



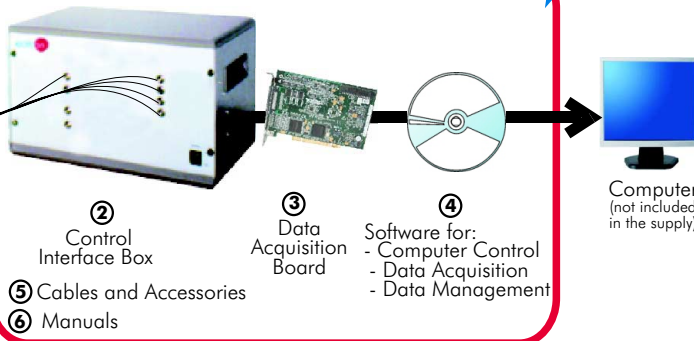
① Unit: TSPC. Saturation Pressure Unit

Always included in the supply:

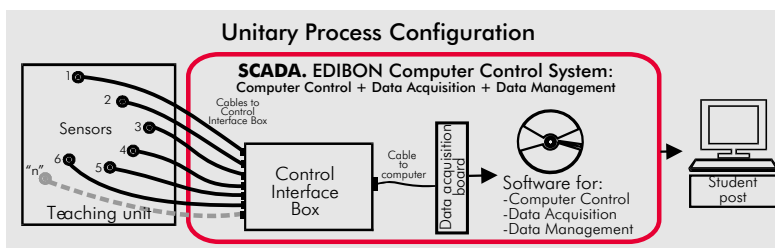
EDIBON PATENT

SCADA. EDIBON Computer Control System

Teaching Technique used



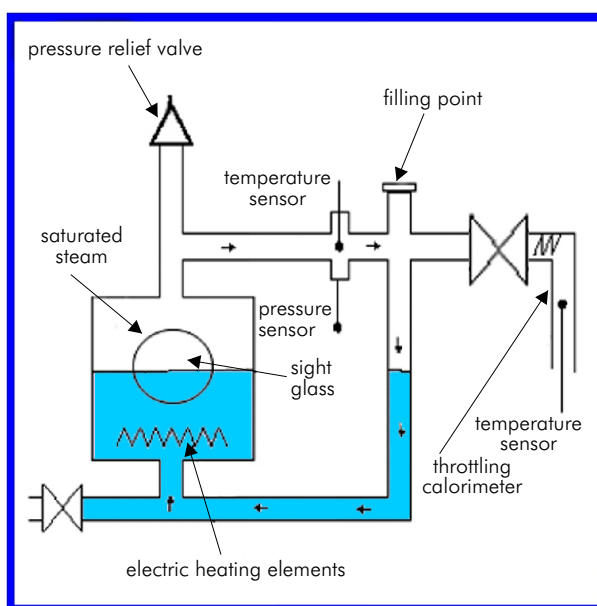
Unitary Process Configuration



www.edibon.com

Products
Products range
Units
9.-Thermodynamics
& Thermotechnics

PROCESS DIAGRAM AND ELEMENTS ALLOCATION



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

DESCRIPTION

The Saturation Pressure Unit has been designed to introduce students to how the temperature of water behaves at its boiling point variation in the absolute pressure. The quality of steam exiting the unit can be determined by a throttling calorimeter connected at the point of discharge. It allows the measurement of the relationship between temperature and pressure of the saturated vapour in the loop. 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.

SPECIFICATIONS

Items supplied as standard

① TSPC. 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.
Boiler vessel and pipe loop with a pressure relief valve to limit the operation pressure to 8 bar gauge and a pressure sensor that indicates the pressure in the unit for safe operation.
Sight glass in the boiler allows observation of the boiling patterns.
Convenient control of heat input to the boiler using variable power control.
2 electric heating elements (500W approx. each one) for heating the boiler, with variable power control and over-temperature protection.
A throttling calorimeter allows the condition of the saturated steam to be determined by measuring the temperature of the steam following throttling to atmospheric pressure.
Temperature sensors, in the pipe and in the throttling calorimeter.
Pressure in the loop is measured using and pressure sensor.



TSPC. Unit

② TSPC/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 pins numbers (from 2 to 16), to avoid connection errors. Single cable between the control interface box and computer.

The unit control elements are permanently computer controlled, without necessity of changes or connections during the whole process test procedure. Simultaneously visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process.

Real time curves representation about system responses. Storage of all the process data and results in a file. Graphic representation, in real time, of all the process/system responses.

All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process. All the actuators and sensors values and their responses are placed in only one computer screen.

Shield and filtered signals to avoid external interferences.

Real time 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 time and in a 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 control interface and the third one in the control software.



TSPC/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)= ± 10 V. Data transfers=DMA, interrupts, programmed I/O. DMA channels=6.

Analog output: Channels=2. Resolution= 16 bits, 1 in 65536. Max. output rate up to: 833 KS/s.

Output range(V)= ± 10 V. Data transfers=DMA, interrupts, programmed I/O.

Digital Input/Output: Channels=24 inputs/outputs. D0 or DI Sample Clock frequency: 0 to 1 MHz.

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



DAB

④ TSPC/CCSOF. Computer Control+ Data Acquisition+ Data Management Software:

Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen. Compatible with the industry standards. Registration and visualization of all process variables in an automatic and simultaneously way. Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.

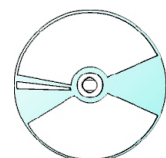
Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second guaranteed. Calibration system for the sensors involved in the process.

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

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

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

This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.



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

Complementary items to the standard supply

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

⑦ PLC-PI. PLC Module:

Circuit diagram in the front panel.

Front panel:

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

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

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

Analog inputs block:

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

Analog outputs block:

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

Touch screen:

High visibility and multiple functions.

Display of a highly visible status.

Recipe function.

Bar graph function.

Flow display function.

Alarm list.

Multi language function.

True type fonts.

Back panel:

Power supply connector.

Fuse 2A.

RS-232 connector to PC.

Inside:

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

Panasonic PLC:

High-speed scan of 0.32 μ sec. for a basic instruction.

Program capacity of 32 Ksteps, with a sufficient comment area.

Free input AC voltage(100 to 240 V AC).

DC input: 16 (24 VDC).

Relay output: 14 (250 VA AC/2 A).

High-speed counter.

Multi-point PID control.

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

Communication RS232 wire, to computer (PC).

⑧ TSPC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.



PLC-PI

Items available on request

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

⑩ TSPC/FSS. Faults Simulation System.

EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

- 1.- Measurement of the relationship between temperature and pressure of the saturated vapour in the loop.
- 2.- Understanding the origin and use of steam tables.
- 3.- Understanding saturation curves.
- 4.- To study the characteristics of a two phase fluid.
- 5.- Using a throttling calorimeter to determine the quality of wet steam.

Saturation Loop:(6 to 13)

- 6.- Observation of the patterns of boiling at the surface of the water.
- 7.- To study the concept of a saturation line.
- 8.- Gauge and absolute pressures.
- 9.- Measurement of the temperature of saturated steam over the range of pressures 0 to 7 bar gauge and comparison of the saturation curves obtained.
- 10.- Temperature scales.
- 11.- Observation of the effect of rate of response on the accuracy of measurement.
- 12.- To study the characteristic behaviour of a two phase fluid.
- 13.- The describing equation and linearisation.

Throttling Calorimeter: (14 to 18)

- 14.- Determination of the condition of the wet steam (quality of the steam) produced by the saturation pressure unit at different operating pressures.
- 15.- The two property rule.
- 16.- The difference in enthalpy between phases-enthalpy of vaporisation.
- 17.- Use of steam tables.
- 18.- Use of the steady flow energy equation.

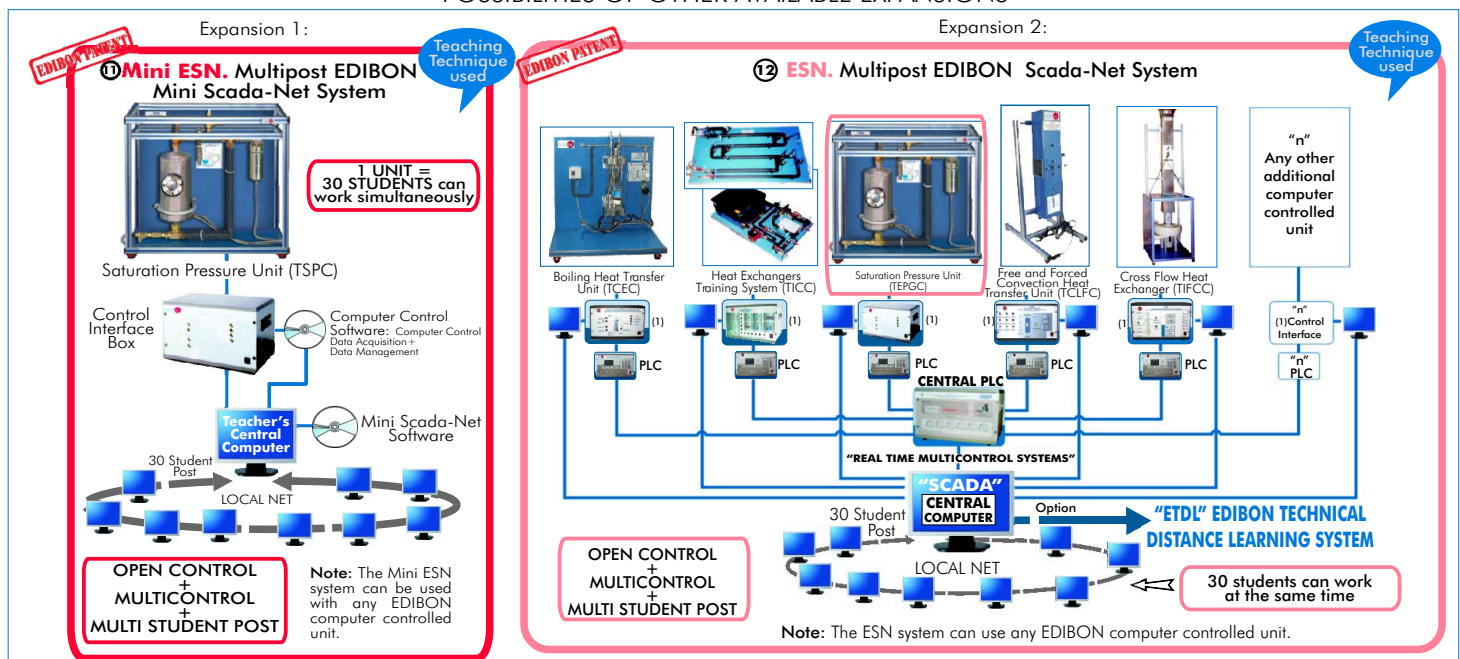
Other possible practices:

- ## 19.- Sensors calibration.

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

- 20.- Control of the TSPC unit process through the control interface box without computer.
- 21.- Visualization of all the sensors values used in TSPC unit process.
- 22.- Calibration of all sensors included in TSPC unit process.
- 23.- Hand on of all the actuators involved in the TSPC 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 the TSPC unit.
- 28.- PLC structure.
- 29.- PLC inputs and outputs configuration.
- 30.- PLC configuration possibilities.
- 31.- PLC program languages.
- 32.- PLC different programming standard languages (literal structured, graphic, etc.).
- 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 TSPC unit process.
- 36.- Possibility of creating new process in relation with the TSPC 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: TSPC. Saturation Pressure Unit.
- ② TSPC/CIB. Control Interface Box.
- ③ DAB. Data Acquisition Board.
- ④ TSPC/CCSOF. Computer Control + Data Acquisition + Data Management Software.
- ⑤ Cables and Accessories, for normal operation.
- ⑥ Manuals.

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

Complementary items to the standard supply

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

- ⑦ PCL-PI.PLC Module.
- ⑧ TSPC/PLC-SOF. PLC Control Software.
- ⑨ TSPC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request).
- ⑩ TSPC/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.
Water supply.
Computer (PC).

DIMENSIONS & WEIGHTS

TSPC Unit :	-Dimensions: 700 x 400 x 600 mm. approx. -Weight: 40 Kg. approx.
Control Interface Box:	-Dimensions: 490 x 330 x 310 mm. approx. -Weight: 10 Kg. approx.
PLC Module (PLC-PI):	-Dimensions: 490 x 330 x 310 mm. approx. -Weight: 30 Kg. approx.

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



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

Issue: ED01/09
Date: December/2009

REPRESENTATIVE: