Basic Teaching Unit for the Study of Regulation and Control

RYC/B

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⇨PRODUCTS
  ⇨2.- ELECTRONICS
      AND
  6.- MECHATRONICS,
      AUTOMATION &
      COMPUMECHATRONICS

INTRODUCTION

Nowadays, the regulation and control engineering has an essential role in a wide range of control systems. A system can be mechanic, electric, chemical, etc., and the mathematical modeling, analysis and controller design uses control theory in time, frequency and complex-x domains, depending on the nature of the design problem.

The Basic Teaching Unit for the Study of Regulation and Control, "RYC/B", has been designed by EDIBON, it allows students to learn the most important concepts about regulation and control in an easy and comprehensive way.

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

GENERAL DESCRIPTION

The Basic Teaching Unit for the Study of Regulation and Control, "RYC/B", allows the user to learn the basics about of regulation and control of first and second order systems.

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

The unit has three modules: reference signals, PID controller, first order system and second order system module.

ISO 9001: Quality Management (for
Design, Manufacturing, Commercialization
and After-sales service)

European Union Certificate
(total safety)

Certificates ISO 14001 and ECO-
Management and Audit Scheme
(environmental management)

"Worlddidac Quality Charter"
and Platinum Member of
Worlddidac

SPECIFICATIONS

Metallic box, including all the modules and elements.
Power supply.
Protection fuse.
Block diagrams in the front panel.
Modules:
  Reference signals:
    Step: Amplitude: ±10 V. Frequency: 0 Hz to 1000 Hz.
    Ramp: Amplitude: ±10 V. Frequency: 0 Hz to 1000 Hz.
    Sine: Amplitude: ±10 V. Frequency: 0 Hz to 1000 Hz.
  PID controller:
    P controller: Kp: 0 to 10.
    I controller: Ti: 1 ms to 10 ms.
    D controller: Td: 1 ms to 10 ms.
  Systems:
    First order system:
      Time constant T: 1 ms to 100 ms.
    Second order system:
      Damping coefficient x: 0 to 1.5.
      Natural frequency (ω n): 1 Hz to 2 π*100 rad/s (100 Hz).
Cables and accessories, for normal operation.
Manuals:
    This unit is supplied with the following manuals: Required services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices manuals.

EXERCISES AND 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).

REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.

REQUIRED ELEMENTS (Not included)

- MED87. Two Channel Digital Oscilloscope 70 MHz.

DIMENSIONS AND WEIGHTS

RYC/B:
  - Dimensions: 490 x 330 x 310 mm approx.
                (19.29 x 12.99 x 12.20 inches approx.)
  - Weight: 10 kg approx.
                (22 pounds approx.)

SIMILAR UNITS AVAILABLE

Offered in this catalog:
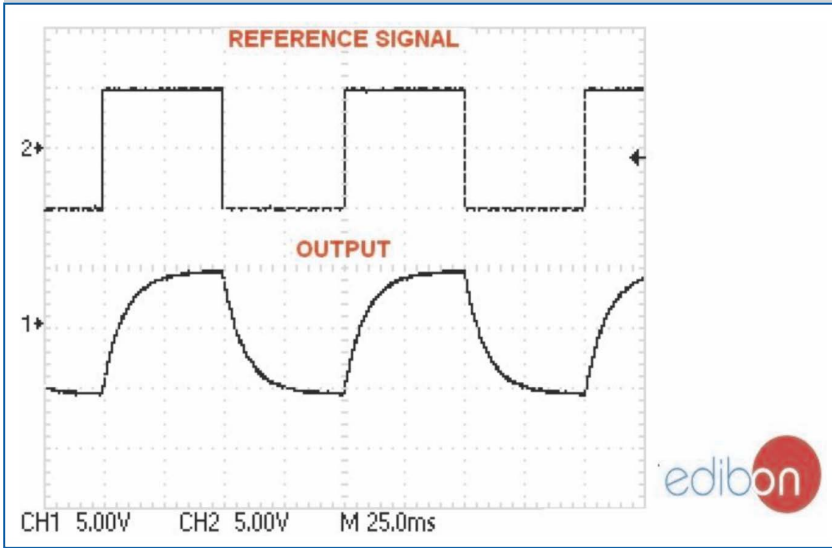- RYC/B. Basic Teaching Unit for the Study of Regulation and Control.
Offered in other catalog:
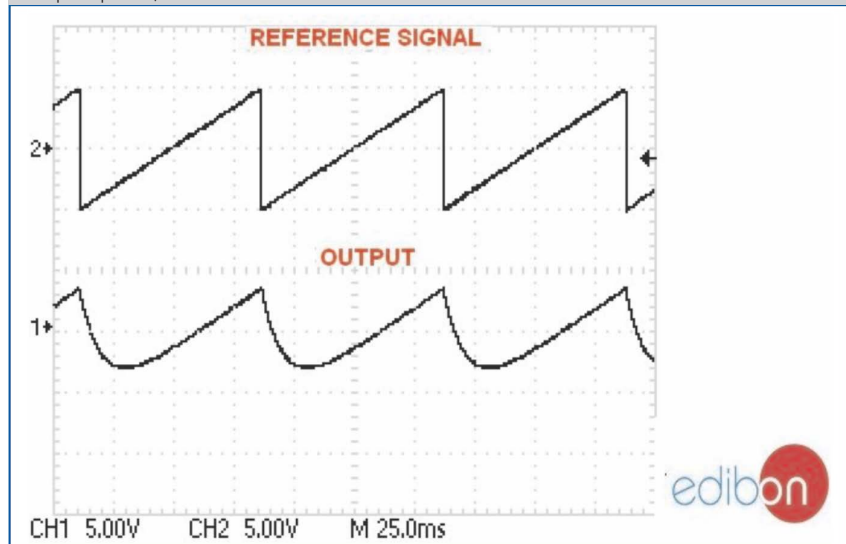- RYC/T. Computer Controlled Modular Control and Regulation Unit.
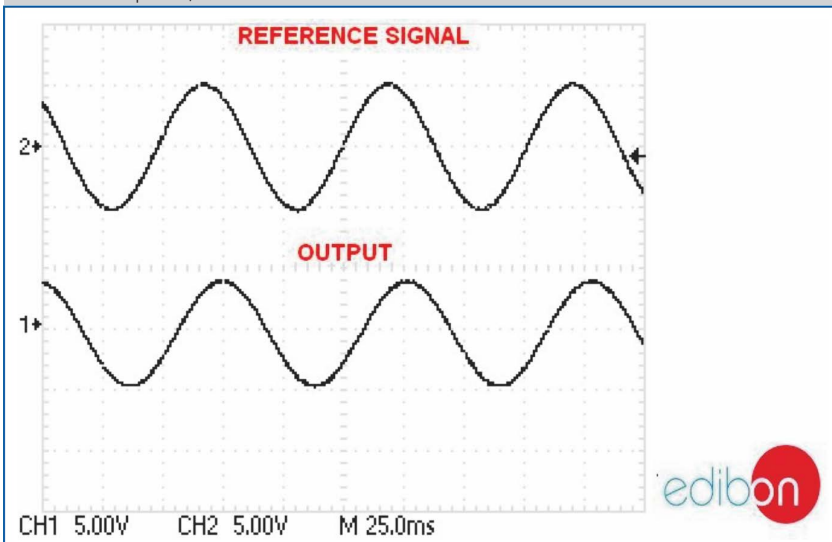
Response of a first order system in time domain

Step-response, time constant T=10 ms

Ramp-response, time constant T=10 ms

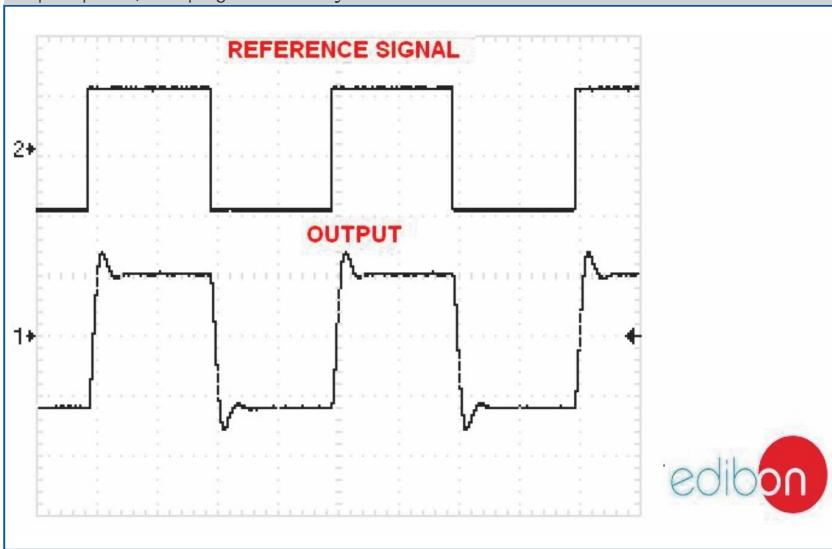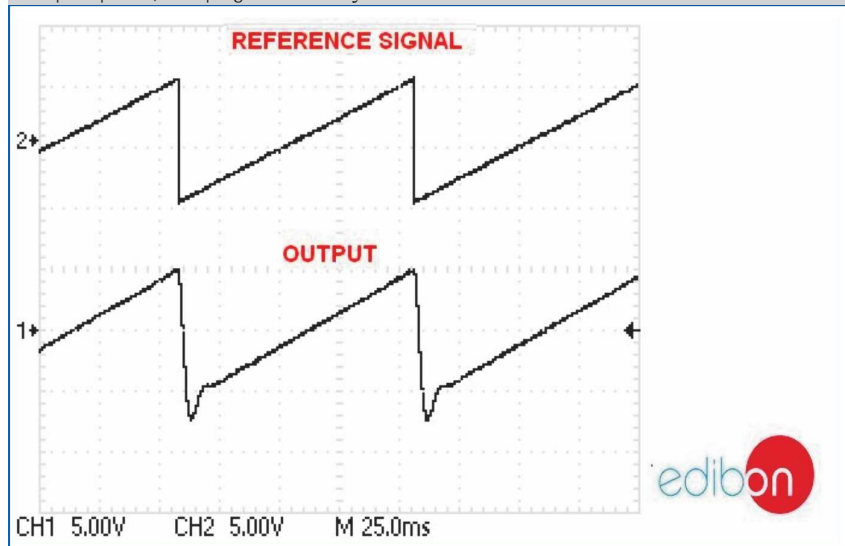Sinusoidal-response, time constant T=10 ms

Some **real** results obtained from this unit
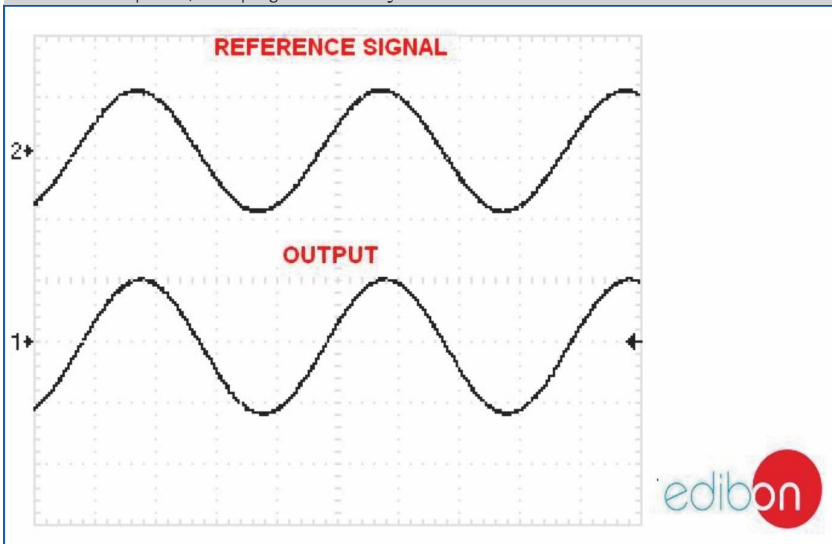
<u>Response of a second order system in time domain</u>

Step-response, damping coefficient ξ=0.5
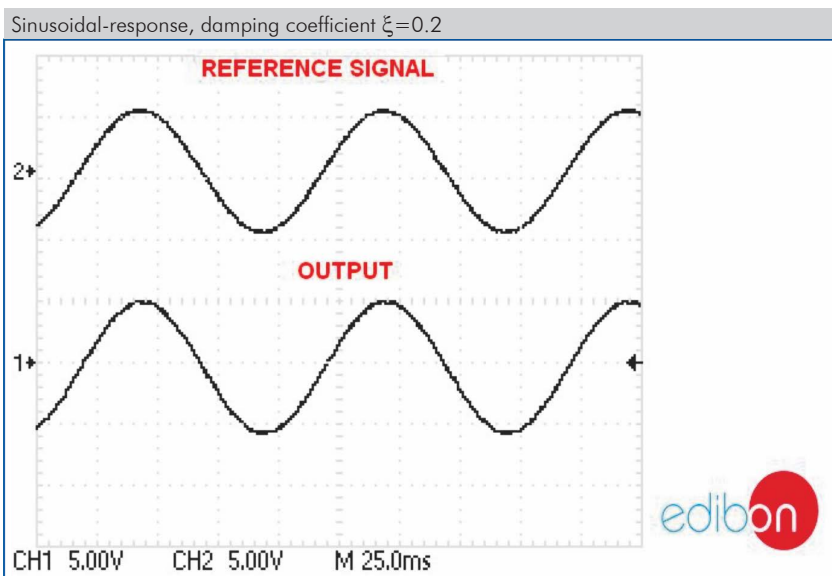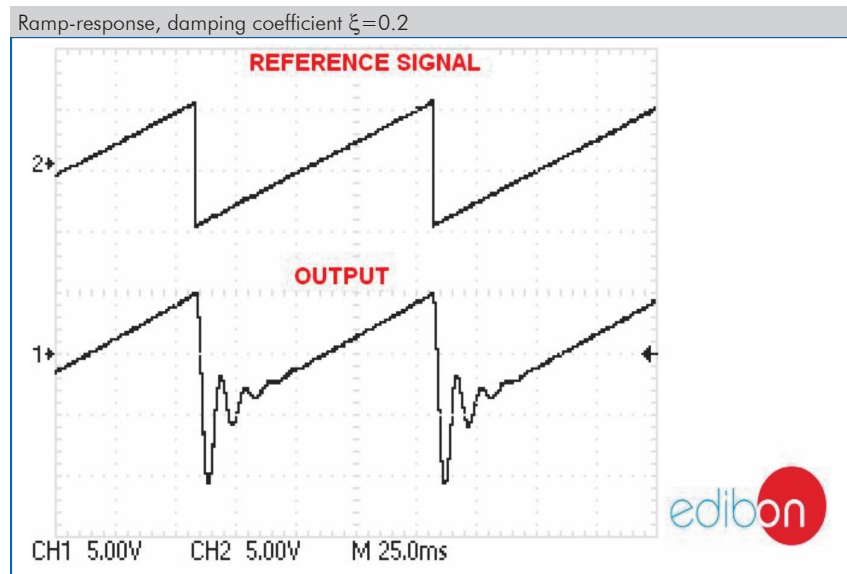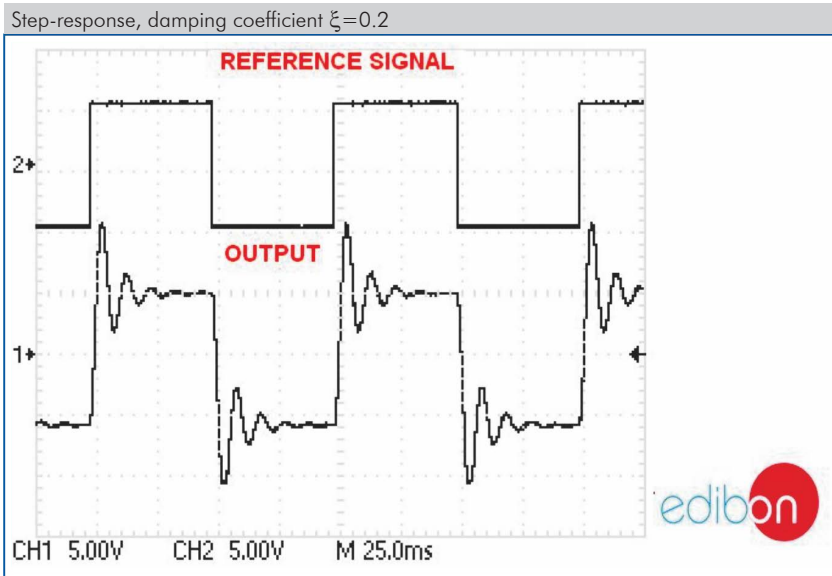

Ramp-response, damping coefficient ξ=0.5

CH1 5.00V   CH2 5.00V   M 25.0ms

Sinusoidal-response, damping coefficient ξ=0.5

Some **real** results obtained from this unit
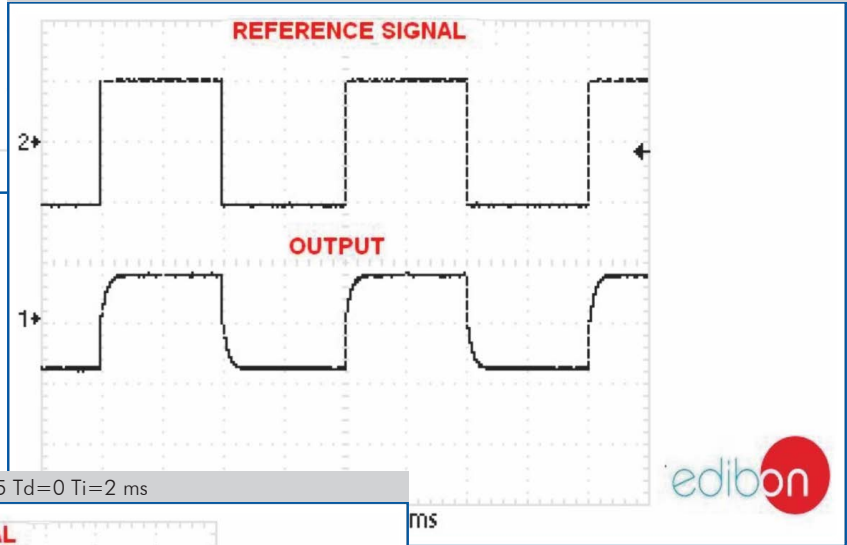
Response of a second order system in time domain

Step-response, damping coefficient ξ=0.2

Ramp-response, damping coefficient ξ=0.2

Sinusoidal-response, damping coefficient ξ=0.2

Some **real** results obtained from this unit

<u>PID control of a first order system</u>

Output of the system without PID controller

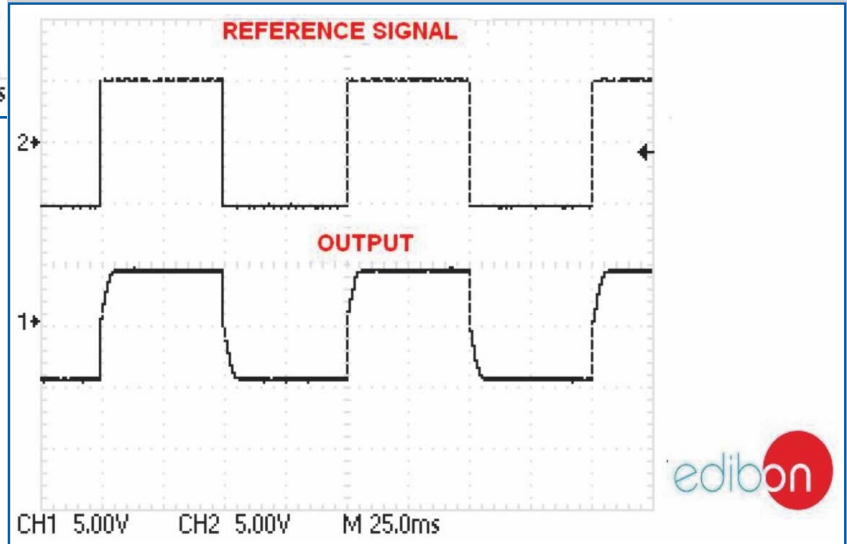REFERENCE SIGNAL

OUTPUT

CH1 5.00V   CH2 5.00V   M 25.0ms

Output of the system with PID controller Kp=2.5 Td=0 Ti=0

REFERENCE SIGNAL

OUTPUT

Output of the system with PID controller Kp=2.5 Td=0 Ti=2 ms

REFERENCE SIGNAL

OUTPUT

CH1 5.00V   CH2 5.00V   M 25.0ms

Output of the system with PID controller Kp=2.5 Td=2 ms Ti=2 ms

REFERENCE SIGNAL

OUTPUT

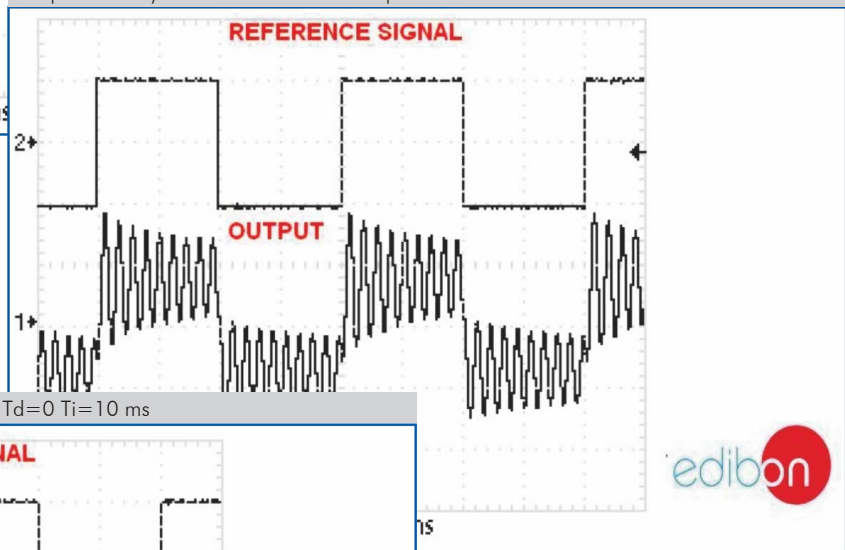CH1 5.00V   CH2 5.00V   M 25.0ms

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Some **real** results obtained from this unit

<u>PID Control of a second order system</u>
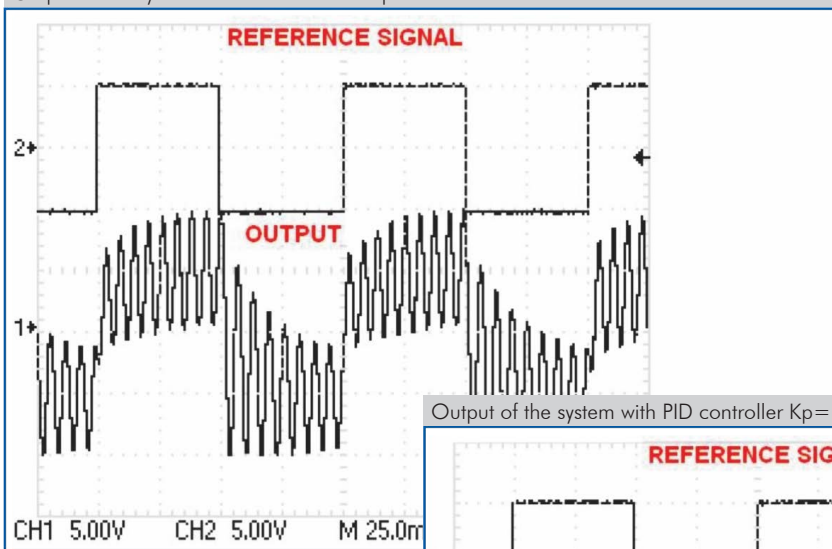
Output of the system without PID controller
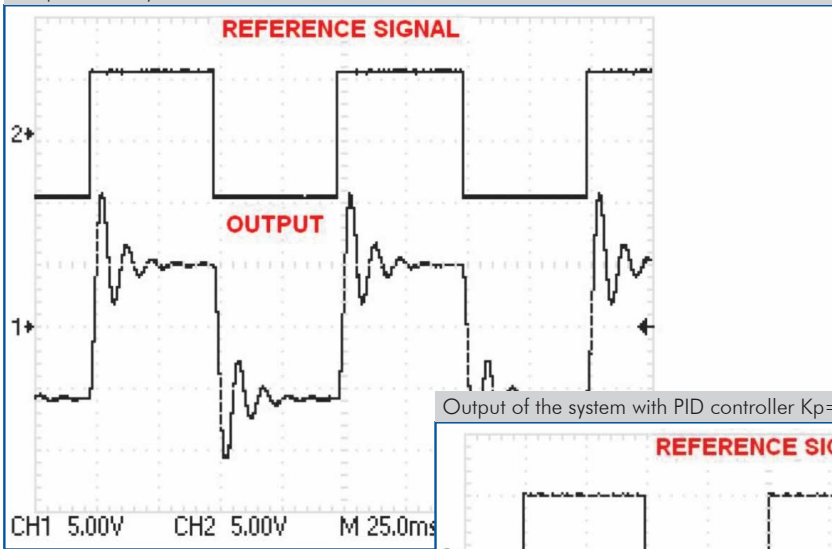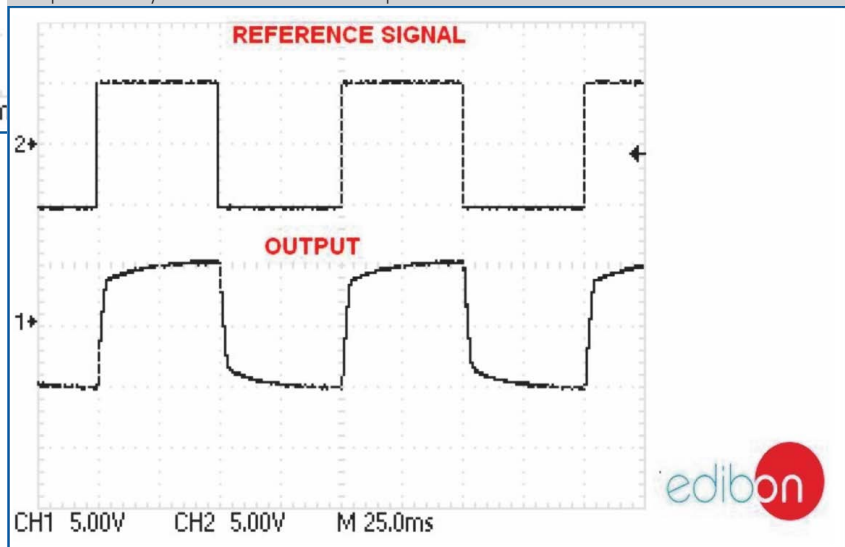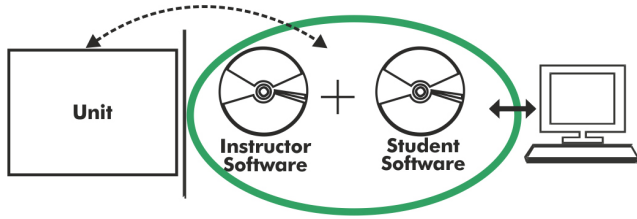

Output of the system with PID controller Kp=1 Td=0 Ti=0

Output of the system with PID controller Kp=1 Td=0 Ti=10 ms

Output of the system with PID controller Kp=1 Td=10 ms Ti=10 ms

RYC/B/ICAI. Interactive Computer Aided Instruction Software:

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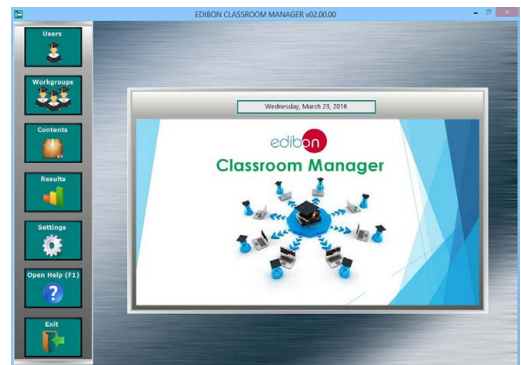
Instructor Software

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

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

Innovative features:

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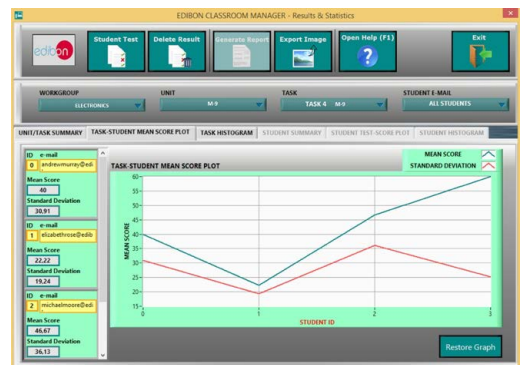- Report generation, User Progression Monitoring and Statistics.

ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen
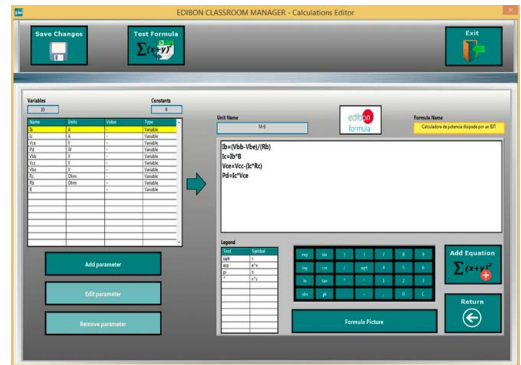
ECAL. EDIBON Calculations Program Package - Formula Editor Screen
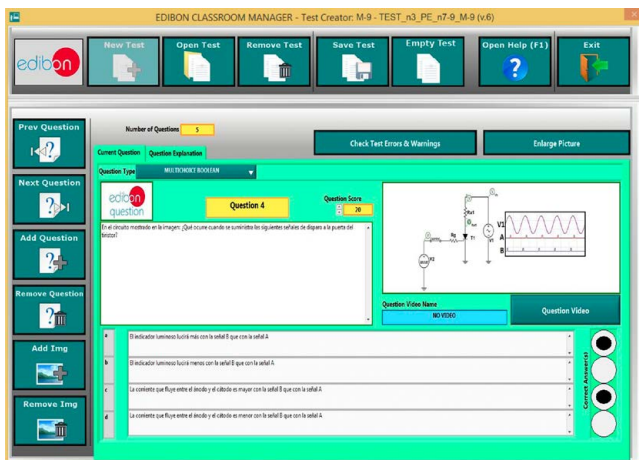
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

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

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

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

Innovative features:

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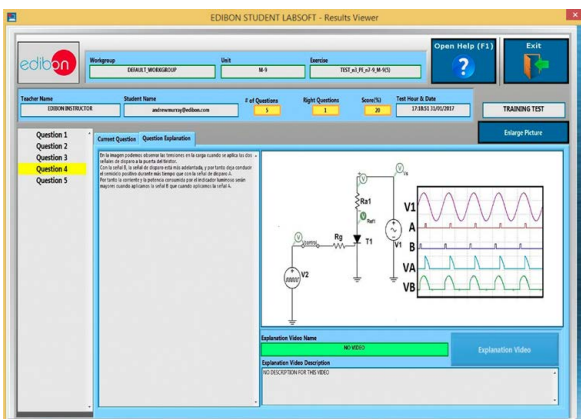- Multimedia-Supported auxiliary resources.

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

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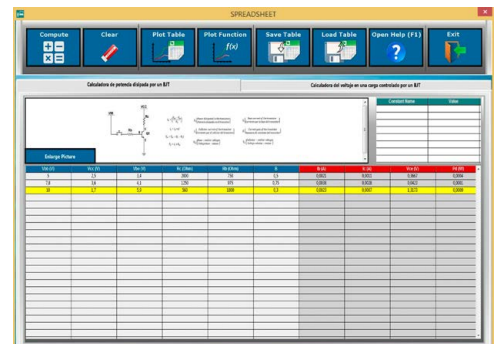

ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen
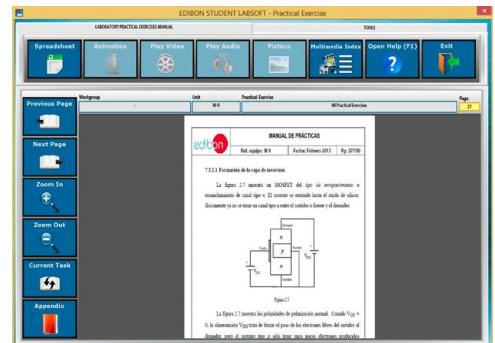
EPE. EDIBON Practical Exercise Program Package Main Screen

ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

✱ Specifications subject to change without previous notice, due to the convenience of improvement of the product.

REPRESENTATIVE: