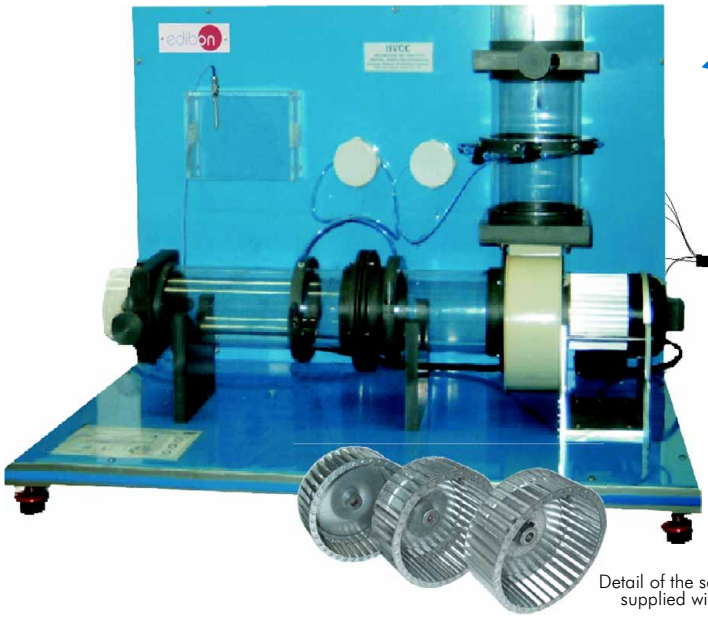
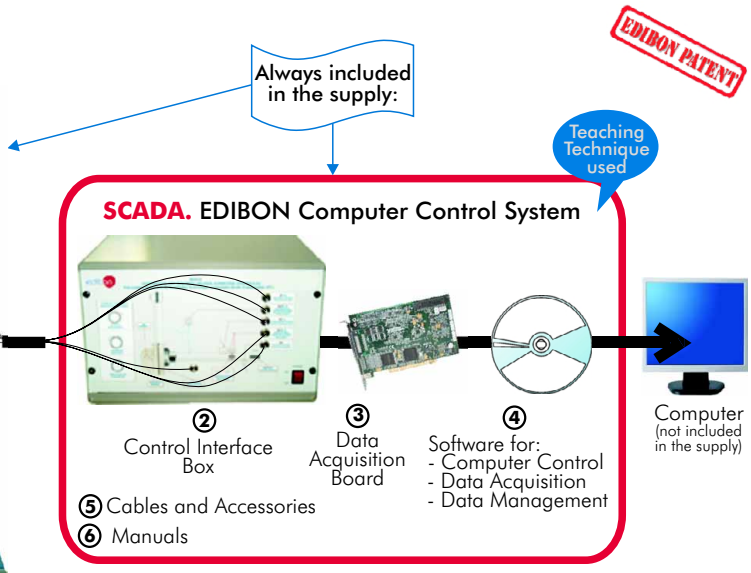
edibon
Technical Teaching Equipment

Computer Controlled **Centrifugal Fan Teaching Trainer**

HVCC

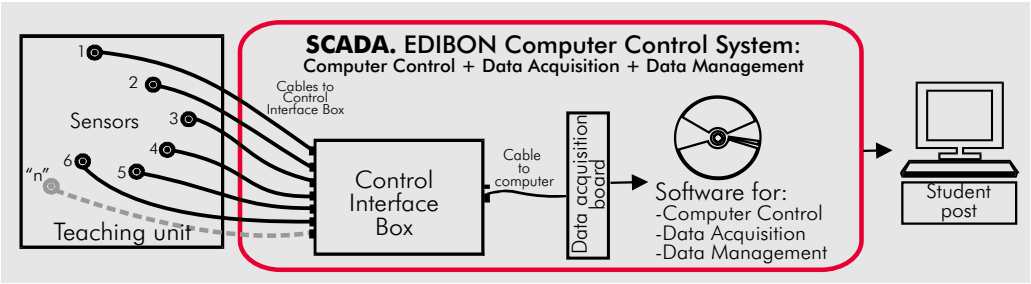


Detail of the set of turbines supplied with the unit



①Unit: HVCC. Centrifugal Fan Teaching Trainer

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL



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8.-Fluid Mechanics & Aerodynamics

ISO 9000: Quality Management
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European Union Certificate
(total safety)

Certificates ISO 14000 and
ECO-Management and Audit Scheme
(environmental management)

Worlddidac Quality Charter Certificate
(Worlddidac Member)

DESCRIPTION

A fan is a machine that can move or drive a gas as a consequence of the pressure increase that it causes.

Centrifugal fans are radial, so that the gas comes out in a radial way in relation to the shaft of the fan.

Centrifugal fans are usually used for implementations in which a bigger working pressure than in axial fans is required.

This centrifugal teaching trainer, computer controlled, is mainly formed by:

A centrifugal fan with speed control from the computer (PC).

Aspiration and discharge transparent ducts.

A speed sensor.

An orifice plate with differential pressure sensor for air flow measurement.

Butterfly valves in order to regulate the flow.

Pressure sensors in order to know the pressure.

A temperature sensor at the air inlet and a humidity sensor to know the air conditions.

This unit is supplied with a set of 3 interchangeable turbines:

One with the blades forwards.

One with the blades backwards.

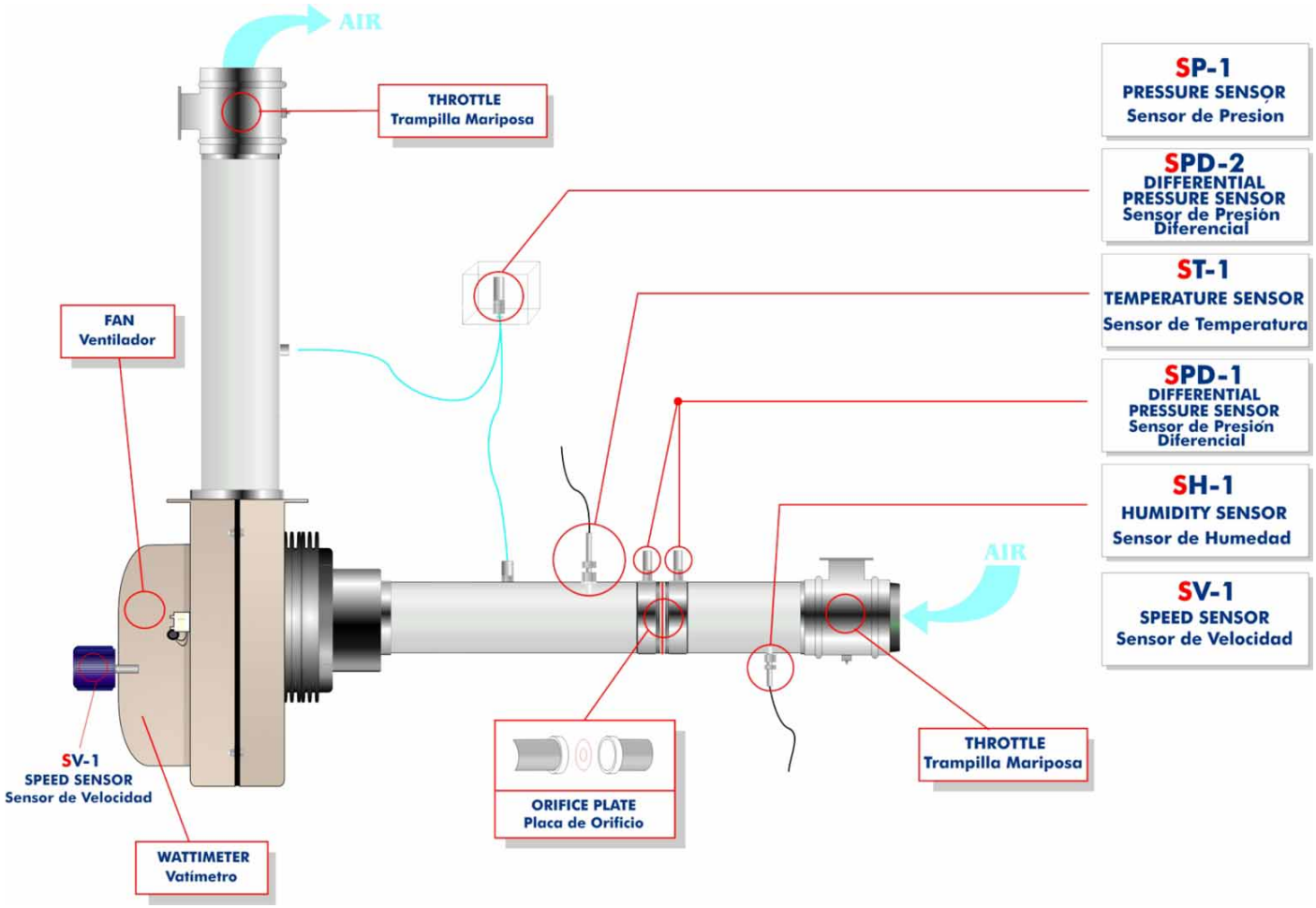
One with flat blades.

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.

PROCESS DIAGRAM AND ELEMENTS ALLOCATION

1 actuator and 7 sensors controlled from any computer, and working simultaneously

OPEN CONTROL + MULTICONTROL + REAL TIME CONTROL

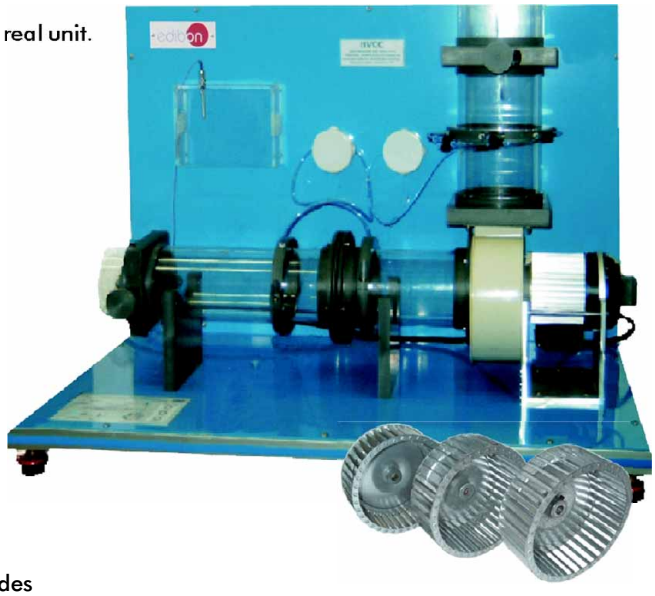


Items supplied as standard

① HVCC. Unit:

Bench-top unit.
Anodized aluminium structure and panels in painted steel (epoxy paint).
Main metallic elements in stainless steel.
Diagram in the front panel with similar distribution to the elements in the real unit.
Centrifugal fan with speed control from the computer (PC):
- Maximum power consumption: 180 W.
- Maximum pressure: 60 mm. W.C. (2.2 inches W.C.)
- Maximum flow rate: 1000 m^3/h.
- Speed range: 0-3000 rpm.

Aspiration and discharge transparent ducts.
Orifice plate with differential pressure sensor, for measuring the air flow.
Butterfly valves, placed in the inlet and the outlet of the system, for regulating flow and pressure.
Set of valves to facilitate the measurements of the fan pressure, the fan aspiration and the differential pressure.
Speed sensor, range: 0-3000 rpm.
Pressure sensors (0-1 psi).
Temperature sensor.
Humidity sensor.
Power measurement from the computer (PC).
The unit is supplied with a set of 3 interchangeable turbines : with the blades forwards, with the blades backwards and with flat blades.



HVCC. Unit

OPTIONAL Set of Accessories:

- HVCC-C2TP. 144mm. duct with two static pressure takings.
- HVCC-C1TP. 144mm. duct with one static pressure taking.
- HVCC-CTPP. 94mm. duct and pressure taking with Pitot.
- HVCC-CTPG. 144mm. duct and pressure taking with Pitot.
- HVCC-EFCG. 144mm. flow straightener by cells.
- HVCC-EFCP. 94mm. flow straightener by cells.
- HVCC-EFS. Flow straightener by sectors.
- HVCC-OS. Simmetrical shutter.
- HVCC-AA7. Angle adapter (less than 7°).
- HVCC-AA3. Angle adapter (less than 3°).
- HVCC-T2D. Nozzle of two diameters: 94mm. and 144 mm.
- HVCC-CDP. Cylinder pressure distribution.
- HVCC-TC. Heat transfer model.
- HVCC-TA. Pipe fittings.

② HVCC/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.

HVCC/CIB

Continue...

Items supplied as standard (continuation)

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= ±10V.

Data transfers=DMA, interrupts, programmed I/0.

Number of DMA channels=6.

DAB

Analog output:

Number of **Channels=2**.

Resolution=16 bits, 1 in 65536.

Max. output rate up to: 833KS/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.

④ HVCC/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.

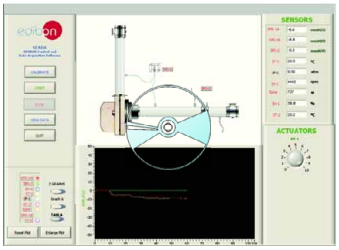
Management, processing, comparison and storage of data.

Sampling velocity up to 250,000 data per second.

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.



HVCC/CCSOF

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.

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

Continue...

Additional and optional 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.

PLC-PI

Back panel:

Power supply connector.

Fuse 2A.

RS-232 connector to PC.

USB 2.0 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 HVCC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

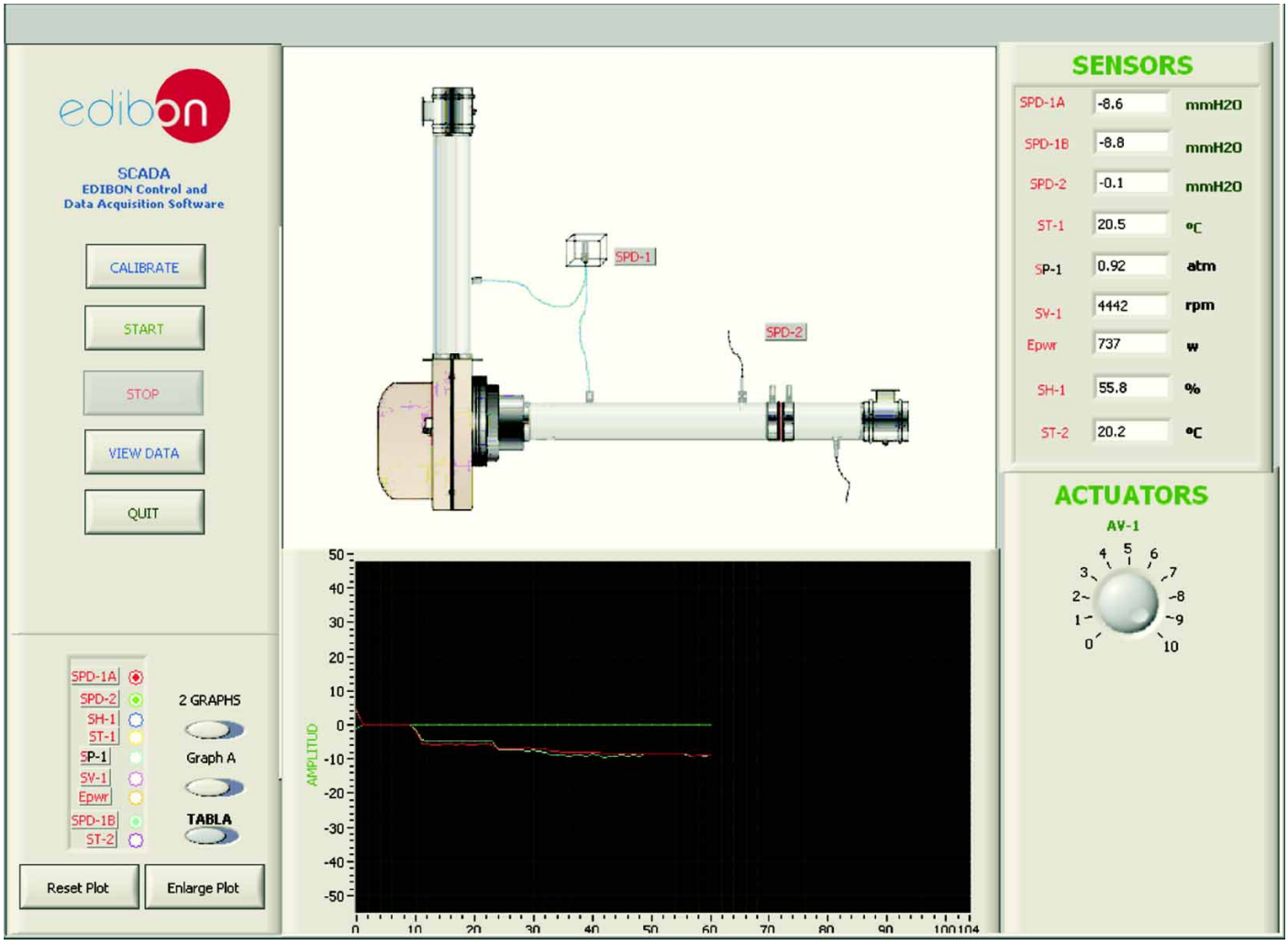
Items available on request

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

⑩ HVCC/FSS. Faults Simulation System.

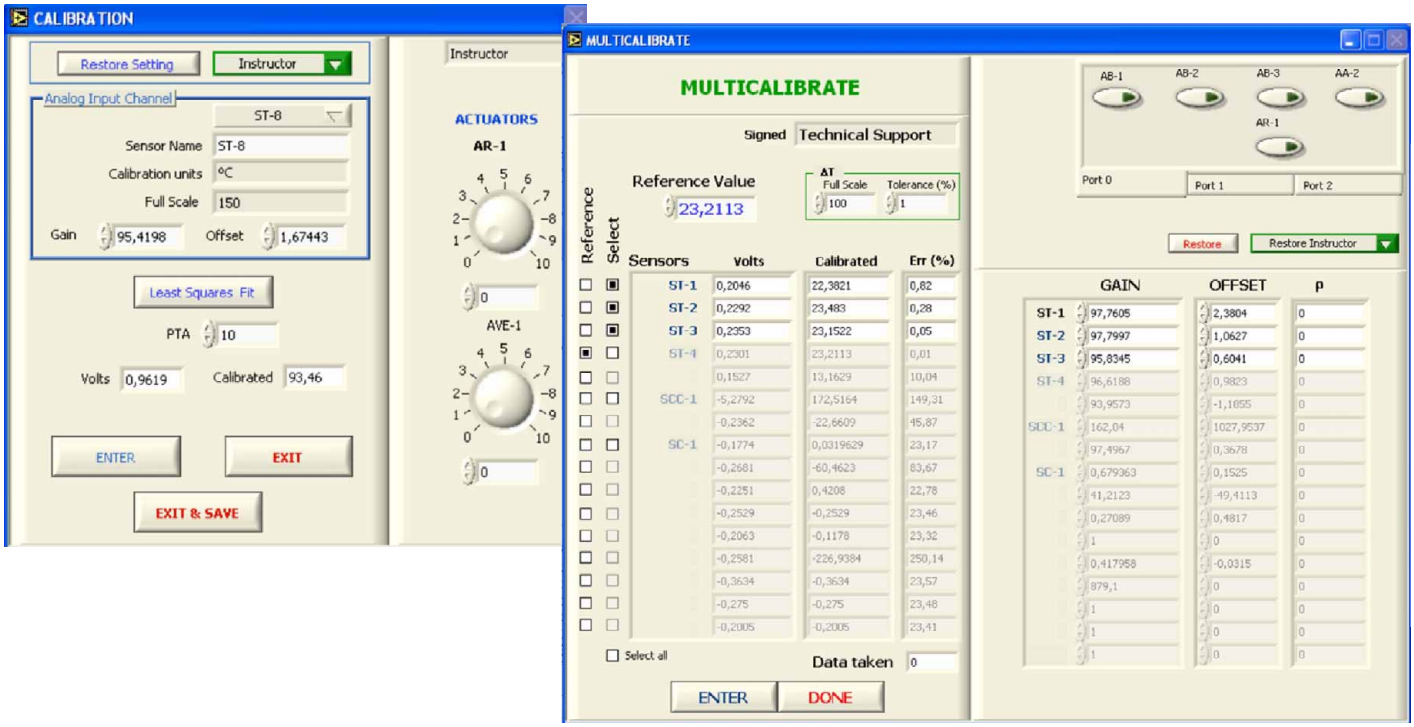
Software Main Screens

Main screen



Note: SPD=Differential pressure sensor. SP=Pressure sensor. ST= Temperature sensor. SV=Speed sensor. SH=Humidity sensor. AV= Fan.

Examples of Sensors Calibration screens



OPTIONAL SET OF ACCESSORIES

HVCC-C2TP.
144mm. duct with two
static pressure takings

HVCC-C1TP.
144mm. duct with one
static pressure taking

HVCC-CTPP.
94mm. duct and
pressure taking with Pitot

HVCC-CTPG.
144mm. duct and
pressure taking with Pitot

HVCC-EFCG.
144mm. flow straightener
by cells

HVCC-EFCP.
94mm. flow straightener
by cells

HVCC-EFS.
Flow straightener
by sectors

HVCC-OS.
Simmetrical shutter

HVCC-AA7.
Angle adapter
(less than 7°)

HVCC-AA3.
Angle adapter
(less than 3°)

HVCC-T2D.
Nozzle of two
diameters: 94mm. and 144 mm

Other accessories:

- HVCC-CDP. Cylinder pressure distribution.
- HVCC-TC. Heat transfer model.
- HVCC-TA. Pipe fittings.

EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

1.- Measurement of constant-speed fan performance in terms of static and total pressures, rotor speed and motor shaft power, as a function of inlet flow.

2.- Calculation of flow with and orifice plate.

3.- Calculation of the fan efficiency.

4.- Introduction to similarity laws for scale-up.

5.- Calculation of the flow by static pressure measurement, dynamic pressure measurement and total pressure depending of the test.

6.- Practices with the different of turbines: with the blades forwards, with the blades backwards and with flat blades.

7.- Determination of the fan characteristics curves.

8.- Calculation of the typical curve of a fan at a constant turning speed (turbine with blades forwards).

9.- Calculation of the typical curve of a fan at a constant turning speed (turbine with blades backwards).

10.- Calculation of the typical curve of a fan at a constant turning speed (turbine with flat blades).

11.- Measurement of performance at constant speeds.

12.- Static pressure increasing.

13.- Sensors calibration.

Other possible practices (with the optional Set of Accessories):

14.- Calculation of flow. Test with discharge duct and nozzle.

15.- Calculation of flow. Test with aspiration duct and nozzle.

16.- Calculation of the differential flow according to the turbines position in the discharge duct.

17.- Calculation of the differential flow according to the turbines position in the aspiration duct.

18.- Determination of the fan characteristics curves (with the optional Set of Accessories).

19.- Measuring a cooling curve.

20.- Determination of the coefficient of heat transfer from the cooling curve.

21.- Measurement of the pressure distribution around a cylinder in a transverse flow.

22.- Measurements behind a cylinder in a transverse flow.

23.- Pressure loss measurements at a bend.

24.- Pressure loss measurements on pipe sections.

25.- Pressure loss measurements at an elbow.

26.- To investigate the influence of different shaped pipe inlets.

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

27.- Control of the HVCC unit process through the control interface box without the computer.

28.- Visualization of all the sensors values used in the HVCC unit process.

29.- Calibration of all sensors included in the HVCC unit process.

30.- Hand on of all the actuators involved in the HVCC unit process.

31.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).

32.- 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).

33.- PLC hardware general use and manipulation.

34.- PLC process application for HVCC unit.

35.- PLC structure.

36.- PLC inputs and outputs configuration.

37.- PLC configuration possibilities.

38.- PLC program languages.

39.- PLC different programming standard languages.

40.- New configuration and development of new process.

41.- Hand on an established process.

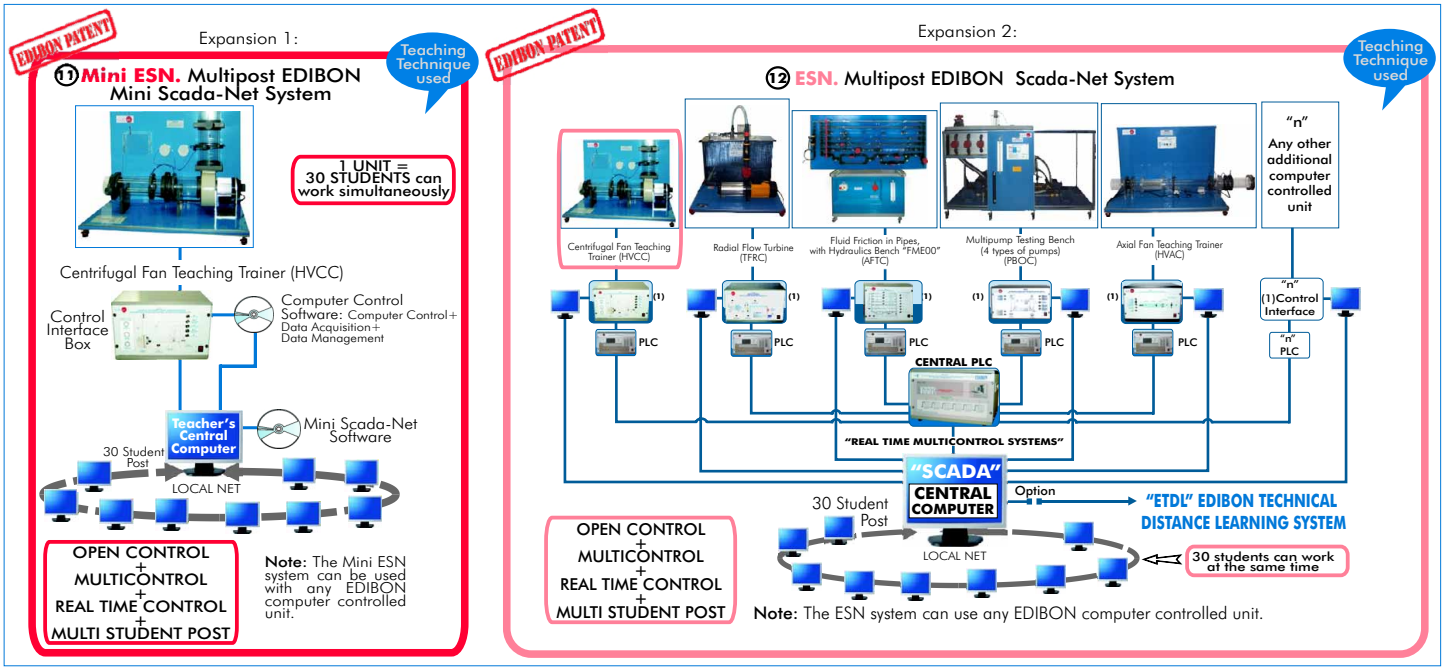
42.- To visualize and see the results and to make comparisons with the HVCC unit process.

43.- Possibility of creating new process in relation with the HVCC unit.

44.- PLC Programming Exercises.

45.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS



ORDER INFORMATION

Items supplied as standard

Minimum configuration for normal operation includes:

① **Unit: HVCC. Centrifugal Fan Teaching Trainer.**

② **HVCC/CIB. Control Interface Box.**

③ **DAB. Data Acquisition Board.**

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

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

⑥ **Manuals.**

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

Additional and optional items to the standard supply

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

⑦ PCL-PI.PLC Module.

⑧ HVCC/PLC-SOF. PLC Control Software.

⑨ HVCC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request).

⑩ HVCC/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, 220V./50 Hz. or 110 V./60 Hz.
- Computer (PC).

DIMENSIONS & WEIGHTS

HVCC Unit:	-Dimensions: 1000 x 600 x 700 mm. approx.
	-Weight: 50 Kg. approx.
Control Interface Box:	-Dimensions: 490 x 330 x 310 mm. approx.
	-Weight: 10 Kg. approx.
PLC Module (PLC-PI):	-Dimensions: 490 x 330 x 310 mm. approx.
	-Weight: 30 Kg. approx.

OPTIONAL SET OF ACCESSORIES

- HVCC-C2TP. 144mm. duct with two static pressure takings.
- HVCC-C1TP. 144mm. duct with one static pressure taking.
- HVCC-CTPP. 94mm. duct and pressure taking with Pitot.
- HVCC-CTPG. 144mm. duct and pressure taking with Pitot.
- HVCC-EFCG. 144mm. flow straightener by cells.
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- HVCC-OS. Simmetrical shutter.
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- HVCC-T2D. Nozzle of two diameters: 94mm. and 144 mm.
- HVCC-CDP. Cylinder pressure distribution.
- HVCC-TC. Heat transfer model.
- HVCC-TA. Pipe fittings.

AVAILABLE VERSIONS

Offered in this catalogue:

- **HVCC.** Computer Controlled **Centrifugal Fan Teaching Trainer.**

Offered in other catalogue:

- **HVCB. Centrifugal Fan Teaching Trainer.**

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

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