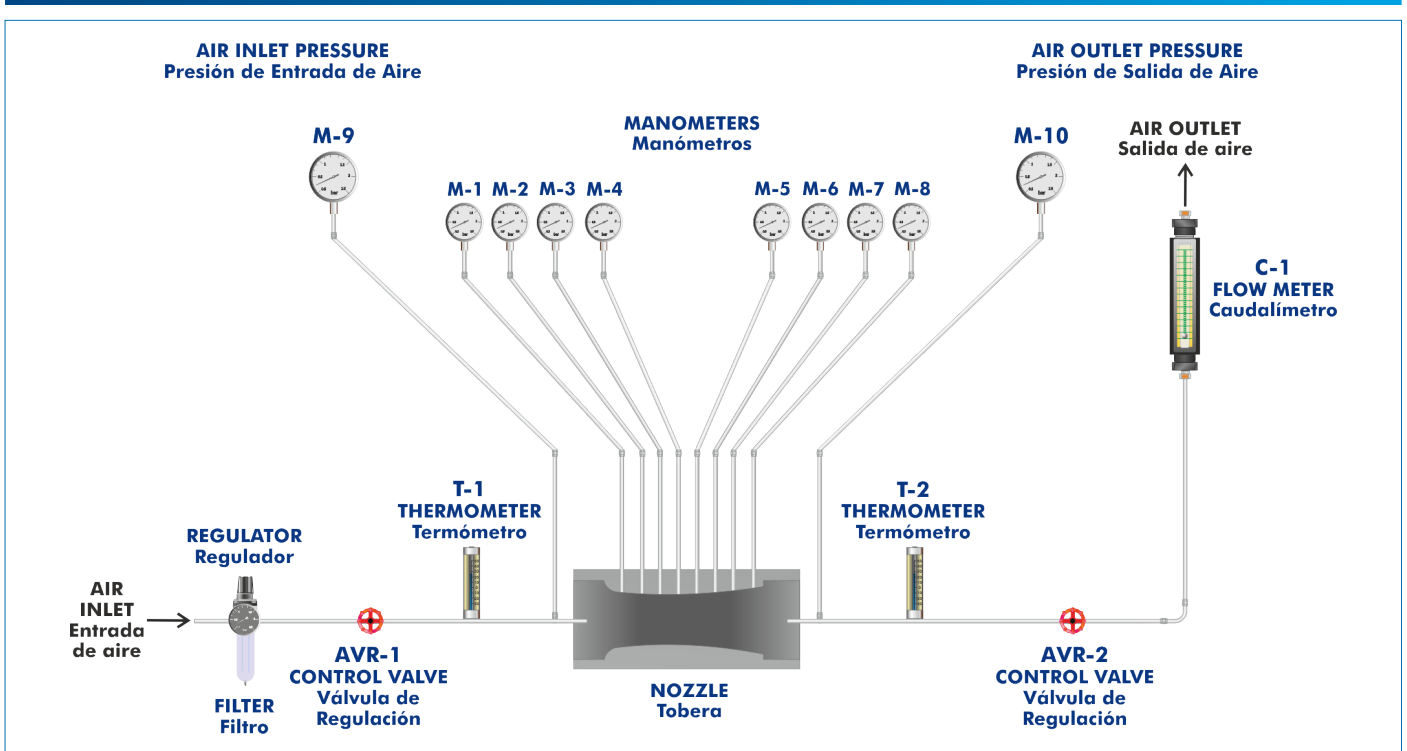




## PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)



European Union Certificate (total safety)



Certificates ISO 14001 and ECO-Management and Audit Scheme (environmental management)



"Worlddidac Quality Charter" and Platinum Member of Worlddidac

## INTRODUCTION

Nozzles are suitably shaped openings in which a fluid is accelerated while its pressure decreases. If the fluid is compressible (e.g. a gas or vapour), very high velocities can be obtained, with fairly moderate pressure ratios.

Nozzles are extremely important components in a wide variety of engineering applications, for instance: turbines, jet propulsion, rockets and ejectors, etc.

The Nozzle Pressure Distribution Unit, "TPT", has been designed to demonstrate the phenomena associated to fluxes through nozzles and to allow the students investigating quickly the pressure distribution in them. Besides, it allows the investigation of the mass flow rate through convergent-divergent and convergent nozzles.

## GENERAL DESCRIPTION

The Nozzle Pressure Distribution Unit, "TPT", allows to investigate the pressure distribution and the mass flow rate in nozzles (convergent-divergent and convergent nozzles).

The unit includes three types of nozzles:

- Convergent type (conical) nozzle, with six pressure tapings.

- Convergent - divergent nozzle, with five pressure tapings.

- Convergent - divergent nozzle, with eight pressure tapings.

The nozzles are made of brass and have been mechanized accurately. Several pressure tapping are available, being each one connected to its own manometer.

Compressed air supplied from an external service must be provided to the unit. This air passes through an air filter and pressure regulator to provide constant pressure, clean and water free air to the unit.

In the unit, the air passes through a control valve, which allows an accurate control of the pressure at the inlet of the nozzle. The inlet pressure and inlet temperature are measured and then the air is expanded through the chosen nozzle. When discharging from the nozzle, the pressure is controlled by other valve, and finally the air goes through a flowmeter to the atmosphere. The outlet pressure and outlet temperature are measured before the air passes through the flowmeter.

The unit includes ten manometers: two manometers to indicate the inlet and outlet pressure of the air and the rest to indicate the pressure on the measuring points of the nozzles.

Two thermometers to indicate the air temperature are included.

## SPECIFICATIONS

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

The unit includes three types of nozzles, which can be changed quickly and easily:

- Convergent type (conical), with six pressure tapings.

- Convergent - divergent type, with five pressure tapings, for a design pressure ratio of 0.25.

- Convergent - divergent, with eight pressure tapings, for a design pressure ratio of 0.1.

Two control valves to provide an accurate control of the air pressure at the inlet and at the outlet as well.

Two manometers with a diameter of 100 mm, with a manometric pressure range from 0 to 10 bar, to indicate the inlet and outlet pressure of the air.

Eight manometers of 63 mm diameter, with a manometric pressure range from -1 to 9 bar, to indicate the pressure on the measuring points of the nozzle.

Two thermometers, from 0 °C to 60 °C, to indicate the air temperature before and after the nozzle.

Variable area flowmeter to indicate airflow in standard conditions (correction factors for other pressures and temperatures are provided).

Air filter and pressure regulator to provide constant pressure, clean and water-free air to the unit.

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



TPT detail

## EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Study of the flow in a convergent - divergent nozzle.
  - 2.- Study of the flow in a convergent nozzle.
  - 3.- Visual demonstration of the choking effect.
  - 4.- Visual demonstration of the pressure distribution.
  - 5.- Visual demonstration of the counter - pressure on the recompression position.
  - 6.- Determination of the inlet pressure effect on the mass flow rate with a constant counter - pressure and comparison with the theoretical predictions.
  - 7.- Determination of the counter-pressure effect on the mass flow rate.
  - 8.- Observation of the pressure distribution in nozzles.
- Other practical possibilities:
- 9.- Visual demonstration of under expansion and over expansion with re-compression.
  - 10.- Investigation of the relationship between inlet pressure and mass flow rate.
  - 11.- Investigation of the relationship between outlet pressure and mass flow rate for a convergent nozzle.
  - 12.- Investigation of the relationship between outlet pressure and mass flow rate for convergent - divergent nozzles.
  - 13.- Investigation of the pressure distribution in convergent and convergent - divergent nozzles when working over a variety of overall pressure ratios.
  - 14.- Study of the effect of air temperature at the nozzles inlet and outlet.

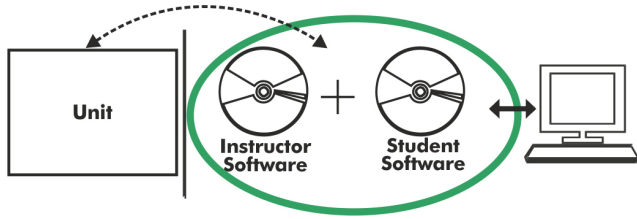
### REQUIRED SERVICES

- Clean and dry compressed air between 7 and 9 bar.

### DIMENSIONS AND WEIGHTS

- TPT:
- Dimensions: 800 x 500 x 850 mm approx.  
(31.50 x 19.68 x 33.46 inches approx.)
  - Weight: 50 Kg approx.  
(110 pounds approx.)

**TPT/ICAI. Interactive Computer Aided Instruction Software:**



With no physical connection between unit and computer, this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

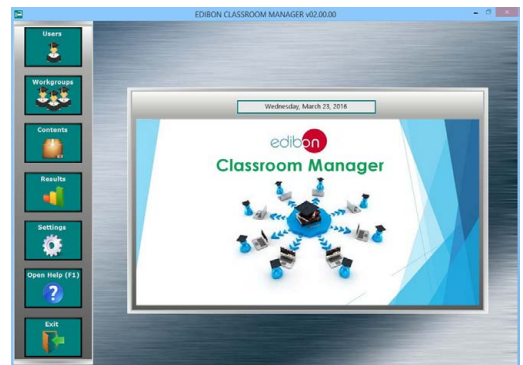
Instructor Software

**- ECM-SOF. EDIBON Classroom Manager (Instructor Software).**

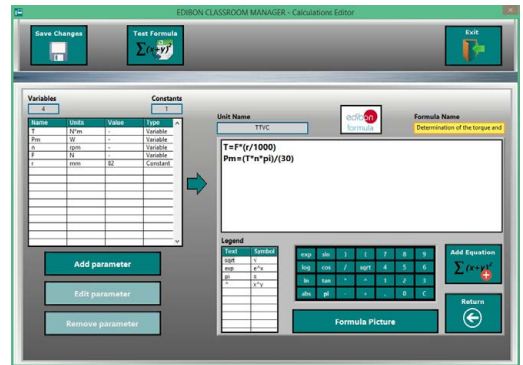
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

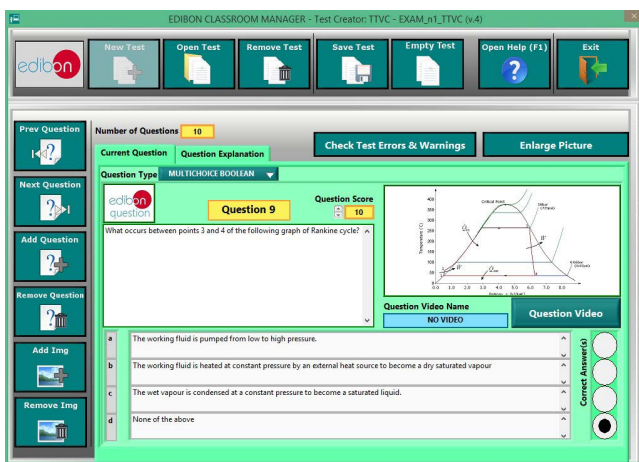
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.



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



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



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



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

Optional  
Student Software

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

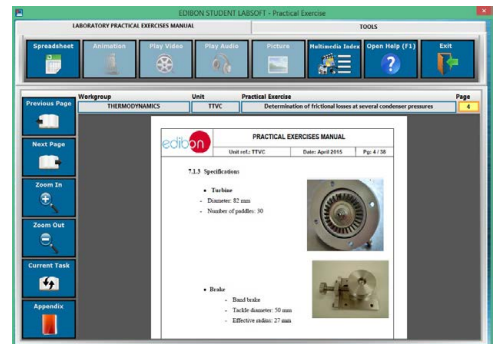
Innovative features:

- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- Test self-correction.
- Calculations computing and plotting.
- Equation System Solver Engine.
- User Monitoring Learning & Printable Reports.
- Multimedia-Supported auxiliary resources.

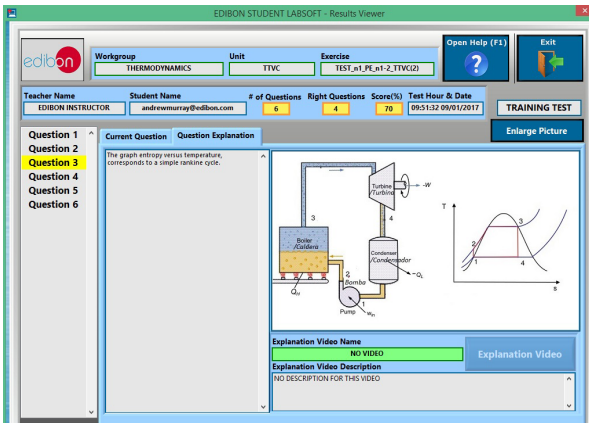
For more information see ICAI catalogue. Click on the following link:  
[www.edibon.com/en/interactive-computer-aided-instruction-software](http://www.edibon.com/en/interactive-computer-aided-instruction-software)



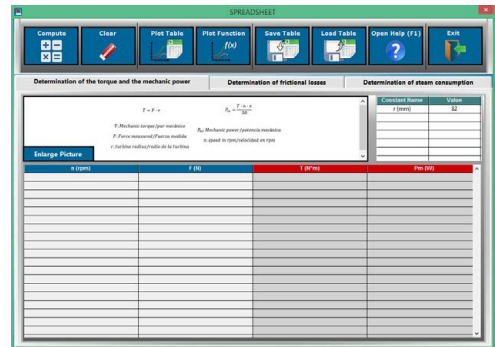
ESL-SOF. EDIBON Student LabSoft (Student Software)  
Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

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



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REPRESENTATIVE:

