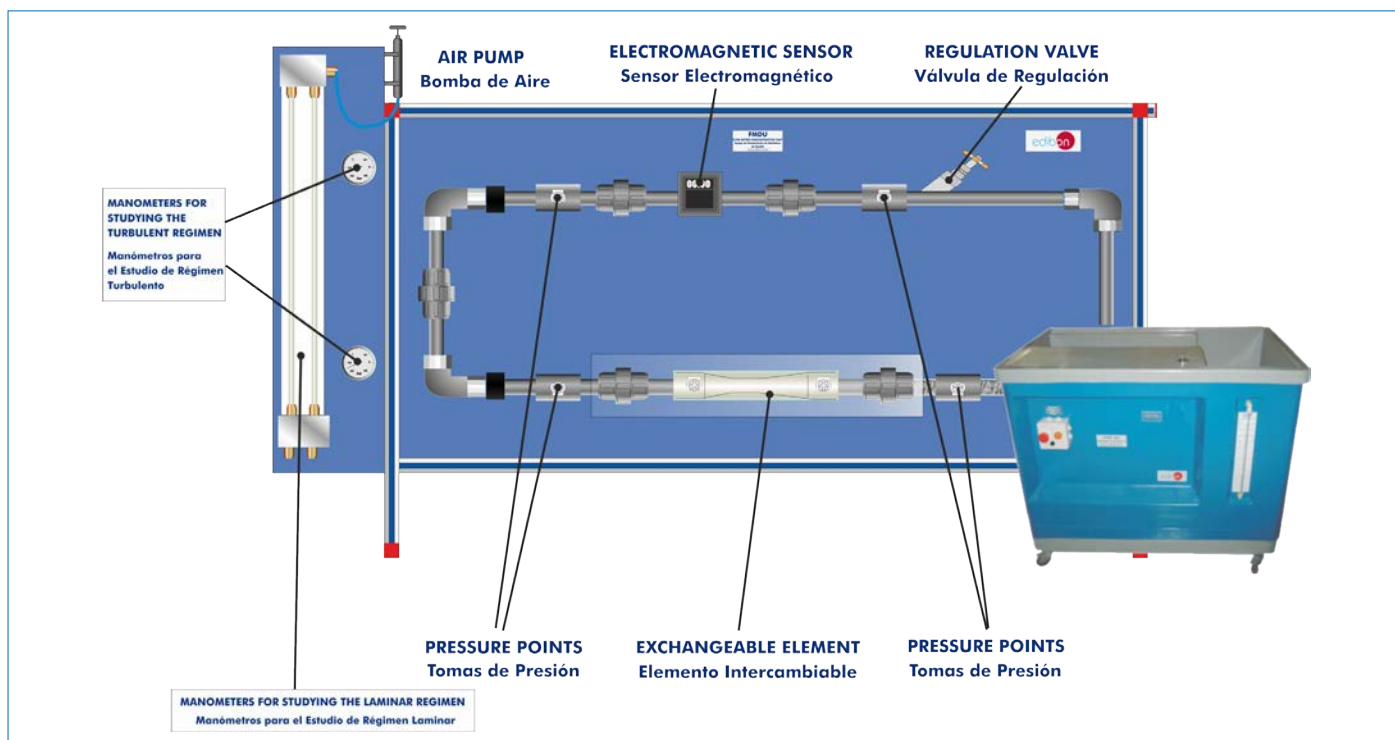




PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



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

Water measurement is the quantification of the flow of water passing through the cross-section of a river, channel or pipeline. It is also known as water gauging.

This water measurement results from the need to provide greater control over its use and distribution. This measurement is carried out with flow meters. They are devices that use different mechanical or physical principles to quantify a flow of water.

The flow is determined for various purposes: water supply systems, irrigation works, drainage systems studies, hydroelectric power plants, etc.

GENERAL DESCRIPTION

The Flow Meters Demonstration Unit, "FMDU", designed by EDIBON demonstrates the important characteristics of fifteen types of flow meters used in the measurement of water flow through pipes or open channels.

The main elements are a service module (Hydraulics Bench), flow meters and flow meters support structure.

A centrifugal pump draws water from the sump tank in the Hydraulics Bench and delivers it to a flow meter test pipe. Flow meters mounted in pipes can be fitted into the unit test zone quickly and easily. These meters give a variety of different measuring principles and degrees of accuracy.

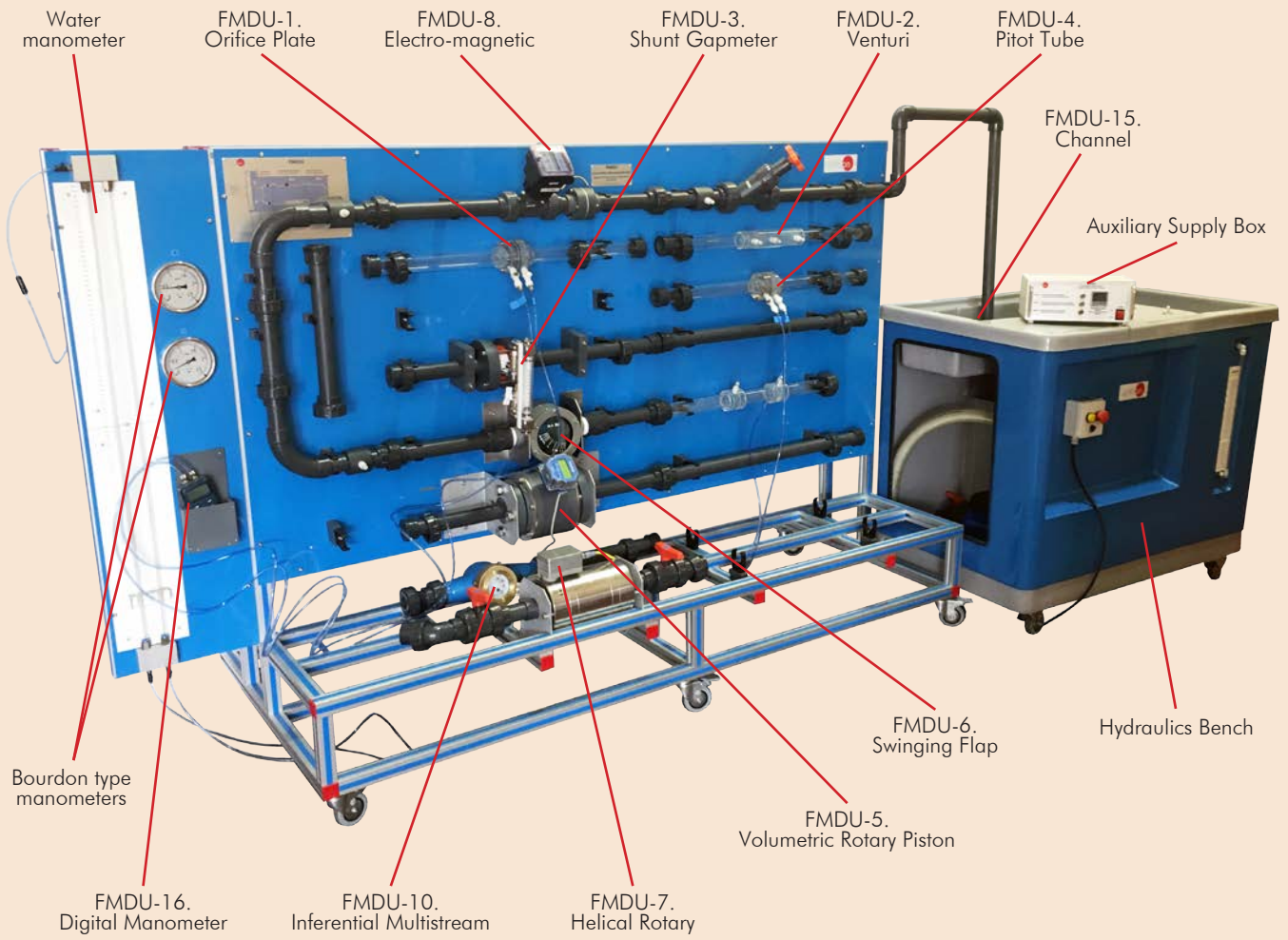
By using a water manometer or two Bourdon type manometers the pressure drop across each of the flow meter can be measured. Valves ensure rapid bleeding of all manometer pipework.

A channel (FMDU-15) accommodates the Broad Crested Weir (FMDU-11) , the Crump Weir (FMDU-12) and the Sharp Crested Weirs (FMDU-18), also the "H" Flume (FMDU-13) and Washington Flume (FMDU-14). By using the Hook and Point Gauge (FMDU-17) the levels in the channel can be determined.

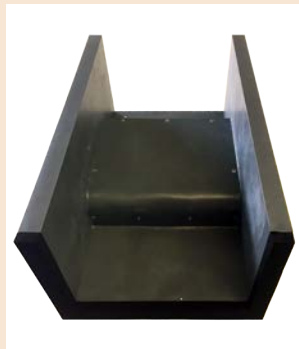
Water discharging from the flow meter on test is collected in the volumetric tank (in the Hydraulics Bench) where the flow may be determined absolutely. This tank is stepped to accommodate low or high flow rates and incorporates a stilling baffle to reduce turbulence. A level tube with a scale shows the water level. Water is returned to the sump tank by a dump valve.

DETAIL OF THE COMPLETE UNIT

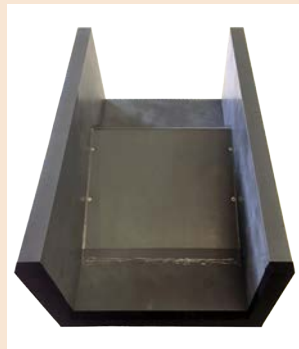
The Flow Meters Demonstration Unit, "FMDU", includes:



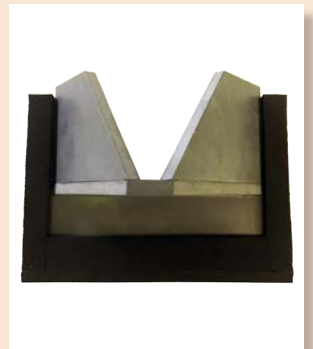
FMDU-9. Current Velocity Meter



FMDU-11. Broad Crested Weir



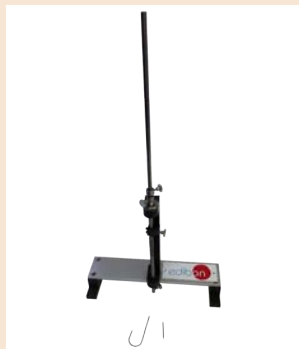
FMDU-12. Crump Weir



FMDU-13. "H" Flume



FMDU-14. Washington Flume



FMDU-17. Hook and Point Gauge



FMDU-18. Sharp Crested Weirs



Auxiliary Supply Box

SPECIFICATIONS

FMDU. Unit: (complete version)

A self-contained unit to demonstrate the characteristics of flow meters used in measurement of water flow through pipes or open channels.

Anodized aluminum frame and panels made of painted steel.

The unit includes wheels to facilitate its mobility.

Main metallic elements made of stainless steel.

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

Pipe circuit, including:

Flow regulation valve.

Several pressure measurement tapings.

Air entrainment device.

Flexible pipe to connect to the Hydraulics Bench.

Additional pipes to change the pipe circuit configuration.

Water manometer of 1 m length and two Bourdon type manometers from 0 – 2.5 bar, precision 1%, to measure the pressure drop.

Flow meters are mounted in pipes that can be fitted into the unit test zone quickly and easily.

Auxiliary Supply Box (for FMDU-7, FMDU-5 and FMDU-8).

Quick and easy removal of pipes with test flow meters for evaluation and inspection.

Meters can be used independently to support research or student project work.

Hydraulics Bench:

Mobile hydraulic bench, made in polyester reinforced with fibreglass, and mounted on wheels for mobility.

Centrifugal pump, 0.55 kW, 2.5 Bar, 150 l/min., single phase 220 V/50 Hz or 110 V/60 Hz. Pump breaker starting.

Sump tank capacity: 165 l.

Small channel: 8 l.

Flow measurement: volumetric tank, gauged from 0 – 7 l for low flow values and from 0 – 40 l for high flow values.

Remote hand-operating dump valves in the base of the volumetric tank.

Level tube with a scale that shows the water level in the upper tank.

Flow stilling baffle for reducing the turbulence rate.

Manufactured with corrosion resistant materials ensuring a long life of the unit. Safety and contact light.

Elements included:

FMDU-1. Orifice Plate:

Made of transparent methacrylate.

Pipe diameter D1: 35 mm.

Orifice diameter D2: 20 mm.

Area 1 = $9.079 \times 10^{-4} \text{ m}^2$. Area 2 = $3.14 \times 10^{-4} \text{ m}^2$.

FMDU-2. Venturi:

Made of transparent methacrylate.

Diameter h1: 32 mm. Diameter h2: 20 mm. Diameter h3: 32 mm.

Distance between h1 and h2: 67.5 mm. Distance between h2 and h3: 87.5 mm.

Area 1 = $8.04 \times 10^{-4} \text{ m}^2$. Orifice diameter: 20 mm. Area 2 = $3.14 \times 10^{-4} \text{ m}^2$.

Upstream narrowing: 14°.

Downstream narrowing: 21°.

FMDU-3. Shunt Gage:

Made of steel.

Range: 0 – 20 m³/h.

FMDU-4. Pitot Tube:

Made of transparent methacrylate.

Pipe diameter: 35 mm.

FMDU-5. Volumetric Rotary Piston:

Precision: +/- 0.8%.

Repeatability: +/- 0.3%.

Measurement range: 30/1800 l/h.

FMDU-6. Swinging Flap:

Pipe Dn40 flowmeter.

Range: 1 – 12 m³/h.

FMDU-7. Helical Rotary:

Made of stainless steel.

Range: 1 – 150 l/min.

Precision: +/- 1% of the reading.

Repeatability: +/- 0.05%.

Maximum pressure: 450 Bar.

FMDU-8. Electro-magnetic:

PVC pipe Dn32.

Range: 0.05 – 10 m/s.

Measure error: +/- 2%.

Linearity: +/- 1%.

Reproducibility: 0.25% of medium value.

Conductivity: minimum 20 mS/cm.

Operation temperature: 0 – 80 °C.

FMDU-9. Current Velocity Meter:

Measurement range: 0 – 40 m/s.

Precision: 0.5% of the value.

Resolution: 0.1 m/s.

FMDU-10. Inferential Multistream:

Maximum flow Q_{max.}: 20 m³/h.

Nominative flow Q_{n.}: 10 m³/h.

Minimum flow Q_{min.}: 200 l/h.

Sensibility: 48 l/h.

Minimum reading: 0.05 l.

Maximum reading: 1000000 m³.

Maximum pressure P_{max.}: 16 Bar.

FMDU-11. Broad Crested Weir.

FMDU-12. Crump Weir.

FMDU-13. "H" Flume.

FMDU-14. Washington Flume.

FMDU-15. Channel for FMDU-11, FMDU-12, FMDU-13, FMDU-14 and FMDU-18.

FMDU-16. Digital Manometer:

Differential pressure manometer. Two measure scales, ranges:

0 – 199.9 mbar.

0 – 2000 mbar.

Precision: 0.15% above the range.

FMDU-17. Hook and Point Gauge.

FMDU-18. Sharp Crested Weirs.

Cables and Accessories, for normal operation.

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

EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- To demonstrate the important characteristics of fifteen types of flow meters used in the measurement of water flow through pipes or open channels.
- 2.- Comparing the use, application and limitations of different types of flow meters.
- 3.- To study the application of Bernoulli's Theorem.
- 4.- Understanding the principles on which various types of flow meters are based.
- 5.- Implications of performance, convenience, accuracy, head loss, etc., on flow meters selection.
- 6.- Effect of the air in the hydraulic stream on flow meter performance.
- 7.- To use manometers to measure pressure drop.
- 8.- Relating pressure drop across a flow meter to flow rate.
- 9.- Measure error determination using the venturimeter.
- 10.-Factor C_d determination in the venturi.
- 11.-Strangulation determination in the venturi.
- 12.-Measure error determination using the orifice plate.
- 13.-Factor C_d determination in the orifice plate.
- 14.-Effective area determination in the orifice plate.
- 15.-Measure error determination using the Pitot tube.
- 16.-Factor C_d determination in the Pitot tube.
- 17.-Measure error using the swinging flap meter.
- 18.-Measure error using the rotary piston meter.
- 19.-Measure error using the shunt gap meter.
- 20.-Energy loss comparison in the different meters.
- 21.-Measure error using the helical rotary type flow meter.
- 22.-Measure error using the inferential multi stream type flow meter.
- 23.-Broad crested weir.
- 24.-Crump weir.
- 25.-"H" flume.
- 26.-Washington flume.

REQUIRED SERVICES

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

RECOMMENDED ACCESSORIES (Not included)

- Stopwatch.

DIMENSIONS AND WEIGHTS

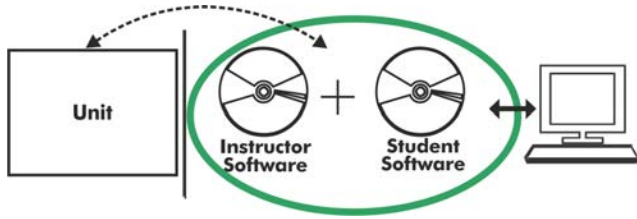
FMDU:

- Dimensions: 3200 x 1300 x 1500 mm approx.
(125.98 x 51.18 x 59.05 inches approx.)
- Weight: 300 Kg approx.
(661.3 pounds approx.)

AVAILABLE VERSIONS

- FMDU/B. Flow Meter Demonstration Unit (Basic):
Includes the following elements: FMDU-1 + FMDU-2 + FMDU-3 + FMDU-4 + FMDU-8.
Rest of specifications as "FMDU" unit.
- FMDU/Q. Flow Meter Demonstration Unit (Mechanic / Chemical):
Includes the following elements: FMDU-1 + FMDU-2 + FMDU-3 + FMDU-4 + FMDU-5 + FMDU-6 + FMDU-8 + FMDU-16.
Rest of specifications as "FMDU" unit.
- FMDU/C. Flow Meter Demonstration Unit (Civil):
Includes the following elements: FMDU-7 + FMDU-8 + FMDU-9 + FMDU-10 + FMDU-11 + FMDU-12 + FMDU-15 + FMDU-17 + FMDU-18.
Rest of specifications as "FMDU" unit.
- FMDU/A. Flow Meter Demonstration Unit (Agriculture):
Includes the following elements: FMDU-7 + FMDU-8 + FMDU-9 + FMDU-10 + FMDU-12 + FMDU-13 + FMDU-14 + FMDU-15 + FMDU-17 + FMDU-18.
Rest of specifications as "FMDU" unit.

FMDU/ICAI. Interactive Computer Aided Instruction Software System:



With no physical connection between unit and computer (PC), 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.

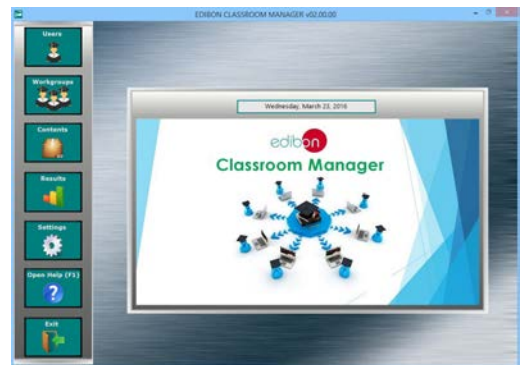
Instructor Software

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

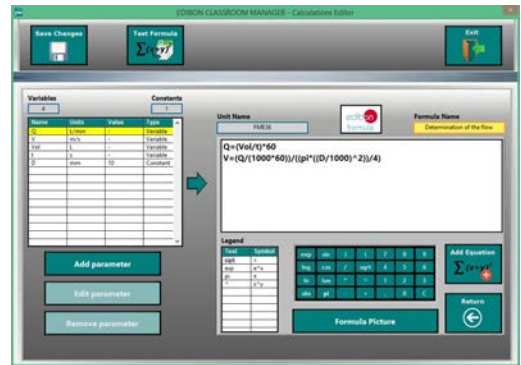
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

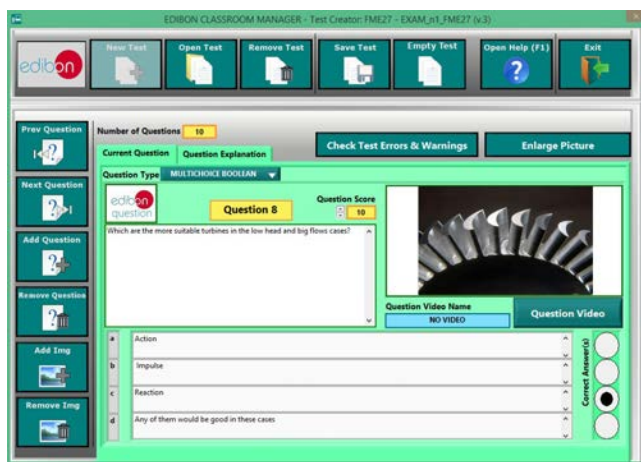
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.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

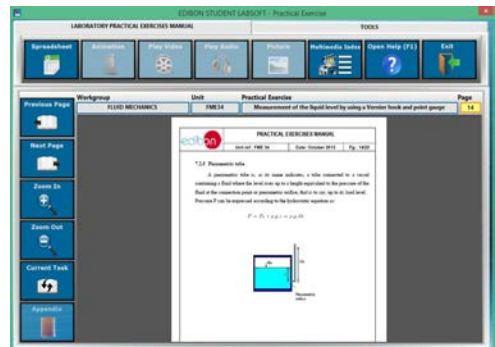
- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- 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:

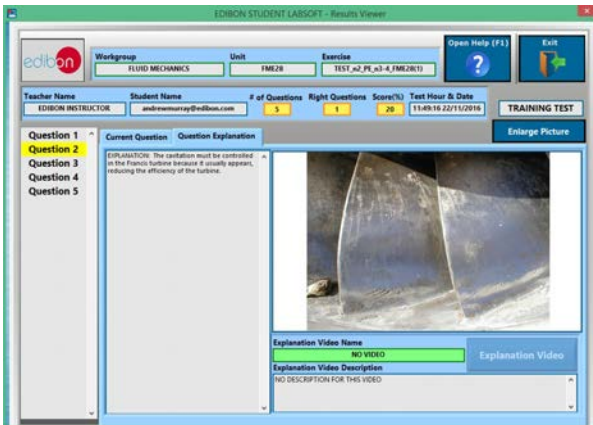
www.edibon.com/en/files/expansion/ICAI/catalog



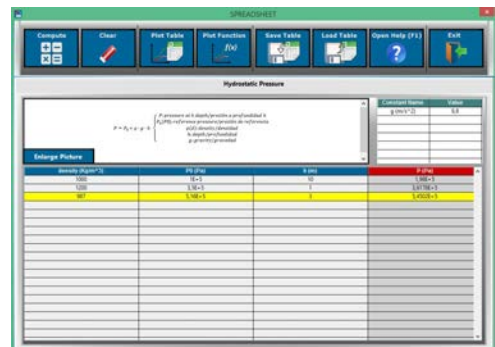
ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen



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:

