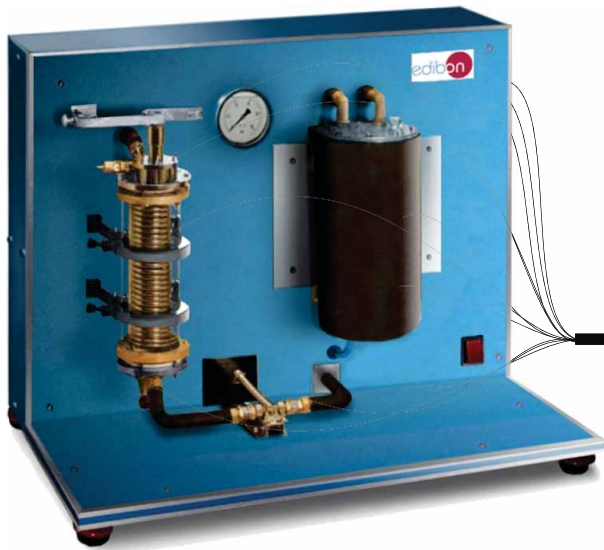
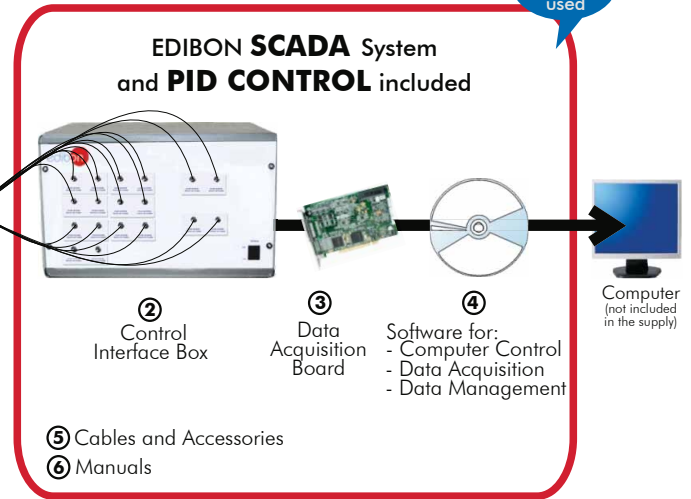




Teaching Technique used



① Unit: HTVC. Solar/Heat Source Vapour Turbine

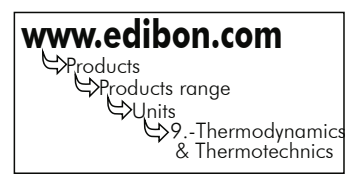


*Minimum supply always includes: 1 + 2 + 3 + 4 + 5 + 6
(Computer not included in the supply)

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**



For more information about Key Features, click here:



DESCRIPTION

This unit has been designed to provide an easily understood vapour power plant and to demonstrate, on a lab scale, the ability to produce shaft power from Solar Radiation.

It is a compact and bench-top unit, using R141b refrigerant and operating on the Rankine Cycle from a hot water heat source within the unit. Mechanical output is from a single stage impulse turbine and heat is rejected to a water cooled condenser.

With the unit it is supplied a Control Interface Box, a Data Acquisition Board and a Computer Control + Data Acquisition + Data Management Software to control all process and parameters.

Optional solar panels and installation kit to enable the unit to operate from solar energy are available.

SPECIFICATIONS

① HTVC. Unit:

Compact and bench-top unit, using R141b refrigerant.
Anodized aluminium structure and panels in painted steel.
Panels and main metallic elements in stainless steel.
Diagram in the front panel with similar distribution to the elements in the real unit.
Vapour generator: copper generating coil in water filled tank with thermostatically controlled heater.
Single stage impulse turbine, power output 35W at 20000 rev. min⁻¹ approx.
Condenser: water cooled coil housed in a chamber.
Feed pump (single acting plunger pump).
Accumulator.
Circulating pump to circulate water through vapour generator tank and solar panels.
Up to 12 Temperature sensors. 2 Pressure sensors. Flow sensors.
Torque and speed measurement.
High pressure cut-out.

OPTIONAL ACCESSORY: (not included in the standard supply)

Solar Panels and Installation Kit:

Two solar panels. Water flow sensor. Temperature sensors. Expansion tank. Pipe, fittings, etc.

② HTVC/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.

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)= ±1.0V. Data transfers=DMA, interrupts, programmed I/O. N° of DMA channels=6.

Analog output:

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

Output range(V)= ±1.0V. Data transfers=DMA, interrupts, programmed I/O.

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.

④ HTVC/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.

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

Items supplied as standard



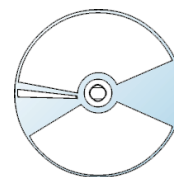
HTVC. Unit



HTVC/CIB



DAB



HTVC/CCSOF

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 HTVC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.



PLC-PI

Items available on request

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

⑩ HTVC/FSS. Faults Simulation System.

EXERCISES AND PRACTICAL POSSIBILITIES

Practical Possibilities of the Unit:

- 1.-Production of torque/speed and power/speed curves for the turbine.
- 2.-Easy and clearly observed demonstration of a classic Rankine cycle.
- 3.-Determination of thermal efficiency at a range of turbine inlet and exhaust pressures.
- 4.-Use of property charts or tables and the application of the First Law of Thermodynamics to produce energy balances.
- 5.-Estimation of total frictional losses in turbines.
- 6.-Comparison of performance with the Rankine Cycle, (including the external isentropic efficiency of turbines).

Other possible practices:

- 7.-Sensors Calibration.

Possible Practices with OPTIONAL Solar Panels:

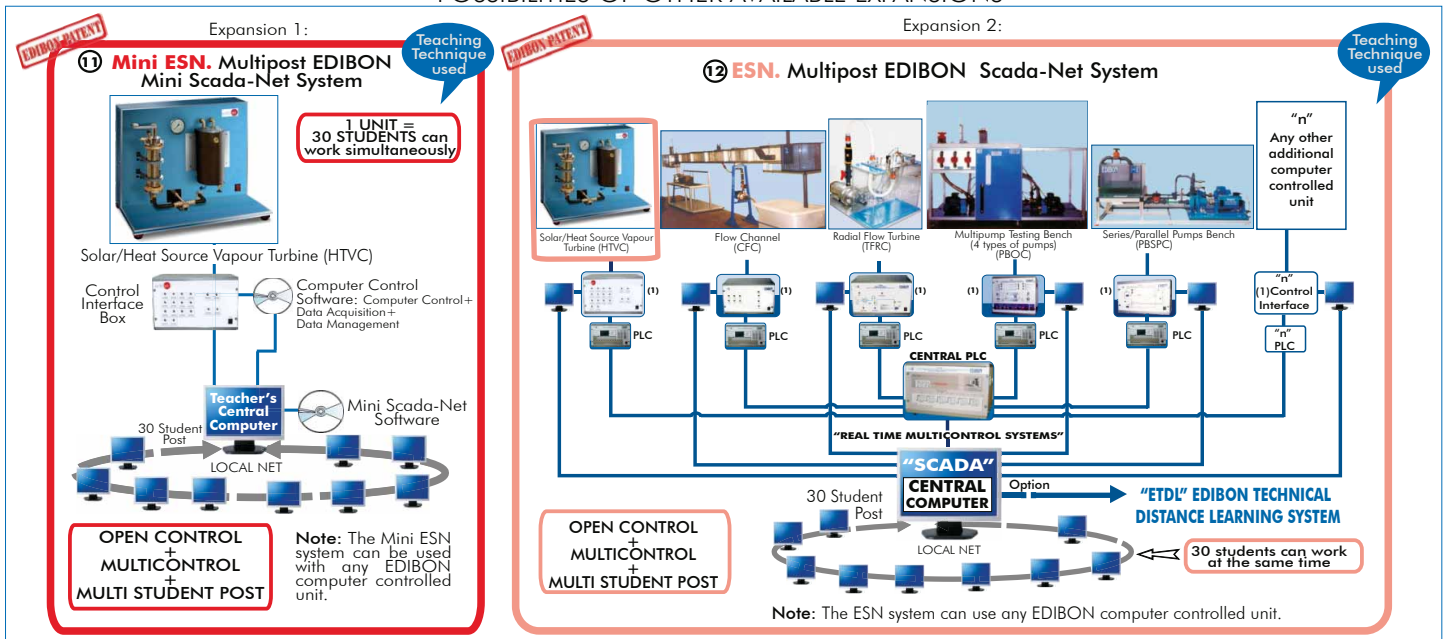
- 8.-Measurement of the solar energy collection at a range of mean water temperatures.
- 9.-Demonstration of the production of shaft work from solar radiation.

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

- 10.-Control of the HTVC unit process through the control interface box without the computer.
- 11.-Visualization of all the sensors values used in the HTVC unit process.
- 12.-Calibration of all sensors included in the HTVC unit process.
- 13.-Hand on of all the actuators involved in the HTVC 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 HTVC 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 HTVC unit process.
- 26.-Possibility of creating new process in relation with the HTVC unit.
- 27.-PLC Programming Exercises.
- 28.-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: HTVC. Solar/Heat Source Vapour Turbine.
- ② HTVC/CIB.Control Interface Box.
- ③ DAB.Data Acquisition Board.
- ④ HTVC/CCSOF. Computer Control + Data Acquisition + Data Management Software.
- ⑤ Cables and Accessories.
- ⑥ Manuals.

*** IMPORTANT: Under HTVC 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 HTVC/PLC-SOF. PLC Control Software.
- ⑨ HTVC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request)
- ⑩ HTVC/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).

OPTIONAL ACCESSORIES

- Solar Panels and Installation Kit.

DIMENSIONS & WEIGHTS

- HTVC Unit: -Dimensions: 1000 x500 x925 mm. approx.
-Weight :80 Kg. approx.
- Control Interface Box: -Dimensions: 490x330x310 mm. approx.
-Weight: 10 Kg. approx.
- PLC Module (PLC-PI): -Dimensions: 490x330x310 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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