



* Minimum supply always includes: 1 + 2 + 3 + 4 + 5 + 6
(Computer not included in the supply)

Key features:

- **Advanced Real-Time SCADA.**
- **Open Control + Multicontrol + Real-Time Control.**
- **Specialized EDIBON Control Software based on LabVIEW.**
- **National Instruments Data Acquisition board (250 KS/s, kilo samples per second).**
- **Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.**
- **Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.**
- **Capable of doing applied research, real industrial simulation, training courses, etc.**
- **Remote operation and control by the user and remote control for EDIBON technical support, are always included.**
- **Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).**
- **Designed and manufactured under several quality standards.**
- **Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user's knowledge and progress reached.**
- **This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.**

**OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL**



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↳ 80.- FLUID MECHANICS

For more information about Key Features, click here



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)



Certificate and Worlddidac Member

INTRODUCTION

Aerodynamics is the part of fluid mechanics that studies the motion of gases and the forces or reactions to which the bodies they interact with are subjected. Aerodynamics is not only important by itself but also as a complement to aeronautics. According to Mach number, or relative speed of a movable object with respect to air, these studies are divided into subsonic and supersonic aerodynamics, depending on whether that number is higher or lower than one.

Knowing the aerodynamics principles is useful for many activities, from the take-off and piloting of an airplane to driving a car or kicking a ball. Every time we move or throw an object, there are many physical principles acting, but we do not notice them.

A wind tunnel is a place widely used to determine the action of wind on different types of bodies. The model under study remains motionless, whereas air moves to generate the desired flow.

GENERAL DESCRIPTION

The Computer Controlled Aerodynamic Tunnel, 50 x 250 mm, "TA50/250C", is a wind tunnel designed to study subsonic aerodynamics in a tunnel in open circuit and with incompressible subsonic flow. Air is drawn by a variable speed fan, computer controlled, located at the discharge end of the tunnel. Several models and accessories are available, allowing a comprehensive study of subsonic aerodynamics.

The unit includes several tunnel sections. In the same order in which the flow crosses them, they are: lips, haven section, contraction, working area, diffuser and fan.

Lips and a haven section are incorporated at the tunnel inlet to reduce the pressure drop and the interferences in the flow. An 8:1 contraction ratio and a perfectly studied contour curve of the contraction ensures well developed airflow through the working area.

The working area is located after the contraction. It is a constant section tract, where the models to be tested are assembled, and the dimensions of the transverse section is bigger than the models. It is made of clear acrylic resin to allow to observe the models. This section includes a Pitot static tube in the top side to study the static pressure, dynamic pressure and total pressure.

A diffuser is included at the tunnel outlet to avoid the generation of turbulences, which can generate damages in the current quality at the working area.

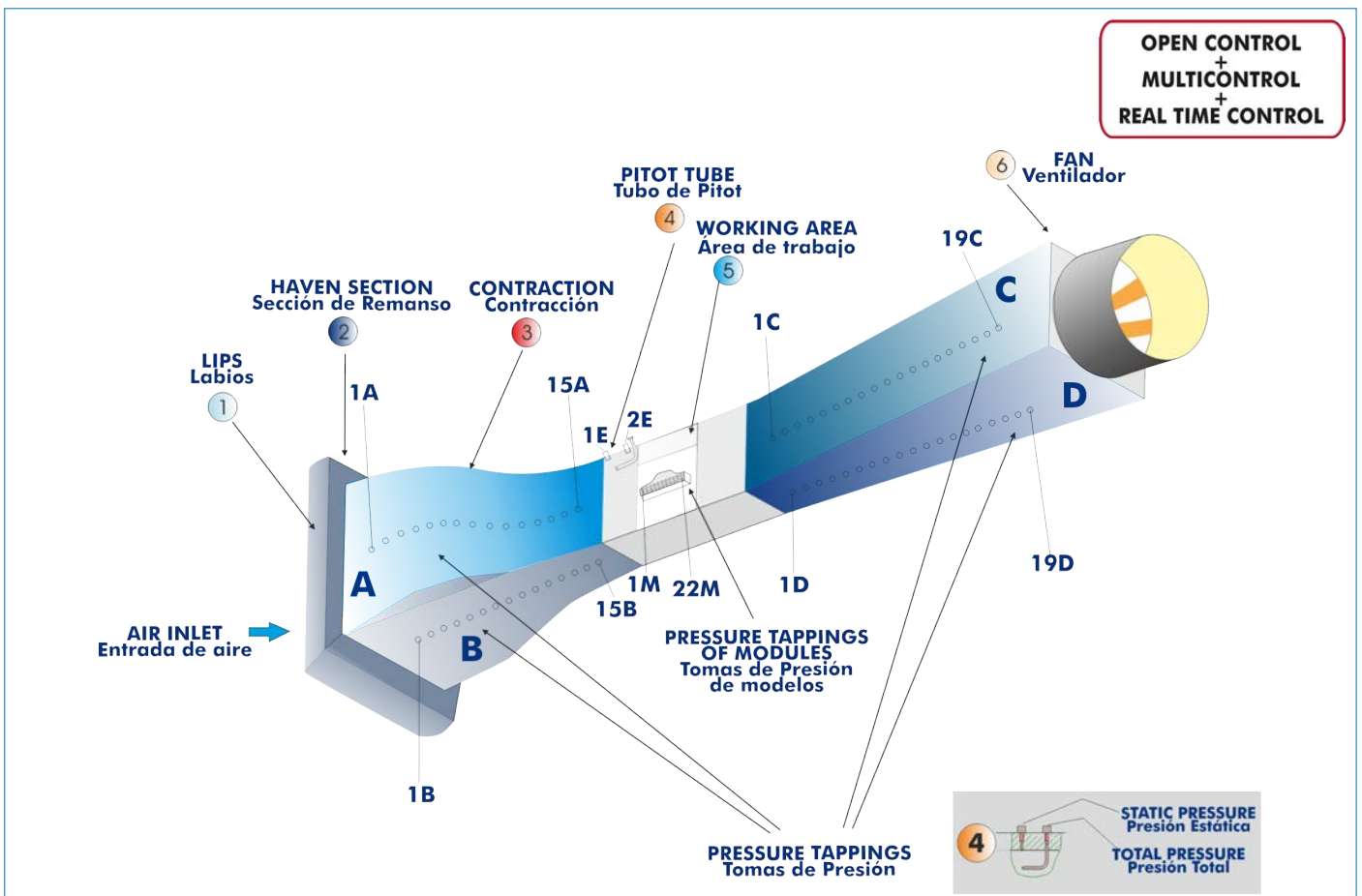
An axial-flow fan, located at the discharge end of the tunnel, provides a more uniform velocity profile at the working area.

There are sixty different appropriate tapings for the pressure takings (along the tunnel and in the different models). The unit includes thirty differential pressure sensors to measure the static pressure.

The models are mounted on a circular hatch (200 mm), and they are coupled to the working area to seal the opening. They are secured by knobs on the side wall of the working area.

This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), and includes: The unit itself + a Control Interface Box + a Data Acquisition Board + Computer Control, Data Acquisition and Data Management Software Packages, for controlling the process and all parameters involved in the process.

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



With this unit there are several options and possibilities:

- Main items: 1, 2, 3, 4, 5 and 6.
- Optional items: 7, 8, 9, 10 and 11.

Let us describe first the main items (1 to 6):

① **TA50/250C. Unit:**

Bench-top wind tunnel in open circuit and with incompressible subsonic flow.

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.

Inlet section with lips, a haven section and a 8:1 contraction ratio.

Transparent working area of 50 x 250 mm to assemble and test the different models.

The working area includes a Pitot static tube mounted in the top side.

Outlet section with diffuser that allows to avoid the generation of turbulences, which can generate damages the current quality in the working area.

Variable speed axial-flow fan, computer controlled:

Velocity range: 0 – 2800 rpm.

Air velocity in the working area: 0 – 27 m/s.

Sixty different pressure tappings (along the tunnel and in the models).

Thirty differential pressure sensors, range: 0 – 1 PSI.

Several models and accessories are available, allowing a comprehensive study of subsonic aerodynamics.

All these models include several pressure tappings.

Models and Accessories included:

- TA1. House Scale Model.
- TA2. Cylinder Model.
- TA3. Convex Semi-Cylinder Model.

The complete unit includes as well:

Advanced Real-Time SCADA.

Open Control + Multicontrol + Real-Time Control.

Specialized EDIBON Control Software based on LabVIEW.

National Instruments Data Acquisition board (250 KS/s, kilo samples per second).

Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.

Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.

Capable of doing applied research, real industrial simulation, training courses, etc.

Remote operation and control by the user and remote control for EDIBON technical support, are always included.

Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).

Designed and manufactured under several quality standards.

Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user's knowledge and progress reached.

This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

Optional Models and Accessories: (Not included)

- TA4. Car Model.
- TA5. Lorry Model.
- TA6. Lorry with Wind Deflector Model.
- TA7. Plane Model.
- TA8. Train Model.
- TA9. Projectile Model.
- TA10. Circular Disc Model.
- TA11. Wing of a Plane Model.
- TA12. Concave Semi-Cylinder Model.
- TA13. Blunt Element Model.
- TA14. Bernoulli Apparatus Model.
- TA15. Boundary Layer Plate Model.
- TA16. Model under "Custom Design".
- TA17. Wake Survey Rake.
- TA18. Streamlined Shape (TA19 + TA50/250C-TARC models are required).
- TA19. Lift and Drag Balance (TA50/250C-TARC model is always required to operate TA18 and/or TA20 models).
- TA20. Drag Models (Sphere, Hemisphere, Convex, Hemisphere Concave, Circular Disc) (TA19 + TA50/250C-TARC models are required).
- TA50/250C-TARC. Forces Measurement Interface (TA19 model is always required to operate TA18 and/or TA20 models).
- TA50/250-BLE. Boundary Layer Experiment Accessory.
- TA50/250-SG1. Smoke Generator.



Unit: TA50/250C

Models and Accessories included:



TA1. House Scale Model



TA2. Cylinder Model



TA3. Convex Semi-Cylinder Model

② TA50/250C/CIB. Control Interface Box:

The Control Interface Box is part of the SCADA system.

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.

Simultaneous 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 displayed on only one screen in the computer.

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, heating elements, control valves, etc.

Real time computer control for parameters involved in the process simultaneously.

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

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



TA50/250C/CIB

③ DAB. Data Acquisition Board:

The Data Acquisition board is part of the SCADA system.

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

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)= ±10 V. Data transfers=DMA, interrupts, programmed I/O. DMA channels=6.

Analog output:

Number of channels=2. Resolution= 16 bits, 1 in 65536.

Maximum output rate up to: 900 KS/s.

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

Digital Input/Output:

Number of channels=24 inputs/outputs. D0 or DI Sample Clock frequency: 0 to 100 MHz.

Timing: Number of Counter/timers=4. Resolution: Counter/timers: 32 bits.



DAB

④ TA50/250C/CCSOF. Computer Control + Data Acquisition + Data Management Software:

The three softwares are part of the SCADA system.

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 simultaneous 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 KS/s (kilo samples per second).

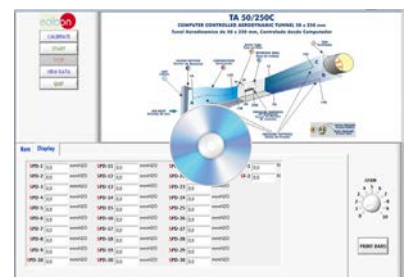
Calibration system for the sensors involved in the process.

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.

Open software, allowing 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 to different work levels.

This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.



TA50/250C/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 are the main items: TA50/250C + TA50/250C/CIB + DAB + TA50/250C/CCSOF + Cables and Accessories + Manuals are included in the minimum supply for enabling normal and full operation.

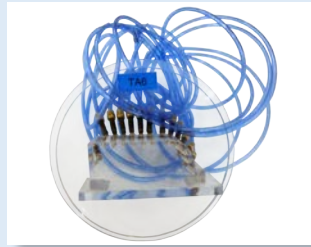
Optional Models and Accessories: (Not included)



TA4. Car Model



TA5. Lorry Model



TA6. Lorry with Wind Deflector Model



TA7. Plane Model



TA8. Train Model



TA9. Projectile Model



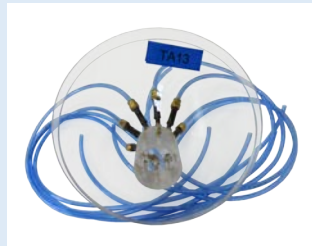
TA10. Circular Disc Model



TA11. Wing of a Plane Model



TA12. Concave Semi-Cylinder Model



TA13. Blunt Element Model



TA14. Bernoulli Apparatus Model



TA15. Boundary Layer Plate Model



TA16. Model under "Custom Design"



TA17. Wake Survey Rake



TA18. Streamlined Shape
(TA19 + TA50/250C-TARC models are required)



TA19. Lift and Drag Balance
(TA50/250C-TARC model is always required to operate TA18 and/or TA20 models)



TA20. Drag Models
(TA19 + TA50/250C-TARC models are required)



TA50/250C-TARC. Forces Measurement Interface (TA19 model is always required to operate TA18 and/or TA20 models)



TA50/250-BLE. Boundary Layer Experiment Accessory



TA50/250-SG1. Smoke Generator

EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH THE MAIN ITEMS

- 1.- Comprehensive study of subsonic aerodynamics and airflow studies.
 - 2.- Measurement of pressure distribution around a two dimensional body.
 - 3.- Study of flow visualization.
 - 4.- Study of static pressure, dynamic pressure and total pressure using a Pitot' tube.
 - 5.- Study of velocity measurement using a Pitot tube.
 - 6.- Flux in a nozzle: Determination of the characteristics of the pressures field in a nozzle.
 - 7.- Flux in a nozzle: Observation of the local characteristics, depending on whether the walls have a curvature or not, as well as what happens at the inlet and outlet areas of the contraction.
 - 8.- House Scale Model (TA1): Study of aerodynamic forces due to the wind on a house.
 - 9.- House Scale Model (TA1): Determination of the aerodynamic loads generated by the wind on a house walls.
 - 10.-Cylinder Model (TA2): Study of flow around a cylinder.
 - 11.-Cylinder Model (TA2): Determination of the form of the pressures field around a cylinder on which a current perpendicular to the axis impacts.
 - 12.-Cylinder Model (TA2): Determination, by the type of detachment, whether the boundary layer finally becomes turbulent or remains laminar.
 - 13.-Cylinder Model (TA2): Determination of the resistance coefficient of the cylinder.
 - 14.-Cylinder Model (TA2): Relation of all the above-mentioned with the Reynolds's number.
 - 15.-Convex Semi-Cylinder Model (TA3): Study of flow around a convex semi-cylinder.
 - 16.-Convex Semi-Cylinder Model (TA3): Determination of the field of pressures in the convex semi-cylinder.
 - 17.-Convex Semi-Cylinder Model (TA3): Determination of the aerodynamic resistance coefficients in the convex semi-cylinder.
- Additional practical possibilities:
- 18.-Sensors calibration.
- Additional practical possibilities to be done with the Optional Models and Accessories: (Not included)
- 19.-Study of aerodynamic forces due to the wind on a Car Model (TA4).
 - 20.-Study of aerodynamic forces due to the wind on a Lorry Model (TA5).
 - 21.-Study of aerodynamic forces due to the wind on a Lorry with Wind Deflector Model (TA6).
 - 22.-Study of aerodynamic forces due to the wind on a Plane Model (TA7).
 - 23.-Study of aerodynamic forces due to the wind on a Train Model (TA8).
 - 24.-Study of aerodynamic forces due to the wind on a Projectile Model (TA9).
 - 25.-Study of aerodynamic forces due to the wind on a Circular Disc Model (TA10).
 - 26.-Study of aerodynamic forces due to the wind on a Wing of a Plane Model (TA11).
 - 27.-Study of flow and pressure distribution around a Wing of a Plane Model (TA11) at different angles of attack.
 - 28.-Study of aerodynamic forces due to the wind on a Concave Semi-Cylinder Model (TA12).
 - 29.-Study of aerodynamic forces due to the wind on a Blunt Element Model (TA13).
 - 30.-Study of effect of changing in Bernoulli Apparatus Model (TA14) the cross section and application of the Bernoulli equation.
 - 31.-Study of laminar and turbulent boundary layer development with the Boundary Layer Plate Model (TA15) and the Boundary Layer Experiment Accessory (TA50/250-BLE).
 - 32.-Study of static pressure, dynamic pressure and total pressure with the Wake Survey Rake (TA17).
 - 33.-Study of aerodynamic forces due to the wind on a Streamlined Shape (TA18).
 - 34.-Investigation into the influence of models shape in the drag forces (Lift and Drag Balance (TA19), Drag Models (TA20) and Forces Measurement Interface (TA50/250C-TARC)).
 - 35.-Demonstration of flow patterns around different objects with the Smoke Generator (TA50/250-SG1).
- Other possibilities to be done with this Unit:
- 36.-Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
 - 37.-Open Control, Multicontrol and Real Time Control.
This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivative parameters; etc, in real time.
 - 38.-The Computer Control System with SCADA allows a real industrial simulation.
 - 39.-This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
 - 40.-This unit can be used for doing applied research.
 - 41.-This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
 - 42.-Control of the TA50/250C unit process through the control interface box without the computer.
 - 43.-Visualization of all the sensors values used in the TA50/250C unit process.
- By using PLC-PI additional 19 more exercises can be done.
- Several other exercises can be done and designed by the user.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

TA50/250C:

Unit:

-Dimensions: 2720 x 820 x 700 mm approx.
(107.08 x 32.28 x 27.56 inches approx.)

-Weight: 200 Kg approx.
(441 pounds approx.)

Control Interface Box:

-Dimensions: 490 x 330 x 310 mm approx.
(19.29 x 12.99 x 12.20 inches approx.)

-Weight: 20 Kg approx.
(44 pounds approx.)

OPTIONAL MODELS AND ACCESSORIES (Not included)

- TA4. Car Model.
- TA5. Lorry Model.
- TA6. Lorry with Wind Deflector Model.
- TA7. Plane Model.
- TA8. Train Model.
- TA9. Projectile Model.
- TA10. Circular Disc Model.
- TA11. Wing of a Plane Model.
- TA12. Concave Semi-Cylinder Model.
- TA13. Blunt Element Model.
- TA14. Bernoulli Apparatus Model.
- TA15. Boundary Layer Plate Model.
- TA16. Model under "Custom Design".
- TA17. Wake Survey Rake.
- TA18. Streamlined Shape (TA19 + TA50/250C-TARC models are required).
- TA19. Lift and Drag Balance (TA50/250C-TARC model is always required to operate TA18 and/or TA20 models).
- TA20. Drag Models (Sphere, Hemisphere, Convex, Hemisphere Concave, Circular Disc) (TA19 + TA50/250C-TARC models are required).
- TA50/250C-TARC. Forces Measurement Interface (TA19 model is always required to operate TA18 and/or TA20 models).
- TA50/250-BLE. Boundary Layer Experiment Accessory.
- TA50/250-SG1. Smoke Generator.

AVAILABLE VERSIONS

Offered in this catalogue:

- TA50/250C. Computer Controlled Aerodynamic Tunnel, 50 x 250 mm.

Offered in other catalogue:

- TA50/250. Aerodynamic Tunnel, 50 x 250 mm.

SOFTWARE MAIN SCREENS

SCADA Main screen

- I Main software operation possibilities.
- II Sensors displays, real time values, and extra output parameters. Sensors: SPD=Differential pressure sensor. SF=Force sensor.
- III Actuators controls. Actuator: AFAN=Fan.

Software for Sensors Calibration

Example of screens

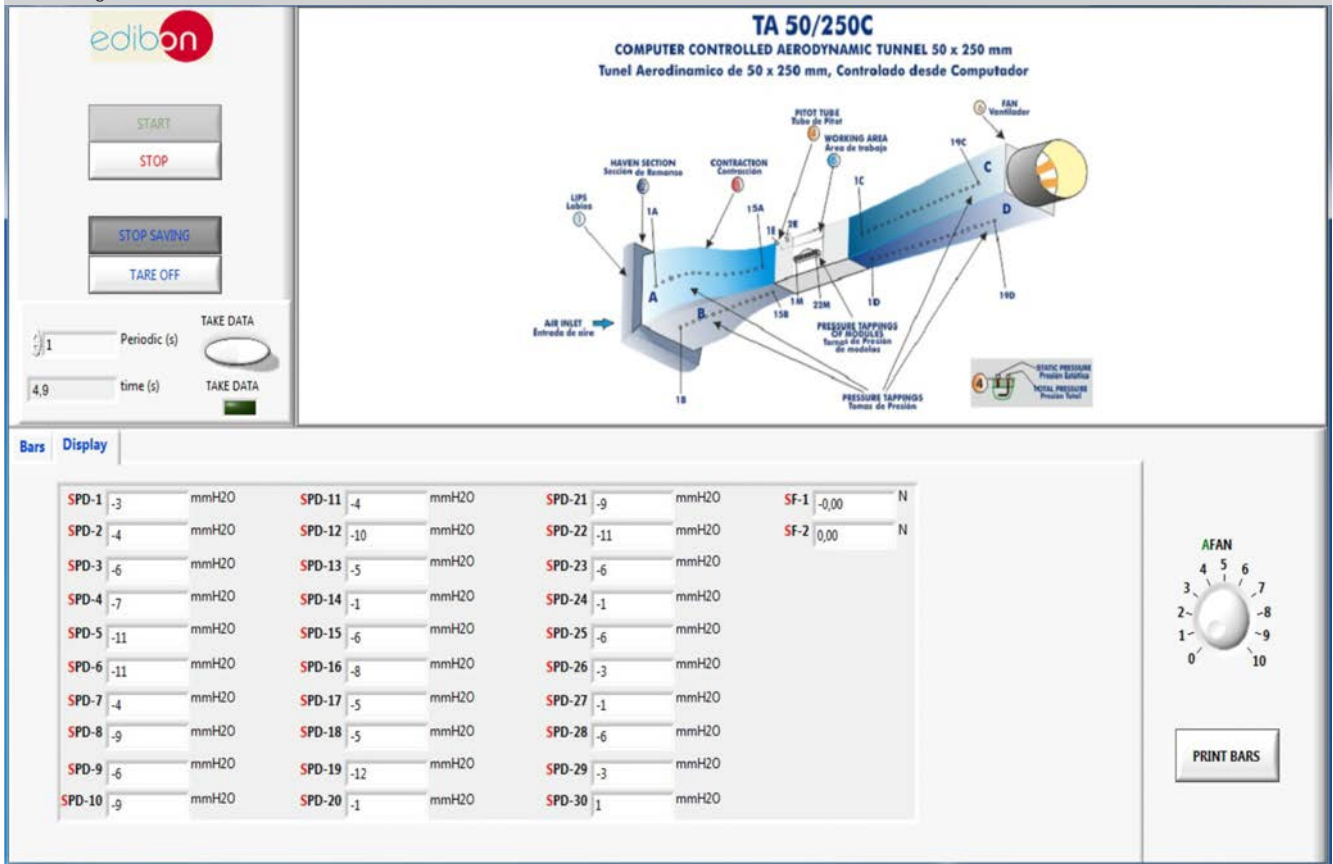
VOLTS	CALIBRATED
SPD-1	4,9704
SPD-2	4,9858
SPD-3	-0,0068
SPD-4	-0,0067
SPD-5	-0,0763
SPD-6	-0,0221
SPD-7	-0,056
SPD-8	0,0041
SPD-9	0,0508
SPD-10	0,0972
SPD-11	-0,0488
SPD-12	-0,0083
SPD-13	-0,0551
SPD-14	-0,0206
SPD-15	-0,0561
SPD-16	0
SPD-17	0
SPD-18	0
SPD-19	0
SPD-20	0
SPD-21	0
SPD-22	0
SPD-23	0
SPD-24	0
SPD-25	0
SPD-26	0
SPD-27	0
SPD-28	0
SPD-29	0
SPD-30	0
SF-1	0,0101
SF-2	0

GAIN	OFFSET	R	
SPD-1	90,0682	SPD-16	87,7155
SPD-	88,0905	SPD-	92,645
SPD-3	87,5392	SPD-18	86,7486
SPD-4	87,5267	SPD-19	91,9153
SPD-5	90,0206	SPD-20	88,2083
SPD-6	94,2585	SPD-21	87,4332
SPD-7	94,1605	SPD-22	93,0337
SPD-8	90,702	SPD-23	93,1893
SPD-9	88,1789	SPD-24	90,3589
SPD-10	87,5109	SPD-25	94,7974
SPD-11	91,0217	SPD-26	96,464
SPD-12	89,2163	SPD-27	95,3879
SPD-13	89,6037	SPD-28	92,5261
SPD-14	89,0718	SPD-29	89,1078
SPD-15	89,1813	SPD-30	92,3957
SF-1	0,6262	SF-2	0,6113

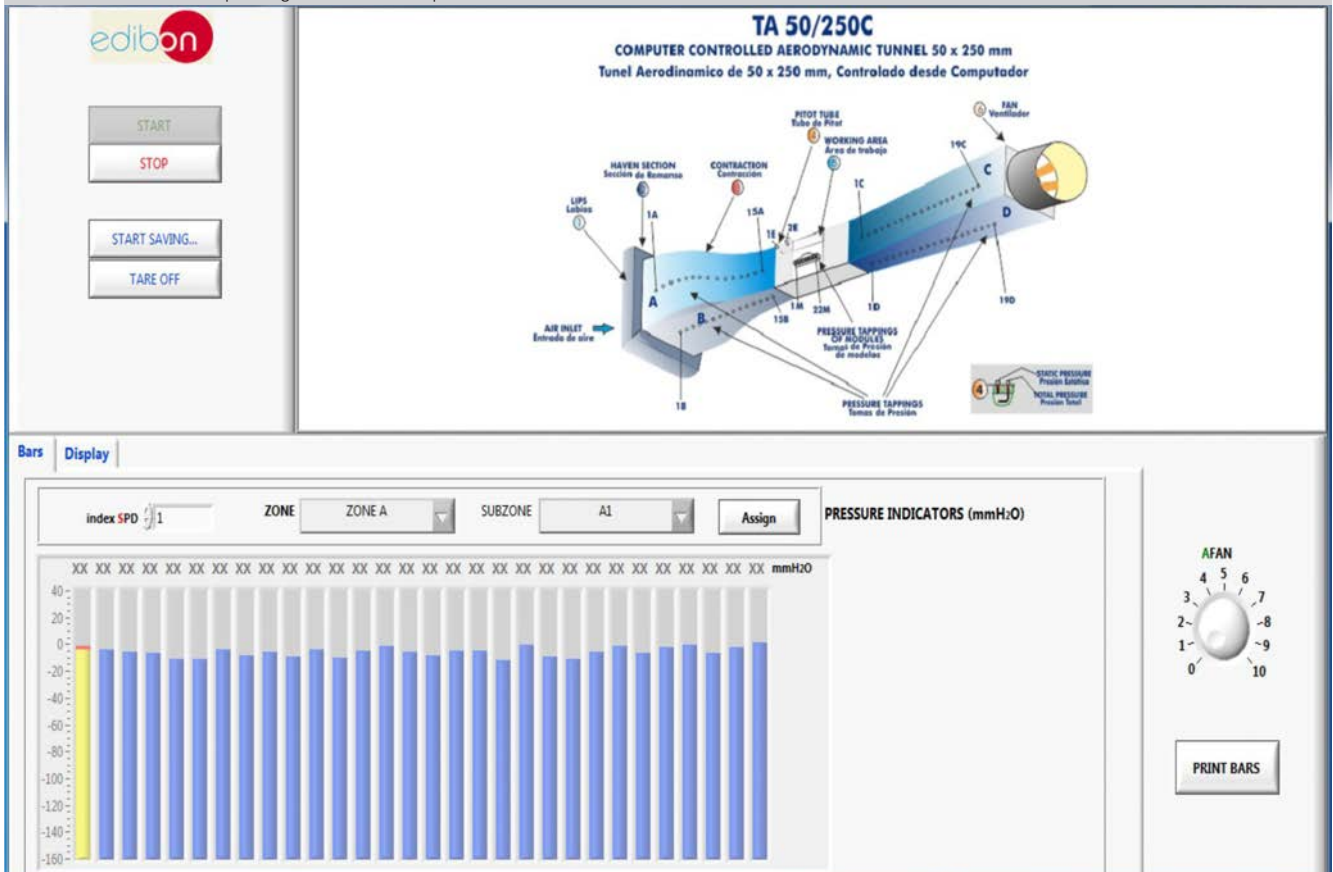
The teacher and the students can calibrate the unit with a password provided by EDIBON. The teacher can restore the factory calibration any time.

SOME REAL RESULTS OBTAINED FROM THIS UNIT

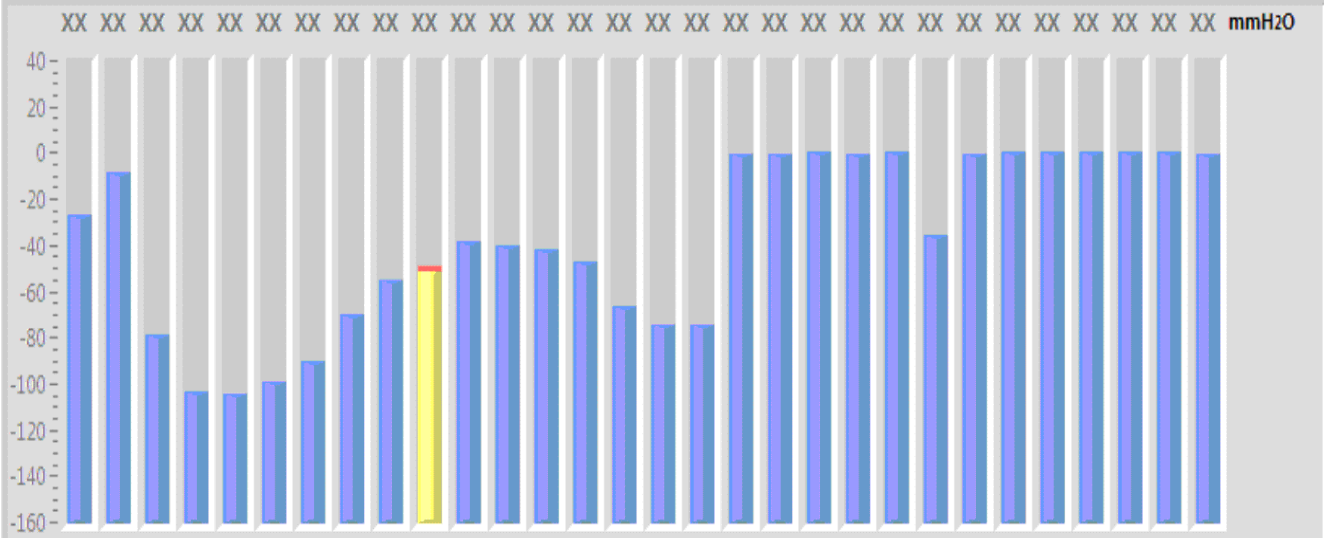
The software enables to visualize all pressure values along the tunnel and in the different models. The force measurement accessory "TA50/250C-TARC" together with the TA19 model allow the measurement of resistance forces of the TA18 and TA20 models.



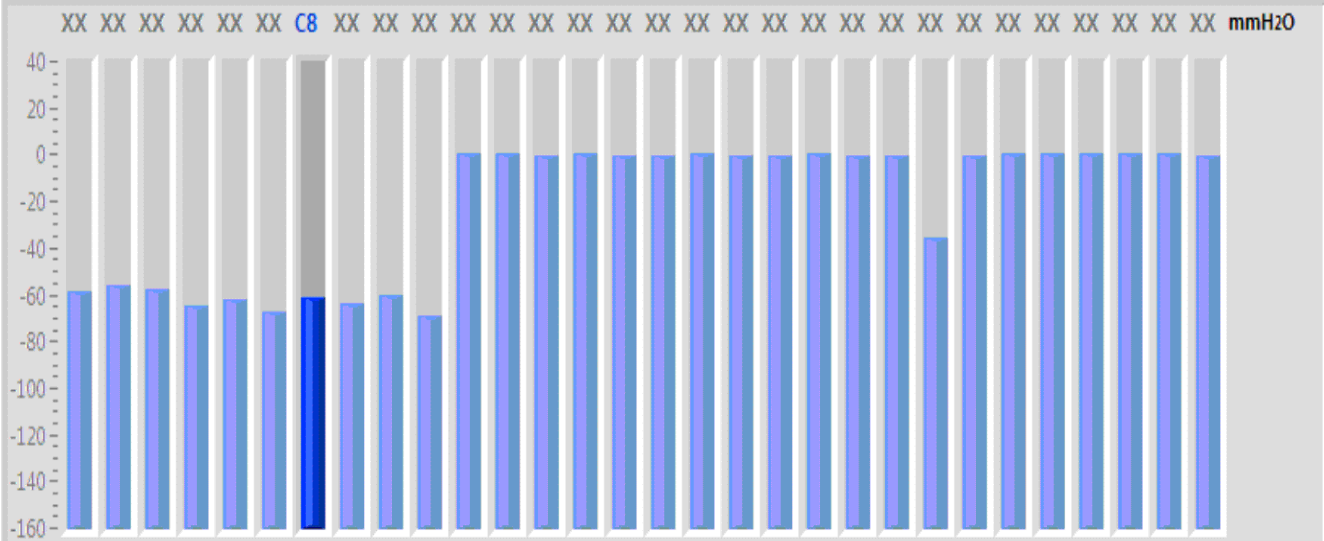
The software allows the plotting of the different pressure sensors.



Pressure profile of model TA11: Wing of a Plane Model.



Pressure profile of model TA17: Wake Survey Rake.



COMPLETE TECHNICAL SPECIFICATIONS (for optional items)

Additionally to the main items (1 to 6) described, we can offer, as optional, other items from 7 to 11.

All these items try to give more possibilities for:

- a) Industrial configuration. (PLC)
- b) Technical and Vocational Education configuration. (ICAI and FSS)
- c) Multipost Expansions options. (Mini ESN and ESN)

a) Industrial configuration

⑦ **PLC. Industrial Control using PLC** (it includes PLC-PI Module plus PLC-SOF Control Software):

-PLC-PI. PLC Module:

Metallic box.

Circuit diagram in the module 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 (-10 V. to + 10 V.) (through SCSI connector).

Analog outputs block:

4 Analog outputs (-10 V. to + 10 V.) (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. 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 μ sec. for a basic instruction.

Program capacity of 32 Ksteps, with a sufficient comment area.

Power supply input (100 to 240 V AC).

DC input: 16 (24 V DC).

Relay output: 14.

High-speed counter.

Multi-point PID control.

Digital inputs/outputs and analog inputs/outputs Panasonic modules.

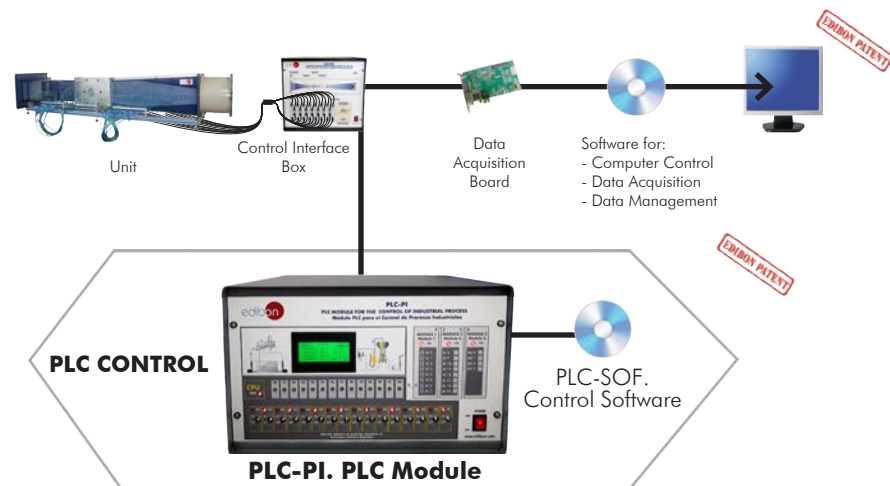
Communication RS232 wire to computer (PC).

Dimensions: 490 x 330 x 310 mm. approx. (19.29 x 12.99 x 12.20 inches approx.). Weight: 30 Kg. approx. (66 pounds approx.).

-TA50/250C/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

The software has been designed using Labview and it follows the unit operation procedure and linked with the Control Interface Box used in the Computer Controlled Aerodynamic Tunnel, 50 x 250 mm (TA50/250C).



Practices to be done with PLC-PI:

- 1.- Control of the particular unit process through the control interface box without the computer.
- 2.- Visualization of all the sensors values used in the particular unit process.
- 3.- Calibration of all sensors included in the particular unit process.
- 4.- Hand on of all the actuators involved in the particular unit process.
- 5.- Realization of different experiments, in automatic way, without having in front the particular unit. (These experiments can be decided previously).
- 6.- 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).
- 7.- PLC hardware general use.
- 8.- PLC process application for the particular unit.
- 9.- PLC structure.
- 10.- PLC inputs and outputs configuration.
- 11.- PLC configuration possibilities.
- 12.- PLC program languages.
- 13.- PLC different programming standard languages (ladder diagram (LD), structured text (ST), instructions list (IL), sequential function chart (SFC), function block diagram (FBD)).
- 14.- New configuration and development of new process.
- 15.- Hand on an established process.
- 16.- To visualize and see the results and to make comparisons with the particular unit process.
- 17.- Possibility of creating new process in relation with the particular unit.
- 18.- PLC Programming Exercises.
- 19.- Own PLC applications in accordance with teacher and student requirements.

b) Technical and Vocational Education configuration

⑧ TA50/250C/ICAI. Interactive Computer Aided Instruction Software System.

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.

This software is optional and can be used additionally to items (1 to 6).

- 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.

- 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

Instructor Software



ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen

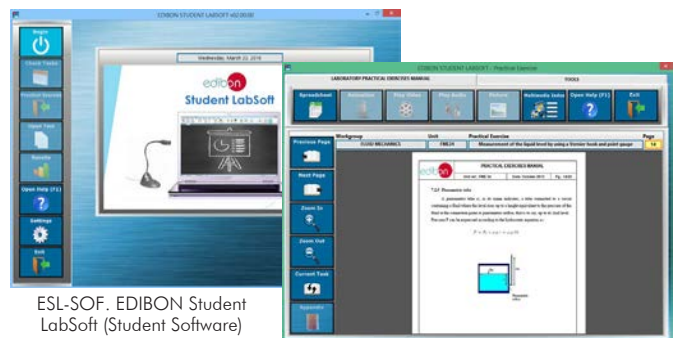
ECAL. EDIBON Calculations Program Package - Formula Editor Screen



ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

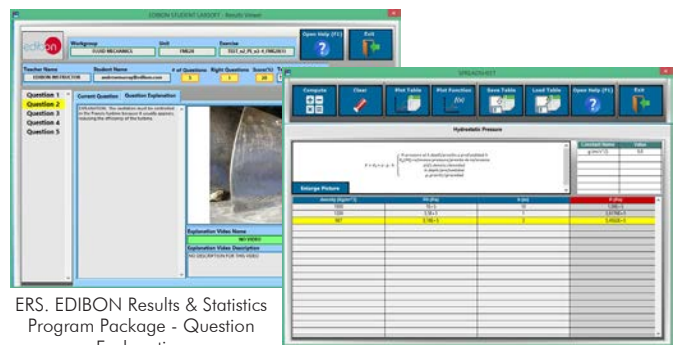
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

Student Software



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

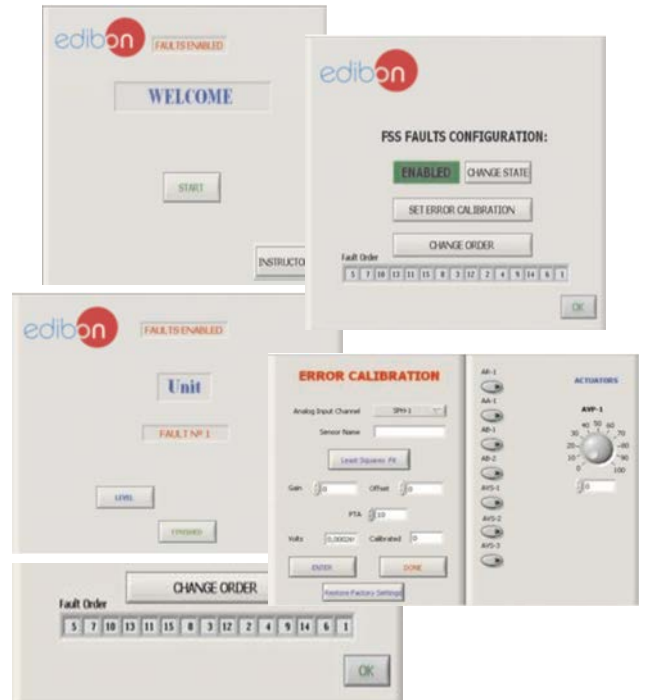
⑨ **TA50/250C/FSS. Faults Simulation System.**

Faults Simulation System (FSS) is a Software package that simulates several faults in any EDIBON Computer Controlled Unit. It is useful for Technical and Vocational level.

The "FAULTS" mode consists in causing several faults in the unit normal operation. The student must find them and solve them. There are several kinds of faults that can be grouped in the following sections:

- Faults affecting the sensors measurement:
 - An incorrect calibration is applied to them.
 - Non-linearity.
- Faults affecting the actuators:
 - Actuators channels interchange at any time during the program execution.
 - Response reduction of an actuator.
- Faults in the controls execution:
 - Inversion of the performance in ON/OFF controls.
 - Reduction or increase of the calculated total response.
 - The action of some controls is annulled.
- On/off faults:
 - Several on/off faults can be included.

Example of some screens



For more information see FSS catalogue. Click on the following link:

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

c) Multipost Expansions options

⑩ **Mini ESN. EDIBON Mini Scada-Net System.**

Mini ESN. EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously. It is useful for both, Higher Education and/or Technical and Vocational Education.

The Mini ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit. Then, the number of possible users who can work with the same unit is higher than in an usual way of working (usually only one).

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing "real time" control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

For more information see Mini ESN catalogue. Click on the following link:

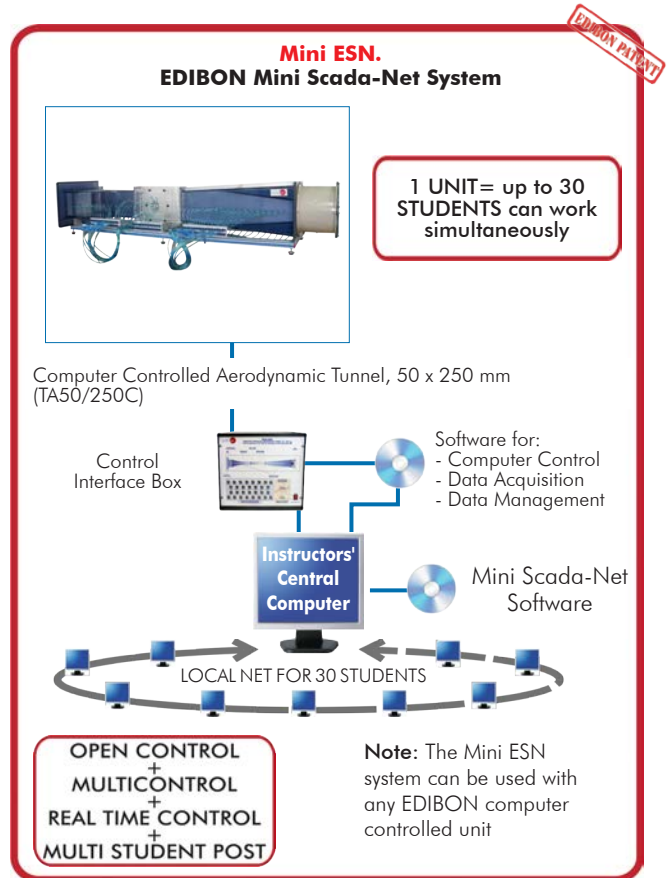
www.edibon.com/products/catalogues/en/Mini-ESN.pdf

⑪ **ESN. EDIBON Scada-Net System.**

This unit can be integrated, in the future, into a Complete Laboratory with many Units and many Students.

For more information see ESN catalogue. Click on the following link:

www.edibon.com/products/catalogues/en/units/fluidmechanicsaerodynamics/esn-fluidmechanics/ESN-FLUID_MECHANICS.pdf



ORDER INFORMATION

Main items (always included in the supply)

Minimum supply always includes:

- ① **Unit: TA50/250C. Computer Controlled Aerodynamic Tunnel, 50 x 250 mm.**
- ② **TA50/250C/CIB. Control Interface Box.**
- ③ **DAB. Data Acquisition Board.**
- ④ **TA50/250C/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
- ⑤ **Cables and Accessories**, for normal operation.
- ⑥ **Manuals.**

***IMPORTANT:** Under TA50/250C we always supply all the elements for immediate running as 1, 2, 3, 4, 5 and 6.

Optional items (supplied under specific order)

a) Industrial configuration

- ⑦ PLC. Industrial Control using PLC (it includes PLC-PI Module plus PLC-SOF Control Software):
 - PCL-PI. PLC Module.
 - TA50/250C/PLC-SOF. PLC Control Software.

b) Technical and Vocational Education configuration

- ⑧ TA50/250C/ICAI. Interactive Computer Aided Instruction Software System.
- ⑨ TA50/250C/FSS. Faults Simulation System.

c) Multipost Expansions options

- ⑩ Mini ESN. EDIBON Mini Scada-Net System.
- ⑪ ESN. EDIBON Scada-Net System.

① TA50/250C. Unit:

Bench-top wind tunnel in open circuit and with incompressible subsonic flow.
 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.
 Inlet section with lips, a haven section and a 8:1 contraction ratio.
 Transparent working area of 50 x 250 mm to assemble and test the different models.
 The working area includes a Pitot static tube mounted in the top side.
 Outlet section with diffuser that allows to avoid the generation of turbulences, which can generate damages the current quality in the working area.
 Variable speed axial-flow fan, computer controlled:
 Velocity range: 0 – 2800 rpm.
 Air velocity in the working area: 0 – 27 m/s.
 Sixty different pressure tappings (along the tunnel and in the models).
 Thirty differential pressure sensors, range: 0 – 1 PSI.
 Several models and accessories are available, allowing a comprehensive study of subsonic aerodynamics.
 All these models include several pressure tappings.
Models and Accessories included:
 - TA1. House Scale Model.
 - TA2. Cylinder Model.
 - TA3. Convex Semi-Cylinder Model.
 The complete unit includes as well:
 Advanced Real-Time SCADA.
 Open Control + Multicontrol + Real-Time Control.
 Specialized EDIBON Control Software based on LabVIEW.
 National Instruments Data Acquisition board (250 KS/s, kilo samples per second).
 Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.
 Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.
 Capable of doing applied research, real industrial simulation, training courses, etc.
 Remote operation and control by the user and remote control for EDIBON technical support, are always included.
 Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).
 Designed and manufactured under several quality standards.
 Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user's knowledge and progress reached.
 This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

Optional Models and Accessories: (Not included)

- TA4. Car Model.
- TA5. Lorry Model.
- TA6. Lorry with Wind Deflector Model.
- TA7. Plane Model.
- TA8. Train Model.
- TA9. Projectile Model.
- TA10. Circular Disc Model.
- TA11. Wing of a Plane Model.
- TA12. Concave Semi-Cylinder Model.
- TA13. Blunt Element Model.
- TA14. Bernoulli Apparatus Model.
- TA15. Boundary Layer Plate Model.
- TA16. Model under "Custom Design".
- TA17. Wake Survey Rake.
- TA18. Streamlined Shape (TA19 + TA50/250C-TARC models are required).
- TA19. Lift and Drag Balance (TA50/250C-TARC model is always required to operate TA18 and/or TA20 models).
- TA20. Drag Models (Sphere, Hemisphere, Convex, Hemisphere Concave, Circular Disc) (TA19 + TA50/250C-TARC models are required).
- TA50/250C-TARC. Forces Measurement Interface (TA19 model is always required to operate TA18 and/or TA20 models).
- TA50/250-BLE. Boundary Layer Experiment Accessory.
- TA50/250-SG1. Smoke Generator.

② TA50/250C/CIB. Control Interface Box:

The Control Interface Box is part of the SCADA system.
 Control interface box with process diagram in the front panel.
 The unit control elements are permanently computer controlled.
 Simultaneous 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.
 All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process.
 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 parameters involved in the process simultaneously.
 Open control allowing modifications, at any moment and in real time, of parameters involved in the process simultaneously.
 Three safety levels, one mechanical in the unit, another electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

The Data Acquisition board is part of the SCADA system.
 PCI Express Data acquisition board (National Instruments) to be placed in a computer slot.
 Analog input: Channels= 16 single-ended or 8 differential. Resolution=16 bits, 1 in 65536. Sampling rate up to: 250 KS/s (kilo samples per second).
 Analog output: Channels=2. Resolution=16 bits, 1 in 65536.
 Digital Input/Output: Channels=24 inputs/outputs.

④ TA50/250C/CCSOF. Computer Control + Data Acquisition+ Data Management Software:

The three softwares are part of the SCADA system.
 Compatible with the industry standards.
 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 KS/s (kilo samples 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.
 Open software, allowing 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 to different work levels.
 This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

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.

Exercises and Practical Possibilities to be done with the Main Items

- 1.- Comprehensive study of subsonic aerodynamics and airflow studies.
 - 2.- Measurement of pressure distribution around a two dimensional body.
 - 3.- Study of flow visualization.
 - 4.- Study of static pressure, dynamic pressure and total pressure using a Pitot' tube.
 - 5.- Study of velocity measurement using a Pitot tube.
 - 6.- Flux in a nozzle: Determination of the characteristics of the pressures field in a nozzle.
 - 7.- Flux in a nozzle: Observation of the local characteristics, depending on whether the walls have a curvature or not, as well as what happens at the inlet and outlet areas of the contraction.
 - 8.- House Scale Model (TA1): Study of aerodynamic forces due to the wind on a house.
 - 9.- House Scale Model (TA1): Determination of the aerodynamic loads generated by the wind on a house walls.
 - 10.-Cylinder Model (TA2): Study of flow around a cylinder.
 - 11.-Cylinder Model (TA2): Determination of the form of the pressures field around a cylinder on which a current perpendicular to the axis impacts.
 - 12.-Cylinder Model (TA2): Determination, by the type of detachment, whether the boundary layer finally becomes turbulent or remains laminar.
 - 13.-Cylinder Model (TA2): Determination of the resistance coefficient of the cylinder.
 - 14.-Cylinder Model (TA2): Relation of all the above-mentioned with the Reynolds's number.
 - 15.-Convex Semi-Cylinder Model (TA3): Study of flow around a convex semi-cylinder.
 - 16.-Convex Semi-Cylinder Model (TA3): Determination of the field of pressures in the convex semi-cylinder.
 - 17.-Convex Semi-Cylinder Model (TA3): Determination of the aerodynamic resistance coefficients in the convex semi-cylinder.
- Additional practical possibilities:
- 18.-Sensors calibration.
- Additional practical possibilities to be done with the Optional Models and Accessories: (Not included)
- 19.-Study of aerodynamic forces due to the wind on a Car Model (TA4).
 - 20.-Study of aerodynamic forces due to the wind on a Lorry Model (TA5).
 - 21.-Study of aerodynamic forces due to the wind on a Lorry with Wind Deflector Model (TA6).
 - 22.-Study of aerodynamic forces due to the wind on a Plane Model (TA7).
 - 23.-Study of aerodynamic forces due to the wind on a Train Model (TA8).
 - 24.-Study of aerodynamic forces due to the wind on a Projectile Model (TA9).
 - 25.-Study of aerodynamic forces due to the wind on a Circular Disc Model (TA10).
 - 26.-Study of aerodynamic forces due to the wind on a Wing of a Plane Model (TA11).
 - 27.-Study of flow and pressure distribution around a Wing of a Plane Model (TA11) at different angles of attack.
 - 28.-Study of aerodynamic forces due to the wind on a Concave Semi-Cylinder Model (TA12).
 - 29.-Study of aerodynamic forces due to the wind on a Blunt Element Model (TA13).
 - 30.-Study of effect of changing in Bernoulli Apparatus Model (TA14) the cross section and application of the Bernoulli equation.
 - 31.-Study of laminar and turbulent boundary layer development with the Boundary Layer Plate Model (TA15) and the Boundary Layer Experiment Accessory (TA50/250-BLE).
 - 32.-Study of static pressure, dynamic pressure and total pressure with the Wake Survey Rake (TA17).
 - 33.-Study of aerodynamic forces due to the wind on a Streamlined Shape (TA18).
 - 34.-Investigation into the influence of models shape in the drag forces (Lift and Drag Balance (TA19), Drag Models (TA20) and Forces Measurement Interface (TA50/250C-TARC)).
 - 35.-Demonstration of flow patterns around different objects with the Smoke Generator (TA50/250-SG1).
- Other possibilities to be done with this Unit:
- 36.-Many students view results simultaneously.
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
 - 37.-Open Control, Multicontrol and Real Time Control.
This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivative parameters; etc, in real time.
 - 38.-The Computer Control System with SCADA allows a real industrial simulation.
 - 39.-This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
 - 40.-This unit can be used for doing applied research.
 - 41.-This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
 - 42.-Control of the TA50/250C unit process through the control interface box without the computer.
 - 43.-Visualization of all the sensors values used in the TA50/250C unit process.
- By using PLC-PI additional 19 more exercises can be done.
 - Several other exercises can be done and designed by the user.

TENDER SPECIFICATIONS (for optional items)

a) Industrial configuration

⑦ **PLC. Industrial Control using PLC** (it includes PLC-PI Module plus PLC-SOF Control Software):

-PLC-PI. PLC Module:

Metallic box.

Circuit diagram in the module front panel.

Digital inputs (X) and Digital outputs (Y) block: 16 Digital inputs. 14 Digital outputs.

Analog inputs block: 16 Analog inputs.

Analog outputs block: 4 Analog outputs.

Touch screen.

Panasonic PLC:

High-speed scan of 0.32 μ sec. Program capacity of 32 Ksteps. High-speed counter. Multi-point PID control.

Digital inputs/outputs and analog inputs/outputs Panasonic modules.

-TA50/250C/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

Practices to be done with PLC-PI:

- 1.- Control of the particular unit process through the control interface box without the computer.
- 2.- Visualization of all the sensors values used in the particular unit process.
- 3.- Calibration of all sensors included in the particular unit process.
- 4.- Hand on of all the actuators involved in the particular unit process.
- 5.- Realization of different experiments, in automatic way, without having in front the particular unit. (These experiments can be decided previously).
- 6.- 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).
- 7.- PLC hardware general use.
- 8.- PLC process application for the particular unit.
- 9.- PLC structure.
- 10.- PLC inputs and outputs configuration.
- 11.- PLC configuration possibilities.
- 12.- PLC program languages.
- 13.- PLC different programming standard languages (ladder diagram (LD), structured text (ST), instructions list (IL), sequential function chart (SFC), function block diagram (FBD)).
- 14.- New configuration and development of new process.
- 15.- Hand on an established process.
- 16.- To visualize and see the results and to make comparisons with the particular unit process.
- 17.- Possibility of creating new process in relation with the particular unit.
- 18.- PLC Programming Exercises.
- 19.- Own PLC applications in accordance with teacher and student requirements.

b) Technical and Vocational Education configuration

⑧ **TA50/250C/ICAL. Interactive Computer Aided Instruction Software System.**

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.

- 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.

- 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.

⑨ **TA50/250C/FSS. Faults Simulation System.**

Faults Simulation System (FSS) is a Software package that simulates several faults in any EDIBON Computer Controlled Unit. The "FAULTS" mode consists in causing several faults in the unit normal operation. The student must find them and solve them. There are several kinds of faults that can be grouped in the following sections:

Faults affecting the sensors measurement:

- An incorrect calibration is applied to them.
- Non-linearity.

Faults affecting the actuators:

- Actuators channels interchange at any time during the program execution.
- Response reduction of an actuator.

Faults in the controls execution:

- Inversion of the performance in ON/OFF controls.
- Reduction or increase of the calculated total response.
- The action of some controls is annulled.

On/off faults:

- Several on/off faults can be included.

c) Multipost Expansions options

⑩ **Mini ESN. EDIBON Mini Scada-Net System.**

EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously.

The Mini ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit.

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing "real time" control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

The system basically will consist of:

This system is used with a Computer Controlled Unit.

- Instructor's computer.
- Students' computers.
- Local Network.
- Unit-Control Interface adaptation.
- Unit Software adaptation.
- Webcam.
- Mini ESN Software to control the whole system.
- Cables and accessories required for a normal operation.

* Specifications subject to change without previous notice, due to the convenience of improvement of the product.



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Edition: ED01/17
Date: November/2017

REPRESENTATIVE: