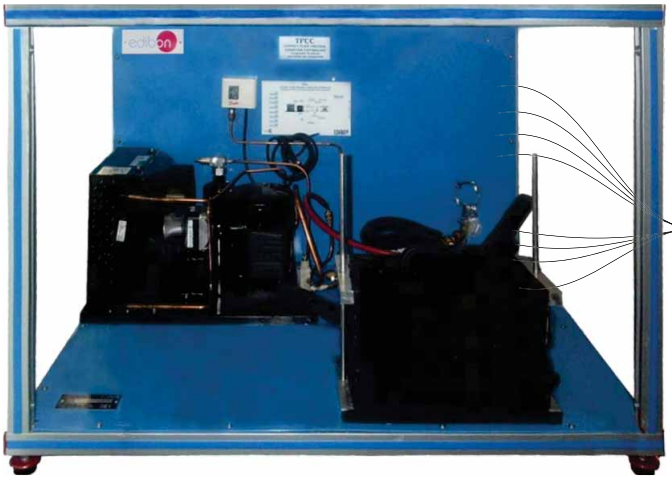
Computer Controlled **Contact Plate Freezer,** with SCADA

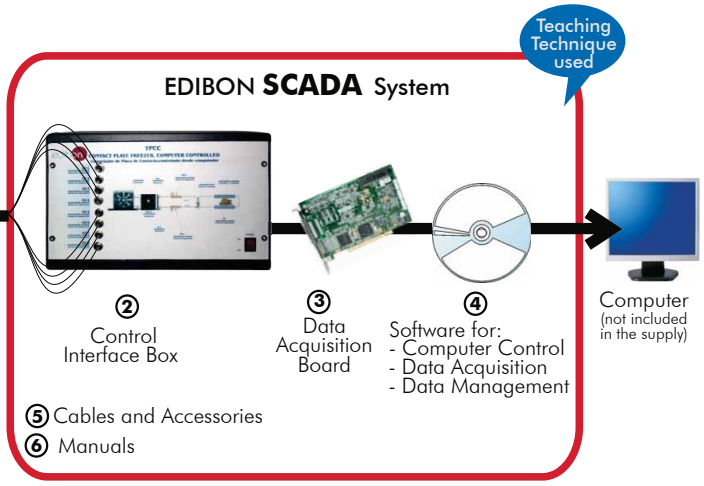
TPCC

Technical Teaching Equipment

EDIBON PATENT



①Unit: TPCC. Contact Plate Freezer



*Minimum supply always includes: 1 + 2 + 3 + 4 + 5 + 6
(Computer not included in the supply)

Key features:

- **Advanced Real-Time SCADA.**
- **Open Control + Multicontrol + Real-Time Control.**
- **Specialized EDIBON Control Software based on Labview.**
- **National Instruments Data Acquisition board (250 KS/s , kilo samples per second).**
- **Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.**
- **Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.**
- **Capable of doing applied research, real industrial simulation, training courses, etc.**
- **Remote operation and control by the user and remote control for EDIBON technical support, are always included.**
- **Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).**
- **Designed and manufactured under several quality standards.**
- **Optional 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.**

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

www.edibon.com
Products
Products range
Units
9.-Thermodynamics & Thermotechnics
and
12.- Food & Water Technologies

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
(Worlddidac Member)

DESCRIPTION

In the food industry, the quick deep freezing processes are applied to a wide range of products, among them, baked goods, meats, fishes, seafood, vegetables and prepared food.

The TPCC unit has as aim to introduce the students to quick freezing processes, to their advantages compared with conventional freezing processes, as well as to proceed to the study of the thermodynamic process, through which such freezing is obtained.

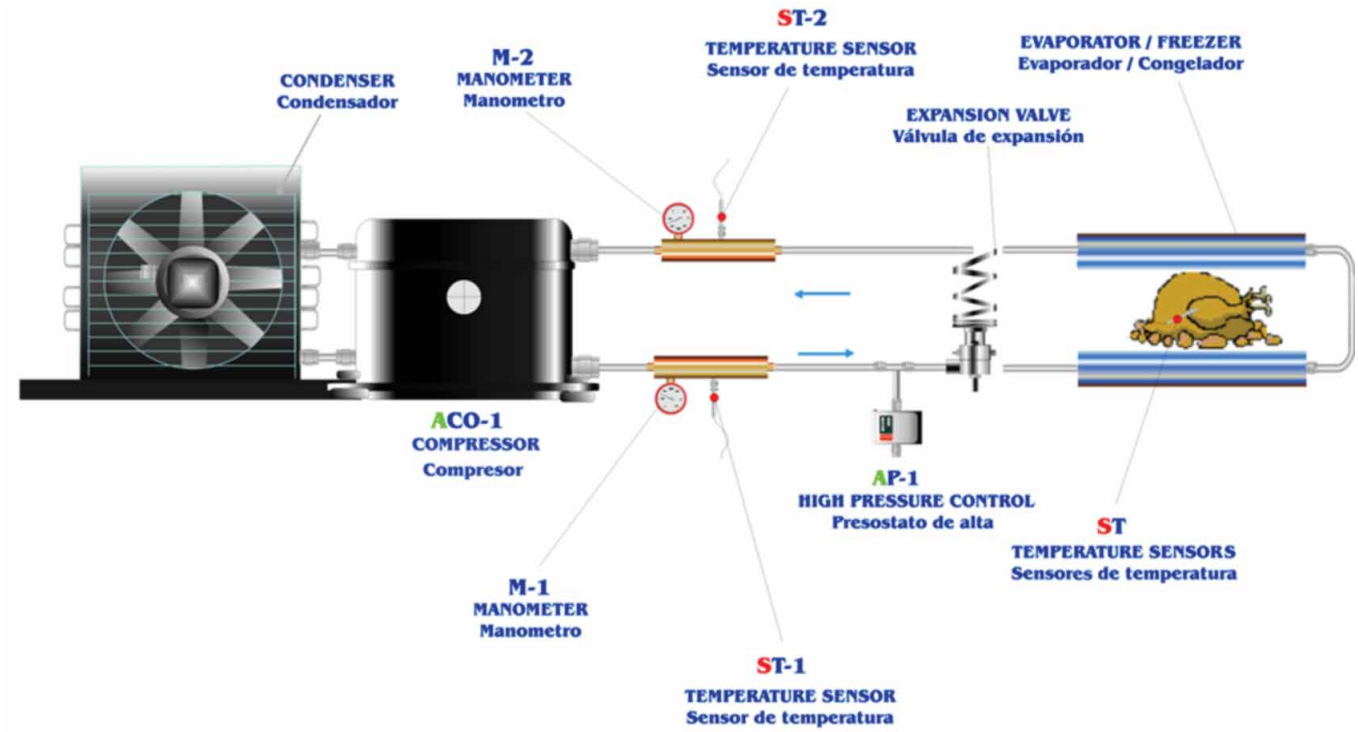
Basically, this unit is made up of a refrigeration circuit. The unit has been designed to observe the thermodynamic changes occuring during the process, for a given coolant, allowing the study of the refrigeration cycle.

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

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

1 actuator and 8 sensors controlled from any computer, and working simultaneously

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL



Items supplied as standard

① TPCC. Unit:

TPCC 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.
2 Manometers.
Coolant compressor, computer controlled.
Air condenser.
High pressure control.
Coolant accumulation tank.
Expansion valve.
Four-way valve.
Evaporator-freezer, with two freezing plates of 180 mm x 280 mm. One freezing plate is fixed and the other one is height adjustable.
Plate temperature (both plates): <-35°C.
8 Temperature sensors:
- 2 Temperature sensors, type J (temperature measurement of the coolant).
- 6 Temperature sensors, type J (temperature measurement of the food).

Enthalpy diagram of the coolant R404a.

② TPCC/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.

TPCC/CIB

The unit control elements are permanently computer controlled, without necessity of changes or connections during the whole process test procedure. **Simultaneous visualization in the computer of all parameters involved in the process.**
Calibration of all sensors involved in the process.
Real time curves representation about system responses.
Storage of all the process data and results in a file. Graphic representation, in real time, of all the process/system responses.
All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process. All the actuators and sensors values and their responses are displayed on only one screen in the computer.
Shield and filtered signals to avoid external interferences.
Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Real time computer control for pumps, compressors, resistances, control valves, etc. **Open control** allowing modifications, at any moment and in real time, of parameters involved in the process simultaneously.
Three safety levels, one mechanical in the unit, other electronic in the control interface and the third one in the control software.

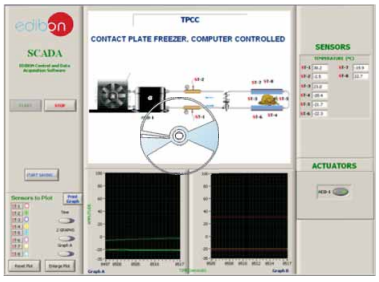
③ DAB. Data Acquisition Board:

DAB

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

④ TPCC/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 simultaneous way.



TPCC/CCSOF

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.**
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.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals:

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

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

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Additional and optional 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.
USB 2.0 connector to PC.

Inside:

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

Panasonic PLC:

High-speed scan of 0.32 μsec. for a basic instruction.
Program capacity of 32 Ksteps, with a sufficient comment area.
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).

PLC-PI

⑧ TPCC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.

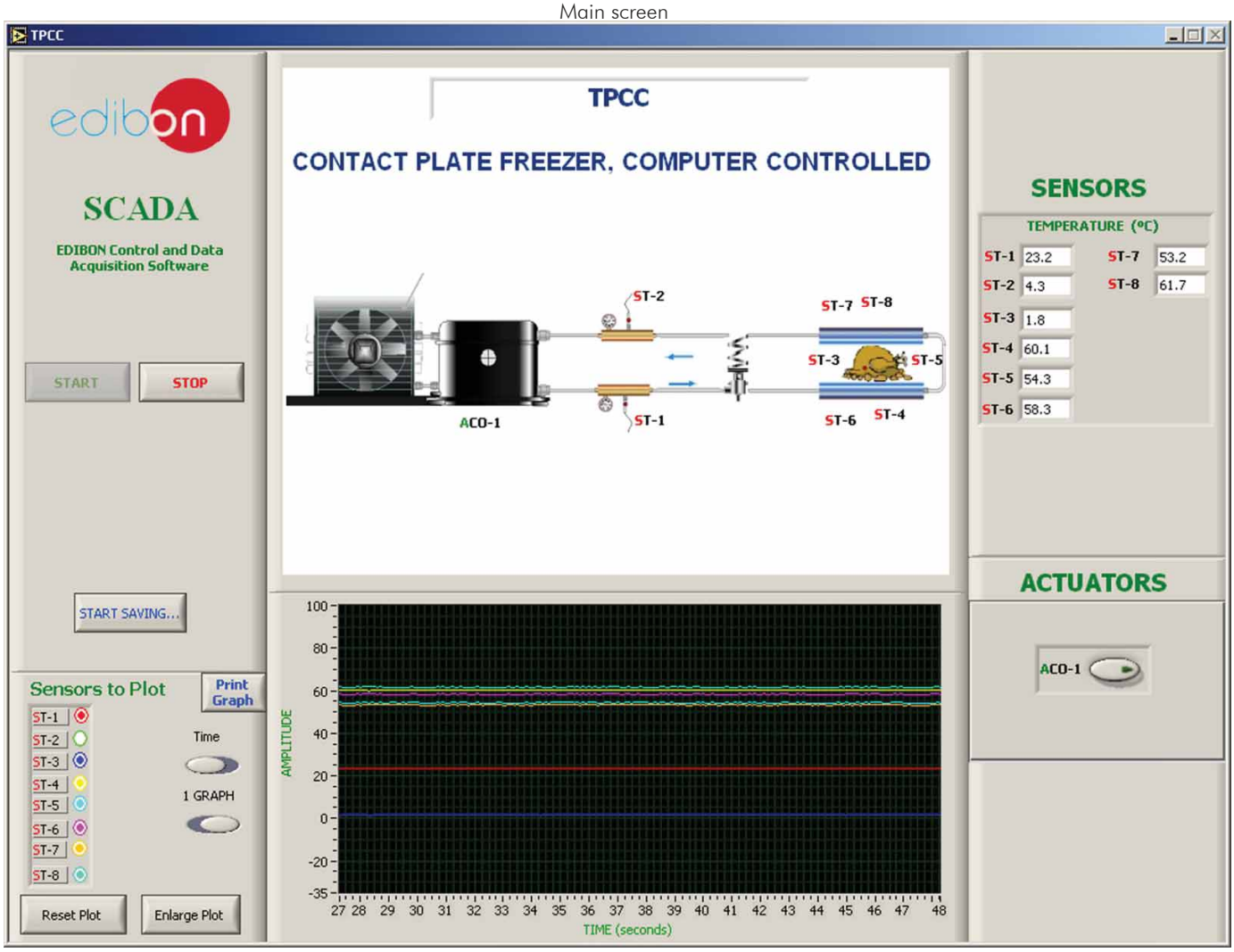
Items available on request

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

⑩ TPCC/FSS. Faults Simulation System.

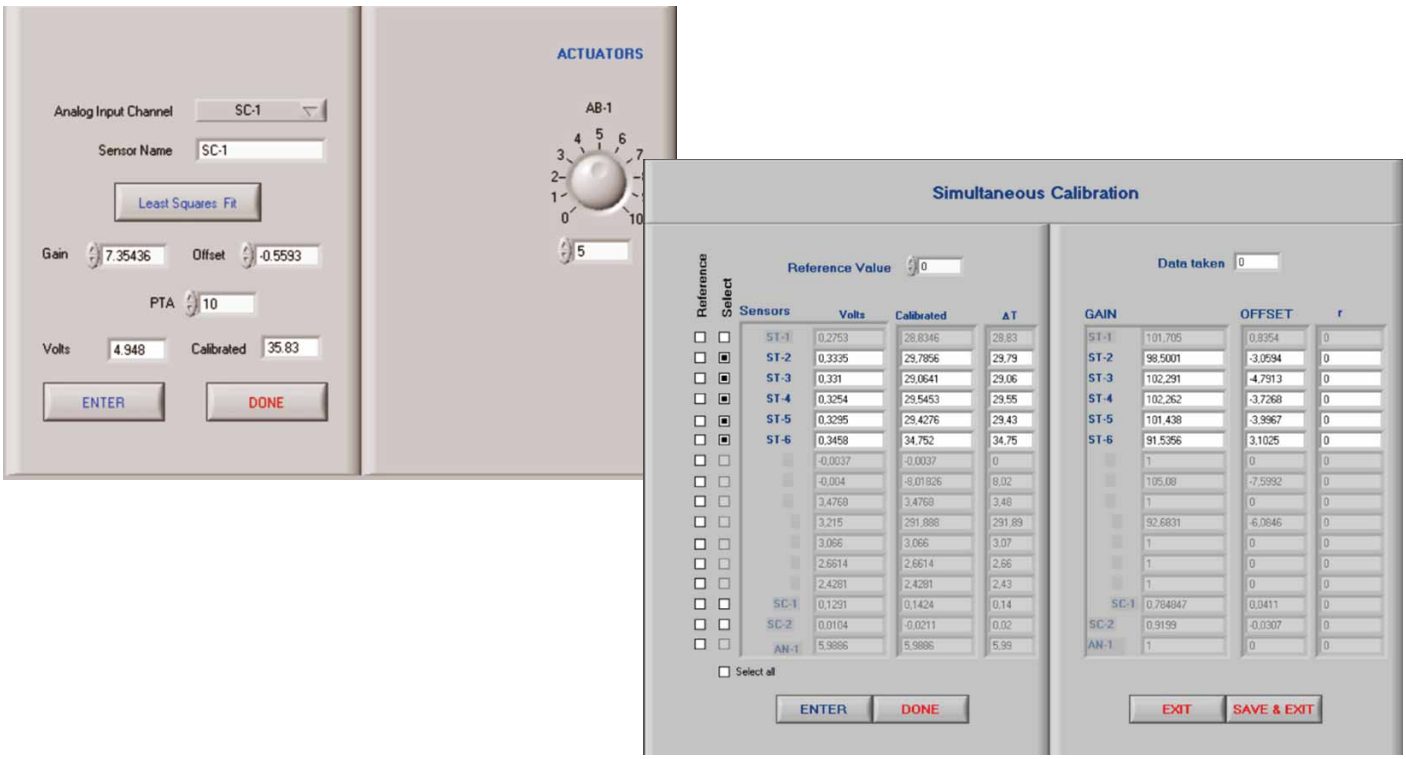
Software Main Screens

Main screen



Note: ST= Temperature sensor. ACO-1= Compressor.

Examples of Sensors Calibration screens



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Some typical exercises results

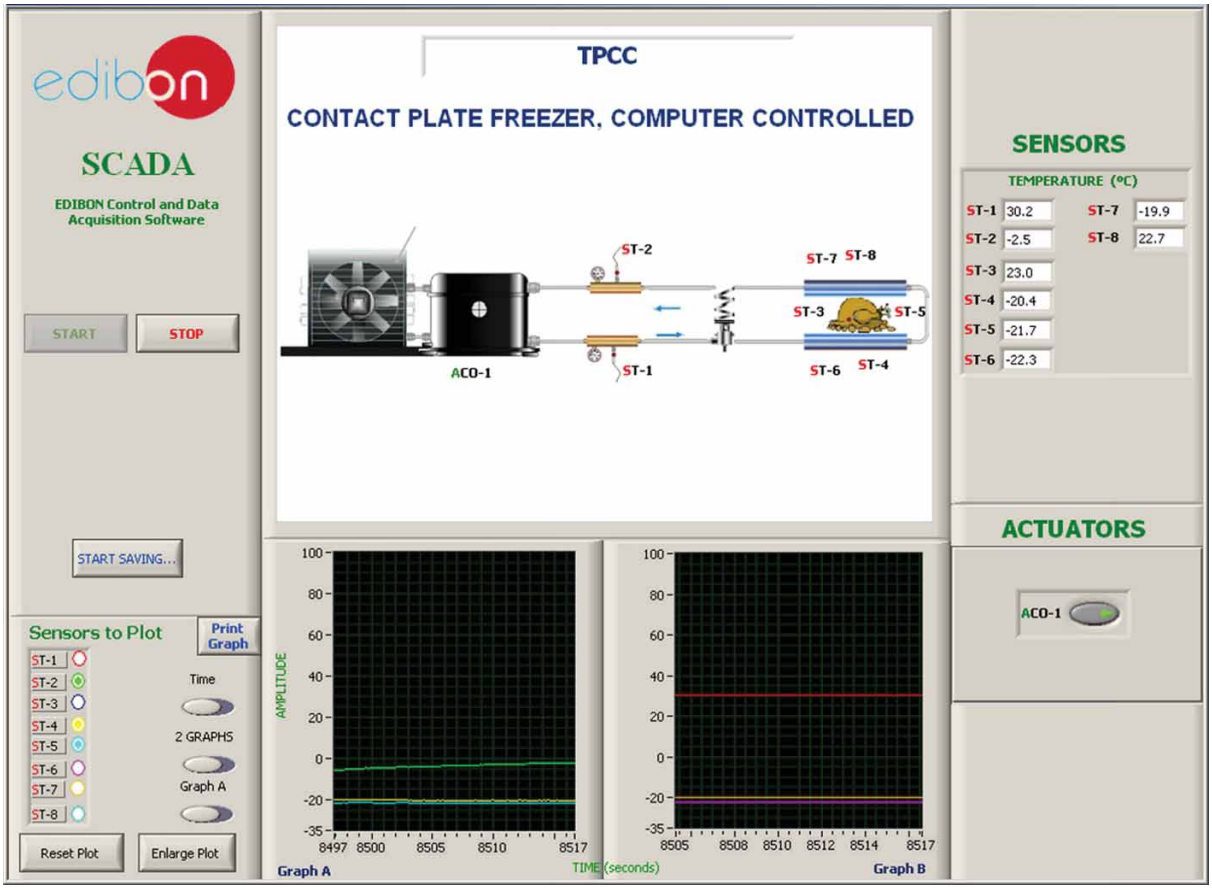
Both screens show the sample temperature reached after 2 hours and 30 min of work. No significant differences are observed.

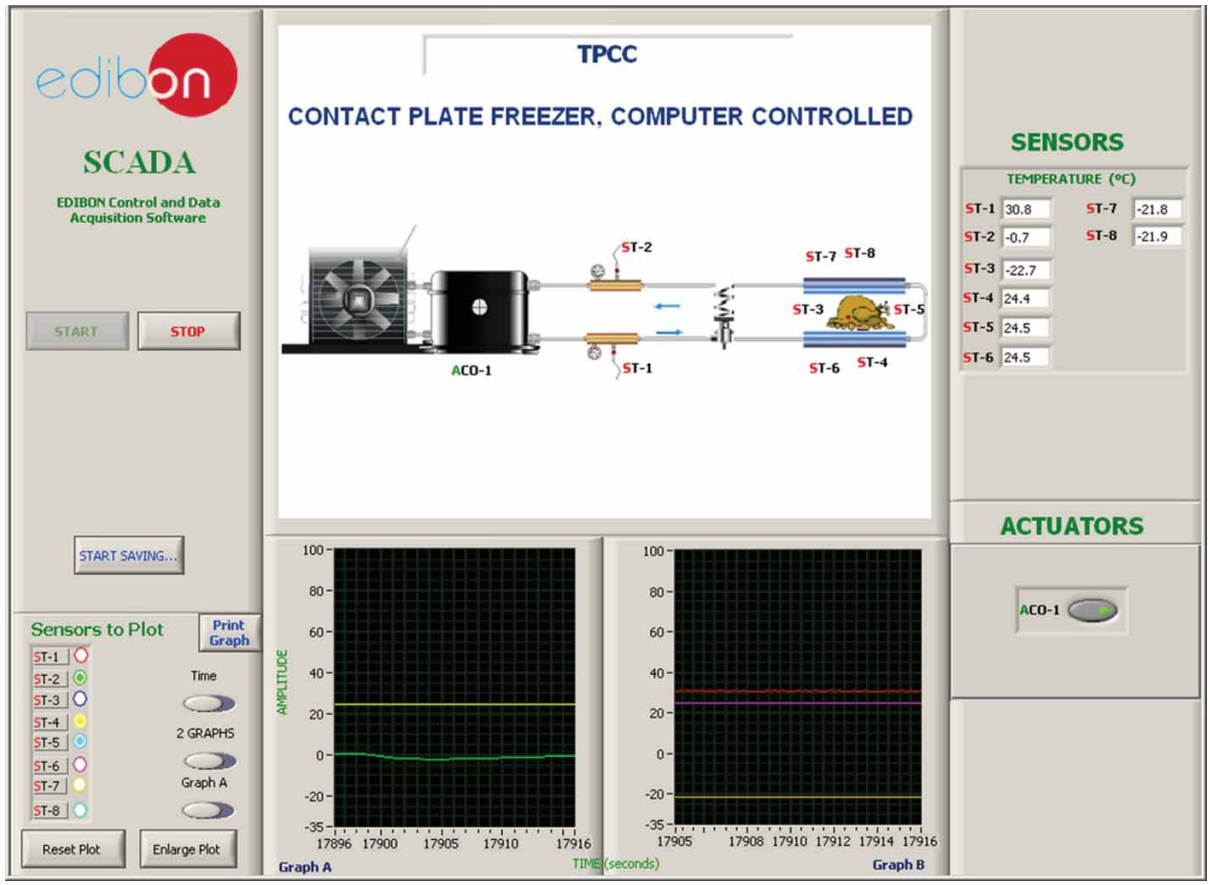
We can see in both how a temperature lower than -18°C is reached in the sample. The difference between the temperature sensor measurements is due to the different temperature in each point of the sample. This temperature has been reached for less than 4 hours, so the quick freezing process is producing.

The process will finish when all the sample temperature sensors show the same value.

In general, all the sensors and actuators are shown in the front panel. Eight temperature sensors, six of which (ST3...ST-8) can be put in the sample, and ST-1 and ST-2, corresponding to the high and low pressure temperature. With these thermocouples the process is characterized.

The only actuator that appears let us to start the compressor.





Note: ST= Temperature sensor. ACO-1= Compressor.

EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

1.- Study of industrial freezing process.
2.- Study of food preservation.
3.- Study the effect of freezing on food.
4.- Investigate the effect on the freezing process of parameters such as the shape of the product, portion size, the packaging, etc.
5.- To evaluate the difference between fast freezing and domestic freezing.
6.- Freezing rates.
7.- Study of fast freezing vs slow freezing.
8.- Temperature sensing.
9.- Taste and texture assessments.
10.- Study of the deep-freezing process effect: structural.
11.- Study of the deep-freezing process effect: compositional.
12.- Study of the deep-freezing process effect: sensorial.
13.- Study of the thermal process.
14.- Study the effect of the temperature on bacteria.
15.- Quality control.
16.- Quality assurance.
17.- Freezing curves analysis.
18.- Links with Physics (refrigeration) and with Biology(food structure).

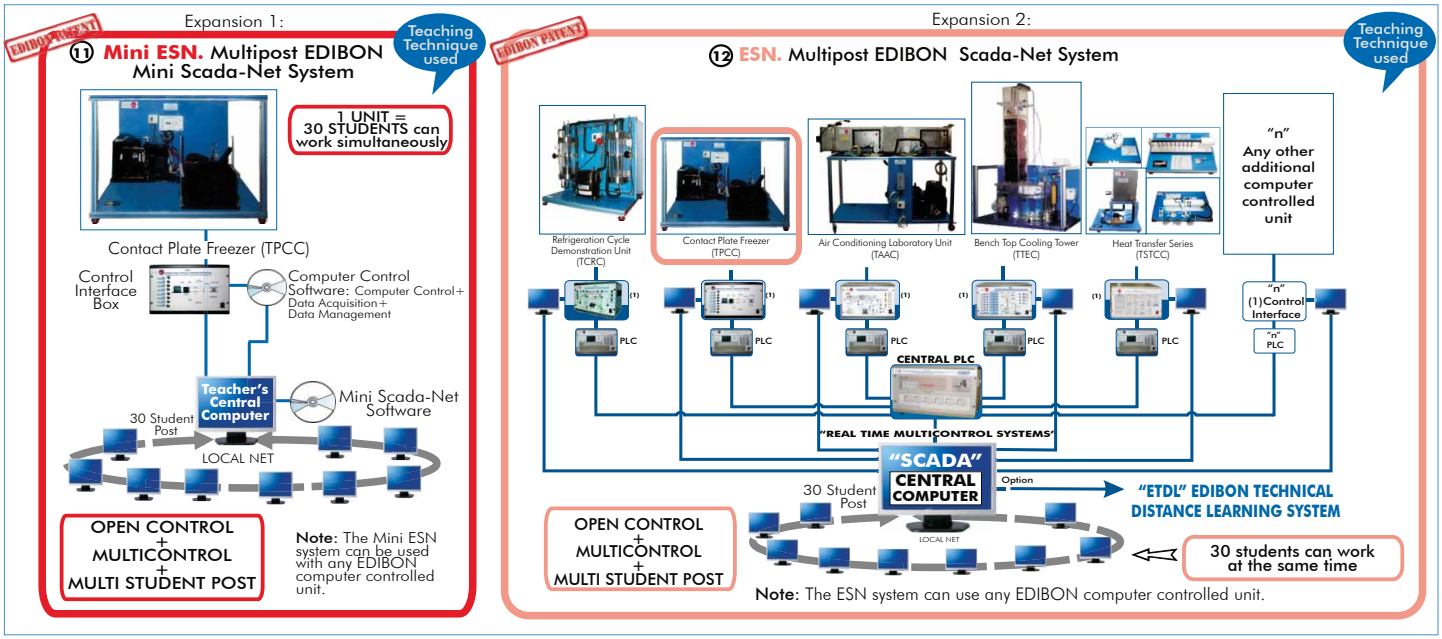
Other possible practices:

19.- Sensors calibration.

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

20.- Control of the TPCC unit process through the control interface box without the computer.
21.- Visualization of all the sensors values used in the TPCC unit process.
22.- Calibration of all sensors included in the TPCC unit process.
23.- Hand on of all the actuators involved in the TPCC unit process.
24.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).
25.- 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).
26.- PLC hardware general use and manipulation.
27.- PLC process application for TPCC unit.
28.- PLC structure.
29.- PLC inputs and outputs configuration.
30.- PLC configuration possibilities.
31.- PLC program languages.
32.- PLC different programming standard languages.
33.- New configuration and development of new process.
34.- Hand on an established process.
35.- To visualize and see the results and to make comparisons with the TPCC unit process.
36.- Possibility of creating new process in relation with the TPCC unit.
37.- PLC Programming Exercises.
38.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS



ORDER INFORMATION

Items supplied as standard

Minimum configuration for normal operation includes:

① **Unit: TPCC. Contact Plate Freezer.**
② **TPCC/CIB.Control Interface Box.**
③ **DAB.Data Acquisition Board.**
④ **TPCC/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
⑤ **Cables and Accessories,** for normal operation.
⑥ **Manuals.**

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

Additional and optional items to the standard supply

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

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

Expansions

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

REQUIRED SERVICES

-Electrical supply: single-phase, 220V./50 Hz or 110V./60 Hz.
-Water supply.
-Computer (PC).

DIMENSIONS & WEIGHTS

TPCC Unit:	-Dimensions: 900 x 600 x 500 mm. approx. -Weight: 90 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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