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Technical Teaching Equipment

# Gyroscope
## MGI

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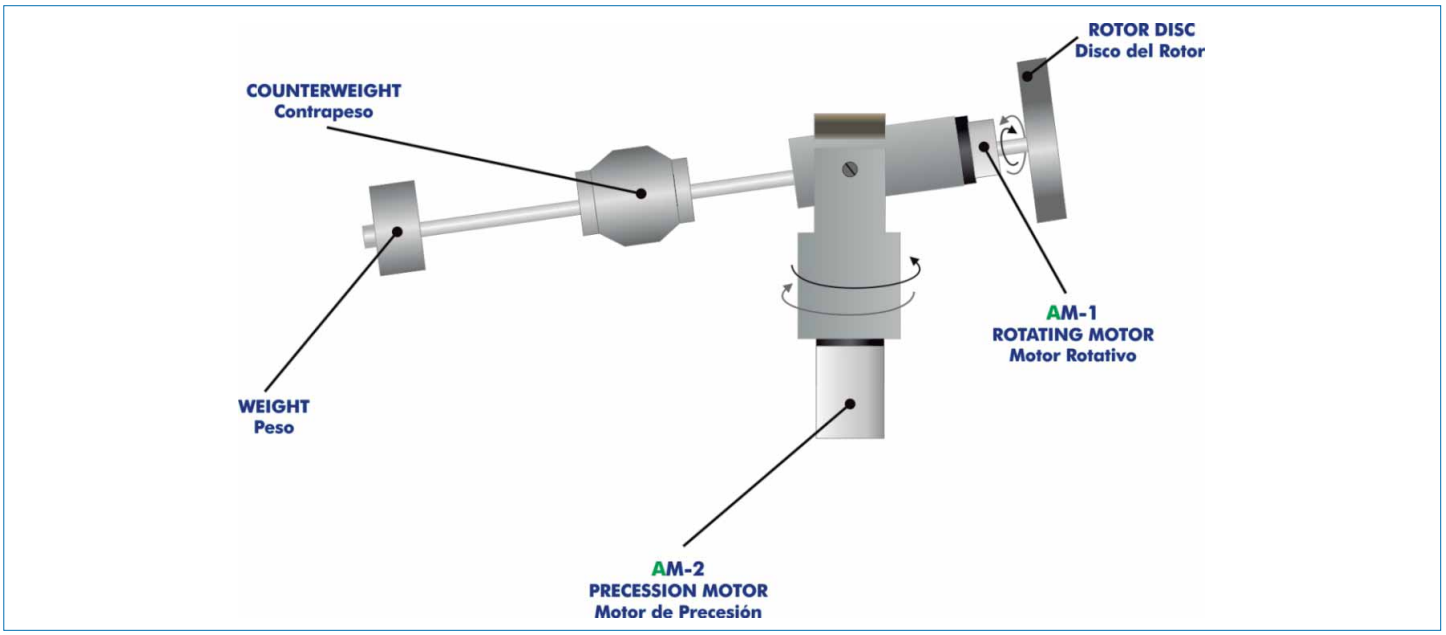
Products
Products range
Units
7.-Mechanics & Materials


## PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION




**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** and
**Worlddidac Member**

## INTRODUCTION

A gyroscope is defined as a rigid rotating object, composed of an electrical motor rotor coupled to a horizontally supported shaft (torque arm) with a rotor disc. A second electric motor turns a turntable under the gyroscope, causing precession about a vertical axis. Precession describes a change in the direction of the axis of a rotating object, so in this case a change in the spin axis of the gyroscope.

Gyroscopic action occurs whenever the axis of a rotating object (rotor disc) is made to change its direction. The angular momentum of the rotating object causes the axis of rotation to remain in the same direction as long as no external couple acts on the system. However, if a turning couple is applied to the axis, a torque reaction (or "gyroscopic couple") is produced, which tends to turn the axis in a plane at right angles to the plane in which the applied couple acts. This torque reaction results from attempting to alter the direction of angular momentum of the rotating object.

The study of gyroscopic action is important in the field of vehicle engineering. The gyroscopic couple produced by rotating components can often lead to undesirable effects which affect the stability of vehicles.

The Gyroscope (MGI) allows the demonstration of the gyroscopic effects and enables the relationship between the gyroscopic couple and the direction of rotation (or "precession") of the gyroscope axis to be determined.

## GENERAL DESCRIPTION

The Gyroscope (MGI) allows the experimental demonstration of the different rotation modes of a gyroscope and the moments generated by the gyroscopic effect.

The rotor of the electric motor (rotating motor) shares a horizontally supported shaft (torque arm) with a rotor disc about its own axis. The rotor disc is mounted together with its motor as a yoke and forms the gyroscope. A second electrical motor (precession motor) turns a turntable under the gyroscope, causing precession about a vertical axis. The speed of both motors are electronically regulated and independently controlled. The rotational velocity of the rotating motor and the precession motor can be visualized in digital displays (in the electronic console).

The gyroscopic moment can be preselected by positioning a counterweight with retaining screws at different radii.

Additional weights can be attached to the end of the torque arm to balance the gyroscopic couple produced when the rotor disc is spinning and the gyroscope is being rotated (precessed) about the vertical axis.

A transparent protective cover provides protection against rotating parts and enables different experiments to be observed. Opening this cover automatically stops the two electrical motors.

## SPECIFICATIONS

Unit mounted on an anodized aluminum structure with painted steel panel.

Gyroscope, consists of:

- Rotor disc, diameter: 80 mm.
- Torque arm, length: 240 mm approximately.
- Counterweight with retaining screws to preselect the gyroscopic moment.
- Two motors:
  - Rotating motor, speed range: 0-4260 rpm.
  - Precession motor, speed range: 0-60 rpm.
  - Both motors are electronically regulated and independently controlled. They can rotate clockwise or anticlockwise.

A transparent protective cover, made of plastic, provides protection against the rotating parts and enables different experiments to be observed. This cover includes a subminiature switch, which allows automatically stops the two electrical motors if the cover is opened.

A bull's eye level is provided to enable to level the unit.

Weights:

1 x 125 g., 1 x 100 g., 1 x 60 g., 1 x 50 g., 1 x 40 g., 1 x 30 g.

Electronic console (in separate metallic box):

- Motors connections.
- ON/OFF controller for the rotating motor. ON/OFF controller for the precession motor.
- Rotating motor direction controller. Precession motor direction controller.
- Rotating motor speed controller. Precession motor speed controller.
- Digital display for the rotating motor speed. Digital display for the precession motor speed.

Cables and accessories, for normal operation.

Manuals: This unit is supplied with the following manuals: Required services, Assembly and Installation, Starting-up, Security, Maintenance and Practices manual.

## EXERCISES AND PRACTICAL POSSIBILITIES

1.- Study of the laws of gyroscopes.

2.- Demonstration of the precession and stability of a gyroscope system.

3.- Investigation of gyroscopic couple direction for each combination of the rotor and the precession directions.

4.- Study of the magnitude of gyroscope couple in function of the rotor velocity and the precession velocity.

5.- Determination of the moment of inertia of the gyroscope rotor.

6.- Demonstration the independent influence of precession velocity with the gyroscope couple.

7.- Demonstration the independent influence of rotor velocity with the gyroscope couple.

## REQUIRED SERVICES

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

## DIMENSIONS & WEIGHTS

MGI:

Unit:

-Dimensions: 600 x 600 x 540 mm. approx.
(23.62 x 23.62 x 21.26 inches approx.).

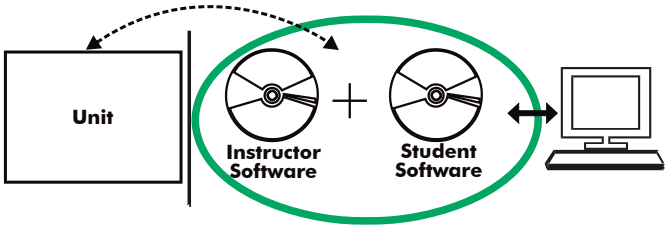
-Weight: 20 Kg. approx.
(44 pounds approx.).

Electronic console:

-Dimensions: 300 x 190 x 130 mm. approx.
(11.81 x 7.48 x 5.12 inches approx.).

-Weight: 3 Kg. approx.
(6.6 pounds approx.).

## MGI/CAI. Computer Aided Instruction Software System:




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

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

The Instructor can:

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

...and many other facilities.

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

Example of software screens

Instructor Software


### MGI/SOF. Computer Aided Instruction Software (Student Software).

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

- This software contains:

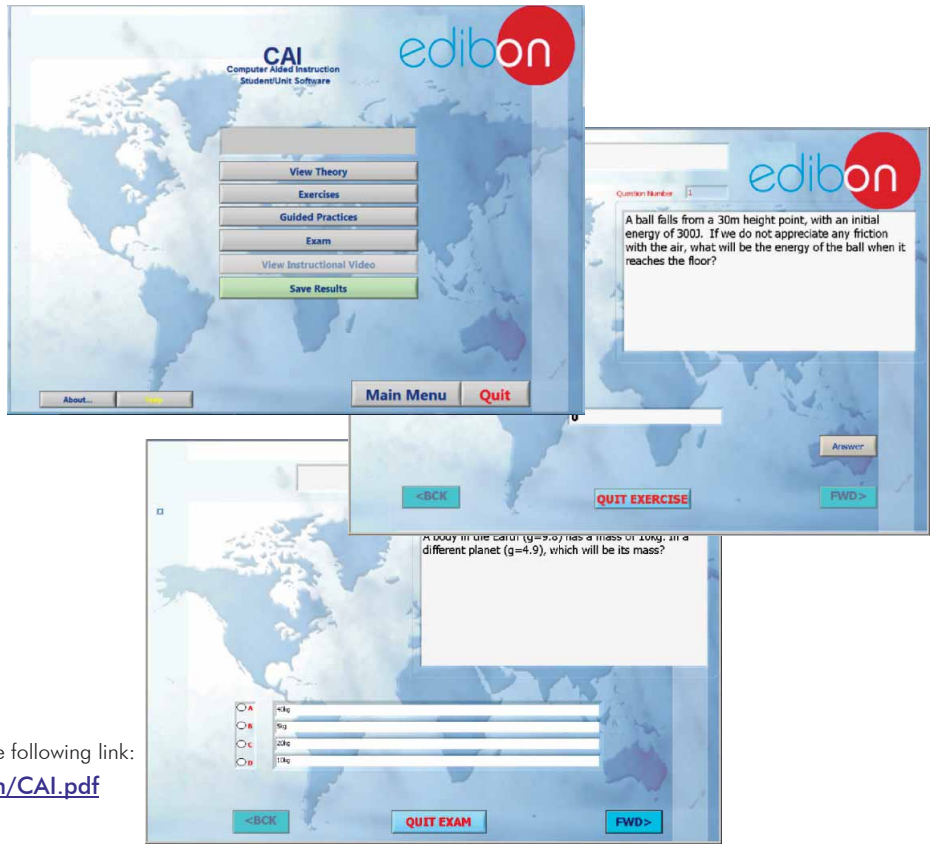
**Theory:** gives the student the theoretical background for a total understanding of the studied subject.

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

**Guided Practices:** presents several practices to be done with the unit, showing how to perform the exercises and practices.

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

Student Software




For more information see **CAI** catalogue. Click on the following link:
www.edibon.com/products/catalogues/en/CAI.pdf

## MGI/CAL. Computer Aided Learning Software (Results Calculation and Analysis):

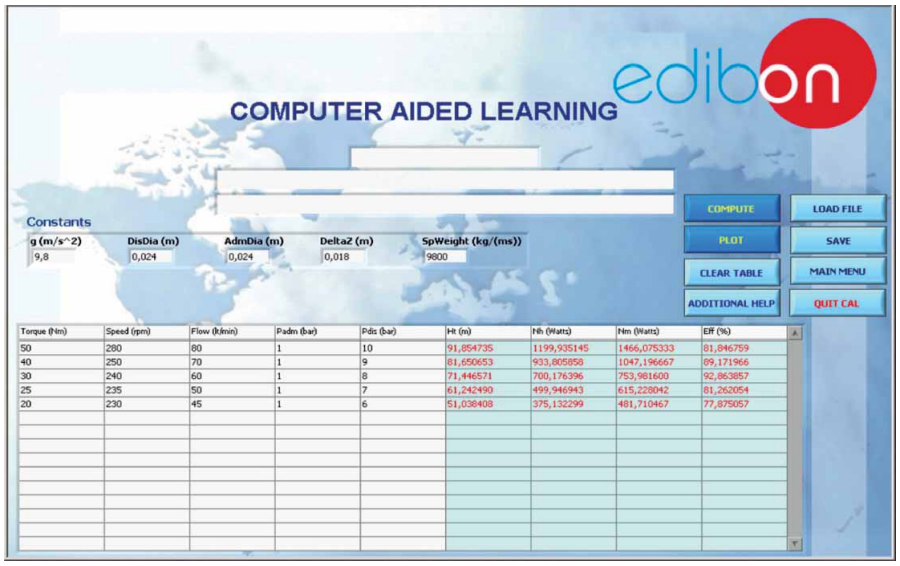
This Computer Aided Learning Software (Results Calculation and Analysis) "CAL" is a Windows based software, simple and very easy to use, specifically developed by EDIBON.

CAL is a class assistant that helps in doing 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 and performs the calculations.

Also, CAL allows to plot and print the results. Within the plotting options, any variable can be represented against any other.

Available different plotting displays.

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




On a table, we introduce data obtained during the development of the exercise.

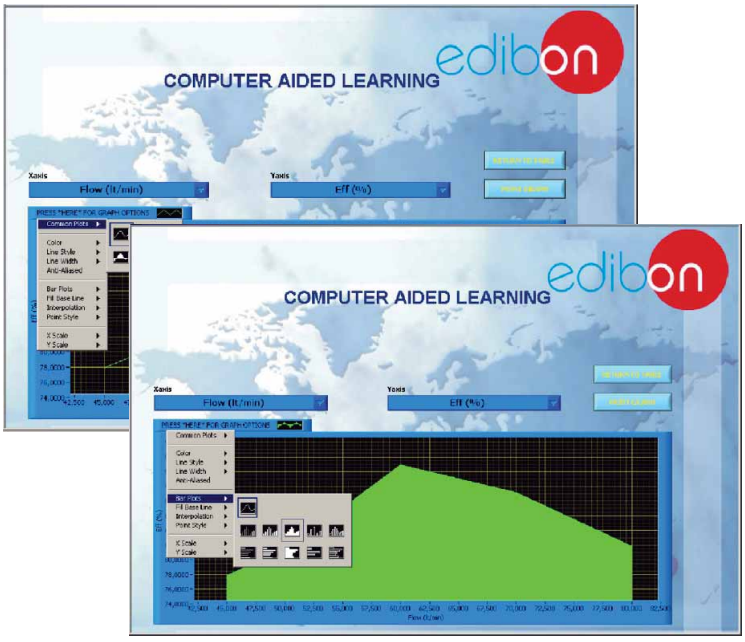
Above this table, it is shown "Constants" theoretically involved with the field of study. The values of these "Constants" may be modified to our convenience, assigning the appropriate values.

Simply, by clicking on "COMPUTE", CAL performs the calculations of the desired variables.

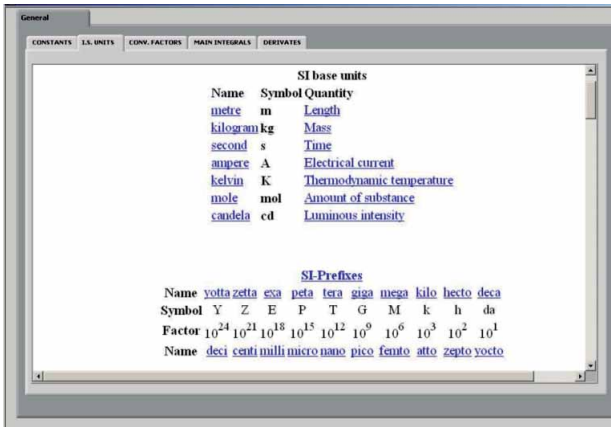
We can save and print the data of the experiment or calculations.

Also we can load any data file saved previously.

With the calculated variables, CAL gives the option of plotting the results. It is possible to represent any variable against any other. It has the option of representing the graph with different layouts. Screens below give an example of the multiple choices.




CAL has a wide range of help information. By clicking the button "ADDITIONAL HELP" opens a window where we have information about typical Constants, International System Units, Conversion Factors, and Table of Main Integrals and Derivatives (General), and there is other specific help for the particular unit.




For more information see **CAL** catalogue. Click on the following link:
www.edibon.com/products/catalogues/en/CAL.pdf

✱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: ED02/14
Date: December/2014

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