edibon

Engineering and Technical Teaching Equipment

# Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (2x1 m)

## ESH(2x1m)

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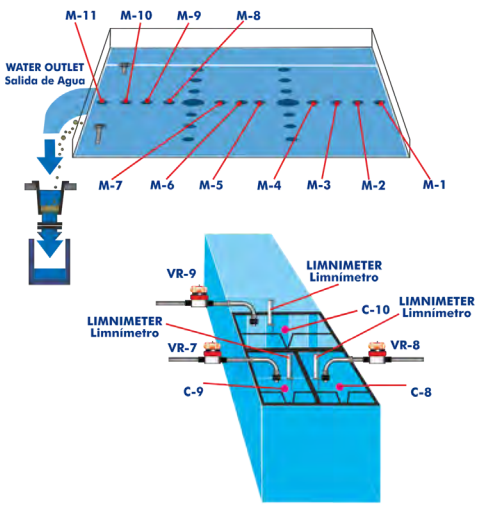
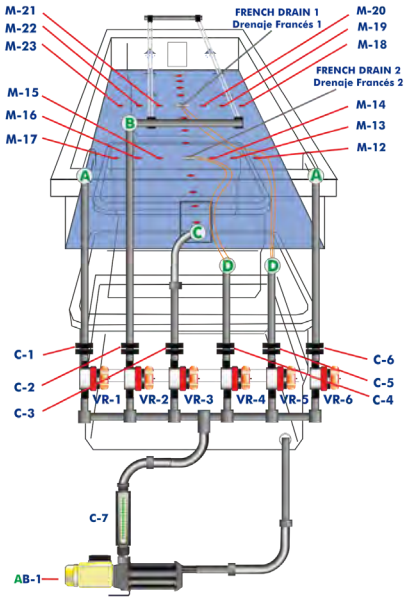
↳PRODUCTS
↳8.- FLUID MECHANICS AND 13.-ENVIRONMENT

## PROCESS DIAGRAMS AND UNIT ELEMENTS ALLOCATION

### PRESSURE TAKINGS DIAGRAM
### Diagrama de Tomas de Presión




| AB- | M- | C- | VR- |
|---|---|---|---|
| PUMP<br>Bomba | MANOMETER<br>Manómetro | FLOW METER<br>Caudalímetro | REGULATION VALVE<br>Válvula de Regulación |

| | | | |
|---|---|---|---|
| A WATER AUXILIARY INLETS<br>Entradas Auxiliares de Agua | B RAIN<br>Lluvia | C RIVER<br>Río | D FRENCH DRAINS<br>Drenajes Franceses |

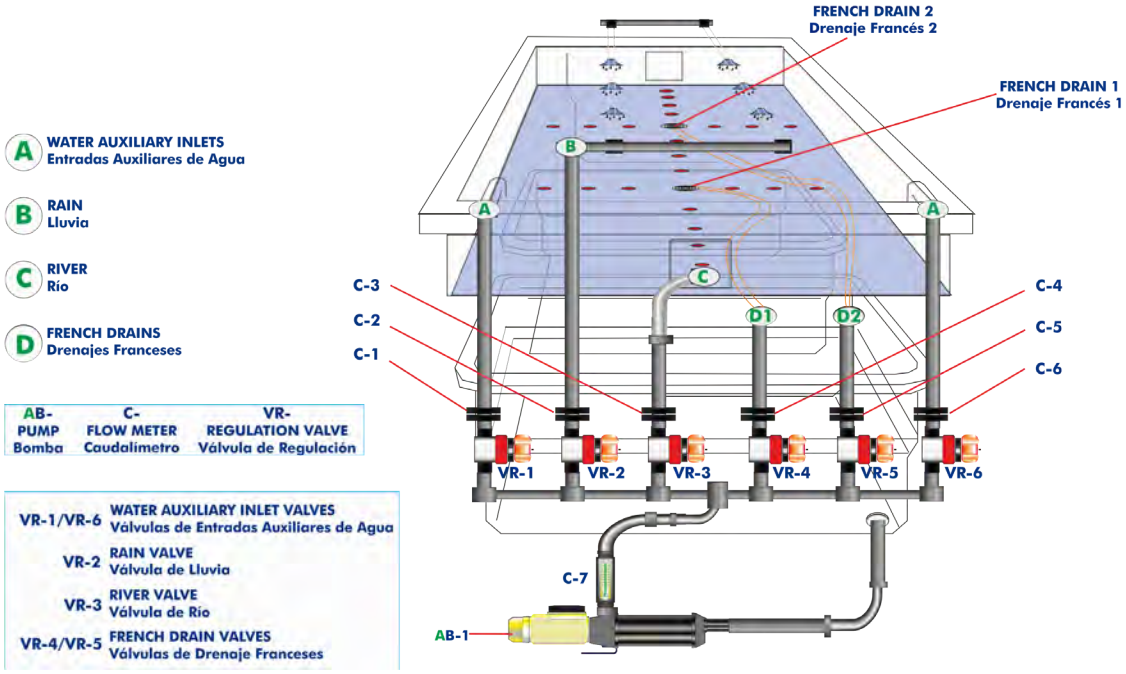
ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)

European Union Certificate (total safety)

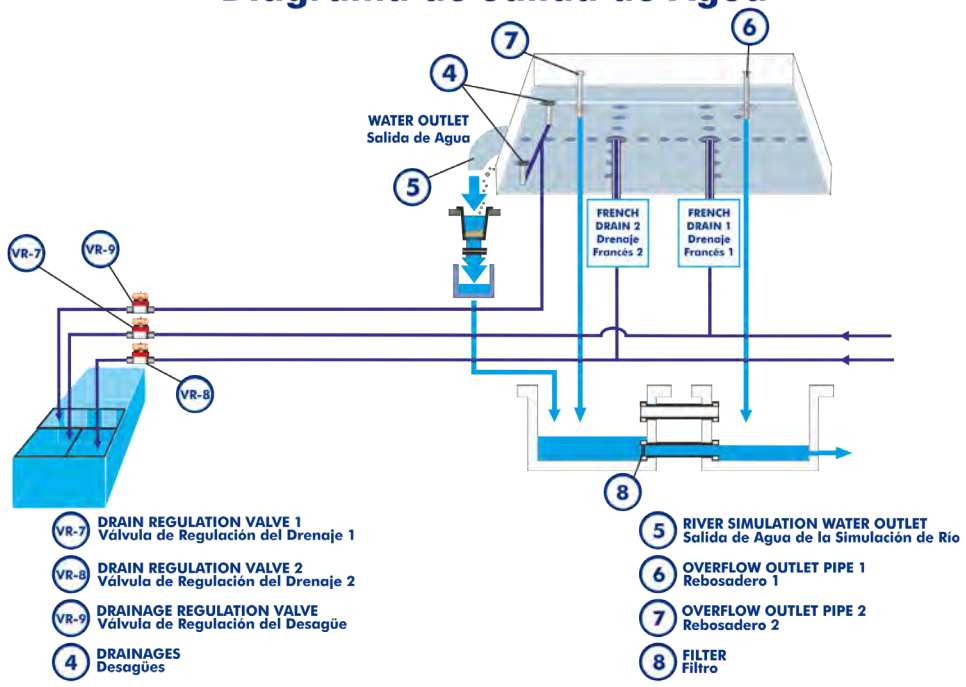
Certificates ISO 14001 and ECO-Management and Audit Scheme (environmental management)

"Worlddidac Quality Charter" and Platinum Member of Worlddidac

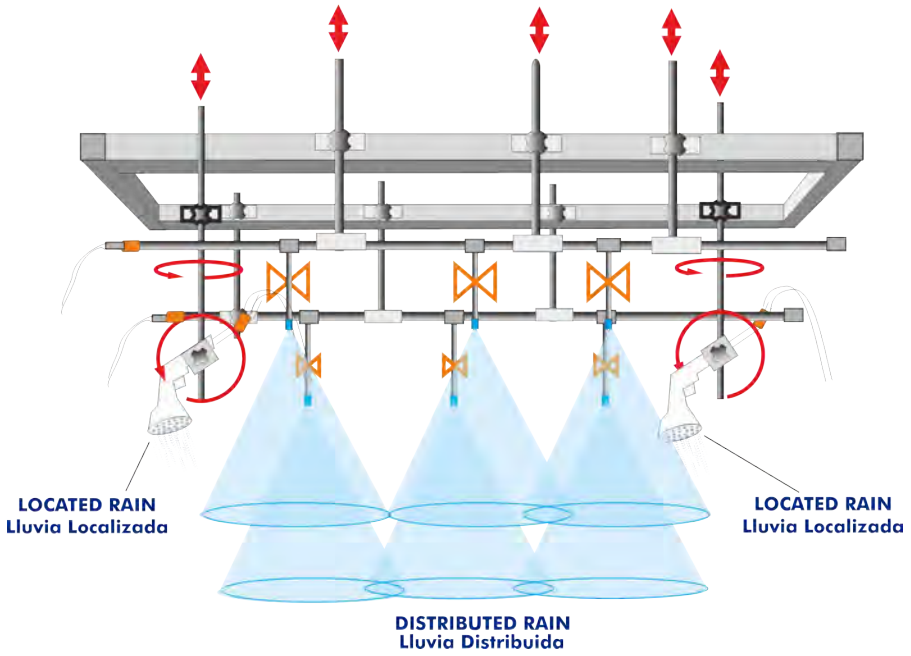
# INLET VALVES DIAGRAM
# Diagrama de Entrada de Válvulas



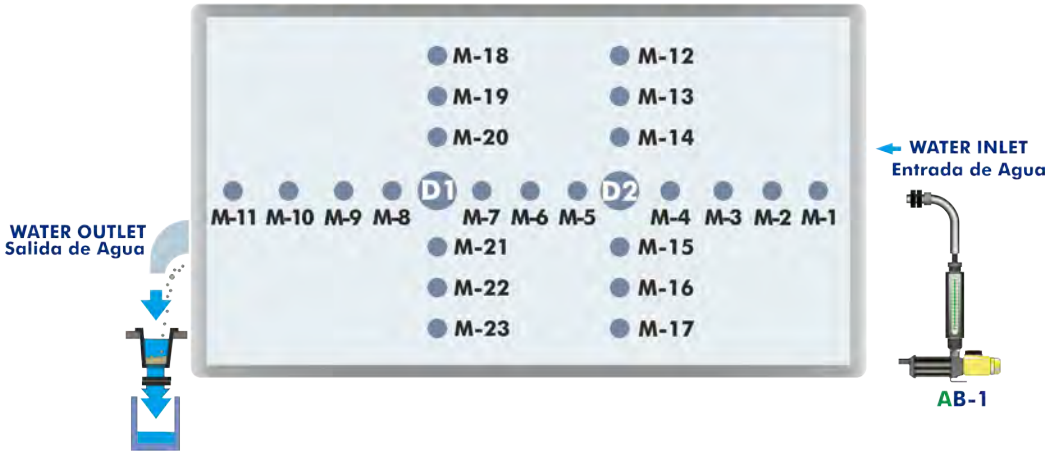

# WATER OUTLET DIAGRAM
# Diagrama de Salida de Agua



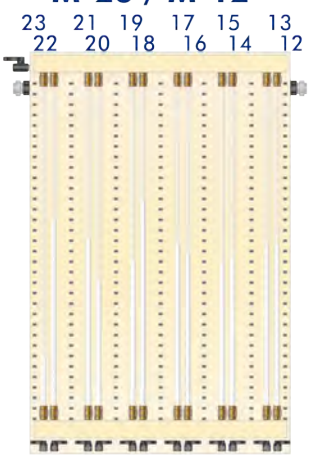
## RAIN INLET DIAGRAM
## Diagrama de Entrada de Lluvia



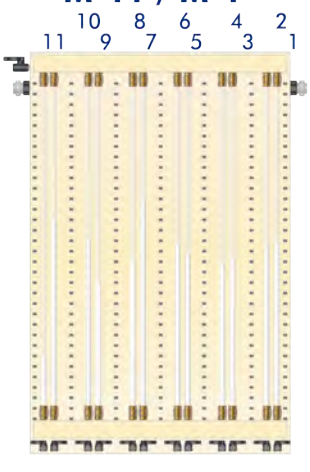

## MANOMETERS DIAGRAM
## Diagrama de Manómetros



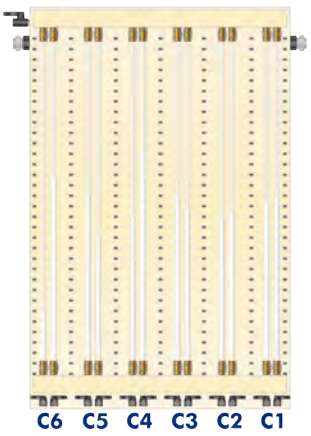

### M-23 / M-12




### M-11 / M-1




### ORIFICE PLATE PRESSURE



## INTRODUCTION

Fluvial geomorphology is the branch of geomorphology whose main objective is to explain the relationships between the physical processes of the flow in movable bed channels, the mechanics of the sediment transport forced by the flow and the shapes of alluvial channels created by the sediment transport.

This subfield is usually overlapped with the hydrography field. It studies river formations and shape - including the transverse and longitudinal configuration of the riverbed, the geometry of the cross sections and the shape of the bed - and analyzes the dynamic processes that transform the main features of watercourses over time.

In general, fluvial geomorphology can be divided into two branches: one studies the patterns that characterize the different river systems, called fluvial morphology, and the other studies the different dynamic processes that modify those patterns over time, called fluvial dynamics.

## GENERAL DESCRIPTION

The Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (2x1 m), "ESH(2x1m)", is a self-contained unit designed to demonstrate some physical processes found in hydrology and fluvial geomorphology, including: rainfall hydrographs for catchment areas of varying permeability, the formation of rivers and their features and effects of sediment transport, the abstraction of ground water by drains, both with and without surface recharge from rainfall, etc. This unit allows demonstrating, on a small scale, the hydrological principles of ground water flow and the applications of these principles to some engineering constructions. Moreover, it allows to study the use of drains for water abstraction, de-watering and drainage of lakes, and demonstration of flood risks linked to land drainage works.

ESH(2x1m) detail

The main element of the unit is a test tank, which can be filled with sand and its tilt regulated by a lifting system. Water is supplied to the test tank through different systems: from two flexible separate hoses (simulating water inlets), from an inlet tank (simulating a river), from spray and showers nozzles located above the tank (simulating rain), or from french drains. Water is output from a river outlet tank, from the drainages located on two test tank corners, from the french drains, which have independent outlets; or from the overflows.

Two large plastic storage tanks are located under the test tank to store water.

A pump, with speed regulation, impels water from the storage tanks to the test tank.

Two flexible separate hoses, placed at the test tank front side, allow adding great inlet flows.

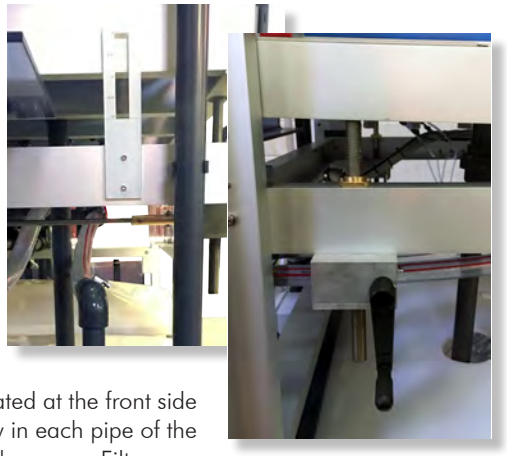
In order to be able to simulate a river, the test tank has a tank attached to the inlet and other tank attached to the outlet. Gravel can be put inside the river inlet tank to deaden the flow and avoid turbulence. The use of a suitable channel section provides appropriate flow conditions in the test tank. The river outlet tank is located at the other end of the test tank and is used for hydrographs, run-off and river formation demonstrations.

The river tanks are communicated with the test tank through a floodgate that has two trap doors, a hermetic one and a meshed one.

Eight spray nozzles are mounted at a double line mobile bridge placed on the test tank and are arranged in a longitudinally equidistant way to provide an even water distribution along the test tank. These nozzles are also adjustable in height and width and can be easily fixed. Each nozzle has an associated ball valve, allowing a wide variety of moving rain precipitation patterns to be simulated.

Two shower nozzles with multiple flows are placed on the test tank and allow storms and local inputs simulation. These nozzles are also adjustable in height and length, and they can be separated from the support to move them manually.

The subsurface flow inputs are via two french drains, located in the middle of the test tank. These french drains extend the full width of the tank. Each french drain can be configured as an inlet or an outlet to permit a wide variety of hydrological demonstrations.



The outlet tank consists of a sediment collection basket.

There are three tanks at the rear part of the unit, each of them connected to one french drain and the other one connected to the drainages. Each one of these tanks has a spillway, which allows to calculate the outlet flow of each tank. The water flow in each tank is measured by a depth gauge. The outlet system (from french drains or drainages to tanks) includes three diaphragm valves to regulate the flow.

The test tank includes two overflows that are communicated with the storage tanks. The water table can be kept constant by means of these overflows, with adjustable height.

The flow of all the inlet systems can be regulated by a group of diaphragm valves located at the front side of the unit. There are six orifice plates that allow measuring and control the water flow in each pipe of the inlet system with a panel of manometric tubes. A flow meter is located at the outlet of the pump. Filters are included in the water supply lines, minimizing system disturbances.

The test tank includes 23 tapping points configured in a cruciform pattern. These 23 tapping points have two functions, depending on the position of the valves included. On the one hand, they are used to taking samples to chemically analyze the water at the twenty three points, a feature that allows to broaden the use of the unit to the study of drag and transport of fluvial polluting agents. On the other hand they are used to measuring and display the phreatic surface (or ground water table levels) in several panels of manometric tubes.

## SPECIFICATIONS

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

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

This unit includes wheels for its mobility and steps for a correct visualization of the practical exercises performed in the test tank.

Test tank, made of fiberglass, with four windows made of polycarbonate, to be filled with sand. It provides a large working surface, dimensions: 2 m long, 1 m wide and 0.40 m deep.

Lifting system to regulate the tilt.

Two storage tanks of 400 l, that supply the water required to the test tank. These tanks are interconnected with a butterfly valve and spillways and include a drain device and a filter to stop any possible solid particle.

Two flexible separate hoses, placed at the test tank front side, allow to add great inlet flows.

Tank attached to the inlet of the test tank and other tank attached to the outlet of the test tank to simulate a river:

Both tanks include a valve to drain them.

The river outlet tank allows to measure the amount of sediment collected over a certain period of time.

The communication of the river tanks with the test tank is done through a floodgate that includes two trap doors. The unit includes two hermetic trap doors and two meshed trap doors.

Spray and shower nozzles located above the test tank to simulate rain:

It has a metallic frame located at the upper side of the test tank. It includes a curtain to reduce possible spillages.

Eight spray nozzles are mounted at a double line mobile bridge to give an even distribution across the test tank. These nozzles are also adjustable in height and width. Each nozzle has an associated ball valve, allowing a wide variety of moving rainfall patterns to be simulated.

Two shower nozzles with multiple flows allow to simulate storms and local inputs. These nozzles are also adjustable in height and length and can be separated from the holder to move them manually.

Two french drains: they include a metallic filter to avoid sand transport to the storage tanks.

Two drainages: they include a metallic filter to avoid sand transport to the storage tanks.

Two overflows: they allow to keep water table (or phreatic surface) constant in the test tank.

Three outlet tanks (made of PVC glass) for the flow measurement in the drainages and french drains:

Each outlet tank includes: one spillway and one depth gauge that allow to determine the flow removed in the drainages and french drains. They include a valve to drain them.

Centrifugal pump, with speed control, (maximum pressure: 7 bar, maximum flow: 106 l/min) that impels water from the storage tank to the test tank through six different inlets. A cylindrical filter at the inlet of the pump stops any possible solid particle.

The test tank includes 23 tapping points, configured in a cruciform pattern. These tapping points have two functions: to take water samples and to use with two panels with 23 manometric tubes to show the water table (or phreatic surface) levels, length: 500 mm.

Six orifice plates that, together with a panel of manometric tubes and a flow meter (range: 600 – 6000 l/h), allow to determine the flow through every inlet that connect the outlet of the pump to the test tank.

Nine diaphragm valves: six of them are located in each inlet that connect the outlet of the pump to the test tank, and three of them are located in each outlet that connect the drainages and french drains to the outlet tanks.

Electronic console:

Metallic box.

Switch for the centrifugal pump.

Speed regulation for the centrifugal pump.

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.

Recommended elements: (Not included)

- ESH-1. Surface models for use with ESH.

  The optional accessory "ESH-1" contains a set of models with different shapes to investigate surface flow effects and run-off effects when using those models.

ESH-1

## EXERCISES AND PRACTICAL POSSIBILITIES

1.- Determination of the surface drag.
2.- Determination of a hydrograph.
3.- Study of the hydrograph of one or several storms.
4.- Calculation of concentration time for a short storm.
5.- Determination of the compactness index.
6.- Determination of the drainage density.
7.- Obtaining of the pressure profile in a dike.
8.- Determination of the water obtained thanks to the gravity force and the field capacity.
9.- Study of fluvial-mechanical experiments.
10.-Formation and development of rivers over time.
11.-Study of sediment transport in models of rivers.
12.-Study of a meandering river.
13.-Study of the erosion on river beds and the speed of the flow.
14.-Study of groundwater catchment.
15.-Study of the cone of depression of a well.
16.-Study of the interaction of cones of depression by two adjoining wells.
17.-Study of a well in the center of a round island (it requires the ESH-1 accessory).
18.-Influence of a rainfall water catchment reservoir (it requires the ESH-1 accessory).
19.-Obstacle in a riverbed (it requires the ESH-1 accessory).
20.-Extracting water from an isolated well in a confined aquifer (it requires the ESH-1 accessory).
21.-Draining an excavation area (it requires the ESH-1 accessory).
22.-Draining a polder or lake (requiere el accesorio ESH-1).
23.-Well at the center of a round island (it requires the ESH-1 accessory).

Additional practical possibilities:

24.-Study of the storm hydrograph of a previously saturated catchment.
25.-Study of the storm hydrograph of an impermeable catchment.
26.-Study of the effect of a moving storm on a flood hydrograph.
27.-Study of the effect of reservoir storage on a flood hydrograph.
28.-Study of the effect of drain pipes on a flood hydrograph.
29.-Investigation of stream flows modeled in alluvial material.
30.-Study of sediment transport, bedload motion, scour and erosion.
31.-Construction of drawdown curves for one well and two wells systems.

## REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.
- Water supply and drain.

## REQUIRED ELEMENTS (Not included)

- Sand, with a grain diameter between 1 mm and 2.5 mm.

## DIMENSIONS AND WEIGHTS

ESHC(2x1m):

-Dimensions: 2700 x 1500 x 2000 mm approx.
(106.30 x 59.05 x 78.74 inches approx.)

-Weight: 950 Kg approx.
(2094 pounds approx.)

## RECOMMENDED ELEMENTS (Not included)

- ESH-1. Surface models for use with ESH.

## AVAILABLE VERSIONS

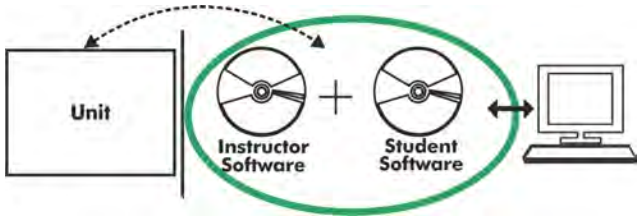
Offered in this catalogue:

- ESH(2x1m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (2x1 m).

Offered in other catalogues:

- ESHC(2x1m). Computer Controlled Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (2x1 m).
- ESHC(4x2m). Computer Controlled Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (4x2 m).

**ESH(2x1m)/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.

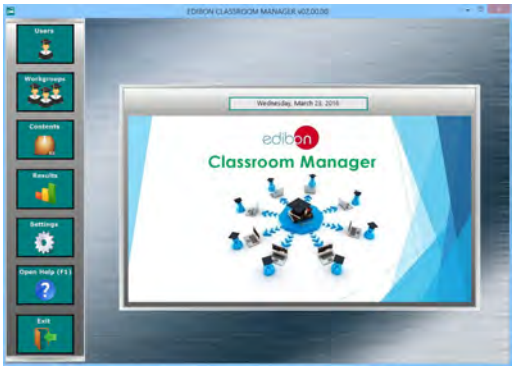
Instructor Software

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

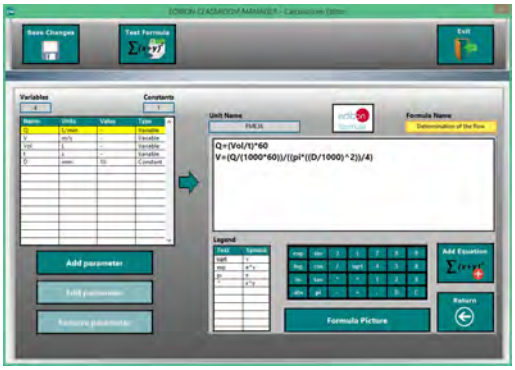
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

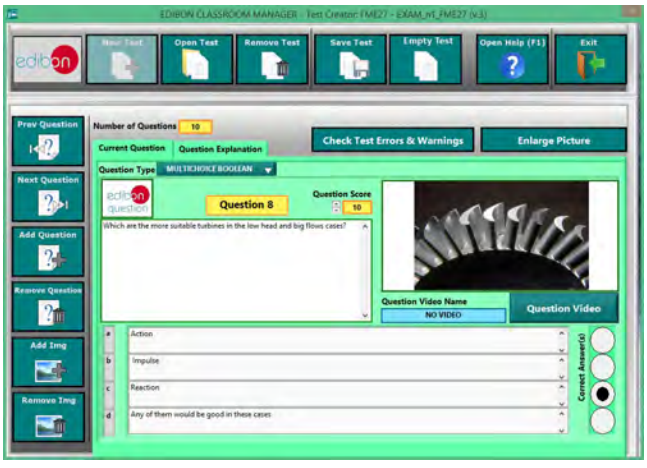
- **User Data Base Management.**
- **Administration and assignment of Workgroup, Task and Training sessions.**
- **Creation and Integration of Practical Exercises and Multimedia Resources.**
- **Custom Design of Evaluation Methods.**
- **Creation and assignment of Formulas & Equations.**
- **Equation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

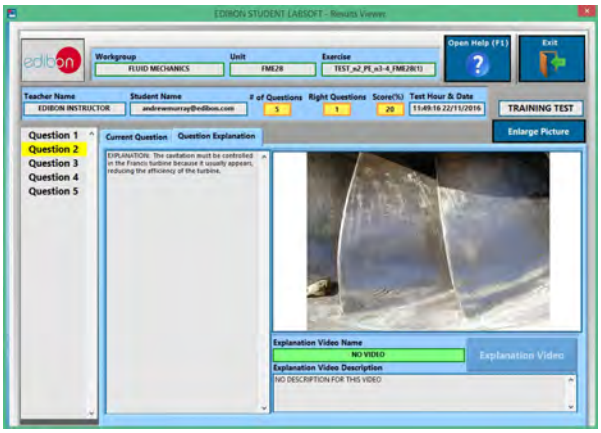
Innovative features:

- **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.**

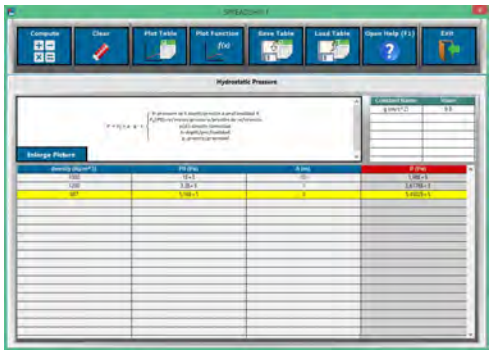

ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen

EPE. EDIBON Practical Exercise Program Package Main Screen

For more information see **ICAI** catalogue. Click on the following link:
www.edibon.com/en/files/expansion/ICAI/catalog



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.


INTERNATIONAL

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REPRESENTATIVE: