Computer Controlled **Hydrologic Systems, Rain Simulator and Irrigation Systems Unit**

ESHC

edibon

Technical Teaching Equipment

EDIBON PATENT

Always included in the supply:

SCADA. EDIBON Computer Control System
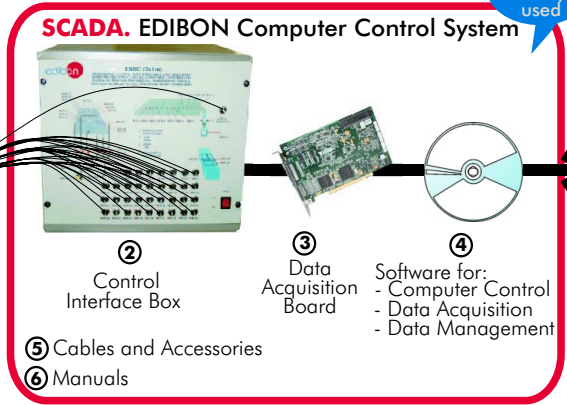
Teaching Technique used

② Control Interface Box

③ Data Acquisition Board

④ Software for:
- Computer Control
- Data Acquisition
- Data Management

Computer (not included in the supply)

⑤ Cables and Accessories

⑥ Manuals

① Unit: ESHC. Hydrologic Systems, Rain Simulator and Irrigation Systems Unit.
   Avalaible versions:
   - ESHC (2x1m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (2x1m).
   - ESHC (4x2m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (4x2m).

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

SCADA. EDIBON Computer Control System:
Computer Control + Data Acquisition + Data Management

1 ○
2 ○
Sensors 3 ○
"n" 6 ○ 4 ○
5 ○
Teaching unit

Cables to Control Interface Box

Control Interface Box

Cable to computer

Data acquisition board

Software for:
-Computer Control
-Data Acquisition
-Data Management

Student post
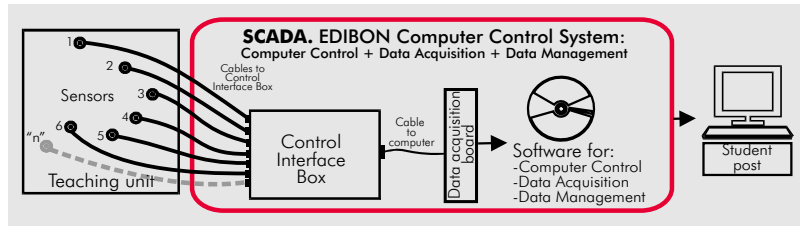
www.edibon.com
⇨Products
⇨Products range
⇨Units
⇨13.-Environment

DESCRIPTION

This Unit demonstrates some of the major physical process found in hydrology and fluvial geomorphology, including: rainfall hydrographs for catchment areas of varying permeability, the formation of river features and effects of sediment transport, the abstraction of ground water by wells, both with and without surface recharge from rainfall, etc.

Moreover it is capable of demonstrating , on a small scale, the hydrological principles of ground water flow, and the applications of the principles to some engineering constructions.

It is possible to study the use of wells for water abstraction, de-watering and drainage of lakes, and demonstration of flood risks associated with land drainage works.
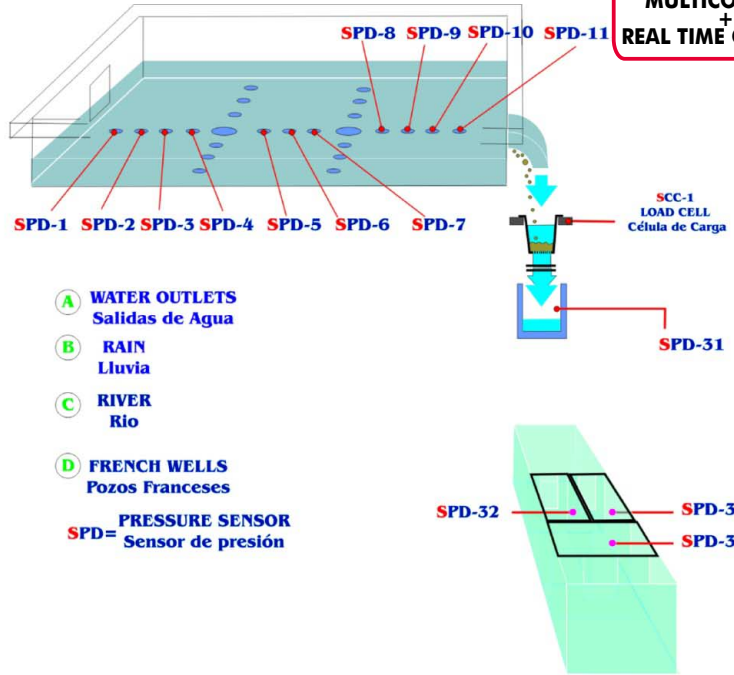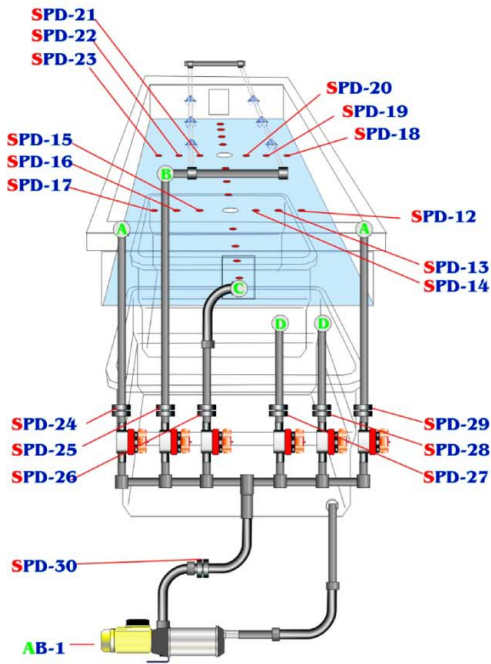
This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), including: Control interface Box + Data Acquisition Board + Computer Control and Data Acquisition Software, for controlling the process and the parameters involved.

1 actuator and 35 sensors controlled from any computer, and working simultaneously

SPD-21
SPD-22
SPD-23
SPD-20
SPD-19
SPD-18
SPD-15
SPD-16
SPD-17
SPD-12
SPD-13
SPD-14
SPD-24
SPD-25
SPD-26
SPD-29
SPD-28
SPD-27
SPD-30
AB-1

SENSORS DIAGRAM
Diagrama de sensores

SPD-8 SPD-9 SPD-10 SPD-11

SPD-1 SPD-2 SPD-3 SPD-4 SPD-5 SPD-6 SPD-7

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

SCC-1
LOAD CELL
Célula de Carga

SPD-31

Ⓐ WATER OUTLETS
   Salidas de Agua

Ⓑ RAIN
   Lluvia

Ⓒ RIVER
   Rio

Ⓓ FRENCH WELLS
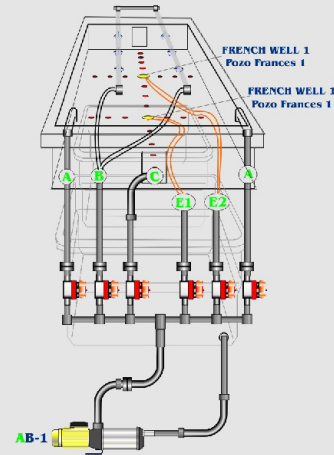   Pozos Franceses

SPD= PRESSURE SENSOR
     Sensor de presión

SPD-32   SPD-33
              SPD-34

WATER OUTLET DIAGRAM
Diagrama de salida de agua

WELL 1
Pozo 1
WELL 2
Pozo 2
D1 D2
D3
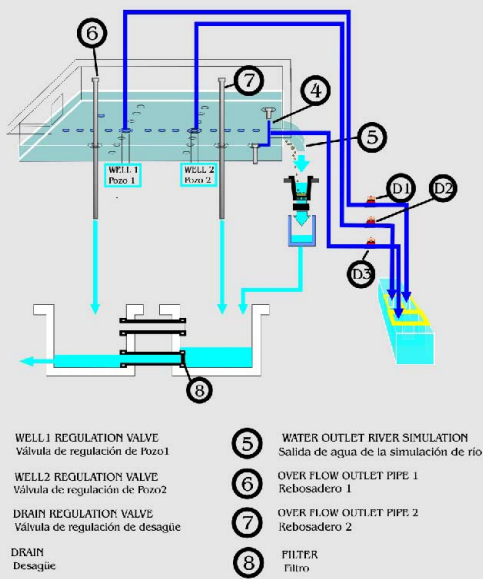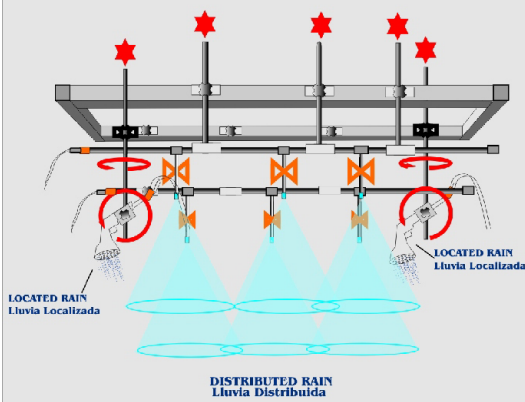
D1 WELL1 REGULATION VALVE
    Válvula de regulación de Pozo1
D2 WELL2 REGULATION VALVE
    Válvula de regulación de Pozo2
D3 DRAIN REGULATION VALVE
    Válvula de regulación de desagüe
4   DRAIN
    Desagüe
5   WATER OUTLET RIVER SIMULATION
    Salida de agua de la simulación de rio
6   OVER FLOW OUTLET PIPE 1
    Rebosadero 1
7   OVER FLOW OUTLET PIPE 2
    Rebosadero 2
8   FILTER
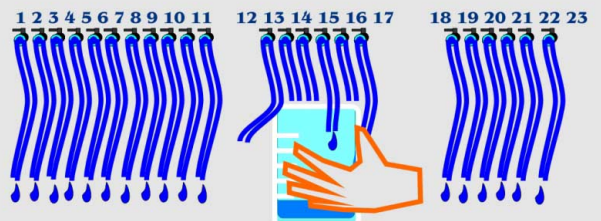   Filtro

VALVES DIAGRAM
Diagrama de Válvulas

Ⓐ AUXILIAR INLETS   Ⓑ RAIN INLET
   Entradas Auxiliares   Entrada Lluvia

Ⓒ RIVER INLET   Ⓔ FRENCH WELLS INLET
   Entrada de Rio   Entrada a Pozos Franceses

FRENCH WELL 1
Pozo Frances 1
FRENCH WELL 1
Pozo Frances 1

Ⓐ Ⓑ Ⓒ   Ⓐ
      Ⓔ1 Ⓔ2

AB-1

RAIN INLET DIAGRAM
Diagrama de entrada de lluvia

LOCATED RAIN
Lluvia Localizada
LOCATED RAIN
Lluvia Localizada

DISTRIBUTED RAIN
Lluvia Distribuida

SAMPLES DIAGRAM
Diagrama de Muestras

1 2 3 4 5 6 7 8 9 10 11   12 13 14 15 16 17   18 19 20 21 22 23

Items supplied as standard

① **ESHC Unit:**

There are two versions:

ESHC (2x1m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (2x1m).

ESHC (4x2m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (4x2m).

Metallic structure. Panels and main metallic elements in stainless steel.

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

Test tank, which is a large sized tank that provides a large working surface:

For ESHC(2x1m): tank dimensions: L=2m, W=1m.

For ESHC(4x2m): tank dimensions: L=4m, W=2m.

Storage tanks, that supply the water required:

For ESHC (2x1m)= two 400 litres tanks.

For ESHC (4x2m)= four 400 litres tanks.

2 porous "well" tubes (french wells).

Drain.

Water outlet river simulation.

2 Over flow outlet pipes.

Filter.

Single-phase motor pump with 7 bar at maximum pressure, 106 l/min as maximum flow. Pump with speed control.

Rain simulator comprised of 8 spray nozzles, and 2 showers.

3 outlet tanks for the flow measurement in the drains and wells.

6 water inlet valves (2 auxiliary inlets, rain inlet, river inlet, 2 french wells inlets).

2 Independent flexible pipes.

34 Pressure sensors.

27 Sample capturing takings.

7 Flow sensors (orifice plate).

Load Cell.

The flow intakes to the test tank may be cut off by valves, to separate fluvial flow from the alluvial.

The unit incorporates wheels for mobility.

ESHC (2x1m). Unit

② **ESHC/CIB. Control Interface Box :**

Control interface box with process diagram in the front panel and with the same distribution that the different elements located in the unit, for an easy understanding by the student.

All sensors, with their respective signals, are properly manipulated from -10V. to +10V computer output.

Sensors connectors in the interface have different pines numbers (from 2 to 16), to avoid connection errors.

Single cable between the control interface box and computer.

The unit control elements are permanently computer controlled, without necessity of changes or connections during the whole process test procedure.

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

Calibration of all sensors involved in the process.

Real time curves representation about system responses. Storage of all the process data and results in a file. Graphic representation, in real time, of all the process/system responses.

All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process. All the actuators and sensors values and their responses are placed in only one computer screen.

Shield and filtered signals to avoid external interferences.

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

Real time computer control for pumps, compressors, resistances, control valves, etc.

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

Three safety levels, one mechanical in the unit, other electronic in control interface and the third one in the control software.

ESHC/CIB

③ **DAB. Data Acquisition Board:**

PCI Data acquisition board (National Instruments) to be placed in a computer slot. Bus PCI.

Analog input:

Number of **channels= 16** single-ended or 8 differential. **Resolution=16 bits**, 1 in 65536.

Sampling rate up to: 250 KS/s (Kilo samples per second). Input range (V)= ±10V.

Data transfers=DMA, interrupts, programmed I/0. Number of DMA channels=6.

Analog output:

Number of **channels=2**. **Resolution=16 bits**, 1 in 65536. Maximum output rate up to: 833 KS/s.

Output range(V)=±10V. Data transfers=DMA, interrupts, programmed I/0.

Digital Input/Output: Channels=24 inputs/outputs. D0 or Dl Sample Clock frequency: 0 to 1 MHz.

Timing: **Counter/timers=2**. Resolution:Counter/timers: 32 bits.

DAB

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

Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen.

Compatible with the industry standards.

Registration and visualization of all process variables in an automatic and simultaneously way.

Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters. **Management, processing, comparison and storage of data.**

Sampling velocity up to 250,000 data per second guaranteed.

Calibration system for the sensors involved in the process.

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

Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access at different work levels.

This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.
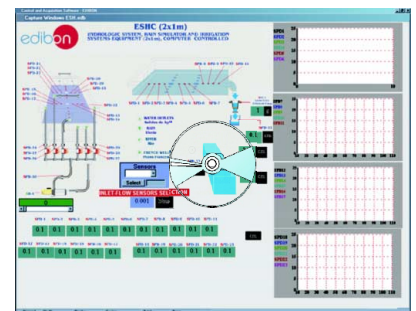
ESHC/CCSOF

⑤ **Cables and Accessories**, for normal operation.

⑥ **Manuals:**

This unit is **supplied with 8 manuals:** Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

✱ **References 1 to 6: ESHC + ESHC/CIB + DAB + ESHC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply, enabling a normal operation.**

Complementary items to the standard supply

PLC. Industrial Control using PLC (7 and 8):

⑦ **PLC-PI. PLC Module:**
Circuit diagram in the front panel.
Front panel:
  Digital inputs(X) and Digital outputs (Y) block:
    16 Digital inputs, activated by switches and 16 LEDs for confirmation (red).
    14 Digital outputs (through SCSI connector) with 14 LEDs for message (green).
  Analog inputs block:
    16 Analog inputs (-10V. to + 10V.)(through SCSI connector).
  Analog outputs block:
    4 Analog outputs (-10V. to + 10V) (through SCSI connector).
  Touch screen:
    High visibility and multiple functions.
    Display of a highly visible status.
    Recipe function.
    Bar graph function.
    Flow display function.
    Alarm list.
    Multi language function.
    True type fonts.
Back panel:
  Power supply connector.
  Fuse 2A.
  RS-232 connector to PC.
Inside:
  Power supply outputs: 24 Vdc, 12 Vdc, -12 Vdc, 12 Vdc variable.
  Panasonic PLC:
    High-speed scan of 0.32 μsec. for a basic instruction.
    Program capacity of 32 Ksteps, with a sufficient comment area.
    Free input AC voltage(100 to 240 V AC).
    DC input:16 (24 V DC).
    Relay output: 14 (250 V A AC/2 A).
    High-speed counter.
    Multi-point PID control.
    Digital inputs/outputs and analog inputs/outputs Panasonic modules.
  Communication RS232 wire, to computer (PC).

⑧ **ESHC/PLC-SOF. PLC Control Software:**
  For this particular unit, always included with PLC supply.

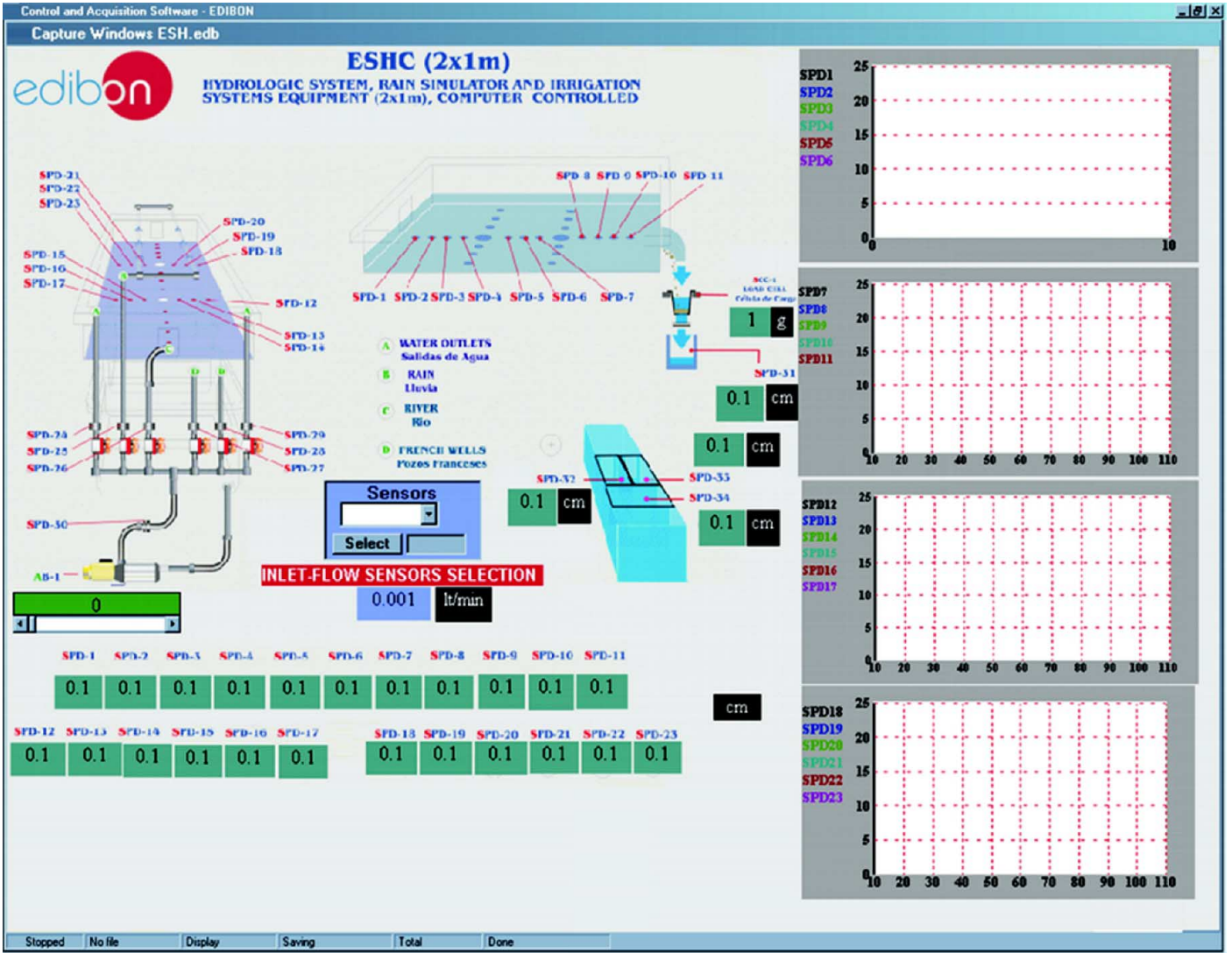
PLC-PI

Items available on request

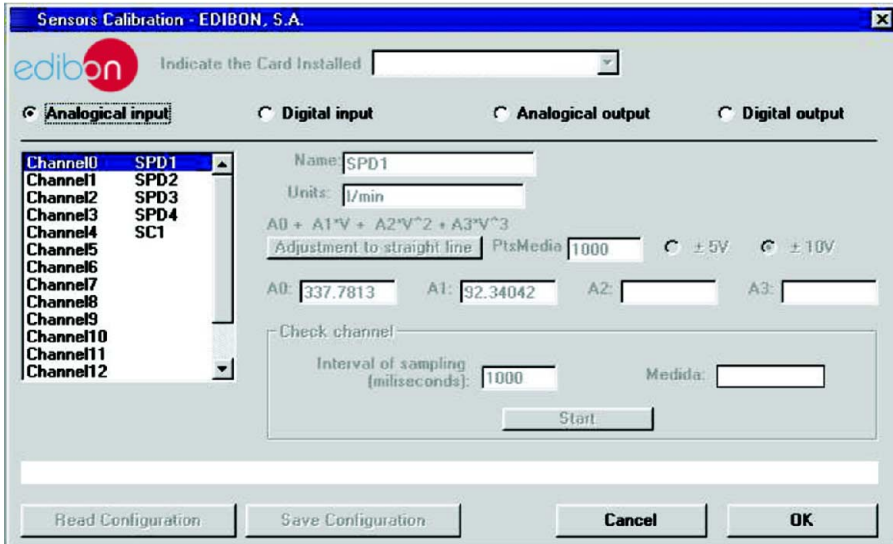⑨ **ESHC/CAL. Computer Aided Learning Software (Results Calculation and Analysis)**.

⑩ **ESHC/FSS. Faults Simulation System.**

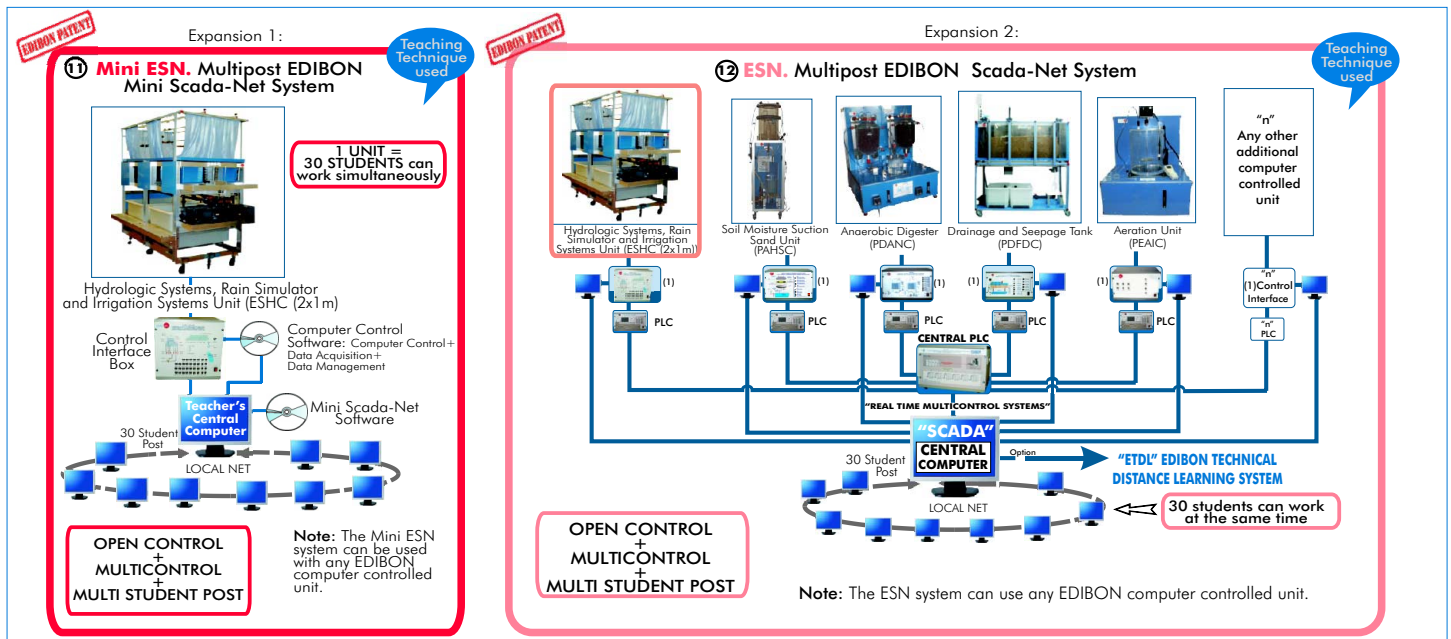## Software Main Screens

Main screen

Example of Sensors Calibration screen

Some Practical Possibilities of the Unit:

1.- Determination of the superficial dragging.
2.- Hydrograph curve, strong storm.
3.- Calculation of concentration time for a short storm.
4.- Storm hydrographs from single or multiple storms.
5.- Storm hydrograph from a previously saturated catchment.
6.- Storm runoff from an impermeable catchment.
7.- Drainage density determination
8.- Effect of a moving storm flood hydrograph.
9.- Effect of a reservoir storage on flood hydrograph.
10.-Effect of land drains on flood hydrograph.
11.-Reservoir filling and flooding.
12.-Gravity force of water.
13.-Fluvial-mechanical experiments.
14.-Model stream flow in alluvial material.
15.-Sediment transport in river models.
16.-Formation and development of river features over time.
17.-Meandering river.
18.-Erosion on river beds and current speed.
19.-Sediment transport, bedload motion, scour and erosion.
20.-Underground water capture studies.
21.-Well depression cone.
22.-Interaction of depression cones by two adjoining wells.
23.-Well in the centre of a circular island.
24.-Draw-down curves for one well and two wells systems.

Other possible practices:

25.-Sensors calibration.

Practices to be done by PLC Module (PLC-PI)+PLC Control Software:

26.- Control of the ESHC unit process through the control interface box without the computer.
27.- Visualization of all the sensors values used in the ESHC unit process.
28.- Calibration of all sensors included in the ESHC unit process.
29.- Hand on of all the actuators involved in the ESHC unit process.
30.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).
31.- Simulation of outside actions, in the cases do not exist hardware elements. (Example: test of complementary tanks, complementary industrial environment to the process to be studied, etc).
32.- PLC hardware general use and manipulation.
33.- PLC process application for ESHC unit.
34.- PLC structure.
35.- PLC inputs and outputs configuration.
36.- PLC configuration possibilities.
37.- PLC program languages.
38.- PLC different programming standard languages (literal structured, graphic, etc.).
39.- New configuration and development of new process.
40.- Hand on an established process.
41- To visualize and see the results and to make comparisons with the ESHC unit process.
42.- Possibility of creating new process in relation with the ESHC unit.
43.- PLC Programming Exercises.
44.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS

Expansion 1:

⑪ **Mini ESN.** Multipost EDIBON Mini Scada-Net System

1 UNIT = 30 STUDENTS can work simultaneously

Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (ESHC (2x1m))

Control Interface Box

Computer Control Software: Computer Control+ Data Acquisition+ Data Management

Teacher's Central Computer

Mini Scada-Net Software

30 Student Post

LOCAL NET

OPEN CONTROL + MULTICONTROL + MULTI STUDENT POST

Note: The Mini ESN system can be used with any EDIBON computer controlled unit.

Expansion 2:

⑫ **ESN.** Multipost EDIBON Scada-Net System

Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (ESHC (2x1m))

Soil Moisture Suction Sand Unit (PAHSC)

Anaerobic Digester (PDANC)

Drainage and Seepage Tank (PDFDC)

Aeration Unit (PEAIC)

"n" Any other additional computer controlled unit

PLC / PLC / PLC / PLC / PLC / "n" (1)Control Interface / "n" PLC

CENTRAL PLC

"REAL TIME MULTICONTROL SYSTEMS"

"SCADA" CENTRAL COMPUTER

30 Student Post

LOCAL NET

Option → "ETDL" EDIBON TECHNICAL DISTANCE LEARNING SYSTEM

30 students can work at the same time

OPEN CONTROL + MULTICONTROL + MULTI STUDENT POST

Note: The ESN system can use any EDIBON computer controlled unit.

ORDER INFORMATION

Items supplied as standard

Minimum configuration for normal operation includes:

① **Unit: ESHC. Hydrologic Systems, Rain Simulator and Irrigation Systems Unit:**
   Available versions:
   - ESHC (2x1m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (2x1m).
   - ESHC (4x2m). Hydrologic Systems, Rain Simulator and Irrigation Systems Unit (4x2m).
② **ESHC/CIB. Control Interface Box.**
③ **DAB. Data Acquisition Board.**
④ **ESHC/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
⑤ **Cables and Accessories,** for normal operation.
⑥ **Manuals.**

* **IMPORTANT: Under ESHC we always supply all the elements for immediate running as 1, 2, 3, 4, 5 and 6.**

Complementary items to the standard supply

PLC. Industrial Control using PLC (7 and 8):

⑦ PCL-PI.PLC Module.
⑧ ESHC/PLC-SOF. PLC Control Software.
⑨ ESHC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request).
⑩ ESHC/FSS. Faults Simulation System. (Available on request).

Expansions

⑪ Mini ESN. Multipost EDIBON Mini Scada-Net System.
⑫ ESN. Multipost EDIBON Scada-Net System.

REQUIRED SERVICES

- Electrical supply: single-phase with ground, 220V./50Hz or 110V./60Hz.
- Water supply and draining system.
- Sand, with a grain diameter between 1 mm and 2.5 mm.
- Computer (PC).

DIMENSIONS & WEIGHTS

ESHC Unit:
  Available versions:
    -ESHC (2x1m) Unit: -Dimensions: 2700 x 1500 x 1800 mm. approx.
                          -Weight: 950 Kg. approx.
    -ESHC (4x2m) Unit: -Dimensions: 4600 x 2250 x 1800 mm. approx.
                          -Weight: 1990 Kg. approx.
Control Interface Box: -Dimensions: 490 x 450 x 470 mm. approx.
                          -Weight: 20 Kg. approx.
PLC Module (PLC-PI): -Dimensions: 490 x 330 x 310 mm. approx.
                          -Weight: 30 Kg. approx.

AVAILABLE VERSIONS

Offered in this catalogue:

- ESHC (4x2m).   Computer Controlled **Hydrologic Systems, Rain Simulator and Irrigation Systems Unit** (4x2m).

- ESHC (2x1m).   Computer Controlled **Hydrologic Systems, Rain Simulator and Irrigation Systems Unit** (2x1m).

Offered in other catalogue:

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

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

REPRESENTATIVE: