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Units
7.-Mechanics & Materials

INTRODUCTION

When a vehicle takes a curve, the external wheel must travel a greater distance than the internal wheel. The shaft is divided to enable the wheels of a same shaft have different speeds, guaranteeing the coupling of both parts with the differential.

It is difficult for many students to visualize the action of a differential when used to provide a drive from the gearbox to each shaft, allowing at the same time an independent motion between the shafts.

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

GENERAL DESCRIPTION

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.

When the vehicle is travelling in a straight line, the differential must behave as if it were rigid and make both wheels rotate at the same speed. It means that in this situation the sun gears do not spin around their own axis, in other words, they act as wedges to transmit the motion of the crown.

Therefore, the differential allows to provide the torque to either both wheels or only one wheel. When both wheels have the same load the differential supplies the same torque to both of them, but when one of them supports a greater load than the other, then motion is distributed uniformly.

This unit consists of:

- An input pinion.
- A crown-wheel.
- Three gears, named sun gears.
- Two gears coupled to the shafts of the wheels, named planetary gears.
- Three pulleys with protractor.

The input pinion transfers the power to the crown. That motion of the crown drives the sun gears and they, rotating together with the crown-wheel, transfer the power to the planetary gears. The planetary gears at the same time transfer the power to the output shafts, allowing them to rotate at the same or different speed.



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



European Union Certificate
(total safety)



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



Worlddidac Quality Charter
Certificate and
Worlddidac Member

SPECIFICATIONS

The MDC unit is mounted on a frame consisting of aluminum profiles with panel made of painted steel, 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.

The MDC unit includes a differential group consisting of:

- Input pinion ($Z = 21$).
- Crown-wheel ($Z = 63$).
- 3 sun gears ($Z = 16$).
- 2 planetary gears ($Z = 32$).

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 "B" type are required. (See "required accessories" section).

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

EXERCISES AND PRACTICAL POSSIBILITIES

- | | |
|--|---|
| 1.- Determination of the input and output speed ratio and the torque distribution. | 4.- Visualization and demonstration of the behaviour of a differential when used as a means to provide a drive. |
| 2.- Study of the efficiency. | 5.- Verification of the gear ratio. |
| 3.- Study of the use of a differential as a simple transmission system. | |

DIMENSIONS & WEIGHT

-Dimensions: 450 x 350 x 700 mm. approx. (17.72 x 13.78 x 27.55 inches approx.). -Weight: 17Kg. approx. (37.4 pounds approx.).

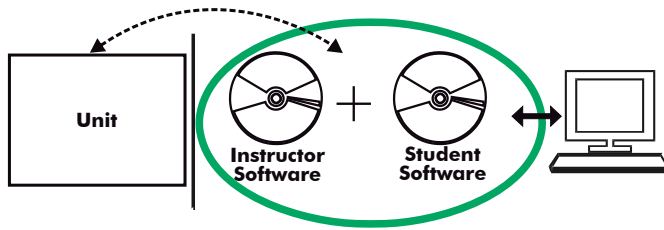
REQUIRED ACCESSORIES

- 3 Sets of weights "B type" (set B).

Each "B type" set is composed of:

- 6 weights of 200 gr. (0.44 pounds approx.)
- 6 weights of 100 gr. (0.22 pounds approx.)
- 2 weights of 50 gr. (0.11 pounds approx.)
- 2 weights of 20 gr. (0.044 pounds approx.)
- 2 weights of 10 gr. (0.022 pounds approx.)
- 1 support hook of 100 gr. (0.22 pounds approx.)

MDC/CAI. Computer Aided Instruction Software System:



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

Example of software screens

Instructor Software

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

The Instructor can:

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

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



MDC/SOF. Computer Aided Instruction Software (Student Software):

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

- This software contains:

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

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

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

Exams: set of questions to test the obtained knowledge.

Student Software



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

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

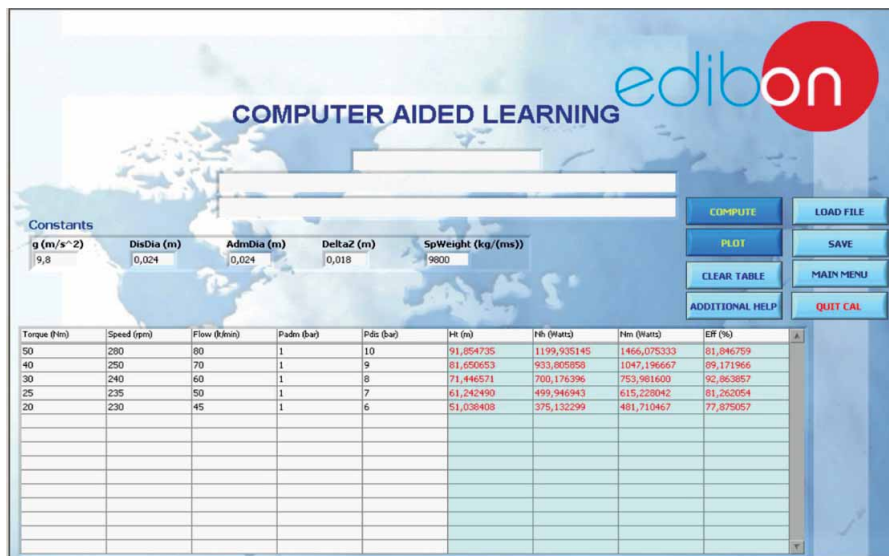
This Computer Aided Learning Software (Results Calculation and Analysis) "CAL" is a Windows based software, simple and very easy to use, specifically developed by EDIBON.

CAL is a class assistant that helps in doing the necessary calculations to extract the right conclusions from data obtained during the experimental practices. With a single click, CAL computes the value of all the variables involved and performs the calculations.

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

Available different plotting displays.

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



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

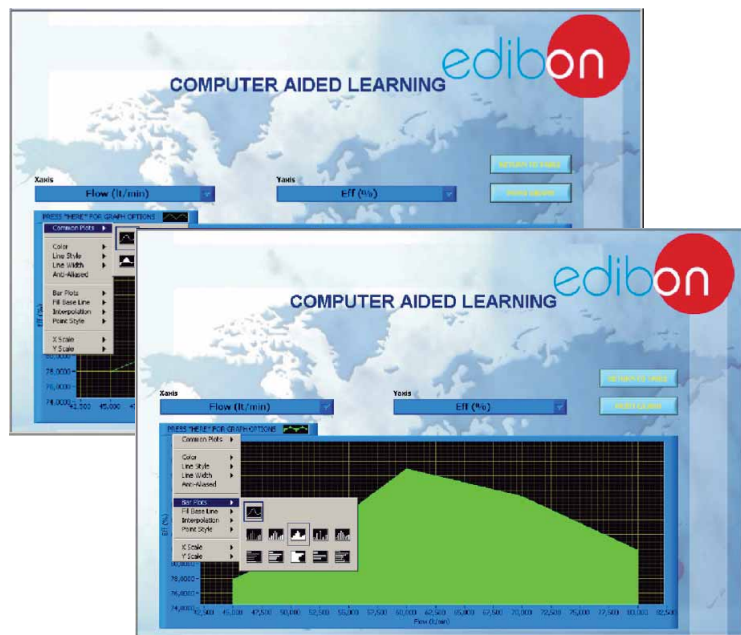
Above this table, it is shown "Constants" theoretically involved with the field of study. The values of these "Constants" may be modified to our convenience, assigning the appropriate values.

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

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

Also we can load any data file saved previously.

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



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

General		
CONSTANTS		
SI base units		
Name	Symbol	Quantity
metre	m	Length
kilogram	kg	Mass
second	s	Time
ampere	A	Electrical current
kelvin	K	Thermodynamic temperature
mole	mol	Amount of substance
candela	cd	Luminous intensity
SI-Prefixes		
Name	Symbol	Factor
yotta	Y	10 ²⁴
zetta	Z	10 ²¹
exa	E	10 ¹⁸
peta	P	10 ¹⁵
tera	T	10 ¹²
giga	G	10 ⁹
mega	M	10 ⁶
kilo	k	10 ³
hecto	h	10 ²
deca	da	10 ¹
deci	d	10 ⁻¹
centi	c	10 ⁻²
milli	m	10 ⁻³
micro	μ	10 ⁻⁶
nano	n	10 ⁻⁹
pico	p	10 ⁻¹²
femto	f	10 ⁻¹⁵
atto	a	10 ⁻¹⁸
zepto	z	10 ⁻²¹
yocto	y	10 ⁻²⁴

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

*Specifications subject to change without previous notice, due to the convenience of improvements of the product.



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REPRESENTATIVE:

