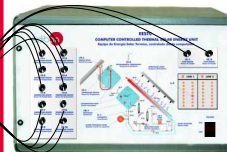




Always included  
in the supply:

Teaching  
Technique  
used

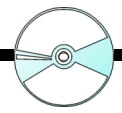
### SCADA. EDIBON Computer Control System



②  
Control  
Interface Box



③  
Data  
Acquisition  
Board



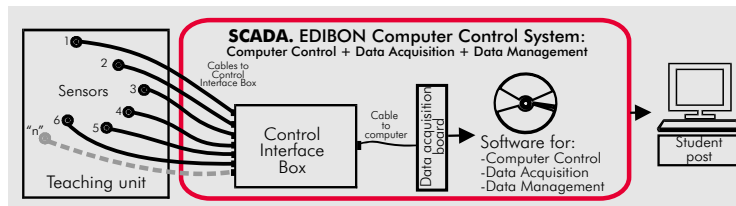
④  
Software for:  
- Computer Control  
- Data Acquisition  
- Data Management



Computer  
(not included  
in the supply)

⑤ Cables and Accessories  
⑥ Manuals

① Unit: EESTC. Thermal Solar Energy Unit

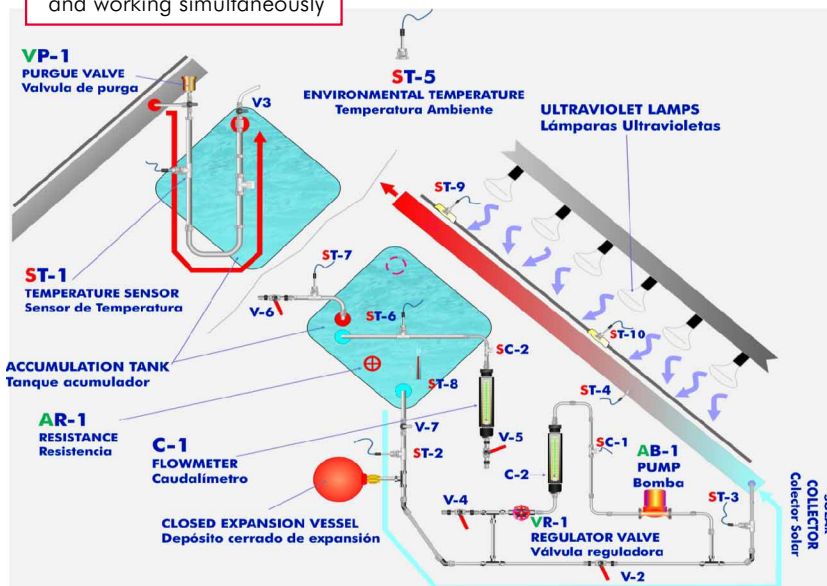


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Units  
5.-Energy

## PROCESS DIAGRAM AND ELEMENTS ALLOCATION

5 actuators and 12 sensors  
controlled from any computer,  
and working simultaneously

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



- VP-1: Main purge valve-primary circuit.
- VR-1: Regulation valve-primary circuit.
- V2: Valve in free circulation circuit-primary circuit.
- V3: Second purge valve-primary circuit.
- V4: Valve to fill the water closed circuit-primary circuit.
- V5: Valve to Open/Close the cold water inlet-secondary circuit.
- V6: Valve to Open/Close the hot water outlet-secondary circuit.
- V7: Third purge valve.
- C1 and SC1: Flowmeter and flow sensor in primary circuit.
- C2 and SC2: Flowmeter and flow sensor in secondary circuit.
- ST1 to ST10: Temperature sensors.

## DESCRIPTION

The unit is a system that transforms solar energy into calorific energy. It uses the thermosiphon system to heat water or the traditional pumping system. In both cases, the absorbed calorific energy is given by the solar radiation simulated, in our case, by a panel with powerful luminous sources.

This Computer Controlled Unit, is supplied with the EDIBON Computer Control System (SCADA), including: Control Interface Box + Data Acquisition Board + Computer Control and Data Acquisition Software, for controlling the process and the parameters involved.

## SPECIFICATIONS

### Items supplied as standard

#### ① EESTC. Unit:

Anodized aluminium structure. Main metallic elements in steel.

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

Solar panel (Thermal solar collector):

Steel structure.

Pipes (already prepared) to connect the panel and the accumulator (copper pipes)

Over pressure security valve.

Manometer, range: 0-4 bar.

Temperature sensors, type "J", range: -40 to 750° C.

Thermal accumulator tank (from 150 to 200 l. approx.):

Vacuum vitrified heater, high efficiency heating and anti-corrosion protections.

It has a supporting heating group, with a regulation electric resistance.

Range of the resistance: 3000W.

Contact thermostat to control temperature.

Solar simulator:

Aluminum structure regulated in height.

Sixteen solar spectrum lamps of 300 W each one.

Electricity security group, made up by 3 magnetothermics.

Feed wire.

With this unit you can simulate three operating possibilities: with all the lamps on (16), with half of the lamps on (8), and with only one lamp on.

Pumping equipment:

Impulse pump, computer controlled, range: 0-2l./min.; 0.6 bar.

Flowmeters:

One of 0-2 l./min. in the primary circuit (forced circulation, with pump).

One of 4-60cc/min. in the primary circuit (free circulation, without pump).

One of 2-10l./min. in the secondary circuit.

Flow sensors, range: 0.2 - 6.5 l./min.

10 Temperature sensors, type "J", range: -40 to 750° C.

Protection curtains.

#### ② EESTC/CIB. Control Interface Box :

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

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

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

Single cable between the control interface box and computer. **The unit control elements are permanently computer controlled**, without necessity of changes or connections during the whole process test procedure.

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

Calibration of all sensors involved in the process.

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

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

Shield and filtered signals to avoid external interferences.

**Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process.** Real time computer control for pumps, compressors, resistances, control valves, etc. **Open control** allowing modifications, at any time and in a real time, of parameters involved in the process simultaneously.

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

#### ③ DAB. Data Acquisition Board:

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

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

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

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

Analog output: Channels=2. Resolution= 16 bits, 1 in 65536. Maximum output rate up to: 833 KS/s.

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

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

#### ④ EESTC/CCSOF. Computer Control + Data Acquisition + Data Management Software:

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

**Compatible with the industry standards.** Registration and visualization of all process variables in an automatic and simultaneously way. **Flexible, open and multicontrol software**, developed with actual windows graphic systems, acting simultaneously on all process parameters. **Management, processing, comparison and storage of data.** Sampling velocity up to 250,000 data per second guaranteed.

Calibration system for the sensors involved in the process.

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

Comparative analysis of the obtained data, after the process and modification of the conditions during the process. **Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords** to facilitate the teacher's control on the student, and allowing the access at different work levels.

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

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

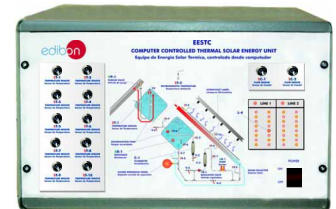
#### ⑥ Manuals:

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



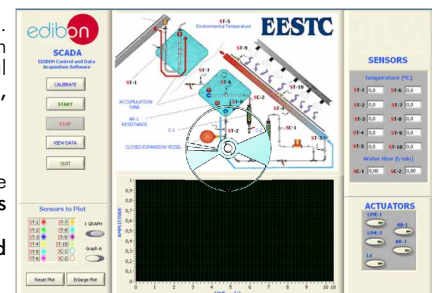
EESTC. Unit



EESTC/CIB



DAB



EESTC/CCSOF

Continue...

**Complementary items to the standard supply**

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

**⑦ PLC-PI. PLC Module:**

Circuit diagram in the front panel.

Front panel:

**Digital inputs(X) and Digital outputs (Y) block:**

**16 Digital inputs**, activated by switches and 16 LEDs for confirmation (red).

**14 Digital outputs** (through SCSI connector) with 14 LEDs for message (green).

**Analog inputs block:**

**16 Analog inputs** (-10V. to + 10V.)( through SCSI connector).

**Analog outputs block:**

**4 Analog outputs** (-10V. to + 10V) (through SCSI connector).

**Touch screen:**

High visibility and multiple functions.

Display of a highly visible status.

Recipe function.

Bar graph function.

Flow display function.

Alarm list.

Multi language function.

True type fonts.

Back panel:

Power supply connector.

Fuse 2A.

RS-232 connector to PC.

Inside:

Power supply outputs: 24 Vdc, 12 Vdc, -12 Vdc, 12 Vdc variable.

**Panasonic PLC:**

**High-speed scan of 0.32  $\mu$ sec.** for a basic instruction.

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

Free input AC voltage(100 to 240 V AC).

DC input: 16 (24 VDC).

Relay output: 14 (250 VA AC/2 A).

**High-speed counter.**

**Multi-point PID control.**

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

Communication RS232 wire, to computer (PC).

**⑧ EESTC/PLC-SOF. PLC Control Software:**

For this particular unit, always included with PLC supply.



PLC-PI

**Items available on request**

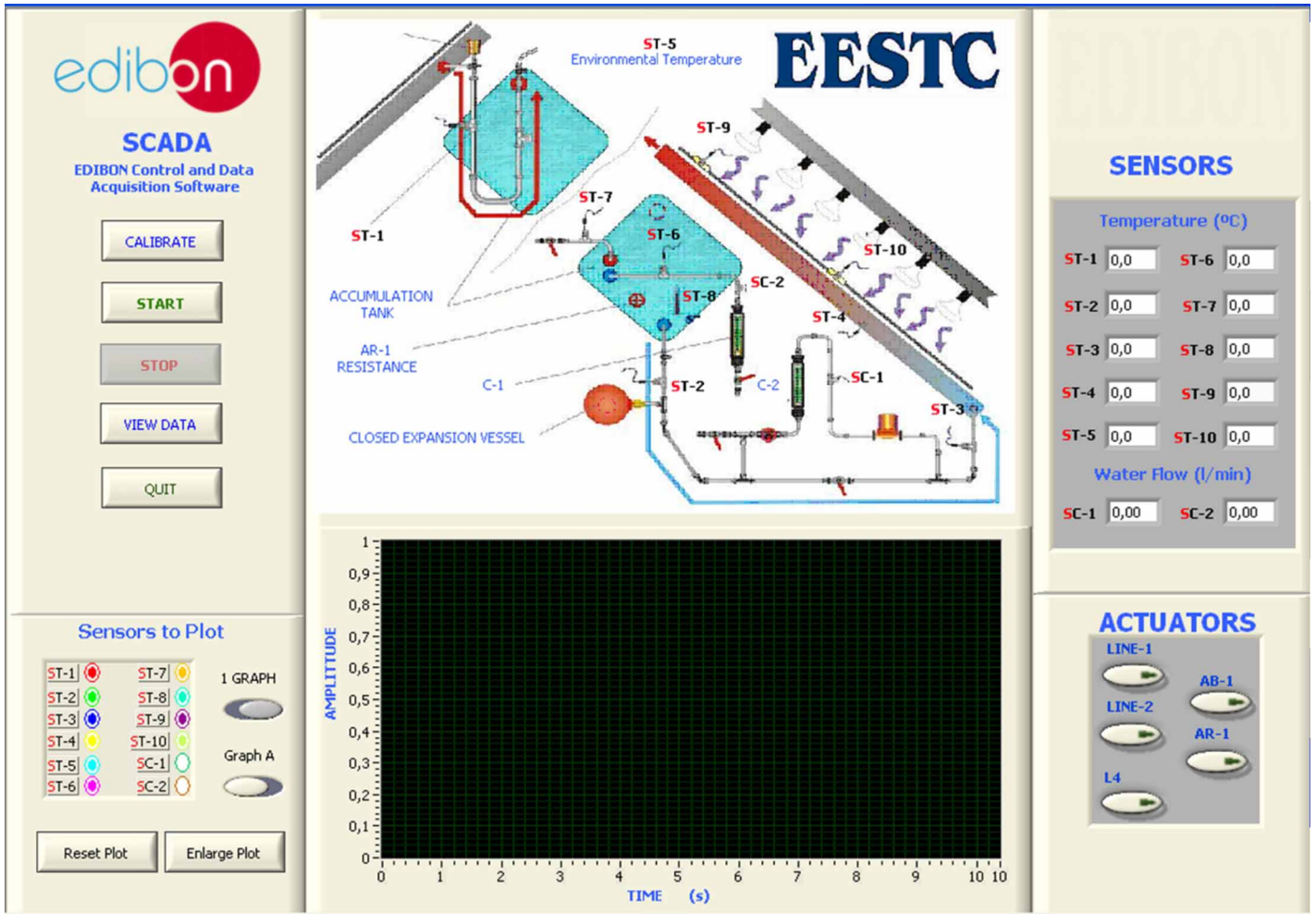
**⑨ EESTC/CAL. Computer Aided Learning Software (Results Calculation and Analysis).**

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

## Software Main Screens

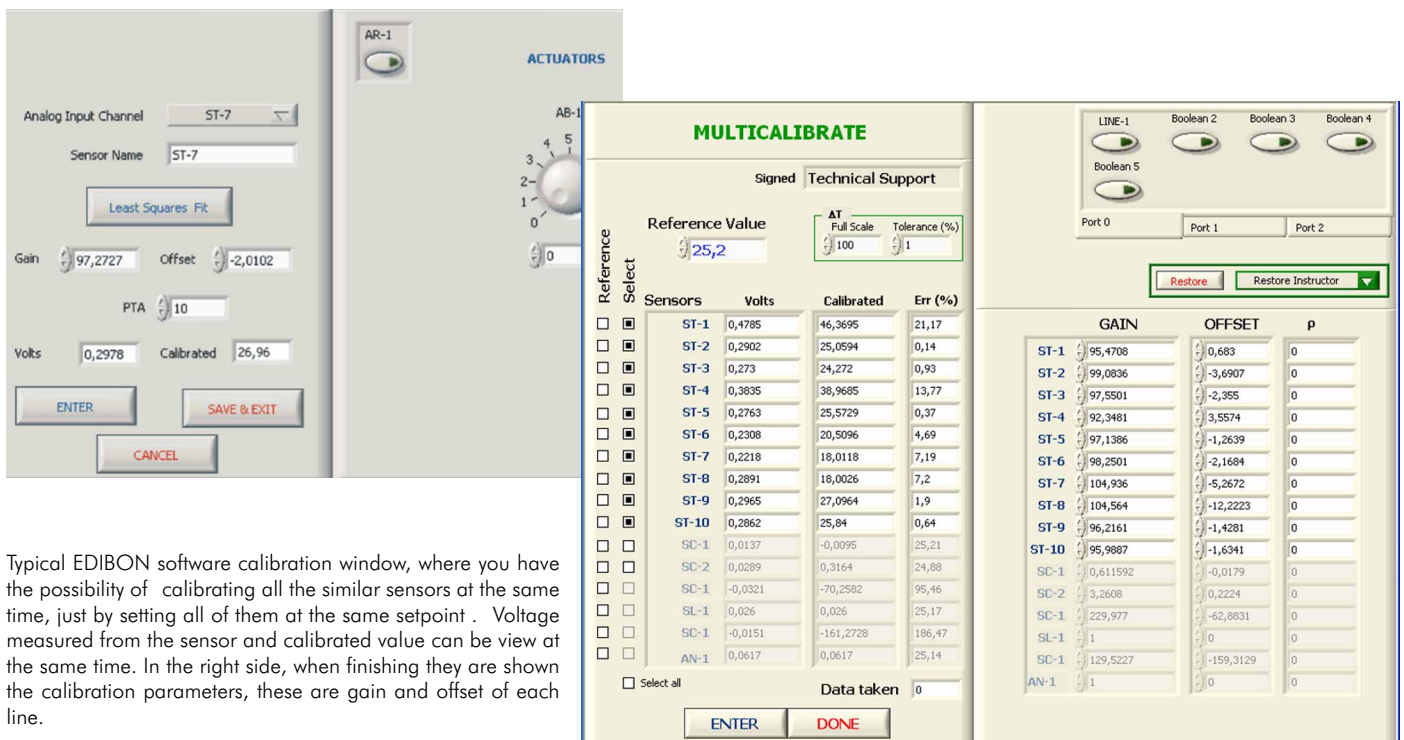
### Main screen

Main screen of the software. As usual, on the right side all the sensors are shown (flow and temperature). On the bottom, the controls which let us to switch on/off the lamps and the resistance.



**Note:** ST= Temperature sensor SC= Flow sensor AB= Pump AR=Electric resistance. LINE = Lamps group. L4= One lamp.

### Examples of Sensors Calibration screens

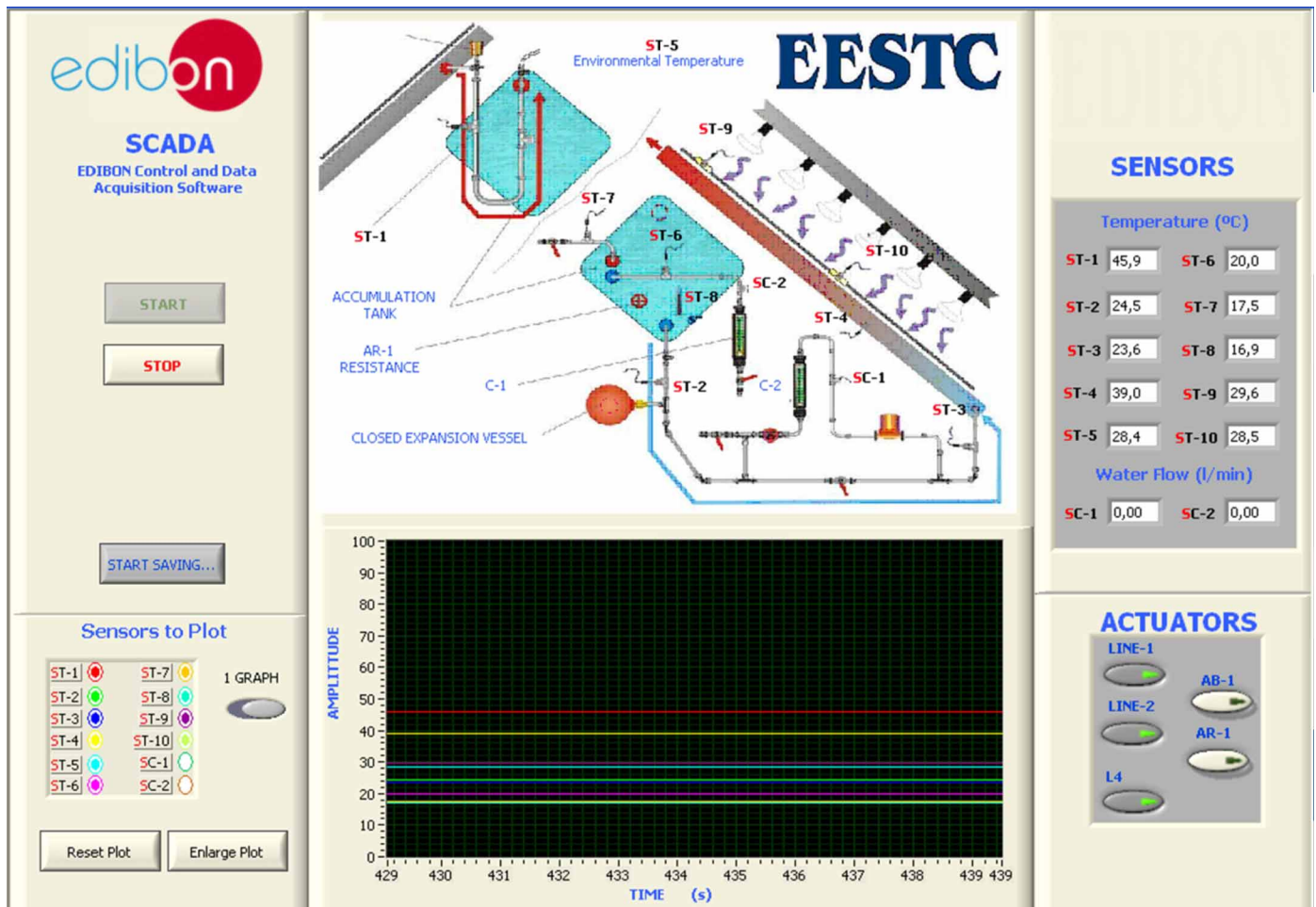


Continue...

## Some typical exercises results

When doing the experiments, the readings from the sensors you have selected can be plotted in a real time.

The data saving starts when clicking on the "start saving" button. In this case, we can see the difference between the temperature sensors readings, depending on the place they are located.



## EXERCISES AND PRACTICAL POSSIBILITIES

### Some Practical Possibilities of the Unit:

- 1.- Study of how the thermosiphon works.
- 2.- Study of the lamp illumination profile.
- 3.- Study of the solar collector efficiency.
- 4.- Free circulation: Inclination angle influence on the equipment efficiency.
- 5.- Relationship between the flow and the temperature.
- 6.- Energy balance of the solar collector.
- 7.- Energy balance in the accumulator tank.
- 8.- Experimental efficiency determination.
- 9.- Influence of the incidence angle over the temperature.

Other possible practices:

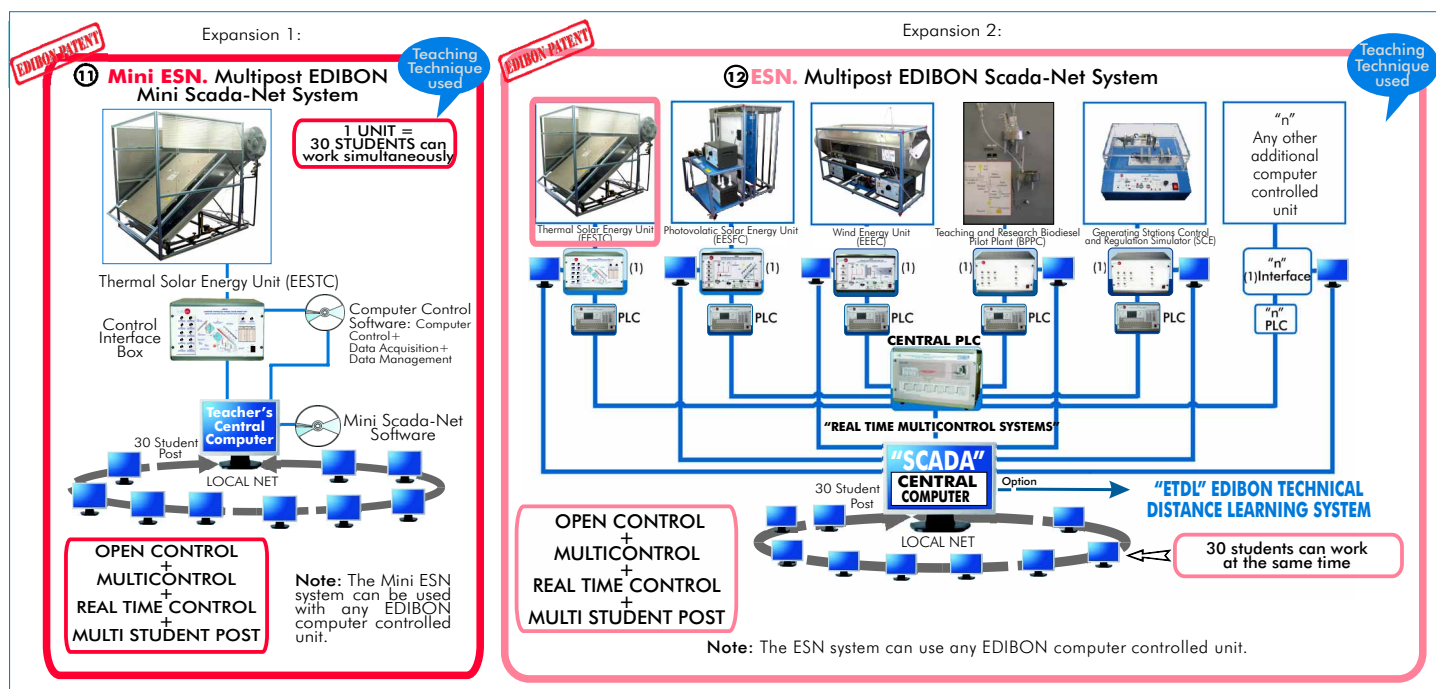
- 10.- Sensors calibration.
- 11.- Flowmeter calibration.

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

- 12.- Control of the EESTC unit process through the control interface box without the computer.
- 13.- Visualization of all the sensors values used in the EESTC unit process.
- 14.- Calibration of all sensors included in the EESTC unit process.
- 15.- Hand on of all the actuators involved in the EESTC unit process.
- 16.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).

- 17.- 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).
- 18.- PLC hardware general use and manipulation.
- 19.- PLC process application for EESTC unit.
- 20.- PLC structure.
- 21.- PLC inputs and outputs configuration.
- 22.- PLC configuration possibilities.
- 23.- PLC program languages.
- 24.- PLC different programming standard languages (ladder structured, graphic, etc.).
- 25.- New configuration and development of new process.
- 26.- Hand on an established process.
- 27.- To visualize and see the results and to make comparisons with the EESTC unit process.
- 28.- Possibility of creating new process in relation with the EESTC unit.
- 29.- PLC Programming Exercises.
- 30.- Own PLC applications in accordance with teacher and student requirements.

## POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS



## ORDER INFORMATION

### Items supplied as standard

Minimum configuration for normal operation includes:

- ① Unit: EESTC. Thermal Solar Energy Unit.
- ② EESTC/CIB. Control Interface Box.
- ③ DAB. Data Acquisition Board.
- ④ EESTC/CCSOF. Computer Control + Data Acquisition + Data Management Software.
- ⑤ Cables and Accessories, for normal operation.
- ⑥ Manuals.

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

### Complementary items to the standard supply

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

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

### Expansions

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

## REQUIRED SERVICES

- Electrical supply: single-phase, 220V. /50 Hz or 110V/60 Hz, minimum power 6000 W.
- Water supply: 2 bars.
- Computer (PC).

## DIMENSIONS & WEIGHTS

EESTC Unit:	-Dimensions: 2200 x 1200 x 2005 mm. approx. -Weight : 290 Kg. approx.
Control Interface Box:	-Dimensions: 490 x 330 x 310 mm. approx. -Weight: 10 Kg. approx.
PLC Module (PLC-PI):	-Dimensions: 490 x 330 x 310 mm. approx. -Weight: 30 Kg. approx.

## AVAILABLE VERSIONS

Offered in this catalogue:

-EESTC. **Computer Controlled Thermal Solar Energy Unit.**

Offered in other catalogues:

-EEST. **Thermal Solar Energy Unit.**

-MINI-EESTC. **Computer Controlled Thermal Solar Energy Basic Unit.**

-MINI-EEST. **Thermal Solar Energy Basic Unit.**

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



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