Computer Controlled **Axial Fan Teaching Trainer**

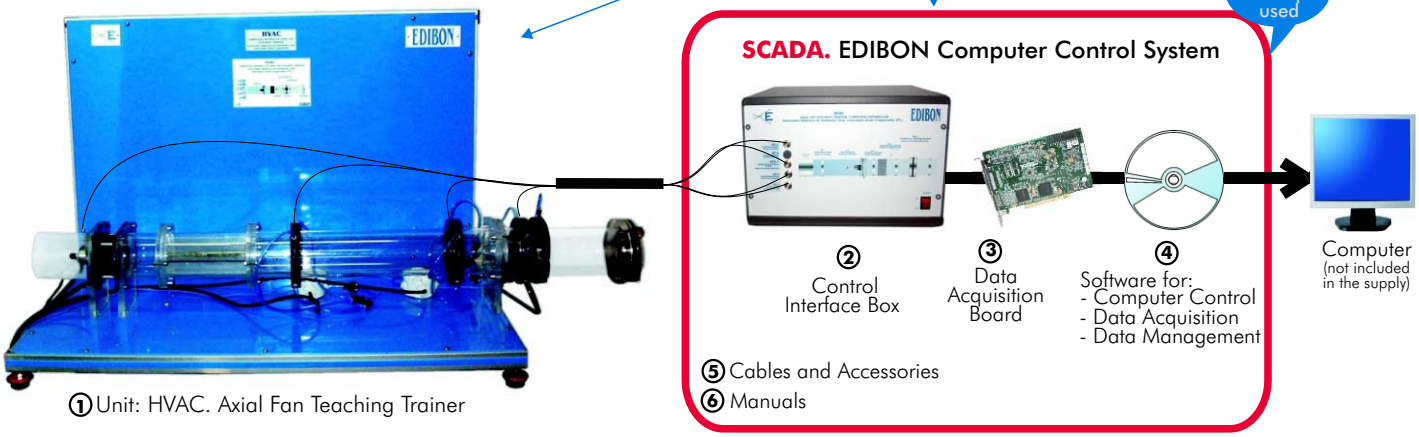
HVAC

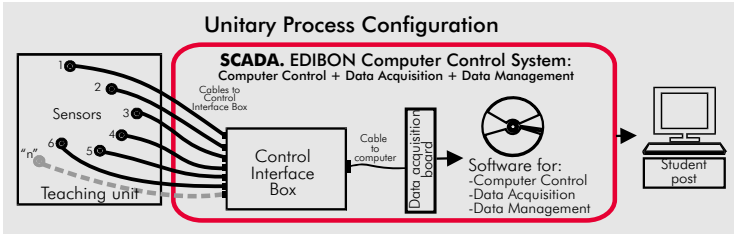
Technical Teaching Equipment

EDIBON PATENT

Always included in the supply:

Teaching Technique used





www.edibon.com
Products
Products range
Units
8.-Fluid Mechanics & Aerodynamics

PROCESS DIAGRAM AND ELEMENTS ALLOCATION

1 actuator and 5 sensors controlled from any computer, and working simultaneously

OPEN CONTROL + MULTICONTROL + REAL TIME CONTROL

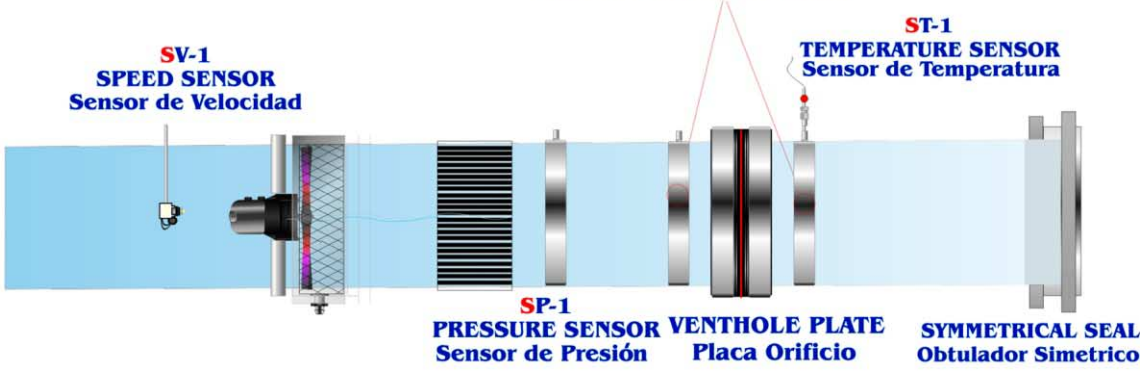
SP-1 PRESSURE SENSOR Sensor de presión

SP-2 PRESSURE SENSOR Sensor de presión

SPD-1 DIFFERENTIAL PRESSURE SENSOR Sensor de presión Diferencial

ST-1 TEMPERATURE SENSOR Sensor de temperatura

SV-1 SPEED SENSOR Sensor de Velocidad



ISO:9001-2000 Certificate of Approval. Reg. No. E204034

European Union Certificate

Certificates ISO 14001: 2004 and ECO-Management and Audit Scheme (environmental management)

Worlddidac Quality Charter Certificate
Worlddidac Member

Items supplied as standard

① HVAC. Unit:

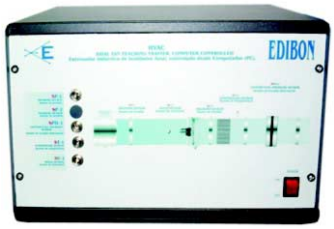
The HVAC unit allows the observation and the working process analysis of an axial-flow fan. Likewise, it allows the possibility of displaying and controlling the variables of the process, in real time.
Anodized aluminium structure. Panels and main metallic elements in stainless steel.
Diagram in the front panel with similar distribution that the elements in the real unit.
Bench desktop unit.
Transparent straight duct with a diameter of 115 mm with:
- A sector rectifier.
- Symmetrical seal.
- Hole plate with a static pressure taking.

Single stage axial fan, driven by a 12W output AC induction motor.
Adjustable aperture system for varying the air flow rate.
Differential Pressure sensor.
2 Pressure sensors.
Speed sensor.
Temperature sensor.

HVAC. Unit

② HVAC/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 for -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.



HVAC/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.

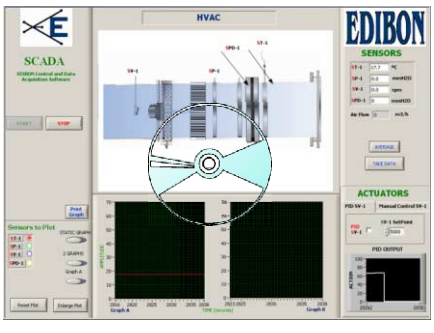
Digital Input/Output:
- Number of **channels=24 inputs/outputs**.
- D0 or DI Sample Clock frequency: 0 to 1 MHz.

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


DAB

④ HVAC/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.
Student calibration system for all 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 to 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.



HVAC/CCSOF

⑤ Cables and Accessories.

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: HVAC + HVAC/CIB + DAB + HVAC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply, enabling a normal operation.

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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).

PLC-PI

⑧ HVAC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

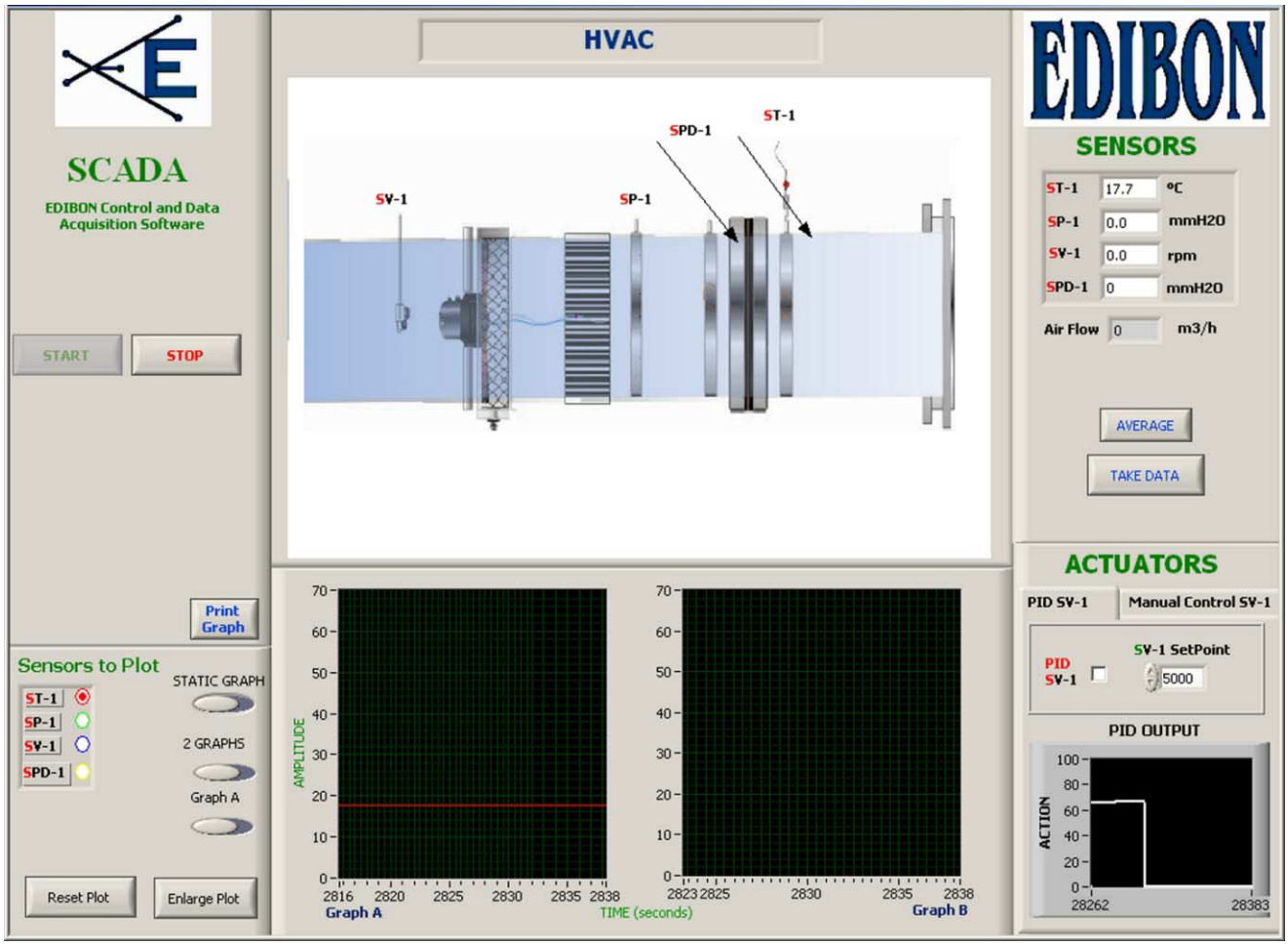
Items available on request

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

⑩ HVAC/FSS. Faults Simulation System.

Software Main Screens

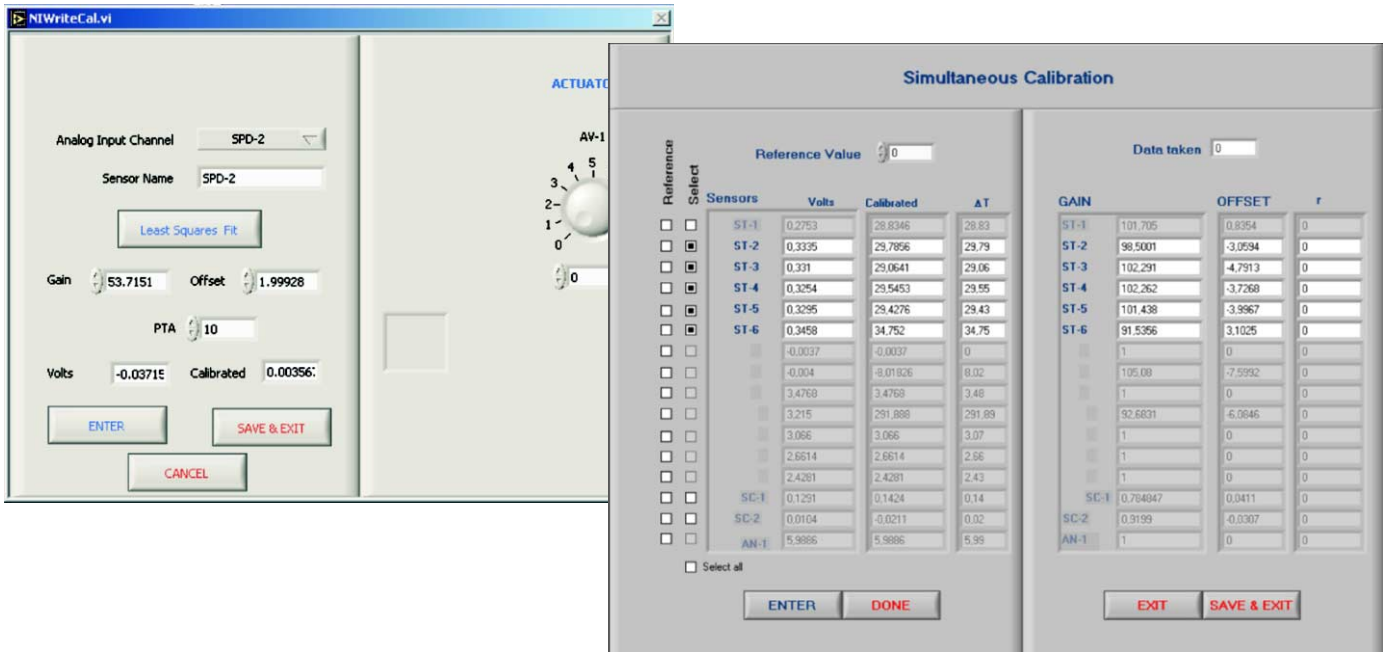
Main screen



Note: SP= Pressure sensor. ST= Temperature sensor. SPD= Differential Pressure sensor. SV=Speed sensor.

The main screen of the HVAC unit let us plot the characteristic curve of the fan. We can study the process while the conditions are changed.
All the sensors can be plotted continuously in a real time, versus time, or in a static way, versus another sensor, when we click "take data".
The air temperature and the pressure in the tube are shown.
The rotation speed of the fan is added too. By measuring the differential pressure in a hole plate, the air flow is obtained.
The fan speed control can be made by two ways: one, manually, by controlling the speed fan with the knob. In this way, when we change the pressure conditions (by closing the outlet) the fan speed does not maintain constant. In the other way, by a PID control, the fan speed maintains constant in spite of changing outlet conditions.

Examples of Sensors Calibration screens



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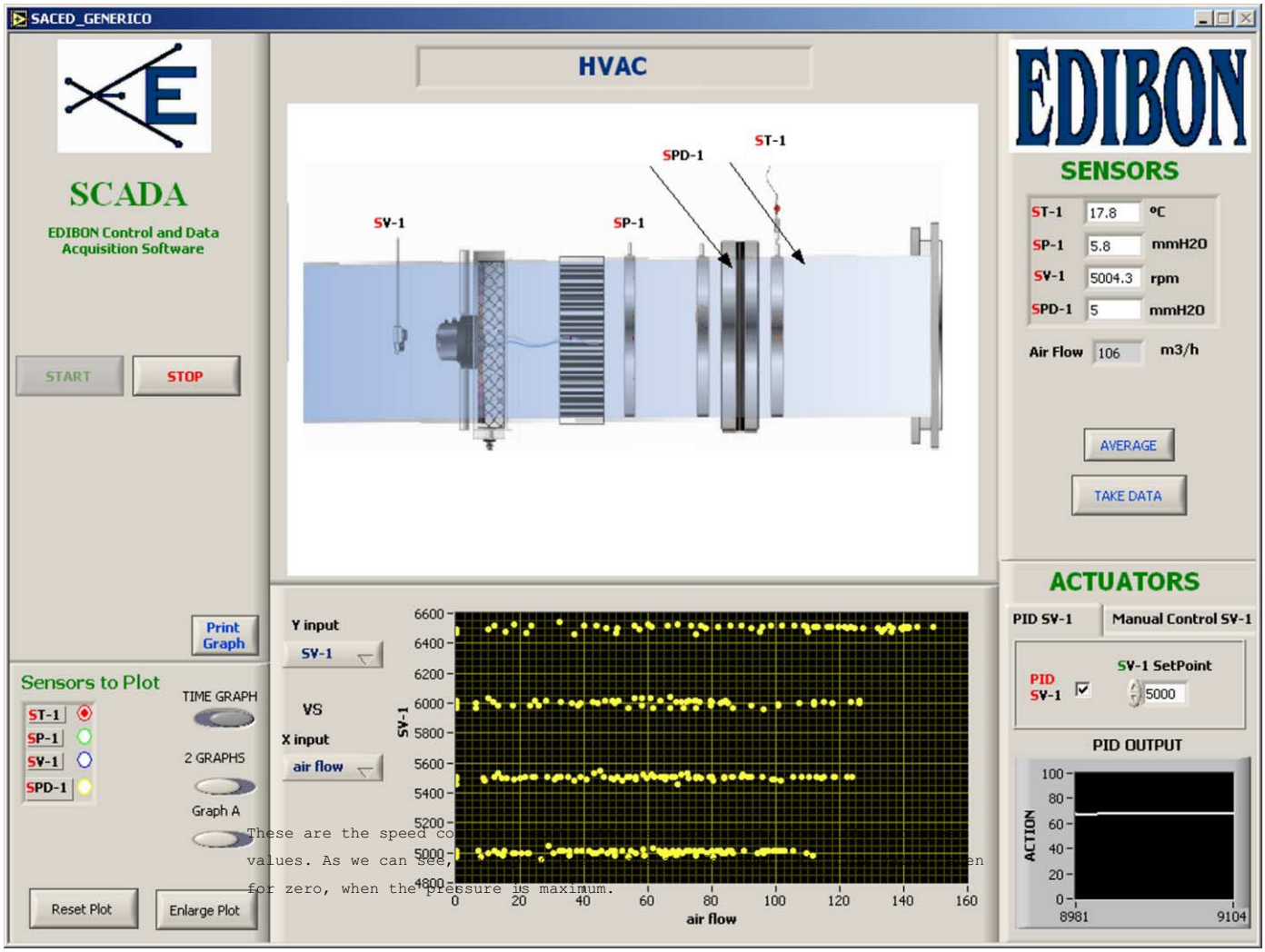
Some typical exercises results



These are the speed control results after an experiment, for different speed values. As we can see, the speed keeps constant for every air flow value, even for zero, when the pressure is maximum.

EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

1.- Measurement of overall efficiency and estimation of impeller power efficiency.
2.- Measurement of performance at constant speeds.
3.- Study of the axial fan regulation varying its turning speed.
4.- Measurement of inherent-speed machine performance in terms static and total pressure, rotor speed and motor input power, as an inlet flow function.
5.- Introduction to similarity laws for scale-up.
6.- Obtaining of the characteristic curves of an axial fan.
7.- Calculation of the Flow on a Hole Plate.
8.- Calculation of the Flow through a Symmetrical Seal. Test with an Outlet Duct and a Nozzle.
9.- Calculation of the Fan Output.
10.- Introduction to the Scaling Similitude Law.
11.- Flow calculation through a measurement of the static, dynamic and total pressure.
12.- Typical curve calculation of a fan with a constant turning speed depending on the flow used by the symmetrical seal.

Other possible practices:

13.- Sensors calibration.

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

14.- Control of the HVAC unit process through the control interface box without he computer.
15.- Visualization of all the sensors values used in the HVAC unit process.
16.- Calibration of all sensors included in the HVAC unit process.
17.- Hand on of all the actuators involved in the HVAC unit process.
18.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).
19.- 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).
20.- PLC hardware general use and manipulation.
21.- PLC process application for HVAC unit.
22.- PLC structure.
23.- PLC inputs and outputs configuration.
24.- PLC configuration possibilities.
25.- PLC program languages.
26.- PLC different programming standard languages.
27.- New configuration and development of new process.
28.- Hand on an established process.
29.- To visualize and see the results and to make comparisons with the HVAC unit process.
30.- Possibility of creating new process in relation with the HVAC unit.
31.- PLC Programming Exercises.
32.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS

Expansion 1:

EDIBON PATENT

Teaching Technique used

⑪ Mini ESN. Multipost EDIBON Mini Scada-Net System

1 UNIT = 30 STUDENTS can work simultaneously

Axial Fan Teaching Trainer (HVAC)

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

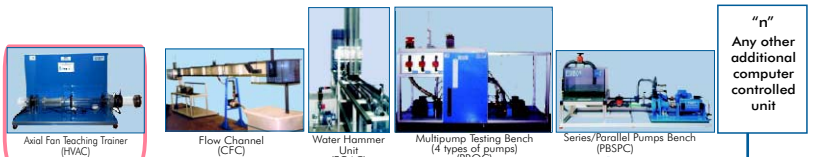
Note: The Mini ESN system can be used with any EDIBON computer controlled unit.

Expansion 2:

EDIBON PATENT

Teaching Technique used

⑫ ESN. Multipost EDIBON Scada-Net System



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: HVAC. Axial Fan Teaching Trainer.
② HVAC/CIB. Control Interface Box.
③ DAB. Data Acquisition Board.
④ HVAC/CCSOF. Computer Control + Data Acquisition + Data Management Software.
⑤ Cables and Accessories.
⑥ Manuals.

* IMPORTANT: Under HVAC 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 HVAC/PLC-SOF. PLC Control Software.
⑨ HVAC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request).
⑩ HVAC/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: 220V./50 Hz. or 110 V./60 Hz, directly from the mains.
- Computer (PC).

DIMENSIONS & WEIGHTS

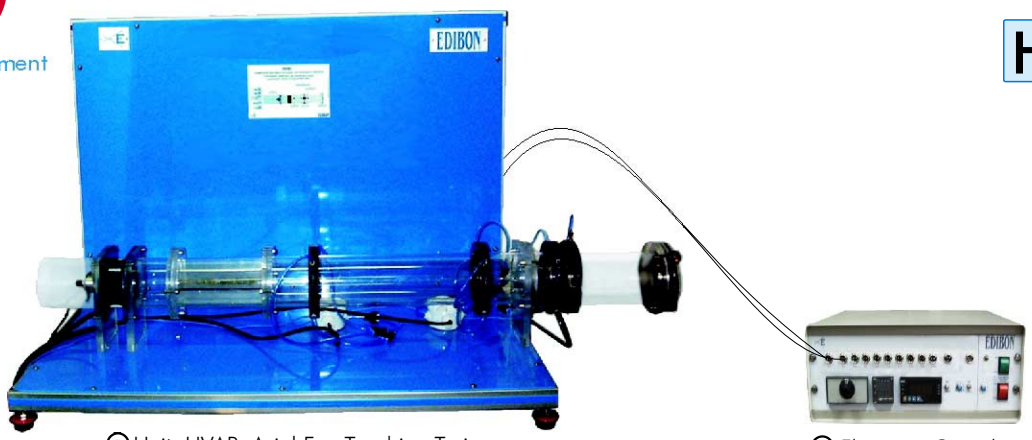
HVAC Unit: -Dimensions: 1800 x 580 x 700 mm. approx.
-Weight: 50 Kg. approx.
Control Interface Box: -Dimensions: 490x330x310 mm. approx.
-Weight: 10 Kg. approx.
PLC Module (PLC-PI): -Dimensions: 490x330x310 mm. approx.
-Weight: 30 Kg. approx

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

Axial Fan Teaching Trainer

(Manual version)

HVAB



① Unit: HVAB. Axial Fan Teaching Trainer

② Electronic Console

SPECIFICATIONS

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This unit allows the observation and the working process analysis of an axial-folw fan.
Anodized aluminium structure. Panels and main metallic elements in stainless steel.
Diagram in the front panel with similar distribution that the elements in the real unit.
Bench desktop unit.
Transparent straight duct with a diameter of 115 mm with:
- **A sector rectifier.**
- **Symmetrical seal.**
- **Hole plate with a static pressure taking.**

Single stage axial fan, driven by a 12W output AC induction motor.
Adjustable aperture system for varying the air flow rate.
Pressure meters.
Speed meter.
Temperature sensor.

② Electronic Console:
Metallic box.
Fan regulator.
Temperature sensors connections.
Sensor digital display for temperature sensors.
Sensor selector for temperature sensors.
Wattmeter.

③ Cables and accessories for a normal operation.

④ Manuals:
This unit is **supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance and Practices Manuals.**

EXERCISES AND PRACTICAL POSSIBILITIES

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REPRESENTATIVE:

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