edibon

Technical Teaching Equipment

Always included in the supply:

Teaching Technique used

SCADA. EDIBON Computer Control System

② Control Interface Box

③ Data Acquisition Board

④ Software for:
- Computer Control
- Data Acquisition
- Data Management

⑤ Cables and Accessories

⑥ Manuals

Computer (not included in the supply)

① Unit: TAAUC. Automobile Air Conditioning Trainer

Unitary Process Configuration

SCADA. EDIBON Computer Control System:
Computer Control + Data Acquisition + Data Management

Sensors

1
2
3
4
5
"n"
6

Cables to Control Interface Box

Teaching unit

Control Interface Box

Cable to computer

Data acquisition board

Software for:
- Computer Control
- Data Acquisition
- Data Management

Student post

www.edibon.com
- Products
- Products range
- Units
- 9.-Thermodynamics & Thermotechnics

PROCESS DIAGRAM AND ELEMENTS ALLOCATION
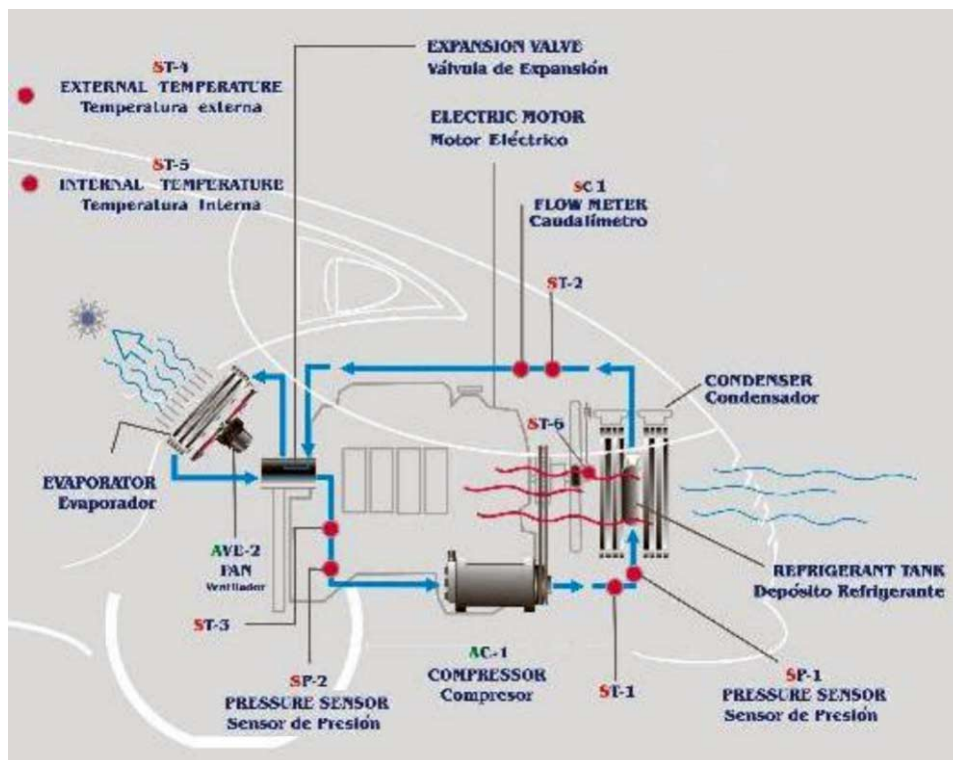
OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

EXPANSION VALVE
Válvula de Expansión

ELECTRIC MOTOR
Motor Eléctrico

ST-4
EXTERNAL TEMPERATURE
Temperatura externa

ST-5
INTERNAL TEMPERATURE
Temperatura Interna

SC 1
FLOW METER
Caudalímetro

ST-2

ST-6

CONDENSER
Condensador

EVAPORATOR
Evaporador

REFRIGERANT TANK
Depósito Refrigerante

AVE-2
FAN
Ventilador

ST-3

SP-2
PRESSURE SENSOR
Sensor de Presión

AC-1
COMPRESSOR
Compresor

ST-1

SP-1
PRESSURE SENSOR
Sensor de Presión

Available sensors in the TAAUC unit:

Identification	Description
ST-1	Temperature sensor, type "J".
ST-2	Temperature sensor, type "J".
ST-3	Temperature sensor, type "J".
ST-4	Temperature sensor, type "J".
ST-5	Temperature sensor, type "J".
SP-1	Absolute pressure sensor.
SP-2	Absolute pressure sensor.
SC-1	Flow sensor.

Available activations in the TAAUC unit:

Identification	Description
AC-1	Compressor.
AV-1	Radiator inlet fan.
AV-1	Radiator inlet fan.
AV-2	Automobile inlet fan (Fan Control).
-	Circulator (it cools the internal air of the automobile or the air coming from the outside).
-	Engine speed (automobile engine speed).

5 actuators and 8 sensors controlled from any computer, and working simultaneously

The automobile air conditioning unit (TAAUC) introduces the student into the world of the air conditioning installations, as well as allows studying and determining the optimum parameters for the unit functioning with regards to the basic functions of an automobile.

This unit is composed basically by a compressor which is triggered by an engine which simulates the automobile engine. The air enters by the fans through the condenser inside the cooling system, in order to suffer a cooling cycle through this system.

The unit has been designed to study not only the air conditions change, but also the cooling circuit, by placing strategicaly temperature and pressure sensors and flowmeters which enable us to study the cooling cycle.

This computer controlled unit (TAAUC) is provided with 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.

Items supplied as standard

① **TAAUC. Unit:**
   Bench-top unit.
   Anodized aluminium structure.
   Panels and main metallic elements in stainless steel.
   Diagram in the front panel with similar distribution that the elements in the real unit.
   2 Fans with speed control by computer.
   Condenser.
   Compressor, computer controlled.
   Filter.
   Electrical engine with speed control by computer. (It simulates the car combustion motor)
   Evaporator.
   Expansion valve.
   Refrigerant tank.
   5 Temperature sensors, type "J".
   2 Absolute pressure sensors.
   Flow sensor(refrigerant).
   Automobile control panel (including in the control interface box).
   Ventilation motors visualization (including in the control interface box).
   Enthalpy diagram R134a.

TAAUC Unit

② **TAAUC/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 for -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.
   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 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 time and in a real time , of parameters involved in the process simultaneously.
   Three safety levels, one mechanical in the unit, other electronic in control interface and the third one in the control software.
   Automobile control panel.
   Ventilation motors visualization section.

TAAUC/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 **TAAUC/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.
   Student calibration system for all 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 to 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.

TAAUC/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.

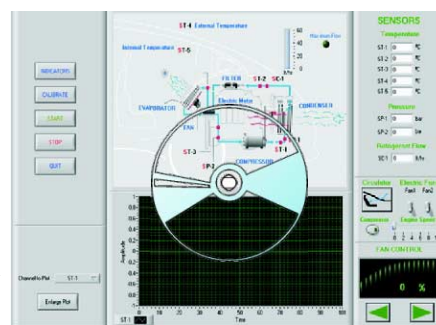✱ **References 1 to 6: TAAUC + TAAUC/CIB + DAB + TAAUC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply, enabling a normal operation.**

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 μsec. 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 V DC).

Relay output: 14 (250 V A 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 **TAAUC/PLC-SOF. PLC Control Software:**

For this particular unit, always included with PLC supply.

PLC-PI

Items available on request

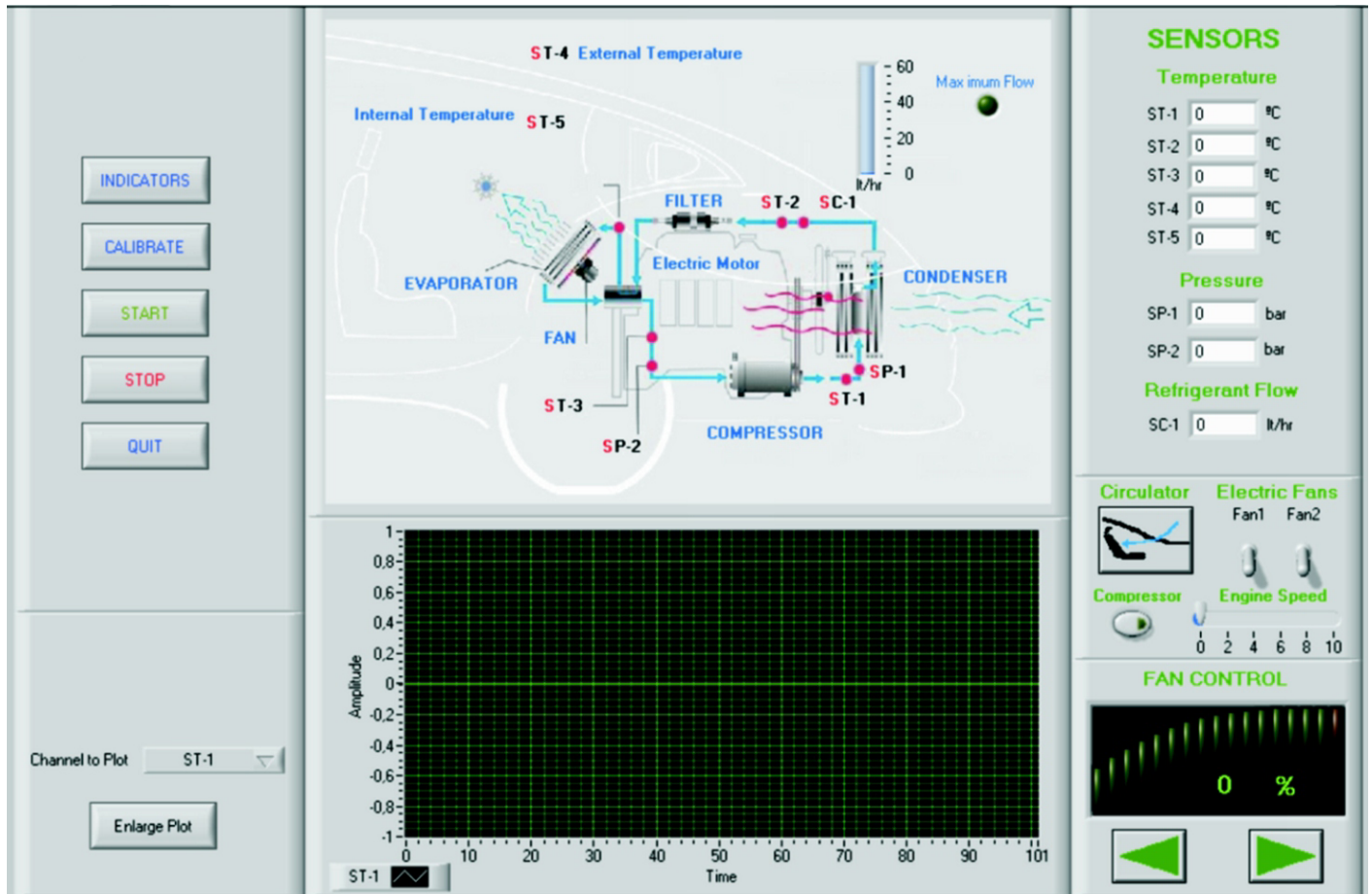⑨ **TAAUC/CAL. Computer Aided Learning Software (Results Calculation and Analysis)**.
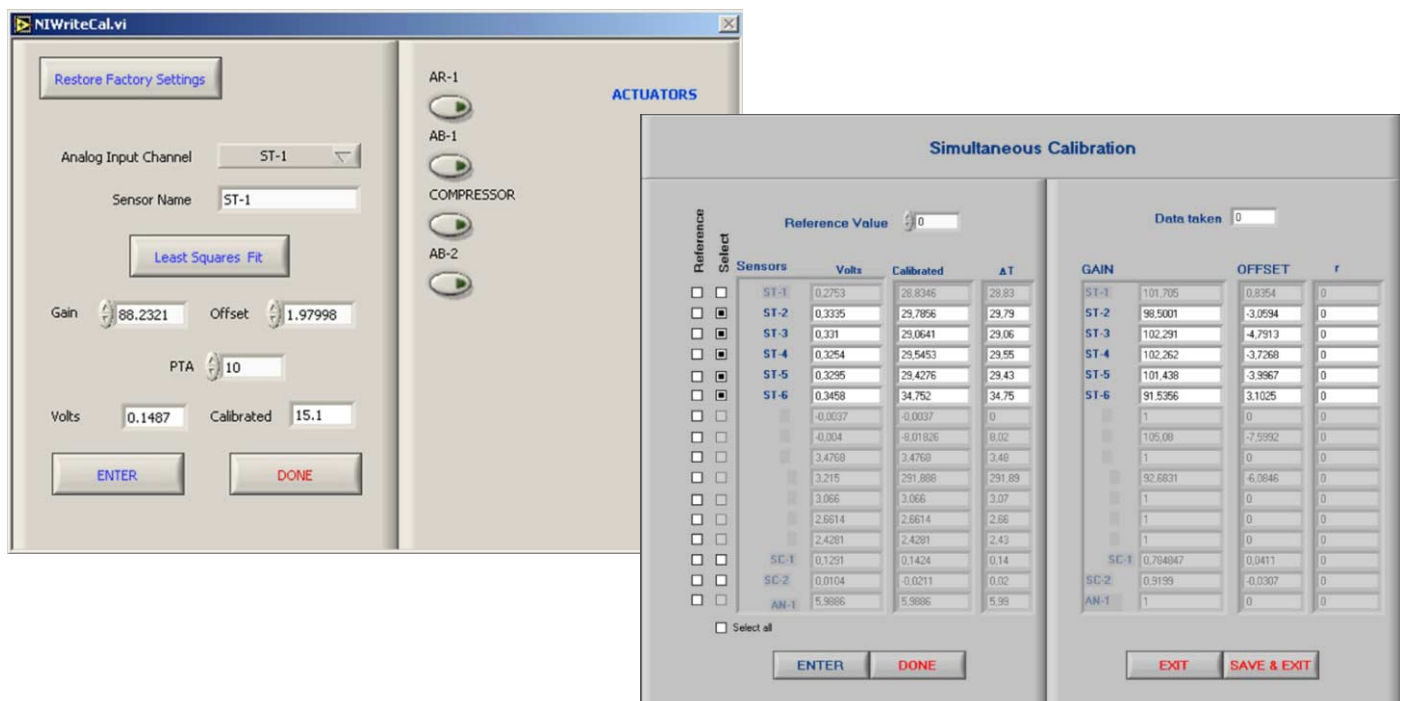
⑩ **TAAUC/FSS. Faults Simulation System.**
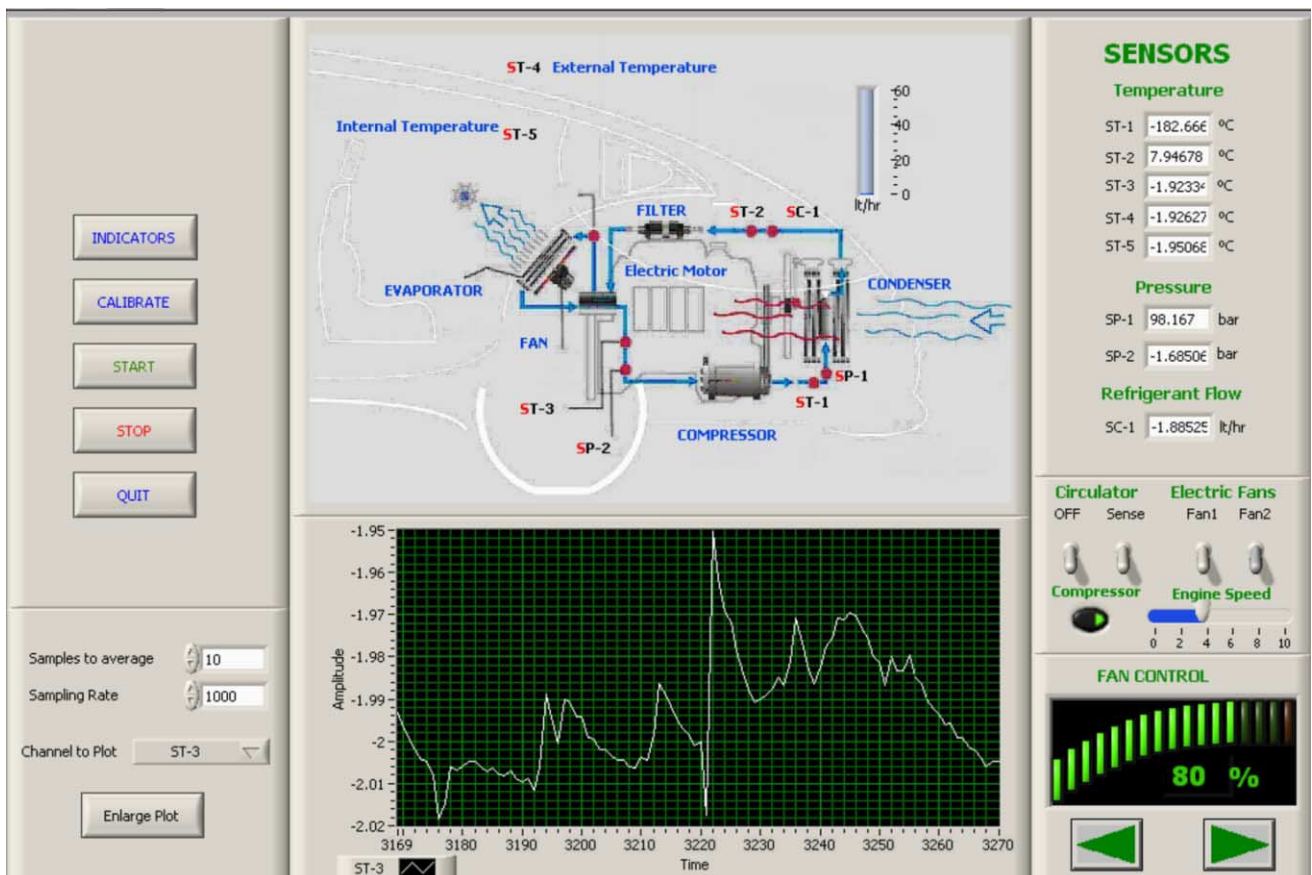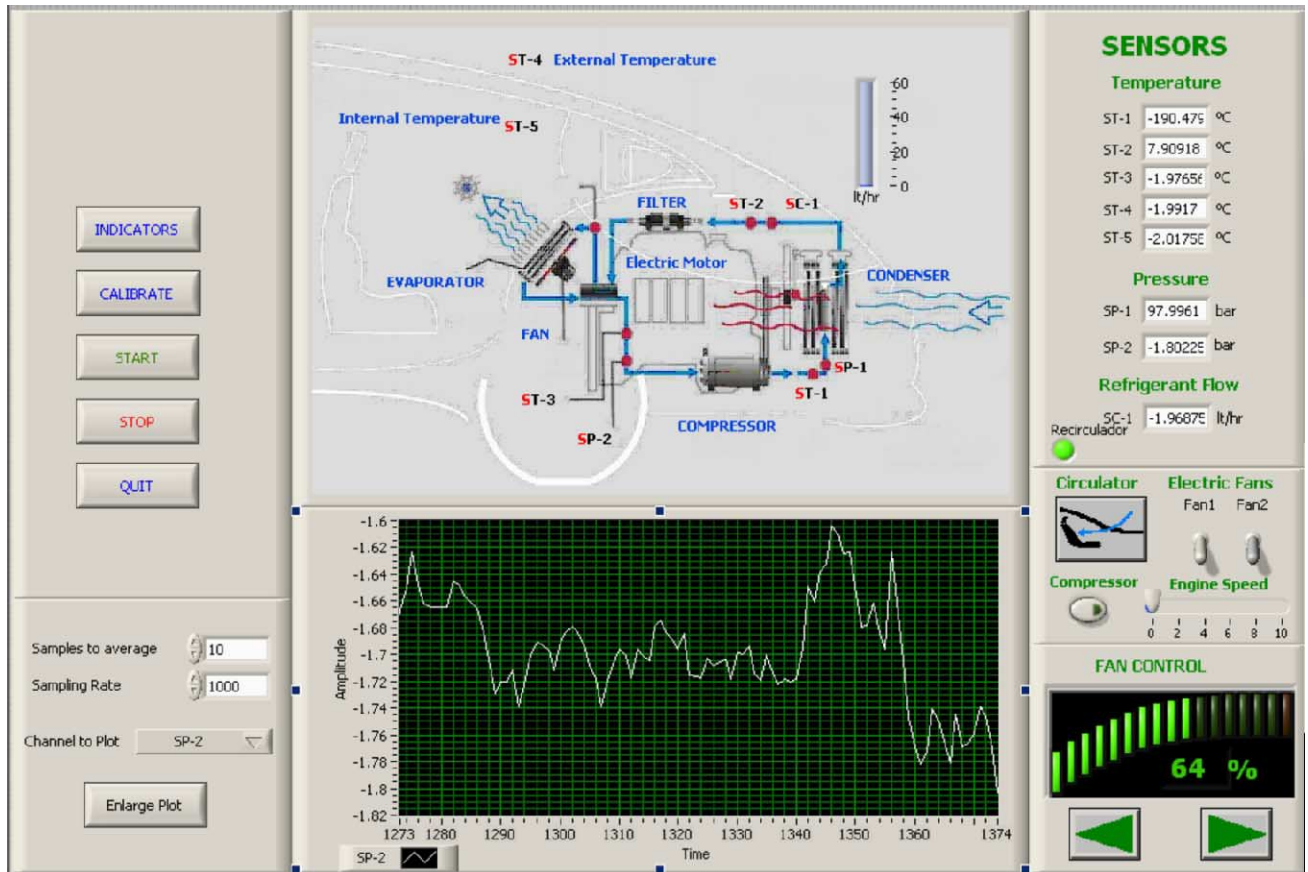
Software Main Screens

Main screen

SENSORS

Temperature

ST-1	0	ºC
ST-2	0	ºC
ST-3	0	ºC
ST-4	0	ºC
ST-5	0	ºC

Pressure

SP-1	0	bar
SP-2	0	bar

Refrigerant Flow

SC-1	0	lt/hr

INDICATORS
CALIBRATE
START
STOP
QUIT

Channel to Plot   ST-1

Enlarge Plot

ST-4 External Temperature
Internal Temperature ST-5
Maximum Flow
FILTER ST-2 SC-1
Electric Motor
EVAPORATOR
CONDENSER
FAN
ST-3
SP-1
ST-1
COMPRESSOR
SP-2

Circulator   Electric Fans
Fan1 Fan2
Compressor   Engine Speed
0 2 4 6 8 10

FAN CONTROL
0 %

Note: ST= Temperature sensor.   SP=Pressure sensor.   SC=Flow sensor.

Examples of Sensors Calibration screens

NIWriteCal.vi

Restore Factory Settings

Analog Input Channel   ST-1
Sensor Name   ST-1

Least Squares Fit

Gain 88.2321   Offset 1.97998

PTA 10

Volts 0.1487   Calibrated 15.1

ENTER   DONE

AR-1
AB-1   **ACTUATORS**
COMPRESSOR
AB-2

Simultaneous Calibration

Reference Value 0   Data taken 0

Reference	Select	Sensors	Volts	Calibrated	ΔT		GAIN	OFFSET	r
☐	☐	ST-1	0,2753	28,8346	28,83		ST-1	101,705	0,8354	0
☐	☑	ST-2	0,3335	29,7856	29,79		ST-2	98,5001	-3,0594	0
☐	☑	ST-3	0,331	29,0641	29,06		ST-3	102,291	-4,7913	0
☐	☑	ST-4	0,3254	29,5453	29,55		ST-4	102,262	-3,7268	0
☐	☑	ST-5	0,3295	29,4276	29,43		ST-5	101,438	-3,9967	0
☐	☑	ST-6	0,3458	34,752	34,75		ST-6	91,5356	3,1025	0
☐	☐		-0,0037	-0,0037	0			1	0	0
☐	☐		-0,004	-8,01826	8,02			105,08	-7,5992	0
☐	☐		3,4769	3,4768	3,48			1	0	0
☐	☐		3,215	291,888	291,89			92,6831	-6,0846	0
☐	☐		3,066	3,066	3,07			1	0	0
☐	☐		2,6614	2,6614	2,66			1	0	0
☐	☐		2,4281	2,4281	2,43			1	0	0
☐	☐	SC-1	0,1291	0,1424	0,14		SC-1	0,764847	0,0411	0
☐	☐	SC-2	0,0104	-0,0211	0,02		SC-2	0,9199	-0,0307	0
☐	☐	AN-1	5,9886	5,9886	5,99		AN-1	1	0	0

☐ Select all

ENTER   DONE   EXIT   SAVE & EXIT

Some typical exercises results

EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

1.- General use of the air conditioning: Manual /Auto modes.
2.- Cooling with and without internal circulation.
3.- Speed of the automobile engine.
4.- Cooling in function of the radiator fans.
5.- Cooling in function of the automobile inlet fan.
6.- Energy balance in the evaporator.
7.- Matter balance in the evaporator.
8.- Experimental determination of the specific calorific capacity of the air.
9.- Optimum determination of the parameters involved in an air conditioning process.
10.- Temperature sensors calibration.
11.- Absolute pressure sensors calibration.

Other possible practices:

12.- Use of a psychometric map.
13.- Properties of the coolant R134a.
14.- Enthalpy diagram - pressure of the R134a.

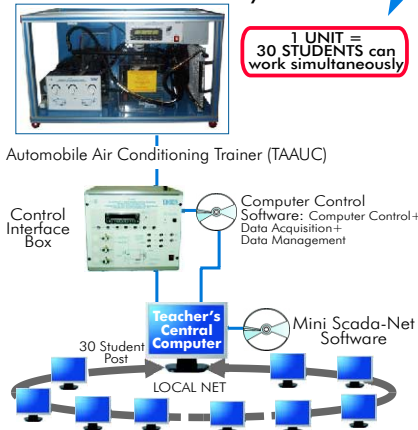Practices to be done by PLC Module (PLC-PI) + PLC Control Software:

15.- Control of the TAAUC unit process through the control interface box without the computer.
16.- Visualization of all the sensors values used in the TAAUC unit process.
17.- Calibration of all sensors included in the TAAUC unit process.
18.- Hand on of all the actuators involved in the TAAUC unit process.

19.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).
20.- 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).
21.- PLC hardware general use and manipulation.
22.- PLC process application for TAAUC unit.
23.- PLC structure.
24.- PLC inputs and outputs configuration.
25.- PLC configuration possibilities.
26.- PLC program languages.
27.- PLC different programming standard languages (literal structured, graphic, etc.).
28.- New configuration and development of new process.
29.- Hand on an established process.
30.- To visualize and see the results and to make comparisons with the TAAUC unit process.
31.- Possibility of creating new process in relation with the TAAUC unit.
32.- PLC Programming Exercises.
33.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS

Expansion 1:

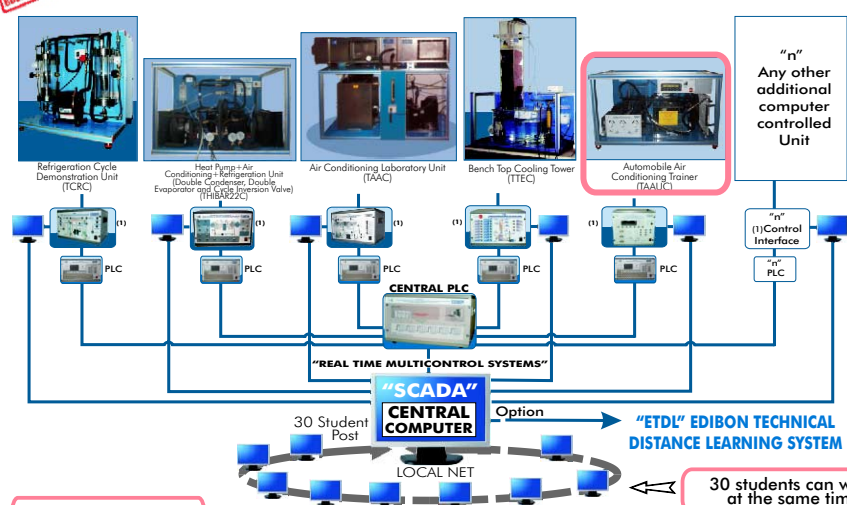⑪ **Mini ESN.** Multipost EDIBON Mini Scada-Net System

1 UNIT = 30 STUDENTS can work simultaneously

Automobile Air Conditioning Trainer (TAAUC)

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

Refrigeration Cycle Demonstration Unit (TCRC)
Heat Pump+Air Conditioning+Refrigeration Unit (Double Condenser, Double Evaporator and cycle inversion Valve) (THIBAR22C)
Air Conditioning Laboratory Unit (TAAC)
Bench Top Cooling Tower (TTEC)
Automobile Air Conditioning Trainer (TAAUC)

"n" Any other additional computer controlled Unit

CENTRAL PLC

"REAL TIME MULTICONTROL SYSTEMS"

"SCADA" CENTRAL COMPUTER

30 Student Post

LOCAL NET

Option

"ETDL" EDIBON TECHNICAL DISTANCE LEARNING SYSTEM

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: TAAUC. Automobile Air Conditioning Trainer.
② TAAUC/CIB.Control Interface Box.
③ DAB.Data Acquisition Board.
④ TAAUC/CCSOF. Computer Control + Data Acquisition + Data Management Software.
⑤ Cables and Accessories.
⑥ Manuals.

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

RECOMMENDED ACCESSORIES

For refilling R134a refrigerant and maintenance, we recommend:
- T/KIT1. Maintenance Kit, containing: vacuum pump, hoses and manometers.
- T/KIT2. Maintenance Kit, containing: leakage detector.
- R134a refrigerant (to be acquired by the customer locally).

DIMENSIONS & WEIGHTS

TAAUC Unit:	- Dimensions: 1560 x 860 x 760 mm. approx.
	- Weight: 100 Kg. approx.
Control Interface Box:	- Dimensions: 490 x 450 x 470 mm. approx.
	- Weight: 20 Kg. approx.
PLC Module (PLC-PI):	- Dimensions: 490 x 330 x 310 mm. approx.
	- Weight: 30 Kg. approx.

AVAILABLE VERSIONS

Offered in this catalogue:

- **TAAUC.** Computer Controlled **Automobile Air Conditioning Trainer.**

Offered in other catalogue:

- **TAAU. Automobile Air Conditioning Trainer.**

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

REPRESENTATIVE: