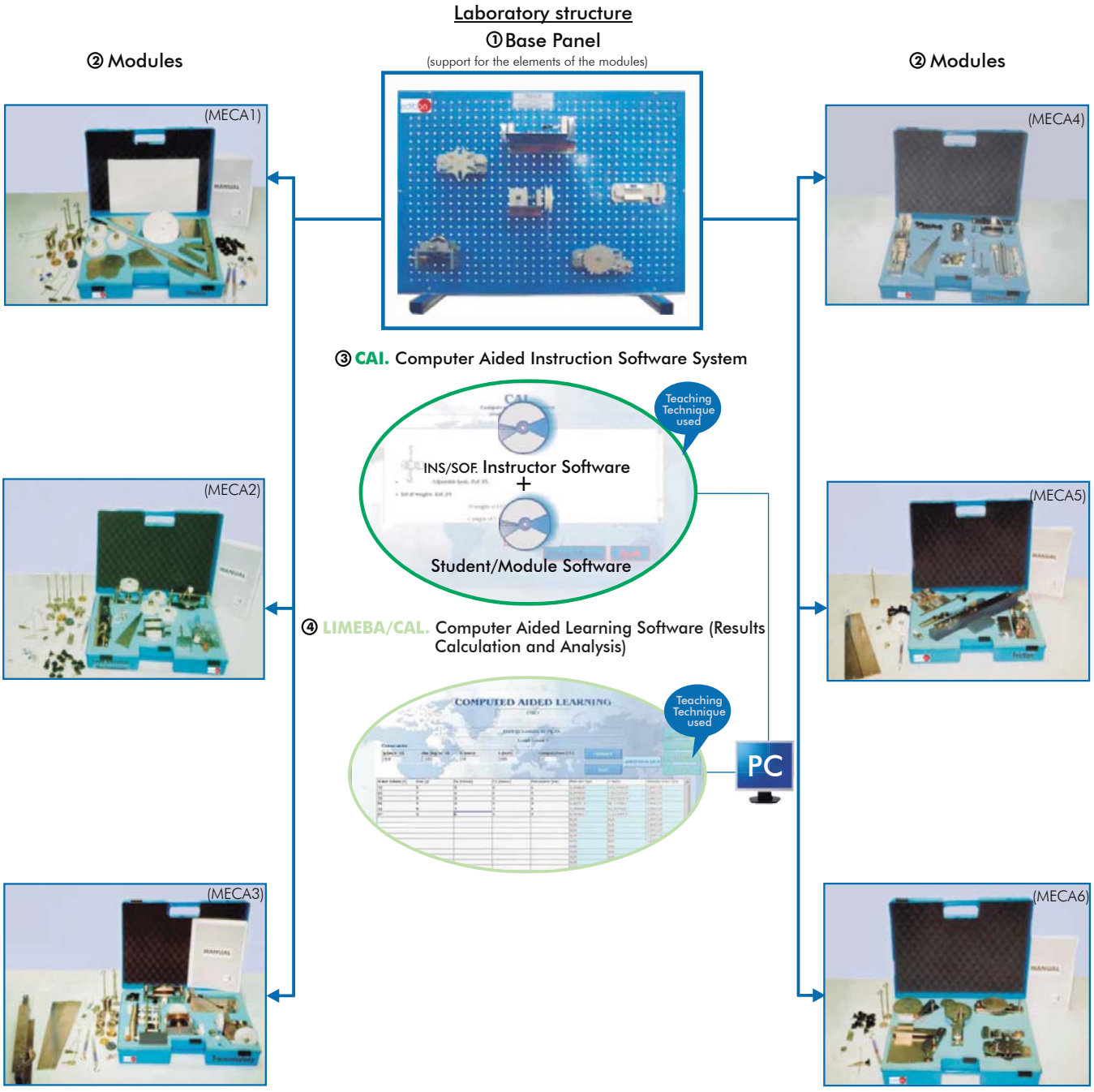
7.- Mechanics & Materials

Equipment list

LIMEBA. **Basic Mechanics Integrated Laboratory:**



The complete laboratory includes parts 1 to 4 but any part can be supplied individually or additionally to others. (Base Panel + Module/s is the minimum supply).

Some Available Modules:

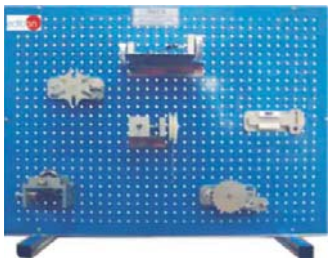
- MECA1. **Statics Experiments.**
- MECA2. **Load Elevation Mechanisms Experiments.**
- MECA3. **Transmissions Experiments.**
- MECA4. **Dynamics Experiments.**
- MECA5. **Friction Experiments.**
- MECA6. **Special Mechanisms Experiments.**

LIMEBA consists on a complete set of exercises and practical experiments belonging to the area of Applied Mechanics in its two main subareas: Statics (the analysis of structures in balance) and Dynamics (analysis of the motion of mechanisms). LIMEBA is divided into various experimental modules, each one presenting a subject of Statics or Dynamics.
Students are expected to build the experiments on the base panel, where distance measurements are possible due to equidistant spacings between holes on the base panel.
Thanks to the Manuals and the necessary theoretical knowledge imparted by the teacher, students shall be able to do all the measurements.
The MECA series is split up into six parts, named Modules, each of which contains the elements needed for completing a specific group of related exercises and experiments.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/basic/LIMEBA.pdf

LIMEBA. **Basic Mechanics Integrated Laboratory:**

①Base Panel



SPECIFICATIONS SUMMARY

It is the supporting structure where the modules's elements are mounted in order to undertake the experiments and hence, the base panel is necessary along with any module.
The panel is pierced with equidistant holes that help students to take measurements.
Anodized aluminium structure.
Front Panel in painted steel.
The holes on the base panel are accurately spaced at 25mm centres.
Dimensions (approx.): 950 x 400 x 550 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/basic/LIMEBA.pdf

②Modules

Each module is formed by different experiment components and is packed in a high quality case.
The experimental elements of each module are made out of special anodized aluminium, a high quality material to achieve total precision and to obtain 100% accuracy in carried out practices.
Manuals include laboratory sheets for every experiment, listing the elements needed in every experiment and giving the correct position of each element on the base panel. These sheets also give valuable guidance on how to conduct the experiments and recording the results.
There is a particular manual for each Module (8 manuals normally supplied).

MECA1. **Statics Experiments**

SPECIFICATIONS SUMMARY

All experiment elements are made in special anodized aluminum.
Centres of gravity of various shaped plates: rectangle, circle, triangle, T, kite and irregular.
Drawing panel.
3 Cords and ring. 5 Cords and ring.
Beam balance. Beam.
2 forces equality divided.
The simple pendulum.
Pivot screw. Adjustable hooks.
Set of weights of 0.05 N., 0.1 N., 0.5 N., 1 N., 2 N., 5 N.
Weight hooks. Light weight hooks.
Pulleys. Screws. Knurled nuts.
Large ext. spring. Small ext. spring. Dynamometer. Spare rope.
Dimensions (approx.): 500 x 360 x 120 mm.
Weight: 5 Kg.

More information in:
www.edibon.com/products/catalogues/en/units/mechanicsmaterials/basic/LIMEBA.pdf

PRACTICAL POSSIBILITIES

1.- Centres of gravity (Centres of gravity (I) and Centres of gravity (II)): Specification of the centre of gravity of plates of different shapes using the simple pendulum and graphical methods.
2.- Triangle of forces. To test that three non-parallel forces in equilibrium acting in the same plane can be represented by a Triangle of forces.
3.- Parallelogram of forces. When three non-parallel forces in the same plane are in equilibrium, their lines of action meet at a point, and hence to show that the resultant of two forces can be found using the Parallelogram of forces.
4.- Polygon of forces. Verification of the fact that four or more forces in equilibrium acting on the same point, can be represented by a Polygon of forces.
5.- Principle of moments. Verification of the principle of moments for parallel and non parallel forces.
6.- The Pivot or beam balance. To demonstrate that the action of weighing with a beam balance or slide balance is based upon the principle of moments.
7.- Levers: To determine the mechanical advantage of various types of levers using the ratio resistance/power (W/P) and to verify that this is the same as the ratio between distances.
8.- Beam reaction forces. Verification of the fact that a distributed load applied over a beam may be considered as an equivalent concentrated load applied at the centre of gravity of the distributed load. Reactions located at supports due to the load acting on the simply supported beam may be calculated using the momentum principle, independent of the position of these beam supports.

MECA2. **Load Elevation Mechanisms Experiments**

SPECIFICATIONS SUMMARY

All experiment elements are made in special anodized aluminum.
Three pulley block. Two pulley block. Wheel and axle set. Weston differential chain block. Screw jack. Support screw. Adjustable hooks.
Set of weights of 0.05 N., 0.1 N., 0.5 N., 1 N., 2 N., 5 N.
Weight hooks. Light weight hook. Pulleys. Adjustable pulley. Single pulley block. Knurled nuts. Dynamometer. Spare rope. Screws.
Dimensions (approx.): 500 x 360 x 120 mm.
Weight: 9 Kg.

More information in:
www.edibon.com/products/catalogues/en/units/mechanicsmaterials/basic/LIMEBA.pdf

PRACTICAL POSSIBILITIES

1.- Simple pulleys. Verification of the variation of cable tension in a pulley with the cable's direction as it passes over the pulley. To determine the mechanical advantages of a simple combination of fixed and movable pulleys.
2.- Pulley blocks. Analysis of the mechanical features of a set of pulley blocks, which has three sheaves in the upper block and two pulleys in the lower block.
3.- Single axle and wheel. Determine the law of the Machine for a simple axle and wheel, and the variation of mechanical advantage and efficiency with load.
4.- Differential axle and wheel. Determine the law of the Machine for differential axle and wheel. Verification that the mechanical advantage and efficiency increases with load up to a limiting maximum.
5.- Weston differential chain blocks. Analysis of the specific characteristics of these chains.
6.- Screw Jack. To measure the effort required to raise various loads using a simple form of screw jack and to determine how the mechanical advantage and efficiency varies with load.

MECA3. **Transmissions Experiments**

SPECIFICATIONS SUMMARY

All experiment elements are made in special anodized aluminum.
System of belt drive (includes: flat belt, round belt and leather strip). Chain drive. Simple gear train. Bevel gears. Worm gears. Universal coupling. Support screw. Adjustable screws.
Set of weights of 0.05 N., 0.1 N., 0.5 N., 1 N., 2 N., 5 N.
Weight hooks. Light weight hooks. Pulley. Screws. Knurled nuts. Dynamometers. Spare rope.
Dimensions (approx.): 500 x 360 x 120 mm.
Weight: 7 Kg.

More information in:
www.edibon.com/products/catalogues/en/units/mechanicsmaterials/basic/LIMEBA.pdf

PRACTICAL POSSIBILITIES

1.- Belt drive (Belt drive (I) and Belt drive (II): Verification of the direction of rotation of open and crossed belt drives. Verification of the speed of rotation of the two pulleys is inversely proportional to their diameters. To measure the difference intension between the two sides of a belt drive and to determine the efficiency of drive transmission.
2.- Chain drive. Verification of the speed ratio of a chain drive. Measurement of the efficiency of drive transmission.
3.- The Geared winch (two parallel axles). Comparison of the velocity ratios of a system of single-stage and double stage geared winch. Specification of their corresponding mechanical advantages and efficiencies under varying loads.
4.- Bevel gears (two intersecting axles). Verification of the efficiency velocity-ratio and mechanical advantages of the Bevel gear unit under different loads.
5.- Worm gear (two crossed axles). Verification of the speed ratio of a worm and specification of the transmission efficiency under different loads.
6.- Universal coupling. To investigate the effect of introducing universal coupling to a simple drive shaft.

LIMEBA. **Basic Mechanics Integrated Laboratory:**

② Modules

MECA4. **Dynamics Experiments**

SPECIFICATIONS SUMMARY

All experiment elements are made in special anodized aluminum.
The spring balance.
Friction with rear.
Friction equipment.
Wheel.
Centrifugal force system.
The simple pendulum.
Adjustable screw.
Set of weights of 0.05 N., 0.1 N., 0.5 N., 1 N., 2 N., 5 N.
Weight hooks.
Adjustable pulley.
Screws.
Knurled nuts.
Small ext. Spring.
Large ext. Spring.
Dynamometer.
Spare rope.
Dimensions (approx.): 500 x 360 x 120 mm.
Weight: 7 Kg.

More information in:
www.edibon.com/products/catalogues/en/units/mechanicsmaterials/basic/LIMEBA.pdf

PRACTICAL POSSIBILITIES

1.- Spring balance. To verify that the extension of a coiled spring is proportional to the load applied, to show the principle of a spring balance.

2.-Simple pendulum. To show that the time of a simple pendulum depends only on the length of the pendulum, and to determine the value of the force of gravity using a simple pendulum.

3.- Kinetic and potential energy. Analysis of some features of kinetic and potential energy and to show that energy exists, that is may be transformed, and that it may be "stored" and "given back" .

4.- Inertia. The wheel. To find the energy stores in a wheel by supplying a known quantity of energy .

5.- Belt-pulley friction. Verification of the fact that the driving force of a transmission belt increases with the helical angle.

6.- Centrifugal force. Demonstration of the laws of the centrifugal force.

MECA5. **Friction Experiments**

SPECIFICATIONS SUMMARY

All experiment elements are made in special and anodized aluminum.
Friction equipment.
Friction with roar.
Foils of friction.
Roller.
Block of wheels with roar.
Set of rollers in a marc.
Principle of wedge.
Bearings.
The simple pendulum.
Set of weights of 0.05 N., 0.1 N., 0.5 N., 1 N., 2 N., 5 N.
Weight hooks.
Light weight hook.
Pulley.
Adjustable pulley.
Single pulley block.
Screws. Knurled nuts.
Dynamometer.
Spare rope.
Dimensions (approx.): 500 x 360 x 120 mm.
Weight: 6 Kg.

More information in:
www.edibon.com/products/catalogues/en/units/mechanicsmaterials/basic/LIMEBA.pdf

PRACTICAL POSSIBILITIES

1.- Sliding friction. Verification of the laws of friction and to measure the coefficient of friction for different materials.

2.- Inclined plane (Inclined plane (I) and Inclined plane (II)) Analysis of the forces acting on an inclined plane due to a weighted of a roller supported on the plane. Calculation of the starting force needed for dragging a block on the plane.

3.- Angle of friction. Measurement of the angle of friction and from it find the coefficient of friction. To show that the coefficient of friction is equal to tangent of the angle of friction.

4.- Friction. To show the extent to which friction is reduced by using wheels and rollers and to compare the effects of different bearing surfaces.

5.- The wedge. Determine mechanical advantage and efficiency obtained using two different wedges, and to show that overhauling may be prevented if the angle of inclination of a wedge is small.

6.- Bearings. Comparison of the resistance to turning due to friction of four bearings made of different materials, and to show something of the progress made in bearing development.

MECA6. **Special Mechanisms Experiments**

SPECIFICATIONS SUMMARY

All experiment elements are made in special and anodized aluminum
The cam and roller mechanisms (included two cams).
Geneva mechanism.
The ratchet mechanisms.
Scotch yoke.
Crank mechanism.
Quick return mechanism.
Adjustable hooks.
Set of weights of 0.05 N., 0.1 N., 0.5 N., 1 N., 2 N., 5 N.
Weight hooks.
Adjustable pulley.
Screws.
Knurled nuts.
Dynamometer.
Dimensions (approx.): 500 x 360 x 120 mm.
Weight: 7 Kg.

More information in:
www.edibon.com/products/catalogues/en/units/mechanicsmaterials/basic/LIMEBA.pdf

PRACTICAL POSSIBILITIES

1.- Cam and roller. To study the difference aspects of cam design.

2.- Geneva motion. Verification of how the circular motion of the drive unit is transformed into the intermittent motion of the Geneva motion, and of how this mechanism accelerates and decelerates during the transmission process.

3.- Ratchet mechanisms. Examination of the parts of the Ratchet assembly supplied in which a swinging lever is fitted with two pawls.

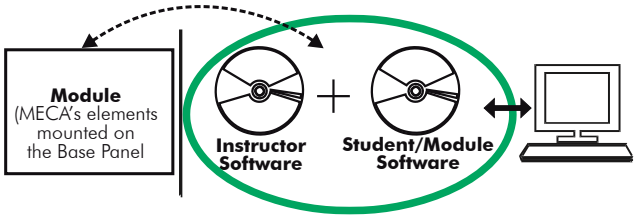
4.- Scotch yoke. Analysis and verification of the motion of a driving crank and its relation to the reciprocal element of motion.

5.- Crank mechanism. Analysis of the features of a crank mechanism, drawing a rotation torque diagram and educing the relation between the crank rotation and the slide platform movement.

6.- Quick return mechanism. To show a quick return mechanism at work and to record the relationship between the rotation of the crank and the movement of the slide.

LIMEBA. **Basic Mechanics Integrated Laboratory:**

③ CAI. Computer Aided Instruction Software System



With no physical connection between module and computer (PC), this complete software package consists of an Instructor Software (INS/SOF) totally integrated with the Student/Module Software (MECA../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):

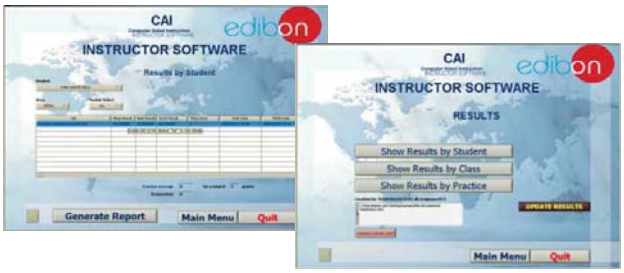
The Instructor can:

- 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.

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

Instructor Software



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

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

Each module has its own Student Software:

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

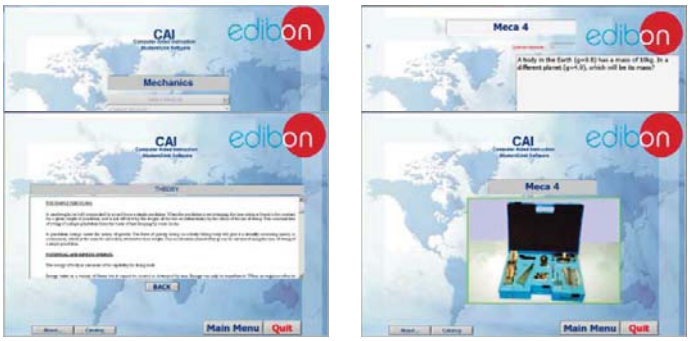
  Theory: gives the student the theoretical background for a total understanding of the studied subject.

  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 module, showing how to perform the exercises and practices.

  Exams: set of questions to test the obtained knowledge.

Student/Module Software



Available Student/Module Softwares:

- MECA1/SOF.	Statics.	- MECA4/SOF.	Dynamics.
- MECA2/SOF.	Load Elevation Mechanisms.	- MECA5/SOF.	Friction.
- MECA3/SOF.	Transmissions.	- MECA6/SOF.	Special Mechanisms.

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

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

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

CAL computes the value of all the variables involved and performs the calculations.

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

Different plotting displays.

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

Calculations

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

Plotting options

Available Softwares:

- MECA1/CAL.	Statics.	- MECA4/CAL.	Dynamics.
- MECA2/CAL.	Load Elevation Mechanisms.	- MECA5/CAL.	Friction.
- MECA3/CAL.	Transmissions.	- MECA6/CAL.	Special Mechanisms.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/basic/LIMEBA.pdf

7.2.1- Automotive Mechanisms

MFT. **Drum Brake System**

SPECIFICATIONS SUMMARY

The Drum Brake System (MFT) is particularly suitable for motor vehicle teaching. The unit permits to demonstrate the difference in the braking torque between leading and trailing shoe braking systems and the effect on the braking torque of the different combinations of leading and trailing shoes.

With this unit we can carry out studies and experiments to investigate the relationship between actuating forces and the braking torques and for the determination of the coefficient of friction between the brake lining and the drum.

To have drum torque and braking load applied by weights hangers and cord.

Two shoes with brake linings are provided.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 455 x 270 x 300 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MFT.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of a drum brake with leading and trailing shoes.
2.- Demonstration of the effect on the braking torque of different combinations of leading and trailing shoes.
3.- To study the difference in the braking torque between leading and trailing shoe braking systems.
4.- To determine experimentally the variation of tangencial force with braking load.
5.- To investigate the relationship between actuating forces and the braking forces.
6.- Determination of the coefficient of friction between the drum and the brake shoe.
7.- With the optional accessory MFTA the student can investigate the effect on the braking torque when the pressure point on the brake shoe is displaced relative to the pivot point.

MEM. **Plate Clutch**

SPECIFICATIONS SUMMARY

This unit has been designed to perform studies and experiments on surface friction and the function of a plate clutch. We can also carry out experiments to investigate the relationship between the pressure applied to the friction surfaces, the radius of the friction discs and the torque.
This unit is mounted on a aluminum and painted steel structure.
The unit comprises a lower plate and a upper plate. On top of the lower plate sits the upper plate whose shaft rotates in ball bearings.
Between the lower and upper plates will be the interchangeable friction discs. Three interchangeable discs of different diameters are supplied.
The self weight of the upper plate is the minimum pressure or force on the friction disc. Adding weights to the upper plate we can increase the contact pressure.
Torque is applied to the upper plate through pulleys and loaded cords. By means of hangers and masses or weights we can modify the loading force and also adjust the torque.
This unit can be wall mounted.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 300 x 400 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MEM.pdf

PRACTICAL POSSIBILITIES

1.- Function of a plate clutch.
2.- Relationship between contact force and friction moment.
3.- To determine the coefficient of friction.
4.- To study the influence of the materials used on the friction moment.
5.- To study the influence of the friction surface geometry on the friction moment.
6.- To investigate the relationship between the pressure applied to the friction surfaces, the radius of the friction surfaces, the number of friction surfaces and the torque.
7.- To show that the minimum torque to maintain rotation is proportional to the axial load and diameter of the friction surface.

MFD. **Disk Brake**

SPECIFICATIONS SUMMARY

This unit has ben designed to carry out experiments to investigate the relationship between the normal force acting on the brake pads, the effective radius of the brake pads and the braking torque.
The brake pads are located on bell crank levers to which the load hangers may be attached. A load beam is supplied for use when carrying out experiments with two brake pads. The support shafts are drilled and pins provided so that the bell crank levers can be located in different radial positions.
Different brake pads materials can be tested.
The braking torque can be determined by attaching masses or weights to a cord wrapped round the pulley on the disc shaft.
This unit may be wall mounted.
Manuals: This unit is supplied with 8 manuals.
Dimension(approx.): 400 x 350 x 350 mm. Weight: 15 Kg.

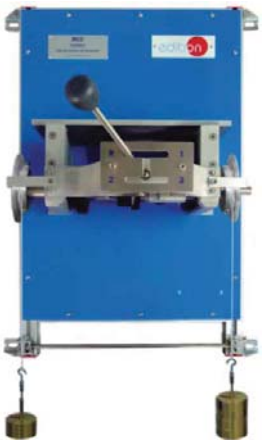
More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MFD.pdf

PRACTICAL POSSIBILITIES

With this unit we can study and carry out experiments to investigate:

1.- Normal forces.
2.- Friction.
3.- Effective radius of the brake pads.
4.- Normal force acting on the brake pads.
5.- Determination of the braking torque.
6.- Material suitability testing.

MCC. **Gearbox**



SPECIFICATIONS SUMMARY

The Gearbox unit (MCC) has been designed to represent the typical position of a simple gearbox with three gears ratio and reverse. Basically, the gearbox consists of several gears of different size that can be meshed as required.
The MCC unit, Gearbox, is mounted on a frame made of aluminum profiles and panel made of painted steel.
The gears and shafts are made of stainless steel.
The number of gears and the teeth of the gears is:2 gears with 20 teeth each. 3 gears with 30 teeth each. 2 gears with 40 teeth each. 1 gear with 16 teeth.
The unit includes two pulleys, which are made of aluminum.
The shafts of the unit are mounted on ball bearings. Thus, inertia will be low and losses due to friction will decrease, allowing an easier execution of the practical exercises.
To perform the practical exercises the unit can be either placed on a table or hung from a wall, allowing a more comfortable performance of the practical exercises with the weights or masses.
In order to carry out some of the practices with MCC unit, 2 sets of weights "B type" are required.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 580 x 350 x 500 mm. Weight: 17 Kg.

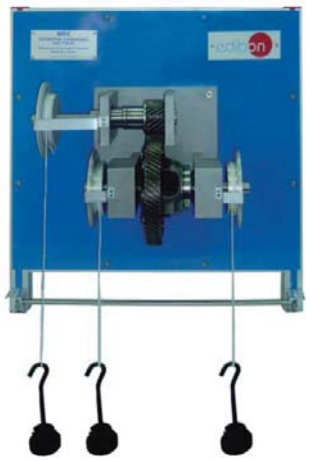
More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MCC.pdf

PRACTICAL POSSIBILITIES

1.- Study of mechanism that represents a gearbox.
2.- Measurement of the angular displacement at the input and output of the gearbox and comparison with the theoretical values.
3.- Determination of the minimum effort required at the input shaft to lift a series of loads.
4.- Calculation of the efficiency for different ratios depending on the input torque.
5.- Plot of characteristic curves.
6.- Determination of the torque and speed ratio for different gears.

7.2.1- Automotive Mechanisms

MDC. **Differential-Crownwheel and Pinion**



SPECIFICATIONS SUMMARY

The MDC unit has been designed to demonstrate the action of the elements of a differential: the crown-wheel and the pinion.

The MDC unit, designed by EDIBON, simulates a differential mechanism. The function of the differential mechanism is to enable the drive wheels rotate at different speeds, regardless of whether they are the front or rear wheels.

The MDC unit allows to be operated horizontally, since it is mounted on a frame consisting of aluminum profiles with panels made of steel and painted, with legs that enable to locate it on an appropriate surface.

On the other hand, it also includes brackets that allow to hang the unit on a wall. Thus, the user can work comfortably in vertical position.

The MDC unit includes a differential group consisting of:

-Input pinion.

-Crown-wheel (Z = 9).

-2 sun gears (Z = 71).

-2 planetary gears (Z = 13).

Gears are distributed on different shafts (input shaft, right output shaft and left output shaft), which are mounted on ball bearings that will allow low inertia and a decrease of the losses due to friction. Both the input shaft and the output shafts have pulleys equipped with protractors with the aim of enabling the student to determine and verify the torque and speed ratios. They are made of aluminum and their radius is 40mm.

In order to carry out some of the practices with MDC unit, 3 sets of weights "C" type are required.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 550 x 300 x 550 mm. Weight: 17 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MDC.pdf

PRACTICAL POSSIBILITIES

1.- Determination of the input and output speed ratio and the torque distribution.

2.- Study of the efficiency.

3.- Study of the use of a differential as a simple transmission system.

4.- Visualization and demonstration of the behaviour of a differential when used as a means to provide a drive.

5.- Verification of the gear ratio.

MFF. **Braking and Accelerating Forces Unit**

SPECIFICATIONS SUMMARY

A load transfer between front and rear wheels takes place under conditions of braking or acceleration of a vehicle (a car for example). The problem of load transfer occurs since the accelerating or braking force is not applied to the centre of gravity of the vehicle but to the point of contact of the wheels with the road.

The MFF unit has been designed to demonstrate and study this load transfer.

This unit allows to carry out practices and experiments to study the relationship between the forces involved in car braking and acceleration.

This unit also allows the demonstration of the relationship between these forces on front wheel drive, rear wheel drive, and four wheel drive.

It is mounted on an anodized aluminium and steel structure. A car model is supported on a beam load cell and has road wheels. A pin can be inserted in different positions to represent the centre of gravity of the car.

Pulleys, weigths and cords are used to apply different horizontal braking or acceleration and inertia forces to the car .

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 800 x 600 x 800 mm. Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MFF.pdf

PRACTICAL POSSIBILITIES

1.- Investigation of the relationship between the forces involved in vehicle braking and acceleration.

2.- Study of the inertia force.

3.- Demonstration of the relationship between these forces on front wheel drive, rear wheel drive, and four wheel drive.

4.- Study of the load transfer between front and rear wheels.

5.- Study of different conditions varying the position of the centre of gravity.

6.- Appplication of the accelerating or braking force on different points of the centre of gravity.

7.2.2- Gears and Transmissions

MEC. **Overdrive Unit**

SPECIFICATIONS SUMMARY

The Overdrive Unit (MEC) includes a set of epicyclical gears that represent an application of a simple epicyclic arrangement of the type used in a motor vehicle overdrive.

The MEC unit is assembled in an anodized aluminum structure with a painted steel panel.

Besides, it is provided with four brackets to be suspended in the wall, which allows the experiments with weights to be carried out more easily.

This unit is mainly composed of:

The epicyclic gears set, formed by:

- Sun gear (Z=21). - Planet gears set (Z=21). - Ring (Z=63).

2 Graduated discs located at the input and output shafts.

The shafts of the unit are made in stainless steel. The discs and gears are made in aluminum to facilitate the experiments.

The pinions are made of aluminum and are mounted on ball bearings to reduce of losses due to friction, making the practical exercises execution easy.

Manuals: This unit is supplied with 8 manuals.

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

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MEC.pdf

PRACTICAL POSSIBILITIES

1.- To study the overdrive speed.

2.- To demonstrate the operation of an epicyclic gears system to obtain the overdrive speed.

3.- To determine the angular displacement at the input and output and to compare it with the overdrive reduction ratio calculated.

4.- To determine the minimum effort required at the input to raise a load at the output in an overdrive reduction ratio.

5.- Power transmission: checking the ratio between input torque and output torque for an overdrive reduction ratio.

7.2.2- Gears and Transmissions

MEE. **Geared Lifting Machine**

SPECIFICATIONS SUMMARY

This unit has been designed to study a simple lifting mechanism and its use to determine the velocity ratio, mechanical advantages and efficiency.

This unit is mounted on a metallic structure and may be wall mounted.

In order to carry out some of the practices with MEE unit, 2 Sets of weights "B type" are required.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MEE.pdf

PRACTICAL POSSIBILITIES

1.- Study of a simple lifting mechanism and its use to determine the velocity ratio, mechanical advantages and efficiency.

2.- Use of pulleys and gears to simulate simple wheel and shaft, single gear and double gear.

3.- Measurement of the linear displacement between the masses and comparison with the calculated values.

4.- Calculation of the minimum work to lift a load and the efficiency.

MBW. **Borg-Warner Automatic Transmission**

SPECIFICATIONS SUMMARY

The MBW unit simulates the working of all the elements that compose an automatic transmission and it lets the student learn its working, being able to proceed to its diagnosis and study the consequences of a fault in a clutch or in band brakes.

This unit is mainly composed of:

Planetary gear set formed for:

2 sun gears, one for forward operations and the other one for reverse operations.

2 set of pinions: long and short pinions.

A common carrier for the pinions.

A ring gear.

2 graduated discs placed in the input and output shaft.

2 input discs to simulate the clutch of gears.

Some mechanic actuators or pins that simulate the pilot valves used to brake the different components of the planetary gear.

The shaft of the unit is made of stainless steel. The discs and the gears are made of aluminum to facilitate the practice's carrying out.

MBW is a bench-top unit supported by four legs.Besides, it is provided with four brackets to be suspended in the wall, which allows an easier carrying out of the practice with weights.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 450 x 320 x 300 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MBW.pdf

PRACTICAL POSSIBILITIES

Selection of the gears:

1.- First gear (lockup selected).

2.- First gear imposed (drive selected).

3.- Second gear.

4.- Third gear.

5.- Reverse gear.

6.- Neutral position.

7.- Parking break.

Faults simulation:

8.- Forward gear clutch fault.

9.- Reversing gear clutch fault.

10.- Brakes fault.

Power transmission:

11.- Checking the connection between the torque of the input and the torque of the output.

12.- Experiment for the different connections of reduction but activating the motor brake of the transmission.

MED. **Static & Dynamic Balancing Unit**

SPECIFICATIONS SUMMARY

The "MED" is an unit to study and analyze the oscillations and vibrations and how to eliminate or diminish them.

This unit has:

An electrical motor with variable speed which can reach 8300 r.p.m.

It has a transmission through pulleys and a belt from the motor to the shaft.

2 Balancing discs, made of aluminum.

An aluminum external disc, that we will name Graduated disc.

The unit is completed with a set of sector masses and weights to perform the practices:

2 Sector masses of 27° angle. 2 Sector masses of 114° angle.

2 Sector masses of 43° angle. 2 Sector masses of 72° angle.

18 weights of 60 gr., 40 gr., 30 gr., 20 gr. and 15 gr., to do the balance of masses in rotation experiments.

Auxiliary Module for the electrical supply and the motor control. At its back, there are connections and at its front part it has a potentiometer to control the speed of the motor.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.):

Unit: 450 x 550 x 600 mm. Weight: 30 Kg

Auxiliary Module: 310 x 220 x 145 mm. Weight: 2 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MED.pdf

PRACTICAL POSSIBILITIES

1.- Balance on an individual plane of revolution.

2.- Balance on separated planes of revolution.

3.- Simple demonstration experiments.

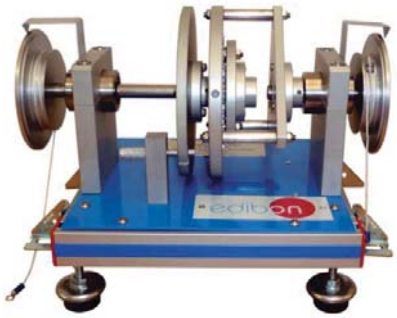
4.- Illustrate the dynamic balance of rotation and reciprocating systems.

5.- Balance of reciprocating masses.

6.- Observe the effects on oscillations of various conditions of partial balance in the reciprocating systems.

7.2.2- Gears and Transmissions

MTE1. **Epicyclic Gear Unit** (1 element)



SPECIFICATIONS SUMMARY

The MTE1 unit includes a set of epicyclic gears that allows the student to study different reduction ratios (direct drive and overdrive), as well as torque conversion.

The MTE1 unit is assembled in an anodized aluminum structure with a painted steel panel. MTE1 is a bench-top unit supported by four legs. Besides, it is provided with four brackets to be suspended in the wall, which allows the experiments with weights to be carried out more easily.

This unit is mainly composed of:

The epicyclic gears set, formed by:

- Sun gear (Z=21). - Planet gears set (Z=21). - Ring (Z=63).

2 Graduated discs located at the input and output shafts.

The shafts of the unit are made in stainless steel. The discs and gears are made in aluminum to facilitate the experiments.

The pinions are made of aluminum and are mounted on ball bearings to reduce of losses due to friction, making the practical exercises execution easy.

Manuals: This unit is supplied with 8 manuals.

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

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MTE1.pdf

PRACTICAL POSSIBILITIES

1.- To demonstrate the operation of an epicyclic gears system.
2.- To determine and verify the speed and torque ratio between the input and output shafts.
3.- To study the mechanical advantage and efficiency of an epicyclic system.
4.- To determine the angular displacement at the input and output and to compare with the ratio calculated.
5.- To determine the minimum effort required at the input to raise a load at the output.
6.- Selection of gears:
  6.1- Overdrive.
  6.2- Direct drive.
7.- Power transmission: checking the relation between input torque and output torque.

MTE2. **Epicyclic Gear Unit** (2 elements)

SPECIFICATIONS SUMMARY

EDIBON "MTE2" transmission consists of two coupled epicyclic gears sets. It will allow the students to carry out experiments of different gear ratios, as well as the torque conversions.

This unit is mainly composed of:

2 Coupled epicyclic gears sets, formed by:
  Sun gears.
  Satellite gears set.
  Common support of the satellites.
  External ring.

2 Graduated discs located at the input and output shafts.

Different mechanical pins that simulate the pilot valves used to brake the different planetary components.

The shafts of the unit are made in stainless steel. The discs and gears are made of aluminum to make the experiments easier.

The pinions are mounted on ball bearings to reduce frictional losses. They are made of aluminum, so the inertia will be less and the results of the experiments can be improved.

The MTE2 unit provides three forward speeds.

The MTE2 is a bench-top unit supported by four legs. Also, four brackets are provided so the unit can be mounted on the wall, which allows the experiments with weights to be carried out more easily.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 360 x 260 x 300 mm. Weight: 24 Kg

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MTE2.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of the function of an epicyclic gear system.
2.- To determine and verify the velocity and torque ratios between the input and output shafts.
3.- Study of the mechanical advantage and efficiency of a planetary system.
4.- Determination of the angular displacement at the input and output and comparison with calculated ratios.
5.- Determination of the minimum force at the input to move a weight at the output.

Gears selection:

6.- First gear.
7.- Second gear.
8.- Third gear.
9.- Neutral.

Power transmission:

10.- Checking the relation between the input motor torque and the output motor torque.

MTE3. **Epicyclic Gear Unit** (3 elements)

SPECIFICATIONS SUMMARY

EDIBON "MTE3" transmission consists of three coupled epicyclic gears sets. It will allow the students to carry out experiments of different gear ratios, as well as the torque conversions.

This unit is mainly composed of:

3 Coupled epicyclic gear sets, formed by:
  Sun gears.
  Satellite gears set.
  Common support of the satellites.
  External ring.

2 Graduated discs located at the input and output shafts.

Different mechanical pins that simulate the pilot valves used to brake the different planetary components.

The shafts of the unit are made in stainless steel. The discs and the gears are made in aluminum to facilitate the experiments.

The pinions are mounted on ball bearings to reduce frictional losses. They are made in aluminum, so the inertia will be less and the results of the experiments will be improved.

The MTE3 unit provides three forward speeds and one reverse speed.

MTE3 is a bench-top unit supported by four legs. Also, four brackets are provided so the unit can be mounted on the wall, which allows the experiments with weights to be carried out more easily.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 500 x 260 x 300 mm. Weight: 30 Kg

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MTE3.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of the function of an epicyclic gear system.
2.- To determine and verify the velocity and torque ratios between the input and output shafts.
3.- Study of the mechanical advantage and efficiency of a planetary system.
4.- Determination of the angular displacement at the input and output and comparison with calculated ratios.
5.- Determination of the minimum force at the input to move a weight at the output.

Gears selection:

6.- First gear.
7.- Second gear.
8.- Third gear.
9.- Reverse gear.
10.- Neutral.

Power transmission:

11.- Checking the relation between the input motor torque and the output motor torque.

7.2.3- Mechanisms

MSH. **Simple Hydraulic System**

SPECIFICATIONS SUMMARY

The Simple Hydraulic System (MSH) has been designed for mechanical engineering and motor vehicle studies. It is used to demonstrate how a liquid can be used to transmit a force.

The unit can also be used to carry out experiments to study the relationships between the force on the plungers, the cross section area of the plungers and the fluid pressure in the system.

This unit is mounted on an anodized aluminum structure and painted steel panel.

The unit consists of three cylinders and plungers whose cross-section areas are in the ratio 1, 2 and 6. These three cylinders and the pressure gauge are connected in parallel. Using the on/off taps included in the circuit any of the cylinder units can be isolated from the system.

Load hangers are supplied.

In order to carry out some of the practices with MSH unit, 2 Sets of weights "B type" are required.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 710 x 600 x 810 mm. Weight: 25 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MSH.pdf

MBD. **Slider Crank Mechanism**

SPECIFICATIONS SUMMARY

The MBD Unit, designed by EDIBON, is an example of slider-crank mechanism, which is one of the most important and more numerous mechanisms.

This is a mechanism able to transform rotational motion of a piston into linear motion of a crankshaft. Its greatest application is in internal combustion engines.

It is assembled in an anodized aluminum profile structure, with steel painted panel.

This mechanism is made of aluminum and consists of a rotary element (graduated disc), called crank, connected to a rigid bar, called connecting rod. When rotating the crank, the connecting rod moves backwards and forwards. The rotating motion of a crank or crankshaft generates the alternative linear motion of a piston or plunger.

It is a reversible system, if the connecting rod generates the input motion (for example, a piston in a car's engine), the crank rotates.

The input angle is set on the ball bearing mounted crank disc and it is read on an angle measuring scale. A millimeter scale is fitted for the linear motion of the connecting rod.

The MBD unit includes two connecting rods of different length so that they can be compared.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 400 x 300 x 100 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MBD.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of the action of a simple in-line slider-crank mechanism.

2.- Study of the relationship between the linear displacement of the sliding block (connecting rod) and the angular displacement of the rotary element (crank).

3.- To illustrate graphically and study the effect of changing the length of the connecting rod.

4.- Determination of the velocity and acceleration of the sliding block by graphical differentiation and compared with the values obtained by equations of motion or by velocity and acceleration diagrams.

MYE. **Scotch Yoke Mechanism**

SPECIFICATIONS SUMMARY

The Scotch Yoke Mechanism (MYE), designed by EDIBON, is an example of slider-crank mechanism. The MYE is a mechanism for converting the linear motion of a slider into rotational motion or vice versa.

The unit is a bench top-unit with an anodized aluminum profile structure, and painted steel panel.

The main metallic elements are made of anodized aluminum.

This unit is composed of:

A rotary element (crank) with a graduated disc to read the angle.

A piston with a millimeter scale to measure the linear motion.

A vertical pivot links the rotary element (crank) and the piston.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 400 x 300 x 100 mm. Weight: 2 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MYE.pdf

PRACTICAL POSSIBILITIES

1.- Study of the conversion of smooth rotary motion into purely harmonic reciprocating motion.

2.- Demonstrating the behaviour of a simple crank-driven Scotch yoke mechanism.

3.- Plotting the relation between the linear displacement of the Scotch yoke and the angular displacement of the crank.

4.- Determining the velocity and acceleration of the Scotch yoke by graphical differentiation.

5.- Comparing the values obtained by the equations of motion.

MBM1. **Slotted Link Mechanism**

SPECIFICATIONS SUMMARY

The slotted link mechanism (MBM1), designed by EDIBON, is an example of a quick-return mechanism.
This mechanism is a combination of an inversion of the slider-crank chain and slider block.
The unit is assembled in an anodized aluminum profile structure, with steel painted panel.
The MBM1 is a mechanism able to transform circular movement into reciprocating movement. It is made of aluminium and consists of a rotary element (graduated disk), called crank, connected to a rigid bar, called connecting rod. When rotating the crank, the connecting rod moves back and forward. The rotation motion of a crank or crankshaft causes a rectilinear reciprocating motion of a piston or plunger.
It is a reversible system through which the connecting rod can be displaced by turning the crank and the other way round. If the connecting rod generates the input motion (as a piston in a car's engine does), the crank is obliged to rotate.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 300 x 100 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MBM1.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of the action of a simple crank and slotted link mechanism.

2.- Graphic determination of the relationship between the linear displacement of the sliding block and the angular displacement of the input crank.

Other possible practices:

3.- More advanced exercises may include the determination of the velocity and acceleration of the slider block by graphical differentiation and comparison with the values obtained by velocity and acceleration diagrams.

MBM2. **Whitworth Quick Return Mechanism**

SPECIFICATIONS SUMMARY

The MBM2 is a mechanism able to transform circular movement into reciprocating movement.
The unit is a bench top-unit with an anodized aluminum profile structure, and painted steel panel.
The main metallic elements are made of anodized aluminum.
This unit is composed of:
A rotary element (crank) with a graduated disc to read the angle.
A rigid bar (connecting rod) with a millimeter scale to measure the linear motion.
2 Rigid bars for transfer motion.
All axles are equipped with ball bearings.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 300 x 100 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MBM2.pdf

PRACTICAL POSSIBILITIES

1.- To demonstrate the action of a simple Whitworth quick-return mechanism.

2.- Graphic determination of the relationship between the linear displacement of the connecting rod and the angular displacement of the input crank.

3.- More exercises and practices may include the determination of the velocity and acceleration of the connecting rod by graphical differentiation and comparison with the values obtained by velocity and acceleration diagrams.

MCA. **Four Bar Chain Mechanism**

SPECIFICATIONS SUMMARY

The four bar chain mechanism (MCA), designed by EDIBON, is an unit to perform laboratory experiments.
The mechanism is assembled in an anodized aluminium structure, with painted steel panel.
It is made of anodized aluminum and consists of two rotary elements (graduated discs) mounted on ball bearings. The discs include a scale to measure the input and output angles accurately with the aid of a methacrylate indicator. The rotary motion of one of the discs is transferred through the bars and generates the rotary motion of the other disc.
The bars, made of anodized aluminum, can be connected at different lengths using easy to fit knurled bolts.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 300 x 100 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MCA.pdf

PRACTICAL POSSIBILITIES

1.- To demonstrate the action of a four-bar mechanism with different geometrical arrangements of joints.

2.- To demonstrate Grashof law.

3.- To determine graphically the relationship between the angular displacements of the input crank and the output joint of a simple four-bar system.

4.- To determine of the velocity and acceleration of the output joint by graphical differentiation and compared with the values obtained in velocity and acceleration diagrams.

MME. **Geneva Stop Mechanism**

SPECIFICATIONS SUMMARY

The Geneva Stop Mechanism (MME), designed by EDIBON, is a mechanism that transforms continuous circular motion into intermittent motion. It is a positive drive in which the driven wheel is positively moved or locked.
The unit is a bench top-unit with an anodized aluminum profile structure, and painted steel panel.
The main metallic elements are made of anodized aluminum.
This unit is composed of:
A rotating drive wheel with a pin and a raise half-moon blocking disc.
A driven wheel with six slots. The pin of the drive wheel reaches into a slot of the driven wheel, advancing it by one step. The raised half-moon blocking disc of the drive wheel locks the driven wheel in position between steps.
The drive wheel and the driven wheel are mounted in two rotary elements with a graduated disc to read the angle.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 300 x 160 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MME.pdf

PRACTICAL POSSIBILITIES

1.- Demonstrating the action of a Geneva mechanism during the indexing and dwell periods.

2.- Plotting the relationship between the angular displacement of the input crank and the output Geneva wheel during the indexing period.

3.- Determining the velocity and acceleration of the Geneva wheel by graphical differentiation.

4.- Comparing the values obtained by the equations of motion or the use of velocity and acceleration diagrams.

7.2.3- Mechanisms

MAC. **Coupling Mechanism**

SPECIFICATIONS SUMMARY

The Coupling Mechanism (MAC) represents a simple Oldham type coupling. The lateral displacement of the input and output shafts may be varied and circular scales are fitted to the input and output flanges.

The unit is a bench top-unit with an anodized aluminum profile structure, and painted steel panel.

The main metallic elements are made of anodized aluminum.

This unit is composed of:

Two outer discs made of aluminum.

A central disc made of acetal, located between both outer discs. It acts as the torque transmitting element. Torque transmission is accomplished by mating drive keys of the central disc, located on opposite sides and oriented 90 degrees apart, with the slots of the outer discs.

Both outer discs are mounted in two rotary elements with a graduated disc to read the angle.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 400 x 300 x 160 mm. Weight: 2 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MAC.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of the action of an Oldham coupling when the input and output shafts are laterally displaced.

2.- Observation of the angular displacement of the input and output shafts, that for varying lateral displacements, the velocity ratio remains constant.

MUN. **Hook's Joint Mechanism**

SPECIFICATIONS SUMMARY

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 300 x 230 x 180 mm. Weight: 5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MUN.pdf

MEX. **Cam and Follower Mechanism**

SPECIFICATIONS SUMMARY

The MEX unit allows to study the cam-follower and eccentric-follower mechanisms. For that purpose, several plate cam models, an eccentric and several roller-shaped and flat-shaped followers models are supplied.

The unit is assembled in an anodized aluminum profile structure, with painted steel panel.

This unit is mainly composed of:

Four cams (aluminum) of different shapes.

One eccentric (aluminum).

Two roller-shaped followers (brass) with different diameter, constituting mechanisms which transform the circular motion of the cam into the angular motion of the follower.

One flat-shaped follower (aluminum), constituting a mechanism which transforms the circular motion of the cam into a linear motion.

In order to carry out some of the practices with MEX unit 1 set of weights "B type"is required.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 370 x 400 x 510 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MEX.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of the action of a plate cam and an eccentric with different geometrical profiles and various types of followers.

-Demonstration of the conversion of the circular motion of a plate cam into the angular motion of a roller follower.

-Demonstration of the conversion of the circular motion of a plate cam into the linear motion of a flat follower.

2.- Study of the influence of the roller follower's diameter in the conversion of the circular motion of the plate cam into the angular motion of a roller follower.

3.- Determination and graphical illustration of the relationship between the displacement of the follower and the angular displacement of the cam for several types of cams and followers.

4.- Measurement of the force needed to be overcome in order to rotate a cam at different angular positions.

Other possible practices:

5.- More advanced exercises may include the determination of the velocity and acceleration by graphical differentiation and comparison with values obtained by the equations of motion.

MBI. **Crank Mechanism**

SPECIFICATIONS SUMMARY

The Crank Mechanism (MBI) is an unit that allows to observe, study and record the crank motion and forces involved with a simple engine mechanism.

This unit is mounted on an aluminum and painted steel structure.

The crank effort can be determined by attaching masses or weights to the beam balance arm.

The piston is fitted with rollers running on guide bars and roller bearings are fitted in the connecting rod.

Attached to the crank there is a protractor which can be rotated on the beam balance arm and locked in any predetermined angular position.

The piston displacement can be measured with the help of a linear scale attached to the piston guide. The piston can be fitted with removable masses or weights to change the piston mass.

This unit may be wall mounted.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 500 x 300 x 600 mm. Weight: 18 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MBI.pdf

PRACTICAL POSSIBILITIES

1.- To investigate the relationship between the piston displacement and the crank angle for a given connecting rod/crank radius ratio.

2.- To investigate the relationship between the turning moment on the crank shaft and the crank angle for a given force on the piston.

3.- Determination of the crank effort.

4.- Balancing the crank shaft.

5.- Measurement of the piston displacement.

MFPG. **Unit for studying Forces in a Jib Crane**

SPECIFICATIONS SUMMARY

The Unit for studying Forces in a Jib Crane (MFPG) allows to determine the forces in the jib crane members and to confirm the results obtained with the theoretical calculations and with the graphical results from a force parallelogram.

This unit is designed to study the tensile and compressive forces in a planar central force system based on the example of a jib crane.

Anodized aluminum structure with panel of painted steel.

The unit consists of a compression jib and a tension tie:

- Bar of adjustable length (compression jib). It includes a spring balance for compressive forces. Pressure force: 0-60N.
- Adjustable chain (tension tie). It includes a spring balance for tensile forces. Tensile force: 0-60N.
- Max. load on jib crane: 60N.
- A retaining bar: material: stainless steel, length: 600 mm.
- Set of weights:
  - Material: steel.
  - 4 x 1N, 2 x 5N and 4 x 10N.
  - It includes one 1 N weight holder.
- Three adjustable clamping elements.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 650 x 250 x 650 mm. Weight: 16 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MFPG.pdf

PRACTICAL POSSIBILITIES

1.- Study of the force parallelogram.

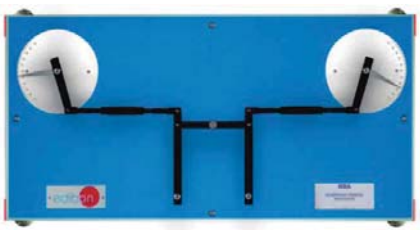
2.- Graphical breakdown of forces by force parallelogram.

3.- Determination of the bar forces on various jib forms: resultant cable force, tensile force and compressive force.

4.- Comparison of results obtained in the practical exercises, the theoretical values and the values obtained from the graphical method with the force parallelogram.

5.- Comprehension of the action of the crane cable forces on the jib and the effect of the jib inclination.

MDA. **Ackermann Steering Mechanism**



SPECIFICATIONS SUMMARY

The Ackermann Steering Mechanism (MDA) allows to explain the special features of the Ackermann steering geometry and to study the influence of the steering angle with varying steering geometry.

This unit is a bench-mounting unit designed to determine the lead angle of a steering trapezoid in an Ackermann steering mechanism, the disadvantages of incorrectly adjusted track rods and the influence of the track rod length.

Anodized aluminum structure with panel of painted steel.

The unit includes:

- King pin spacing: 460 mm. approx.
- Two levers made of aluminum.
- An intermediate steering rod made of aluminum.
- Two track rods, with individual adjustable length by means an adjustment nut.
- Two track rod arms made of aluminum.
- Two indicators to indicate the steering angle.
- Two scales for angle displacement.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 620 x 300 x 100 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MDA.pdf

PRACTICAL POSSIBILITIES

1.- Determination of the lead angle of a steering trapezoid.

2.- Demonstrating how Ackerman angles are determined in a steering system.

3.- Study of the influence of the track rod length.

4.- Determining the steering error as a function of the steering angle with varying steering geometry.

5.- Determining the variation on turns caused by track mal-adjustment.

6.- Determining the variation on turns caused by damage.

7.2.3- Mechanisms

MEMB2. **Unit for studying Equilibrium of Moments on a Two Arm Lever**

SPECIFICATIONS SUMMARY

The Unit for studying Equilibrium of Moments on a Two Arm Lever (MEMB2) provides a simple way of understanding experiments on the equilibrium of moments.

allows to study the fundamentals of the equilibrium of moments and the application of the law of levers on a two-arm lever.

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

The unit includes:

Two-arm lever:

Ball bearing-mounted beam. This beam is pivoted at a vertical support.

Beam dimensions: 700 x 30 x 10 mm.

The beam is graduated in each direction from the central pivot.

Arm lever length: 350 mm, each one.

Three movable riders to vary the positions of the loads in the levers.

Set of weights:

3 x 0.5N

12 x 1N

6 x 5N

It includes three 1N weight holders.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 700 x 350 x 420 mm. Weight: 13 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MEMB2.pdf

PRACTICAL POSSIBILITIES

1.- Investigation of the equilibrium of moments on a two-arm lever: applied forces, generated moments and equilibrium.

2.- Demonstration of the simple equilibrium of moments by loading a pivoted beam.

3.- Study of the stable system of a loaded pivoted beam.

4.- Comparison of the experimental values with the theoretical values using simple moments.

5.- Study of the action of forces dependent on the lever arm.

7.2.4- Lubrication Wear Friction

MPCO. **Journal Bearing Unit**

SPECIFICATIONS SUMMARY

The Journal Bearing Unit (MPCO) allows to study the pressure distribution in sliding bearings. It illustrates the principle of hydrodynamic lubrication.
The distribution of pressure and the carrying capacity can be determined on a sliding bearing model at different bearing loads and speeds.
The unit is mounted on a metallic structure assembled on wheels for its mobility.
Anodized aluminum structure and panels of painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
Sliding bearing:
- The sliding bearing consists of a journal bearing driven by an electrical motor and a freely moving bearing housing. It includes 16 pressure tappings to measure the radial and the axial distribution of pressure of the oil in the sliding bearing.
- Nominal bearing diameter: 52 mm. approx.
- Bearing gap: 4 mm. approx. Bearing width: 75 mm. approx.
- Bearing load, range: 6.5 – 16.5N approx.

Motor: Power output: 0.37 KW approx. Max. speed: 3000 rpm approx.
A multi-manometer to display the radial and axial pressure distribution of the oil film in the sliding bearing. It includes 16 tube manometers of 1750 mm. length.
A methacrylate tank for oil, volume: 3.5 l. approx.
Set of weights: up to 10 N.
Electronic console, including:
- Metallic box.
- Motor connector.
- Motor speed controller.
- Digital display for the motor speed.

Cables and accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 1200 x 800 x 2700 mm. Weight: 65 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MPCO.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of the principle of hydrodynamic lubrication.
2.- Relocation of the shaft journals in relation to speed.
3.- Determination of the pressure distribution in the bearing with constant load and at various speeds.
4.- Comparison of theoretical pressure profiles with practical results.
5.- Observation of oil wedge (film thickness) and hence eccentricity variations for different speeds and loads.
6.- Demonstration of the critical speed in relation to load.
7.- Demonstration of the critical speed and viscosity in relation to oil temperature.
8.- Demonstration of self-excited vibrations.

MCF. **Belt Friction Unit**

SPECIFICATIONS SUMMARY

The Belt Friction Unit (MCF) allows us to carry out studies and investigations to compare the driving torque for a given degree of overlap of a flat belt (leather or rope) and a `V´ belt.
We can observe the relationship between the tensions in the two sides of a belt, to evaluate the differences between flat (leather or rope) and "V" belts and to investigate the effect of the angle lap, among others.
Tension is introduced into the belt by hanging a mass or weight. The slipping torque is determined by the addition of a suitable mass attached to a cord wrapped round the drum.
The unit is mounted in a metallic structure and basically consists of a pulley, 3 belts and load hangers.
4 pulleys: a flat one and 3 "V" pulleys (one of them is correctly fitted and the others are badly fitted). The angle of overlap can be varied in increments of 10 degrees.
The pulley is balanced and mounted on bearings to reduce frictional losses. It has machined grooves to suit the belts.
Three belts are supplied ("V" , leather and rope).
Set of weights.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 550 x 500 x 600 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MCF.pdf

PRACTICAL POSSIBILITIES

1.- Investigation of the relationship between the belt tensions and the angle of lap for a flat belt.
2.- Comparison of the driving torque for a given angle of lap.

Other possible practices:

3.- To evaluate the differences between Vee `V´ and flat belts.
4.- To determine the coefficient of friction between the pulley and belt for the belt sections.
5.- To verify the belt tension equation.

MEF. **Friction Study Unit**

SPECIFICATIONS SUMMARY

The Friction Study Unit "MEF" allows to illustrate the friction force by simple demonstrations. It is designed for the study of the relations between friction forces and normal forces, between hard or soft surfaces, between lubricated or dry surfaces and between rolling surfaces for several types of materials.
The unit is assembled in an anodized aluminum profile structure, with steel painted panel.
This unit is mainly composed of:
- Friction rollers.
- Brake mechanism.
- Movement pulley.
- Friction cushions set: friction pads having stainless steel, brass, ferodo, nylon and rubber surfaces are provided as standard.

The weight makes the roller set turn while another weight exerts some pressure on the brake, the relation between both of them determines the coefficient of friction for different materials and different operational conditions.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 400 x 600 mm. Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MEF.pdf

PRACTICAL POSSIBILITIES

1.- Investigation of the relations between the friction forces and normal forces between surfaces in contact.
2.- Comparison of the values between dry surfaces in contact, using several materials, by the sliding coefficient.
3.- Comparison of the friction values for dry and lubricated surfaces.
4.- Comparison of the friction force for sliding surfaces with rolling surfaces.
5.- Comparison of the friction force of soft and hard rolling surfaces.

7.2.5- Dynamics

MEER. **Whirling of Shafts Unit**

SPECIFICATIONS SUMMARY

The Whirling of Shafts Unit (MEER) is a self-contained bench mounting unit designed to study critical rotational speeds on simply loaded and continuous shafts. It´s a very visual unit and allows to show first and second mode whirl speeds and how to predict them.
Anodized aluminum structure and panels of painted steel.
Diagram in the front panel with similar distribution to the elements in the real unit.
Motor:
- Power: 0.25 KW approx.
- Speed: 0... 6000 rpm approx.
- Speed controlled from the electronic console.

Six rotor shafts of different lengths and diameters:
- Made of steel
- Diameter: 3 mm, 6 mm, 7 mm.
- Length: 650 mm, 950 mm approx.

Rotor mass disc, made of steel; diameter: 90 mm.
Electronic console:
- Metallic box.
- Motor connector. Motor speed controller.
- Digital display for the motor speed.

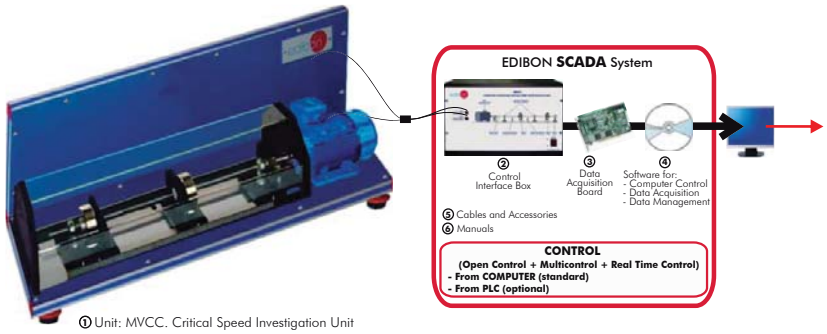
Four self-aligning bearings for the rotor shafts.
Three securing catch bearings can be positioned for the rotor.
Protective cover made of transparent plastic.
Cables and accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions and weights (approx.):
- Unit: 1500 x 400 x 600 mm. Weight: 62 Kg
- Electronic console: 310 x 220 x 145 mm. Weight: 2 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MEER.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of basic whirling.
2.- Study of speed-dependent experiments on rotation.
3.- Study of modes of oscillation of a rotor shaft with individual masses (Laval rotor):
   - Critical speed.
   - Self-centering.
4.- Study of modes of oscillation of a continuous rotor shaft:
   - For varying bearing spacing.
   - For varying shaft diameter.
   - For varying shaft length.

MVCC. Computer Controlled **Critical Speed Investigation Unit**



① Unit: MVCC. Critical Speed Investigation Unit

SPECIFICATIONS SUMMARY
Items supplied as standard

① MVCC. Unit:
The Computer Controlled Critical Speed Investigation Unit (MVCC) allows to investigate critical bending speeds on a rotor shaft. It helps students to understand different problems with long rotor shafts and allow their use in their designs. It allows to study the resonance and bending oscillation on a rotating rotor shaft at various speeds, and to show the oscillation form of 1st and 2nd critical speed.
Anodized aluminum structure and panels of painted steel.
Diagram in the front panel with similar distribution to the elements in the real unit.
Computer controlled electric motor: power: 0.25 KW; speed: 300... 3000 rpm.
Rotor shaft: made of high-strength stainless steel; diameter: 5 mm; length: 600 mm.
Two pivoting bearings for positioning at any point to support the rotor shaft: adjustable bearing spacing: 300-500mm.
Two rigid weights for attachment at any location along the rotor shaft.
Quick-acting clamps to safely attach the pivoting bearings and weights.
A catch is used to lock on the rotor shaft to limit the amplitude of the oscillation.
Two vibration sensors to measure the displacement rotor shaft.
A protective cover made of transparent plastic.

② MVCC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Express Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s . 2 Analog outputs. 24 Digital Inputs/Outputs.

④ MVCC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.
⑥ Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.) =Unit: 1250 x 400 x 600 mm. Weight: 50 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MVCC.pdf

PRACTICAL POSSIBILITIES

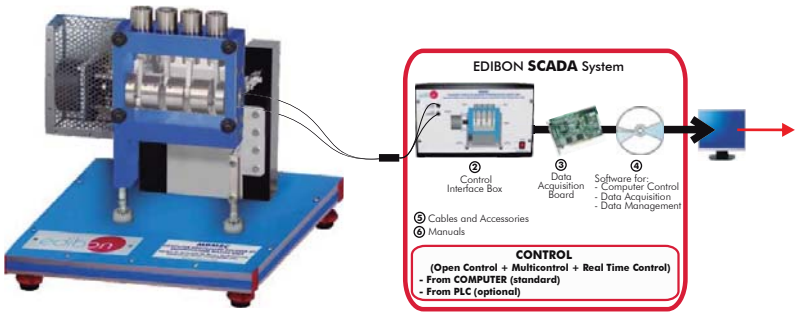
1.- Study of the bending oscillation and resonance on a simply loaded rotor shaft at various speed.
2.- Study of the bending critical speed on a simply loaded rotor shaft.
3.- Study of the oscillation form on a simply loaded rotor shaft at various speed.
4.- Study of self-centering on a simply loaded rotor shaft.
5.- Study of the bending oscillation and resonance on a double loaded rotor shaft at various speeds.
6.- Study of the oscillation form of 1st and 2nd critical speed on a double loaded rotor shaft at various speed.
7.- Study of the bending oscillation and resonance on a floating disc at various speeds.
8.- Study of the critical speed on a floating disc.

Other possible practices:

9.- Sensors calibration.
10-28.- Practices with PLC.

7.2.5- Dynamics

MBMRC. Computer Controlled **Balance of Reciprocating Masses Unit**



① Unit: MBMRC. Balance of Reciprocating Masses Unit

SPECIFICATIONS SUMMARY

Items supplied as standard

① MBMRC. Unit:

The Computer Controlled Balance of Reciprocating Masses Unit (MBMRC) is a bench-mounting unit that allows to investigate and examine the free masses and moments of a reciprocating engine with a single cylinder, with two cylinders or with four cylinders.

The MBMRC unit is mounted on an anodized aluminum structure with panels of painted steel.

It includes rubber elements to have a vibration isolation and a removable transparent guard with a safety device protects students from the moving crankshaft and allows the visibility of the practical exercises and elements of the unit.

The unit includes:

Engine:

Number of cylinders: 4.

Piston mass: 45 g. approx.

Additional mass: 46 g.

Crankshaft:

Mass of connecting rod: 20 g. approx.

Centre distance of cylinders: 35 mm.

Crank radius: 15 mm.

Length of connecting rod: 70 mm.

Computer controlled motor:

Speed: 100 – 3000 rpm.

Speed of the motor is controlled and measured from the computer (PC).

Two forces sensors to measure the forces and moments, range: 0 – 500 N.

② MBMRC/CIB. Control Interface Box :

With process diagram in the front panel.

The unit control elements are permanently computer controlled. Simultaneous visualization in the computer of all parameters involved in the process.

Calibration of all sensors involved in the process. Real time curves representation.

All the actuators' values can be changed at any time from the keyboard.

Shield and filtered signals to avoid external interferences.

Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process.

Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

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

16 Analog inputs. Sampling rate up to: 250 KS/s . 2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data.

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

It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 450 x 400 x 400 mm. Weight: 45 Kg. Control Interface Box: 490 x 330 x 310 mm. Weight: 10 Kg.

PRACTICAL POSSIBILITIES

1.- Study of the effect of mass forces in dependence on the speed.

2.- Study of the effect of mass forces in dependence on the piston mass.

3.- Study of the first and second order mass forces and moments in popular engine configurations-one, two and four cylinder.

4.- Study of first and second forces and moments for different crank settings.

5.- Study of first and second forces and moments for different crank settings: 4-cylinder, symmetrical, 180° angle between cranks.

6.- Study of first and second forces and moments for different crank settings: 4-cylinder, non-symmetrical, 90° angle between cranks.

7.- Study of first and second forces and moments for different crank settings: 2-cylinder, 180° angle between cranks.

8.- Study of first and second forces and moments for different crank settings: single cylinder.

9.- Comparing calculated forces and moments with actual results.

Other possible practices:

10.- Sensors calibration.

11-29.- Practices with PLC.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MBMRC.pdf

7.2.5- Dynamics

MEAL. **Cam Analysis Unit**

SPECIFICATIONS SUMMARY

The Cam Analysis Unit (MEAL) allows the observation of the effect of a cam profile, the study of the displacement, velocity and acceleration profile of the cam and the identification of the factors which may modify the cam dynamics.
Unit mounted on an anodized aluminum structure with panel of painted steel.
Diagram in the panel with similar distribution to the elements in the real unit.
Electric motor with variable speed:
- Speed: 0-670 rpm approx.
- Speed controlled from the console. The unit allows to measure the motor speed and to visualize it in the console display.

An extension shaft made of stainless steel.
Four interchangeable cams:
- Two circular cams with different head radius.
- One hollow cam. One tangent cam.

Follower with 2 tracers: One roller. One flat face.
Three interchangeable springs with different rigidity to simulate a valve.
Five weights to simulate a valve. Weight: 40 g., each one.
Drum recording system, consisting of a drum plotter with plotting spring and coated paper. Protective guards made of transparent plastic.
Console:
- Metallic box. Motor connector. Motor speed controller.
- Digital display for the motor speed.

The unit includes a combination wrench and blocks of plotter paper.
Cables and accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions and weights (approx.):
- Unit: 750 x 500 x 500 mm. Weight: 70 Kg
- Console: 300 x 190 x 130 mm. Weight: 2.5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MEAL.pdf

PRACTICAL POSSIBILITIES

1.- Observation of the effect of cam profile on the cam dynamics.
2.- Comparison of different cam designs.
3.- Study of the displacement, velocity and acceleration profile of cam.
4.- Determination of the limit speed and comparison with the theoretical value.
5.- Study of the variable follower inertia and compression spring rate.
6.- Plotting of lift curves for non-matching tracer.
7.- Plotting of lift curve for skipping tracer.
8.- Comparison of the theoretical and experimental lift curve with different spring rate, tensions, tapped weight and speed.
9.- Study of the influence of a moving mass.
10.- Study of the influence of the spring rigidity.
11.- Study of the relationship between cam and spring force.
12.- Identification of the factors which may improve the cam dynamics.

MTSF. **Worm and Wheel Unit**

SPECIFICATIONS SUMMARY

Anodized aluminum frame, with panel in painted steel.
The unit is self-contained and the wheel, worm and pulleys are mounted on ball bearings.
The unit includes:
- Wheel, made of bronze.
- Worm, made of steel:
  - Modulus: 4 mm. Number of gears: 1. Power transmission: 10.
  - The worm and wheel pair has a single start and a transmission ratio of 30:1.
- Two pulleys, made of aluminum:
  - One pulley is located on the worm shaft (diameter: 40mm) to help to exert the effort to raise a load and the other pulley on the wheel shaft (diameter: 120mm) to load the system.
- Set of weights:
  - Weights on worm side:
    - 1 x 50N. 1 x 20N. 2 x 10N. 2 x 5N.
    - It includes a 5 N weight holder.
  - Weights on wheel side:
    - 1 x 5N. 4 x 2N. 2 x 1N. 2 x 0.5N.
    - It includes a 0.5 N weight holder.

Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 400 x 800 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MTSF.pdf

PRACTICAL POSSIBILITIES

1.- Learning the key variables and correlations of a worm gear.
2.- Learning the basic terminology of gearing (number of teeth, reference circle and axle base and modulus).
3.- Investigation of transmission ratio, torque, friction and self-locking.
4.- Experimental determination of velocity ratio.
5.- Comparison of the determined velocity ratio with the calculated value.
6.- Determination of effort with variation of load.
7.- Determination of friction with variation of load.
8.- Determination of efficiency with variation of load.
9.- Determination of limiting efficiency of the unit.

MMEL. **Winch Mechanism**

SPECIFICATIONS SUMMARY

The Winch Mechanism (MMEL) allows to demonstrate the principle of a winch and its behaviour and to study different terms (transmission ratio, unwinding speed, angular speed, efficiency) concerned to the winch.
The Winch Mechanism (MMEL) allows to study the lifting velocity and load transmission of a winch. Efficiency and load transmission can be determined by force equilibrium.
Anodized aluminum and steel frame and painted steel panel.
The unit includes:
- 2 Gear wheels:
  - Small: 14 teeth. Large: 70 teeth. Module: 2 mm each.
- Pulleys:
  - Material: aluminum.
  - Driving pulley, diameter: 250 mm. Driven pulley, diameter: 125 mm.
- Set of weights and holders:
  - Driving pulley:
    - 1 x 5N. 4 x 2N. 2 x 1N. 2 x 0.5N.
    - It includes a 0.5 N weights holder.
  - Driven pulley:
    - 1 x 50N. 2 x 20N. 1 x 10N. 1 x 5N.
    - It includes a 5 N weights holder.
- The unit includes safety element to prevent reversal of direction of rotation.

Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 450 x 850 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MMEL.pdf

PRACTICAL POSSIBILITIES

1.- Determination of the transmission ratio of the winch.
2.- Determination of the unwinding speed of the winch.
3.- Determination of the angular speed of the winch.
4.- Determination of the efficiency of the winch.
5.- Estimation of the velocity ratio.
6.- Study of the behaviour of a winch, especially noting the characteristics of the unit with increasing load.
7.- Examination of the safety features of the winch.

MRYE1. **Wheel and Axle Unit**

SPECIFICATIONS SUMMARY

The Wheel and Axle Unit (MRYE1) allows to demonstrate the equilibrium of moments of the mechanics of a simple wheel and axle machine.
Anodized aluminum frame with panel made of painted steel.
The unit is self-contained and includes an anodized aluminum base plate.
The unit includes:
- Two pulleys (wheels):
  - Material: anodized aluminum.
  - Pulley no.1 diameter = 150mm.
  - Pulley no.2 diameter = 75mm.
  - Two cords can be wrapped in either direction around each pulley.
- One axle of stainless steel:
  - This axle is supported on pivots with two ball bearings.
- Set of weights:
  - 4 x 5N, 4 x 2N, 5 x 1N and 5 x 0.5N.
  - It includes two 1 N weight holders.

Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 400 x 800 mm. Weight: 22 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MRYE1.pdf

PRACTICAL POSSIBILITIES

1.- Study of equilibrium of moments.

2.- Determination of velocity ratio and comparison with calculated value.

3.- Determination of variation of effort with load.

4.- Determination of variation of efficiency with load.

MRYE2. **Wheel and Differential Axle Unit**

SPECIFICATIONS SUMMARY

The Wheel and Differential Axle Unit (MRYE2) allows to study the conditions of equilibrium of forces and moment on a differential pulley block (or wheel and differential axle machine).
Anodized aluminum frame with panel of painted steel.
The unit is self-contained and includes an anodized aluminum base plate.
The unit includes:
- Wheel, composed of a pulley:
  - Material: anodized aluminum, diameter: 200 mm.
  - A single cord can be wrapped around the pulley.
- Differential axle composed of two pulleys:
  - Material: anodized aluminum.
  - Diameter no.1 (major axle): 117 mm.
  - Diameter no.2 (minor axle): 39 mm.
  - A single cord can be wrapped in differing directions onto each pulley and this direction can be changed.
- Loose pulley of anodized aluminum.
- Shaft of stainless steel. This shaft is supported on pivots with two ball bearings.
- Set of weights:
  - 4 x 5N, 4 x 2N, 5 x 1N and 5 x 0.5N.
  - It includes two 1 N weight holders.

Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 400 x 800 mm. Weight: 24 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MRYE2.pdf

PRACTICAL POSSIBILITIES

1.- Study of equilibrium of forces.

2.- Study of equilibrium of moments.

3.- Demonstration of the force reduction on a differential pulley block.

4.- Determination of velocity ratio and comparison with calculated value.

5.- Study of the relationship between the force reduction and cord travel.

6.- Determination of variation of effort with load.

7.- Determination of variation of efficiency with load.

8.- Determination of variation with limiting efficiency of the unit.

MDFC. **Coriolis Force Demonstration Unit**

SPECIFICATIONS SUMMARY

The Coriolis Force Demonstration Unit (MDFC) allows the visual demonstration to the Coriolis Effect (force) in a rotating reference system, using a jet of water as moving mass.
This unit is used to observe the deflection of a jet of water generated by a pump attached to a rotating arm that rotates to different speeds in a horizontal plane. An electronically controlled motor rotates the arm at different speeds.
Unit mounted on an anodized aluminum frame with panel made of painted steel.
Transparent water tank. It includes a scale to read the deflection of the water jet.
Pump, type: immersible. Motor, with speed regulation.
Rotating arm coupled to the motor.
Electronic console (in separate metallic box):
- Motor connector.
- Motor speed controller.
- Flow rate controller for the pump.
- Digital display for the motor speed.
- Digital display for the speed of the jet of water (pump flow rate).

Cables and accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions and weights (approx.):
- Unit: 400 x 400 x 300 mm. Weight: 20 Kg
- Electronic console: 300 x 190 x 130 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MDFC.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of the Coriolis force.

2.- Observation the Coriolis force on a jet of water being rotated in a horizontal plane.

3.- Study of the influence of jet deflection as a function of pump rotational speed and the direction of rotation.

7.2.5- Dynamics

MFCE. **Centrifugal Force Unit**

SPECIFICATIONS SUMMARY

The Centrifugal Force Unit (MFCE) allows to study the centrifugal force and the angular velocity on rotating masses and the laws of the behaviour of rotating masses.
This unit is used to demonstrate the relationship between centrifugal force, the rotational speed, the mass of a rotating body and the distance from the axis.
Unit mounted on an anodized aluminum structure with panels made of painted steel.
Motor:
- Speed range: 0-600 rpm.
- The motor speed is controlled through the electronic console and the value of the speed is visualized in the digital display.

Five different path radii: 25mm, 50mm, 75mm, 100mm, 125mm.
Four different rotating weights (made of stainless steel) of 55g., 80g., 105g. and 130g.
Force sensor, range: 0-25N.
A transparent protective cover, made of plastic, provides protection against the rotating parts and enables different experiments to be observed.
Electronic console (in separate metallic box), including:
- Motor connector.
- Motor speed controller.
- Digital display for the motor speed.
- Force sensor connector.
- Digital display for the force sensor.

Cables and accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions and weights (approx.):
- Unit: 400 x 400 x 400 mm. Weight: 20 Kg
- Electronic console: 300 x 190 x 130 mm. Weight: 2.5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MFCE.pdf

PRACTICAL POSSIBILITIES

1.- Verification of the relationship between centrifugal force and the mass of a rotating body.

2.- Verification of the relationship between centrifugal force and the distance from the axis of rotation (radius of rotation).

3.- Verification of the relationship between centrifugal force and the rotational speed.

4.- Comparison of the experimental results with the results calculated from theory.

MGI. **Gyroscope**

SPECIFICATIONS SUMMARY

The Gyroscope (MGI) allows the demonstration of the different rotation modes of a gyroscope.
This unit allows the experimental demonstration of the moments generated by the gyroscope effect.
Unit mounted on an anodized aluminum structure with painted steel panels.
Gyroscope:
- Mass of the gyroscope body: 60 g.
- A counterweight to preselect the gyroscopic moment. Radius range of the counterweight: 0-95mm.

Two motors:
- Rotor motor, speed up to 6500 rpm.
- Precession motor, speed range: 5-63 rpm.
- Both motors are electronically regulated and independently controlled.

A transparent protective cover, made of plastic, provides protection against the rotating parts and enables different experiments to be observed.
Electronic console (in separate metallic box):
- Motors connections.
- Rotor motor speed controller.
- Precession motor speed controller.
- Digital display for the rotor motor speed.
- Digital display for the precession motor speed.

Cables and accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions and weights (approx.):
- Unit: 400 x 400 x 400 mm. Weight: 20 Kg
- Electronic console: 300 x 190 x 130 mm. Weight: 3 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/general/MGI.pdf

PRACTICAL POSSIBILITIES

1.- Study of the laws of gyroscopes.

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

3.- Study of the effect of the rotor and precession velocity in the gyroscopic moment.

MCAM. **Bell Casting Basic Training Set**

Detail of the finished, fettled castings

SPECIFICATIONS SUMMARY

Didactic case for the study of foundry fundamentals.
Introduction to sand casting: student experiments with 3 different patterns (bell, anvil and anchor).
Operations of ramming up of the moulding sand, melting of the metal, pouring, forming and fettling can be performed step by step.
The student will practice in first place with symmetrical pieces and after this with asymmetrical ones.
Training set in a case, containing:
- Aluminum cope and drag box, screwable.
- Aluminum pattern plate.
- 3 different plastic patterns:
  - The Bell as a natural or an on-piece pattern.
  - The Anvil as a split, asymmetrical pattern demonstrates the shrinkage cavitation.
  - The Anchor, as a split, symmetrical pattern.
- Rammer. Small downgate and big downgate.
- Bell clapper. Bell mountings.
- Thermometer.
- Soucepan.
- Pencil brush.
- Pattern-draw tool.
- Shovel. Scraper.
- Lancet.
- Brush.
- Separating agent.
- 2 Kg. metal alloy (melting point 200°C approx.) and 6 Kg. moulding sand in a separate container.

All instruction set is supplied ready to use, including enough test material.
All material is recoverable.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 600 x 400 x 200 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/specialfoundry/MCAM.pdf

PRACTICAL POSSIBILITIES

1.- Study of foundry fundamentals.
2.- Introduction to sand casting: student experiments with 3 different patterns (bell, anvil and anchor).
3.- The bell as a natural or a one-piece pattern.
4.- The Anvil as a split, asymmetrical pattern, demonstrate the shrinkage cavitation.
5.- The Anchor, as a split, symmetrical pattern.

MCLA. **Foundry Building-up Training Set 1**

Detail of the finished casting, free of sand

SPECIFICATIONS SUMMARY

Didactic case for the study of foundry fundamentals.
Operations of ramming up of the moulding sand, melting of the metal, pouring, forming and fettling can be performed step by step.
Practice of melting, unmelting and foundry with irregular and asymmetrical patters.
Making up a casting with cavity (pipe reduction).
Training set in a case, containing:
- Aluminum cope and drag box, screwable.
- Pattern plate with pattern.
- Core box.
- Downgate.
- Small and big risers.
- Shovel.
- Brush.
- Scraper.
- Saucepan.
- Ramer.
- Pencil brush.
- Lancet.
- Thermometer.
- 2 Kg. metal alloy (melting point 70°C approx.), and 6 kg moulding sand in a separate container.

All instruction set is supplied ready to use, including enough test material.
All material is recoverable.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 600 x 400 x 200 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/specialfoundry/MCLA.pdf

PRACTICAL POSSIBILITIES

1.- Study of foundry fundamentals.
2.- To manufacture of a pipe-reducing flange with cavity of 1 kg-mass approx.
3.- Practice of melting, unmelting and foundry with irregular and asymmetrical patterns.

MCEN. **Centrifugal Casting Building-up Training Set 2**

SPECIFICATIONS SUMMARY

This unit is designed for production of hollow bodies in a fast rotating die.
This unit is mounted on a 2mm. thick steel sheet, primed and painted with epoxy paint, and hold by a frame of extruded and anodized aluminum, which provides a great stiffness and resistance.
Three-phase motor that does 1.67A with 2700 rpm.
A variator that controls the motor. It can turn with a maximum frequency of 50Hz (which corresponds to 3000rpm approximately) and a minimum one of 5 Hz. The motor turning speed can be changed from this variator. Turning anticlockwise direction.
Stainless steel cast axis with a diameter of 20 mm.
The cast is cylindrical and is made of aluminium, outer diameter of 82 mm, inner diameter of 70 mm and length of 150 mm.
The cast useless length is 110mm, once the lids have been placed.
The cast is made with a little cone-shape to make easier the extraction of piece towards the inlet side.
A small saucepan in which the tin can be heated.
A crucible from which the tin can be pour in order to the start the experiment.
2 Kg. tin bar.
Thermometer.
All instruction set is supplied ready to use, including enough test material.
All material is recoverable.
Cables and Accessories, for normal operation
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 700 x 500 x 500 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/specialfoundry/MCEN.pdf

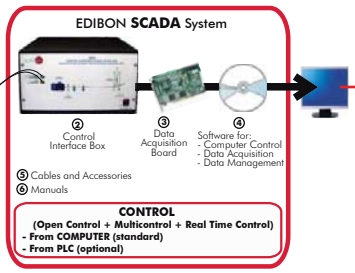
PRACTICAL POSSIBILITIES

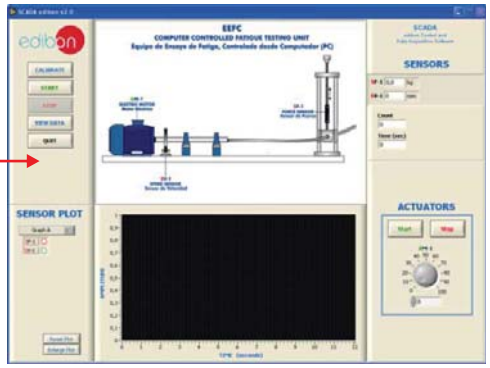
1.- Study of foundry fundamentals.
2.- Production of hollow bodies in a fast rotating die.
3.- Centrifugal casting with different turn speeds.
4.- Centrifugal casting with different temperatures of tin.
5.- Centrifugal casting for different amounts of tin.

7.5.1- General Strength of Materials

EEFC. Computer Controlled **Fatigue Testing Unit** ✱

① Unit: EEFC. Fatigue Testing Unit





SPECIFICATIONS SUMMARY

Items supplied as standard

① EEFC. Unit:
With this unit it is possible to determine the basic principles of the fatigue strength testing.
Anodized aluminum structure and panels of painted steel. Diagram in the front panel.
Electrical motor, maximum speed: 1500 rpm. Motor speed control by a frequency regulator, controlled by the control software. Metallic protective covers, one for the motor axis zone, and other for the test specimen zone, with safety protection system to avoid accidents. Safety switch that stops the motor when the metallic protection is removed. Automatic shut down on specimen fracture controlled from the control software (from the computer (PC)).
Test specimens (test bars): 2 stainless steel AISI 304L cylindrical test specimens; 6 stainless steel AISI 304L cylindrical test specimens, with different notches; 2 carbon steel F-1 cylindrical test specimens; 6 carbon steel F-1 cylindrical test specimens, with different notches; 2 steel F-212 cylindrical test specimens; 6 steel F-212 cylindrical test specimens, with different notches.
Loading device with load cell. Adjustment using threaded spindle with hand wheel. Force sensor, range: 0-30 kg.
Speed sensor and cycle counter: range: from 0 to 5000 rpm.

② EEFC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any moment and in real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Express Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s . 2 Analog outputs. 24 Digital Inputs/Outputs.

④ EEFC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =Unit: 1000 x 600 x 600 mm. Weight: 50 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/EEFC.pdf

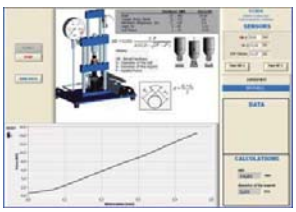
PRACTICAL POSSIBILITIES

1.- Determination of the basic principles of fatigue strength testing.
2.- Influence of the type of material on fatigue strength.
3.- Determination of the influence of notching and surface finish on fatigue strength.
4.- Influence of different curvature radio and surface finish on fatigue strength.
5.- Influence of the section on fatigue strength.
6.- Fatigue strength of specimens (bars) subject to cyclic bending load.
7.- Preparation of a stress-number (S-N) diagram.
8.- Obtaining of S-N curves.

Other possible practices:

9.- Sensors calibration.
10-28.- Practices with PLC.

EEU/20KN. **Universal Material Testing Unit**



SPECIFICATIONS SUMMARY

This unit is formed by:
EEU/20KN-UB. Base Unit with Hardware and Software for Data Acquisition:
Base unit with feet.
Upper crosspiece. Lower crosspiece. Frame pillars.
Test load is generated using a hand operated hydraulic system.
Maximum stroke: 45mm. Maximum test force: 20kN.
Dynamometer: 0-20kN.
Elongation gauge: 0-10mm.
Fastening elements for accessories. Methacrylate protective covering.
Force sensor. Deformation displacement sensor.
Computer Data Acquisition System, formed by:
Data Acquisition Console and Data Acquisition and Calculations Software.
Cables and accessories, for normal operation.
Accessories and Specimens:
-EEU/20KN-1. Shear Tests Accessories & Specimens:
Device for shear tests.
Set of 16 specimens for shear tests made of steel, brass, aluminum and copper (4 units per material).
-EEU/20KN-2. Brinell Hardness Tests Accessories & Specimens:
Device for Brinell tests. Penetrating ball: 10mm.
Set of Brinell specimens made of steel, brass, aluminum and copper (1 unit per material).
-EEU/20KN-3. Compression Tests Accessories & Specimens:
Set of two compression plates with fastening elements.
Set of 16 specimens for compression tests made of steel, brass, aluminum and copper (4 units per material).
-EEU/20KN-4. Tensile Tests Accessories with Standard, Flat and Round Specimens:
Jaws for tensile tests with flat and round specimens (2 units).
Set of 16 flat specimens to measure tension made of steel, brass, aluminum and copper (4 units per material).
Set of 16 rods for tensile tests made of steel, brass, aluminum and copper (4 units per material).
Device for tensile tests with standard specimens (2 units).
Set of 16 standard specimens for tensile tests made of steel, brass, aluminum and copper (4 units per material).
-EEU/20KN-5. Deep Draw (cupping) Tests Accessories & Specimens:
Device for deep draw (cupping) tests.
Set of 16 specimens for deep draw (cupping) tests made of steel, brass, aluminum and copper (4 units per material).
-EEU/20KN-6. Bending Tests Accessories & Specimens:
Device for bending tests.
Set of specimens for bending tests made of steel, brass, aluminum and copper (1 unit per material).
-EEU/20KN-7. Disc and Helical Spring Tests Accessories & Specimens:
Disc springs (2 units). Helical springs (2 units).
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 550 x 500 x 800 mm. Weight: 60 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/EEU-20KN.pdf

PRACTICAL POSSIBILITIES

1.- Learning how to use the instrumentation required to perform the main tests on materials.
2.- Study and familiarization with universal material testing machines.
3.- Tensile strength tests.
4.- Compressive strength tests.
5.- Brinell hardness tests.
6.- Bending tests.
7.- Shear tests.
8.- Deep draw (cupping) tests.
9.- Tests with disc springs.
10.- Tests with helical springs either in series or in parallel.
11.- Recording stress-strain diagrams.
12.- Using the computer data acquisition system.

✱ Non computer controlled version available too.

7.5- Strength of Materials

7.5.1- General Strength of Materials

EEFCR. **Creep testing Unit**

SPECIFICATIONS SUMMARY

The EEFCR unit allows the student to determine experimentally the yield strength of plastic materials and the relation of deformation due to yield with time and temperature.
The EEFCR unit for the creep testing is mounted on a structure of aluminum profiles which a painted steel panel is supported on.
This unit is designed to carry out experiments on specimens of plastic materials.
Temperature conditioning box made of methacrylate. Here, the adequate temperature conditions to carry out the experiment are created. Inside it, the specimen which will be experimented is located. To reach the temperature, an isotherm bag will be used. To know the experiment conditions, there is a thermometer at the upper part of the box.
Load arm. It is a stainless steel beam on which the loads are applied to the specimen. It pivots on a shaft inserted in the support column. Tensile stress range: 0-35 N/mm^2.
Support screw for supporting the load arm before starting the experiment.
Clamps. They are into the space to fasten the specimens.
A dial indicator of 10 mm of measurement. It measures the elongation of the specimen which is under the load and temperature concrete conditions.
The specimens are flat type, made in different plastic materials. They have a section of 5 mm x 2 mm to make the experiments easier.
Set of weights and support hook.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 700 x 350 x 600 mm. Weight: 25 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/EEFCR.pdf

PRACTICAL POSSIBILITIES

1.- Experimental determination of the behaviour of different plastic materials.
2.- Experimental determination of the creep limit of different plastic materials.
3.- Determination of the temperature effect in the creep behaviour of a plastic material.
4.- Relation of the deformation caused by the creep in function of the time. Phases of the creep.

EEICI. **Charpy and Izod Impact Testing Unit**

SPECIFICATIONS SUMMARY

The EEICI unit is designed for carrying out resilience or impact tests on plastic materials. The EEICI unit is designed for testing plastic specimens. Therefore, it is a type of pendulum that reaches potential energy thresholds that are adequate for breaking these plastic specimens. The specimens and the tests are developed according to the following standards:
- Charpy method: Standard ISO 179. - Izod method: Standard ISO 180.
The EEICI unit for impact testing with the Charpy and the Izod pendulums is mounted on an aluminum structure that provides the device great rigidity. The aluminum structure is covered by a painted steel panel.
The unit consists of the following elements:
Pendulum: It is supported by bearings and has an length of 330 mm. On one of its ends we can mount the appropriate hammer for each test, be it Charpy or Izod: Initial angle: 150°. Charpy potential energy: 5 J, 7.5 J and 10 J. Izod potential energy: 8.5 J.
Hammers:
The Charpy Hammer has the shape of a "C" and it is used for impact tests on specimens that are supported on both ends.
The Izod Hammer is used to impact on specimens that are fitted vertically.
Charpy clamp. It is composed with the accessories needed for supporting the specimens, according to Standard ISO 179.
Izod clamp. It is composed with the accessories needed for supporting the specimens, according to Standard ISO 180. A graduated disc with a pointer will mark the energy used to break the specimen.
Specimens made in different plastic materials:
They have a notch in order to make their braking easier.
They are made of PVC, PTFE and Acrylic.
Support system for the pendulum at the starting point of the test.
Protection transparent cover that allows the safe viewing of the experiments by the student.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 1000 x 600 x 600 mm. Weight: 70 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/EEICI.pdf

PRACTICAL POSSIBILITIES

1.- Experimental determination of the energy needed in order to break specimens of different materials using the Charpy method.
2.- Experimental determination of the energy necessary to break specimens of different materials using the Izod method.
3.- Experimental determination of the pendulum's friction losses.

EEDB. **Brinell Hardness Testing Unit**

SPECIFICATIONS SUMMARY

The EEDB unit is a hardness tester that determines Brinell hardness in metals, hard alloys, tempered steels, etc. Besides, it can be used with other materials, such as rigid plastics, bakelite, etc.
Brinell hardness testing unit 30kN:
It can work with round, flat or irregular shape test pieces.
Response time control: adjustable between 5 and 60 seconds. Measurement range: 8-650HBW. The test load is applied by an electrical motor.
Applied test force: 612.9 N (62.5 Kgf) – 980 N (100 Kgf), 1226 N (125 Kgf) - 1839 N (187.5 Kgf) – 2452N (250 Kgf) – 4900 N (500 Kgf) -7355 N (750 Kgf) – 9807 N (1000 Kgf) - 2940N (3000 Kgf).
Maximum height of the test piece: 220 mm. Throat depth (distance between the central point of the indenter and the hardness tester body): 135 mm. Small test piece holder plate: 60 mm. diameter. Large test piece holder plate: 200 mm. diameter. "V" shape test piece holder plate: 80 mm. diameter. Indenters: Steel ball of 2.5 mm. diameter, steel ball of 5 mm. diameter, steel ball of 10 mm. diameter, four additional balls of each size. 2 Testing blocks: HBW/3000/10 (150~250), HBW/750/5 (150~250). Portable microscope to read the imprints.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): Unit: 300 x 500 x 800 mm. Weight: 150 Kg.
Case for elements: 350 x 300 x 150 mm.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/EEDB.pdf

PRACTICAL POSSIBILITIES

1.- To learn how to use the instrumentation to perform hardness tests.
2.- Study and familiarization with Brinell hardness test equipment.
3.- Brinell hardness measurement on different materials.
4.- To observe the behaviour of diverse materials under different loads applied.
5.- To know the types of standard test pieces for these types of tests.
6.- To know the types of standard indenters for these types of tests.

7.5.1- General Strength of Materials

EBVR. **Brinell, Vickers and Rockwell Hardness Testing Unit**

SPECIFICATIONS SUMMARY

The EBVR unit consists of a hardness testing machine that determines the three main types of hardness (Brinell, Vickers and Rockwell) in metals, hard alloys, quenched steels, etc. Besides it can also be used to measure the hardness of other materials, such as rigid plastics, bakelite, etc.

Dead weight universal analogical hardness tester. It allows to combine three hardness tests: Brinell, Vickers and Rockwell.

Simple testing cycle through a lever.

Test loads.

Brinell: 31.25 - 62.5 - 187.5 Kg. (306 - 613 - 1839 N).
Vickers: 30 - 100 Kg. (294 - 588 - 980 N).
Rockwell: 60 - 100 - 150 Kg. (588 - 980 - 1471 N).

Testing surface, diameter: 60 mm. V anvils, diameters: 40 and 60 mm.

Flat anvil, diameter: 60 mm. Gage block with hardness of ±450 HV.

Gage block with hardness of ±200 HB. Gage block with hardness of ±60 HRC. Gage block with hardness of ±30 HRC. Gage block with hardness of ±85 HRB. Brinell test: balls of 2.5 and 5 mm. Vickers test: cone made of diamond 136°. Rockwell test: cone made of diamond 120° and ball of 1/16". Maximum test height: 180 mm. Maximum depth (from the center): 200 mm. Micrometric lens of 15 X. Lenses (2,5 X) and (5 X).

Lamp for Brinell measurements.

Cables and accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions and weights (approx.):

Unit: 300 x 560 x 800 mm. Weight: 100 Kg
2 Cases for elements (each one): 380 x 330 x 150 mm.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/EBVR.pdf

PRACTICAL POSSIBILITIES

1.- To learn how to use the instrumentation to perform hardness tests.
2.- Study and familiarization with Brinell, Vickers and Rockwell hardness testing unit.
3.- Brinell hardness measurement on different materials.
4.- Vickers hardness measurement on different materials.
5.- Rockwell hardness measurement on different materials.
6.- To observe the behaviour of diverse materials under different loads applied.
7.- To know the types of standard test pieces for these types of tests.
8.- To know the types of standard indenters for these types of tests.

MVV. **Unsymmetrical Cantilever Unit**

SPECIFICATIONS SUMMARY

The unsymmetrical cantilever unit is designed to demonstrate the unsymmetrical bending of beams.

Simple experiments may be carried out to determine the deflections Δ_U and Δ_V at the free end of cantilevers of different sections for varying angles of applied load from which the relationship between $\frac{\Delta_U}{W}$ and $\frac{\Delta_V}{W}$ may be determined graphically.

The system consists of a vertical cantilever rigidly clamped at its lower end to the main column which is attached to a rigid structure. Beams of different sections may be used.

Bench-top unit mounted on a structure of anodized aluminum profiles, with painted steel panel, and with legs.

The unit basically consists on:

A main column, made in aluminium.
A loading head, made in aluminium, located at the upper end of the column, which can rotate 180° at 15° intervals around the vertical axis of the beam.
Set of pulley, located at the loading head, to apply a horizontal load.
2 Dial gauges of 0-25 mm, to measure Δ_U and Δ_V deflections.
2 Steel beams are supplied, one with rectangular section and the other one with L shape section.

Manuals: This unit is supplied with 8 manuals.

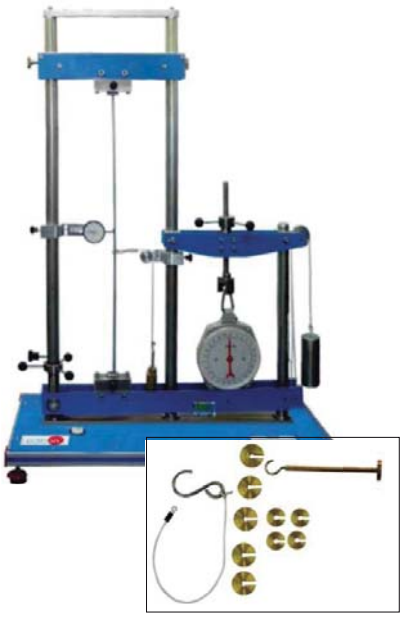
Dimensions (approx.): 400 x 300 x 400 mm. Weight: 14 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MVV.pdf

PRACTICAL POSSIBILITIES

1.- Determining the deflection of the beam depending on the intensity of the force applied.
2.- Determining the deflection of the beam depending on the direction of the force applied.
3.- Determining the Δ_U and Δ_V deflections at free ends of cantilevers.
4.- Studying the deflections at two planes, for several sections.
5.- Determining deflections for different angles of force applied.
6.- Studying the rigidity variation.
7.- Determining the position of the torsion centre of the beam (with accessory MVVC).

MUP. **Loading of Struts Unit**



SPECIFICATIONS SUMMARY

MUP is an unit to demonstrate the phenomenon of crippling load for struts.

The unit has been designed to carry out tests with different lengths and different ends conditions:

-Both ends pinned. -Both ends fixed. -One end pinned and the other fixed.

MUP is designed to work with two types of struts: of circular section and rectangular section. Therefore, the experiments can be carried out according to the different ends conditions and the different lengths between 400 mm and 800 mm.

The unit basically consists on:

Two porticoes:

-A 1m height portico, where the test struts are placed. It is designed to accommodate struts of different height by using two pins. Therefore, at the upper and lower parts, there are special clamps to subject the strut to the desired end conditions.
-A 50cm height portico, where the experimental strut will be subjected to load by means of a spring balance situated at the upper part and which will tend to elevate the lower beams, so the experimental strut will be subjected to compression.

Bubble level to equilibrate the system. Regulation nut which, together with a bubble level, will allow to equilibrate the horizontal beams.

Balance 0-50 kg to measure the strut compression load. Weight of 1 kg.

Dial gauge, measurement range: 0-20 mm, to check the strut flexion according to the experimental strut is subjected to load.

Accessory to create perturbing load over the test strut, which consists of support, pulley and set of massses. Set of masses and set of test struts.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 800 x 400 x 1200 mm. Weight: 60 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MUP.pdf

PRACTICAL POSSIBILITIES

1.- Experimental determination of the relation between the crippling load for different thickness, materials and shapes of the test struts.
2.- Experimental determination of the relation between the crippling load and the test struts ends conditions.
3.- To establish the critic load differences for different lengths and different strut sections.
4.- Determination of the crippling load for vertical beams for different slenderness modulus and several conditions at the ends.
5.- Rectangular test specimens for the deflection occurs in a determined plane of lengths.
6.- Application of a light lateral load to measure the lateral deflection.

MTP. **Twist and Bend Machine**

SPECIFICATIONS SUMMARY

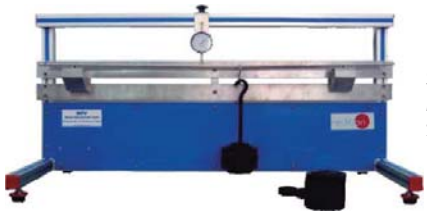
The MTP unit is a combined apparatus for the demonstration of both twist and bend to be used in the laboratory or as a complement of the theoretical study about twist and bend.
In flexion experiments, the student will be able to calculate the Elasticity Modulus of different materials, demonstrating the relation load-deformation.
In torsion experiments, the student will also be able to check the relation load-deformation and get the Rigidity Modulus of different materials.
Bench-top unit with structure made of anodized aluminum profiles, with painted steel panel. It is mounted on 4 adjustable in height rubber legs.
It consists of two stainless steel guides of 800 mm, which allow to displace the supports in the whole range. This allows the student to carry out the experiment of beams of different length.
4 Test pieces with circular section, of 8 mm diameter, of different materials (steel, aluminum, brass, bronze). They have marks every 50 mm to make the measurement of the beam length easier.
7 Test pieces with different rectangular cross section made of stainless steel. They also have marks every 50 mm to make the measurement of the beam length easier.
Dial gauge of 0-10 mm to measure the deformations.
The elements required to perform the practical exercises are supplied:
Allen key of 3 mm to assemble the beams in the supports.
Set of weights adapted to the MTP unit with special hooks for each type of experiment.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 850 x 500 x 650 mm. Weight: 18 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MTP.pdf

PRACTICAL POSSIBILITIES

1.- Study of the beams flexion for different sections and lengths.
2.- Determination of the Elasticity Modulus for stainless steel.
3.- Study of the relation between the torsional moment, beam length and torsion angle of one shaft.
4.- Determination of the Rigidity Modulus for steel, bronze and aluminum.

MFV. **Beam Deflection Unit**



SPECIFICATIONS SUMMARY

This unit designed to enable the students to observe and study the following phenomena in simply supported beams and cantilever beams:
- Relation between the deflections and the applied loads.
- Effect of the length and the cross section on the beam behaviour. Ex: deflection load ratio.

Structure of anodized aluminum and stainless steel.
Metallic guide with a graduated ruler for positioning the different supports.
2 Removable stainless steel supports.
1 Removable stainless steel cantilever support.
Dial gauge, 0-25 mm.
It allows experimentation with beams up to 1000 mm length for their study.
Three test rectangular beams (made of stainless steel) with different cross sections and 1 m. of length are supplied.
The unit allows test as:
- cantilever beam.
- beam fixed at one end and simply supported at the other end.
- simply supported beam.

Adjustable legs for balancing the unit.
In order to carry out some of the practices with MFV unit, 2 sets of weights "C type" are required.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 1200 x 400 x 400 mm. Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MFV.pdf

PRACTICAL POSSIBILITIES

1.- Study the characteristics of simply-supported and cantilever beams.
2.- Determination of the relationship between applied load and deflection.
3.- Beam supported on its two ends with a central loading point.
4.- Study of the variation of length in deflection.
5.- The effect the beam´s length has on a centrally loaded beam supported by its two ends.
6.- The effect of the cross-section of deflection of beams.
7.- The effect the beam´s section has on a centrally loaded beam supported on its two ends.
8.- Cantilever beam with a load on one of its ends.
9.- The effect the beam´s length has on a cantilever with a load on one of its ends.
10.- The effect of a cross-section in a cantilever with a load on one of its ends.
11.- Beam supported by two points and subjected to a momentum of uniform bending.
12.- Study of bending, application of loads at different points with fixed or free ends.

MTB. **Torsion Unit**

SPECIFICATIONS SUMMARY

The MTB unit allows to verify the basis of torsion and to perform practical exercises to demonstrate:
- Circular rods elastic torsion equation.
- The rigidity modulus of different materials.

The unit is mounted on an anodized aluminum structure with painted steel panel.
The main frame is supported on aluminum blocks. The two guides are made of stainless steel, the rest of the components are aluminum.
The two guides of the unit on which the mobile clamp slides are for testing rods of different lengths.
Mobile clamp located at one end that has a crank in the bottom to adjust the test rod to the desired length. It is made of stainless steel.
Fixed clamp, consists of two bearings which allow it to turn. It has an arm on which the force is applied. It has a notch placed 60 mm from the longitudinal axis of the test rod, to carry out the measurements. The dial gauge should be placed on this notch to properly measure the deformation. The clamp is made of stainless steel.
Test rods: standard supply of 3 test rods: steel, brass and aluminum. They are 8 mm in diameter and 350 mm in length. They have marks every 50 mm, to make the performance of practical exercises at different lengths easier.
A Dynamometer up to 10 Kg. to apply the forces on the test rod. A Dial gauge of 0- 10 mm. to measure the deformation of the test rod subjected to the force.
All the necessary tools to carry out the experiments are provided.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 600 x 400 x 600 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MTB.pdf

PRACTICAL POSSIBILITIES

1.- Verification of the elastic torsion equation of circular rods.
2.- Experimental determination of the relationship between the torsion moment and the shaft angular deformation.
3.- Experimental determination of the relationship between the test rod length and the shaft turn angle for a same torsional force.
4.- Experimental determination of the value of the Modulus of Rigidity for steel, brass and aluminum.

7.5.1- General Strength of Materials

MFLT. **Strut Buckling Unit**

SPECIFICATIONS SUMMARY

MFLT is an unit to demonstrate the buckling of structures under compression. MFLT unit allows the student to obtain experimentally the buckling critical load of slender struts subjected to compression.
The unit allows to study the buckling of pieces of different lengths, ranging from 300 mm. to 625 mm., to which different support conditions can be applied:
- -Pin-joined end conditions.
- -Rigidly fixed end conditions.
- -One end pinned and the other fixed.

This unit is mounted on a frame made of anodized aluminum profiles and painted steel panel and supports.
The unit basically consists of:
- -2 Guides to slide the movable clamp, made of stainless steel, that allow to test pieces up to 650 mm long.
- -Universal supports to fasten the test piece, according to the required end conditions.
- -Movable clamp located at one end. It has a crank to adjust the test piece to the desired length. Besides, it has a system to measure the applied force, by measuring the deformation of an elastic ring. The clamp can be placed in pinned end or fixed end position, according to the desired practical exercise.
- -Fixed clamp, which has several functions. The knob has two positions according to the desired end conditions for the clamp. Other function is the system to apply the force to the test piece, consisting of a crank, that compress the structure when it is turned to the right.
- -Differential screw to allows the system compression.
- -Dial gauge, with a measuring range of 0-5mm., to determine the compression load to which the test piece is subjected.

Nine test pieces of different length are included. They are made of tempered steel and their dimensions are 20 mm. wide and 1.5 mm. thick.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 1000 x 300 x 250 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MFLT.pdf

PRACTICAL POSSIBILITIES

1.- Study of deformation in beams.
2.- Demonstration of the Euler theory for beams.
3.- Determination of the relationship between buckling load and slenderness modulus for axial loads.
4.- Determination of the critical buckling load of a flat test piece, pinned at both ends.
5.- Determination of the critical buckling load of a flat test piece, with one fixed end and one pinned end.
6.- Determination of the critical buckling load of a flat test piece with both ends fixed.

MVS. **Suspension Bridge Unit**

SPECIFICATIONS SUMMARY

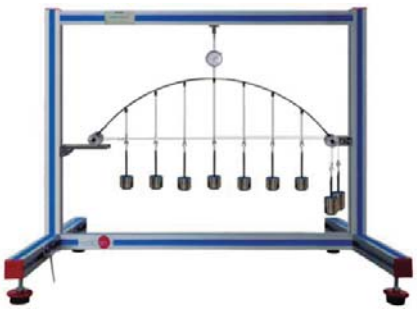
MVS is a visual realistic suspension bridge that allows to compare experimental and theoretical cable tensions and to study the performance of the suspension bridge under different load conditions.
This unit has been designed to represent a simple application of a suspended beam and it can be used to determine experimentally the tension in the cables supporting a beam carrying a series of distributed loads.
The MVS unit is assembled in an anodized aluminum and steel structure.
A metal beam is supported on tie rods attached at pivot points to cross members threaded on the supporting cables which pass over pulleys.
Tension in the supporting cables is determined by attaching suitable masses or weights to the cables stirrups.
Loads may be applied to the beam by attaching masses or weights at different loading points.
1 set of weights and ropes are supplied.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 850 x 380 x 510 mm. Weight: 20 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MVS.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of the characteristics of a simple suspension bridge.
2.- Determination of the experimental tension in the supporting cables.
3.- Observation the stability of the structure.
4.- Examination of the relationship between applied loads and the suspension cable tension.
5.- To determine experimental value of the tension in the supporting cables of a suspended beam subjected to a uniformly distributed load.
6.- Comparison of theoretical and experimental results.

MARP. **Parabolic Arch Unit**



SPECIFICATIONS SUMMARY

The Parabolic Arch Unit (MARP) allows to investigate a parabolic arch, optionally statically determinate (1 fixed end and 1 movable end) or indeterminate (2 fixed ends).
Anodized aluminum structure.
The unit includes:
A parabolic pre-shaped arch:
Material: steel
The parabolic arch has a fixed end and other is on a roller bearing that runs on a track plate.
Length: 950 mm. Height: 270 mm.
Cross-section: 20 x 6 mm. It includes 7 chains to situated the hangers.
The parabolic arch can be loaded with a distributed load by means of equi-spaced load chains or by point loads.
2 Deflection rollers with fixture allow to locate the weight set used to cancel the movement of the movable end. They include a chain to situate the weight hangers.
2 Dial gauges record the deflection of the arch under load and the horizontal displacement of the movable bearing. Dial gauge range: 0-25mm. Increments: 0.01 mm.
Set of weights and hangers allow to compensate for the reaction of the fixed end and to apply loads on vertical equi-spaced chains and hangers:
11 hangers of 1N. 20 weights of 1N. 20 weights of 5N.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 1400 x 450 x 1100 mm. Weight: 55 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MARP.pdf

PRACTICAL POSSIBILITIES

1.- Study of the mechanical principles of the parabolic arch.
2.- Measurement of the deformations of the arch under load.
3.- Study of the differences between statically determinate and statically indeterminate arches.
4.- Measurement of the support reactions on the statically indeterminate arch under load.
5.- Study of the influence of point load or distributed load on reaction forces and deformation of the arch.
6.- To calculate the support reactions.
7.- To compare the actual results with the theoretical results.
8.- Use of the influence line for the horizontal displacement.
9.- Comparison of the horizontal displacement with the simplified theory.
10.- Study of the derivation of the influence line for horizontal displacement.
11.- Model analysis evaluation of horizontal thrust.
12.- Evaluation of the relationship between applied loads and horizontal displacement.

MART. **Three-Hinged Arch Unit**

SPECIFICATIONS SUMMARY

The MART unit allows to investigate 2 statically determinate three-hinged arches (symmetrical or unsymmetrical). This unit allows the student to become familiar with three-hinged arches, to calculate the bearing forces (for point load, for uniformly distributed load and for moving load), to investigate the influence of the load on the horizontal thrust in the supports, to determine the influence lines and to calculate support reactions. Anodized aluminum structure.

The unit includes:

- Three arch segments to produce a symmetrical or unsymmetrical three-hinged arch:
  - 2 long segments (they make a symmetrical arch together), length of each long segments: 500mm; total arch length: 1000mm.
  - 1 short segment (it makes an unsymmetrical arch together with one long segment), length of the short segment: 250mm; total arch length: 750mm. Arch height: 250mm.
- Three hinges: 1 crown hinge. 2 abutment hinges at the bearing points.
- One arch bridge deck allows for unrestricted positioning of the loads along the arch span.
- Set of weights with deflection rollers to compensate for the support reactions of an abutment hinge:
  - 18 x 5N. 36 x 1N.
  - It includes four 1 N weight holder and a moving load with joining link, which can be dismantled to produce two point loads of different magnitude (10N+20N).
- Two bearings to support the left hand hinge.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.): 1500 x 450 x 1100 mm. Weight: 60 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MART.pdf

PRACTICAL POSSIBILITIES

1.- Familiarization with three-hinged arches.
2.- Understanding the characteristics of symmetrical and unsymmetrical three-hinged arches.
3.- Study of the method of sections.
4.- Application of the method of sections and the conditions of equilibrium to calculate the bearing forces for a point load.
5.- Application of the method of sections and the conditions of equilibrium to calculate the bearing forces for a uniformly distributed load.
6.- Application of the method of sections and the conditions of equilibrium to calculate the bearing forces for a moving load.
7.- Simulation of a vehicle passing over an arch using a tandem rolling load.
8.- Investigation of the relationship of the applied loads on the horizontal thrust in the supports.
9.- Study of the influence line for a horizontal thrust.
10.- Study of the influence lines for the supports under a moving load.
11.- Comparison of the calculated and measured support reactions for a static and a moving load.
12.- Comparison of theory with experimental results.

MFBS. **Unit for studying Forces in a Simple Bar Structure**

SPECIFICATIONS SUMMARY

The Unit for studying Forces in a Simple Bar Structure (MFBS) allows the resolution of forces in a single plane, statically determinate system. This unit represents a simple bar structure that allows the measurement of bar forces and the comparison of the experimental results with the calculations and the graphical method.

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

The unit consists of three members, three node discs and a set of weights with a weight holder.

The members are made up by coupling these elements:

- -Three dial gauges, measuring range: 0-10mm.
- -Three springs, force measuring range: 0-60N.
- -Three bars. There are two fixed length bars (465 mm) and a variable length bar. These bars can form numerous simple bar structures with different angles.

Three node discs: Two of them are used as support of the bar structure

Set of weights: 2 x 20N. 1 x 10N. 1 x 5N. It includes a 1 N weight holder.

Manuals: This unit is supplied with 8 manuals.

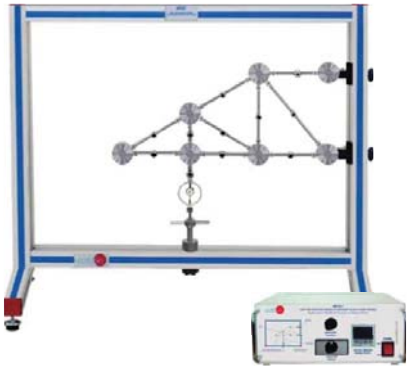
Dimensions (approx.): 1000 x 350 x 620 mm. Weight: 18 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MFBS.pdf

PRACTICAL POSSIBILITIES

1.- Investigation of the forces in a simple bar structure.
2.- Measurement of bar forces in the different configurations of the simple bar structure.
3.- Calculation of bar forces in the different configurations of the simple bar structure by the method of joints.
4.- Calculation of bar forces in the different configurations of the simple bar structure by calculations.
5.- Comparison of the experimental bar forces with the calculations and the graphical method in the different configurations of the simple bar structure.

MFCS1. **Unit for studying Forces in Different Single Plane Trusses**



SPECIFICATIONS SUMMARY

The Unit for studying Forces in Different Single Plane Trusses (MFCS1) allows the measurement of the bar forces in a single plane truss subjected to a single external force, in a statically determinate truss. This unit allows the measurement of the bar forces in various single plane trusses, the study of the dependency on the external force and the comparison of the experimental bar forces with several mathematical methods.

The unit includes:

- Anodized aluminum frame.
- 20 bars made of stainless steel:
  - 1 bar of 520 mm long. 3 bars of 430 mm long. 1 bar of 400 mm long. 8 bars of 300 mm long. 5 bars of 259 mm long. 2 bars of 150 mm long. These bars can form several plane trusses structures with different angles between bars. Maximum bar force: 500N.
- Strain gauge to measure force on each bar.
- Seven node discs, two of them are used to hinge the truss structure to the frame of the unit.
- A load application device with a force gauge mountable on different node discs; range: -500...500 N, graduations: 10N.
- Electronic console (in separate metallic box):
  - Strain gauge connectors. Digital display for the strain gauges.
  - Selector for strain gauges. Amplifier.
  - USB connector for the connection to the computer (PC).
- Software to evaluate measurement data.
- Cables and accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions and weights (approx.):

- Unit: 1400 x 450 x 1150 mm. Weight: 22 Kg
- Electronic console: 300 x 190 x 130 mm. Weight: 2.5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MFCS1.pdf

PRACTICAL POSSIBILITIES

1.- Investigation of the forces in a single plane truss.
2.- Measurement of bar forces in the different configurations of the single plane trusses using strain gauges.
3.- Study of the dependency on the external force in the different configurations of the single plane trusses with the direction of the force.
4.- Study of the dependency on the external force in the different configurations of the single plane trusses with the magnitude of the force.
5.- Study of the dependency on the external force in the different configurations of the single plane trusses with the application point of the force.
6.- Calculation of bar forces in the different configurations of the single plane truss by the Ritter's method of sections.
7.- Calculation of bar forces in the different configurations of the single plane truss by the method of joints.
8.- Comparison of the experimental bar forces with the Ritter's method of sections and the method of joints in the different configurations of the single plane truss.

7.5.1- General Strength of Materials

MFL. **Two Pinned Arch Unit**

SPECIFICATIONS SUMMARY

The unit (MFL) enables to determine experimentally the horizontal component of the abutment thrust of a two hinged arch beam.
The beam is supported on ball bearing rollers attached to each end of the beam and the horizontal movement of the free end is indicated by a dial gauge so that the beam can be returned to it's original unloaded span.
The horizontal thrust force is applied to the free end of the beam by means of masses or weights attached to a cord passing over the ball bearing pulleys.
Varying loads can be applied to the beam by means of load hangers and masses. A dial gauge enables to measure the vertical displacement.
It is a bench-top unit with structure made in anodized aluminum and steel.
Steel arch beam. 2 Dial gauges: range: 0-10 mm. Cord with a hook.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 700 x 400 x 700 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MFL.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of the characteristics of a two pinned arch.
2.- To examine the relationship between applied loads and horizontal thrust.
3.- Determination of the horizontal thrust in a support point of an arch beam subjected to a vertical load.
4.- Study of the horizontal force change with the magnitude of the applied load.
5.- To determine the experimental value of the horizontal component thrust at the abutment end of a two pinned arch beam subjected to a vertical load.

MPO. **Portal Frame Unit**

SPECIFICATIONS SUMMARY

The portal frame unit has been designed to determine the deflection at the load point for a rectangular portal frame subjected to horizontal and vertical loads.
The system is formed by a frame attached to a rigid base and loads can be applied by mass hangers and a range of masses or weights. The horizontal and vertical deflections of the frame can be measured by means of dial gauges.
Steel portal frame. Dial gauge: range: 0-10 mm. Cord with a hook. Hanger.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 700 x 400 x 450 mm. Weight: 15 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MPO.pdf

PRACTICAL POSSIBILITIES

1.- To determine the experimental value of the deflection at the load point for a rectangular portal frame subjected to a vertical load.
2.- To determine the experimental value of the deflection at the load point for a rectangular portal frame subjected to a horizontal load.
3.- To compare the theoretical and experimental results.

MDB. **Deflection of Curved Bars Unit**

SPECIFICATIONS SUMMARY

The Deflection of Curved Bars unit is designed to enable the student to determine experimentally the horizontal and vertical displacements at the free end of various curved bars when subject to single concentrated load.
"MDB" unit consists of a structure of aluminum and steel that allows the incorporation of different curved bars to be studied. It allows tests with curved bars of different shape.
The use of two dial gauges placed perpendicularly to each other makes it possible to determine the displacements produced in both directions.
The load is applied when hanging weights in the application point.
Bench-top unit mounted on a structure of anodized aluminum, with painted steel panel, and with regulable in height legs.
The unit basically consist of:
Structure of aluminum and steel on which the dial gauges are mounted and clamps for the test bars.
2 Dial gauges with range from 0-10 mm, to measure the deformation of the test bar subjected to a force.
4 Test curved bars, made of steel, with different lengths and curvatures.
Set of weights. Steel hook to hand the weights and it is hanging in the application point of the force.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 370 x 220 x 400 mm. Weight: 8 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MDB.pdf

PRACTICAL POSSIBILITIES

1.- Study of deflection of curved bars.
2.- Determination of the horizontal and vertical displacements at the free end of various curved bars when subject to single concentrated loads.
3.- Study of the different types of bars geometry and for different positions.
4.- Measurement of the horizontal and vertical displacements produced at the free end of the curved bar.
5.- Effect of the load value in the bar response.
6.- Effect of the bar morphological characteristics in its response to the load.

MMF. **Shear Force and Bending Momentum Unit**

SPECIFICATIONS SUMMARY

This unit has been designed to show experimentally that in a cantilever beam subject to transverse loads, at any cross section of the beam:
-The shear force is the algebraic sum of the transverse components of the forces to one side of the section.
-The bending moment is the algebraic sum of the moments of the forces to one side of the section.
Several experiments will be carried out in order to determine the magnitudes of these moments and shear forces, while observing the bending process in a beam.
An articulated structure makes it possible to convert the application of one vertical force into both a bending moment and a shearing force on the beam. Both effects are created by the use of a set of weights that balance the system using a double-pulley system.
Constructed on aluminum profiles with painted steel panels.
Double -pulley system which allows us to achieve equilibrium of the bending moment on the beam.
Double -pulley system which allows us to achieve equilibrium of the shear force on the beam.
Different application points for the loads.
"MMF" unit uses a rule made in methacrylate that allows us to equilibrate the system with the absence of weights before beginning each experiment.
3 Hooks to hang weights are provided to carry out the experiments.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 400 x 216 x 350 mm. Weight: 8 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MMF.pdf

PRACTICAL POSSIBILITIES

1.- Study of cantilever beams subject to loads at different points.
2.- Demonstration of the shear force as the algebraic sum of the transverse components of the forces to one side of the section.
3.- Demonstration of the bending moment as the algebraic sum of the moments of the forces to one side of the section.
4.- Study of the equilibrium and the applied balancing forces when the applied masses are varied.

7.5.1- General Strength of Materials

MOT. **Torsional Oscillations Unit**

SPECIFICATIONS SUMMARY

The Torsional Oscillations Unit (MOT) enables to illustrate and investigate the torsional oscillations of single rotor, multi-rotor and geared systems.
The unit basically consists of a rigid frame that have some fasteners which enable to situate its different elements. It also has a set of helical springs to simulate long flexible shafts, and a set of discs of varying mass moment of inertias. Suitable gears of various sizes are also provided to change the gear ratio.
Fasteners offer the possibility to modify the arrangement of discs and gears, as well as the use of different types of spring. That enables the study of the different existing systems.
The natural frequencies are of flow order and can be counted. Besides, a line drawn axially on the spring serves to illustrate the elastic line and facilitates the experimental location of the nodes.
The MOT unit basically consists of:

- 3 helical torsion springs of different torsion constant.
- 8 metallic discs of different diameter.
- 6 metallic gears with different number of teeth.
- 2 closure plates.
- Fastening and anchoring elements.

The unit can be wall mounted.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 700 x 400 x 400 mm. Weight: 30 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MOT.pdf

PRACTICAL POSSIBILITIES

1.- Single rotor connected to the free end of a torsionally flexible member.

2.- Single rotor connected to the free end of a series of torsionally flexible members.

3.- Two rotors connected to the free ends of a torsionally flexible member.

4.- Two rotors connected to the free ends of a series of torsionally flexible members.

5.- Three rotors connected by two torsionally flexible members.

6.- Two rotors joined to the free end of two flexible members which are connected by gears whose inertia is appreciable.

MVL. **Free Vibration Unit**

SPECIFICATIONS SUMMARY

The Free Vibration Unit (MVL) has been developed to cover a range of demonstrations and experiments which provide the user with an understanding of the free vibrations of a simple spring-mass-damper system.

Simple adjustments can be made to the unit and the motion of the mass can be readily observed and recorded on the pen recorder provided.

Demonstrations may be carried out to illustrate free and damped vibrations of a simple spring-mass system having one degree of freedom and the response of a second order mechanical system to a step input.

Experiments can be carried out by the students to investigate the relationship between the mass of the body, the stiffness of the spring and the period/frequency of oscillation and to observe the effect of viscous damping on the system.

The main structure of the unit is a rigid frame, made of steel and aluminum, with two vertical guides, an upper mounting plate for the spring and a lower mounting plate for the damper.

This rigid frame supports the different elements of the unit.

The mass carriage, to which various slotted weights may be attached, is constrained by rollers which run along the vertical guides to provide a single degree of freedom with minimum uncontrolled damping.

The lower end of the spring is attached to the mass carriage and the upper end is attached to the frame. This section of the frame is adjustable so that the free position of the carriage may be varied.

The system produces amplitude versus time recordings using a mechanical strip chart recorder that consists of a drum recorder and a pen holder.

The drum recorder is attached to the rigid frame and consists of a drum, driven by a synchronous motor, and a roll of paper.

Before being rolled around the drum, the paper passes through a tensioning device that provides enough tension to ensure that the paper speed is constant.

The pen holder is attached to the mass carriage and uses a spring to maintain continuous contact between the pen tip and the paper on the drum.

An electronic console is used to switch the synchronous motor on and off during experiments.

Three springs, with varying stiffness, can be interchanged as the connection between the rigid frame and the mass carriage.

Five weights of 1 kg each can be added and secured to the mass carriage.

An adjustable oil damper provides controlled damping and can be attached to the carriage by means of a screw.

Oil is provided to fill the damper.

Cables and accessories, for normal operation

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.):

Unit: 530 x 560 x 1030 mm. Weight: 25 Kg.

Electronic console: 300 x 190 x 130 mm. Weight: 2 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MVL.pdf

PRACTICAL POSSIBILITIES

1.- Investigation of the relationship between the mass of the body, the stiffness of the spring and the period/frequency of oscillation for a simple spring mass system with one degree of freedom.

2.- Investigation of the relationship between the applied force, the viscosity of the oil and the velocity for various settings of the adjustable oil damper.

3.- Observation of how varying the degree of damping affects the response of a second order mechanical system to a step input.

4.- Observation of the free vibrations of a system having one degree of freedom.

5.- Study of the effect of viscous damping on the free vibrations of a simple spring-mass-damper system.

6.- Determination of the damping ratio for a given spring-mass-damper system.

7.5.1- General Strength of Materials

MVLF. **Free & Forced Vibration Unit**

SPECIFICATIONS SUMMARY

The Free and Forced Vibration Unit (MVLF) has been developed to cover a range of demonstrations and experiments which provide the user with an understanding of the free and forced vibrations of a simple spring-mass-damper system. Simple adjustments can be made to the unit and the motion of the mass can be readily observed and recorded on the pen recorders provided.

A feature of the Free and Forced Vibration Unit (MVLF), which approaches the problems of forced damped vibrations for the first time, is the simple way in which it is presented so that free and forced vibration phenomena can be readily observed.

Experiments can be carried out by the students to investigate the relationship between the mass of the body, the stiffness of the spring and the period/frequency of oscillation and to observe the effect of viscous damping on the system.

The main structure of the unit is a rigid frame, made of steel and aluminum, with two vertical guides, an upper mounting plate for the spring, a lower mounting plate for the damper, a variable speed motor and a drive unit. This rigid frame supports the different elements of the unit.

The mass carriage, to which various slotted weights may be attached, is constrained by rollers which run along the vertical guides to provide a single degree of freedom with minimum uncontrolled damping. The lower end of the spring is attached to the mass carriage and the upper end is attached to the frame. This section of the frame is adjustable so that the free position of the carriage may be varied.

The system uses two mechanical strip chart recorders that consists of a drum recorder and a pen holder:

The first records amplitude and frequency measurements. It has a drum recorder that is attached to the rigid frame and consists of a drum, driven by a synchronous motor, and a roll of paper. Before being rolled around the drum, the paper passes through a tensioning device that provides enough tension to ensure that the paper speed is constant.

The second records amplitude and phase measurements. It also has a drum recorder that is attached to the rigid frame and consists of a drum, wrapped in recording paper, driven by the main drive unit at the applied forcing angular frequency.

Both pen holders are attached to the mass carriage and use a spring to maintain continuous contact between the pen tip and the paper on the drum.

The variable speed motor and drive unit are attached to the rigid frame and provide two methods of forcing vibrations:

An unit consisting of two contra-rotating out-of-balance discs may be attached to the mass carriage and are driven by a flexible drive which is connected to the main drive unit. This provides a periodic disturbing force to the mass carriage.

A crank rotated by the drive unit and a connecting rod, which can be attached to the crank and the upper spring mounting, provides a periodic displacement to the point of support of the spring.

Frequency of the oscillations can be measured with an optical sensor.

An electronic console is used to switch the synchronous motor on and off, control the speed of the forced vibrations motor and display the frequency.

Three springs, with varying stiffness, can be interchanged as the connection between the rigid frame and the mass carriage.

Five weights of 1 kg each can be added and secured to the mass carriage

An adjustable oil damper provides controlled damping and can be attached to the carriage by means of a screw.

Oil is provided to fill the damper.

Cables and accessories, for normal operation

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.):

Unit: 660 x 560 x 1030 mm. Weight: 30 Kg.

Electronic console: 300 x 190 x 130 mm. Weight: 2.5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MVLF.pdf

PRACTICAL POSSIBILITIES

1.- Investigation of the relationship between the mass of the body, the stiffness of the spring and the period/frequency of oscillation for a simple spring mass system with one degree of freedom.

2.- Investigation of the relationship between the applied force, the viscosity of the oil and the velocity for various settings of the adjustable oil damper.

3.- Observation of how varying the degree of damping affects the response of a second order mechanical system to a step input.

4.- Observation of the free vibrations of a system having one degree of freedom.

5.- Study of the effect of viscous damping on the free vibrations of a simple spring-mass-damper system.

6.- Determination of the damping ratio for a given spring-mass-damper system.

7.- Investigation of the relationship between the amplitude of the steady state vibration of the vibrating mass and the forcing frequency for various damping ratios. Vibrations induced by applying a periodic disturbing force to the mass.

8.- Investigation of the relationship between the amplitude of the steady state vibration of the vibrating mass and the forcing frequency for various damping ratios. Vibrations induced by a periodic displacement of the point of support of the spring.

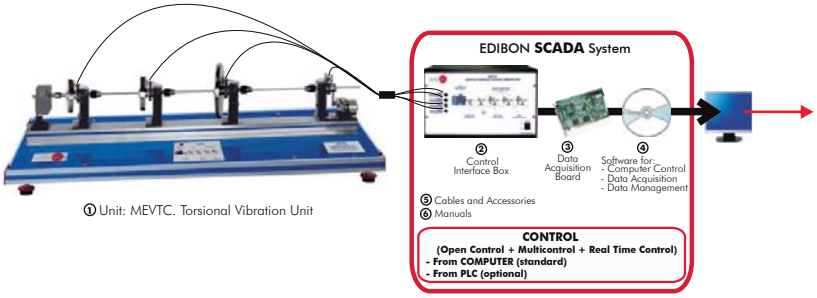
9.- Investigation of the phase relationship between the vibrating mass and the periodic displacement of the spring support for varying damping ratios.

10.- Study of the vibrations induced by applying a periodic disturbing force to the mass in a viscous damped system.

11.- Study of the vibrations induced by a periodic displacement of the point of support of the spring in a viscous damped system.

7.5.1- General Strength of Materials

MEVTC. Computer Controlled **Torsional Vibration Unit**



① Unit: MEVTC. Torsional Vibration Unit

SPECIFICATIONS SUMMARY
Items supplied as standard

① MEVTC. Unit:

The Computer Controlled Torsional Vibration Unit (MEVTC) allows to investigate torsional vibration and torsional stiffness with demonstrations and experiments.

The Computer Controlled Torsional Vibration Unit (MEVTC) is an unit designed to study the torsional vibration, the torsional stiffness and the behaviour of a torsional vibration system with two and three torsional weight vibrator.

Bench-top unit mounted on an anodized aluminum structure and panel of painted steel, and with rubber feet.

Main metallic elements in stainless steel.

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

Torsion test bar:

Made of stainless steel.

Diameter: 5 mm.

Length: 1400 mm.

Computer controlled electrical motor with several excitation amplitudes.

Four bearings mounted in movable pillars, with chucks and flanges, for positioning at any point and support the torsion bar.

Three weight discs for attachment at any location along the bar:

Material: Stainless steel.

Two weight discs with diameter 150 mm and 2.6 kg, approx.

One weight disc with diameter 230 mm and 4.9 kg, approx.

Sealed oil damper with adjustable coefficient.

Four rotation angle sensors.

② MEVTC/CIB. Control Interface Box :

With process diagram in the front panel.

The unit control elements are permanently computer controlled.

Simultaneous visualization in the computer of all parameters involved in the process.

Calibration of all sensors involved in the process.

Real time curves representation.

All the actuators' values can be changed at any time from the keyboard of the computer (PC).

Shield and filtered signals to avoid external interferences.

Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process.

Open control allowing modifications, at any moment and in real time, of parameters involved in the process.

3 safety levels: mechanical in the unit, electronic in the control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:

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

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

2 Analog outputs. 24 Digital Inputs/Outputs.

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data.

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

It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions and weights (approx.) =

Unit: 1500 x 450 x 450 mm. Weight: 55 Kg.

Control Interface box: 490 x 330 x 310 mm. Weight: 10 Kg.

PRACTICAL POSSIBILITIES

1.- Determination of the torsional stiffness of a torsion bar.

2.- Determination of the modulus of rigidity of a torsion bar.

3.- Study of the behaviour of torsional vibrations.

4.- Study of the frequency of oscillations.

5.- Determination of the mass moment of inertia.

6.- Determination of the damping of torsional vibrations.

7.- Study of forced torsional vibrations.

8.- Study of the resonance and phase change.

9.- Study of the behaviour of a torsional vibration system with two and three weights torsional vibrator.

Other possible practices:

10.- Sensors calibration.

11-29.- Practices with PLC.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MEVTC.pdf

7.5.1- General Strength of Materials

MELH. **Unit for studying Hooke's Law**

SPECIFICATIONS SUMMARY

The Unit for studying Hooke's Law (MELH) allows the study of the elastic behaviour of tension springs under different loads.
This unit demonstrates the application of Hooke's Law and allows the visualization of the deformation of tension springs under load and the performance of oscillation experiments on a spring-mass system.
The unit includes:
- A metal stand with a scale (graduations: 1mm.)
- Two helical springs:
  - Short spring:
    - Number of coils: 55.
    - Diameter: 18 mm.
    - Wire diameter: 1.0 mm.
  - Long spring:
    - Number of coils: 112.
    - Diameter: 18 mm.
    - Wire diameter: 1.0 mm.
  - These springs can be configured in series or individually.
- Set of weights:
  - 12 x 0.5N.
  - It includes a 1N weight holder.

Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 300 x 300 x 1100 mm. Weight: 7 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MELH.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of Hooke's Law.

2.- Investigation of the proportionality of the force generated by the weights and the elongation of the spring.

3.- Determination of the spring constant.

4.- Study of the series configuration of two tension springs.

5.- Investigation of the influence of the spring constant on the oscillation frequency of a spring-mass system.

MAE. **Acceleration of Geared Systems Unit**

SPECIFICATIONS SUMMARY

This unit is supported in a metallic frame and can be wall mounted.
The unit basically consists on three shafts, each mounted on ball races and connected by gearing. A flywheel is attached to one of the shafts.
The discs having varying mass moments of inertia can be attached to the other two shafts.
It permits to change the gear ratios. Gears of suitable sizes are provided.
A torque drum is mounted in each shaft and by means of masses or weights, attached to one of the drums with a cord, allow a way to apply a torque to the system. The acceleration of the system can be calculated.
In order to carry out some of the practices with MAE unit, 1 set of weights "B type" is required.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.): 700 x 350 x 400 mm. Weight: 25 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MAE.pdf

PRACTICAL POSSIBILITIES

1.- To determine the moment of inertia of a single shaft and of this shaft connected to other two shafts.

2.- To study the relationship between gears when applying different torques to the system.

3.- To determine the acceleration of the system.

MES. **Simple Balancing Unit**

SPECIFICATIONS SUMMARY

The Simple Balancing Unit (MES) developed by EDIBON is an unit to study and analyze the oscillations and vibrations and how to eliminate or diminish them.
Bench-top unit mounted on a structure made of anodized aluminum profiles, with a painted steel panel and with legs.
All the elements of the MES unit are made of aluminum, stainless steel and treated steel.
This unit has:
- An electrical motor with variable speed which can reach 8300 r.p.m.
- It has a transmission through pulley and a belt from the motor to the shaft.
- An aluminum external disc, that we will name.
- Graduated disc. It has a diameter of 150 mm.
- The disc have drills to proceed, through fixing the masses, to the system destabilization and then to its subsequent balancing.

The unit is completed with a set of sector masses and weights to do the practices.
Auxiliary module for the electrical supply and the motor control.
At its back, there are connections and at its front part it has a potentiometer to control the speed of the motor.
Cables and Accessories, for normal operation.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.):
- Unit: 450 x 550 x 600 mm. Weight: 25 Kg.
- Auxiliary module: 310 x 220 x 145 mm. Weight: 2 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MES.pdf

PRACTICAL POSSIBILITIES

1.- Demonstrations and experiments in the balancing of co-planar rotating systems.

2.- Balance in a single plane of revolution.

3.- Observe the effects on oscillations of various conditions of balance.

7.5- Strength of Materials

7.5.1- General Strength of Materials

MBU. **Universal Bench Mounted Frame**

SPECIFICATIONS SUMMARY

The frame is designed to accommodate two units, allowing adequate space for students to work on each piece of equipment simultaneously.

However it is possible to mount three pieces, in the case of the simple transmission system.

Manuals: This unit is supplied with 8 manuals.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MBU.pdf

MCD. **Thin Cylinder Unit**

SPECIFICATIONS SUMMARY

This unit has been developed to enable the student to verify the various analytical formulae with actual measured results.
Strain gauges mounted in various positions and orientations on the cylinder provide an opportunity for students to interpret the strains and stresses for a biaxial stress system.
In the unit means are provided for relieving the cylinder of all longitudinal stress, so that the value of Poisson's Ratio and Young's Modulus for the cylinder material may be accurately determined.
The thin cylinder unit and hand operated pump are mounted on a bench-top base plate. A thin wall tube contains two pistons.
The first piston is located axially; it extends beyond the end of the tube and is drilled to suit a pressure gauge and a high pressure flexible rubber hose connecting the hand operated pressure pump to the unit. This piston also has an in-built pressure relief valve. The oil from the relief valve returns to the pump reservoir connection by means of flexible pipe.
The second piston is free to move axially within the tube, but its travel outwards is limited by a plate and end-cap.
The cylinder unit which is resting on the four pins is supported on a frame and located axially by a fixed stop and an adjustable stop.
Maximum test pressure: 40 bar.
Technical data about the thin cylinder unit:
- Reservoir capacity: 75 cm^3. Recommended oil: Castor oil.
- Pressure gauge (Manometer): 0-50 bar.
- Pre-set relief valve setting: 450psi approx.
- Cylinder material: Aluminum alloy. Strain gauges: Foil type.

Six active strain gauges are cemented onto the cylinder to allow the measurement of surface strains at various angles, and other six temperature compensating gauges are cemented to a plate.
With the unit is supplied a strain gauges console with selector for the different strain gauges. The measurement of the selected gauge is shown in a display. The reading visualized in the display gather the compensation due to temperature.
Manuals: This unit is supplied with 8 manuals.
Dimensions (approx.):
- Unit: 660 x 400 x 300 mm. Weight: 24 Kg.
- Strain gauges console: 310 x 200 x 140 mm. Weight: 5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MCD.pdf

PRACTICAL POSSIBILITIES

1.- Determination of Young's modulus and Poisson's ratio. Open ends condition.

2.- Determination of Young's modulus and Poisson's ratio. Closed ends condition.

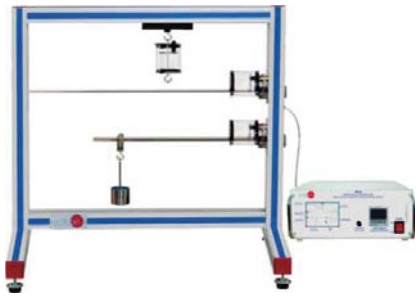
3.- Determination of theoretical strain. Open ends condition.

4.- Determination of theoretical strain. Closed ends condition.

5.- Study with Mohr Strain Circle and determination of circumferential, biaxial, radial and longitudinal stresses. Open ends condition.

6.- Study with Mohr Strain Circle and determination of circumferential, biaxial, radial and longitudinal stresses. Closed ends condition.

MEGE. **Strain Gauge Training Unit**



SPECIFICATIONS SUMMARY

The Strain Gauge Training Unit (MEGE) allows to study strain gauges and their application for the measurement of strain.This unit provides an introduction to the fundamentals of measurement with strain gauges, to compare how resistance strain gauges work and how they measure strains in different structures (torsion, tension and bending systems).
The unit includes:
- Anodized aluminum frame.
- Three strain gauge test specimens (bars), each with strain gauge measuring points in full bridge circuit:
  - Torsion test bar:
    - Material: stainless steel. Length: 500mm. Diameter: 10mm.
  - Tension test bar:
    - Material: stainless steel. Length: 50mm. Cross-section: 2x10mm.
  - Bending test bar:
    - Material: stainless steel. Length: 400mm. Cross-section: 4x25mm.
  - Strain gauge measuring point: full bridge, 350Ω.
  - The strain gauges are inside a transparent cover that protects them and make them clearly visible for the visualization of the process.
- Set of weights:
  - 10 x 0.5N. 1 x 5N. 2 x 10N. 1 x 20N.
  - It includes a 1N weight holder and a 5N weight holder, and an adjustable rider.
- Console:
  - Metallic box. Strain gauge connector. Digital display for the strain gauge.
  - Amplifier: measuring range: +/-2mV/V., zero balancing adjustment.

Manuals: This unit is supplied with 8 manuals.
Dimensions and weights (approx.):
- Unit: 600 x 450 x 600 mm. Weight: 20 Kg.
- Electronic console: 300 x 190 x 130 mm. Weight: 2.5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MEGE.pdf

PRACTICAL POSSIBILITIES

1.- Introduction to the fundamentals of measuring with strain gauges.

2.- Study of the strain gauges and application techniques.

3.- Study of the strain and stress in a torsion system.

4.- Study of the strain and stress in a tension system and the elasticity modulus (Poisson's ratio and Young's modulus).

5.- Study of the strain and stress in a bending system.

6.- Calculation of the mechanical deformations under torsion, tension and bending.

7.- Study of the correlation between mechanical strain and electrical resistance in a strain gauge.

8.- Study of the tensile strain and stress in different materials and comparison of the elasticity modulus (Poisson's ratio and Young's modulus) of additional tension bars (optional accessories).

9.- Comparison of different strain measurement systems and how they could measure force.

7.5.1- General Strength of Materials

MFGE. **Unit for determining the Gauge Factor of Strain Gauges**

SPECIFICATIONS SUMMARY

The Unit for determining the Gauge Factor of Strain Gauges (MFGE) is used to measure deformation in a bar by means of a dial gauge and four strain gauges in full bridge configuration.The gauge factor is calculated through several measurements taken with the strain gauges.

Unit mounted on an metallic frame.

A bending bar:

- Material: stainless steel.
- Dimensions: 680 x 25 x 12 mm.
- The bar is supported on ball bearings at two points, allowing to apply a purely bending stress.
- It includes two strain gauges on the tension side and two strain gauges on the compression side in full bridge configuration:
  - Strain gauge measuring point: full bridge, 350Ω.

A mechanical load application device. It includes a spindle, a cross-arm and a flywheel.

Dial gauge with adjustable dial for direct deflection measurement, range: 0-20mm.

Electronic console (in separate metallic box), including:

- Strain gauge connector.
- Digital display for the strain gauge.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.):

- Unit: 700 x 400 x 500 mm. Weight: 25 Kg.
- Electronic console: 300 x 190 x 130 mm. Weight: 2.5 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/MFGE.pdf

PRACTICAL POSSIBILITIES

1.- Study of the fundamentals of measurement using strain gauges.

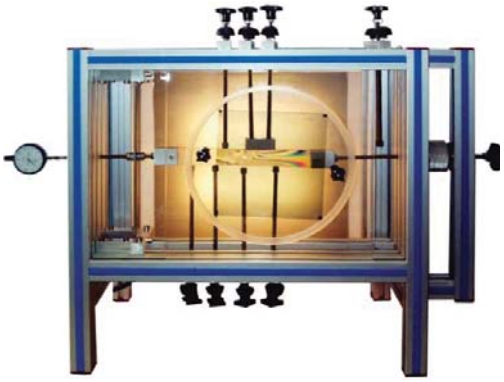
2.- Determination of the gauge factor of the strain gauges.

3.- Measurement of deflection in a bar using a dial gauge.

4.- Comparison of the experimental values obtained by the strain gauge with the experimental values obtained by the dial gauge.

7.5.2- Strength of Materials (Photoelasticity)

EFO. **Photoelasticity Unit**



EFO-K1. Kit of Static Test Specimens (basic kit)

SPECIFICATIONS SUMMARY

Unit for photoelasticity practices, illustrating the subjects of the Photoelasticity theory, the Elasticity theory, Strength of Materials, and Structure theory.

It is very suitable for the introduction and study of photoelasticity: optical elements, isochromatic, isoclinic, band order, band factor, edge tensionsing, etc.

Using this unit, photoelastic experiments and practices of transparent test specimens (models) may be performed.

Bench-top unit.

Anodized aluminum structure.

Light source, two fluorescent tubes of 30 cm and 8W.

Monochromatic light 35W.

Opalescent diffuser plate.

Double effect polarizing filters (linear polarization and circular polarization), of 30 x 30 cm and protected by methacrylate plates.

Load frame with pulling jack.

Dynamometric bar.

Comparator clock (millesimal indicator).

10 pressure screws and accessories.

This unit is supplied with the EFO-K1. Kit of Static Test Specimens (basic kit), formed by:

- N°3. Stepped Rectangular Specimen.
- N°4. Compact Circular Specimen.
- N°5. Circular with Orifice Specimen.
- N°9. Medium Rectangular Specimen.
- N°13. "C" Specimen.
- N°14. Specimen with Arch.
- N°17. Square with Diagonal Bar Specimen.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.):750 x 400 x 550 mm. Weight:20 Kg.

Additional and optional Test Specimens: (not included in the standard supply)

- -EFO-K2. Kit of Static Test Specimens (advanced kit).
- -EFO-K5. Kit of Articulated Structures.
- -EFO-K6. Kit of Dynamic Panels.

PRACTICAL POSSIBILITIES

1.- Introduction to photoelasticity: optical elements, isochromatic, isoclinic, band order, band factor, edge tension sign, etc.

2.- Determination of principal stress difference.

3.- Isochromatics.

4.- Illustration of the themes about elasticity, strength of materials and structures using photoelastic tests.

5.- Pure traction/optical-tensional law.

6.- Diametrically compressed disc.

7.- Ring with diametrical compression traction.

8.- Ring with diametrical compression.

9.- Plate with circular drill with traction.

10.- Comparison of the effects from different engraves in piece with traction.

11.- Pure traction in a piece with section linearly variable.

12.- Pure flexion.

13.- Simple flexion.

14.- Simple flexion, compound beams.

15.- Compound flexion.

16.- Compound central core of the section.

17.- Piece with a great curvature subjected to flexion.

18.- Arch built-in with a central charge.

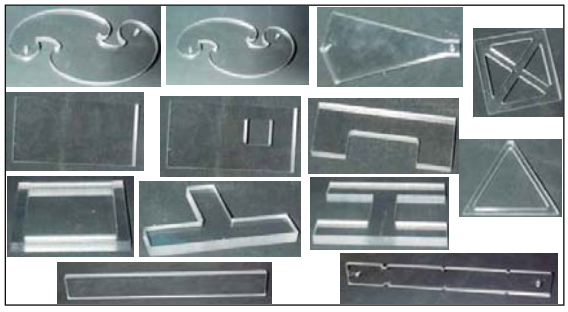
19.- Triangular structure.

20.- Comparison of the structures.

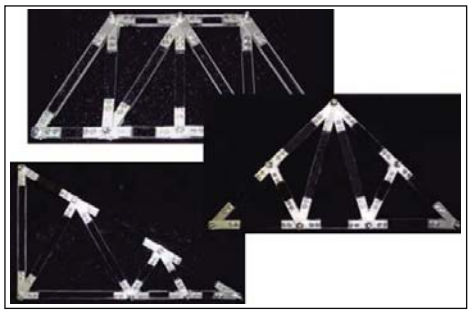
21.- Comparison of the effect of different notches.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/EFO.pdf

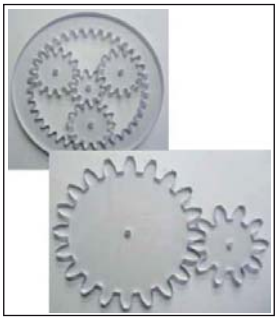
Additional and optional Test Specimens



EFO-K2. Kit of Static Test Specimens (advanced kit)



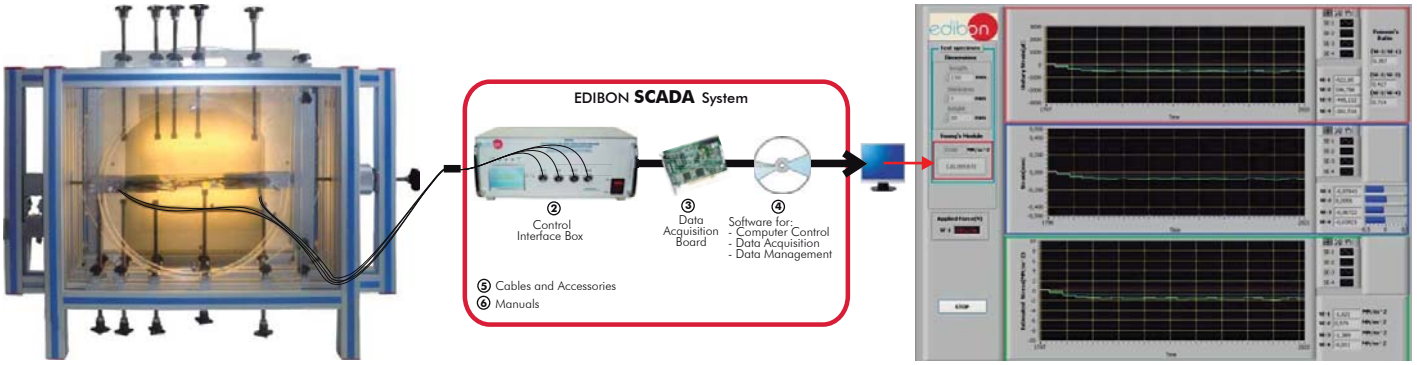
EFO-K5. Kit of Articulated Structures



EFO-K6. Kit of Dynamic Panels

7.5.2- Strength of Materials (Photoelasticity)

EFOC. **Photoelasticity Unit with Strain Gauges Measurement System**



① Unit: EFOC. Photoelasticity Unit with Strain Gauges Measurement System

SPECIFICATIONS SUMMARY

Items supplied as standard

① EFOC. Unit:

Unit for photoelasticity practices, illustrating the subjects of the Photoelasticity theory, the Elasticity theory, Strength of Materials, and Structure theory. It is very suitable for the introduction and study of photoelasticity: optical elements, isochromatic, isoclinic, band order, band factor, edge tensionsing, and for strain and stress analysis and measurement with strain gauges. With the aid of the SCADA system it is possible to analyze and process the captured data during test experiments, making measurements with strain gauges.

-EFO. Unit

Bench-top unit. Anodized aluminum structure. Light source, two fluorescent tubes of 30 cm and 8W. Monochromatic light 35W. Opalescent diffuser plate. Double effect polarizing filters (linear polarization and circular polarization), of 30 x 30 cm and protected by methacrylate plates. Load frame with pulling jack. 10 pressure screws and accessories.

This unit is supplied with:

-EFO-K1. Kit of Static Test Specimens (basic kit), formed by:

N°3. Stepped Rectangular Specimen. N°4. Compact Circular Specimen.
N°5. Circular with Orifice Specimen. N°9. Medium Rectangular Specimen.
N°13. "C" Specimen. N°14.Specimen with Arch.
N°17. Square with Diagonal Bar Specimen.

-EFO-K3. Kit of Test Specimens with Strain Gauges (basic kit), formed by:

N°7-G. Trapezoidal Specimen with strain gauges + N°7. Trapezoidal Specimen.
N°8-G. Big Rectangular Specimen with strain gauges + N°8. Big Rectangular Specimen.
N°19-G. "T" Beam Specimen with strain gauges + N°19. "T" Beam Specimen.

-EFOC-KIT.

Load cell for direct force measurement. Electronics, hardware and software for strain gauges measurement from PC, and direct force measurement applied to the specimens.

Additional and optional Test Specimens: (not included in the standard supply)

-EFO-K2. Kit of Static Test Specimens (advanced kit).
-EFO-K4. Kit of Test Specimens with Strain Gauges (advanced kit).
-EFO-K5. Kit of Articulated Structures.
-EFO-K6. Kit of Dynamic Panels.

② EFOC/V/CIB. Control Interface Box:

Metallic box. Sensors connectors. Main switch.

③ UDAB. USB Data Acquisition Board:

USB Data acquisition board (National Instruments). Bus USB. 8 Analog inputs. Sampling rate: 10 KS/s (Kilo samples per second). 2 Analog outputs. 12 Digital Inputs/Outputs.

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

Compatible with actual Windows operating systems. Control and Data Acquisition in real time. Management, processing, comparison and storage of data.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 750 x 400 x 550 mm. Weight: 22 Kg.
Control Interface: 310 x 220 x 180 mm. Weight: 3 Kg.

PRACTICAL POSSIBILITIES

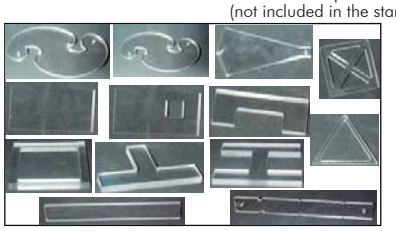
1.- Introduction to photoelasticity: optical elements, isochromatic, isoclinic, band order, band factor, edge tension sign, etc.
2.- Determination of principal stress difference.
3.- Isochromatics.
4.- Illustration of the themes about elasticity, strength of materials and structures using photoelastic tests.
5.- Pure traction/optical-tensional law.
6.- Diametrically compressed disc.
7.- Ring with diametrical compression traction.
8.- Ring with diametrical compression.
9.- Plate with circular drill with traction.
10.- Comparison of the effects from different engraves in piece with traction.
11.- Pure traction in a piece with section linearly variable.
12.- Pure flexion.
13.- Simple flexion.
14.- Simple flexion, compound beams.
15.- Compound flexion.
16.- Compound central core of the section.
17.- Piece with a great curvature subjected to flexion.
18.- Arch built-in with a central charge.
19.- Triangular structure.
20.- Comparison of the structures.
21.- Comparison of the effect of different notches.
22.- Strain and stress analysis and measurements with strain gauges using computer.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/EFOC.pdf

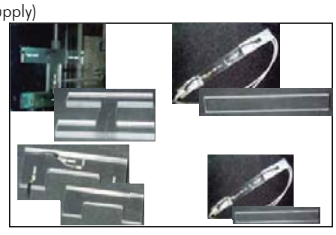
Test Specimens:
(always included with the EFOC unit)

EFO-K1. Kit of Static Test Specimens (basic kit)

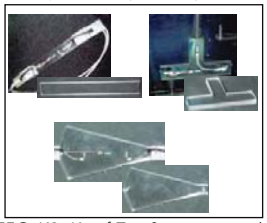
Additional and optional Test Specimens:
(not included in the standard supply)



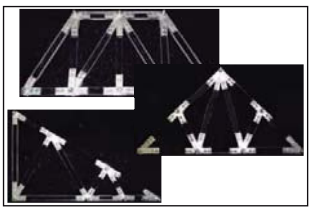
EFO-K2. Kit of Static Test Specimens (advanced kit)



EFO-K4. Kit of Test Specimens with Strain Gauges (advanced kit)



EFO-K3. Kit of Test Specimens with Strain Gauges (basic kit)

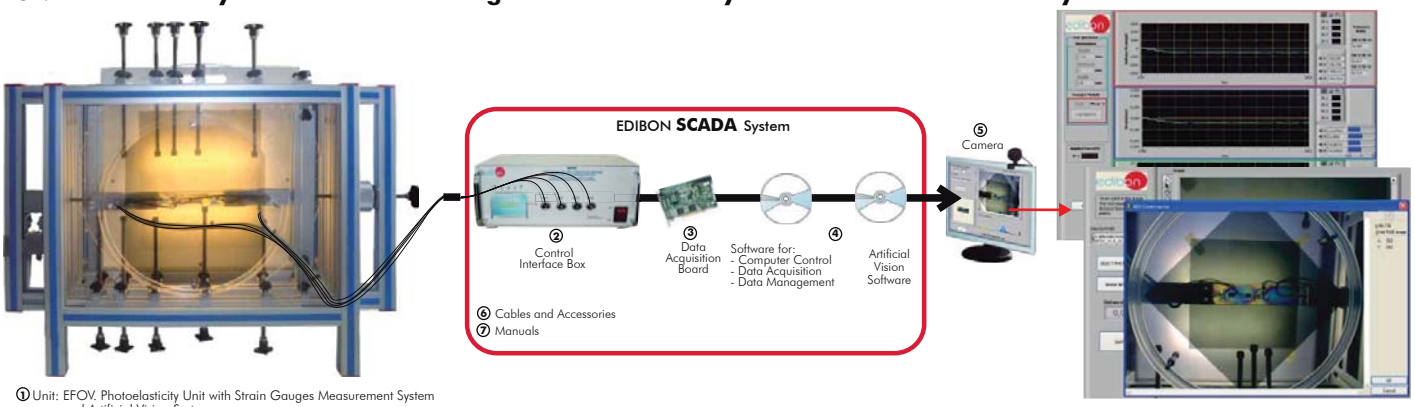


EFO-K5. Kit of Articulated Structures

EFO-K6. Kit of Dynamic Panels

7.5.2- Strength of Materials (Photoelasticity)

EFOV. **Photoelasticity Unit with Strain Gauges Measurement System and Artificial Vision System**



① Unit: EFOV. Photoelasticity Unit with Strain Gauges Measurement System and Artificial Vision System

SPECIFICATIONS SUMMARY

Items supplied as standard

① EFOV. Unit:

Unit for photoelasticity practices, illustrating the subjects of the Photoelasticity theory, the Elasticity theory, Strength of Materials, and Structure theory. It is very suitable for the introduction and study of photoelasticity: optical elements, isochromatic, isoclinic, band order, band factor, edge tensionsing, and for strain and stress analysis and measurement with strain gauges. With the aid of the SCADA system it is possible to analyze and process the captured data during test experiments, making measurements with strain gauges. The artificial vision software allows analyze and process the captured images during test experiments.

-EFO. Unit

Bench-top unit. Anodized aluminum structure. Light source, two fluorescent tubes of 30 cm and 8W. Monochromatic light 35W. Opalescent diffuser plate. Double effect polarizing filters (linear polarization and circular polarization), of 30 x 30 cm and protected by methacrylate plates. Load frame with pulling jack. 10 pressure screws and accessories.

This unit is supplied with:

-EFO-K1. Kit of Static Test Specimens (basic kit), formed by:

N°3. Stepped Rectangular Specimen. N°4. Compact Circular Specimen.
N°5. Circular with Orifice Specimen. N°9. Medium Rectangular Specimen.
N°13. "C" Specimen. N°14.Specimen with Arch.
N°17. Square with Diagonal Bar Specimen.

-EFO-K3. Kit of Test Specimens with Strain Gauges (basic kit), formed by:

N°7-G. Trapezoidal Specimen with strain gauges + N°7. Trapezoidal Specimen.
N°8-G. Big Rectangular Specimen with strain gauges + N°8. Big Rectangular Specimen.
N°19-G. "T" Beam Specimen with strain gauges + N°19. "T" Beam Specimen.

-EFOC-KIT.

Load cell for direct force measurement. Electronics, hardware and software for strain gauges measurement from PC, and direct force measurement applied to the specimens.

-EFOV-KIT.

Hardware and software for image acquisition and treatment.

Additional and optional Test Specimens: (not included in the standard supply)

-EFO-K2. Kit of Static Test Specimens (advanced kit).
-EFO-K4. Kit of Test Specimens with Strain Gauges (advanced kit).
-EFO-K5. Kit of Articulated Structures.
-EFO-K6. Kit of Dynamic Panels.

② EFOC/V/CIB. Control Interface Box:

Metallic box. Sensors connectors. Main switch.

③ UDAB. USB Data Acquisition Board:

USB Data acquisition board (National Instruments). Bus USB. 8 Analog inputs. Sampling rate: 10 KS/s (Kilo samples per second). 2 Analog outputs. 12 Digital Inputs/Outputs.

④ EFOV/CCSOF. Computer Control+ Data Acquisition+ Data Management Software + Artificial Vision Software:

Compatible with actual Windows operating systems. Control and Data Acquisition in real time. Management, processing, comparison and storage of data.

⑤ EFOV/CAM. Camera.

⑥ Cables and Accessories, for normal operation.

⑦ Manuals: This unit is supplied with 8 manuals.

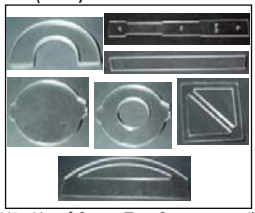
Dimensions (approx.) = Unit: 750 x 400 x 550 mm. Weight: 22 Kg. Control Interface: 310 x 220 x 180 mm. Weight: 3 Kg.

PRACTICAL POSSIBILITIES

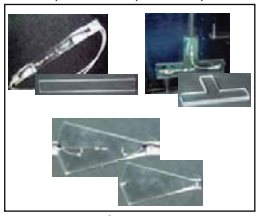
1.- Introduction to photoelasticity: optical elements, isochromatic, isoclinic, band order, band factor, edge tension sign, etc.
2.- Determination of principal stress difference.
3.- Isochromatics.
4.- Illustration of the themes about elasticity, strength of materials and structures using photoelastic tests.
5.- Pure traction/optical-tensional law.
6.- Diametrically compressed disc.
7.- Ring with diametrical compression traction.
8.- Ring with diametrical compression.
9.- Plate with circular drill with traction.
10.- Comparison of the effects from different engraves in piece with traction.
11.- Pure traction in a piece with section linearly variable.
12.- Pure flexion.
13.- Simple flexion.
14.- Simple flexion, compound beams.
15.- Compound flexion.
16.- Compound central core of the section.
17.- Piece with a great curvature subjected to flexion.
18.- Arch built-in with a central charge.
19.- Triangular structure.
20.- Comparison of the structures.
21.- Comparison of the effect of different notches.
22.- Strain and stress analysis and measurements with strain gauges using computer.
23.- Image acquisition and treatment with software.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/strengthmaterials/EFOV.pdf

Test Specimens:
(always included with the EFOV unit)

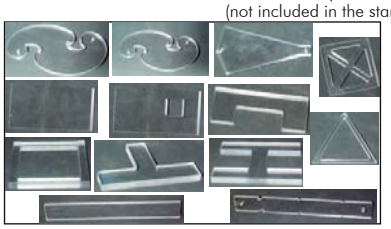


EFO-K1. Kit of Static Test Specimens (basic kit)

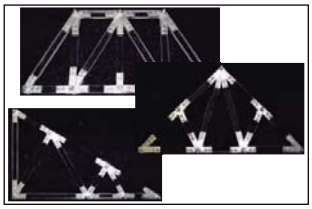


EFO-K3. Kit of Test Specimens with Strain Gauges (basic kit)

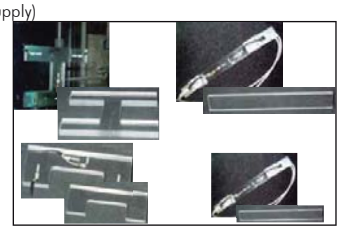
Additional and optional Test Specimens:
(not included in the standard supply)



EFO-K2. Kit of Static Test Specimens (advanced kit)



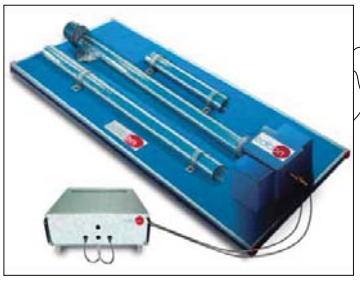
EFO-K5. Kit of Articulated Structures



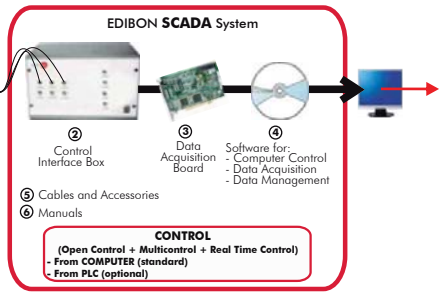
EFO-K4. Kit of Test Specimens with Strain Gauges (advanced kit)

EFO-K6. Kit of Dynamic Panels

TIAC. Computer Controlled **Acoustic Impedance Tube/Acoustic Insulation Test Unit**



① Unit: TIAC. Acoustic Impedance Tube/ Acoustic Insulation Test Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① TIAC. Unit:
This unit has been designed to provide students with an easy and simple method for understanding and investigating the relative acoustic properties of several materials.
Anodized aluminum structure and panel of painted steel. Diagram in the front panel with similar distribution to the elements in the real unit.
An acoustics standing wave unit driven by two loudspeakers and a separate console mounted power amplifier.
A small microphone travelling in the transparent plastic tube allows the acoustic signal to be fed to the console mounted microphone amplifier.
The transparent plastic tube combine with a scale and marker allow the microphone axial position to be measured.
Wide range of tested samples allow a wide range of tests on differing materials.
The units is very useful for the teaching of students in different areas as: Sound and Vibration, Mechanical, Aeronautical, Building, Health and Safety, etc.

② TIAC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any time and in a real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Express Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s. 2 Analog outputs. 24 Digital Inputs/Outputs.

④ TIAC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =Unit: 1500 x 500 x 200 mm. Weight: 10 Kg. Control Interface : 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/building/TIAC.pdf

PRACTICAL POSSIBILITIES

1.- Study and investigation of the relative acoustic properties of different materials.
2.- Determination of the sound absorption coefficient for many of the normal building lining materials such as carpet, cork, fibre board and many of the better acoustic attenuating materials.
3.- To determine the speed of sound in air at ambient temperature and comparison of this with the calculated value.
4.- Determine the sound absorption coefficient of the these and some poor absorbers at a range of frequencies between approximately 500 and 4000 Hz.

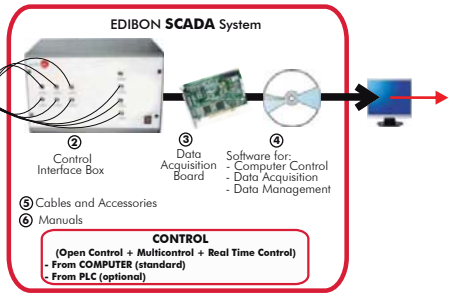
Other possible practices:

5.- Sensors calibration.

6-24.- Practices with PLC

TDRC. Computer Controlled **Noise Control Demonstration Unit**

① Unit: TDRC. Noise Control Demonstration Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① TDRC. Unit:
Self-contained unit for the demonstration of the methods of noise and vibration control.
Anodized aluminum structure. Diagram in the front panel with similar distribution to the elements in the real unit.
Integral 240 V. electric motor and gear box together with a fan (12 V.) unit provide two noise sources.
Variable control of both voltage sources allows speed control of both motors.
A rigid reinforced enclosure with acoustic lining may be placed over either noise source attachements allow investigation of sound attenuation in ducts. Openings in both ends of the box allow demonstration of the effects of small holes in the enclosure and the transmission of mechanical and aerodynamically generated noise along ducts.
Two microphones are provided, one fixed adjacent to the noise source and the other mounted on the wand that may be moved around over the unit. Each of the two microphones may be connected to a dBA filter and amplifier that illuminates a bar display in the panel, to show relative loudness levels. Resilient mountings and mount bypass equipment. These allow study variation of vibration modes at various frequencies and transmission of noise through solids.

② TDRC/CIB. Control Interface Box :
With process diagram in the front panel. The unit control elements are permanently computer controlled. Simultaneous visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process. Real time curves representation. All the actuators' values can be changed at any time from the keyboard. Shield and filtered signals to avoid external interferences. Real time control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Open control allowing modifications, at any time and in a real time, of parameters involved in the process. 3 safety levels: mechanical in the unit, electronic in control interface, and the third one in the control software.

③ DAB. Data Acquisition Board:
PCI Express Data acquisition National Instruments board to be placed in a computer slot. 16 Analog inputs. Sampling rate up to: 250 KS/s . 2 Analog outputs. 24 Digital Inputs/Outputs.

④ TDRC/CCSOF. Computer Control+Data Acquisition+Data Management Software:
Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) =Unit: 950 x 600 x 410 mm. Weight: 40 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/building/TDRC.pdf

PRACTICAL POSSIBILITIES

1.- Demonstration of noise and vibration control.
2.- Attenuation of mechanical or aerodynamic noise source using a rigid enclosure and combining this with an absorbent acoustic lining.
3.- Rapid degeneration in effectiveness of the enclosure method, due to minor imperfections in construction.
4.- The transmission of noise along ducts and methods of attenuation using acoustic linings.
5.- The transmission of noise along solid paths and he methods of reduction by isolation.
6.- Rigid body modes of vibration of a resiliently mounted source and the effects of mass variation on the resonant frequencies and modes of vibration.
7.- The effect of the noise frequency on the effectiveness of attenuation methods.

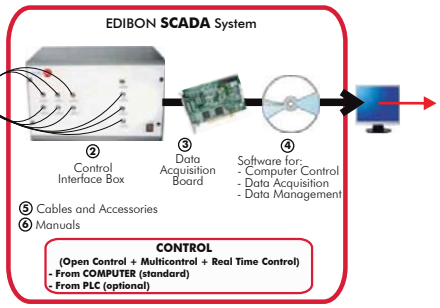
Other possible practices:

8.- Sensors calibration.

9-27 .-Practices with PLC.

TEVC. Computer Controlled **Ventilation Trainer**

① Unit:TEVC. Ventilation Trainer



SPECIFICATIONS SUMMARY

Items supplied as standard

①TEVC. Unit:

This ventilation training unit enables students to study basic airflow and fluid mechanics as well as process of commissioning and balancing a multiducted air distribution system.

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

Variable speed centrifugal fan, computer controlled. Rectangular air intake and filter holder.

The fan discharges into a 200 mm diameter steel duct and this connects to distribution ductwork. Connections and ductwork are manufactured in steel and may be connected in different forms. The ductwork is supported from air distribution isolation mounts hung on steel pedestals linked towether.

Necessary components are supplied with the unit to enable parallel branch and line balancing experiments to be undertaken.

Air power supply points are provide that may be balanced on the assembled unit to supply a range of airflows. Pressure sensors. Flow sensors. Pitot static tube.

②TEVC/CIB. Control Interface Box:

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

③DAB. Data Acquisition Board:

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

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤Cables and Accessories, for normal operation.

⑥Manuals: This unit is supplied with 8 manuals.

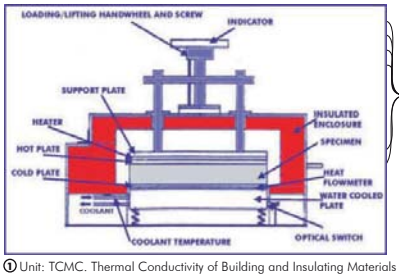
Dimensions (approx.) =Unit: 10000 x 3000 x 2000 mm. Weight: 300 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/building/TEVC.pdf

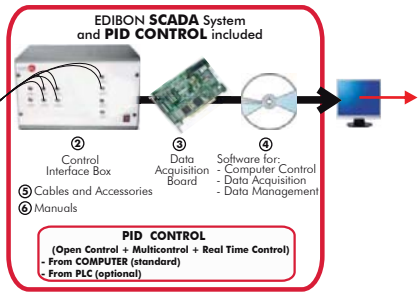
PRACTICAL POSSIBILITIES

1.- Examination of typical components, fabrication, installation and assembly techniques used in air handling systems.
2.- Investigation of pressure losses in beds, branches, changes of section and over straight lengths of duct, together with the variation in pressure drop with velocity.
3.- Measurement of air flow rate using pitot-static traverse, orifice pressure differential and anemometer methods.
4.- Examination of standard types of panel an bag filters and their pressure drop against face velocity.
5.- Determination of the "k" factor for the pressure loss of the above components in each particular configuration.
6.- Investigation of the fan pressure and volume flow characteristics at various supply voltages.
7.- Balancing of air flow distribution in a series or two branch parallel distribution system using either main damper or fan speed flow control.
8.- Allows an additional parallel branch and two diffusers to be investigated.
9.- Addition of the ductwork leakage test set allows students to carry out commissioning leak testing on the above components.
10.- Allows an additional tee branch and two diffusers to be investigated.
11.- Sensors calibration.
12-30.- Practices with PLC.

TCMC. Computer Controlled **Thermal Conductivity of Building and Insulating Materials Unit**



① Unit: TCMC. Thermal Conductivity of Building and Insulating Materials Unit



SPECIFICATIONS SUMMARY

Items supplied as standard

① TCMC. Unit:

Computer Controlled unit for determination of thermal conductivity of building materials and other insulating materials. Specimens are placed between a heated plate and a water cooled plate, maximum specimen thicknesses of 75mm, maximum hot plate temperature 70° C. Bench-top unit with metallic structure.

Measurement of thermal conductivity for materials with thermal resistance in the range 0.1 to 1.4 m^2K/W. Suitable for sheet, fibrous, granular and cellular materials. Suitable for soft, rigid, and semi-rigid materials. Suitable for homogeneous and non-homogeneous materials. Thermally insulated enclosure. PID controlled (hot) plate electrical heater. Water cooled cold plate and heat flux meter. Loading/lifting handwheel and screw. Optical switch under the cold plate senses the compression of loading springs to ensure that a consistent pressure is applied to the specimen. Heat flux sensor, flitted to cold plate. Temperature sensors, located in different points of the unit, for the cooling water, for surface temperature, etc. A set of specimens, 8 pieces.

② TCMC/CIB. Control Interface Box:

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

③ DAB. Data Acquisition Board:

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

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

Flexible, open and multicontrol software. Management, processing, comparison and storage of data. Sampling velocity up to 250 KS/s (kilo samples per second). It allows the registration of the alarms state and the graphic representation in real time.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals: This unit is supplied with 8 manuals.

Dimensions (approx.) = Unit: 950 x 700 x 500 mm. Weight: 60 Kg. Control Interface: 490 x 330 x 310 mm. Weight: 10 Kg.

More information in: www.edibon.com/products/catalogues/en/units/mechanicsmaterials/building/TCMC.pdf

PRACTICAL POSSIBILITIES

1.- Determination of the thermal conductivity of different materials.
2.- Determination of the thermal resistance.
3.- Thermal conductivity of several specimens connected in series.
4.- Industrial research capability.

Other possible practices:

5.- Sensors calibration.

6-24.- Practices with PLC.