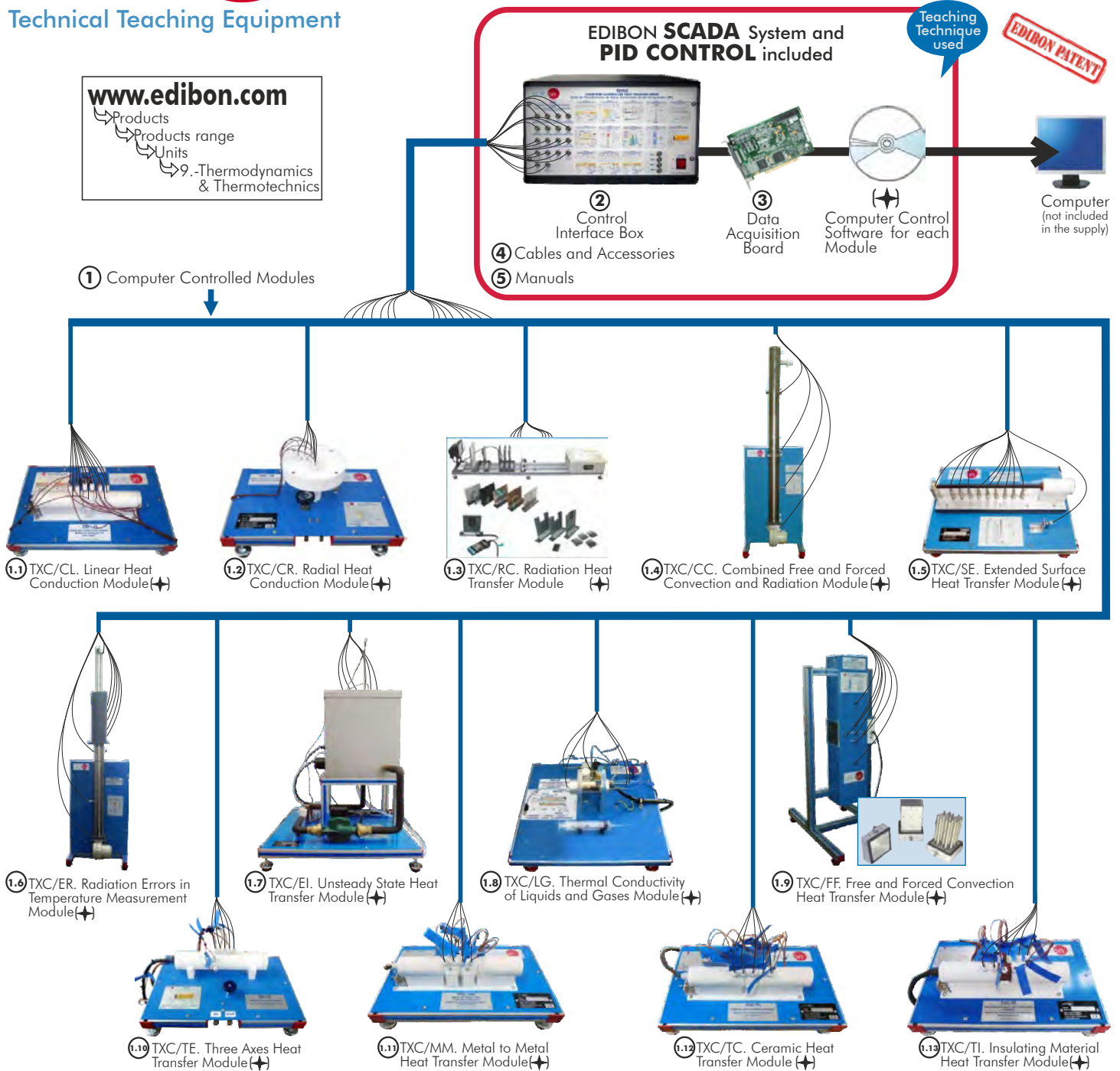


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- ↳ Products
- ↳ Products range
- ↳ Units
- ↳ 9.-Thermodynamics & Thermotechnics



Key features:

- ▶ **Advanced Real-Time SCADA and PID Control.**
- ▶ **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 CAL software helps the user perform calculations and comprehend the results.**
- ▶ **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.**

For more information about Key Features, click here:



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



European Union Certificate (total safety)



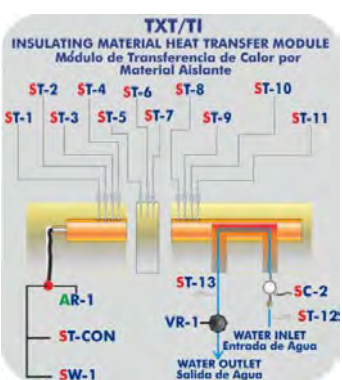
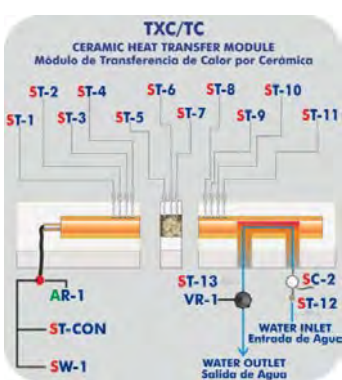
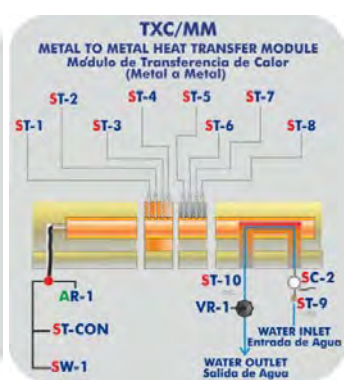
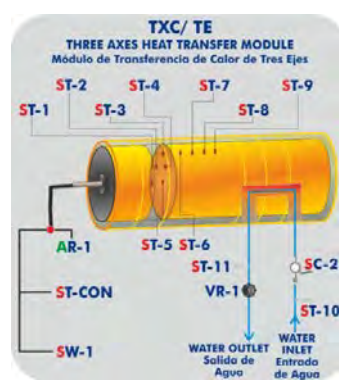
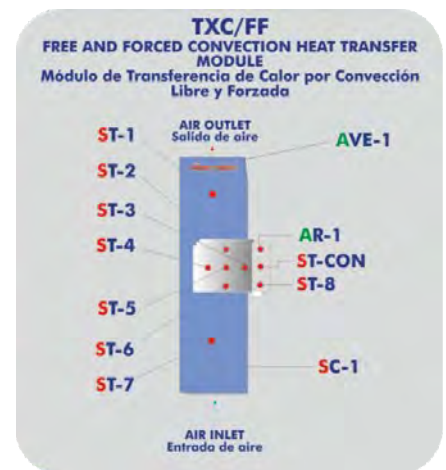
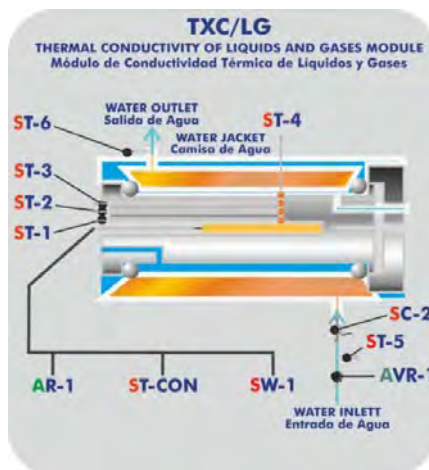
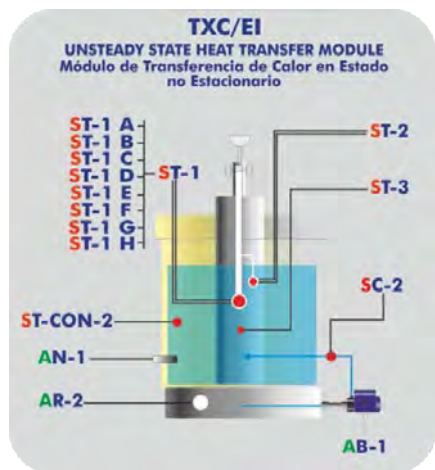
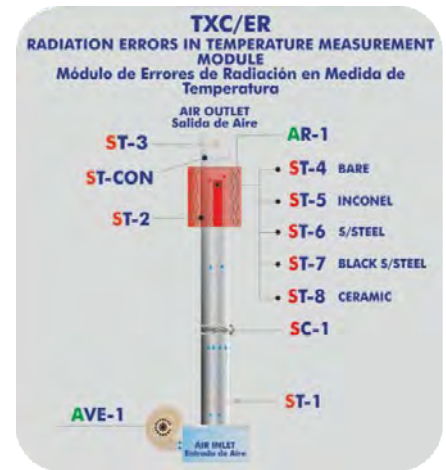
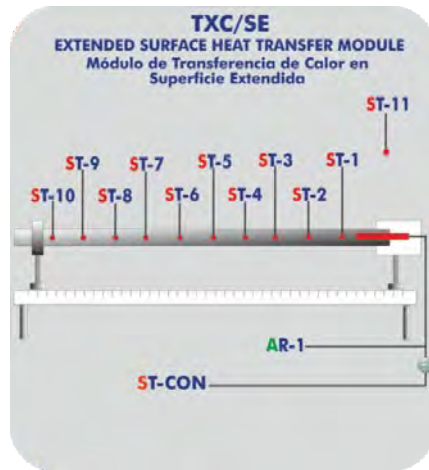
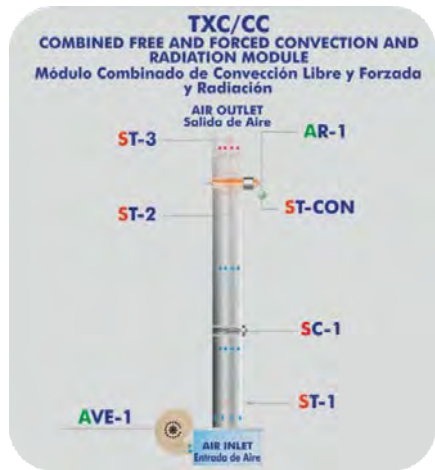
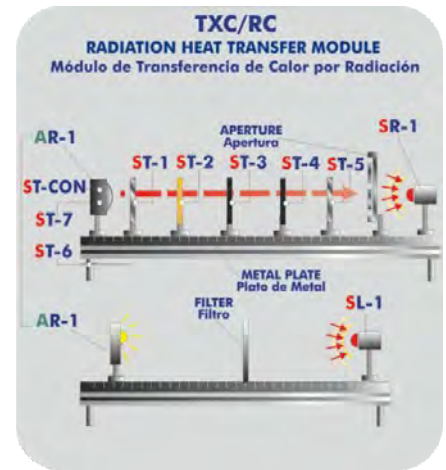
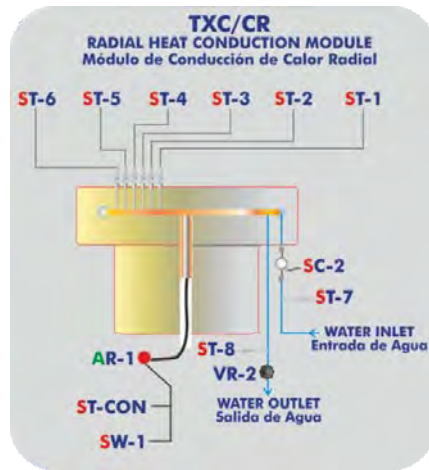
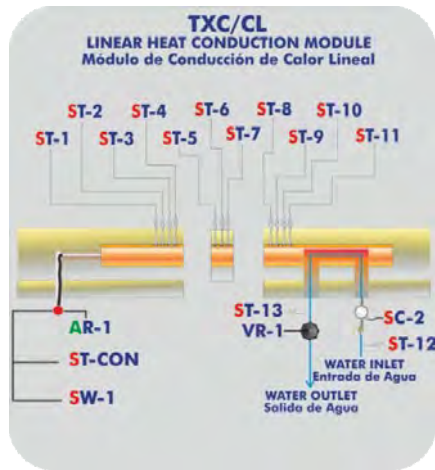
Certificates ISO 14000 and ECO-Management and Audit Scheme (environmental management)



Worlddidac Quality Charter Certificate and Worlddidac Member

4 actuators and 19 sensors controlled from any computer, and working simultaneously

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL



Note: ST=Temperature sensor. SC=Flow sensor. AR=Heating element. SR=Radiometer. SL=Luxmeter. AVE=Fan. AB=Pump. AN=Level switch.

① **Computer Controlled Modules**

①① **TXC/CL. Linear Heat Conduction Module:**

Bench-top unit to study the principles of linear heat conduction and to allow the conductivity of various solid conductors and insulators to be measured. It is given with interchangeable samples of different materials, different diameters and different insulating materials that allow to demonstrate the area effects, the conductivity and the combinations in series in the heat transfer process.

Anodized aluminum structure and panel of painted steel.

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

Input heat section.

Electric heater, computer controlled.

Refrigeration section with a surface cooled by water.

Interchangeable central sections:

With brass of 25 mm of diameter.

With brass of 10 mm of diameter.

With stainless steel of 25 mm of diameter.

Flow sensor to measure the cooling water flow, range: 0.25-6.5 l./min.

Water flow regulation valve.

Thermal paste is supplied to demonstrate the difference between poor and good thermal contact between the sections.

19 Temperature sensors, "T" type (high precision):

17 Temperature sensors distributed in the heating section (4 sensors), refrigeration section (4 sensors) and central sections (3 sensors in each central section).

1 Temperature sensor at the water inlet of the unit.

1 Temperature sensor at the water outlet of the unit.

Power measurement from the computer.

Cables and Accessories, for normal operation.

This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Linear Heat Conduction Module (TXC/CL).

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.

Analog and digital PID control.

Menu for PID and set point selection required in the whole work range.

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.

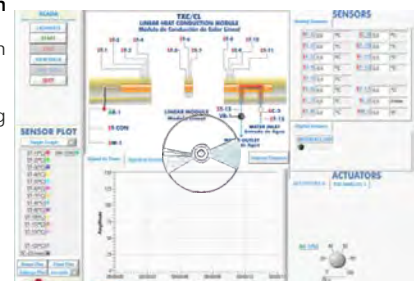
Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.

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

-This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



TXC/CL



①② **TXC/CR. Radial Heat Conduction Module:**

Bench-top unit to study the principles of radial heat conduction, and to allow the conductivity of solid brass disk to be measured.

Anodized aluminum structure and panel of painted steel.

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

Brass disk of 110 mm of diameter and 3 mm of thickness.

Electric heater, computer controlled.

Peripheral cooling tube.

Flow sensor to measure the cooling water flow, range: 0.25-6.5 l./min.

Water flow regulation valve.

8 Temperature sensors, "T" type (high precision):

6 Temperature sensors distributed in the unit.

1 Temperature sensor at the water inlet of the unit.

1 Temperature sensor at the water outlet of the unit.

Power measurement from the computer.

Cables and Accessories, for normal operation.

This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Radial Heat Conduction Module (TXC/CR).

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.

Analog and digital PID control.

Menu for PID and set point selection required in the whole work range.

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.

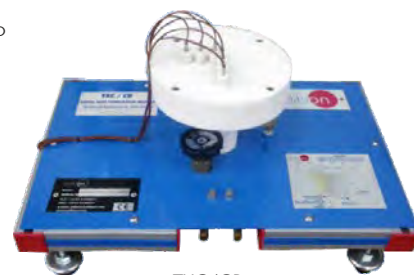
It allows the registration of the alarms state and the graphic representation in real time.

Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

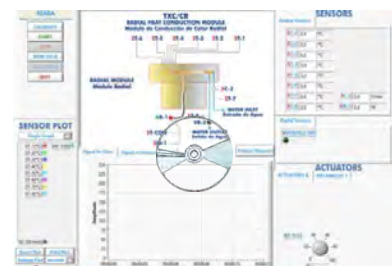
Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.

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

-This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



TXC/CR



Continue...

① **Computer Controlled Modules** (continuation)

⑬ **TXC/RC. Radiation Heat Transfer Module:**

Bench-top unit designed to demonstrate the laws of radiant heat transfer and radiant heat exchange.

It basically consists of 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 light and the power in the heating element or bulb.

Anodized aluminum structure and panels of painted steel.

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

This unit consists of a metal plate with a heating element at one side and a lamp in the another side. Lengthwise of the metal plate you can place the elements supplied with the unit.

Heating element (ceramic), computer controlled.

Lamp 150 W, with diffuser.

The unit is provided with accessories for light experiments and radiation experiments.

Light accessories:

Luxmeter that allows to measure the intensity of the light:

Scale:	Resolution:	Accuracy:
0 to 1999 lux	1 lux	8%
2000 to 19990	10 lux	
20000 to 50000	100 lux	
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 accessories:

Radiometer (50 x 50 mm, 5 v (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 aluminum.

Anodized aluminum.

Brass.

2 Black bodies

Variable slit or aperture. It allows to regulate the area of the radiation.

7 Temperature sensors, "T" type (high precision).

Power measurement from the computer.

Radiation measurement from the computer.

Lux measurement from the computer.

Cables and Accessories, for normal operation.

This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Radiation Heat Transfer Module (TXC/RC).

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.

Analog and digital PID control.

Menu for PID and set point selection required in the whole work range.

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.

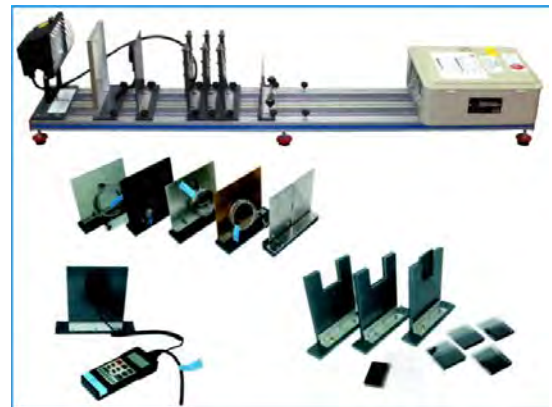
Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

Open software, allowing to the teacher to modify texts, instructions.

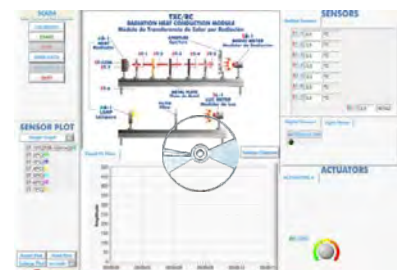
Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.

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

-This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



TXC/RC



① **Computer Controlled Modules** (continuation)

⑬ **TXC/CC. Combined Free and Forced Convection and Radiation Module:**

Bench-top unit to study the principles of combined free and forced convection with radiation from a horizontal heater cylinder.

It studies the variation experimented by the local heat transfer coefficient around of a horizontal cylinder. It is subject to a forced and a free convection.

Anodized aluminum structure and panel of painted steel.

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

Centrifugal fan (computer controlled) of 2650 rpm, which provides a maximum flow of 1200 l./min. and allows to the air to reach a maximum velocity around 5 m/s.

Stainless steel duct with interior cover, including:

Temperature sensor, "T" type (high precision), in order to measure the temperature of inlet air.

Flow sensor for measuring the air flow generated in the duct.

Temperature sensor, "T" type (high precision), in order to measure the temperature of outlet air.

Heater:

Copper cylinder with exterior cover: Interior heating element (computer controlled).

Temperature sensor, "T" type (high precision).

Power measurement from the computer.

Cables and Accessories, for normal operation.

This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Combined Free and Forced Convection and Radiation Module (TXC/CC).

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.

Analog and digital PID control.

Menu for PID and set point selection required in the whole work range.

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.

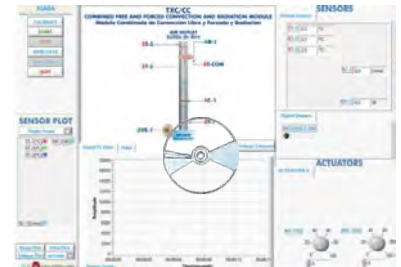
Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.

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

-This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



TXC/CC



⑭ **TXC/SE. Extended Surface Heat Transfer Module:**

Bench-top unit designed to demonstrate the temperature profiles and heat transfer characteristics for an extended surface. It studies the effect of adding fins to a body in order to extend its surface for a change in the cooling rate. Fins of different materials and cross section shapes are used to analyse the effect of cooling.

Anodized aluminum structure and panel of painted steel.

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

Heating element (computer controlled), embedded in a copper capsule to permit a good contact with the interchangeable fins. The copper capsule is isolated by a coat of Teflon.

The fins are interchangeable, providing two different materials: brass and stainless steel and three different cross section shapes: square, circular and hexagonal.

The power to the heating element is controlled from the computer.

11 Temperature sensors, "T" type (high precision).

Power measurement from the computer.

Cables and Accessories, for normal operation.

This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Extended Surface Heat Transfer Module (TXC/SE).

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.

Analog and digital PID control.

Menu for PID and set point selection required in the whole work range.

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.

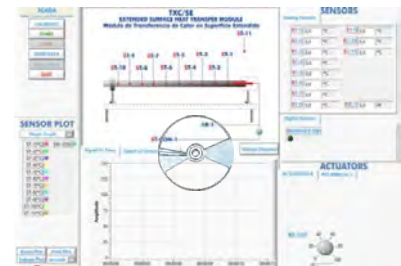
Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.

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

-This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



TXC/SE



Continue...

① Computer Controlled Modules (continuation)

①.9 TXC/ER. Radiation Errors in Temperature Measurement Module:

Bench-top unit to demonstrate how temperature measurements can be influenced by sources of thermal radiation.

The objective of this module is to measure the error in a black thermocouple due the radiation with respect with another normal thermocouple where there are not radiative shielding in comparison when there are radiative shielding, error in function of material of the thermocouple's capsule, size of the thermocouple, etc.

Anodized aluminum structure and panel of painted steel.

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

Centrifugal fan (computer controlled):

2650 rpm.

Maximum flow of 1200 l./min.

It allows to the air to reach a maximum velocity around 5 m/s.

Stainless steel duct with interior cover, including:

Temperature sensor, "T" type (high precision), in order to measure the temperature of inlet air.

Flow sensor for measuring the air flow generated in the duct.

Temperature sensor, "T" type (high precision), in order to measure the temperature of outlet air.

Copper cylinder with exterior cover:

Interior heating element (computer controlled).

Temperature sensor, for measuring the temperature of the cylinder.

5 Temperature sensors, "T" type (high precision), with different styles and sizes installed in the duct to demonstrate the differences in readings obtained:

Temperature sensor of bare.

Temperature sensor of inconel.

Temperature sensor of s/steel.

Temperature sensor of black s/steel.

Temperature sensor of ceramic.

Power measurement from the computer.

Cables and Accessories, for normal operation.

This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+ Data Management Software for Radiation Errors in Temperature Measurement Module (TXC/ER).

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.

Analog and digital PID control.

Menu for PID and set point selection required in the whole work range.

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.

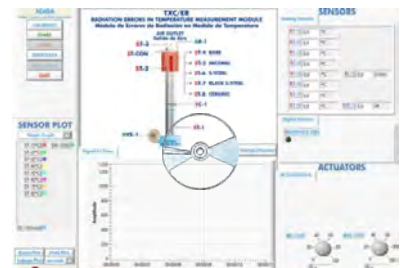
Open software, allowing to the teacher to modify texts, instructions.

Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.

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



TXC/ER



① **Computer Controlled Modules** (continuation)

① **TXC/EI . Unsteady State Heat Transfer Module:**

Bench-top unit designed to allow practices and exercises to be performed in unsteady state heat transfer.

It studies the transient conduction with convection. Using different shapes (rectangular slabs, spheres and cylinders) of different materials, the temperature of other shapes and materials can be predicted.

Anodized aluminum structure and panel of painted steel.

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

Dual concentric open top tanks filled with water, total tank capacity: 40 l., 300 x 350 x 400 mm. concentric tank: 1.2 l., diameter: 70 mm.

Different shapes of different size and material are studied:

- Brass sphere (diameter: 40 mm).
- Brass sphere (diameter: 25 mm).
- Stainless steel sphere (diameter: 40 mm).
- Stainless steel sphere (diameter: 25 mm).
- Brass cylinder (diameter: 15 mm, length: 150 mm).
- Stainless steel cylinder (diameter: 15 mm, length: 150 mm).
- Aluminum rectangular slab (40 x 10 x 150 mm).
- Stainless steel rectangular slab (40 x 10 x 150 mm).

Each shape is fitted with a temperature sensor at the center of the object.

The shapes are installed in special holder at the center of the top cover of the large tank. The holder also has a temperature sensor that enters in the water bath at the same time as the shape.

Heating element (immersion heater). The high power allows reaching the steady state faster. It is computer controlled.

Water pump with variable speed (computer controlled). It allows to reach a maximum flow of 4 l./min.

2 Temperature sensors, "T" type (high precision), allow to control the stability of the temperature of the water bath.

Flow sensor, range: 0.25 - 6.5 l./min.

2 Temperature sensors, "T" type (high precision):

- The first one permits to record the evolution of the temperature of the shape at its center.
- The second one, works as a stopwatch, it will indicate the precise moment in which the shape is submerged.

Level switch.

Power measurement from the computer.

Cables and Accessories, for normal operation.

This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Unsteady State Heat Transfer Module (TXC/EI).

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.

Analog and digital PID control.

Menu for PID and set point selection required in the whole work range.

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 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 to different work levels.

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

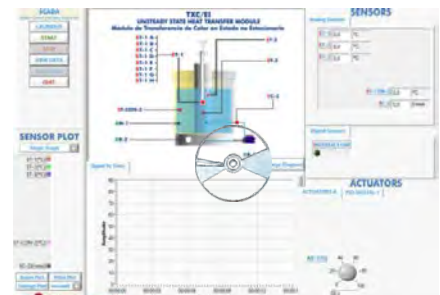
-This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



TXC/EI



Detail of the different shapes



① **Computer Controlled Modules** (continuation)

①.8 **TXC/LG. Thermal Conductivity of Liquids and Gases Module:**

This unit has been designed to enable students to easily determine the thermal conductivity of liquids and gases. By the realization of the practices the student can determine the thermal conductivity of any suitable gas or compatible liquid with materials on construction.
 Anodized aluminum structure and panel of painted steel.
 Diagram in the panel with similar distribution to the elements in the real unit.
 Aluminum body (cylinder) with brass jacket that contains the test fluid and the refrigeration water.
 Variable heating element (in the cylinder), computer controlled. Heating element power controlled from computer. The power is measured by a sensor.
 6 Temperature sensors, "T" type (high precision).
 Flow sensor to measure the cooling water flow, range: 0.25-6.5 l./min.
 Water flow regulation valve.
 Valves. Syringe.
 Power measurement from the computer.
 Cables and Accessories, for normal operation.
 This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.
 Computer Control Software:



TXC/LG

Computer Control+Data Acquisition+Data Management Software for Thermal Conductivity of Liquids and Gases Module (TXC/LG).

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.
Analog and digital PID control.
Menu for PID and set point selection required in the whole work range.
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 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 to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all results and manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
 -This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



①.9 **TXC/FF. Free and Forced Convection Heat Transfer Module:**

This unit allows to study the efficiency of different exchangers, analyzing the heat transfer coefficients of each of the exchangers exposed to different airflows. A fan placed in the upper part of the tunnel allows controlling the airflow that goes through the tunnel.
 Anodized aluminum structure and panels of painted steel.
 Diagram in the front panel with similar distribution to the elements in the real unit.
 Stainless steel tunnel of rectangular section, 700 mm long, painted and resistant to corrosion. In the tunnel three type of different heat exchangers can be set.
 Methacrylate viewer that allows a good visualization of the exchanger that is in use.
 Stabilizers to guarantee an uniform air flux.
 8 Temperature sensors, "T" type (high precision):
 2 Temperature sensors measure the air temperature at the inlet and outlet of the area of heat exchange.
 Temperature measurements, at different distances of the base of the pins and fins exchangers, are made by other 5 temperature sensors that are introduced by one side of the tunnel.
 1 Temperature sensor in the exchangers.
 Maximum working temperature: 120°C.
 Flow sensor for measuring the air flow generated in the tunnel.
 3 Aluminum exchangers:
 Flat heat exchanger (100 x 100 mm).
 Pins heat exchanger. 17 pins, each one of 10 mm diameter and 125 mm longitude.
 Fins heat exchanger. 9 fins, each one of 100 x 125 mm.
 Heating element for each exchanger, computer controlled.
 Variable speed fan, computer controlled, which generates air flux through the tunnel, range: 0-1200 l./min.
 Cables and Accessories, for normal operation.
 This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.
 Computer Control Software:

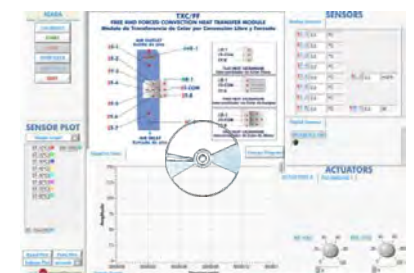


Sight of the different heat exchangers used

TXC/FF

Computer Control+Data Acquisition+Data Management Software for Free and Forced Convection Heat Transfer Module (TXC/FF).

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.
Analog and digital PID control.
Menu for PID and set point selection required in the whole work range.
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 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 to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all results and manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
 -This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



① **Computer Controlled Modules** (continuation)

①.10 **TXC/TE. Three Axes Heat Transfer Module:**

Bench-top unit designed to carry out heat transfer experiments and exercises studying the direction in three axes. Anodized aluminum structure and panel of painted steel. Diagram in the panel with similar distribution to the elements in the real unit. Brass cylinder to study heat transfer. Electric heater, computer controlled. Refrigeration section with a surface cooled by water. Flow sensor to measure the cooling water flow, range: 0.25-6.5 l./min. Water flow regulation valve.

11 Temperature sensors, "T" type (high precision):

- 1 temperature sensor at the water inlet of the unit.
- 1 temperature sensor at the water outlet of the unit.
- 5 Temperature sensors at different depth in a specific cross section.
- 4 temperature sensors longitudinally distributed.

Power measurement from the computer.
Cables and Accessories, for normal operation.
This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.
Computer Control Software:



TXC/TE

Computer Control+Data Acquisition+Data Management Software for Three Axes Heat Transfer Module (TXC/TE).

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

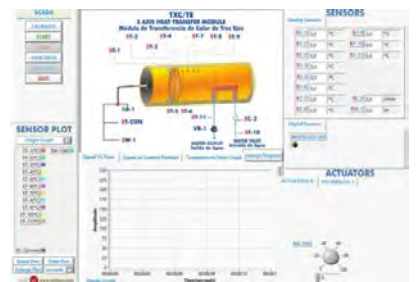
Compatible with the industry standards.
Registration and visualization of all process variables in an automatic and simultaneous way.

Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.

Analog and digital PID control.
Menu for PID and set point selection required in the whole work range.

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 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 to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all results and manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
-This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



①.11 **TXC/MM. Metal to Metal Heat Transfer Module:**

Bench-top unit designed to study of the heat transfer of different metallic materials situated in series. Anodized aluminum structure and panel of painted steel. Diagram in the panel with similar distribution to the elements in the real unit. Input heat section. It includes:

- Electric heater, computer controlled.

Interchangeable central sections. They are formed by two different cylinders chosen from the four cylinders supplied:

- A copper cylinder of 25mm of diameter.
- A brass cylinder of 25mm of diameter.
- A stainless steel cylinder of 25mm of diameter.
- An aluminum cylinder of 25mm of diameter.

4 temperature sensors, "T" type (high precision) for each cylinder.
Refrigeration section with surface cooled by water. It includes 4 temperature sensors, type "T" (high precision).
Water flow regulation valve.
Two temperature sensors, "J" type, for the cooling water inlet and outlet.
Flow sensor to measure the cooling water flow, range: 0.25-6.5 l./min.
Thermal paste is supplied to demonstrate the difference between poor and good thermal contact between the sections.
Power measurement from the computer.
Cables and Accessories, for normal operation.
This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.
Computer Control Software:



TXC/MM

Computer Control+Data Acquisition+Data Management Software for Metal to Metal Heat Transfer Module (TXC/MM).

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

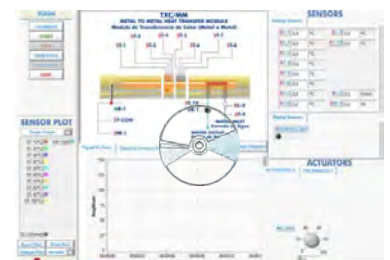
Compatible with the industry standards.
Registration and visualization of all process variables in an automatic and simultaneous way.

Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.

Analog and digital PID control.
Menu for PID and set point selection required in the whole work range.

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 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 to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all results and manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
-This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



① **Computer Controlled Modules** (continuation)

①.12 **TXC/TC. Ceramic Heat Transfer Module:**

Bench-top unit designed to study of the heat transfer of different ceramic materials. Anodized aluminum structure and panel of painted steel. Diagram in the panel with similar distribution to the elements in the real unit. Input heat section. It includes:
 Electric heater, computer controlled.
 4 temperature sensors, "T" type (high precision).
 Interchangeable central sections. There are two types:
 A ceramic cylinder with a thermal conductivity of 1.46 W/m·°C.
 A ceramic cylinder with a thermal conductivity of 0.49 W/m·°C.
 3 temperature sensors, "T" type (high precision), for each cylinder.
 Refrigeration section with surface cooled by water. It includes 4 temperature sensors, "T" type (high precision).
 Water flow regulation valve.
 Two temperature sensors, "J" type, for the cooling water inlet and outlet.
 Flow sensor to measure the cooling water flow, range: 0.25-6.5 l./min.
 Thermal paste is supplied to demonstrate the difference between poor and good thermal contact between the sections.
 Power measurement from the computer.
 Cables and Accessories, for normal operation.
 This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.
 Computer Control Software:



TXC/TC

Computer Control+Data Acquisition+Data Management Software for Ceramic Heat Transfer Module (TXC/TC).

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.
Analog and digital PID control.
Menu for PID and set point selection required in the whole work range.
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 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 to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all results and manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
 -This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



①.13 **TXC/TI. Insulating Material Heat Transfer Module:**

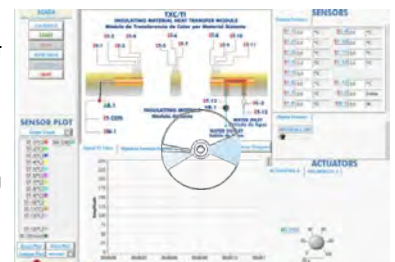
Bench-top unit to study the thermal conduction resistance of different thermal insulating materials. Anodized aluminum structure and panel of painted steel. Diagram in the panel with similar distribution to the elements in the real unit. Input heat section.
 Electric heater, computer controlled.
 Refrigeration section with a surface cooled by water.
 Interchangeable central sections:
 With nylon of 50 mm of diameter.
 With Teflon of 50 mm of diameter.
 With Bakelite of 50 mm of diameter.
 Flow sensor to measure the cooling water flow, range: 0.25-6.5 l./min.
 Water flow regulation valve.
 Thermal paste is supplied to demonstrate the difference between poor and good thermal contact between the sections.
 19 Temperature sensors, "T" type (high precision):
 17 Temperature sensors distributed in the heating section (4 sensors), refrigeration section (4 sensors) and central sections (3 sensors in each central section).
 1 Temperature sensor at the water inlet of the unit.
 1 Temperature sensor at the water outlet of the unit.
 Power measurement from the computer.
 Cables and Accessories, for normal operation.
 This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.
 Computer Control Software:



TXC/TI

Computer Control+Data Acquisition+Data Management Software for Insulating Material Heat Transfer Module (TXC/TI).

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.
Analog and digital PID control.
Menu for PID and set point selection required in the whole work range.
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 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 to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all results and manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
 -This module requires Control Interface Box (TSTCC/CIB) and Data Acquisition Board (DAB).



Items Common for the Modules type "TxC"

② TSTCC/CIB. Control Interface Box:

This control interface is common for the modules type "TxC" and can work with one or several modules.

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 PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process.

Real time PID and on/off control for pumps, compressors, heating elements, control valves, etc.

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

Proportional control, integral control and derivative control, based on the real PID mathematical formula, by changing the values, at any time, of the three control constants (proportional, integral and derivative constants).

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

Possibility of automatization of the actuators involved in the process.

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



TSTCC/CIB

③ DAB. Data Acquisition Board:

Common for the modules type "TxC".

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)= 10V.

Data transfers=DMA, interrupts, programmed I/O. Number of 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)= 10V.

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: Counter/timers=4. Resolution: Counter/timers: 32 bits.



DAB

④ Cables and Accessories, for normal operation.

⑤ Manuals:

This system is supplied with 8 manuals for each module: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Some Practical Possibilities of the System:

Practices to be done with the Linear Heat Conduction Module (TXC/CL):

- 1.- Conduction through a simple bar.
- 2.- Conduction through a compound bar.
- 3.- Determination of the thermal conductivity "k" of different materials (conductors and insulators).
- 4.- The thermal conductivity properties of insulators may be found by inserting paper or other elements between the heating and cooling sections.
- 5.- Insulation effect.
- 6.- Determination of the thermal contact resistance R_{tc} .
- 7.- Effect of the crossing sectional area.
- 8.- Understanding the use of the Fourier equation in determining rate of heat flow through solid materials.

Additional practical possibilities:

- 9.- Sensors calibration.

Practices to be done with the Radial Heat Conduction Module (TXC/CR):

- 10.- Radial conduction.
- 11.- Determination of the thermal conductivity "k".
- 12.- Determination of the thermal contact resistance R_{tc} .
- 13.- Insulation effect.
- 14.- Understanding the use of the Fourier equation in determining rate of heat flow through solid materials.

Additional practical possibilities:

- 15.- Sensors calibration.

Practices to be done with the Radiation Heat Transfer Module (TXC/RC):

- 16.- Inverse of the distant square law for the radiation.
- 17.- Stefan Boltzmann Law.
- 18.- Emission power I.
- 19.- Emission power II.
- 20.- Kirchorff Law.
- 21.- Area factors.
- 22.- Inverse of the distant square law for the light.
- 23.- Lambert 's Cosine Law.
- 24.- Lambert Law of Absorption.

Additional practical possibilities:

- 25.- Sensors calibration.

Practices to be done with the Combined Free and Forced Convection and Radiation Module (TXC/CC):

- 26.- Demonstration of the combined heat transfer effect by radiation and convection on the surface of the cylinder. Determination of the combined heat transfer effect by forced convection and radiation.
- 27.- Demonstration of the influence of air flow in the heat transfer. Determination of the combined heat transfer effect by forced convection and radiation.
- 28.- Demonstration of the influence of input power in the heat transfer. Determination of the combined heat transfer effect by forced convection and radiation.
- 29.- Demonstration of the combined heat transfer effect of the radiation and convection on the surface of the cylinder. Determination of the combined heat transfer effect by free convection and radiation.

Additional practical possibilities:

- 30.- Sensors calibration.
- 31.- Determination of the airflow.

Practices to be done with the Extended Surface Heat Transfer Module (TXC/SE):

- 32.- Heat transfer from a Fin.
- 33.- Effect of cross section shape in heat transfer from a Fin.
- 34.- Heat transfer from Fins of two different materials.
- 35.- Measuring the temperature distribution along an extended surface.

Additional practical possibilities:

- 36.- Sensors calibration.

Practices to be done with the Radiation Errors in Temperature Measurement Module (TXC/ER):

- 37.- Radiation errors in temperature measurement.
- 38.- Measurement the errors in thermocouples in function of its painting, material of its capsules, size.
- 39.- Effect of air velocity on measurement error.

Additional practical possibilities:

- 40.- Sensors calibration.

Practices to be done with the Unsteady State Heat Transfer Module (TXC/EI):

- 41.- Predicting temperature at the center of a cylinder using transient conduction with convection.
- 42.- Predicting the conductivity of a similar shape constructed from a different material.
- 43.- Conductivity and temperature dependence on volume.
- 44.- Conductivity and temperature dependence on surrounding temperature T .

Additional practical possibilities:

- 45.- Sensors calibration.

Practices to be done with the Thermal Conductivity of Liquids and Gases Module (TXC/LG):

- 46.- Obtaining of the curve of thermal conductivity of the air.
- 47.- Thermal conductivity in vacuum.
- 48.- Water thermal conductivity determination.
- 49.- Thermal conductivity determination of a mineral oil.
- 50.- Calibration of the Unit.

Additional practical possibilities:

- 51.- Sensors calibration.
- 52.- Dry air thermal conductivity under atmospheric pressure.

Practices to be done with the Free and Forced Convection Heat Transfer Module (TXC/FF):

- 53.- Demonstration of the basic principles of free and forced convection.
- 54.- Comparison between free and forced convection.
- 55.- Free convection in flat surfaces.
- 56.- Forced convection in flat surfaces.
- 57.- Dependence of the heat transfer with the temperature.
- 58.- Dependence of the heat transfer with the speed of the fluid.
- 59.- Dependence of the heat transfer with the exchanger geometry (finned or pinned surface).
- 60.- Temperature distribution in the additional surfaces.
- 61.- Study of the advantage of using pinned and finned surfaces in heat transfer in free convection.
- 62.- Study of the advantage of using pinned and finned surfaces in heat transfer in forced convection.
- 63.- Comparative study between the free convection of a horizontal surface and vertical surface.

Additional practical possibilities:

- 64.- Sensors calibration.

Practices to be done with the Three Axes Heat Transfer Module (TXC/TE):

- 65.- Determination of the thermal conductivity "k".
- 66.- Conduction through a simple bar.
- 67.- Conduction through three axes.

Additional practical possibilities:

- 68.- Sensors calibration.

Practices to be done with the Metal to Metal Heat Transfer Module (TXC/MM):

- 69.- Conduction in a simple bar.
- 70.- Determination of the thermal conductivity "k".
- 71.- Determination of the thermal contact resistance.

Additional practical possibilities:

- 72.- Sensors calibration.

Practices to be done with the Ceramic Heat Transfer Module (TXC/TC):

- 73.- Conduction in a simple bar.
- 74.- Determination of the thermal conductivity "k".
- 75.- Conduction through a compound bar.
- 76.- Determination of the thermal contact resistance.

Additional practical possibilities:

- 77.- Sensors calibration.

Practices to be done with the Insulating Material Heat Transfer Module (TXC/TI):

- 78.- Determination of the thermal conductivity "k".
- 79.- Calculation of the heat transfer properties of different specimens.
- 80.- Conduction through a compound bar.
- 81.- Insulation effect.

Additional practical possibilities:

- 82.- Sensors calibration.

Other possibilities to be done with this System:

- 83.- Many students view results simultaneously.

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

- 84.- Open Control, Multicontrol and Real Time Control.

This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivate parameters; etc, in real time.

- 85.- The Computer Control System with SCADA and PID Control allow a real industrial simulation.

- 86.- This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.

- 87.- This unit can be used for doing applied research.

- 88.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.

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

- 90.- Visualization of all the sensors values used in the 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, 220V./50 Hz or 110V./60Hz.

Water supply and drainage.

Computer.

DIMENSIONS & WEIGHTS

TXC/CL Module:	-Dimensions: 400 x 300 x 300 mm. approx. (15.74 x 11.81 x 11.81 inches approx.).
	-Weight: 20 Kg. approx. (44 pounds approx.).
TXC/CR Module:	-Dimensions: 400 x 300 x 300 mm. approx. (15.74 x 11.81 x 11.81 inches approx.).
	-Weight: 20 Kg. approx. (44 pounds approx.).
TXC/RC Module:	-Dimensions: 1400 x 500 x 500 mm. approx. (55.11 x 19.68 x 19.68 inches approx.).
	-Weight: 40 Kg. approx. (88 pounds approx.).
TXC/CC Module:	-Dimensions: 430 x 350 x 1300 mm. approx. (16.93 x 13.78 x 51.18 inches approx.).
	-Weight: 50 Kg. approx. (110 pounds approx.).
TXC/SE Module:	-Dimensions: 600 x 300 x 175 mm. approx. (23.62 x 11.81 x 6.89 inches approx.).
	-Weight: 20 Kg. approx. (44 pounds approx.).
TXC/ER Module:	-Dimensions: 430 x 350 x 1300 mm. approx. (16.93 x 13.78 x 51.18 inches approx.).
	-Weight: 50 Kg. approx. (110 pounds approx.).
TXC/EI Module:	-Dimensions: 600 x 600 x 750 mm. approx. (23.62 x 23.62 x 29.52 inches approx.).
	-Weight: 60 Kg. approx. (132 pounds approx.).
TXC/LG Module:	-Dimensions: 500 x 400 x 300 mm. approx. (19.68 x 15.74 x 11.81 inches approx.).
	-Weight: 40 Kg. approx. (88 pounds approx.).
TXC/FF Module:	-Dimensions: 370 x 610 x 920 mm. approx. (14.56 x 24.01 x 36.22 inches approx.).
	-Weight: 25 Kg. approx. (55 pounds approx.).
TXC/TE Module:	-Dimensions: 400 x 300 x 300 mm. approx. (15.74 x 11.81 x 11.81 inches approx.).
	-Weight: 20 Kg. approx. (44 pounds approx.).
TXC/MM Module:	-Dimensions: 400 x 300 x 300 mm. approx. (15.74 x 11.81 x 11.81 inches approx.).
	-Weight: 20 Kg. approx. (44 pounds approx.).
TXC/TC Module:	-Dimensions: 400 x 300 x 300 mm. approx. (15.74 x 11.81 x 11.81 inches approx.).
	-Weight: 20 Kg. approx. (44 pounds approx.).
TXC/TI Module:	-Dimensions: 400 x 300 x 300 mm. approx. (15.74 x 11.81 x 11.81 inches approx.).
	-Weight: 20 Kg. approx. (44 pounds approx.).
Control Interface Box:	-Dimensions: 490 x 330 x 310 mm. approx. (19.29 x 12.99 x 12.20 inches approx.).
	-Weight: 10 Kg. approx. (22 pounds approx.).

AVAILABLE VERSIONS

Offered in this catalogue:

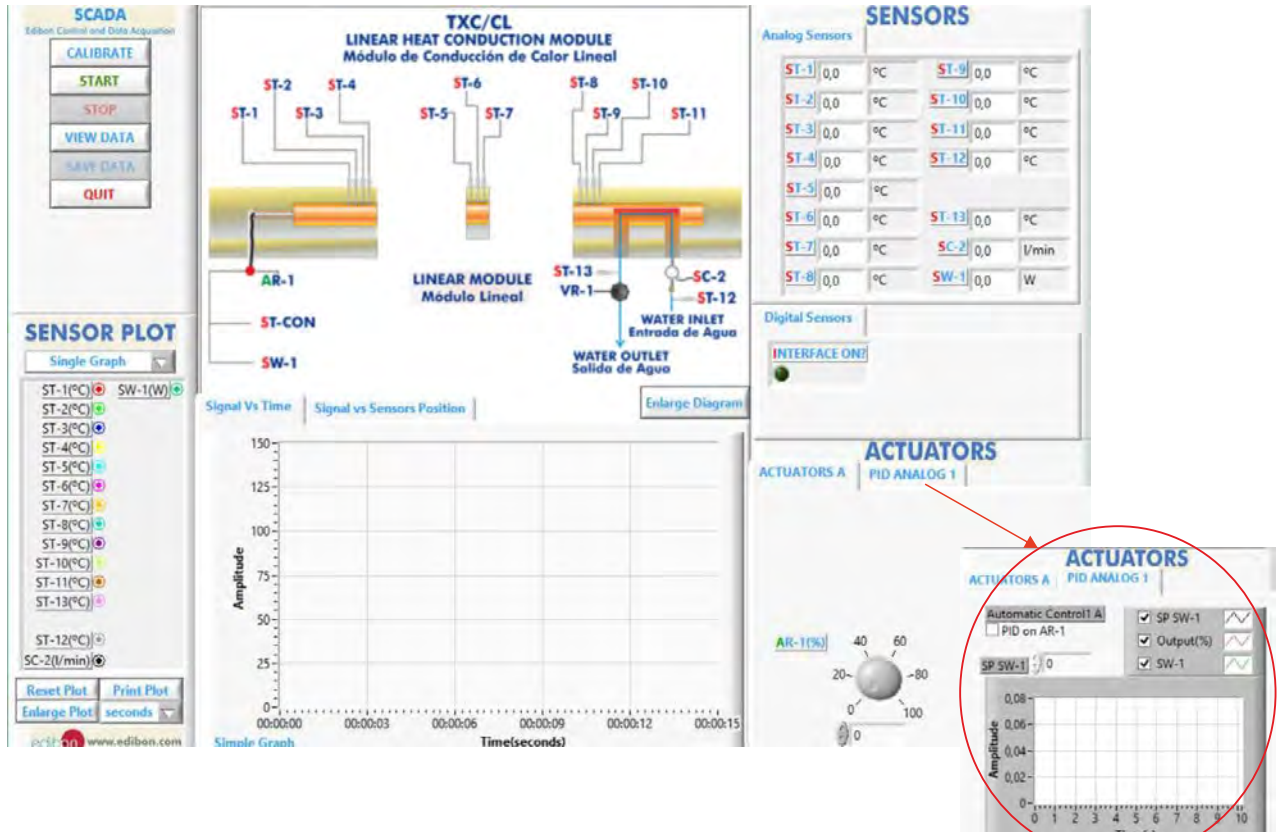
-TSTCC. Computer Controlled Heat Transfer Series.

Offered in other catalogue:

-TSTCB. Heat Transfer Series.

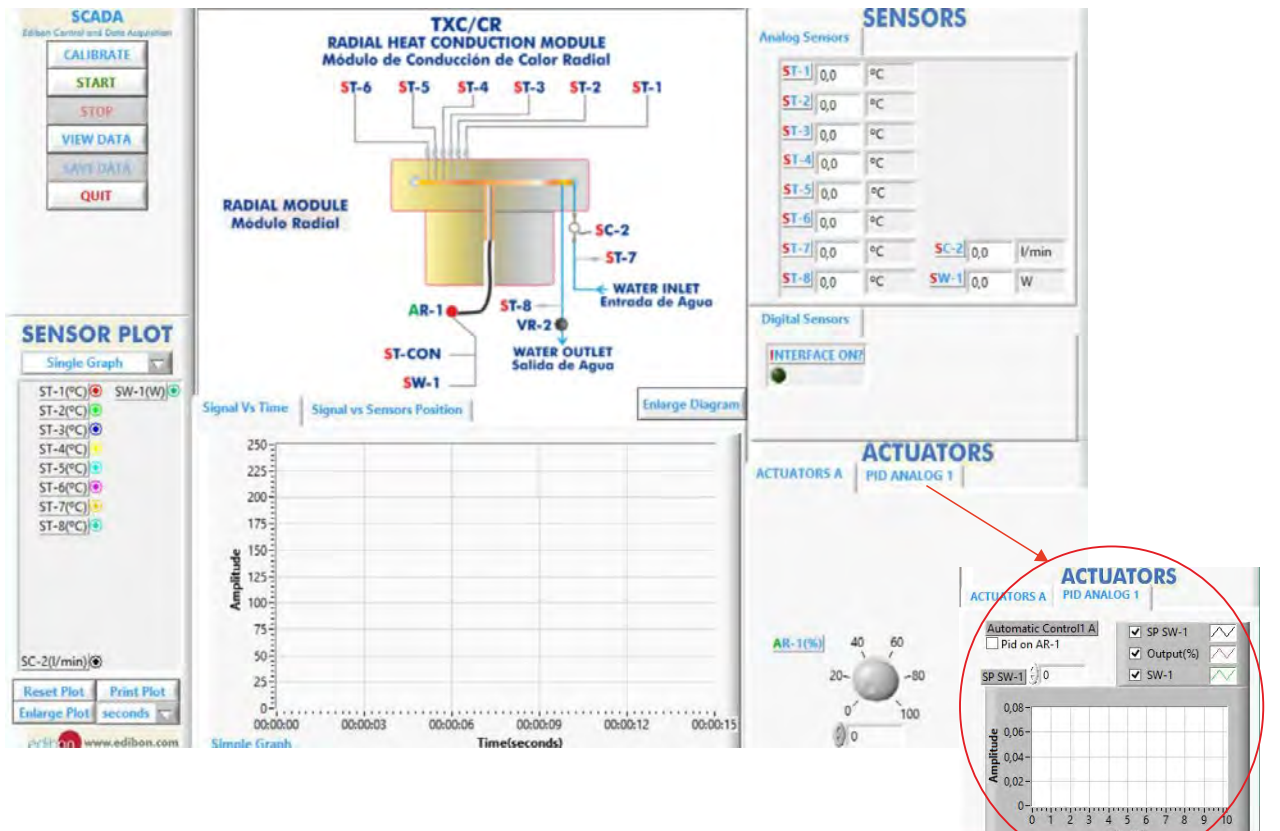
SCADA and PID Control

Linear Heat Conduction Module (TXC/CL) Main Screen



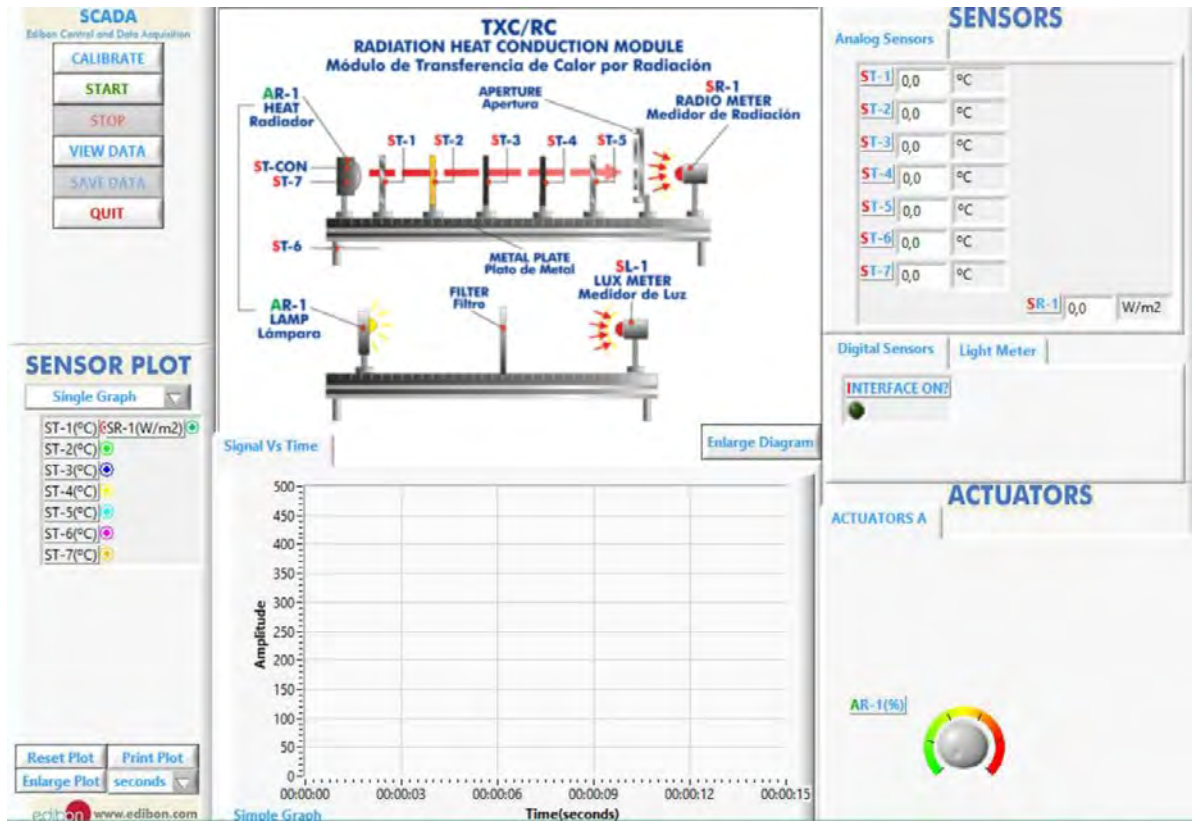
Note:
Sensors: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
Actuator: AR=Heating element.

Radial Heat Conduction Module (TXC/CR) Main Screen



Note:
Sensors: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
Actuator: AR=Heating element.

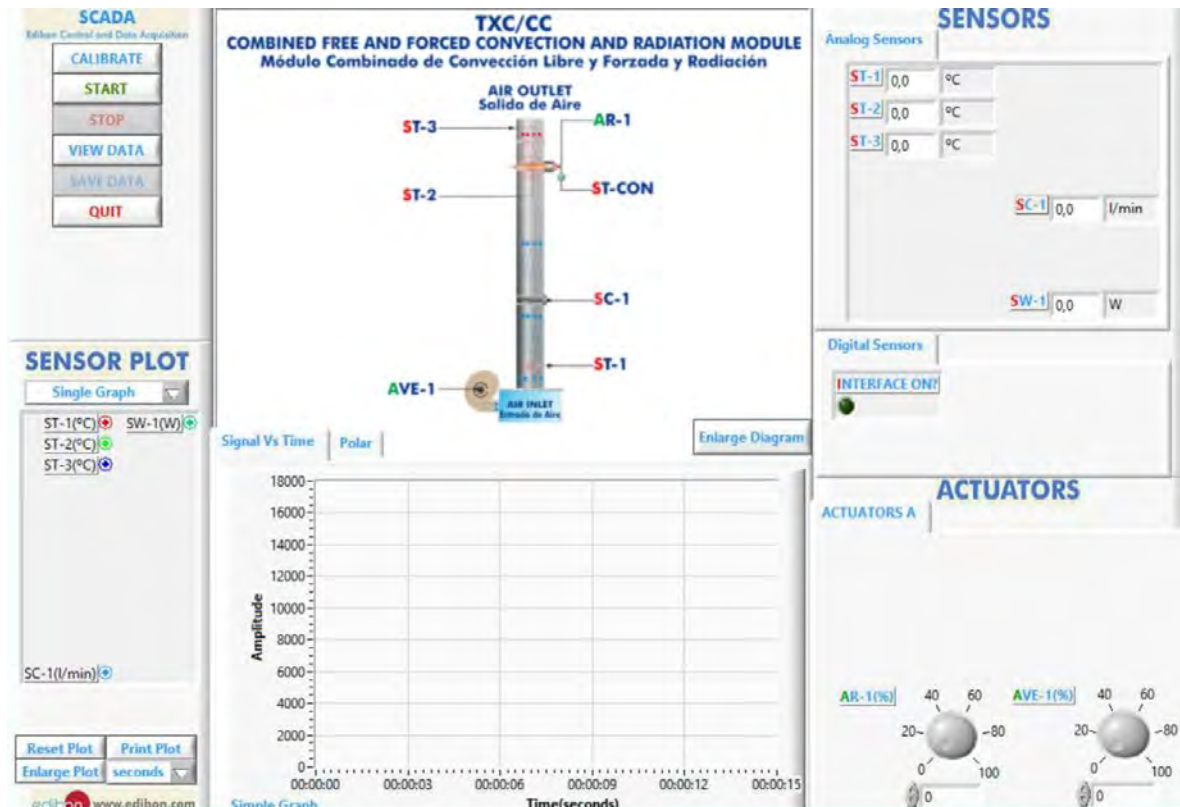
Radiation Heat Transfer Module (TXC/RC) Main Screen



Note:

Sensors/Meters: ST=Temperature sensor. SW=Power sensor. SR=Radiometer. SL=Luxometer.
Actuator: AR=Heating element.

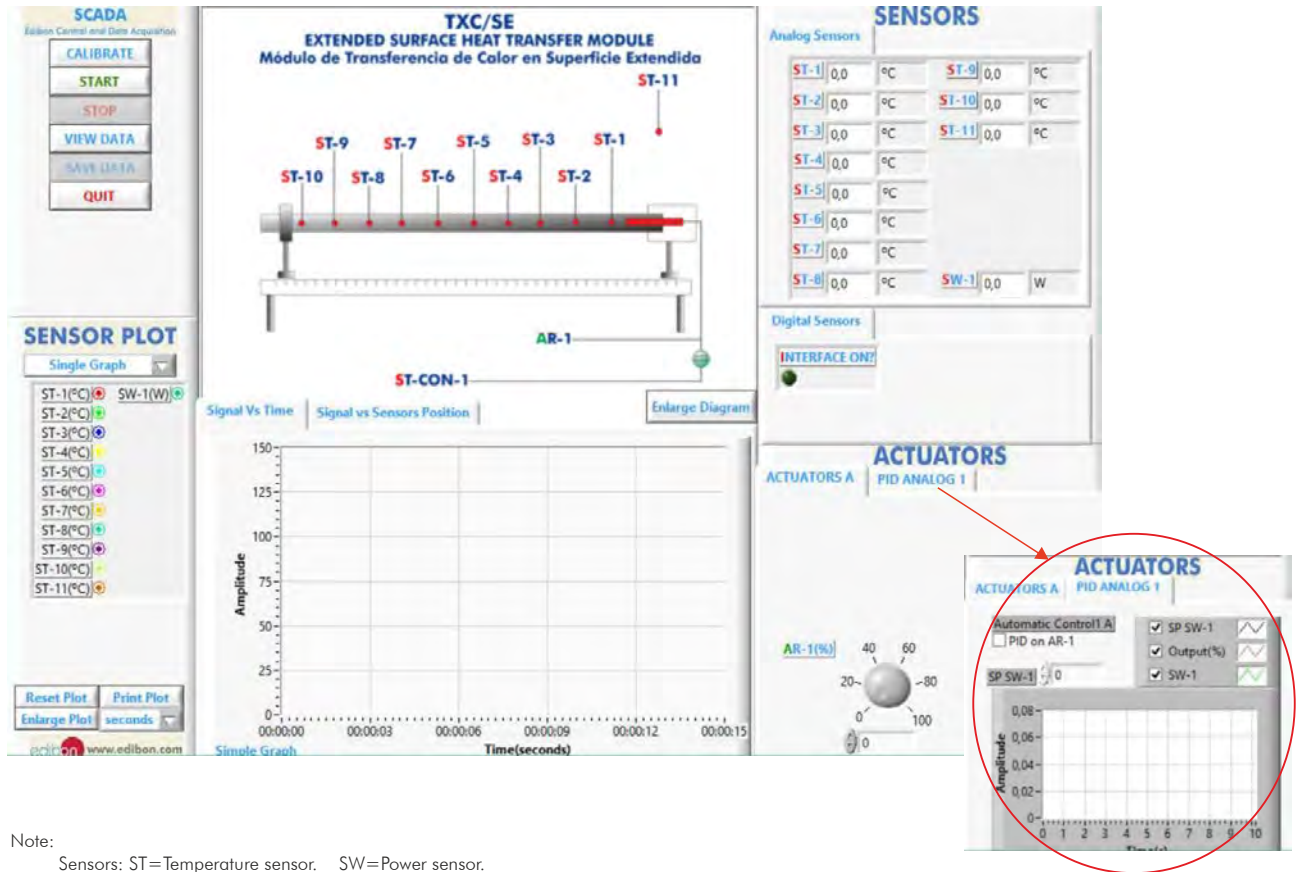
Combined Free and Forced Convection and Radiation Module (TXC/CC) Main Screen



Note:

Sensors: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
Actuators: AR=Heating element. AVE=Fan.

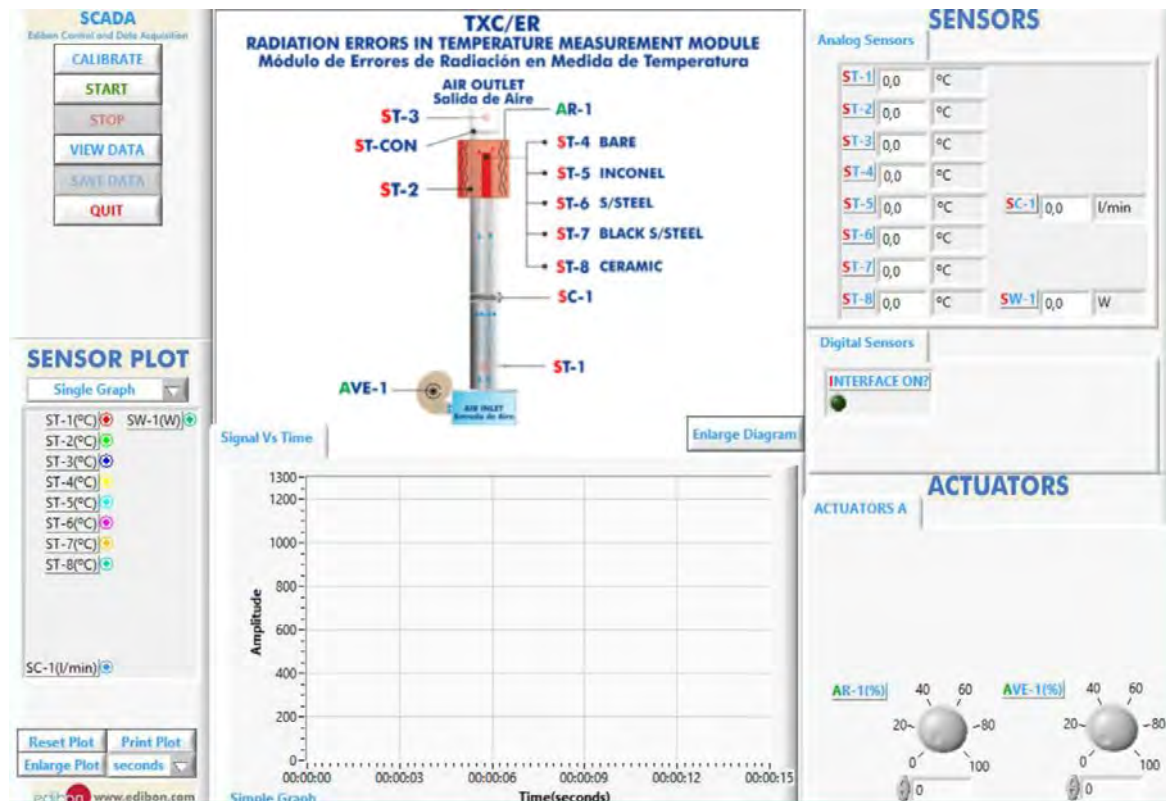
Extended Surface Heat Transfer Module (TXC/SE) Main Screen



Note:

Sensors: ST=Temperature sensor. SW=Power sensor.
Actuator: AR=Heating element.

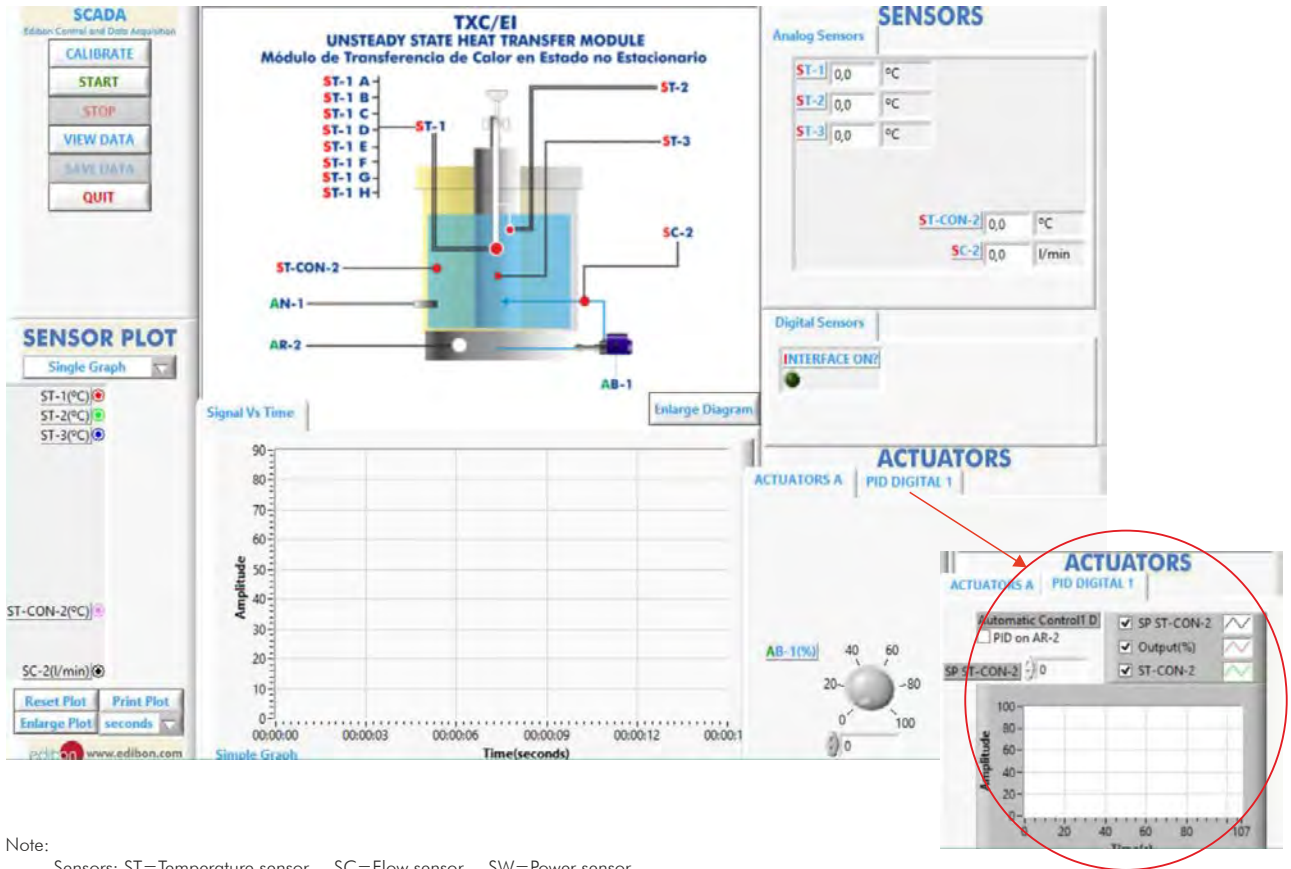
Radiation Errors in Temperature Measurement Module (TXC/ER) Main Screen



Note:

Sensors: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
Actuators: AR=Heating element. AVE=Fan.

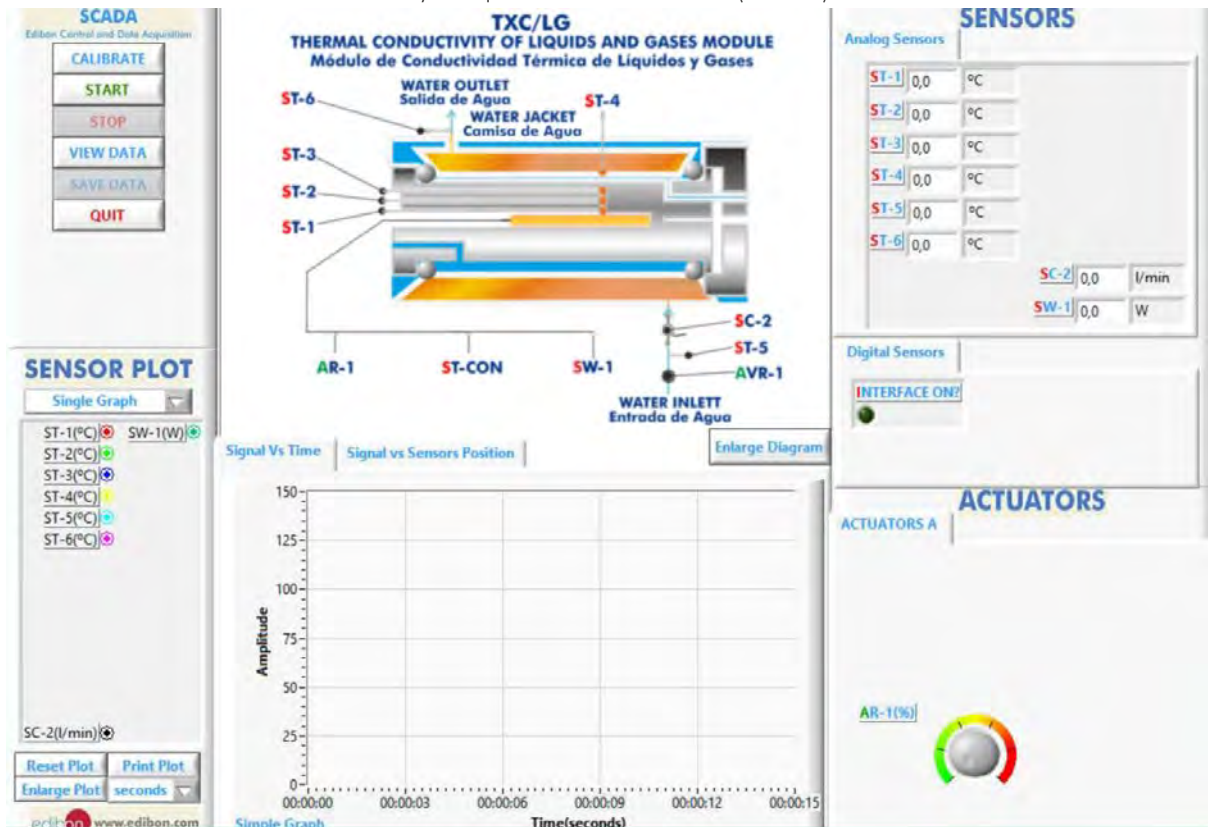
Unsteady State Heat Transfer Module (TXC/EI) Main Screen



Note:

Sensors: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
Actuators: AR=Heating element. AB=Pump.

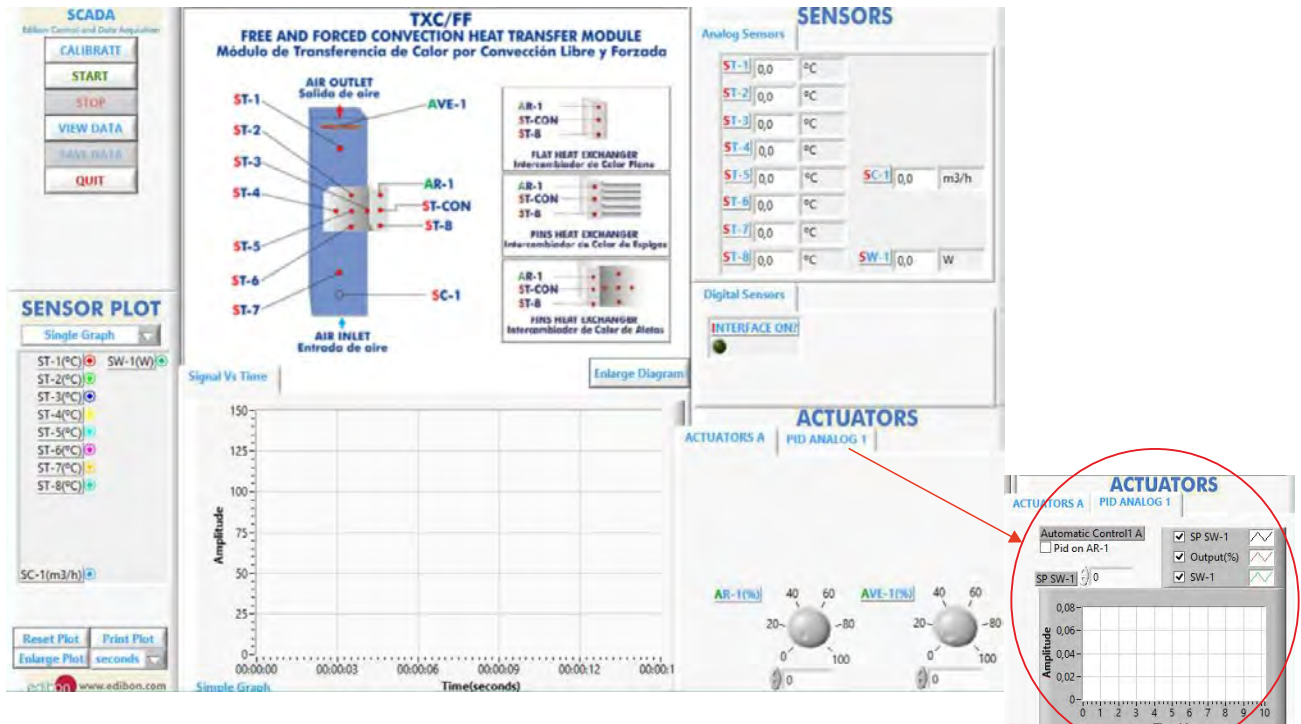
Thermal Conductivity of Liquids and Gases Module (TXC/LG) Main Screen



Note:

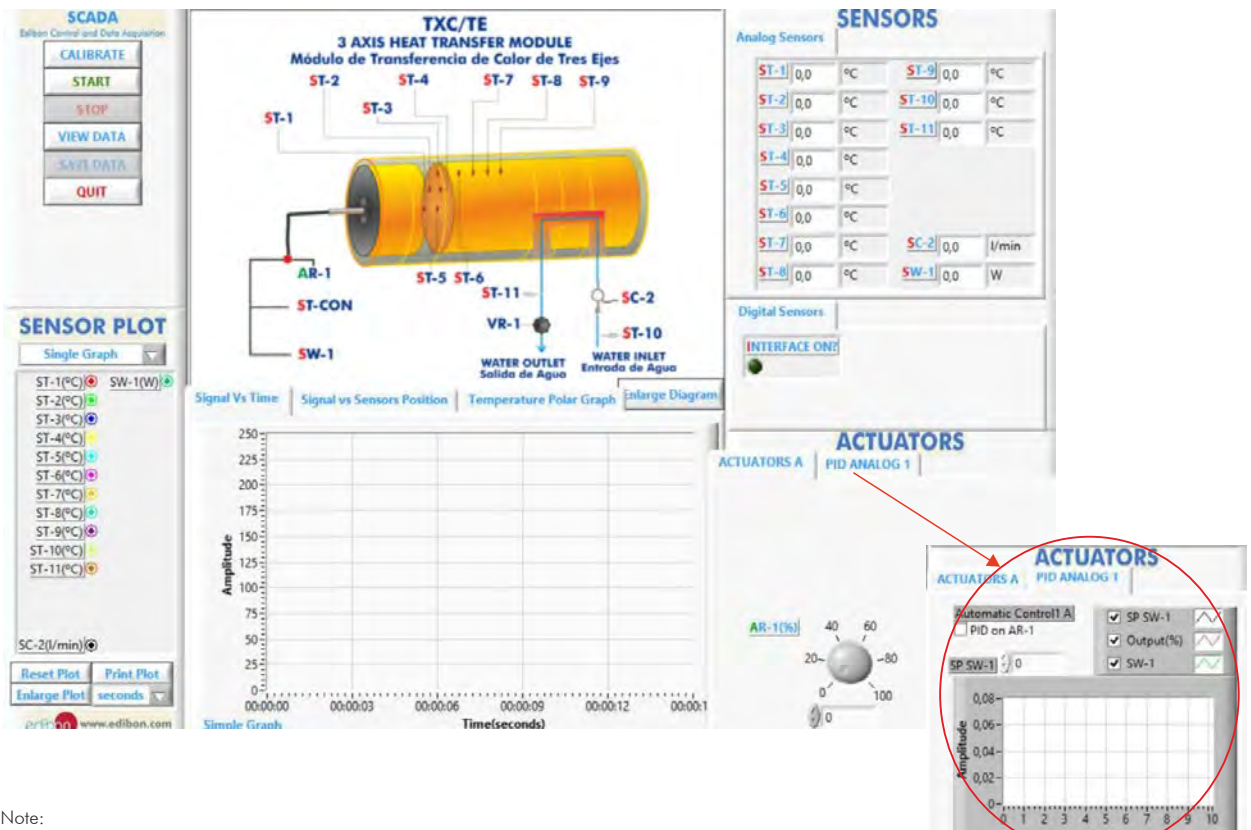
Sensors: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
Actuator: AR=Heating element.

Free and Forced Convection Heat Transfer Module (TXC/FF) Main Screen



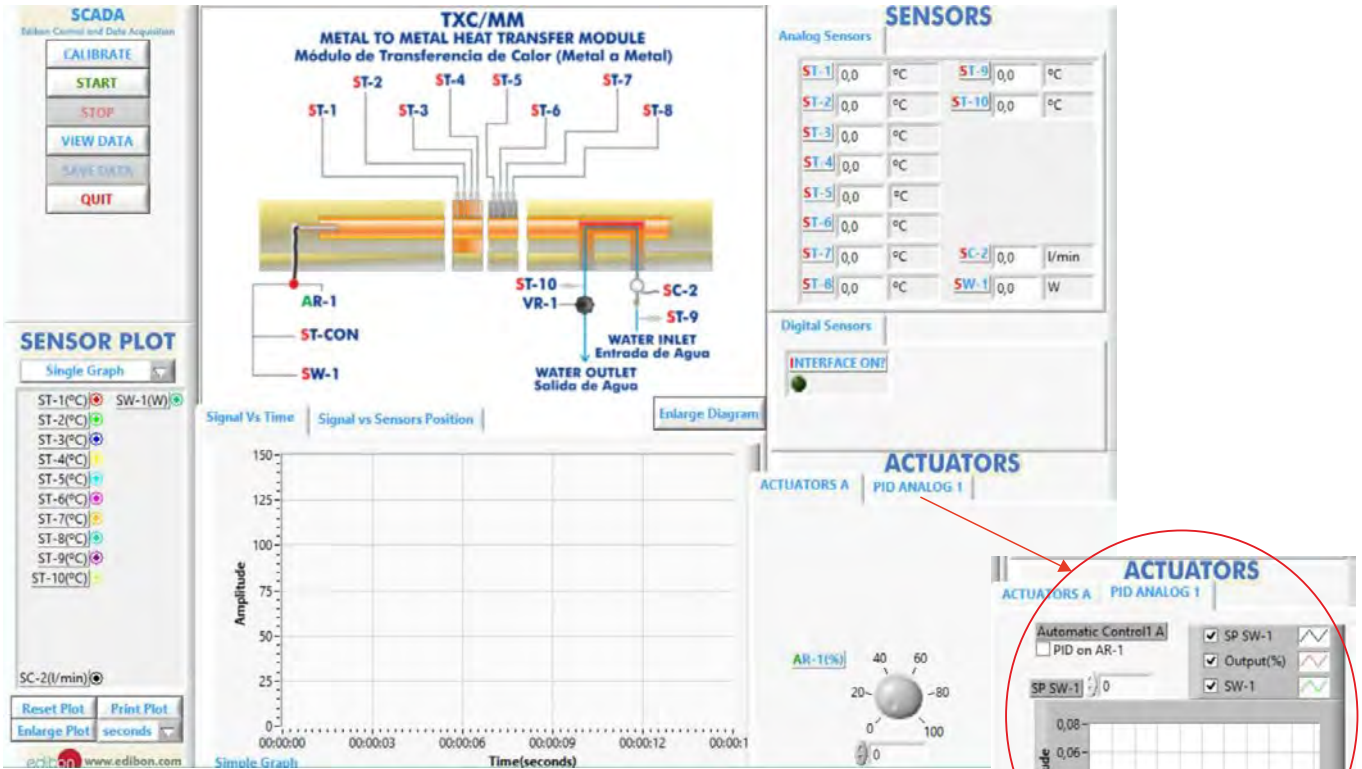
Note:
 Sensor: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
 Actuators: AR=Heating element. AVE=Fan.

Three Axes Heat Transfer Module (TXC/TE) Main Screen



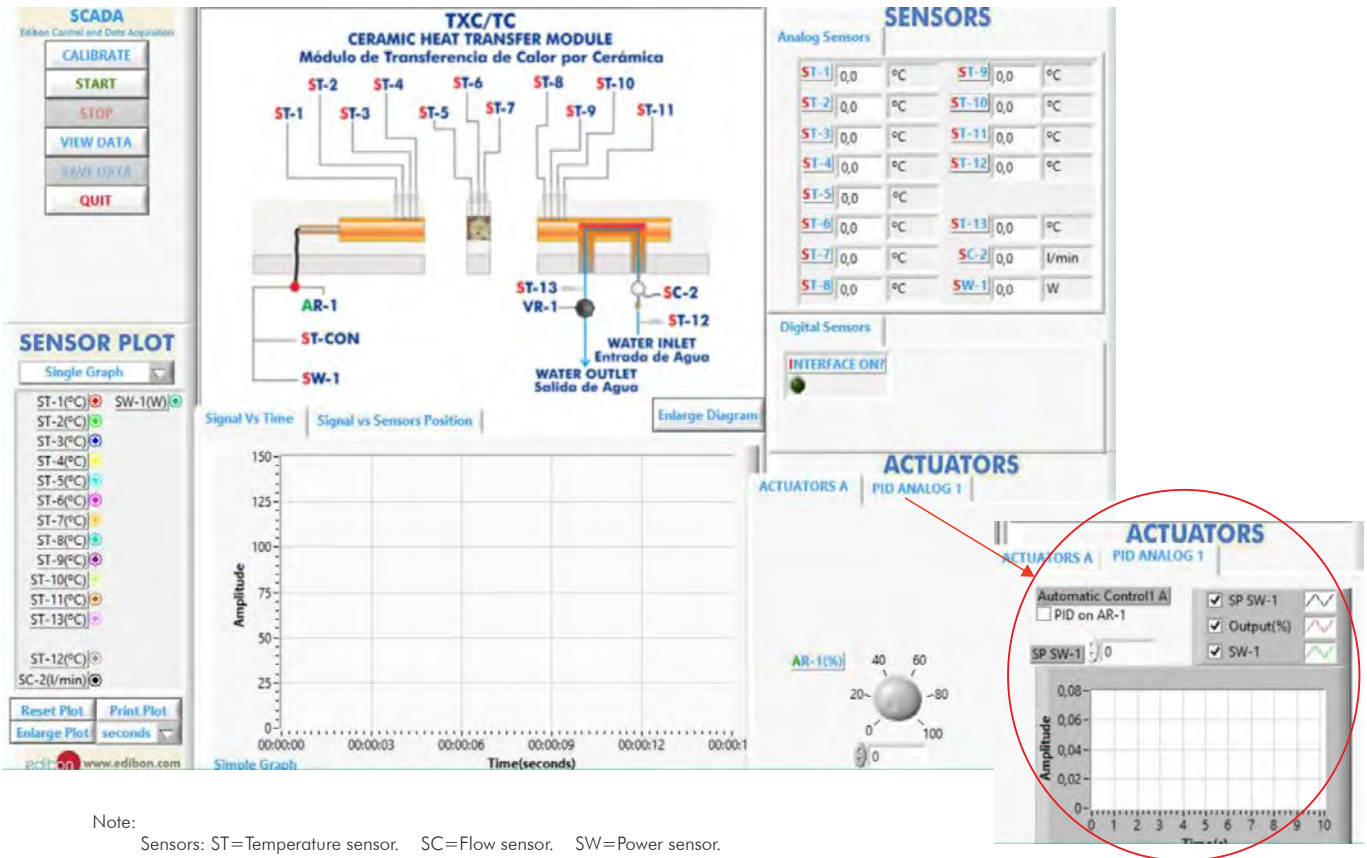
Note:
 Sensors: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
 Actuator: AR=Heating element.

Metal to Metal Heat Transfer Module (TXC/MM) Main Screen



Note:
 Sensor: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
 Actuators: AR=Heating element.

Ceramic Heat Transfer Module (TXC/TC) Main Screen



Note:
 Sensors: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
 Actuator: AR=Heating element.

SCADA and PID Control

Insulating Material Heat Transfer Module (TXC/TI) Main Screen

SCADA
Edibon Control and Data Acquisition

TXC/TI
INSULATING MATERIAL HEAT TRANSFER MODULE
Módulo de Transferencia de Calor por Material Aislante

SENSORS
Analog Sensors

ST-1	0,0	°C	ST-9	0,0	°C
ST-2	0,0	°C	ST-10	0,0	°C
ST-3	0,0	°C	ST-11	0,0	°C
ST-4	0,0	°C	ST-12	0,0	°C
ST-5	0,0	°C	ST-13	0,0	°C
ST-6	0,0	°C	SC-2	0,0	l/min
ST-7	0,0	°C	SW-1	0,0	W
ST-8	0,0	°C			

Digital Sensors
INTERFACE ON?

ACTUATORS
ACTUATORS A | PID ANALOG 1

ACTUATORS
ACTUATORS A | PID ANALOG 1

Automatic Control A
 PID on AR-1
SP SW-1
Output(%)
SW-1

Amplitude vs Time (seconds) graph showing 0 to 250 Amplitude over 00:00:00 to 00:00:12.

Note:
Sensor: ST=Temperature sensor. SC=Flow sensor. SW=Power sensor.
Actuators: AR=Heating element.

Software for Sensors Calibration

Examples of screens

CALIBRATION

Restore Setting | Instructor

Analog Input Channel: SR-1

Sensor Name: SR-1
Calibration units: W/m2
Full Scale: 5000
Gain: 0,004 | Offset: 0

Least Squares Fit
PTA: 10
Volts: 0,3918 | Calibrated: 0,00156

ENTER | EXIT | EXIT & SAVE

MULTICALIBRATE

Signed Technical Support

Reference Value: 23,8994
AT Full Scale: 100 | Tolerance (%): 1

Reference Select	Sensors	Volts	Calibrated	Err (%)
<input checked="" type="checkbox"/>	ST-1	0,2343	22,0472	1,95
<input type="checkbox"/>	ST-2	0,2366	23,9027	0
<input type="checkbox"/>	SP-1	0,0182	0,0618	21,64
<input type="checkbox"/>	SP-2	-0,0429	0,0239	20,38
<input type="checkbox"/>	SC-1	-0,0002	-0,4090	24,97
<input type="checkbox"/>	flow	0,0965	-0,0131	23,91
<input type="checkbox"/>	DC-1	-0,0698	-4,2920	28,13
<input type="checkbox"/>	SF-1	-0,0601	1,44802	27,24
<input type="checkbox"/>	ST-5	0,0011	0,008	23,85
<input type="checkbox"/>	ST-6	0,0227	2,087	20,54
<input type="checkbox"/>	ST-7	-0,0777	1,0391	25,66
<input type="checkbox"/>	SW-1	0,0417	2,576	21,61
<input type="checkbox"/>	SC-1	-0,0121	-10,4794	51,68
<input type="checkbox"/>		0,2201	0,0301	25,91
<input type="checkbox"/>		-0,0162	-0,9162	24,90
<input type="checkbox"/>	AV-1	0,0547	0,0547	0,00

Select all | Data taken: 0

ENTER | DONE

GAIN | **OFFSET** | **p**

Sensor	Gain	Offset	p
ST-1	95,7706	-0,3916	0
ST-2	97,2702	-0,8832	0
SP-1	1,3620	0,0257	0
SP-2	1,86905	0,1137	0
SC-1	26,0768	-0,4420	0
flow	0,66814	-0,0499	0
SC-1	94,0404	2,3276	0
SF-1	0,486107	-1,8879	0
ST-5	93,7694	-0,1169	0
ST-6	94,2812	-0,025	0
ST-7	95,1516	-1,7614	0
SW-1	180,108	-0,0512	0
SC-1	879,1	0	0
	1	0	0
AV-1	1	0	0

By using a free of charge code, the teacher and the students can calibrate the unit.

The teacher can recover his/her own calibration by using the EDIBON code that we give free of charge.

⑥ **PLC. Industrial Control using PLC** (it includes PLC-PI Module plus PLC-SOF Control Software):

-PLC-PI. PLC Module:

This unit is common for the modules type "TXC" and can work with one or several modules.

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 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.

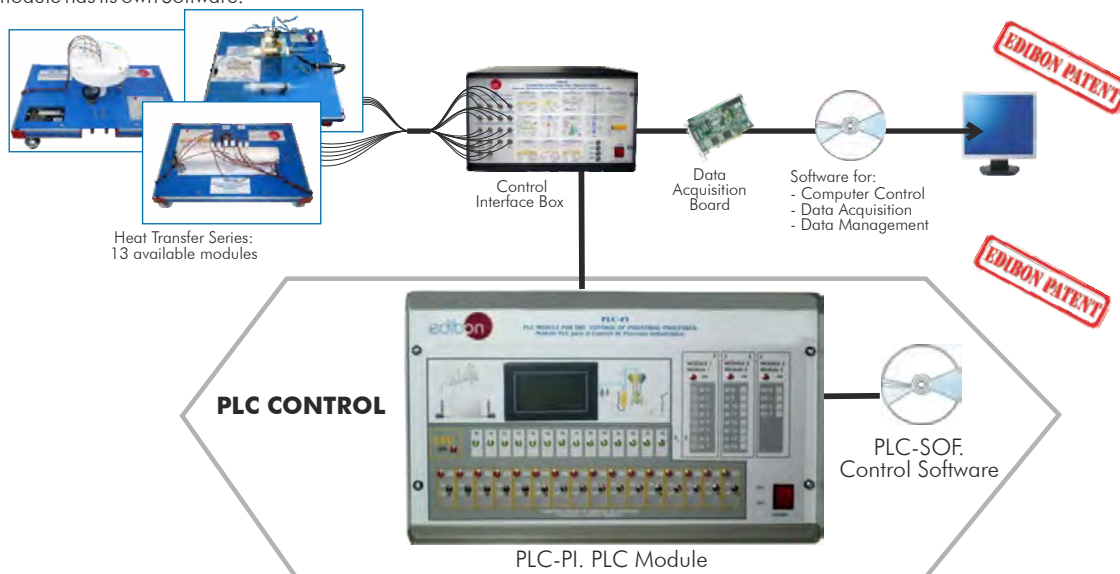
Communication RS232 wire to computer (PC).

Dimensions: 490 x 330 x 310 mm. approx. (19.3 x 12.99 x 12.20 inches approx.). Weight: 30 Kg. approx. (66 pounds approx.).

-TSTCC/PLC-SOF. PLC Control Software:

Always included with PLC supply.

Each module has its own Software.



Practices to be done with PLC-PI:

- 1.- Control of the unit process through the control interface box without the computer.
- 2.- Visualization of all the sensors values used in the unit process.
- 3.- Calibration of all sensors included in the unit process.
- 4.- Hand on of all the actuators involved in the unit process.
- 5.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).
- 6.- Simulation of outside actions, in the cases hardware elements do not exist. (Example: test of complementary tanks, complementary industrial environment to the process to be studied, etc).
- 7.- PLC hardware general use and manipulation.
- 8.- PLC process application for the unit.
- 9.- PLC structure.
- 10.- PLC inputs and outputs configuration.
- 11.- PLC configuration possibilities.
- 12.- PLC programming languages.
- 13.- PLC different programming standard languages.
- 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 unit process.
- 17.- Possibility of creating new process in relation with the unit.
- 18.- PLC Programming exercises.
- 19.- Own PLC applications in accordance with teacher and student requirements.

⑦ **TSTCC/CAI. Computer Aided Instruction Software System.**

This complete software package includes two Softwares: the INS/SOF. Classroom Management Software (Instructor Software) and the TSTCC/SOF. Computer Aided Instruction Software (Student Software).

This complete software package consists of an Instructor Software (INS/ SOF) totally integrated with the Student Software (TSTCC/SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

-INS/SOF. Classroom Management Software (Instructor Software):

The Instructor can:

- Organize Students by Classes and Groups.
- Create easily new entries or delete them.
- Create data bases with student information.
- Analyze results and make statistical comparisons.
- Generate and print reports.
- Detect student's progress and difficulties.
- ...and many other facilities.

Instructor Software



-TSTCC/SOF. Computer Aided Instruction Software (Student Software):

It explains how to use the unit, run the experiments and what to do at any moment.

This Software contains:

- Theory.
- Exercises.
- Guided Practices.
- Exams.

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

www.edibon.com/products/catalogues/en/CAI.pdf

Student Software



⑧ **TSTCC/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 on 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.

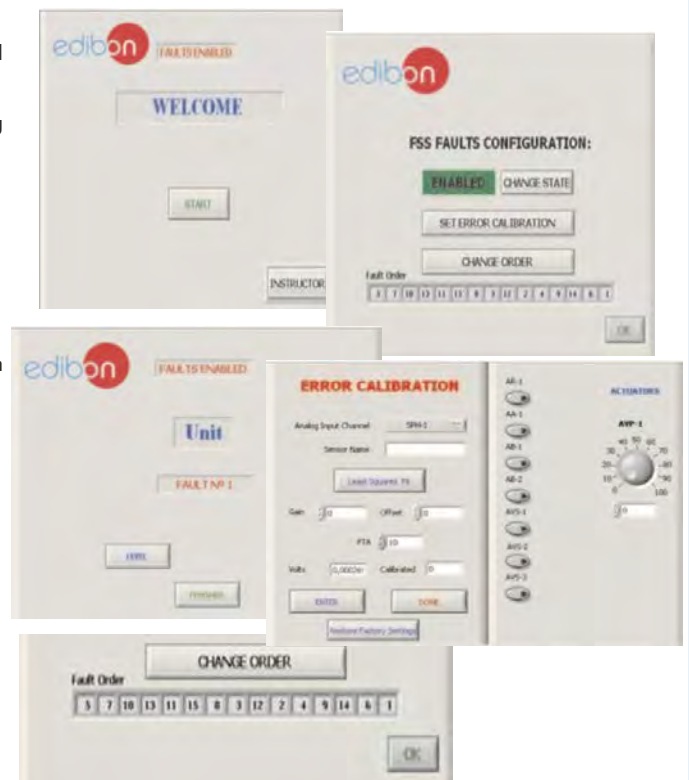
On/off faults:

- Several on/off faults can be included.

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

www.edibon.com/products/catalogues/en/FSS.pdf

Example of some screens



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

This Computer Aided Learning Software (CAL) is a Windows based software, simple and very easy to use, specifically developed by EDIBON. It is very useful for Higher Education level.

CAL is a class assistant that helps in doing the necessary calculations to extract the right conclusions from data obtained during the experimental practices.

CAL computes the value of all the variables involved and performs the calculations.

It allows to plot and print the results. Within the plotting options, any variable can be represented against any other.

Different plotting displays.

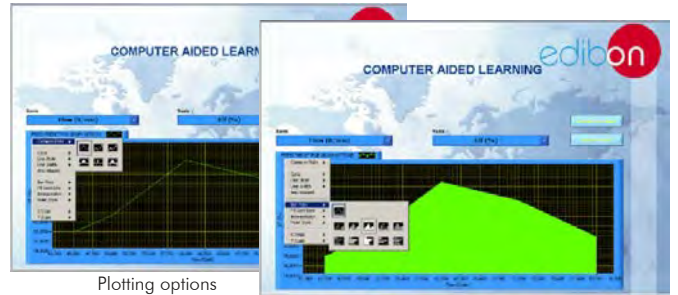
It has a wide range of information, such as constant values, unit conversion factors and integral and derivative tables.

For more information see CAL catalogue. Click on the following link:
www.edibon.com/products/catalogues/en/CAL.pdf



Calculations

Information of constant values, unit conversion factors and integral and derivative tables



Plotting 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.

The Mini ESN system consists on the adaptation of any EDIBON Computer Controlled Unit with SCADA and PID Control 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).

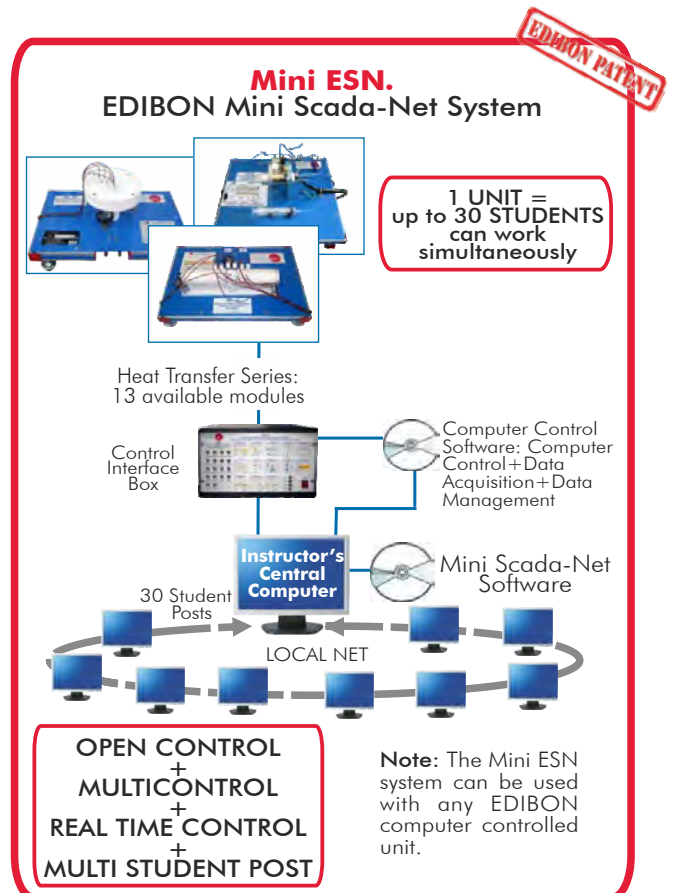
Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA and PID Control, 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/thermodynamicsthermotechnics/esn-thermodynamics/ESN-THERMODYNAMICS.pdf

Items always supplied as minimum configuration

Additional and optional items

① Computer Controlled Modules:

- ⑬ TXC/CL. **Linear Heat Conduction Module**, and/or
 - ⑭ TXC/CR. **Radial Heat Conduction Module**, and/or
 - ⑮ TXC/RC. **Radiation Heat Transfer Module**, and/or
 - ⑯ TXC/CC. **Combined Free and Forced Convection and Radiation Module**, and/or
 - ⑰ TXC/SE. **Extended Surface Heat Transfer Module**, and/or
 - ⑱ TXC/ER. **Radiation Errors in Temperature Measurement Module**, and/or
 - ⑲ TXC/EI. **Unsteady State Heat Transfer Module**, and/or
 - ⑳ TXC/LG. **Thermal Conductivity of Liquids and Gases Module**, and/or
 - ㉑ TXC/FF. **Free and Forced Convection Heat Transfer Module**, and/or
 - ㉒ TXC/TE. **Three Axes Heat Transfer Module**, and/or
 - ㉓ TXC/MM. **Metal to Metal Heat Transfer Module**, and/or
 - ㉔ TXC/TC. **Ceramic Heat Transfer Module**, and/or
 - ㉕ TXC/TI. **Insulating Material Heat Transfer Module**.
- ② TSTCC/CIB. **Control Interface Box**. (Common for the modules type "TXC" and can work with one or several modules).
- ③ DAB. **Data Acquisition Board**. (Common for the modules type "TXC").
- ④ **Cables and Accessories**, for normal operation.
- ⑤ **Manuals**.

- ⑥ PLC. **Industrial Control using PLC** (it includes PLC-PI Module plus PLC-SOF Control Software):
 - PCL-PI. PLC Module.
 - TSTCC/PLC-SOF. PLC Control Software.
- ⑦ TSTCC/CAI. **Computer Aided Instruction Software System**.
- ⑧ TSTCC/FSS. **Faults Simulation System**.
- ⑨ TSTCC/CAL. **Computer Aided Learning Software**. (Results Calculation and Analysis).

Expansions

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

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



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