edibon

Engineering and Technical Teaching Equipment

Computer Controlled **Teaching Unit for the Study of Regulation and Control,** with SCADA and PID Control

RYC

EDIBON PATENT

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

Teaching Technique used

EDIBON **SCADA** System and **PID Control** included

- Control Interface included in the Unit
- ② Data Acquisition Board
- ③ Software for:
  - Computer Control
  - Data Acquisition
  - Data Management
- ④ Cables and Accessories
- ⑤ Manuals

Computer (not included in the supply)

* **Minimum supply always includes: 1 + 2 + 3 + 4 + 5**
(Computer not included in the supply)

⑥ **Additional applications** for working with the RYC unit:

- 6.1 RYC-SM. DC Servo Motor Module
- 6.2 RYC-BB. Ball and Beam Module
- 6.3 RYC-TAR. Air Flow Temperature Control Module
- 6.4 RYC-TAG. Water Flow Temperature Control Module
- 6.5 RYC-T. Temperature Control Module
- 6.6 RYC-P. Pressure Control Module
- 6.7 RYC-N. Level Control Module
- 6.8 RYC-C. Flow Rate Control Module
- 6.9 RYC-I. Luminosity Control Module
- 6.10 RYC-pH. pH Control Module
- 6.11 RYC-CP. Position Control Module
- 6.12 RYC-PI. Inverted Pendulum Control Module
- 6.13 RYC-CLM. Magnetic Levitation Control Module

Key features:

- **Advanced Real-Time SCADA and PID Control.**
- **Open Control + Multicontrol + Real-Time Control.**
- **Specialized EDIBON Control Software based on LabVIEW.**
- **National Instruments Data Acquisition board (250 KS/s, kilo samples per second).**
- **Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.**
- **Capable of doing applied research, real industrial simulation, training courses, etc.**
- **Remote operation and control by the user and remote control for EDIBON technical support, are always included.**
- **Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).**
- **Designed and manufactured under several quality standards.**
- **Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc.**
  Apart from monitoring user's knowledge and progress reached.
- **This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.**
- **Wide range of applications for working with RYC.**

OPEN CONTROL + MULTICONTROL + REAL TIME CONTROL

POWERED BY NATIONAL INSTRUMENTS LabVIEW

www.edibon.com
PRODUCTS
20.- ELECTRONICS AND
60.- MECHATRONICS & COMPUMECHATRONICS

For more information about Key Features, click here

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)

Certificate and Worlddidac Member

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-s domains, depending on the nature of the design problem.

The Computer Controlled Teaching Unit for the Study of Regulation and Control, "RYC", is 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

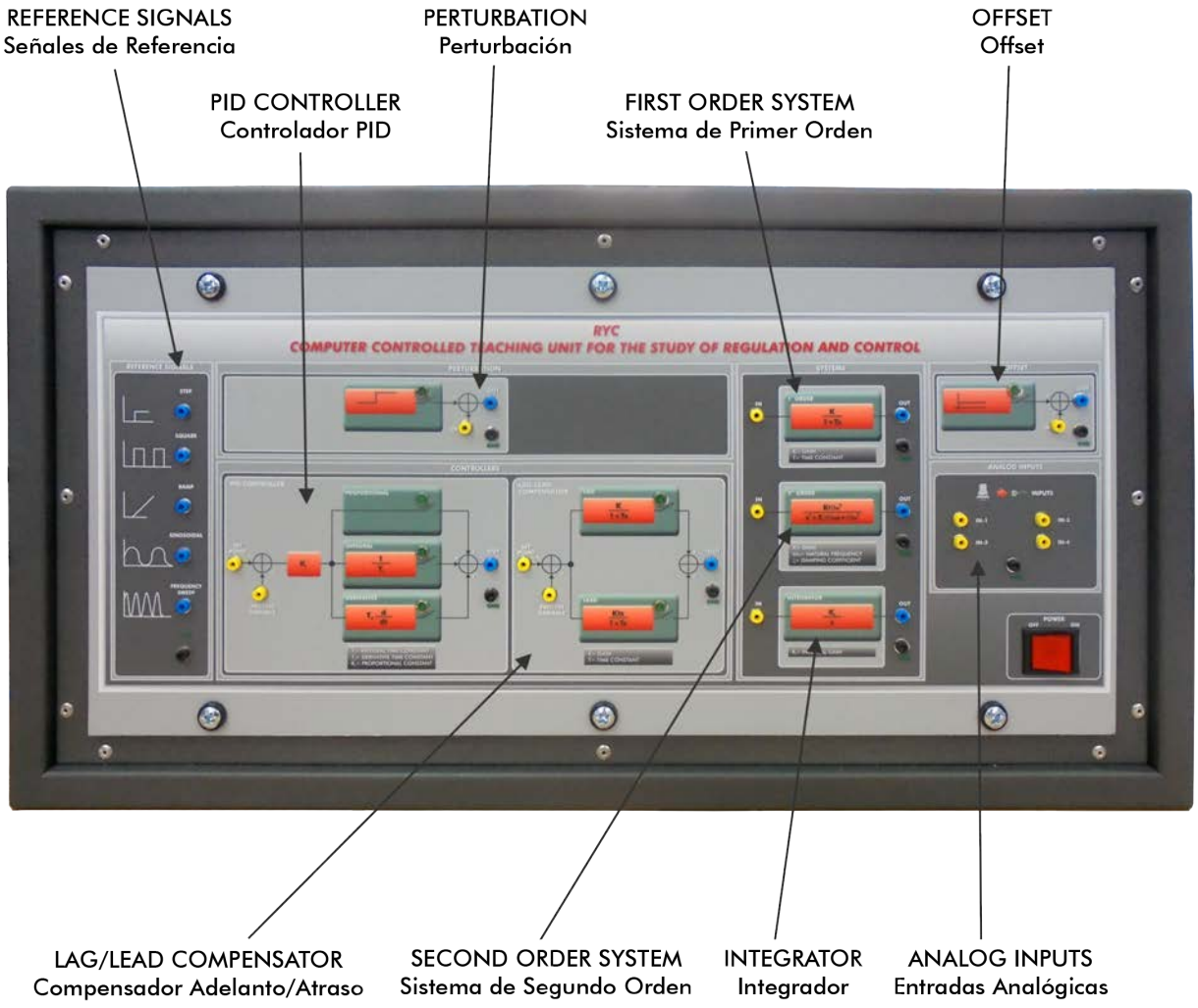
Regulation and control theory is divided into two major divisions in, namely, classical and modern. The implementation of classical controller designs as compared to systems designed using modern control theory is easier and these controllers are preferred in most industrial applications. The most common controllers designed using classical control theory, are PID controllers.

The Computer Controlled Teaching Unit for the Study of Regulation and Control, "RYC", allows the students to simulate an integrator system, a first order system and a second order system and regulate them with a PID controller or Lead & Lag compensator. The unit also allows to simulate perturbations and offsets to analyze the response of the system.

A wide range of applications: DC Servo Motor Module, Ball and Beam Module, etc. for working with the "RYC" unit are available to study a real control systems response to complement the Study of regulation and control in real time.

This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), and includes: The unit itself + a Control Interface Box + a Data Acquisition Board + Computer Control, Data Acquisition and Data Management Software Packages, for controlling the process and all parameters involved in the process.

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



With this unit there are several options and possibilities:

- Main items: 1, 2, 3, 4 and 5.
- Additional applications for working with the RYC unit: 6.
- Optional items: 7, 8 and 9.

Let us describe first the main items (1 to 5):

① RYC. Unit:

Unit:

Metallic box.

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

Reference signals module:

This module allows to generate four different types of signals: step, square, ramp and sine. The frequency and amplitude of the signals can be adjusted through the computer.

Step output. Square output. Ramp output. Sine output.

Step: amplitude: 0 V to 5 V, frequency: 0Hz to 200 Hz.

Square: amplitude: ±10 V, frequency: 0Hz to 200 Hz.

Ramp: amplitude: ±10 V, frequency: 0Hz to 200 Hz.

Sine: amplitude: ±10 V, frequency: 0Hz to 200 Hz.

Frequency sweep: this module performs a frequency sweep needed for calculating the Bode plot.

Unit: RYC

PID controller module:

This module is subdivided into proportional, integrative and derivative blocks. The module allows to adjust each parameter independently from the computer:

P controller: Kc: -10 to +10. I controller: Ti: 0 to 100 s. D controller: Td: 0 to 100 s.

Sample time: 0.1 to 100 ms.

Lead/Lag compensator:

This module represents a compensator system in the Laplace domain. The system allows to modify the zero, the pole and the gain of the compensator through the computer:

K lead: 1 to 100 s. K lag: 1 to 100 s. Gain: 1 to 10. Sample time: 0.1 to 100 ms.

Integrator system:

This module represents and integrator system in the Laplace domain. The system allows to modify the gain and the saturation valve of the system through the computer:

Gain: -10 to 10.

Saturation: -10 to 10.

First order system:

This module represents a first order system in the Laplace domain. The system allows to modify the time constant of the system through the computer. The gain can be also adjusted using the computer:

Gain: 0 to 10. Time constant T: 0 to 100 s.

Second order system:

This module represents a second order system in Laplace domain. The system allows to modify through the computer the three parameters of the system: gain, damping coefficient and the natural frequency:

Gain: 1 to 10.

Damping coefficient ξ: 0 to 1.5 in steps of 0.1.

Natural frequency (ω n): 1Hz to 2 π*100 rad/s (100 Hz).

Perturbation module:

This module allows to insert disturbances in the systems. The perturbation can be inserted in different places of the control loop:

Perturbation value: -10 to 10.

Offset module:

This module allows to add an offset to the input signal.

Offset value: -10 to 10.

Analog Inputs:

This module is provided with 4 analog inputs. The inputs are used to visualize different signals in the computer.

Connector to computer.

Control Interface included.

Wide range of **Additional applications** for working with the RYC unit. (Not included) (see pages from 5 to 11)

The complete unit includes as well:

Advanced Real-Time SCADA and PID Control.

Open Control + Multicontrol + Real-Time Control.

Specialized EDIBON Control Software based on LabVIEW.

National Instruments Data Acquisition board (250 KS/s, kilo samples per second).

Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.

Capable of doing applied research, real industrial simulation, training courses, etc.

Remote operation and control by the user and remote control for EDIBON technical support, are always included.

Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).

Designed and manufactured under several quality standards.

Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc.

Apart from monitoring user's knowledge and progress reached.

This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

③ DAB. Data Acquisition Board:

The Data Acquisition board is part of the SCADA system.

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

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).

Input range (V)=±10 V. Data transfers=DMA, interrupts, programmed I/0. DMA channels=6.

Analog output:

Number of **channels=2**. **Resolution=16 bits**, 1 in 65536.

Maximum output rate up to: 900 KS/s.

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

Digital Input/Output:

Number of **channels=24 inputs/outputs**. D0 or DI Sample Clock frequency: 0 to 100 MHz.

Timing: Number of **Counter/timers=4**. Resolution: Counter/timers: 32 bits.

DAB

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

The three softwares are part of the SCADA system.

Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen. **Compatible with the industry standards.**

The software allows to visualize the signal in time domain and perform the Bode diagram of the analyzed system.

The software allows to modify all parameters of the reference signals generators, system simulators (integrator, first order system and second order system) and controllers (PID and Lead/Lag Compensator). The Software also allows to modify the offset and the pertubation value.

Registration, visualization and control of all process variables in an automatic and simultaneous way.

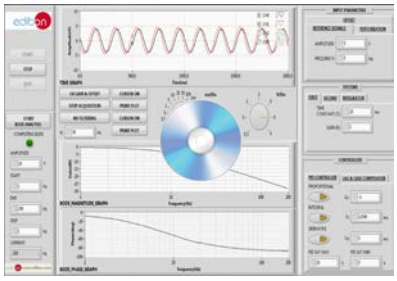
Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.

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.

This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.



RYC/CCSOF

⑤ Cables and Accessories, for normal operation.

⑥ Manuals:

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

*References 1 to 5 are the main items: RYC + DAB + RYC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply for enabling normal and full operation.

⑥ Additional applications for working with the RYC unit:

⑥.1 RYC-SM. **DC Servo Motor Module.**

The "RYC-SM" Servo Motor module has been designed to study a practical control system, through the control of the position and speed of a DC Servo Motor.

The "RYC-SM" module consists of two main components: the "RYC-SM" apparatus and the "RYC-SM" interface box. The "RYC-SM" apparatus contains all the sensors and actuators such as tachometer sensor, DC motor, etc. and the "RYC-SM" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the position and the speed of the motor.

The system allows to insert disturbances manually.

RYC-SM Apparatus

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RYC-SM Interface Box

Specifications:

- Metallic structure.
- DC Motor:
  - Motor supply: 10Vdc.
  - Max speed: 10000 rpm.
  - Gear ratio: 21:1.
- Tachometer (motor speed sensor):
  - Tachometer output: 10 Vdc.
  - Max speed: 10000 rpm.
- Potentiometer (motor position sensor):
  - Potentiometer output: 10 Vdc.

Dimensions: 300 x 225 x 300 mm. approx. (11.81 x 8.85 x 11.81 inches approx.).

Weight: 5 Kg. approx. (11 pounds approx.).

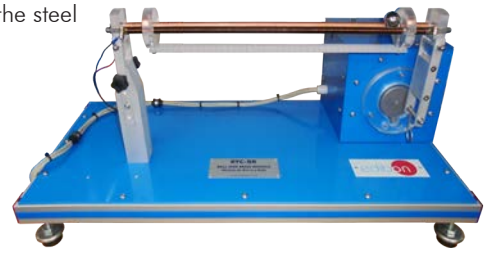
⑥.2 RYC-BB. **Ball and Beam Module.**

The "RYC-BB" Ball and Beam module has been designed to study a practical control system, through the study of a classical control system; the Ball and Beam Control system.

The "RYC-BB" module consists of two main components: the "RYC-BB" apparatus and the "RYC-BB" interface box. The "RYC-BB" apparatus contains all the sensors and actuators such as a motor, a wire-wound rod that work as a position sensor, etc. and the "RYC-BB" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the position of the steel ball along the beam.

The system allows to insert disturbances manually.



RYC-BB Apparatus

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RYC-BB Interface Box

Specifications:

- Metallic structure.
- DC Servo Motor:
  - Motor supply: 10 Vdc.
  - Max speed: 10700 rpm.
  - Gear reduction: 21:1.
- Shaft angle position sensor:
  - Transducer: Potentiometer (10 KΩ).
  - Measurement range: 180 degrees.
  - Output: ±10V.
- Ball position sensor:
  - Transducer: Potentiometer (750Ω).
  - Measurement range: ±200mm.
  - Output: ±10V.
- Ball and Beam structure:
  - Steel ball:
    - Radius: 12.7 mm.
    - Mass: 0.064 Kg.
  - Beam length: 425 mm.
  - Level arm length: 120 mm.
  - Support arm length: 160 mm.

Dimensions: 1000 x 400 x 350 mm. approx. (39.37 x 15.74 x 13.78 inches approx.).

Weight: 18 Kg. approx. (39 pounds approx.).

⑥ Additional applications for working with the RYC unit:

⑥.③ RYC-TAR. **Air Flow Temperature Control Module.**

The "RYC-TAR" Air Flow Temperature Control module has been designed to study a practical control system, through the control of an air flow temperature.

The "RYC-TAR" module consists of two main components: the "RYC-TAR" apparatus and the "RYC-TAR" interface box. The "RYC-TAR" apparatus contains all the sensors and actuators such as temperature sensors at different position, axial fan, heater, etc. and the "RYC-TAR" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the air flux temperature at three different points through the control of the power of the axial fan.

RYC-TAR Apparatus

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RYC-TAR Interface Box

Specifications:

- Metallic structure.
- Cross sectional chamber area: 0.0064 m^3.
- Air blower:
  - Nominal input voltage: 220V.
  - Nominal airflow: 1.02 m^3/min.
  - Max. speed: 2700 rpm.
- Heating element:
  - Nominal input voltage: 220V.
  - Max. power: 400 W.
- Temperature sensor:
  - Three selectable thermocouples, distributed along the duct.
  - Transducer: PT1000.
  - Output: 0.1V/ºC.

Dimensions: 500 x 150 x 100 mm. approx. (19.68 x 5.90 x 3.93 inches approx.).

Weight: 12 Kg. approx. (26 pounds approx.).

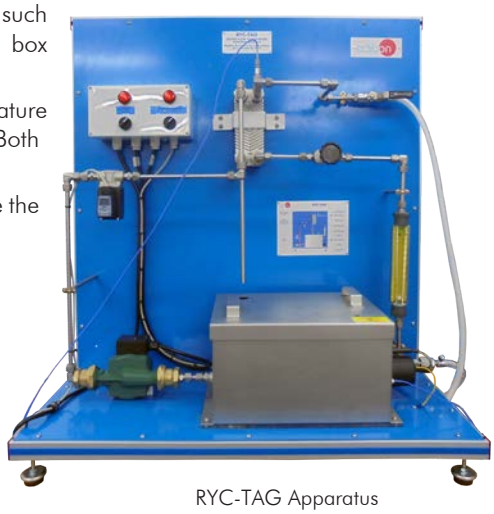
⑥.④ RYC-TAG. **Water Flow Temperature Control Module.**

The "RYC-TAG" Water Flow Temperature Control module has been designed to study a practical control system, through the control of water flow temperature.

The "RYC-TAG" module consists of two main components: the "RYC-TAG" apparatus and the "RYC-TAG" interface box. The "RYC-TAG" apparatus contains all the sensors and actuators such as temperature sensor, flow meter, water pump, etc. and the "RYC-TAG" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the water temperature of the cold water circuit, through the control of the water flow of the hot water circuit. Both circuits are related by a heat exchanger.

The system allows to insert disturbances manually, through a manual valve that change the water flow of the cold water circuit.



RYC-TAG Apparatus

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RYC-TAG Interface Box

Specifications:

- Metallic structure.
- Reservoir Tank: 15 l.
- Level switch: level float switch sensor with an ON/OFF output.
- Water Pump: max. water flow 8 l./min.
- Manual valve to generate disturbances.
- Regulation valve control de the cold circuit flow value.
- Electronic Proportional Valve:
  - Control input voltage: 0 to 3V.
  - Aperture range: 0 to 100%.
- Analog flow meter:
  - Range of measurement: 0-2 l./min.
- Temperature sensors:
  - Transducer type: "J" type thermocouple.
  - Output: 0.1 V/ºC.
- Heating element:
  - Power consumption: 1500W.
  - Control input voltage: ±10V.

Dimensions: 900 x 900 x 700 mm. approx. (35.43 x 35.43 x 27.55 inches approx.).

Weight: 50 Kg. approx. (110 pounds approx.).

⑥ **Additional applications** for working with the RYC unit:

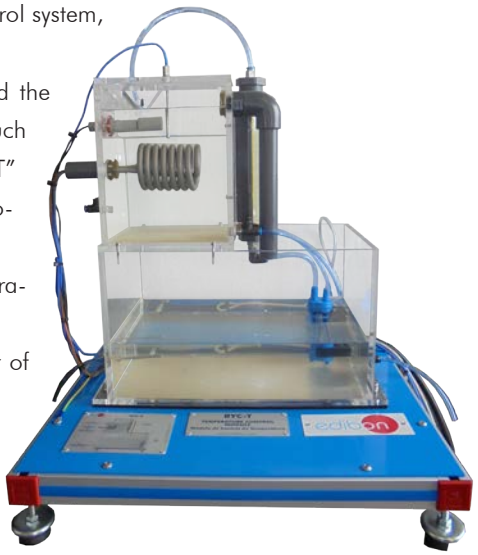
⑥.⑤ RYC-T. **Temperature Control Module.**

The "RYC-T" Temperature Control module has been designed to study a practical control system, through the control of the water temperature in a tank.

The "RYC-T" module consists of two main components: the "RYC-T" apparatus and the "RYC-T" interface box. The "RYC-T" apparatus contains all the sensors and actuators such as temperature sensor, flow meter, water pump, heating element, etc. and the "RYC-T" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the water temperature of a tank, through the control of the water flow of the water circuit.

The system allows to insert disturbances manually, through the variation of the power of the heating element.



RYC-T Apparatus

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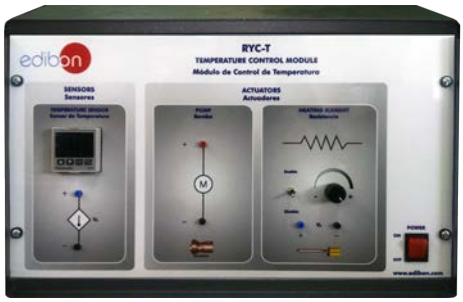

RYC-T Interface Box

Specifications:

- Metallic structure.
- Temperature controlled Tank: 1.9 l.
- Cool water input Tank: 3 l.
- Reservoir Tank: 15 l.
- Security level switch: level float switch sensor with an ON/OFF output.
- Water Pump: max water flow 8 l./min.
- Analog flow meter:
  - Range of measurements: 0-2 l./min.
- "J" type thermocouple.
- Heating element:
  - Power consumption: 1500W.
  - Control input voltage: ±10V.

Dimensions: 900 x 330 x 400 mm. approx. (35.43 x 12.99 x 15.74 inches approx.).

Weight: 22 Kg. approx. (48 pounds approx.).

⑥.⑥ RYC-P. **Pressure Control Module.**

The "RYC-P" Pressure Control module has been designed to study a practical control system, through the control of the air pressure level of an air pressure tank.

The "RYC-P" module consists of two main components: the "RYC-P" apparatus and the "RYC-P" interface box. The "RYC-P" apparatus contains all the sensors and actuators such as pressure sensor, air compressor, etc. and the "RYC-P" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the air pressure level of an air pressure tank, through the control of the air input flow to the pressure tank.

The system allows to insert disturbances manually, through a manual Relief valve.

Specifications:

- Metallic structure.
- Air compressor.
- Analog manometer.
- Pressure sensor.
- Air pressure tank with security valve.
- Manual relief valve.

Dimensions: 400 x 350 x 300 mm. approx. (15.74 x 13.78 x 11.81 inches approx.).

Weight: 12 Kg. approx. (26 pounds approx.).

⑥ **Additional applications** for working with the RYC unit:

⑥.7 RYC-N. **Level Control Module.**

The "RYC-N" Level Control module has been designed to study a practical control system, through the control of the water level of a tank.

The "RYC-N" module consists of two main components: the "RYC-N" apparatus and the "RYC-N" interface box. The "RYC-N" apparatus contains all the sensors and actuators such as pressure sensor to measure the water level, water pump, flow meter, etc. The "RYC-N" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the water level of a tank, through the control of the water input flow.

The system allows to insert disturbances manually, through a manual valve that change the output water flow of the controlled tank.

Specifications:

- Metallic structure.
- Level controlled tank: 6 l.
- Reservoir tank: 15 l.
- Water Pump: max water flow 8 l./min.
- Two manual valves.
- Analog flow meter:
  - Range of measurements: 0-2 l./min.
- Differential pressure sensor:
  - Measurement range: 0 to 10 psi.
  - Sensitivity: 3.33 mV/psi.

Dimensions: 900 x 300 x 400 mm. approx. (35.43 x 11.81 x 15.74 inches approx.).

Weight: 14 Kg. approx. (30 pounds approx.).

RYC-N Apparatus

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RYC-N Interface Box

⑥.8 RYC-C. **Flow Rate Control Module.**

The "RYC-C" Flow Rate Control module has been designed to study a practical control system, through the flow rate of a close water circuit.

The "RYC-C" module consists of two main components: the "RYC-C" apparatus and the "RYC-C" interface box. The "RYC-C" apparatus contains all the sensors and actuators such as electronic proportional valve, water pump, flow meter, etc. The "RYC-C" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the water flow rate of a close circuit, through the control of the electronic valve.

The system allows to insert disturbances manually.

Specifications:

- Metallic structure.
- Reservoir tank: 15 l.
- Water Pump: max water flow 8 l./min.
- Analog flow meter:
  - Range of measurements: 0-2 l./min.
- Electronic Proportional Valve:
  - Control input voltage: 0 to 3V.
  - Aperture range: 0 to 100%.

Dimensions: 900 x 300 x 550 mm. approx. (35.43 x 11.81 x 21.65 inches approx.).

Weight: 18 Kg. approx. (39 pounds approx.).

⑥ **Additional applications** for working with the RYC unit:

⑥.9 RYC-I. **Luminosity Control Module.**

The "RYC-I" Luminosity Control module has been designed to study a practical control system and study different light sensors, through the luminosity control with three different light sensors.

The "RYC-I" module consists of two main components: the "RYC-I" apparatus and the interface box. The "RYC-I" apparatus contains all the sensors and actuators such as a lamp, photodiode, phototransistor, etc. The "RYC-I" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the luminosity inside a box, through the control of the power consumption of the lamp.

The system allows to insert disturbances manually.

Specifications:

- Metallic structure.
- Adjustable lamp.
- Photodiode.
- Phototransistor.
- Light Dependent Resistor (LDR).

Dimensions: 900 x 300 x 300 mm. approx. (35.43 x 11.81 x 11.81 inches approx.).

Weight: 7 Kg. approx. (15 pounds approx.).

⑥.10 RYC-pH. **pH Control Module.**

The "RYC-pH" pH Control module has been designed to study a practical control system, through the pH dissolution control in a stirred tank.

The "RYC-pH" module consists of two main components: "RYC-pH" apparatus and "RYC-pH" interface box. The "RYC-pH" apparatus contains all the sensors and actuators such as pumps for the acid and for the base circuit, stirred tank, pH meter, etc. The "RYC-pH" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the pH of a pH dissolution inside a stirred tank, through the control of the flow rate of one of the circuits, keeping constant the flow rate of the other circuit.

The system allows to insert disturbances manually.

Specifications:

- Metallic structure.
- Pump to send acid solution to the tank.
- Pump to send basic solution to the tank.
- Stirred metallic tank:
  - Capacity: 2 l.
  - pH meter.
  - Stirring element.
- Electronic Proportional Valve:
  - Control input voltage: 0 to 3V.
  - Aperture range: 0 to 100%.

Dimensions: 600 x 400 x 550 mm. approx. (23.62 x 15.74 x 21.65 inches approx.).

Weight: 24 Kg. approx. (52 pounds approx.).

⑥ **Additional applications** for working with the RYC unit:

⑥.11 RYC-CP. **Position Control Module.**

The "RYC-CP" Position Control module has been designed to study a practical control system, through the control of a linear position system.

The "RYC-CP" module consists of two main components: the "RYC-CP" apparatus and the "RYC-CP" interface box. The "RYC-CP" apparatus contains all the sensors and actuators such as DC motor, potentiometer, movable cart, etc. The "RYC-CP" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the cart position along a beam. The system allows to insert disturbances manually.

Specifications:

- Metallic structure.
- Movable cart.
- DC Motor:
  - Motor supply: 10Vdc.
  - Max speed: 10000 rpm.
  - Gear ratio: 21:1.
- Potentiometer (motor position sensor):
  - Potentiometer output: 10 Vdc.
- 2 limit switches to the beginning and ending of the linear movement.

Dimensions: 700 x 350 x 300 mm. approx. (27.55 x 13.78 x 11.81 inches approx.).

Weight: 22 Kg. approx. (48 pounds approx.).

⑥.12 RYC-PI. **Inverted Pendulum Control Module.**

The "RYC-PI" Inverted Pendulum Control module has been designed to study a practical control system, through the control of a linear position system of movable cart.

The "RYC-PI" module consists of two main components: the "RYC-PI" apparatus and the "RYC-PI" interface box. The "RYC-PI" apparatus contains all the sensors and actuators such as angle sensor, DC motor, etc. The "RYC-PI" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the pendulum position, holding it in a vertical position through the correct control of the movement of the cart.

Specifications:

- Linear structure with rails on the top.
- Movable cart.
- Pendulum attached to the movable cart.
- DC servo motor.
- Toothed belt, communicating the cart with the DC servo motor.
- Angle encoder for measure the cart position.
- Shaft encoder for measure the angle of the pendulum.
- 2 limit switches to the beginning and ending of the linear movement.

Dimensions: 1700 x 350 x 550 mm. approx. (66.92 x 13.78 x 21.65 inches approx.).

Weight: 19 Kg. approx. (41 pounds approx.).

⑥ **Additional applications** for working with the RYC unit:

⑥.13 RYC-CLM. **Magnetic Levitation Control Module.**

The "RYC-CLM" Magnetic Levitation Control module has been designed to study a practical control system.

The "RYC-CLM" module consists of two main components: the "RYC-CLM" apparatus and the "RYC-CLM" interface box. The "RYC-CLM" apparatus contains all the sensors and actuators such as electromagnet, current sensor, position sensor, etc. The "RYC-CLM" interface box contains all necessary components for power supplying, signal conditioning, etc.

The components are used in conjunction with the "RYC" unit to control the vertical position of the metallic ball through the control of the feeding current of the electromagnet.

The system allows to insert disturbances manually

Specifications:

- Metallic structure.
- Electromagnet.
- Current sensor of the feeding current of the electromagnet.
- Coil driver circuit.
- Steel ball.
- Ball position sensor.

Dimensions: 400 x 400 x 300 mm. approx. (15.74 x 15.74 x 11.81 inches approx.).

Weight: 12 Kg. approx. (26 pounds approx.).

EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH THE MAIN ITEMS

Practical possibilities to be done with the Regulation and Control Unit (RYC):

1.- Response of a first order system in time domain. (Stepresponse).
2.- Response of a first order system in time domain. (Rampresponse).
3.- Response of a first order system in time domain. (Sineresponse).
4.- Response of a first order system in frequency domain. (Sineresponse).
5.- Response of a second order system in time domain. (Stepresponse).
6.- Response of a second order system in time domain. (Rampresponse).
7.- Response of a second order system in time domain. (Sineresponse).
8.- Response of a second order system in frequency domain. (Sineresponse).
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).

Practical possibilities to be done with the Additional Applications, for working with RYC Unit:

- DC Servo Motor Module (RYC-SM):

20.- Familiarization with the main module components.
21.- Study a potentiometer used for the position measuring.
22.- Study a Tachometer used for the speed measuring.
23.- Analyze of the DC motor transient Response.
24.- Analyze the time constant of the DC motor in open loop.
25.- Analyze the time constant of the DC motor in closed loop.
26.- Study of the stability of the system to gain changes.
27.- Position control of DC motor with a PID controller and the potentiometer.
28.- Analysis of the different responses of the system to modifications of PID parameters for the position control.
29.- Speed control of DC motor with P, PI, PD and PID controllers.
30.- Analysis of the different responses of the system to modifications of PID parameters for the speed control.

- Ball and Beam Module (RYC-BB):

31.- Familiarization with the main module components.
32.- Estimate the ball velocity and the ball position.
33.- Analyze the transient Response of the system.
34.- Analyze the time constant of the system in closed loop.
35.- Study of the Ball position control with a PID controller.
36.- Analysis of the different responses of the system to modifications of PID parameters.

- Air Flow Temperature Control Module (RYC-TAR):

37.- Familiarization with the main module components.
38. - Analyze the transient response of the system.
39.- Analyze the system response in open loop.
40.- Analyze the system response in closed loop.
41.- Air temperature control with P, PI, PD and PID controllers.
42.- Setting and optimizing the parameters of the PID control.
43.- Analysis of the different responses of the system to modifications of PID parameters.
44.- Study of the disturbances in a controlled system with a PID controller.

- Water Flow Temperature Control Module (RYC-TAG):

45.- Familiarization with the main module components.
46.- Analyze the transient response of the system.
47.- Analyze the system response in open loop.
48.- Analyze the system response in closed loop.
49.- Water flow temperature control with a P, PI, PD and PID controller.
50.- Setting and optimizing the parameters of the PID control.
51.- Analysis of the different responses of the system to modifications of PID parameters.
52.- Study of the disturbances in a controlled system with a PID controller.

- Temperature Control Module (RYC-T):

53. - Familiarization with the main module components.
54. - Analyze the transient response of the system.
55.- Analyze the system response in open loop.
56.- Analyze the system response in closed loop.
57.- Air temperature control with a P, PI, PD and PID controller.
58.- Setting and optimizing the parameters of the PID control.
59.- Analysis of the different responses of the system to modifications of PID parameters.

- Pressure Control Module (RYC-P):

60.- Familiarization with the main module components.
61.- Analyze the transient response of the system.
62.- Analyze the system response in open loop.
63.- Analyze the system response in closed loop.
64.- Pressure control with a P, PI, PD and PID controller.
65.- Setting and optimizing the parameters of the PID control.
66.- Analysis of the different responses of the system to modifications of PID parameters.
67.- Study of the disturbances in a controlled system with a PID controller.

- Level Control Module (RYC-N):

68.- Familiarization with the main module components.
69.- Analyze the transient response of the system.

70.- Analyze the system response in open loop.

71.- Analyze the system response in closed loop.

72.- Level control with a P, PI, PD and PID controller.

73.- Setting and optimizing the parameters of the PID control.

74.- Analysis of the different responses of the system to modifications of PID parameters.

75.- Study of the disturbances in a controlled system with a PID controller.

- Flow Rate Control Module (RYC-C):

76.- Familiarization with the main module components.

77.- Analyze the transient response of the system.

78.- Analyze the system response in open loop.

79.- Analyze the system response in closed loop.

80.- Flow rate control with a P, PI, PD and PID controller.

81.- Setting and optimizing the parameters of the PID control.

82.- Analysis of the different responses of the system to modifications of PID parameters.

83.- Study of the disturbances in a controlled system with a PID controller.

- Luminosity Control Module (RYC-I):

84.- Familiarization with the main module components.

85.- Study the photoresistor characteristics.

86.- Study the phototransistor characteristics.

87.- Study the photodiode characteristics.

88.- Analyze the transient response of the system.

89.- Analyze the system response in open loop.

90.- Analyze the system response in closed loop.

91.- Luminosity control with a P, PI, PD and PID controller.

92.- Setting and optimizing the parameters of the PID control.

93.- Analysis of the different responses of the system to modifications of PID parameters.

94.- Study of the disturbances in a controlled system with a PID controller.

- pH Control Module (RYC-pH):

95.- Familiarization with the main module components.

96.- Analyze the transient response of the system.

97.- Analyze the system response in open loop.

98.- Analyze the system response in closed loop.

99.- pH level control with a P, PI, PD and PID controller.

100.-Setting and optimizing the parameters of the PID control.

101.-Analysis of the different responses of the system to modifications of PID parameters.

102.-Study of the disturbances in a controlled system with a PID controller.

-Position Control Module (RYC-CP):

103.-Familiarization with the main module components.

104.-Analyze the transient response of the system.

105.-Analyze the system response in open loop.

106.-Analyze the system response in closed loop.

107.-Position control with a P, PI, PD and PID controller.

108.-Setting and optimizing the parameters of the PID control.

109.-Analysis of the different responses of the system to modifications of PID parameters.

- Inverted Pendulum Control Module (RYC-PI):

110.-Familiarization with the main module components.

111.-Control of the cart position.

112.-Analyze the transient response of the system.

113.-System stabilization.

114.-Study the position control with PID controller.

115.-Setting and optimizing the parameters of the PID control.

116.-Analysis of the different responses of the system to modifications of PID parameters.

117.-Study the swing of the pendulum with the correct PID parameters.

- Magnetic Levitation Control Module (RYC-CLM):

118.-Familiarization with the main module components.

119.-Study the linear model system.

120.-Study the Non-linear model system.

121.-Control of the ball position.

122.-Analyze the transient response of the system.

123.-Study the control of the ball position through a PD and PID controller.

124.-Setting and optimizing the parameters of the PID control.

125.-Analysis of the different responses of the system to modifications of PID parameters.

Other possibilities to be done with this RYC Unit:

126.-Many students view results simultaneously.

To view all results in real time in the classroom by means of a projector or an electronic whiteboard.

127.-Open Control, Multicontrol and Real Time Control.

This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivative parameters; etc, in real time.

128.-This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.

129.-This unit can be used for doing applied research.

130.-This unit can be used for giving training courses to Industries even to other Technical Education Institutions.

131.-Control of the RYC unit process through the control interface box without the computer.

132.-Visualization of all the sensors values used in the RYC unit process.

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

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

RYC.
Unit:
-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.)

ADDITIONAL APPLICATIONS (Not included)

- RYC-SM.DC Servo Motor Module.
- RYC-BB. Ball and Beam Module.
- RYC-TAR. Air Flow Temperature Control Module.
- RYC-TAG. Water Flow Temperature Control Module.
- RYC-T. Temperature Control Module.
- RYC-P. Pressure Control Module.
- RYC-N. Level Control Module.
- RYC-C. Flow Rate Control Module.
- RYC-I. Luminosity Control Module.
- RYC-pH. pH Control Module.
- RYC-CP. Position Control Module.
- RYC-PI. Inverted Pendulum Control Module.
- RYC-CLM. Magnetic Levitation Control Module.

AVAILABLE VERSIONS

Offered in this catalogue:

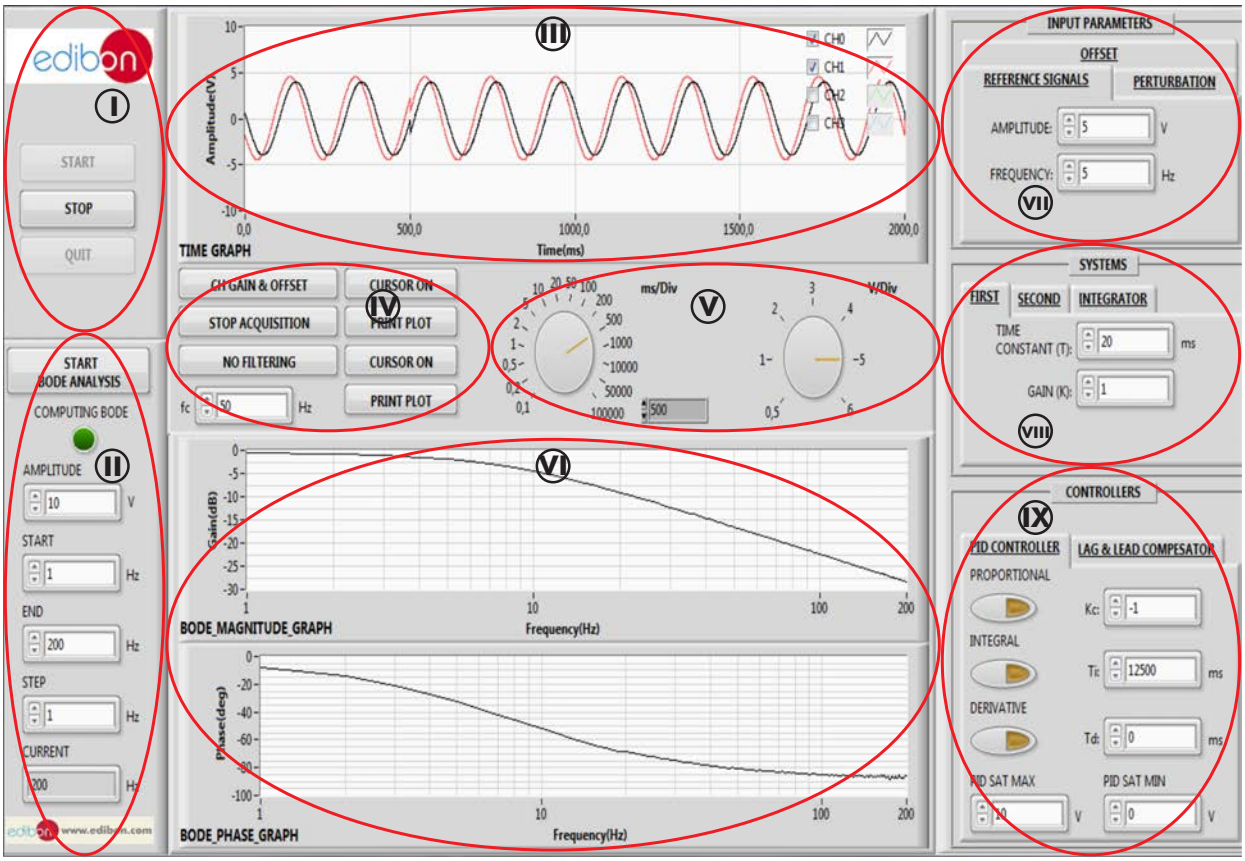
- RYC. Computer Controlled Teaching Unit for the Study of Regulation and Control.

Offered in other catalogue:

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

SCADA and PID Control
Main screen

The screen below shows the response of a first order system (with 20 ms of time constant) to an oscillating input signal.



(I) Main software operation buttons.

(II) The Bode graph includes scale parameters (amplitude, start frequency, end frequency and the frequency steps) for the complete configuration of the graph.

(III) Time domain graph of the selected signals, with the scale parameters for the complete configuration of the graph.

(IV) Graphs control panel: allows to stop the signal acquisition, activate the cursors of the time domain graph and the Bode graph and adjust the offset and the gain of every channel separately. The graph control panel includes the buttons to print the current time domain graph and the Bode graph to save the data for further analysis. The Graphs control panel allows to activate a configurable low pass filter to facilitate the signal analysis.

(V) The time domain graph includes two knobs to adjust the time per division and the voltage per division.

(VI) Bode graph (system results in frequency domain), the software allows to perform a complete Bode graph in amplitude and phase.

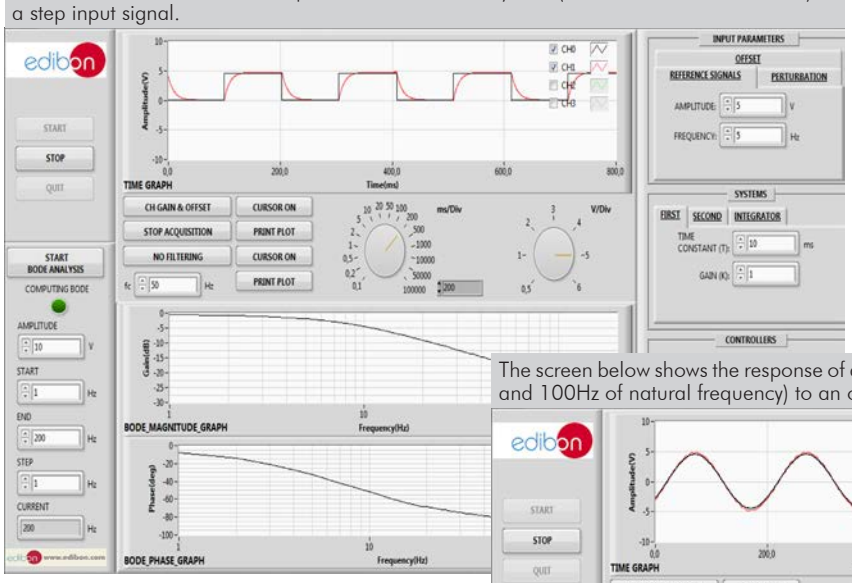
(VII) Input parameters, this block allows to set the reference signals block, the offset block and the perturbation block values.

(VIII) System parameters, this block allows to set the integrator, the first order system and the second order system values.

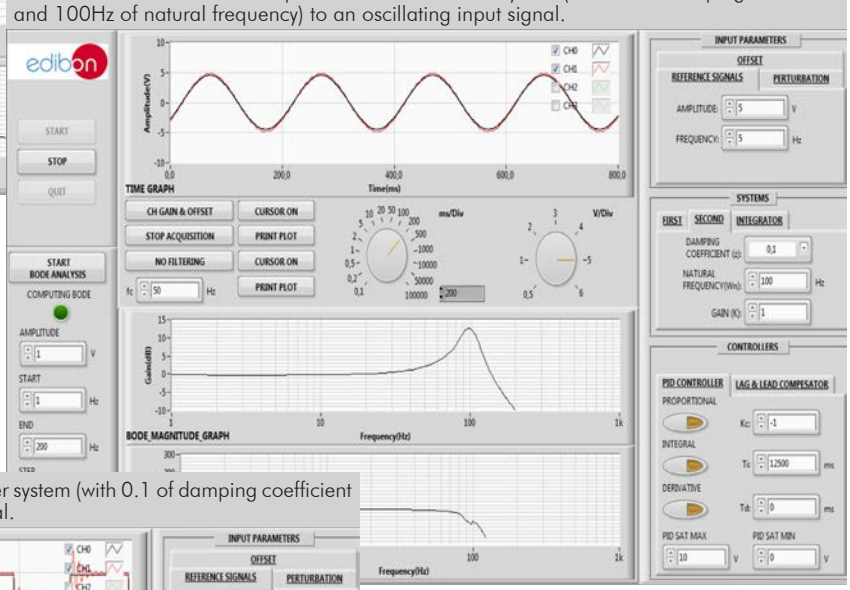
(IX) Controller parameters, this block allows to set the PID and Lag and lead compensator controllers values.

- For improve the understandable of the trainer, when the students turn on an option in the software, the corresponding LED in the hardware, switches on automatically.

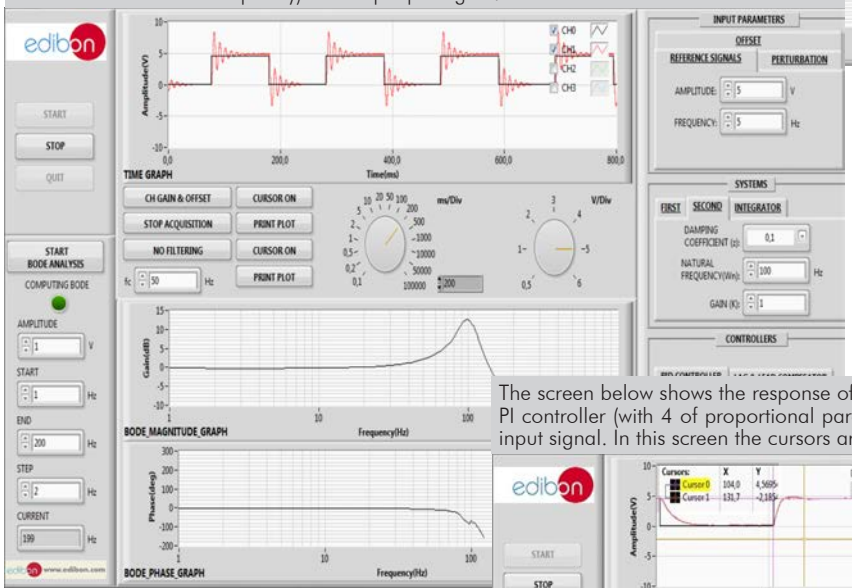
The screen below shows the response of a first order system (with 10ms of time constant) to a step input signal.



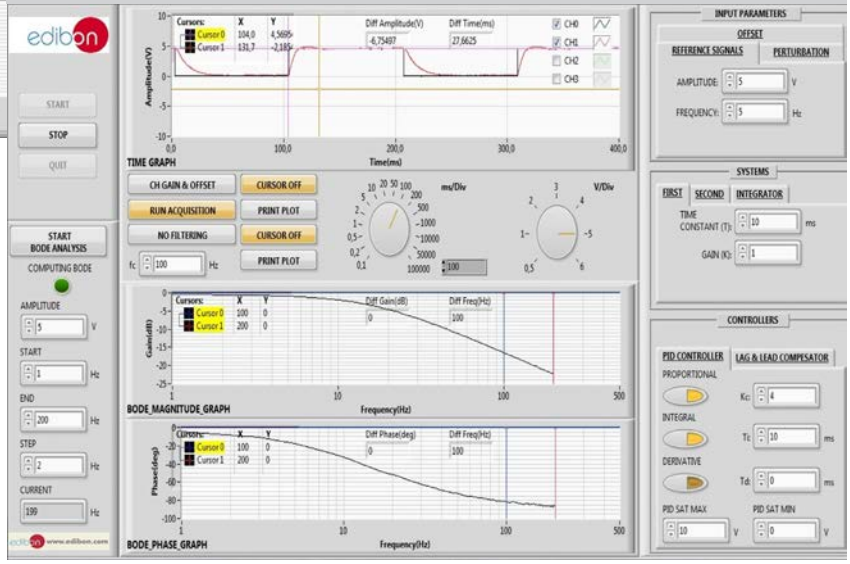
The screen below shows the response of a second order system (with 0.1 of damping coefficient and 100Hz of natural frequency) to an oscillating input signal.



The screen below shows the response of a second order system (with 0.1 of damping coefficient and 100Hz of natural frequency) to a step input signal.



The screen below shows the response of a first order system (with 10ms of time constant) with PI controller (with 4 of proportional parameter and 10ms of integrative parameter) to a step input signal. In this screen the cursors are activated in the time domain graph.



Apart from the main items (1 to 5) and the additional applications (6) described, we can offer, as optional, other items from 7 to 9.
All these items try to give more possibilities for:

a) Technical and Vocational Education configuration. (ICAI)
b) Multipost Expansions options. (Mini ESN and ESN)

a) Technical and Vocational Education configuration

⑦ RYC/ICAI. Interactive Computer Aided Instruction Software System.

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.

This software is optional and can be used additionally to items (1 to 6).

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.

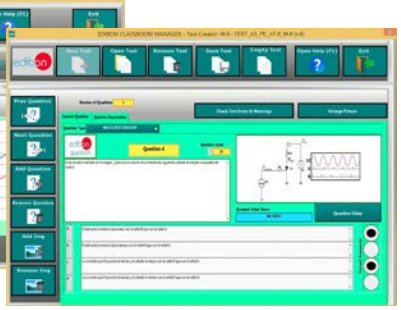
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen

ECAL. EDIBON Calculations Program Package - Formula Editor Screen

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.**

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



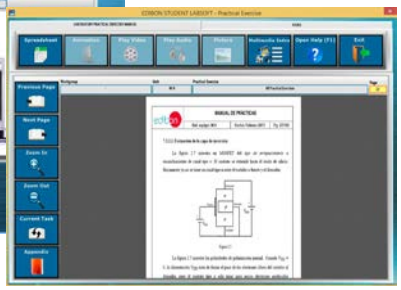
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

- 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.

Student Software

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



EPE. EDIBON Practical Exercise Program Package Main Screen

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.**

ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

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

www.edibon.com/en/files/expansion/ICAI/catalog

b) Multipost Expansions options

⑧ Mini ESN. EDIBON Mini Scada-Net System.

Mini ESN. EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously. It is useful for both, Higher Education and/or Technical and Vocational Education.

The Mini ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA and PID Control integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit. Then, the number of possible users who can work with the same unit is higher than in an usual way of working (usually only one).

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA and PID Control, connected in a local net.

- Open Control + Multicontrol + Real Time Control + Multi Student Post.

- Instructor controls and explains to all students at the same time.

- Any user/student can work doing "real time" control/multicontrol and visualisation.

- Instructor can see in the computer what any user/student is doing in the unit.

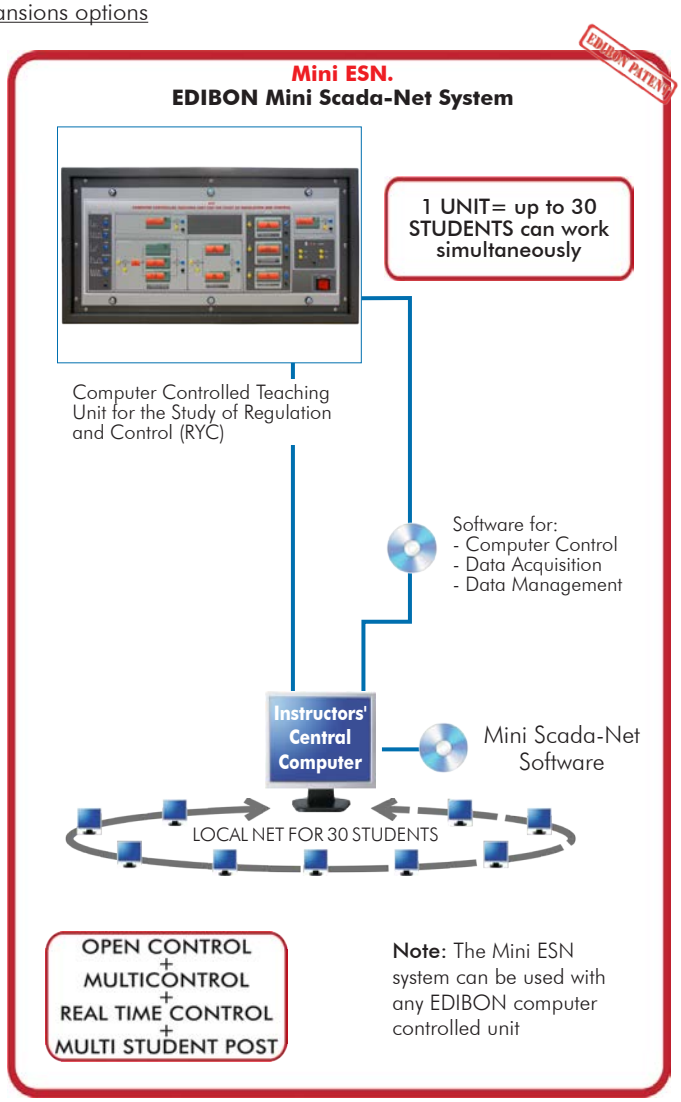
- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.

- This system allows you can save time and cost.

- Future expansions with more EDIBON Units.



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

www.edibon.com/products/catalogues/en/Mini-ESN.pdf

⑨ ESN. EDIBON Scada-Net System.

This unit can be integrated, in the future, into a Complete Laboratory with many Units and many Students.

Main items (always included in the supply)

Minimum supply always includes:

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

② **RYC. Data Acquisition Board.**

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

④ **Cables and Accessories**, for normal operation.

⑤ **Manuals.**

*IMPORTANT: Under RYC we always supply all the elements for immediate running as 1, 2, 3, 4 and 5.

⑥ **Additional applications** for working with the RYC unit:
(Not included)

6.1 RYC-SM. **DC Servo Motor Module.**
6.2 RYC-BB. **Ball and Beam Module.**
6.3 RYC-TAR. **Air Flow Temperature Control Module.**
6.4 RYC-TAG. **Water Flow Temperature Control Module.**
6.5 RYC-T. **Temperature Control Module.**
6.6 RYC-P. **Pressure Control Module.**
6.7 RYC-N. **Level Control Module.**
6.8 RYC-C. **Flow Rate Control Module.**
6.9 RYC-I. **Luminosity Control Module.**
6.10 RYC-pH. **pH Control Module.**
6.11 RYC-CP. **Position Control Module.**
6.12 RYC-PI. **Inverted Pendulum Control Module.**
6.13 RYC-CLM. **Magnetic Levitation Control Module.**

Optional items (supplied under specific order)

a) Technical and Vocational Education configuration

⑦ RYC/ICAI. Interactive Computer Aided Instruction Software System.

b) Multipost Expansions options

⑧ Mini ESN. EDIBON Mini Scada-Net System.

⑨ ESN. EDIBON Scada-Net System.

①RYC. Unit:

Unit:
- Metallic box.
- Diagram in the front panel with distribution of the elements similar to the real one.
- Reference signals module:
  - This module allows to generate four different types of signals: step, square, ramp and sine. The frequency and amplitude of the signals can be adjusted through the computer.
  - Step output. Square output. Ramp output. Sine output.
  - Step: amplitude: 0 V to 5 V, frequency: 0Hz to 200 Hz.
  - Square: amplitude: ±10 V, frequency: 0Hz to 200 Hz.
  - Ramp: amplitude: ±10 V, frequency: 0Hz to 200 Hz.
  - Sine: amplitude: ±10 V, frequency: 0Hz to 200 Hz.
  - Frequency sweep: this module performs a frequency sweep needed for calculating the Bode plot.
- PID controller module:
  - This module is subdivided into proportional, integrative and derivative blocks. The module allows to adjust each parameter independently from the computer:
    - P controller: Kc: -10 to +10. I controller: Ti: 0 to 100 s. D controller: Td: 0 to 100 s.
    - Sample time: 0.1 to 100 ms.
- Lead/Lag compensator:
  - This module represents a compensator system in the Laplace domain. The system allows to modify the zero, the pole and the gain of the compensator through the computer:
    - K lead: 1 to 100 s. K lag: 1 to 100 s. Gain: 1 to 10. Sample time: 0.1 to 100 ms.
- Integrator system:
  - This module represents and integrator system in the Laplace domain. The system allows to modify the gain and the saturation valve of the system through the computer:
    - Gain: -10 to 10.
    - Saturation: -10 to 10.
- First order system:
  - This module represents a first order system in the Laplace domain. The system allows to modify the time constant of the system through the computer. The gain can be also adjusted using the computer:
    - Gain: 0 to 10. Time constant T: 0 to 100 s.
- Second order system:
  - This module represents a second order system in Laplace domain. The system allows to modify through the computer the three parameters of the system: gain, damping coefficient and the natural frequency:
    - Gain: 1 to 10.
    - Damping coefficient ξ: 0 to 1.5 in steps of 0.1.
    - Natural frequency (ω n): 1Hz to 2 π*100 rad/s (100 Hz).
- Perturbation module:
  - This module allows to insert disturbances in the systems. The perturbation can be inserted in different places of the control loop:
    - Perturbation value: -10 to 10.
- Offset module:
  - This module allows to add an offset to the input signal.
    - Offset value: -10 to 10.
- Analog Inputs:
  - This module is provided with 4 analog inputs. The inputs are used to visualize different signals in the computer.
- Connector to computer.
- Control Interface included.

Wide range of **Additional applications** for working with the RYC unit. (Not included)

The complete unit includes as well:
- Advanced Real-Time SCADA and PID Control.
- Open Control + Multicontrol + Real-Time Control.
- Specialized EDIBON Control Software based on LabVIEW.
- National Instruments Data Acquisition board (250 KS/s, kilo samples per second).
- Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.
- Capable of doing applied research, real industrial simulation, training courses, etc.
- Remote operation and control by the user and remote control for EDIBON technical support, are always included.
- Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).
- Designed and manufactured under several quality standards.
- Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc.
- Apart from monitoring user's knowledge and progress reached.
- This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

②DAB. Data Acquisition Board:

The Data Acquisition board is part of the SCADA system.
PCI Express Data acquisition board (National Instruments) to be placed in a computer slot.
Analog input: 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: Channels=2. Resolution=16 bits, 1 in 65536.
Digital Input/Output: Channels=24 inputs/outputs.

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

The three softwares are part of the SCADA system.
Compatible with the industry standards.
Compatible with the industry standards.
The software allows to visualize the signal in time domain and perform the Bode diagram of the analyzed system.
The software allows to modify all parameters of the reference signals generators, system simulators (integrator, first order system and second order system) and controllers (PID and Lead/Lag Compensator). The Software also allows to modify the offset and the pertubation value.
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).
This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

④Cables and Accessories, for normal operation.

⑤Manuals:

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

⑥Additional applications for working with the RYC unit:

⑥-1RYC-SM. DC Servo Motor Module.

The "RYC-SM" Servo Motor module has been designed to study a practical control system, through the control of the position and speed of a DC Servo Motor.
The "RYC-SM" module consists of two main components: the "RYC-SM" apparatus and the "RYC-SM" interface box. The "RYC-SM" apparatus contains all the sensors and actuators such as tachometer sensor, DC motor, etc. and the "RYC-SM" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the position and the speed of the motor.
The system allows to insert disturbances manually.
Specifications:
- Metallic structure.
- DC Motor:
  - Motor supply: 10Vdc.
  - Max speed: 10000 rpm.
  - Gear ratio: 21:1.
- Tachometer (motor speed sensor):
  - Tachometer output: 10 Vdc.

Max speed: 10000 rpm.
Potentiometer (motor position sensor):
Potentiometer output: 10 Vdc.
Dimensions: 300 x 225 x 300 mm. approx. (11.81 x 8.85 x 11.81 inches approx.).
Weight: 5 Kg. approx. (11 pounds approx.).

6.2 RYC-BB. **Ball and Beam Module.**
The "RYC-BB" Ball and Beam module has been designed to study a practical control system, through the study of a classical control system; the Ball and Beam Control system.
The "RYC-BB" module consists of two main components: the "RYC-BB" apparatus and the "RYC-BB" interface box. The "RYC-BB" apparatus contains all the sensors and actuators such as a motor, a wire-wound rod that work as a position sensor, etc. and the "RYC-BB" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the position of the steel ball along the beam.
The system allows to insert disturbances manually.
Specifications:
Metallic structure.
DC Servo Motor:
Motor supply: 10 Vdc.
Max speed: 10700 rpm.
Gear reduction: 21:1.
Shaft angle position sensor:
Transducer: Potentiometer (10 KΩ).
Measurement range: 180 degrees.
Output: ±10V.
Ball position sensor:
Transducer: Potentiometer (750Ω).
Measurement range: ±200mm.
Output: ±10V.
Ball and Beam structure:
Steel ball:
Radius: 12.7 mm.
Mass: 0.064 Kg.
Beam length: 425 mm.
Level arm length: 120 mm.
Support arm length: 160 mm.
Dimensions: 1000 x 400 x 350 mm. approx. (39.37 x 15.74 x 13.78 inches approx.).
Weight: 18 Kg. approx. (39 pounds approx.).

6.3 RYC-TAR. **Air Flow Temperature Control Module.**
The Air Flow Temperature Control Module, "RYC-TAR", has been designed to study a practical control system, through the control of an air flow temperature.
The "RYC-TAR" module consists of two main components: the "RYC-TAR" apparatus and the "RYC-TAR" interface box. The "RYC-TAR" apparatus contains all the sensors and actuators such as temperature sensors at different position, axial fan, heater, etc. and the "RYC-TAR" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the air flux temperature at three different points through the control of the power of the axial fan.
Specifications:
Metallic structure.
Cross sectional chamber area: 0.0064 m^3.
Air blower:
Nominal input voltage: 220 V.
Nominal airflow: 1.02 m^3/min.
Max. speed: 2700 rpm.
Heating element:
Nominal input voltage: 220 V.
Max. power: 400 W.
Temperature sensor:
Three selectable thermocouples, distributed along the duct.
Transducer: PT1000.
Output: 0.1 V/ºC.
Dimensions: 500 x 150 x 100 mm approx. (19.68 x 5.90 x 3.93 inches approx.)
Weight: 12 Kg approx. (26 pounds approx.)

6.4 RYC-TAG. **Water Flow Temperature Control Module.**
The Water Flow Temperature Control Module, "RYC-TAG", has been designed to study a practical control system, through the control of water flow temperature.
The "RYC-TAG" module consists of two main components: the "RYC-TAG" apparatus and the "RYC-TAG" interface box. The "RYC-TAG" apparatus contains all the sensors and actuators such as temperature sensor, flow meter, water pump, etc. and the "RYC-TAG" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the water temperature of the cold water circuit, through the control of the water flow of the hot water circuit. Both circuits are related by a heat exchanger.
The system allows to insert disturbances manually, through a manual valve that change the water flow of the cold water circuit.
Specifications:
Metallic structure.
Reservoir Tank: 15 l.
Level switch: level float switch sensor with an ON/OFF output.
Water Pump: max. water flow 8 l/min.
Manual valve to generate disturbances.
Regulation valve control de the cold circuit flow value.
Electronic Proportional Valve:
Control input voltage: 0 to 3 V.
Aperture range: 0 to 100 %.
Analog flow meter:
Range of measurement: 0 - 2 l/min.
Temperature sensors:
Transducer type: "J" type thermocouple.
Output: 0.1 V/ºC.
Heating element:
Power consumption: 1500 W.
Control input voltage: ±10 V.
Dimensions: 900 x 900 x 700 mm approx. (35.43 x 35.43 x 27.55 inches approx.)
Weight: 50 Kg approx. (110 pounds approx.)

6.5 RYC-T. **Temperature Control Module.**
The Temperature Control Module, "RYC-T", has been designed to study a practical control system, through the control of the water temperature in a tank.
The "RYC-T" module consists of two main components: the "RYC-T" apparatus and the "RYC-T" interface box. The "RYC-T" apparatus contains all the sensors and actuators such as temperature sensor, flow meter, water pump, heating element, etc. and the "RYC-T" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the water temperature of a tank, through the control of the water flow of the water circuit.
The system allows to insert disturbances manually, through the variation of the power of the heating element.
Specifications:
Metallic structure.
Temperature controlled Tank: 1.9 l.
Cool water input Tank: 3 l.

Reservoir Tank: 15 l.
Security level switch: level float switch sensor with an ON/OFF output.
Water Pump: max water flow 8 l/min.
Analog flow meter:
Range of measurements: 0 - 2 l/min.
"J" type thermocouple.
Heating element:
Power consumption: 1500 W.
Control input voltage: ±10 V.
Dimensions: 900 x 330 x 400 mm approx. (35.43 x 12.99 x 15.74 inches approx.)
Weight: 22 Kg approx. (48 pounds approx.)

6.6 RYC-P. **Pressure Control Module.**
The Pressure Control Module, "RYC-P", has been designed to study a practical control system, through the control of the air pressure level of an air pressure tank.
The "RYC-P" module consists of two main components: the "RYC-P" apparatus and the "RYC-P" interface box. The "RYC-P" apparatus contains all the sensors and actuators such as pressure sensor, air compressor, etc. and the "RYC-P" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the air pressure level of an air pressure tank, through the control of the air input flow to the pressure tank.
The system allows to insert disturbances manually, through a manual Relief valve.
Specifications:
Metallic structure.
Air compressor.
Analog manometer.
Pressure sensor.
Air pressure tank with security valve.
Manual relief valve.
Dimensions: 400 x 350 x 300 mm approx. (15.74 x 13.78 x 11.81 inches approx.)
Weight: 12 Kg approx. (26 pounds approx.)

6.7 RYC-N. **Level Control Module.**
The Level Control Module, "RYC-N", has been designed to study a practical control system, through the control of the water level of a tank.
The "RYC-N" module consists of two main components: the "RYC-N" apparatus and the "RYC-N" interface box. The "RYC-N" apparatus contains all the sensors and actuators such as pressure sensor to measure the water level, water pump, flow meter, etc. The "RYC-N" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the water level of a tank, through the control of the water input flow.
The system allows to insert disturbances manually, through a manual valve that change the output water flow of the controlled tank.
Specifications:
Metallic structure.
Level controlled tank: 6 l.
Reservoir tank: 15 l.
Water Pump: max water flow 8 l/min.
Two manual valves.
Analog flow meter:
Range of measurements: 0 - 2 l/min.
Differential pressure sensor:
Measurement range: 0 to 10 psi.
Sensitivity: 3.33 mV/psi.
Dimensions: 900 x 300 x 400 mm approx. (35.43 x 11.81 x 15.74 inches approx.)
Weight: 14 Kg approx. (30 pounds approx.)

6.8 RYC-C. **Flow Rate Control Module.**
The Flow Rate Control Module, "RYC-C", has been designed to study a practical control system, through the flow rate of a close water circuit.
The "RYC-C" module consists of two main components: the "RYC-C" apparatus and the "RYC-C" interface box. The "RYC-C" apparatus contains all the sensors and actuators such as electronic proportional valve, water pump, flow meter, etc. The "RYC-C" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the water flow rate of a close circuit, through the control of the electronic valve.
The system allows to insert disturbances manually.
Specifications:
Metallic structure.
Reservoir tank: 15 l.
Water Pump: max water flow 8 l/min.
Analog flow meter:
Range of measurements: 0 - 2 l/min.
Electronic Proportional Valve:
Control input voltage: 0 to 3 V.
Aperture range: 0 to 100 %.
Dimensions: 900 x 300 x 550 mm approx. (35.43 x 11.81 x 21.65 inches approx.)
Weight: 18 Kg approx. (39 pounds approx.)

6.9 RYC-I. **Luminosity Control Module.**
The Luminosity Control Module, "RYC-I", has been designed to study a practical control system and study different light sensors, through the luminosity control with three different light sensors.
The "RYC-I" module consists of two main components: the "RYC-I" apparatus and the interface box. The "RYC-I" apparatus contains all the sensors and actuators such as a lamp, photodiode, phototransistor, etc. The "RYC-I" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the luminosity inside a box, through the control of the power consumption of the lamp.
The system allows to insert disturbances manually.
Specifications:
Metallic structure.
Adjustable lamp.
Photodiode.
Phototransistor.
Light Dependent Resistor (LDR).
Dimensions: 900 x 300 x 300 mm approx. (35.43 x 11.81 x 11.81 inches approx.)
Weight: 7 Kg approx. (15 pounds approx.)

6.10 RYC-pH. **pH Control Module.**
The pH Control Module, "RYC-pH", has been designed to study a practical control system, through the pH dissolution control in a stirred tank.
The "RYC-pH" module consists of two main components: "RYC-pH" apparatus and "RYC-pH" interface box. The "RYC-pH" apparatus contains all the sensors and actuators such as pumps for the acid and for the base circuit, stirred tank, pH meter, etc. The "RYC-pH" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the pH of a pH dissolution inside a stirred tank, through the control of the flow rate of one of the circuits, keeping constant the flow rate of the other circuit.
The system allows to insert disturbances manually.
Specifications:
Metallic structure.
Pump to send acid solution to the tank.
Pump to send basic solution to the tank.
Stirred metallic tank:
Capacity: 2 l.
pH meter.
Stirring element.

Electronic Proportional Valve:
Control input voltage: 0 to 3 V.
Aperture range: 0 to 100 %.
Dimensions: 600 x 400 x 550 mm approx. (23.62 x 15.74 x 21.65 inches approx.)
Weight: 24 Kg approx. (52 pounds approx.)

6.11 RYC-CP. **Position Control Module.**
The Position Control Module, "RYC-CP", has been designed to study a practical control system, through the control of a linear position system.
The "RYC-CP" module consists of two main components: the "RYC-CP" apparatus and the "RYC-CP" interface box. The "RYC-CP" apparatus contains all the sensors and actuators such as DC motor, potentiometer, movable cart, etc. The "RYC-CP" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the cart position along a beam.
The system allows to insert disturbances manually.
Specifications:
Metallic structure.
Movable cart.
DC Motor:
Motor supply: 10 Vdc.
Max speed: 10000 rpm.
Gear ratio: 21:1.
Potentiometer (motor position sensor):
Potentiometer output: 10 Vdc.
Two limit switches to the beginning and ending of the linear movement.
Dimensions: 700 x 350 x 300 mm approx. (27.55 x 13.78 x 11.81 inches approx.).
Weight: 22 Kg approx. (48 pounds approx.).

6.12 RYC-PI. **Inverted Pendulum Control Module.**
The Inverted Pendulum Control Module, "RYC-PI", has been designed to study a practical control system, through the control of a linear position system of movable cart.
The "RYC-PI" module consists of two main components: the "RYC-PI" apparatus and the "RYC-PI" interface box. The "RYC-PI" apparatus contains all the sensors and actuators such as angle sensor, DC motor, etc. The "RYC-PI" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the pendulum position, holding it in a vertical position through the correct control of the movement of the cart.
Specifications:
Linear structure with rails on the top.
Movable cart.
Pendulum attached to the movable cart.
DC servo motor.
Toothed belt, communicating the cart with the DC servo motor.
Angle encoder for measure the cart position.
Shaft encoder for measure the angle of the pendulum.
Two limit switches to the beginning and ending of the linear movement.
Dimensions: 1700 x 350 x 550 mm approx. (66.92 x 13.78 x 21.65 inches approx.)
Weight: 19 Kg approx. (41 pounds approx.)

6.13 RYC-CLM. **Magnetic Levitation Control Module.**
The Magnetic Levitation Control Module, "RYC-CLM", has been designed to study a practical control system.
The "RYC-CLM" module consists of two main components: the "RYC-CLM" apparatus and the "RYC-CLM" interface box. The "RYC-CLM" apparatus contains all the sensors and actuators such as electromagnet, current sensor, position sensor, etc. The "RYC-CLM" interface box contains all necessary components for power supplying, signal conditioning, etc.
The components are used in conjunction with the "RYC" unit to control the vertical position of the metallic ball through the control of the feeding current of the electromagnet.
The system allows to insert disturbances manually
Specifications:
Metallic structure.
Electromagnet.
Current sensor of the feeding current of the electromagnet.
Coil driver circuit.
Steel ball.
Ball position sensor.
Dimensions: 400 x 400 x 300 mm approx. (15.74 x 15.74 x 11.81 inches approx.)
Weight: 12 Kg approx. (26 pounds approx.)

Exercises and Practical Possibilities to be done with the Main Items

Practical possibilities to be done with the Regulation and Control Unit (RYC):

1.- Response of a first order system in time domain. (Stepresponse).
2.- Response of a first order system in time domain. (Rampresponse).
3.- Response of a first order system in time domain. (Sineresponse).
4.- Response of a first order system in frequency domain. (Sineresponse).
5.- Response of a second order system in time domain. (Stepresponse).
6.- Response of a second order system in time domain. (Rampresponse).
7.- Response of a second order system in time domain. (Sineresponse).
8.- Response of a second order system in frequency domain. (Sine-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).

Practical possibilities to be done with the Additional Applications, for working with RYC Unit:

- DC Servo Motor Module (RYC-SM):

20.- Familiarization with the main module components.
21.- Study a potentiometer used for the position measuring.

22.- Study a Tachometer used for the speed measuring.
23.- Analyze of the DC motor transient Response.
24.- Analyze the time constant of the DC motor in open loop.
25.- Analyze the time constant of the DC motor in closed loop.
26.- Study of the stability of the system to gain changes.
27.- Position control of DC motor with a PID controller and the potentiometer.
28.- Analysis of the different responses of the system to modifications of PID parameters for the position control.
29.- Speed control of DC motor with P, PI, PD and PID controllers.
30.- Analysis of the different responses of the system to modifications of PID parameters for the speed control.
- Ball and Beam Module (RYC-BB):
31.- Familiarization with the main module components.
32.- Estimate the ball velocity and the ball position.
33.- Analyze the transient Response of the system.
34.- Analyze the time constant of the system in closed loop.
35.- Study of the Ball position control with a PID controller.
36.- Analysis of the different responses of the system to modifications of PID parameters.
- Air Flow Temperature Control Module (RYC-TAR):
37.- Familiarization with the main module components.
38. - Analyze the transient response of the system.
39.- Analyze the system response in open loop.
40.- Analyze the system response in closed loop.
41.- Air temperature control with P, PI, PD and PID controllers.
42.- Setting and optimizing the parameters of the PID control.
43.- Analysis of the different responses of the system to modifications of PID parameters.
44.- Study of the disturbances in a controlled system with a PID controller.
- Water Flow Temperature Control Module (RYC-TAG):
45.- Familiarization with the main module components.
46.- Analyze the transient response of the system.
47.- Analyze the system response in open loop.
48.- Analyze the system response in closed loop.
49.- Water flow temperature control with a P, PI, PD and PID controller.
50.- Setting and optimizing the parameters of the PID control.
51.- Analysis of the different responses of the system to modifications of PID parameters.
52.- Study of the disturbances in a controlled system with a PID controller.
- Temperature Control Module (RYC-T):
53. - Familiarization with the main module components.
54. - Analyze the transient response of the system.
55.- Analyze the system response in open loop.
56.- Analyze the system response in closed loop.
57.- Air temperature control with a P, PI, PD and PID controller.
58.- Setting and optimizing the parameters of the PID control.
59.- Analysis of the different responses of the system to modifications of PID parameters.
- Pressure Control Module (RYC-P):
60.- Familiarization with the main module components.
61.- Analyze the transient response of the system.
62.- Analyze the system response in open loop.
63.- Analyze the system response in closed loop.
64.- Pressure control with a P, PI, PD and PID controller.
65.- Setting and optimizing the parameters of the PID control.
66.- Analysis of the different responses of the system to modifications of PID parameters.
67.- Study of the disturbances in a controlled system with a PID controller.
Some Practical Possibilities
- Level Control Module (RYC-N):
68.- Familiarization with the main module components.
69.- Analyze the transient response of the system.
70.- Analyze the system response in open loop.
71.- Analyze the system response in closed loop.
72.- Level control with a P, PI, PD and PID controller.
73.- Setting and optimizing the parameters of the PID control.
74.- Analysis of the different responses of the system to modifications of PID parameters.
75.- Study of the disturbances in a controlled system with a PID controller.
- Flow Rate Control Module (RYC-C):
76.- Familiarization with the main module components.
77.- Analyze the transient response of the system.
78.- Analyze the system response in open loop.
79.- Analyze the system response in closed loop.
80.- Flow rate control with a P, PI, PD and PID controller.

81.- Setting and optimizing the parameters of the PID control.
82.- Analysis of the different responses of the system to modifications of PID parameters.
83.- Study of the disturbances in a controlled system with a PID controller.
- Luminosity Control Module (RYC-I):
84.- Familiarization with the main module components.
85.- Study the photoresistor characteristics.
86.- Study the phototransistor characteristics.
87.- Study the photodiode characteristics.
88.- Analyze the transient response of the system.
89.- Analyze the system response in open loop.
90.- Analyze the system response in closed loop.
91.- Luminosity control with a P, PI, PD and PID controller.
92.- Setting and optimizing the parameters of the PID control.
93.- Analysis of the different responses of the system to modifications of PID parameters.
94.- Study of the disturbances in a controlled system with a PID controller.
- pH Control Module (RYC-pH):
95.- Familiarization with the main module components.
96.- Analyze the transient response of the system.
97.- Analyze the system response in open loop.
98.- Analyze the system response in closed loop.
99.- pH level control with a P, PI, PD and PID controller.
100.-Setting and optimizing the parameters of the PID control.
101.-Analysis of the different responses of the system to modifications of PID parameters.
102.-Study of the disturbances in a controlled system with a PID controller.
-Position Control Module (RYC-CP):
103.-Familiarization with the main module components.
104.-Analyze the transient response of the system.
105.-Analyze the system response in open loop.
106.-Analyze the system response in closed loop.
107.-Position control with a P, PI, PD and PID controller.
108.-Setting and optimizing the parameters of the PID control.
109.-Analysis of the different responses of the system to modifications of PID parameters.
- Inverted Pendulum Control Module (RYC-PI):
110.-Familiarization with the main module components.
111.-Control of the cart position.
112.-Analyze the transient response of the system.
113.-System stabilization.
114.-Study the position control with PID controller.
115.-Setting and optimizing the parameters of the PID control.
116.-Analysis of the different responses of the system to modifications of PID parameters.
117.-Study the swing of the pendulum with the correct PID parameters.
- Magnetic Levitation Control Module (RYC-CLM):
118.-Familiarization with the main module components.
119.-Study the linear model system.
120.-Study the Non-linear model system.
121.-Control of the ball position.
122.-Analyze the transient response of the system.
123.-Study the control of the ball position through a PD and PID controller.
124.-Setting and optimizing the parameters of the PID control.
125.-Analysis of the different responses of the system to modifications of PID parameters.
Other possibilities to be done with this RYC Unit:
126.-Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
127.-Open Control, Multicontrol and Real Time Control.
This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivative parameters; etc, in real time.
128.-This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
129.-This unit can be used for doing applied research.
130.-This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
131.-Control of the RYC unit process through the control interface box without the computer.
132.-Visualization of all the sensors values used in the RYC unit process.
- Several other exercises can be done and designed by the user.

a) Technical and Vocational Education configuration

⑦ RYC/ICAI. Interactive Computer Aided Instruction Software System.

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.

- 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.

- 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.

b) Multipost Expansions options

⑧ Mini ESN. EDIBON Mini Scada-Net System.

EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously.

The Mini ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA and PID Control integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit.

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA and PID Control, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing "real time" control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

The system basically will consist of:

This system is used with a Computer Controlled Unit.

- Instructor's computer.
- Students' computers.
- Local Network.
- Unit-Control Interface adaptation.
- Unit Software adaptation.
- Webcam.
- Mini ESN Software to control the whole system.
- Cables and accessories required for a normal operation.

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

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