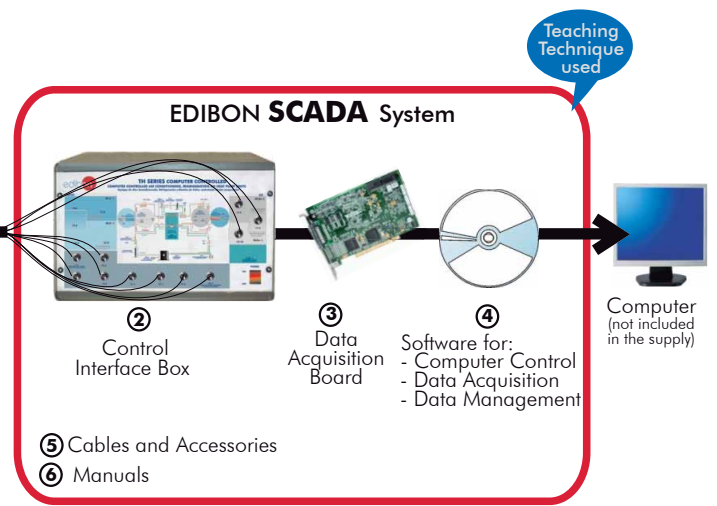


EDIBON PATENT



① Unit: THBAAC. Heat Pump Unit (one condenser (air) and one evaporator (air))



\*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](http://www.edibon.com)

- ↳ Products
- ↳ Products range
- ↳ Units
- ↳ 9.-Thermodynamics & Thermotechnics

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)

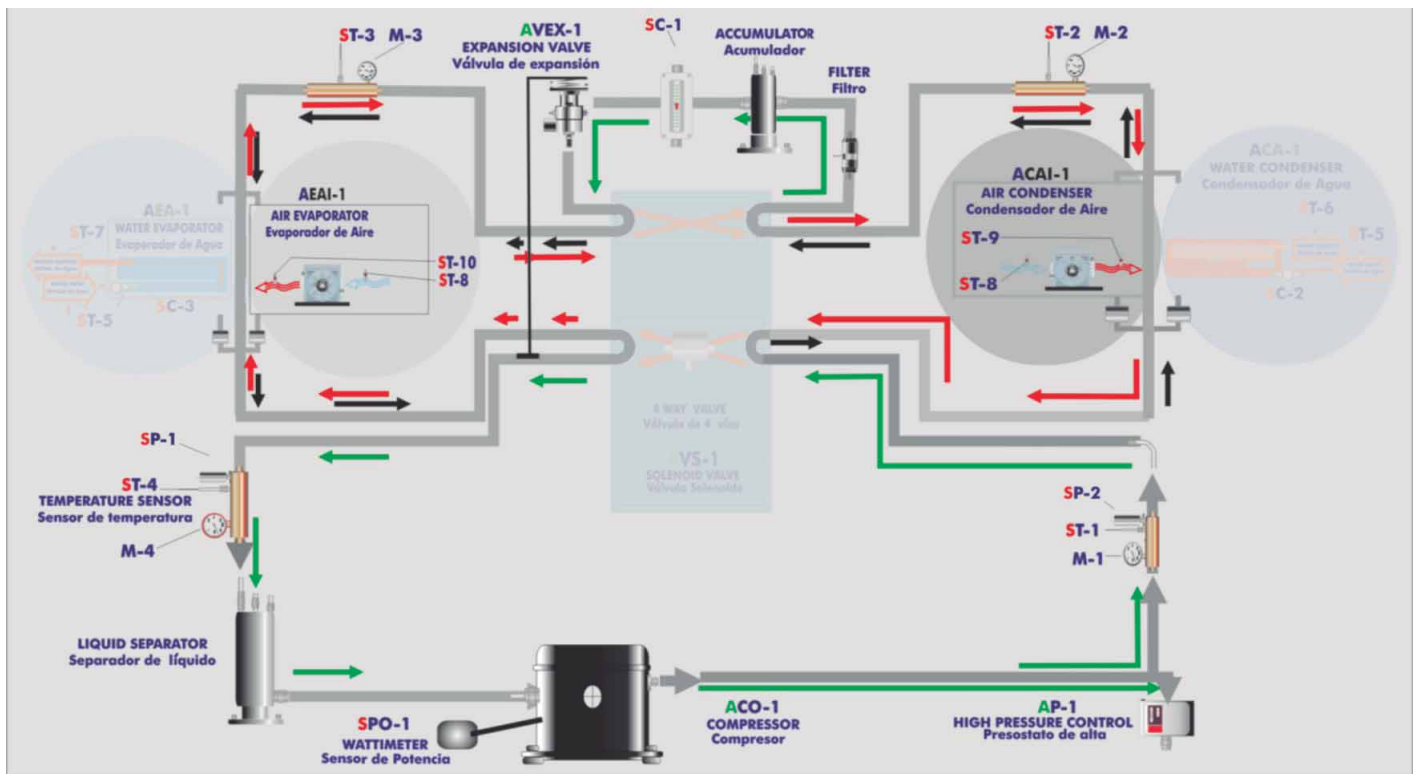


Certificates ISO 14000 and  
ECO-Management and Audit Scheme  
(environmental management)



Worlddidac Quality Charter  
Certificate  
(Worlddidac Member)

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



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

**Items supplied as standard**

① **THBAAC. Unit:**

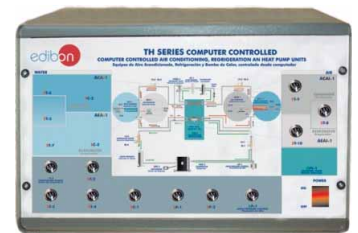
- Bench-top unit.
- Anodized aluminium structure and panels in painted steel.
- Main metallic elements in stainless steel.
- Diagram in the front panel with similar distribution to the elements in the real unit.
- Cooling compressor, computer controlled.
- Air condenser, computer controlled.
- High pressure control.
- Coolant accumulation tank.
- Cooling filter.
- Expansion valve.
- Air evaporator, computer controlled.
- Tank of division of the cooling liquid.
- 4 Manometers.
- 7 Temperature sensors:
  - Temperature sensor, J type (compressor outlet).
  - Temperature sensor, J type (condenser outlet).
  - Temperature sensor, J type (evaporator inlet).
  - Temperature sensor, J type (compressor inlet).
  - Temperature sensor, J type (room air).
  - Temperature sensor, J type (condenser outlet/air).
  - Temperature sensor, J type (evaporator outlet/air).
- Flow sensor.
- 2 Pressure sensors:
  - Cooling pressure sensor (compressor outlet).
  - Cooling pressure sensor (compressor inlet).
- Wattmeter.
- Enthalpy diagram of the refrigerant R134a.



THBAAC. Unit

② **THBAAC/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 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.



THBAAC/CIB

③ **DAB. Data Acquisition Board:**

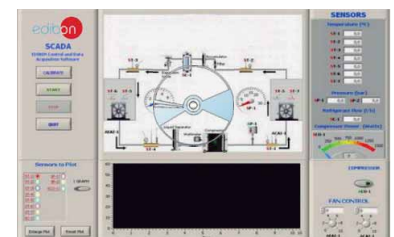
- PCI Data acquisition board (National Instruments) to be placed in a computer slot. Bus PCI.
- Analog input: Channels= 16 single-ended or 8 differential. Resolution= 16 bits, 1 in 65536.
  - Sampling rate up to: 250 KS/s (Kilo samples per second). Input range (V)=±1 0V.
  - Data transfers=DMA, interrupts, programmed I/O. Number of DMA channels=6.
- Analog output: Channels=2. Resolution= 16 bits, 1 in 65536. Maximum output rate up to: 833 KS/s.
  - Output range(V)=±1 0V. 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 **THBAAC/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.
- 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 as 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.



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

Continue...

**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 THBAAC/PLC-SOF. PLC Control Software:**

For this particular unit, always included with PLC supply.



PLC-PI

**Items available on request**

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

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

Software Main Screens

Main screen

The main screen displays the EDIBON SCADA interface. On the left, there are control buttons: CALIBRATE, START, STOP, and QUIT. Below these is a 'Sensors to Plot' section with a list of sensors (ST-1 to ST-7, SP-1 to SP-2, SC-1, ACO-1) and a '1 GRAPH' indicator. The central part of the screen shows a schematic diagram of a refrigeration cycle with components like the Expansion Valve, Accumulator, Filter, Compressor, Liquid Separator, Watermeter, and various sensors (ST-1 to ST-7, SC-1, ACO-1, AEAI-1, ACAI-1). Two pressure gauges (SP-1, SP-2) and a refrigerant flow gauge (SC-1) are also visible. On the right, there are several sensor readouts: Temperature (°C) for ST-1 to ST-7, Pressure (bar) for SP-1 and SP-2, Refrigerant Flow (l/h) for SC-1, and Compressor Power (Watts) for ACO-1. At the bottom right, there are 'COMPRESSOR' and 'FAN CONTROL' sections with sliders and buttons for AEAI-1 and ACAI-1.

Note: ST= Temperature sensor. SP= Pressure sensor. SC= Flow sensor. ACO-1=Compressor. AEAI-1= Air evaporator. ACAI-1= Air condenser.

Examples of Sensors Calibration screens

The calibration interface consists of two main windows. The first window, titled 'WriteCal\_Adlink.vi', shows settings for an analog input channel (ST-1) and sensor name. It includes a 'Least Squares Fit' button, gain (709.058) and offset (-18.1623) sliders, points to average (100), and current voltage (0.37607) and calibrated (248.498) values. The second window, titled 'Simultaneous Calibration', displays a table of sensor calibration data. The table has columns for Reference Value, Sensors, Volts, Calibrated, and ΔT. A 'Data taken' field is set to 0. The table lists various sensors and their corresponding values.

Reference Value	Sensors	Volts	Calibrated	ΔT
<input type="checkbox"/>	ST-1	0.2753	29.8346	29.83
<input checked="" type="checkbox"/>	ST-2	0.3335	29.7856	29.79
<input checked="" type="checkbox"/>	ST-3	0.331	29.0641	29.06
<input checked="" type="checkbox"/>	ST-4	0.3254	29.5453	29.55
<input checked="" type="checkbox"/>	ST-5	0.3295	29.4276	29.43
<input checked="" type="checkbox"/>	ST-6	0.3458	34.752	34.75
<input type="checkbox"/>		-0.0037	-0.0037	0
<input type="checkbox"/>		4.004	-8.01826	8.02
<input type="checkbox"/>		3.4769	3.4769	3.48
<input type="checkbox"/>		3.215	291.888	291.89
<input type="checkbox"/>		3.066	3.066	3.07
<input type="checkbox"/>		2.6614	2.6614	2.66
<input type="checkbox"/>		2.4281	2.4281	2.43
<input checked="" type="checkbox"/>	SC-1	0.1251	0.1424	0.14
<input checked="" type="checkbox"/>	SC-2	0.0104	-0.0211	0.02
<input checked="" type="checkbox"/>	AN-1	5.9085	5.9085	5.99

The 'Simultaneous Calibration' window also includes a table for GAIN, OFFSET, and r values for each sensor.

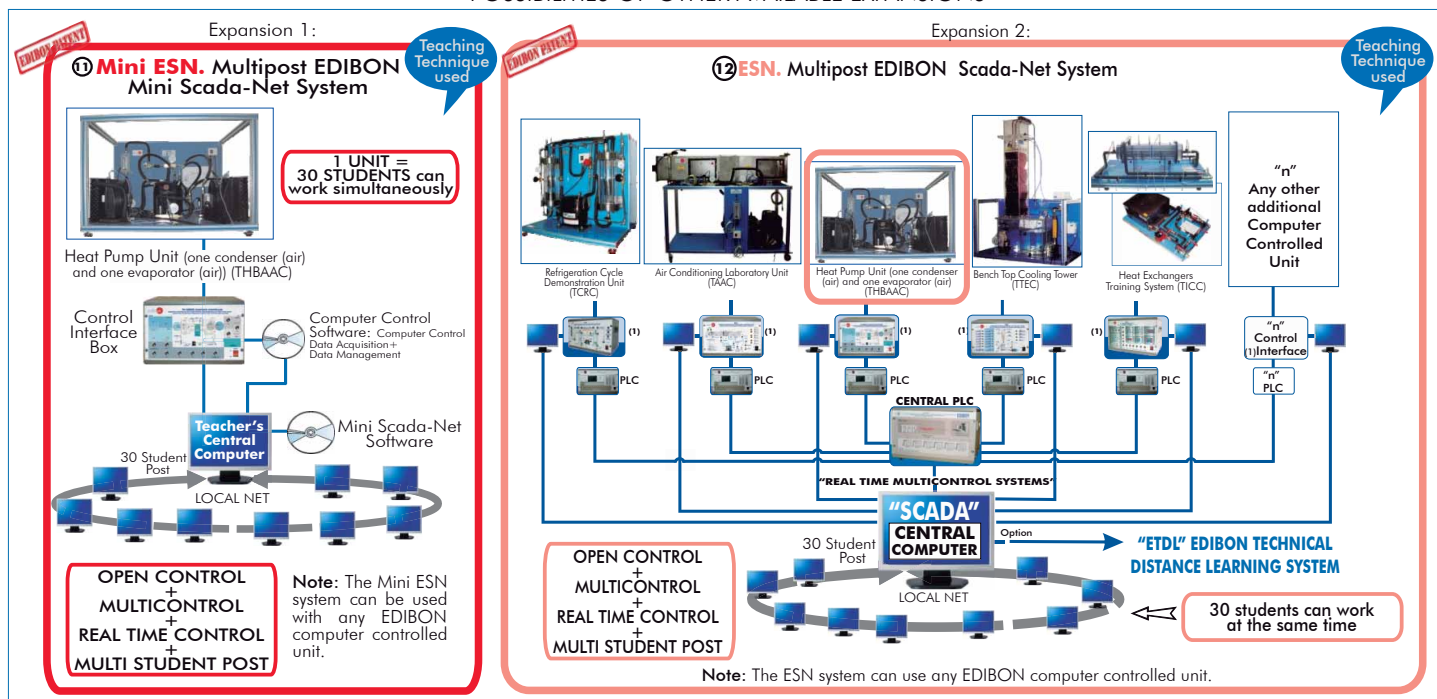
GAIN	OFFSET	r	
ST-1	101.705	0.8354	0
ST-2	98.5001	-3.0594	0
ST-3	102.291	4.7913	0
ST-4	102.262	-3.7268	0
ST-5	101.438	-3.9967	0
ST-6	91.5356	3.1025	0
	1	0	0
	105.08	-7.5592	0
	1	0	0
	92.6831	-6.0846	0
	1	0	0
	1	0	0
	1	0	0
SC-1	0.784947	0.0411	0
SC-2	0.9199	-0.0307	0
AN-1	1	0	0

## EXERCISES AND PRACTICAL POSSIBILITIES

### Some Practical Possibilities of the Unit:

- 1.- Determination of the inlet power, produced heat and performance coefficient. Air as heat source.
  - 2.- Preparation of performances curves of the heat pump at different inlet and outlet temperatures. Air as a heat pump.
  - 3.- Lay out of the steam compression cycle in a diagram P-H and comparison with the ideal cycle. Air as heat source.
  - 4.- Preparation of the performance curves of the heat pump based on the properties of the refrigerant and at different condensation and evaporation temperatures. Air as heat source.
- Other possible practices:
- 5.- Temperature sensors calibration.
  - 6.- Flow sensor calibration.
  - 7.- Pressure sensors calibration.
- Practices to be done by PLC Module (PLC-PI) + PLC Control Software:
- 8.- Control of the THBAAC unit process through the control interface box without computer.
  - 9.- Visualization of all the sensors values used in THBAAC unit process.
  - 10.- Calibration of all sensors included in THBAAC unit process.
  - 11.- Hand on of all the actuators involved in the THBAAC unit process.
  - 12.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).
  - 13.- 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).
  - 14.- PLC hardware general use and manipulation.
  - 15.- PLC process application for the THBAAC unit.
  - 16.- PLC structure.
  - 17.- PLC inputs and outputs configuration.
  - 18.- PLC configuration possibilities.
  - 19.- PLC program languages.
  - 20.- PLC different programming standard languages (literal structured, graphic, etc.).
  - 21.- New configuration and development of new process.
  - 22.- Hand on an established process.
  - 23.- To visualize and see the results and to make comparisons with the THBAAC unit process.
  - 24.- Possibility of creating new process in relation with the THBAAC unit.
  - 25.- PLC Programming Exercises.
  - 26.- 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: THBAAC. Heat Pump Unit (one condenser (air) and one evaporator (air)).
- ② THBAAC/CIB. Control Interface Box.
- ③ DAB. Data Acquisition Board.
- ④ THBAAC/CCSOF. Computer Control + Data Acquisition + Data Management Software.
- ⑤ Cables and Accessories, for normal operation.
- ⑥ Manuals.

### Additional and optional items to the standard supply:

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

#### Expansions

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

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

## REQUIRED SERVICES

Electrical supply: 220V, 1-phase + neutral + ground, 50 Hz.; or 110V, 1-phase + neutral + ground, 60Hz.; and 1 CV max.

Computer (PC).

## DIMENSIONS & WEIGHTS

THBAAC Unit :	-Dimensions: 900 x 600 x 500 mm. approx. -Weight : 75 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.

## 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).

## AVAILABLE VERSIONS

Offered in this catalogue:

- **THBAAC. Computer Controlled Heat Pump Unit (one condenser (air) and one evaporator (air)).**

Offered in other catalogue:

- **THBAAB. Heat Pump Unit (one condenser (air) and one evaporator (air)).**

## OTHER AVAILABLE HEAT PUMP UNITS

- **THIBAR22C. Computer Controlled Heat Pump + Air Conditioning + Refrigeration Unit with Cycle Inversion Valve.**
- **THIBAR22B. Heat Pump + Air Conditioning + Refrigeration Unit with Cycle Inversion Valve.**
- **THB22C. Computer Controlled Heat Pump Unit (two condensers (water and air) and two evaporators (water and air)).**
- **THB22B. Heat Pump Unit (two condensers (water and air) and two evaporators (water and air)).**
- **THB2LC. Computer Controlled Heat Pump Unit (two condensers (water and air) and one evaporator (water)).**
- **THB2LB. Heat Pump Unit (two condensers (water and air) and one evaporator (water)).**
- **THBL2C. Computer Controlled Heat Pump Unit (one condenser (water) and two evaporators (water and air)).**
- **THBL2B. Heat Pump Unit (one condenser (water) and two evaporators (water and air)).**
- **THBA2C. Computer Controlled Heat Pump Unit (one condenser (air) and two evaporators (water and air)).**
- **THBA2B. Heat Pump Unit (one condenser (air) and two evaporators (water and air)).**
- **THBLLC. Computer Controlled Heat Pump Unit (one condenser (water) and one evaporator (water)).**
- **THBLLB. Heat Pump Unit (one condenser (water) and one evaporator (water)).**
- **THBALC. Computer Controlled Heat Pump Unit (one condenser (air) and one evaporator (water)).**
- **THBALB. Heat Pump Unit (one condenser (air) and one evaporator (water)).**
- **THB2AC. Computer Controlled Heat Pump Unit (two condensers (water and air) and one evaporator (air)).**
- **THB2AB. Heat Pump Unit (two condensers (water and air) and one evaporator (air)).**
- **THBLAC. Computer Controlled Heat Pump Unit (one condenser (water) and one evaporator (air)).**
- **THBLAB. Heat Pump Unit (one condenser (water) and one evaporator (air)).**

\*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](http://www.edibon.com)

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