

① Unit: TAS25/100C. Computer Controlled Supersonic Wind Tunnel

\* 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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↳ PRODUCTS  
↳ 8.- 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)



"Worlddidac Quality Charter" and Platinum Member of Worlddidac

## INTRODUCTION

Aerodynamics is the area of fluid mechanics dealing with moving gases and the forces or reactions to which the bodies within them are subjected to. The importance of aerodynamics is enhanced by the value of its contribution to aeronautics. Knowledge of the principles of aerodynamics is useful in a wide range activities, from lifting and flying an airplane, to driving a vehicle or kicking a ball. Every time we move or throw an object, various physical principles act that we usually do not notice. Wind tunnels are much used facilities for determining the wind actions on different types of bodies. The model being studied remains at rest while the flow medium is set in motion, and thus the desired flow around the model is generated.

According to the relative velocity of a mobile device in relation to air, aerodynamics is divided into subsonic and supersonic depending on whether this value is higher or lower than speed of sound.

Subsonic and supersonic flows behave differently. Whereas subsonic flows are accelerated by reducing the cross-section and decelerated by enlarging the cross-section, in supersonic flows it is exactly the opposite. Understanding these supersonic flow phenomena makes it easier to design, e.g. gas and steam turbines, rockets, etc.

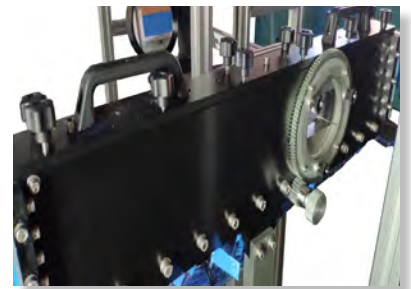
## GENERAL DESCRIPTION

The Computer Controlled Supersonic Wind Tunnel, "TAS25/100C", is an open wind tunnel for the study of the aerodynamic properties of different drag bodies subject to subsonic and supersonic flows. Air flows through a vacuum pump or blower incorporating a computer controlled power regulator, located on the discharge side of the tunnel. The air enters the tunnel through a nozzle, which has a flow rectifier where the fluid is accelerated. Then, the transparent working section is located, which consists of a section where the resistance models are mounted, and the accelerated air flows around these models. The models included have different forms: rocket, projectile, wedges of different slopes and double wedge with different inclinations.

There are three different upper profiles of the working section to generate different velocities up to two times the speed of sound (2 Mach).

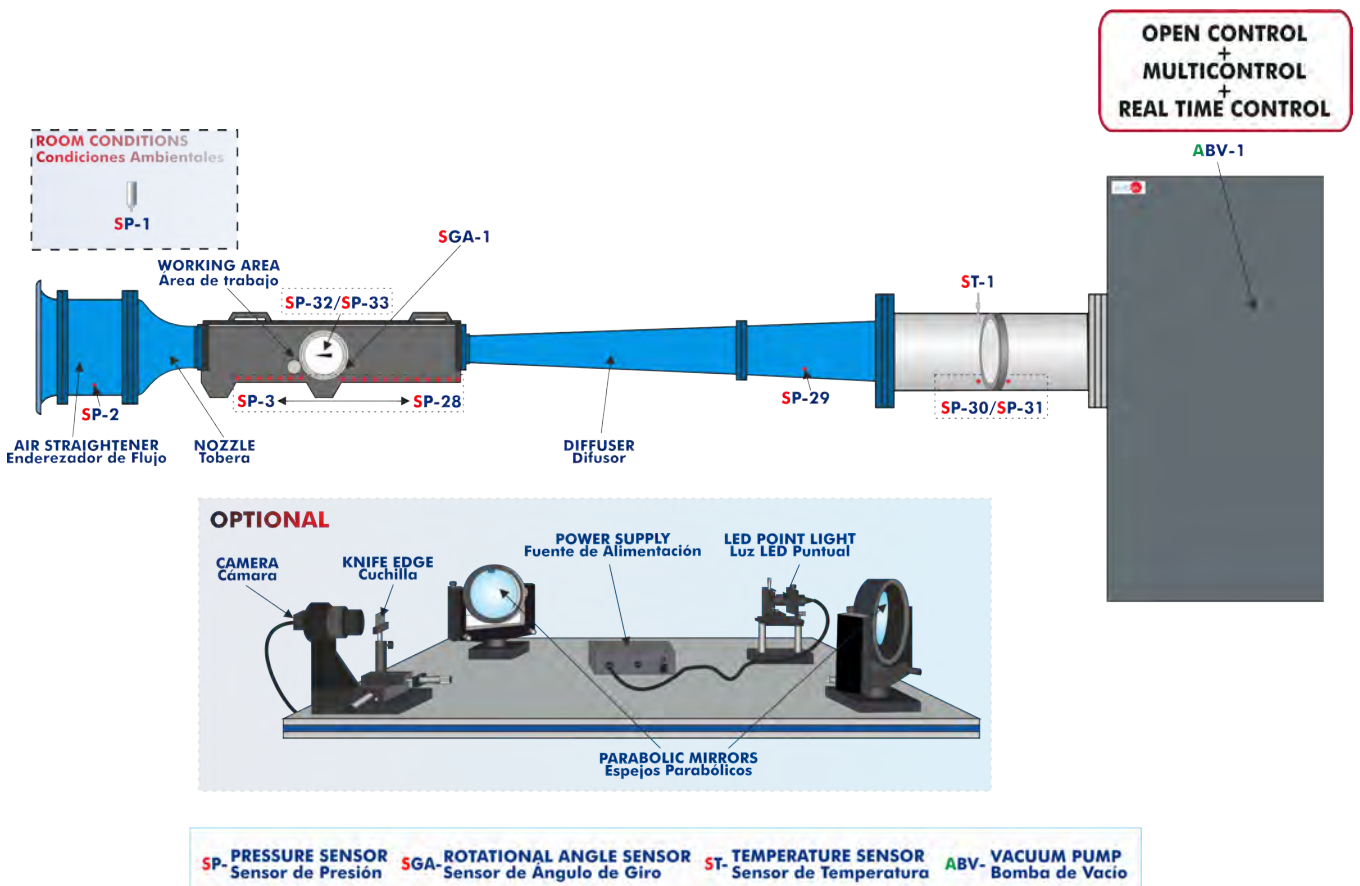
The optional "TAS25/100-SO" accessory, an optical Schlieren system, allows you to directly observe and photograph the supersonic flow and shock fronts formed around the aerodynamic models, thus enabling a greater number of experiments.

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.



TAS25/100C detail

## 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, and 9.

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

① **TAS25/100C. Unit:**

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.

Open circuit wind tunnel:

Nozzle.

Made of fiberglass.

Flow straightener. Length: 200 mm.

Working section:

Made of anodized aluminum.

Dimensions: 100 x 25 x 740 mm.

Three interchangeable Laval contours with different shapes which allow to reach different wind speeds inside the working area:

Supersonic (up to 2 Mach).

Transonic (up to 1.4 Mach).

Subsonic.

Two clear glass windows for the study of aerodynamics on different resistance models.

High quality optical glass – BK7 type.

Diameter: 110 mm.

Aerodynamic models:

5° single wedge.

7° double wedge.

10° double wedge with pressure taps.

Projectile.

Rocket.

Angle regulator which make it possible to modify the wind attack angle with regard to the aerodynamic model. Range:  $\pm 10^\circ$ .

Diffuser.

Made of fiberglass.

Flexible stainless steel pipe section for vibration absorption.

Vacuum pump:

Total power of 60 kW.

Maximum flow rate of the set: 2700 m<sup>3</sup>/h.

Intake silencer.

Supply silencer.

Check valve.

Safety valve.

Chassis with elastic feet.

Suction filter.

Vacuum gauge.

A soundproofed enclosure with internal ventilation by a forced-cooling fan.

Rotational angle sensor in the window.

33 pressure sensors for relative pressure measurement via computer.

Temperature sensor.

Orifice plate for flow measurement.

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.**

Additional recommended elements (Not included):

- TAS25/100-SO. Schlieren optics Accessory.



Unit: TAS25/100C

② **TAS25/100C/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.**



TAS25/100C/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. DO or DI Sample Clock frequency: 0 to 100 MHz.

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

**The Data Acquisition board model may change at any moment, providing the same or better features than those required for the unit.**



DAB

④ **TAS25/100C/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).**

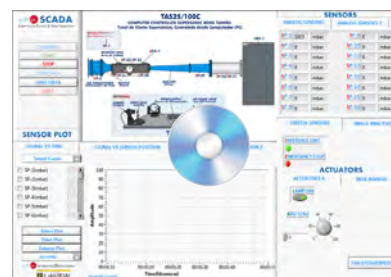
**Calibration system for the sensors involved in the process.**

**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.**



TAS25/100C/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: TAS25/100C + TAS25/100C/CIB + DAB + TAS25/100C/CCSOF + Cables and Accessories + Manuals are included in the minimum supply for enabling normal and full operation.



**Additional recommended elements:** (Not included)

**TAS25/100-SO. Schlieren optics Accessory**

Two parabolic mirrors:

Diameter: 150 mm.

Focal length: 1200 mm.

Two Gimbal mirror mounts:

Variation of the angle in polar and azimuthal direction: 360°.

Micrometric adjustment:  $\pm 6^\circ$ .

3 W LED lamp.

Knife-edge on adjustable support.

Camera.

5 MP sensor.

USB connection.

Camera zoom lens.

Dimensions and weights:

Space required (wide x long x deep): 500 x 1500 x 2000 mm.

Weight: 50 kg.



## EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH THE MAIN ITEMS

- 1.- Pressure distribution in subsonic and supersonic flows.
- 2.- Calculation of the air velocity inside a supersonic wind tunnel.
- 3.- Comparison between experimental and theoretical pressure profile.
- 4.- Pressure distribution in a two-dimensional model under subsonic and supersonic flows.
- 5.- Influence of the attack angle on the forces exerted on a double wedge model.
- 6.- Shock wave display (required TAS25/100-SO accessory).
- 7.- Determination of Mach number from the shock wave angle (required TAS25/100-SO accessory).
- 8.- Experimental testing of the relationship between corner angle, Mach number and shock wave angle (required TAS25/100-SO accessory).

Other possibilities to be done with this Unit:

- 9.- Many students view results simultaneously.

To view all results in real time in the classroom by means of a projector or an electronic whiteboard.

- 10.- 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.

- 11.- The Computer Control System with SCADA allows a real industrial simulation.
  - 12.- This unit is totally safe as uses mechanical, electrical/electronic, and software safety devices.
  - 13.- This unit can be used for doing applied research.
  - 14.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
  - 15.- Control of the TAS25/100C unit process through the control interface box without the computer.
  - 16.- Visualization of all the sensors values used in the TAS25/100C unit process.
- Several other exercises can be done and designed by the user.

### REQUIRED SERVICES

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

\* The laboratory where the TAS25/100C unit is installed must have its own three-phase electrical system suitable for providing enough power to the vacuum pump (60 kW approx.) and its own magnetothermal and differential three-phase protections.

- Computer.

### DIMENSIONS AND WEIGHTS

TAS25/100C:

Unit:

- Dimensions: 2000 x 5000 x 1500 mm approx.  
(78.74x 196.84 x 59.05 inches approx.)

- Weight: 2000 Kg approx.  
(4409 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.)

### ADDITIONAL RECOMMENDED ELEMENTS (Not included)

- TAS25/100-SO. Schlieren optics Accessory.

### SIMILAR UNITS AVAILABLE

Offered in this catalogue:

- TAS25/100C. Computer Controlled Supersonic Wind Tunnel.

Offered in other catalogue:

- TAS25/100C-3B. Computer Controlled Supersonic Wind Tunnel (Three Blowers).
- TA50/250C. Computer Controlled Aerodynamic Tunnel, 50 x 250 mm.
- TA300/300C. Computer Controlled Aerodynamic Tunnel, 300 x 300 mm.
- TA50/250. Aerodynamic Tunnel, 50 x 250 mm.
- TA300/300. Aerodynamic Tunnel, 300 x 300 mm.





SOME REAL RESULTS OBTAINED FROM THIS UNIT

Pressure profile in the working area (supersonic flow).

**editon SCADA**  
Supervisory Control & Data Acquisition

CALIBRATE  
START  
STOP  
VIEW DATA  
SAVE DATA  
QUIT

**TAS25/100C**  
COMPUTER CONTROLLED SUPERSONIC WIND TUNNEL  
Túnel de Viento Supersónico, Controlado desde Computador (PC)

**SENSORS**

ANALOG SENSORS 2    CALCULATIONS

SP-17	-835	mbar	SP-25	-588	mbar
SP-18	-848	mbar	SP-26	-586	mbar
SP-19	-821	mbar	SP-27	-585	mbar
SP-20	-749	mbar	SP-28	-585	mbar
SP-21	-688	mbar	SP-29	-524	mbar
SP-22	-649	mbar	SP-30	-523	mbar
SP-23	-617	mbar	SP-31	-540	mbar
SP-24	-597	mbar	ST-1	33,4	°C

DIGITAL SENSORS    IMAGE ANALYSIS

ANALYZER

**SENSOR PLOT**

SIGNAL VS TIME    SIGNAL VS SENSOR POSITION    SIGNAL VS SENSOR POSITION 2

Pressure Sensors

Reset Plot  
Print Plot  
Enlarge Plot  
seconds

www.edibon.com  
LabVIEW

Speed profile in the working area (supersonic flow).

**editon SCADA**  
Supervisory Control & Data Acquisition

CALIBRATE  
START  
STOP  
VIEW DATA  
SAVE DATA  
QUIT

**TAS25/100C**  
COMPUTER CONTROLLED SUPERSONIC WIND TUNNEL  
Túnel de Viento Supersónico, Controlado desde Computador (PC)

**SENSORS**

ANALOG SENSORS 2    CALCULATIONS

SP-17	-834	mbar	SP-25	-587	mbar
SP-18	-848	mbar	SP-26	-585	mbar
SP-19	-818	mbar	SP-27	-584	mbar
SP-20	-747	mbar	SP-28	-584	mbar
SP-21	-686	mbar	SP-29	-524	mbar
SP-22	-648	mbar	SP-30	-523	mbar
SP-23	-616	mbar	SP-31	-540	mbar
SP-24	-596	mbar	ST-1	33,4	°C

DIGITAL SENSORS    IMAGE ANALYSIS

ANALYZER

**SENSOR PLOT**

SIGNAL VS TIME    SIGNAL VS SENSOR POSITION    SIGNAL VS SENSOR POSITION 2

M

0=M3,  
1=M4  
2=M5..    value

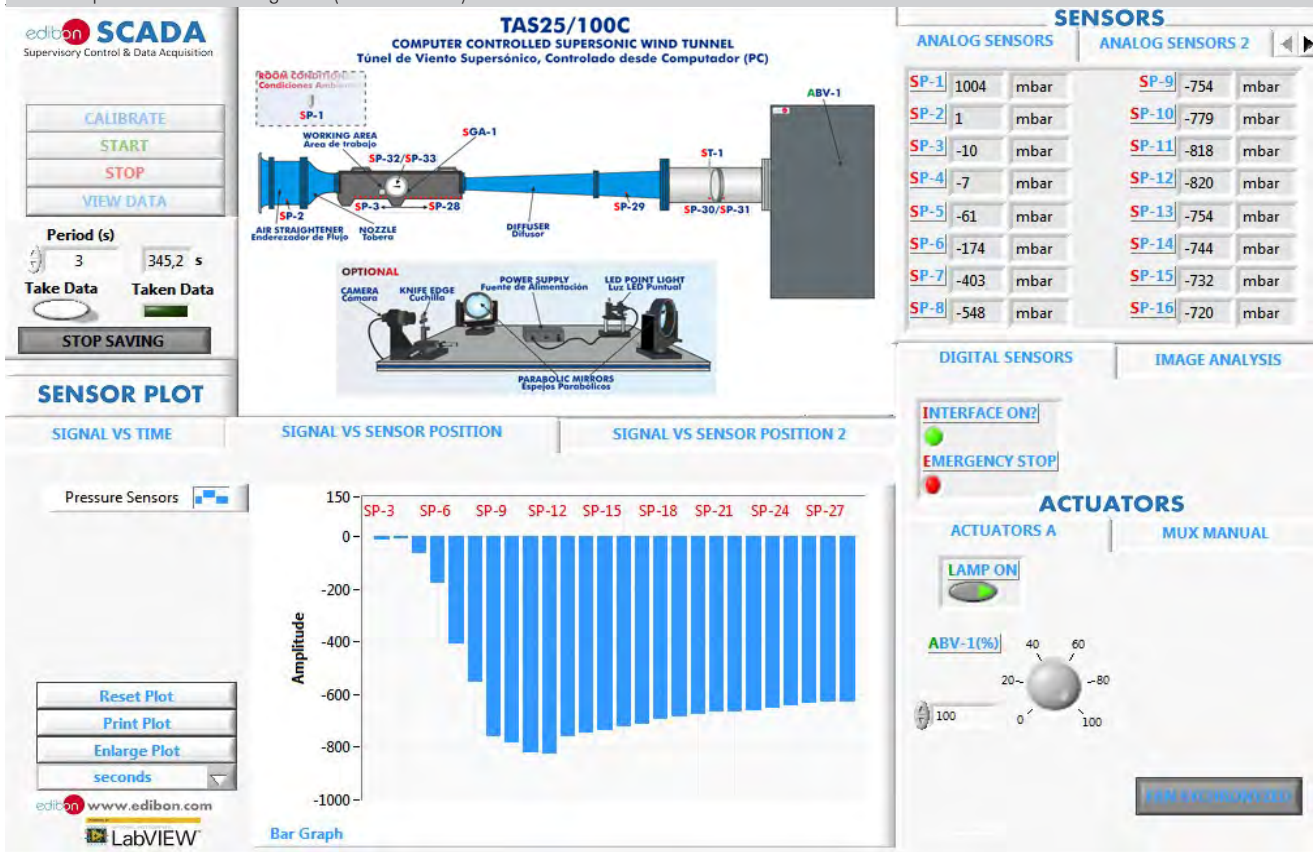
16    1,97323

Reset Plot  
Print Plot  
Enlarge Plot  
seconds

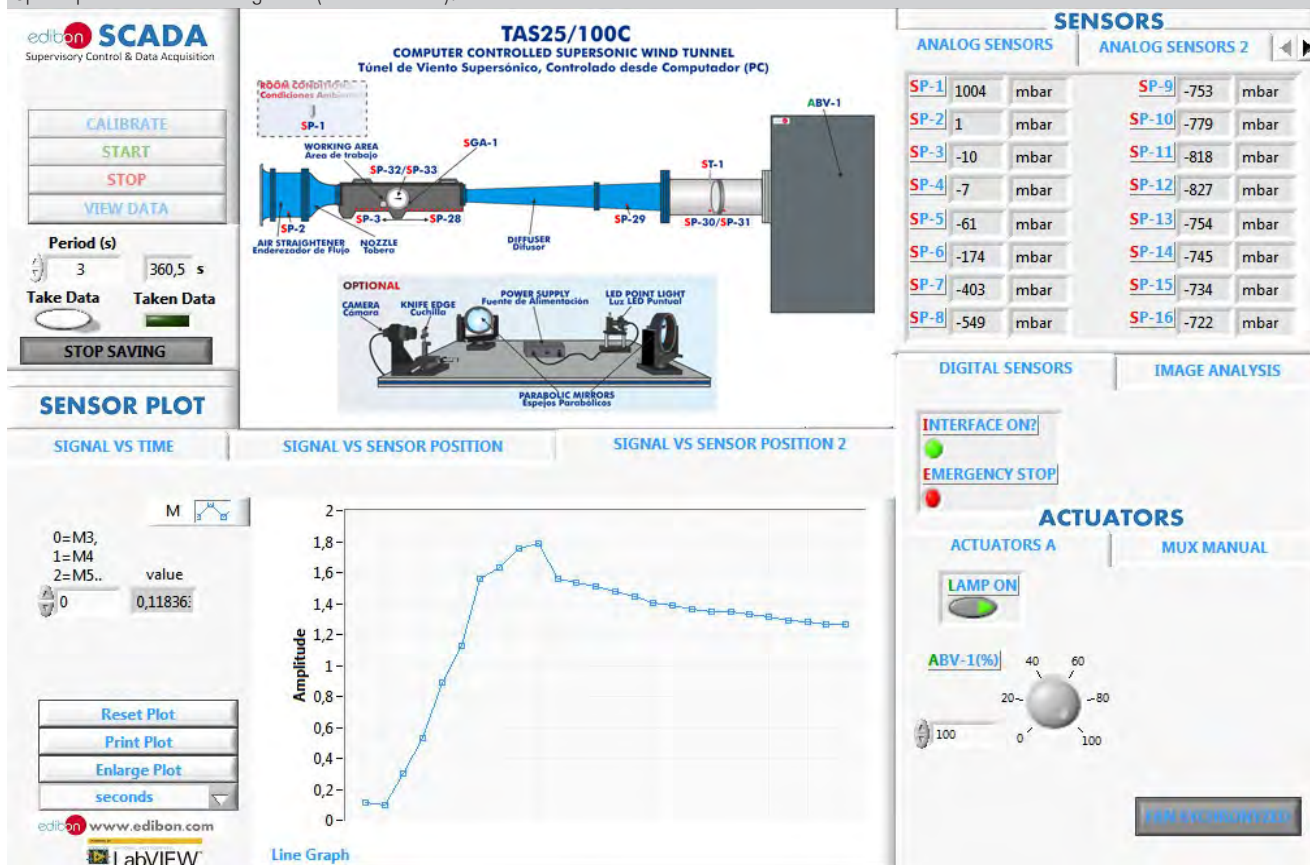
www.edibon.com  
LabVIEW



Pressure profile in the working area (transonic flow).



Speed profile in the working area (transonic flow).



Angle measurement tool from TAS25/100C software.

Log Image  
Clear Image  
New Angle  
Exit

Angle (°)	Angle Array (°)	M
43,5498	43,5498	1,45141
	0	0
	0	0

Zoom Factor (%)  
12,3457

Angle measurement tool from TAS25/100C software.

Log Image  
Clear Image  
New Angle  
Exit

Angle (°)	Angle Array (°)	M
39,9814	39,9814	1,55641
	0	0
	0	0

Zoom Factor (%)  
12,3457



## 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 9.

All these items try to give more possibilities for:

- a) Technical and Vocational Education configuration. (ICAI)
- b) Multipost Expansions options. (MINI ESN and ESN)

### a) Technical and Vocational Education configuration

#### ⑦ **TAS25/100C/ICAI. Interactive Computer Aided Instruction Software.**

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.

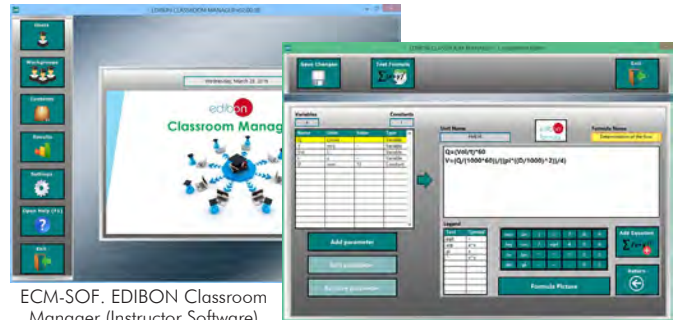
Innovative features:

- 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](http://www.edibon.com/en/files/expansion/ICAI/catalog)

### Instructor Software



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

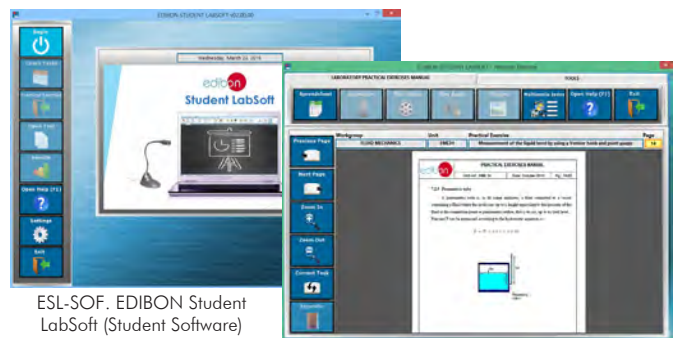
ECAL. EDIBON Calculations Program Package - Formula Editor Screen



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

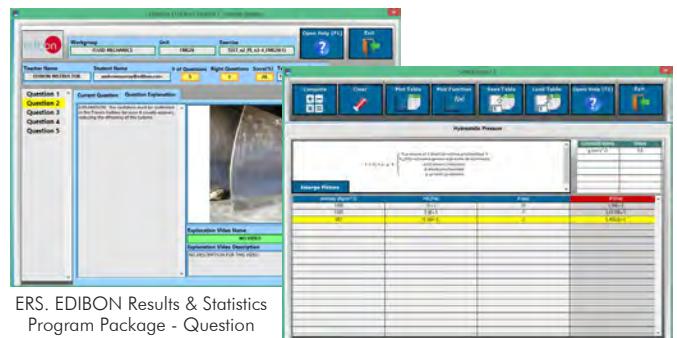
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

### 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



b) Multipost Expansions options

③ **MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.**

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:

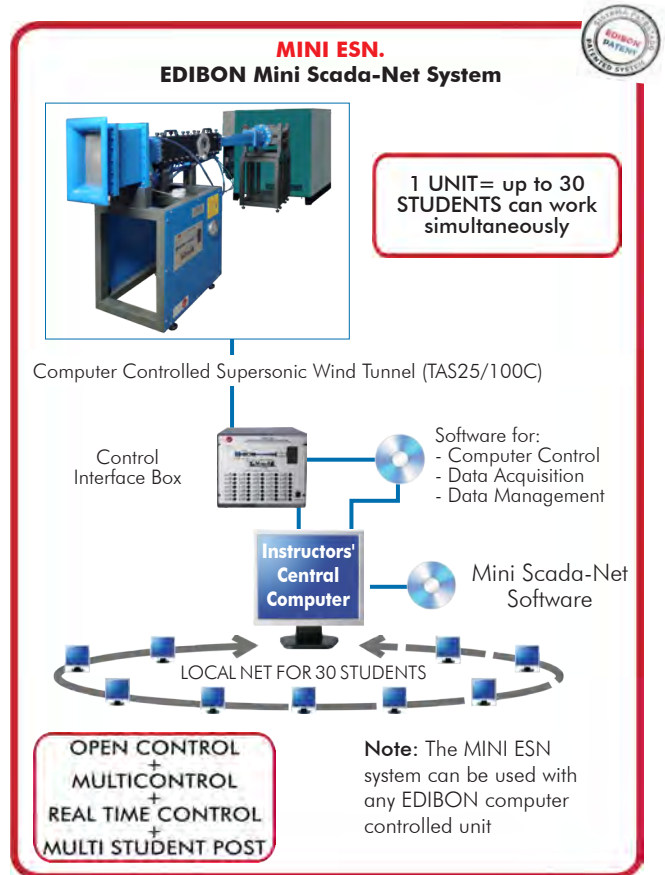
[www.edibon.com/en/files/expansion/MINI-ESN/catalog](http://www.edibon.com/en/files/expansion/MINI-ESN/catalog)

③ **ESN. EDIBON Scada-Net Systems.**

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/en/files/expansion/ESN/catalog](http://www.edibon.com/en/files/expansion/ESN/catalog)



## ORDER INFORMATION

### **Main items** (always included in the supply)

Minimum supply always includes:

- ① **Unit: TAS25/100C. Computer Controlled Supersonic Wind Tunnel.**
- ② **TAS25/100C/CIB. Control Interface Box.**
- ③ **DAB. Data Acquisition Board.**
- ④ **TAS25/100C/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
- ⑤ **Cables and Accessories**, for normal operation.
- ⑥ **Manuals.**

\***IMPORTANT:** Under TAS25/100C we always supply all the elements for immediate running as 1, 2, 3, 4, 5 and 6.

### **Optional items** (supplied under specific order)

a) Technical and Vocational Education configuration

- ⑦ TAS25/100C/ICAL. Interactive Computer Aided Instruction Software.

b) Multipost Expansions options

- ⑧ MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.
- ⑨ ESN. EDIBON Scada-Net Systems.

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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.  
 Open circuit wind tunnel:  
 Nozzle.  
 Made of fiberglass.  
 Flow straightener. Length: 200 mm.  
 Working section:  
 Made of anodized aluminum.  
 Dimensions: 100 x 25 x 740 mm.  
 Three interchangeable Laval contours with different shapes which allow to reach different wind speeds inside the working area:  
 Supersonic (up to 2 Mach).  
 Transonic (up to 1.4 Mach).  
 Subsonic.  
 Two clear glass windows for the study of aerodynamics on different resistance models.  
 High quality optical glass – BK7 type.  
 Diameter: 110 mm.  
 Aerodynamic models:  
 5° single wedge.  
 7° double wedge.  
 10° double wedge with pressure taps.  
 Projectile.  
 Rocket.  
 Angle regulator which make it possible to modify the wind attack angle with regard to the aerodynamic model. Range:  $\pm 10^\circ$ .  
 Diffuser.  
 Made of fiberglass.  
 Flexible stainless steel pipe section for vibration absorption.  
 Vacuum pump:  
 Total power of 60 kW.  
 Maximum flow rate of the set: 2700 m<sup>3</sup>/h.  
 Intake silencer.  
 Supply silencer.  
 Check valve.  
 Safety valve.  
 Chassis with elastic feet.  
 Suction filter.  
 Vacuum gauge.  
 A soundproofed enclosure with internal ventilation by a forced-cooling fan.  
 Rotational angle sensor in the window.  
 33 pressure sensors for relative pressure measurement via computer.  
 Temperature sensor.  
 Orifice plate for flow measurement.  
 The complete unit includes as well:  
 Advanced Real-Time SCADA.  
 Open Control + Multicontrol + Real-Time Control.  
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 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.  
 Additional recommended elements (Not included):  
 - TAS25/100-SO. Schlieren optics Accessory.

**② TAS25/100C/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.  
 The Data Acquisition board model may change at any moment, providing the same or better features than those required for the unit.

**④ TAS25/100C/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.- Pressure distribution in subsonic and supersonic flows.
- 2.- Calculation of the air velocity inside a supersonic wind tunnel.
- 3.- Comparison between experimental and theoretical pressure profile.
- 4.- Pressure distribution in a two-dimensional model under subsonic and supersonic flows.
- 5.- Influence of the attack angle on the forces exerted on a double wedge model.
- 6.- Shock wave display (required TAS25/100-SO accessory).
- 7.- Determination of Mach number from the shock wave angle (required TAS25/100-SO accessory).
- 8.- Experimental testing of the relationship between corner angle, Mach number and shock wave angle (required TAS25/100-SO accessory).

Other possibilities to be done with this Unit:

- 9.- Many students view results simultaneously.  
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
  - 10.- 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.
  - 11.- The Computer Control System with SCADA allows a real industrial simulation.
  - 12.- This unit is totally safe as uses mechanical, electrical/electronic, and software safety devices.
  - 13.- This unit can be used for doing applied research.
  - 14.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
  - 15.- Control of the TAS25/100C unit process through the control interface box without the computer.
  - 16.- Visualization of all the sensors values used in the TAS25/100C unit process.
- Several other exercises can be done and designed by the user.

## TENDER SPECIFICATIONS (for optional items)

### a) Technical and Vocational Education configuration

#### ⑦ **TAS25/100C/ICAI. Interactive Computer Aided Instruction Software.**

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.

### b) Multipost Expansions options

#### ⑧ **MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.**

MINI ESN. 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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