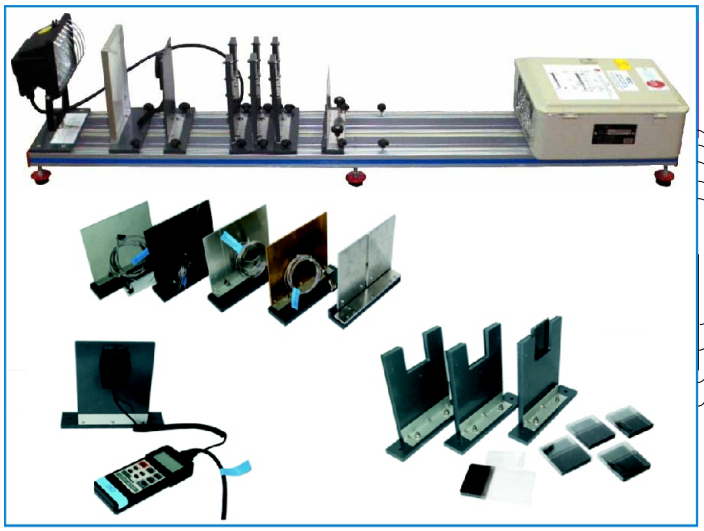
edibon
Technical Teaching Equipment

Computer Controlled
Thermal Radiation and Light Radiation Unit

TRTC

EDIBON PATENT



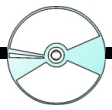
Always included in the supply:

Teaching Technique used

SCADA. EDIBON Computer Control System

② Control Interface Box

③ Data Acquisition Board

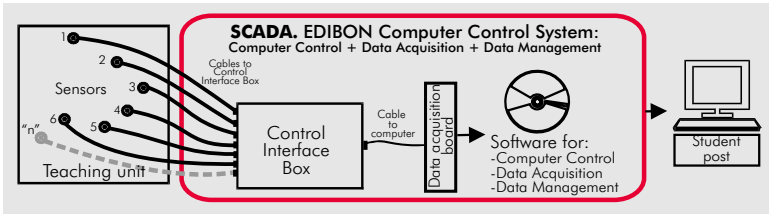


④ Software for:
- Computer Control
- Data Acquisition
- Data Management

Computer (not included in the supply)

⑤ Cables and Accessories
⑥ Manuals

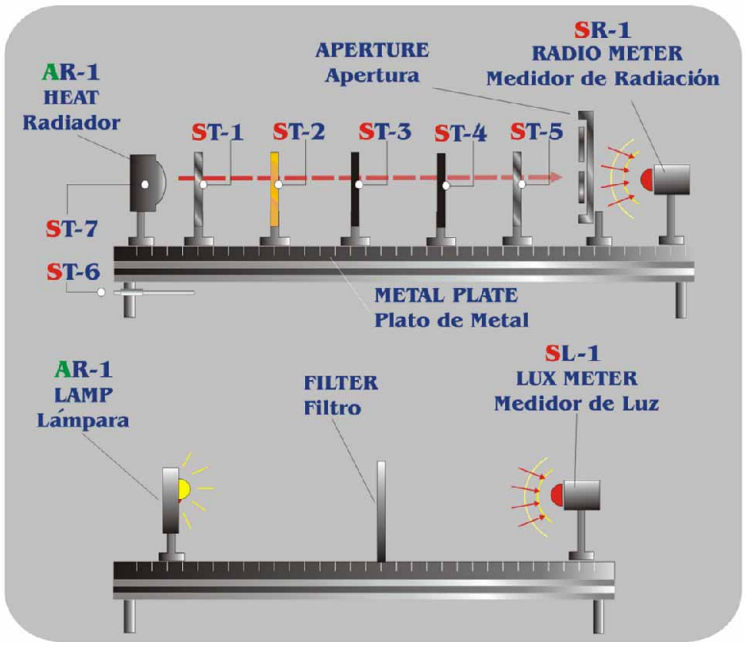
① Unit: TRTC. Thermal Radiation and Light Radiation Unit



www.edibon.com
Products
Products range
Units
9.-Thermodynamics & Thermotechnics

PROCESS DIAGRAM AND ELEMENTS ALLOCATION

2 actuators and 9 sensors controlled from any computer, and working simultaneously



OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

ISO 9001:2000 Certificate of Approval

European Union Certificate

Certificates ISO 14001: 2004 and ECO-Management and Audit Scheme (environmental management)

Worlddidac Quality Charter Certificate
Worlddidac Member

DESCRIPTION

Unit designed to demonstrate the laws of radiant heat transfer and radiant heat exchange.

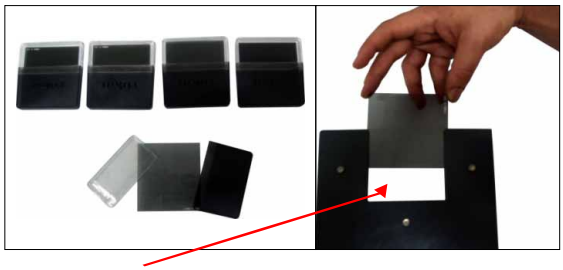
It basically consists in two independent parts. One of the parts is for the light radiation experiments and another part is for the thermal radiation experiments.

The elements provided with the unit allow making the measuring of the temperature, radiation, intensity of light and the power in the resistance or bulb.

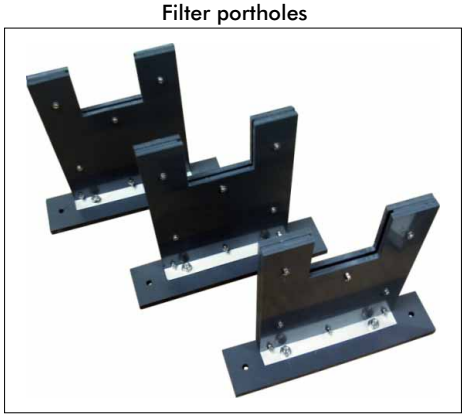
This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), including: Control interface Box + Data Acquisition Board + Computer Control and Data Acquisition Software, for controlling the process and the parameters involved.

Luxmeter

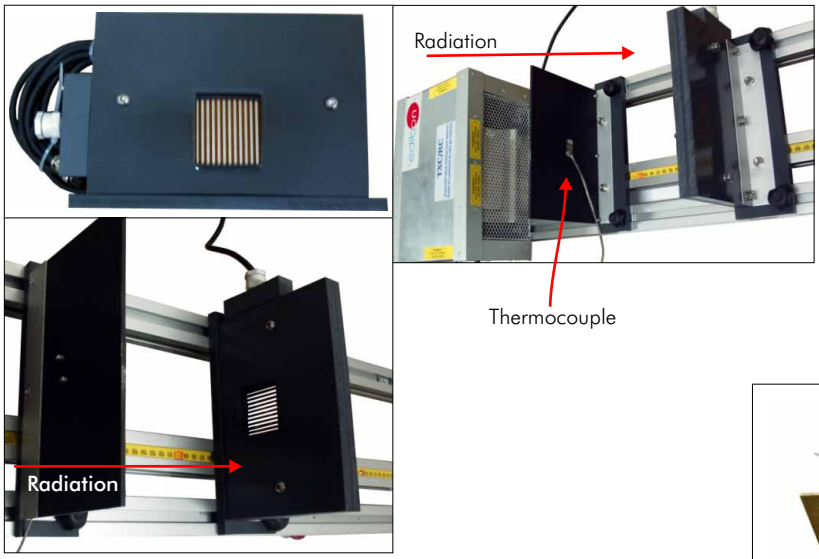
Filters



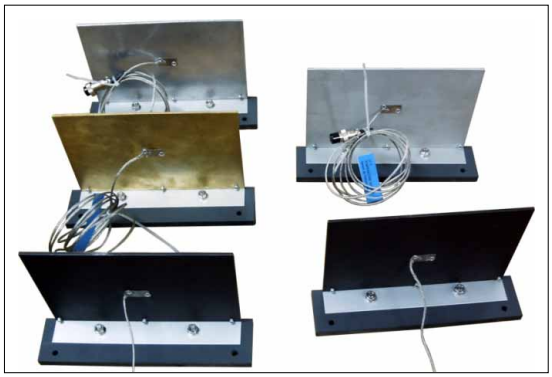
Filter portholes



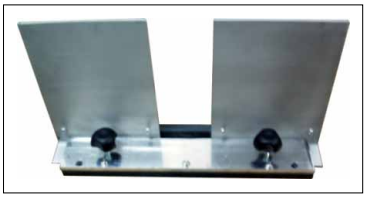
Radiometer



Plane Surfaces



Variable slit or aperture



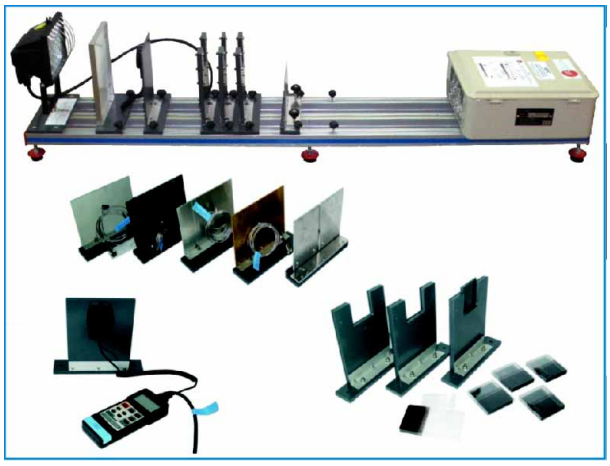
Items supplied as standard

① TRTC. Unit:

Bench-top unit.
Anodized aluminium structure and panels in painted steel.
Main metallic elements in stainless steel.
Diagram in the front panel with similar distribution to the elements in the real unit.
This unit consist on a metal plate with a resistance at one side and a lamp in another side. Lengthwise of the metal plate you can place the elements supplied with the unit.
Heating resistance (ceramic resistance: 500 W), computer controlled.
Lamp 150 W, with diffuser.
The unit is provided with accesories for light experiments and radiation experiments.
Light accesories:
Luxmeter that allows to measure the intensity of the light:

Scale:	Resolution:	Accuracy:
0 to 1999 lux	1 lux	
2000 to 19990	10 lux	
20000 to 50000	100 lux	8%
Selection of light	Day, Tungsten, fluorescence or mercury	
Sensor	Photodiode with filter of adjustment of filter	
Sample frequency:	0.4 s	
Work temperature:	0 to 50°C	

Filters:
They allow to filtrate the light in the experiments.
There are:
3 Grey Neutral Density A153 filters.
1 Grey Neutral Density A152 filter.
1 Grey Neutral Density A154 filter.
3 Filter portholes.
Radiation accesories:
Radiometer (50 x 50 mm, 5 μv (w/m²)). It allows to measure the intensity of the radiation.
Planes surfaces. They are elements for studying the radiation and each one contains one temperature sensor:
Polished aluminium.
Anodized aluminium.
Brass
2 Black bodys.
Variable slit or aperture. It allows to regulate the area of the radiation.
7 Temperature sensors.
Power measurement from the computer.
Radiation measurement from the computer.



TRTC. Unit

② TRTC/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.

TRTC/CIB

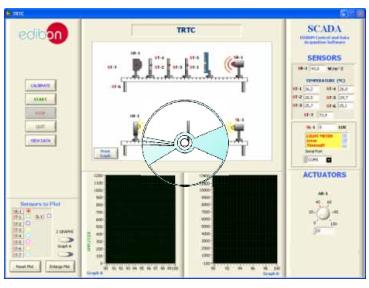
③ DAB. Data Acquisition Board:

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. **Sampling rate up to: 250 KS/s** (Kilo samples per second). Input range (V)=±10V. Data transfers=DMA, interrupts, programmed I/0. DMA channels=6.
Analog output: Number of **channels=2**. **Resolution=16 bits**, 1 in 65536. Max. output rate up to: 833 KS/s. Output range(V)=±10V. Data transfers=DMA, interrupts, programmed I/0.
Digital Input/Output: Channels=24 inputs/outputs. D0 or DI Sample Clock frequency: 0 to 1 MHz.
Timing: **Counter/timers=2**. Resolution: Counter/timers: 32 bits.

DAB

④ TRTC/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.



TRTC/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 Manual.

✱ References 1 to 6: TRTC + TRTC/CIB + DAB + TRTC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply, enabling a normal operation.

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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 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).

PLC-PI

⑧ TRTC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

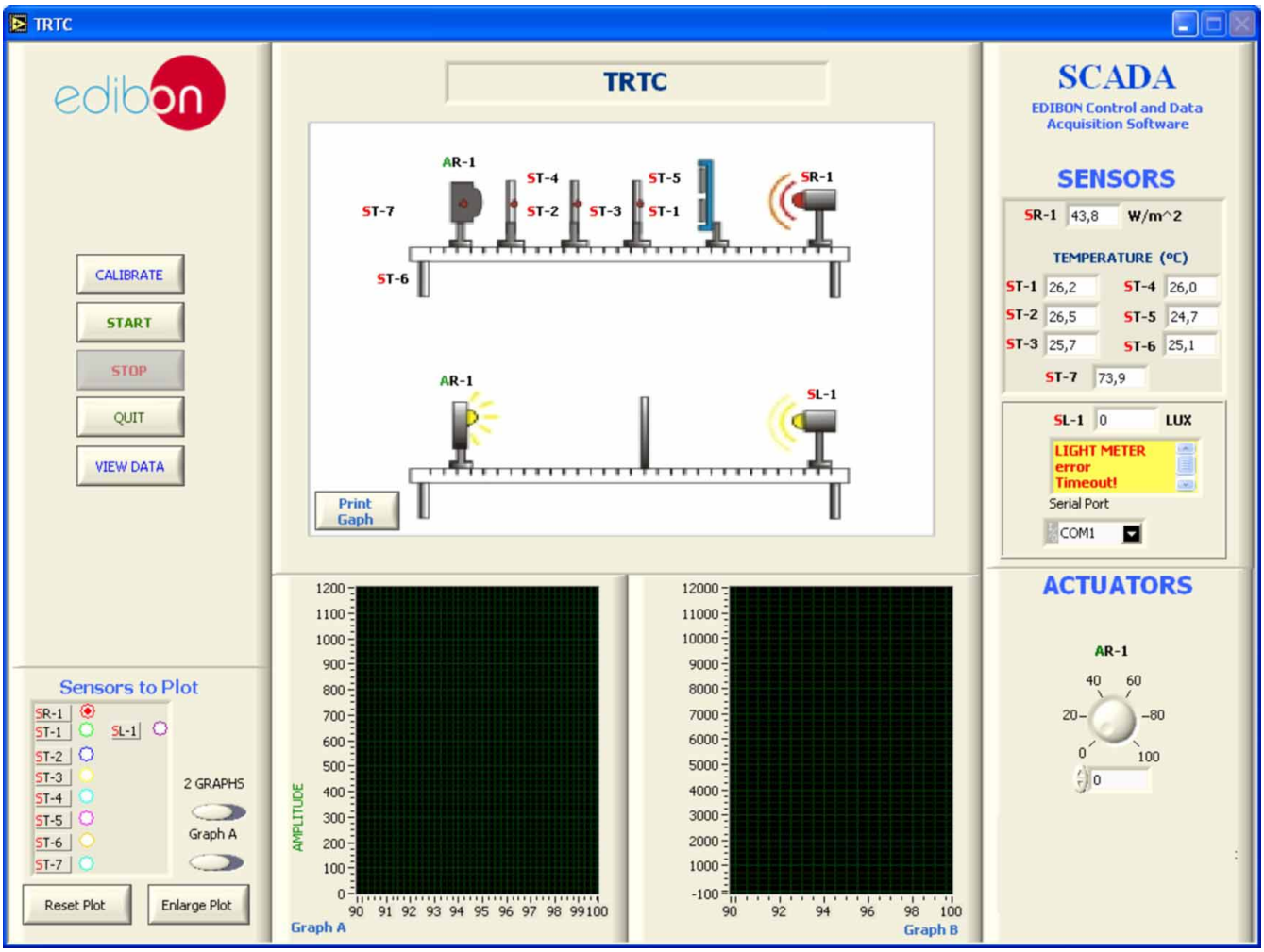
Items available on request

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

⑩ TRTC/FSS. Faults Simulation System.

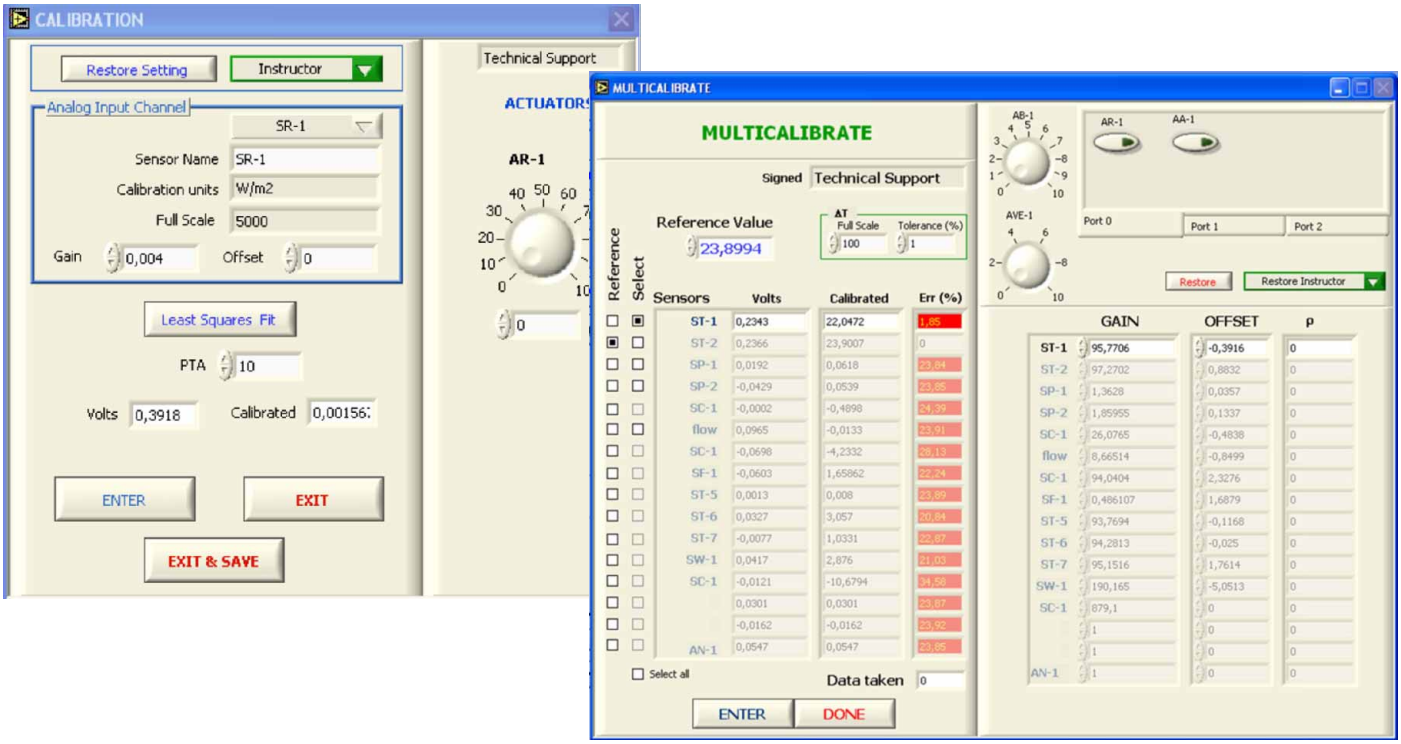
Software Main Screens

Main screen



Note: ST= Temperature sensor. SR= Radiometer. SL= Luxmeter. AR= Heating resistance.

Examples of Sensors Calibration screens



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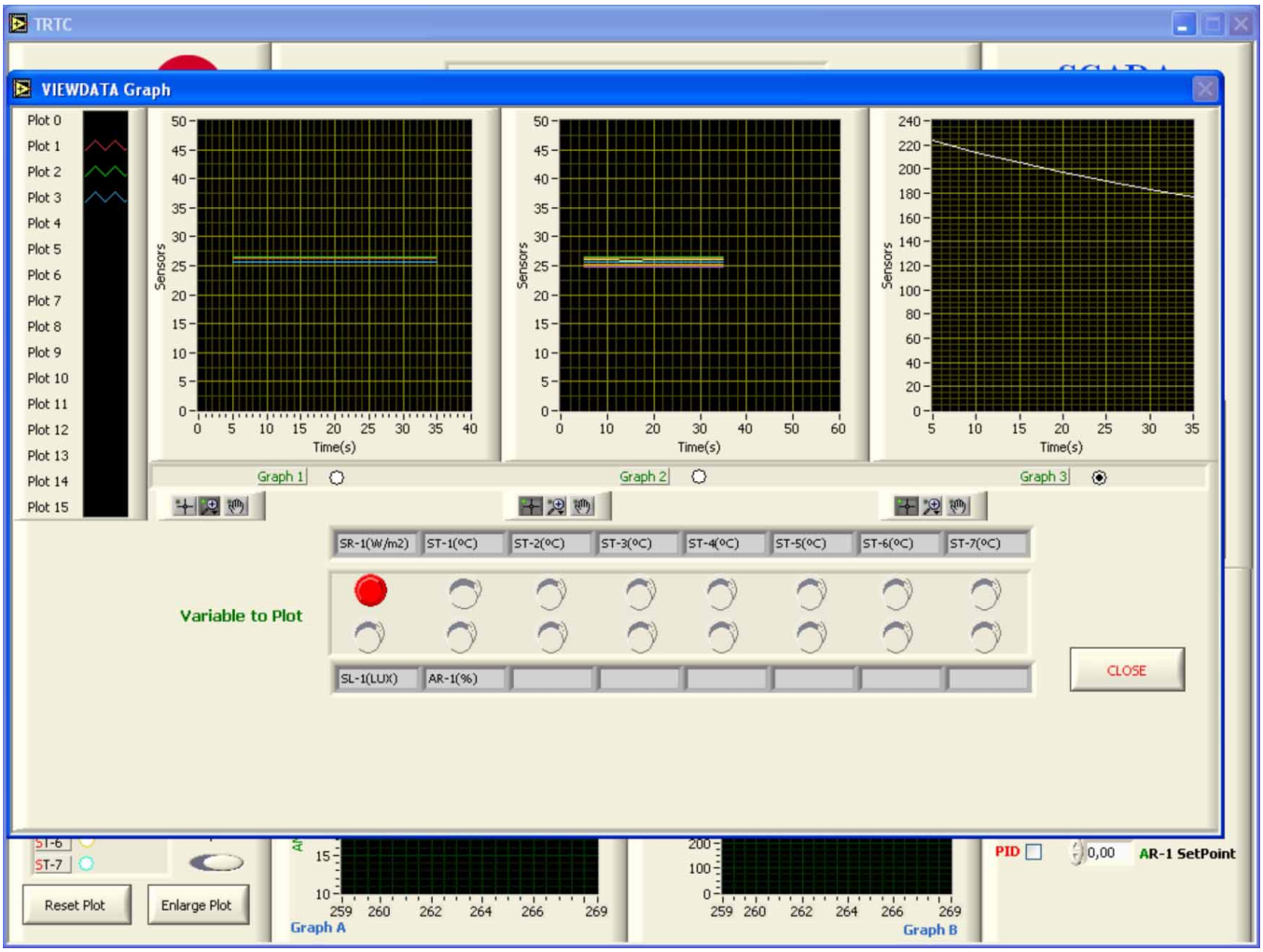
Software Main Screens



EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

1.- Inverse of the distant square law for the radiation.

2.- Stefan Boltzmann Law.

3.- Emission power I.

4.- Emission power II.

5.- Kirchorff Law.

6.- Area factors.

7.- Inverse of the distant square law for the light.

8.- Lambert's Cosine Law.

9.- Lambert Law of Absorption.

Other possible practices:

10.- Sensors Calibration.

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

11.- Control of the TRTC unit process through the control interface box without the computer.

12.- Visualization of all the sensors values used in the TRTC unit process.

13.- Calibration of all sensors included in the TRTC unit process.

14.- Hand on of all the actuators involved in the TRTC unit process.

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

16.- 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).

17.- PLC hardware general use and manipulation.

18.- PLC process application for TRTC unit.

19.- PLC structure.

20.- PLC inputs and outputs configuration.

21.- PLC configuration possibilities.

22.- PLC program languages.

23.- PLC different programming standard languages .

24.- New configuration and development of new process.

25.- Hand on an established process.

26.- To visualize and see the results and to make comparisons with the TRTC unit process.

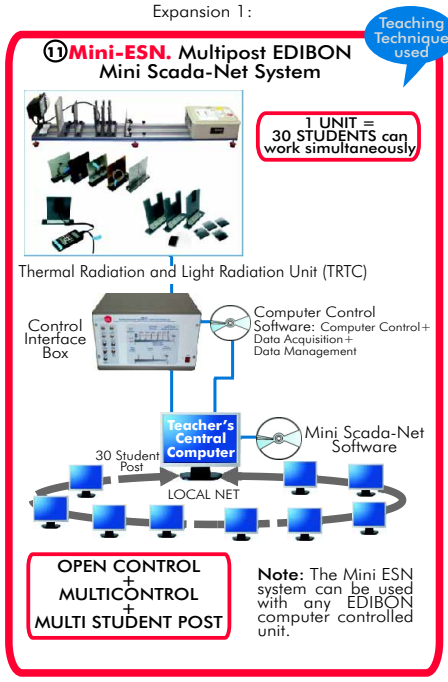
27.- Possibility of creating new process in relation with the TRTC unit.

28.- PLC Programming Exercises.

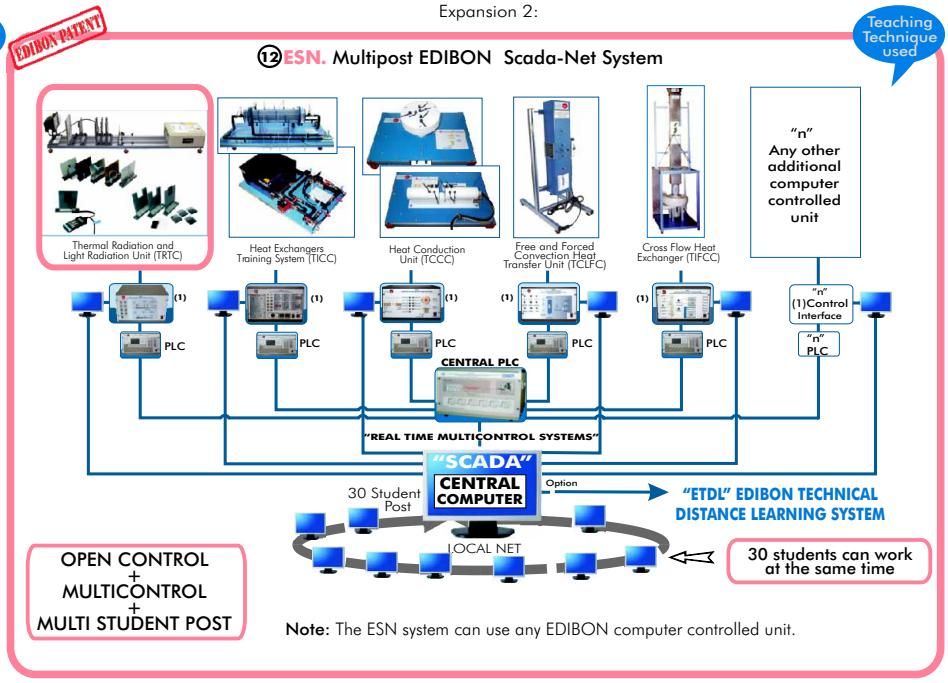
29.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS

Expansion 1:



Expansion 2:



ORDER INFORMATION

Items supplied as standard

Minimum configuration for normal operation includes:

① **Unit: TRTC. Thermal Radiation and Light Radiation Unit.**

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

③ **DAB. Data Acquisition Board.**

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

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

⑥ **Manuals.**

*** IMPORTANT: Under TRTC 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 TRTC/PLC-SOF. PLC Control Software.

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

⑩ TRTC/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: 220V./50 Hz or 110V./60 Hz.
-Computer (PC).

DIMENSIONS & WEIGHTS

TRTC Unit:	-Dimensions: 1400 x 500 x 500 mm. approx. -Weight: 40 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.

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

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