50 mA. Leak current at OFF: 0.1 mA
Speed range: 130-2000 r.p.m.
Besides the motor speed controller, all the indicators, connecting cables and additional components are included.
Dimensions (approx.): 400 x 600 x 500 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

PRACTICAL POSSIBILITIES

1.- Motor parameters adjustment.
2.- Working at a frequency given by the panel.
3.- Working at a frequency given by an analog input (potentiometer).
4.- Turn inversion.
5.- Display of analog output.
6.- Digital inputs configuration.
7.- Outputs from alarm to relay.
8.- Outputs from alarm to transistor.

VVCA/M. **AC Motor Speed Controller** (intermediate option)

SPECIFICATIONS SUMMARY

This unit consist in a simple AC motor speed controller.
Metallic box.
Power: 3kVA.
Frequency: 1-50 Hz.
Phase voltage: 230 Vac.
Maximum current: 8A.
Overcurrent thermal protection.
ON/OFF switch.
It has two blocks in the front panel:
Speed control: Start/Stop switch and speed control potenciometer.
Connections to motor: Three-phase connection to AC motor and ground connection.
Dimensions (approx.): 300 x 190 x 120 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

Individual Elemenents:

SPECIFICATIONS SUMMARY

VVCA/B. **AC Motor Speed Controller**, with no other elements
Frequency from 0 to 60Hz.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

LIMEL. **Integrated Laboratory for Electrical Machines:**

⑨ PLC (Programmable Logic Controller)

The Programmable Logic Controller is a device designed for real time control of sequential processes in an industrial environment. In this case, EDIBON has developed this PLC module for controlling the Electrical Machines Units.

PLC-PI. **PLC Module for the Control of Industrial Processes**

PLC-PI

+

PLC-SOF

SPECIFICATIONS SUMMARY

This module has been designed for the Control of Industrial Processes. The application has been developed to be used with any individual electric machine.

PLC-PI. PLC Module:
- Metallic box. Circuit diagram in the front panel.
- Front panel:
  - Digital inputs(X) and Digital outputs (Y) block:
    - 16 Digital inputs.
    - 14 Digital outputs.
  - Analog inputs block:
    - 16 Analog inputs.
  - Analog outputs block:
    - 4 Analog outputs.
  - Touch screen.
- Back panel:
  - Power supply connector. 2 A Fuse. RS-232 connector to PC. USB 2.0 connector to PC.
- Inside:
  - Power supply outputs: 24 Vdc, 12 Vdc, -12 Vdc, 12 Vdc variable.
  - Panasonic PLC:
    - High-speed scan of 0.32 µsec. for a basic instruction.
    - Program capacity of 32 Ksteps, with a sufficient comment area.
    - High-speed counter.
    - Multi-point PID control.
  - Digital inputs/outputs and analog inputs/outputs Panasonic modules.
- RS232 Communication wire to computer (PC).

PLC-SOF. PLC Control Software:
- The software package is always included with the PLC-PI module.

Electrical supply required: single-phase, 220 V. - 110 V.
Dimensions (approx.): 490 x 330 x 310 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

PRACTICAL POSSIBILITIES

1.- Control of the particular unit process through the control interface box without the computer (PC).
2.- PID control.
3.- Visualization of all the sensors values used in the particular unit process.
4.- Calibration of all sensors included in the particular unit process.
5.- Hand on of all the actuators involved in the particular unit process.
6.- Realization of different experiments, in automatic way, without having in front the particular unit. (This experiment can be decided previously).
7.- Simulation of outside actions, in the cases hardware elements do no exit.
8.- PLC hardware general use and manipulation.
9.- PLC process application for the particular unit.
10.- PLC structure.
11.- PLC inputs and outputs configuration.
12.- PLC configuration possibilities.
13.- PLC program languages.
14.- PLC different programming standard languages.
15.- New configuration and development of new process.
16.- Hand on an established process.
17.- Visualization and see the results and to make comparisons with the particular unit process.
18.- Possibility of creating new process in relation with the particular unit process.
19.- PLC Programming exercises.
20.- Own PLC applications in accordance with teacher and student requirements.

EDIBON FP-X/CPU. **PLC**, with no other elements

SPECIFICATIONS SUMMARY

Inputs: 8.
Output: 6. Output type: Relay 2A.
Data memory: 12285.
Bit memory: 4096.
High Speed Counter.
Number of interruption programs: 15 programs (14 external, 1 internal).
Dimension (w, d, h): 60 x 79 x 90 mm.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

⑩ Tachogenerator

TECNEL/T. **Tachogenerator**

SPECIFICATIONS SUMMARY

The Tachogenerator, as a speed transducer, provides a means of converting the rotational speed into an analog voltage signal. Thus, it is mainly used for measuring the motor speed.
TECNEL/T is an automatic unit, that could be permanently connected to the motor.
Output voltage gradient: 60 +/- 5% V/1000 r.p.m.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

TECNEL/TM. **Hand Tachometer**

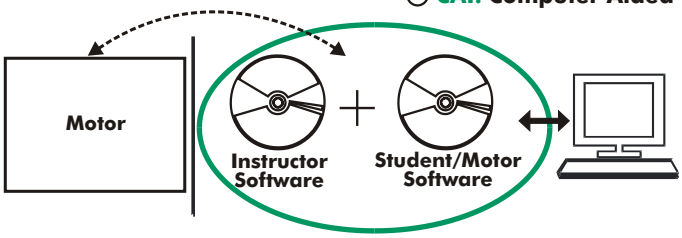
SPECIFICATIONS SUMMARY

This is a hand optical tachometer. It cannot be attached to the motor, what implies that the measurements have to be taken manually.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

LIMEL. **Integrated Laboratory for Electrical Machines:**

⑪ CAI. Computer Aided Instruction Software System



With no physical connection between motor and computer, this complete package consists on an Instructor Software (INS/SOF) totally integrated with the Student Software (EMT../SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students. These, on the other hand, get a virtual instructor who helps them to deal with all the information on the subject of study.

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

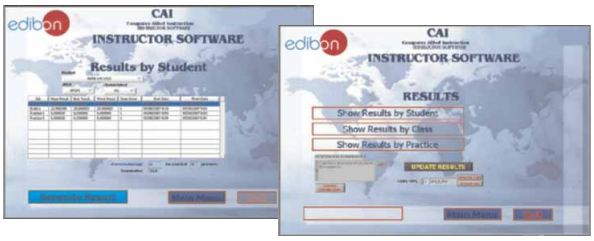
The Instructor can:

- Organize Students by Classes and Groups.
- Create easily new entries or delete them.
- Create data bases with student information.
- Analyze results and make statistical comparisons.
- Print reports.
- Develop own examinations.
- Detect student's progress and difficulties.

...and many other facilities.

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

Instructor Software



- EMT../SOF. Computer Aided Instruction Softwares (Student Software):

It explains how to use the motor, run the experiments and what to do at any moment. Each motor has its own Student Software.

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

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

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

  Guided Practices: presents several practices to be done with the motor, showing how to complete the circuits and get the right information from them.

  Exams: set of questions presented to test the obtained knowledge.

Student Software

Available Student Softwares:

➤Motors (D.C.)

-EMT1/SOF. D.C. Independent excitation motor-generator.
-EMT2/SOF. D.C. Series excitation motor-generator.
-EMT3/SOF. D.C. Shunt excitation motor-generator.
-EMT4/SOF. D.C. Compound excitation motor-generator.
-EMT5/SOF. D.C. Shunt-series compound excitation motor.
-EMT12/SOF. Universal motor (single-phase).
-EMT15/SOF. D.C. Permanent magnet motor.
-EMT18/SOF. D.C. Brushless motor.
-EMT19/SOF. Stepper motor.

➤Motors (A.C.)

-EMT6/SOF. A.C. Synchronous three-phase motor alternator.
-EMT6B/SOF. Permanent magnets synchronous three-phase generator (24 Vac).
-EMT7/SOF. Asynchronous three-phase motor of squirrel cage.
-EMT7B/SOF. Asynchronous three-phase motor of squirrel cage (4 poles).
-EMT7C/SOF. Asynchronous three-phase motor of squirrel cage (8 poles).
-EMT8/SOF. Asynchronous three-phase motor with wound rotor.
-EMT9/SOF. Dahlander three-phase (two-speeds).
-EMT10/SOF. Asynchronous three-phase motor of two independent speeds.
-EMT11/SOF. Asynchronous single-phase motor with starting capacitor.
-EMT12/SOF. Universal motor (single-phase).
-EMT14/SOF. Repulsion motor, single-phase with short-circuited brushes.
-EMT16/SOF. Asynchronous single-phase motor with starting and running capacitor.
-EMT17/SOF. Three-phase motor of squirrel cage with "Y" connection.
-EMT20/SOF. Asynchronous single-phase motor with split phase.
-EMT21/SOF. Three-phase reluctance motor.
-EMT22/SOF. Single-phase shaded pole motor.

⑫ CAL. Computer Aided Learning Software (Results Calculation and Analysis)

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

CAL is a class assistant that helps in making the necessary calculations to extract the right conclusions from data obtained during the experimental practices.

CAL will perform the calculations.

CAL computes the value of all the variables involved.

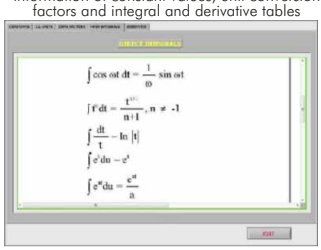
It allows to plot and print the results. Between the plotting options, any variable can be represented against any other.

Different plotting displays.

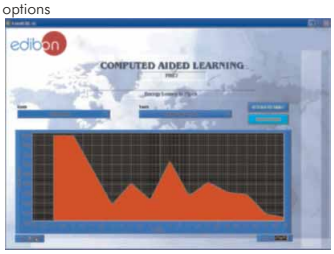
It has a wide range of information, such as constant values, unit conversion factors and integral and derivative tables.

Calculations

Information of constant values, unit conversion factors and integral and derivative tables



Plotting options



Available Softwares:

➤Motors (D.C.)

-EMT1/CAL. D.C. Independent excitation motor-generator.
-EMT2/CAL. D.C. Series excitation motor-generator.
-EMT3/CAL. D.C. Shunt excitation motor-generator.
-EMT4/CAL. D.C. Compound excitation motor-generator.
-EMT5/CAL. D.C. Shunt-series compound excitation motor.
-EMT12/CAL. Universal motor (single-phase).
-EMT15/CAL. D.C. Permanent magnet motor.
-EMT18/CAL. D.C. Brushless motor.
-EMT19/CAL. Stepper motor.

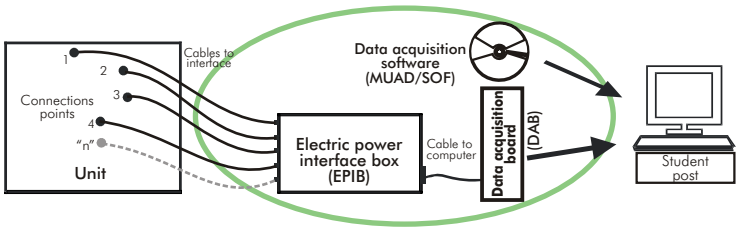
➤Motors (A.C.)

-EMT6/CAL. A.C. Synchronous three-phase motor alternator.
-EMT6B/CAL. Permanent magnets synchronous three-phase generator (24 Vac).
-EMT7/CAL. Asynchronous three-phase motor of squirrel cage.
-EMT7B/CAL. Asynchronous three-phase motor of squirrel cage (4 poles).
-EMT7C/CAL. Asynchronous three-phase motor of squirrel cage (8 poles).
-EMT8/CAL. Asynchronous three-phase motor with wound rotor.
-EMT9/CAL. Dahlander three-phase (two-speeds).
-EMT10/CAL. Asynchronous three-phase motor of two independent speeds.
-EMT11/CAL. Asynchronous single-phase motor with starting capacitor.
-EMT12/CAL. Universal motor (single-phase).
-EMT14/CAL. Repulsion motor, single-phase with short-circuited brushes.
-EMT16/CAL. Asynchronous single-phase motor with starting and running capacitor.
-EMT17/CAL. Three-phase motor of squirrel cage with "Y" connection.
-EMT20/CAL. Asynchronous single-phase motor with split phase.
-EMT21/CAL. Three-phase reluctance motor.
-EMT22/CAL. Single-phase shaded pole motor.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

LIMEL. **Integrated Laboratory for Electrical Machines:**

⑬ MUAD. Electric Power Data Acquisition System



MUAD is the perfect link between the unit and the PC. MUAD is a continuous data acquisition system with virtual instrumentation, that measures, analyzes and represents the parameters involved in the process.

MUAD allows voltage and current acquisition and measurement, data processing, frequency spectrum and all the functions of a digital oscilloscope.

We easily connect the Electric Power Interface Box (EPIB) to the unit with the supplied cables (there are several connection points placed for it). The EPIB is connected to the PC through the Data Acquisition Board (DAB), and by using the Data Acquisition with Virtual Instrumentation Software the student can get results from the undertaken experiment/practice, see them on the screen and work with them.

This MUAD System includes EPIB + DAB + MUAD/SOF:

1) EPIB. **Electric Power Interface Box** (dimensions: 300 x 180 x 120 mm. approx.):

Interface that carries out the conditioning of the diverse signals that can be acquired in a process, for their later treatment and visualisation.

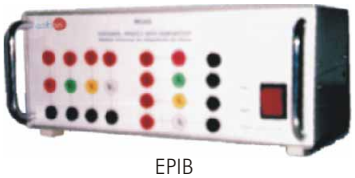
In the front panel, the elements are separated in two parts: left-hand part to VOLTAGE sensors, and right-hand part corresponds with CURRENT sensors.

8 analog input channels.

Sampling range: 250 KSPS (Kilo samples per second).

4 Tension sensors AC/DC, 400V.

4 Current sensors.



EPIB

+

2) DAB. **Data Acquisition Board :**

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

Analog input:

Number of channels= 16 single-ended or 8 differential.

Resolution=16 bits, 1 in 65536.

Sampling rate up to: 250 KS/s (Kilo samples per second).

Analog output:

Number of channels=2.

Resolution=16 bits, 1 in 65536.

Digital Input/Output:

Number channels=24inputs/outputs.

Timing: Counter/timers=2.

DAB

+

3) MUAD/SOF. **Data Acquisition Software** :

Data Acquisition Software with Graphic Representation:

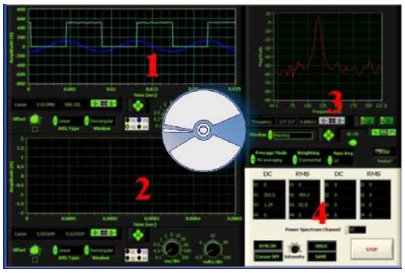
Friendly graphical frame.

Compatible with actual Windows operating systems.

Configurable software allowing the representation of temporal evolution of the different signals.

Visualization of a tension of the circuits on the computer screen.

Sampling velocity up to 250 KS/s. (Kilo samples per second).



MUAD/SOF

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/LIMEL.pdf

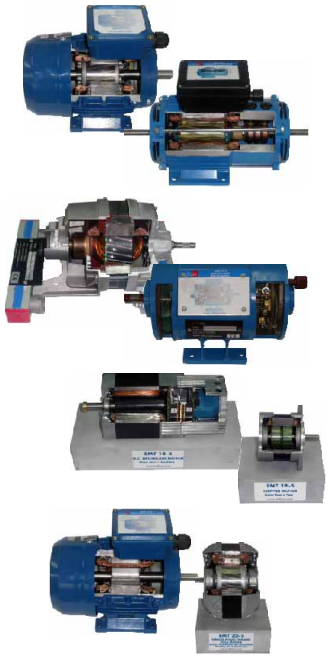
EMT-E. **Motors**

Available motors:

➤Motors (D.C.)
-EMT1-E. D.C. Independent excitation motor-generator.
-EMT2-E. D.C. Series excitation motor-generator.
-EMT3-E. D.C. Shunt excitation motor-generator.
-EMT4-E. D.C. Compound excitation motor-generator.
-EMT5-E. D.C. Shunt-series compound excitation motor.
-EMT12-E. Universal motor (single-phase).
-EMT15-E. D.C. Permanent magnet motor.
-EMT18-E. D.C. Brushless motor.
-EMT19-E. Stepper motor.

➤Motors (A.C.)
-EMT6-E. A.C. Synchronous three-phase motor alternator.
-EMT6B-E. Permanent magnets synchronous three-phase generator (24 Vac).
-EMT7-E. Asynchronous three-phase motor of squirrel cage.
-EMT7B-E. Asynchronous three-phase motor of squirrel cage (4 poles).
-EMT7C-E. Asynchronous three-phase motor of squirrel cage (8 poles).
-EMT8-E. Asynchronous three-phase motor with wound rotor.
-EMT9-E. Dahlander three-phase (two-speeds).
-EMT10-E. Asynchronous three-phase motor of two independent speeds.
-EMT11-E. Asynchronous single-phase motor with starting capacitor.
-EMT12-E. Universal motor (single-phase).
-EMT14-E. Repulsion motor, single-phase with short-circuited brushes.
-EMT16-E. Asynchronous single-phase motor with starting and running capacitor.
-EMT17-E. Three-phase motor of squirrel cage with "Y" connection.
-EMT20-E. Asynchronous single-phase motor with split phase.
-EMT21-E. Three-phase reluctance motor.
-EMT22-E. Single-phase shaded pole motor.

EMT-S. **Cut Away Motors**



Available cut away motors:

➤Motors (D.C.)
-EMT1-S. D.C. Independent excitation motor-generator.
-EMT2-S. D.C. Series excitation motor-generator.
-EMT3-S. D.C. Shunt excitation motor-generator.
-EMT4-S. D.C. Compound excitation motor-generator.
-EMT5-S. D.C. Shunt-series compound excitation motor.
-EMT12-S. Universal motor (single-phase).
-EMT15-S. D.C. Permanent magnet motor.
-EMT18-S. D.C. Brushless motor.
-EMT19-S. Stepper motor.

➤Motors (A.C.)
-EMT6-S. A.C. Synchronous three-phase motor alternator.
-EMT6B-S. Permanent magnets synchronous three-phase generator (24 Vac).
-EMT7-S. Asynchronous three-phase motor of squirrel cage.
-EMT7B-S. Asynchronous three-phase motor of squirrel cage (4 poles).
-EMT7C-S. Asynchronous three-phase motor of squirrel cage (8 poles).
-EMT8-S. Asynchronous three-phase motor with wound rotor.
-EMT9-S. Dahlander three-phase (two-speeds).
-EMT10-S. Asynchronous three-phase motor of two independent speeds.
-EMT11-S. Asynchronous single-phase motor with starting capacitor.
-EMT12-S. Universal motor (single-phase).
-EMT14-S. Repulsion motor, single-phase with short-circuited brushes.
-EMT16-S. Asynchronous single-phase motor with starting and running capacitor.
-EMT17-S. Three-phase motor of squirrel cage with "Y" connection.
-EMT20-S. Asynchronous single-phase motor with split phase.
-EMT21-S. Three-phase reluctance motor.
-EMT22-S. Single-phase shaded pole motor.

ESAM. **Faults Simulation Trainer in Electrical Motors**

SPECIFICATIONS SUMMARY

Teaching trainer for the simulation of faults in three-phase motors.
Unit and motor are mounted in a painted steel structure.
Unit:
Metallic box. Electrical diagram of the motor on the front panel.
The motor can be connected in star or delta connection.
Connections for the measurements. The resistance of the windings can be measured. Pilot lamps. 6-position selector for the selection of the fault sequences. Switch for faults activation.
Faults are implemented by means a PLC and internal relays. This lets the motor can keep on working in different conditions when certain faults are caused.
6 fuses of 2A to protect the motor. Automatic Magnetothermal Differential switch.
Dahlander three-phase motor, including cable and connector.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 800 mm x 400 mm x 400 mm approx. Weight: 30Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/ESAM.pdf

PRACTICAL POSSIBILITIES

1.- Detection of fault on a phase.
2.- Detection of fault on the supply voltage.
3.- Coils with turns in short circuit.
4.- Measurement the resistance of the windings.
5.- Detection of open-ended coil.
6.- Detection of short circuit in coils from different phase.
7.- Measurement the resistance between coils from different phases.
8.- Detection of ground fault.
9.- Measurement of the insulation resistance between the winding and the motor case.
10.- Motor in star connection.
11.- Motor in delta connection.

ESAE. **Electrical Faults Simulation Trainer**

SPECIFICATIONS SUMMARY

Metallic box. Diagram in the front panel with similar distribution to the elements in the real unit.

With this trainer the following troubles or faults, among others, may be fixed and determined:

- Power off.
- Fuse blown.
- Defective main circuit broker.
- Defective leak current coil relay.
- Ground fault.
- Detection of fault on the supply voltage.
- Capacitor.
- Thermostat contacts stuck open and closed.
- Relay contacts stuck closed.
- Relay windings open.
- Fan.
- Motor.
- Compressor.
- Low voltage.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions: 400 x 330 x 400 mm. approx.

Weight: 10 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/ESAE.pdf

PRACTICAL POSSIBILITIES

With this trainer the following troubles or faults, among others, may be fixed and determined:

1.- Power off.
2.- Fuse blown.
3.- Defective main circuit broker.
4.- Defective leak current coil relay.
5.- Ground fault.
6.- Detection of fault on the supply voltage.
7.- Capacitor:
   Starting capacitor open and run capacitor open.
   Starting capacitor shorted and run capacitor shorted.
8.- Thermostat contacts stuck open and closed.
9.- Relay contacts stuck closed.
10.- Relay windings open.
11.- Fan:
   Fan motor windings open and shorted.
   Fan relay windings open and shorted. Fan relay contacts stuck closed. Fan relay contacts are rusting.
   Fan thermostat contacts stuck closed. Fan thermostat sensor bulb stuck opened.
12.- Motor:
   Starting motor windings open and shorted.
   Running motor windings open and shorted.
13.- Compressor:
   Thermal overload open.
   Compressor motor winding grounded.
14.- Low voltage.

EEA. **Alternators Study Unit**

SPECIFICATIONS SUMMARY

Unit for the study of alternators. Starting, operation and regulation of an alternator without load, half load and full load.

The unit comprises:

Base structure (painted steel and anodized aluminium). Couplings. Connectors.

EMT7. Asyncrhonous Three-phase motor of squirrel cage.

EMT6. A. C. Syncrhonous alternator motor.

VVCA/B. AC motors speed controller:

This unit enables to change the speed of an asynchronous motor, obtaining features which characterize a motor.

Cables and accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 750 x 250 x 250 mm. Weight: 30 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/EEA.pdf

PRACTICAL POSSIBILITIES

1.- Starting, voltage and frequency regulation in a three-phase alternator.
2.- Typical practices for a three-phase alternator.
3.- Characteristic curve of an alternator without load.
4.- Characteristic curve of an alternator in short circuit.
5.- Characteristic curve of an alternator with load.
6.- Synchronous motor starting.
7.- Working at a frequency given.
8.- Curves in V at constant power (1/4, 1/3, ½,1) PN and different power factors.

EGMG24. **Motor-Generator Group,** three-phase 24 Vac, no excitation required (permanent magnets)

SPECIFICATIONS SUMMARY

Motor-Generator Group mounted in a painted steel structure.

This Motor-Generator Group allows the study of the three phase alternator in both no-load and load regime.

Couplings.

Connectors.

EMT6/E. Permanent magnets synchronous three-phase generator (24 Vac):

Power: 450 W. Speed: 750 r.p.m. Frequency: 50 Hz.
V. Armature: 3 x 24 Vac.
I. Armature: 11 A.

EMT7/E. Asynchronous three-phase motor of squirrel cage:

Power: 550 W. Speed: 750 r.p.m. Connections: Triangle/Star.
Frequency: 50-60 Hz.
V. Armature: 3 x 230/400 V.
I. Armature nominal: 3,6-2 A.

Protections cover.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 750 x 250 x 250 mm. Weight: 35 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/EGMG24.pdf

PRACTICAL POSSIBILITIES

1.- Measurements of voltage with no load, measurement of the frequency and measurement of no load losses.
2.- Connection to a load. Measurement of the voltage drop with load. Measurement of the power supplied.
3.- Behaviour of the alternator with different cos φloads.

ERP. **Protection Relays Test:**

ERP-UB. **Protection Relays Test Unit**

SPECIFICATIONS SUMMARY

This is a teaching unit which gives students theoretical and practical experience with several industrial relays. Unit designed for comprehensive investigations into the theory and practice of electrical power system protection.

This unit is common for the relays modules type "ERP" and can use one or more relays.

Floor-standing unit, mounted in anodized aluminium structure and panels in painted steel, enabling wide range of protection relay investigations.

It uses genuine industrial application relays, not simulations, with full range of safety features incorporated throughout.

Diagrams on the unit enable students to set up and perform practices and experiments with minimal supervision.

Comprehensive controls, transformers, supplies and instrumentation.

Modern, ergonomic and practical design which includes desk space for users or students to work on, and mounting area for relays.

It is supplied with relay support software.

This Unit basically consists on these main parts:

- Main connections, control and measurement board.
- Three-phase Voltage Regulation Dial Selector.
- Three-phase Load Regulation Dial Selector.
- Unit Power Supply and Protection.
- Transmission Lines Simulation Module.
- Fault Injection Module.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 1250 x 800 x 2000 mm. Weight: 400 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/ERP.pdf

PRACTICAL POSSIBILITIES

1.- A wide range of practices and investigations into the performance and characteristics of a variety of different industrial relays.

ERP-SFT. **Overcurrent and Earth Fault Protection Relay Module**

SPECIFICATIONS SUMMARY

ERP-SFT. Overcurrent and Earth Fault Protection Relay Module, for use with the Protection Relays Test Unit (ERP-UB), to enable investigations into protection and monitoring of transformers, transmission lines and distribution schemes.

Modern and robust enclosure (steel box) with carrying handles.

The connections are via safety sockets.

The main functions:

- Phase Instantaneous Overcurrent (50P1-50P6).
- Phase Time-Overcurrent (51P1T, 51P2T).
- Single-phase Instantaneous Overcurrent (50A, 50B, 50C).
- Neutral Ground Instantaneous Overcurrent (50N1, 50N2).
- Neutral Ground Time-Overcurrent (51N1T).
- Residual Ground Instantaneous Overcurrent (50G1, 50G2).
- Residual Ground Time-Overcurrent (51G1T).
- Negative-Sequence Instantaneous Overcurrent (50Q1, 50Q2).
- Negative-Sequence Time-Overcurrent (51Q1T, 51Q2T).
- Setting Range, 5 A nominal, Instantaneous Overcurrent (OFF, 0.5-80.0 A).
- Setting Range, 5 A nominal, Time- Overcurrent (OFF, 0.5-16.0 A).
- One Auto-Reclosing Function 79.
- Selectable blocking.
- Circuit monitoring.
- Trend, fault and disturbance records.

The connection to the experimental circuit is via current transformers with ratio to suit the inputs of the relay.

It allows an effective demonstration of the effect of current and voltage transformer ratio, connection and rating on protective relays.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/ERP.pdf

PRACTICAL POSSIBILITIES

1.- Verification of Overcurrent Protection functionality.

2.- Verification of Phase Overcurrent Elements.

3.- Verification of Residual Ground Overcurrent Elements.

4.- Verification of Phase Instantaneous Overcurrent Protection.

5.- Verification of Phase Time Overcurrent Protection.

6.- Verification of Neutral Ground Instantaneous Overcurrent Protection.

7.- Verification of Neutral Ground Time-Overcurrent Protection.

8.- Verification of Residual Ground Instantaneous Overcurrent Protection.

9.- Verification of Residual Ground Time-Overcurrent Protection.

10.- Verification of Current Transformer Measurement accuracy.

11.- Power Transformer Overcurrent Protection.

12.- Power Transmission Line Overcurrent Protection.

13.- Load Feeder Overcurrent Protection.

14.- Distribution System Overcurrent Protection.

15.- Power Transmission System Overcurrent Protection.

ERP. **Protection Relays Test:**

ERP-SDND. **Directional/Non Directional Overcurrent Protection Relay Module**

SPECIFICATIONS SUMMARY

ERP-SDND. Directional/Non Directional Overcurrent Protection Relay Module, for use with the Protection Relays Test Unit (ERP-UB), to enable investigations into protection and monitoring of generator and transformer schemes, overhead lines, underground cables and backup on high-voltage systems.

Modern and robust enclosure (steel box) with carrying handles.

The connections are via safety sockets.

The main functions:

The ERP-SDND Unit includes numerous phase, negative-sequence, residual-ground, and neutral overcurrent elements, as shown in the next table:

Overcurrent Element Operating Quantity	Number of Elements	Directional Control	Torque Control	Definite-Time Delay
Maximum phase current (IA, IB, or IC)	1 inverse-time (51P) 6 instantaneous (50P1-50P6)	Yes Yes, on first 4	Yes Yes, on first 4	NA Yes, on first 4
Maximum phase-phase current (IAB, IBC, or ICA)	4 instantaneous (50PP1-50PP4)	No	No	No
Independent phase current	3 inverse-time (51A, 51B, 51C)	Yes	Yes	NA
Residual-ground current (3I0)	2 inverse-time (51G1,51G2) 6 instantaneous (50G1-50G6)	Yes Yes, on first 4	Yes Yes, on first 4	NA Yes, on first 4
Negative-sequence current (3I2)	1 inverse-time (51Q) 6 instantaneous (50Q1-50Q6)	Yes Yes, on first 4	Yes Yes, on first 4	NA Yes, on first 4
Neutral current (IN)	1 inverse-time (51N) 6 instantaneous (50N1-50N6)	Yes Yes, on first 4	Yes Yes, on first 4	NA Yes, on first 4

Inverse-time overcurrent element settings include a wide and continuous pickup current range, continuous time-dial setting range, and time-current curve choices from both US (IEEE) and IEC standard curves.

Undervoltage Protection Element (27).

Phase Overvoltage Protection Element (59P).

Ground Overvoltage Protection Element (59G).

Negative Sequence Overvoltage Protection (59Q).

Creating fault and disturbance records.

Selectable blocking.

Selogic Control Equations.

Event Report.

Sequential Events Recorder (SER).

Breaker Wear Monitor.

Station Battery Monitor.

DNP3 Serial LAN/WAN Outstation (Slave).

Modbus RTU and TPC.

High-Accuracy Metering.

Remote and Local Control Switches.

Wye or Delta Voltage Connection.

Synchrophasor Measurements.

Fault Locator.

Fast SER Protocol.

Directional/Definite-Time Overcurrents Elements.

Two Residual-Ground Time-Overcurrents Elements.

Six Frequency Elements.

Sensitive Earth Fault Protection and Directional Protection for Various System Grounding Practices.

Load-Encroachment Logic.

Synchronism Check.

ACSELERATOR QuickSet Compatible.

The connection to the experimental circuit is via current transformers with ratio to suit the inputs of the relay.

It allows an effective demonstration of the effect of current and voltage transformer ratio, connection and rating on protective relays.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/ERP.pdf

PRACTICAL POSSIBILITIES

1.- Verification of Directional Protection functionality.

2.- Directional Protection with different measurement circuit conditions.

3.- Directional Protection application to Transmission Line under different load conditions.

4.- Forward Directional Protection.

5.- Reverse Directional Protection.

6.- Non-Directional Overcurrent Protection.

7.- Residual Ground Time-Overcurrent Protection.

8.- Residual Ground Instantaneous Overcurrent Protection.

9.- Verification of Cable Undervoltage Protection.

10.- Verification of Cable Overvoltage Protection.

11.- Verification of Current Transformers Measurements accuracy.

12.- Verification of Voltage Transformers Measurements accuracy.

13.- Distribution System Directional Protection.

ERP. **Protection Relays Test:**

ERP-PDF. **Differential Protection Relay Module**

SPECIFICATIONS SUMMARY

ERP-PDF. Differential Protection Relay Module, for use with Protection Relays Test Unit (ERP-UB), to enable investigations into protection of transformers, autotransformers, generators, Bus Bar and other apparatus with two windings.

It demonstrates the characteristics of three-phase differential protection.

Modern and robust enclosure (steel box) with carrying handles.

The connections are via safety sockets.

The main functions:

Eight Overcurrent Elements for Winding 1	Instantaneous	Definite Time	Inverse Time
Phase	50P1H	50P1	51P1
Negative Sequence		50Q1	51Q1
Residual	50N1H	50N1	51N1
Eight Overcurrent Elements for Winding 2	Instantaneous	Definite Time	Inverse Time
Phase	50P2H	50P2	51P2
Negative Sequence		50Q2	51Q2
Residual	50N2H	50N2	51N2
Setting Ranges, 5 A Model, (A secondary)	OFF, (0.5-80)	OFF, (0.5-80)	OFF, (0.5-16)

Selogic Control Equations. Event Reports.

ASCII. Bynari, and Distributed Port Switch Communications.

Phase, Ground, Negative-Sequence, Differential and Harmonic Metering.

Restrained and Unrestrained Differential Elements.

Second- and Fourth Harmonic Restraint.

Fifth-Harmonic and DC Blocking.

CT and Transformer Connection Compensation.

Connection to the primary and secondary windings of the experimental is circuit via current transformers with ratio to suit the inputs of the relay. This provides an effective demonstration of the effect of current and voltage transformer ratio, connection and rating on protective relays.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

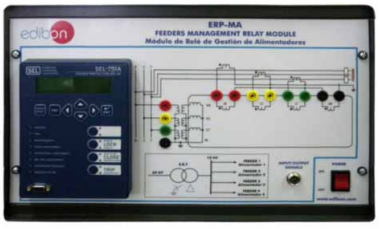
Dimensions(approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/ERP.pdf

PRACTICAL POSSIBILITIES

1.- Verification of Differential Protection functionality.
2.- Transformer Differential Protection with variable TAP's voltage regulation.
3.- Transformer Differential Protection with different transformer connection diagrams.
4.- Verification of Phase Instantaneous Overcurrent Protection for Winding 1.
5.- Verification of Phase Definite Time-Overcurrent Protection for Winding 1.
6.- Verification of Phase Inverse Time-Overcurrent Protection for Winding 1.
7.- Verification of Phase Instantaneous Overcurrent Protection for Winding 2.
8.- Verification of Phase Definite Time-Overcurrent Protection for Winding 2.
9.- Verification of Phase Inverse Time-Overcurrent Protection for Winding 2.
10.- Verification of Current Transformers Measurement accuracy.
11.- Power Transformer Overcurrent Protection.
12.- Distribution Substation Bus-Bar Differential Protection.
13.- Transmission Substation Bus-Bar Differential Protection.
14.- Analysis of Event Reports and Human Machine Interface.

ERP-MA. **Feeders Management Relay Module**



SPECIFICATIONS SUMMARY

ERP-MA. Feeders Management Relay Module, for use with the Protection Relays Test Unit (ERP-UB), to enable investigations into protection and monitoring of overhead lines, underground cables and feeders.

Modern and robust enclosure (steel box) with carrying handles.

The connections are via safety sockets.

The main functions:

Four levels of Phase Instantaneous Overcurrent Element (50P).
Four levels of Negative-Sequence Overcurrent Element (50Q).
Four levels of Residual Overcurrent Element (50G).
Four levels of Neutral Overcurrent Element (50G).
Two levels of Phase Time-Overcurrent Element (51P).
Two levels of Residual Time-Overcurrent Element (51G).
Two levels of Ground Time-Overcurrent Element (51G).
One level of Negative-Sequence Time-Overcurrent Element (51Q).
Phase to Ground Overvoltage (59G).
Phase to Phase Overvoltage (59P).
Negative-Sequence Overvoltage (59Q).
Residual Overvoltage (59G).
Phase to Ground Undervoltage (27G).
Phase to Phase Undervoltage (27P).
Six levels of Secure Overfrequency (81O).
Six levels of Secure Underfrequency (81U).
Two levels of Negative Power Flow with Definite Time Delay (32).
Two levels of Positive Power Flow with Definite Time Delay (32).
Station Battery Monitor. Breaker Wear Monitoring.
Synchrophasor Protocol. Peak Demand and Demand Metering. Auto-Reclosing.
Creating fault and disturbance records.

The connection to the experimental circuit is via current transformers with ratio to suit the inputs of the relay.

It allows an effective demonstration of the effect of current and voltage transformer ratio, connection and rating on protective relays.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

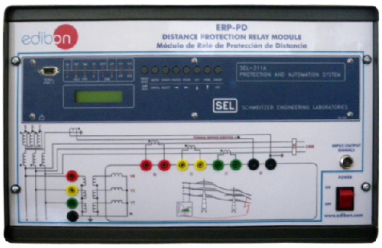
More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/ERP.pdf

PRACTICAL POSSIBILITIES

1.- Verification of the Feeder Management Relay functionality.
2.- Phase Overcurrent Element of the Feeder Management Relay.
3.- Residual Ground Overcurrent Element of the Feeder Management Relay
4.- Overvoltage Element of the Feeder Management Relay
5.- Undervoltage Element of the Feeder Management Relay.
6.- Verification of Phase Instantaneous Overcurrent Protection.
7.- Verification of Phase Time-Overcurrent Protection.
8.- Verification of Residual Overcurrent Element.
9.- Verification of Residual Time-Overcurrent Element.
10.- Verification of Neutral Overcurrent Element.
11.- Verification of Overfrequency Protection Element.
12.- Verification of Underfrequency Protection Element.
13.- Verification of Positive (forward) Power Flow Protection Element.
14.- Verification of Negative (reverse) Power Flow Protection Element.
15.- Protection of Distribution Feeder Example.
16.- Protection of Overhead Transmission Line Example.

ERP. **Protection Relays Test:**

ERP-PD. **Distance Protection Relay Module**



SPECIFICATIONS SUMMARY

For use with the Protection Relays Test Unit (ERP-UB), to enable investigations into protection and monitoring of overhead transmission lines and underground cables.

Modern and robust enclosure (steel box) with carrying handles.

The connections are via safety sockets.

The main functions:

- Two zones of Phase Mho Distance Protection Element (21P).
- Two zones of Ground Mho Distance Protection Element (21G).
- Directional Phase Overcurrent Protection Element (67P).
- Directional Ground Overcurrent Protection Element (67G).
- Phase Overcurrent Protection Element (50P).
- Ground Overcurrent Protection Element (50G).
- Phase Time-Overcurrent Protection Element (51P).
- Ground Time-Overcurrent Protection Element (51G).
- Event Reports.
- Breaker Wear Monitor.
- Fault Locator.
- Local Display.
- Synchronophasors.
- Load Encroachment.
- Metering and Monitoring Functions.
- Creating fault and disturbance records.
- Blocking of any one protection element.

The connection to the experimental circuit is via current transformers with ratio to suit the inputs of the relay.

It allows an effective demonstration of the effect of current and voltage transformer ratio, connection and rating on protective relays.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machines/ERP.pdf

PRACTICAL POSSIBILITIES

1.- Verification of Line Distance Protection functionality.
2.- Line Distance Protection with different measurement circuit conditions.
3.- Line Distance Protection with different Line Loads conditions.
4.- Verification of Phase Instantaneous Overcurrent Element.
5.- Verification of Ground Instantaneous Overcurrent Element.
6.- Verification of Phase Time-Overcurrent Protection Element.
7.- Verification of Ground Time-Overcurrent Protection Element.
8.- Verification of Current Transformer Measurement accuracy.
9.- Verification of Current Transformers Connection Diagram.
10.- Verification of Voltage Transformers Measurement Accuracy and Connection Diagram for Distance Protection.
11.- Overhead Transmission Line Parameters Estimation for Distance Protection.
12.- Overhead Transmission Line Distance Protection.
13.- Distance Protection Event Reports Analysis.
14.- Distance Protection Relay Human Machine Interface.
15.- Distance Protection Relay Configuration.
16.- Distance Protection of Simple Power System Example.

EMT-KIT. **Disassembly Machines Kit**

SPECIFICATIONS SUMMARY

This Disassembly Machines Kit "EMT-KIT" allows the student to construct, operate and make more than 50 assemblies and practices of different electrical machines.

We have designed EMT-KIT to introduce students to electrical machines basic principles and a good understanding of motors and generators operation.

The student, using this Kit, will see clearly the machines components and how interconnecting them, both electrically and mechanically.

It includes:

- Baseplate.
- Frame ring.
- Fixed and removable bearing housings.
- Shaft.
- Squirrel cage rotor.
- Wound stator.
- Couplings.
- Armature poles and hub.
- Brushes.
- Brush holders.
- Commutator/slip rings.
- Interpoles.
- Armature, field and interpole coils.
- Compound field coils.
- Field poles.
- Centrifugal switch.
- Robust case for the elements.
- Necessary tools and elements for normal working operation.
- All machines that may be assembled use low voltage.
- Protected rotating parts.
- Operating at low power levels.
- Panel for connections and protections:
  - Anodized aluminium structure with panel in painted steel.
  - Diagrams for each practice, which explains the different connection configurations.
  - Connections box, that allows to make different connections for each practice.
  - Protection circuit that is used to protect each module short circuits.
- Drive motor: Asynchronous Three-phase motor of squirrel cage:
  - Power: 370W. Speed: 2730 r.p.m.
- WCA/M. AC Motor Speed Controller (intermediate option):
  - This unit consist in a simple AC motor speed controller.
  - This unit also is used for feeding the drive motor and for feeding and controlling the induction motor, squirrel cage assembly.
  - Power: 3kVA. Frequency: 1-50 Hz. Phase voltage: 230 Vac. Maximum current: 8A.
  - It has two blocks in the front panel:
    - Speed control: Start/Stop switch and speed control potenciometer.
    - Connections to motor: Three-phase connection to AC motor and ground connection.
- WCC/M. DC Motor Speed Controller (intermediate option):
  - This unit consists in a variable transformer followed by a rectifier bridge and an anti-ripple capacitor with a resistor to get discharged.
  - This unit is used for controlling the DC motors assemblies.
  - Adjustable voltage: up to 320 Vdc. Maximum current: 2 A. At the top of the unit there is a knob to adjust the DC voltage. Front panel including: Positive, negative and ground connections. ON/OFF switch.
- WPP/B. Velocity Control for stepper motor:
  - This unit is used for controlling the stepper motor assembly.
- Cables and accessories, for normal operation.
- Manuals: This Kits is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/electricity/machineskits/EMT-KIT.pdf

PRACTICAL POSSIBILITIES

The student can study and make these machines assemblies:

1.- Machines operating principles.
2.- Electromagnetism introduction.
3.- Basic DC and AC generators.
4.- DC shunt motor (with and without interpoles).
5.- DC shunt motor faults.
6.- DC series motor (with and without interpoles).
7.- DC compound motor (with and without interpoles).
8.- DC shunt generator (with and without interpoles).
9.- DC series generator (with and without interpoles).
10.- DC compound generator (with and without interpoles).
11.- DC separately excited generator (with and without interpoles).
12.- Single-phase AC series universal motor.
13.- Single-phase AC induction motor, squirrel cage (4 pole).
14.- Single-phase AC induction motor, squirrel cage (2 pole).
15.- Single-phase AC synchronous motor/generator (4 pole).
16.- Single-phase AC synchronous motor/generator (2 pole).
17.- Single-phase AC repulsion motor.
18.- Single-phase AC generator, rotating armature.
19.- Single-phase AC generator, rotating field.
20.- AC brushless generator.
21.- Three-phase AC induction motor, squirrel cage (4 pole).
22.- Three-phase AC induction motor, squirrel cage (2 pole).
23.- Three-phase AC synchronous motor (2 pole).
24.- Three-phase AC synchronous generator (2 pole).
25.- Shaded pole induction motor.
26.- Split field series motor.
27.- Stepper motors.
28.- 4 pole induction motor faults.
29.- Pole changing induction motor.
30.- Synchronous motor characteristics.
31.- Synchronisation.
32.- AC motors power factor correction.
33.- DC motor dynamic braking.

Summarized
Catalogue

two(2)

5. Energy

	page
5.1. Energy: Simulation.	
5.2. Energy Power Plants.	105-120
5.3. Renewable (Alternative) Energies.	121-133
5.4. Relays Units.	134-137
5.5. Smart Grid.	138-145

edibon

www.edibon.com

page

5.1- Energy Simulation

5.2- Energy Power Plants

-APS12 **Advanced Electrical Power System and Mechanical Power Plants Simulator** (Generation, Transformation, Transport, Distribution and Consumption). 105-114

-MPSS/ESN **Modular Power System Simulator, with SCADA Control System and SCADA-NET System.** 115-116

-MPSS/C **Modular Power System Simulator, with SCADA Control System.** 117-118

-MPSS/M **Modular Power System Simulator (Medium).** 119

-MPSS/B **Modular Power System Simulator (Basic).** 120

5.3- Renewable (Alternative) Energies

Photovoltaic

-EESFC Computer Controlled **Photovoltaic Solar Energy Unit.** 121

-EESFB **Photovoltaic Solar Energy Unit.**

-MINI-EESF **Photovoltaic Solar Energy Modular Trainer.** 122

Solar Thermal

-EESTC Computer Controlled **Thermal Solar Energy Unit.** 123

-EEST **Thermal Solar Energy Unit.**

-MINI-EESTC Computer Controlled **Thermal Solar Energy Basic Unit.** 123

-MINI-EEST **Thermal Solar Energy Basic Unit.**

Wind

-EEEC Computer Controlled **Wind Energy Unit.** 124

-EEE **Wind Energy Unit.**

-MINI-EEEC Computer Controlled **Wind Energy Basic Unit.** 124

-MINI-EEE **Wind Energy Basic Unit.**

Fuel Cells

-EC5C Computer Controlled **PEM Fuel Cell Unit.** 125

-EC5B **PEM Fuel Cell Unit.**

-EC6C Computer Controlled **PEM Fuel Cell Advanced Unit.** 125

-EC6B **PEM Fuel Cell Advanced Unit.**

Biofuels

-EBDC Computer Controlled **Biodiesel Process Unit.** 126

-EBDB **Biodiesel Process Unit.**

-EBEC Computer Controlled **Bioethanol Process Unit.** 126

-EBEB **Bioethanol Process Unit.**

-EBGC Computer Controlled **Biogas Process Unit.** 127

-EBGB **Biogas Process Unit.**

-EBMC Computer Controlled **Biomass Process Unit.** 127

-EBMB **Biomass Process Unit.**

page

Sea

-EOMC Computer Controlled **Waves Energy Unit.** 128-129

-EOMB **Waves Energy Unit.**

-EMMC Computer Controlled **Tidal Energy Unit.** 130

-EMMB **Tidal Energy Unit.**

-ECMC Computer Controlled **Submarine Currents Energy Unit.** 130

-ECMB **Submarine Currents Energy Unit.**

Geothermal

-EG5C Computer Controlled **Geothermal (low enthalpy) Energy Unit.** 131

-EG5B **Geothermal (low enthalpy) Energy Unit.**

-EG6C Computer Controlled **Geothermal (high enthalpy) Energy Unit.** 131

-EG6B **Geothermal (high enthalpy) Energy Unit.**

Hydro

-SCE Computer Controlled **Generating Stations Control and Regulation Simulator.** 132

Others

-TMSC Computer Controlled **Stirling Motor.** 132

-TMSB **Stirling Motor.**

-ETMC Computer Controlled **Ocean Thermal Energy Unit.** 133

-ETMB **Ocean Thermal Energy Unit.**

-TORC Computer Controlled **Organic Rankine Cycle Unit.** 133

-EFTEC **Turbine Electric Hub Troubleshooting Learning System.** 133

-EFTNC **Turbine Nacelle Troubleshooting Learning System.** 133

5.4- Relays Units

-ERP **Protection Relays Test:** 134-137

- ERP-UB **Protection Relays Test Unit** (common for the relays modules type "ERP").

Relays Modules

- ERP-SFT **Overcurrent and Earth Fault Protection Relay Module.**
- ERP-SDND **Directional/Non Directional Overcurrent Protection Relay Module.**
- ERP-PDF **Differential Protection Relay Module.**
- ERP-MA **Feeders Management Relay Module.**
- ERP-PD **Distance Protection Relay Module.**

5.5- Smart Grid

-SG/ESN **Smart Grid Trainer, with SCADA Control System and SCADA-NET System.** 138-139

-SG/C **Smart Grid Trainer, with SCADA Control System.** 140-141

-FUSG **Final User Smart Grid Trainer.** 142

-ASG12 **Advanced Smart Grid Trainer** with three Electrical Power Systems and Mechanical Power Plant and Energy System, with the twelve Power Plants and Energy System Simulation Softwares (complete). 143-144

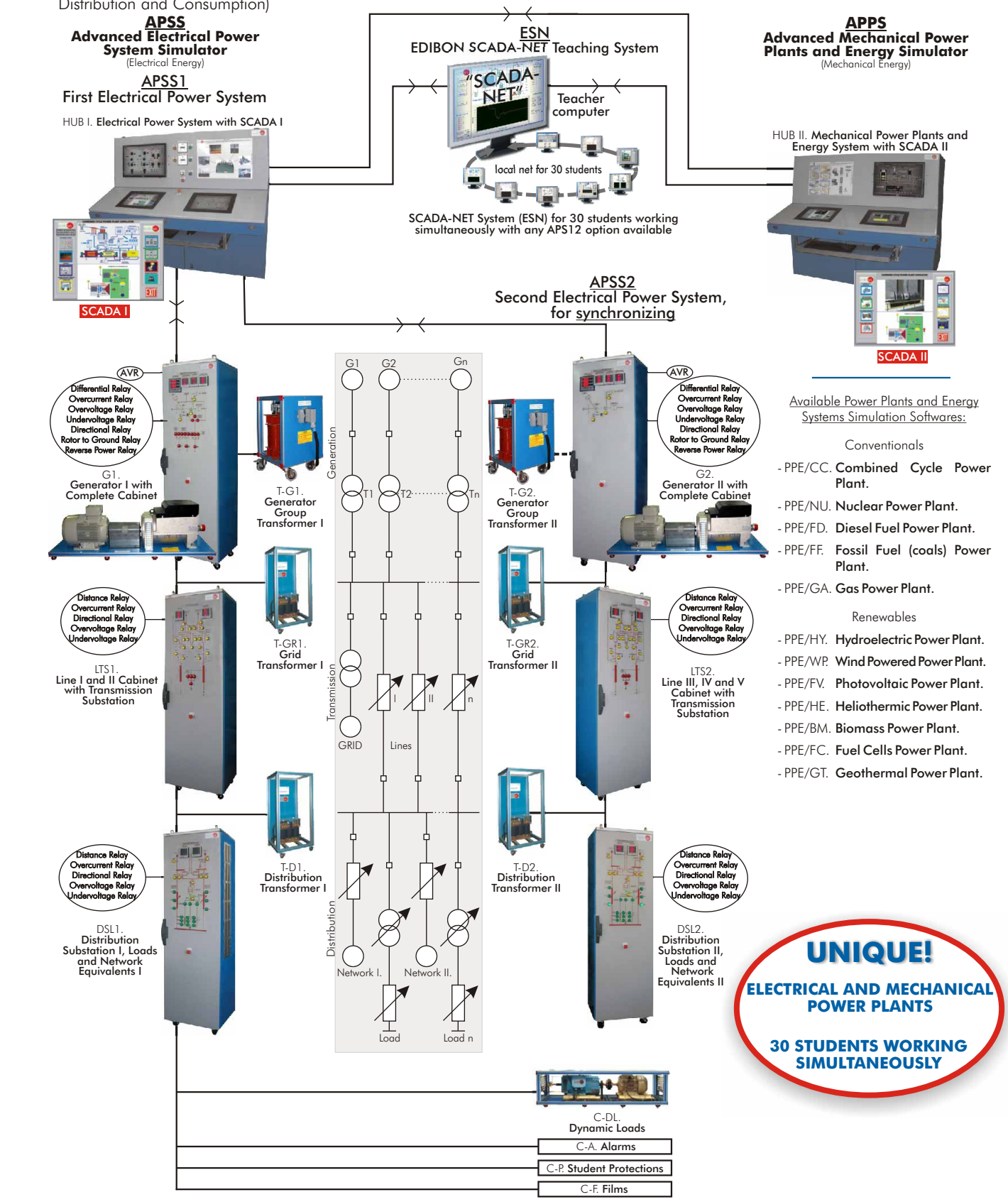
-ASG3 **Advanced Smart Grid Trainer** with three Electrical Power Systems and Mechanical Power Plant and Energy System, with three Power Plants and Energy System Simulation Softwares. 144

-ASG2 **Advanced Smart Grid Trainer** with two Electrical Power Systems and Mechanical Power Plant and Energy System, with two Power Plants and Energy System Simulation Softwares. 144

-ASG1 **Advanced Smart Grid Trainer** with Electrical Power System and Mechanical Power Plant and Energy System, with one Power Plant and Energy System Simulation Software. 145

-ASG0 **Advanced Smart Grid Trainer** with Electrical Power System. 145

APS12. **Advanced Electrical Power System and Mechanical Power Plants Simulator** (Generation, Transformation, Transport, Distribution and Consumption)



Available Power Plants and Energy Systems Simulation Softwares:

Conventionals

- PPE/CC. **Combined Cycle Power Plant.**
- PPE/NU. **Nuclear Power Plant.**
- PPE/FD. **Diesel Fuel Power Plant.**
- PPE/FF. **Fossil Fuel (coals) Power Plant.**
- PPE/GA. **Gas Power Plant.**

Renewables

- PPE/HY. **Hydroelectric Power Plant.**
- PPE/WP. **Wind Powered Power Plant.**
- PPE/FV. **Photovoltaic Power Plant.**
- PPE/HE. **Heliothermic Power Plant.**
- PPE/BM. **Biomass Power Plant.**
- PPE/FC. **Fuel Cells Power Plant.**
- PPE/GT. **Geothermal Power Plant.**

UNIQUE!

ELECTRICAL AND MECHANICAL POWER PLANTS

30 STUDENTS WORKING SIMULTANEOUSLY

APS12. Advanced Electrical Power System and Mechanical Power Plants Simulator with 12 Real Power Plants Softwares options (APSS + APPS + ANY of 12 plants + SCADA-NET).

The EDIBON "APS12" are TWO MAIN SYSTEMS IN ONE, the Advanced Electrical Power System Simulator (APSS), plus the Advanced Mechanical Power Plants and Energy Simulator (APPS) that includes 12 Power Plants Simulation options as, Combined Cycle, Hydroelectric, etc. Additionally Synchronization and SCADA-NET (ESN) is available too.

1) APSS. Advanced Electrical Power System Simulator: (electrical energy)
   1.1) APSS1. First Electrical Power System.
   1.2) APSS2. Second Electrical Power System for Synchronizing two Electrical Power Systems.
2) APPS. Advanced Mechanical Power Plants and Energy Simulator. (mechanical energy with 12 Power Plants softwares available)
3) ESN. EDIBON SCADA-NET Teaching System.

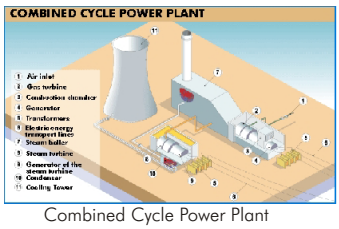
The "APS12" is modular as are availble many configurations related with any budget.
The practical minimum configuration is HUB I + any module.

More information in: www.edibon.com/products/catalogues/en/units/energy/energypowerplants/APS12.pdf

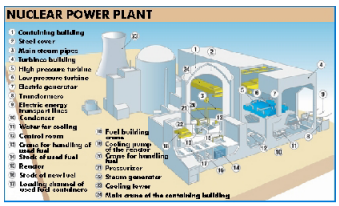
Continue...

APS12. **Advanced Electrical Power System and Mechanical Power Plants Simulator** (Generation, Transformation, Transport, Distribution and Consumption)

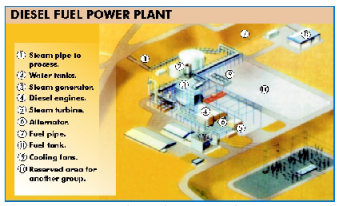
Available Power Plants :



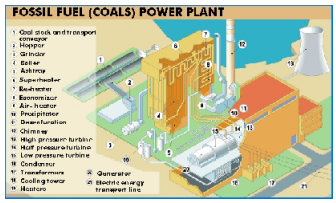
Combined Cycle Power Plant



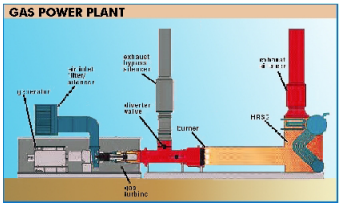
Nuclear Power Plant



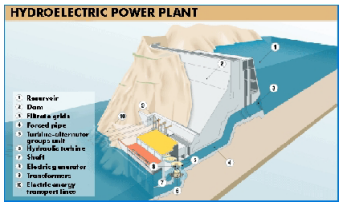
Diesel Fuel Power Plant



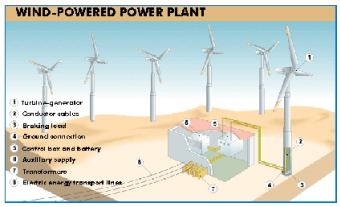
Fossil Fuel (coals) Power Plant



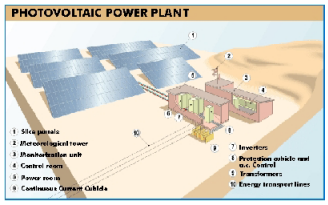
Gas Power Plant



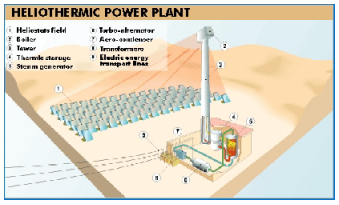
Hydroelectric Power Plant



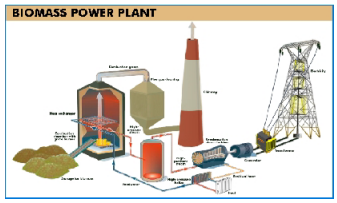
Wind-Powered Power Plant



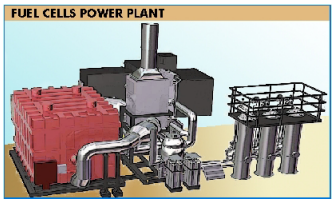
Photovoltaic Power Plant



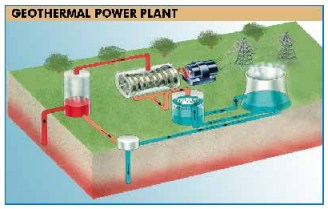
Heliothermic Power Plant



Biomass Power Plant



Fuel Cells Power Plant



Geothermal Power Plant

SPECIFICATIONS SUMMARY

The complete Simulator includes the following parts:

1) APSS. Advanced Electrical Power System Simulator:
   1.1) APSS1. First Electrical Power System.
   1.2) APSS2. Second Electrical Power System for Synchronizing two Electrical Power Systems.
2) APPS. Advanced Mechanical Power Plants and Energy Simulator.
3) ESN. EDIBON SCADA-NET Teaching System.

1) APSS. Advanced Electrical Power System Simulator:

1.1) APSS1. First Electrical Power System:

The APSS1. First Electrical Power system includes the following items:

-HUB I. Electrical Power System with SCADAI.
-G1. Generator I with Complete Cabinet, inluding AVR (Automatic Voltage Regulator), with Synchronization System, Protection Relays and Power Analyzers.
-T-G1. Generator Group Transformer I.
-T-GR1. Grid Transforme I.
-LST1. Line I and II Cabinet with Transmission Substation.
-T-D1. Distribution Transformer I.
-DSL1. Distribution Substation I, Loads and Network Equivalents I.

-HUB I. Electrical Power System with SCADA I:

This HUB I will contain the Electrical Control Desk (I) plus the SCADA I System (II) and plus the SCADA I Communications (III).

I) Electrical Control Desk, including:

Two touch screens and one normal screen. Computer (PC). General emergency stop switch. General emergency stop indicator. Security key indicator. Security key switch. Security keys for synchronization and fault insertion are included. Generator manual synchronization push button. Generator synchronizer device. Generator manual synchronization indicator. Programmable logic controller (PLC) with 42 I/O signals and RS-485 communication interface. Magneto-thermal switches. Connectors of 6 and 24 pins. 4 ports RS232-RS485 Converter.

SCADA I system with computer control electronics and the proper software package for controlling the units of the system and to exchange information with HUB II Power Plant Energy System and SCADA II. All functions are done and controlled by SCADA I.

The complete SCADA I System is formed by: The SCADA I System itself and the SCADA I Communications:

II) SCADA I System:

SCADA I system itself is an industry-standard supervisory control and data acquisition (SCADA) software for realistic experience of power system control.

It can connect to multiple generation systems for remote control and supervision of local generation and distributed generation.

It includes alarms and logs data for detailed analysis of APSS during stable and transient operation.

It communicates with programmable logic controllers (PLCs), power analyzers, numerical protection relays, automatic voltage regulators and prime-mover simulation device of the Power System Simulator to control and collect information from the power system.

Remotely controls the generator and prime-mover of the Electrical Power System Simulator in different power system operation control methods.

The package includes industrial-standard SCADA software, a computer and communications hardware.

Students select the correct screen for the experiment they want to perform.

The generators synchronization can be performed.

Continue...

APS12. Simulator

SPECIFICATIONS SUMMARY (continuation)

SCADA I allows the control and supervision of the operations related to the generation, transformation, transmission and distribution of the electrical energy.

Through a sophisticated human-machine interface, executed in the high performance computer, it is possible to monitor and control a lot of events and alarms as well as analyse, display and control the information acquired from the different controllers, regulators, analyzers, relays, etc.

SCADA I system is connected to the PLCs communication networks, network analyzers, protection relays and the rest of the units of the APSS.

The equipments connected to the SCADA I make:

Respond to the commands of the control computer.

Transmit to SCADA the ON/OFF state of the electrical equipment that conform the Simulated Electrical Power System.

Vary all the set points of the controlled parameters.

Measurement and management of all the acquired electrical parameters.

Protection of the electrical circuits and the equipments.

III) SCADA I Communications:

The SCADA I communication facilities are:

a) HUB I communication with Generator Module and Generator itself (G1 Module).

b) HUB I communication with Lines Cabinet with Transmission Substation (LTS1 Module).

c) HUB I communication with Distribution Substation, Loads and Network Equivalents (DSL1 Module).

d) HUB I communication with PLC in HUB I.

e) All modules communication.

a) HUB I communication with Generator Module and Generator itself (G1 Module). Information Exchange Description and Communication between HUB-I, SCADA I, and Generator with Complete Cabinet (G1 Module).

The HUB-I SCADA System communicate with the control, protection and measurement device in the G1 Module via serial communication interface port, over a RS-485 communication bus.

The SCADA I exchange information (commands, devices status, digital and analog variables, etc) with the devices in the G1 Module as (PLC's, Protection Relays, Power Analyzers, Turbine Governor System, Generator AVR System, etc).

a.1) PLCs communication in Generator Module (G1 Module).

The PLC read 32 digital inputs signals inside the G1 Module and exchanges this information with the SCADA via communication, for visual representation of Switch status, alarms and events record, logical control, etc. The PLC control 32 digital output signals, executing different commands, sent from the SCADA System, following the logical program saved in the PLC memory. The PLC control 2 analogue output signals. One of them is the reference value for the turbine governor system and the other one is the reference for the generator AVR system.

a.2) Protection Relays communication in Generator Module (G1 Module).

The Protection Relays exchanges information with the HUB-I via communication. From SCADA you can run the relay management software to change relays settings, to access protection status, upload the event records, to analyze the trip oscilloscope and graphs, etc.

a.2.1)Directional/Non Directional Overcurrent Protection Relay.

This relay allows investigating into protection, generator monitoring, transformer schemes, overhead lines, underground cables and backup on high-voltage systems.

a.2.2)Differential Protection Relay.

Differential Protection Relay Module, for investigations into protection of transformers, autotransformers, generators, Bus Bar and other apparatus with two windings.

a.3) Power Measurement Analyzers communication in Generator Module (G1 Module).

The Power analyzers exchange information with the HUB-I SCADA via communication bus. From SCADA you can access all measurement information of the analyzer in real time.

a.4) Turbine Governor System Controller communication in Generator Module (G1 Module).

The Turbine Governor Controller exchanges information with the HUB-I SCADA, G1-PLC and Generator AVR Controller via communication bus and physical connections. From SCADA you can send commands and change the set-point of this device.

a.5) Turbine Simulation Devices communication in Generator Module (G1 Module).

The Turbine system is simulated with a vector inverter supplying an AC Motor. AC Motors Inverter.

a.6) Automatic Voltage Regulator AVR communication in Generator Module (G1 Module).

The AVR is an Automatic Voltage Regulator that exchanges information with the HUB-I SCADA, G1-PLC and Turbine Governor Controller via communication bus and physical connections. From SCADA you can send commands and change the set-point of this device.

b) HUB I communication with Lines Cabinet with Transmission Substation (LTS1 Module). Information Exchange Description and Communication between HUB-I,SCADA I, and Lines I and Cabinet with Transmission Substation in (LTS1 Module).

The HUB-I SCADA System communicate with the control, protection and measurement devices in the LTS1 Module via serial communication interface port, over a RS-485 communication bus.

The SCADA exchange information (commands, devices status, digital and analogues variables,etc) with the devices of the LTS1 Module (PLC, Protection Relay and Power Analyzers).

b.1) PLCs communication in LTS1 Module.

The PLC read 32 digital inputs signals inside the LTS1 Module and exchanges this information with the SCADA via communication, for visual representation of Switch status, alarms and events record, logical control and etc. The PLC control 32 digital output signals, executing different commands, sent from the SCADA System, following the logical program saved in the PLC memory.

b.2) Protection Relays communication in LTS1 Module.

The Protection Relays exchanges information with the HUB-I via communication. From SCADA you can run the relay management software to change relays settings, to access protection status, upload the event records, to analyze the trip oscilloscope and graph etc.

b.2.1) Overhead Transmission Line Distance Protection Relay

This device allows investigating into protection and monitoring of overhead transmission lines as well as underground cables.

b.3) Power Measurement Analyzers communication in LTS1 Module.

The Power analyzers exchange information with the HUB-I SCADA via communication bus. From SCADA you can access all measurement information of the analyzer in real time.

Continue...

APS12. Simulator

SPECIFICATIONS SUMMARY (continuation)

c) HUB I communication with Distribution Substation, Loads and Network Equivalents (DSL1 Module). Information Exchange Description and Communication between HUB-I, SCADA I, and Distribution Substation I, Loads and Network Equivalents I (DSL1 Module).

The HUB-I SCADA System communicate with the control, protection and measurement devices inside the DSL1 Module via serial communication interface port, over a RS-485 communication bus.

The SCADA exchange information (commands, devices status, digital and analogues variables, etc) with the devices of the DSL1 Module (PLC´s, Protection Relay and Power Analyzers).

c.1) PLCs communication in DSL1 Module.

The PLC´s read 40 digital inputs signals inside the DSL1 Module and exchanges this information with the SCADA via communication, for visual representation of Switch status, alarms and events record, logical control, etc. Additionally the DSL1 Module incorporates another PLC, for control of the Distribution transformer TAP CHANGER automatically.

The PLC´s control 38 digital output signals, executing different commands, sent from the SCADA System, following the logical program saved in the PLC´s memory.

c.2) Protection Relays communication in DSL1 Module.

The Protection Relays exchanges information with the HUB-I via communication. From SCADA you can run the relay management software to change relays settings, to access protection status, upload the event records, to analyze the trip oscilloscope and graphs, etc.

c.2.1) Directional/Non Directional Overcurrent Protection Relay

This relay allows investigating into protection, transformer schemes monitoring, overhead lines, underground cables, backup on high-voltage systems, etc.

c.2.2) Differential Protection Relay

Differential Protection Relay Module, for investigations into protection of transformers, autotransformers, generators, Bus Bar and other apparatus with two windings.

d) HUB I communication with PLC in HUB I. Information Exchange Description and Communication between HUB-I, SCADA I, and PLC in HUB I.

The HUB-I SCADA System communicate with PLC inside the HUB-I via serial communication interface port, over a RS-485 communication bus and exchange information (commands, devices status, digital and analogues variables, etc) with this PLC. The PLC read 8 digital inputs signals inside the HUB-I and exchanges this information with the SCADA via communication, for visual representation of Switch status, alarms and events record, logical control and etc. The PLC control 8 digital output signals, executing different commands, sent from the SCADA System, following the logical program saved in the PLC memory.

e) Communication, in real time, with all modules at the same time. All modules can work simultaneously.

-**G1. Generator I with Complete Cabinet,** inluding AVR (Automatic Voltage Regulator), with Synchronization System, Protection Relays and Power Analyzers:

Generator:

Generator: Three-phase synchronous generator: 7KVA, 230/400Vac, 1500 r.p.m., Cos φ: 0.8, with brush excitation system.

Motor prime mover: Three-phase squirrel cage motor, 7KW, 1500 r.p.m., 400 Vac, 50Hz, Cos φ: 0.86 , driven by a vector controlled multifunction inverter with RS-485 interface.

Cabinet:

Metallic cubicle, with wheels. Front panel diagram.

Inductances for simulating the transient and subtransient state of the generator.

Power supply. Current transformers. Voltage transformers.

Vector inverter with automatic frequency load controller (AFLC). Automatic/manual voltage regulator (AVR) and automatic/manual synchronization device. Magneto-thermal switches. Connectors. Power energy analyzers with RS-485 communication interface.

Digital protection relays with RS-485 communication interface. Differential Relay. Overcurrent Relay. Overvoltage Relay. Undervoltage Relay. Directional Relay. Generator Rotor to Ground Relay. Generator Reverse Power Flow Relay.

Programable logic controller (PLC) with 42 I/O signals and RS-485 interfaces for generation system topology configuration.

Contactors. Power switches and fault state indicators in the front panel. Back-up generation protection devices.

-**T-G1. Generator Group Transformer I:**

Three-phase power transformer, 5KVA, Dy11 connection, with multi- tapped primary and secondary windings.

-**T-GR1. Grid Transformer I:**

Three-phase power transformer with connection group Dy11, 5kVA , with multi- tapped secondary.

-**LST1. Line I and II Cabinet with Transmission Substation:**

Metallic cubicle, with wheels. Front panel diagram.

Inductances and capacitors for lines parameters simulation.

Voltage transformers. Current transformers. Magneto-thermal switches. Connectors. Contactors.

It includes tapping points for changing the length of lines and the configuration of PI or T line loss profiling, and fault injection with the help of PLC control device.

Digital protection relay with RS-485 communication interface. Distance Relay. Overcurrent Relay. Directional Relay. Overvoltage Relay. Undervoltage Relay.

Power meter analyzers with RS-485 communication interface.

Programmable logic controller (PLC) with 42 I/O signals for controlling and state estimation of all line elements and fault injection switches.

-**T-D1. Distribution Transformer I:**

Three-phase transformer, 2kVA, phaser group Yd1, with multi-tapped primary.

-**DSL1. Distribution Substation I, Loads and Network Equivalents I:**

Metallic cubicle, with wheels. Front panel diagram.

Inductances, capacitors, resistors and active load modules for load simulation.

Contactors. Power meter analyzers with RS-485 communication interface. Voltage transformers.

Digital protection relays with RS-485 communication interface. Directional Relay. Differential Relay. Overcurrent Relay. Overvoltage Relay. Undervoltage Relay. Dissipator fan. Connectors. Magneto-thermal circuit breaker.

It includes tapping points for charging load topology configuration and fault injection with the help of PLC control device.

Programmable logic controller (PLC) with 42 I/O signals for controlling, state estimation of all distribution substation elements and load configuration and fault injection.

Back-up protection for external network connection.

Continue...

APS12. Simulator

SPECIFICATIONS SUMMARY (continuation)

1.2) **APSS2. Second Electrical Power System**, for synchronizing two electrical power systems:

-**G2. Generator II with Complete Cabinet,** inluding AVR (Automatic Voltage Regulator), with Synchronization System, Protection Relays and Power Analyzers:

Generator:

Generator: Three-phase synchronous generator: 7KVA, 230/400Vac, 1500 r.p.m., Cos φ: 0.8, with brushexcitation system.

Motor prime mover: Three-phase squirrel cage motor, 7KW, 1500 r.p.m., 400 Vac, 50Hz, Cos φ: 0.86 , driven by a vector controlled multifunction inverter with RS-485 interface.

Cabinet:

Metallic cubicle, with wheels. Front panel diagram. Inductances for simulating the transient and subtransient state of the generator. Power supply. Current transformers. Voltage transformers. Vector inverter with automatic frequency load controller (AFLC). Automatic/manual voltage regulator (AVR) and automatic/manual synchronization device. Magneto-thermal switches. Connectors. Power energy analyzers with RS-485 communication interface. Digital protection relays with RS-485 communication interface. Differential Relay. Overcurrent Relay. Overvoltage Relay. Undervoltage Relay. Directional Relay. Generator Rotor to Ground Relay. Generator Reverse Power Flow Relay. Programable logic controller (PLC) with 42 I/O signals and RS-485 interfaces for generation system topology configuration. Contactors. Power switches and fault state indicators in the front panel. Back-up generation protection devices.

-**T-G2. Generator Group Transformer II:**

Three-phase power transformer, 5KVA, Dy11 connection, with multi- tapped primary and secondary windings.

-**T-GR2. Grid Transformer II:**

Three-phase power transformer with connection group Dy11, 5kVA , with multi- tapped secondary.

-**LST2. Line III, IV and V Cabinet with Transmission Substation:**

Metallic cubicle, with wheels. Front panel diagram. Inductances and capacitors for lines parameters simulation. Voltage transformers. Current transformers. Magneto-thermal switches. Connectors. Contactors.It includes tapping points for changing the length of lines and the configuration of PI or T line loss profiling, and fault injection with the help of PLC control device. Digital protection relay with RS-485 communication interface. Distance Relay. Overcurrent Relay. Directional Relay. Overvoltage Relay. Undervoltage Relay. Power meter analyzers with RS-485 communication interface. Programmable logic controller (PLC) with 42 I/O signals for controlling and state estimation of all line elements and fault injection switches.

-**T-D2. Distribution Transformer II:**

Three-phase transformer, 2kVA, phaser group Yd1, with multi-tapped primary.

-**DSL2. Distribution Substation II, Loads and Network Equivalents II:**

Metallic cubicle, with wheels. Front panel diagram. Inductances, capacitors, resistors and active load modules for load simulation. Contactors. Power meter analyzers with RS-485 communication interface. Voltage transformers. Digital protection relays with RS-485 communication interface. Directional Relay. Differential Relay. Overcurrent Relay. Overvoltage Relay. Undervoltage Relay. Dissipator fan. Connectors. Magneto-thermal circuit breaker. It includes tapping points for charging load topology configuration and fault injection with the help of PLC control device. Programmable logic controller (PLC) with 42 I/O signals for controlling, state estimation of all distribution substation elements and load configuration and fault injection. Back-up protection for external network connection.

Main exercises to be done with the Electrical Power System Simulator (APSS)

1.1.- Mechanical Power Plant Simulator Components recognition and operation introduction.

1.2.- Study of Unit-1 feeding isolated loads through Line-1 with automatic frequency control and voltage adjustment at remote distribution substation busbars.

1.3.- Study of Unit-1 feeding isolated loads through Line-2 with automatic frequency control and voltage adjustment at remote distribution substation busbars.

1.4.- Study of Unit-1 feeding isolated loads through Line-1 and Line-2 with automatic frequency control and voltage adjustment at remote distribution substation busbars.

1.5.- Study of Unit-1 feeding isolated loads through Line-2 with automatic frequency control and voltage adjustment at transmission substation busbars.

1.6.- Study of Unit-1 feeding isolated loads through Line-2 with automatic frequency control and without voltage control.

1.7.- Study of Unit-1 connected to the network through Line-1 with different network equivalent reactances, operating at constant active power and variable field current.

1.8.- Study of Unit-1 connected to the network through Line-2 with different network equivalent reactances, operating at constant active power and variable field current.

1.9.- Study of Unit-1 connected to the network through Line-1 and Line-2 with different network equivalent reactances, operating at constant active power and variable field current.

1.10.- Study of Unit-1 connected to the network through Line-1 with different network equivalent reactances, operating at variable active power and constant field current.

1.11.- Study of Unit-1 connected to the network through Line-2 with different network equivalent reactances, operating at variable active power and constant field current.

1.12.- Study of Unit-1 connected to the network through Line-1 and Line-2 with different network equivalent reactances, operating at variable active power and constant field current.

1.13.- Study of Load Flow when Unit-1 is connected through Lines 1 and Line 2 to the network with different network equivalent reactances.

1.14.- Verification of the automatic frequency-load control operation under small disturbances of Unit-1 feeding isolated loads through Line-1.

1.15.- Verification of the automatic frequency-load control operation under small disturbances of Unit-1 feeding isolated loads through Line-2.

1.16.- Verification of the automatic frequency-load control operation under small disturbances of Unit-1 feeding isolated loads through Line-1 and Line-2.

1.17.- Study of Unit-1 connected to the network through Line-1, operating on different modes: base load program, fixed load program and regulating load program.

1.18.- Study of Unit-1 connected to the network through Line-2, operating on different modes: base load program, fixed load program and regulating load program.

1.19.- Study of Unit-1 connected to the network through Line-1 and Line-2, operating on different modes: base load program, fixed load program and regulating load program.

1.20.- Verification of the automatic voltage control (AVR) operation under small disturbances of Unit-1 feeding isolated loads through Line-1.

1.21.- Verification of the automatic voltage control (AVR) operation under small disturbances of Unit-1 feeding isolated loads through Line-2.

1.22.- Verification of the automatic voltage control (AVR) operation under small disturbances of Unit-1 feeding isolated loads through Line-1and Line-2.

1.23.- Verification of Generator Rotor to Ground Protection functionality.

1.24.- Verification of Generator Differential Protection functionality.

1.25.- Power Plant and Power System Power Switches Interlocks Analysis.

1.26.- Auxiliary Services Operation in the Power Plant Diagram.

More information in: www.edibon.com/products/catalogues/en/units/energy/energypowerplants/APS12.pdf

Continue...

APS12. Simulator

SPECIFICATIONS SUMMARY (continuation)

2) **APPS. Advanced Mechanical Power Plants and Energy Simulator:**

-HUB II. Mechanical Power Plants and Energy System with SCADA II:

This HUB II will contain the Electrical Control Desk (I) plus the SCADAII System (II):

I) Energy Control Desk, including:

Two touch screens. One normal screen. Computer (PC). Power cables and communication cable. Magneto-thermal switches. Communication interface with HUB I.

II) SCADA II system with computer control electronics and the proper operation software package.

SCADA II Screens distribution.

a) HUB II screen 1. Main menu touch screen display (screen 1): This screen appears in the left bottom display on Energy Control Desk and from this screen it is possible to navigate and explore others operation screens that conform the power plant processes control and operation simulation. When you push a button on this screen, an operational screen appears in the right bottom touch screen (screen 2) display.

Elements of the main menu screen:

a.1) Power Plant General Principles: This screen works like power point slider document and the objective is to introduce you to the principles of power plan operation. From this menu screen you can access all elements of the power plant, and take a theoretical background about the principles of operation individually and in conjunction.

a.2) Primary Mover Principles of Operation: This screen works like power point slider document and the objective is to introduce you to the principles of primary mover. You can take a theoretical background about the principles of energy conversion from the primary mover to electrical energy, what kind of element participate in that conversion and how to control and operate these elements.

a.3) Power Plant General Layouts: This screen works like power point slider document and the objective is to introduce you to the Power Plant individual and generals control and operation layouts. You can take a theoretical background about how to interpret different primary mover control layouts.

a.4) Power Plant Control Principles:This screen works like power point slider document and the objective is to introduce you to the control principles of the power plant. You can take a theoretical background about the differerent control loops in this type of power plant by mean of description of what variables are measured and controlled.

a.5) Power Plant Start-Up and Shutdowns Operation Sequences: This screen works like power point slider document and the objective is to training you on the general sequences that any power plant operator must be follow to Start and shutdown a power plant.

a.6) Mains Power Plant Control Loops Simulation: This screen shows the real time simulation of mathematical model of the primary mover as part of the power system and the objective is to explain indetail the simulation of the mains control loops of the Power Plant and how these control loops interact between then and with the real time electrical power system. You can analyse the frequency-load control, voltage-reactive power control, etc.

b) HUB II screen 2. Operational touch display (screen 2): This will indicate information at second level related to any one of the elements of main menu screen.

c) HUB II screen 3. General state diagram screen display (screen 3): This will indicate the particular diagram we are working on at any time and any selection.

SCADA II Software description:

The MECHANICAL POWER PLANT SIMULATOR is a simulation and control system software developed taking into account the experience related to Power Plants. In this system are different configuration and management levels that allow the teacher to design and execute different practices related with the power plant processes control and operation.

The computer placed in the Energy Control Desk is equipped with all elements necessary for achieve a real time simulation of the power plant main processes.

The software describes the simulation of the energy and electromechanical conversion part of the simulator. It will be launched from Windows Desktop, appearing as three screens in the corresponding displays. If a new start is needed, the program will appear on Windows Desktop.

Available Power Plants and Energy Systems Simulation Softwares:

- PPE/CC. Combined Cycle Power Plant.	- PPE/GA. Gas Power Plant.	- PPE/HE. Heliothermic Power Plant.
- PPE/NU. Nuclear Power Plant.	- PPE/HY. Hydroelectric Power Plant.	- PPE/BM. Biomass Power Plant.
- PPE/FD. Diesel Fuel Power Plant.	- PPE/WP. Wind Powered Power Plant.	- PPE/FC. Fuel Cells Power Plant.
- PPE/FF. Fossil Fuel (coals) Power Plant.	- PPE/FV. Photovoltaic Power Plant.	- PPE/GT. Geothermal Power Plant.

Main Exercises to be done with the Mechanical Power Plants and Energy Simulator (APPS)

Combined Cyle Power Plant

2.1./CC- Combined Cycle Power Plant General Principles of Operation.
2.2./CC- Gas Turbine of the Combined Cycle Power Plant General Principles of Operation.
2.3./CC- Steam Turbine of the Combined Cycle Power Plant General Principles of Operation.
2.4./CC- Combined Cycle Power Plant General Control Layouts.
2.5./CC- Combined Cycle Power Plant Control and Instrumentation Principles.
2.6./CC- Introduction to Mechanical and Electrical System Simulation.
2.7./CC- Introduction to Combined Cycle Power Plant Block Diagram and Transfer Functions.
2.8./CC- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.9./CC- Analysis of Proportional Controller.
2.10./CC-Analysis of Integral Controller.
2.11./CC-Analysis of Derivative Controller.
2.12./CC-Analysis of PID Controller.
2.13./CC-Analysis and Simulation of Gas Turbine Fuel System of the Combined Cycle Power Plant.
2.14./CC-Analysis and Simulation of Compressor-Turbine System of the Combined Cycle Power Plant.
2.15./CC-Analysis and Simulation of Gas Turbine Temperature Control of the Combined Cycle Power Plant.
2.16./CC-Analysis and Simulation of Gas Turbine Governor/Speed Control of the Combined Cycle Power Plant.
2.17./CC-Analysis and Simulation of Steam Turbine Governor/Speed Control of the Combined Cycle Power Plant.
2.18./CC-Analysis and Simulation of Gas Turbine Generator Excitation System of the Combined Cycle Power Plant.
2.19./CC-Analysis and Simulation of Steam Turbine Generator Excitation System of the Combined Cycle Power Plant.
2.20./CC-Analysis and Simulation of Gas Turbine Outer/Loop MW Control of the Combined Cycle Power Plant.
2.21./CC-Analysis and Simulation of Steam Turbine Outer/Loop MW Control of the Combined Cycle Power Plant.
2.22./CC-Analysis and Simulation of Gas Turbine Electrical Generator of the Combined Cycle Power Plant.
2.23./CC-Analysis and Simulation of Steam Turbine Electrical Generator of the Combined Cycle Power Plant.
2.24./CC-Analysis and Simulation of Gas Turbine Lubrication Oil Cooling Temperature Control of the Combined Cycle Power Plant.
2.25./CC-Analysis and Simulation of Gas Turbine Generator Exciter Cooler Temperature Control of the Combined Cycle Power Plant.
2.26./CC-Combined Cycle Power Plant Start-Up Procedure Analysis and Simulation.
2.27./CC-Combined Cycle Power Plant Start-Up execution with the real Hardware.
2.28./CC-Combined Cycle Power Plant Shut-Down Procedure Analysis and Simulation.
2.29./CC-Combined Cycle Power Plant Shut-Down execution with the real Hardware.
2.30./CC-Combined Cycle Power Plant Active Power Control in isolated mode of operation (two generators).
2.31./CC-Combined Cycle Power Plant Frequency Control in isolated mode of operation.
2.32./CC-Combined Cycle Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.33./CC-Combined Cycle Power Plant Voltage Control in isolated mode of operation.
2.34./CC-Combined Cycle Power Plant Synchronization.
2.35./CC-Combined Cycle Power Plant Active Power Control when connected to the Grid.
2.36./CC-Combined Cycle Power Plant Reactive Power Control when connected to the Grid.
2.37./CC-Faults in Combined Cycle Power Plant Operation.

Continue...

APS12. Simulator

SPECIFICATIONS SUMMARY (continuation)

Main Exercises to be done with the Mechanical Power Plants and Energy Simulator (APPS) (continuation)

Nuclear Power Plant

2.1./NU- Nuclear Power Plant General Principles of Operation.
2.2./NU- Steam Turbine General Principles of Operation.
2.3./NU- Nuclear Power Plant General Control Layouts.
2.4./NU- Nuclear Power Plant Control and Instrumentation Principles.
2.5./NU- Introduction to Mechanical and Electrical System Simulation.
2.6./NU- Introduction to Nuclear Power Plant Block Diagram and Transfer Functions.
2.7./NU- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.8./NU- Analysis of Proportional Controller.
2.9./NU- Analysis of Integral Controller.
2.10./NU- Analysis of Derivative Controller.
2.11./NU- Analysis of PID Controller.
2.12./NU- Analysis and Simulation of Steam Turbine Feed System.
2.13./NU- Analysis and Simulation of Steam Turbine Temperature Control.
2.14./NU- Analysis and Simulation of Steam Turbine Governor/Speed Control.
2.15./NU- Analysis and Simulation of Steam Turbine Generator Excitation System.
2.16./NU- Analysis and Simulation of Steam Turbine Outer/Loop MW Control.
2.17./NU- Analysis and Simulation of Steam Turbine Electrical Generator.
2.18./NU- Analysis and Simulation of Steam Turbine Lubrication Oil Cooling Temperature Control.
2.19./NU- Analysis and Simulation of Steam Turbine Generator Exciter Cooler Temperature Control.
2.20./NU- Nuclear Power Plant Start-Up Procedure Analysis and Simulation.
2.21./NU- Nuclear Power Plant Start-Up execution with the real Hardware.
2.22./NU- Nuclear Power Plant Shut-Down Procedure Analysis and Simulation.
2.23./NU- Nuclear Power Plant Shut-Down execution with the real Hardware.
2.24./NU- Nuclear Power Plant Active Power Control in isolated mode of operation (two generators).
2.25./NU- Nuclear Power Plant Frequency Control in isolated mode of operation.
2.26./NU- Nuclear Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.27./NU- Nuclear Power Plant Voltage Control in isolated mode of operation.
2.28./NU- Nuclear Power Plant Synchronization.
2.29./NU- Nuclear Power Plant Active Power Control when connected to the Grid.
2.30./NU- Nuclear Power Plant Reactive Power Control when connected to the Grid.
2.31./NU- Faults in Nuclear Power Plant Operation.

Diesel Fuel Power Plant

2.1./FD- Diesel Fuel Power Plant General Principles of Operation.
2.2./FD- Steam Turbine General Principles of Operation.
2.3./FD- Diesel Fuel Power Plant General Control Layouts.
2.4./FD- Diesel Fuel Power Plant Control and Instrumentation Principles.
2.5./FD- Introduction to Mechanical and Electrical System Simulation.
2.6./FD- Introduction to Diesel Fuel Power Plant Block Diagram and Transfer Functions.
2.7./FD- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.8./FD- Analysis of Proportional Controller.
2.9./FD- Analysis of Integral Controller.
2.10./FD- Analysis of Derivative Controller.
2.11./FD- Analysis of PID Controller.
2.12./FD- Analysis and Simulation of Steam Turbine Feed System.
2.13./FD- Analysis and Simulation of Steam Turbine Temperature Control.
2.14./FD- Analysis and Simulation of Steam Turbine Governor/Speed Control.
2.15./FD- Analysis and Simulation of Steam Turbine Generator Excitation System.
2.16./FD- Analysis and Simulation of Steam Turbine Outer/Loop MW Control.
2.17./FD- Analysis and Simulation of Steam Turbine Electrical Generator.
2.18./FD- Analysis and Simulation of Steam Turbine Lubrication Oil Cooling Temperature Control.
2.19./FD- Analysis and Simulation of Steam Turbine Generator Exciter Cooler Temperature Control.
2.20./FD- Diesel Fuel Power Plant Start-Up Procedure Analysis and Simulation.
2.21./FD- Diesel Fuel Power Plant Start-Up execution with the real Hardware.
2.22./FD- Diesel Fuel Power Plant Shut-Down Procedure Analysis and Simulation.
2.23./FD- Diesel Fuel Power Plant Shut-Down execution with the real Hardware.
2.24./FD- Diesel Fuel Power Plant Active Power Control in isolated mode of operation (two generators).
2.25./FD- Diesel Fuel Power Plant Frequency Control in isolated mode of operation.
2.26./FD- Diesel Fuel Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.27./FD- Diesel Fuel Power Plant Voltage Control in isolated mode of operation.
2.28./FD- Diesel Fuel Power Plant Synchronization.
2.29./FD- Diesel Fuel Power Plant Active Power Control when connected to the Grid.
2.30./FD- Diesel Fuel Power Plant Reactive Power Control when connected to the Grid.
2.31./FD- Faults in Diesel Fuel Power Plant Operation.

Fossil Fuel (coals) Power Plant

2.1./FF- Fossil Fuel (coals) Power Plant General Principles of Operation.
2.2./FF- Steam Turbine General Principles of Operation.
2.3./FF- Fossil Fuel (coals) Power Plant General Control Layouts.
2.4./FF- Fossil Fuel (coals) Power Plant Control and Instrumentation Principles.
2.5./FF- Introduction to Mechanical and Electrical System Simulation.
2.6./FF- Introduction to Fossil Fuel (coals) Power Plant Block Diagram and Transfer Functions.
2.7./FF- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.8./FF- Analysis of Proportional Controller.
2.9./FF- Analysis of Integral Controller.
2.10./FF- Analysis of Derivative Controller.
2.11./FF- Analysis of PID Controller.
2.12./FF- Analysis and Simulation of Steam Turbine Feed System.
2.13./FF- Analysis and Simulation of Steam Turbine Temperature Control.
2.14./FF- Analysis and Simulation of Steam Turbine Governor/Speed Control.
2.15./FF- Analysis and Simulation of Steam Turbine Generator Excitation System.
2.16./FF- Analysis and Simulation of Steam Turbine Outer/Loop MW Control.
2.17./FF- Analysis and Simulation of Steam Turbine Electrical Generator.
2.18./FF- Analysis and Simulation of Steam Turbine Lubrication Oil Cooling Temperature Control.
2.19./FF- Analysis and Simulation of Steam Turbine Generator Exciter Cooler Temperature Control.
2.20./FF- Fossil Fuel (coals) Power Plant Start-Up Procedure Analysis and Simulation.
2.21./FF- Fossil Fuel (coals) Power Plant Start-Up execution with the real Hardware.
2.22./FF- Fossil Fuel (coals) Power Plant Shut-Down Procedure Analysis and Simulation.
2.23./FF- Fossil Fuel (coals) Power Plant Shut-Down execution with the real Hardware.
2.24./FF- Fossil Fuel (coals) Power Plant Active Power Control in isolated mode of operation (two generators).
2.25./FF- Fossil Fuel (coals) Power Plant Frequency Control in isolated mode of operation.
2.26./FF- Fossil Fuel (coals) Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.27./FF- Fossil Fuel (coals) Power Plant Voltage Control in isolated mode of operation.
2.28./FF- Fossil Fuel (coals) Power Plant Synchronization.
2.29./FF- Fossil Fuel (coals) Power Plant Active Power Control when connected to the Grid.
2.30./FF- Fossil Fuel (coals) Power Plant Reactive Power Control when connected to the Grid.
2.31./FF- Faults in Fossil Fuel (coals) Power Plant Operation.

Continue...

APS12. Simulator

SPECIFICATIONS SUMMARY (continuation)

Main Exercises to be done with the Mechanical Power Plants and Energy Simulator (APPS) (continuation)

Gas Power Plant

2.1./GA- Gas Power Plant General Principles of Operation.
2.2./GA- Gas Turbine General Principles of Operation.
2.3./GA- Gas Power Plant General Control Layouts.
2.4./GA- Gas Power Plant Control and Instrumentation Principles.
2.5./GA- Introduction to Mechanical and Electrical System Simulation.
2.6./GA- Introduction to Gas Turbine Power Plant Block Diagram and Transfer Functions.
2.7./GA- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.8./GA- Analysis of Proportional Controller.
2.9./GA- Analysis of Integral Controller.
2.10./GA- Analysis of Derivative Controller.
2.11./GA- Analysis of PID Controller.
2.12./GA- Analysis and Simulation of Gas Turbine Fuel System.
2.13./GA- Analysis and Simulation of Compressor-Turbine System.
2.14./GA- Analysis and Simulation of Gas Turbine Temperature Control.
2.15./GA- Analysis and Simulation of Gas Turbine Governor/Speed Control.
2.16./GA- Analysis and Simulation of Gas Turbine Generator Excitation System.
2.17./GA- Analysis and Simulation of Gas Turbine Outer/Loop MW Control.
2.18./GA- Analysis and Simulation of Gas Turbine Electrical Generator.
2.19./GA- Analysis and Simulation of Gas Turbine Lubrication Oil Cooling Temperature Control.
2.20./GA- Analysis and Simulation of Gas Turbine Generator Exciter Cooler Temperature Control.
2.21./GA- Gas Turbine Power Plant Start-Up Procedure Analysis and Simulation.
2.22./GA- Gas Turbine Power Plant Start-Up execution with the real Hardware.
2.23./GA- Gas Turbine Power Plant Shut-Down Procedure Analysis and Simulation.
2.24./GA- Gas Turbine Power Plant Shut-Down execution with the real Hardware.
2.25./GA- Gas Turbine Power Plant Active Power Control in isolated mode of operation (two generators).
2.26./GA- Gas Turbine Power Plant Frequency Control in isolated mode of operation.
2.27./GA- Gas Turbine Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.28./GA- Gas Turbine Power Plant Voltage Control in isolated mode of operation.
2.29./GA- Gas Turbine Power Plant Synchronization.
2.30./GA- Gas Turbine Power Plant Active Power Control when connected to the Grid.
2.31./GA- Gas Turbine Power Plant Reactive Power Control when connected to the Grid.
2.32./GA- Faults in Gas Power Plant Operation.

Hydroelectric Fuel Power Plant

2.1./HY- Hydroelectric Power Plant General Principles of Operation.
2.2./HY- Hydraulic Turbine General Principles of Operation.
2.3./HY- Hydroelectric Power Plant General Control Layouts.
2.4./HY- Hydroelectric Power Plant Control and Instrumentation Principles.
2.5./HY- Introduction to Mechanical and Electrical System Simulation.
2.6./HY- Introduction to Hydroelectric Power Plant Block Diagram and Transfer Functions.
2.7./HY- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.8./HY- Analysis of Proportional Controller.
2.9./HY- Analysis of Integral Controller.
2.10./HY- Analysis of Derivative Controller.
2.11./HY- Analysis of PID Controller.
2.12./HY- Analysis and Simulation of Hydraulic Turbine Feed System.
2.13./HY- Analysis and Simulation of Hydraulic Turbine Temperature Control.
2.14./HY- Analysis and Simulation of Hydraulic Turbine Governor/Speed Control.
2.15./HY- Analysis and Simulation of Hydraulic Turbine Generator Excitation System.
2.16./HY- Analysis and Simulation of Hydraulic Turbine Outer/Loop MW Control.
2.17./HY- Analysis and Simulation of Hydraulic Turbine Electrical Generator.
2.18./HY- Analysis and Simulation of Hydraulic Turbine Lubrication Oil Cooling Temperature Control.
2.19./HY- Analysis and Simulation of Hydraulic Turbine Generator Exciter Cooler Temperature Control.
2.20./HY- Hydroelectic Power Plant Start-Up Procedure Analysis and Simulation.
2.21./HY- Hydroelectic Power Plant Start-Up execution with the real Hardware.
2.22./HY- Hydroelectic Power Plant Shut-Down Procedure Analysis and Simulation.
3.23./HY- Hydroelectic Power Plant Shut-Down execution with the real Hardware.
2.24./HY- Hydroelectic Power Plant Active Power Control in isolated mode of operation (two generators).
2.25./HY- Hydroelectic Power Plant Frequency Control in isolated mode of operation.
2.26./HY- Hydroelectic Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.27./HY- Hydroelectic Power Plant Voltage Control in isolated mode of operation.
2.28./HY- Hydroelectic Power Plant Synchronization.
2.29./HY- Hydroelectic Power Plant Active Power Control when connected to the Grid.
2.30./HY- Hydroelectic Power Plant Reactive Power Control when connected to the Grid.
2.31./HY- Faults in Hydroelectic Power Plant Operation.

Wind Powered Power Plant

2.1./WP- Wind Powered Power Plant General Principles of Operation.
2.2./WP- Wind Turbine General Principles of Operation.
2.3./WP- Wind Powered Power Plant General Control Layouts.
2.4./WP- Wind Powered Power Plant Control and Instrumentation Principles.
2.5./WP- Introduction to Mechanical and Electrical System Simulation.
2.6./WP- Introduction to Wind Powered Power Plant Block Diagram and Transfer Functions.
2.7./WP- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.8./WP- Analysis of Proportional Controller.
2.9./WP- Analysis of Integral Controller.
2.10./WP- Analysis of Derivative Controller.
2.11./WP- Analysis of PID Controller.
2.12./WP- Analysis and Simulation of Wind Turbine Governor/Speed Control.
2.13./WP- Analysis and Simulation of Wind Turbine Generator Excitation System.
2.14./WP- Analysis and Simulation of Wind Turbine Outer/Loop MW Control.
2.15./WP- Analysis and Simulation of Wind Turbine Electrical Generator.
2.16./WP- Analysis and Simulation of Wind Turbine Lubrication Oil Cooling Temperature Control.
2.17./WP- Analysis and Simulation of Wind Turbine Generator Exciter Cooler Temperature Control.
2.18./WP- Wind Powered Power Plant Start-Up Procedure Analysis and Simulation.
2.19./WP- Wind Powered Power Plant Start-Up execution with the real Hardware.
2.20./WP- Wind Powered Power Plant Shut-Down Procedure Analysis and Simulation.
2.21./WP- Wind Powered Power Plant Shut-Down execution with the real Hardware.
2.22./WP- Wind Powered Power Plant Active Power Control in isolated mode of operation (two generators).
2.23./WP- Wind Powered Power Plant Frequency Control in isolated mode of operation.
2.24./WP- Wind Powered Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.25./WP- Wind Powered Power Plant Voltage Control in isolated mode of operation.
2.26./WP- Wind Powered Power Plant Synchronization.
2.27./WP- Wind Powered Power Plant Active Power Control when connected to the Grid.
2.28./WP- Wind Powered Power Plant Reactive Power Control when connected to the Grid.

Continue...

APS12. Simulator

SPECIFICATIONS SUMMARY (continuation)

Main Exercises to be done with the Mechanical Power Plants and Energy Simulator (APPS) (continuation)

Photovoltaic Power Plant

2.1./FV- Photovoltaic Power Plant General Principles of Operation.
2.2./FV- Photovoltaic Grid Inverter General Principles of Operation.
2.3./FV- Photovoltaic Power Plant General Control Layouts.
2.4./FV- Photovoltaic Power Plant Control and Instrumentation Principles.
2.5./FV- Introduction to Mechanical and Electrical System Simulation.
2.6./FV- Introduction to Photovoltaic Power Plant Block Diagram and Transfer Functions.
2.7./FV- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.8./FV- Analysis of Proportional Controller.
2.9./FV- Analysis of Integral Controller.
2.10./FV- Analysis of Derivative Controller.
2.11./FV- Analysis of PID Controller.
2.12./FV- Analysis and Simulation of Grid Inverter System.
2.13./FV- Photovoltaic Power Plant Start-Up Procedure Analysis and Simulation.
2.14./FV- Photovoltaic Power Plant Start-Up execution with the real Hardware.
2.15./FV- Photovoltaic Power Plant Shut-Down Procedure Analysis and Simulation.
2.16./FV- Photovoltaic Power Plant Shut-Down execution with the real Hardware.
2.17./FV- Photovoltaic Power Plant Active Power Control in isolated mode of operation.
2.18./FV- Photovoltaic Power Plant Frequency Control in isolated mode of operation.
2.19./FV- Photovoltaic Power Plant Reactive Power Control in isolated mode of operation.
2.20./FV- Photovoltaic Power Plant Voltage Control in isolated mode of operation.
2.21./FV- Photovoltaic Power Plant Synchronization.
2.22./FV- Photovoltaic Power Plant Active Power Control when connected to the Grid.
2.23./FV- Photovoltaic Power Plant Reactive Power Control when connected to the Grid.
2.24./FV- Faults in Photovoltaic Power Plant Operation.

Heliothermic Power Plant

2.1./HE- Heliothermic Power Plant General Principles of Operation.
2.2./HE- Steam Turbine General Principles of Operation.
2.3./HE- Heliothermic Power Plant General Control Layouts.
2.4./HE- Heliothermic Power Plant Control and Instrumentation Principles.
2.5./HE- Introduction to Mechanical and Electrical System Simulation.
2.6./HE- Introduction to Heliothermic Power Plant Block Diagram and Transfer Functions.
2.7./HE- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.8./HE- Analysis of Proportional Controller.
2.9./HE- Analysis of Integral Controller.
2.10./HE- Analysis of Derivative Controller.
2.11./HE- Analysis of PID Controller.
2.12./HE- Analysis and Simulation of Steam Turbine Feed System.
2.13./HE- Analysis and Simulation of Steam Turbine Temperature Control.
2.14./HE- Analysis and Simulation of Steam Turbine Governor/Speed Control.
2.15./HE- Analysis and Simulation of Steam Turbine Generator Excitation System.
2.16./HE- Analysis and Simulation of Steam Turbine Outer/Loop MW Control.
2.17./HE- Analysis and Simulation of Steam Turbine Electrical Generator.
2.18./HE- Analysis and Simulation of Steam Turbine Lubrication Oil Cooling Temperature Control.
2.19./HE- Analysis and Simulation of Steam Turbine Generator Exciter Cooler Temperature Control.
2.20./HE- Heliothermic Power Plant Start-Up Procedure Analysis and Simulation.
2.21./HE- Heliothermic Power Plant Start-Up execution with the real Hardware.
2.22./HE- Heliothermic Power Plant Shut-Down Procedure Analysis and Simulation.
2.23./HE- Heliothermic Power Plant Shut-Down execution with the real Hardware.
2.24./HE- Heliothermic Power Plant Active Power Control in isolated mode of operation (two generators).
2.25./HE- Heliothermic Power Plant Frequency Control in isolated mode of operation.
2.26./HE- Heliothermic Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.27./HE- Heliothermic Power Plant Voltage Control in isolated mode of operation.
2.28./HE- Heliothermic Power Plant Synchronization.
2.29./HE- Heliothermic Power Plant Active Power Control when connected to the Grid.
2.30./HE- Heliothermic Power Plant Reactive Power Control when connected to the Grid.
2.31./HE- Faults in Heliothermic Power Plant Operation.

Biomass Power Plant

2.1./BM- Biomass Power Plant General Principles of Operation.
2.2./BM- Steam Turbine General Principles of Operation.
2.3./BM- Biomass Power Plant General Control Layouts.
2.4./BM- Biomass Power Plant Control and Instrumentation Principles.
2.5./BM- Introduction to Mechanical and Electrical System Simulation.
2.6./BM- Introduction to Biomass Power Plant Block Diagram and Transfer Functions.
2.7./BM- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.8./BM- Analysis of Proportional Controller.
2.9./BM- Analysis of Integral Controller.
2.10./BM- Analysis of Derivative Controller.
2.11./BM- Analysis of PID Controller.
2.12./BM- Analysis and Simulation of Steam Turbine Feed System.
2.13./BM- Analysis and Simulation of Steam Turbine Temperature Control.
2.14./BM- Analysis and Simulation of Steam Turbine Governor/Speed Control.
2.15./BM- Analysis and Simulation of Steam Turbine Generator Excitation System.
2.16./BM- Analysis and Simulation of Steam Turbine Outer/Loop MW Control.
2.17./BM- Analysis and Simulation of Steam Turbine Electrical Generator.
2.18./BM- Analysis and Simulation of Steam Turbine Lubrication Oil Cooling Temperature Control.
2.19./BM- Analysis and Simulation of Steam Turbine Generator Exciter Cooler Temperature Control.
2.20./BM- Biomass Power Plant Start-Up Procedure Analysis and Simulation.
2.21./BM- Biomass Power Plant Start-Up execution with the real Hardware.
2.22./BM- Biomass Power Plant Shut-Down Procedure Analysis and Simulation.
2.23./BM- Biomass Power Plant Shut-Down execution with the real Hardware.
2.24./BM- Biomass Power Plant Active Power Control in isolated mode of operation (two generators).
2.25./BM- Biomass Power Plant Frequency Control in isolated mode of operation.
2.26./BM- Biomass Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.27./BM- Biomass Power Plant Voltage Control in isolated mode of operation.
2.28./BM- Biomass Power Plant Synchronization.
2.29./BM- Biomass Power Plant Active Power Control when connected to the Grid.
2.30./BM- Biomass Power Plant Reactive Power Control when connected to the Grid.
2.31./BM- Faults in Biomass Power Plant Operation.

Continue...

APS12. Simulator

SPECIFICATIONS SUMMARY (continuation)

Main Exercises to be done with the Mechanical Power Plants and Energy Simulator (APPS) (continuation)

Fuell Cells Power Plant

2.1./FC- Fuel Cells Power Plant General Principles of Operation.
2.2./FC- Gas Turbine General Principles of Operation.
2.3./FC- Fuel Cell Principles Operation.
2.4./FC- Fuel Cells Power Plant General Control Layouts.
2.5./FC- Fuel Cells Power Plant Control and Instrumentation Principles.
2.6./FC- Introduction to Mechanical and Electrical System Simulation.
2.7./FC- Introduction to Gas Turbine Power Plant Block Diagram and Transfer Functions.
2.8./FC- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.9./FC- Analysis of Proportional Controller.
2.10./FC- Analysis of Integral Controller.
2.11./FC- Analysis of Derivative Controller.
2.12./FC- Analysis of PID Controller.
2.13./FC- Analysis and Simulation of Fuel Cell System of the Fuel Cells Power Plant.
2.14./FC- Analysis and Simulation of Gas Turbine Fuel System of the Fuel Cells Power Plant.
2.15./FC- Analysis and Simulation of Compressor-Turbine System.
2.16./FC- Analysis and Simulation of Gas Turbine Temperature Control.
2.17./FC- Analysis and Simulation of Gas Turbine Governor/Speed Control.
2.18./FC- Analysis and Simulation of Gas Turbine Generator Excitation System.
2.19./FC- Analysis and Simulation of Gas Turbine Outer/Loop MW Control.
2.20./FC- Analysis and Simulation of Gas Turbine Electrical Generator.
2.21./FC- Analysis and Simulation of Gas Turbine Lubrication Oil Cooling Temperature Control.
2.22./FC- Analysis and Simulation of Gas Turbine Generator Exciter Cooler Temperature Control.
2.23./FC- Fuel Cells Power Plant Start-Up Procedure Analysis and Simulation.
2.24./FC- Fuel Cells Power Plant Start-Up execution with the real Hardware.
2.25./FC- Fuel Cells Power Plant Shut-Down Procedure Analysis and Simulation.
2.26./FC- Fuel Cells Power Plant Shut-Down execution with the real Hardware.
2.27./FC- Fuel Cells Power Plant Active Power Control in isolated mode of operation (two generators).
2.28./FC- Fuel Cells Power Plant Frequency Control in isolated mode of operation.
2.29./FC- Fuel Cells Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.30./FC- Fuel Cells Power Plant Voltage Control in isolated mode of operation.
2.31./FC- Fuel Cells Power Plant Synchronization.
2.32./FC- Fuel Cells Power Plant Active Power Control when connected to the Grid.
2.33./FC- Fuel Cells Power Plant Reactive Power Control when connected to the Grid.
2.34./FC- Faults in Fuel Cells Power Plant Operation.

Geothermal Power Plant

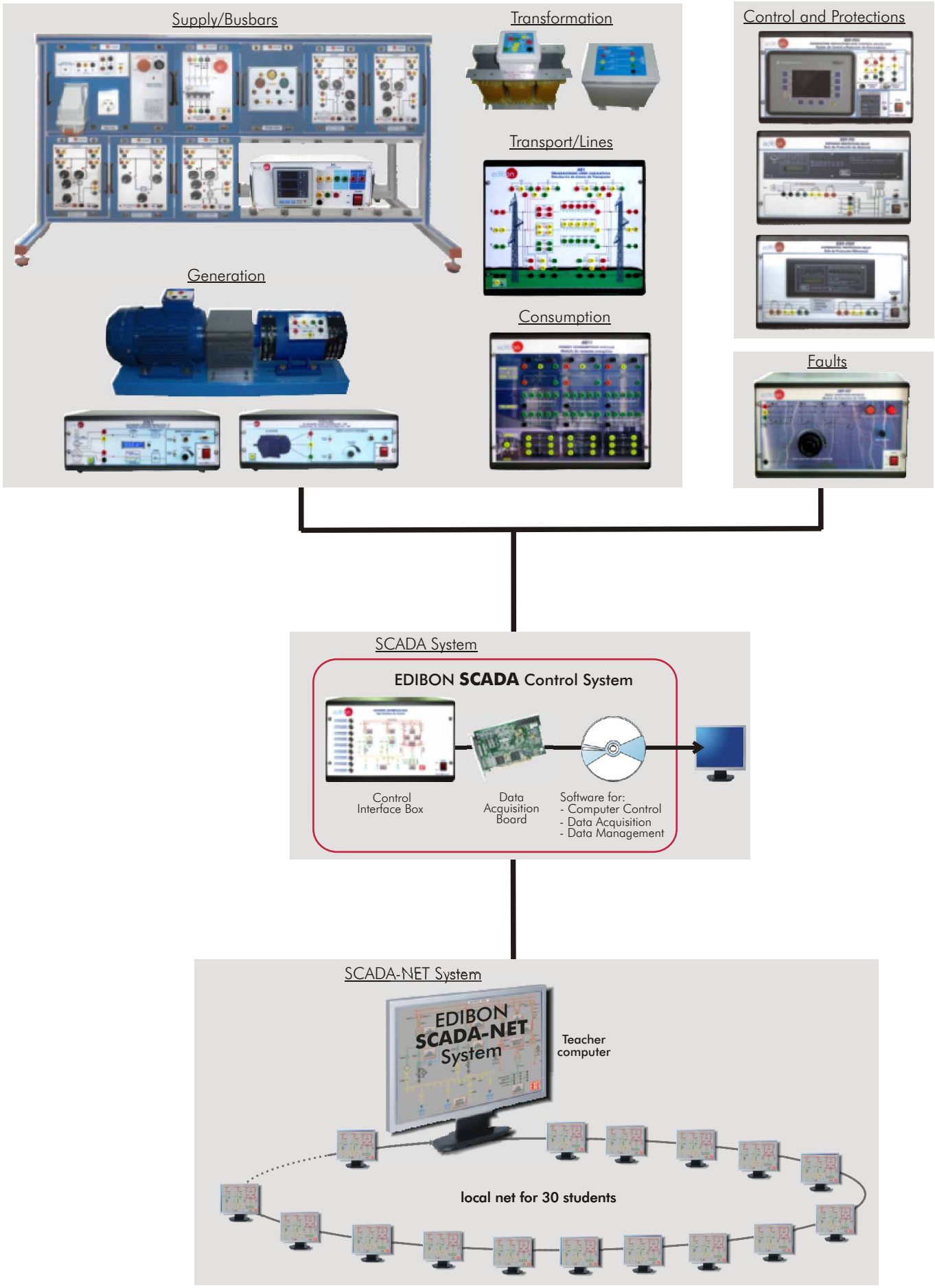
2.1./GT- Geothermal Power Plant General Principles of Operation.
2.2./GT- Steam Turbine General Principles of Operation.
2.3./GT- Geothermal Power Plant General Control Layouts.
2.4./GT- Geothermal Power Plant Control and Instrumentation Principles.
2.5./GT- Introduction to Mechanical and Electrical System Simulation.
2.6./GT- Introduction to Geothermal Power Plant Block Diagram and Transfer Functions.
2.7./GT- Introduction to Proportional, Integral and Derivate (PID) Controllers used in Power Plant Control.
2.8./GT- Analysis of Proportional Controller.
2.9./GT- Analysis of Integral Controller.
2.10./GT- Analysis of Derivative Controller.
2.11./GT- Analysis of PID Controller.
2.12./GT- Analysis and Simulation of Steam Turbine Feed System.
2.13./GT- Analysis and Simulation of Steam Turbine Temperature Control.
2.14./GT- Analysis and Simulation of Steam Turbine Governor/Speed Control.
2.15./GT- Analysis and Simulation of Steam Turbine Generator Excitation System.
2.16./GT- Analysis and Simulation of Steam Turbine Outer/Loop MW Control.
2.17./GT- Analysis and Simulation of Steam Turbine Electrical Generator.
2.18./GT- Analysis and Simulation of Steam Turbine Lubrication Oil Cooling Temperature Control.
2.19./GT- Analysis and Simulation of Steam Turbine Generator Exciter Cooler Temperature Control.
2.20./GT- Geothermal Power Plant Start-Up Procedure Analysis and Simulation.
2.21./GT- Geothermal Power Plant Start-Up execution with the real Hardware.
2.22./GT- Geothermal Power Plant Shut-Down Procedure Analysis and Simulation.
2.23./GT- Geothermal Power Plant Shut-Down execution with the real Hardware.
2.24./GT- Geothermal Power Plant Active Power Control in isolated mode of operation (two generators).
2.25./GT- Geothermal Power Plant Frequency Control in isolated mode of operation.
2.26./GT- Geothermal Power Plant Reactive Power Control in isolated mode of operation (two generators).
2.27./GT- Geothermal Power Plant Voltage Control in isolated mode of operation.
2.28./GT- Geothermal Power Plant Synchronization.
2.29./GT- Geothermal Power Plant Active Power Control when connected to the Grid.
2.30./GT- Geothermal Power Plant Reactive Power Control when connected to the Grid.
2.31./GT- Faults in Geothermal Power Plant Operation

3) **ESN. EDIBON SCADA-NET Teaching System:**

System for being used with the Advanced Electrical Power System and Mechanical Power Plants Simulator (APS12) and for 30 students working simultaneously.

More information in: www.edibon.com/products/catalogues/en/units/energy/energypowerplants/APS12.pdf

MPSS/ESN. **Modular Power System Simulator, with SCADA Control System and SCADA-NET System**



More information in: www.edibon.com/products/catalogues/en/units/energy/energypowerplants/MPSS-ESN.pdf

MPSS/ESN. **Modular Power System Simulator, with SCADA Control System and SCADA-NET System**

SPECIFICATIONS SUMMARY

The "MPSS/ESN" is a Modular Power System Simulator with SCADA Control System and SCADA-NET System specially designed for Technicians at Technical and Vocational level or initial level at Higher Education.

The simulator will include the main parts of a Power System as:

- Generation.
- Transformation.
- Transport.
- Distribution.
- Consumption.

It will include important and key elements that play a very important roll in a Power System control and protection, as:

-Automatic voltage regulator.

-Automatic frequency control.

-All the main protection relays involved.

-Automatic and Manual synchronization.

The simulator includes the following modules:

Supply/Busbars

-BASB. Basic Frame.

-ALI01. Power Supply.

-INX20/P. Generator Protection Module.

-IND05. Synchronism Module.

-BUS01. Busbar model 1 (Generation).

-BUS02. Busbar model 2 (Transport).

-BUS03. Busbar model 3 (Coupling).

-BUS04. Busbar model 4 (Consumption).

-BUS05. Busbar model 5 (Transport).

-EAL. Network Analyzer Unit.

Generation

-EGMG/P. Generation Group.

-AVR/P. Automatic Voltage Regulator.

-VVCA/MP. AC Motors Speed Controller.

Transformation

-TRANS/3A. Step-up Transformer.

-TRANS/3B. Step-down Transformer.

Transport/Lines

-AE1. Transmission Lines Simulation Unit.

Consumption

-AE11. Energy Consumption Module.

Control and Protections

-ERP-PGC. Generators Protection and Control Device Unit.

-ERP-PD. Distance Protection Relay Unit.

-ERP-PDF. Differential Protection Relay Unit.

Faults

-ERP-MF. Fault Injection Module.

-Units reconfigurations and interconnections between modules.

SCADA System

-EDIBON SCADA Control System.

SCADA-NET System

-ESN. EDIBON SCADA-NET System, for being used with the Modular Power System Simulator and for 30 students working simultaneously.

More information in: www.edibon.com/products/catalogues/en/units/energy/energypowerplants/MPSS-ESN.pdf

PRACTICAL POSSIBILITIES

1.- Power System Simulator Components recognition and operation introduction.

2.- Study of generation unit feeding isolated resistive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.

3.- Study of generation unit feeding isolated inductive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.

4.- Study of generation unit feeding isolated capacitive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.

5.- Study of generation unit feeding isolated mixed loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.

6.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.

7.- Study of unit feeding isolated resistive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.

8.- Study of unit feeding isolated inductive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.

9.- Study of unit feeding isolated capacitive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.

10.- Study of unit feeding isolated mixed RLC loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.

11.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at transmission substation busbar.

12.- Study of generator armature reaction when feeding isolated resistive loads through transmission line with automatic frequency control and without voltage control.

13.- Study of generator armature reaction when feeding isolated inductive loads through transmission line with automatic frequency control and without voltage control.

14.- Study of generator armature reaction when feeding isolated capacitive loads through transmission line with automatic frequency control and without voltage control.

15.- Study of generator armature reaction when feeding isolated mixed RCL loads through transmission line with automatic frequency control and without voltage control.

16.- Study of generator armature reaction when feeding isolated unbalanced loads through transmission line with automatic frequency control and without voltage control.

17.- Study of generation unit connected to the network through different transmission lines, operating at constant active power and variable field current.

18.- Study of generation unit connected to the network through different transmission lines, operating at variable active power and constant field current.

19.- Calculation of the line parameters.

20.- No laad transmission line operation and voltage regulation.

21.- Pure resistive load transmission line operation and voltage regulation.

22.- Pure inductive load transmission line operation and voltage regulation.

23.- Pure capacitive load transmission line operation and voltage regulation.

24.- Mixed R-L load transmission line operation and voltage regulation.

25.- Mixed R-C load transmission line operation and voltage regulation.

26.- Mixed L-C load transmission line operation and voltage regulation.

27.- Mixed R-L-C load transmission line operation and voltage regulation.

28.- Unbalanced load transmission line operation and voltage regulation.

29.- Verification of generator rotor to ground protection functionality.

30.- Verification of differential protection functionality.

31.- Verification of line distance protection functionality.

Some other practices to be done with the SCADA System:

32.- To open and close circuit breakers and switches in the busbars.

33.- To connect the generator to the lines.

34.- To connect the generator. Voltage measurement.

35.- To connect the lines. Voltage measurement.

36.- To connect the loads. Voltage and current measurement.

37.- To change the parameters of the relays.

38.- To simulate different fault currents.

Some other practices to be done with the SCADA-NET System:

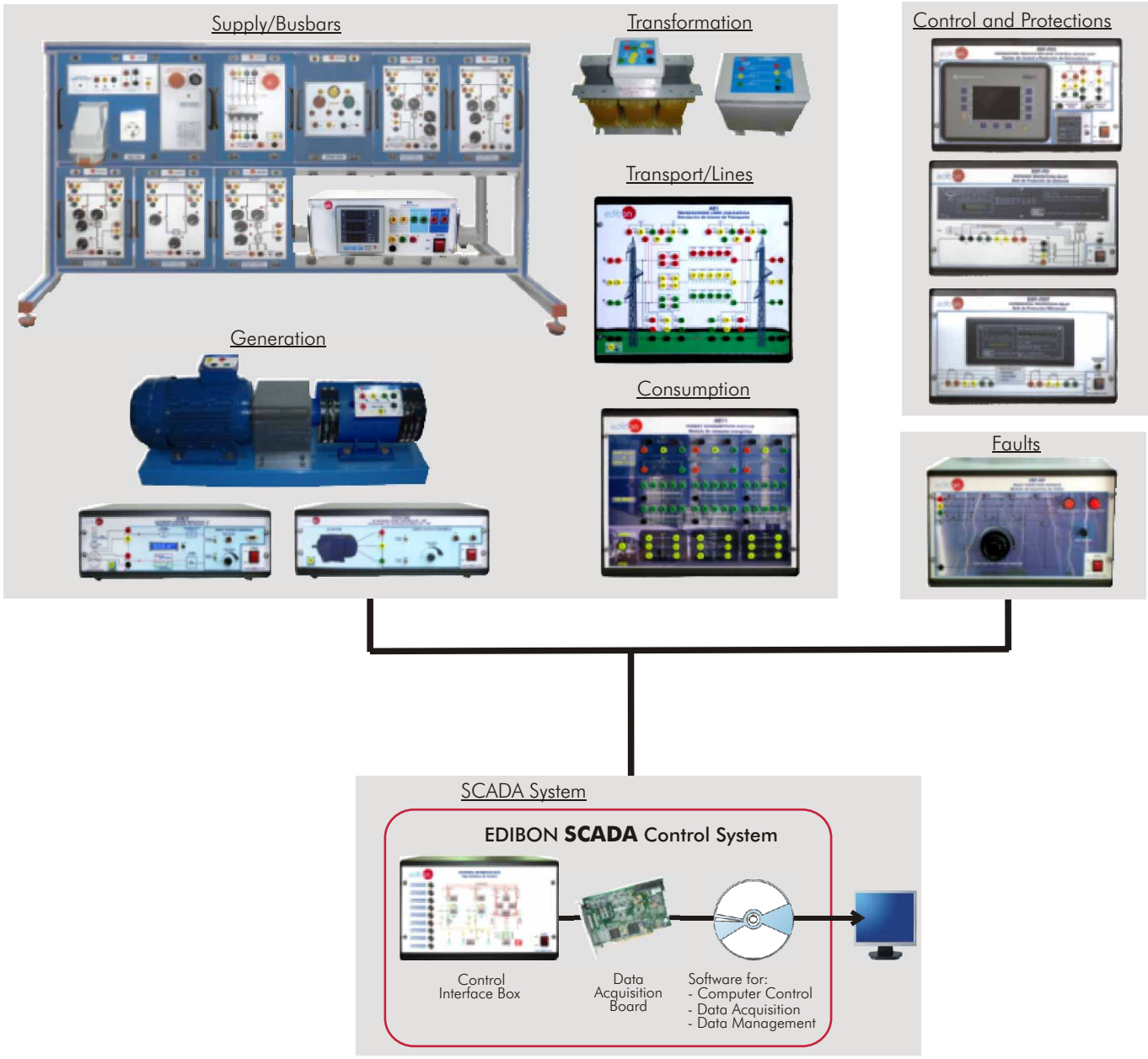
39.- Units explanation simultaneously to all students.

40.- Teacher and students real time communication.

41.- Exam configuration allowing to evaluate the level of understanding.

42.- Full control system by teacher and students.

MPSS/C. **Modular Power System Simulator, with SCADA Control System**



More information in: www.edibon.com/products/catalogues/en/units/energy/energypowerplants/MPSS-C.pdf

MPSS/C. **Modular Power System Simulator, with SCADA Control System**

SPECIFICATIONS SUMMARY

The "MPSS/C" is a Modular Power System Simulator with SCADA Control System specially designed for Technicians at Technical and Vocational level or initial level at Higher Education. It has the same characteristics as MPSS/ESN, but without the ESN. EDIBON SCADA-NET System.

The simulator will include the main parts of a Power System as:

- Generation.
- Transformation.
- Transport.
- Distribution.
- Consumption.

It will include important and key elements that play a very important roll in a Power System control and protection, as:

-Automatic voltage regulator.

-Automatic frequency control.

-All the main protection relays involved.

-Automatic and Manual synchronization.

The simulator includes the following modules:

Supply/Busbars

-BASB. Basic Frame.

-ALI01. Power Supply.

-INX20/P. Generator Protection Module.

-IND05. Synchronism Module.

-BUS01. Busbar model 1 (Generation).

-BUS02. Busbar model 2 (Transport).

-BUS03. Busbar model 3 (Coupling).

-BUS04. Busbar model 4 (Consumption).

-BUS05. Busbar model 5 (Transport).

-EAL. Network Analyzer Unit.

Generation

-EGMG/P. Generation Group.

-AVR/P. Automatic Voltage Regulator.

-VVCA/MP. AC Motors Speed Controller.

Transformation

-TRANS/3A. Step-up Transformer.

-TRANS/3B. Step-down Transformer.

Transport/Lines

-AE1. Transmission Lines Simulation Unit.

Consumption

-AE11. Energy Consumption Module.

Control and Protections

-ERP-PGC. Generators Protection and Control Device Unit.

-ERP-PD. Distance Protection Relay Unit.

-ERP-PDF. Differential Protection Relay Unit.

Faults

-ERP-MF. Fault Injection Module.

-Units reconfigurations and interconnections between modules.

SCADA System

-EDIBON SCADA Control System.

More information in: www.edibon.com/products/catalogues/en/units/energy/energypowerplants/MPSS-C.pdf

PRACTICAL POSSIBILITIES

1.- Power System Simulator Components recognition and operation introduction.

2.- Study of generation unit feeding isolated resistive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.

3.- Study of generation unit feeding isolated inductive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.

4.- Study of generation unit feeding isolated capacitive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.

5.- Study of generation unit feeding isolated mixed loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.

6.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.

7.- Study of unit feeding isolated resistive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.

8.- Study of unit feeding isolated inductive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.

9.- Study of unit feeding isolated capacitive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.

10.- Study of unit feeding isolated mixed RLC loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.

11.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at transmission substation busbar.

12.- Study of generator armature reaction when feeding isolated resistive loads through transmission line with automatic frequency control and without voltage control.

13.- Study of generator armature reaction when feeding isolated inductive loads through transmission line with automatic frequency control and without voltage control.

14.- Study of generator armature reaction when feeding isolated capacitive loads through transmission line with automatic frequency control and without voltage control.

15.- Study of generator armature reaction when feeding isolated mixed RCL loads through transmission line with automatic frequency control and without voltage control.

16.- Study of generator armature reaction when feeding isolated unbalanced loads through transmission line with automatic frequency control and without voltage control.

17.- Study of generation unit connected to the network through different transmission lines, operating at constant active power and variable field current.

18.- Study of generation unit connected to the network through different transmission lines, operating at variable active power and constant field current.

19.- Calculation of the line parameters.

20.- No laad transmission line operation and voltage regulation.

21.- Pure resistive load transmission line operation and voltage regulation.

22.- Pure inductive load transmission line operation and voltage regulation.

23.- Pure capacitive load transmission line operation and voltage regulation.

24.- Mixed R-L load transmission line operation and voltage regulation.

25.- Mixed R-C load transmission line operation and voltage regulation.

26.- Mixed L-C load transmission line operation and voltage regulation.

27.- Mixed R-L-C load transmission line operation and voltage regulation.

28.- Unbalanced load transmission line operation and voltage regulation.

29.- Verification of generator rotor to ground protection functionality.

30.- Verification of differential protection functionality.

31.- Verification of line distance protection functionality.

Some other practices to be done with the SCADA System:

32.- To open and close circuit breakers and switches in the busbars.

33.- To connect the generator to the lines.

34.- To connect the generator. Voltage measurement.

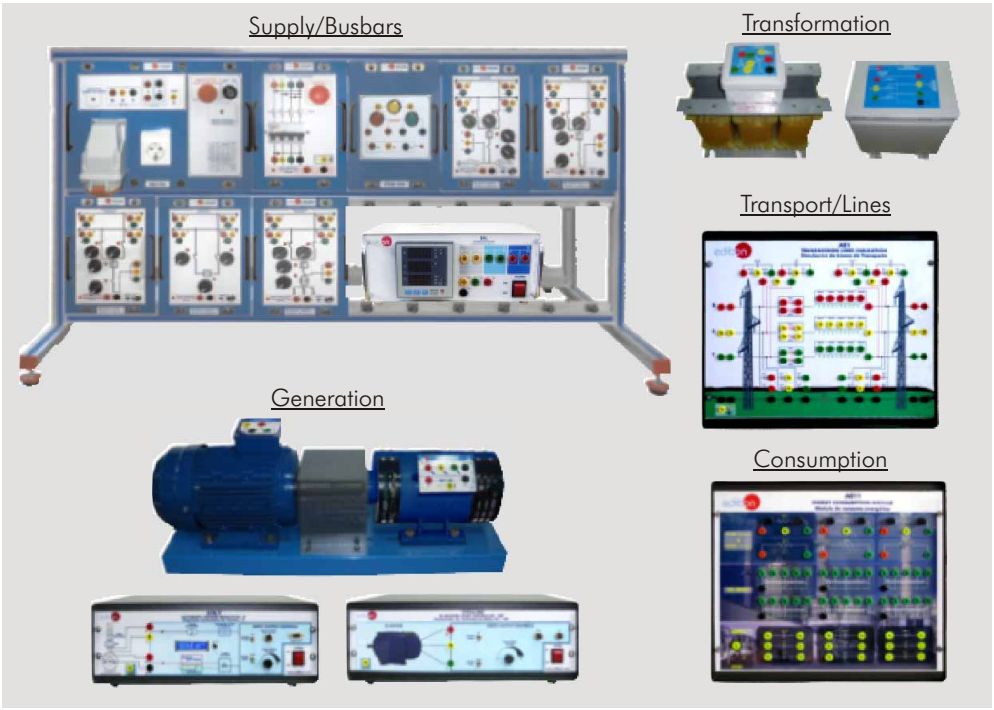
35.- To connect the lines. Voltage measurement.

36.- To connect the loads. Voltage and current measurement.

37.- To change the parameters of the relays.

38.- To simulate different fault currents.

MPSS/M. **Modular Power System Simulator** (Medium)



SPECIFICATIONS SUMMARY

The "MPSS/M" is a Modular Power System Simulator specially designed for Technicians at Technical and Vocational level. It has the same characteristics as MPSS/ESN, but without the SCADA Control System and without the ESN. EDIBON SCADA-NET System.

The simulator will include the main parts of a Power System as:

- Generation.
- Transformation.
- Transport.
- Distribution.
- Consumption.

It will include important and key elements that play a very important roll in a Power System control and protection, as:

-Automatic voltage regulator.
-Automatic frequency control.
-All the main protection relays involved.
-Automatic and Manual synchronization.

The simulator includes the following modules:

Supply/Busbars

-BASB. Basic Frame.
-ALI01. Power Supply.
-INX20/P. Generator Protection Module.
-IND05. Synchronism Module.
-BUS01. Busbar model 1 (Generation).
-BUS02. Busbar model 2 (Transport).
-BUS03. Busbar model 3 (Coupling).
-BUS04. Busbar model 4 (Consumption).
-BUS05. Busbar model 5 (Transport).
-EAL. Network Analyzer Unit.

Generation

-EGMG/P. Generation Group.
-AVR/P. Automatic Voltage Regulator.
-VVCA/MP. AC Motors Speed Controller.

Transformation

-TRANS/3A. Step-up Transformer.
-TRANS/3B. Step-down Transformer.

Transport/Lines

-AE1. Transmission Lines Simulation Unit.

Consumption

-AE11. Energy Consumption Module.

Control and Protections

-ERP-PGC. Generators Protection and Control Device Unit.
-ERP-PD. Distance Protection Relay Unit.
-ERP-PDF. Differential Protection Relay Unit.

Faults

-ERP-MF. Fault Injection Module.

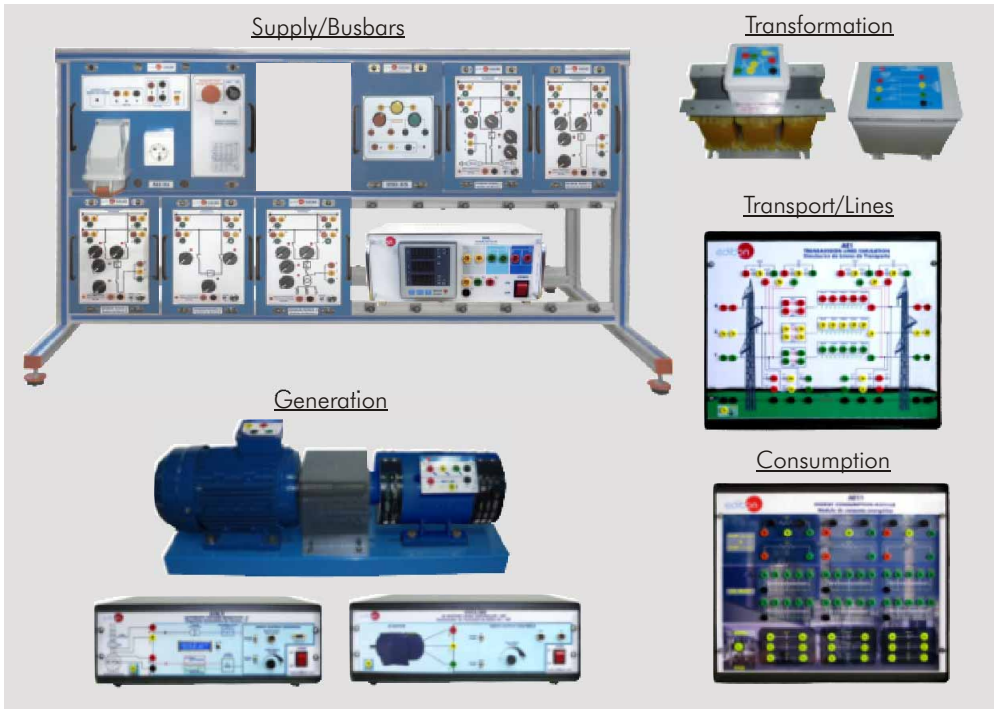
-Units reconfigurations and interconnections between modules.

More information in: www.edibon.com/products/catalogues/en/units/energy/energypowerplants/MPSS-M.pdf

PRACTICAL POSSIBILITIES

1.- Power System Simulator Components recognition and operation introduction.
2.- Study of generation unit feeding isolated resistive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
3.- Study of generation unit feeding isolated inductive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
4.- Study of generation unit feeding isolated capacitive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
5.- Study of generation unit feeding isolated mixed loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
6.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
7.- Study of unit feeding isolated resistive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
8.- Study of unit feeding isolated inductive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
9.- Study of unit feeding isolated capacitive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
10.- Study of unit feeding isolated mixed RLC loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
11.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at transmission substation busbar.
12.- Study of generator armature reaction when feeding isolated resistive loads through transmission line with automatic frequency control and without voltage control.
13.- Study of generator armature reaction when feeding isolated inductive loads through transmission line with automatic frequency control and without voltage control.
14.- Study of generator armature reaction when feeding isolated capacitive loads through transmission line with automatic frequency control and without voltage control.
15.- Study of generator armature reaction when feeding isolated mixed RCL loads through transmission line with automatic frequency control and without voltage control.
16.- Study of generator armature reaction when feeding isolated unbalanced loads through transmission line with automatic frequency control and without voltage control.
17.- Study of generation unit connected to the network through different transmission lines, operating at constant active power and variable field current.
18.- Study of generation unit connected to the network through different transmission lines, operating at variable active power and constant field current.
19.- Calculation of the line parameters.
20.- No laad transmission line operation and voltage regulation.
21.- Pure resistive load transmission line operation and voltage regulation.
22.- Pure inductive load transmission line operation and voltage regulation.
23.- Pure capacitive load transmission line operation and voltage regulation.
24.- Mixed R-L load transmission line operation and voltage regulation.
25.- Mixed R-C load transmission line operation and voltage regulation.
26.- Mixed L-C load transmission line operation and voltage regulation.
27.- Mixed R-L-C load transmission line operation and voltage regulation.
28.- Unbalanced load transmission line operation and voltage regulation.
29.- Verification of generator rotor to ground protection functionality.
30.- Verification of differential protection functionality.
31.- Verification of line distance protection functionality.

MPSS/B. **Modular Power System Simulator** (Basic)



SPECIFICATIONS SUMMARY

The "MPSS/B" is a Modular Power System Simulator specially designed for Technicians at Technical and Vocational level.

The simulator will include the main parts of a Power System as:

- Generation.
- Transformation.
- Transport.
- Distribution.
- Consumption.

It will include important and key elements that play a very important roll in a Power System control and protection, as:

-Automatic voltage regulator.
-Automatic frequency control.
-All the main protection relays involved.
-Automatic and Manual synchronization.

The simulator includes the following modules:

Supply/Busbars

-BASB. Basic Frame.
-ALI01. Power Supply.
-IND05. Synchronism Module.
-BUS01. Busbar model 1 (Generation).
-BUS02. Busbar model 2 (Transport).
-BUS03. Busbar model 3 (Coupling).
-BUS04. Busbar model 4 (Consumption).
-BUS05. Busbar model 5 (Transport).
-EAL. Network Analyzer Unit.

Generation

-EGMG/P. Generation Group.
-AVR/P. Automatic Voltage Regulator.
-VVCA/MP. AC Motors Speed Controller.

Transformation

-TRANS/3A. Step-up Transformer.
-TRANS/3B. Step-down Transformer.

Transport/Lines

-AE1. Transmission Lines Simulation Unit.

Consumption

-AE11. Energy Consumption Module.

Control and Protections (Basic option)

-Protection System

Faults

-ERP-MF. Fault Injection Module.

-Units reconfigurations and interconnections between modules.

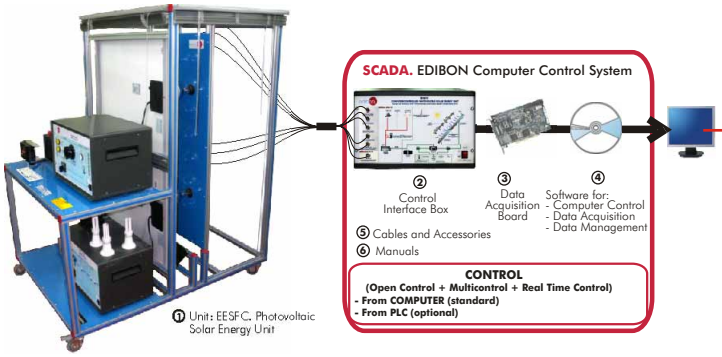
More information in: www.edibon.com/products/catalogues/en/units/energy/energypowerplants/MPSS-B.pdf

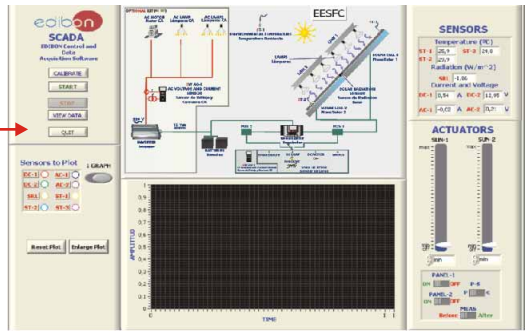
PRACTICAL POSSIBILITIES

1.- Power System Simulator Components recognition and operation introduction.
2.- Study of generation unit feeding isolated resistive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
3.- Study of generation unit feeding isolated inductive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
4.- Study of generation unit feeding isolated capacitive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
5.- Study of generation unit feeding isolated mixed loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
6.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
7.- Study of unit feeding isolated resistive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
8.- Study of unit feeding isolated inductive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
9.- Study of unit feeding isolated capacitive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
10.- Study of unit feeding isolated mixed RLC loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
11.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at transmission substation busbar.
12.- Study of generator armature reaction when feeding isolated resistive loads through transmission line with automatic frequency control and without voltage control.
13.- Study of generator armature reaction when feeding isolated inductive loads through transmission line with automatic frequency control and without voltage control.
14.- Study of generator armature reaction when feeding isolated capacitive loads through transmission line with automatic frequency control and without voltage control.
15.- Study of generator armature reaction when feeding isolated mixed RCL loads through transmission line with automatic frequency control and without voltage control.
16.- Study of generator armature reaction when feeding isolated unbalanced loads through transmission line with automatic frequency control and without voltage control.
17.- Study of generation unit connected to the network through different transmission lines, operating at constant active power and variable field current.
18.- Study of generation unit connected to the network through different transmission lines, operating at variable active power and constant field current.
19.- Calculation of the line parameters.
20.- No laad transmission line operation and voltage regulation.
21.- Pure resistive load transmission line operation and voltage regulation.
22.- Pure inductive load transmission line operation and voltageregulation.
23.- Pure capacitive load transmission line operation and voltage regulation.
24.- Mixed R-L load transmission line operation and voltage regulation.
25.- Mixed R-C load transmission line operation and voltage regulation.
26.- Mixed L-C load transmission line operation and voltage regulation.
27.- Mixed R-L-C load transmission line operation and voltage regulation.
28.- Unbalanced load transmission line operation and voltage regulation.
29.- Verification protection system fuctionality with varying the parameters of the protection system.

➤Photovoltaic

EESFC. Computer Controlled **Photovoltaic Solar Energy Unit** ✱





SPECIFICATIONS SUMMARY

Items supplied as standard

① EESFC. Unit:

"EESFC" is a computer controlled unit for the study of the transformation of solar energy in electric energy. This unit uses the photoconversion solar system for the direct conversion of solar radiation into electricity. The absorbed energy is provided by simulated solar radiation; in our case, this is done by means of a panel with powerful light sources.

Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

2 Photovoltaic solar panels (polycrystallines).

Solar simulator: Aluminium structure adjustable in horizontal position. 11 Solar spectrum lamps, distributed in two independent voltage regulated circuits. Electrical safety.

Ventilation system that allows us to analyze the temperature influence on the system performance operation.

DC Load and Battery Charger Regulator.

Auxiliary battery charger.

Battery.

DC Loads Module: DC lamps of 12Vdc. DC motor of 24-36Vdc. Rheostat of 300W. Independent connection for every load with the help of the 4 Positions selector.

Sensors: 3 Temperature sensors (one in the solar panel 1, other in the solar panel 2 and another of room temperature). Light radiation sensor. DC current sensor and DC voltage sensor.

Optional (NOT included in the standard supply):

-EE-KIT. Kit of Conversion and Consumption Simulation (AC).

-EE-KIT2. Grid Connection Inverter Kit.

② EESFC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EESFC/CCSOF. Computer Control+Data Acquisition+Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 2200 x 1200 x 2005 mm. Weight: 300 Kg.

Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EESFC.pdf

PRACTICAL POSSIBILITIES

1.- Determination of the typical parameters of the solar panels.

2.- Study of the existing relation between generated power and power of solar radiation.

3.- Study of the solar panels maximum performance.

4.- Study of the influence of the temperature on the tension of circuit opened of the solar panels.

5.- Study of the behaviour of the solar panels connected in parallel.

6.- Study of the behaviour of the solar panels connected in series.

7.- Study of the behaviour of the system connected in parallel depending on temperature.

8.- Lamps illumination profile study.

9.- Efficiency experimental determination.

10.- Influence of the angle of incidence on the temperature.

11.- Determination of the material that makes up the solar cell.

12.- Determination of the p and n side of a solar cell.

13.- Determination of the first quadrant of the I-V curve, without illumination of the solar cell.

14.- Determination of the inverse current or the saturation current with regard to a solar cell without illumination.

15.- Determination of the resistance in series and in parallel of a solar cell without illumination.

16.- Dependence of the voltage of open circuit (V_{oc}) with the lumens.

17.- Determination the characteristic parameters of a solar cell with illumination.

18.- Relation of the maximum power with the power input.

19.- Determination of the parameters that define the quality of a solar cell.

20.- Solar energy measurement.

21.- Measurement of the solar panel voltage in vacuum.

22.- Determination of the cells disposition in a solar panel.

23.- Measurement of the maximum power for a solar panel with load.

24.- Measurement of the solar panel voltage in vacuum with constant illumination and different temperature.

25.- Study of V,I,W according to different loads.

26.- Familiarization with the regulator parameters.

27.- Study of functionality of the photovoltaic system series/parallel with connection of different loads and without the support of the storage battery.

28.- Study of functionality of the photovoltaic system series/paralell with connection of different loads DC and with the support of the storage battery.

29.- Connection of loads to direct voltage.

Other possible practices:

30.- Sensors calibration.

Practices to be done with the OPTIONAL KIT "EE-KIT":

31.- Study of functionality of the photovoltaic system series/parallel with connection of different loads and without the support of the storage battery.

32.- Study of functionality of the photovoltaic system series/paralell with connection of different loads AC and with the support of the storage battery.

33.- Connection of loads to alternating voltage of 220 V.

Practices to be done with the OPTIONAL KIT "EE-KIT2":

34.- Study of the grid utility inverter.

35-53.- Practices with PLC.

✱ Non computer controlled version available too.

MINI-EESF. **Photovoltaic Solar Energy Modular Trainer** (Complete version)

SPECIFICATIONS SUMMARY

Photovoltaic Solar Energy Modular Trainer "MINI-EESF", is a laboratory scaled unit designed to study all the parameters governing the Solar radiation direct conversion into electricity.

The trainer is based on some application modules and photovoltaic solar panels assembled in mobile structures.

It is specially designed for the theoretical and practical study of the electrical installations with photovoltaic solar energy, the typical configurations used in photovoltaic installations and the operation of the different elements involved in the conversion.

Main features:

Supply and Consumption at 12 V (DC).

Supply and Consumption in alternating current (AC).

Supply to the public network (grid).

Photovoltaic module:

Solar Panel (polycrystaline) mounted on an anodized aluminum structure with wheels for mobility, and with calibrated cell to measure solar irradiation.

Battery.

Set of interconnection cables.

Anodized aluminum framework for modules allocation.

Modules:

ES10. Solar charge controller with an automatic recognition for operating voltage 12 V or 24 V. It monitors several parameters such as voltage, current and charge level of the battery, load current and status, accumulative values, etc.

ES20. Loads module that incorporates two 12 V, 50W lamps, with independent switches.

ES30. DC/AC inverter that outputs a sinewave shaped output of 230V/50Hz ± 2% (or 115V/60Hz ± 3%) and the nominal input voltage is 12Vdc. Two different operating modes: continuous mode and ASB mode (Auto Standby) to reduce the power consumption.

ES40. AC Voltage measurements module until 250V. and DC until 250 V.

ES50. Loads module that incorporates two lamps of 220V. or 110V., 50 W., with independent switches.

ES80. Module for measurements of solar irradiation (W/m^2) and measurements of current until 10 A.

ES90. Module for 12Vdc battery charger.

EE-KIT2. Grid Connection Inverter Kit.

It is formed by Grid Connection Inverter and Energy Generation Simulator.

Inverter used for the conversion and injection to the grid of the power generated by a simulated source of renewable energy. The simulated source is a simulator used to obtain a variable power to be injected to the grid.

It is equipped with extensive safety measures to ensure that it switches off immediately as soon as the AC plug is removed from the wall socket or the public grid fails in operation.

The inverter can be connected to a PC through RS232 communication to display some parameters such as voltage and current inputs, mains voltage and frequency, maximum AC power, Kwh, etc.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.):

Framework with modules: 1300 x 370 x 750 mm.

Weight: 35 Kg.

Photovoltaic module: 730 x 510 x 1150 mm. Weight: 10 Kg.

Grid Connection Inverter Kit: 490 x 330 x 410 mm.

Weight: 15 Kg.

Other available versions:

MINI-EESF/M. **Photovoltaic Solar Energy Modular Trainer** (Intermediate version).

MINI-EESF/B. **Photovoltaic Solar Energy Modular Trainer** (Basic version).

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/MINI-EESF.pdf

PRACTICAL POSSIBILITIES

1.- Determination of the constituent material of the solar cell.

2.- Determination of the I-V first quadrant curve without illuminating the solar cell.

3.- Determination of the inverse (or saturation) current of the cell without illumination.

4.- Determination of parallel and series resistance of a solar cell without illumination.

5.- Dependency of the open circuit voltage (V_{oc}) with lumens (luminous flux).

6.- Determination of the parameters that describe the quality of a solar cell.

7.- Solar energy measurement.

8.- Measurement of the solar panel voltage with no load.

9.- Determination of the disposition of cells in a solar panel.

10.- Familiarisation with the regulator parameters.

11.- Loads connection to 12 Volts DC.

12.- Loads connection to 220 Volts AC.

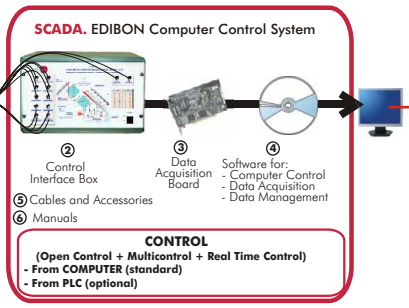
13.- Study of the grid utility inverter.

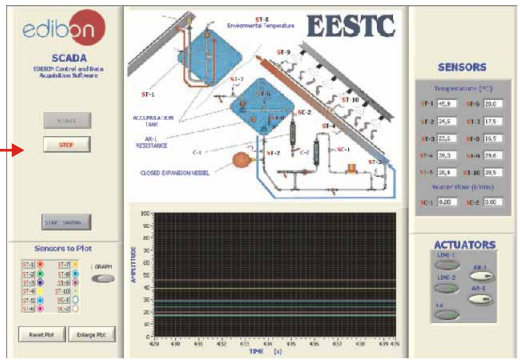
14.- Battery charging.

➤Solar Thermal

EESTC. Computer Controlled **Thermal Solar Energy Unit** ✱

① Unit: EESTC. Thermal Solar Energy Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

①EESTC. Unit:
The unit is a system that transforms solar energy into calorific energy. This unit uses the thermosiphon system to heat water or the traditional pumping system. In both cases, the absorbed calorific energy is given by the solar radiation simulated, in our case, by a panel with powerful luminous sources.
Anodized aluminium structure and main metallic elements in steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Solar panel (Thermal solar collector): steel structure, pipes (already prepared) to connect the panel and the accumulator, over pressure security valve, manometer, temperature sensors.
Thermal accumulator tank (from 150 to 200 l. approx.): vacuum vitrified heater; it has a supporting heating group, with a regulation electric resistance (3000 W); contact thermostat to control temperature.
Solar simulator: aluminum structure regulated in height; sixteen solar spectrum lamps; electricity security group, made up by 3 magnetothermic.
Pumping equipment: impulse pump, computer controlled; flow sensors; 3 flowmeters.
10 Temperature sensors in different points of the unit.

②EESTC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③DAB. Data Acquisition Board:
PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④EESTC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤Cables and Accessories, for normal operation.

⑥Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)=Unit: 2200 x 1200 x 2005 mm. Weight: 290 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EESTC.pdf

PRACTICAL POSSIBILITIES

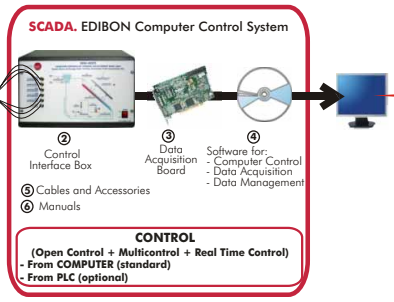
1.- Study of how the thermosiphon works.
2.- Study of the lamp illumination profile.
3.- Study of the solar collector efficiency.
4.- Free circulation: Inclination angle influence on the equipment efficiency.
5.- Relationship between the flow and the temperature.
6.- Energy balance of the solar collector.
7.- Energy balance in the accumulator tank.
8.- Experimental efficiency determination.
9.- Influence of the incidence angle over the temperature.

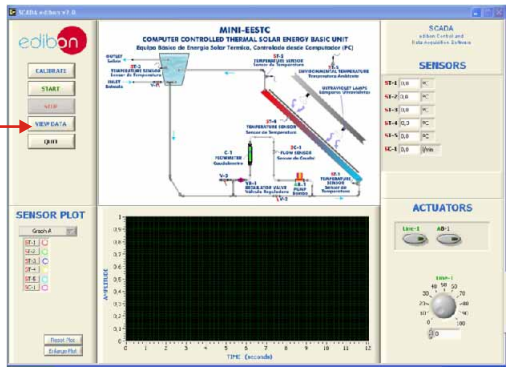
Other possible practices:

10.- Sensors calibration.
11.- Flowmeter calibration.
12-30.- Practices with PLC.

MINI-EESTC. Computer Controlled **Thermal Solar Energy Basic Unit** ✱

① Unit: MINI-EESTC. Thermal Solar Energy Basic Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

①MINI-EESTC. Unit:
This unit is a system that transforms solar energy into calorific energy. It uses the thermosiphon system to heat water or the traditional pumping system. In both cases, the absorbed calorific energy is given by the solar radiation simulated, in our case, by a panel with powerful luminous sources.
Anodized aluminium and steel structure. Diagram in the front panel with similar distribution to the elements in the real unit.
Solar panel (thermal solar collector): Metallic structure. Solar panel is made of polycarbonate, with polypropylene pipes. Pipes (already prepared) to connect the panel and the accumulator. Temperature sensors.
Accumulator tank of 30 l.
Solar simulator: Aluminium structure with adjustable height. 2 Solar spectrum lamps of 300W each one. Lamps intensity control from the computer (PC).
Pumping equipment: Impulse pump, computer controlled. 2 Flowmeters.
5 Temperature sensors in different points of the unit.

②MINI-EESTC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③DAB. Data Acquisition Board:
PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④MINI-EESTC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤Cables and Accessories, for normal operation.

⑥Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1300 x 800 x 1500 mm. Weight: 70 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/MINI-EESTC.pdf

PRACTICAL POSSIBILITIES

1.- Study of how the thermosiphon works.
2.- Study of the lamp illumination profile.
3.- Study of the solar collector efficiency.
4.- Study of the influence of the inclination angle of the lamp panel on the unit efficiency.
5.- Relationship between the flow and the temperature.
6.- Energy balance of the solar collector.
7.- Experimental efficiency determination.

Other possible practices:

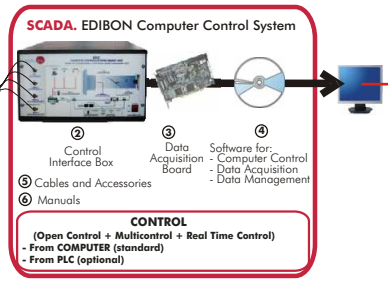
8.- Sensors calibration.
9-27.- Practices with PLC.

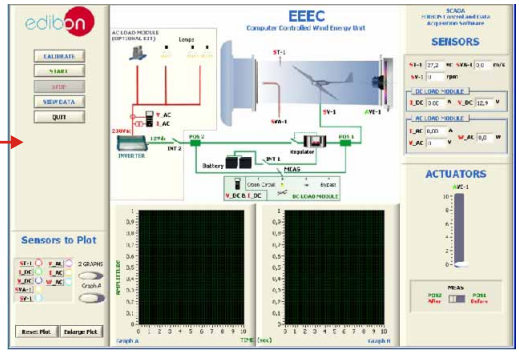
✱ Non computer controlled version available too.

EEEC. Computer Controlled **Wind Energy Unit** ✱

➤Wind

① Unit: EEEC. Wind Energy Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① EEEC. Unit:
"EEEC"is a laboratory-scale unit designed to study the eolic energy and the influence of some factors on this generation.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Stainless steel tunnel of 2000 x 550 x 550 mm. approx., which includes two transparent windows of 1100 x 200 mm. approx.
Aerogenerator of 6 blades (with angle-adjustable and with removable and angle-adjustable blades). Power 60 W.
Axial fan with speed variation for the wind simulation, computer controlled (2800 r.p.m.).
Load and Battery Charger Regulator. Auxiliary battery charger for battery of 12Vdc. Battery.
DC Loads Module: DC lamps of 12Vdc. DC motor of 24-36Vdc. Rheostat of 300W. 4 Positions Selector.
Sensors: Temperature sensor. Air speed sensor. Speed sensor (aerogenerator). DC voltage and current sensors (before and after the regulator).

Optional (NOT included in the minimum supply):
-EE-KIT. Kit of Conversion and Consumption Simulation (AC).
-EE-KIT2. Grid Connection Inverter Kit.

② EEEC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EEEC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =Unit: 2300 x 630 x 1080 mm. Weight: 120Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

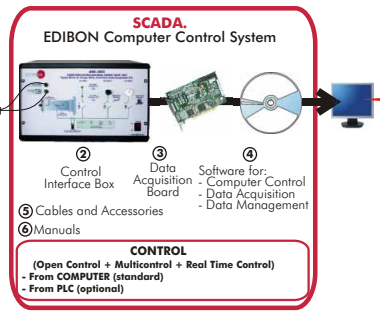
More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EEEC.pdf

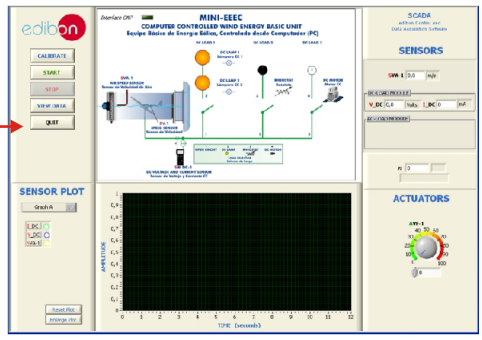
PRACTICAL POSSIBILITIES

1.- Study of the aerogenerator operation in function of the wind speed variation.
2.- Generator angle of incidence variation.
3.- Operation differences using the three available blades configurations (aerogenerator with 6, 3 or 2 blades).
4.- Operation differences depending on the angle of the blades.
5.- Load variation influence on the aerogenerator.
6.- Study of the voltage, power and current.
7.- Study of V, I, W in function of different loads.
8.- Efficiency experimental determination (depending on: number of blades, angle of the blades, generator´s angle; among others).
9.- Wind energy measurement.
10.- Familiarization with the regulator parameters.
11.- Study of the power generated by the aerogenerator depending on the wind speed.
12.- Study of the power generated by the aerogenerator depending on the air incident angle.
13.- Connection of loads to direct voltage.
Other possible practices:
14.- Sensors calibration.
Practices to be done with the OPTIONAL KIT "EE-KIT":
15.- Connection of loads to alternating voltage of 220V.
Practices to be done with the OPTIONAL KIT "EE-KIT2":
16.- Study of the grid utility inverter.
17-35.- Practices with PLC.

MINI-EEEC. Computer Controlled **Wind Energy Basic Unit** ✱

① Unit: MINI-EEEC. Wind Energy Basic Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① MINI-EEEC. Unit:
MINI-EEEC is an unit, at small scale, designed to study the wind energy and the influence of some factors on this generation.
Anodized aluminium structure and panel in painted steel. Diagram in the front panel.
Air generator: Axial fan with speed regulator, computer controlled (maximum flow of 1473 m^3/h). Air tunnel, made of methacrylate, of 500 mm. long and 300 mm. of diameter approx.
Aerogenerator: the safety turbine is a simple injection model that joins the ends of up to six air blades, set of six blades for the aerogenerator, power (at a rotor speed of 2000 r.p.m): 1W. Minimum speed of the wind required to generate electricity: 2m/s. Air speed sensor. Aerogenerator turning speed sensor, range: 0-2000 rpm.
DC load module (LEDs, rheostat, DC motor). Load selector. Voltage and current sensor.

② MINI-EEEC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ MINI-EEEC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 600 x 400 x 500 mm. Weight: 20 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

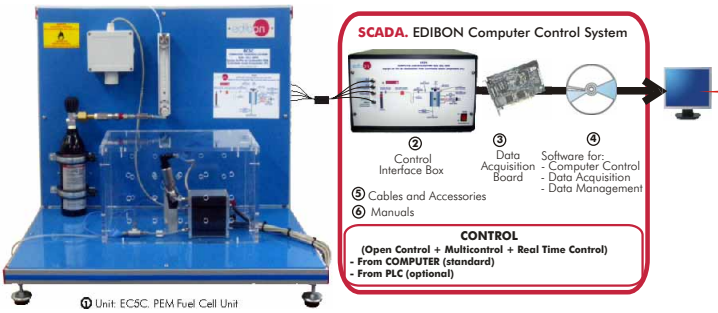
More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/MINI-EEEC.pdf

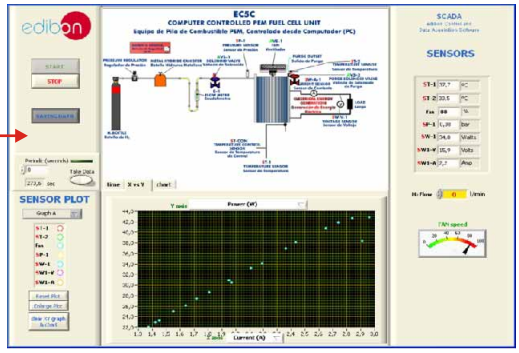
PRACTICAL POSSIBILITIES

1.- Study of the aerogenerator operation depending on the wind variation.
2.- Determination of the aerogenerator typical parameters.
3.- Differences in the operation by using the three available blades's configurations (aerogenerator with 6, 3 and 2 blades).
4.- Influence of the load variation in the aerogenerator.
5.- Study of voltage, power and current.
6.- Experimental determination of efficiency.
7.- Study of the power generated by the aerogenerator depending on the wind speed.
8.- Study of the power generated by the aerogenerator depending on the number of blades.
9.- Wind energy measurement.
10.- Study of the characteristic curve of the aerogenerator at constant wind speed.
11.- Study of the characteristic curve of the aerogenerator at constant revolutions.
12.- DC loads connection.
Other possible practices:
13.- Sensors calibration.
14-32.- Practices with PLC.

✱ Non computer controlled version available too.

EC5C. Computer Controlled **PEM Fuel Cell Unit**∗





SPECIFICATIONS SUMMARY

Items supplied as standard

① EC5C. Unit:

The unit has been designed to give students a good understanding of fuel cells technology. This unit demonstrates a PEM Fuel Cell, generating electrical power from hydrogen.

Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Fuel cell stack with 24 cells, and a rated power of 100W. Cells are self-humidifying and do not require any type of external humidification. Integrated fan in the stack. Solenoid valve to supply H_2. Bottle of metal hydride for the storage of H_2. Pressure regulator of the metal hydride. Pressure regulator of the H_2 bottle. Suitable tubes and hoses for their use with H_2 with a high safety factor. Purge solenoid valve. Load module: Rheostat. Hydrogen leakage detector, and software warning. Failure protection with solenoid valve at the stack inlet. Over current shut down. Low voltage shut down. Over temperature shut down in the stack. Flow sensor to measure the inlet H_2 flow to the stack. Control temperature sensor placed between two bipolar plates of the cell. Temperature sensor for the purge flow. Pressure sensor to measure the H_2 at the stack inlet. Current, voltage and power sensors.

② EC5C/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EC5C/CCSOF. Computer Control+Data Acquisition+Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 700 x 400 x 550 mm. Weight: 20 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EC5C.pdf

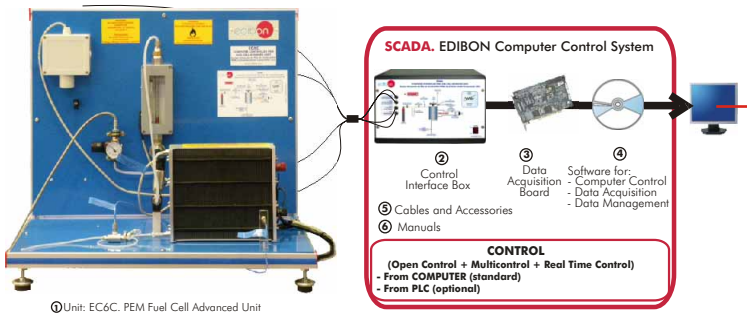
PRACTICAL POSSIBILITIES

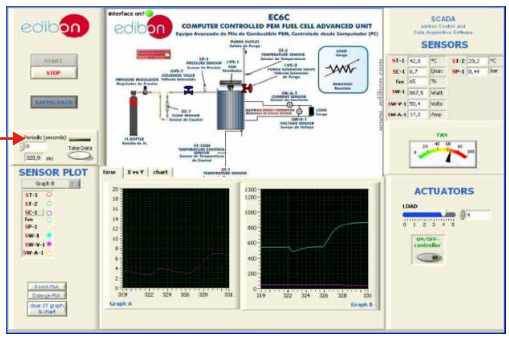
1.- Study of the fundamental principles of how the PEM based fuel cell operates.
2.- Study of the structure and main principles of a metal hydride accumulator/storage battery.
3.- Calculation of a fuel cell efficiency.
4.- Study of the influence of air consumption and hydrogen in the efficiency of a fuel cell.
5.- Study of the influence of generated power in the efficiency of a fuel cell.
6.- Determination of the current density-voltage characteristics of a fuel cell.
7.- Power density from a single cell and a stack of cells.
8.- Representation of the polarization curve of a fuel cell.
9.- Study of the influence of the reagents' flows in the generation of electrical power.
10.- Study of the use of reagents and transport phenomena.
11.- Investigation into reactant utilisation.
12.- Kinetic parameters, thermodynamics.

Other possible practices:

13.- Sensors calibration.
14-32.- Practices with PLC.

EC6C. Computer Controlled **PEM Fuel Cell Advanced Unit**∗





SPECIFICATIONS SUMMARY

Items supplied as standard

① EC6C. Unit:

This unit has been designed to allow the students to understand the fuel cells technology; especially that of a proton exchange membrane fuel cell (PEM). The main operation principles of a PEM fuel cell can be studied with this unit. It also enables to calculate several fundamental parameters of a PEM type fuel cell, such as power density, polarization curves, efficiency, etc., and the variation of some of these parameters in function of the consumption of reagents and the developed power. Anodized aluminium structure and panels in painted steel. Diagram in the front panel. Fuel cell stack with 72 cells and a rated power of 1000W. Cells are self-humidifying. Fan incorporated in the stack. Solenoid valve to supply H_2. Pressure regulator for the H_2 bottle. Pressure regulator for the hydrogen inlet at the PEM fuel cell. Suitable tubes and hose for its use with H_2 with a high safety factor. Load module. Hydrogen leakage detector and software warning.

Failure protection with solenoid valve at the stack inlet: over current and low voltage shut down, over temperature shut down in the stack.

Flow sensor to measure the inlet H_2 flow to the stack. Control temperature sensor placed between two bipolar plates of the cell. Temperature sensor for the purging flow. Pressure sensor to measure the H_2 pressure at the stack inlet. Current, voltage and power sensors.

② EC6C/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EC6C/CCSOF. Computer Control+Data Acquisition+Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 700 x 400 x 550 mm. Weight: 25 Kg. Load module: 490 x 330 x 310 mm. Weight: 10 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EC6C.pdf

PRACTICAL POSSIBILITIES

1.- Study of the main principles of a proton exchange fuel cell (PEM) operation.
2.- Calculation of the efficiency of a PEM fuel cell.
3.- Study of the influence of air consumption and hydrogen consumption in the efficiency of a PEM fuel cell.
4.- Study of the power density of a PEM fuel cell.
5.- Representation of the polarization curve of a PEM fuel cell.
6.- Determination of the voltage and current density characteristics of a PEM fuel cell.
7.- Influence of hydrogen consumption in the electric power generation.
8.- Study of the influence of the generated power in the efficiency of PEM a fuel cell.
9.- Study of the influence of the reagents' flows in the generation of electrical power.
10.- Study of the use of reagents and transport phenomena.

Other possible practices:

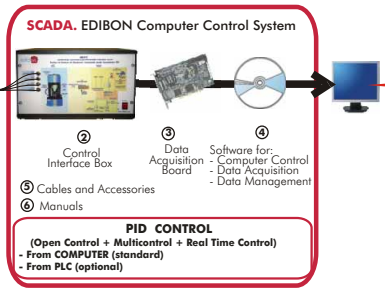
11.- Sensors calibration.
12-30.- Practices with PLC.

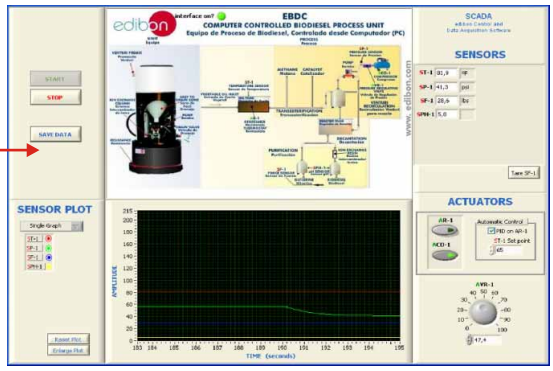
∗ Non computer controlled version available too.

➤**Biofuels**

EBDC. Computer Controlled **Biodiesel Process Unit** ✱

① Unit: EBDC. Biodiesel Process Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① EBDC. Unit:

The Computer Controlled Biodiesel Process Unit (EBDC) is a unit which allows the study of the biodiesel production cycle different stages. Different parameters that affect the whole process, as well as the obtained biodiesel quality, may also be studied. Anodized aluminium structure and panels in painted steel. Diagram in the front panel.

Reactor tank with inner tap (75 litres). Oil heating tank (65 litres). Heating band computer controlled, of 1.5 kW for the tank. Premix bottle with couplings and hoses. Membrane pump, operated by a compressor. Compressor, computer controlled. Stainless steel recirculation hose. Venturi recirculation system for the premixing process. Glycerin outlet tube and tap (glycerin drainage system). Biodiesel hose and tap. Purification compartment with two Kg of Amberlite (ion exchange resin column). Funnel with mesh for particles. Regulator and air connectors. Hoses and air connectors. Graduated biodiesel jerry can of 60 litres with dispenser tap. Graduated glycerin can of 10 litres with dispenser tap. Pumps for methanol and for catalyst. Pressure regulating valve. Temperature sensor. Pressure sensor. Force sensor to measure the obtained glycerin and biodiesel weight. pH sensor to determine the quality of the obtained biodiesel. Titration kit.

Biodiesel production:

Batch of 50 l. of biodiesel every 24 hours.

Raw material needed for 50 l. of biodiesel: 50 l. of raw of used oil. 8 l. of methanol, and catalyst.

② EBDC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any time and in a real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EBDC/CCSOF. PID Computer Control + Data Acquisition + Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 1800 x 810 x 1550 mm. Weight: 160 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EBDC.pdf

PRACTICAL POSSIBILITIES

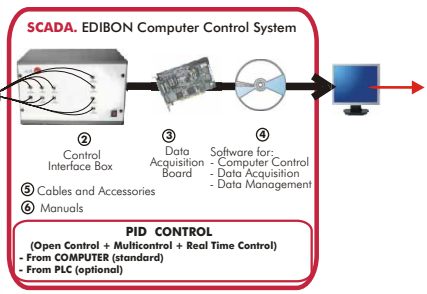
1.- Familiarization with the operation of a biodiesel production unit and identification and study of the different stages which comprises the biodiesel production process: heating, mixing, separation and purification.
2.- Study and performance of tests to determine the appropriate amount of catalyst to be used in the biodiesel production process (titration).
3.- Study of the agitation and mixing level influence on the final quality of the obtained biodiesel.
4.- Study of the washing and purifying stage influence on the final quality of the obtained biodiesel.
5.- Study of the influence of temperature at the vegetable oils preheating stage in the final quality of the obtained biodiesel.

Other possible practices:

6.- Sensors calibration.
7.- Study of vegetable oils transesterification with an alcohol to produce biodiesel.
8.- Biodiesel quality test.
9-27.- Practices with PLC.

EBEC. Computer Controlled **Bioethanol Process Unit** ✱

① Unit: EBEC. Bioethanol Process Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① EBEC. Unit:

This unit has been designed to study and control the process of bioethanol.

The system consists of three main parts: a mash unit, a fermentation unit and a distillation unit.

Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Tanks: Mash tank with stirrer. Fermentation tank with stirrer. Sump tank. Product tank. Distillation column and sump heater. 2 Pumps for delivering the mash. Metering pump.

Sensors: temperature sensors, water flow sensor and pH sensor.

PID control of the temperature, cooling water flow, etc.

② EBEC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any time and in a real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EBEC/CCSOF. PID Computer Control + Data Acquisition + Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 2000 x 650 x 1800 mm. Weight: 200 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EBEC.pdf

PRACTICAL POSSIBILITIES

1.- Familialization with the steps and elements for the bioethanol process.
2.- Study of the effect of the temperature on bioethanol purity.
3.- Study of the effect of the fermentation time on bioethanol results.
4.- Study of the effect type of the yeast added on fermentation period.
5.- Study of the use of different raw materials for the bioethanol production process.

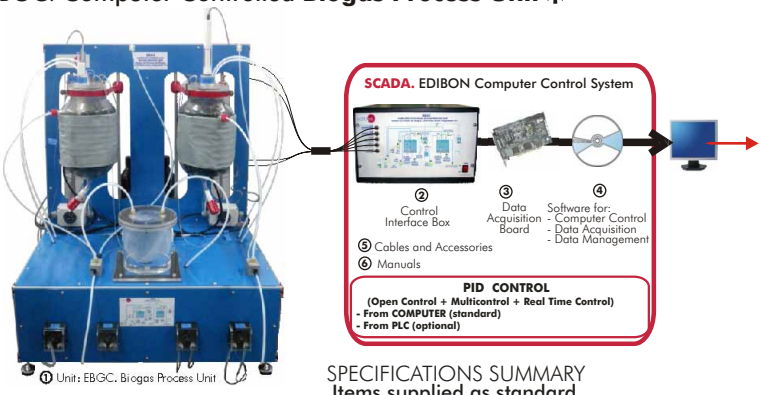
Other possible practices:

6.- Sensors calibration.
7-25.- Practices with PLC.

✱ Non computer controlled version available too.

➤Biofuels

EBGC. Computer Controlled **Biogas Process Unit** ✱



SPECIFICATIONS SUMMARY

Items supplied as standard

① EBGC. Unit:
The EBGC unit is designed to study and understand the different processes given during the biogas generation through anaerobic breakdown, as well as the study of the different parameters that affect the anaerobic digestion itself and the value of the obtained biogas.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
2 Packed anaerobic digesters of 5 liters. Reactors packing: 25 mm. diameter bactoballs.
2 Heating blankets of 120W with a thermostat, and a temperature sensor to control, together with the thermostat and with the computer (PID control), the heating temperature. Temperature range: 0-90°C.
4 Peristaltic pumps, computer controlled.
Feeding flows measurement by the pumps calibration.
2 Volumetric tanks for the storage and volume measurement of the generated biogas.
Buffer vessel. 2 Pyrex vessels, for the acid and the base. Waste tank.
Methane sensor to measure its concentration in the generated biogas, 0-100%.
2 pH sensors. 2 Temperature sensors.

②EBGC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any time and in a real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④EBGC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

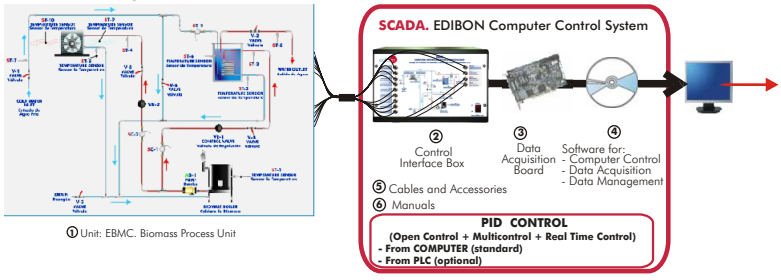
Dimensions (approx.)= Unit: 1000 x 800 x 1000 mm. Weight: 70 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EBGC.pdf

PRACTICAL POSSIBILITIES

1.- Study of the stabilization process.
2.- Study of the effect of temperature in the anaerobic digestion, purification and quality of the obtained biogas.
3.- Study of the pH effect of the feeding waste water in the anaerobic digestion, purification and quality of the obtained biogas.
4.- Study of the influence of the feeding rate in the anaerobic digestion, purification and quality of the obtained biogas.
5.- Study of the influence of the type of the feeding waste water in the anaerobic digestion, purification and quality of the obtained biogas.
6.- Study of the concentration of nutrients influence of the feeding waste water in the anaerobic digestion, purification and quality of the obtained biogas.
7.- Study of the hydraulic load effect in the anaerobic digestion, purification and quality of the obtained biogas.
8.- Study of the inhibitors influence in the anaerobic digestion, purification and quality of the obtained biogas.
9.- Comparison between the mesophilic and thermophilic anaerobic digestion and their influence in the biogas obtention.
10.- Determination of the optimum operation temperature.
11.- Determination of the optimum feeding rate.
12.- Determination of the optimum solids/water relation.
13.- Determination of the optimum degradable/non degradable solids relation.
14.- Determination of the multistage nature in the anaerobic digestion.
15.- Determination of the kinetics.
16.- Carbon balance.
17.- Solids balance.
18.- Biogas balance.
Other possible practices:
19.- Sensors calibration.
20-38.- Practices with PLC.

EBMC. Computer Controlled **Biomass Process Unit** ✱



SPECIFICATIONS SUMMARY

Items supplied as standard

① EBMC. Unit:
The main objective of this unit is to study the biomass process for heating applications, using different types of biomass fuels such as pellets, wood chips, etc.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Biomass boiler, computer controlled; as heating element, of 8 kW of thermal power, regulated from 100% to 30%:
Automatic electronic ignition. Combustion chamber in stainless steel. Boiler water capacity: 40 l.
Water temperature: 70° to 90° C. Flue gas temperature: 120° C. The boiler can work with pellets or other biomass fuels.
Hydraulic system formed by two circuits:
First circuit: the hot water obtained in the boiler is used to heat a cold water stream with a heat exchanger, which can be used for a domestic hot water network.
Second circuit: the hot water of the boiler is used to heat an air stream driven through a radiator by a fan.
Circulating pump, computer controlled, to feed the water in both circuits. Water tank. Fan, computer controlled.
Sensors: Temperature sensors in different points of the unit. Three flow sensors: in the first and second water circuits and in the cold water stream.

②EBMC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any time and in a real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in control interface and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④EBMC/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EBMC.pdf

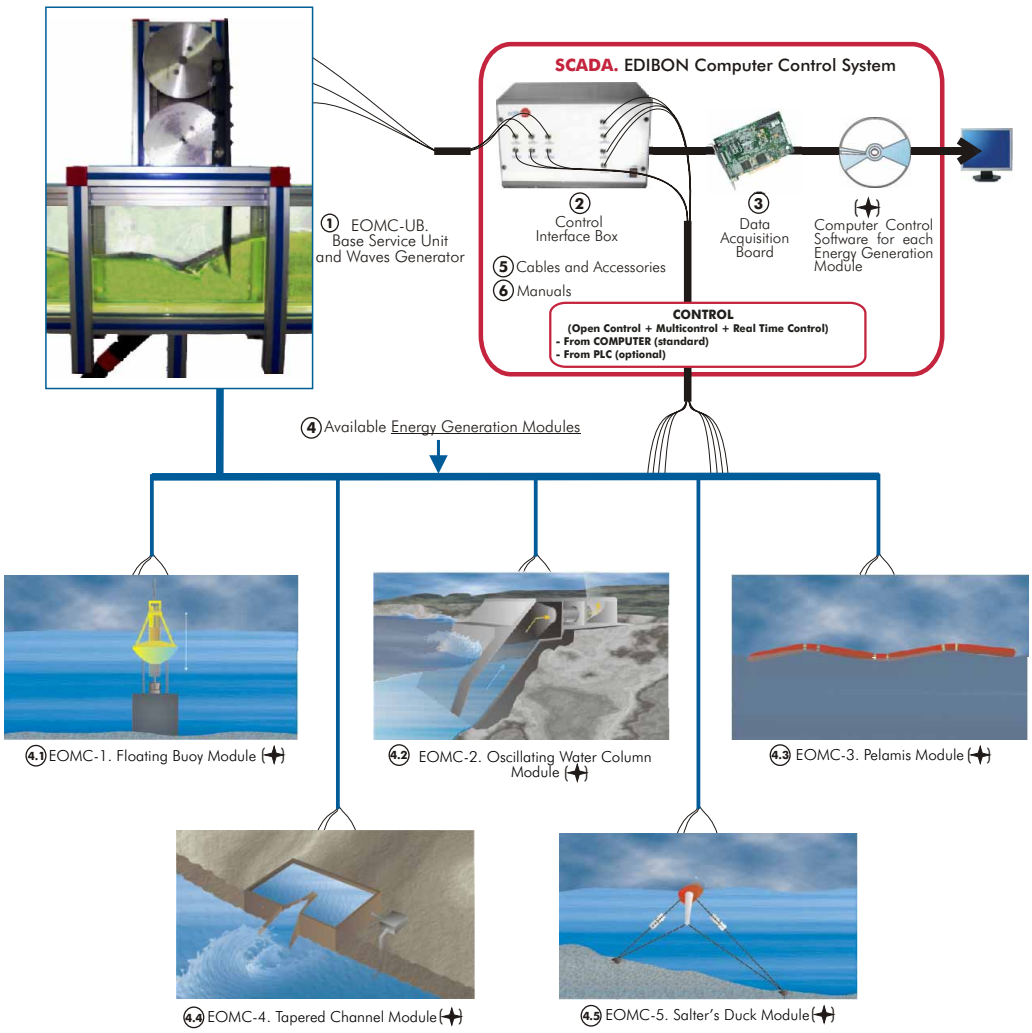
PRACTICAL POSSIBILITIES

1.- Starting up of the unit.
2.- Adjustment of parameters.
3.- Preventive maintenance.
4.- Safety procedures.
5.- Water treatment of the boiler.
6.- Measurement of flow, pressure and temperature.
7.- Measurement of the emissions.
8.- Measurement of the thermal transfer from the fuel to the water tank.
9.- Measurement of the unit efficiency with different type of biomass fuels.
10.- Study the influence of different air flows in the efficiency of the unit.
11.- Study of the influence of varying the cold water flow in the heat transfer.
12.- Study of the influence of varying the hot water flow at the tank inlet.
13.- Study of the influence of varying the hot water flow before the radiator.
Other possible practices:
14.- Sensors calibration.
15-33.- Practices with PLC.

✱ Non computer controlled version available too.

➤Sea

EOMC. Computer Controlled **Waves Energy Unit** ✱



SPECIFICATIONS SUMMARY

Common items for the Energy Generation Modules type"EOMC"

①EOMC-UB. Base Service Unit and Waves Generator:

This unit is common for Energy Generation Modules type "EOMC" and can work with one or several modules.

Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.

The unit is mainly formed by:

Rectangular transparent tank, to be filled with water, where the different energy generation modules will be placed.

Waves generator: the waves generator produce different types of waves. Speed control from the computer (PC). Blade, adjustable in height.

6 Pressure sensors placed in the bottom of the tank for measuring the wave shape.

DC generator and DC loads module.

Power measurement from the computer (PC).

This unit is supplied with 8 manuals.

②EOMC/CIB. Control Interface Box :

With process diagram in the front panel.

The unit control elements are permanently computer controlled.

Simultaneously visualization in the computer of all parameters involved in the process.

Calibration of all sensors involved in the process.

Real time curves representation about system responses.

All the actuators' values can be changed at any time from the keyboard.

Shield and filtered signals to avoid external interferences.

Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process.

Open control allowing modifications, at any moment and in real time, of parameters involved in the process.

3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

Dimensions (approx.) =490 x 330 x 310 mm. Weight: 10 Kg.

③DAB. Data Acquisition Board:

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

16 Analog inputs. Sampling rate up to: 250 KS/s (kilo samples per second).

2 Analog outputs. 24 Digital Inputs/Outputs.

Continue...

✱ Non computer controlled version available too.

➤Sea

EOMC. Computer Controlled **Waves Energy Unit** ✱

SPECIFICATIONS SUMMARY

④ **Energy Generation Modules** to be used with the Base Service Unit and Waves Generator:

④.1 EOMC-1. Floating Buoy Module:

A Floating Buoy system consists of a floating structure anchored to the seabed, which is used as the support of a cylinder which freely floats with an upwards and downwards vertical movement, following the waves. This cylinder slides by a central shaft joint to the immobile structure. The relative movement of the cylinder sliding through the shaft and the fixed structure serves to activate an energy converter which can be hydraulic or electromagnetic.

The module EOMC-1 is designed for simulating this energy generation system, allowing the study and tests of the operation and performance of a floating buoy for energy generation. This module will generate mechanical and/or electrical energy.

The module is prepared to be installed in the Base Service Unit and it is supplied with the suitable sensors and instrumentation for the most representative measurements.

This unit is supplied with 8 manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Floating Buoy Module (EOMC-1).

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 samples per second. It allows the registration of the alarms state and the graphic representation in real time.

④.2 EOMC-2. Oscillating Water Column Module:

An Oscillating Water Column system is a structure with an opening for the wave. When the water enters in the enclosure, it displaces the existing air into the enclosure and forces the air to exit by a duct where a turbine is installed. The air makes the turbine coupled to a generator to rotate. When the wave retires, the air enters in the enclosure through the same duct, at this moment in the reverse direction.

The module EOMC-2 is designed for simulating this energy generation system, allowing the study and tests of the operation and performance of an oscillating water column for energy generation. This module will generate mechanical and/or electrical energy.

The module is prepared to be installed in the Base Service Unit and it is supplied with the suitable sensors and instrumentation for the most representative measurements.

This unit is supplied with 8 manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Oscillating Water Column Module (EOMC-2).

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 samples per second. It allows the registration of the alarms state and the graphic representation in real time.

④.3 EOMC-3. Pelamis Module:

The "Pelamis" is an attenuating type device. It consists on a longitudinal chain of cylinders linked each one with the others and anchored to the seabed, so that they are correspondingly aligned to the waves direction. A cylinders nodding is produced because of the wave height and this movement is used by the pistons connected between each cylinder to impulse the fluid in an hydraulic circuit to produce electric energy.

The module EOMC-3 is designed for simulating this energy generation system, allowing the study and tests of the operation and performance of a pelamis device for energy generation. This module will generate mechanical and/or electrical energy.

The module is prepared to be installed in the Base Service Unit and it is supplied with the suitable sensors and instrumentation for the most representative measurements.

This unit is supplied with 8 manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Pelamis Module (EOMC-3).

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 samples per second. It allows the registration of the alarms state and the graphic representation in real time.

④.4 EOMC-4. Tapered Channel Module:

The Tapered Chanel is a channel built on the coast in the direction of the incident wave. The channel progressively narrows to the inside of the coast. When the wave enters the channel, it goes to a every time less section, which makes it to take a every time higher height to enter in a tank placed at the end of the channel. Thus, there is water at a bigger height which can be used to turbine.

Summarizing, it concentrates the waves and guides them up a tapered ramp into a tank, from which a turbine extracts energy.

The module EOMC-4 is designed for simulating this energy generation system, allowing the study and tests of the operation and performance of a tapered channel for energy generation. This module will generate mechanical and/or electrical energy.

The module is prepared to be installed in the Base Service Unit and it is supplied with the suitable sensors and instrumentation for the most representative measurements.

This unit is supplied with 8 manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Tapered Channel Module (EOMC-4).

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 samples per second. It allows the registration of the alarms state and the graphic representation in real time.

④.5 EOMC-5. Salter´s Duck Module:

Salter's Duck is a small buoy anchored to the seabed in a particular way which seems a duck moves in a swinging way when receiving the waves. This rotation is used to move, by means of mechanisms, a system connected to a generator.

The EOMC-5 module is designed for simulating this energy generation system, allowing the study and tests of the operation and performance of a salter's duck for energy generation. This module will generate mechanical and/or electrical energy.

The module is prepared to be installed in the Base Service Unit and it is supplied with the suitable sensors and instrumentation for the most representative measurements.

This unit is supplied with 8 manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Salter's Duck Module (EOMC-5).

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 samples per second. It allows the registration of the alarms state and the graphic representation in real time.

PRACTICAL POSSIBILITIES

1.- Study of the different waves energy generation systems.

2.- Study of the operation and performance of the different waves energy generation systems.

3.- Energy available from a wave.

4.- Buoyancy and Archimedes principle.

5.- Relationship between wave form and buoyancy.

6.- Potencial Energy in a fluid.

7.- Float shape in determining energy extraction.

8.- Effect of wave shape on its breaking characteristics.

9.- Effect of slope on wave shape and breaking.

10.- Effect of width contraction on wave shape.

11.- Measures and Controls.

Other possible practices:

12.- Sensors calibration.

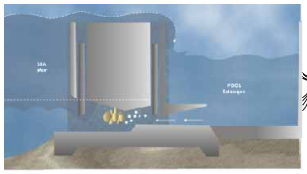
13-31.- Practices with PLC.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EOMC.pdf

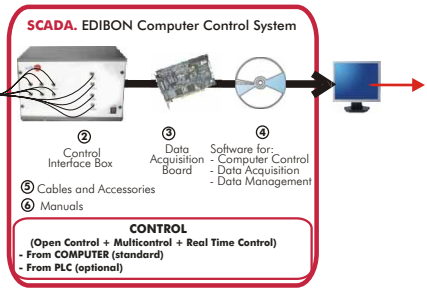
✱ Non computer controlled version available too.

➤Sea

EMMC. Computer Controlled **Tidal Energy Unit** ✱



① EMMC. Tidal Energy Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① EMMC. Unit:

Unit designed for simulating a tidal barrage energy generation system.
This unit is mounted in an anodized aluminium structure with painted steel panels. Diagram in the front panel with similar distribution to the elements in the real unit.
The unit is formed by the following main elements:
Two transparent working sections to be filled with water.
Water pump, computer controlled.
Turbine-generator.
Two pressure sensors for measuring the water volume and an orifice plate with two pressure sensors for measuring the flow.
DC loads module.
Power measurement from the computer (PC).

②EMMC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④EMMC/CCSOF. Computer Control+Data Acquisition+Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EMMC.pdf

PRACTICAL POSSIBILITIES

1.- Electrical energy generation with different type of tides.

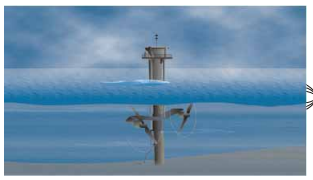
2.- Measures and controls.

Other possible practices:

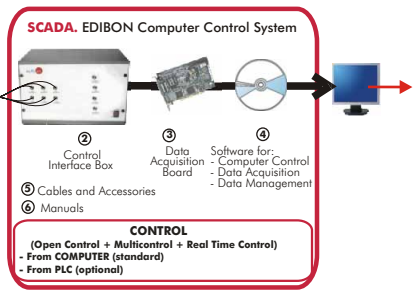
3.- Sensors calibration.

4-22.- Practices with PLC.

ECMC. Computer Controlled **Submarine Currents Energy Unit** ✱



① ECMC. Submarine Currents Energy Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① ECMC. Unit:

Unit designed for simulating an energy generation system from the ocean currents, using the technology of turbine-driven generators anchored in place into the current stream.
This unit is mounted in an anodized aluminium structure with painted steel panels. Diagram in the front panel with similar distribution to the elements in the real unit.
The unit is formed by the following main elements:
Transparent working section to be filled with water.
Water pump, computer controlled.
Turbine-generator.
Orifice plate with two pressure sensors for measuring the flow.
DC loads module.
Power measurement from the computer (PC).

②ECMC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ECMC/CCSOF. Computer Control+Data Acquisition+Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/ECMC.pdf

PRACTICAL POSSIBILITIES

1.- Study of the energy available from a water stream.

2.- Potential energy of water.

3.- Measures and controls.

Other possible practices:

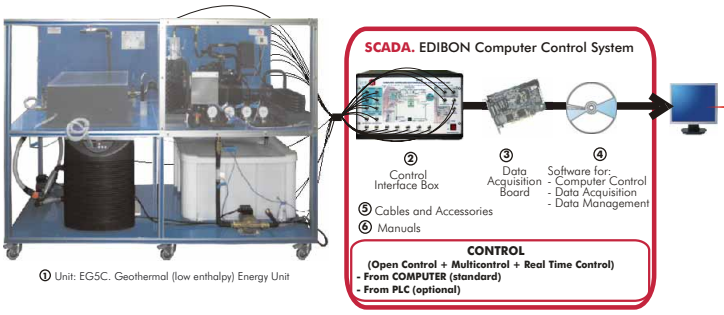
4.- Sensors calibration.

5-23.- Practices with PLC.

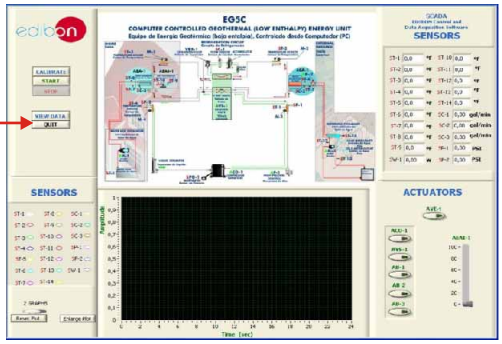
✱ Non computer controlled version available too.

➤Geothermal

EG5C. Computer Controlled **Geothermal (low enthalpy) Energy Unit**∗



① Unit: EG5C. Geothermal (low enthalpy) Energy Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① EG5C. Unit:

Geothermal (low enthalpy) Energy Unit (EG5C) developed by EDIBON has the aim of introducing the student in a renewable energy increasingly a leader in the energy market like is the geothermal energy; particularly in the use of this energy to climate control of buildings. Moreover it allows the students to begin in the knowledge of installations with heat pump and in the study and calculation of the operating parameters of the unit in relation to the environmental demands (heat, temperature, refrigeration, etc.). This unit allows the study of the geothermal energy using a geothermal heat pump system for heating and/or cooling.

Unit mounted in anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in real unit.

Heat pump:

Hermetic compressor. 2 Water condensers/evaporators (depending on heating or cooling configuration (winter or summer conditions), by using the cycle inversion valve). Air condenser/evaporator (depending on heating or cooling configuration (winter or summer conditions), by the cycle inversion valve). Coolant accumulation tank. Cooling filter. Tank of division of the cooling liquid. Expansion valve. 4 way - valve (cycle inversion valve) - solenoid valve. High pressure safety switch.

Sensors: 4 Temperature sensors for the refrigerant circuit. 2 Temperature sensors for the air temperature. 2 Pressure sensors for the refrigerant circuit. 4 Manometers for the refrigerant circuit. 1 Refrigerant flow sensor.

Sanitary water circuit: Water tank. Water pump. Sensors: Water flow sensor. 3 Temperature sensors for the water temperature.

Geothermal exchanger simulator:

Water heat exchanger: A pipe system into a water bath (at constant temperature). 3Temperature sensors for the water temperature.

Water pump, to send the water of the pipe system to the water evaporator/condenser.

Chilling unit to maintain constant temperature into the water bath.

Water pump, to send the water from the chilling unit to the water bath.

Sensors: Temperature sensors. Water flow sensor.

Power measurement from the computer (PC). Enthalpy diagram of the refrigerant R134a.

② EG5C/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation about system responses. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EG5C/CCSOF. Computer Control + Data Acquisition + Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 2000 x 800 x 1550 mm. Weight: 200 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/EG5C.pdf

PRACTICAL POSSIBILITIES

1.- Study of geothermal energy using a geothermal heat pump system for heating and/or cooling.

2.- Study of the system with different ground temperatures.

3.- Determination of the inlet power, produced heat and coefficient of performance, working in heating mode. Water-water heat pump.

4.- Determination of the inlet power, produced heat and coefficient of performance, working in cooling mode. Water-water heat pump.

5.- Determination of the inlet power and valuation of the air temperatures, working in heating mode. Water-air heat pump.

6.- Determination of the inlet power and valuation of the air temperature, working in cooling mode. Water-air heat pump.

7.- Preparation of performance curves of the heat pump, working in heating mode, with different inlet and outlet temperatures. Water-water heat pump.

8.- Preparation of performance curves of the heat pump, working in cooling mode, with different inlet and outlet temperatures. Water-water heat pump.

9.- Lay out of the steam compression cycle in a diagram P-H and comparison with the ideal cycle. Water-water heat pump. Heating mode.

10.- Lay out of the steam compression cycle in a diagram P-H and comparison with the ideal cycle. Water-air heat pump. Heating mode.

11.- Preparation of the performance curves of the heat pump based on the properties of the refrigerant and at different condensation and evaporation temperatures. Water-water heat pump. Heating mode.

12.- Preparation of the performance curves of the heat pump based on the properties of the refrigerant and at different condensation and evaporation temperatures. Water-water heat pump. Cooling mode.

Other possible practices:

13.- Sensors calibration.

14-42.- Practices with PLC.

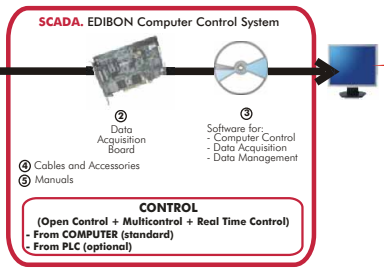
EG6C. Computer Controlled **Geothermal (high enthalpy) Energy Unit**∗

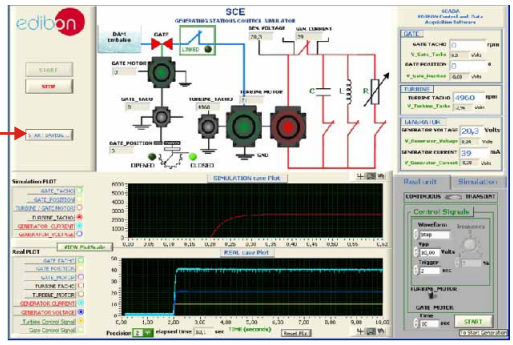
∗ Non computer controlled version available too.

➤**Hydro**

SCE. Computer Controlled **Generating Stations Control and Regulation Simulator**

① Unit: SCE. Generating Stations Control and Regulation Simulator





SPECIFICATIONS SUMMARY

Items supplied as standard

① SCE. Unit:
Unit designed to simulate the regulation behaviour of a hydroelectric generating station ,as a didactic application with different aspects of regulation, control and simulation.
Anodized aluminum structure. Diagram in the front panel with similar distribution to the of the elements in the real unit.
It is possible to work with this unit in 2 ways:
- REAL mode (continuous or transient analysis). - SIMULATED mode.

The unit consists mainly of an interface for the conditioning of input and output signals.
For its part, this one will be connected to the computer and to the two subsystems that we try to control: Gate subsystem and turbine-generator subsystem.
The unit has (in the interface) some switches to establish different loads to the generator output and different conditions of the real system.
Gate subsystem: It consists of a motor that controls the gate opening, and some mechanisms that emulate it.
Turbine-generator system: This subsystem will be analyzed separately or linked up with the previous one, achieving that the motor that simulates the turbine turns according to the gate opening percentage. This turbine is connected with a generator system and with a system that simulates different loads (inductive, capacitive or resistive). Three loads in parallel are connected at the generator output, that simulate the consumption of the energy distribution system: Variable resistance, capacitance and inductance.
Control interface.

② DAB. Data Acquisition Board:
PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

③ SCE/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second guaranteed. It allows the registration of the alarms state and the graphic representation in real time.
This Software has got 2 operating modes: REAL mode: through motors, actuators and sensors that the unit includes (Continuous, transient). SIMULATED mode: through the mathematical modelization of the motors, previously mentioned.

④ Cables and Accessories, for normal operation.

⑤ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 405 x 350 x 250 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/SCE.pdf

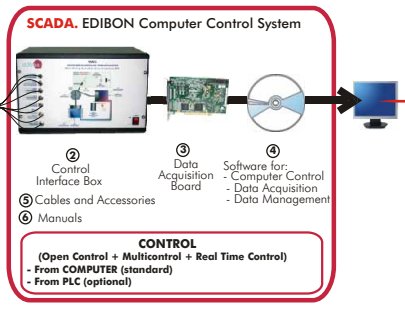
PRACTICAL POSSIBILITIES

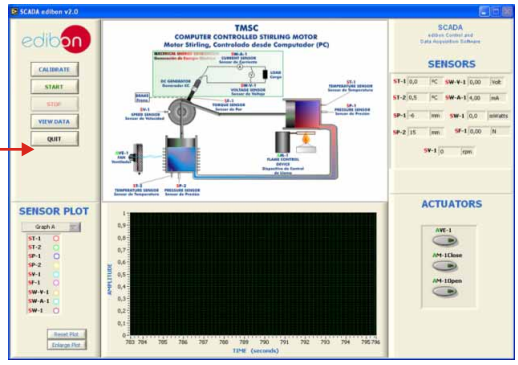
1.- Modelization of the motor as a standard motor.
2.- Modelization of the motor with the constants corrections of the mathematical model.
3.- Calculation of the dynamos speed constant.
4.- Obtaining of the transient responses of the gate motor.
5.- Obtaining of the transient response of the turbine motor.
6.- Obtaining of the transient response of the gate simulated motor.
7.- Obtaining of the transient response of the turbine simulated motor.
8.- Comparative analysis of the transient response of the turbine real motor vs the transient response of the simulated motor for resistive load.
9.- Comparative analysis of the transient response of the turbine real motor vs the transient response of the simulated motor for capacitive load.
10.- Comparative analysis of the transient response of the turbine real motor vs the transient response of the simulated motor for inductive load.
11.- Comparative analysis of the response of the gate real motor vs the response of the gate simulated motor for continuous (manually from the computer) control signals.
12.- Comparative analysis of the response of the gate real motor vs the response of the gate simulated motor for sinusoidal control signals.
13.- Comparative analysis of the response of the gate real motor vs the response of the gate simulated motor for square control signals.
14.- Comparative analysis of the response of the gate real motor vs the response of the gate simulated motor for triangular control signals.
15.- Comparative analysis of step response between real motor and simulated motor (gate or turbine).

➤**Others**

TMSC. Computer Controlled **Stirling Motor** ✱

① Unit: TMSC. Stirling Motor





SPECIFICATIONS SUMMARY

Items supplied as standard

① TMSC. Unit:
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Alfa type Stirling motor: hot and cold cylinders made of stainless steel and pistons made of bronze. Device to control the flame of the heating element, to cover it and to release it. Alcohol lamp as heating element. Braking system.
Electrical generator with a pulley for converting the generated mechanical energy into electrical energy. Equipped with an electrical load and current and voltage measurement system. 2 Tempeature sensors, one in the hot cylinder and the other in the cold cylinder. 2 Pressure sensors, one in the hot cylinder and the other in the cold cylinder. Speed sensor (rpm). Force sensor (torque). Current sensor. Voltage sensor. Power measurement from the computer (PC). Torque measurement by a brake and a force sensor. Overtemperature protection with the activation of the device to control the flame.

② TMSC/CIB. Control Interface Box:
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ TMSC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= Unit: 450 x 400 x 480 mm. Weight: 35 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/alternativeenergies/TMSC.pdf

✱ Non computer controlled version available too.

PRACTICAL POSSIBILITIES

1.- Study of the conversion of thermal-mechanical-electrical energy.
2.- Study of the relation between the temperatures difference of the thermal machine and the speed generated.
3.- Calculation of the "threshold" temperatures difference which generate motion.
4.- Study of the mechanical power in relation to speed.
5.- Study of the electrical power in relation to speed.
6.- Mechanical efficiency calculation.
7.- Electrical efficiency calculation.
8.- Speed measurement (rpm).
9.- Torque measurement.
10.- Measurement of the generated electrical power.
11.- Temperature measurements.
12.- Pressure measurements.

Other possible practices:

13.- Sensors calibration.
14-32.- Practices with PLC.

➤Others

ETMC. Computer Controlled **Ocean Thermal Energy Unit**✱

TORC. Computer Controlled **Organic Rankine Cycle Unit**

EFTEC. **Turbine Electric Hub Troubleshooting Learning System**

EFTNC. **Turbine Nacelle Troubleshooting Learning System**

✱ Non computer controlled version available too.

ERP. **Protection Relays Test:**

ERP-UB. **Protection Relays Test Unit**

SPECIFICATIONS SUMMARY

This is a teaching unit which gives students theoretical and practical experience with several industrial relays. Unit designed for comprehensive investigations into the theory and practice of electrical power system protection.

This unit is common for the relays modules type "ERP" and can use one or more relays.

Floor-standing unit, mounted in anodized aluminium structure and panels in painted steel, enabling wide range of protection relay investigations.

It uses genuine industrial application relays, not simulations, with full range of safety features incorporated throughout.

Diagrams on the unit enable students to set up and perform practices and experiments with minimal supervision.

Comprehensive controls, transformers, supplies and instrumentation.

Modern, ergonomic and practical design which includes desk space for users or students to work on, and mounting area for relays.

It is supplied with relay support software.

This Unit basically consists on these main parts:

- Main connections, control and measurement board.
- Three-phase Voltage Regulation Dial Selector.
- Three-phase Load Regulation Dial Selector.
- Unit Power Supply and Protection.
- Transmission Lines Simulation Module.
- Fault Injection Module.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

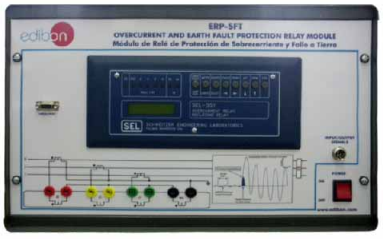
Dimensions (approx.): 1250 x 800 x 2000 mm. Weight: 400 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/relaysunits/ERP.pdf

PRACTICAL POSSIBILITIES

1.- A wide range of practices and investigations into the performance and characteristics of a variety of different industrial relays.

ERP-SFT. **Overcurrent and Earth Fault Protection Relay Module**



SPECIFICATIONS SUMMARY

ERP-SFT. Overcurrent and Earth Fault Protection Relay Module, for use with the Protection Relays Test Unit (ERP-UB), to enable investigations into protection and monitoring of transformers, transmission lines and distribution schemes.

Modern and robust enclosure (steel box) with carrying handles.

The connections are via safety sockets.

The main functions:

- Phase Instantaneous Overcurrent (50P1-50P6).
- Phase Time-Overcurrent (51P1T, 51P2T).
- Single-phase Instantaneous Overcurrent (50A, 50B, 50C).
- Neutral Ground Instantaneous Overcurrent (50N1, 50N2).
- Neutral Ground Time-Overcurrent (51N1T).
- Residual Ground Instantaneous Overcurrent (50G1, 50G2).
- Residual Ground Time-Overcurrent (51G1T).
- Negative-Sequence Instantaneous Overcurrent (50Q1, 50Q2).
- Negative-Sequence Time-Overcurrent (51Q1T, 51Q2T).
- Setting Range, 5 A nominal, Instantaneous Overcurrent (OFF, 0.5-80.0 A).
- Setting Range, 5 A nominal, Time- Overcurrent (OFF, 0.5-16.0 A).
- One Auto-Reclosing Function 79.
- Selectable blocking.
- Circuit monitoring.
- Trend, fault and disturbance records.

The connection to the experimental circuit is via current transformers with ratio to suit the inputs of the relay.

It allows an effective demonstration of the effect of current and voltage transformer ratio, connection and rating on protective relays.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/relaysunits/ERP.pdf

PRACTICAL POSSIBILITIES

1.- Verification of Overcurrent Protection functionality.

2.- Verification of Phase Overcurrent Elements.

3.- Verification of Residual Ground Overcurrent Elements.

4.- Verification of Phase Instantaneous Overcurrent Protection.

5.- Verification of Phase Time Overcurrent Protection.

6.- Verification of Neutral Ground Instantaneous Overcurrent Protection.

7.- Verification of Neutral Ground Time-Overcurrent Protection.

8.- Verification of Residual Ground Instantaneous Overcurrent Protection.

9.- Verification of Residual Ground Time-Overcurrent Protection.

10.- Verification of Current Transformer Measurement accuracy.

11.- Power Transformer Overcurrent Protection.

12.- Power Transmission Line Overcurrent Protection.

13.- Load Feeder Overcurrent Protection.

14.- Distribution System Overcurrent Protection.

15.- Power Transmission System Overcurrent Protection.

ERP. **Protection Relays Test:**

ERP-SDND. **Directional/Non Directional Overcurrent Protection Relay Module**

SPECIFICATIONS SUMMARY

ERP-SDND. Directional/Non Directional Overcurrent Protection Relay Module, for use with the Protection Relays Test Unit (ERP-UB), to enable investigations into protection and monitoring of generator and transformer schemes, overhead lines, underground cables and backup on high-voltage systems.

Modern and robust enclosure (steel box) with carrying handles.

The connections are via safety sockets.

The main functions:

The ERP-SDND Unit includes numerous phase, negative-sequence, residual-ground, and neutral overcurrent elements, as shown in the next table:

Overcurrent Element Operating Quantity	Number of Elements	Directional Control	Torque Control	Definite-Time Delay
Maximum phase current (IA, IB, or IC)	1 inverse-time (51P) 6 instantaneous (50P1-50P6)	Yes Yes, on first 4	Yes Yes, on first 4	NA Yes, on first 4
Maximum phase-phase current (IAB, IBC, or ICA)	4 instantaneous (50PP1-50PP4)	No	No	No
Independent phase current	3 inverse-time (51A, 51B, 51C)	Yes	Yes	NA
Residual-ground current (3I0)	2 inverse-time (51G1,51G2) 6 instantaneous (50G1-50G6)	Yes Yes, on first 4	Yes Yes, on first 4	NA Yes, on first 4
Negative-sequence current (3I2)	1 inverse-time (51Q) 6 instantaneous (50Q1-50Q6)	Yes Yes, on first 4	Yes Yes, on first 4	NA Yes, on first 4
Neutral current (IN)	1 inverse-time (51N) 6 instantaneous (50N1-50N6)	Yes Yes, on first 4	Yes Yes, on first 4	NA Yes, on first 4

Inverse-time overcurrent element settings include a wide and continuous pickup current range, continuous time-dial setting range, and time-current curve choices from both US (IEEE) and IEC standard curves.

Undervoltage Protection Element (27).

Phase Overvoltage Protection Element (59P).

Ground Overvoltage Protection Element (59G).

Negative Sequence Overvoltage Protection (59Q).

Creating fault and disturbance records.

Selectable blocking.

Selogic Control Equations.

Event Report.

Sequential Events Recorder (SER).

Breaker Wear Monitor.

Station Battery Monitor.

DNP3 Serial LAN/WAN Outstation (Slave).

Modbus RTU and TPC.

High-Accuracy Metering.

Remote and Local Control Switches.

Wye or Delta Voltage Connection.

Synchrophasor Measurements.

Fault Locator.

Fast SER Protocol.

Directional/Definite-Time Overcurrents Elements.

Two Residual-Ground Time-Overcurrents Elements.

Six Frequency Elements.

Sensitive Earth Fault Protection and Directional Protection for Various System Grounding Practices.

Load-Encroachment Logic.

Synchronism Check.

ACSELERATOR QuickSet Compatible.

The connection to the experimental circuit is via current transformers with ratio to suit the inputs of the relay.

It allows an effective demonstration of the effect of current and voltage transformer ratio, connection and rating on protective relays.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/relaysunits/ERP.pdf

PRACTICAL POSSIBILITIES

1.- Verification of Directional Protection functionality.

2.- Directional Protection with different measurement circuit conditions.

3.- Directional Protection application to Transmission Line under different load conditions.

4.- Forward Directional Protection.

5.- Reverse Directional Protection.

6.- Non-Directional Overcurrent Protection.

7.- Residual Ground Time-Overcurrent Protection.

8.- Residual Ground Instantaneous Overcurrent Protection.

9.- Verification of Cable Undervoltage Protection.

10.- Verification of Cable Overvoltage Protection.

11.- Verification of Current Transformers Measurements accuracy.

12.- Verification of Voltage Transformers Measurements accuracy.

13.- Distribution System Directional Protection.

ERP. **Protection Relays Test:**

ERP-PDF. **Differential Protection Relay Module**

SPECIFICATIONS SUMMARY

ERP-PDF. Differential Protection Relay Module, for use with Protection Relays Test Unit (ERP-UB), to enable investigations into protection of transformers, autotransformers, generators, Bus Bar and other apparatus with two windings.

It demonstrates the characteristics of three-phase differential protection.

Modern and robust enclosure (steel box) with carrying handles.

The connections are via safety sockets.

The main functions:

Eight Overcurrent Elements for Winding 1	Instantaneous	Definite Time	Inverse Time
Phase	50P1H	50P1	51P1
Negative Sequence		50Q1	51Q1
Residual	50N1H	50N1	51N1
Eight Overcurrent Elements for Winding 2	Instantaneous	Definite Time	Inverse Time
Phase	50P2H	50P2	51P2
Negative Sequence		50Q2	51Q2
Residual	50N2H	50N2	51N2
Setting Ranges, 5 A Model, (A secondary)	OFF, (0.5-80)	OFF, (0.5-80)	OFF, (0.5-16)

Selogic Control Equations. Event Reports.

ASCII. Bynari, and Distributed Port Switch Communications.

Phase, Ground, Negative-Sequence, Differential and Harmonic Metering.

Restrained and Unrestrained Differential Elements.

Second- and Fourth Harmonic Restraint.

Fifth-Harmonic and DC Blocking.

CT and Transformer Connection Compensation.

Connection to the primary and secondary windings of the experimental is circuit via current transformers with ratio to suit the inputs of the relay. This provides an effective demonstration of the effect of current and voltage transformer ratio, connection and rating on protective relays.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/energy/relaysunits/ERP.pdf

PRACTICAL POSSIBILITIES

1.- Verification of Differential Protection functionality.
2.- Transformer Differential Protection with variable TAP's voltage regulation.
3.- Transformer Differential Protection with different transformer connection diagrams.
4.- Verification of Phase Instantaneous Overcurrent Protection for Winding 1.
5.- Verification of Phase Definite Time-Overcurrent Protection for Winding 1.
6.- Verification of Phase Inverse Time-Overcurrent Protection for Winding 1.
7.- Verification of Phase Instantaneous Overcurrent Protection for Winding 2.
8.- Verification of Phase Definite Time-Overcurrent Protection for Winding 2.
9.- Verification of Phase Inverse Time-Overcurrent Protection for Winding 2.
10.- Verification of Current Transformers Measurement accuracy.
11.- Power Transformer Overcurrent Protection.
12.- Distribution Substation Bus-Bar Differential Protection.
13.- Transmission Substation Bus-Bar Differential Protection.
14.- Analysis of Event Reports and Human Machine Interface.

ERP-MA. **Feeders Management Relay Module**

SPECIFICATIONS SUMMARY

ERP-MA. Feeders Management Relay Module, for use with the Protection Relays Test Unit (ERP-UB), to enable investigations into protection and monitoring of overhead lines, underground cables and feeders.

Modern and robust enclosure (steel box) with carrying handles.

The connections are via safety sockets.

The main functions:

Four levels of Phase Instantaneous Overcurrent Element (50P).
Four levels of Negative-Sequence Overcurrent Element (50Q).
Four levels of Residual Overcurrent Element (50G).
Four levels of Neutral Overcurrent Element (50G).
Two levels of Phase Time-Overcurrent Element (51P).
Two levels of Residual Time-Overcurrent Element (51G).
Two levels of Ground Time-Overcurrent Element (51G).
One level of Negative-Sequence Time-Overcurrent Element (51Q).
Phase to Ground Overvoltage (59G).
Phase to Phase Overvoltage (59P).
Negative-Sequence Overvoltage (59Q).
Residual Overvoltage (59G).
Phase to Ground Undervoltage (27G).
Phase to Phase Undervoltage (27P).
Six levels of Secure Overfrequency (81O).
Six levels of Secure Underfrequency (81U).
Two levels of Negative Power Flow with Definite Time Delay (32).
Two levels of Positive Power Flow with Definite Time Delay (32).
Station Battery Monitor. Breaker Wear Monitoring.
Synchrophasor Protocol. Peak Demand and Demand Metering. Auto-Reclosing.
Creating fault and disturbance records.

The connection to the experimental circuit is via current transformers with ratio to suit the inputs of the relay.

It allows an effective demonstration of the effect of current and voltage transformer ratio, connection and rating on protective relays.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

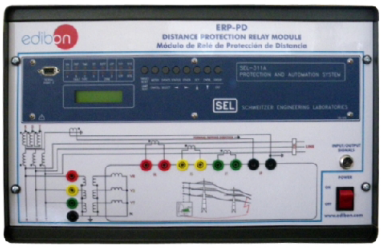
More information in: www.edibon.com/products/catalogues/en/units/energy/relaysunits/ERP.pdf

PRACTICAL POSSIBILITIES

1.- Verification of the Feeder Management Relay functionality.
2.- Phase Overcurrent Element of the Feeder Management Relay.
3.- Residual Ground Overcurrent Element of the Feeder Management Relay
4.- Overvoltage Element of the Feeder Management Relay
5.- Undervoltage Element of the Feeder Management Relay.
6.- Verification of Phase Instantaneous Overcurrent Protection.
7.- Verification of Phase Time-Overcurrent Protection.
8.- Verification of Residual Overcurrent Element.
9.- Verification of Residual Time-Overcurrent Element.
10.- Verification of Neutral Overcurrent Element.
11.- Verification of Overfrequency Protection Element.
12.- Verification of Underfrequency Protection Element.
13.- Verification of Positive (forward) Power Flow Protection Element.
14.- Verification of Negative (reverse) Power Flow Protection Element.
15.- Protection of Distribution Feeder Example.
16.- Protection of Overhead Transmission Line Example.

ERP. **Protection Relays Test:**

ERP-PD. **Distance Protection Relay Module**



SPECIFICATIONS SUMMARY

For use with the Protection Relays Test Unit (ERP-UB), to enable investigations into protection and monitoring of overhead transmission lines and underground cables.

Modern and robust enclosure (steel box) with carrying handles.

The connections are via safety sockets.

The main functions:

- Two zones of Phase Mho Distance Protection Element (21P).
- Two zones of Ground Mho Distance Protection Element (21G).
- Directional Phase Overcurrent Protection Element (67P).
- Directional Ground Overcurrent Protection Element (67G).
- Phase Overcurrent Protection Element (50P).
- Ground Overcurrent Protection Element (50G).
- Phase Time-Overcurrent Protection Element (51P).
- Ground Time-Overcurrent Protection Element (51G).
- Event Reports.
- Breaker Wear Monitor.
- Fault Locator.
- Local Display.
- Synchronophasors.
- Load Encroachment.
- Metering and Monitoring Functions.
- Creating fault and disturbance records.
- Blocking of any one protection element.

The connection to the experimental circuit is via current transformers with ratio to suit the inputs of the relay.

It allows an effective demonstration of the effect of current and voltage transformer ratio, connection and rating on protective relays.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

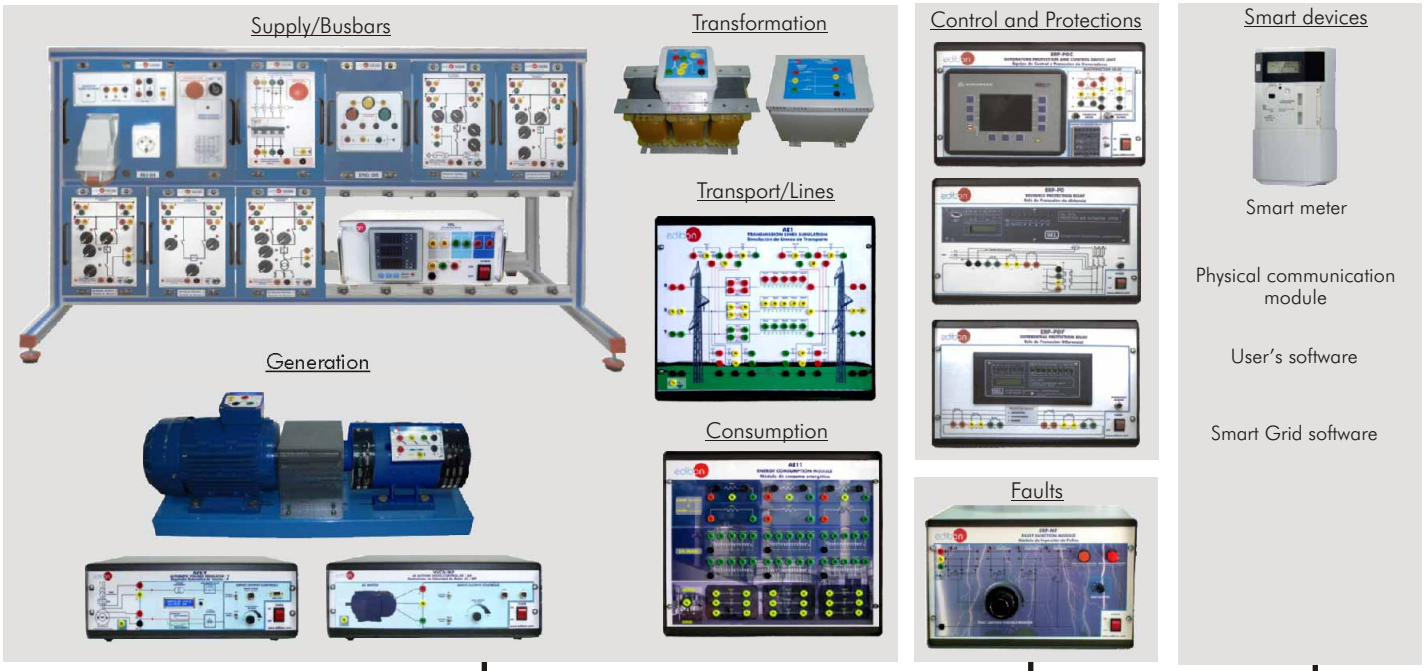
Dimensions(approx.): 490 x 330 x 310 mm. Weight: 10 Kg.

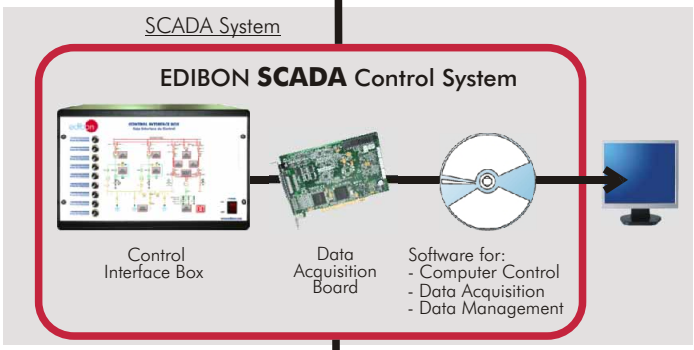
More information in: www.edibon.com/products/catalogues/en/units/energy/relaysunits/ERP.pdf

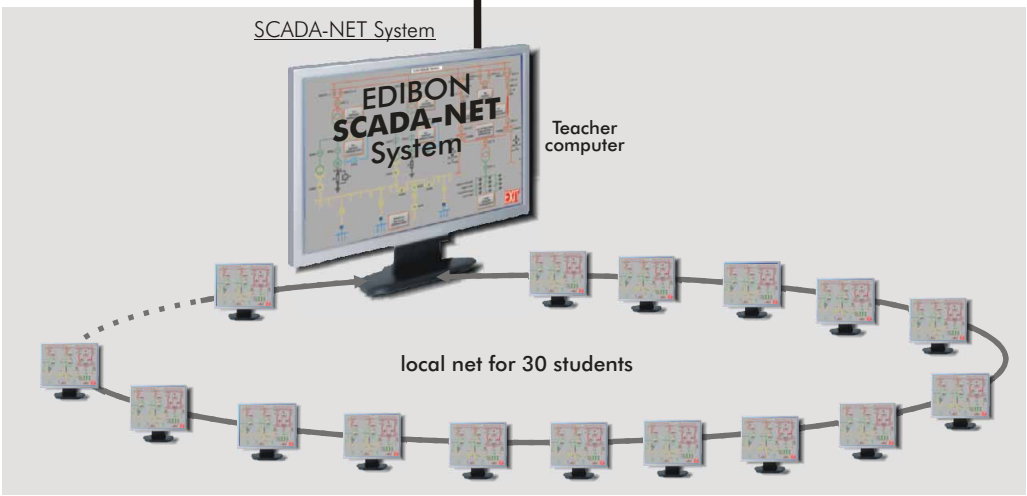
PRACTICAL POSSIBILITIES

1.- Verification of Line Distance Protection functionality.
2.- Line Distance Protection with different measurement circuit conditions.
3.- Line Distance Protection with different Line Loads conditions.
4.- Verification of Phase Instantaneous Overcurrent Element.
5.- Verification of Ground Instantaneous Overcurrent Element.
6.- Verification of Phase Time-Overcurrent Protection Element.
7.- Verification of Ground Time-Overcurrent Protection Element.
8.- Verification of Current Transformer Measurement accuracy.
9.- Verification of Current Transformers Connection Diagram.
10.- Verification of Voltage Transformers Measurement Accuracy and Connection Diagram for Distance Protection.
11.- Overhead Transmission Line Parameters Estimation for Distance Protection.
12.- Overhead Transmission Line Distance Protection.
13.- Distance Protection Event Reports Analysis.
14.- Distance Protection Relay Human Machine Interface.
15.- Distance Protection Relay Configuration.
16.- Distance Protection of Simple Power System Example.

SG/ESN. **Smart Grid Trainer, with SCADA Control System and SCADA-NET System**







SG/ESN. **Smart Grid Trainer, with SCADA Control System and SCADA-NET System**

SPECIFICATIONS SUMMARY

The smart grid trainer "SG/ESN" includes the following modules:
(All components are adapted to smart grid standards).

Supply/Busbars

-BASB. Basic Frame.
-ALI01. Power Supply.
-INX20/P. Generator Protection Module.
-IND05. Synchronism Module.
-BUS01. Busbar model 1 (Generation).
-BUS02. Busbar model 2 (Transport).
-BUS03. Busbar model 3 (Coupling).
-BUS04. Busbar model 4 (Consumption).
-BUS05. Busbar model 5 (Transport).
-EAL. Network Analyzer Unit.

Generation

-EGMG/P. Generation Group.
-AVR/P. Automatic Voltage Regulator.
-VVCA/MP. AC Motors Speed Controller.

Transformation

-TRANS/3A. Step-up Transformer.
-TRANS/3B. Step-down Transformer.

Transport/Lines

-AE1. Transmission Lines Simulation Unit.

Consumption

-AE11. Energy Consumption Module.

Control and Protections

-ERP-PGC.Generators Protection and Control Device Unit.
-ERP-PD. Distance Protection Relay Unit.
-ERP-PDF. Differential Protection Relay Unit.

Faults

-ERP-MF. Fault Injection Module.

-Units reconfigurations and interconnections between modules.

SCADA System

-EDIBON SCADA Control System.
The Complete SCADA System includes: Control Interface Box + Data Acquisition Board + Computer Control, Data Acquisition and Data Management Software.

SCADA-NET System

-ESN. EDIBON SCADA-NET System, for being used with the trainer and for 30 students working simultaneously.

Smart devices:

-Bidirectional smart meter:
Intelligent meter that allows communication in two ways i.e from the customer to the utility and viceversa. In addition it incorporates the control of the loads, connect-disconnect , by program or via telephone.
Some characteristics:
Accurate knowledge of the systems characteristics with maximum, minimum and average values for voltage, current, power vaules, frequency, power factor, symmetry , etc.
Detection of more than 50 basic values.
Power counters for comprensive load detection.
Its measuring accuracy meets the high requirements found in power counters standard.
Easy operation and configuration. Configuration of multiple devices.
Ethernet interface.
Power management software allowing: comprehensive measured value detection, processing and control of the power distribution system, load management, consumption, etc.

-Physical communication module:
Communication possibilities over RS232, RS485.
Connection to PC via protocol.

-User's software:
The smart meter can be connected via its expansion ports and serial link to home devices, displays, etc.

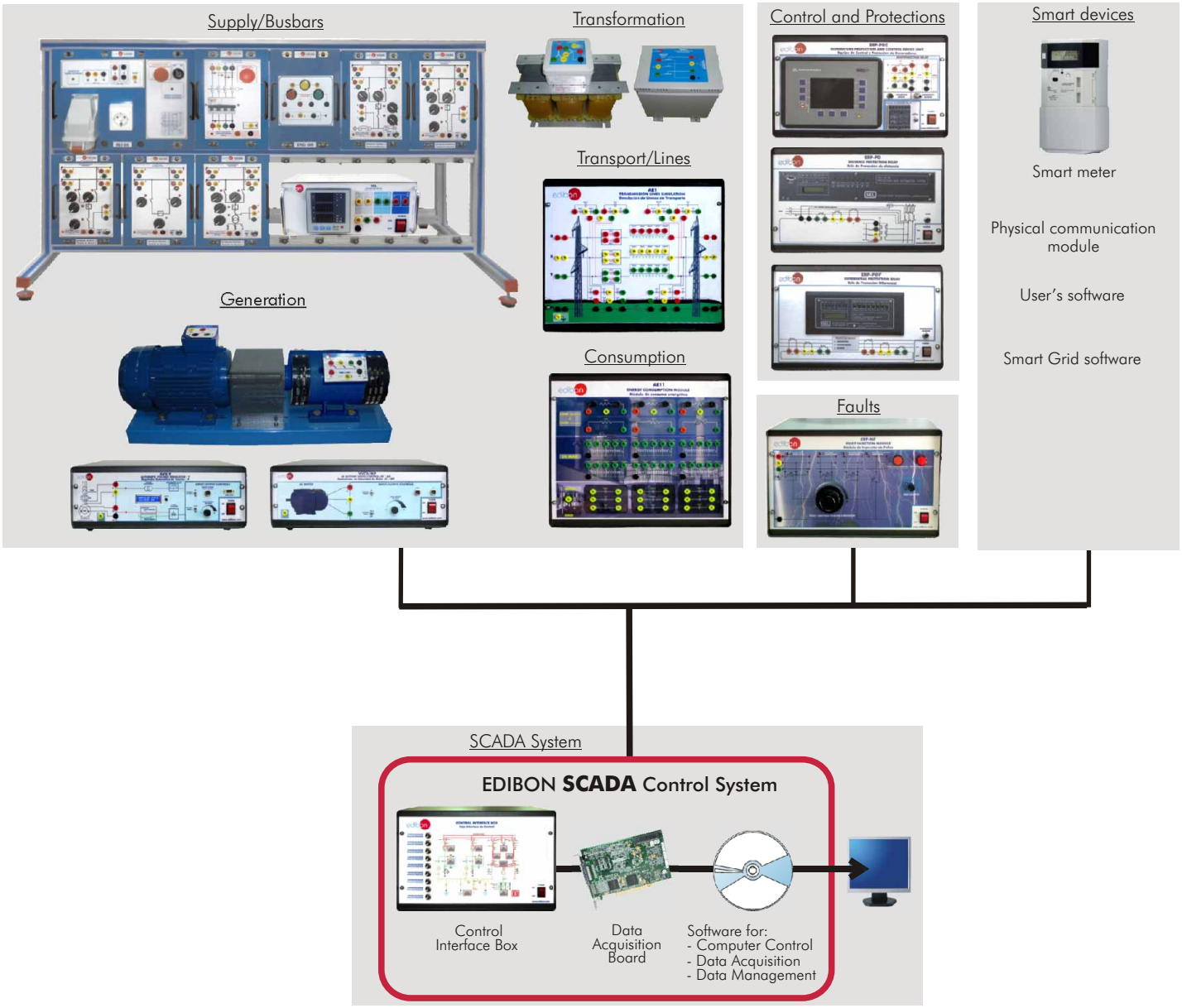
-Smart Grid software:
The smart meter can communicate to the control computer of the utility through standard communication protocols.

More information in: www.edibon.com/products/catalogues/en/units/energy/smartgrid/SG-ESN.pdf

PRACTICAL POSSIBILITIES

1.- Power System Simulator Components recognition and operation introduction.
2.- Study of generation unit feeding isolated resistive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
3.- Study of generation unit feeding isolated inductive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
4.- Study of generation unit feeding isolated capacitive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
5.- Study of generation unit feeding isolated mixed loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
6.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
7.- Study of unit feeding isolated resistive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
8.- Study of unit feeding isolated inductive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
9.- Study of unit feeding isolated capacitive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
10.- Study of unit feeding isolated mixed RLC loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
11.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at transmission substation busbar.
12.- Study of generator armature reaction when feeding isolated resistive loads through transmission line with automatic frequency control and without voltage control.
13.- Study of generator armature reaction when feeding isolated inductive loads through transmission line with automatic frequency control and without voltage control.
14.- Study of generator armature reaction when feeding isolated capacitive loads through transmission line with automatic frequency control and without voltage control.
15.- Study of generator armature reaction when feeding isolated mixed RCL loads through transmission line with automatic frequency control and without voltage control.
16.- Study of generator armature reaction when feeding isolated unbalanced loads through transmission line with automatic frequency control and without voltage control.
17.- Study of generation unit connected to the network through different transmission lines, operating at constant active power and variable field current.
18.- Study of generation unit connected to the network through different transmission lines, operating at variable active power and constant field current.
19.- Calculation of the line parameters.
20.- No laad transmission line operation and voltage regulation.
21.- Pure resistive load transmission line operation and voltage regulation.
22.- Pure inductive load transmission line operation and voltage regulation.
23.- Pure capacitive load transmission line operation and voltage regulation.
24.- Mixed R-L load transmission line operation and voltage regulation.
25.- Mixed R-C load transmission line operation and voltage regulation.
26.- Mixed L-C load transmission line operation and voltage regulation.
27.- Mixed R-L-C load transmission line operation and voltage regulation.
28.- Unbalanced load transmission line operation and voltage regulation.
29.- Verification of generator rotor to ground protection functionality.
30.- Verification of differential protection functionality.
31.- Verification of line distance protection functionality.
Some other practices to be done with the SCADA System:
32.- To open and close circuit breakers and switches in the busbars.
33.- To connect the generator to the lines.
34.- To connect the generator. Voltage measurement.
35.- To connect the lines. Voltage measurement.
36.- To connect the loads. Voltage and current measurement.
37.- To change the parameters of the relays.
38.- To simulate different fault currents.
Some other practices to be done with the SCADA-NET System:
39.- Units explanation simultaneously to all students.
40.- Teacher and students real time communication.
41.- Exam configuration allowing to evaluate the level of understanding.
42.- Full control system by teacher and students.
Some Smart Grid specific practical possibilities:
43.- To register the load profiles.
44.- To register events and list of alarms.
45.- To study and simulate smart appliance controls to optimize power usage.
46.- To use smart metering techniques.
47.- To use the smart meter with different programs. To change the smart meter to different programs.

SG/C. **Smart Grid Trainer, with SCADA Control System**



SG/C. **Smart Grid Trainer, with SCADA Control System**

SPECIFICATIONS SUMMARY

The smart grid trainer "SG/C" includes the following modules:
(All components are adapted to smart grid standards).

Supply/Busbars

-BASB. Basic Frame.
-ALI01. Power Supply.
-INX20/P. Generator Protection Module.
-IND05. Synchronism Module.
-BUS01. Busbar model 1 (Generation).
-BUS02. Busbar model 2 (Transport).
-BUS03. Busbar model 3 (Coupling).
-BUS04. Busbar model 4 (Consumption).
-BUS05. Busbar model 5 (Transport).
-EAL. Network Analyzer Unit.

Generation

-EGMG/P. Generation Group.
-AVR/P. Automatic Voltage Regulator.
-VVCA/MP. AC Motors Speed Controller.

Transformation

-TRANS/3A. Step-up Transformer.
-TRANS/3B. Step-down Transformer.

Transport/Lines

-AE1. Transmission Lines Simulation Unit.

Consumption

-AE11. Energy Consumption Module.

Control and Protections

-ERP-PGC.Generators Protection and Control Device Unit.
-ERP-PD. Distance Protection Relay Unit.
-ERP-PDF. Differential Protection Relay Unit.

Faults

-ERP-MF. Fault Injection Module.

-Units reconfigurations and interconnections between modules.

SCADA System

-EDIBON SCADA Control System.

The Complete SCADA System includes: Control Interface Box + Data Acquisition Board + Computer Control, Data Acquisition and Data Management Software.

Smart devices:

-Bidirectional smart meter:

Intelligent meter that allows communication in two ways i.e from the customer to the utility and viceversa. In addition it incorporates the control of the loads, connect-disconnect , by program or via telephone.

Some characteristics:

Accurate knowledge of the systems characteristics with maximum, minimum and average values for voltage, current, power vaules, frequency, power factor, symmetry , etc.
Detection of more than 50 basic values.
Power counters for comprensive load detection.
Its measuring accuracy meets the high requirements found in power counters standard.
Easy operation and configuration. Configuration of multiple devices.
Ethernet interface.
Power management software allowing: comprehensive measured value detection, processing and control of the power distribution system, load management, consumption, etc.

-Physical communication module:

Communication possibilities over RS232, RS485.
Connection to PC via protocol.

-User's software:

The smart meter can be connected via its expansion ports and serial link to home devices, displays, etc.

-Smart Grid software:

The smart meter can communicate to the control computer of the utility through standard communication protocols.

More information in: www.edibon.com/products/catalogues/en/units/energy/smartgrid/SG-C.pdf

PRACTICAL POSSIBILITIES

1.- Power System Simulator Components recognition and operation introduction.
2.- Study of generation unit feeding isolated resistive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
3.- Study of generation unit feeding isolated inductive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
4.- Study of generation unit feeding isolated capacitive loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
5.- Study of generation unit feeding isolated mixed loads through a medium transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
6.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at remote distribution substation busbar.
7.- Study of unit feeding isolated resistive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
8.- Study of unit feeding isolated inductive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
9.- Study of unit feeding isolated capacitive loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
10.- Study of unit feeding isolated mixed RLC loads through transmission line with automatic frequency control and voltage adjustment at transmission substation busbars.
11.- Study of generation unit feeding isolated unbalanced resistive loads through a transmission line with automatic frequency control and voltage adjustment at transmission substation busbar.
12.- Study of generator armature reaction when feeding isolated resistive loads through transmission line with automatic frequency control and without voltage control.
13.- Study of generator armature reaction when feeding isolated inductive loads through transmission line with automatic frequency control and without voltage control.
14.- Study of generator armature reaction when feeding isolated capacitive loads through transmission line with automatic frequency control and without voltage control.
15.- Study of generator armature reaction when feeding isolated mixed RCL loads through transmission line with automatic frequency control and without voltage control.
16.- Study of generator armature reaction when feeding isolated unbalanced loads through transmission line with automatic frequency control and without voltage control.
17.- Study of generation unit connected to the network through different transmission lines, operating at constant active power and variable field current.
18.- Study of generation unit connected to the network through different transmission lines, operating at variable active power and constant field current.
19.- Calculation of the line parameters.
20.- No laad transmission line operation and voltage regulation.
21.- Pure resistive load transmission line operation and voltage regulation.
22.- Pure inductive load transmission line operation and voltage regulation.
23.- Pure capacitive load transmission line operation and voltage regulation.
24.- Mixed R-L load transmission line operation and voltage regulation.
25.- Mixed R-C load transmission line operation and voltage regulation.
26.- Mixed L-C load transmission line operation and voltage regulation.
27.- Mixed R-L-C load transmission line operation and voltage regulation.
28.- Unbalanced load transmission line operation and voltage regulation.
29.- Verification of generator rotor to ground protection functionality.
30.- Verification of differential protection functionality.
31.- Verification of line distance protection functionality.

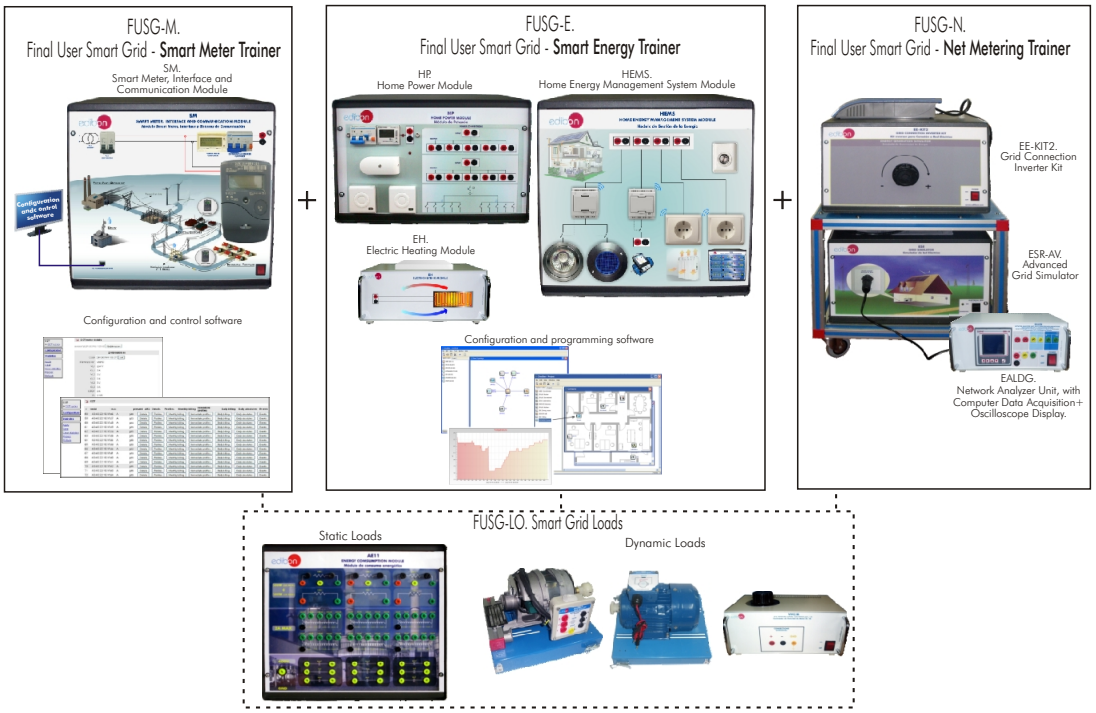
Some other practices to be done with the SCADA System:

32.- To open and close circuit breakers and switches in the busbars.
33.- To connect the generator to the lines.
34.- To connect the generator. Voltage measurement.
35.- To connect the lines. Voltage measurement.
36.- To connect the loads. Voltage and current measurement.
37.- To change the parameters of the relays.
38.- To simulate different fault currents.

Some Smart Grid specific practical possibilities:

39.- To register the load profiles.
40.- To register events and list of alarms.
41.- To study and simulate smart appliance controls to optimize power usage.
42.- To use smart metering techniques.
43.- To use the smart meter with different programs. To change the smart meter to different programs.

FUSG. **Final User Smart Grid Trainer**



SPECIFICATIONS SUMMARY

The FUSG Trainer is formed by three main trainers and a set of static and dynamic loads.

The complete FUSG. Final Smart Grid Trainer consists of:

a) FUSG-M. Final User Smart Grid-Smart Meter Trainer, formed by:

- -SM. Smart Meter, Interface and communication system module.
- -Configuration and control software.

b) FUSG-E. Smart Grid-Smart Energy Trainer, formed by:

- -HP. Home Power Module.
- -HEMS. Home Energy Management System Module.
- -EH. Electric Heating Module.
- -Control and programming software.

c) FUSG-N. Final User Smart Grid-Net Metering Trainer, formed by:

- -EE-KIT2. Grid Connection Inverter Kit.
- -ESR-AV. Advanced Grid Simulator.
- -EALDG. Network Analyzer Unit, with Computer Data Acquisition + Oscilloscope Display.

d) FUSG-LO. Smart Grid Loads:

Set of static and dynamic loads, formed by:

- -AE11. Energy Consumption Module.
- -EMT12. Universal Motor (single-phase).
- -FRECP. Eddy Current Brake.
- -VVCC/M. DC Motor Speed Controller.

e) Optional accessories: (not included in the standard supply)

- -OSM. Additional Smart Meter with FUSG-LO. Smart Grid Loads.
- -Home automation modules to complete the knowledge about smart control systems:
  - -HP-EM. Home Emergency Module.
  - -HP-SE. Home Security Module.
  - -HE-EN. Home Energy Module.

PRACTICAL POSSIBILITIES

FUSG-M Final User Smart Grid - Smart Meter Trainer:

1.- Real time monitoring of the load's consumption with a smart grid interface.
2.- Load profiles comparison for different consumption levels with smart grid devices.
3.- Power factors comparison for different load combinations.
4.- Comparison of the grid energy consumption using the interface trainer (as utilities do) and the power meter display (as final customers do).
5.- Study of the load profile and consumption optimization depending on the programmed fare.
6.- Setting of the fares in function of different tariff periods by the user.
7.- Verification of the demanded maximum power through the smart grid trainer interface, as utilities do.
8.- Power factor correction using capacitor banks. The user can configure different loads and test the quality of the electrical grid with the smart grid trainer in real time through the load module.
9.- Monitoring of several parameters in order to analyze the state of the grid: it can register different events, for example, a power loss due to different reasons (the customer demands more power than what he has contracted).
10.- Instantaneous measurement of current, voltage, active power, reactive power and power factor to perform a real time diagnosis.
11.- To record different energy measurements (Kwh, Kvar, etc.) using the Smart Grid interface, and analyze the information for different purposes (safety, quality, continuity of the grid, etc.).
12.- To consult different details about the recorded measurements until the last moment (as utilities do)using the Smart Grid interface application
13.- Access to the verification of monthly billing with the FUSG-M trainer interface application and generation of load profiles.
14.- Verification of daily billing with the FUSG-M trainer interface application and generation of daily load profiles.
15.- Remote scheduling of the smart meter's relay depending on the power contracted by the final customer.

Note: All practical exercises above can be done remotely, as actual utilities do with real Smart Grids.

FUSG-E. Final User Smart Grid - Smart Energy Trainer:

16.- Studying the energy efficiency increase by using capacitor banks to compensate the reactive power of dynamic loads (industrial induction motor).
17.- Real time monitoring of local consumptions with induction, resistor or capacitive loads.
18.- Setting by the user of the load profile to study the optimal consumption according to the tariff's prices.
19.- Simulation of different tariffs and scheduling of the Home Energy Management System devices by the final customer.
20.- Study of the optimal load demand and programming the smart devices according to different programming schemes.
21.- Remote scheduling of smart devices (Smart plug, Smart relays, thermostat, different sensors, etc.) according to the tariff.
22.- Developing switching scandhemes for appliances connected to the smart plugs, smart relays or thermostat with the management platform.

Practical exercises of FUSG-E Trainer with FUSG-M Trainer:

23.- Measurement of energy consumption at home or by an industrial consumer and comparison of this measurement with the utility´s register (smart meter).
24.- Simulation of different tariffs and scheduling of the Home Energy Management System devices by the final customer in function of the prices predefined for each period.
25.- Simulation by the utility of different tariffs and programming the smart meter's tariff.
26.- Study of the associated cost for each period and comparison of these values with other possible tariffs.

FUSG-N. Final User Smart Grid - Net Metering Trainer:

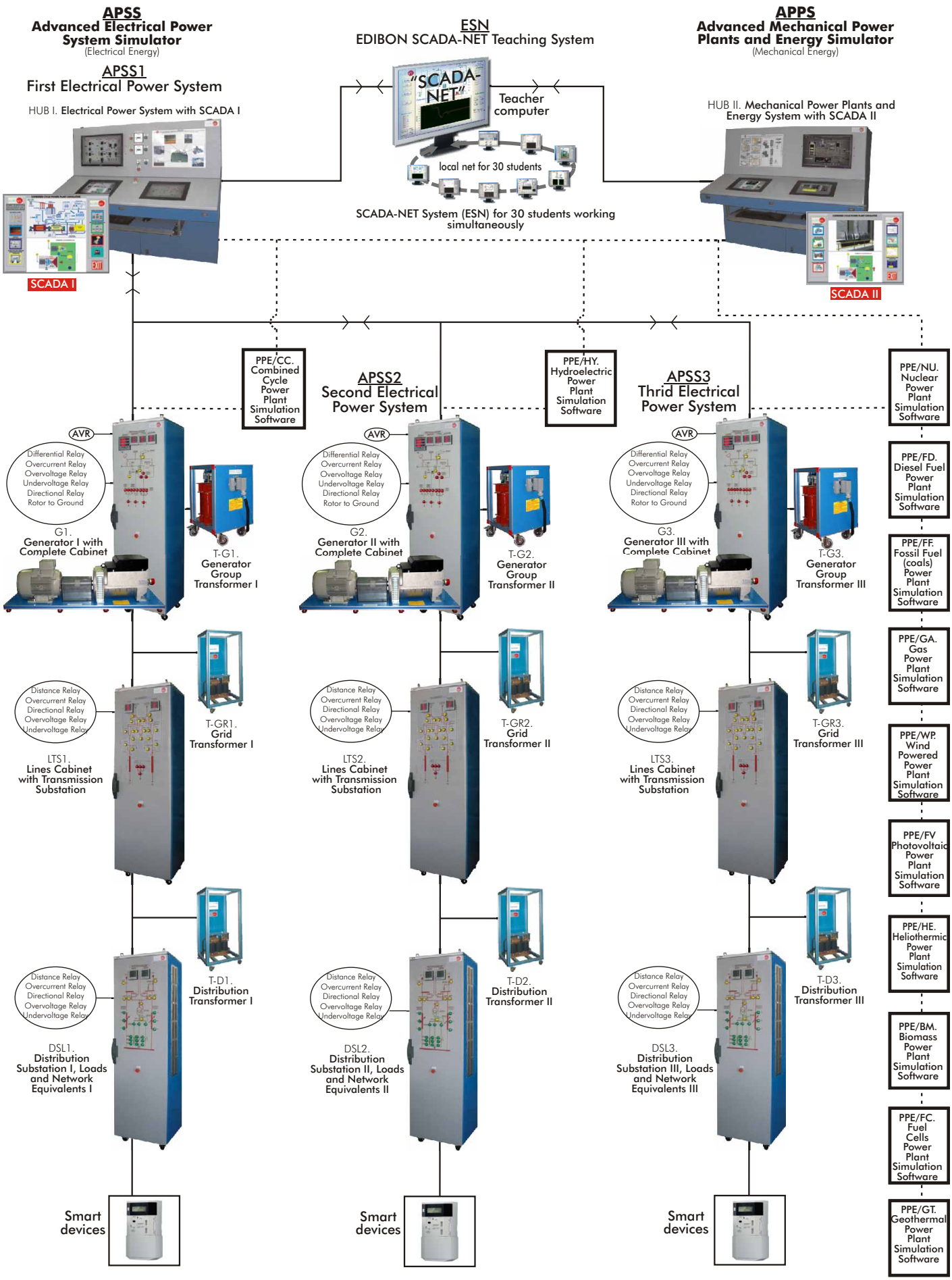
27.- Simulation of renewable energy generation through Photovoltaic panels simulated by the EE-KIT 2.
28.- Measurement of the energy generated by the Photovoltaic simulator.
29.- Net Metering. Measuring the energy consumed and the energy injected to the grid and, finally, measuring the positive or negative energy balance.
30.- Simulation of energy buying and selling.
31.- Study of the energy efficiency increase by using capacitor banks for the compensation of the dynamic loads reactive power (industrial induction motor).
32.- Real time monitoring of local consumptions with induction, resistor or capacitive loads.

Other practical exercises that can be carry out with FUSG Trainer (complete system):

33.- Measurement of energy consumption at home or by an industrial consumer and comparison of this measurement with the utility´s register (smart meter).
34.- Study of the associated cost for the consumption period and comparison of these values with other possible tariffs.
35.- Remote scheduling of Smart devices (Smart plug, Smart relays, thermostat, different sensors, etc.) according to the tariff proposed by the utilities.
36.- Development of switching schemes through the management platform for appliances connected to the smart plugs, smart relays or the thermostat.
37.- Scheduling the energy consumption for optimal periods of sunlight.

More information in: www.edibon.com/products/catalogues/en/units/energy/smartgrid/FUSG.pdf

ASG.. **Advanced Smart Grid Trainers**



www.edibon.com/products/index.php?area=energy&subarea=smartgrid&lang=en

ASG.. Advanced Smart Grid Trainers:

ASG12. **Advanced Smart Grid Trainer** with three Electrical Power Systems and Mechanical Power Plant and Energy System, with the twelve Power Plants and Energy System Simulation Softwares (complete).

SPECIFICATIONS SUMMARY

The complete ASG12 Trainer includes the following parts:

1) APSS. Advanced Electrical Power System Simulator: (See "APS12. Advanced Electrical Power System and Mechanical Power Plants Simulator" catalogue)
   1.1) APSS1. First Electrical Power System.
   1.2) APSS2. Second Electrical Power System.
   1.3) APSS3. Thrid Electrical Power System.
2) APPS. Advanced Mechanical Power Plants and Energy Simulator. (See "APS12. Advanced Electrical Power System and Mechanical Power Plants Simulator" catalogue)
   With the 12 Power Plants and Energy System Simulation Softwares:

PPE/CC. Combined Cycle Power Plant.	PPE/NU. Nuclear Power Plant.	PPE/FD. Diesel Fuel Power Plant.
PPE/FF. Fossil Fuel (coals) Power Plant.	PPE/GA. Gas Power Plant.	PPE/HY. Hydroelectric Power Plant.
PPE/WP. Wind Powered Power Plant.	PPE/FV. Photovoltaic Power Plant.	PPE/HE.Heliothermic Power Plant.
PPE/BM. Biomass Power Plant.	PPE/FC. Fuel Cells Power Plant.	PPE/GT.Geothermal Power Plant.

3) Smart devices:
   -Smart meter.
   -Physical communication module.
   -Communication software.

Can be added as additional:

4) ASG12/ESN. EDIBON SCADA-NET Teaching System, for being used with the Smart Grid Trainer (ASG12) and for 30 students working simultaneously.

ASG3. **Advanced Smart Grid Trainer** with three Electrical Power Systems and Mechanical Power Plant and Energy System, with three Power Plants and Energy System Simulation Softwares:

SPECIFICATIONS SUMMARY

The complete ASG3 Trainer includes the following parts:

1) APSS. Advanced Electrical Power System Simulator: (See "APS12. Advanced Electrical Power System and Mechanical Power Plants Simulator" catalogue)
   1.1) APSS1. First Electrical Power System.
   1.2) APSS2. Second Electrical Power System.
   1.3) APSS3. Thrid Electrical Power System.
2) APPS. Advanced Mechanical Power Plants and Energy Simulator. (See "APS12. Advanced Electrical Power System and Mechanical Power Plants Simulator" catalogue)
   With 3 to choose of the following Power Plants and Energy System Simulation Softwares:

PPE/CC. Combined Cycle Power Plant.	PPE/NU. Nuclear Power Plant.	PPE/FD. Diesel Fuel Power Plant.
PPE/FF. Fossil Fuel (coals) Power Plant.	PPE/GA. Gas Power Plant.	PPE/HY. Hydroelectric Power Plant.
PPE/WP. Wind Powered Power Plant.	PPE/FV. Photovoltaic Power Plant.	PPE/HE.Heliothermic Power Plant.
PPE/BM. Biomass Power Plant.	PPE/FC. Fuel Cells Power Plant.	PPE/GT.Geothermal Power Plant.

3) Smart devices:
   -Smart meter.
   -Physical communication module.
   -Communication software.

Can be added as additional:

4) ASG3/ESN. EDIBON SCADA-NET Teaching System, for being used with the Smart Grid Trainer (ASG3) and for 30 students working simultaneously.

ASG2. **Advanced Smart Grid Trainer** with two Electrical Power Systems and Mechanical Power Plant and Energy System, with two Power Plants and Energy System Simulation Softwares:

SPECIFICATIONS SUMMARY

The complete ASG2 Trainer includes the following parts:

1) APSS. Advanced Electrical Power System Simulator: (See "APS12. Advanced Electrical Power System and Mechanical Power Plants Simulator" catalogue)
   1.1) APSS1. First Electrical Power System.
   1.2) APSS2. Second Electrical Power System.
2) APPS. Advanced Mechanical Power Plants and Energy Simulator. (See "APS12. Advanced Electrical Power System and Mechanical Power Plants Simulator" catalogue)
   With 2 to choose of the following Power Plants and Energy System Simulation Softwares:

PPE/CC. Combined Cycle Power Plant.	PPE/NU. Nuclear Power Plant.	PPE/FD. Diesel Fuel Power Plant.
PPE/FF. Fossil Fuel (coals) Power Plant.	PPE/GA. Gas Power Plant.	PPE/HY. Hydroelectric Power Plant.
PPE/WP. Wind Powered Power Plant.	PPE/FV. Photovoltaic Power Plant.	PPE/HE.Heliothermic Power Plant.
PPE/BM. Biomass Power Plant.	PPE/FC. Fuel Cells Power Plant.	PPE/GT.Geothermal Power Plant.

3) Smart devices:
   -Smart meter.
   -Physical communication module.
   -Communication software.

Can be added as additional:

4) ASG2/ESN. EDIBON SCADA-NET Teaching System, for being used with the Smart Grid Trainer (ASG2) and for 30 students working simultaneously.

www.edibon.com/products/index.php?area=energy&subarea=smartgrid&lang=en

ASG1. **Advanced Smart Grid Trainer** with Electrical Power System and Mechanical Power Plant and Energy System, with one Power Plant and Energy System Simulation Software:

SPECIFICATIONS SUMMARY

The complete ASG1 Trainer includes the following parts:

1) APSS. Advanced Electrical Power System Simulator: (See "APS12. Advanced Electrical Power System and Mechanical Power Plants Simulator" catalogue)
   1.1) APSS1. First Electrical Power System.
2) APPS. Advanced Mechanical Power Plants and Energy Simulator. (See "APS12. Advanced Electrical Power System and Mechanical Power Plants Simulator" catalogue)
   With 1 to choose of the following Power Planst and Energy System Simulation Softwares:

PPE/CC. Combined Cycle Power Plant.	PPE/NU. Nuclear Power Plant.	PPE/FD. Diesel Fuel Power Plant.
PPE/FF. Fossil Fuel (coals) Power Plant.	PPE/GA. Gas Power Plant.	PPE/HY. Hydroelectric Power Plant.
PPE/WP. Wind Powered Power Plant.	PPE/FV. Photovoltaic Power Plant.	PPE/HE.Heliothermic Power Plant.
PPE/BM. Biomass Power Plant.	PPE/FC. Fuel Cells Power Plant.	PPE/GT.Geothermal Power Plant.

3) Smart devices:
   -Smart meter.
   -Physical communication module.
   -Communication software.

Can be added as additional:

4) ASG1/ESN. EDIBON SCADA-NET Teaching System, for being used with the Smart Grid Trainer (ASG1) and for 30 students working simultaneously.

ASG0. **Advanced Smart Grid Trainer** with Electrical Power System

SPECIFICATIONS SUMMARY

The complete ASG0 Trainer includes the following parts:

1) APSS. Advanced Electrical Power System Simulator: (See "APS12. Advanced Electrical Power System and Mechanical Power Plants Simulator" catalogue)
   1.1) APSS1. First Electrical Power System.
2) Smart devices:
   -Smart meter.
   -Physical communication module.
   -Communication software.

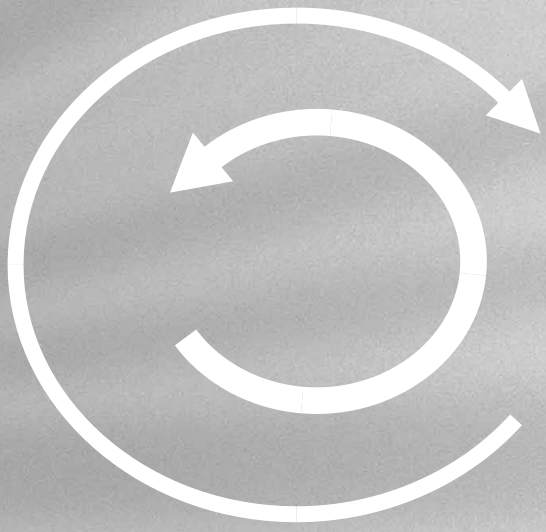
Can be added as additional:

3) ASG0/ESN. EDIBON SCADA-NET Teaching System, for being used with the Smart Grid Trainer (ASG0) and for 30 students working simultaneously.

www.edibon.com/products/index.php?area=energy&subarea=smartgrid&lang=en

Summarized
Catalogue

two(2)



6. Mechatronics & Automation

	page
6.1. Automation (PLC Process Emulation).	148-158
6.2. Automation (PLC Small Scale Real Applications).	159-163
6.3. Automation (Industrial PLC Applications).	164
6.4. Automation (PLC Unit Operations Control).	165
6.5. Automation (Regulation and Control).	166
6.6. Automation (Control).	167-168
6.7. Systems.	169

edibon

www.edibon.com

page

6.1- Automation (PLC Process Emulation)

-PLCE **PLCE Trainer.** 148-158

PLC Process Emulators for working with PLCE:

Traffic and Parking
- •PLCE-CST **Traffic Signal Control.**
- •PLCE-AV **Car Parking.**
- •PLCE-AG2Z **Two Zones Parking Garage.**

Small Industrial Machines
- •PLCE-CA **Elevator Control.**
- •PLCE-CLA **Automatic Washing Machine Control.**
- •PLCE-MB **Drinks Machine.**
- •PLCE-MBC **Hot Drinks Machine.**
- •PLCE-CB **Pump Control.**
- •PLCE-MA **Embossing Machine.**

Small Industrial Systems
- •PLCE-ST **Drilling System.**
- •PLCE-SBAR **Dirty-Water Pump System.**
- •PLCE-SBP **Pump System (Pressure).**
- •PLCE-SL **Cleaning System.**
- •PLCE-SALL **Automatic Filling System.**
- •PLCE-SBT **Conveyor Belts System.**
- •PLCE-SCCT **Conveyor Charging System.**
- •PLCE-SCA **Canalization System.**
- •PLCE-SDT **Pipe Bending System.**
- •PLCE-PAE **Automatic Stamping Press.**

Big Industrial Systems
- •PLCE-PLLT **Filling Process of Tanks.**
- •PLCE-SCC **Collecting Belt Conveyor.**
- •PLCE-MCC **Mails Allocation Machine.**
- •PLCE-RAC **Compressed Air Network.**
- •PLCE-TC **Coal Treatment.**
- •PLCE-PELE **Packing Line and Bottling Plant.**

Simple Control Applications
- •PLCE-CA2P **Two-Doors Access Control.**
- •PLCE-CI **Fire Control.**
- •PLCE-CP **Proximity Control** (security).
- •PLCE-CCO **Sluice Gate Control.**
- •PLCE-CNC **Level and Flow Control.**
- •PLCE-CNTA **Water Tower Level Control.**
- •PLCE-CF **Photo Control.**
- •PLCE-CMM **Molding Machine Control.**
- •PLCE-CPOS **Position Control.**
- •PLCE-CS **Silo Control.**
- •PLCE-CACV **Vehicle Feeding & Loading Control.**

Industrial Control Applications
- •PLCE-ACC **Feeding and Loading Control.**
- •PLCE-CML **Liquids Blending Control.**
- •PLCE-CME **Mixer Control.**
- •PLCE-CR **Reactor Control.**
- •PLCE-CCP **Count and Position Control.**
- •PLCE-CL **Rolling Mill Control.**
- •PLCE-CTRA **WorkCell Application.**
- •PLCE-CTI **Tower Lighting Control.**

Thermal Applications
- •PLCE-AC **Buffer Storage.**
- •PLCE-RT **Temperature Regulation.**
- •PLCE-CSC **Heating System Control.**
- •PLCE-CSV **Ventilation System Control.**

Electrical Machines Control (Motors)
- •PLCE-M **Motor Control.**
- •PLCE-MPP **Stepper Motor Control.**
- •PLCE-MET **Star-Delta Connection.**
- •PLCE-MCETI **Reversing Star-Delta Connection.**
- •PLCE-MD **Dahlander Motor Circuit.**
- •PLCE-M2BS **Motor with 2 Separate Windings.**
- •PLCE-MAC **Starting a Wound-Rotor Motor.**

Alarms/Current
- •PLCE-AN **Annunciator.**
- •PLCE-SLU **Running Lights.**
- •PLCE-CPR **Reactive Current Compensation.**
- •PLCE-MCI **Reversing Contactor.**

page

6.2- Automation (PLC Small Scale Real Applications)

-PLCE **PLCE Trainer.** 159-163

PLC Small Scale Real Applications for working with PLCE:

Sensors
- •PLCE-BS1 **Vibration and/or Deformation Test Module.**
- •PLCE-BS2 **Temperature Test Module.**
- •PLCE-BS3 **Pressure Test Module.**
- •PLCE-BS4 **Flow Test Module.**
- •PLCE-BS5 **Ovens Test Module.**
- •PLCE-BS6 **Liquid Level Test Module.**
- •PLCE-BS7 **Tachometers Test Module.**
- •PLCE-BS8 **Proximity Test Module.**
- •PLCE-BS9 **Pneumatic Test Module.**
- •PLCE-BS10 **Light Test Module.**

6.3- Automation (Industrial PLC Applications)

-PLC-IN **PLC Industrial Control System.** 164

6.4- Automation (PLC Unit Operations Control)

-PLC-PI **PLC Module for Unit Operations Control** (for working with EDIBON Computer Controlled Units). 165

-EDIBON FP-X-CPU **PLC,** with no additional elements. 165

6.5- Automation (Regulation and Control)

-RYC Computer Controlled **Teaching Unit for the Study of Regulation and Control.** 166

-RYC/B **Basic Teaching Unit for the Study of Regulation and Control.** 166

-RYC/SOF **Regulation and Control Simulation Software Package.**

6.6- Automation (Control)

-CECI **Industrial Controllers Trainer.** 167

-CRCI **Industrial Controllers Networking.** 167

-CEAB **Trainer for Field Bus Application.** 167

-CEAC **Controller Tuning Trainer.** 168

-EPID/T **Industrial Regulation Trainer, PID type (Temperature).** 168

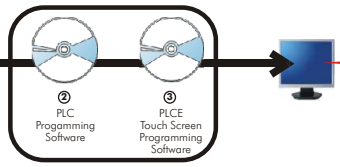
6.7- Systems

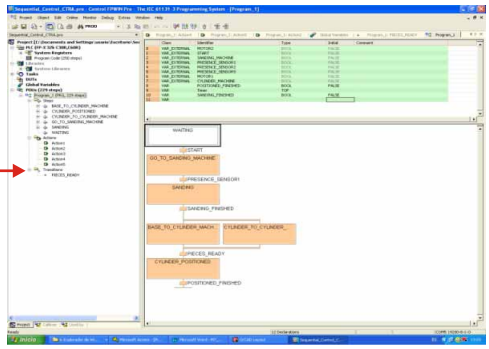
-SCE Computer Controlled **Generating Stations Control and Regulation Simulator.** 169

-SBB **Ball and Beam System.** 169

-CPVM **DC Motor Position and Speed Control.** 169

PLCE. **PLC Trainer**





① Unit: PLCE. PLC Trainer

SPECIFICATIONS SUMMARY

Items supplied as standard

The PLCE is a PLC trainer designed by EDIBON. It allows the user to learn about logic programming without any background knowledge or experience.

The PLCE includes digital and analog inputs and outputs, switches, push buttons, potentiometers, etc., allocated in the front panel of the box.

This trainer is provided with a set of practices, through which the user will understand how a PLC works and how to program a PLC application to obtain a required functionality.

The PLCE can also be used to work with the PLC Process Emulators.

① PLCE. Unit:

Steel box.

Power supply 110-240Vac.

RS232 cable to communicate with PC.

SUB-D connector to communicate with the PLCE applications.

FP-X C30R Panasonic PLC unit. The key features are:

Ultra-high processing speed of 0.32 µs per instruction.

Large Program Capacity of 16 Kstep.

Independent Comment Memory.

Maximum number of I/O points is 300.

3 different I/O modules:

1) Digital I/O module:

Inputs: Number of inputs: 16. Voltage: 24Vdc.

Outputs: Number of outputs: 14. Output type: relay. Output capacity: 2A.

8 On/off switches.

8 Push-buttons.

2) Analog I/O module:

Inputs: Number: 8. Input Range: 0 to +10V.

Outputs: Number: 4. Output Range: -10V to +10V. Resolution: 12bits.

6 Adjustable analog signals: Range: 0 to +10V.

3) Touch screen.

② PLC Programming Software:

Programming software developed according to the standard IEC 61131-3.

Compatible with Windows operating systems.

Five programming languages.

Remote programming, service, and diagnostics.

Minimum program size.

Powerful debugging and monitoring tools.

Supports user created functions and function blocks.

Saves project files inside the PLC.

③ PLCE Touch Screen Programming Software:

Tools for Screen Creation.

Plenty of functions. Screens Creation.

Drawing Functions.

Easy Operativity (Click and slip).

Easy creation of user libraries:

Printing. The different screens of the project can be printed.

Easy use. Bitmaps Editor.

④ Cables and Accessories, for normal operation.

⑤ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 490 x 330 x 310 mm.

Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PRACTICAL POSSIBILITIES

Using the PLC Programing Software:

1.- Understanding how to create different PLC applications and downloading to PLCE.
2.- Developing fundamental programs in different languages:
- Ladder Diagram (LD).
- Structured Text (ST).
- Instructions list (IL).
- Sequential Functional Chart (SFC).
- Functional Block Diagram (FBD).

3.- Studying number systems and data types:
- Decimal, Binary, Octal, Hexadecimal Systems.
- Bool, Integer, Word, Double, etc.

4.- Studying the fundamentals of logic:
- AND, OR, and NOT Functions and Bool Algebra.
- Developing Circuits from Boolean Expressions.
- Producing the Boolean Equation from a Given Circuit.
- Hardwired Logic versus Programmed Logic.
- Programming Word-Level Logic Instructions.

5.- Creating basic applications to test the digital I/O modules:
- Using switches and push-buttons as digital inputs.
- Using LEDs as outputs indicator.

6.- Creating basic applications to test the analog I/O modules:
- Using the analog input to read real analog signals.
- Using the analog outputs to generate analog signals and waveforms.

7.- Understanding how timers work and how to use them to control time-based processes:
- On-Delay timer instructions and function blocks.
- Off-Delay timer instructions and function blocks.
- Cascading Timers.

8.- Understanding how counters work and how counting is carried out:
- Up-Counter.
- Down-Counter.
- Cascading Counters.

9.- Data Manipulation Instructions:
- Data Manipulation.
- Memorize data.
- Data Transfer Operations.
- Data Compare Instructions.

10.- Understanding program control instructions:
- Jump and Conditional Instructions and Subroutines.
- Sequential control.

11.- Using math and arithmetic instructions:
- Addition.
- Subtraction.
- Multiplication.
- Division.
- Additional instructions.

12.- Functions Blocks and libraries.
13.- Complex control systems. PID function.

* Some applications related to these practices are included in the supply.

Using the PLCE Touch Screen Programming Software:

14.- How to create a simple application for the PLCE screen.
15.- How to commute digital outputs of the PLC through the screen.
16.- How to commute several digital outputs simultaneously. (Working with words).
17.- Writing on and reading from a data register.
18.- How to write a data register in a range of values.
19.- Switching from one screen to another.

* Some applications related to these practices are included in the supply.

Specific Applications with the PLC Process Emulators.

Other practical possibilities:

- It is possible to make simulations without need of any external element, causing analog inputs and/or digital ones, and to observe what happens in the outputs.
- It is also possible to introduce real analog inputs (for example: the transducer value in volts of a temperature sensor) and/or digital inputs (for example: an external pulser) and to connect real actuators in the output, (for example: a pump).

PLCE. **PLC Trainer**

PLC Process Emulators for working with PLCE:

They are units that emulate different process, systems, machines, etc, controlled by the PLCE.
The emulators include:
- Metallic box.
- Diagram or drawing of the simulated application.
- Fuse protection.
- D-SUB connector to communicate with PLCE.
- LEDs and different displays as indicators.
- Switches and push-buttons.
- Potentiometers.

These process emulators are provided with switches, push buttons and LEDs to emulate common elements such as motors, detectors, sensors, pumps, valves, conveyors, etc.
Dimensions: 410 x 298 x 107 mm. approx. Weight: 2 Kg. approx.
These emulators offer us, among many others, several practical possibilities: industrial complex processes control, how to control machines with different controllable elements, control of electrical systems, control of hydraulic and electromechanic systems, using the analog inputs and outputs with the systems control, simulation of distributed control of processes, etc.

➤Traffic and Parking

PLCE-CST. **Traffic Signal Control**

SPECIFICATIONS SUMMARY

The PLCE-CST is a two roads traffic light control system. This unit is provided with switches, push buttons and leds to simulate common elements such as traffic lights, car detectors, etc. These elements simulate requests conditions such as pedestrians requests, sensors, etc. These requests are produced by these elements and the PLCE recognizes these signals in order to perform the required action.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-AV. **Car Parking**

SPECIFICATIONS SUMMARY

The PLCE-AV is a training unit to work with PLCE. The unit is provided with switches, push buttons and leds to simulate the commonly elements in an automatic parking for vehicles. These elements simulate conditions such as barrier open, motor off, motor on, etc. These conditions are evaluated by the PLCE in order to perform the required action.
The PLCE-AV unit is a model of an automatic parking for vehicles. It includes the most common elements in this system such as a sensor up/down, motors, barriers, traffic lights, etc.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-AG2Z. **Two Zones Parking Garage**

SPECIFICATIONS SUMMARY

It represents a parking garage with two zones where is possible to emulate the control of four barriers, two in the entrances an two in the exits, in the automatic parking.
We can know the number of vehicles inside the parking with lights and if the parking is full or free.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

➤Small Industrial Machines

PLCE-CA. **Elevator Control**

SPECIFICATIONS SUMMARY

The PLCE-CA represents a three-level elevator system. This unit is provided with switches, push buttons and leds to simulate the common elements in an elevator like calling buttons, floor indicators, sensors, etc. These elements simulate requesting conditions such as calling, lights, alarms, etc. These requests are produced by these common elements and the PLCE recognizes these signals in order to perform the required action.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CLA. **Automatic Washing Machine Control**

SPECIFICATIONS SUMMARY

The PLCE-CLA is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in an automatic washing machine. These elements simulate conditions such as door open, drum empty, motor on, etc. These conditions are evaluated by the PLCE in order to perform the required action.
The PLCE-CLA unit represents an automatic washing machine. It includes the most common elements in this device such as a program selector, motor, pum, agitator, thermostat, etc.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE. **PLC Trainer**

PLC Process Emulators for working with PLCE:

➤Small Industrial Machines

PLCE-MB. **Drinks Machine**

SPECIFICATIONS SUMMARY

The PLCE-MB is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in an automatic drinks machine. These elements simulate conditions such as sensors, leds, etc. These conditions are evaluated by the PLCE in order to perform the required action.
The PLCE-MB unit represents an automatic drinks machine. It includes the most common elements in this device such as a sensor on/off, leds inputs and outputs, etc.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-MBC. **Hot Drinks Machine**

SPECIFICATIONS SUMMARY

It represents an automatic hot drinks machine where we have the possibility of work with a complete scheme of actions of an automatic hot drinks machine.
We can select a drink, we can know the level of drink using sensors and the status of the machine.
Finally we can select sugar and extra-milk.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CB. **Pump Control**

SPECIFICATIONS SUMMARY

It represents a pump control where we have four pumps inserting water in a big tank.
We can regulate the number of pumps working and to know the level of water into the tank using level sensors.
Is possible to regulate the discharge rate with the output valve in the tank.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-MA. **Embossing Machine**

SPECIFICATIONS SUMMARY

It represents the embossing process of metal disks controlled with an electropneumatic system.
The valves regulate the flow of gas to the electropneumatic system moving the steel punches and we can know the position of the steel punches using position sensors.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

➤Small Industrial Systems

PLCE-ST. **Drilling System**

SPECIFICATIONS SUMMARY

It represents a drilling system where we can emulate the movements of a drill.
We have two motors one for vertical movements and the other one is the motor of the drill.
We can switch on/off the coolant valve and to select the clamping pressure.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-SBAR. **Dirty-Water Pump System**

SPECIFICATIONS SUMMARY

It represents a dirty-water pump system where we can emulate the control of the dirty-water flow using a valve and two pumps which insert dirty-water in the pipe from the dirty-water tank.
The level of dirty-water into the tank is measured using four level sensors.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE. **PLC Trainer**

PLC Process Emulators for working with PLCE:

➤**Small Industrial Systems**

PLCE-SBP. **Pump System (Pressure)**

SPECIFICATIONS SUMMARY

It represents a pressure system where we use two pumps with their motors when we have to introduce air in the tank.
We can activate or deactivate the pumps with the three-phase contactors.
In the tank we have two level sensors and a pressure sensor.
The output of the pressured air is controlled using a flow sensor.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-SL. **Cleaning System**

SPECIFICATIONS SUMMARY

It represents a cleaning system where is possible to emulate the movement of a basket which has vertical movements.
The electrovalve has three positions and it can move the basket from its position to the designated position with a manual regulator.
We can know the position of the basket using position sensors.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-SALL. **Automatic Filling System**

SPECIFICATIONS SUMMARY

It represents an automatic filling system where we can choose the number of elements packed in each pack.
We can emulate the motors and the presence sensor of the system working.
We can emulate the movement of the conveyor belt with the packs in this filling process.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-SBT. **Conveyor Belts System**

SPECIFICATIONS SUMMARY

The PLCE-SBT is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in conveyor control system. These elements simulate conditions such as motor left, motor right, conveyors, etc. These conditions are evaluated by the PLCE in order to perform the required action.
It includes the most common elements in this system such as a positioning sensor, presence sensor, etc.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-SCCT. **Conveyor Charging System**

SPECIFICATIONS SUMMARY

It represents a conveyor charging system where is possible to emulate the work of four conveyor belts switching on/off their motors and we can open or close three lock gates.
With this system we can control the conveyor charge process.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-SCA. **Canalization System**

SPECIFICATIONS SUMMARY

It represents a channeling system where we have a dam which provides water using a general pipe with a general valve.
This general pipe provides water to other pipes, those pipes provides water to the houses, parks, etc using their own little valves.
In the homes the valves which regulate the water flow are taps.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE. **PLC Trainer**

PLC Process Emulators for working with PLCE:

➤Small Industrial Systems

PLCE-SDT. **Pipe Bending System**

SPECIFICATIONS SUMMARY

It represents a pipe bending system where we can emulate the bending process of the pipe.
We can start/stop the system using a switch and to know the state of the machine with maximum/minimum sensors, to insert pipes with an electrovalve and to control the conveyor belt.
We will know if we have a pipe in the machine with the piece presence sensor.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-PAE. **Automatic Stamping Press**

SPECIFICATIONS SUMMARY

It represents an automatic stamping press where is possible to emulate the pressing process of steel sheets.
We can know the state of the press and electrovalve with the maximum/minimum sensors.
The press has a piece presence sensor, and warning lights.
We can control the rollers and the conveyor belt with switches.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

➤Big Industrial Systems

PLCE-PLLT. **Filling Process of Tanks**

SPECIFICATIONS SUMMARY

It represents a filling process of tanks with three tanks where we can emulate the filling and emptying processes of the tanks and the level of the liquid inside the tanks.
Is possible to switch on or switch off the different input or output valves of each tank.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-SCC. **Collecting Belt Conveyor**

SPECIFICATIONS SUMMARY

It represents a collecting belt conveyor system where is possible to emulate five conveyor belts transporting different materials to the general conveyor belt.
We can activate or deactivate the five conveyor belt motors and switch on/off the general conveyor belt in two directions left and right.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-MCC. **Mails Allocation Machine**

SPECIFICATIONS SUMMARY

It represents a mails allocation machine which allocate the mails to different cities.
It uses five motors, one for each city and a conveyor belt.
We can activate or deactivate each motor and the general conveyor belt.
The general system can be activated or deactivated.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-RAC. **Compressed Air Network**

SPECIFICATIONS SUMMARY

It represents a compressed air network where is possible to emulate the actions in an air network.
We can control valves, dryer, motors with contactors and we can know the flow in the output of the compressor with a sensor.
The electrovalve moves the final piston.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

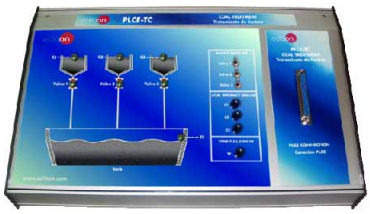
More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE. **PLC Trainer**

PLC Process Emulators for working with PLCE:

➤**Big Industrial Systems**

PLCE-TC. **Coal Treatment**



SPECIFICATIONS SUMMARY

It represents a coal treatment system where we can see three chutes with three valves each one and a big tank.
We can control the flow of coal with the three valves and is possible to know if the tank or the chutes are full using coal presence sensors.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-PELE. **Packing Line and Bottling Plant**

SPECIFICATIONS SUMMARY

The PLCE-PELE is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in a automatic bottling line. These elements simulate conditions such as presence sensors, control switches, etc. These conditions are evaluated by the PLCE in order to perform the required action.
The PLCE-PELE unit represents an automatic bottling line. It includes the most common elements in this system such as a sensor, piston, motors, conveyor, etc.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

➤**Simple Control Applications**

PLCE-CA2P. **Two-Doors Access Control**

SPECIFICATIONS SUMMARY

It represents two automatic doors where is possible to emulate the movements and positions of each automatic door using sensors and electrical motors.
We have the option of activate or deactivate the electrical motors.
The doors can be opened using the presence sensors.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CI. **Fire Control**

SPECIFICATIONS SUMMARY

The PLCE-CI is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in a fire control. These elements simulate conditions such as smoke detectors, heat sensors, etc. These conditions are evaluated by the PLCE in order to perform the required action.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CP. **Proximity Control** (security)

SPECIFICATIONS SUMMARY

The PLCE-CP is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in an automatic proximity control. These elements simulate conditions such as PIR detector activated, infrared sensor activated, magnetic detector, etc. These conditions are evaluated by the PLCE in order to perform the required action.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CCO. **Sluice Gate Control**

SPECIFICATIONS SUMMARY

The PLCE-CCO represents an automatic sluices or barriers system and it is a training unit to work with PLCE. This unit is provided with switches, push buttons, sensors and leds to simulate the commonly elements in an automatic sluices control system. These elements simulate conditions such as sluice closed, valve open, motor off, motor on, etc.
These conditions are evaluated by the PLCE in order to perform the required action.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE. **PLC Trainer**

PLC Process Emulators for working with PLCE:

➤**Simple Control Applications**

PLCE-CNC. **Level and Flow Control**

SPECIFICATIONS SUMMARY

The PLCE-CNC is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in a flow and level controller system. These elements simulate conditions such as barrier open, motor off, motor on, etc. These conditions are evaluated by the PLCE in order to perform the required action.

It includes common elements in this system such as level sensors, flow controllers, etc.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CNTA. **Water Tower Level Control**

SPECIFICATIONS SUMMARY

It represents a water tower level control where is possible to emulate the water flow control with the input valve and the motor of the pump. We can measure the level of water in the tank and in the water tower using sensors.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CF. **Photo Control**

SPECIFICATIONS SUMMARY

The PLCE-CF represents an automatic photo control machine and it is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in an automatic photo control. These elements simulate conditions such as, coins detected, camera on, flash activated, switches, etc. These conditions are evaluated by the PLCE in order to perform the required action.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CMM. **Molding Machine Control**

SPECIFICATIONS SUMMARY

It represents a molding machine control where we can emulate a machine which gives shape to the pieces pushing them.

It works with three electrovalves which we can activate or deactivate, each electrovalve has a limit switch.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CPOS. **Position Control**

SPECIFICATIONS SUMMARY

It represents a position control where we can move the sheet to the correct position using a motor with a lefthand and righthand rotation and crowling speed the incremental shaft encoder can count pulses and to give a fine sincronism.

We have the possibility of saw the sheet connecting the saw motor.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CS. **Silo Control**

SPECIFICATIONS SUMMARY

It represents a silo control system where we can emulate the filling process. The filling motor has a manual rate or an automatic rate and the output valve has its own discharge rate.

We can measure the level with four presence sensors and to know if the silo is full with the full sensor.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE. **PLC Trainer**

PLC Process Emulators for working with PLCE:

➤**Simple Control Applications**

PLCE-CACV. **Vehicle Feeding & Loading Control**

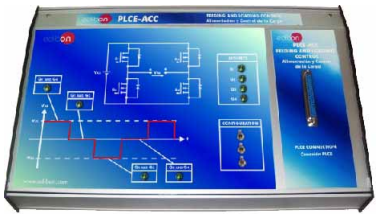
SPECIFICATIONS SUMMARY

The PLCE-CACV is a training unit to work with PLCE. It represents the process of obtaining tequila through the agave fermentation.
This unit is provided with switches, push buttons and leds to simulate the commonly elements in an automatic feed control and load truck. These elements simulate conditions such as open and close valves, motor running, etc. These conditions are evaluated by the PLCE in order to perform the required action.
It is a model of feed control and load on truck and includes the most common elements in this system such as presence sensors, pressure sensors, level detectors, etc.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

➤**Industrial Control Applications**

PLCE-ACC. **Feeding and Loading Control**

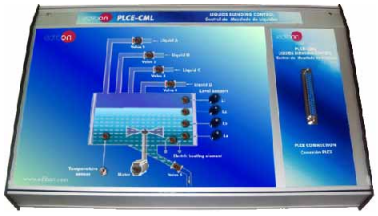


SPECIFICATIONS SUMMARY

It represents a feeding and loading control system where we can control the voltage in the load between the A-B terminals.
We have to select a configuration which activate or deactivate the mosfets and we can know what switch is closed with its own light.
We can see in the graph the state of the voltage in the load between the A-B terminals.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CML. **Liquids Blending Control**



SPECIFICATIONS SUMMARY

It represents a liquids blending control where is possible to emulate the mix of different liquids and their flows are regulated using four valves.
The liquids are mixed using a mixer with its own motor.
The flow of the mix is regulated using an output valve.
We can measure the temperature and the level of liquid with sensors.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CME. **Mixer Control**

SPECIFICATIONS SUMMARY

It represents a mixer control where we can emulate the mix with two different products in a big chute from two little chutes using conveyor belts, finally the general conveyor belt will transport the mix.
We will control the motors of the conveyor belts and the valves in the system and we will know the big chute's level using sensors.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CR. **Reactor Control**

SPECIFICATIONS SUMMARY

It represents a reactor control where is possible to emulate the mix of a catalyst, an inert gas and the substance.
We can regulate the catalyst and the inert gas flow with valves, and the substance with a pump.
The inlet and the output of the product are regulated using valves.
We mix the substances with an agitator into the reactor.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CCP. **Count and Position Control**

SPECIFICATIONS SUMMARY

The PLCE-CCP is a training unit to work with PLCE. This unit is provided with switches, pushbuttons and leds to simulate the commonly elements in the counting and positioning controller. These elements simulate the control and movement of motors and pincer hand by presence sensors.
It represents of counting and positioning controller that distributes industrial pieces to specific positions. It includes the most common elements in this system such as presence sensors, control switches, etc.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE. **PLC Trainer**

PLC Process Emulators for working with PLCE:

➤Industrial Control Applications

PLCE-CL. **Rolling Mill Control**

SPECIFICATIONS SUMMARY

The PLCE-CL is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in a laminate control system. These elements simulate conditions such as cooling control to vary the hardness of the alloy, motor on, motor off, metal cutter, simple effect cylinder, etc. These conditions are evaluated by the PLCE in order to perform the required action.

It is a model of an automatic laminate control. It includes the most common elements in this system such as a sensor up/down, presence sensors, control switches, etc.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CTRA. **WorkCell Application**

SPECIFICATIONS SUMMARY

The PLCE-CTRA is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in an automatic working cell. These elements simulate conditions such as sanding, soldering, motor off, motor on, etc. These conditions are evaluated by the PLCE in order to perform the required action.

It is a model of an automatic working cell. It includes the most common elements in this system such as sensors, control switches, etc.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CTI. **Tower Lighting Control**

SPECIFICATIONS SUMMARY

It represents a tower lighting control where is possible to emulate the lighting of different levels of a tower using a lights system.

It has two directions up and down and we can know the level using a display.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

➤Thermal Applications

PLCE-AC. **Buffer Storage**

SPECIFICATIONS SUMMARY

It represents a buffer storage system where is possible to emulate the storage of heat using fluids.

We can control the valves state, the pumps, the boiler, and the buffer storage tank state.

Is possible to know when the collector is working using a sensor.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-RT. **Temperature Regulation**

SPECIFICATIONS SUMMARY

The PLCE-RT is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in a temperature controller system. These elements simulate conditions such as level sensor, temperature sensor, etc. These conditions are evaluated by the PLCE in order to perform the required action.

It is a model of a temperature controller and includes the most common elements in this system such as a level sensors, filling a tank, temperature sensor, flood sensor, etc.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CSC. **Heating System Control**

SPECIFICATIONS SUMMARY

It represents a heating system control where is possible to emulate the heating process controlling the flow of hot water into the circuit activating or deactivating the valves in the pipes and using the temperature control regulator.

We can start/stop the system using a general switch.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE. **PLC Trainer**

PLC Process Emulators for working with PLCE:

➤Thermal Applications

PLCE-CSV. **Ventilation System Control**

SPECIFICATIONS SUMMARY

It represents a ventilation system control where we are trying to clean the air in a garage.
We can control the air inside measuring the level of CO and smoke with sensors.
We can activate four pumps and two fans.
Is possible to control the traffic lights and the automatic barriers.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

➤Electrical Machines Control (Motors)

PLCE-M. **Motor Control**

SPECIFICATIONS SUMMARY

The PLCE-M is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the common elements in an automatic motor control. These elements simulate conditions such as motor off, motor on, etc. These conditions are evaluated by the PLCE in order to perform the required action.
It is a model of an automatic motor control and includes the most common elements in this system such as a speed buttons, control switches, etc.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-MPP. **Stepper Motor Control**

SPECIFICATIONS SUMMARY

It represents a motor control where is possible to emulate the stepper motor.
We can start/stop the stepper motor using a switch.
It has reverse/forward directions controlled by a switch, and it can be controlled in manual or automatic mode.
The speed regulation is controlled using three switches and the position is controlled using an encoder.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-MET. **Star-Delta Connection**

SPECIFICATIONS SUMMARY

It represents a star-delta connection in the secondary and emulates the motor's movement.
Is possible to switch on/off the motor and connect the secondary in star-delta connection using the three-phase contactors.
We can simulate faults with the three-phase fuses and the magnetothermics.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-MCETI. **Reversing Star-Delta Connection**

SPECIFICATIONS SUMMARY

It represents a reversing motor with star-delta connection in the secondary and emulates the motor's movement.
Is possible to switch on/off the motor in both turning directions and connect the secondary in star-delta connection using the three-phase contactors.
We can simulate faults with the three-phase fuses and the magnetothermics.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-MD. **Dahlander Motor Circuit**

SPECIFICATIONS SUMMARY

It represents a Dahlander motor which has two connections of velocity with 2 and 4 poles and emulates the motor's movement.
Is possible to switch on/off the motor in both turning directions and to connect it with 2 or 4 poles using the three-phase contactors.
We can simulate faults with the three-phase fuses and the magnetothermics.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE. **PLC Trainer**

PLC Process Emulators for working with PLCE:

➤Electrical Machines Control (Motors)

PLCE-M2BS. **Motor with 2 Separate Windings**

SPECIFICATIONS SUMMARY

It represents a motor with two separate windings and emulates the motor's movement.
Is possible to switch on/off the motor and to connect the different windings and the secondary with the three-phase contactors.
We can simulate faults with the three-phase fuses and the magnetothermics.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-MAC. **Starting a Wound-Rotor Motor**

SPECIFICATIONS SUMMARY

It represents the starting of a wound-rotor motor where is possible to emulate the motor's movement.
Is possible to switch on/off the motor and to connect the secondary with different loads with the three-phase contactors.
We can simulate faults with the three-phase fuses and the magnetothermics.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

➤Alarms/Current

PLCE-AN. **Annunciator**

SPECIFICATIONS SUMMARY

The PLCE-AN is a training unit to work with PLCE. This unit is provided with switches, push buttons and leds to simulate the commonly elements in an annunciator. These conditions are evaluated by the PLCE in order to perform the required action.
It is a model of an annunciator that is used to display messages through a seven digits display. It includes the most common elements in this device such as a keypad, selection switches, etc. These elements are simulated using switches, push buttons and leds and they are connected to the inputs and outputs of the PLC.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-SLU. **Running Lights**

SPECIFICATIONS SUMMARY

It represents a running lights system where we can emulate the control of the eight lights in different speed, sequence and direction.
We can start/stop the system using a switch and we can do it in automatic or manual state.
We have three kinds of sequences and two directions and an speed control.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE-CPR. **Reactive Current Compensation**

SPECIFICATIONS SUMMARY

It represents a reactive current compensation system where is possible to emulate the connection of three-phase capacitive loads.
We can connect each load using the three-phase contactors.
We can simulate faults with the three-phase fuses.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

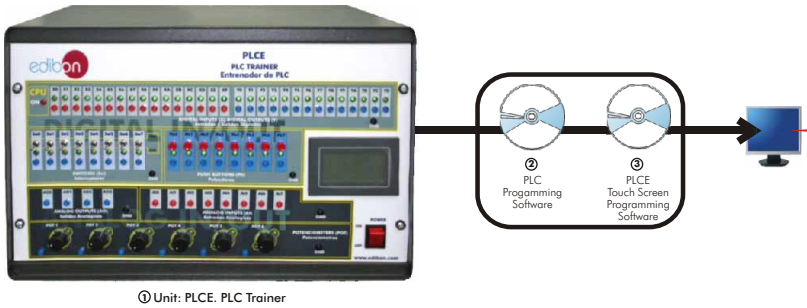
PLCE-MCI. **Reversing Contactor**

SPECIFICATIONS SUMMARY

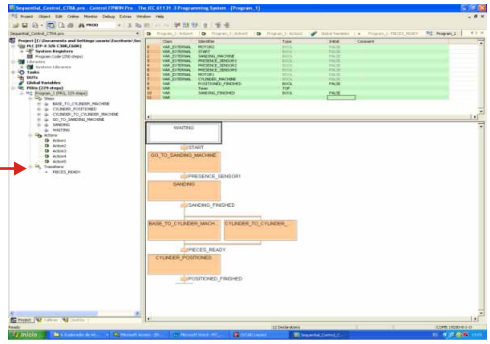
It represents a three-phase motor with reversing contactors and emulates the motor's movement.
Is possible to switch on/off the motor in both turning directions using the three-phase contactors.
We can simulate faults with the three-phase fuses and the magnetothermics.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcprocessemulation/PLCE.pdf

PLCE. **PLC Trainer**



① Unit: PLCE. PLC Trainer



SPECIFICATIONS SUMMARY

Items supplied as standard

The PLCE is a PLC trainer designed by EDIBON. It allows the user to learn about logic programming without any background knowledge or experience.

The PLCE includes digital and analog inputs and outputs, switches, push buttons, potentiometers, etc., allocated in the front panel of the box.

This trainer is provided with a set of practices, through which the user will understand how a PLC works and how to program a PLC application to obtain a required functionality.

The PLCE can also be used to work with the PLC Small Scale Real Applications.

① PLCE. Unit:

Steel box.

Power supply 110-240Vac.

RS232 cable to communicate with PC.

SUB-D connector to communicate with the PLCE applications.

FP-X C30R Panasonic PLC unit. The key features are:

Ultra-high processing speed of 0.32 μs per instruction.

Large Program Capacity of 16 Kstep.

Independent Comment Memory.

Maximum number of I/O points is 300.

3 different I/O modules:

1) Digital I/O module:

Inputs: Number of inputs: 16. Voltage: 24Vdc.

Outputs: Number of outputs: 14. Output type: relay. Output capacity: 2A.

8 On/off switches.

8 Push-buttons.

2) Analog I/O module:

Inputs: Number: 8. Input Range: 0 to +10V.

Outputs: Number: 4. Output Range: -10V to +10V. Resolution: 12bits.

6 Adjustable analog signals: Range: 0 to +10V.

3) Touch screen.

② PLC Programming Software:

Programming software developed according to the standard IEC 61131-3.

Compatible with Windows operating systems.

Five programming languages.

Remote programming, service, and diagnostics.

Minimum program size.

Powerful debugging and monitoring tools.

Supports user created functions and function blocks.

Saves project files inside the PLC.

③ PLCE Touch Screen Programming Software:

Tools for Screen Creation.

Plenty of functions. Screens Creation.

Drawing Functions.

Easy Operativity (Click and slip).

Easy creation of user libraries:

Printing. The different screens of the project can be printed.

Easy use. Bitmaps Editor.

④ Cables and Accessories, for normal operation.

⑤ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 490 x 330 x 310 mm.

Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PRACTICAL POSSIBILITIES

Using the PLC Programing Software:

1.- Understanding how to create different PLC applications and downloading to PLCE.
2.- Developing fundamental programs in different languages:
- Ladder Diagram (LD).
- Structured Text (ST).
- Instructions list (IL).
- Sequential Functional Chart (SFC).
- Functional Block Diagram (FBD).

3.- Studying number systems and data types:
- Decimal, Binary, Octal, Hexadecimal Systems.
- Bool, Integer, Word, Double, etc.

4.- Studying the fundamentals of logic:
- AND, OR, and NOT Functions and Bool Algebra.
- Developing Circuits from Boolean Expressions.
- Producing the Boolean Equation from a Given Circuit.
- Hardwired Logic versus Programmed Logic.
- Programming Word-Level Logic Instructions.

5.- Creating basic applications to test the digital I/O modules:
- Using switches and push-buttons as digital inputs.
- Using LEDs as outputs indicator.

6.- Creating basic applications to test the analog I/O modules:
- Using the analog input to read real analog signals.
- Using the analog outputs to generate analog signals and waveforms.

7.- Understanding how timers work and how to use them to control time-based processes:
- On-Delay timer instructions and function blocks.
- Off-Delay timer instructions and function blocks.
- Cascading Timers.

8.- Understanding how counters work and how counting is carried out:
- Up-Counter.
- Down-Counter.
- Cascading Counters.

9.- Data Manipulation Instructions:
- Data Manipulation.
- Memorize data.
- Data Transfer Operations.
- Data Compare Instructions.

10.- Understanding program control instructions:
- Jump and Conditional Instructions and Subroutines.
- Sequential control.

11.- Using math and arithmetic instructions:
- Addition.
- Subtraction.
- Multiplication.
- Division.
- Additional instructions.

12.- Functions Blocks and libraries.
13.- Complex control systems. PID function.
* Some applications related to these practices are included in the supply.

Using the PLCE Touch Screen Programming Software:

14.- How to create a simple application for the PLCE screen.
15.- How to commute digital outputs of the PLC through the screen.
16.- How to commute several digital outputs simultaneously. (Working with words).
17.- Writing on and reading from a data register.
18.- How to write a data register in a range of values.
19.- Switching from one screen to another.
* Some applications related to these practices are included in the supply.

Specific Applications with the PLC Small Scale Real Applications.

Other practical possibilities:

- It is possible to make simulations without need of any external element, causing analog inputs and/or digital ones, and to observe what happens in the outputs.
- It is also possible to introduce real analog inputs (for example: the transducer value in volts of a temperature sensor) and/or digital inputs (for example: an external pulser) and to connect real actuators in the output, (for example: a pump).

PLCE. **PLC Trainer**

PLC Small Scale Real Applications for working with PLCE:

They are real applications of processes using small units, controlled by the PLCE. We can control process like liquid level, vibration, pressure, flow, proximity, deformation, temperature, etc.
These units are provided with real elements like Hall effect sensors, manometric pressure sensors, thermocouples, LVDT sensors, ultrasound sensors, air compressors, thermistors, encoders, etc.

➤**Sensors**

PLCE-BS1. **Vibration and/or Deformation Test Module**

SPECIFICATIONS SUMMARY

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Extensiometric gauges:
- Gauges of a metallic material that vary their resistance depending on the distortion to which they are going to be subjected.

Heating resistance and thermocouple:
- Resistance used to produce temperature variations in the vibrant bar and to see how this situation affects the extensiometric gauges.
- A K thermocouple place near the resistance measures the bar temperature.

LVDT Sensor:
- Linear displacement sensor, that detects the relative displacement of a ferromagnetic core between the primary and the secondary.

D-SUB to communicate with PLCE.
Connection pins.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 405 x 300 x 350 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PLCE-BS2. **Temperature Test Module**

SPECIFICATIONS SUMMARY

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Bimetallic switch sensor.
Adjustable bimetallic thermostat, with heater resistor that allows minimizing the differential cycles and preventing overpeaks.
Relay AC:
- It allows to turn on and off the heater light bulbs placed over the temperature sensors.

Capillary thermostat.
Thermocouples:
- 3 Cromel-Alumel thermocouples type K.

D-SUB to communicate with PLCE.
Connection pins.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 405 x 280 x 335 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PLCE-BS3. **Pressure Test Module**

SPECIFICATIONS SUMMARY

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Linear positioning sensor (Potentiometer).
LVDT sensor.
Differential pressure sensor.
Extensiometric gauges.
Manometric pressure sensor.
Absolute pressure sensor.
Air Compressor.
D-SUB to communicate with PLCE.
Connection pins.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 270 x 320 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PLCE. **PLC Trainer**

PLC Small Scale Real Applications for working with PLCE:

➤**Sensors**

PLCE-BS4. **Flow Test Module**

SPECIFICATIONS SUMMARY

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Flow optical sensor:
It gives an output in pulses proportional to the liquid flow. It is made up of a paddle wheel, placed on the fluid current that turns producing a pulse signal while passing between the emitter and the paddle detector.
High resolution optical flow sensor:
It works in the same way as the sensor just described with the difference that it is able to measure with a good resolution very low flow. At the output of this sensor we get a pulse signal with a frequency proportional to the flow volume that crosses the sensor.
Underwater pump:
The variation in the pump power supply voltage enables to change the water volume in the test module.
Level sensor by pressure:
It is a differential pressure sensor that measures the pressure practice by the water in relation to the atmospheric pressure, so the liquid level in the tank can be calculated.
Differential pressure sensor (Hole board system):
This sensor is connected to a hole-board system to measure the pressure difference caused by the volume narrowing of the conduct through which the water flows.
On this way, with the measurement of the pressure difference between the hole board water output and input, it is possible to calculate the water volume that crosses the board.
Changeable flow meter:
Using a small floating buoy that is inside the tube calibrated in liter/minute, it can be read the volume measure flowing through the pipe.
V narrowing:
The connection between the main and the secondary tank, a dam, includes a "V" narrowing. The altitude of the water level above the dam bottom is a very precise measure of the flow relation. The ruler fixed on the right end of the tank will show this height. Main and secondary tanks.
D-SUB to communicate with PLCE.
Connection pins.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 405 x 280 x 400 mm. approx. Weight: 10 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PLCE-BS5. **Ovens Test Module**

SPECIFICATIONS SUMMARY

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Oven chamber.
Heating resistance:
Oven heating resistance made up of two parallel resistances with a maximum dissipation power of 500W.
Inside the heating element there is a temperature sensor element.
Fan:
Fan with changeable speed that can be operated varying the fan energy supply voltage.
Thermocouples:
4 thermocouples placed inside the oven, each one of them at a different height.
Platinum resistance thermometer:
Platinum resistance temperature detector, suitable for measuring air and gas temperatures.
Thermistor:
NTC thermistor for temperature measurement and control, with great sensitivity and stability.
Semiconductor temperature sensor:
Reverse polarized diode. The current through the diode depends on the temperature at which balance with the surrounding environment is achieved.
Therefore it needs a conditioning circuit able to transform this current variation in voltage proportional to temperature.
D-SUB to communicate with PLCE.
Connection pins.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 405 x 300 x 470 mm. approx. Weight: 10 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PLCE. **PLC Trainer**

PLC Small Scale Real Applications for working with PLCE:

➤**Sensors**

PLCE-BS6. **Liquid Level Test Module**

SPECIFICATIONS SUMMARY

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Water tanks.
Capacitative level sensor:
Level sensor immersed in the tank.
Pressure level sensor.
It is a differential pressure sensor that measures the pressure practiced by the water compared to the atmospheric pressure.
Level gauge changeable resistance with path end and beginning switches:
It is a resistance fixed to a float arm that will vary its position compared to the water level. This system complements itself with two end and beginning path switches respectively.
Conduction sensor:
This sensor works with two electrodes immersed in one of the tanks. As the water level rises and covers the electrodes its resistance will decrease until it arrives to KΩ unit values, as long as the water does not touch the electrodes, the resistance between them will be very big and will behave like an open circuit.
Magnetic float level sensor:
Sensor formed by a small float that has inside a magnetic element, the float base has a Hall effect element that detects when the float has gone up due to the effect of the water.
Optical level sensor:
It is a photodiode and phototransistor, which in presence of water changes its refraction properties and make the output state approximately change from 3Vdc to 0Vdc.
2 Minipumps:
The volume supplied by these pumps can be regulated varying the dc voltage value with which they are supplied.
D-SUB to communicate with PLCE.
Connection pins.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 400 x 300 x 400 mm. approx. Weight: 10 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PLCE-BS7. **Tachometers Test Module**

SPECIFICATIONS SUMMARY

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Inductive Sensor.
DC Motor.
DC Tachometer.
Refractive Infrared Sensor:
Sensor where an infrared emitting diode and an NPN silicon phototransistor encased side-by-side on coverging optical axes in a black thermoplastic housing.
Slot Sensor:
Slotted optical switch where an input LED and an output phototransistor are capsulated.
Hall Effect:
Hall-effect position sensor where exist a relationship between supply voltage and the combined effects of a change in sensitivity (gain) and null voltage output at room temperature.
Encoder:
This optical encoder contains a lensed LED source, an integrated circuit with detectors and output circuit, and a codewheel which rotates between the emitter and the detector IC.
D-SUB to communicate with PLCE.
Connection pins.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 300 x 200 x 200 mm. approx. Weight: 10 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PLCE. **PLC Trainer**

PLC Small Scale Real Applications for working with PLCE:

➤**Sensors**

PLCE-BS8. **Proximity Test Module**

SPECIFICATIONS SUMMARY

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
DC Motor.
Proximity capacitative sensor:
It can detect metallic objects.
Hall effect sensor:
Proximity switch using the Hall effect, switching when there is a magnetic field.
Infrared sensor by reflection:
Emission narrow beam GaAs IR Emitter. Detection narrow beam IR Photodetector.
Transmission infrared sensor:
Emission narrow beam GaAs IR Emitter. Detection narrow beam IR Photodetector.
Conduction sensor:
Proximity sensor with plate sensible to magnetic fields. Contact material: Rhode.
Inductive sensor:
Sensor that gives variations in the output voltage as a variation of the magnetic field, caused by the near ferromagnetic material movement.
Ultrasound sensor.
D-SUB to communicate with PLCE.
Connection pins.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 400 x 270 x 200 mm. approx. Weight: 10 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PLCE-BS9. **Pneumatic Test Module**

SPECIFICATIONS SUMMARY

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Proportional valve 1 and 2.
Differential pressure sensor.
Pneumatic switch.
LVDT Sensor.
Regulation filter.
D-SUB to communicate with PLCE.
Connection pins.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 300 x 300 x 300 mm. approx. Weight: 10 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PLCE-BS10. **Light Test Module**

SPECIFICATIONS SUMMARY

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Photodiode:
This sensor converts light into either current or voltage, depending upon the mode of operation.
Phototransistor: It also consists of a photodiode with internal gain.
Light Dependent Resistor:
A LDR is a resistor whose resistance decreases with increasing incident light intensity.
Photovoltaic Cell:
A photovoltaic cell converts solar radiation into direct current electricity.
Infrared emitter-receiver:
This element consists of a IR emitter LED and IR phototransistor.
D-SUB to communicate with PLCE.
Connection pins.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions: 405 x 300 x 350 mm. approx. Weight: 10 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcrealapplications/PLCE.pdf

PLC-IN. **PLC Industrial Control System**

SPECIFICATIONS SUMMARY

The EDIBON PLC-IN is a PLC Industrial Control System that use Allen-Bradley ControlLogix system. The ControlLogic system allows to connect elements like HMI (Human Machine Interface), drives, frequency controllers, starters, sensors, safety elements and much more other devices for simulating real situations in the industry.

* Note: This PLC-IN system can work with any other PLC, as: Siemens, Omron, Panasonic, etc.

The system is composed by a PLC connected to a switch for creating an EtherNet/IP network. HMI touch screen is integrated in this network.

The system will allow to program different real industrial situations like use of PID and analogue signal and digital inputs/outputs.

The system admits four different programming languages:

Relay Ladder programming language.

Function block diagram.

Sequential function chart.

Structured text.

The system also shows how to program HMI and configure different front panels and applications. During practices user learns how to program faults and status messages and inputs and outputs variables.

There is also a panel with AC and DC busbars for supply different voltage levels. And also the inputs and Outputs of the PLC will be easily presented for making connections.

Additionally in this panel there are typical elements like pushbuttons, lights, and other to simulate inputs and outputs to the PLC.

Some of the elements presented in this panel will be used in the assembly of different typical electrical applications.

Technical Data:

Allen-Bradley ControlLogix system:

-32 Digital Inputs. and 32 Digital Outputs.

-8 Analogue Inputs of current or voltage.

-4 Analogue Outputs of current or voltage.

-Logix Processor 5561.

-Bridge EtherNet Module 10/100.

-Power supply 110/220 Vac for PLC.

-Software.

Allen-Bradley Versa View 1200P. Integrated Display and Workstation (HMI):

-Touchscreen Option: Resistive anti-glare.

-Processor Type: Celeron M 1.06 GHz.

-I/O: 4 USB 2.0, 2 10/100/1000 EtherNet, 1 serial port, audio in/out and microphone.

-Software.

Stratix 2000 Unmanaged EtherNet Switch:

For network, and all devices communication (included some devices from the applications).

-5 ports for RJ 45 EtherNet/IP standard cables.

Additional elements: 8 Pushbuttons with NO/NC contacts. 2 Start/Stop push buttons. 3 ON/OFF switches. 1 Cylinder lock operator. 2 End switches. 2 Power relays. 4 Contactors. 1 Timer. 2 Emergency pushbutton. 8 lights (different colours). 2 Buzzers. Three-phase 380/220 V. transformer.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Available Industrial PLC Applications:

(for working with PLC-IN)

PLC-IN-1. **Motor Control Application:**

- Direct Starter.
- Soft Starter.
- Frequency Drive.
- Squirrel Cage AC Motor.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcindustrial/PLC-IN.pdf

PRACTICAL POSSIBILITIES

PLC-IN. **PLC Industrial Control System:**

Some PLC Practical Possibilities:

1.- PLC Programming and Download to the PLC. Running Applications.

PLC Programming with different languages:

2.- Relay Ladder (LD).
3.- Function Block Diagram (FBD).
4.- Sequential Function Chart (SFC).
5.- Structured Text (ST).

Using math and arithmetic instructions:

6.- Addition.
7.- Subtraction.
8.- Multiplication.
9.- Division.
10.- Aditional instructions.

Studying Number Systems and Data Types:

11.- Decimal, Binary, Octal, Hexadecimal Systems.
12.- Bool, Integer, Word, Double, etc.

Studying the fundamentals of logic:

13.- AND, OR, and NOT Functions and Bool Algebra.
14.- Developing Circuits from Boolean Expressions.
15.- Producing the Boolean Equation from a Given Circuit.
16.- Hardwired Logic versus Programmed Logic.
17.- Programming Word-Level Logic Instructions.
18.- Use of Functions Blocks and libraries.
19.- Timer/Counter instructions and function blocks.

Creating basic applications to test the analog I/O modules:

20.- Using the analog input to read real analog signals.
21.- Using the analog outputs to generate analog signals and waveforms.

Creating basic applications to test the digital I/O modules:

22.- Connecting hardware inputs (push buttons, timers, etc).
23.- Connecting hardware outputs (lamps, contactor coils, etc.).

Configuration of control loops:

24.- An open loop (start end switch stop).
25.- An analogue input PID with analogue output and alarm.
26.- An analogue input PID with PWM output.
27.- Configuring single and dual loops.

* Some applications related to these practices are included in the supply.

Some HMI (Human Machine Interface) Practical Possibilities:

28.- Connection of the HMI to the PLC.
29.- Ethernet/IP connection and starting.
30.- How to create a simple application for the HMI screen.
31.- How to simulate digital / analog inputs from the HMI
32.- How to operate digital/analog outputs from the HMI.
33.- Industrial type applications simulation.

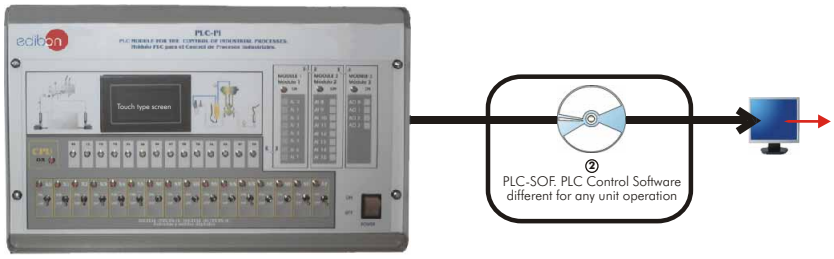
Some Electrical Applications Practical Possibilities:

34.- Programmable interlocks in control circuits.
35.- Relay operation from control line to power line.
36.- Contactors and power elements control from the PLC.
37.- Timer configuration for on delay, off delay, etc.
38.- Contactors actuated by hardware timers.
39.- Manoeuvre Counters and actuation according to pushbutton pulses.
40.- Alarm actuation caused by end switches detection.
41.- Emergency stop and acoustic and light alarms.

PLC-IN-1. **Motor Control Application:**

1.- Connecting devices to the Ethernet / IP.
2.- Squirrel cage Delta/Star connection and parameters measurement.
3.- Electrical protections wiring associated to the electrical machine installation.
4.- Delta/Star running of a squirrel cage asynchronous machine.
5.- Direct/Inverse rotation of motor.
6.- Connecting a Direct Starter. Local Mode start and setting adjustment.
7.- Connecting a Direct Starter. Remote Mode start and setting adjustment.
8.- Connecting a Soft Starter. Local Mode start and setting adjustment.
9.- Connecting a Soft Starter. Remote Mode start and setting adjustment.
10.- Connecting a Frequency Drive. Local Mode start and setting adjustment.
11.- Connecting a Frequency Drive. Remote Mode start and setting adjustment.
12.- Ramps up and slow down program of the Frequency converter.
13.- Programming steps in motor control devices, according to external signals.
14.- Alarm wiring and programming of Electrical machines control devices.

PLC-PI. **PLC Module for Unit Operations Control** (for working with EDIBON Computer Controlled Units)



①Unit: PLC-PI. PLC Module for Unit Operations Control (for working with EDIBON Computer Controlled Units)

SPECIFICATIONS SUMMARY

Items supplied as standard

①PLC-PI. Unit:

This PLC-PI unit contains a box, with a front panel in order to manipulate the unit in a simple and easy way, the power supply and all necessary connectors and cabling and, additionally, the PLC itself with its own touch screen. We have design and supply the proper software for any particular application (for each particular EDIBON Computerized Teaching Unit).

Steel box.

Circuit diagram in the front panel.

Front panel:

Digital inputs(X) and Digital outputs (Y) block. 16 Digital inputs. 14 Digital outputs.

Analog inputs block: 16 Analog inputs. Analog outputs block: 4 Analog outputs.

Touch screen.

Back panel:

Power supply connector.

Fuse 2A.

RS-232 connector to PC.

USB 2.0 connector to PC.

Inside:

Power supply outputs: 24 Vdc, 12 Vdc, -12 Vdc, 12 Vdc variable.

Panasonic PLC:

High-speed scan of 0.32 µsec. for a basic instruction.

Program capacity of 32 Ksteps, with a sufficient comment area.

Multi-point PID control.

Digital inputs/outputs and analog inputs/outputs Panasonic modules.

Communication RS232 wire, to computer (PC).

②PLC-SOF. PLC Control Software:

For each particular EDIBON Computerized Teaching Unit.

③ Cables and Accessories, for normal operation.

④ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =Unit: 490 x 330 x 310 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcunitoperations/PLC-PI.pdf

PRACTICAL POSSIBILITIES

1.- Control of the particular unit process through the control interface box without the computer (PC).
2.- PID control.
3.- Visualization of all the sensors values used in the particular unit process.
4.- Calibration of all sensors included in the particular unit process.
5.- Hand on of all the actuators involved in the particular unit process.
6.- Realization of different experiments, in automatic way, without having in front the particular unit. (This experiment can be decided previously).
7.- Simulation of outside actions, in the cases hardware elements do no exit.
8.- PLC hardware general use and manipulation.
9.- PLC process application for the particular unit.
10.- PLC structure.
11.- PLC inputs and outputs configuration.
12.- PLC configuration possibilities.
13.- PLC program languages.
14.- PLC different programming standard languages.
15.- New configuration and development of new process.
16.- Hand on an established process.
17.- Visualization and see the results and to make comparisons with the particular unit process.
18.- Possibility of creating new process in relation with the particular unit process.
19.- PLC Programming exercises.
20.- Own PLC applications in accordance with teacher and student requirements.

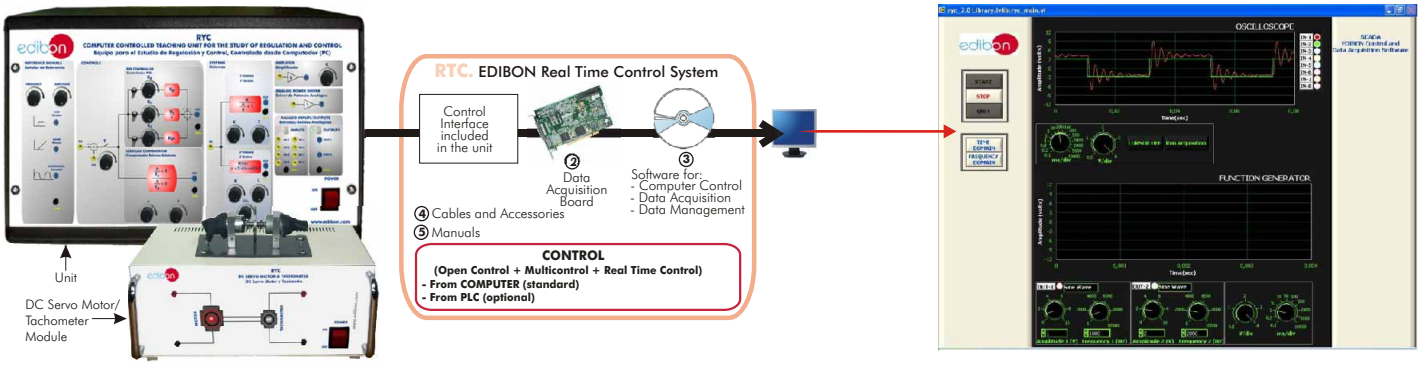
EDIBON FP-X-CPU. **PLC,** with no additional elements

SPECIFICATIONS SUMMARY

Inputs: 8.
Output: 6.
Output type: Relay 2A/pt Max.
Execution time: 0.32μs.
Data memory: 12285.
Bit memory: 4096.
High Speed Counter.
Number of interruption programs: 15 programs (14 external, 1 internal).
Dimension (w, d, h): 60 x 79 x 90 mm.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/plcunitoperations/EDIBON%20FP-X-CPU.pdf

RYC. Computer Controlled **Teaching Unit for the Study of Regulation and Control**



① Unit: RYC. Teaching Unit for the Study of Regulation and Control

SPECIFICATIONS SUMMARY

Items supplied as standard

① RYC. Unit:

The RYC is a Regulation and Control training unit designed by EDIBON. It allows students to learn the most important concepts about Regulation and Control in an easy and quick way. The unit is provided with a set of practices, through which the user will understand how to characterize first and second order systems and how a PID controller works.

Unit:

Metallic box. Diagram in the front panel with similar distribution to the elements in the real unit.

This unit includes the following modules:

Reference signals module: It allows to generate three different types: step, ramp and sinusoidal. The frequency and amplitude of the signals can be adjusted using the potentiometers.

PID controller module: It is subdivided into proportional, integrative and derivative blocks. Each block has its own potentiometer to adjust each parameter independently.

Lead / Lag Compensator: It represents a compensator system in the Laplace domain. The system has a potentiometer z to modify the zero, p to modify the pole and K to modify the gain of the compensator.

First Order System: It represents a first order system in the Laplace domain. The system has a potentiometer T to modify the time constant of the system. The gain can be also adjusted using the K potentiometer.

Second Order System: It represents a second order system in Laplace domain. The system has three potentiometers to modify the three parameters of the system: gain K, damping coefficient and the natural frequency.

Amplifier module: It can be used for signal amplification. There is a potentiometer, K, to adjust the gain of the amplifier.

Analog Power Driver: It consists of a power amplifier that can be used as the last stage when a application requires high power supply (for example a DC Motor, pump, etc).

Analog I/O: It is provided with 8 analog inputs and 2 analog outputs. The inputs are used to visualize different signals in the computer. The analog outputs are for signal generation.

Control Interface included.

DC Servo Motor/Tachometer Module:

Metallic box. DC Servo Motor (speed: 3600 rpm max.). Tachometer (speed: 3600 rpm max.).

② DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

③ RYC/CCSOF. Computer Control+Data Acquisition+Data Management Software:

Registration and visualization of all process variables in an automatic and simultaneously way. Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

④ Cables and Accessories, for normal operation.

⑤ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 490 x 330 x 310 mm. Weight: 10 Kg.
DC Servo Motor/Tachometer Module: 310 x 220 x 145 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/automationregulation/RYC.pdf

PRACTICAL POSSIBILITIES

1.- Response of a first order system in time domain. (Step-response).
2.- Response of a first order system in time domain. (Ramp-response).
3.- Response of a first order system in time domain. (Sinusoidal-response).
4.- Response of a first order system in frequency domain. (Sinusoidal-response).
5.- Response of a second order system in time domain. (Step-response).
6.- Response of a second order system in time domain. (Ramp-response).
7.- Response of a second order system in time domain. (Sinusoidal-response).
8.- Response of a second order system in frequency domain. (Sinusoidal-response).
9.- Phase Lead Compensator experiment.
10.- Phase Lag Compensator experiment.
11.- Structure of a PID controller (Proportional-Integrative-Derivative blocks).
12.- PID control of a first order system in open-loop.
13.- PID control of a second order system in open-loop.
14.- PID control of a first order system in closed- loop. (Mathematical tuning)
15.- PID control of a first order system in closed- loop. (Experimental tuning)
16.- PID control of a first order system in closed- loop. (Ziegler -Nichols tuning).
17.- PID control of a second order system in closed- loop. (Mathematical tuning).
18.- PID control of a second order system in closed- loop. (Experimental tuning).
19.- PID control of a second order system in closed- loop. (Ziegler -Nichols tuning).
20.- Characterization of a DC motor.
21.- DC motor speed control with a PID controller.

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

SPECIFICATIONS SUMMARY

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

Metallic enclosure, including all the modules and elements.

Power Supply.

Protection fuse.

Block diagrams in the front panel.

The unit includes the following modules:

Reference signals:

Step, Ramp and Sine.

PID controller:

P controller, I controller and D controller.

Systems:

First Order System.

Second Order System.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 490 x 330 x 310 mm.
Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/automationregulation/RYC-B.pdf

PRACTICAL POSSIBILITIES

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

CECI. **Industrial Controllers Trainer**

SPECIFICATIONS SUMMARY

Trainer for industrial process controllers. This trainer allows students the study and familiarisation with the function and operation of a industrial process controller.

Configurable digital controller:

2 inputs, 1 output. Configurable as P, PI or PID controller. Proportional gain X_p: 0 -999.9%. Integral action time T_n: 0-3600s. Derivative time T_v: 0-1200s. RS232 interface for configuration on computer (PC).

Digital voltmeter: 0 -20V.

Signal generator with potentiometer. Reference variables generator: 2 voltages selectable. Output voltage: 0-10V.

Controlled system simulator:

Controlled system type: First order lag. Time constant: 20s.

All variables accessible as analog signals at lab jacks .

Possibility of connection of external instruments via lab jacks (for example: line recorder, plotter, oscilloscope...).

Configuration software CD. Interface cable. Set of lab cables.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= 490 x 330 x 310 mm. Weight: 8 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/automationcontrol/CECI.pdf

PRACTICAL POSSIBILITIES

To study methods and terminology of process control:

1.- Closed loop control.
2.- Static and dynamic transfer function.
3.- To study the step response.
4.- Reference variable step.

To learn and to familiarise with a process controller:

5.- Configuration level.
6.- Parameter level.
7.- Operation control levels.

Control parameters:

8.- Setting input channels.
9.- Setting output channels.
10.- To use computer (PC)-based configuration tools.
11.- Scaling displays.

CRCI. **Industrial Controllers Networking**

SPECIFICATIONS SUMMARY

This trainer enables to take the first steps in process automation using field buses. This trainer demonstrates the operation of a process control system based on a simple application. This trainer allows student the familiarisation with the function and operation of an industrial process controller.

2 Digital process controllers, with field bus interface:

Configurable as P, PI or PID controller. Proportional gain X_p: 0-999.9%. Integral action time T_n: 0-3600s. Derivative time T_v: 0- 1200s. Controller parameter setting via field bus system.

2 Signal generators: 0-10V. Profibus DP interface card for computer (PC).

Process variables as analog signals: 0-10V. All variables accessible as analog signals at lab jacks.

Software CD with driver software, OPC server and process control software.

Possibility of connection of external instruments via lab jacks (for example: line recorder, oscilloscope, etc). Set of cables.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)=490 x 330 x 310 mm. Weight: 12 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/automationcontrol/CRCI.pdf

PRACTICAL POSSIBILITIES

1.- Function of a digital industrial controller.
2.- Layout of a field bus system.

To learn and to familiarise with the operation and structure of a process control system under Profibus DP:

3.- Controller parameter setting via field bus system.
4.- Profibus DP field bus system.
5.- OPC (OLE for Process Control) server function.
6.- Online controller parameters setting.
7.- Master / slave assignment.
8.- To configure and display alarms.
9.- Reading control variables and displaying them online.
10.- Scaling displays.
11.- Bus configuration.

CEAB. **Trainer for Field Bus Application**

SPECIFICATIONS SUMMARY

This Trainer is used to teach the initial or first steps in field bus tecnology based on Profibus DP. The field bus permits networking terminal devices (controllers, actuators or sensors) in the plant system (field level) with the control room (control level).

Several devices (slaves) are activated and read by a computer (PC) with a Profibus DP interface (master).

Different subjects or topics can be covered and studied: bus topology, system configurator with Device Master File "DMF", communication protocols, tags, OPC server, output and input process data, etc.

Digital process controller, with Profibus DP interface:

Configurable as P, PI or PID controller. Proportional gain X_p:0-999.9%. Derivative time T_v:0-1200s. Integral action time T_n: 0-3600s.

Signal generators: 0-10V. Digital voltmeter: 0-20V.

Digital Profibus DP I module. Digital Profibus DP O module. Four digital inputs. Four digital outputs.

Analog Profibus DP I module. Analog Profibus DP O module. Four analog inputs: 0-10V. Two analog outputs: 0-10V.

Profibus DP interface card for computer (PC).

Process variables as analog signals at lab jacks: 0-10V.

Software CD with driver software, system configurator, OPC server and process control software.

Possibility of connection of external instruments via lab jacks (for example: chart recorder, oscilloscope, etc). Set of cables.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= 490 x 330 x 310 mm. Weight: 12 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/automationcontrol/CEAB.pdf

PRACTICAL POSSIBILITIES

1.- Operation and function of a digital industrial controller.
2.- Function of an analog input/outputs module.
3.- Function of a digital input/output module.
4.- Layout of a field bus system.
5.- Familiarisation with the field bus stations.
6.- Defining the bus technology with the stations.
7.- Reading out and in, and online displaying of analog and digital process variables.
8.- Communication protocols.
9.- To define tags.
10.- Familiarisation with the device master file "DMF".
11.- OPC server.
12.- Access to the OPC database from the process control program.

CEAC. **Controller Tuning Trainer**

SPECIFICATIONS SUMMARY

Trainer for controller tuning. This unit permits the interaction between controller and controlled system. The objective is that the closed control loop, formed by the controller and the controlled system, to show the desired optimum response.

With a simulation software the setting of controller parameters can be practised safely. Closed and open loop control, step response, stability, disturbance and control response are demonstrated.

This trainer no needs real controlled systems, the controlled system is simulated on a computer (PC) by the simulation program. In this program the most important types of controlled systems can be selected.

The process controller used can be easily configured from the computer (PC). The controller and the computer (PC) are connected by a data acquisition card with AD and DA converters.

Configurable digital process controller, with interface:

Configurable as P, PI or PID controller. Proportional gain X_p: 0-999.9%. Integral action time T_n: 0-3600s. Derivative time T_v: 0-1200s.

Interface for computer (PC). Data acquisition card for computer (PC).

Simulation Software for controlled system models, such as 1st and 2nd order lags, time-delayed systems etc. Controlled system simulation models with proportional, integral, 1st order lag, 2nd order lag, time-delayed response, non-linearity and limitation.

Configuration software for process controller. Recording and evaluation of time response on computer (PC). Set of cables.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)= 490 x 330 x 310 mm. Weight: 8 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/automationcontrol/CEAC.pdf

PRACTICAL POSSIBILITIES

1.- To use commonly applied tuning rules, such as Ziegler-Nichols.
2.- To study the difference between open and closed loop control.
3.- Control loop comprising controller and controlled system.
4.- To determine the system parameters.
5.- Closed-loop control system response.
6.- Choice of optimum controller parameters.
7.- Stability, steady state and transient response.
8.- Study and investigation of control and disturbance response.
9.- Study of the stability of the closed control loop.
10.- Learning methods and terminology involved in process control.
11.- To adapt the process controller to different controlled systems.
12.- Use and practices with the simulation software.

EPID-T. **Industrial Regulation Trainer, PID type (Temperature)**

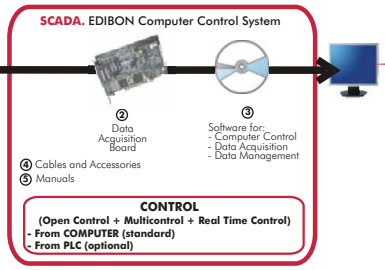
SPECIFICATIONS SUMMARY

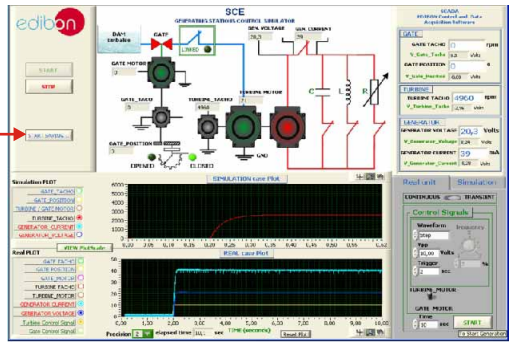
Steel box with handles for an easy transport.
Diagram in the front panel.
The processes regulator is integrated on the unit itself, as well as the universal converter to measure the temperature.
Terminals for an easy and quick connection.
High accurecy temperature controller: PID control with +/- 0.2 scale background.
Possibility of 18 types of analog inputs (thermocouples: K, J, R, S, B, E, T, etc.; inputs in current, inputs in voltage, RTD), connected to terminal connections
2 digital inputs, connected to some terminal connections, with input for a 4 wires thermoresistance.
3 digital outputs. 3 different types of outputs: relay output, output in voltage and output in current 4-20mA DC.
Auto tuning for PID automatic setting.
An alarm in case of heater breakdown is available.
2nd. optional output for the heat-cold control, ON/OFF control of double actuation.
Communication functions: RS485 ASCII / Modbus.
Double display for visualization of the actual value and of the set point control.
Programing software.
Programing and visualization from computer (PC).
Cables and Accessories for normal operation.
Manuals: This unit is supplied with 8 manuals
Dimensions(approx.): 310mm x 220mm x 145mm. Weight:5 Kg. approx.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/automationcontrol/EPID-T.pdf

SCE. Computer Controlled **Generating Stations Control and Regulation Simulator**

① Unit: SCE. Generating Stations Control and Regulation Simulator





SPECIFICATIONS SUMMARY

Items supplied as standard

① SCE. Unit:

Unit designed to simulate the regulation behaviour of a hydroelectric generating station ,as a didactic application with different aspects of regulation, control and simulation.

Anodized aluminum structure. Diagram in the front panel with similar distribution to the of the elements in the real unit.

It is possible to work with this unit in 2 ways:

- REAL mode (continuous or transient analysis).
- SIMULATED mode.

The unit consists mainly of an interface for the conditioning of input and output signals.

For its part, this one will be connected to the computer and to the two subsystems that we try to control: Gate subsystem and turbine-generator subsystem.

The unit has (in the interface) some switches to establish different loads to the generator output and different conditions of the real system.

Gate subsystem: It consists of a motor that controls the gate opening, and some mechanisms that emulate it.

Turbine-generator system: This subsystem will be analyzed separately or linked up with the previous one, achieving that the motor that simulates the turbine turns according to the gate opening percentage. This turbine is connected with a generator system and with a system that simulates different loads (inductive, capacitive or resistive). Three loads in parallel are connected at the generator output, that simulate the consumption of the energy distribution system: Variable resistance, capacitance and inductance.

Control interface.

② DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

③ SCE/CCSOF. Computer Control + Data Acquisition + Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second guaranteed. It allows the registration of the alarms state and the graphic representation in real time.

This Software has got 2 operating modes: REAL mode: through motors, actuators and sensors that the unit includes (Continuous, transient). SIMULATED mode: through the mathematical modelization of the motors, previously mentioned.

④ Cables and Accessories, for normal operation.

⑤ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 405 x 350 x 250 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/systems/SCE.pdf

PRACTICAL POSSIBILITIES

1.- Modelization of the motor as a standard motor.

2.- Modelization of the motor with the constants corrections of the mathematical model.

3.- Calculation of the dynamos speed constant.

4.- Obtaining of the transient responses of the gate motor.

5.- Obtaining of the transient response of the turbine motor.

6.- Obtaining of the transient response of the gate simulated motor.

7.- Obtaining of the transient response of the turbine simulated motor.

8.- Comparative analysis of the transient response of the turbine real motor vs the transient response of the simulated motor for resistive load.

9.- Comparative analysis of the transient response of the turbine real motor vs the transient response of the simulated motor for capacitive load.

10.- Comparative analysis of the transient response of the turbine real motor vs the transient response of the simulated motor for inductive load.

11.- Comparative analysis of the response of the gate real motor vs the response of the gate simulated motor for continuous (manually from the computer) control signals.

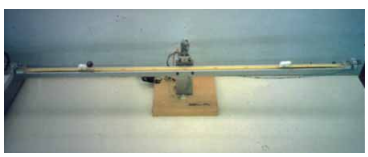
12.- Comparative analysis of the response of the gate real motor vs the response of the gate simulated motor for sinusoidal control signals.

13.- Comparative analysis of the response of the gate real motor vs the response of the gate simulated motor for square control signals.

14.- Comparative analysis of the response of the gate real motor vs the response of the gate simulated motor for triangular control signals.

15.- Comparative analysis of step response between real motor and simulated motor (gate or turbine).

SBB. **Ball and Beam System**



SPECIFICATIONS SUMMARY

Unit for the study of the stabilization of a naturally unstable system, and control of the position of the ball.

The system allows to place a ball moving along a guide, oscillating from the central point, at any desired point of the guide.

Self-contained unit with direct connection to the main, and with interface with other systems through terminals, to connect the inputs and outputs.

All power and electronics measurements inside de unit.

Possibility to use an analogical or digital controller.

The unit includes:

DC motor with gear box, and armature controlled, that alllows the oscillating movement of the guide adjusted to the motor axis.

Rod with guide for ball displacement and Ball.

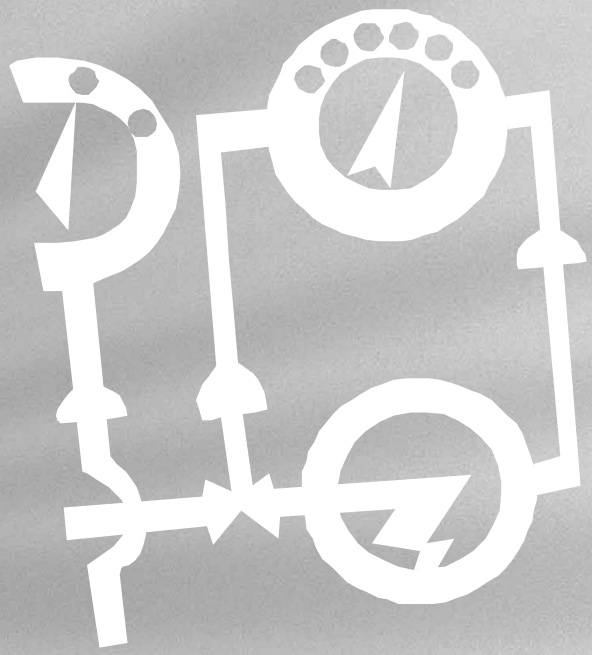
Ball position sensor in the guide, rod inclination angle (potentiometer) and motor speed (tachometric dynamo).

More information in: www.edibon.com/products/catalogues/en/units/automationsystems/systems/SBB.pdf

CPVM. **DC Motor Position and Speed Control**

Summarized
Catalogue

two(2)



10. Process Control

page

10.1. Process Control. Fundamentals. 172-176
10.2. Industrial Process Control. 177

edibon

www.edibon.com

page

10.1- Process Control. Fundamentals

-UCP Computer Controlled **Process Control System (with electronic control valve):** 172

- •UCP-UB **Base Unit.** (Common for all Sets for process control type "UCP").

Sets (sensor and elements + computer control software) **used in the base unit**

- •UCP-T **Set for Temperature Process Control.**
- •UCP-C **Set for Flow Process Control.**
- •UCP-N **Set for Level Process Control.**
- •UCP-PA **Set for Pressure Process Control.**
- •UCP-PH **Set for pH Process Control.**
- •UCP-CT **Set for Conductivity and TDS (Total Dissolved Solids) Process Control.**

-UCPCN Computer Controlled **Process Control System (with pneumatic control valve):** 173

- •UCPCN-UB **Base Unit.** (Common for all Sets for process control type "UCPCN").

Sets (sensor and elements + computer control software) **used in the base unit**

- •UCPCN-T **Set for Temperature Process Control.**
- •UCPCN-C **Set for Flow Process Control.**
- •UCPCN-N **Set for Level Process Control.**
- •UCPCN-PA **Set for Pressure Process Control.**
- •UCPCN-PH **Set for pH Process Control.**
- •UCPCN-CT **Set for Conductivity and TDS (Total Dissolved Solids) Process Control.**

-UCPCV Computer Controlled **Process Control System (with speed controller):** 174

- •UCPCV-UB **Base Unit.** (Common for all Sets for process control type "UCPCV").

Sets (sensor and elements + computer control software) **used in the base unit**

- •UCPCV-T **Set for Temperature Process Control.**
- •UCPCV-C **Set for Flow Process Control.**
- •UCPCV-N **Set for Level Process Control.**
- •UCPCV-PA **Set for Pressure Process Control.**
- •UCPCV-PH **Set for pH Process Control.**
- •UCPCV-CT **Set for Conductivity and TDS (Total Dissolved Solids) Process Control.**

-UCP-P Computer Controlled **Process Control Unit for the Study of Pressure (Air).** 175

-CECI **Industrial Controllers Trainer.** 176

-CRCI **Industrial Controllers Networking.** 176

-CEAB **Trainer for Field Bus Applications.** 176

-CEAC **Controller Tuning Trainer.** 176

page

10.2- Industrial Process Control

-CPIC Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (Flow, Temperature, Level and Pressure). 177

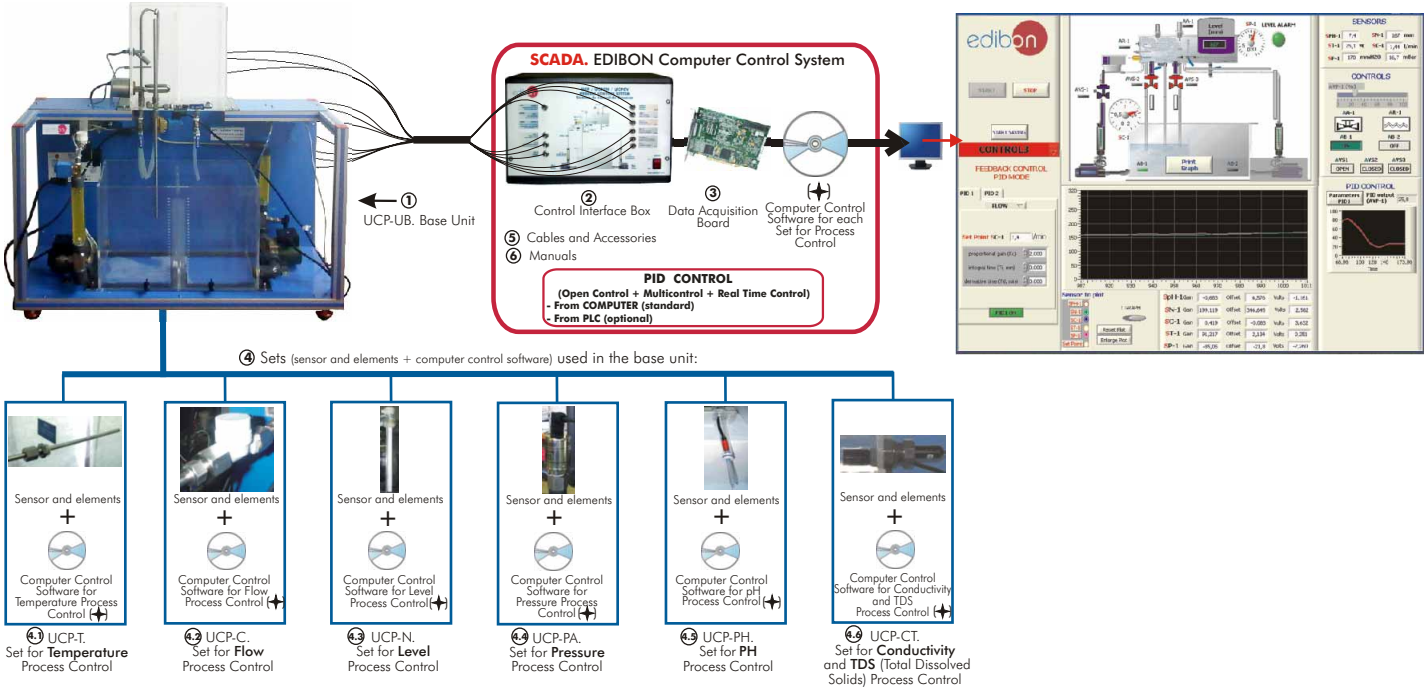
-CPIC-C Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Flow).

-CPIC-T Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Temperature).

-CPIC-N Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Level).

-CPIC-P Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Pressure).

UCP. Computer Controlled **Process Control System, with electronic control valve :**



SPECIFICATIONS SUMMARY

Common items for all Process Control parameters:

① UCP-UB. Unit:
This unit is common for all Sets for Process Control type "UCP" and can work with one or several sets.
Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit. Main tank and collector with an orifice in the central dividing wall. (2 x 25 dm^3), and drainage in both compartments. Dual process tank (2 x 10 dm^3), interconnected through an orifice and a ball valve and an overflow in the dividing wall; a graduate scale and a threaded drain of adjustable level with bypass. Centrifugal pumps. Variable area flow meters (0.2-2 l/min, and 0.2-10 l/min), and with a manual valve. Line of on/off regulation valves (solenoid), and manual drainage valves of the upper tank. Proportional valve: motorized control valve.

② UCP/CIB. Control Interface Box :
This is common for all Sets for Process Control type "UCP" and can work with one or several sets.
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/ Outputs.

④ Sets (sensor and elements + computer control software) used in the base unit: (These Sets will be supplied and installed in the Base Unit and ready for working)

④.1 UCP-T. Set for Temperature Process Control:
Temperature sensor "J type". Electric resistor (0.5 KW). Helix agitator. On/off level switch.
Computer Control Software for Temperature Process Control:
(#) Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

④.2 UCP-C. Set for Flow Process Control:
Turbine type flow sensor.
Computer Control Software for Flow Process Control. **(#)**

④.3 UCP-N. Set for Level Process Control:
0-300mm level sensor (of capacitive immersion, 4-20mA).
Computer Control Software for Level Process Control. **(#)**

④.4 UCP-PA. Set for Pressure Process Control:
Pressure sensor.
Computer Control Software for Pressure Process Control. **(#)**

④.5 UCP-PH. Set for pH Process Control:
pH sensor. Helix agitator.
Computer Control Software for pH Process Control. **(#)**

④.6 UCP-CT. Set for Conductivity and TDS (Total Dissolved Solids) Process Control:
Conductivity and TDS (Total Dissolved Solids) sensor.
Computer Control Software for Conductivity and TDS Process Control.**(#)**

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.) = UCP-UB. Unit: 500 x 1000 x 1000 mm. Weight: 40 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/UCP.pdf

PRACTICAL POSSIBILITIES

Temperature Process Control:
1.- Temperature control loops (Manual).
2.- Temperature control loops (On/Off).
3.- Temperature control loops (Proportional).
4.- Temperature control loops (Proportional + Integral).
5.- Temperature control loops (Proportional + Derivative).
6.- Temperature control loops (Proportional + Derivative +Integral).
7.- Adjustment of the constant of a controller of temperature (Ziegler-Nichols).
8.- Adjustment of the constant of a controller of temperature (Reaction Curves).
9.- Temperature sensor calibration.

Flow Process Control:
10.- Flow control loops (Manual).
11.- Flow control loops (On/Off).
12.- Flow control loops (Proportional).
13.- Flow control loops (Proportional + Integral).
14.- Flow control loops (Proportional + Derivative).
15.- Flow control loops (Proportional + Derivative + Integral).
16.- Adjustment of the flow controller constants (Ziegler-Nichols).
17.- Adjustment of the flow controller constants (Reaction Curves).
18.- Flow sensor calibration.

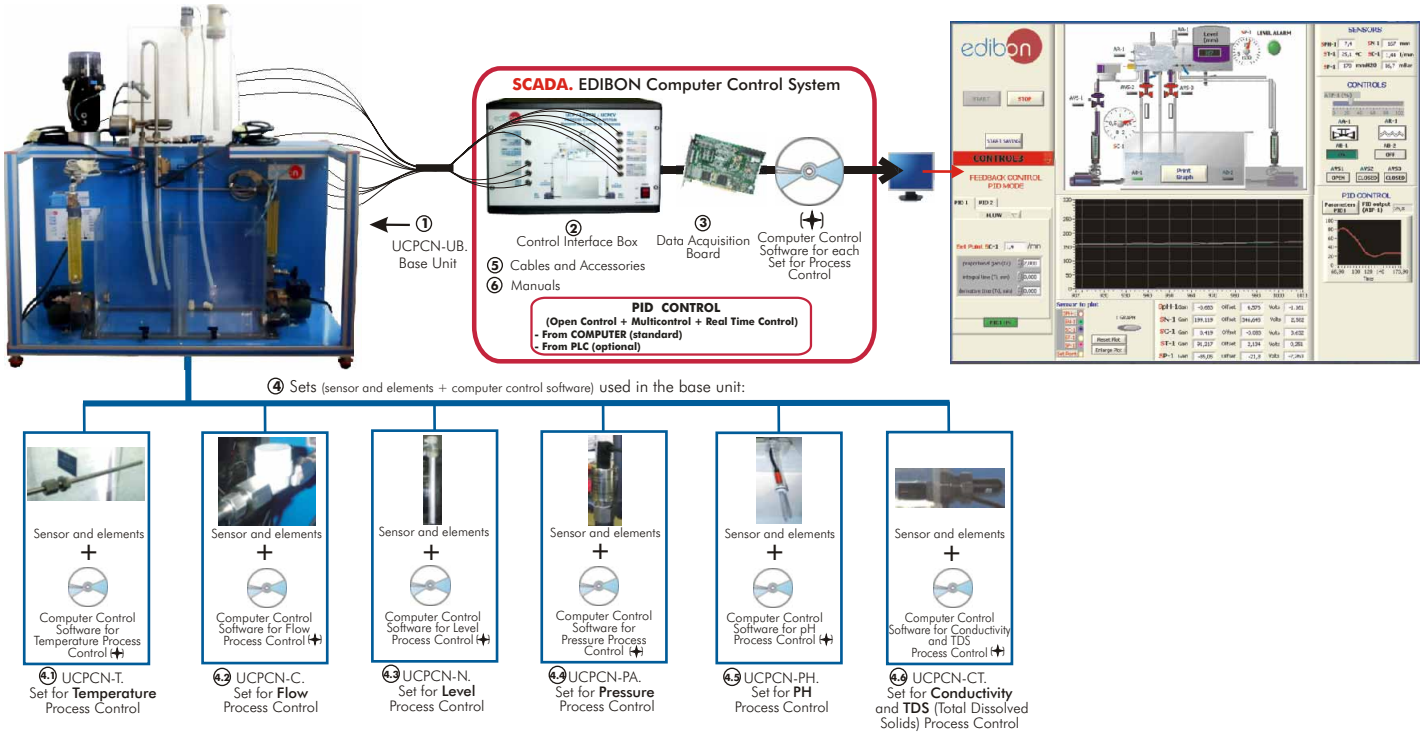
Level Process Control:
19.- Level control loops (Manual).
20.- Level control loops (On/Off).
21.- Level control loops (Proportional).
22.- Level control loops (Proportional + Integral).
23.- Level control loops (Proportional + Derivative).
24.- Level control loops (Proportional + Derivative + Integral).
25.- Adjustment of the constants of a flow controller (Ziegler-Nichols).
26.- Adjustment of the constants of a flow controller (Reaction Curves).
27.- Level sensor calibration.

Pressure Process Control:
28.- Pressure control loops (Manual).
29.- Pressure control loops (On/Off).
30.- Pressure control loops (Proportional).
31.- Pressure control loops (Proportional + Integral).
32.- Pressure control loops (Proportional + Derivative).
33.- Pressure control loops (Proportional + Derivative + Integral).
34.- Adjustment of the constant of a Pressure controller (Ziegler-Nichols).
35.- Adjustment of the constant of a Pressure controller (Reaction Curves).
36.- Pressure sensor calibration.

pH Process Control:
37.- pH control loops (Manual).
38.- pH control loops (On/Off).
39.- pH control loops (Proportional).
40.- pH control loops (Proportional + Integral).
41.- pH control loops (Proportional + Derivative).
42.- pH control loops (Proportional + Derivative + Integral).
43.- Adjustment of the constant of a pH controller (Ziegler-Nichols).
44.- Adjustment of the constant of a pH controller (Reaction Curves).
45.- pH sensor calibration.

Conductivity and TDS (Total Dissolved Solids) Process Control:
46.- Conductivity control loops (Manual).
47.- Conductivity control loops (On/Off).
48.- Conductivity control loops (Proportional).
49.- Conductivity control loops (Proportional + Integral).
50.- Conductivity control loops (Proportional + Derivative).
51.- Conductivity control loops (Proportional + Derivative + Integral).
52.- Adjustment of the constant of a Conductivity controller (Ziegler-Nichols).
53.- Adjustment of the constant of a Conductivity controller (Reaction Curves).
54.- TDS control loops (Manual).
55.- TDS control loops (On/Off).
56.- TDS control loops (Proportional).
57.- TDS control loops (Proportional + Integral).
58.- TDS control loops (Proportional + Derivative).
59.- TDS control loops (Proportional + Derivative + Integral).
60.- Adjustment of the constant of a TDS controller (Ziegler-Nichols).
61.- Adjustment of the constant of a TDS controller (Reaction Curves).
62.- Conductivity and TDS sensor calibration.
63-81.- Practices with PLC.

UCPCN. Computer Controlled **Process Control System, with pneumatic control valve :**



SPECIFICATIONS SUMMARY

Common items for all Process Control parameters:

① UCPCN-UB. Unit:

This unit is common for all Sets for Process Control type "UCPCN" and can work with one or several sets.

Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit. Main tank and collector with an orifice in the central dividing wall.(2 x 25 dm^3), and drainage in both compartments. Dual process tank (2 x 10 dm^3), interconnected through an orifice and a ball valve and an overflow in the dividing wall; a graduate scale and a threaded drain of adjustable level with bypass. Centrifugal pumps. Variable area flow meters (0.2-2 l/min, and 0.2-10 l/min), and with a manual valve. Line of on/off regulation valves (solenoid), and manual drainage valves of the upper tank. Pneumatic Control Valve.

② UCPCN/CIB. Control Interface Box :

This is common for all Sets for Process Control type "UCPCN" and can work with one or several sets.

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/ Outputs.

④ Sets (sensor and elements + computer control software) used in the base unit: (These Sets will be supplied and installed in the Base Unit and ready for working)

④.1 UCPCN-T. Set for Temperature Process Control:

Temperature sensor "J type". Electric resistor (0.5 KW). Helix agitator. On/off level switch.

Computer Control Software for Temperature Process Control:

(#) Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

④.2 UCPCN-C. Set for Flow Process Control:

Turbine type flow sensor.

Computer Control Software for Flow Process Control. **(#)**

④.3 UCPCN-N. Set for Level Process Control:

0-300mm level sensor (of capacitive immersion, 4-20mA).

Computer Control Software for Level Process Control. **(#)**

④.4 UCPCN-PA. Set for Pressure Process Control:

Pressure sensor.

Computer Control Software for Pressure Process Control. **(#)**

④.5 UCPCN-PH. Set for pH Process Control:

pH sensor. Helix agitator.

Computer Control Software for pH Process Control. **(#)**

④.6 UCPCN-CT. Set for Conductivity and TDS (Total Dissolved Solids) Process Control:

Conductivity and TDS (Total Dissolved Solids) sensor.

Computer Control Software for Conductivity and TDS Process Control.**(#)**

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.) = UCPCN-UB. Unit: 500 x 1000 x 1000 mm. Weight: 40 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/UCPCN.pdf

PRACTICAL POSSIBILITIES

Temperature Process Control:
1.- Temperature control loops (Manual).
2.- Temperature control loops (On/Off).
3.- Temperature control loops (Proportional).
4.- Temperature control loops (Proportional + Integral).
5.- Temperature control loops (Proportional + Derivative).
6.- Temperature control loops (Proportional + Derivative + Integral).
7.- Adjustment of the constant of a controller of temperature (Ziegler-Nichols).
8.- Adjustment of the constant of a controller of temperature (Reaction Curves).
9.- Temperature sensor calibration.

Flow Process Control:
10.- Flow control loops (Manual).
11.- Flow control loops (On/Off).
12.- Flow control loops (Proportional).
13.- Flow control loops (Proportional + Integral).
14.- Flow control loops (Proportional + Derivative).
15.- Flow control loops (Proportional + Derivative + Integral).
16.- Adjustment of the flow controller constants (Ziegler-Nichols).
17.- Adjustment of the flow controller constants (Reaction Curves).
18.- Flow sensor calibration.

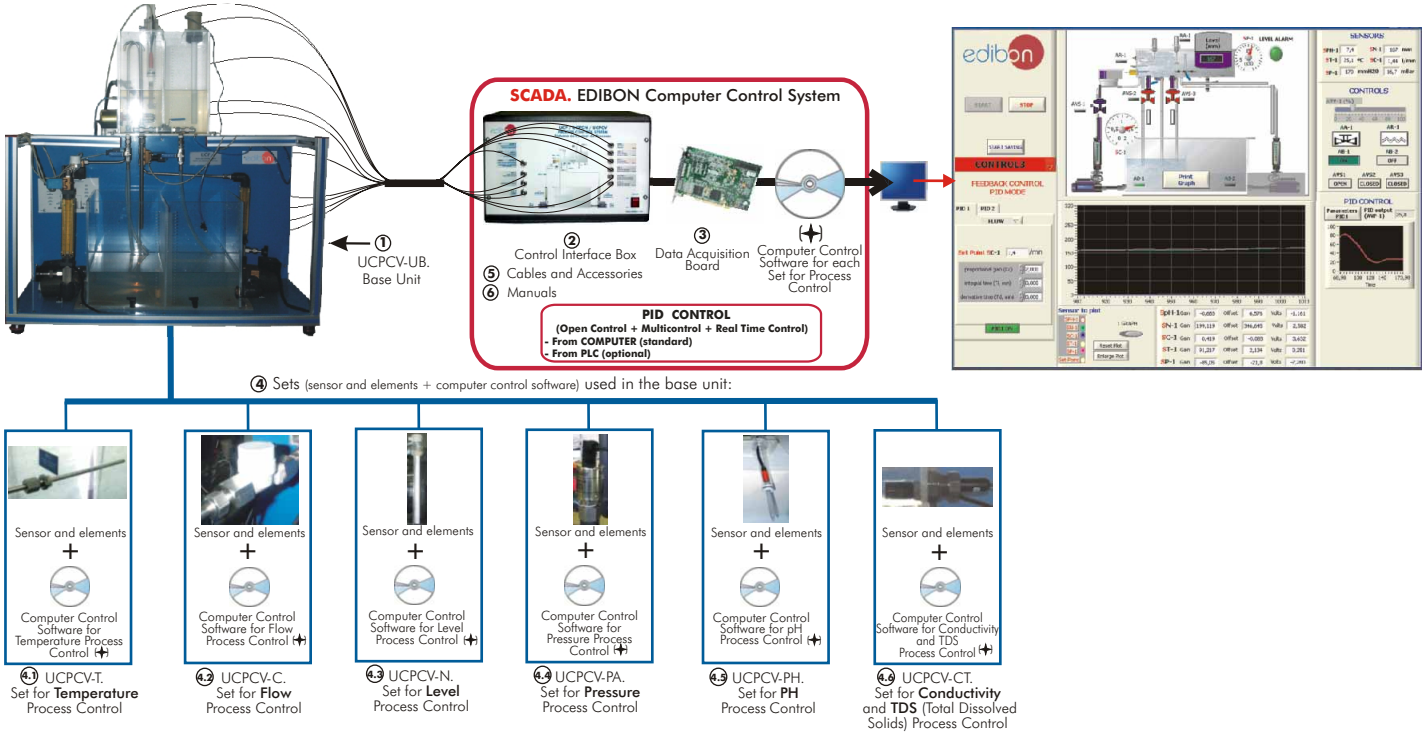
Level Process Control:
19.- Level control loops (Manual).
20.- Level control loops (On/Off).
21.- Level control loops (Proportional).
22.- Level control loops (Proportional + Integral).
23.- Level control loops (Proportional + Derivative).
24.- Level control loops (Proportional + Derivative + Integral).
25.- Adjustment of the constants of a flow controller (Ziegler-Nichols).
26.- Adjustment of the constants of a flow controller (Reaction Curves).
27.- Level sensor calibration.

Pressure Process Control:
28.- Pressure control loops (Manual).
29.- Pressure control loops (On/Off).
30.- Pressure control loops (Proportional).
31.- Pressure control loops (Proportional + Integral).
32.- Pressure control loops (Proportional + Derivative).
33.- Pressure control loops (Proportional + Derivative + Integral).
34.- Adjustment of the constant of a Pressure controller (Ziegler-Nichols).
35.- Adjustment of the constant of a Pressure controller (Reaction Curves).
36.- Pressure sensor calibration.

pH Process Control:
37.- pH control loops (Manual).
38.- pH control loops (On/Off).
39.- pH control loops (Proportional).
40.- pH control loops (Proportional + Integral).
41.- pH control loops (Proportional + Derivative).
42.- pH control loops (Proportional + Derivative + Integral).
43.- Adjustment of the constant of a pH controller (Ziegler-Nichols).
44.- Adjustment of the constant of a pH controller (Reaction Curves).
45.- pH sensor calibration.

Conductivity and TDS (Total Dissolved Solids) Process Control:
46.- Conductivity control loops (Manual).
47.- Conductivity control loops (On/Off).
48.- Conductivity control loops (Proportional).
49.- Conductivity control loops (Proportional + Integral).
50.- Conductivity control loops (Proportional + Derivative).
51.- Conductivity control loops (Proportional + Derivative + Integral).
52.- Adjustment of the constant of a Conductivity controller (Ziegler-Nichols).
53.- Adjustment of the constant of a Conductivity controller (Reaction Curves).
54.- TDS control loops (Manual).
55.- TDS control loops (On/Off).
56.- TDS control loops (Proportional).
57.- TDS control loops (Proportional + Integral).
58.- TDS control loops (Proportional + Derivative).
59.- TDS control loops (Proportional + Derivative + Integral).
60.- Adjustment of the constant of a TDS controller (Ziegler-Nichols).
61.- Adjustment of the constant of a TDS controller (Reaction Curves).
62.- Conductivity and TDS sensor calibration.
63-81.- Practices with PLC.

UCPCV. Computer Controlled **Process Control System, with speed controller :**



SPECIFICATIONS SUMMARY

Common items for all Process Control parameters:

① UCPCV-UB. Unit:
This unit is common for all Sets for Process Control type "UCPCV" and can work with one or several sets.
Anodized aluminium structure. Diagram in the front panel with similar distribution to the elements in the real unit. Main tank and collector with an orifice in the central dividing wall.(2 x 25 dm^3), and drainage in both compartments. Dual process tank (2 x 10 dm^3), interconnected through an orifice and a ball valve and an overflow in the dividing wall; a graduate scale and a threaded drain of adjustable level with bypass. Centrifugal pumps. Variable area flow meters (0.2-2 l/min, and 0.2-10 l/min), and with a manual valve. Line of on/off regulation valves (solenoid), and manual drainage valves of the upper tank. Speed controller (into the Control Interface Box).

② UCPCV/CIB. Control Interface Box :
This is common for all Sets for Process Control type "UCPCV" and can work with one or several sets.
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/ Outputs.

④ Sets (sensor and elements + computer control software) used in the base unit: (These Sets will be supplied and installed in the Base Unit and ready for working)

④.1 UCPCV-T. Set for Temperature Process Control:
Temperature sensor "J type". Electric resistor (0.5 KW). Helix agitator. On/off level switch.
Computer Control Software for Temperature Process Control:
(#) Flexible, open and multicontrol software. Management, processing,comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

④.2 UCPCV-C. Set for Flow Process Control:
Turbine type flow sensor.
Computer Control Software for Flow Process Control. **(#)**

④.3 UCPCV-N. Set for Level Process Control:
0-300mm level sensor (of capacitive immersion, 4-20mA).
Computer Control Software for Level Process Control. **(#)**

④.4 UCPCV-PA. Set for Pressure Process Control:
Pressure sensor.
Computer Control Software for Pressure Process Control. **(#)**

④.5 UCPCV-PH. Set for pH Process Control:
pH sensor. Helix agitator.
Computer Control Software for pH Process Control. **(#)**

④.6 UCPCV-CT. Set for Conductivity and TDS (Total Dissolved Solids) Process Control:
Conductivity and TDS (Total Dissolved Solids) sensor.
Computer Control Software for Conductivity and TDS Process Control.**(#)**

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions(approx.) = UCPCV-UB. Unit: 500 x 1000 x 1000 mm. Weight: 40 Kg.
Control Interface: 490 x 330 x 310 mm. Weight: 12 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/UCPCV.pdf

PRACTICAL POSSIBILITIES

Temperature Process Control:
1.- Temperature control loops (Manual).
2.- Temperature control loops (On/Off).
3.- Temperature control loops (Proportional).
4.- Temperature control loops (Proportional + Integral).
5.- Temperature control loops (Proportional + Derivative).
6.- Temperature control loops (Proportional + Derivative +Integral).
7.- Adjustment of the constant of a controller of temperature (Ziegler-Nichols).
8.- Adjustment of the constant of a controller of temperature (Reaction Curves).
9.- Temperature sensor calibration.

Flow Process Control:
10.- Flow control loops (Manual).
11.- Flow control loops (On/Off).
12.- Flow control loops (Proportional).
13.- Flow control loops (Proportional + Integral).
14.- Flow control loops (Proportional + Derivative).
15.- Flow control loops (Proportional + Derivative + Integral).
16.- Adjustment of the flow controller constants (Ziegler-Nichols).
17.- Adjustment of the flow controller constants (Reaction Curves).
18.- Flow sensor calibration.

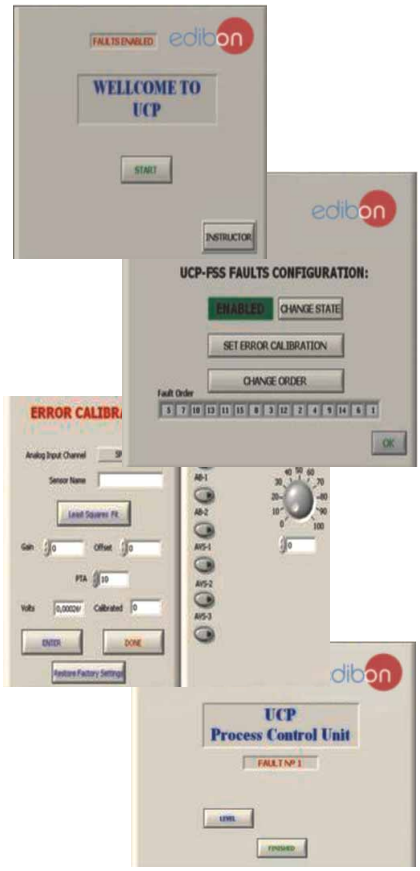
Level Process Control:
19.- Level control loops (Manual).
20.- Level control loops (On/Off).
21.- Level control loops (Proportional).
22.- Level control loops (Proportional + Integral).
23.- Level control loops (Proportional + Derivative).
24.- Level control loops (Proportional + Derivative + Integral).
25.- Adjustment of the constants of a flow controller (Ziegler-Nichols).
26.- Adjustment of the constants of a flow controller (Reaction Curves).
27.- Level sensor calibration.

Pressure Process Control:
28.- Pressure control loops (Manual).
29.- Pressure control loops (On/Off).
30.- Pressure control loops (Proportional).
31.- Pressure control loops (Proportional + Integral).
32.- Pressure control loops (Proportional + Derivative).
33.- Pressure control loops (Proportional + Derivative + Integral).
34.- Adjustment of the constant of a Pressure controller (Ziegler-Nichols).
35.- Adjustment of the constant of a Pressure controller (Reaction Curves).
36.- Pressure sensor calibration.

pH Process Control:
37.- pH control loops (Manual).
38.- pH control loops (On/Off).
39.- pH control loops (Proportional).
40.- pH control loops (Proportional + Integral).
41.- pH control loops (Proportional + Derivative).
42.- pH control loops (Proportional + Derivative + Integral).
43.- Adjustment of the constant of a pH controller (Ziegler-Nichols).
44.- Adjustment of the constant of a pH controller (Reaction Curves).
45.- pH sensor calibration.

Conductivity and TDS (Total Dissolved Solids) Process Control:
46.- Conductivity control loops (Manual).
47.- Conductivity control loops (On/Off).
48.- Conductivity control loops (Proportional).
49.- Conductivity control loops (Proportional + Integral).
50.- Conductivity control loops (Proportional + Derivative).
51.- Conductivity control loops (Proportional + Derivative + Integral).
52.- Adjustment of the constant of a Conductivity controller (Ziegler-Nichols).
53.- Adjustment of the constant of a Conductivity controller (Reaction Curves).
54.- TDS control loops (Manual).
55.- TDS control loops (On/Off).
56.- TDS control loops (Proportional).
57.- TDS control loops (Proportional + Integral).
58.- TDS control loops (Proportional + Derivative).
59.- TDS control loops (Proportional + Derivative + Integral).
60.- Adjustment of the constant of a TDS controller (Ziegler-Nichols).
61.- Adjustment of the constant of a TDS controller (Reaction Curves).
62.- Conductivity and TDS sensor calibration.
63-81.- Practices with PLC.

UCP/FSS. **Faults Simulation System** (Process Control Unit)



SPECIFICATIONS SUMMARY

The "FAULTS" mode consists on causing several faults in the unit normal operation. The student must find them and solve them.
There are several kinds of faults that can be grouped in the following sections:

Faults affecting the sensors measurement:
- An incorrect calibration is applied to them. In this case, the student should proceed to calibrate the affected sensor through the values collection.
- Non-linearity. When we have the measures taken by the sensor, a quadratic or inverse function is applied to them. Thus, the value measured will not be the real one, as in the case above mentioned, but when we calibrate again, the sensor will not operate linearly and we will not be able to calibrate it by lest squares fits.

Faults affecting the actuators:
- Actuators canals interchange at any time during the program execution. This error does not admit any solution.
- Response reduction of an actuator. By the reduction of the output voltage in analog outputs, we can get an response with a fraction of what it should be, either with a manual execution or with any control type (ON/OFF, PID...).

Faults in the controls execution:
- Inversion of the performance in ON/OFF controls. The state of some actuator is inverted, when it should be ON is OFF instead, and vice versa. The student should provide the correct operating logic.
- Reduction or increase of the calculated total response. We multiply by a factor the total response calculated by the PID, causing, thus, the reduction or increase of the action really applied to the actuator, and the consequent instability of the control. The student should notify it and try to calculate this factor.
- The action of some controls is annulled.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/UCP.pdf

PRACTICAL POSSIBILITIES

Incorrect Calibration:
1.- Load the calibration error of the PH sensor.
2.- Load the calibration error of the Level sensor.
3.- Load the calibration error of the Flow sensor.
4.- Load the calibration error of the Temperature sensor.

Non Linearity:
5.- Non inverse linearity of the pH sensor.
6.- Non quadratic linearity of the Level sensor.
7.- Non quadratic linearity of the Flow sensor.
8.- No inverse linearity of the Temperature sensor.

Interchange of actuators:
9.- Interchange the bombs AB-1 and AB-2 between them during the operations of the controls ON/OFF and PID. (Affected sensor: Level sensor).

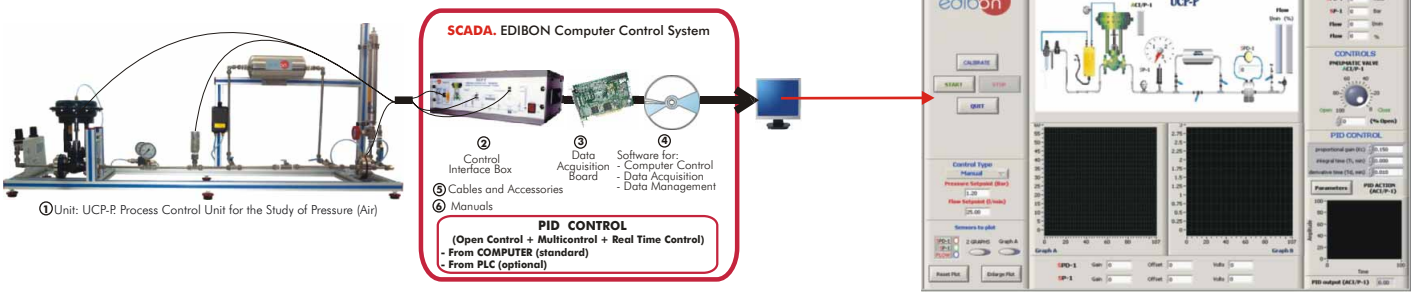
Reduction of an actuator response:
10.- In the PID, the real response of the proportional valve is half the amount calculated by the PID control. Thus, the maximum real opening that will be able to reach is 50%. (Affected sensor: Flow sensor).

Inversion of the performance in ON/OFF controls:
11.- In the ON/OFF control, the actuation sensor of the AVS-1 is inverted, acting, thus, on the same way as the others 2 valves (for a good control, it should operate the other way around to how the others 2 do it). (Affected sensor: pH).

Reduction or increase of the calculated total response:
12.- In the PID, the real action in the resistance is half of the total calculated. (Affected sensor: Temperature sensor).

The action of some controls is annulled:
13.- The Integral control does not work. It is reduced to a PD control (Proportional-Derivative).
14.- The Derivative Control does not work. It is reduced to a PI Control (Proportional-Integral).
15.- The Integral and Derivative controls do not work. They are reduced to a Proportional Control.

UCP-P. Computer Controlled **Process Control Unit for the Study of Pressure (Air)**



①Unit: UCP-P. Process Control Unit for the Study of Pressure (Air)

SPECIFICATIONS SUMMARY

Items supplied as standard

①UCP-P. Unit:
This unit basically consist of the following elements:
Pneumatic circuit consisting of a tank, valves, pressure sensors, pressure regulators and pressure manometers.
For the pressure and flow control, a pneumatically operated control valve, an I/P converter and an absolute pressure sensor and a differential pressure sensor are used.
Anodized aluminium structure and panels in painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
2 Pressure regulators, one for controlling the pneumatically operated control valve and the second for suppling the necessary flow and/or pressure to the circuit that is to be adjusted.
I/P Converter.
On/off valves. Inlet/outlet valves.
Pneumatically operated control valve.
Storage (air) tank, capacity: 2 l.
Absolute pressure sensor. Differential pressure sensor.
Diaphragm. Flow meter. 3 pressure manometers.

② UCP-P/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, other electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ UCP-P/CCSOF. PID Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.)=Unit: 1000 x 500 x 600 mm. Weight: 20 Kg. Control Interface: 490 x 330 x 175 mm. Weight: 5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/UCP-P.pdf

PRACTICAL POSSIBILITIES

1.- Calculating the fluid flow in function of different pressure sensor.
2.- Calibration processes.
3.- Pressure sensor calibration. Study of the hysteresis curve.
4.- I/P converter calibration.
5.- Identification of the pneumatic valve type.
6.- Determination of the influence of the flow rate of the conduction.
7.- Pressure control in conduction using a PID controller.
8.- Proportional control (P) characteristics.
9.- Characteristics of a proportional and integral control (P+I).
10.- Characteristics of a proportional and derivative control (P+D).
11.- Optimization of the variables of a PID controller.
12.- Optimization of the variables of the PID controller, flow control.
13.- Flow rate control in conduction with a PID controller.
14-32.- Practices with PLC.

CECI. **Industrial Controllers Trainer**

SPECIFICATIONS SUMMARY

Trainer for industrial process controllers. This trainer allows students the study and familiarisation with the function and operation of a industrial process controller.
Configurable digital controller:
2 inputs, 1 output. Configurable as P, PI or PID controller. Proportional gain X_p: 0 -999.9%. Integral action time T_n: 0-3600s. Derivative time T_v: 0-1200s. RS232 interface for configuration on computer (PC).
Digital voltmeter: 0 -20V.
Signal generator with potentiometer. Reference variables generator: 2 voltages selectable. Output voltage: 0-10V.
Controlled system simulator:
Controlled system type: First order lag. Time constant: 20s.
All variables accessible as analog signals at lab jacks .
Possibility of connection of external instruments via lab jacks (for example: line recorder, plotter, oscilloscope...).
Configuration software CD. Interface cable. Set of lab cables.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 8 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/CECI.pdf

PRACTICAL POSSIBILITIES

To study methods and terminology of process control:
1.- Closed loop control.
2.- Static and dynamic transfer function.
3.- To study the step response.
4.- Reference variable step.
To learn and to familiarise with a process controller:
5.- Configuration level.
6.- Parameter level.
7.- Operation control levels.
Control parameters:
8.- Setting input channels.
9.- Setting output channels.
10.- To use computer (PC)-based configuration tools.
11.- Scaling displays.

CRCI. **Industrial Controllers Networking**

SPECIFICATIONS SUMMARY

This trainer enables to take the first steps in process automation using field buses. This trainer demonstrates the operation of a process control system based on a simple application. This trainer allows student the familiarisation with the function and operation of an industrial process controller.
2 Digital process controllers, with field bus interface:
Configurable as P, PI or PID controller. Proportional gain X_p: 0-999.9%. Integral action time T_n: 0-3600s. Derivative time T_v: 0- 1200s. Controller parameter setting via field bus system.
2 Signal generators: 0-10V. Profibus DP interface card for computer (PC).
Process variables as analog signals: 0-10V. All variables accessible as analog signals at lab jacks.
Software CD with driver software, OPC server and process control software.
Possibility of connection of external instruments via lab jacks (for example: line recorder, oscilloscope, etc). Set of cables.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 12 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/CRCI.pdf

PRACTICAL POSSIBILITIES

1.- Function of a digital industrial controller.
2.- Layout of a field bus system.
To learn and to familiarise with the operation and structure of a process control system under Profibus DP:
3.- Controller parameter setting via field bus system.
4.- Profibus DP field bus system.
5.- OPC (OLE for Process Control) server function.
6.- Online controller parameters setting.
7.- Master / slave assignment.
8.- To configure and display alarms.
9.- Reading control variables and displaying them online.
10.- Scaling displays.
11.- Bus configuration.

CEAB. **Trainer for Field Bus Applications**

SPECIFICATIONS SUMMARY

This Trainer is used to teach the initial or first steps in field bus tecnology based on Profibus DP. The field bus permits networking terminal devices (controllers, actuators or sensors) in the plant system (field level) with the control room (control level).
Several devices (slaves) are activated and read by a computer (PC) with a Profibus DP interface (master).
Different subjects or topics can be covered and studied: bus topology, system configurator with Device Master File "DMF", communication protocols, tags, OPC server, output and input process data, etc.
Digital process controller, with Profibus DP interface:
Configurable as P, PI or PID controller. Proportional gain X_p:0-999.9%. Derivative time T_v:0-1200s. Integral action time T_n: 0-3600s.
Signal generators: 0-10V. Digital voltmeter: 0-20V.
Digital Profibus DP I module. Digital Profibus DP O module. Four digital inputs. Four digital outputs.
Analog Profibus DP I module. Analog Profibus DP O module. Four analog inputs: 0-10V. Two analog outputs: 0-10V.
Profibus DP interface card for computer (PC).
Process variables as analog signals at lab jacks: 0-10V.
Software CD with driver software, system configurator, OPC server and process control software.
Possibility of connection of external instruments via lab jacks (for example: chart recorder, oscilloscope, etc). Set of cables.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 12 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/CEAB.pdf

PRACTICAL POSSIBILITIES

1.- Operation and function of a digital industrial controller.
2.- Function of an analog input/outputs module.
3.- Function of a digital input/output module.
4.- Layout of a field bus system.
5.- Familiarisation with the field bus stations.
6.- Defining the bus technology with the stations.
7.- Reading out and in, and online displaying of analog and digital process variables.
8.- Communication protocols.
9.- To define tags.
10.- Familiarisation with the device master file "DMF".
11.- OPC server.
12.- Access to the OPC database from the process control program.

CEAC. **Controller Tuning Trainer**

SPECIFICATIONS SUMMARY

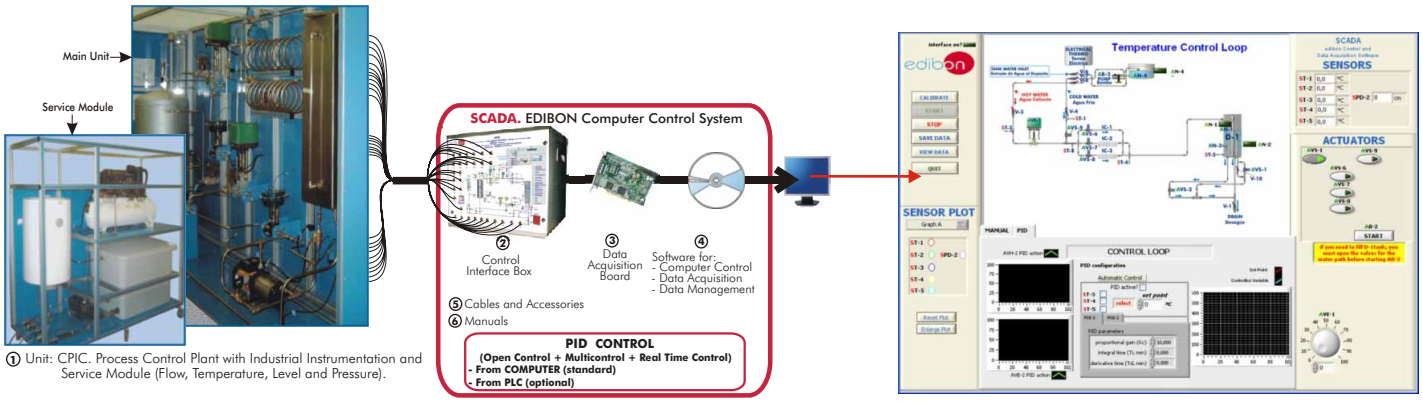
Trainer for controller tuning. This unit permits the interaction between controller and controlled system. The objective is that the closed control loop, formed by the controller and the controlled system, to show the desired optimum response.
With a simulation software the setting of controller parameters can be practised safely. Closed and open loop control, step response, stability, disturbance and control response are demonstrated.
This trainer no needs real controlled systems, the controlled system is simulated on a computer (PC) by the simulation program. In this program the most important types of controlled systems can be selected.
The process controller used can be easily configured from the computer (PC). The controller and the computer (PC) are connected by a data acquisition card with AD and DA converters.
Configurable digital process controller, with interface:
Configurable as P, PI or PID controller. Proportional gain X_p: 0-999.9%. Integral action time T_n: 0-3600s. Derivative time T_v: 0-1200s.
Interface for computer (PC). Data acquisition card for computer (PC).
Simulation Software for controlled system models, such as 1st and 2nd order lags, time-delayed systems etc. Controlled system simulation models with proportional, integral, 1st order lag, 2nd order lag, time-delayed response, non-linearity and limitation.
Configuration software for process controller. Recording and evaluation of time response on computer (PC). Set of cables.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) = 490 x 330 x 310 mm. Weight: 8 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/fundamentals/CEAC.pdf

PRACTICAL POSSIBILITIES

1.- To use commonly applied tuning rules, such as Ziegler-Nichols.
2.- To study the difference between open and closed loop control.
3.- Control loop comprising controller and controlled system.
4.- To determine the system parameters.
5.- Closed-loop control system response.
6.- Choice of optimum controller parameters.
7.- Stability, steady state and transient response.
8.- Study and investigation of control and disturbance response.
9.- Study of the stability of the closed control loop.
10.- Learning methods and terminology involved in process control.
11.- To adapt the process controller to different controlled systems.
12.- Use and practices with the simulation software.

CPIC. Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (Flow, Temperature, Level and Pressure)



① Unit: CPIC. Process Control Plant with Industrial Instrumentation and Service Module (Flow, Temperature, Level and Pressure).

SPECIFICATIONS SUMMARY

Items supplied as standard

① CPIC. Unit:

CPIC is a "Computerized Industrial Process Control Plant", that offers, on a reasonable laboratory scale, the different process and elements that are commonly used by any kind the industry. It also shows the complexity that can take place while controlling in processes the same variable.

Metallic structure. Panels and main metallic elements in stainless steel. Diagram in the front panel with similar distribution to the elements in the real unit.

Main Unit contains the following elements:

Two pneumatics valves with C_v: 0.25. Actuator (I/P) from 0.2 to 1.0 bar for electric signal from 4 to 20 mA.
Two electronic valves for electric signal from 4 to 20mA.
Twelve solenoid valves, normally closed.
Two solenoid valves, normally open, placed at the air loop and flow loop.
Three differential pressure sensors.
Five temperature sensors placed along the unit to control the temperature in different lines.
One level sensor (effective length: 300 mm.).
Four level switches.
Water pump: maximum water flow: 106 l./min. and maximum pressure: 7 bar.
Stainless steel water tank: maximum capacity: 100 l.
Stainless steel tank: maximum capacity: 200 l., maximum pressure:16 bar. It has eight takings, but only six are used in this unit. In the upper part, there is a safety valve that opens when the pressure exceeds 4 bar. Two takings are used to measure the water height by the means of a differential pressure sensor. Other differential pressure sensor gives us the inner pressure.

Service Module contains the following elements:

Heater unit: A tank with a maximum capacity of 80 litres and an electrical resistance of 1.2 kW as maximum electrical power, the temperature control is placed in the electrical resistance. It has a safety valve and purge valve. The lower part of the unit has an inlet pipe (cold water) and an outlet pipe (hot water).
Compressor unit: Maximum pressure: 10 bar. This unit has a regulating valve with a manometer to fix the outlet maximum pressure.
Water system: Water tank, capacity: 400 l. Water pump: 2500 l./h. The inlet pipe of the tank has an automatic filling system. Drain valve in the water tank.

② CPIC/CIB. Control Interface Box :

With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the PC of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time PID control with flexibility of modifications from the PC keyboard of the PID parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

PCI Data acquisition National Instruments board to be placed in a computer slot. 16 analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ CPIC/CCSOF. PID Computer Control + Data Acquisition + Data Management Software:

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second. It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =

-Main Unit: 5000 x 1500 x 2500 mm. Weight: 1000 Kg.
-Service Module: 2000 x 1500 x 2000 mm. Weight: 200 Kg.
-Control Interface: 490 x 450 x 470 mm. Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/processcontrol/industrial/CPIC.pdf

PRACTICAL POSSIBILITIES

1.- Familiarisation with the different components of the system and their symbolic representation. Identification of components and description of their functions.
2.- The auxiliary systems: air and hot water supply.
3.- Flow sensors calibration.
4.- Temperature sensors calibration.
5.- Level sensor calibration.
6.- I/P converter calibration.
7.- Flow control loop (on/off).
8.- Flow control loop (proportional).
9.- Flow control loop (P+I).
10.- Flow control loop (P+D).
11.- Flow control loop (P+I+D).
12.- Adjust of the flow controller constants (Ziegler-Nichols).
13.- Adjust of the flow controller constants (reaction curves).
14.- Search of simple shortcomings in the loop of flow control.
15.- Temperature control loop (on/off).
16.- Temperature control loop (proportional).
17.- Temperature control loop (P+I).
18.- Temperature control loop (P+D).
19.- Temperature control loop (P+I+D).
20.- Adjust of the temperature controller constants (minimum area or reduction rate).
21.- Adjust of the temperature controller constants (minimum disturbance criterion).
22.- Adjust of the temperature controller constants (minimum width criterion).
23.- Study of the retards for speed/distance, exemplified through the temperature control loop.
24.- Study of the energy lost in the temperature control loop.
25.- Search of simple shortcomings in temperature control loop.
26.- Level control loop (on/off).
27.- Level control loop (proportional).
28.- Level control loop (P+I).
29.- Level control loop (P+D).
30.- Level control loop (P+I+D).
31.- Adjust of the level controller constants (minimum area or reduction rate).
32.- Adjust of the level controller constants (minimum disturbance criterion).
33.- Adjust of the level controller constants (minimum width criterion).
34.- Search of simple shortcomings in level control loop.
35.- Pressure control loop (on/off).
36.- Pressure control loop (proportional).
37.- Pressure control loop (P+I).
38.- Pressure control loop (P+D).
39.- Pressure control loop (P+I+D).
40.- Adjust of the pressure controller constants (minimum area or reduction rate).
41.- Adjust of the pressure controller constants (minimum disturbance criterion).
42.- Adjust of the pressure controller constants (minimum width criterion).
43.- Search of simple shortcomings in the pressure control loop.
44.- The use of the controllers in cascade, exemplified with the level/ flow control loop.
45.- Adjust of cascade control constants (minimum area or reduction rate).
46.- Adjust of cascade control constants (minimum disturbance criterion).
47.- Adjust of cascade control constants (minimum width criterion).
48.- Search of simple shortcomings in cascade control loop.
49.- Practical operation of the control plant to some wanted specific values: transfers without interferences.
50.- Calculation of the fluid flow in function of the differential pressure sensor.
51-69.- Practices with PLC.

Other available Units:

CPIC-C. Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Flow)

CPIC-T. Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Temperature)

CPIC-N. Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Level)

CPIC-P. Computer Controlled **Process Control Plant with Industrial Instrumentation and Service Module** (only Pressure)

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

edibon
INTERNATIONAL

C/ Del Agua, 14.
Polígono Industrial San José de Valderas.
28918 Leganés (Madrid). SPAIN.
Phone +34 91 619 93 63
Fax +34 91 619 86 47
edibon@edibon.com
www.edibon.com

REPRESENTATIVE:

ISO 9000: Quality Management
(for Design, Manufacturing, Commercialization and After-sales service)

European Union Certificate
(total safety)

Certificates ISO 14000 and **ECO-Management and Audit Scheme**
(environmental management)

Worlddidac Quality Charter Certificate
(Worlddidac Member)