Computer Controlled **Teaching Yogurt Incubator,** with SCADA and PID Control

IYDC

EDIBON PATENT

Teaching Technique used

EDIBON **SCADA** System and **PID CONTROL** included

② Control Interface Box

③ Data Acquisition Board

④ Software for:
- Computer Control
- Data Acquisition
- Data Management
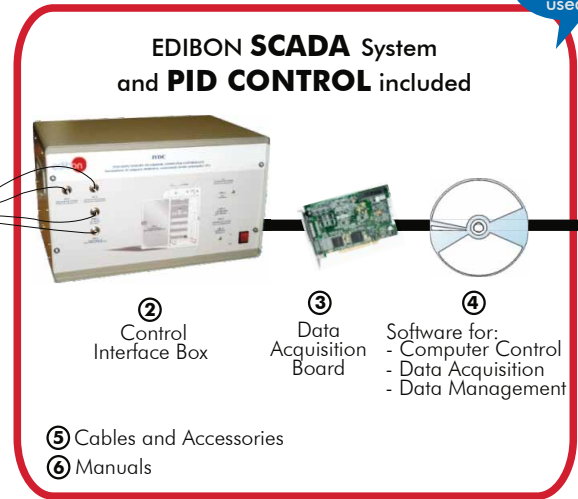
Computer (not included in the supply)

⑤ Cables and Accessories
⑥ Manuals

① Unit: IYDC. Teaching Yogurt Incubator

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

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.**

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

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⤷Products
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⤷Units
⤷12.-Food & Water Technologies

For more information about Key Features, click here:

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

1- PC   2- MANUAL

ST-1
TEMPERATURE SENSOR
Sensor de temperatura

AVE-1
FAN
Ventilador

SpH-1
pH-METER
pH-Metro

ST-2
TEMPERATURE SENSOR
Sensor de Temperatura

AR-1
RESISTANCE
Resistencia

SS-1
SAFETY SWITCH
Interruptor de Seguridad
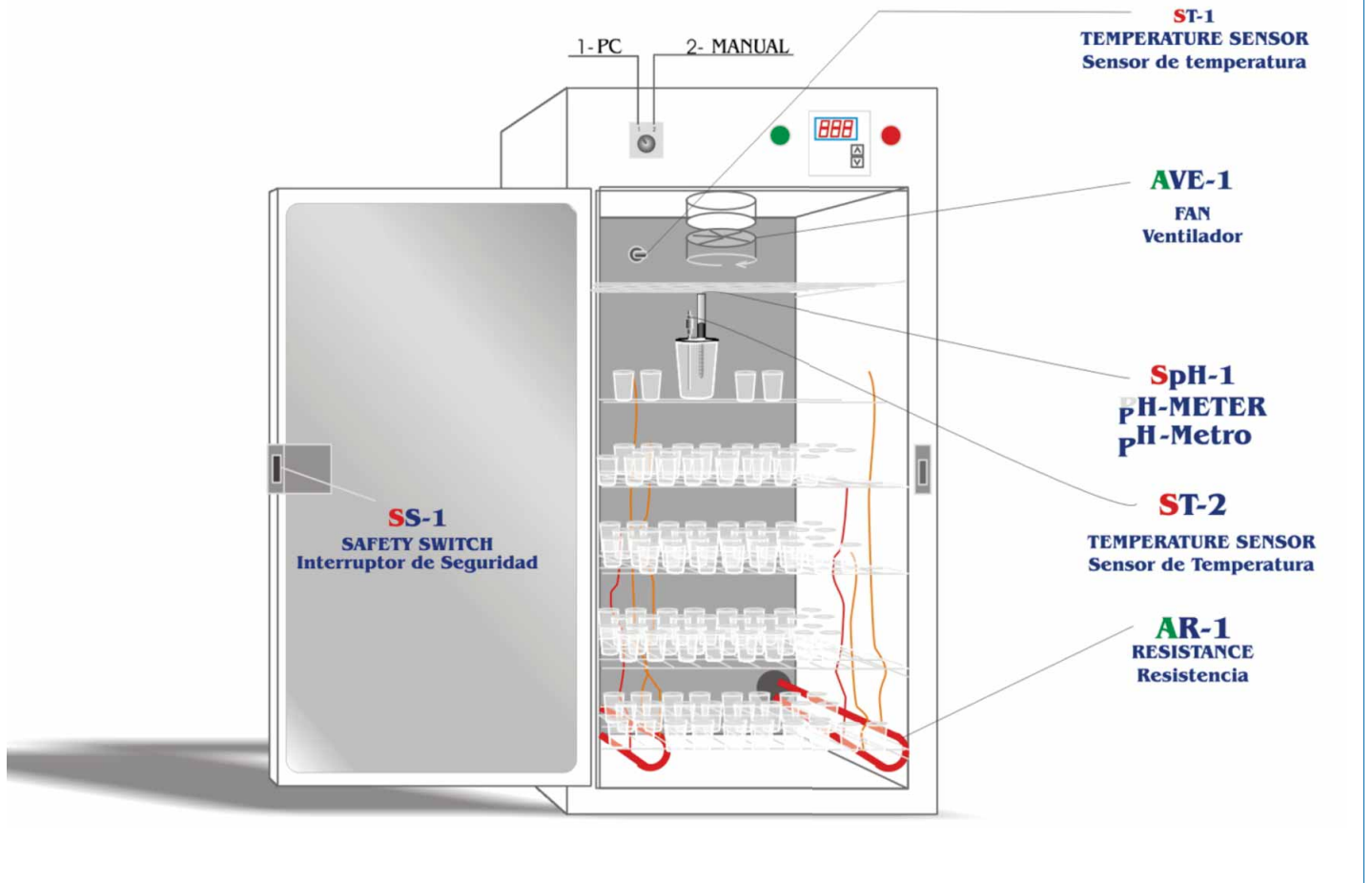
Items supplied as standard

① IYDC. Unit:

The objective of this unit is to teach to the students, in the most visual way as possible, the production of yoghurt, as well as the physical parameters that can be measured with this unit.

This unit is designed as yogurt maker or yogurt heater. The yogurt maker consists of a series of shelves where the containers, in which the yoghurt will be formed, will placed.

It has a resistance to control the process of heating needed for making yoghurt, an a fan that avoids that the unit overheats. A temperature sensor has been added to the unit, so the temperature of the unit can be computer controlled in any moment through the interface. Also, it has incorporated and electrode connected to the interface to control the proper pH to make yoghurt.

Panels and main metallic elements in stainless steel.
Diagram in the front panel with similar distribution to the elements in the real unit.
Unit with enameled chassis and with reinforced isolation.
Stainless steel AISI 304 main body.
3000W resistance.
2 Temperature Sensors, type K.
pH Sensor with electrolyte solution.
Fan.
250ml vessel.
Several mobile grills.
Safety switch (alarm open door).
Temperature digital controller with sensor.
Manual or Computer Control switch.
Unit on/off switch.
Unit on/off indicator led.
Safety indicator led (alarm open door).
Resistance on/off indicator led.
Sensors connectors and resistance and fan connectors to interface (computer control).

IYDC Unit

② IYDC/CIB. Control Interface Box :

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

All sensors, with their respective signals, are properly manipulated from -10V. to +10V computer output.
Sensors connectors in the interface have different pines numbers (from 2 to 16), to avoid connection errors.
Single cable between the control interface box and computer.
The unit control elements are permanently computer controlled, without necessity of changes or connections during the whole process test procedure.
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, resistances, 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, other electronic in the control interface and the third one in the control software.

IYDC/CIB

③ DAB. Data Acquisition Board:

PCI Data acquisition board (National Instruments) to be placed in a computer slot. Bus PCI.
Analog input:
Number of **channels= 16** single-ended or 8 differential. **Resolution=16 bits**, 1 in 65536.
Sampling rate up to: 250 KS/s (Kilo samples per second).
Input range (V)= ±10V.
Data transfers=DMA, interrupts, programmed I/0. Number of DMA channels=6.
Analog output:
Number of **channels=2**. **Resolution=16 bits**, 1 in 65536. Maximum output rate up to: 833 KS/s.
Output range(V)=±10V. Data transfers=DMA, interrupts, programmed I/0.
Digital Input/Output:
Number of **channels=24 inputs/outputs**. D0 or DI Sample Clock frequency: 0 to 1 MHz.
Timing: **Counter/timers=2**. Resolution: Counter/timers: 32 bits.

DAB

④ IYDC/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.
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 250,000 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.
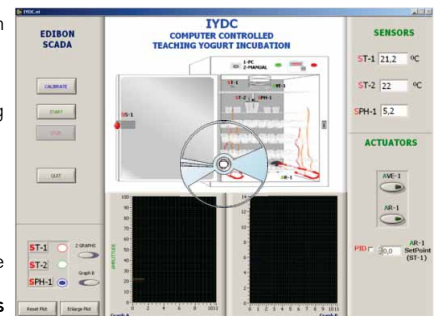
IYDC/CCSOF

⑤ Cables and Accessories, for normal operation.

⑥ Manuals:

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

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

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).

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

For this particular unit, always included with PLC supply.


PLC-PI

Items available on request

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

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

Software Main Screens

Main screen

Main screen of the software. As usual, on the right side all the sensors are shown (chamber temperature yogurt temperature and ph). On the bottom, the fan and resistance control is made through two switches. Also, the resistance control can be made on a PID way, selecting the set point and waiting for an automatic control.
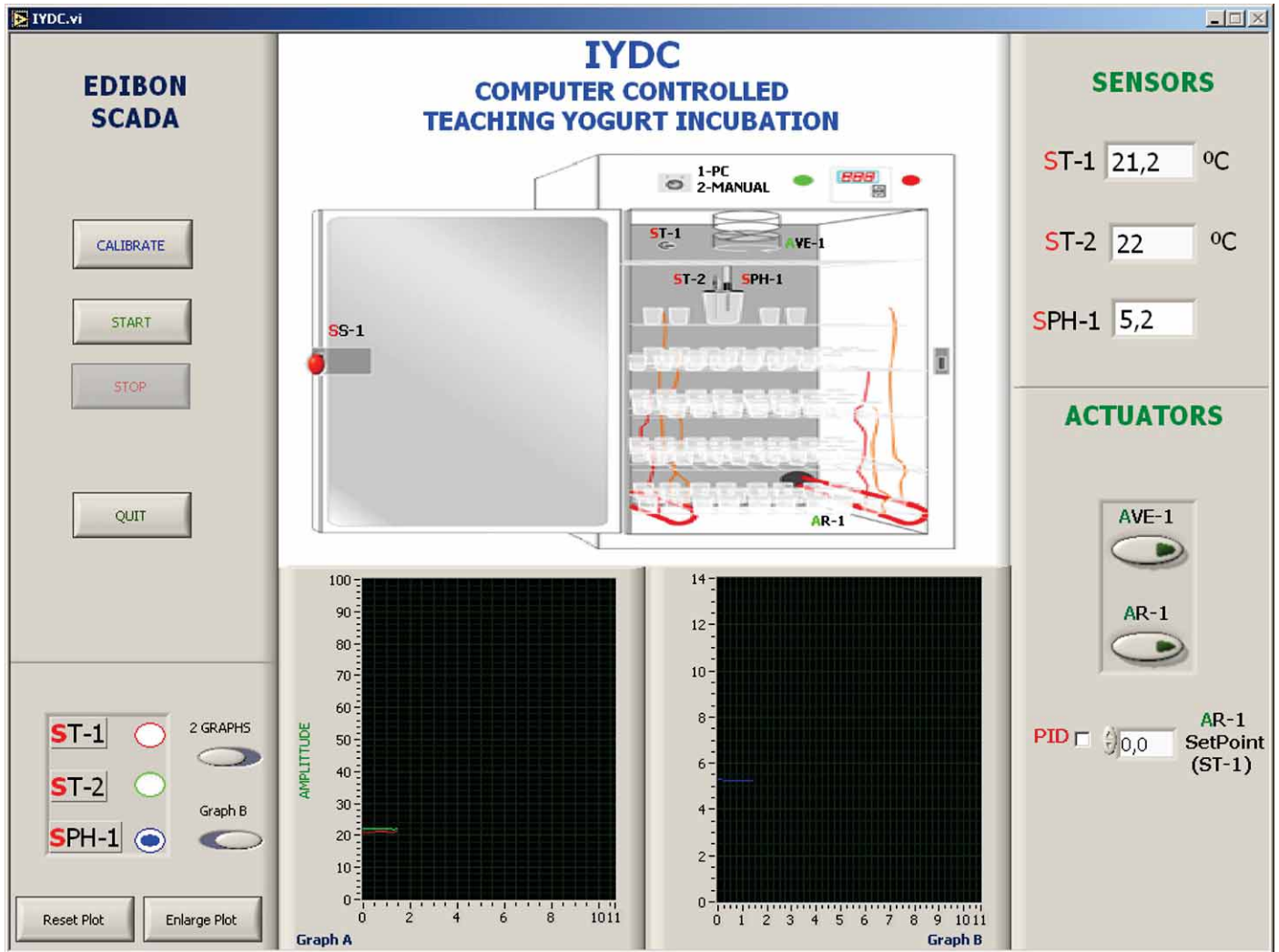
Note: ST=Temperature sensor.   SPH=pH sensor.   AR=Heater resistance.   AVE=Fan.   SS=Safety switch.

Examples of Sensors Calibration screens
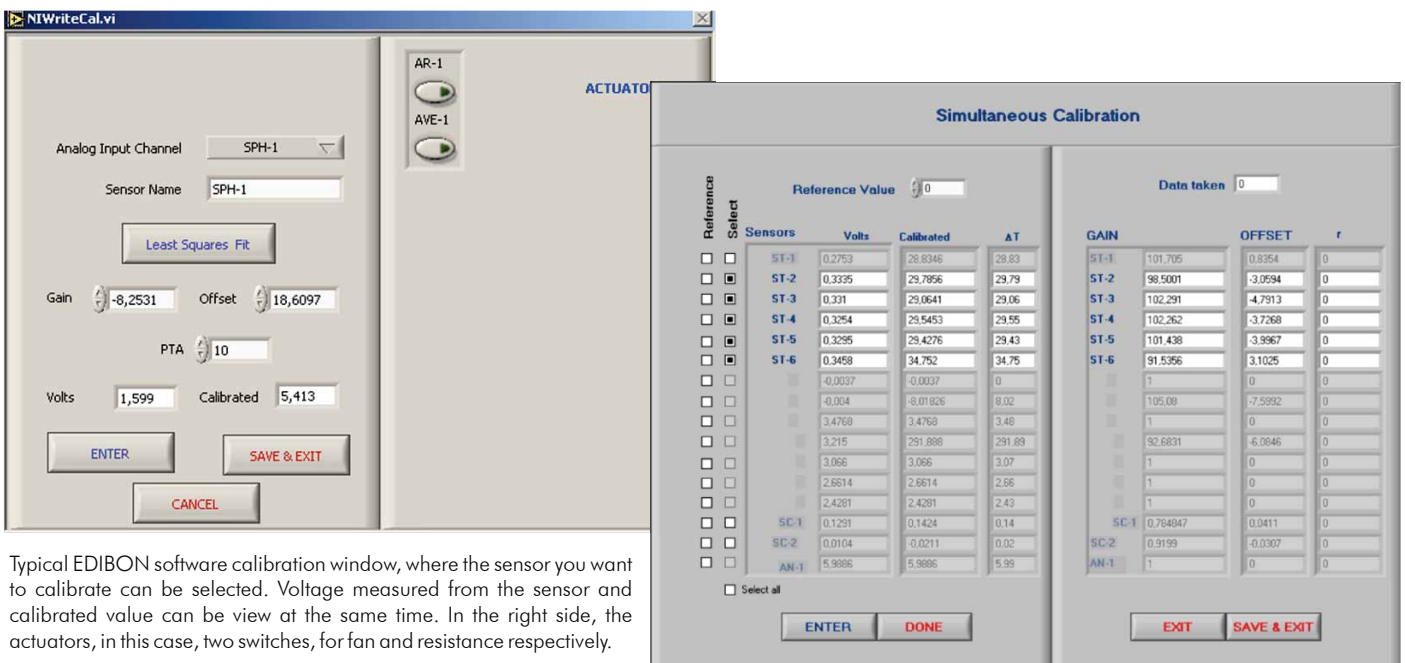
Typical EDIBON software calibration window, where the sensor you want to calibrate can be selected. Voltage measured from the sensor and calibrated value can be view at the same time. In the right side, the actuators, in this case, two switches, for fan and resistance respectively.

Some typical exercises results

The typical way of doing the experiments, in which the readings from the sensors you have selected are plotted in a real time.
The data saving starts when clicking on the "start saving" button.
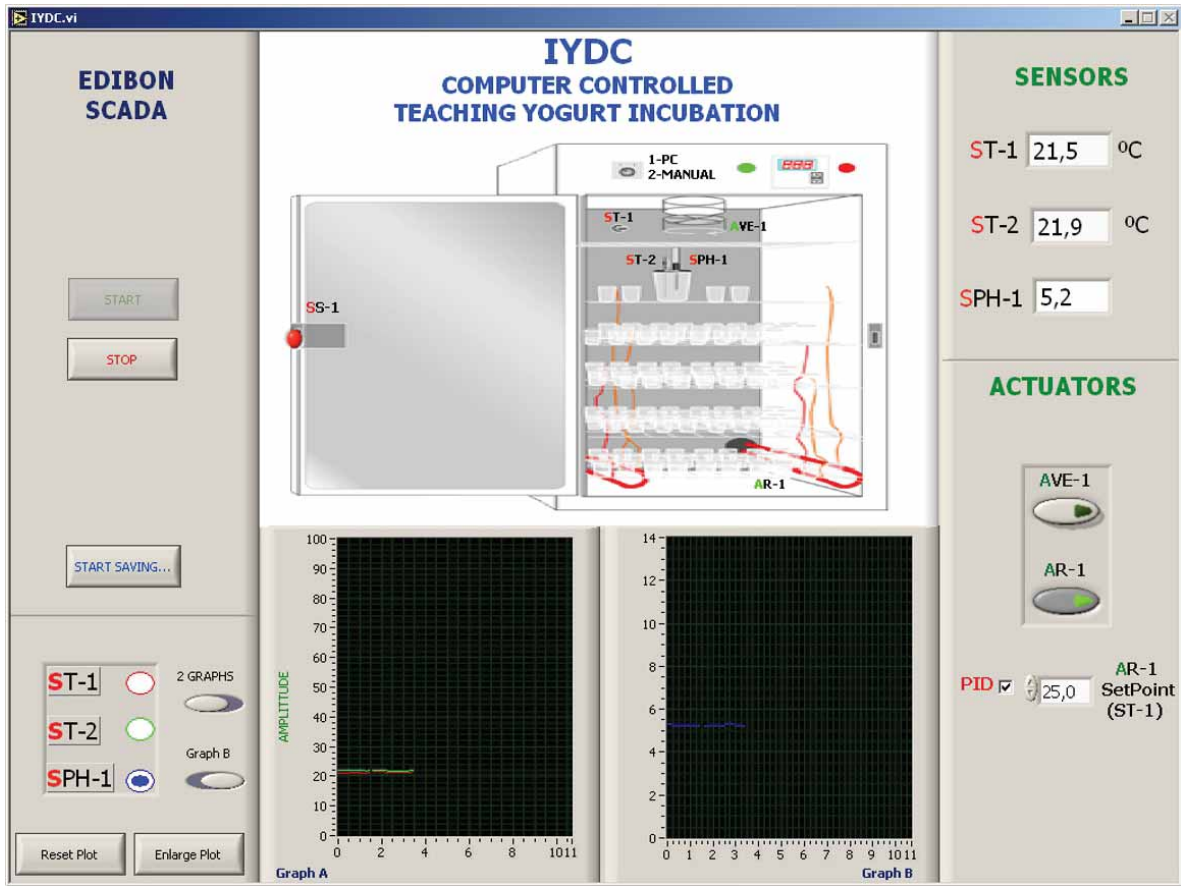
There is a safety system in order to avoid the resistance works if the door is opened. When the door is opened, the resistance is always turn off. If the door is opened while the resistance is working, a hardware system makes it to turn off. When this happens, a message appears on the software window, just to know that the experiment can not be made, because the resistance can not be turned on.

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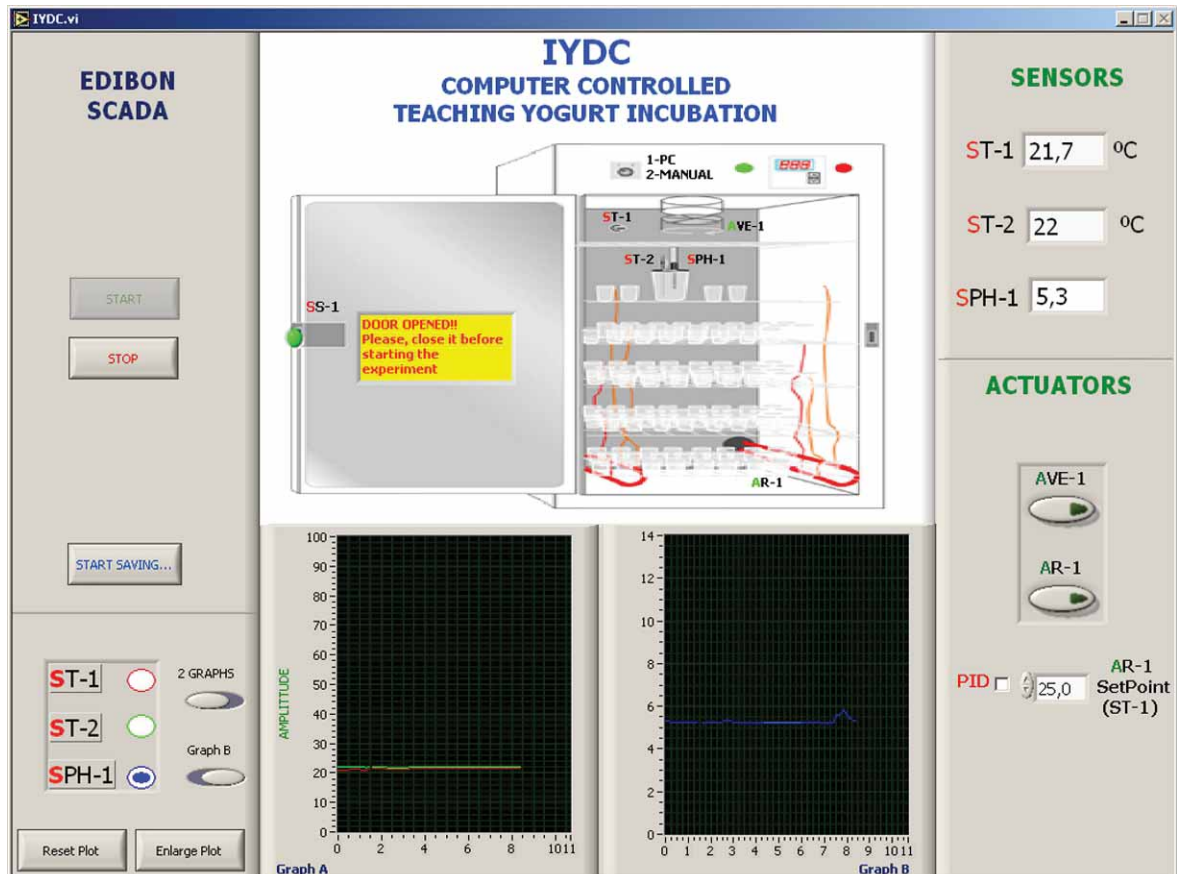
Practical Possibilities of the Unit:
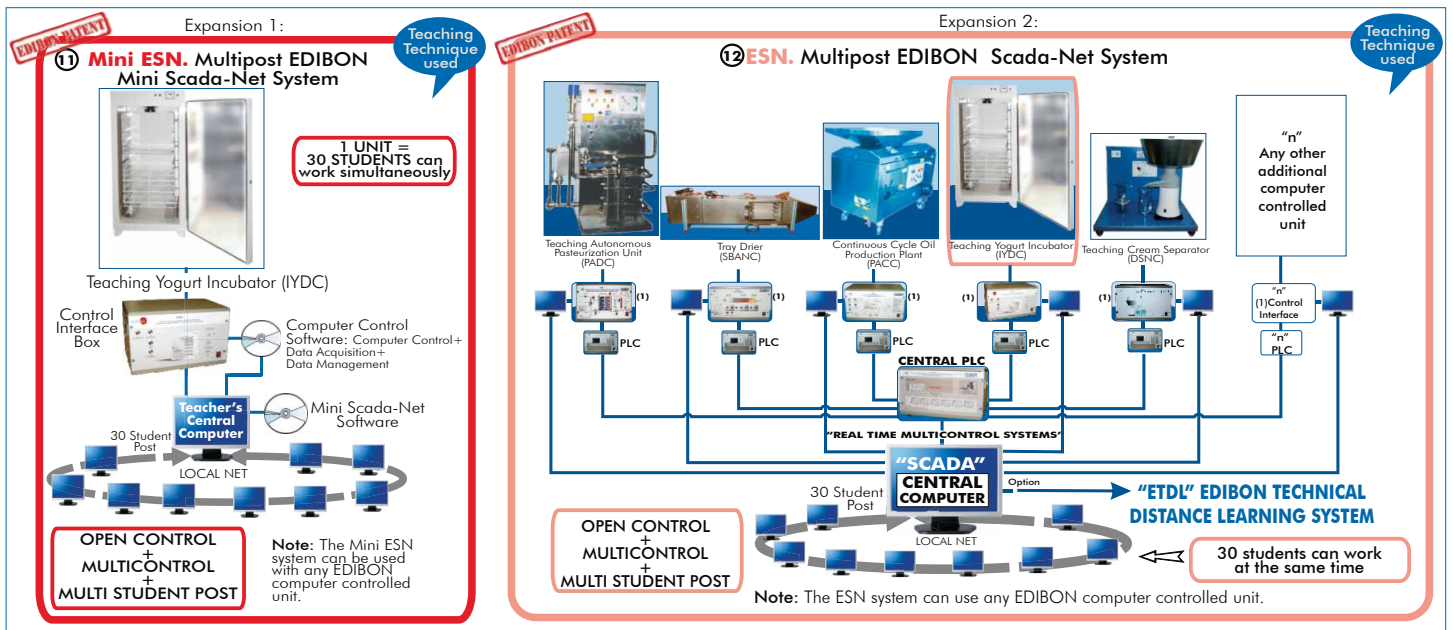
1.- Making of yogurt.
2.- Obtained Yogurt acidity measurements.
3.- Obtained Yogurt viscosity measurements.
4.- Measurement of the two main bacteria used for making yogurt.
5.- Comparison of the results in function of the beaker placement inside of the yogurt incubator.
6.- Viscosity change in function of the yogurt pH.
7.- Differences in yoghurt when using whole milk or skim milk.
8.- Control System. Temperature Sensor Calibration.
9.- Control System. PH Sensor Calibration.

Practices to be done by PLC Module (PLC-PI) + PLC Control Software: 1

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

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

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS

Expansion 1:
⑪ **Mini ESN.** Multipost EDIBON Mini Scada-Net System

Teaching Technique used

1 UNIT = 30 STUDENTS can work simultaneously

Teaching Yogurt Incubator (IYDC)

Control Interface Box

Computer Control Software: Computer Control+ Data Acquisition+ Data Management

Teacher's Central Computer

Mini Scada-Net Software

30 Student Post

LOCAL NET

OPEN CONTROL + MULTICONTROL + MULTI STUDENT POST

Note: The Mini ESN system can be used with any EDIBON computer controlled unit.

Expansion 2:
⑫**ESN.** Multipost EDIBON Scada-Net System

Teaching Technique used

Teaching Autonomous Pasteurization Unit (PADC)
Tray Drier (SBANC)
Continuous Cycle Oil Production Plant (PACC)
Teaching Yogurt Incubator (IYDC)
Teaching Cream Separator (DSNC)

"n" Any other additional computer controlled unit

PLC | PLC | PLC | PLC | PLC

"n" (1)Control Interface

"n" PLC

CENTRAL PLC

"REAL TIME MULTICONTROL SYSTEMS"

"SCADA" CENTRAL COMPUTER

Option

"ETDL" EDIBON TECHNICAL DISTANCE LEARNING SYSTEM

30 Student Post

LOCAL NET

30 students can work at the same time

OPEN CONTROL + MULTICONTROL + MULTI STUDENT POST

Note: The ESN system can use any EDIBON computer controlled unit.

ORDER INFORMATION

Items supplied as standard

Minimum configuration for normal operation includes:
① Unit: IYDC. Teaching Yogurt Incubator.
② IYDC/CIB. Control Interface Box.
③ DAB. Data Acquisition Board.
④ IYDC/CCSOF. Computer Control + Data Acquisition + Data Management Software.
⑤ Cables and Accessories.
⑥ Manuals.

* **IMPORTANT:** Under **IYDC** 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 IYDC/PLC-SOF. PLC Control Software.
⑨ IYDC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request).
⑩ IYDC/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 / 50Hz or 110V / 60Hz, with ground.
- Computer (PC).

RECOMMEND ACCESSORIES

- Analytic balance.
- Flask.
- Containers of glass.
- Lactic ferments.
- Chronometer.
- Thermometer.

DIMENSIONS & WEIGHTS

IYDC Unit: -Dimensions: 610 x 600 x 1400 mm. approx.
-Weight: 100 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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