edibon
Technical Teaching Equipment

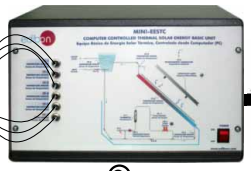
Computer Controlled
Thermal Solar Energy Basic Unit
MINI-EESTC

EDIBON PATENT

Always included in the supply:

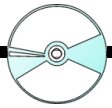
Teaching Technique used

SCADA. EDIBON Computer Control System



② Control Interface Box

③ Data Acquisition Board



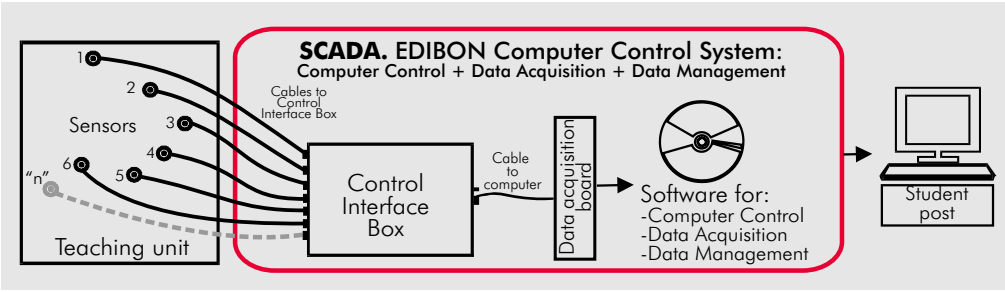
④ Software for:
- Computer Control
- Data Acquisition
- Data Management

Computer (not included in the supply)

⑤ Cables and Accessories
⑥ Manuals

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

① Unit: MINI-EESTC. Thermal Solar Energy Basic Unit



www.edibon.com
Products
Products range
Units
5.-Energy

ISO 9000: Quality Management
(for Design, Manufacturing, Commercialization and After-sales service)

European Union Certificate
(total safety)

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

Worlddidac Quality Charter Certificate
(Worlddidac Member)

DESCRIPTION

This 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.

Basically the unit is formed by:

- Thermal solar panel.
- Tank.
- Solar simulator.
- Lamps.
- Pump.
- Temperature sensors.
- Flow sensor.
- Valves set to work in thermosiphon mode or pumping mode.

The solar panel is made of polycarbonate. It is mounted over an aluminium structure with a copper conduct for the thermal fluid. It has been developed carefully taking into account the geometrical shape of the absorbing surface in order to obtain the highest output levels possible.

The tank satisfies the set standards both in its construction and its equipment. The hot water outlet is through an overflow placed at the top of the tank. Its capacity is 30 litres.

Lamps present radiation features that are similar to those of the sun.

This unit makes it possible to simulate two different functioning modes: thermosiphon mode, the water is moved due to the temperature differences, that is to say, without pump, and pumping mode.

5 temperature sensors allow to know the temperature in different points of the unit.

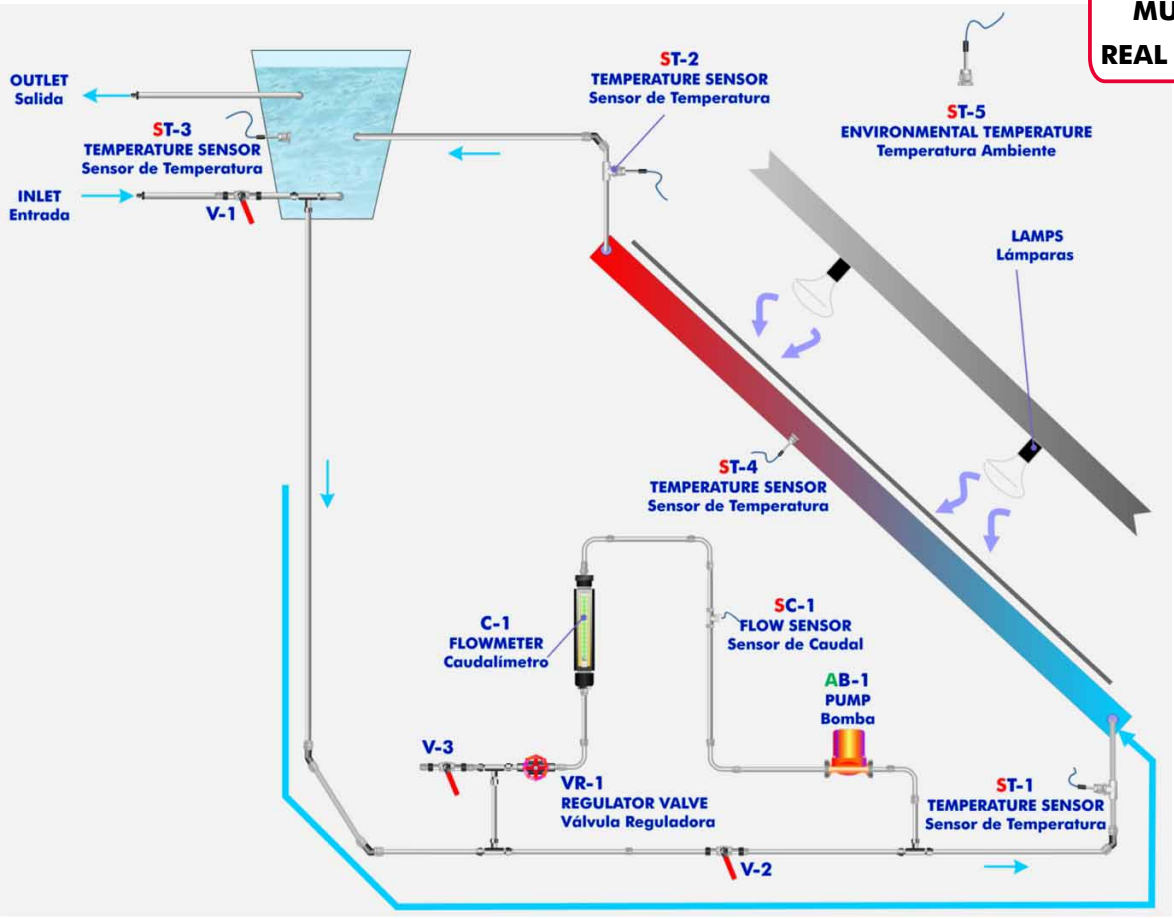
The flowmeter and the flow sensor allow to know the water that is running through the pump and the colector.

The Unit has every pipes and connections for its optimal function.

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

PROCESS DIAGRAM AND ELEMENTS ALLOCATION

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL



Note:
ST= Temperature sensor.
SC= Flow sensor.
C= Flowmeter.
AB= Pump.
VR= Regulation Valve.
V= Valve.

Items supplied as standard

① MINI-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):
- Metallic structure.
- Solar panel is made of polycarbonate, with polypropylene pipes.
- Pipes (already prepared) to connect the panel and the accumulator.
- Temperature sensors, type "J ".

Accumulator tank of 30 l.
Solar simulator:
- Aluminium structure with adjustable height.
- 2 Solar spectrum lamps of 300W each one.
- Feed wire.
- Lamps intensity control from the computer (PC).

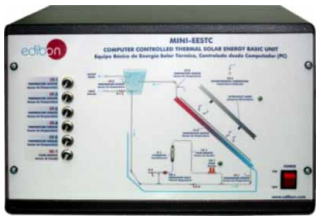
Pumping equipment:
- Impulse pump, computer controlled, range: 0 - 2 l./min.
- Flowmeter, range: 0 - 2 l./min.
- Flow sensor, range: 0 - 4 l./min.

5 Temperature sensors, type "J ", in different points of the unit.
Protection curtains.
The unit has wheels for its mobility.

MINI-EESTC. Unit

② MINI-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.



MINI-EESTC/CIB

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot.
Bus PCI.
Analog input:
- Number of **channels= 16** single-ended or 8 differential. **Resolution=16 bits**, 1 in 65536.
- **Samplingrate up to: 250 KS/s (Kilo samples per second).**
- Input range (V)=±10V.
- Data transfers=DMA, interrupts, programmed I/0. Number of DMA channels=6.

Analog output:
- Number of **channels=2**. **Resolution=16 bits**, 1 in 65536.
- Maximum output rate up to: 833 KS/s.
- Output range(V)=±10V.
- Data transfers=DMA, interrupts, programmed I/0.

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

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

DAB

Continue...

Items supplied as standard (continuation)

④ MINI-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.

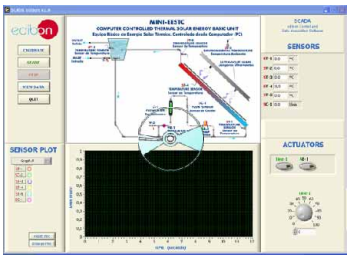
It allows the registration of the alarms state and the graphic representation in real time.

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.



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

Continue...

Additional and optional items to the standard supply

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

⑦PLC-PI. PLC Module:

Circuit diagram in the front panel.

Front panel:

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

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

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

Analog inputs block:

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

Analog outputs block:

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

Touch screen:

High visibility and multiple functions.
Display of a highly visible status.
Recipe function.
Bar graph function.
Flow display function.
Alarm list.
Multi language function.
True type fonts.

PLC-PI

Back panel:

Power supply connector.
Fuse 2A.
RS-232 connector to PC.
USB 2.0 connector to PC.

Inside:

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

Panasonic PLC:

High-speed scan of 0.32 μsec. for a basic instruction.
Program capacity of 32 Ksteps, with a sufficient comment area.
Free input AC voltage(100 to 240 V AC).
DC input:16 (24 V DC).
Relay output: 14 (250 V A AC/2 A).
High-speed counter.
Multi-point PID control.

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

Communication RS232 wire, to computer (PC).

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

For this particular unit, always included with PLC supply.

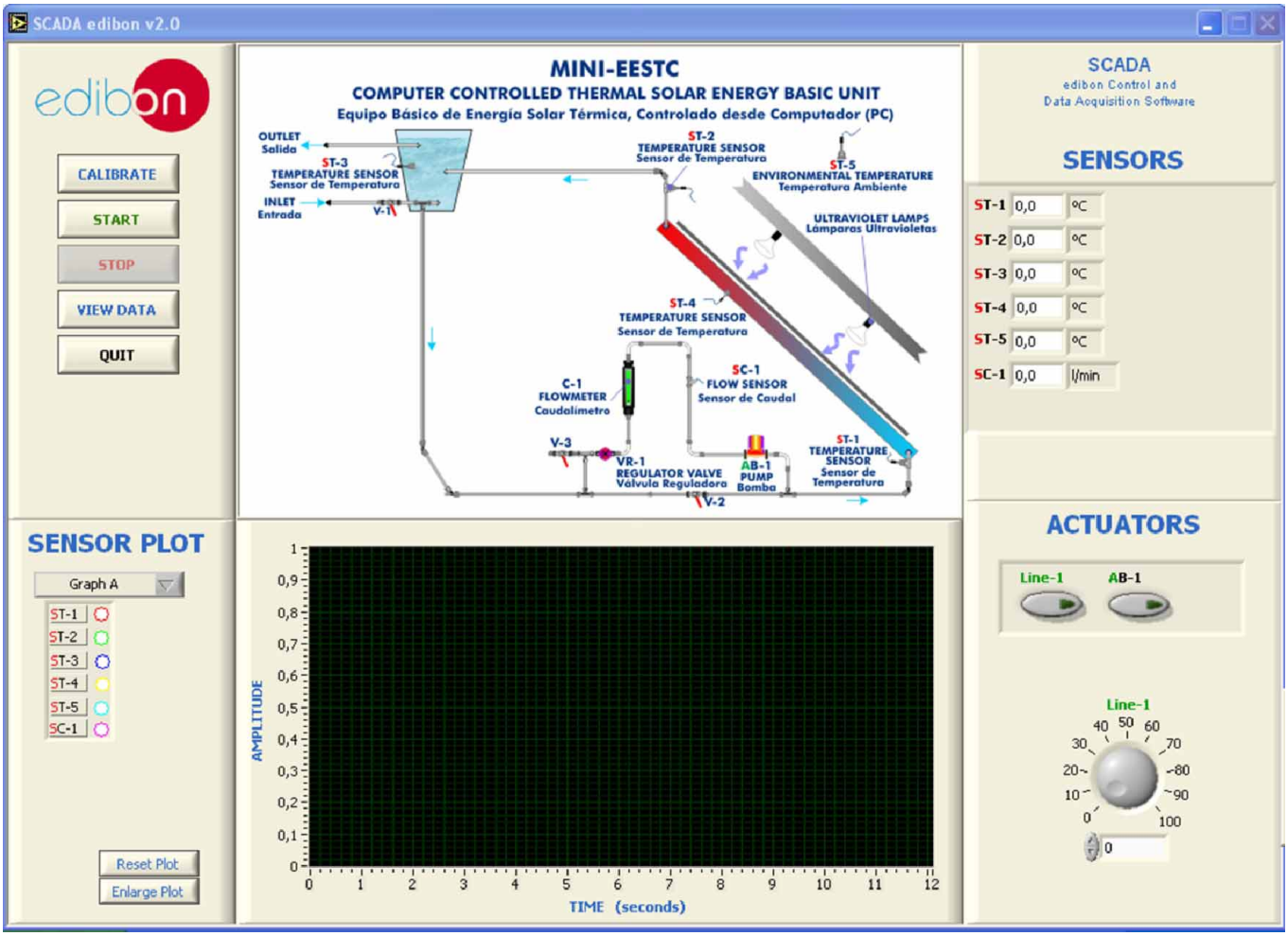
Items available on request

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

⑩MINI-EESTC/FSS. Faults Simulation System.

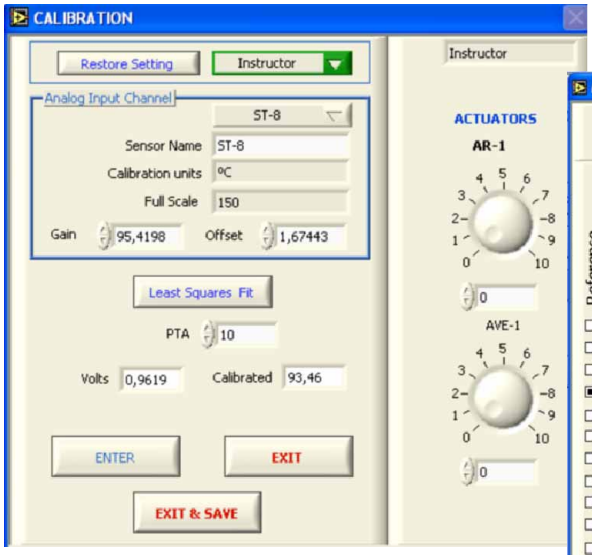
Software Main Screens

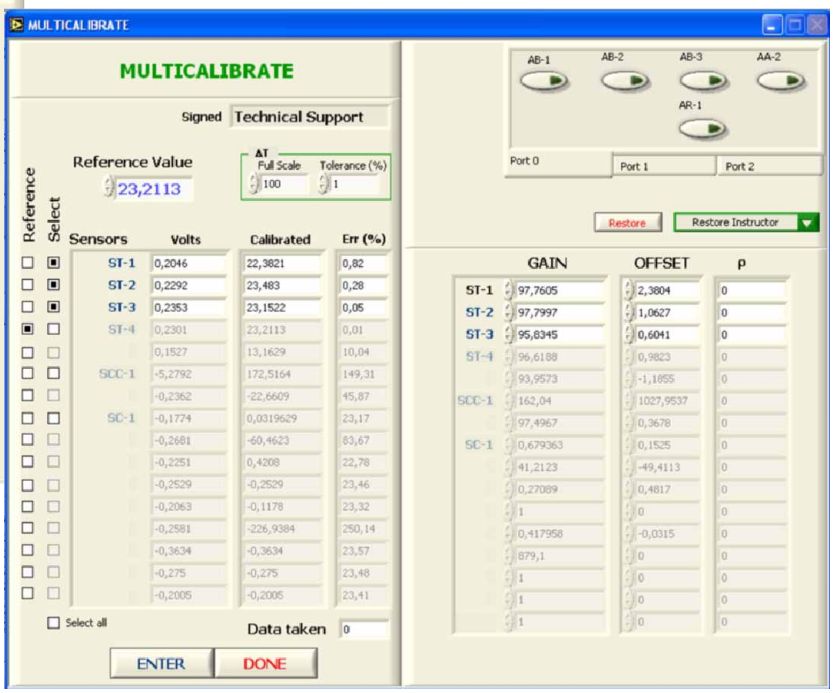
Main screen



Note: ST= Temperature sensor. SC= Flow sensor. AB=Pump. Line= Lamps

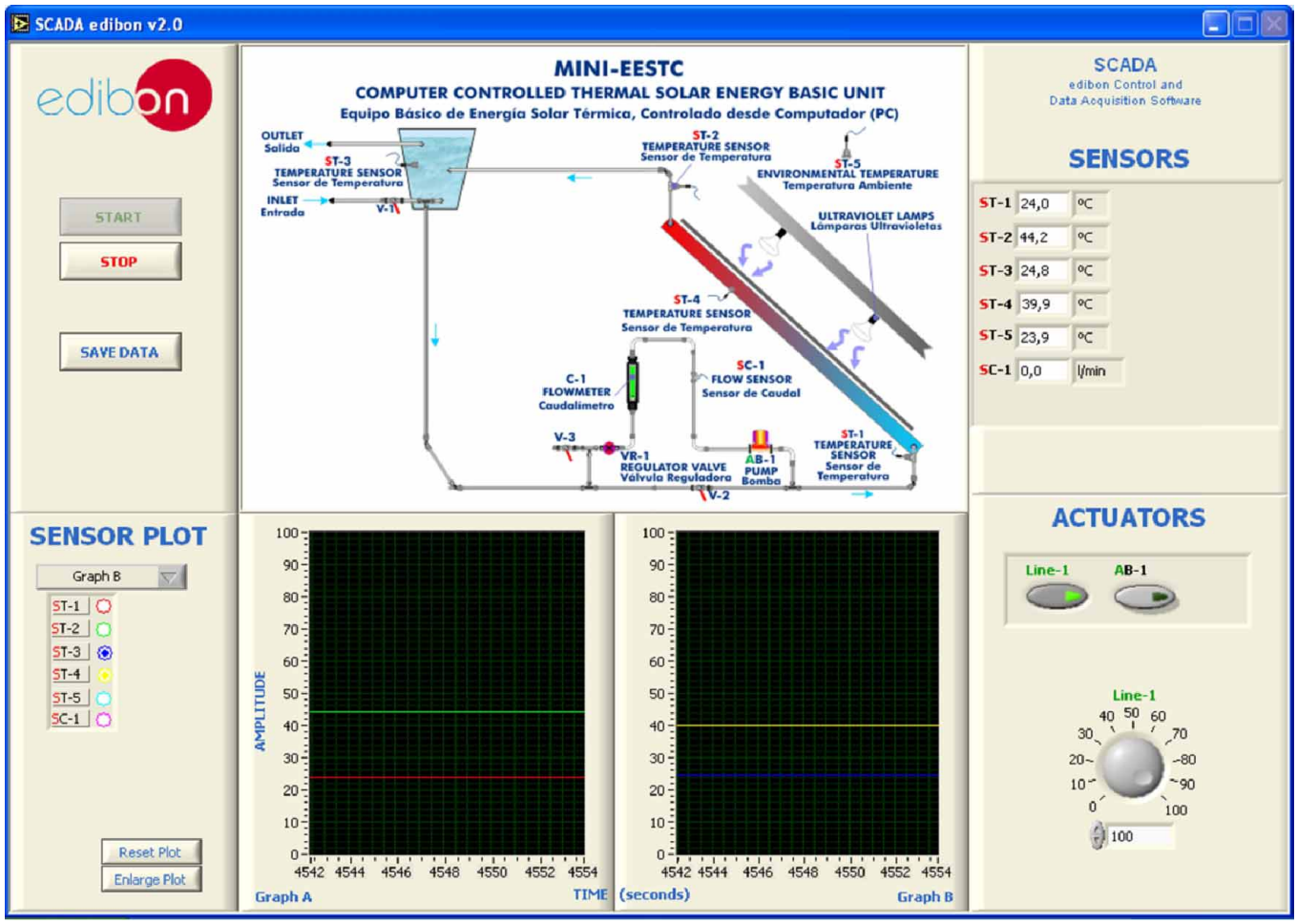
Examples of Sensors **Calibration** screens

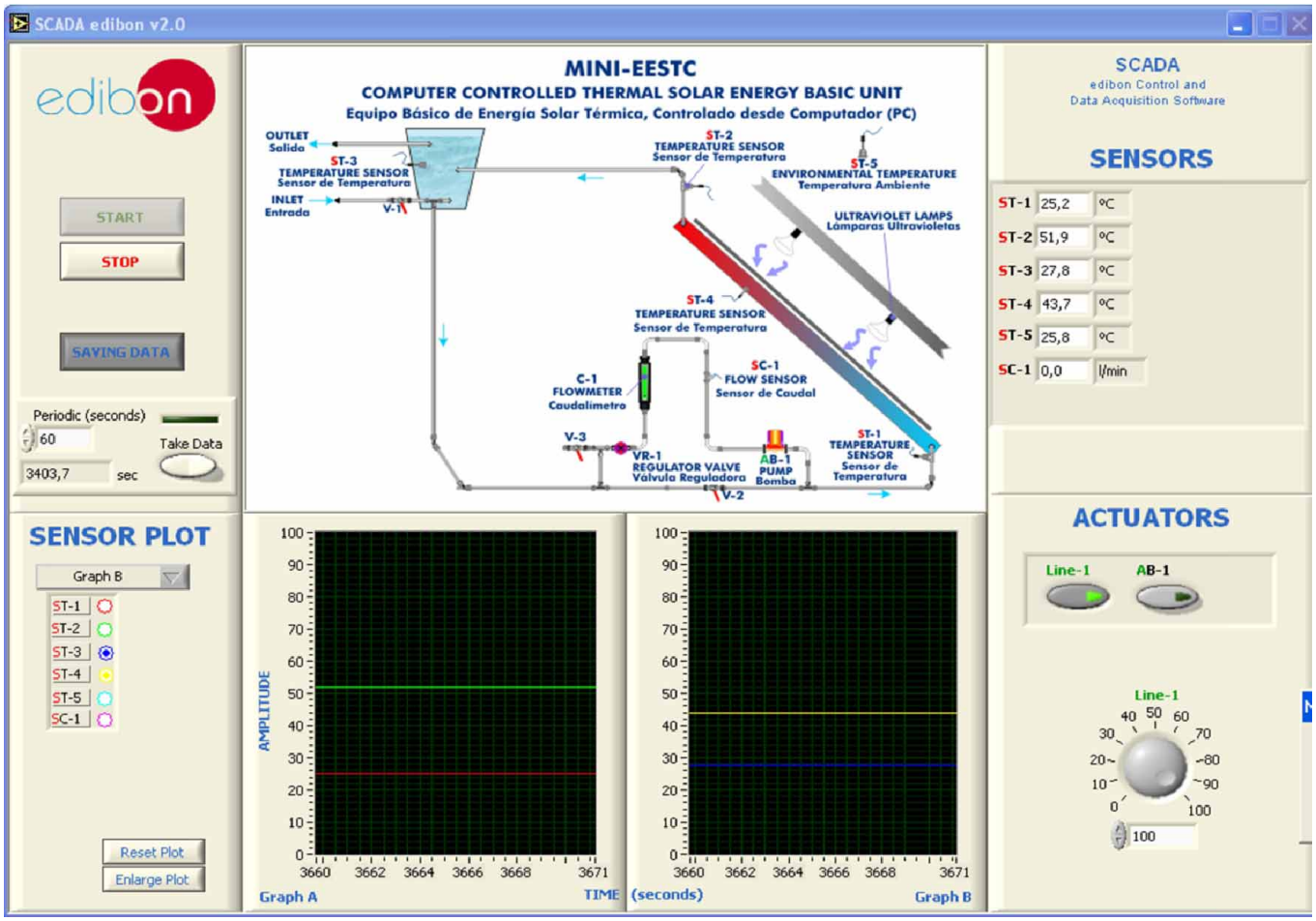




Continue...

Some typical exercises results





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.- Study of the influence of the inclination angle of the lamp panel on the unit efficiency.
5.- Relationship between the flow and the temperature.
6.- Energy balance of the solar collector.
7.- Experimental efficiency determination.

Other possible practices:

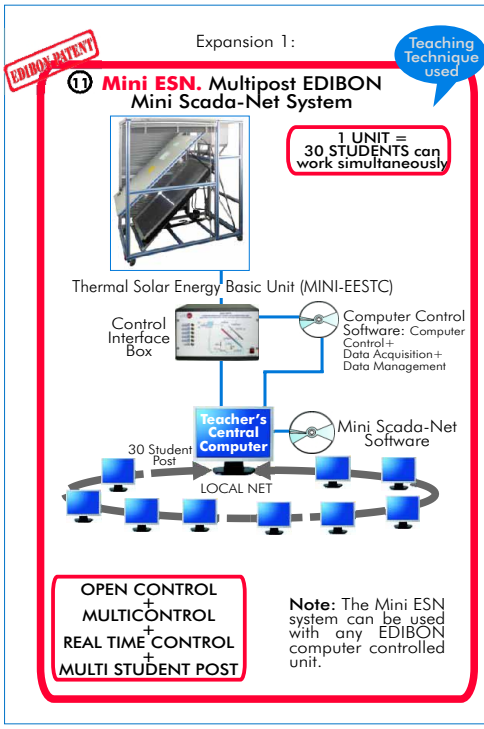
8.- Sensors calibration.

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

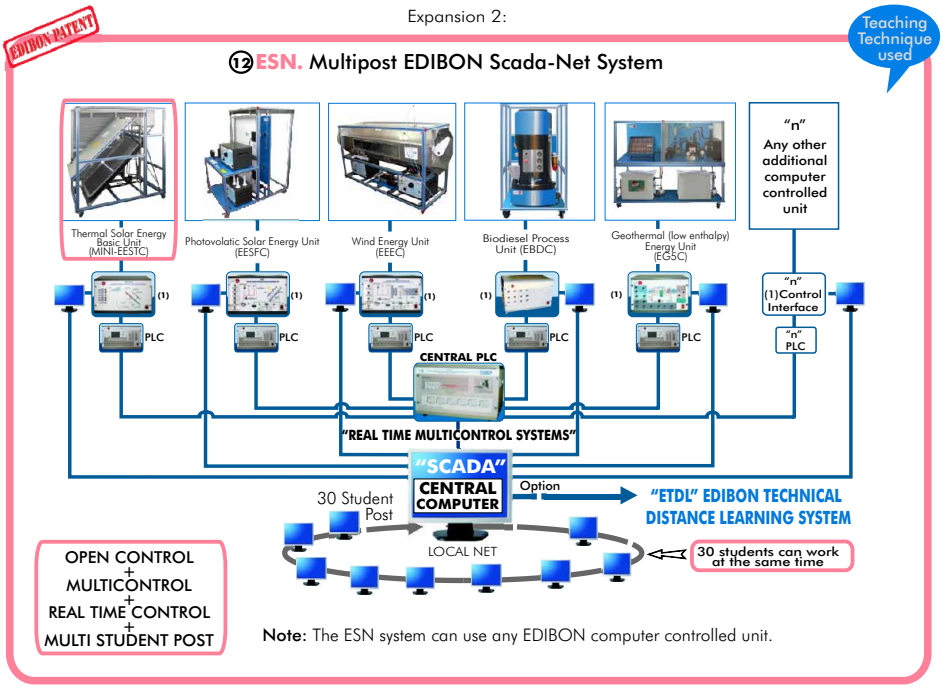
9.- Control of the MINI-EESTC unit process through the control interface box without the computer.
10.- Visualization of all the sensors values used in the MINI-EESTC unit process.
11.- Calibration of all sensors included in the MINI-EESTC unit process.
12.- Hand on of all the actuators involved in the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

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS

Expansion 1:



Expansion 2:



ORDER INFORMATION

Items supplied as standard

Minimum configuration for normal operation includes:

① Unit: MINI-EESTC. Thermal Solar Energy Basic Unit.

② MINI-EESTC/CIB. Control Interface Box.

③ DAB. Data Acquisition Board.

④ MINI-EESTC/CCSOF. Computer Control + Data Acquisition + Data Management Software.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals.

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

Additional and optional items to the standard supply

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

⑦ PCL-PI.PLC Module.

⑧ MINI-EESTC/PLC-SOF. PLC Control Software.

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

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

DIMENSIONS & WEIGHTS

Unit:	-Dimensions: 1300x800x1500 mm. approx. -Weight: 70 Kg. approx.
Control Interface Box:	-Dimensions: 490x330x310 mm. approx. -Weight: 10 Kg. approx.
PLC Module (PLC-PI):	-Dimensions: 490x330x310 mm. approx. -Weight: 30 Kg. Approx.

AVAILABLE VERSIONS

Offered in this catalogue:

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

Offered in other catalogues:

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

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

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

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

edibon INTERNATIONAL

C/ Del Agua, 14. Polígono Industrial San José de Valderas.
28918 LEGANÉS. (Madrid). SPAIN.
Phone: 34-91-6199363 FAX: 34-91-6198647
E-mail: edibon@edibon.com WEB site: **www.edibon.com**

Issue: ED01/11
Date: June/2011

REPRESENTATIVE: