Technical Teaching Equipment

Basic Teaching Unit for the Study of Regulation and Control

RYC/B

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Products
Products range
Units
2.-Electronics and 6.-Automation & Systems

DESCRIPTION

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.

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

SPECIFICATIONS

Metallic enclosure, including all the modules and elements.

Power Supply.

Protection fuse.

Block diagrams in the front panel.

Modules:

Reference signals:

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

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

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

PID controller:

P controller: 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 : 1ms to 100 ms

Second Order System:

Damping coefficient ξ: 0 to 1.5.

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

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.

ISO 9000: Quality Management
(for Design, Manufacturing, Commercialization and After-sales service)

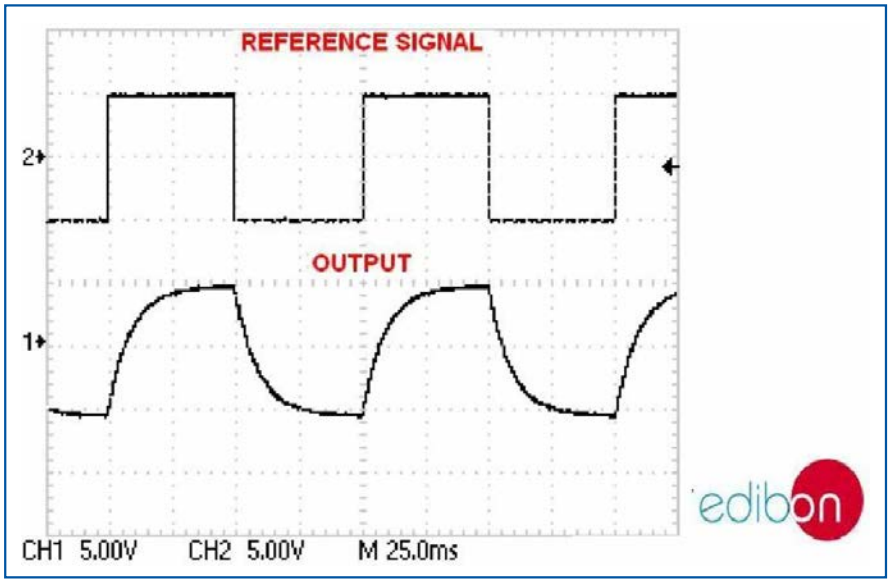
European Union Certificate
(total safety)

Certificates ISO 14000 and **ECO-Management and Audit Scheme**
(environmental management)

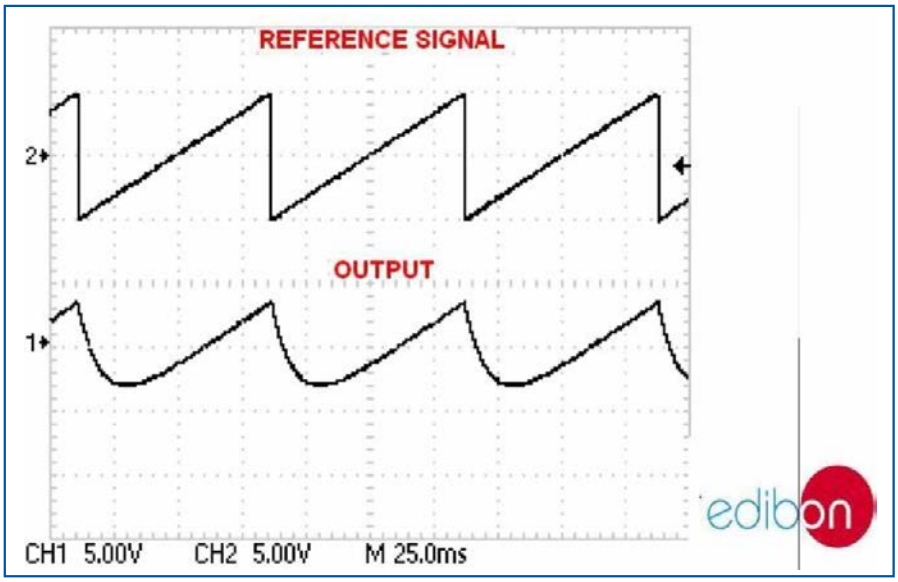
Worlddidac Quality Charter Certificate
(Worlddidac Member)

Some typical exercises results screens

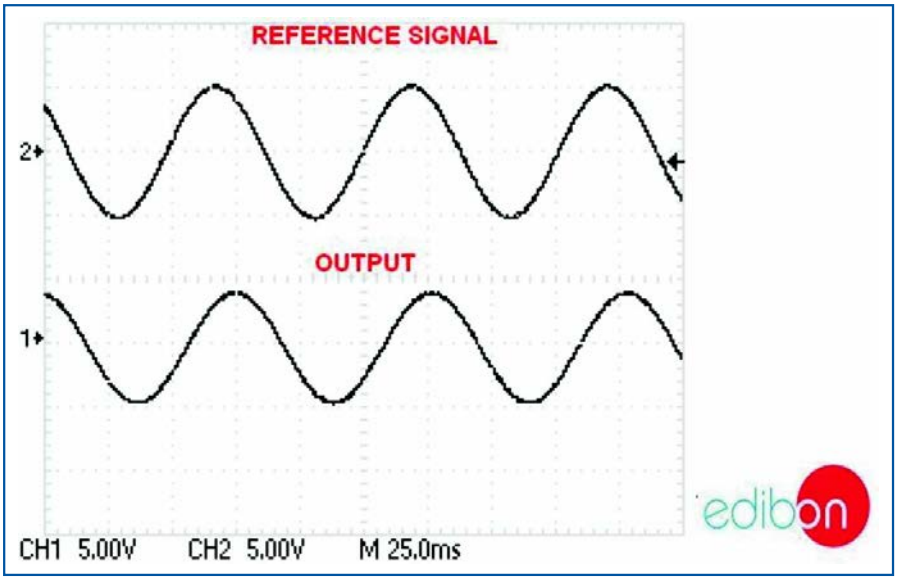
Response of a first order system in time domain



Step-Response Time Constant=10ms



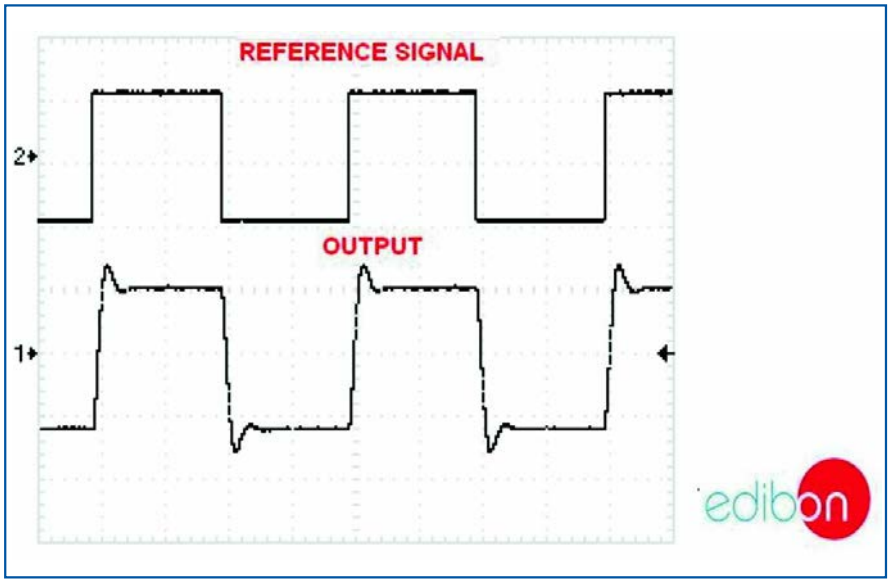
Ramp-Response Time Constant=10ms



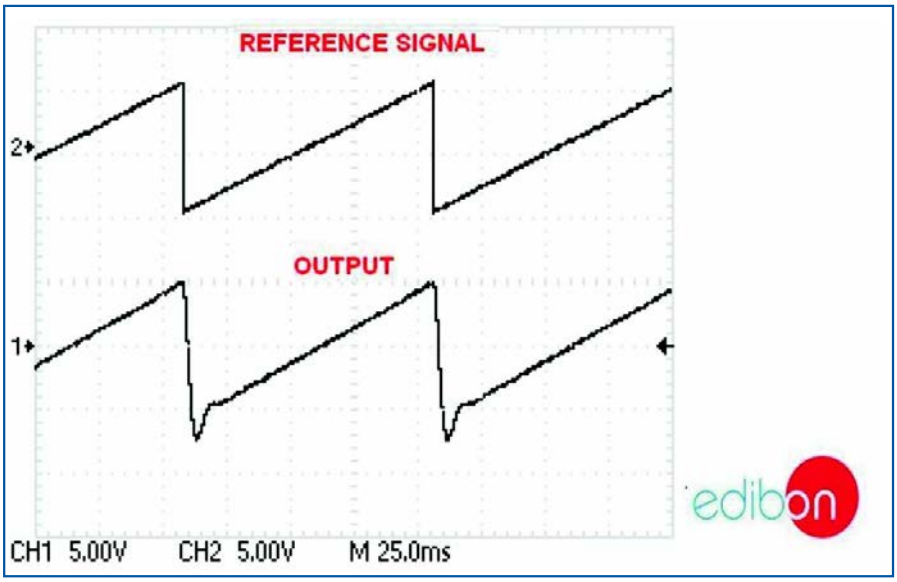
Sinusoidal-Response T=10ms

Continue...

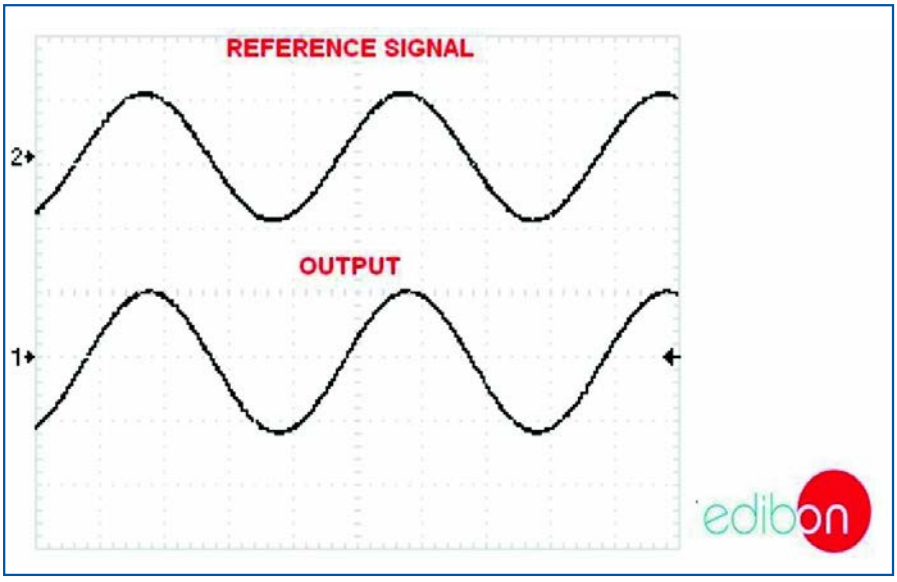
Response of a second order system in time domain



Step-Response Damping Coefficient ξ=0.5



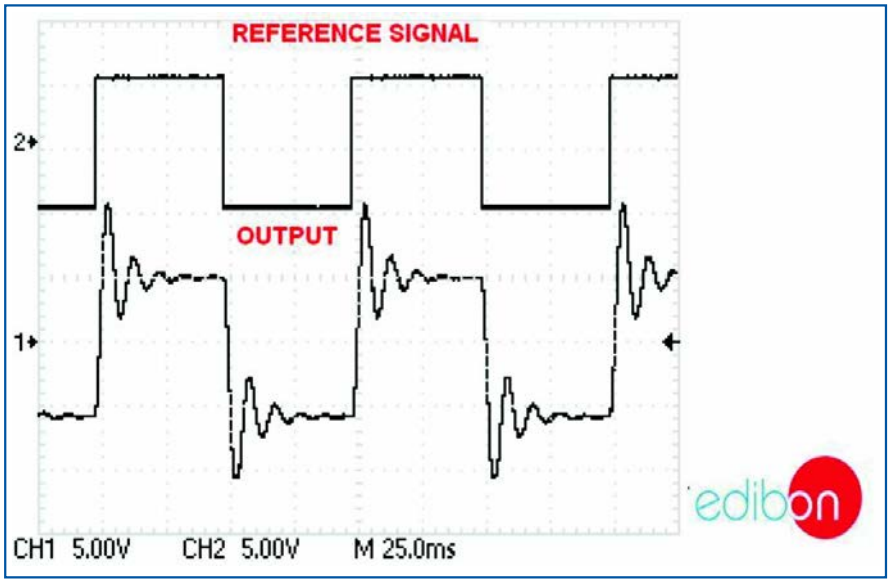
Ramp-Response Damping Coefficient ξ=0.5



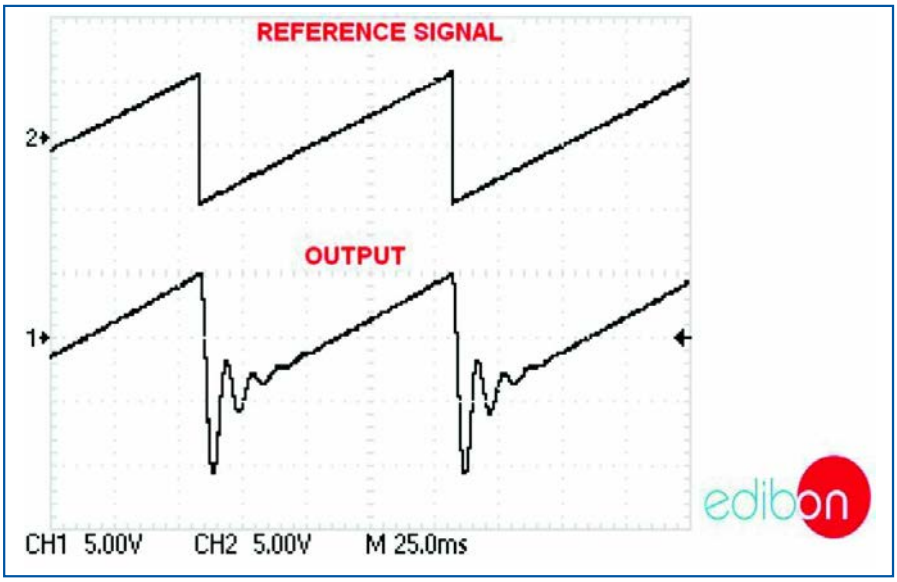
Sinusoidal-Response Damping Coefficient ξ=0.5

Continue...

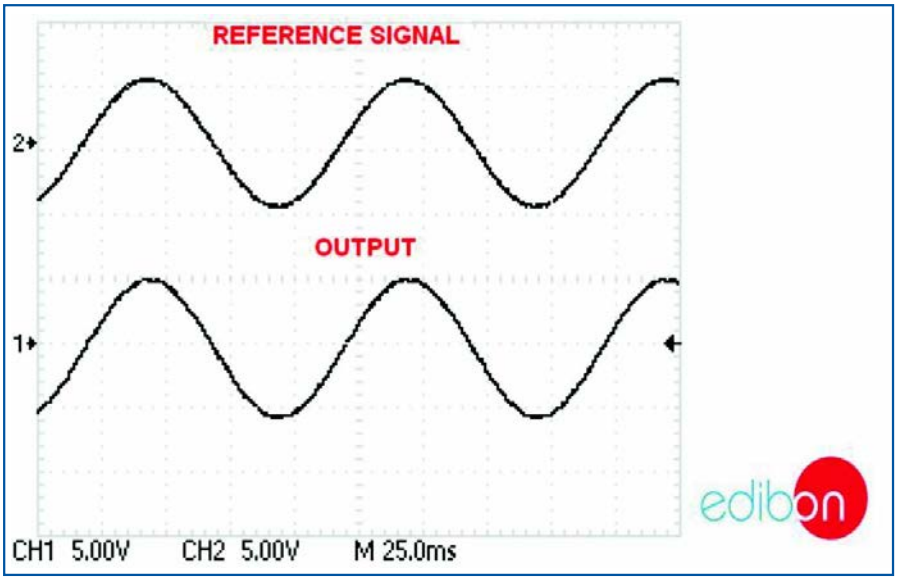
Response of a second order system in time domain (continuation)



Step-Response Damping Coefficient ξ=0.2



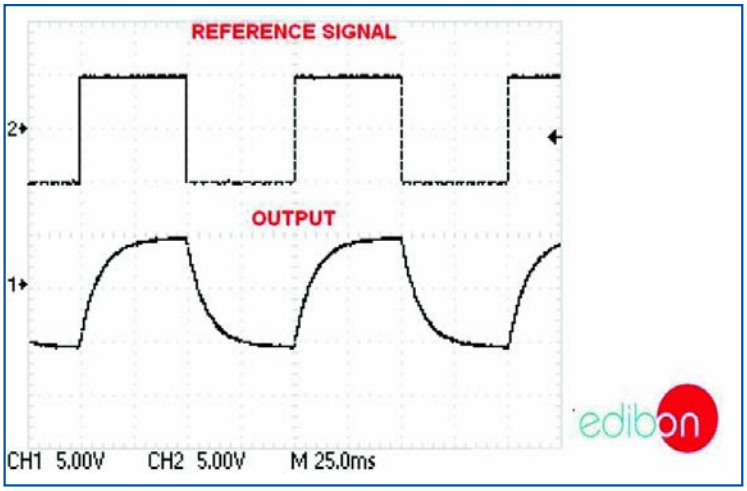
Ramp-Response Damping Coefficient ξ=0.2



Sinusoidal-Response Damping Coefficient ξ=0.2

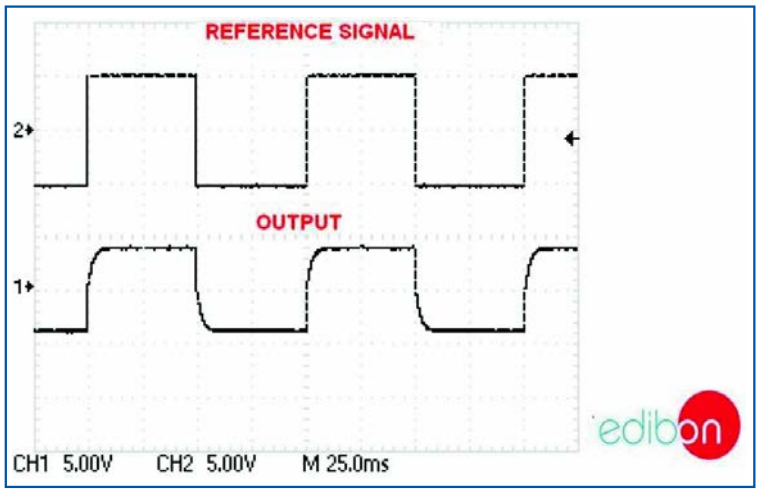
Continue...

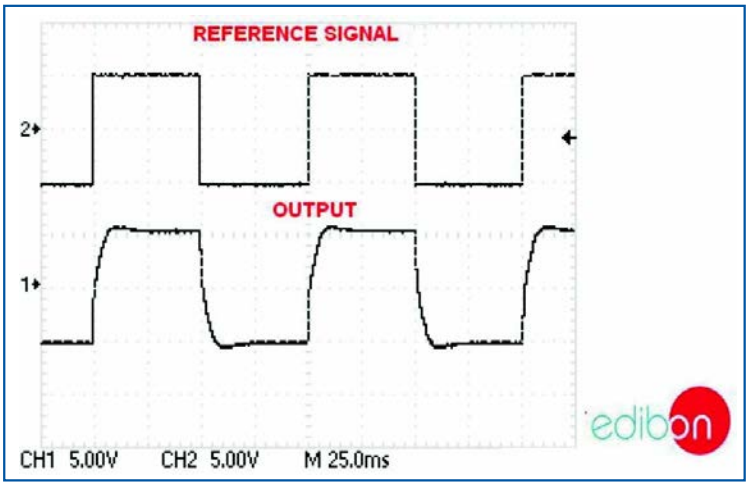
PID Control of a first order system



Output of the system without PID controller

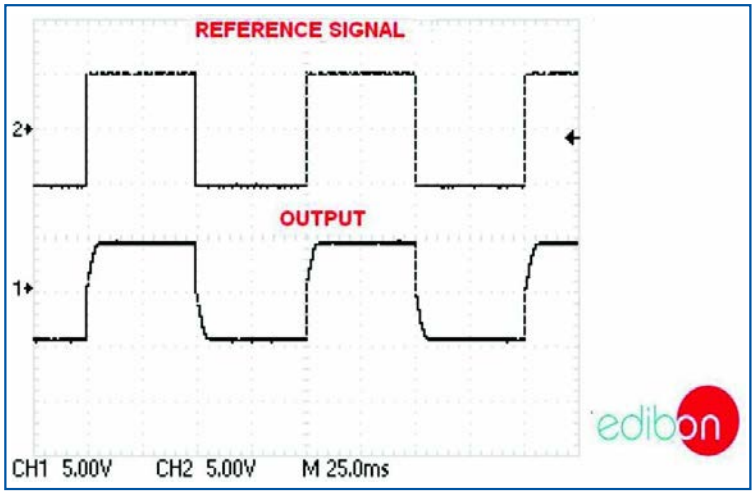
Output of the system with PID controller Kp=2.5 Td=0 Ti=0





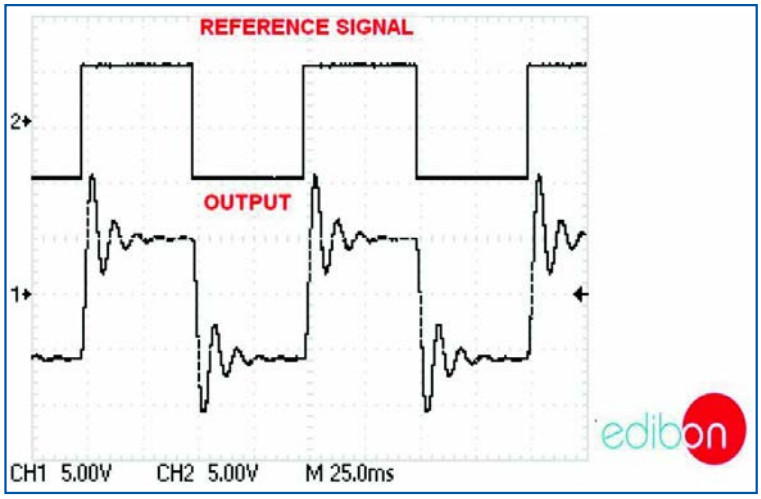
Output of the system with PID controller Kp=2.5 Td=0 Ti =2ms

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



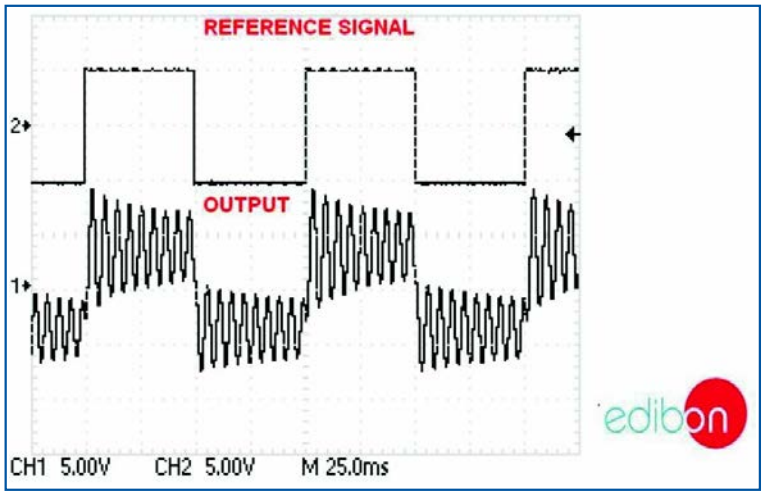
Continue...

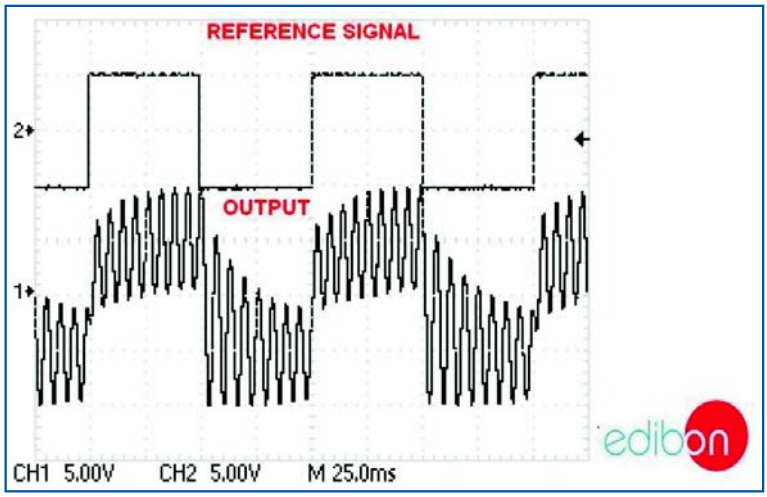
PID Control of a second order system



Output of the system without PID controller

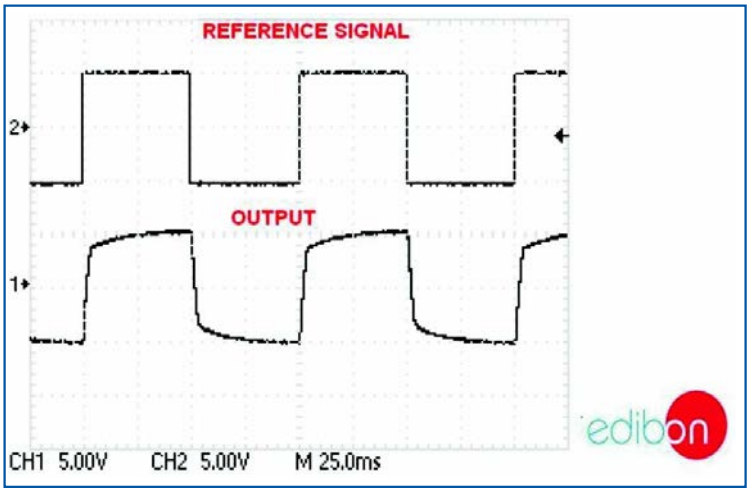
Output of the system with PID controller Kp=1 Td=0 Ti=0





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

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



EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

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, 220V./50Hz or 110V./60Hz.

DIMENSIONS & WEIGHTS

- Dimensions: 490 x 330 x 310 mm. approx.
- Weight: 10 Kg. approx.

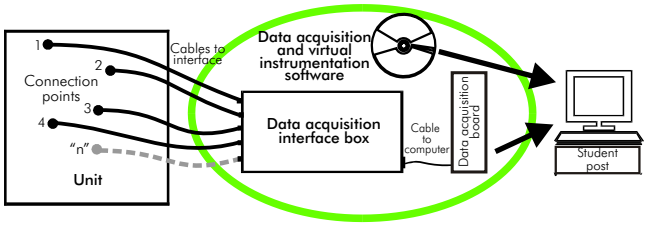
OPTIONAL AND ADDITIONAL

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

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

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

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



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

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

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

DAIB. Data Acquisition Interface Box:

Metallic box. Dimensions: 310 x 220 x 145 mm. approx.

Front panel:

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

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

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

2 Analog outputs.

24 Digital inputs/outputs, configurable as inputs or outputs, with 24 state led indicators. These digital inputs/outputs are grouped in three ports of eight channels (P0, P1 and P3).

4 Digital signal switches 0-5V. 2 Analog signal potentiometers ±12V.

Main ON/OFF switch.

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

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

Connecting cables.

DAIB

+

DAB. Data Acquisition Board:

For EDAS/VIS 1.25 Version:

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

Analog input: Number of **channels= 16** single-ended or 8 differential. **Resolution=16 bits**, 1 in 65536. **Sampling rate up to: 1,250,000 S/s (samples per second)**. Input range (V)=±10V. Data transfers=DMA, interrupts, programmed I/0. DMA channels=6.

Analog output: Number **channels=2. Resolution=16 bits**, 1 in 65536. **Max. output rate up to: 833KS/s.** Output range(V)=±10V. Data transfers=DMA, interrupts, programmed I/0.

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

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

DAB

For EDAS/VIS 0.25 Version:

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

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

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

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

+

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

Compatible with actual Windows operating systems. Amicable graphical frame.

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

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

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

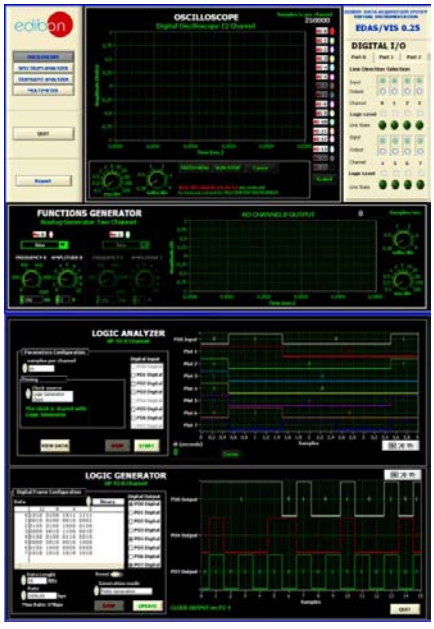
Set of Virtual Instruments:

- **Oscilloscope:**
  - **Channels: 12** simultaneous. Maximum input voltage: ±10V.
  - **All 12 input channels could be scaled** to compare signal with different voltage levels.
  - **"Math Menu"** with operations as Addition, Subtraction, Multiplication and Division, between any of the 12 oscilloscope channels.
- **Function Generator:**
  - **Two independent signal generators**, for sinusoidal, triangular, saw tooth and square.
  - **Channels: 2** (allowing working simultaneously). Maximum output voltage: ±10V.
  - **It includes a graph where an output signal for each channel is shown.**
- **Spectrum Analyzer:**
  - **Channels: 12** (simultaneous). Max. voltage: ±10V. Spectrum analyzer: based on the FFT.
- **Multimeter:**
  - **Voltmeter** (**Channels: 12** (simultaneous). Max. voltage: ±10V RMS).
  - **Ammeter** (**Channels: 2** (simultaneous). Max. Ampere: 500 mA rms per channel).
- **Transient Analyzer.**
- **Logic Analyzer:**
  - **Number of Input channels: 8.** TTL Voltage Level. **Clock Source: 3 different sources.**
  - This instrument allows receiving as far as 8 digital signal simultaneously at 1 or 8 Mbps (depending the version).
- **Logic Generator:**
  - **Number of transmission channels: 8.** TTL voltage level.
  - This instrument allows generating up to 8 digital simultaneous signals of 1 or 8 Mbps (depending of the version).

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

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

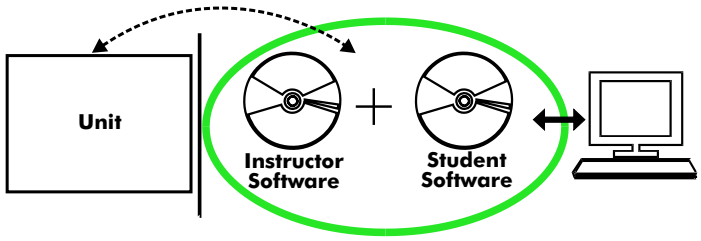
Manuals: This system **is supplied with the following manuals**: Required Services, Assembly and Installation, Interface and Software, Starting-up, Safety, Maintenance & Practices Manuals.



EDAS/VIS-SOF

* Software available in English and Spanish. Any other language available on request.

CAI. Computer Aided Instruction Software System



With no physical connection between unit and computer, this complete package consists on an Instructor Software (INS/ SOF) totally integrated with the Student Software (RYC/B/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.

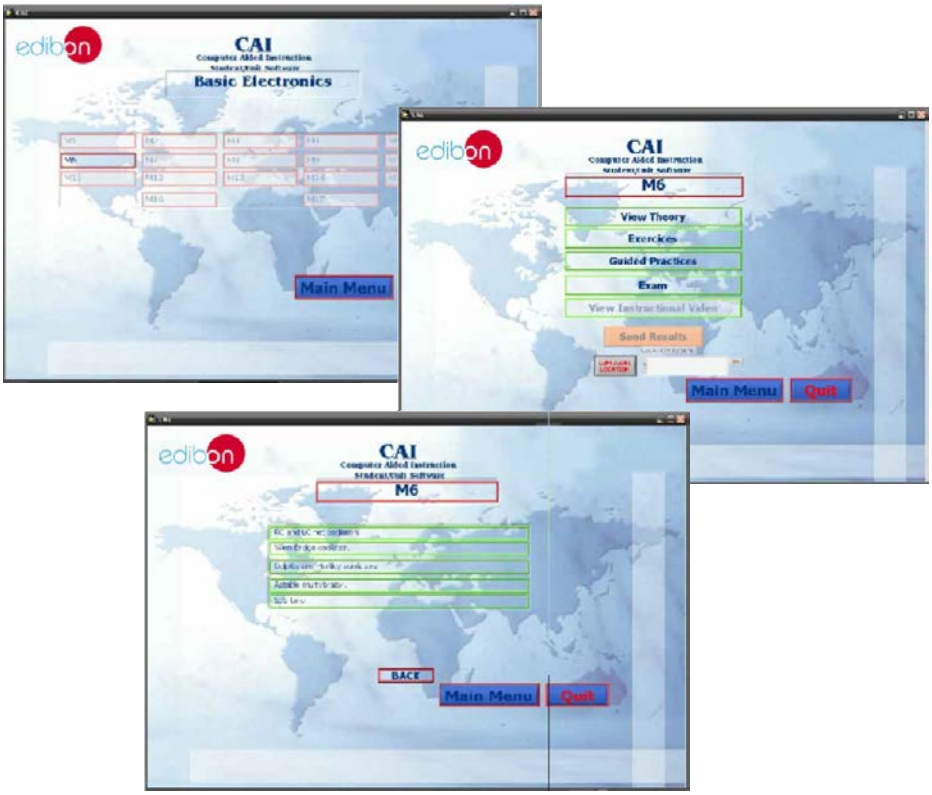
Examples of the Software screens

With the **INS/SOF. Classroom Management Software Package (Instructor Software)**, the Instructor has a whole range of options, among them:

- 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.

This Instructor Software, working in network configuration, allows controlling all the students in the classroom.



RYC/B/SOF. Computer Aided Instruction Software Package (Student Software).

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

- The options are presented by pull-down menus and pop-up windows.
- Each Software Package 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, alongside the unit, showing how to complete exercises and practices.

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

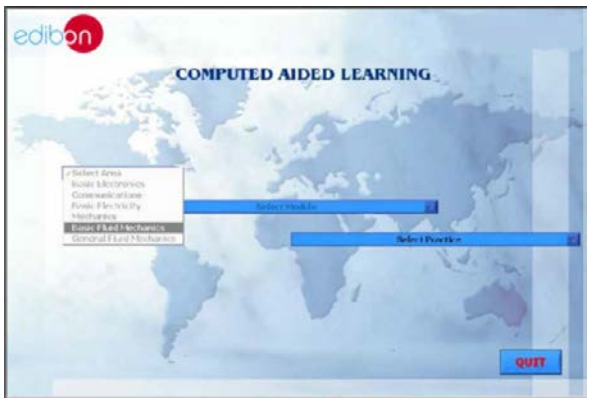
∗ Software is available in English and Spanish. Any other language available on request.

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

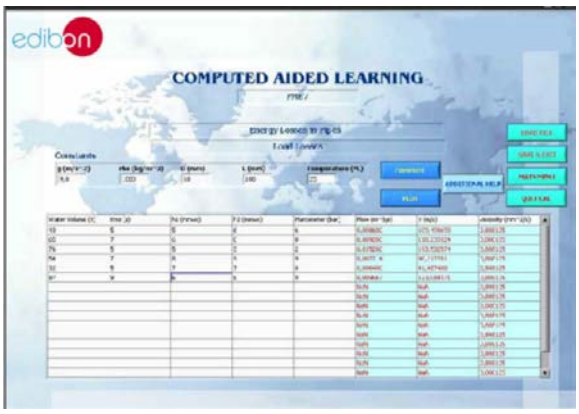
This Computer Aided Learning Software (CAL) is a Windows based software, simple and very easy to use specifically developed by EDIBON. It has been designed to cover different areas of science: Basic Electronics, Communications, Basic Electricity, Energy, Mechanics, Basic Fluid Mechanics and General Fluid Mechanics*.

*Although only the purchased areas will be activated and ready to use.

CAL is a class assistant that helps in making the necessary calculations to extract the right conclusions from data obtained during the experimental practices.
With a single click, CAL computes the value of all the variables involved.
Also, CAL gives the option of plotting and printing the results.



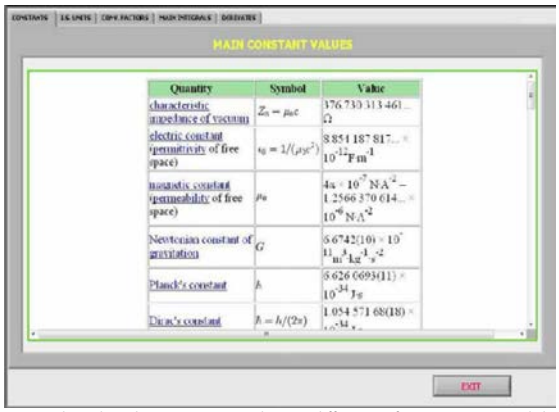
Once the Area of study is selected, the right module can be chosen among a wide range, each one with its own set of lab exercises.



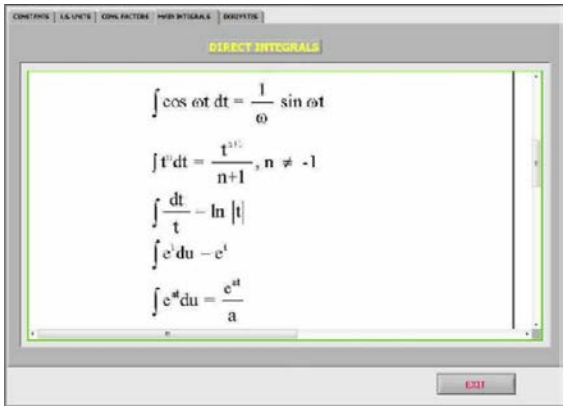
Simply insert the experimental data, with a single click CAL will perform the calculations.

Between the plotting options, any variable can be represented against any other.
And there exist a great range of different plotting displays.

Among the given choices, an additional help button can be found, which offers a wide range of information, such as constant values, unit conversion factors and integral and derivative tables.



It provides a handy option to avoid using different reference sources while in progress. For example: the values of Physical constants, their symbols and right names, conversion factors...



...and the very useful Integral and Derivative tables.

* Software is available in English and Spanish. Any other language available on request.

✱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: 34-91-6199363 FAX: 34-91-6198647
E-mail: edibon@edibon.com WEB site: www.edibon.com

Issue: ED01/11
Date: April/2011

REPRESENTATIVE: