



CATALOGUE No. 27-C
THERMOTRONICS

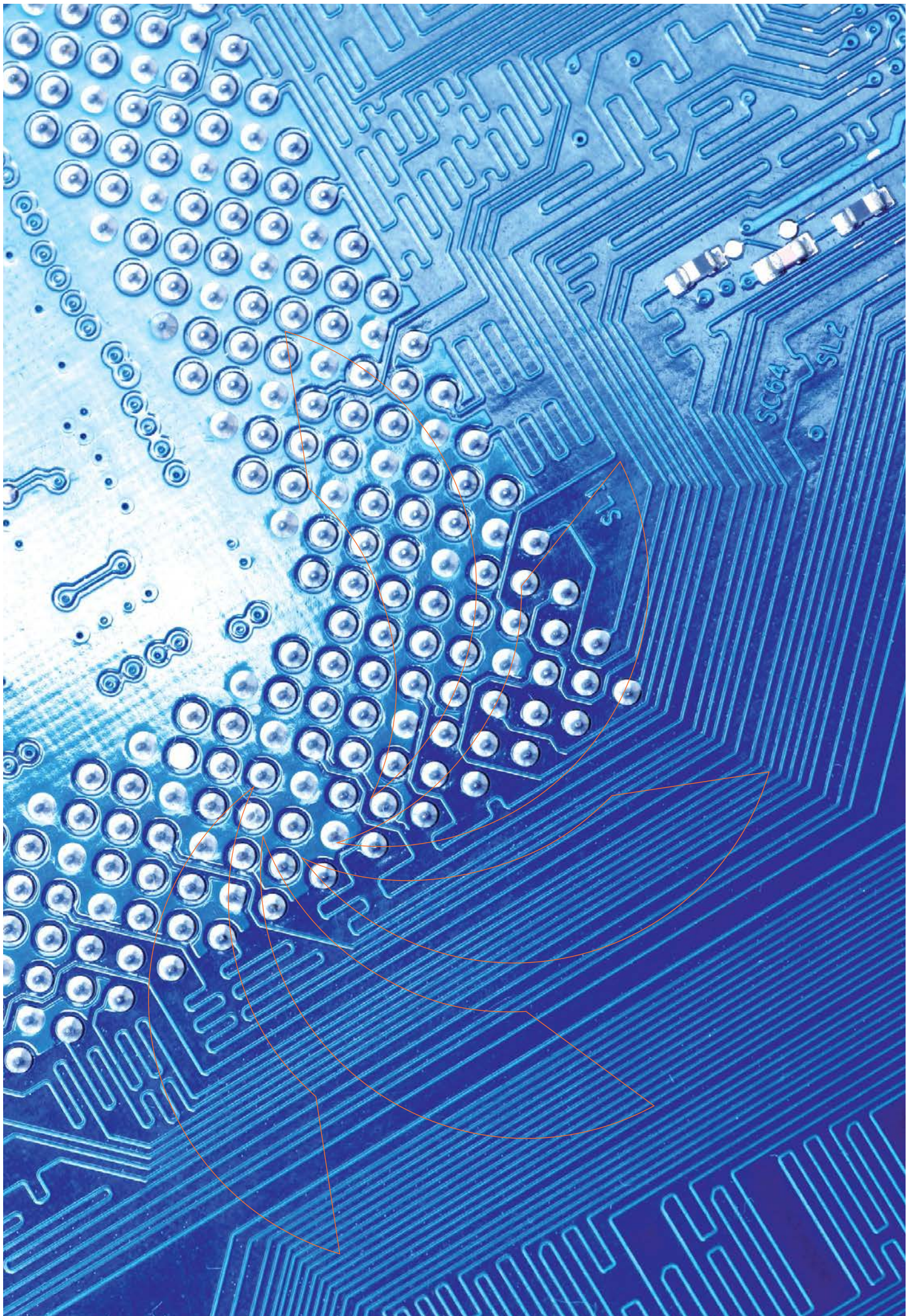


CATALOGUE No. 27-C
THERMOTRONICS

Thermotronics

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www.elettronicaveneta.com

27C-E
Rel. B21



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CV

PRESENTATION

CV 5

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CV 48

MOD. DAC-K/EV

CV 49

MOD. SPLIT-K/EV

CV 50

MOD. VAC-K/EV

CV 51

MOD. SHCU/EV

CV 52

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CV 52

HEATING AND SANITARY SYSTEMS

HS

PRESENTATION

HS 5

PLANTS

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HEATING ELEMENTS MODULE
HEAT CONTROL AND DISTRIBUTION MODULE
DOMESTIC HOT WATER PRODUCTION MODULE
HOT WATER PRODUCTION UNIT
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UNIT FOR STUDYING ENERGY DISTRIBUTION AND CONTROL
MODULE FOR STUDYING HEATING SYSTEMS IN CIVIL APPLICATIONS
COMPUTERIZED MODULE FOR STUDYING
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OF A BUILDING ENVELOPE
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MOD. MC/EV

HS 7

MOD. RP/EV

HS 8

MOD. RC/EV

HS 9

MOD. SC/EV

HS 10

MOD. HWPU/EV

HS 11

MOD. HEU/EV

HS 12

MOD. EDCU/EV

HS 13

MOD. CHT/EV

HS 14

MOD. CHTC/EV

HS 15

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HS 16

MOD. DT/EV

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HS 18

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THERMAL POWER DISTRIBUTION SIMULATOR

MOD. SIM-MC/EV

HS 21

MOD. SIM-RP/EV

HS 22

MOD. SIM-HHR/EV

HS 23

MOD. SIM-HH/EV

HS 24

MOD. SIM-ED/EV

HS 25

WORKSHOP EQUIPMENT

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BASE UNIT FOR HEAT DISTRIBUTION
BASE UNIT FOR HEATING ELEMENTS
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ASSEMBLY KIT OF ENERGY CONTROL AND DISTRIBUTION
ASSEMBLY KIT OF HYDRO-SANITARY SYSTEMS
WATER SOFTENING UNIT
ASSEMBLY KIT OF WATER SOFTENING

MOD. A/EV

HS 27

MOD. B/EV

HS 28

MOD. C/EV

HS 29

MOD. CTR/EV

HS 30

MOD. HW/EV

HS 31

MOD. DW/EV

HS 32

MOD. PL/EV

HS 33

MOD. AD-E/EV

HS 34

MOD. AD/EV

HS 35

ACCESSORIES AND INSTRUMENTS

AI

OPTIONAL ACCESSORIES

PORTABLE VACUUM AND CHARGING STATION
 RECOVERY-RECYCLING UNIT
 ELECTRONIC BALANCE
 MANIFOLD
 GAS BURNER
 INDOOR LIGHTING DEVICE
 POWER DISSIPATION KIT
 POWER DISSIPATION KIT WITH RADIATORS

MOD. VACU-2
 MOD. RERE
 MOD. RECH
 MOD. MFLD
 MOD. BGRG
 MOD. SS-1/EV
 MOD. DW-E/EV
 MOD. DW-R/EV

AI 3
 AI 3
 AI 3
 AI 3
 AI 4
 AI 4
 AI 4
 AI 4

OTHER ACCESSORIES

RECOVERY UNIT
 VACUUM PUMP
 FLEXIBLE PIPES
 WELDING CART
 CHARGING CYLINDER (W/O REFRIGERANT)

MOD. RECO
 MOD. VACUP
 MOD. FLEXP
 MOD. TW
 MOD. CYL

AI 5
 AI 5
 AI 5
 AI 5
 AI 5

OPTIONAL INSTRUMENTS

ELECTRONIC REFRIGERATION ANALYZER
 ELECTRONIC LEAK DETECTOR
 PORTABLE VANE ANEMOMETER
 PORTABLE THERMOHYGROMETER WITH REMOVABLE PROBE
 PORTABLE THERMOMETER WITH IMMERSION PROBE
 PORTABLE THERMOMETER WITH PROBE FOR SURFACES
 FLUE-GAS ANALYZER
 FLUE-GAS ANALYZER - BASIC VERSION
 SOLAR IRRADIANCE METER
 ELECTRONIC FLOWMETER
 PORTABLE DIFFERENTIAL PRESSURE GAUGE

MOD. REFA-1
 MOD. AHLD-1
 MOD. THAN
 MOD. THHY
 MOD. THRN
 MOD. THRM
 MOD. FGA-1
 MOD. FGA-E
 MOD. SORM
 MOD. FLOW-1
 MOD. MAND

AI 7
 AI 7
 AI 7
 AI 7
 AI 7
 AI 8
 AI 8
 AI 8
 AI 8
 AI 8

OTHER ACCESSORIES

PORTABLE ANEMOMETER
 PORTABLE THERMOHYGROMETER WITH FIXED PROBE
 PEN-TYPE THERMOHYGROMETER
 INFRARED THERMOMETER
 THERMAL IMAGER
 HEAT FLOW METER

MOD. THAM
 MOD. THEH
 MOD. THYP
 MOD. THIR
 MOD. THCM
 MOD. THFL

AI 9
 AI 9
 AI 9
 AI 9
 AI 9
 AI 9



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GENERAL INTRODUCTION

ELETTRONICA VENETA S.p.A. has been designing and manufacturing educational equipment since 1963. This equipment, covering the different fields of technology, fulfils two important educational objectives:

- to facilitate the learning process of the student by means of real systems which illustrate practically the important aspects of the theory learned in the classroom.
- to simplify the work of the teacher enabling the demonstration of the real, practical applications of the theory learned.

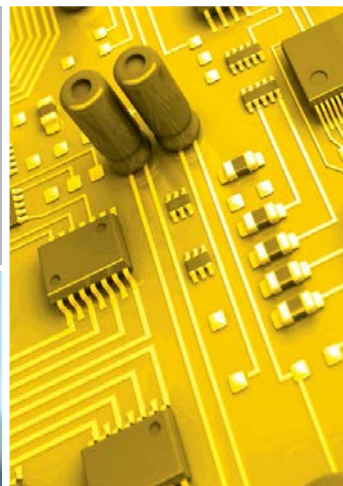
Increasing the efficiency of the didactic process improves and simplifies the integration of young students into the world of employment and justifies the material and human investments made in schools throughout the world.

ELETTRONICA VENETA S.p.A. operates on an international level and takes into consideration the training programmes and cultures of each specific country. In order to meet different requirements, we offer flexible systems which ensure maximum compliance with the latest technologies, technological advances and the professional profile requirements of local industry.

The proposed laboratories and training equipment are suitable for regular school education as well as ongoing post-diploma training courses and professional re-qualification.

Our training equipment covers most of the technological sectors included in the training programmes of vocational schools, technical institutes and universities, both national and international.

ELETTRONICA VENETA S.p.A. headquarters is located in the green fields of the Veneto region, not far from Venice, and constitute a centre for equipment design and development suited to the training needs of all professional and technical profiles. The modern premises integrates R&D laboratories, a production plant and a fully equipped teacher training centre.



The integration of these efficient training systems into local school structures ensures high-quality, state-of-the-art training programmes which meet the diverse professional expectations of the student and the technological requirements of industry and research within their specific local contexts.

The ISO 9001 (Quality System Certification) obtained in 1998 and updated in application of the latest edition of the International Standard, is further testament to the quality-driven organisation of **ELETTRONICA VENETA S.p.A.** aimed at providing top standard equipment, training and service.

PRESENTATION

This catalogue of thermotronics includes all educational equipment for an easy study of thermotechnics applied to domestic and industrial installations.

The apparatuses have been designed to train thermotechnical engineers so that they can acquire skills on the most advanced applications besides the basics of thermotechnics. Moreover the development of technology leads to a continuous theoretical, experimental and practical refreshment of the operators in this sector.

All that involves the need of having flexible and modular training systems being able to adapt to diversified and varying requirements.

ELETTRONICA VENETA S.p.A. has developed systems and solutions for training and research answering this purpose perfectly: in fact the apparatuses produced enable to analyze all the topics concerning thermotechnics from both the theoretical and experimental points of view, starting from the basic concepts to the most complex issues.

This catalogue is subdivided into three product lines:

- **Refrigeration**
- **Air Conditioning and Ventilation**
- **Heating and Sanitary systems**

Every line covers the topic under examination exhaustively; for instance, as regards Refrigeration, attention can be focused onto the study of vapour compression refrigerating cycle, of compressors or of the electric components in refrigeration systems, of domestic and industrial refrigeration, and so on.



The offer of equipment produced by **ELETTRONICA VENETA S.p.A.** for **THERMOTRONICS** Laboratories consists of three product lines:

- **REFRIGERATION**
- **AIR CONDITIONING AND VENTILATION**
- **HEATING AND SANITARY SYSTEMS**





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REFRIGERATION

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Aim:

- Training in the sectors of Domestic and Industrial Refrigeration, Deep-Freezing
- Technical High Schools, Vocational Schools, Universities

Equipment:

- Equipment mounted on wheeled frameworks or tabletop units
- Colour schematic diagrams
- Computer-aided and manual equipment
- Instruments and accessories designed for a theoretical-practical approach to the concerned topic



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REFRIGERATION

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PRESENTATION

This product line includes all the apparatuses and optional units concerning Refrigeration. Attention can be focused onto the study of vapour compression refrigerating cycle or of compressors and their performance, onto the study of the electric components in refrigeration systems, onto the applications of refrigeration to domestic or industrial environments, and so on, according to the needs.

This product line is subdivided into three main sections of different size designed for different users:

- **Plants**
- **Tabletop units**
- **Workshop equipment**

The first section includes the wheeled, computer-aided and manual equipment with instruments and accessories enabling a theoretical and practical approach to the concerned topic. These systems are designed for technical high schools where students' background allows to carry out more or less complex calculations.



The second section includes the tabletop units: although they are not equipped with all the accessories of the systems mentioned above, however these apparatuses enable an in-depth study of their own thermodynamic characteristics and are designed for technical high schools.

Moreover this section also includes:

- the training simulators for the study of control logics of their control systems; they must be used together with a PC for a correct development of the educational program.
- the Computerized Thermotronics Modular Laboratory



The third section includes equipment specifically designed for workshop work: assembling/disassembling hydraulic systems and circuits, realization of electrical connections, etc... They are mainly conceived for practical activities and they do not require the knowledge of high theoretical notions, consequently they perfectly match the needs of vocational schools where practical approach is emphasized.





PLANTS

GENERAL REFRIGERATION TRAINER	MOD. RCT/EV	RE 7
COMPUTERIZED GENERAL REFRIGERATION TRAINER	MOD. RCTC/EV	RE 9
DOMESTIC REFRIGERATION TRAINER	MOD. TRD/EV	RE 10
INDUSTRIAL REFRIGERATION TRAINER	MOD. TRI/EV	RE 11
COMPUTERIZED INDUSTRIAL REFRIGERATION TRAINER	MOD. TRIC/EV	RE 13
POSITIVE TEMPERATURE ROOM	MOD. CFP/EV	RE 14
NEGATIVE TEMPERATURE ROOM	MOD. CFN/EV	RE 15
TRAINER FOR THE STUDY OF A COMMERCIAL MULTIPLE EVAPORATOR REFRIGERATOR	MOD. DEV-M/EV	RE 16
1-DOOR DOMESTIC REFRIGERATOR 2-DOOR DOMESTIC REFRIGERATOR	MOD. DR-1/EV MOD. DR-2/EV	RE 17
DEEP-FREEZING TRAINER	MOD. SUR/EV	RE 18
LYOPHILIZATION TRAINER	MOD. LIF/EV	RE 19
TRAINER FOR REFRIGERATION PLANTS ELECTRIC COMPONENTS AND FAULTS	MOD. ECC/EV	RE 20
TRAINER FOR FAULT SIMULATION ON REFRIGERANT AND ELECTRIC CIRCUIT	MOD. ECC-F/EV	RE 21
COMPUTERIZED TRAINER FOR STUDYING THE HERMETIC COMPRESSOR	MOD. TCC/EV	RE 23
TRAINER FOR THE STUDY OF THE OPEN TYPE COMPRESSOR	MOD. TCC-SO/EV	RE 24
TRAINER FOR THE STUDY OF THE SEMI-HERMETIC COMPRESSOR	MOD. TCC-SS/EV	RE 25
MULTIPLE COMPRESSOR TRAINER	MOD. TCCM/EV MOD. TCCM-C/EV	RE 26
ICE MAKER TRAINER	MOD. TG/EV	RE 28
ABSORPTION REFRIGERATION TRAINER	MOD. TAR/EV	RE 29

GENERAL REFRIGERATION TRAINER

Mod. RCT/EV

INTRODUCTION

This trainer is designed for the in-depth study of vapour-compression cycle. It enables to vary the load conditions of condenser and of evaporator, to use alternative devices for gas expansion, to handle successfully unexpected operating situations, such as the block of the refrigerant flow or a wrong gas charge inside the circuit. Students can become familiar with the refrigerant pressure-enthalpy diagram and evaluate the heat balances corresponding to the different cycle components, by using the set of industrial instruments of the equipment.



TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of a thermostatic expansion valve
- Analyzing the system behaviour versus the variation of:
 - expansion device
 - superheat (when the thermostatic expansion valve is used)
 - air flow rate at condenser and/or evaporator
 - refrigerant charge into the system
- Plotting the cycle in the refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - thermostatic valve superheat
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual EER
 - volumetric compression efficiency
- Troubleshooting of system and of its components

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- Hermetic compressor
- Forced-air condenser with variable flow settable by potentiometer, equipped with 8 glass pipes for displaying the refrigerant condensation process
- Forced-air evaporator with variable flow settable by potentiometer, equipped with 8 glass pipes for displaying the refrigerant evaporation process
- Devices for liquid lamination: internal equalization thermostatic valve, 3 capillary tubes of different geometry
- Liquid receiver, liquid separator
- On-off valves, sight glass, dehydrator filter
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- Full set of instruments for data acquisition, including:
 - flowmeter
 - high and low pressure gauges
 - 3 electronic thermometers with Pt100 probes to be inserted into several test points along the hydraulic circuit
 - digital multimeter
- High and low pressure switches
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 500 VA
(Other voltage and frequency on request)

Dimensions: 140 x 80 x 180 cm

Net weight: 131 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE VANE ANEMOMETER
MOD. THAN



PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY

COMPUTERIZED GENERAL REFRIGERATION TRAINER

Mod. RCTC/EV

INTRODUCTION

This trainer is designed for the in-depth study of vapour-compression cycle; it uses a personal computer (supplied on demand), data acquisition and PC interface board, suitable transducers and sensors. It enables to vary the load conditions at condenser and evaporator, to use alternative devices for the gas expansion, to insert non destructive hydraulic and electric faults for developing diagnostic skills in students; the data acquisition system supplied with the equipment enables students to become familiar with the refrigerant pressure-enthalpy diagram and to analyze the heat balances corresponding to the different cycle components.

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Analyzing the system behaviour versus the variation of:
 - expansion device
 - valve opening degree (when the electronic valve is used for expansion)
 - air flow rate at condenser and/or evaporator
- Plotting the cycle in the refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual EER
 - volumetric compression efficiency
- The software of the equipment allows to enter different sections:
 - system automatic and manual operation
 - refrigerating circuit heat balance
 - faults enabling (10)
 - troubleshooting and plant operation reset
 - system supervision with display of the values detected by the sensors

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- Hermetic compressor
- Forced-air condenser with variable flow settable by potentiometer, equipped with 8 glass pipes for displaying the refrigerant condensation process
- Forced-air evaporator with variable flow settable by potentiometer, equipped with 8 glass pipes for displaying the refrigerant evaporation process
- Devices for liquid lamination: electronic expansion valve, capillary tubes of different length
- Liquid receiver, liquid separator
- Solenoid valves, on-off valves, sight glass, dehydrator filter
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours



- Transducers and sensors for detecting the following system operating parameters: voltage, current, power factor, temperatures, cycle pressures, refrigerant flow rate
- High and low pressure gauges
- High and low pressure switches
- Thermomagnetic - earth leakage control button
- Emergency button
- PC control program

Power supply: 230 Vac 50 Hz single-phase - 600 VA
(Other voltage and frequency on request)

Dimensions: 140 x 80 x 180 cm

Net weight: 145 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



DOMESTIC REFRIGERATION TRAINER

Mod. TRD/EV

INTRODUCTION

Domestic refrigeration trainer is designed to identify and analyze the behaviour of thermodynamic cycle of domestic refrigerators. Students' attention is focused onto the issues concerning refrigerant condensation that is generally inadequate because of the poor heat exchange due to the low convection occurring in the narrow spaces where domestic refrigerators are usually installed.

TRAINING PROGRAM

- ON-OFF control: refrigerator thermostat
- Using the refrigerant pressure-enthalpy diagram as work and diagnosis tool: plotting the refrigeration cycle
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual EER
 - volumetric compression efficiency and its trend versus compression ratio
 - condenser exchange surface
 - heat transfer coefficient between air and refrigerant in the condenser
 - heat losses through the room walls

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- Hermetic compressor
- Static wire condenser
- Refrigerated room with static evaporator
- Thermostat for controlling the room temperature
- Capillary tube
- On-off valves, sight glass, dehydrator filter
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- Full set of instruments for data acquisition, including:
 - flowmeter
 - high and low pressure gauges
 - 2 electronic thermometers with Pt100 probes to be inserted into several test points along the hydraulic circuit
 - digital multimeter
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 150 VA
(Other voltage and frequency on request)

Dimensions: 140 x 80 x 180 cm

Net weight: 132 kg



SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



INDUSTRIAL REFRIGERATION TRAINER

Mod. TRI/EV

INTRODUCTION

This trainer is designed for the study of industrial refrigeration whose main aim consists in controlling the temperature and relative humidity of one or more cold rooms. In this case a unique compressor and a unique condenser are used for two different cold rooms: one for frozen products and the other for fresh products. This trainer is also conceived to identify and analyze the behaviour of all the critical components of the cycle. Users' attention is focused onto important issues concerning the balancing of valves and the keeping of constant operating pressures versus the external and internal load conditions.



TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of a thermostatic expansion valve and its calibration
- Studying the operation of an evaporating pressure controller and its calibration
- ON-OFF control: Refrigerated room thermostat
- Correlation between evaporation temperature, room temperature and relative humidity in positive-temperature rooms
- Analyzing the system behaviour versus the variation of:
 - thermostatic valve superheats
 - condenser air flow
 - evaporating pressure controller working point
- Using the refrigerant pressure-enthalpy diagram as work and diagnosis tool: plotting the refrigeration cycle
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual EER
 - volumetric compression efficiency and its trend versus compression ratio
 - condenser exchange surface
 - heat transfer coefficient between air and refrigerant in the condenser
 - heat losses through the room walls

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- Hermetic compressor
- Forced-air condenser with variable flow settable by potentiometer
- 2 cold rooms with separate evaporators
- Thermostatic expansion valves
- Evaporating pressure controller
- Refrigerated room thermostats
- Liquid receiver, liquid separator
- Solenoid valves, check valve, on-off valves, sight glass, dehydrator filter
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- Full set of instruments for data acquisition, including:
 - flowmeter
 - high and low pressure gauges for detecting pressures on several points along the hydraulic circuit
 - electronic thermometers with Pt100 probes to be inserted into several test points along the hydraulic circuit
 - digital multimeter
- Double pressure switch
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 560 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 180 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE VANE ANEMOMETER
MOD. THAN



PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY

COMPUTERIZED INDUSTRIAL REFRIGERATION TRAINER

Mod. TRIC/EV

INTRODUCTION

This trainer is designed for the study of industrial refrigeration whose main aim consists in controlling the temperature and relative humidity of one or more cold rooms. In this case a unique compressor and a unique condenser are used for two different cold rooms: one for frozen products and the other for fresh products. This trainer also simplifies the learning of data acquisition techniques by using proper instruments and a Personal Computer (supplied on demand).

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of a thermostatic expansion valve and its calibration
- Proportional control
- Correlation between evaporation temperature, room temperature and relative humidity in positive-temperature rooms
- Analyzing the system behaviour versus the variation of:
 - valves opening degree
 - condenser air flow
- Plotting the cycle in the refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual EER
 - volumetric compression efficiency
 - condenser exchange surface
 - heat transfer coefficient between air and refrigerant in the condenser
 - heat losses through the room walls
- The software of the equipment allows to enter different sections:
 - system automatic and manual operation
 - faults enabling (12)
 - troubleshooting and plant operation reset
 - system supervision with display of the values detected by the sensors

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- Hermetic compressor
- Variable flow forced-air condenser
- 2 cold rooms with separate evaporators
- Electronic expansion valve, thermostatic expansion valve, back-pressure valve
- Liquid receiver, liquid separator
- Solenoid valves, check valve, on-off valves, sight glass, dehydrator filter
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours



- Transducers and sensors for detecting the following system operating parameters: voltage, current, power factor, refrigerant temperatures, freezer temperature, refrigerator temperature and relative humidity, cycle pressures (high, low and intermediate), refrigerant flow rate
- High and low pressure gauges
- Double pressure switch
- Thermomagnetic - earth leakage control button
- Emergency button
- PC control program

Power supply: 230 Vac 50 Hz single-phase - 650 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 187 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



POSITIVE TEMPERATURE ROOM

Mod. CFP/EV

INTRODUCTION

The trainer is properly designed for educational aims and studies the refrigeration at positive temperature. It includes all the parts of an industrial refrigeration system, including a properly insulated freezing room with defrost of the garnish of the door and an electronic controller with automatic defrost of the evaporator. An electric heater simulates the variations of temperature inside the room.

TRAINING PROGRAM

- Plant starting and verification of the safety devices intervention
- Study of the operation and set up of a thermostatic expansion valve
- ON/OFF control
- Analysis of the system behaviour at variation of:
 - thermostatic valve superheat
 - Condenser air flow
- Drawing the cycle in the pressure – enthalpy diagram of the refrigerant gas
- Data collection and calculation of:
 - Thermal balances at evaporator, condenser, compressor
 - Cycle EER

TECHNICAL SPECIFICATIONS

- Steel structure on wheels, painted and treated in the oven
- Silk-screened coloured synoptic panel with led
- Hermetic compressor
- Forced air condenser with potentiometer to vary the air flow
- Positive temperature room:
 - Gross volume: approx. 0.5 m³
 - Insulating material: foam - 4 cm thickness
 - Forced air evaporator
 - Electric defrost
 - Electric resistor for thermal load simulation
- Thermostatic expansion valve
- Electronic controller of the unit
- Liquid receiver, liquid separator
- Sight glass, dehydrating filter
- Plant vacuum, gas charge and recovery valve
- Complete set of instruments for data acquisition including:
 - High and low pressure gauges
 - 2 digital thermometers with Pt100 probes to be inserted into different test point along the hydraulic circuit
 - digital multimeter
- Double pressostat
- Thermomagnetic - earth leakage control button
- Emergency button



Power supply: 230 Vac 50 Hz single-phase - 1500 VA
(Other voltage and frequency on request)

Dimensions: 130x80x180 cm

Net weight: 226 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



NEGATIVE TEMPERATURE ROOM

Mod. CFN/EV

INTRODUCTION

The trainer is properly designed for educational aims and studies the refrigeration at negative temperature. It includes all the parts of an industrial refrigeration system, including a properly insulated freezing room with defrost of the garnish of the door and an electronic controller with automatic defrost of the evaporator. An electric heater simulates the variations of temperature inside the room.

TRAINING PROGRAM

- Plant starting and verification of the safety devices intervention
- Study of the operation and set up of a thermostatic expansion valve
- ON/OFF control
- Analysis of the system behaviour at variation of:
 - thermostatic valve superheat
 - Condenser air flow
- Drawing the cycle in the pressure – enthalpy diagram of the refrigerant gas
- Data collection and calculation of:
 - Thermal balances at evaporator, condenser, compressor
 - Cycle EER

TECHNICAL SPECIFICATIONS

- Steel structure on wheels, painted and treated in the oven
- Silk-screened coloured synoptic panel with led
- Hermetic compressor
- Forced air condenser with potentiometer to vary the air flow
- Negative temperature room:
 - Gross volume: approx. 0.5 m³
 - Insulating material: foam - 6 cm thickness
 - Forced air evaporator
 - Electric defrost
 - Electric resistor for thermal load simulation
- Thermostatic expansion valve
- Electronic controller of the unit
- Liquid receiver, liquid separator
- Sight glass, dehydrating filter
- Plant vacuum, gas charge and recovery valve
- Complete set of instruments for data acquisition including:
 - High and low pressure gauges
 - 2 digital thermometers with Pt100 probes to be inserted into different test point along the hydraulic circuit
 - digital multimeter
- Double pressostat
- Thermomagnetic - earth leakage control button
- Emergency button



Power supply: 230 Vac 50 Hz single-phase - 3300 VA
(Other voltage and frequency on request)

Dimensions: 130x80x180 cm

Net weight: 226 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



TRAINER FOR THE STUDY OF A COMMERCIAL MULTIPLE EVAPORATOR REFRIGERATOR

Mod. DEV-M/EV

INTRODUCTION

The trainer, properly designed for educational aims, allows the student to study the operation of a commercial refrigerator with two evaporators, one hermetic compressor and one air condenser.

TRAINING PROGRAM

- Plant starting and verification of the safety devices intervention
- Study of the operation of a thermostatic expansion valve
- ON/OFF control
- Analysis of the system behaviour at variation of:
 - Number of evaporators
 - Condenser / evaporators air flow
 - Thermostatic valves superheat
- Drawing the cycle in the pressure – enthalpy diagram of the refrigerant gas
- Data collection and calculation of:
 - thermal balances at the evaporators, condenser, compressor
 - refrigerant mass flow
 - ideal and real EER
 - compressor volumetric efficiency
 - thermostatic valve superheat

TECHNICAL SPECIFICATIONS

- Steel structure on wheels, painted and treated in the oven
- Silk-screened coloured synoptic panel with LEDs
- Hermetic compressor
- Forced air condenser with variable air flow
- 2 forced air evaporators with variable air flow
- Liquid receiver, liquid separator
- Manual valves, sight glass, dehydrating filter, solenoid valves
- Thermostatic expansion valves
- Plant vacuum, gas charge and recovery valve
- Control thermostats
- Complete set of instruments for data acquisition including:
 - Flowmeter
 - High and low pressure gauges
 - 4 digital thermometers with Pt100 probes to be inserted into different test point along the hydraulic circuit.
 - digital multimeter
- Double pressostat
- Thermomagnetic - earth leakage control button
- Emergency button



Power supply: 230 Vca 50 Hz single-phase - 1500 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 182 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



DOMESTIC REFRIGERATOR

Mod. DR-1/EV (1-door)

Mod. DR-2/EV (2-door)

INTRODUCTION

The equipment has been designed to allow students to see in detail the operation of a 1-door (mod. DR-1/EV) or of a 2-door (mod. DR-2/EV) domestic refrigerator.

It is mounted on wheels and it uses refrigerant environment friendly R134a.

TRAINING PROGRAM

- Domestic refrigerator operation analysis
- ON/OFF regulation: the refrigerated room thermostat
- Evaluation of the cycle pressures and of the corresponding evaporation/condensation temperatures
- Drawing of the cycle on the pressure enthalpy diagram
- Evaluation of the specific energy exchanged at the evaporator and at the condenser
- Cycle EER evaluation
- Fault insertion

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels
- Schematic diagram of the hydraulic circuit
- 1-door (mod. DR-1/EV) or 2-door domestic refrigerator (mod. DR-2/EV) with:
 - hermetic compressor
 - static condenser
 - overall capacity: 85 l (mod. DR-1/EV)
 - refrigerator capacity 184 l and freezer capacity 43 l (mod. DR-2/EV)
 - capillary tube for gas expansion
 - refrigerated room thermostat
- On-off valves, sight glass, filter
- Valve for vacuum, gas recovery and gas charge
- Connecting pipes coloured with different colours
- High and low pressure gauges
- Digital thermometers with Pt100 sensors to be inserted into temperature test points along the hydraulic circuit
- Digital multimeter
- Switches for fault insertion
- Thermomagnetic - earth leakage control button
- Emergency pushbutton



mod. DR-1/EV

Power supply:	230 Vac 50 Hz single-phase (Other voltage and frequency on request)		
mod. DR-1/EV	Dimensions:	138 x 81 x 178 cm	
	Net weight:	107 kg	
	Absorption:	180 VA	
mod. DR-2/EV	Dimensions:	148 x 81 x 178 cm	
	Net weight:	113 kg	
	Absorption:	260 VA	

SUPPLIED WITH
EXPERIMENTAL HANDBOOK



DEEP-FREEZING TRAINER

Mod. SUR/EV

INTRODUCTION

This trainer, specifically conceived for educational aims, allows to study deep freezing that is a technological improvement of freezing.

This trainer permits to determine the actual rate of cold penetration inside the products under examination via two different systems of heat exchange: natural convection (plate-type heat exchanger) and forced convection (finned battery).

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of a thermostatic expansion valve and its calibration
- ON/OFF control: freezing room thermostat
- Analyzing the system behaviour versus the variation of:
 - Thermostatic valves superheat
 - condenser air flow
- Plotting the cycle in the refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual EER
 - volumetric compression efficiency
- Determination of cold penetration rate in the meat, in seafood, in vegetables, etc...
- Identifying the most suitable substances to be deep-frozen
- Duration of deep-frozen products
- Hot gas defrost

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- Hermetic compressor
- Forced-air condenser with variable flow settable by potentiometer
- 2 cold rooms with separate evaporators: plate evaporator and ventilation evaporator
- Thermostatic expansion valves
- Freezing room thermostats
- Liquid receiver
- Hot gas defrosting system
- Solenoid valves, on-off valves, sight glass, dehydrator filter
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- Full set of instruments for data acquisition, including:
 - flowmeter
 - high and low pressure gauges
 - 2 electronic thermometers with Pt100 probes to be inserted into several test points along the hydraulic circuit



- instrument for recording the temperature inside the product core
- digital multimeter
- Double pressure switch
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 850 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 260 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



LYOPHILIZATION TRAINER

Mod. LIF/EV

INTRODUCTION

This trainer, specifically conceived for educational aims, allows to study the lyophilization process that is the best system for preserving perishable goods. It allows to determine the optimum cycle, for quality and cost, of any product by using vacuum to keep the temperature of the product itself lower than its eutectic temperature.

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Determining the eutectic temperature of a substance
- Control of product internal and surface temperature during the lyophilization process and determination of the optimum cycle for each product
- Studying the operation of a thermostatic expansion valve and its calibration
- ON/OFF control: the compressor thermostat
- Analyzing the system behaviour versus the variation of:
 - thermostatic valve superheat
 - condenser fan intervention pressure
 - set vacuum degree
 - thermostat set-point temperature
- Plotting the cycle in the refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual EER
 - volumetric compression efficiency

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- Hermetic compressor
- Forced-air condenser controlled by pressure switch
- Coil evaporator
- Thermostatic expansion valve
- Compressor control thermostat
- Liquid receiver
- On-off valves, sight glass, dehydrator filter
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- Vacuum pump
- Vacuostat for setting the desired vacuum level
- Vacuum breaker valve
- Lyophilization room
- Frost room
- Full set of instruments for data acquisition, including:
 - flowmeter
 - high and low pressure gauges for detecting pressures on several points along the hydraulic circuit



- thermometer for controlling the product internal and surface temperature
- 2 electronic thermometers with Pt100 probes to be inserted into several test points along the hydraulic circuit
- 1 Pirani vacuum gauge for precise vacuum measurements
- digital multimeter
- Double pressure switch
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 1300 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 179 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



TRAINER FOR REFRIGERATION PLANTS ELECTRIC COMPONENTS AND FAULTS

Mod. ECC/EV

INTRODUCTION

This trainer has been conceived and designed so that students can analyze the characteristics and reliability of the electric components that are an integral part of refrigeration systems, besides the hydraulic circuit. Furthermore it can simulate the main faults occurring in industrial systems.

TRAINING PROGRAM

This unit enables to develop and analyze the following subjects:

- Faults on compressor valves
- Faults in oil separator
- Faults due to excess of refrigerant
- Faults due to lack of refrigerant
- Refrigerant prevented from reaching the evaporator
- Expansion valve broken
- Dehydrator clogged
- Too high condensation pressure
- Too high suction pressure
- Too low suction pressure
- Motor phase cutoff
- Both motor phases cutoff
- Refrigeration thermostat faulty
- Freezing thermostat faulty
- Relay coil faulty
- Motor thermal protection faulty
- Start capacitor faulty
- Assembling/disassembling and connecting each component
- Components quality control



TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the possible starting electric circuits
- Hermetic compressor
- Condenser with fan, sight glass, filter, cold room with evaporator and thermal load, thermostatic expansion valve, oil separator
- Instruments for data acquisition:
 - digital multimeter
 - ohmmeter
 - capacity meter
 - flowmeter
 - electronic thermometers
 - high and low pressure gauges
- 0-250 V Voltage variator
- 0-10 A Current variator
- 3 reduced fixed voltages lines

- Full set of components for developing the training program, including:
 - thermostats
 - defrosting timer
 - pressure switch
 - starting relays
 - protectors
 - starting and running capacitors
- 20 switches for inserting faults in the system. The hydraulic faults are enabled by solenoid valves, whereas the electric faults are enabled by relays
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 600 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 188 kg

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



TRAINER FOR FAULT SIMULATION ON REFRIGERANT AND ELECTRIC CIRCUIT

Mod. ECC-F/EV



INTRODUCTION

This trainer was designed for fault simulation on the refrigerating and electric circuits of a positive temperature refrigeration plant charged with fluid R134a. The equipment has two evaporators: one evaporator placed in the open air and the other in a room allowing to operate with two temperature levels and thus to use an evaporating pressure regulator. The second evaporator can be fed with four different types of expansion device. The simulation of the hydraulic faults is carried out by the teacher acting on valves arranged for this purpose. The simulation of the electric faults is carried out using a keyboard. The entire installation is made of copper. The instrumentation mounted on the trainer allows to measure the parameters used for the study and the analysis of the actual refrigeration cycle.

TRAINING PROGRAM

- Plant commissioning
- Investigate the concepts at the base of a refrigerating plant
- Perform electrical and/or fluidic measurements on a plant for calculating power and efficiency and for tracing refrigeration cycles
- Work on different technologies of expansion device
- Parallel operation of evaporators
- Monitoring a plant and determining the cause of the simulated faults

TECHNICAL SPECIFICATIONS

- Steel structure painted and treated in oven and mounted on wheels
- **Refrigerating unit** consisting of:
 - Commercial semi-hermetic compressor with cooling power of 1.100 W (condensation: +45°C, evaporation: -10°C)
 - Dryer filter
 - Sight glass
 - Liquid receiver
 - Valve for fluid recovery
 - Liquid separator
 - Evaporating pressure regulator
 - Shut-off valves
 - Condenser fan speed pressostatic variator (HP)
 - Compressor control pressure switch (LP)
 - Combined safety pressure switch (HP / LP)
 - Liquid-vapour heat exchanger at the common output of the two evaporators
 - Oil separator
- Forced convection **air cooled condenser** with fan electric power of 75 W at the air flow rate of 0,35 m³/s with variable speed controlled by pressostatic speed variator
- Forced convection **air evaporator** (500 W cooling power) placed in the open air, fed by solenoid valve (manually controlled) and thermostatic expansion valve
- Forced convection **air evaporator** (500 W cooling power) installed in a sealed and visible room (to allow the trainer to operate with two temperature levels and to control the correct fans operation), with defrosting timer and fed by solenoid valve (controlled by electronic thermostat) and four different expansion devices (manually selectable, without components dismantling or use of tools):
 - Capillary tube
 - Automatic valve
 - Thermostatic valve with internal equalizer
 - Thermostatic valve with external equalizer
- 24VAC control circuit
- Electric panel consisting of:
 - thermomagnetic - earth leakage control button
 - contactors
 - thermal relays
 - relays
 - state lamps of evaporators, compressor, defrosting heater and of safety pressure switch intervention
 - run button
- Emergency push button
- Electric fault simulator operating with keyboard and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students

The instrumentation mounted on the trainer allows:

- to measure the pressure of the refrigerant fluid with pressure gauge:
 - at compressor inlet and outlet
 - at the inlet of the evaporator (placed in the open air) / outlet of the expansion device
 - at the inlet of the evaporator (placed in the hermetic room) / outlet of the expansion devices
 - at the outlet of the evaporator (placed in the open air)
 - at the outlet of the evaporator (placed in the hermetic room)
- to measure the refrigerant fluid flow rate at the evaporators inlet
- to measure the refrigerant fluid temperature using a thermometer with a probe to be applied along the hydraulic circuit of the installation

The equipment simulates the following faults:

- On the cooling circuit:
 - fault due to low refrigerant charge
 - fault due to too high refrigerant charge
 - dryer filter clogged
 - malfunction of the expansion devices
 - malfunction of the evaporating pressure regulator
 - solenoid valves leakage
- On the condenser and evaporators circuits:
 - crust in the condenser
 - crust in one evaporator
- On the electrical circuits:
 - compressor motor overcurrent
 - cut-off of one phase of the compressor motor
 - stop of a fan of one of the evaporators
 - cut-off of two phases of the compressor motor
 - compressor motor overheating
 - faulty defrosting heater
- On the control circuit:
 - Faulty coil of the solenoid valves
 - Faulty safety double pressure switch
 - Faulty defrost timer
 - Faulty control thermostat
 - Faulty Pump Down pressure switch
 - Faulty pressostatic fan speed variator

Dimensions: 180 x 80 x 180 cm

Net Weight: 203 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Power supply: 400 Vac 50 Hz three-phase - 2000 VA
(Other voltage and frequency on request)

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



COMPUTERIZED TRAINER FOR STUDYING THE HERMETIC COMPRESSOR

Mod. TCC/EV

INTRODUCTION

Only sophisticated instruments must be used to assess the quality of a compressor and analyze its characteristics. This trainer has been designed specifically for educational use so that students can also learn new techniques of data acquisition by the use of proper instruments and of a PC (supplied on demand), besides understanding the issues concerning compressors.

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Analyzing the system behaviour versus the variation of:
 - liquid expansion device
 - valve opening degree (when micrometric expansion valve is used)
 - air flow rate at condenser and/or evaporator
- Examining hermetic compressors and their characteristics
- Assessing the quality of a compressor
- Determining the power of a compressor
- Plotting the cycle in the refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual EER
 - volumetric compression efficiency
- The software of the equipment carries out:
 - the heat balance of the refrigerating circuit
 - the system supervision with the display of the values detected by sensors



TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- Hermetic compressor
- Variable flow forced-air condenser and evaporator
- Liquid lamination devices: micrometric valve or capillary tubes
- Liquid separator, oil separator
- On-off valves, sight glass, dehydrator filter
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- Transducers and sensors for detecting the following operating parameters: voltage, current, power factor, temperatures, cycle pressures
- High and low pressure gauges
- High and low pressure switches
- Thermomagnetic - earth leakage control button
- Emergency button
- PC control program

Power supply: 230 Vac 50 Hz single-phase - 470 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 175 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



TRAINER FOR THE STUDY OF THE OPEN TYPE COMPRESSOR

Mod. TCC-SO/EV

INTRODUCTION

The trainer, properly designed for educational aims, permits the study of the open type compressor applied to the refrigeration equipment.

TRAINING PROGRAM

- Plant starting and verification of the intervention of the safety devices
- Analysis of the system behaviour depending on:
 - Compressor rpm
 - Expansion device
 - Air flow at the evaporators and/or condenser
- Study of the open type compressors
- Evaluation of the power of a compressor
- Drawing the cycle in the pressure - enthalpy diagram of the refrigerant gas
- Data collection and calculation of:
 - Thermal balance at the evaporators, at the condenser, at the compressor
 - Refrigerant gas mass flow
 - Ideal and actual EER
- Compressor volumetric efficiency
- Fault insertion

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Silk-screened printed coloured synoptic reproducing the hydraulic circuit with LEDs
- Open type compressor
- Electric motor
- Frequency converter for continuous variation of the compressor rpm
- Variable flow air condenser
- Variable flow air evaporator with thermostatic expansion valve for gas expansion
- Variable flow air evaporator with capillary tube for gas expansion
- Liquid separator, oil separator
- Pressure regulation valves (inlet – outlet)
- Shut off valves, sight glass, dehydrating filter
- Plant vacuum, gas charge and recovery valve
- Connecting pipes painted with different colours
- Control thermostat
- Complete set of instruments for data acquisition including:
 - Flowmeter
 - High and low pressure gauges
 - 3 digital thermometers with Pt100 probes to be inserted into different points along the hydraulic circuit
 - Tachometer (to measure compressor rpm)
 - Torque meter
 - digital multimeter



- Double pressure switch
- Thermomagnetic - earth leakage control button
- Fault insertion switches
- Safety button

Power supply: 230 Vca 50 Hz single-phase - 1000 VA
(Other voltage and frequency on request)

Dimensions: 138 x 81 x 178 cm

Net weight: 140 kg

SUPPLIED WITH
EXPERIMENTAL HANDBOOK



TRAINER FOR THE STUDY OF THE SEMI-HERMETIC COMPRESSOR

Mod. TCC-SS/EV

INTRODUCTION

The trainer, properly designed for educational use, permits the study of the semi-hermetic compressor applied to the refrigerating plants.

TRAINING PROGRAM

- Plant starting and verification of the intervention of the safety devices
- Analysis of the behavior of the system at the variation of:
 - Compressor rpm
 - Thermostatic valve superheat
 - Air flow at the evaporator and/or condenser
- Study of the semi-hermetic compressors
- Determining the power of a compressor
- Drawing the cycle in the pressure - enthalpy diagram of the refrigeration gas
- Data collection and calculation of:
 - Thermal balance at the evaporator, condenser, compressor
 - Mass flow of the refrigerant
 - Ideal and real EER
 - Volumetric efficiency of the compressor

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Silk-screened printed coloured synoptic reproducing the hydraulic circuit with LEDs
- Semi-hermetic compressor
- Frequency converter for the continuous variation of the compressor rpm
- Air condenser and air evaporator with variable speed
- Thermostatic expansion valve
- Liquid separator, oil separator
- Intercepting valves, sight glass, dehydrating filter
- Valve for plant vacuum, gas charging and discharging
- Connecting pipes among several components painted with different colours
- Complete set of instruments for data acquisition including:
 - Flow-meter
 - High and low pressure gauges
 - 3 digital thermometers with Pt100 probes to be inserted into different test points along the hydraulic circuit
 - Digital multimeter
- Double pressure switch
- Thermomagnetic - earth leakage control button
- Emergency pushbutton



Power supply: 230 Vac 50 Hz single-phase - 830 VA
(Other voltage and frequency on request)

Dimensions: 138 x 81 x 178 cm

Net weight: 145 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



MULTIPLE COMPRESSOR TRAINER

Mod. TCCM/EV

Mod. TCCM-C/EV (computerized vers.)



mod. TCCM-C/EV

INTRODUCTION

The trainer, properly designed for educational purposes, allows to study the combined operation of compressors in a refrigeration system controlled via a regulator (mod. TCCM/EV) or via a control unit/PC (mod. TCCM-C/EV) that switch on and off each compressor depending on the required cooling power. It includes a closed water circuit and a heater to apply a thermal load to the evaporator of the system.

TRAINING PROGRAM

- Study of the combined operation of compressors
- Study of the operation of a compressor pack controller (mod. TCCM/EV)
- Use of the $p - h$ diagram of a refrigerant gas
- Collection of the operating data and calculation of the heat balances and system efficiency
- Electric power consumption measurement depending on the number of active compressors
- Effect of the airflow rate on the condenser performance
- Data acquisition, system supervision and fault insertion via PC (mod. TCCM-C/EV)

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- 3 hermetic compressors (2,0 kW refrigeration capacity, temperature: $-10 + 35\text{ }^{\circ}\text{C}$)
- Variable flow air cooled condenser
- Oil separators, liquid separators, liquid receiver
- Check valves
- Sight glasses, drying filter
- Thermostatic expansion valve
- Water evaporator
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- High and low pressure gauges
- Double pressure switch
- Water closed circuit, including 3-speed pump, storage tank, 1.500 W heater, thermostat, pressure gauge
- Mod. TCCM/EV only: compressor pack controller with high pressure sensor for condenser fan speed regulation and low pressure sensor for compressors management
- Mod. TCCM/EV only: complete set of instruments including:
 - 4 digital thermometers with Pt100 probes to be inserted in many temperature test points along the hydraulic circuits
 - Water flowmeter
 - Digital multimeter
- Mod. TCCM-C/EV only: control unit with the following characteristics:
 - Autonomous operation or Remote Control (via PC, not included in the equipment)
 - USB interface for connection with PC
 - Graphic LCD display for visualizing values and trend in time of input signals such as temperature, pressure, water flow
 - Electronic board and converters for input signals
 - Numerical keyboard
 - Application software developed in NI LabVIEW
 - Fault insertion included
- Mod. TCCM-C/EV only: complete set of sensors including:
 - 6 Pt100 temperature probes
 - 1 water flow sensor
 - 2 pressure sensors
 - 1 electric power converter
- Thermomagnetic - earth leakage control button
- Emergency button
- Refrigerant: CFC free

Power supply: 230 Vca 50 Hz single-phase - 3600 VA
(Other voltage and frequency on request)

Dimensions: 130 x 80 x 180 cm

Net weight: 221 kg

SPECIAL VERSION ON DEMAND only for mod. TCCM/EV:

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with control unit



REQUIRED

PERSONAL COMPUTER
(for mod. TCCM-C/EV only)
- NOT INCLUDED -



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



ICE MAKER TRAINER

Mod. TG/EV

INTRODUCTION

This trainer has been designed to study the thermodynamic cycle of an ice maker. The evaporator is equipped with some special profiles onto which water is sprayed by a set of nozzles. Thus the evaporator is always covered by an ever growing ice layer. When ice is made, a timer stops the water spraying and hot gas is sent to the evaporator so that ice cubes can fall into the proper basin. Ice production capacity varies according to the efficiency of the cycle that depends on the environmental conditions.

TRAINING PROGRAM

- Studying the operation of an ice maker
- Analyzing the system behaviour versus the variation of the temperature of feeding water and of ambient temperature
- Using the refrigerant pressure-enthalpy diagram for work and diagnosis: plotting the refrigeration cycle
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual EER
 - volumetric compression efficiency

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- Hermetic compressor
- Forced-air condenser
- Expansion capillary tube
- Water pump
- Set of spraying nozzles
- Ice making process automatic controller
- Ice maker installed in a transparent material case enabling a comprehensive view of the cooling process
- On-off valves, solenoid valves, sight glass, dehydrator filter
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- Full set of instruments for acquiring operating data, including:
 - flowmeter
 - high and low pressure gauges
 - 3 electronic thermometers with Pt100 probes to be inserted in various test points arranged along the hydraulic circuit
 - digital multimeter
- High pressure switch
- Thermomagnetic - earth leakage control button
- Emergency button



Power supply: 230 Vac 50 Hz single-phase - 750 VA
(Other voltage and frequency on request)

Dimensions: 130 x 80 x 180 cm

Net weight: 145 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water, 6 bar max

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



ABSORPTION REFRIGERATION TRAINER

Mod. TAR/EV

INTRODUCTION

This trainer has been designed to study the absorption refrigeration cycle. The heat coming from a gas burner or from electric resistors vaporizes the ammonia contained in the solution of the generator. Ammonia vapour condenses in the exchanger and passes into the evaporator where it evaporates at low temperature. The ammonia vapour coming from the evaporator and the water coming from the generator are combined again in the absorber and close the cycle passing into the generator. The circulation of fluids occurs by natural convection. Students can experience in using log P-1/T and concentration/enthalpy charts of the solution, besides trying to assess the system output thanks to a set of instruments supplied with the equipment.

TRAINING PROGRAM

- Plotting the absorption refrigeration cycle on log P-1/T chart, with temperature measurements detected along the circuit
- Transferring these values onto the concentration/enthalpy chart and assessing the heat quantity exchanged in the boiler, in the condenser, in the absorber and in the evaporator
- Calculating the average flow rate of the circulating solution
- Data acquisition and calculation of the system output versus the temperature attained in the boiler

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- Welded airtight circuit of carbon steel including 1 boiler, 1 finned condenser for heat exchange with the environment, 1 evaporator and 1 absorber
- Refrigerant: water/ammonia solution
- 12 V electric resistors
- 230 V to 12 V transformer and rectifier
- LPG burner with pressure reducer and electronic ignition
- Cold room in transparent material with 2 compartments
- Full set of instruments for acquiring operating data, including:
 - Electronic thermometers with Pt100 probes to be inserted in various test points arranged along the hydraulic circuit
 - Digital multimeter

Power supply: 230 Vac 50 Hz single-phase - 150 VA
(Other voltage and frequency on request)

Dimensions: 130 x 80 x 180 cm

Net weight: 114 kg



OPTIONAL:

- Photovoltaic generator mod. PT/EV designed to power the Trainer by renewable energy. Wheeled structure with variable inclination.

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK





TABLETOP UNITS

BENCH FOR STUDYING THE REFRIGERATION CYCLE	MOD. BDRC/EV	RE 31
BENCH FOR THE STUDY OF THE ELECTRONIC EXPANSION VALVE	MOD. BDRCEEV/EV	RE 32
BENCH FOR THE STUDY OF THE ICE MAKER	MOD. TGE/EV	RE 33
BENCH FOR THE COMPRESSION REFRIGERATION CYCLE	MOD. BDF/EV	RE 34
BENCH FOR STUDYING THE ELECTRIC COMPONENTS IN REFRIGERATION PLANTS	MOD. BCE/EV	RE 35
AUTOMATED CONTROL SIMULATOR OF AN INDUSTRIAL REFRIGERATION PLANT	MOD. SIM-TRI/EV	RE 36
REFRIGERATION SIMULATOR	MOD. SIM-RF/EV	RE 37

BENCH FOR STUDYING THE REFRIGERATION CYCLE

Mod. BDRC/EV

INTRODUCTION

This unit has been designed for students so that they can acquire the scientific and practical knowledge of the operation of vapour-compression refrigeration cycle.

This equipment has been manufactured according to the safety standards and the used refrigerant complies with anti-pollution measures.

TRAINING PROGRAM

- Studying the refrigerant phases versus pressure and temperature
- Detecting refrigerant pressures, temperatures and flow rate when the equipment is running
- Plotting the refrigeration cycle onto the pressure-enthalpy diagram and detecting the specific thermal energy exchanged at the evaporator and at the condenser
- Studying the operation of a thermostatic valve and of a capillary tube for gas expansion
- Determining the exchanged thermal power
- Determining the thermostatic valve superheat
- Determining the compressor volumetric efficiency
- Assessing the system E.E.R.



TECHNICAL SPECIFICATIONS

- Steel structure painted with epoxy paint and baked
- Hermetic compressor with protector
- Forced-air evaporator and condenser (variable speed)
- Thermostatic expansion valve and capillary tube for controlling flow rate
- Liquid separator
- Dehydrator filter
- Sight glass
- On-off valves
- Double pressure switch
- Operating valve for system filling and draining
- Flowmeter
- High and low pressure gauges
- 2 electronic thermometers with Pt100 probes to be inserted in various test points arranged along the circuit
- Digital multimeter
- Thermomagnetic - earth leakage control button
- Fuses
- Start button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 380 VA
(Other voltage and frequency on request)

Dimensions: 90 x 45 x 76 cm

Net weight: 65 kg

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

**PORTABLE VANE ANEMOMETER
MOD. THAN**



**PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY**

BENCH FOR THE STUDY OF THE ELECTRONIC EXPANSION VALVE

Mod. BDRCEEV/EV

INTRODUCTION

The bench, properly designed for educational purposes, allows the student to deepen the knowledge of the operation of the electronic expansion valve as device used to regulate the refrigerant flow feeding the evaporator of a vapour compression refrigeration plant.

TRAINING PROGRAM

- Study of the operation of a vapour compression refrigeration plant
- Study of the operation of the electronic valve as refrigerant fluid expansion device
- Plant starting and safety devices intervention checking
- Analysing the system behaviour versus the variation of the air flow at the evaporator and/or at the condenser
- Detection of pressures, temperatures, refrigerant flow rate with plant operating
- Determination of electronic valve superheat
- Drawing the refrigerant cycle in the pressure-enthalpy diagram of the refrigerant gas
- Determination of specific energy and power transferred at each plant component (evaporator, condenser, compressor)
- Determination of the volumetric efficiency of the compression
- Evaluation of theoretical and actual cycle E.E.R.



TECHNICAL SPECIFICATIONS

- Steel structure painted and treated in the oven
- Hermetic compressor
- Forced air variable speed evaporator and condenser
- Electronic expansion valve complete with controlling driver (supplied with display), pressure transducer and temperature probe
- Liquid separator
- Dehydrating filter
- Sight glass
- Double pressure switch
- Service valve for plant gas charge and discharge
- Flowmeter
- 2 pressure gauges (high and low pressure)
- 2 digital thermometers with movable probes for temperature measurements along the hydraulic circuit
- Digital multimeter
- Thermomagnetic - earth leakage control button
- Run button
- Emergency push button

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Removable transparent cover to insulate the evaporator from outside
- Electronic thermostat for compressor automatic operation management

Power supply: 230 Vac 50 Hz single-phase - 380 VA
(Other voltage and frequency on request)

Dimensions: 90 x 45 x 76 cm

Net weight: 65 kg

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE VANE ANEMOMETER
MOD. THAN



PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY

BENCH FOR THE STUDY OF THE ICE MAKER

Mod. TGE/EV

INTRODUCTION

The bench has been designed for the study of the thermodynamic cycle of a refrigerator for ice production. The evaporator is provided with special profiles where atomized water is sprayed by a set of nozzles. An increasingly thicker ice coat adheres to the evaporator. When the ice is formed, a timer periodically stops the atomization and sends hot gas to the evaporator, this causing the fall of the ice cubes. The ice production capacity can vary according to the cycle efficiency depending on the ambient conditions.

TRAINING PROGRAM

- Study of the operation of an ice maker
- Analysis of the system behavior depending on the water temperature and the room temperature
- Use of the pressure enthalpy diagram of the refrigerant gas as work and diagnosis instrument: cycle drawing
- Data collection and calculation of:
 - specific thermal balances at the evaporator, condenser, compressor
 - EER

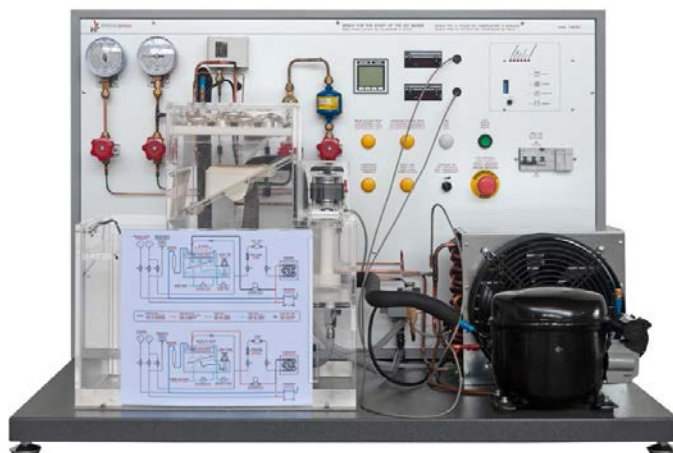
TECHNICAL SPECIFICATIONS

- Hermetic compressor
- Forced air condenser
- Capillary tube for gas expansion
- Water pump
- Series of spraying nozzles
- Ice making process automatic regulation
- Transparent structure for the ice maker enabling a whole view of the cooling process
- Solenoid valves, manual valves, sight glass, dehydrating filter
- Valve for plant vacuum, gas charge and gas recovery
- High and low pressure gauges
- 2 digital thermometers with Pt100 sensors to be inserted into many test points along the hydraulic circuit
- Digital multimeter
- Potentiometer for adjusting the air speed of the condenser fan
- High pressure switch
- Thermomagnetic - earth leakage control button
- Emergency push button

Power supply: 230 Vac 50 Hz single-phase
(Other voltage and frequency on request)

Dimensions: 110 x 70 x 78 cm

Net weight: 68 kg



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water, 6 bar max

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



BENCH FOR THE COMPRESSION REFRIGERATION CYCLE

Mod. BDF/EV

INTRODUCTION

This unit has been designed for students so that they can acquire the scientific and practical knowledge of the operation of vapour-compression refrigeration cycle.

This equipment has been manufactured according to the safety standards and the used refrigerant complies with anti-pollution measures.

TRAINING PROGRAM

- Studying the refrigerant phases versus pressure and temperature
- Detecting refrigerant pressures, temperatures and flow rate when the equipment is running
- Plotting the refrigeration cycle onto the pressure-enthalpy diagram and detecting the specific thermal energy exchanged at the evaporator and at the condenser
- Determining the exchanged thermal power
- Determining the thermostatic valve superheat
- Determining the compressor volumetric efficiency
- Assessing the system E.E.R.

TECHNICAL SPECIFICATIONS

- Steel structure painted with epoxy paint and baked
- Hermetic compressor with protector
- Double pressure switch
- Water condenser
- Liquid separator
- Operating valve for system filling and draining
- Dehydrator filter
- Flow and humidity indicator
- On-off valves
- Thermostatic expansion valve for controlling flow rate
- Water evaporator
- Flowmeter
- 2 high pressure gauges and 2 low pressure gauges
- 2 digital thermometers with Pt100 probes
- Test points arranged along the circuit to detect temperatures
- Digital multimeter
- Thermomagnetic - earth leakage control button
- Fuses
- Start button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 150 VA
(Other voltage and frequency on request)

Dimensions: 90 x 45 x 76 cm

Net weight: 49 kg



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



BENCH FOR STUDYING THE ELECTRIC COMPONENTS IN REFRIGERATION PLANTS

Mod. BCE/EV

INTRODUCTION

This unit has been designed for the assembly of various electric systems and the analysis of each component so that students can acquire the necessary theoretical and practical knowledge to reset the operation of a low power refrigeration system, when the fault concerns the electric system.

TRAINING PROGRAM

- Assessing the electric characteristics of start and run winding of a compressor
- Assembling an RSIR electric starting circuit with ammetric relay and with voltmetric relay
- Assembling a CSIR electric starting circuit with ammetric relay and with voltmetric relay
- PSC start
- CSR start via voltmetric relay
- Start via solid state relay
- Assembling the system control and safety electric circuit of the by connecting it with thermostat and with pressure switch

TECHNICAL SPECIFICATIONS

- Hermetic compressor
- High and low pressure gauges
- Full set of components for developing the training program:
 - solid state relay
 - ammetric relay
 - voltmetric relay
 - thermostat
 - start and run capacitors
- Compressor terminals on front panel
- Coloured wirings for electric connections
- Digital multimeter for electric parameter measurement
- Double pressure switch
- Thermomagnetic - earth leakage control button
- Emergency button
- Fuses
- Start button

Power supply: 230 Vac 50 Hz single-phase - 180 VA
(Other voltage and frequency on request)

Dimensions: 90 x 45 x 76 cm

Net weight: 45 kg



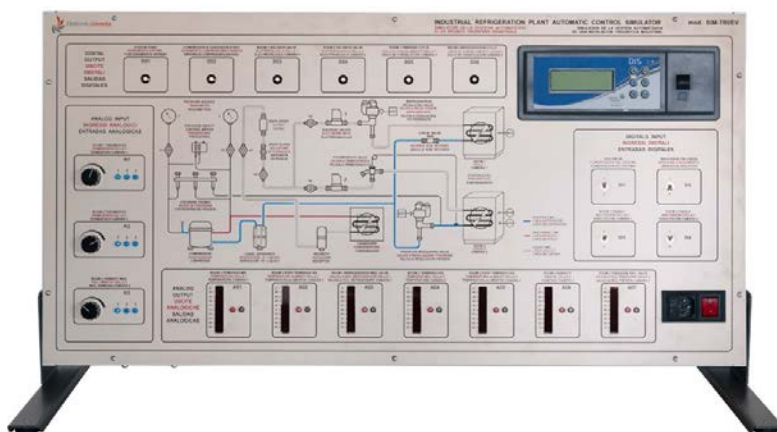
SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



AUTOMATED CONTROL SIMULATOR OF AN INDUSTRIAL REFRIGERATION PLANT

Mod. SIM-TRI/EV



INTRODUCTION

This educational simulator is designed for the training in the sector of computer-aided control of industrial systems and it simulates the operation of an industrial refrigeration system with two cold rooms: one for frozen products (L.T.: low temperature) and the other for fresh vegetable products (M.T.: medium temperature). It is controlled by an industrial digital controller that automatically decides the actions to be performed according to the set parameters thus checking the system behaviour and the importance of the involved parameters, once fixed the set-point values of reference variables (air temperature in L.T. room, air temperature and relative humidity in M.T. room). When connected with a PC (supplied on demand) the simulator allows the supervision of the system by using a dynamic graphics.

TRAINING PROGRAM

Theoretical topics

- Studying on the psychrometric chart the air transformations at the evaporator at a cold room
- Analyzing the behaviour of a refrigeration system with a unique compressor/condenser set and double level of evaporation pressure
- How the difference between room temperature and evaporation temperature affects the relative humidity of a cold room for fresh food

Practical topics

- Analyzing the operation of an electronic expansion valve
- Analyzing the operation of an evaporation pressure regulator
- Proportional and ON/OFF control
- Testing ON/OFF or PI control logics

TECHNICAL SPECIFICATIONS

- Painted metallic framework
- Insulating material front panel representing the refrigeration system
- Web access controller, with remote LCD display, including:
 - 10 universal inputs,
 - 8 digital inputs,
 - 4 analog outputs,
 - 4 configurable outputs,
 - 7 digital outputs
 - PC connection via net cable
 - Controller access via Web browser
- 3 potentiometers with 2-mm holes for simulating the analog inputs
- 7 bargraph LEDs with 2-mm holes for simulating the analog outputs
- 4 switches for simulating the digital inputs
- 6 LEDs for simulating the digital outputs

Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 80 x 40 x 12 cm

Net weight: 18 kg

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL

PERSONAL COMPUTER

REFRIGERATION SIMULATOR

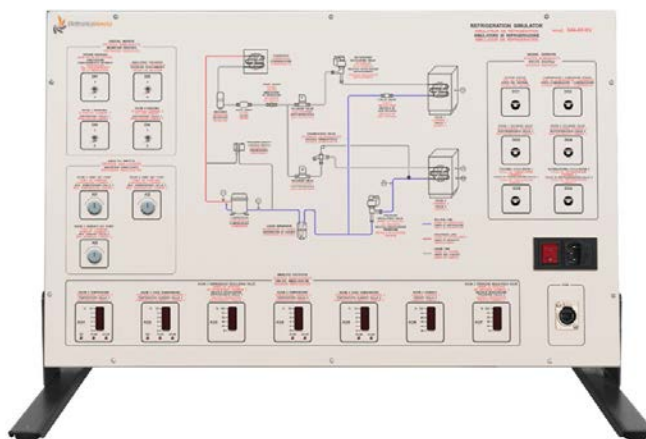
Mod. SIM-RF/EV

INTRODUCTION

This educational simulator mod. SIM-RF/EV is designed for the training in the sector of computer-aided control of industrial systems and it simulates the operation of an industrial refrigeration system with two cold rooms: one for frozen products (L.T.: low temperature) and the other for fresh vegetable products (M.T.: medium temperature). It enables to check the system behaviour and the importance of the involved parameters, once fixed the set-point values of reference variables. This simulator must necessarily be connected with a PC (supplied on demand).

TRAINING PROGRAM

- Studying the pressure-enthalpy diagram of a refrigerant
- Studying on the psychrometric chart the air transformations at the evaporator of a cold room
- Heat balances on refrigerant side and on air side
- Studying the heat losses of a cold room
- Analyzing the behaviour of a refrigeration system with a unique compressor/condenser set and double level of evaporation pressure
- How the difference between room temperature and evaporation temperature affects the relative humidity of a cold room for fresh food
- Analyzing the operation of an electronic expansion valve
- Analyzing the operation of an evaporation pressure regulator
- Proportional and ON/OFF control
- Programming and testing ON/OFF or PI control logics



TECHNICAL SPECIFICATIONS

- Colour panel representing the refrigeration system
- Board for data acquisition and control of output signals to the actuators
- Connection with PC via USB cable
- 3 potentiometers for simulating the following analog inputs:
 - L.T. room air temperature set-point
 - M.T. room air temperature set-point
 - M.T. room air relative humidity set-point
- 7 bargraph LEDs for simulating the following analog outputs:
 - L.T. room air temperature
 - L.T. room product temperature
 - M.T. room air temperature
 - M.T. room product temperature
 - M.T. room air relative humidity
 - control signal of the electronic expansion valve motor (L.T. room)
 - control signal of the evaporation pressure regulator motor (M.T. room)
- 4 switches for simulating the following digital inputs:
 - system operation enabling
 - cold rooms thermal insulation
 - L.T. room solenoid valve enabling
 - M.T. room solenoid valve enabling

- 6 LEDs for simulating the following digital outputs:
 - system enabling
 - compressor enabling
 - L.T. room solenoid valve enabling
 - M.T. room solenoid valve enabling
 - freezing cycle operation
 - refrigeration cycle operation
- Program for simulating the operation of the refrigeration unit control system
- Creation software that can be used to modify the applications programs according to customer's needs.

Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 65 x 40 x 12 cm

Net weight: 5 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK





THERMOTRONICS COMPUTERIZED MODULAR LABORATORY

PRESENTATION		RE 39
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BASE MODULE FOR REFRIGERATION AND AIR-CONDITIONING	MOD. AA/EV	RE 40
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REFRIGERATION

MODULE FOR THE STUDY OF DOMESTIC REFRIGERATION	MOD. AC/EV	RE 42
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MODULE FOR THE STUDY OF INDUSTRIAL REFRIGERATION	MOD. AE/EV	RE 43
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MODULE FOR THE STUDY OF THE ELECTRIC COMPONENTS IN REFRIGERATION PLANTS	MOD. AG/EV	RE 44
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CONDITIONING (REF. NEXT SECTION)

MODULE FOR THE STUDY OF HEAT-TRANSFER THERMODYNAMICS	MOD. AB/EV	CV 43
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MODULE FOR THE STUDY OF DOMESTIC AIR-CONDITIONING	MOD. ADM/EV	CV 44
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MODULE FOR THE STUDY OF INDUSTRIAL AIR-CONDITIONING	MOD. AF/EV	CV 45
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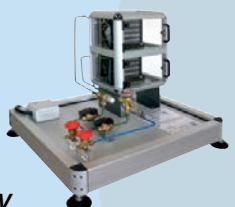
MODULE FOR THE STUDY OF HEAT PUMPS IN AIR-CONDITIONING SYSTEMS	MOD. AH/EV	CV 46
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THERMOTRONICS COMPUTERIZED MODULAR LABORATORY

REFRIGERATION



AC/EV
DOMESTIC REFRIGERATION



AE/EV
INDUSTRIAL REFRIGERATION



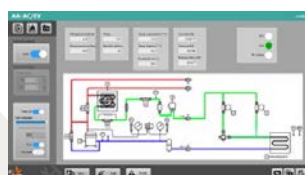
AG/EV
**ELECTRIC COMPONENTS IN
REFRIGERATION PLANTS**

LABORATORY STRUCTURE



AA/EV
BASE MODULE

+



SUPERVISION SOFTWARE
(SPECIFIC FOR EACH MODULE)

CONDITIONING



AB/EV
**HEAT TRANSFER
THERMODYNAMICS**



ADM/EV
DOMESTIC AIR CONDITIONING



AF/EV
**INDUSTRIAL AIR
CONDITIONING**



AH/EV
**HEAT PUMP IN AIR CONDITIONING
SYSTEMS**

PRESENTATION

The Computerized Thermotronics Modular Laboratory combines all the common components of all Laboratory applications into a unique compact Basic Module.

On the contrary, the specific applications can use the Experimental Modules that must be connected (one at a time) with the Basic Module via flexible pipes: these Experimental Modules explain the theoretical and practical issues concerning refrigeration and air conditioning.

The operating modes can be controlled by a PC (not included) via USB cable, thanks to a specific supervision software (different for each module).

This Modular Laboratory has been designed to offer an exhaustive and flexible training program that can be used by vocational school and technical high school, as well as by universities. This Modular Laboratory enables to teach and learn the most advanced installation and PC-control techniques of refrigeration and air conditioning systems.

This section of the catalogue only shows the base module, the software and the laboratory modules concerning refrigeration. The air conditioning modules are described in the next section of this catalogue (see previous page).

BASE MODULE FOR REFRIGERATION AND AIR-CONDITIONING

Mod. AA/EV

INTRODUCTION

The base module mod. AA/EV combines the common components of all Laboratory applications.

It includes connectors and cocks for the necessary electric and hydraulic connections (via flexible pipes) with the experimental module under examination. Thus various configurations representing different aspects of refrigeration and air conditioning techniques can be prepared.

This basic module also includes a display for viewing data. The module is controlled via PC with the help of a specific software, different for each operation module. At last, some non destructive faults can be inserted in the system.

TECHNICAL SPECIFICATIONS

Tabletop unit mounted on an aluminium structure including:

- Hermetic compressor
- Variable speed fan air condenser
- Sight glass, dehydrator filter, liquid separator
- High and low pressure gauges
- 2 temperature sensors to be applied onto different points of the hydraulic circuit
- Electronic flowmeter
- High and low pressure transducers
- Voltage, current and power transducers
- Double pressure switch
- Operating valve for filling and bleeding the refrigerant
- Cocks and flexible pipes with valve for the connection with the experimental module
- Solenoid valves for inserting faults
- Switchboard including:
 - power cord
 - thermomagnetic - earth leakage control button
 - emergency button
 - start button with pilot lamp



- Data acquisition and control system with the following characteristics:
 - Remote Control (via PC, not included in the equipment)
 - USB interface for connection with PC
 - Display for viewing the acquired data such as: temperature, pressure, relative humidity, volume flow rate, air speed, voltage, current, electric power
 - The software allows to control analog and digital inputs and outputs, the state of solenoid valves, of compressor, of fan, of heating, cooling, humidification and dehumidification, etc...
 - Fault insertion according to the experimental module in use

Power supply: 230 Vac 50 Hz single-phase - 350 VA
(Other voltage and frequency on request)

Dimensions: 89 x 74 x 50 cm

Net weight: 54 kg

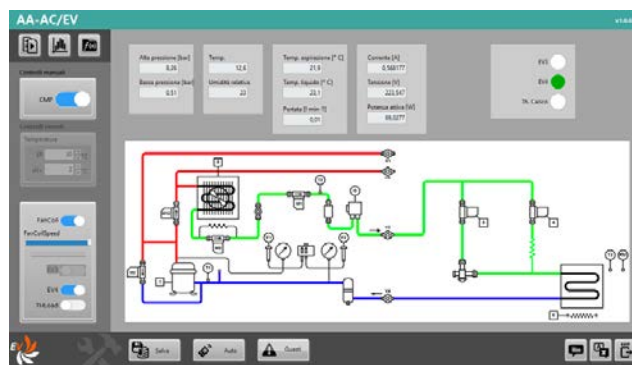
SOFTWARE

The **Supervision Software** (different for each experimental module) is designed to study and verify the laws of thermodynamics and their actual applications to refrigeration and to air conditioning.

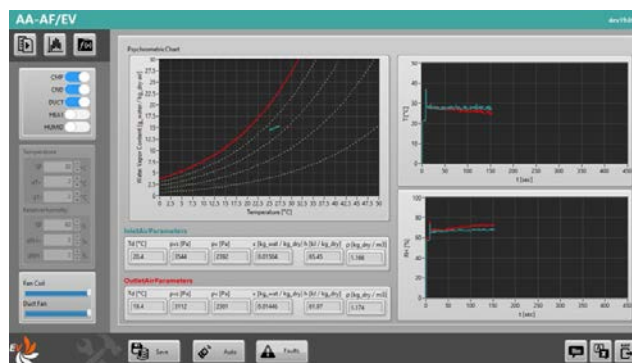
Each program enables to acquire and process the values of input variables and to control the output variables manually or automatically (for the modules that offers this option) according to the logics of industrial processes. They also allow to send the control signals to the actuators for the management of the selected Experimental Module.

Using this software the teacher can also insert some non destructive faults into the system, or modify some operating parameters and consequently the analysis results.

The heat balances at the compressor, at the evaporator and at the condenser are calculated automatically. The volumetric efficiency of the compressor, the C.O.P. or E.E.R. of the system are displayed. Some characteristic parameters of the air such as temperature, relative and specific humidity, enthalpy, are determined.



Supervision software working with module AC/EV



Supervision software working with module AF/EV

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



AT LEAST 1 EXPERIMENTAL MODULE

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



MODULE FOR THE STUDY OF DOMESTIC REFRIGERATION

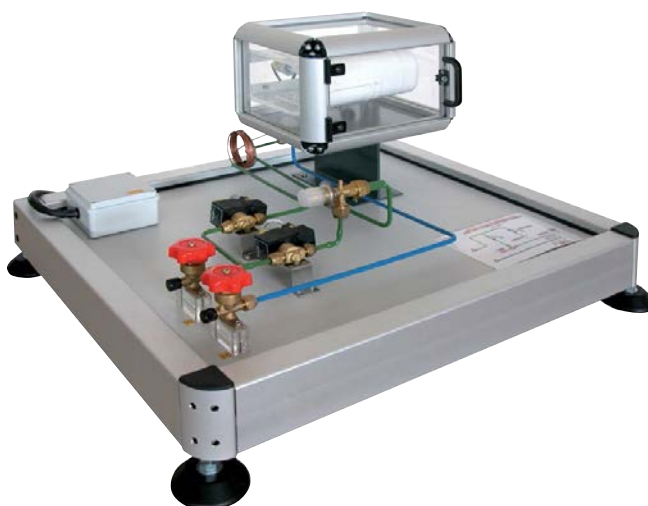
Mod. AC/EV

INTRODUCTION

The experimental module mod. AC/EV is designed so that students can acquire the data characterizing the refrigeration cycle and relate them with the thermal characteristics of the products to be stored at a temperature of approximately 0 °C.

TRAINING PROGRAM

- Basic concepts of thermodynamics and relevant terms
- Domestic refrigeration operating principles
- Refrigerant pressure-enthalpy diagram
- The main components of domestic refrigeration: hermetic compressor, condenser, evaporator, filter. Different devices for flow control: capillary tubes and automatic valves
- System operation with automatic valve or capillary tube
- Checking the intervention of safety devices
- Assessing the parameters of the refrigeration cycle and plotting them onto P-h diagram
- Heat balances of compressor, evaporator, condenser
- Assessing the system E.E.R. and the compressor volumetric efficiency
- Differences between actual and ideal cycles seen on P-h diagram
- Adjusting the automatic valve versus the characteristics of the product to be stored
- Fault insertion tests (via the basic module) are also included.



TECHNICAL SPECIFICATIONS

- Tabletop aluminium structure
- Small cold room with door, static Roll-bond evaporator, internal thermal load, temperature and relative humidity sensor
- Colour printed schematic diagram of the hydraulic circuit
- Capillary tube and automatic valve for gas expansion
- Cocks for an easy connection with the basic module
- Solenoid valves for selecting the expansion device
- Specific supervision software

Dimensions: 74 x 64 x 44 cm

Net weight: 19 kg

REQUIRED

**BASE MODULE
MOD. AA/EV
- NOT INCLUDED -**



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



MODULE FOR THE STUDY OF INDUSTRIAL REFRIGERATION

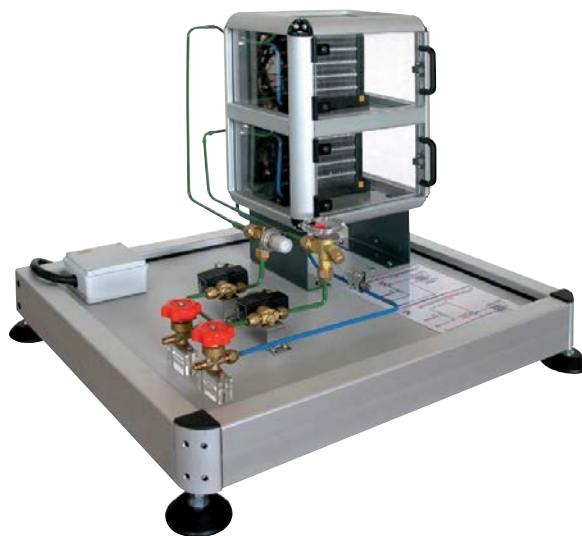
Mod. AE/EV

INTRODUCTION

The aim of experimental module mod. AE/EV consists in showing the different modes of variation of temperature and relative humidity in cold rooms to protect the goods being stored from the activity of microorganisms growing at ambient temperature. It includes two cold rooms for food preservation: a low-temperature room (for frozen food) and a positive-temperature and high relative humidity one (for fresh food).

TRAINING PROGRAM

- Basic concepts of industrial refrigeration
- Pressure-enthalpy diagrams of refrigerants for industrial refrigeration
- Differences between actual and ideal cycles seen on P-h diagram
- System efficiency. Heat flows
- Connecting evaporators in series and in parallel
- Defrosting
- Design parameters. How thermal loads affect design conditions
- Servicing industrial refrigeration systems
- Tests concerning heat exchanges, assessment of the parameters of the refrigeration cycle and their plotting onto P-h diagram. Heat balances of compressor, evaporator, condenser
- Assessing the system E.E.R. and the compressor volumetric efficiency
- Adjusting the automatic valve versus the characteristics of the product to be stored
- Checking the relative humidity inside the cold room for a correct preservation of fresh food
- Analysis of the operation of a thermostatic expansion valve
- Fault insertion tests (via the basic module) are also included.



TECHNICAL SPECIFICATIONS

- Tabletop aluminium structure
- 2 small cold rooms each with door, forced air evaporator, internal thermal load, temperature and relative humidity sensor
- Colour printed schematic diagram of the hydraulic circuit
- Thermostatic and automatic valves for gas expansion
- Cocks for an easy connection with the basic module
- Solenoid valves for selecting the cold room to be examined
- Specific supervision software

Dimensions: 74 x 64 x 59 cm

Net weight: 23 kg

REQUIRED

**BASE MODULE
MOD. AA/EV
- NOT INCLUDED -**



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



MODULE FOR THE STUDY OF THE ELECTRIC COMPONENTS IN REFRIGERATION PLANTS

Mod. AG/EV

INTRODUCTION

The experimental module mod. AG/EV is designed for students so that they can analyze some connection diagrams of the components of a small refrigeration system such as the compressor starting device, the compressor protector, the thermostat controlling the temperature of a cold room. It also allows to analyze the characteristics and reliability of various electric components that are an important part in the study of a refrigeration system.

TRAINING PROGRAM

- Basic concepts of electricity and wiring in refrigeration systems
- Electric components of a system: symbols and characteristics
- Single-phase systems
- Assembling various electric connection circuits
- Compressor operation troubleshooting
- Determining the electric characteristics of compressor start and run windings
- Fault insertion tests (via the basic module) are also included.

TECHNICAL SPECIFICATIONS

- Tabletop aluminium structure
- Small cold room with door and forced air evaporator
- Colour printed schematic diagram of the hydraulic circuit
- Automatic valve for gas expansion
- Cocks for an easy connection with the basic module
- Compressor electric terminals on the module
- Ammetric and solid-state starting relays
- Start and run capacitors
- Overload protector
- Room temperature control thermostat
- 1 ohmmeter, 1 capacitance meter
- Connecting cables
- Specific supervision software

Dimensions: 74 x 64 x 44 cm

Net weight: 22 kg



REQUIRED

**BASE MODULE
MOD. AA/EV
- NOT INCLUDED -**



SUPPLIED WITH

EXPERIMENTAL HANDBOOK





WORKSHOP EQUIPMENT

PREASSEMBLED KIT FOR REFRIGERATION AND AIR-CONDITIONING	MOD. SAS/EV	RE 47
ASSEMBLY KIT OF DOMESTIC REFRIGERATION	MOD. DR-K/EV	RE 49
DOMESTIC REFRIGERATOR SERVICING KIT	MOD. COCG/EV	RE 50
ASSEMBLY KIT OF INDUSTRIAL REFRIGERATION	MOD. IR-K/EV	RE 51
ASSEMBLY KIT OF BEVERAGE COOLER	MOD. BCS-K/EV	RE 52
DOMESTIC REFRIGERATOR (1-DOOR) DOMESTIC REFRIGERATOR (2 -DOOR)	MOD. FRI-1/EV MOD. FRI-2/EV	RE 53
POSITIVE-TEMPERATURE NEGATIVE-TEMPERATURE REFRIGERATION PLANT	MOD. CFTP/EV MOD. CFTN/EV	RE 54

PREASSEMBLED KIT FOR REFRIGERATION AND AIR-CONDITIONING

Mod. SAS/EV



INTRODUCTION

This kit is specifically designed for educational aims; its compact and modular shape leads students to learn operating principles and assembling techniques that are at the base of any refrigeration and air conditioning system. The components are classified according to homogeneous groups and they are mounted on plates that can easily be connected via flexible pipes and threaded connections.

TRAINING PROGRAM

- Hydraulic and electric connection of different modules
- Execution of (optional item required: vacuum and charging station):
 - system bleeding and cleaning
 - gas filling and system tightness check
- Plant starting and safety devices intervention checking
- Analyzing the system versus the variation of:
 - system configuration
 - air flow rate at condenser and/or evaporator
 - system refrigerant charge
- Plotting the cycle onto the pressure-enthalpy diagram of the refrigerant
- Data acquisition and calculation of (optional item required: portable thermometer):
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual E.E.R.
 - volumetric compression efficiency
- With optional items portable thermohygrometer and portable anemometer:
 - transferring the transformations undergone by the air during heating, cooling and dehumidification, onto the psychrometric chart
 - calculating the heat quantity exchanged with the air
 - calculating the exchange coefficients in the condenser and in the evaporator

TECHNICAL SPECIFICATIONS

- Aluminium profiles base structure
- Compressor module including hermetic compressor, shut off valves and connections, holes for electric connection
- Module of water condenser including coil exchanger, glass vessel, shut off valves and connections
- Module of water evaporator including coil exchanger, glass vessel, capillary tube, tank, shut off valves and connections
- Module of flow control including flowmeter, sight glass, dehydrator filter, shut off valves and connections
- Module for checking pressures and safety devices including high and low pressure gauges, double pressure switch, shut off valves and connections, holes for electric connection
- Module of power supply including residual current circuit breaker with overcurrent protection (RCBO), start button, emergency button, warning lights, speed variators for fans, holes for electric connection, digital multimeter
- Module of air cooling and dehumidification (air evaporator) including finned exchanger, fan, capillary tube, tank, shut off valves and connections, holes for electric connection
- Module of air heating (air condenser) including finned exchanger, fan, shut off valves and connections, holes for electric connection
- Set of accessories with flexible pipes, electric cables, 2 capillary tubes

Power supply: 230 Vac 50 Hz single-phase - 190 VA
(Other voltage and frequency on request)

Rack dim.: 116 x 51 x 80 cm

Net weight: 14 kg

Module dim.: 35 x 31,5 cm

Net weight: 40 kg

ON DEMAND

The modules already supplied can be integrated with the following units:

- Expansion module with thermostatic valve mod. SAS-1/EV



- Water condensation module with pressure regulated valve mod. SAS-2/EV



- Consumables and tools

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE VANE ANEMOMETER
MOD. THAN



PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY

PORTABLE VACUUM AND
CHARGING STATION - MOD. VACU-2



ELECTRONIC LEAK DETECTOR
MOD. AHL-1

PORTABLE THERMOMETER
WITH IMMERSION PROBE
MOD. THRN



ASSEMBLY KIT OF DOMESTIC REFRIGERATION

Mod. DR-K/EV

INTRODUCTION

This kit is specifically designed for educational aims to lead students to learn the assembling and servicing techniques of domestic refrigerators. It also includes the pipes and metallic small parts that can be used together with the standard tools for refrigerator technicians to assemble the hydraulic and electric circuits. This kit can easily be disassembled for a repeated use.

TRAINING PROGRAM

- The diagrams supplied with the equipment enable:
 - to carry out the mechanical connections by brazing and flanging
 - to assemble the electric system.
- The optional vacuum and charging station enables:
 - to drain and clean the system
 - to fill the system with refrigerant and to check the system tightness
- Setting the system at work
- Analyzing the system behaviour
- Carrying out the gas recovery (optional recovery-recycling unit required)



TECHNICAL SPECIFICATIONS

This kit includes all the components of a domestic refrigerator, that is:

- hermetic compressor
- static wire condenser
- cold room
- static evaporator
- capillary tube
- control thermostat

Power supply: 230 Vac 50 Hz single-phase - 150 VA
(Other voltage and frequency on request)

Package dim.: 55 x 52 x 54 cm

Net weight: 60 kg

ON DEMAND

- Consumables and tools

OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

RECOVERY-RECYCLING UNIT MOD. RERE



ELECTRONIC BALANCE MOD. RECH

PORTABLE VACUUM AND CHARGING STATION - MOD. VACU-2



ELECTRONIC LEAK DETECTOR MOD. AHLD-1

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



DOMESTIC REFRIGERATOR SERVICING KIT

Mod. COCG/EV

INTRODUCTION

This kit is specifically designed for educational aims to lead students to learn the assembling and servicing techniques of domestic refrigerators. It also includes the pipes and metallic small parts that can be used together with the standard tools for refrigerator technicians to assemble the hydraulic and electric circuits. The kit is supplied disassembled and without refrigerating gas. Once assembled, it can easily be disassembled for a repeated use.

On request, it can be supplied already assembled. It is ideal for vacuum, charge, gas recovery operations (optional items required).

TRAINING PROGRAM

- The diagrams supplied with the equipment enable:
 - to carry out the mechanical connections by brazing and flanging
 - to assemble the electric system
- The optional vacuum and charging station enables:
 - to drain the system
 - to fill the system with refrigerant and to check the system tightness
- Setting the system at work
- Analyzing the system behaviour
- Carrying out the gas recovery (optional recovery-recycling unit required)

TECHNICAL SPECIFICATIONS

- This kit includes all the components of a domestic refrigerator, that is:
 - hermetic compressor
 - static wire condenser
 - static evaporator
 - capillary tube
 - control thermostat
- It also includes:
 - high and low pressure gauges
 - 4 pressure test points (suction, discharge, liquid, process)

Power supply: 230 Vac 50 Hz single-phase - 100 VA
(Other voltage and frequency on request)

Dimensions: 40 x 40 x 90 cm

Net weight: 13,5 kg

ON DEMAND

- Consumables and tools



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)



ELECTRONIC REFRIGERATION ANALYZER
MOD. REFA-1

RECOVERY-RECYCLING UNIT
MOD. RERE



PORTABLE THERMOMETER
WITH PROBE FOR SURFACES
MOD. THRM

PORTABLE VACUUM AND
CHARGING STATION - MOD. VACU-2



ELECTRONIC LEAK DETECTOR
MOD. AHLD-1

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



ASSEMBLY KIT OF INDUSTRIAL REFRIGERATION

Mod. IR-K/EV

INTRODUCTION

This kit is specifically designed for educational aims to lead students to learn the assembling and servicing techniques of industrial refrigerators. It also includes the pipes and electric cables that can be used together with the standard tools for refrigerator technicians to assemble the hydraulic and electric circuits. This kit can easily be disassembled for a repeated use.

TRAINING PROGRAM

- The optional vacuum and charging station enables:
 - to drain and clean the system
 - to fill the system with refrigerant and to check the system tightness
- Setting the system at work and checking the tripping of safety devices
- Analyzing the system behaviour versus the variation of:
 - thermostatic valve superheat
 - the quantity of refrigerant filled in the system.
- Carrying out the gas recovery (optional recovery-recycling unit required)



TECHNICAL SPECIFICATIONS

This kit includes the following refrigeration circuit elements of an industrial refrigerator:

- hermetic compressor
- forced-air condenser
- forced-air evaporator with defrosting resistor
- thermostatic expansion valve
- sight glass, dehydrator filter, liquid receiver
- cocks

This is also equipped with a switchboard including:

- high and low pressure gauges
- double pressure switch
- control thermostat
- digital multimeter
- thermomagnetic - earth leakage control button
- emergency button
- warning lights

Power supply: 230 Vac 50 Hz single-phase - 730 VA
(Other voltage and frequency on request)

Package dim.: 125 x 85 x 70 cm

Net weight: 70 kg

ON DEMAND

- Consumables and tools

OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

RECOVERY-RECYCLING UNIT MOD. RERE



ELECTRONIC BALANCE MOD. RECH

PORTABLE VACUUM AND CHARGING STATION - MOD. VACU-2



ELECTRONIC LEAK DETECTOR MOD. AHLD-1

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



ASSEMBLY KIT OF BEVERAGE COOLER

Mod. BCS-K/EV

INTRODUCTION

This kit is specifically designed for educational aims and it includes all the components of the hydraulic circuit of a beverage cooler. It enables students to deal with the issues concerning the assembling of the hydraulic circuit, the connection of electric components, besides the calibration of the controller for an optimum operation of the system. The kit also includes the pipes that can be used together with the standard tools for refrigerator technicians to assemble the hydraulic circuit. This kit can easily be disassembled for a repeated use.

TRAINING PROGRAM

- The diagrams supplied with the equipment enable:
 - to carry out the hydraulic connections
 - to assemble the electric system.
- The optional vacuum and charging station enables:
 - to drain and clean the system
 - to fill the refrigerant and to check the system tightness
- Setting the system at work and checking the tripping of safety devices
- Analyzing the system behaviour versus the variation of:
 - controller setup
 - condenser air flow
 - the quantity of refrigerant filled in the system.
- The optional thermometer enables:
 - to plot the refrigeration cycle onto the pressure-enthalpy diagram of refrigerant
 - to calculate the heat balances corresponding to evaporator, condenser, compressor; refrigerant mass flow; system E.E.R.; volumetric compression efficiency

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Hermetic compressor
- Forced-air condenser with variable speed
- Forced-air evaporator with defrosting resistor
- Thermostatic expansion valve
- On-off valves, sight glass, dehydrator filter
- Liquid receiver, liquid separator
- Flowmeter
- High and low pressure gauges
- Switchboard including:
 - thermomagnetic - earth leakage control button
 - electronic controller for refrigerating units
 - condenser fan speed variator
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 520 VA
(Other voltage and frequency on request)

Dimensions: 120 x 80 x 175 cm

Net weight: 113 kg

ON DEMAND

- Consumables and tools



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

**PORTABLE VACUUM AND
CHARGING STATION - MOD. VACU-2**



**ELECTRONIC LEAK DETECTOR
MOD. AHLD-1**

**PORTABLE THERMOMETER
WITH IMMERSION PROBE
MOD. THRN**



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



DOMESTIC REFRIGERATOR

Mod. FRI-1/EV (1-door)
Mod. FRI-2/EV (2-door)

INTRODUCTION

The equipment has been designed to allow students to see in detail the operation of a 1-door (mod. FRI-1/EV) or of a 2-door (mod. FRI-2/EV) domestic refrigerator.

It is mounted on wheels and it uses refrigerant environment friendly HFC134a.

TRAINING PROGRAM

- Analysis of the operation of a domestic refrigerator
- ON/OFF regulation: the refrigerated room thermostat
- Evaluation of the cycle pressures and of the corresponding evaporation/condensation temperatures
- Drawing of the cycle on the pressure enthalpy diagram
- Evaluation of the specific energy exchanged at the evaporator and at the condenser
- Cycle EER evaluation

TECHNICAL SPECIFICATIONS

- Structure mounted on wheels
- Colored synoptic
- 1-door (mod. FRI-1/EV) or 2-door (mod. FRI-2/EV) domestic refrigerator with:
 - hermetic compressor
 - static condenser
 - overall capacity: approx. 80 l (mod. FRI-1/EV) or approx. 180 l (mod. FRI-2/EV)
 - freezer capacity: approx. 40 l (only mod. FRI-2/EV)
 - capillary tube for gas expansion
 - refrigerated room thermostat
- Thermomagnetic - earth leakage control button
- Digital thermometers with Pt100 probes
- Emergency push button

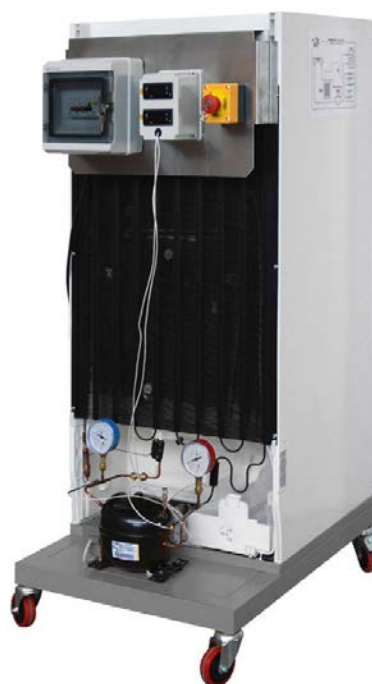
Power supply: 230 Vac 50 Hz single-phase
 (Other voltage and frequency on request)

FRI-1/EV Dimensions: 50 x 85 x 100 cm
Net weight: 60 kg

FRI-2/EV Dimensions: 60 x 85 x 160 cm
Net weight: 80 kg

ON DEMAND

- Consumables and tools



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)



**ELECTRONIC REFRIGERATION ANALYZER
MOD. REFA-1**

**RECOVERY-RECYCLING UNIT
MOD. RERE**



**PORTABLE THERMOMETER
WITH PROBE FOR SURFACES
MOD. THRM**

**PORTABLE VACUUM AND
CHARGING STATION - MOD. VACU-2**



**ELECTRONIC LEAK DETECTOR
MOD. AHLD-1**

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



REFRIGERATION PLANT

Mod. CFTP/EV for positive-temperature
Mod. CFTN/EV for negative-temperature

INTRODUCTION

Thanks to this sophisticated educational unit students can solve rather complex problems concerning both the manual assembling technique and the setting-up of refrigeration cycles for positive-temperature refrigeration (mod. CFTP/EV) or negative (mod. CFTN/EV). This equipment includes all the components of an industrial refrigeration system, even a real size cold room and an infrared thermometer for a fast check of food temperature with no damage for the package.

TRAINING PROGRAM

- Using the instruments usually available in a workshop of refrigeration technicians carry out all the operations for:
 - assembling the system
 - bleeding and cleaning the system
 - filling the gas and checking the tightness
 - setting the system at work
 - checking the tripping of safety devices
- Theoretical and practical exercises
- Practical methods for provoking variations in the refrigeration cycle
- Controlling the evaporator outlet temperature and identifying the products protected by the assembled refrigeration cycles, and vice versa

TECHNICAL SPECIFICATIONS

- Air condensing unit
- 220/380 V – 1 kW three-phase motor
- Cold room:
 - Dimensions: 2,0 x 2,0 x 2,0 m
 - Temperature (for mod. CFTP/EV): +4°C
 - Temperature (for mod. CFTN/EV): -10°C
 - Insulating material: high-density polyurethane
 - Insulation thickness (for mod. CFTP/EV): 6 cm
 - Insulation thickness (for mod. CFTN/EV): 10 cm
 - Door opening: 70 x 187 cm
- Infrared thermometer: - 40°C + 15°C
- Ceiling evaporator, expansion device
- Thermostat with timer
- High and low pressure switch
- Solenoid valve
- Dehydrator filter, sight glass
- Control board

ON DEMAND

- Consumables and tools



Mod. CFTP/EV

Dim. of cold room: 215 x 215 x 215 cm

Net weight of cold room: 445 kg

Mod. CFTN/EV

Dim. of cold room: 223 x 223 x 223 cm

Net weight of cold room: 490 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Power supply: 400 Vac 50 Hz three-phase - 1000 VA

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE VANE ANEMOMETER MOD. THAN



PORTABLE THERMOHYGROMETER WITH REMOVABLE PROBE MOD. THHY

PORTABLE THERMOMETER WITH IMMERSION PROBE MOD. THRN



PORTABLE VACUUM AND CHARGING STATION - MOD. VACU-2

27-C





AIR-CONDITIONING AND VENTILATION

Aim:

- Basic training in the sectors of Industrial and Domestic Air conditioning, room Ventilation, Heat Pumps
- Technical High Schools, Vocational schools, Universities

Equipment:

- Units mounted on wheeled frameworks, or tabletop units
- Colour schematic diagrams
- Computer-aided and manual equipment
- Instruments and accessories for a theoretical-practical approach to the topic under examination



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AIR-CONDITIONING AND VENTILATION

PRESENTATION

CV 5

PLANTS

CV 6

TABLETOP UNITS

CV 24

THERMOTRONICS COMPUTERIZED MODULAR LABORATORY

CV 41

WORKSHOP EQUIPMENT

CV 47

PRESENTATION

This product line includes all the apparatuses and optional units concerning Air Conditioning and Ventilation of rooms. Attention can be focused onto the transformations of the air during a heat exchange process, onto the study of vapour compression refrigerating cycle in heat pumps, onto the use of inverters for an optimum control of a system, onto the applications of air conditioning to domestic or industrial sectors, and so on, according to the needs. This product line also includes the equipment for studying compressed air and its dehumidification.

This product line is subdivided into three main sections of different size designed for different users:

- **Plants**
- **Tabletop units**
- **Workshop equipment**

The first section includes the wheeled, computer-aided and manual equipment with instruments and accessories enabling a theoretical and practical approach to the concerned topic. These systems are designed for technical high schools where students' background allows to carry out more or less complex calculations.



The second section includes the tabletop units: although they are not equipped with all the accessories of the systems mentioned above, however these apparatuses enable an in-depth study of their own thermodynamic characteristics and are designed for technical high schools.

Moreover this section also includes:

- the training simulators for the study of control logics of their control systems; they must be used together with a PC for a correct development of the educational program.
- the Computerized Thermotronics Modular Laboratory



The third section includes equipment specifically designed for workshop work: assembling/disassembling hydraulic systems and circuits, realization of electrical connections, etc... They are mainly conceived for practical activities and they do not require the knowledge of high theoretical notions, consequently they perfectly match the needs of vocational schools where practical approach is emphasized.





PLANTS

GENERAL AIR-CONDITIONING TRAINER	MOD. GCT/EV	CV 7
COMPUTERIZED AIR-CONDITIONING TRAINER	MOD. GCTC/EV	CV 9
DOMESTIC AIR-CONDITIONING TRAINER	MOD. TAC/EV	CV 11
DOMESTIC AIR-CONDITIONING TRAINER WITH INVERTER	MOD. INV/EV	CV 12
AIR-CONDITIONING TRAINER WITH HEAT PUMP	MOD. EPT/EV	CV 13
COMPUTERIZED HEAT PUMP TRAINER	MOD. EPTC/EV	CV 15
TRAINER FOR THE STUDY OF A CHILLER	MOD. IAC-C/EV	CV 16
AUTOMOTIVE AIR-CONDITIONING TRAINER	MOD. ACT-2/EV	CV 17
AUTOMOTIVE AIR-CONDITIONING TRAINER - AUTOMATIC CONTROL	MOD. ACT-3/EV	CV 19
TRAINER FOR WATER CONDENSING UNITS	MOD. WCT/EV	CV 20
MODULE FOR THE STUDY OF AEREAULIC NETWORKS BALANCE	MOD. VENB/EV	CV 21
COMPUTERIZED TRAINER ON THERMODYNAMIC CYCLE OF COMPRESSED AIR	MOD. TTBC/EV MOD. TTAC/EV	CV 22
COMPRESSED-AIR DEHUMIDIFICATION TRAINER	MOD. TDA/EV	CV 23

GENERAL AIR-CONDITIONING TRAINER

Mod. GCT/EV

INTRODUCTION

This trainer is designed for an exhaustive study of the thermodynamic transformations the air undergoes when crossing the various stages of a modern air conditioning unit that serves a room where temperature and relative humidity must be checked.

Measuring air temperature and humidity in different points enables to analyze air cooling, heating, humidification, dehumidification.

Moreover some simulators of room and outdoor temperature and of room humidity are included to verify the logic of control system in all the conditions that can occur in an air handling unit.



TRAINING PROGRAM

- Using the psychrometric chart to study the transformations the air undergoes in the different sections of an air handling unit, that is: sensible heating, steam humidification, cooling and dehumidification
- Assessing the heat balances corresponding to the different sections of the air handling unit
- Analyzing the operation of temperature and humidity controllers for AHU
- Direct and reverse acting proportional control
- ON/OFF step control
- Dampers temperature control

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Silk-screen-printed schematic diagram of the air, water and refrigerant circuits with warning LEDs
- Air psychrometric chart
- Air circuit including
 - inlet, return and by-pass ducts with transparent fore wall
 - cooling and dehumidification battery; proportional control
 - steam humidification battery; proportional control
 - heating battery with electric resistors; step control
 - axial fan
 - ceiling diffuser, "test room" with transparent door, return grille
 - conjugated dampers for changing, recirculating, expelling the room air, with proportional servo control
- Water circuit including centrifugal pump, on-off valves, flow switch, 3-way diverting valve

- Refrigerant circuit including:
 - Hermetic compressor
 - forced-air condenser
 - thermostatic expansion valve
 - filter, sight glass
 - water evaporator
 - double pressure switch
 - valve for plant vacuum, refrigerant charging and recovering
- Full set of instruments for data acquisition, including:
 - high and low pressure gauges on refrigerant side
 - pressure gauge and flowmeters on water side
 - thermohygrometers for measuring temperature and humidity along the air circuit
 - outdoor temperature probe
 - room humidity and temperature probe
 - air speed probe
 - digital multimeter
- Electronic room controller with 2 control loops - P, PI or PID characteristic
- Compressor thermostat
- Simulators of room and outdoor temperatures and of room humidity
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 1500 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 235 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water, 6 bar max

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



COMPUTERIZED AIR-CONDITIONING TRAINER

Mod. GCTC/EV



INTRODUCTION

This trainer is designed for an exhaustive study of the thermodynamic transformations the air undergoes when crossing the various stages of a modern air conditioning unit that serves a room where temperature and relative humidity must be checked.

Measuring air temperature and humidity in different points enables to analyze air cooling, heating, humidification, dehumidification.

Moreover some simulators of room and outdoor temperature and of room humidity are included to verify the logic of control system in all the conditions that can occur in an air handling unit.

The equipment is also provided with sensible and latent heat generators installed in the test room that can be used to vary the thermal load in the same room and to check the response of the control system. The controller includes the functions of calibration and control, as well as logical and energy functions: thanks to an interface to a PC, it enables students to enter the

points of the control system, such as set points, measurement values, etc..., via a PC (supplied on demand), so that any alarm along the circuit can be detected and a different management of the system can be programmed.

TRAINING PROGRAM

- Using the psychrometric chart to study the transformations the air undergoes in the different sections of air handling unit, that is: sensible heating, steam humidification, cooling and dehumidification
- Assessing the heat balances corresponding to the different sections of the air handling unit
- Analyzing the operation of temperature and humidity controllers for AHU
- Direct and reverse acting proportional control
- ON/OFF step control
- Dampers temperature control
- Checking the behaviour of control system versus thermal loads
- System supervision via PC

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Silk-screen-printed schematic diagram of the air, water and refrigerant circuits with warning LEDs
- Air psychrometric chart
- Air circuit including
 - inlet, return and by-pass ducts with transparent fore wall
 - cooling and dehumidification battery; proportional control
 - steam humidification battery; step control
 - heating battery with electric resistors; step control
 - axial fan
 - ceiling diffuser, "test room" with transparent door, return grille
 - conjugated dampers for changing, recirculating, expelling the room air, with proportional servo control
- Water circuit including centrifugal pump, on-off valves, flow switch, 3-way diverting valve
- Refrigerant circuit including
 - hermetic compressor
 - forced-air condenser
 - thermostatic expansion valve
 - filter, sight glass
 - water evaporator
 - double pressure switch
- Valve for plant vacuum, refrigerant charging and recovering
- Full set of instruments for data acquisition, including:
 - high and low pressure gauges on refrigerant side
 - pressure gaug and flow meters on water side
 - thermometers and hygrometers arranged on various points along the air circuit
 - outdoor temperature and humidity probe
 - room humidity and temperature probe
 - air speed probe
 - digital multimeter
 - wattmeters for assessing thermal loads
- Room electronic controller with two P, PI or PID characteristics control loops
- Interface to PC with USB communication port
- PC control program
- Compressor thermostat
- Simulators of room and outdoor temperatures and humidity
- Electric resistors for the continuous variation of sensible and latent load in the test room, via potentiometer
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 1500 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 235 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water, 6 bar max

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



DOMESTIC AIR-CONDITIONING TRAINER

Mod. TAC/EV

INTRODUCTION

This trainer has been designed specifically for educational aims so that students can delve into the hydraulic, mechanical and thermodynamic aspects characterizing split-type air-conditioning systems.

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of a split-type air conditioner
- Operation in Cooling and Dehumidification mode
- Modulating control
- Examining the system behaviour versus the variation of:
 - operating mode
 - flow rate at the evaporator
 - set-point temperature
- Plotting the refrigeration cycle on refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual E.E.R.
 - volumetric compressor efficiency
 - heat balances on air side (optional items thermohygrometer and anemometer required)

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Silk-screen-printed schematic diagram of the hydraulic circuit with warning LEDs
- 7000 BTU/h split-type unit including
 - hermetic compressor
 - forced air condenser
 - 3-speed fan evaporator with deflector
 - refrigerant expansion through capillary tube
 - remote control for adjustment
- On-off valves, sight glass, dehydrator filter
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- Full set of instruments for data acquisition, including:
 - flowmeter
 - high and low pressure gauges
 - 3 electronic thermometers with Pt100 probes to be inserted in various test points
 - digital multimeter
- High and low pressure switches
- Thermomagnetic - earth leakage control button
- Emergency button



Power supply: 230 Vac 50 Hz single-phase - 1000 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 163 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

**PORTABLE VANE ANEMOMETER
MOD. THAN**



**PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY**

DOMESTIC AIR-CONDITIONING TRAINER WITH INVERTER

Mod. INV/EV

INTRODUCTION

This trainer has been designed specifically for educational aims so that students can delve into the hydraulic, mechanical and thermodynamic aspects characterizing split-type air-conditioning systems equipped with INVERTER. Moreover it shows how energy can be saved considerably by the modulation of compressor r.p.m. It also includes fault simulation.

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of a split-type air conditioner with inverter
- Operation in Cooling, Dehumidification and Heating modes
- Proportional control: analysis of the variations of compressor r.p.m. versus the thermal jump between set and detected temperatures
- Examining the system behaviour versus the variation of:
 - operating mode
 - evaporator flow rate
 - set-point temperature
- Plotting the refrigeration cycle on refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual E.E.R.
 - ideal and actual C.O.P.
 - volumetric compressor efficiency
 - heat balances on air side (optional items required: thermohygrometer and anemometer)

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Silk-screen-printed schematic diagram of the two alternative circuits, with warning LEDs
- 7000 BTU/h split-type unit with inverter, including
 - variable-speed hermetic compressor
 - forced air condenser
 - 3-speed fan evaporator with deflector
 - refrigerant expansion through capillary tube
 - 4-way valve
 - remote control for adjustment
- On-off valves
- Valve for plant vacuum, refrigerant charging and recovering
- Full set of instruments for data acquisition, including:
 - flowmeters
 - high and low pressure gauges
 - 4 electronic thermometers with Pt100 probes to be inserted in various test points
 - frequency-meter for measuring compressor r.p.m.
 - digital multimeter



- High and low pressure switches
- Thermomagnetic - earth leakage control button
- Emergency button
- Fault simulator via switches

Power supply: 230 Vac 50 Hz single-phase - 1500 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 165 kg

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

**PORTABLE VANE ANEMOMETER
MOD. THAN**



**PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY**

AIR-CONDITIONING TRAINER WITH HEAT PUMP

Mod. EPT/EV



INTRODUCTION

This trainer has been designed specifically for educational aims so that students can delve into the study of the operation of an air/water heat pump and of its components such as cycle-reversing valve and thermostatic expansion valve. Furthermore students can examine the use of an intermediate fluid for the transport of thermal or refrigerating power from the production site to the place of use.

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of a heat pump
- Studying the operation of a cycle-reversing valve
- Studying the operation of a thermostatic expansion valve
- ON/OFF control
- Examining the system behaviour versus the variation of:
 - season
 - air flow at condenser/evaporator
 - air flow at air/water exchanger
- Plotting the refrigeration cycle on refrigerant pressure-enthalpy chart
- Data acquisition and calculation of:
 - exchange surfaces
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual E.E.R.
 - ideal and actual C.O.P.
 - volumetric compressor efficiency
 - thermostatic valve superheat
 - heat balances on water side
 - heat balances on air side (optional items: thermohygrometer and anemometer required)

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the two alternative cycles, with warning LEDs
- Hermetic compressor
- Forced-air condenser/evaporator with variable flow settable via potentiometer
- Evaporator/condenser coil
- Liquid receiver, liquid separator
- On-off valves, sight glass, dehydrator filter, check valves
- Thermostatic expansion valve
- Electrically driven cycle-reversing valve
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- Heat storage tank for refrigerant/water heat exchange
- Water pump
- Forced-air air/water exchanger with variable flow settable via potentiometer
- Thermostats
- Full set of instruments for data acquisition, including:
 - flowmeters
 - high and low pressure gauges
 - 3 electronic thermometers with Pt100 probes to be inserted in various test points along the hydraulic circuit
 - digital multimeter
- Double pressure switch
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 1000 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 190 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE VANE ANEMOMETER
MOD. THAN



PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY

COMPUTERIZED HEAT PUMP TRAINER

Mod. EPTC/EV

INTRODUCTION

This trainer has been designed specifically for educational aims: besides emphasizing the typical hydraulic, mechanical and thermodynamic aspects of all heat pumps, via a wide set of sensors, it can also acquire in real time all the data of refrigerant and air cycles and assess heat balances and efficiency, via a Personal Computer (supplied on demand).

Furthermore students can examine the use of an intermediate fluid for the transport of thermal or refrigerating power from the production site to the place of use.

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of a heat pump
- Studying the operation of a cycle-reversing valve
- Studying the operation of an electronic expansion valve
- Proportional control
- Examining the system behaviour versus the variation of:
 - season
 - air flow at condenser/evaporator
 - air flow at air/water exchanger
- Plotting the refrigeration cycle on refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - exchange surfaces
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual E.E.R.
 - ideal and actual C.O.P.
 - volumetric compressor efficiency
 - heat balance on water side
- The software of the equipment enables to enter different sections:
 - system automatic or manual operation
 - refrigerating circuit heat balance
 - water/air circuit heat balance
 - enabling the insertion of (11) faults
 - troubleshooting and plant operation reset
 - system supervision with display of the values acquired by sensors



- Heat storage tank for refrigerant/water heat exchange
- Water pump
- Variable flow forced-air air/water exchanger
- Transducers and sensors for acquiring the following system operating parameters: voltage, current, power factor, temperatures, relative humidity, cycle pressures, refrigerant and water flow rate
- High and low pressure gauges
- Double pressure switch
- Thermomagnetic - earth leakage control button
- Emergency button
- PC control program

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the two alternative cycles, with warning LEDs
- Hermetic compressor
- Variable flow forced-air condenser/evaporator
- Evaporator/condenser coil
- Liquid receiver, liquid separator
- On-off valves, sight glass, dehydrator filter, check valves
- Electronic expansion valve
- Electrically driven cycle-reversing valve
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours

Power supply: 230 Vac 50 Hz single-phase - 1000 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 191 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



TRAINER FOR THE STUDY OF A CHILLER

Mod. IAC-C/EV

INTRODUCTION

The trainer, properly designed for educational purposes, allows the student to deepen the study of the operation of a chiller and its components, such as the thermostatic expansion valve and the flow switch. It also allows to analyze the use of an intermediate fluid for the transport of the cooling power from the site of production to the site of use.

TRAINING PROGRAM

- Plant starting and verification of the intervention of the safety devices
- Study of the operation of a chiller
- Study of the operation of a thermostatic expansion valve
- ON/OFF regulation
- Analysis of the behaviour of the system at the variation of:
 - Air flow at the condenser
 - Air flow at the air/water exchanger
- Drawing the refrigerant cycle in the pressure–enthalpy diagram of the refrigerant gas
- Data collection and calculation of:
 - Thermal exchange surfaces
 - Thermal balances at the evaporator, condenser, compressor
 - Mass flow of the refrigerant
 - Ideal and real EER
 - Volumetric efficiency of the compression
 - Thermostatic valve superheat
 - Thermal balance (water side)

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Silk-screened coloured synoptic with LED
- Hermetic compressor
- Forced air condenser with variable speed settable via potentiometer
- Water evaporator with concentric tubes
- Liquid receiver, liquid separator
- Interception valves, sight glass, dehydrating filter
- Thermostatic expansion valve
- Service valve for plant vacuum, gas charging and discharging
- Connection tubes between the several components painted with different colours (discharge, suction, liquid lines)
- Regulating thermostat
- Water pump
- Water flow meter
- Air/water heat exchanger with forced air and variable speed settable via potentiometer
- Complete set of instruments for data acquisition, including:
 - Flow meter
 - High and low pressure gauges
 - 3 digital thermometers with Pt100 probes to be inserted into test points along the hydraulic circuit



- Digital multimeter
- Double pressure switch
- Thermomagnetic - earth leakage control button
- Emergency push button

Power supply: 230 Vac 50 Hz single-phase - 1000 VA
Dimensions: 188 x 81 x 182 cm
Net weight: 160 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



REQUIRED UTILITIES

- Tap water (approx. 1 bar pressure)

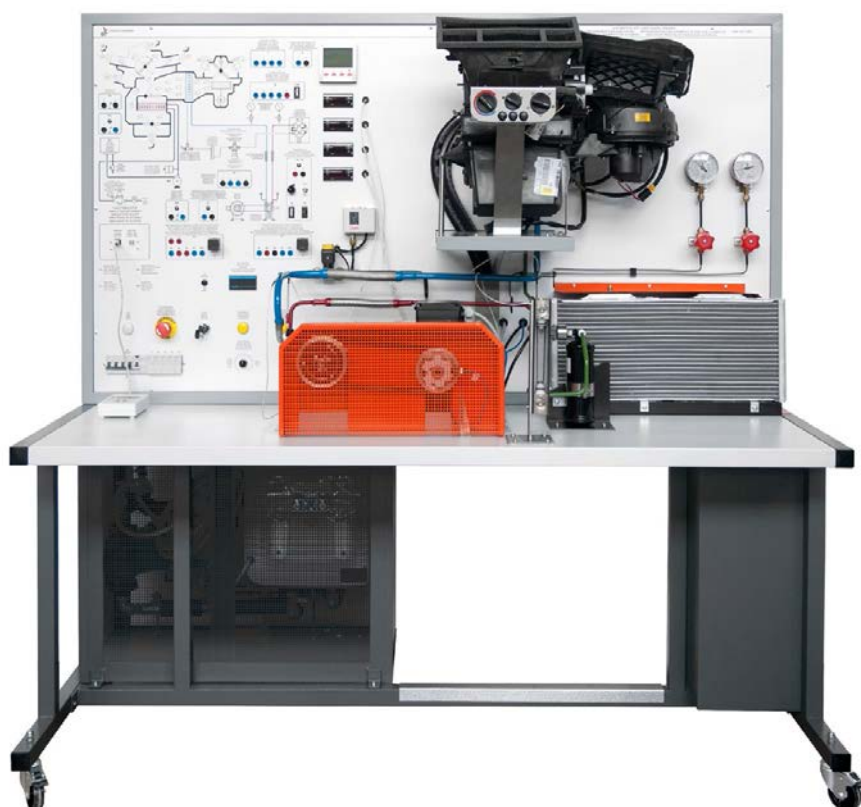
SUPPLIED WITH

EXPERIMENTAL HANDBOOK



AUTOMOTIVE AIR-CONDITIONING TRAINER

Mod. ACT-2/EV



INTRODUCTION

Besides emphasizing vapour compression cycle, this trainer can be used to describe all the problems due to the insertion of this cycle in the car since it has to adapt to a hostile, very hot, moving, vibrating environment that generates variable power mechanical energy.

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of an automotive air conditioner
- Studying the operation of an expansion valve
- ON-OFF control: condenser fan automatic control
- Examining the system behaviour versus the variation of:
 - engine r.p.m.
 - air flow at condenser and/or evaporator
- Plotting the refrigeration cycle on refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual E.E.R.
 - volumetric compressor efficiency
 - thermostatic valve superheat
 - heat balance on air side (optional items: thermohygrometer and anemometer required)

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram, with warning LEDs
- Open-type compressor provided with pulley transmission
- Speed control motor
- Driving belt
- Automotive air conditioning unit
- Forced-air condenser controlled by pressure switch
- Liquid receiver
- Expansion valve
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- Anti-vibration joints on the pipes connected to the motor
- Water pump
- Boiler for hot water production
- Full set of instruments for data acquisition, including:
 - flowmeter
 - high and low pressure gauges
 - electronic thermometers with Pt100 probes to be inserted in various test points along the hydraulic circuit
 - digital multimeter
 - r.p.m. counter
- Double pressure switch for enabling condenser fan
- Pressure switch
- Thermomagnetic - earth leakage control button
- Emergency button
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



Dimensions: 180 x 80 x 180 cm
Net weight: 261 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Power supply: 400 Vac 50 Hz three-phase - 4200 VA
 (Other voltage and frequency on request)

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE VANE ANEMOMETER MOD. THAN



PORTABLE THERMOHYGROMETER WITH REMOVABLE PROBE MOD. THHY

AUTOMOTIVE AIR-CONDITIONING TRAINER - AUTOMATIC CONTROL Mod. ACT-3/EV

INTRODUCTION

Besides emphasizing vapour compression cycle, this trainer can be used to describe all the problems due to the insertion of this cycle in the car since it has to adapt to a hostile, very hot, moving, vibrating environment that generates variable power mechanical energy.

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of an automotive air conditioner
- Studying the operation of an expansion valve
- ON-OFF control: condenser fan automatic control
- Examining the system behaviour versus the variation of:
 - engine r.p.m.
 - air flow

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram, with warning LEDs
- Open-type compressor provided with pulley transmission
- Speed control motor
- Driving belt grid protected for safety reasons
- Automotive air conditioning unit automatically controlled
- Forced-air condenser controlled by pressure switch
- Liquid receiver
- Expansion valve
- Valve for plant vacuum, refrigerant charging and recovering
- Full set of instruments for data acquisition, including:
 - high and low pressure gauges
 - electronic thermometers with Pt100 probes to be inserted in various test points along the hydraulic circuit
 - digital multimeter
 - r.p.m. counter
- Pressure switch for enabling condenser fan
- Pressure switch
- Residual thermomagnetic circuit-breaker
- Emergency button



- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



Dimensions: 115 x 75 x 175 cm
Net weight: 175 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Power supply: 400 Vac 50 Hz three-phase - 4200 VA
(Other voltage and frequency on request)

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



TRAINER FOR WATER CONDENSING UNITS

Mod. WCT/EV

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Studying the operation of:
 - pressure-operated valve
 - dry cooler
 - cooling tower
- Proportional control
- Examining the system behaviour versus the variation of:
 - evaporator air flow
 - device used for condensation
- Plotting the refrigeration cycle on refrigerant pressure-enthalpy diagram
- Data acquisition and calculation of:
 - heat exchange surfaces
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual E.E.R.
 - volumetric compressor efficiency
- Heat balance on water side
- Heat balance on air side of cooling tower (optional items: thermohygrometer and anemometer required)

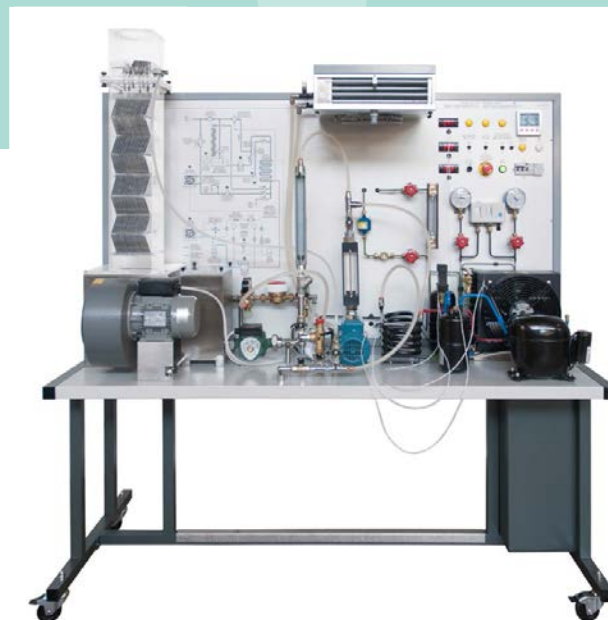
TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit, with warning LEDs
- Hermetic compressor
- Forced-air evaporator with variable flow settable via potentiometer
- Water condenser
- Liquid receiver, liquid separator
- Sight glass, dehydrator filter
- Thermostatic expansion valve
- Valve for plant vacuum, refrigerant charging and recovering
- Pipes connecting the various components painted with different colours
- On-off valves
- Pressure-operated valve
- Forced-air dissipator with fan speed control and water pump
- Evaporating tower including water distribution system, package, fan, water pump, floating switch for water level automatic reset
- Automatic filling unit
- Full set of instruments for data acquisition, including:
 - flowmeters
 - high and low pressure gauges
 - electronic thermometers with Pt100 probes to be inserted in various test points along the hydraulic circuit
 - digital multimeter
- Double pressure switch

INTRODUCTION

This trainer is designed specifically for educational aims to study the techniques used at present for water condensation of refrigerating units:

- the connection with water network via pressure-operated valve
- the use of a dry cooler
- the use of a cooling tower



- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 1000 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 180 cm

Net weight: 180 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at min. 1 bar

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE ANEMOMETER MOD. THAM



PORTABLE THERMOHYGROMETER WITH REMOVABLE PROBE MOD. THHY



MODULE FOR THE STUDY OF THE AERAULIC NETWORKS BALANCE

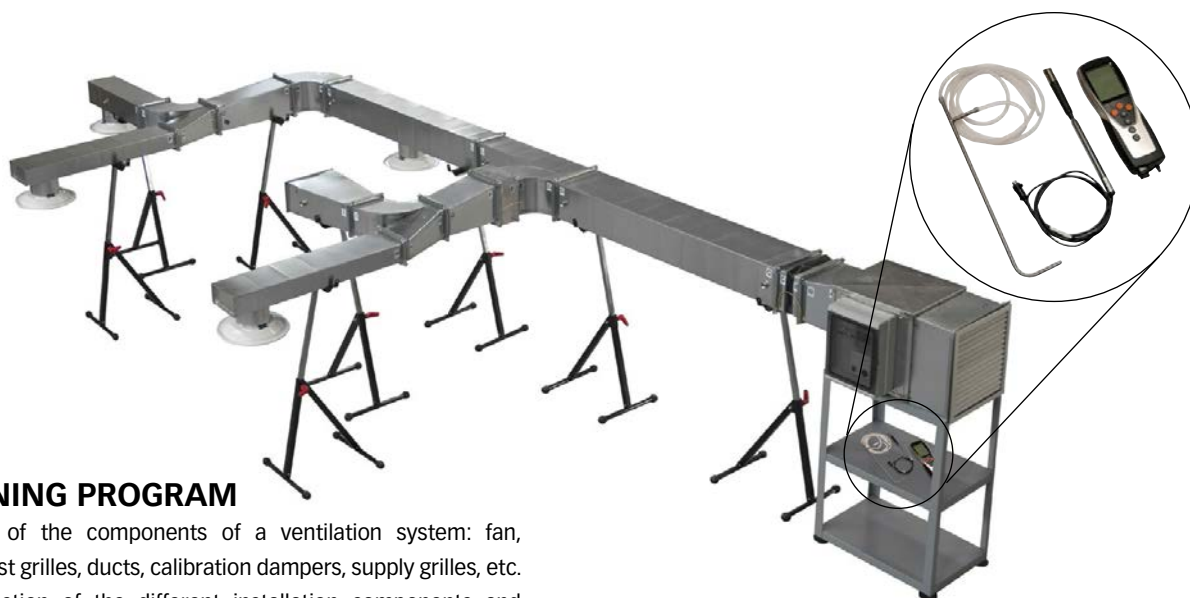
Mod. VENB/EV

INTRODUCTION

Among the ventilation, thermoventilation, air conditioning installations, the verification of a correct aeraulic network balance is an essential condition to avoid vane efforts of a correct design: the unbalance of one or more zones might cause the missing satisfaction of thermal loads or of ventilation flows of each served environment.

The module, properly designed for educational purposes, allows the study of a duct network balance with field evaluation of parameters such as the static pressure and the air speed in correspondence of different points of the circuit.

The student will be able to deepen the knowledge on the problems related with the air flow and with the pressure losses.



TRAINING PROGRAM

- Study of the components of a ventilation system: fan, exhaust grilles, ducts, calibration dampers, supply grilles, etc.
- Connection of the different installation components and verification of the system functionality
- Field measurements of the static, dynamic and total pressure and of the air speed in different points of the air circuit
- Localized and distributed pressure losses
- The loss coefficients
- Dampers calibration to respect the prescribed values of the room air flow

TECHNICAL SPECIFICATIONS

- Air canalization system, to be mounted on stand supports, including:
 - Centrifugal fan
 - Anti-vibration joint
 - Exhaust grille
 - Different sections rectangular ducts
 - Special pieces, convergent, curve
 - Manual damper
 - Diffusers and supply grille each with calibration damper
- Portable instrument with Pitot tube and vane anemometric probe to measure static, dynamic and total pressure and air speed
- Electric Board with:
 - thermomagnetic - earth leakage control button
 - LED for voltage presence signaling
 - digital multimeter
 - fan speed control

Power supply: 230 Vac 50 Hz single-phase - 300 VA
(Other voltage and frequency on request)

Dimensions: 600 x 250 x 131 cm (assembled)

Net weight: 164 kg

OPTIONAL ITEM

Circuit extension
mod. VENB-1/EV including:

- 4 different sections rectangular ducts
- 2 diffusers
- 2 support trestles



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



COMPUTERIZED TRAINER ON THERMODYNAMIC CYCLE OF COMPRESSED AIR

Mod. TTBC/EV TTAC/EV (Version with flow transducer)

INTRODUCTION

This trainer is designed for the in-depth study of air compression cycle and of the relevant energy transfers; it is controlled by a personal computer (supplied on demand) and it includes data acquisition and PC interface card, besides proper transducers and sensors. It is prearranged for the connection with dehumidification trainer mod. TDA/EV.

TRAINING PROGRAM

- Analyzing the pressure/volume diagram of the 1st and 2nd stages with experimental check
- Determining the polytropic index
- Calculating the effective average pressure of the 1st and 2nd stages
- Using the T/S diagram of the air to determine the characteristics of thermal cycles experimentally
- Checking the safety devices

Only for mod. TTAC/EV:

- Heat balance of the thermodynamic transformation
- Calculating the power absorbed by the compressor
- Analysis of the compressor efficiency

For detailed study of air characteristics the dehumidification trainer mod. TDA/EV must be connected to this unit.

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit, with warning LEDs
- 2.2 kW three-phase motor
- Two-stage compressor with 413 cm³ 1st stage and 127 cm³ 2nd stage displacement
- Frequency converter for continuous variation of motor r.p.m.
- Pipes connecting the various components painted with different colours
- Throttling valve
- Data acquisition and PC interface card, transducers and sensors for the acquisition of the following system operating parameters: compressor r.p.m., intake and discharge temperatures of the first and second stages, relative humidity, pressures of the first and second stages, air flow suction (only for mod. TTAC/EV)
- 4 quick connections and connecting pipes for trainer mod. TDA/EV, tank, or for other uses



mod. TTBC/EV

- 100 l tank (mod. TTBC/EV) or 200 l tank (mod. TTAC/EV) with relevant accessories
- High and medium pressure gauges
- Digital multimeter
- High pressure switch
- Thermomagnetic - earth leakage control button
- Emergency button
- Control software

Dimensions: 130 x 80 x 180 cm

Net weight: 154 kg

Tank dimensions: 60 x 60 x 150 cm

Net weight: 50 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Power supply: 400 Vac 50 Hz three-phase - 2800 VA
(Other voltage and frequency on request)

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



COMPRESSED-AIR DEHUMIDIFICATION TRAINER

Mod. TDA/EV

INTRODUCTION

This trainer is specifically designed for educational aims and it enables to study the dehumidification process of compressed air; in fact, as it is well known, compressed air must be previously dried before being distributed to the users. This trainer enables to delve into the study of psychrometry of compressed air.

TRAINING PROGRAM

- Plant starting and safety devices intervention checking
- Analyzing the system
 - as the set-point of thermostat varies
 - as the air flow to the condenser varies
- Plotting the cycle on pressure-enthalpy diagram of refrigerant
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual E.E.R.
 - volumetric compressor efficiency
- Analyzing the thermodynamic characteristics of compressed air with determination of dew point and of its water content
- Specific examination of the characteristics of compressed air after crossing the filters and the refrigerant circuit

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of the hydraulic circuit, with warning LEDs
- Refrigerating circuit including:
 - hermetic compressor
 - forced-air condenser with variable flow settable by potentiometer
 - coil evaporator
 - capillary tube for liquid lamination
 - liquid separator, on-off valves, sight glass, dehydrator filter
 - valve for plant vacuum, refrigerant charging and recovering
 - pipes connecting the various components painted with different colours
 - heat-storage tank for refrigerant/water heat exchange
 - thermostat
 - full set of instruments for the acquisition of system operating data including flowmeter, high and low pressure gauges, 3 electronic thermometers with Pt100 probes to be inserted in various test points along the hydraulic circuit, digital multimeter
 - double pressure switch
- Circuit of compressed air including:
 - 4 quick connections for the coupling with computerized trainer on thermodynamic cycle of compressed air mod. TTAC/EV or TTBC/EV



- 2 air filters with interchangeable cartridge, automatic discharge and condensation indicator
- 2 water/compressed air exchangers
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 420 VA
(Other voltage and frequency on request)

Dimensions: 130 x 80 x 180 cm

Net weight: 133 kg

SPECIAL VERSION ON DEMAND

Besides offering the characteristics of standard version, this version also includes:

- Fault simulator using switches, or
- Fault simulator operating with keypad and microprocessor enabling the teacher to introduce anomalies and to assess the troubleshooting attempts carried out by students



REQUIRED

COMPRESSED AIR SUPPLIED BY TRAINER MOD. TTAC/EV OR TTBC/EV (NOT INCLUDED IN THE EQUIPMENT)

SUPPLIED WITH

EXPERIMENTAL HANDBOOK





27-C

TABLETOP UNITS

THERMOTRONICS

www.elettronicaveneta.com

27C-E-CV

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BENCH FOR THE STUDY OF AIR-CONDITIONING

Mod. BC/EV

INTRODUCTION

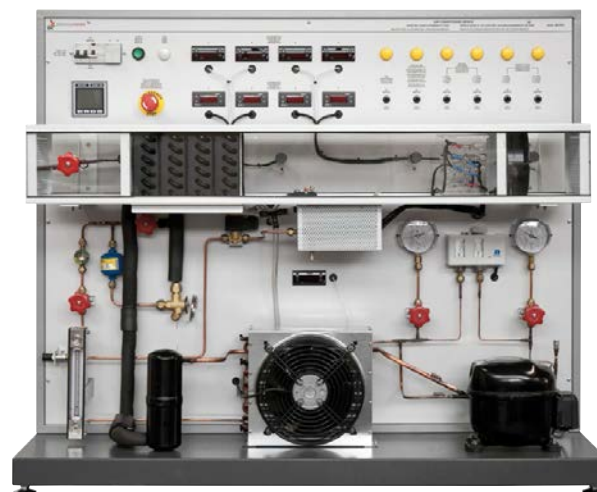
This bench is designed for the complete and exhaustive study of thermodynamic transformations the air undergoes when crossing the sections of an air-conditioning control unit. Thermometric and hygrometric sensors are installed before and after each section so that they enable to assess the changes occurred.

TRAINING PROGRAM

- Study of air psychrometric chart, with determination of dry-bulb and wet-bulb temperatures, specific volume, absolute and relative humidity, enthalpy, dew point
- Thermal factor
- Plotting the transformations due to heating, to cooling, to humidification and to dehumidification, on the psychrometric chart
- Assessing the specific thermal power exchanged in each section of the control unit
- ON-OFF control

TECHNICAL SPECIFICATIONS

- Steel structure painted with epoxy paint and baked
- Air-conditioning control unit equipped with:
 - direct expansion cooling and dehumidification battery
 - two-stage humidification battery with electric resistors plunged in water and solenoid valve for automatic water feeding
 - two-stage heating battery with electric resistors
 - axial fan
 - airflow control damper
- Refrigerant circuit including:
 - hermetic compressor with protector
 - forced-air condenser
 - thermostatic expansion valve for controlling the refrigerant flow rate
 - filter, sight glass, on-off valves
 - liquid separator
 - double pressure switch
 - valve for plant vacuum, refrigerant charging and recovering



- Full set of instruments for the acquisition of system operating data including:
 - High and low pressure gauges
 - Flowmeter
 - Thermometer with Pt100 probes having to be inserted in various test points along the circuit of refrigerant
 - Thermometers and hygrometers arranged along the air circuit to detect its properties at the inlet and outlet of each section of the control unit
- Digital multimeter
- Thermomagnetic - earth leakage control button
- Emergency button
- Start button

Power supply: 230 Vac 50 Hz single-phase - 1050 VA
(Other voltage and frequency on request)

Dimensions: 130 x 53 x 107 cm

Net weight: 94 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water, 6 bar max

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



COMPUTERIZED BENCH FOR THE STUDY OF AIR-CONDITIONING

Mod. BCC/EV

INTRODUCTION

This bench is designed for the complete and exhaustive study of thermodynamic transformations the air undergoes when crossing the sections of an air-conditioning control unit. Thermometric and hygrometric sensors are installed before and after each section so that they enable to assess the changes occurred. An application software ensures the control and supervision from a PC (supplied on demand).

TRAINING PROGRAM

- Study of air psychrometric chart, with determination of dry-bulb and wet-bulb temperatures, specific volume, absolute and relative humidity, enthalpy, dew point
- Thermal factor
- Plotting the transformations due to heating, to cooling, to humidification and to dehumidification, on the psychrometric chart
- Assessing the specific thermal power exchanged in each section of the control unit
- ON-OFF control
- Acquisition of system parameters and assessment of heat balances from PC

TECHNICAL SPECIFICATIONS

- Steel structure painted with epoxy paint and baked
- Air-conditioning control unit equipped with:
 - direct expansion cooling and dehumidification battery
 - two-stage humidification battery with electric resistors plunged in water and solenoid valve for automatic water feeding
 - two-stage heating battery with electric resistors
 - axial fan
 - airflow control damper
 - test room
- Refrigerant circuit including:
 - hermetic compressor with protector
 - forced-air condenser
 - thermostatic expansion valve for controlling the refrigerant flow rate
 - filter, sight glass, on-off valves
 - liquid separator
 - double pressure switch
 - valve for plant vacuum, refrigerant charging and recovering



- Interface card for data acquisition and control via PC
- Thermohygrometric and anemometric sensors
- High and low pressure gauges
- Flowmeter
- Thermometer with Pt100 probes having to be inserted in various test points along the circuit of refrigerant
- Thermometers and hygrometers arranged along the air circuit to detect its properties at the inlet and outlet of each section of the control unit
- Digital multimeter
- Thermomagnetic - earth leakage control button
- Emergency button
- Start button

Power supply: 230 Vac 50 Hz single-phase - 1050 VA
(Other voltage and frequency on request)

Dimensions: 140 x 53 x 107 cm

Net weight: 110 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water, 6 bar max

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



BENCH FOR THE STUDY OF THE AIR-AIR HEAT PUMP

Mod. BPC/EV

INTRODUCTION

This bench has been specifically designed for educational aims so that students can acquire the theoretical-practical knowledge concerning the use of heat pumps in air conditioning.

TRAINING PROGRAM

- Studying the operation of a heat pump
- Studying the operation of a cycle reversing valve
- Analyzing the system behaviour versus the variation of condenser/evaporator air flow
- Plotting the refrigeration cycle on the pressure-enthalpy diagram of the refrigerant
- Data acquisition and calculation of:
 - heat exchange surfaces
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual EER
 - ideal and actual COP
 - volumetric compression efficiency
 - air side heat balance at the condenser with evaluation of the heat exchange coefficient
 - air side heat balance at the evaporator (optional items thermohygrometer and anemometer required)



TECHNICAL SPECIFICATIONS

- Steel structure painted with epoxy paint and baked
- Hermetic compressor
- Forced-air condenser and evaporator with variable flow settable by potentiometer
- Liquid receiver, liquid separator
- Sight glasses, dehydrator filter, check valves
- Expansion device with capillary tube
- 4-way cycle reversing valve for Summer/Winter operation
- Valve for plant vacuum, refrigerant charging and recovering
- Full set of instruments for the acquisition of system operating data including:
 - Flowmeter
 - High and low pressure gauges
 - Electronic thermometers with Pt100 probes to be inserted in various test points along the hydraulic circuit
 - Digital multimeter
- Double pressure switch
- Thermomagnetic - earth leakage control button
- Start button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 400 VA
(Other voltage and frequency on request)

Dimensions: 90 x 45 x 77 cm

Net weight: 61 kg

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

**PORTABLE VANE ANEMOMETER
MOD. THAN**



**PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY**

BENCH FOR THE STUDY OF THE AIR-WATER HEAT PUMP

Mod. BTHP/EV

INTRODUCTION

This bench has been specifically designed for educational aims so that students can acquire the theoretical-practical knowledge concerning the use of heat pumps to transfer heat from one source at a certain temperature to another source at higher temperature. The application concerns the air to water heat pump.

TRAINING PROGRAM

- Studying the operation of a heat pump
- Plant starting and verification of the safety devices intervention
- Analyzing the system behavior when varying:
 - thermostatic valve superheat
 - air flow at the evaporator
 - water temperature in the tank
- Plotting the refrigeration cycle on the pressure-enthalpy diagram of the refrigerant
- Data acquisition and calculation of:
 - heat balances corresponding to evaporator, condenser, compressor
 - refrigerant mass flow
 - ideal and actual COP
 - volumetric compression efficiency



TECHNICAL SPECIFICATIONS

- Steel structure painted with epoxy paint and baked
- Hermetic compressor
- Forced-air variable speed evaporator
- Coil condenser immersed in a Plexiglas tank
- Thermostat
- Thermostatic expansion valve
- Liquid receiver
- Liquid separator
- Dehydrator filter
- Sight glass
- Shut-off valve
- Double pressure switch
- Service valve for plant vacuum, refrigerant charging and recovering
- Flowmeter
- High and low pressure gauges
- 2 electronic thermometers with Pt100 probes to be inserted in various test points along the circuit
- Digital multimeter
- Thermomagnetic - earth leakage control button
- Fuses
- Start button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 380 VA
(Other voltage and frequency on request)

Dimensions: 90 x 45 x 76 cm

Net weight: 65 kg

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

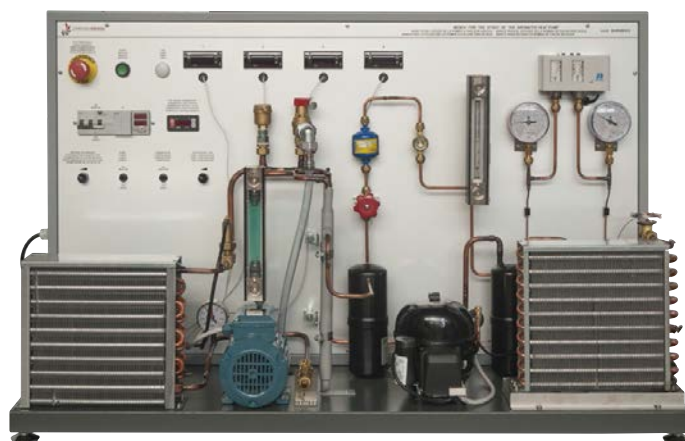
PORTABLE VANE ANEMOMETER
MOD. THAN



PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY

BENCH FOR THE STUDY OF THE AIR-WATER HEAT PUMP WITH AIR DISSIPATION

Mod. BHPAW/EV



INTRODUCTION

The bench allows the student to acquire the theoretical and practical knowledge that characterize the operation of an air / water heat pump.

The application concerns the use of an intermediate fluid (water) for the transport of the thermal power from the place of production to the place of use.

TRAINING PROGRAM

- Studying the operation of an air / water heat pump
- ON/OFF regulation: the hot water temperature control
- Safety: the high and low pressure switch, the flow switch, the safety valve
- Plant starting and safety devices intervention checking
- Detecting the operative parameters when the equipment is running
- Plotting the refrigeration cycle on the pressure-enthalpy diagram of the refrigerant
- Calculation of the heat balances both at refrigerant side and at water side

TECHNICAL SPECIFICATIONS

Steel structure painted with epoxy paint and baked

Refrigeration plant including:

- Hermetic compressor with protector
- Water condenser
- Liquid receiver
- Dehydrator filter, sight glass
- Thermostatic expansion valve
- Forced-air evaporator
- Liquid separator

- Double pressure switch
- Operating valve for system filling and draining

Water plant including:

- Centrifugal pump
- Air heat exchanger
- Flow switch
- Safety valve

Electric system including:

- Thermomagnetic - earth leakage control button
- Fuses
- Voltage presence lamp
- Run button
- Emergency button

Data acquisition and plant control:

- 4 electronic thermometers
- Digital multimeter
- Water flowmeter
- Refrigerant gas flowmeter
- Water pressure gauge
- Refrigerant gas pressure gauges (high and low pressure)
- Compressor and pump switches
- Speed variators for the fans of evaporator and air heat exchanger
- Hot water thermostat

Power supply: 230 Vca 50 Hz single-phase - 620 VA
(Other voltage and frequency on request)

Dimensions: 120 x 45 x 76 cm

Net weight: 75 kg

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



BENCH FOR THE STUDY OF THE ELECTRIC HEAT PUMP

Mod. BPCE/EV

INTRODUCTION

This bench has been specifically designed for educational aims and it concerns the study of thermoelectric heat pumps: these devices represent an alternative to compression cooling systems when it is necessary to obtain energy transfers that cannot be easily resolved with a compression refrigeration cycle.

TRAINING PROGRAM

- Description and analysis of thermoelectric effects in PN junctions
- Determining the value of the voltage available across a thermoelectric cell as the temperature jump induced on the two faces varies
- Determining the power available across a thermoelectric cell as the temperature jump induced on the two faces varies
- Determining the value of the temperature attained across a thermoelectric cell as the forward or reverse current varies
- Determining the C.O.P. of thermoelectric cell with positive polarity and with negative polarity

TECHNICAL SPECIFICATIONS

- Steel structure painted with epoxy paint and baked
- Gloss aluminium fore plate with colour silk-screen-printed schematic diagram
- 2 20 W max thermoelectric modules
- 2 axial cooling fans with speed control by potentiometer
- Power current controlled by potentiometer
- Surface temperature of a module controlled by potentiometer
- Full set of instruments for the acquisition of system operating data including:
 - 3 electronic thermometers with sensors
 - millivoltmeter, milliammeter
 - voltmeter, ammeter
 - selector of start and stop and of 5 operating modes

Power supply: 230 Vac 50 Hz single-phase - 110 VA
(Other voltage and frequency on request)

Dimensions: 54 x 35 x 79 cm

Net weight: 60 kg



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



BENCH FOR THE STUDY OF ROOM AIR DEHUMIDIFIER

Mod. TDEA/EV

INTRODUCTION

This bench has been specifically designed for educational aims and it concerns the study of the operation of a room air dehumidifier. It enables to delve into the study of air psychrometry.

TRAINING PROGRAM

- Starting and checking the system operation
- Analyzing the system behaviour versus the variation of:
 - hygostat set-point
 - airflow
- Plotting the cycle on the pressure-enthalpy diagram of the refrigerant
- Data acquisition and calculation of:
 - specific heat balances corresponding to evaporator, condenser, compressor
 - ideal EER
- Analyzing the thermodynamic characteristics of the air with the determination of dew point and of its water content before and after the passage through the dehumidifier
- Assessment of the quantity of condensed vapour

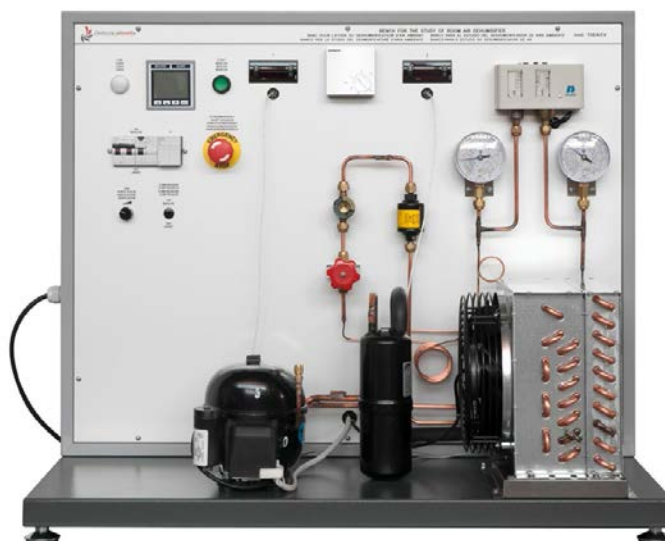
TECHNICAL SPECIFICATIONS

- Steel structure painted with epoxy paint and baked
- Refrigeration circuit including:
 - hermetic compressor
 - forced-air evaporator and condenser with selectable flow rate
 - capillary tube for liquid lamination
 - dehydrator filter
 - valve for plant vacuum, refrigerant charging and recovering
 - pressure switch
 - control hygostat
 - full set of instruments for the acquisition of system operating data including high and low pressure gauges, digital thermometers with probes having to be inserted in various test points along the hydraulic circuit, pen-type thermohygrometer, digital multimeter
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 300 VA
(Other voltage and frequency on request)

Dimensions: 90 x 45 x 77 cm

Net weight: 45 kg



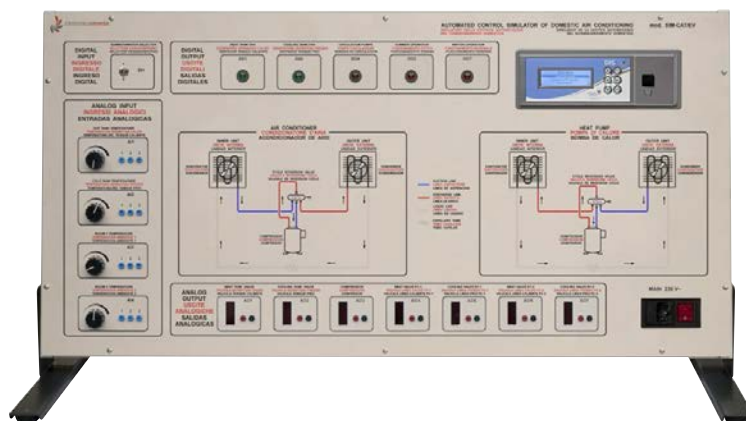
SUPPLIED WITH

EXPERIMENTAL HANDBOOK



AUTOMATED CONTROL SIMULATOR OF DOMESTIC AIR-CONDITIONING

Mod. SIM-CAT/EV



INTRODUCTION

This educational simulator is designed for the training in the field of management of technical systems installed in residential buildings: it simulates the operation of a split-type air-conditioning system with inverter that adjusts compressor r.p.m. according to the gap between room temperature set-point and actual value. It also includes a configurable industrial digital multicontroller: this device decides the actions having to be automatically carried out according to the set parameters, that is outdoor air temperature, room temperature and relative humidity, thermal factor, supplied air temperature, supplied air flow, refrigerant flow, besides enabling to check system behaviour after set-point values of reference variables have been fixed. When connected with a PC (supplied on demand) this simulator allows the supervision of the system by using a dynamic graphics.

TRAINING PROGRAM

Theoretical topics

- Studying the operation of a split-type air conditioner with inverter
- Studying the transformation the air undergoes when crossing an evaporation and condensation battery, with the aid of the psychrometric chart
- Analyzing the operation of a 4-way cycle reversing valve

Practical topics

- Proportional control: analysis of the variations of compressor r.p.m. versus the thermal jump between set temperature and measured temperature
- Testing logics of ON/OFF or PI controls

TECHNICAL SPECIFICATIONS

- Painted metallic framework
- Insulating material front panel reproducing the split-type air-conditioning system
- Web access controller, with remote LCD display, including:
 - 10 universal inputs,
 - 8 digital inputs,
 - 4 analog outputs,
 - 4 configurable outputs,
 - 7 digital outputs
 - PC connection via net cable
 - Controller access via Web browser
- 4 potentiometers with 2-mm holes for simulating the analog inputs
- 7 bargraph LEDs with 2-mm holes for simulating the analog outputs
- 1 switch for simulating the seasonal (summer/winter) switching
- 5 LEDs for simulating the digital outputs

Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 80 x 40 x 12 cm

Net weight: 18 kg

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK

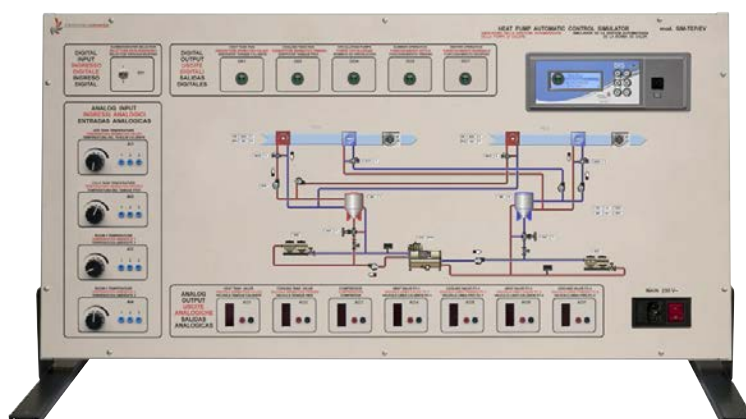


OPTIONAL
PERSONAL COMPUTER

AUTOMATED CONTROL SIMULATOR OF THE HEAT PUMP

Mod. SIM-TEP/EV

CV



INTRODUCTION

This educational simulator is designed for the training in the field of management of technical systems installed in residential buildings and in business facilities: it simulates the operation of an air-conditioning system serving two rooms; the refrigeration unit (a heat pump) is connected with two tanks of warm and cold water, fed respectively by condensation and evaporation fluids; then water is pumped to the hot and cold batteries of the fan-coils of each room according to the demand of heating or of cooling. Any excess of hot or cold energy is eliminated by air dissipators. It also includes an industrial digital controller: this device decides the actions having to be carried out automatically according to the set parameters, such as temperature of hot and cold tanks and temperature of the air in the two rooms, besides enabling to check system behaviour and values of the concerned parameters after set-point values of reference variables have been fixed. When connected with a PC (supplied on demand) the simulator allows the supervision of the system by using a dynamic graphics.

TRAINING PROGRAM

Theoretical topics

- Studying the operation of a refrigeration machine with heat pump
- Studying the transformation the air undergoes when crossing a heating and cooling battery, with the aid of the psychrometric chart

Practical topics

- Analysing the operation of 3-way mixing or diverting valve
- Proportional and ON/OFF control
- Testing logics of ON/OFF or PI controls

TECHNICAL SPECIFICATIONS

- Painted metallic framework
- Insulating material front panel reproducing the heat pump system
- Web access controller, with remote LCD display, including:
 - 10 universal inputs,
 - 8 digital inputs,
 - 4 analog outputs,
 - 4 configurable outputs,
 - 7 digital outputs
 - PC connection via net cable
 - Controller access via Web browser
- 4 potentiometers with 2-mm holes for simulating the analog inputs
- 7 bargraph LEDs with 2-mm holes for simulating the analog outputs
- 1 switch for simulating the seasonal (summer/winter) switching
- 5 LEDs for simulating the digital outputs

Power supply: 230 Vac 50 Hz single-phase - 220 VA
(Other voltage and frequency on request)

Dimensions: 80 x 40 x 12 cm

Net weight: 18 kg

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK

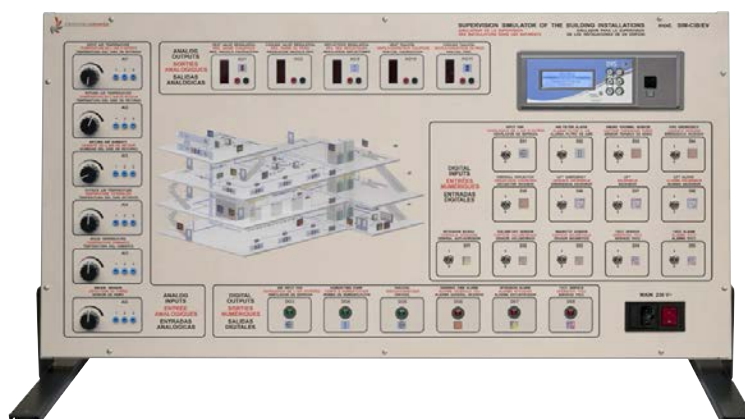


OPTIONAL ACCESSORY

PERSONAL COMPUTER

SIMULATOR OF THE SUPERVISION OF TECHNICAL INSTALLATIONS IN BUILDINGS

Mod. SIM-CIB/EV



INTRODUCTION

This educational simulator has been designed for the study of large industrial /commercial installations management. It simulates the operation of a mixed air / fan coil air-con installation and the management of the fire-fighting system, entrances, lifts, safeties etc. The simulator includes a digital industrial controller. According to the set parameters (indoor / outdoor air temperatures, supplied air temperature, return air temperature and relative humidity), it automatically decides the actions to be taken allowing to verify the system operation once fixed the set-point values.

When connected to the PC (supplied on request), the simulator allows the supervision of the system by using a dynamic graphics.

TRAINING PROGRAM

Theoretical topics

- Study of the following changes of the air in the different sections of an Air Handling Unit (by using the psychrometric chart): sensible heating, adiabatic humidification, cooling & dehumidification, mixing.
- Inlet air conditions to satisfy the thermo-hygrometric requirements of the room to be air-conditioned.

Practical topics

- Analysis of the performance of the temperature and humidity controllers used in Air Handling Units.
- ON/OFF and proportional control.
- Control of the air dampers according to the temperature.
- States and alarm control of: air-con installation, fire-fighting installation, lifts, building entrances, safeties.

TECHNICAL SPECIFICATIONS

- Painted metallic framework
- Insulating material front panel simulating a large building with many technical services
- Web access controller, with remote LCD display, including:
 - 10 universal inputs,
 - 8 digital inputs,
 - 4 analog outputs,
 - 4 configurable outputs,
 - 7 digital outputs
- I/O expansion module with 4 digital inputs
- PC connection via net cable
- Controller access via Web browser
- 6 potentiometers, with 2-mm holes, to simulate the analog inputs
- 5 LED bargraphs, with 2-mm holes, to simulate the digital outputs
- 13 switches to simulate the digital inputs
- 6 LEDs to simulate the digital outputs

Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 80 x 40 x 12 cm

Net weight: 18 kg

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK

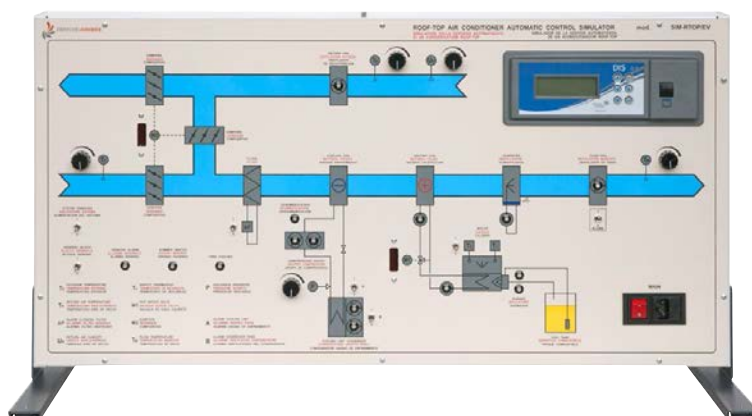


OPTIONAL ACCESSORY

PERSONAL COMPUTER

AUTOMATED CONTROL SIMULATOR OF A ROOF-TOP AIR-CONDITIONER

Mod. SIM-RTOP/EV



INTRODUCTION

This educational simulator has been designed for the study of large tertiary installations management.

It simulates the operation of a Roof-Top air-conditioner.

The simulator includes an industrial controller.

According to the set parameters (outdoor air temperature, supplied air temperature, return air temperature and relative humidity), it automatically decides the actions to be taken allowing to verify the system operation once fixed the set-point values.

When connected to the PC (supplied on request), the simulator allows the supervision of the system by using a dynamic graphics.

TRAINING PROGRAM

Theoretical topics

- Study of the following changes of the air in the different sections of an Air Handling Unit (by using the psychrometric chart): sensible heating, adiabatic humidification, cooling & dehumidification, mixing
- Inlet air conditions to satisfy the thermo-hygrometric requirements of the room to be air-conditioned

Practical topics

- Study of the performance of the temperature and humidity controllers used in Air Handling Units
- ON/OFF and proportional control
- Control of the air dampers according to the temperature
- Free-cooling
- Alarms control

TECHNICAL SPECIFICATIONS

- Painted metallic framework
- Insulating material front panel reproducing the Roof-Top air-conditioner aeraulic diagram
- Web access controller, with remote LCD display, including:
 - 10 universal inputs
 - 8 digital inputs
 - 4 analog outputs
 - 4 configurable outputs
 - 7 digital outputs
 - I/O expansion module with 6 universal inputs, 2 digital inputs, 2 analog outputs, 4 configurable outputs, 3 digital outputs
 - PC connection via net cable
 - Controller access via Web browser
- 5 potentiometers to simulate the analog inputs
- 2 LED bargraphs to simulate the digital output
- 7 switches to simulate the digital inputs
- 15 LEDs to simulate the digital outputs

Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 80 x 40 x 12 cm

Net weight: 18 kg

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL ACCESSORY

PERSONAL COMPUTER

AIR-CONDITIONING CONTROL UNIT SIMULATOR

Mod. SIM-CL/EV

TRAINING PROGRAM

- Studying the transformation the air undergoes when crossing the various sections of an air handling unit, with the aid of the psychrometric chart; these transformations are: sensible heating, adiabatic humidification, cooling and dehumidification, mixing
- Assessing the air supply conditions to meet the thermohygrometric needs of the room having to be air-conditioned
- Thermal factor
- Sizing the heat exchange batteries of an air handling unit
- Analyzing the operation of temperature and humidity regulators for air-handling units
- Proportional and ON/OFF control
- Air dampers control according to temperature

TECHNICAL SPECIFICATIONS

- Colour panel reproducing the air-handling unit
- Board for data acquisition and control of output signals to the actuators
- Connection with PC via USB cable
- 5 potentiometers for simulating the following analog inputs:
 - outdoor air temperature
 - pre-heating/cooling air temperature (dew point)
 - supply air temperature
 - return air temperature
 - return air relative humidity
- 4 bargraph LEDs for simulating the following analog outputs:
 - control signal for the motor of pre-heating battery
 - control signal for the motor of cooling/dehumidification battery
 - control signal for the motor of post-heating battery
 - control signal for the motor of air dampers
- 3 switches for simulating the following digital inputs:
 - system operation enabling
 - fans enabling
 - air filter clogged
- 4 LEDs for simulating the following digital outputs:
 - system status
 - fans status
 - humidifier pump status
 - air filter clogged alarm
- Program for dimensioning the batteries of a single-duct air-handling unit
- Program for the simulation of the air conditioning control system operation

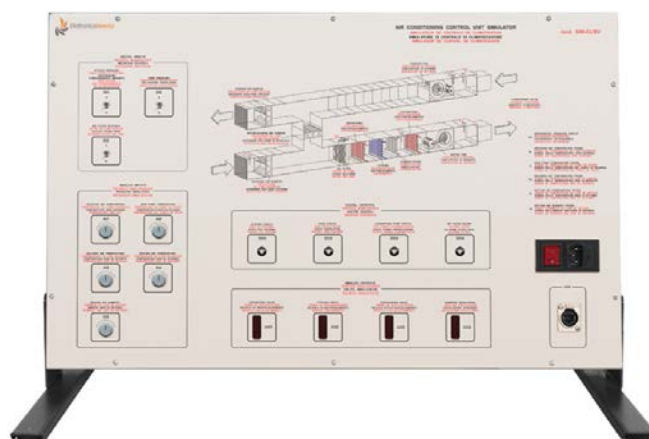
INTRODUCTION

Educational simulator mod. SIM-CL/EV represents a proper and natural adaptation to the new demands of labour market requiring high training levels of all the operators of air-conditioning systems installed in great industrial and business complexes.

This equipment meets two aspects:

- the first one concerns the design of a single-duct air handling unit, with setting of design parameters such as thermal loads, fresh air flow rate, thermohygrometric conditions of outdoor and room air and the assessment of:
 - air flow having to be handled and air inlet conditions for meeting thermohygrometric needs of the room having to be air-conditioned
 - power for feeding pre/post-heating, cooling and dehumidification batteries
- the second aspect concerns the simulation of the operation of the automatic control system of a single-duct air-conditioning installation at the variation of the operating parameters and of their respective set-point values.

This simulator must necessarily be connected with a PC (supplied on demand).



- Development software that can be used to modify the application programs according to one's own needs

Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 65 x 40 x 12 cm

Net weight: 5 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



AIR-CONDITIONING SIMULATOR

Mod. SIM-CLR/EV

INTRODUCTION

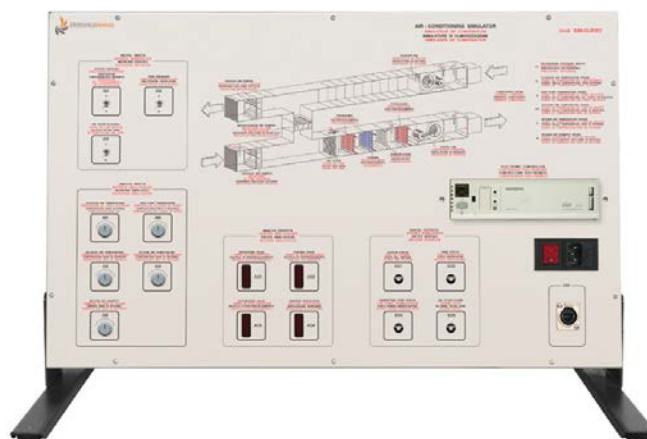
Educational simulator mod. SIM-CLR/EV represents a proper and natural adaptation to the new demands of labour market requiring high training levels of all the operators of air-conditioning systems installed in great industrial and business complexes. This equipment also includes an industrial controller that enables a detailed analysis of the automatic control system for an air-conditioning installation at the variation of operating parameters. It must necessarily be connected to the PC.

TRAINING PROGRAM

- Studying the transformation the air undergoes when crossing the various sections of an air handling unit, with the aid of the psychrometric chart
- Assessing the air supply conditions to meet the thermohygrometric needs of the room having to be air-conditioned
- Analyzing the operation of temperature and humidity regulators for air-handling unit
- Proportional and ON/OFF control
- Air dampers control according to temperature
- Antifreeze function
- Control of alarms
- Supervision of technical installations

TECHNICAL SPECIFICATIONS

- Colour panel reproducing the air-handling unit
- Configurable universal controller for air conditioning having the following characteristics:
 - 8 universal inputs
 - 4 analog outputs
 - 6 digital outputs
 - 3 control loops
 - Controller-PC interface module
- 5 potentiometers for simulating the following analog inputs:
 - outdoor air temperature
 - dew point
 - supply air temperature
 - return air temperature
 - return air relative humidity
- 4 bargraph LEDs for simulating the following analog outputs:
 - control signal for the motor of pre-heating battery
 - control signal for the motor of cooling/dehumidification battery
 - control signal for the motor of post-heating battery
 - control signal for the motor of air dampers
- 3 switches for simulating the following digital inputs:
 - fans pressure switches
 - air filter pressure switch
 - antifreeze thermostat
- 4 LEDs for simulating the following digital outputs:
 - fans control
 - humidifier pump control
 - pre-heating battery pump control
 - alarm
- System supervision software



Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 65 x 40 x 12 cm

Net weight: 5 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



SPLIT-TYPE DOMESTIC AIR-CONDITIONER SIMULATOR

Mod. SIM-SP/EV

INTRODUCTION

Simulator mod. SIM-SP/EV has been designed specifically for educational aims: it simulates the operation of a split-type air-conditioning system with inverter that modulates the compressor r.p.m. according to the deviation from the set point of the room temperature actual value. It enables to verify the system behaviour and to assess the value of the concerned parameters such as heating or cooling power, after the set points of reference variables have been fixed.

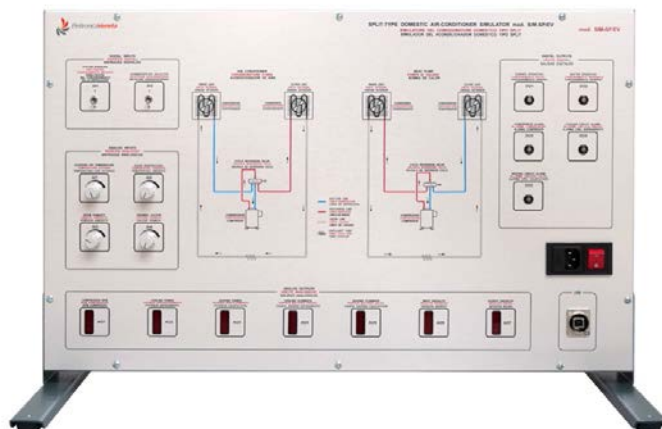
This simulator must necessarily be connected with a PC (supplied on demand).

TRAINING PROGRAM

- Studying the operation of a split-type refrigeration machine for domestic air conditioning
- Studying the transformation the air undergoes when crossing an evaporation and condensation battery, with the aid of the psychrometric chart
- Thermal factor
- Studying the pressure-enthalpy diagram of a refrigerant
- Heat balances on refrigerant side and on air side
- Analyzing the operation of a 4-way cycle reversing valve
- Proportional and ON/OFF control

TECHNICAL SPECIFICATIONS

- Colour panel reproducing the air-conditioning system
- Board for data acquisition and control of output signals to the actuators
- Connection with PC via USB cable
- 4 potentiometers for simulating the following analog inputs:
 - outdoor air temperature
 - room air temperature
 - room air relative humidity
 - thermal factor
- 7 bargraph LEDs for simulating the following analog outputs:
 - compressor r.p.m.
 - cooling power
 - heating power
 - cooling air flow
 - heating air flow
 - outdoor air enthalpy
 - indoor air enthalpy
- 2 switches for simulating the following digital inputs:
 - system enabling
 - seasonal switching (summer/winter)
- 5 LEDs for simulating the following digital outputs:
 - compressor alarm
 - cooling circuit alarm
 - heating circuit alarm
 - summer cycle operation
 - winter cycle operation
- Application software developed in NI LabVIEW™



Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 65 x 40 x 12 cm

Net weight: 5 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



HEAT PUMP SIMULATOR

Mod. SIM-HP/EV

INTRODUCTION

Educational simulator mod. SIM-HP/EV is designed for the training in the field of computer-aided management of industrial systems: it simulates the operation of an air-conditioning system serving two rooms. The refrigeration unit (a heat pump) is connected with two tanks of warm and cold water, fed respectively by condensation and evaporation fluids; then water is pumped to the hot and cold batteries of the fan-coils of each room according to the demand of heating or of cooling. Any excess of hot or cold energy is eliminated by air dissipators. This simulator enables to check the system behaviour and to assess the values of the concerned parameters after set points of reference variables have been fixed.

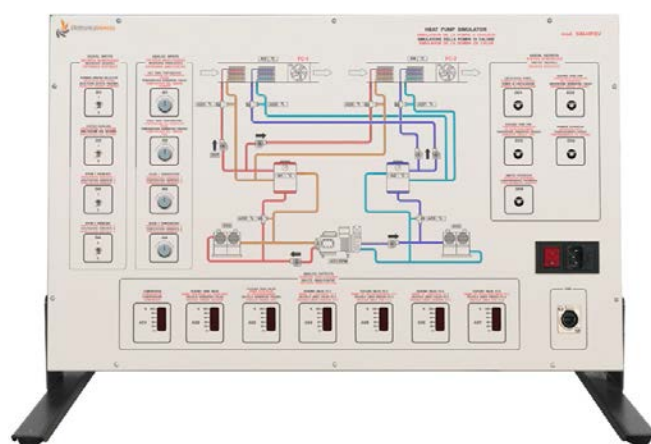
It must necessarily be connected with a PC (supplied on demand).

TRAINING PROGRAM

- Studying the operation of a refrigeration machine with heat pump
- Studying the transformation the air undergoes when crossing a heating or cooling battery, with the aid of the psychrometric chart
- Heat balances on air side
- Studying the pressure-enthalpy diagram of a refrigerant
- Studying how evaporation and condensation temperatures affect the compressor efficiency
- Analyzing the operation of a 3-way mixing or diverting valve
- Proportional and ON/OFF control

TECHNICAL SPECIFICATIONS

- Colour panel reproducing the system with heat pump
- Board for data acquisition and control of output signals to the actuators
- Connection with PC via USB cable
- 4 potentiometers for simulating the following analog inputs:
 - hot tank temperature
 - cold tank temperature
 - air temperature in room 1
 - air temperature in room 2
- 7 bargraph LEDs for simulating the following analog outputs:
 - compressor r.p.m.
 - control signal for the motor of hot tank valve
 - control signal for the motor of cold tank valve
 - control signal for the motor of hot line valve of room 1
 - control signal for the motor of cold line valve of room 1
 - control signal for the motor of hot line valve of room 2
 - control signal for the motor of cold line valve of room 2
- 4 switches for simulating the following digital inputs:
 - seasonal summer/winter switching
 - system enabling
 - starting operation in room 1
 - starting operation in room 2
- 5 LEDs for simulating the following digital outputs:
 - circulation pumps enabling
 - hot tank dissipator fan enabling
 - cold tank dissipator fan enabling
 - summer cycle operation
 - winter cycle operation
- Application software developed in NI LabVIEW™



Power supply:	230 Vac 50 Hz single-phase - 200 VA (Other voltage and frequency on request)
Dimensions:	65 x 40 x 12 cm
Net weight:	5 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



REFRIGERATION BENCH WITH COMPRESSED-AIR

Mod. BRAC/EV

INTRODUCTION

This bench has been specifically designed for educational aims and it concerns the study of the refrigeration with compressed air that is an unusual method for producing cold by the expansion of compressed air. When expanding with whirling motion through a distributor of proper shape that imparts it a rotating movement, compressed air is divided into a cold stream and a hot stream. Cold stream is used, whereas hot stream is exhausted into the environment. This system is used in a lot of small applications in dangerous environments where systems using electric energy cannot be used, or in environments not powered by electric energy.

TRAINING PROGRAM

- Thermodynamics of compressed air
- Demonstration of the possibility of producing hot and cold air through an instrument without moving parts
- Detecting the operating curve of a vortex tube by varying the inlet pressure and the weight ratio between hot and cold air
- Plotting the transformation due to air expansion on Temperature-Entropy diagram, starting from the detected values
- Determining the outlet temperatures versus the feeding pressure
- Determining the useful refrigeration power
- C.O.P. determination

TECHNICAL SPECIFICATIONS

This bench is provided with:

- Steel structure painted with epoxy paint and baked
- Gloss aluminium fore plate with colour silk-screen-printed schematic diagram
- Vortex tube: 300 l/min, 7 bar
- Double-vortex compressed air expansion chamber
- Feeding pressure regulator
- Electronic thermometers
- Pressure gauge
- Flowmeters
- Control of air flow entering the vortex tube by the pressure regulator available on the plate
- Quick connection for compressed air feed

Power supply: 230 Vac 50 Hz single-phase - 50 VA
(Other voltage and frequency on request)

Dimensions: 54 x 30 x 79 cm

Net weight: 30 kg



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Compressed air

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE THERMOHYGROMETER WITH REMOVABLE PROBE MOD. THHY





THERMOTRONICS COMPUTERIZED MODULAR LABORATORY

PRESENTATION

CV 41

REF. REFRIGERATION SEC.	BASE MODULE FOR REFRIGERATION AND AIR-CONDITIONING	MOD. AA/EV	RE 40
	REFRIGERATION		
	MODULE FOR THE STUDY OF DOMESTIC REFRIGERATION	MOD. AC/EV	RE 42
	MODULE FOR THE STUDY OF INDUSTRIAL REFRIGERATION	MOD. AE/EV	RE 43
	MODULE FOR THE STUDY OF THE ELECTRIC COMPONENTS IN REFRIGERATION PLANTS	MOD. AG/EV	RE 44

CONDITIONING

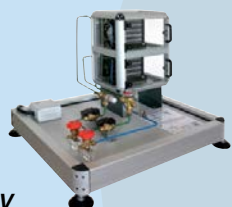
MODULE FOR THE STUDY OF HEAT-TRANSFER THERMODYNAMICS	MOD. AB/EV	CV 43
MODULE FOR THE STUDY OF DOMESTIC AIR-CONDITIONING	MOD. ADM/EV	CV 44
MODULE FOR THE STUDY OF INDUSTRIAL AIR-CONDITIONING	MOD. AF/EV	CV 45
MODULE FOR THE STUDY OF HEAT PUMPS IN AIR-CONDITIONING SYSTEMS	MOD. AH/EV	CV 46

THERMOTRONICS COMPUTERIZED MODULAR LABORATORY

REFRIGERATION



AC/EV
DOMESTIC REFRIGERATION



AE/EV
INDUSTRIAL REFRIGERATION



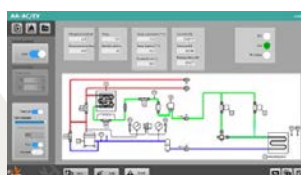
AG/EV
**ELECTRIC COMPONENTS IN
REFRIGERATION PLANTS**

LABORATORY STRUCTURE



AA/EV
BASE MODULE

+



SUPERVISION SOFTWARE
(SPECIFIC FOR EACH MODULE)

CONDITIONING



AB/EV
**HEAT TRANSFER
THERMODYNAMICS**



ADM/EV
DOMESTIC AIR CONDITIONING



AF/EV
**INDUSTRIAL AIR
CONDITIONING**



AH/EV
**HEAT PUMP IN AIR CONDITIONING
SYSTEMS**

PRESENTATION

The Computerized Thermotronics Modular Laboratory combines all the common components of all Laboratory applications into a unique compact Basic Module. On the contrary, the specific applications can use the Experimental Modules that must be connected (one at a time) with the Basic Module via flexible pipes: these Experimental Modules explain the theoretical and practical issues concerning refrigeration and air conditioning.

The operating modes can be controlled by a PC (not included) via USB cable, thanks to a specific supervision software (different for each module).

This Modular Laboratory has been designed to offer an exhaustive and flexible training program that can be used by vocational school and technical high school, as well as by universities. This Modular Laboratory enables to teach and learn the most advanced installation and PC-control techniques of refrigeration and air conditioning systems.

This section of the catalogue only shows the laboratory equipment concerning conditioning. The base and refrigeration modules and the supervision software are described in the previous section of this catalogue (see previous page).

MODULE FOR THE STUDY OF HEAT-TRANSFER THERMODYNAMICS

Mod. AB/EV

INTRODUCTION

The experimental module mod. AB/EV has been designed for an easy learning of the main physical phenomena pertinent to heat transfer, to the phase changes and gas laws, etc..., that are all issues concerning the refrigeration and air conditioning cycles.

TRAINING PROGRAM

- Basic concepts of fluid thermodynamics: temperature, heat, work, power, enthalpy, phase changes
- Refrigeration cycles
- Heat transfer laws: conduction, convection, radiation. Heat exchangers
- The air psychrometric chart: dry-bulb and wet-bulb thermometers, absolute and relative humidity, enthalpy, specific volume
- Air transformations in the psychrometric chart
- Heat balances
- Refrigerant fluids and their pressure/enthalpy diagram
- Heat balances at the compressor, at the evaporator, at the condenser
- Assessing the system E.E.R. and the volumetric efficiency of compressor
- Analyzing the operation of a thermostatic expansion valve
- Calculation of condenser heat exchange coefficient
- This program also includes some exercises concerning the fault insertion (through the basic module)



TECHNICAL SPECIFICATIONS

- Tabletop aluminium structure
- Small duct with forced air evaporator, heating battery, temperature and relative humidity sensors
- Colour printed schematic diagram reproducing the hydraulic circuit
- Refrigerant flow control by capillary tube or thermostatic valve
- Cocks for an easy connection with the basic module
- Solenoid valves for selecting the expansion device
- Specific supervision software

Dimensions: 74 x 64 x 44 cm

Net weight: 19 kg

REQUIRED

**BASE MODULE
MOD. AA/EV
- NOT INCLUDED -**



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



MODULE FOR THE STUDY OF DOMESTIC AIR-CONDITIONING

Mod. ADM/EV

INTRODUCTION

This experimental module emphasizes the hydraulic, mechanical and thermodynamic aspects of split-type domestic air conditioners.

TRAINING PROGRAM

- Basic concepts and relevant terminology of air-conditioning thermodynamics
- Operating principles of split-type air conditioners
- Cooling and phase change processes
- The air psychrometric chart. Transformation of cooling and dehumidification
- How the variation of thermal load can affect the operation of evaporator and of condenser
- Heat flows through the system components
- Gas expansion via capillary tube
- Dehumidification and cooling capacity
- Servicing air-conditioning system
- Calculation of the thermal power extracted from the room and of C.O.P. Heat balances
- Calculation of heat exchange coefficients
- This program also includes some exercises concerning the fault insertion (through the basic module)



TECHNICAL SPECIFICATIONS

- Tabletop aluminium structure
- Wall-mounted split-type evaporating unit including heat exchange battery, tangential fan, motor-driven baffle, remote control
- Temperature and relative humidity sensors
- Colour printed schematic diagram reproducing the hydraulic circuit
- Capillary tube for the refrigerant expansion
- Cocks for an easy connection with the basic module
- Specific supervision software

Dimensions: 74 x 64 x 55 cm

Net weight: 22 kg

REQUIRED

**BASE MODULE
MOD. AA/EV
- NOT INCLUDED -**



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



MODULE FOR THE STUDY OF INDUSTRIAL AIR-CONDITIONING

Mod. AF/EV

INTRODUCTION

The experimental module mod. AF/EV is designed for the complete and exhaustive study of thermodynamic transformations the air undergoes when crossing a three-section central air-conditioning unit.

TRAINING PROGRAM

- The air psychrometric chart. Determination of absolute humidity, enthalpy, specific volume, dew point
- Transformations of the air due to variations of temperature and/or of relative humidity
- Heating, humidification, cooling and dehumidification processes. Heat balances
- Using the air recirculation to save energy
- Air quality. Air handling: mixing and filtration
- Thermohygrometric comfort conditions of room occupants
- System performances far from design conditions
- Determining the airflow in ducts as speed varies
- This program also includes some exercises concerning the fault insertion (through the basic module)

TECHNICAL SPECIFICATIONS

- Tabletop aluminium structure
- Air conditioning unit including: duct with transparent walls, variable speed axial fan, cooling and dehumidification battery, humidifying section, heating battery, temperature and relative humidity sensors, anemometric sensor
- Colour printed schematic diagram reproducing the hydraulic circuit
- Thermostatic expansion valve
- Cocks for an easy connection with the basic module
- Specific supervision software

Dimensions: 74 x 64 x 44 cm

Net weight: 20 kg



REQUIRED

**BASE MODULE
MOD. AA/EV
- NOT INCLUDED -**



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



MODULE FOR THE STUDY OF HEAT PUMPS IN AIR-CONDITIONING SYSTEMS

Mod. AH/EV

INTRODUCTION

The experimental module mod. AH/EV emphasizes the parameters maximizing system C.O.P., the cycle components, the mechanical problems concerning cycle reversal, the winter and summer heat balances.

TRAINING PROGRAM

- Principles and basics of heat pump
- The air psychrometric chart
- Determination of absolute humidity, enthalpy, specific volume, dew point. Transformations of the air due to variations of temperature and/or of relative humidity
- Heating, humidification, cooling and dehumidification processes. Heat balances
- Components and procedures for servicing heat pump systems
- Calculation of thermal power, volumetric compression efficiency, exchange coefficients of evaporator and condenser, system C.O.P. and E.E.R.
- This program also includes some exercises concerning the fault insertion (through the basic module)



TECHNICAL SPECIFICATIONS

- Tabletop aluminium structure
- Evaporation/condensation unit including fan with variable speed, temperature and relative humidity sensors
- Colour printed schematic diagram reproducing the hydraulic circuit
- 4-way cycle reversing valve
- Capillary tube for refrigerant expansion
- Cocks for an easy connection with the basic module
- Specific supervision software

Dimensions: 74 x 64 x 44 cm

Net weight: 20 kg

REQUIRED

**BASE MODULE
MOD. AA/EV
- NOT INCLUDED -**



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



27-C

CV



THERMOTRONICS

WORKSHOP EQUIPMENT

ASSEMBLY KIT OF INDUSTRIAL AIR-CONDITIONING	MOD. IAC-K/EV	CV 48
ASSEMBLY KIT OF DOMESTIC AIR-CONDITIONING	MOD. DAC-K/EV	CV 49
ASSEMBLY KIT OF SPLIT-TYPE DOMESTIC AIR-CONDITIONING	MOD. SPLIT-K/EV	CV 50
ASSEMBLY KIT OF AUTOMOTIVE AIR-CONDITIONING	MOD. VAC-K/EV	CV 51
SECTIONED HERMETIC CONDENSING UNIT	MOD. SHCU/EV	CV 52
SECTIONED ROOM AIR CONDITIONER	MOD. SRAUC/EV	CV 52

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27C-E-CV

ASSEMBLY KIT OF INDUSTRIAL AIR-CONDITIONING

Mod. IAC-K/EV

INTRODUCTION

This kit is specifically designed for educational aims; it enables students to try to assemble and set up an industrial air conditioner for temperature control only, excluding relative humidity. This kit can easily be disassembled for repeated uses. The kit is supplied with the system already filled with refrigerant.

TRAINING PROGRAM

- Analyzing the system operation versus the thermostat set point
- Studying the operation of a thermostatic expansion valve
- Studying the operation of water flow switch
- ON/OFF control
- Setting the system at work
- Procedures for (optional item vacuum and charging station required):
 - bleeding and cleaning the system
 - filling the gas and checking the tightness
- Carrying out gas recovery procedures (optional item recovery-recycling unit required)
- Plotting the theoretical cycle on the pressure-enthalpy diagram of the refrigerant and calculating the thermostatic valve superheat (optional item portable thermometer required)
- Heat balances on air side: calculation of the heat exchanged with the air in the condenser and in the air exchanger (optional items thermohygrometer and anemometer required)

TECHNICAL SPECIFICATIONS

This kit includes:

- Hermetic compressor
- Forced-air condenser
- Thermostatic expansion valve
- Water evaporator
- Liquid receiver, liquid separator
- Service valve for gas vacuum and filling, dehydrator filter
- Double pressure switch
- High and low pressure gauges
- Water pump, storage tank, bleed valve, pressure gauge
- Double air/water exchanger with quick connections
- Water flow switch
- Thermostat
- Digital multimeter
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 850 VA
(Other voltage and frequency on request)

Package dim.: 160 x 70 x 90 cm

Net weight: 130 kg



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE VANE ANEMOMETER
MOD. THAN



PORTABLE THERMOHYGROMETER
WITH REMOVABLE PROBE
MOD. THHY

PORTABLE VACUUM AND
CHARGING STATION - MOD. VACU-2



ELECTRONIC LEAK DETECTOR
MOD. AHLD-1

PORTABLE THERMOMETER
WITH IMMERSION PROBE
MOD. THRN



ELECTRONIC BALANCE
MOD. RECH

RECOVERY-RECYCLING UNIT
MOD. RERE



ASSEMBLY KIT OF DOMESTIC AIR-CONDITIONING Mod. DAC-K/EV

INTRODUCTION

This kit is specifically designed so that students can easily deal with the issues concerning the refrigeration circuit and air conditioning (air flows, humidity, energy balances and yields, etc...). The kit is supplied with the system already filled with refrigerant.

CV

TRAINING PROGRAM

- Procedures for (optional items vacuum and charging station required):
 - bleeding and cleaning the system
 - filling the gas and checking the tightness
- Setting the system at work
- Assessing the system operating parameters
- Carrying out gas recovery procedures (optional item recovery-recycling unit required)

TECHNICAL SPECIFICATIONS

This kit includes all the components of a domestic air conditioner, that is:

- hermetic compressor
- capillary tube direct expansion evaporator
- air condenser
- air circulation unit of transparent material
- pressure gauge set

Moreover the kit is also equipped with switchboard including:

- digital multimeter
- thermomagnetic - earth leakage control button
- emergency button
- warning lights
- digital thermometers with Pt100 probes
- hygrometer

Power supply: 230 Vac 50 Hz single-phase - 1200 VA
(Other voltage and frequency on request)

Package dim.: 100 x 60 x 50 cm

Net weight: 68 kg



SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

RECOVERY-RECYCLING UNIT
MOD. RERE



ELECTRONIC BALANCE
MOD. RECH

PORTABLE VACUUM AND
CHARGING STATION - MOD. VACU-2



ELECTRONIC LEAK DETECTOR
MOD. AHLD-1

ASSEMBLY KIT OF SPLIT-TYPE DOMESTIC AIR-CONDITIONING

Mod. SPLIT-K/EV

INTRODUCTION

This kit is specifically designed so that students can learn the assembling and servicing techniques of split-type domestic air conditioner. It consists of an outdoor moto-condensing unit and of a wall-type indoor unit. Pipes and metallic small items are included. The kit can be easily disassembled for repeated uses. The kit is supplied with the system already filled with refrigerant.

TRAINING PROGRAM

- Examination of the different operating modes: heating, cooling, dehumidification, ventilation
- Procedures for (optional item vacuum and charging station required):
 - bleeding and cleaning the system
 - filling the gas and checking the tightness
- Setting the system at work
- Carrying out gas recovery procedures (optional item recovery-recycling unit required)

TECHNICAL SPECIFICATIONS

This kit includes:

- Steel structure mounted on wheels, painted and treated in the oven
- 7000 BTU/h split-type unit consisting of:
 - hermetic compressor
 - air condenser
 - 3-speed fan evaporator provided with deflector
 - capillary tube for expansion
 - remote control for adjustments
- Sight glass, filter, flow meter
- Pressure gauge set with connection pipes and high and low pressure gauges
- Switchboard with thermomagnetic - earth leakage control button
- 2 thermometers with Pt 100 probes
- 1 hygrometer
- 1 digital multimeter
- Pressure safety switch
- Emergency button



Power supply:	230 Vac 50 Hz single-phase - 900 VA (Other voltage and frequency on request)
Dimensions:	120 x 100 x 160 cm
Net weight:	110 kg

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE VACUUM AND CHARGING STATION - MOD. VACU-2



ELECTRONIC LEAK DETECTOR MOD. AHLD-1

RECOVERY-RECYCLING UNIT MOD. RERE



ASSEMBLY KIT OF AUTOMOTIVE AIR-CONDITIONING

Mod. VAC-K/EV

INTRODUCTION

This kit is specifically designed for educational aims so that students can delve into various topics such as the alignment of important mechanical parts, the operation with open type compressors, operating in narrow spaces, etc... The kit can easily be disassembled for repeated uses. The kit is supplied with the system already filled with refrigerant.

TRAINING PROGRAM

- Procedures for (optional item vacuum and charging station required):
 - bleeding and cleaning the system
 - filling the gas and checking the tightness
- Setting the system at work
- Studying the operation of an automotive air conditioner
- Analyzing the system behaviour versus the variation of:
 - engine r.p.m.
 - condenser fan speed
 - refrigerant filling in the system
- Carrying out gas recovery procedures (optional item recovery-recycling unit required)
- Measurement of cycle operating pressures (optional item manifold required)

TECHNICAL SPECIFICATIONS

This kit includes all the components of an automotive air conditioner, that is:

- open type compressor provided with pulley and electromagnetic coupling
- speed control motor
- driving belt
- vehicle air conditioning unit
- forced-air condenser controlled by pressure switch
- expansion valve

Moreover the kit is also equipped with switchboard including:

- tachometer
- Thermomagnetic - earth leakage control button
- emergency button
- warning lights

Package dim.: 100 x 100 x 50 cm
Net weight: 133 kg



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Power supply: 400 Vac 50 Hz three-phase - 3000 VA
(Other voltage and frequency on request)

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

RECOVERY-RECYCLING UNIT MOD. RERE



ELECTRONIC BALANCE MOD. RECH

PORTABLE VACUUM AND CHARGING STATION - MOD. VACU-2



ELECTRONIC LEAK DETECTOR MOD. AHL-1

MANIFOLD MOD. MFLD



SECTIONED HERMETIC CONDENSING UNIT

Mod. SHCU/EV



INTRODUCTION

This equipment is specifically designed for educational aims to supply students with a detailed view of all the main components of a condensing unit shown as sectioned actual models. This unit is also provided with connection pipes and with a water evaporator.

TRAINING PROGRAM

- Layout and operating principle of:
 - A hermetic compressor
 - A water condenser
 - A liquid receiver
 - A thermostatic expansion valve
 - A water evaporator
- Operating principle of a condensing unit

TECHNICAL SPECIFICATIONS

This equipment includes:

- Base plate
- Sectioned hermetic reciprocating compressor
- Sectioned water condenser
- Sectioned liquid receiver
- Sectioned thermostatic expansion valve
- Connection pipes
- Sectioned water evaporator

Dimensions: 80 x 50 x 34 cm

Net weight: 20 kg

SECTIONED ROOM AIR-CONDITIONER

Mod. SRAUC/EV



INTRODUCTION

This equipment is specifically designed for educational aims to supply students with a detailed view of all the main components of a room air conditioner shown as sectioned and properly coloured actual models. This unit is also provided with connection pipes.

TRAINING PROGRAM

- Layout and operating principle of:
 - A Hermetic compressor
 - An air condenser
 - An evaporator
 - A liquid receiver
 - A dehydrator filter
 - A 4-way cycle reversing valve
- Operating principle of a room air conditioner

TECHNICAL SPECIFICATIONS

This equipment includes:

- Base plate
- Sectioned hermetic compressor
- Sectioned air condenser
- Sectioned evaporator
- Sectioned liquid receiver
- Sectioned dehydrator filter
- Sectioned 4-way cycle reversing valve (heat pump running)
- Connection pipes

Dimensions: 80 x 50 x 38 cm

Net weight: 26 kg





HEATING AND SANITARY SYSTEMS



Aim:

- Training in the sectors of hot water production, heat distribution, typologies of heating elements
- Technical High Schools, Vocational schools, Universities

Equipment:

- Units mounted on wheeled frameworks, or tabletop units
- Colour schematic diagrams
- Computer-aided and manual equipment
- Instruments and accessories for a theoretical-practical approach to the topic under examination







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27-C



THERMOTRONICS

HEATING AND SANITARY SYSTEMS

	PRESENTATION	HS 5
	PLANTS	HS 6
	TABLETOP UNITS	HS 20
	WORKSHOP EQUIPMENT	HS 26

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27C-E-HS

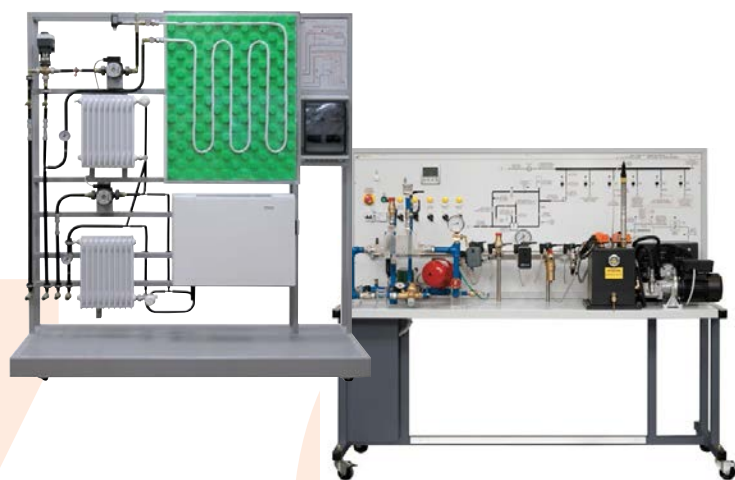
PRESENTATION

This product line includes all the apparatuses and optional units concerning Heating and Sanitary systems. Attention can be focused onto the study of combustion in wall-mounted and/or floor-installed, gas-fired or oil-fired boilers, onto the study of pollutants, onto the heating elements, onto the air heating, onto the applications of heating and sanitary systems to domestic or industrial sector and so on.

This product line is subdivided into three main sections of different size designed for different users:

- **Plants**
- **Tabletop units**
- **Workshop equipment**

The first section includes the wheeled, computer-aided and manual equipment with instruments and accessories enabling a theoretical and practical approach to the concerned topic. These systems are designed for technical high schools where students' background allows to carry out more or less complex calculations.



The second section includes the tabletop training simulators for the study of control logics of their control systems; they must be used together with a PC for a correct development of the educational program. These units too are designed for technical schools.



The third section includes equipment specifically designed for workshop work: assembling/disassembling hydraulic systems and circuits, realization of electrical connections, etc... They are mainly conceived for practical activities and they do not require the knowledge of high theoretical notions, consequently they perfectly match the needs of vocational schools where practical approach is emphasized.





PLANTS

THERMOTRONICS

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27C-E-HS

HOT WATER PRODUCTION MODULE	MOD. MC/EV	HS 7
HEATING ELEMENTS MODULE	MOD. RP/EV	HS 8
HEAT CONTROL AND DISTRIBUTION MODULE	MOD. RC/EV	HS 9
DOMESTIC HOT WATER PRODUCTION MODULE	MOD. SC/EV	HS 10
HOT WATER PRODUCTION UNIT	MOD. HWPU/EV	HS 11
UNIT FOR STUDYING HEATING ELEMENTS	MOD. HEU/EV	HS 12
UNIT FOR STUDYING ENERGY DISTRIBUTION AND CONTROL	MOD. EDCU/EV	HS 13
MODULE FOR STUDYING HEATING SYSTEMS IN CIVIL APPLICATIONS	MOD. CHT/EV	HS 14
COMPUTERIZED MODULE FOR STUDYING HEATING SYSTEMS IN CIVIL APPLICATIONS	MOD. CHTC/EV	HS 15
BENCH FOR THE STUDY OF WALL-MOUNTED CONDENSING LPG BOILER	MOD. GPL-G/EV	HS 16
UNIT FOR STUDYING AND MEASURING HEAT LOSSES	MOD. DT/EV	HS 17
UNIT FOR THE STUDY OF ENERGY PERFORMANCE OF A BUILDING ENVELOPE	MOD. EPBD/EV	HS 18
TEST BENCH FOR SAFETY SYSTEMS	MOD. TCS/EV	HS 19

HOT WATER PRODUCTION MODULE

Mod. MC/EV

INTRODUCTION

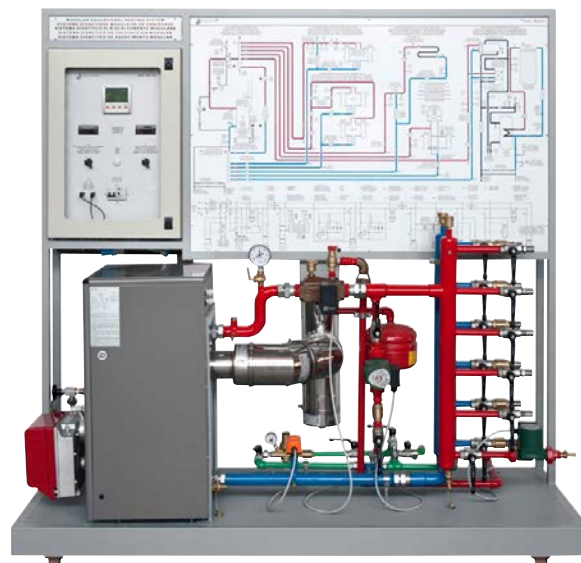
This module for the production of hot water is specifically designed for educational aims and it can be easily connected with dissipation modules mod. RP/EV, RC/EV and SC/EV. It includes a hot water boiler with oil burner, the relevant safety devices and utilities, as well as a system for the distribution of water to the users; it consists of visible and easy to access industrial components and instruments, correctly connected and operating.

TRAINING PROGRAM

- Procedures for:
 - water filling and air bleeding from the system
 - draining and checking system tightness
 - starting the plant and checking the operation of safety devices and of boiler protections
- Protection devices of a machine room
- Safety devices of a machine room
- ON/OFF control: analysis of the operation of the thermostat controlling the hot water production temperature: recirculation pump operation
- With optional item flue-gas analyzer:
 - evaluation of boiler combustion efficiency
 - variation of air and fuel flow to the burner and verification of the effects on combustion efficiency
 - assessment of the quality of the coupling between burner and boiler

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of system hydraulic circuit with warning LEDs
- Cast iron boiler with thermometer, control thermostat and safety thermostat
- 17 kW oil burner
- Fuel tank with level indicator
- Automatic water filling device including pressure reducer, check valve, stop valve, filter, pressure gauge for reading system pressure
- Air separator, expansion vessel, bleed valves
- Anti-condensation by-pass circuit including recirculation pump, check valve, on-off valves, control thermostat
- Flue gas collection and exhaust system including thermometer
- Fuel intercepting valve, safety pressure switch, safety valve
- Delivery and return manifolds with on-off valves on each branch
- Pipes connecting the various components painted with different colours
- Switchboard
- Additional instruments: digital multimeter, digital thermometers with Pt100 probes, pressure gauge
- Quick connections



Power supply: 230 Vac 50 Hz single-phase - 400 VA
(Other voltage and frequency on request)

Dimensions: 200 x 70 x 190 cm

Net weight: 326 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at min. 1 bar
- Chimney for flue gas exhaust ($\varnothing = 145$ mm)
- Water drain

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

FLUE-GAS ANALYZER MOD. FGA-1



**FLUE-GAS ANALYZER - BASIC VERS.
MOD. FGA-E**
As an alternative to mod. FGA-1

GAS BURNER - MOD. BGRG
As an alternative to light oil burner



HEATING ELEMENTS MODULE

Mod. RP/EV

INTRODUCTION

This module has been specifically designed for educational aims and it concerns the study of three types of heating elements:

- radiant floor panels fed at low temperature with 3-way mixing valve and continuous control of delivery temperature
- steel radiators with temperature control via thermostatic valves mounted on each radiator
- manually controlled fan-coils.

TRAINING PROGRAM

- Procedures for water filling and air bleeding from the system
- Plotting the heating elements emission curves
- Analyzing the operation of the 3-way mixing valve and of thermostatic valves
- Determination of the characteristic of the 3-way valve
- Proportional control: radiant system delivery temperature control
- Determining the proportional band of the controller
- Modality for counting and calculating the used thermal energy
- Determining the mixing valve authority (optional item electronic flowmeter required)

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of system hydraulic circuit with warning LEDs
- Underfloor heating system including pipe coil with calibration valves and insulating panel, three-speed circulation pump, three-way motor-driven control valve, proportional controller, provided with room and supplied water temperature sensors and flowmeter, pressure gauges, flow rate metering device, on-off valves
- Distributed control system including steel radiators with thermostatic valves and bleed valves, fan coil, three-speed circulation pump, pressure gauges, flow rate metering device, on-off valves
- Pipes connecting the various components painted with different colours
- Switchboard with controls and 2 digital thermometers
- 6 quick-connection multi-function flexible pipes

Dimensions: 200 x 70 x 190 cm

Net weight: 241 kg



REQUIRED

• MOD. MC/EV - NOT INCLUDED

Module for the production of hot water

OR (PROVIDED BY THE CUSTOMER)

- Hot water
- Power supply: 230 Vac 50 Hz single-phase - 240 VA
(Other voltage and frequency on request)

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

ELECTRONIC FLOWMETER MOD. FLOW-1



HEAT CONTROL AND DISTRIBUTION MODULE

Mod. RC/EV

INTRODUCTION

This module has been specifically designed for educational aims and it concerns the study of two types of heating circuits with radiators:

- a central heating system with outdoor reset control of water delivery temperature
- a distributed heating system with room thermostats, zone valves and heat counters.

TRAINING PROGRAM

- Procedures for water filling and air bleeding from the system
- Outdoor reset control: variation of hot water delivery temperature versus outdoor air temperature
- Determining the proportional band of the controller
- Examination of the control circuit hunting
- Determining the control circuit amplification
- ON/OFF control: room thermostat
- Analyzing the operation of the 3-way mixing valve and of the zone valves
- Determination of the characteristic of the 3-way valve
- Plotting the emission curve of a radiator
- Modality for counting and calculating the used thermal energy
- Determining the authority of mixing valve (optional item electronic flowmeter required)

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of system hydraulic circuit with warning LEDs
- Central heating system with 2 radiators, 1 flowmeter, 1 flow rate metering device, 1 recirculation pump, 1 check valve, 1 three-way motor-driven valve controlled by outdoor reset controller provided with outdoor air and water delivery temperature sensors, pressure gauges
- Zone heating system with 4 steel radiators, 2 solenoid valves controlled by room thermostats, 1 circulation pump, pressure gauge, 2 heat counters
- Pipes connecting the various components painted with different colours
- Switchboard with controls and 2 digital thermometers
- The equipment also includes 10 quick-connection multi-function flexible pipes, bleed valves, on-off valves, lockshield valves

Dimensions: 200 x 70 x 190 cm

Net weight: 291 kg



REQUIRED

• MOD. MC/EV - NOT INCLUDED

Module for the production of hot water

OR (PROVIDED BY THE CUSTOMER)

- Hot water
- Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

ELECTRONIC FLOWMETER MOD. FLOW-1



DOMESTIC HOT WATER PRODUCTION MODULE

Mod. SC/EV

INTRODUCTION

This module has been specifically designed for educational aims and it concerns the study of the systems for the production of sanitary water either of instantaneous use and with storage; in the first case, a plate-type heat exchanger and a shell and tube heat exchanger are compared; whereas, in the other case, a heat pipe solar hot water collector is used.

TRAINING PROGRAM

- Procedures for water filling and air bleeding from the system
- Checking the efficacy of safety devices
- Comparing plate-type and shell-and-tube heat exchangers
- Efficiency of each one of the three exchangers
- Calculating the energy supplied by solar collectors
- Efficiency of solar collectors (optional item solar irradiance meter required)
- Determining the optimum conditions of system operation and management
- Modality for counting and calculating the used thermal energy

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of system hydraulic circuit with warning LEDs
- Automatic water filling device
- Instantaneous use water production system including:
 - plate-type heat exchanger
 - shell-and-tube heat exchanger
 - circulation pump
 - flowmeters, pressure gauges, on-off valves, water flow switch
- Water production system with storage tank including:
 - vacuum glass solar collectors with copper absorbing plate, painted with selective pigments ensuring an absorption of 96%
 - storage tank with exchanger
 - circulation pump
 - flowmeter, pressure gauge, on-off valves, expansion vessel
- Safety valves
- Pipes connecting the various components painted with different colours
- Switchboard with controls, solar system control unit and 2 digital thermometers
- 2 quick-connection multi-function flexible pipes

Dimensions: 200 x 70 x 190 cm

Net weight: 277 kg



REQUIRED

• MOD. MC/EV - NOT INCLUDED

Module for the production of hot water

OR (PROVIDED BY THE CUSTOMER)

- Hot water
- Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

INDOOR LIGHTING DEVICE MOD. SS-1/EV



SOLAR IRRADIANCE METER MOD. SORM

HOT WATER PRODUCTION UNIT

Mod. HWPU/EV

INTRODUCTION

This module for the production of hot water can easily be connected with dissipation modules mod. HEU/EV and EDCU/EV, via flexible pipes. It includes a hot water boiler with oil burner (or with gas burner, on demand), the relevant safety devices and utilities, as well as a system for the distribution of water to the users; it consists of visible and easy to access industrial components and instruments, correctly connected and operating.

TRAINING PROGRAM

- Procedures for:
 - water filling and air bleeding from the system
 - draining and checking system tightness
 - starting the plant and checking the operation of boiler safety and protection devices
- Protection devices of a heating plant
- Safety devices of a heating plant
- ON/OFF control: analysis of the operation of the thermostat for controlling the hot water production temperature: recirculation pump operation
- With optional item flue-gas analyzer:
 - evaluation of boiler combustion efficiency
 - variation of air and fuel flow rate to the burner and verification of the effects on combustion efficiency
 - assessment of the quality of the coupling between burner and boiler

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of system hydraulic circuit with warning LEDs
- Cast iron boiler of with thermometer, control thermostat and safety thermostat
- 17 kW oil burner
- Fuel tank with level indicator
- Automatic water filling device including:
 - pressure reducer
 - check valve
 - stop valve
 - filter
 - pressure gauge for reading system pressure
- Air separator, expansion vessel, bleed valves
- Anti-condensation by-pass circuit including:
 - recirculation pump
 - check valve
 - on-off valves
 - control thermostat
- Flue gas collection and exhaust system including thermometer
- Fuel intercepting valve, safety pressure switch, safety valve
- Delivery and return manifolds with on-off valves on each branch
- Switchboard
- Additional instruments:
 - digital multimeter
 - digital thermometers with Pt100 probes
 - pressure gauge
- Quick connections



- Power supply:** 230 Vac 50 Hz single-phase - 300 VA
(Other voltage and frequency on request)
- Dimensions:** 200 x 70 x 190 cm
- Net weight:** 250 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at min. 1 bar
- Chimney for flue gas exhaust ($\varnothing = 145$ mm)
- Water drain

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

FLUE-GAS ANALYZER MOD. FGA-1



FLUE-GAS ANALYZER - BASIC VERS. MOD. FGA-E

As an alternative to mod. FGA-1

GAS BURNER - MOD. BGRG

As an alternative to light oil burner



UNIT FOR STUDYING HEATING ELEMENTS

Mod. HEU/EV

INTRODUCTION

This module has been specifically designed for educational aims and it concerns the study of three types of heating elements:

- radiant floor panels fed at low temperature with three-way mixing valve and continuous control of delivery temperature
- steel radiators with temperature control via thermostatic valves mounted on each radiator
- manually controlled fan-coil.

TRAINING PROGRAM

- Procedures for water filling and air bleeding from the system
- Plotting the emission curves of the heating elements
- Analyzing the operation of the 3-way mixing valve and of thermostatic valves
- Determination of the characteristic of the 3-way valve
- Proportional control: radiant system delivery temperature control
- Determining the proportional band of the controller
- Modality for counting and calculating the used thermal energy
- Determining the authority of the mixing valve (optional item differential pressure gauge required)

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of system hydraulic circuit with warning LEDs
- Underfloor heating system including:
 - pipe coil with calibration valves and insulating panel
 - three-speed circulation pump
 - three-way motor-driven control valve
 - proportional controller, provided with room and water delivery temperature sensors
 - flowmeters
 - pressure gauge
- Distributed control system including:
 - steel radiators with thermostatic valves and bleed valves
 - fan coil
 - three-speed circulation pump
 - flowmeter
 - pressure gauge
- Switchboard with controls and 2 digital thermometers
- Set of quick-connection flexible pipes for connection with Hot water production unit mod. HWPU/EV

Dimensions: 180 x 70 x 190 cm

Net weight: 174 kg



SPECIAL VERSION ON DEMAND

Mod. HEU-S/EV - Model with system supervision

REQUIRED

- **MOD. HWPU/EV - NOT INCLUDED**

Hot water production unit

OR (PROVIDED BY THE CUSTOMER)

- Hot water
- Power supply: 230 Vac 50 Hz single-phase - 150 VA
(Other voltage and frequency on request)

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

**PORTABLE DIFFERENTIAL PRESSURE GAUGE
MOD. MAND**



UNIT FOR STUDYING ENERGY DISTRIBUTION AND CONTROL

Mod. EDCU/EV

INTRODUCTION

This module has been specifically designed for educational aims and it concerns the study of two types of heating circuits with radiators:

- a central heating system with outdoor reset control of water delivery temperature
- a distributed heating system with room thermostats, zone valves and heat counters.

TRAINING PROGRAM

- Procedures for water filling and air bleeding from the system
- Outdoor reset control: variation of hot water delivery temperature versus outdoor air temperature
- Determining the controller proportional band
- ON/OFF control: room thermostat
- Analyzing the operation of the 3-way mixing valve and of zone valves
- Determination of the characteristic of the 3-way valve
- Plotting the emission curve of a radiator
- Modality for counting and calculating the used thermal energy
- Determining the authority of the mixing valve (optional item differential pressure gauge required)

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of system hydraulic circuit with warning LEDs
- Central heating system including:
 - cast iron radiator and aluminium radiator, each provided with on-off valve, bleed valve and lockshield valve
 - three-speed recirculation pump
 - check valve
 - three-way motor-driven control valve
 - outdoor reset controller provided with outdoor air temperature and water delivery temperature sensors
 - flowmeters
 - pressure gauge
- Zone heating system including:
 - 4 steel radiators, each equipped with on-off valve, bleed valve and lockshield valve
 - three-speed recirculation pump
 - 2 solenoid valves
 - 2 room thermostats
 - 2 heat counters
 - pressure gauge
- Switchboard with controls and 2 digital thermometers
- Set of quick-connection flexible pipes for connection with Hot water production unit mod. HWPU/EV

Dimensions: 200 x 70 x 190 cm

Net weight: 206 kg



SPECIAL VERSION ON DEMAND

Mod. EDCU-S/EV - Model with system supervision

REQUIRED

• **MOD. HWPU/EV - NOT INCLUDED**

Hot water production unit

OR (PROVIDED BY THE CUSTOMER)

- Hot water
- Power supply: 230 Vac 50 Hz single-phase - 150 VA
(Other voltage and frequency on request)

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

**PORTABLE DIFFERENTIAL PRESSURE GAUGE
MOD. MAND**



MODULE FOR STUDYING HEATING SYSTEMS IN CIVIL APPLICATIONS

Mod. CHT/EV

INTRODUCTION

This module has been specifically designed for educational aims and it concerns the study of different engineering solutions used at present in heating systems for civil applications: underfloor heating, heating with radiators or fan-coil.

TRAINING PROGRAM

- Procedures for water filling and air bleeding from the system
- Temperature and flow rate measurement in different points of the circuit
- Calculating the heat emission curve of a heating element
- Studying the operation of a mixing valve
- Modality for calculating the used thermal energy

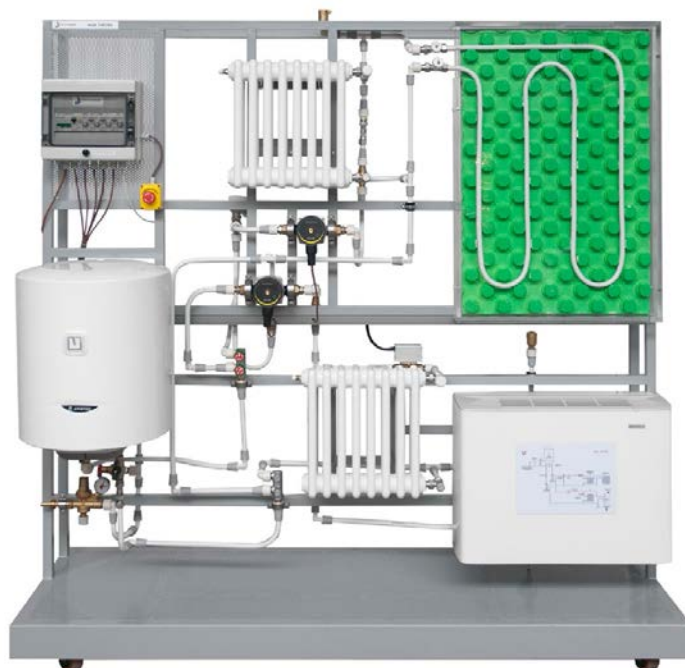
TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour schematic diagram
- Heating system including:
 - 50-liter electric boiler, expansion vessel, automatic bleed valves, automatic filling unit, safety valve, distribution manifolds
 - mixed system with three-way motor-driven valve, calibration valve, circulation pump, radiator and underfloor system
 - distributed system with circulation pump, radiator with zone valve and fan coil
- 2 thermometers
- 2 flowmeters
- 1 manometer
- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 1500 VA
(Other voltage and frequency on request)

Dimensions: 200 x 80 x 200 cm

Net weight: 200 kg



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at 1 bar min.

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



COMPUTERIZED MODULE FOR STUDYING HEATING SYSTEMS IN CIVIL APPLICATIONS

Mod. CHTC/EV

INTRODUCTION

This module has been specifically designed for educational aims and it concerns the study of different engineering solutions used at present in heating systems for civil applications: underfloor heating or heating with radiators, with outdoor reset control of water delivery temperature; heating with radiators and zone valves; fan-coil heating with fan speed control. A control unit enables the autonomous operation (via local joystick) or remote operation (by optional PC via USB connection cable) of the system.

TRAINING PROGRAM

- Procedures for water filling and air bleeding from the system
- Data acquisition via PC (values of water/air temperature, flow rate, pressure in different points of the circuit)
- Calculating the heat emission curve of a heating element
- Studying the operation of a mixing valve and determining its characteristic and authority with respect to the controlled circuit
- Studying the operation of an outdoor reset controller
- Studying the operation of a proportional controller
- Modality for calculating the used thermal energy

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour schematic diagram
- Heating system including:
 - 50-liter electric boiler, expansion vessel, automatic bleed valves, automatic filling unit, safety valve, distribution manifolds;
 - mixed system with three-way motor-driven valve, calibration valve, circulation pump, radiator and underfloor system, with proportional control of delivery temperature versus outdoor temperature (simulated by PC)
 - distributed system with circulation pump, radiator with zone valve and fan coil with proportional control of fan speed versus room temperature
- Control unit with the following characteristics:
 - autonomous operation and remote-controlled operation (via optional PC)
 - USB interface for connection with PC
 - LCD display for displaying the analog outputs, the faults, the input signals: temperatures, pressures, flow rates
 - electronic board and converters for input/output signals
 - multi-function interface board that transforms the module or PC into an industrial apparatus controlling and processing the analog inputs and analog/digital outputs such as the state of solenoid valve, the state of pumps, etc...
 - fault insertion
 - keyboard
- 6 Pt100 probes for detecting temperature
- 2 flow sensors
- 3 pressure sensors



- Thermomagnetic - earth leakage control button
- Emergency button

Power supply: 230 Vac 50 Hz single-phase - 1500 VA
(Other voltage and frequency on request)

Dimensions: 200 x 70 x 190 cm

Net weight: 200 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at 1 bar min.

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL

PERSONAL COMPUTER

BENCH FOR THE STUDY OF WALL-MOUNTED CONDENSING LPG BOILER

Mod. GPL-G/EV

INTRODUCTION

This bench is equipped with a set of several instruments for measuring the parameters that characterize the operation of a condensing boiler with airtight chamber fed by LPG. In conditions of full safety and of maximum efficiency the students can be efficiently trained in the work of installation, servicing and repair, small and medium-size installation boilers for space heating and domestic hot water production. Natural gas boilers are available on demand.

TRAINING PROGRAM

- This bench enables to develop theoretical-practical lessons concerning combustions stoichiometry in various conditions, besides detecting:
 - Instantaneous efficiency
 - Seasonal efficiency
 - Combustion efficiency (optional item flue-gas analyzer FGA-1 or FGA-E required)
 and filling in proper tables with the resulting values
- This bench is also prearranged for the insertion of hydraulic and electric faults to show any malfunction occurring during everyday operation

TECHNICAL SPECIFICATIONS

- Colour schematic diagram showing the water and gas circuits entering and coming out of the boiler
- Power and safety switchboard with potentiometer for the simulation of outdoor temperature
- Modulating airtight chamber boiler fed by LPG, with automatic fault detector, outdoor reset control, water/water exchanger for sanitary hot water production, flowmeter to modulate the flame for sanitary uses
- 1 LPG pressure regulator
- 1 LPG volumetric meter
- 2 heat counters provided with flowmeter and thermocouples for measuring the thermal jump
- 1 thermometer for the continuous temperature control in the combustion chamber via S-type probe. This instrument relates combustion temperature to the efficiency and to the presence of nitric oxides in flue gas (that can be detected by the optional instrument FGA-1 with NOx cell)
- 1 thermometer for the continuous temperature control in the chimney via J-type probe
- 1 external water/water exchanger for cooling the heating water. Water circuits are provided with the necessary usual accessories for a correct operation
- 1 wash basin provided with mixer for drawing warm and cold water, for a visual check of the operation
- Manifolds for the hydraulic connections with other units
- 1 section of chimney with butterfly damper to modify its draught

Power supply: 230 Vac 50 Hz single-phase - 150 VA
(Other voltage and frequency on request)

Dimensions: 105 x 80 x 210 cm

Net weight: 100 kg



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at 1 bar min.
- LPG fuel
- Water drain
- Flue gas exhaust duct Ø 100 mm and air intake duct Ø 60 mm

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

FLUE-GAS ANALYZER MOD. FGA-1
With NOx cell



FLUE-GAS ANALYZER - BASIC VERS. MOD. FGA-E
As an alternative to mod. FGA-1

UNIT FOR STUDYING AND MEASURING HEAT LOSSES

Mod. DT/EV

INTRODUCTION

This equipment has been specifically designed for educational aims and it is used to assess the heat losses through walls, floor and windows of a construction built with components normally used in building. Moreover it enables to determine the heat transfer coefficient of the construction elements and to compare the resulting values to the maximum values allowed by the rules in force.

TRAINING PROGRAM

- Calculating the heat transfer coefficient of a simple wall and of a compound wall
- Verifying whether the building works comply with the rules on the maximum allowable heat loss
- Possibility of modifying masonry thermal resistance by adding new insulating layers (not included in the equipment) and of verifying the effects on the heat losses of the construction

TECHNICAL SPECIFICATIONS

- The equipment consists of:
 - double perforated brick wall with outer plastering
 - solid brick wall with outer plastering
 - double perforated brick wall with air space filled with insulating material and with outer plastering
 - brick and concrete load bearing floor insulated with expanded clay
 - roof of hollow clay blocks and bent tiles fixed with mortar
 - French window of insulating glass for closing the heated space
 - steel radiator controlled by thermostatic valve and provided with pipe fittings for hot water feeding
 - thermometers with probes that can be positioned at different depths into the walls to detect the temperature profile
 - thermal flow meter for assessing heat loss and deciding the necessary interventions
 - thermomagnetic - earth leakage control button

Dimensions: 130 x 130 x 180 cm

Net weight: 2300 kg



Computer and table not included



REQUIRED

- **MOD. MC/EV, or other equivalent module - NOT INCLUDED**
Module for the production of hot water

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



UNIT FOR THE STUDY OF ENERGY PERFORMANCE OF A BUILDING ENVELOPE

Mod. EPBD/EV

HS

THERMOTRONICS

www.elettronicaveneta.com

27C-E-HS-EPBD-1

INTRODUCTION

Besides promoting the improvement of the energy performance of buildings for the reduction of energy consumption, the European directive on the energy performance of buildings and its adoption by national laws state some minimum requirements of energy performance for buildings, as well as a system of energy certification of the same buildings.

This is the context including also the profession of the certifier of energy efficiency: besides being able to draw up designs, this engineer must also carry out in-situ measurements of parameters concerning the energy behaviour of building envelopes.

This equipment has been designed expressly for educational purposes and it enables to see some basic aspects of energy certifier's work first-hand. It includes a multifunction instrument for the calculation of transmittance and of conductance of a wall, and a thermal imager that converts the infrared radiation emitted by the bodies, into a spectrum of temperature, thus enabling to identify and correct any defect of insulation of the building envelope (thermal bridges, discontinuity of insulation material, etc...). Tests can be carried out not only on the small-scale station of the equipment, but also on actual components.

TRAINING PROGRAM

- Using Fourier's heat equation to describe the heat transfer through the walls of a building envelope
- Unidirectional and bidirectional heat flows, thermal bridges
- Heat conductivity of materials
- Insulating and conducting materials
- Opaque surfaces and glazed surfaces
- Experimental determination of transmittance and of conductance of a wall according to the indications of the standard on in-situ testing
- Experimental comparison of performance of different insulating materials
- Thermal emissivity of building materials
- Thermography as method for determining the continuity of thermal insulation in a building and the presence of thermal or humidity bridges that can reduce the thermal performance of the same building



TECHNICAL SPECIFICATIONS

- Wooden station with door
- Plates of insulating materials with different characteristics
- Heating element controlled by thermostat
- Portable multifunction instrument with thermal flow sensor and temperature sensors, including case and data acquisition software, for measurements of transmittance and conductance
- Thermal imager with the following characteristics:
 - sensor of 160x120 pixels
 - range of vision: 32° x 23°
 - wide display of 3.5"
 - software for analysing images and drawing up thermographic reports
 - SD card
 - Suitcase

Power supply: 230 Vac 50 Hz single-phase
(Other voltage and frequency on request)

Dimensions: 120 x 60 x 180 cm

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



TEST BENCH FOR SAFETY SYSTEMS

Mod. TCS/EV

INTRODUCTION

The test bench for safety systems has been designed to supply students with the possibility of analyzing the characteristics and quality of safety and control components that are basic part of small and large thermotechnical systems.

This bench includes:

- 1 water circuit for emphasizing the problems concerning the gas separation in heating systems
- 1 compressed air circuit with safety and control components for assessing their behaviour as pressure varies
- 1 diathermic oil heating circuit with boiler and cooling unit for checking the behaviour of control and safety components as the intervention temperature is attained.

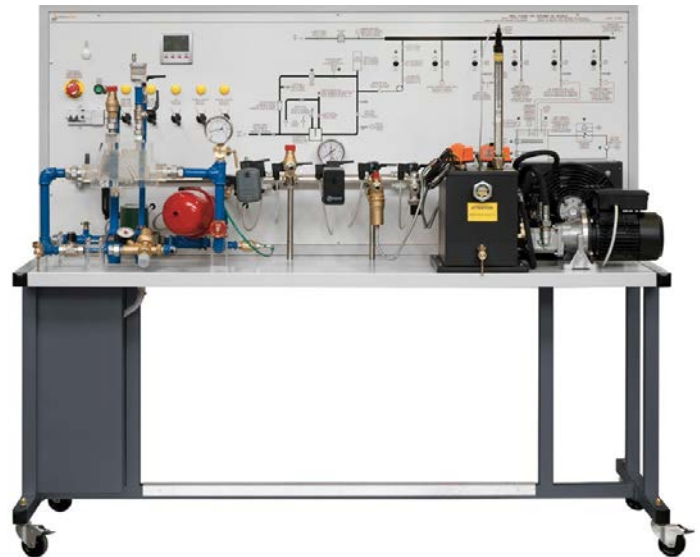
A full set of instruments enables to verify the construction and behaviour characteristics of the components under examination.

TRAINING PROGRAM

- Determining the intervention temperature and/or pressure of the various components under test
- Calculating and/or determining the valves discharge flow rate versus pressure and/or temperature
- Verifying the components reliability
- Analysis of the components operation
- Determining the pump characteristic curve
- Procedures for assembling/disassembling and connecting the components
- Components quality control

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Colour silk-screen-printed schematic diagram of system hydraulic circuit with warning LEDs
- Water circuit including pump, pressure gauge, water flow switch, air separator, automatic bleed valve, safety valve, expansion tank, automatic water feeding unit
- Air circuit including pressure gauge, 2 unidirectional throttle valves, 6 on-off valves, 6 solenoid valves
- Diathermic oil circuit including boiler with electric resistors, thermometer-thermostat, oil-hydraulic pump, forced-air refrigeration unit and respective safety devices



- Components under test: 1 automatic reset control pressure switch and 1 manual reset control pressure switch, 1 safety relief valve and 1 temperature relief valve, 1 fuel shut-off valve
- Thermomagnetic - earth leakage control button

Power supply: 230 Vac 50 Hz single-phase - 1600 VA
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 160 cm

Net weight: 170 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

Compressed air: 6 bar – 2 Nm³/h

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK





27-C

TABLETOP UNITS

**AUTOMATED CONTROL SIMULATOR OF
HEATING PLANTS**

MOD. SIM-MC/EV

HS 21

**AUTOMATED CONTROL SIMULATOR OF
HEAT ENERGY DISTRIBUTION**

MOD. SIM-RP/EV

HS 22

DOMESTIC HEATING PLANT SIMULATOR

MOD. SIM-HHR/EV

HS 23

HOT WATER PRODUCTION SIMULATOR

MOD. SIM-HH/EV

HS 24

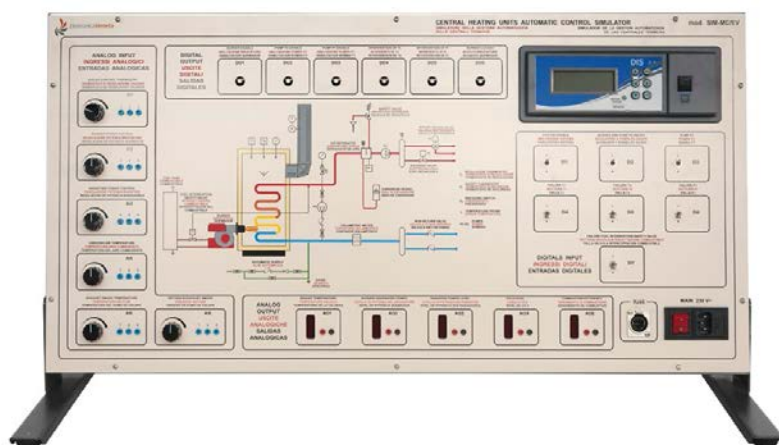
THERMAL POWER DISTRIBUTION SIMULATOR

MOD. SIM-ED/EV

HS 25

AUTOMATED CONTROL SIMULATOR OF HEATING PLANTS

Mod. SIM-MC/EV



INTRODUCTION

This educational simulator is designed for the study of the operation of the components of a heating plant for hot water production with oil fired boiler.

It enables to analyze the system response versus the thermal power required by dissipators, as well as the boiler combustion efficiency versus the set operating parameters; it includes a configurable industrial multicontroller that automatically decides the actions to be carried out according to the set parameters, thus enabling to check the system behaviour and to assess the values of the involved parameters, after the reference variables set points have been fixed.

The simulated heating plant is equipped with all the safety devices stated by the rules in force and it enables to introduce some faults onto the safety and protection systems.

When connected with a PC (supplied on demand), the simulator allows the supervision of the system by using a dynamic graphics.

TRAINING PROGRAM

Theoretical topics

- Protection devices of a heating plant
- Safety devices of a heating plant

Practical topics

- ON/OFF control: analysis of the operation of the thermostat for controlling the hot water production temperature: recirculation pump operation
- Analyzing the combustion efficiency of a boiler

TECHNICAL SPECIFICATIONS

- Painted metallic framework
- Insulating material front panel reproducing the heating plant
- Web access controller, with remote LCD display, including:
 - 10 universal inputs,
 - 8 digital inputs,
 - 4 analog outputs,
 - 4 configurable outputs,
 - 7 digital outputs
- PC connection via net cable
- Controller access via Web browser
- 6 potentiometers with 2-mm holes for simulating the analog inputs
- 5 bargraph LEDs with 2-mm holes for simulating the analog outputs
- 7 switches for simulating the digital inputs
- 6 LEDs for simulating the digital outputs

Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 80 x 40 x 12 cm

Net weight: 18 kg

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK

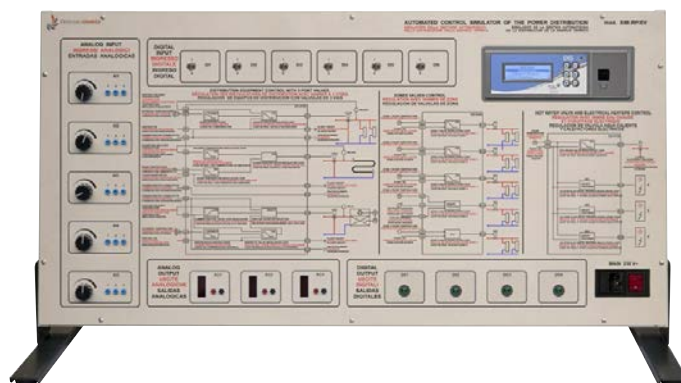


OPTIONAL

PERSONAL COMPUTER

AUTOMATED CONTROL SIMULATOR OF HEAT ENERGY DISTRIBUTION

Mod. SIM-RP/EV



INTRODUCTION

This educational simulator is designed for the training in the field of computer-aided control of industrial systems: it simulates the operation of a set of power distribution systems for heating residential buildings.

In detail it includes:

- a central heating system with radiators and water delivery temperature outdoor reset
- an underfloor heating system with proportional controller
- a fan-coil heating system with outdoor reset control
- a zone heating system with radiators for two rooms.

It also includes an industrial digital multicontroller that automatically decides the actions to be carried out according to the set parameters, thus enabling to check the system behaviour and to assess the values of the involved parameters, after the reference variables set points have been fixed.

When connected with a PC (supplied on demand), the simulator allows the supervision of the system by using a dynamic graphics.

TRAINING PROGRAM

Theoretical topics

- Studying the emission curve of a heating element, the characteristic curve of a three-way mixing valve and the emission of a heating element versus the position of the valve shutter
- Open-loop and closed-loop control
- Studying the performance of a fan coil

Practical topics

- Analyzing the operation of an outdoor reset controller
- Analyzing the operation of a controller for radiant systems with limit function
- Analyzing the operation of a controller for zone heating system with continuously controlled 2-way valve
- Analyzing the operation of a room thermostat
- Testing ON/OFF and PI control logics

TECHNICAL SPECIFICATIONS

- Painted metallic framework
- Insulating material front panel reproducing the dissipation systems
- 5 potentiometers with 2-mm holes for simulating the analog inputs
- 3 bargraph LEDs with 2-mm holes for simulating the analog outputs
- 6 switches for simulating the digital inputs
- 4 LEDs for simulating the digital outputs
- Web access controller, with remote LCD display, including:
 - 10 universal inputs,
 - 8 digital inputs,
 - 4 analog outputs,
 - 4 configurable outputs,
 - 7 digital outputs
 - PC connection via net cable
 - Controller access via Web browser

Power supply: 230 Vac 50 Hz single-phase - 220 VA
(Other voltage and frequency on request)

Dimensions: 80 x 40 x 12 cm

Net weight: 18 kg

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK

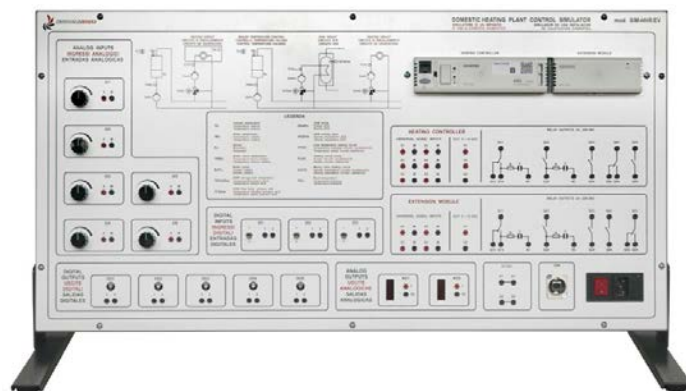


OPTIONAL

PERSONAL COMPUTER

DOMESTIC HEATING PLANT SIMULATOR

Mod. SIM-HHR/EV



INTRODUCTION

The didactic simulator mod. SIM-HHR/EV allows to study the operation of a domestic plant for space heating and domestic water heating production. As it includes an industrial regulator, it allows to analyse in detail the operation of the automatic control system of the plant as a consequence of the variation of the operational parameters. It must necessarily be connected to the PC.

TRAINING PROGRAM

- Outdoor reset control: variation of the hot water temperature as a function of the outdoor air temperature
- Room authority
- Proportional and ON/OFF regulation
- Alarms management
- Electric wiring
- Regulator configuration
- Technical plants supervision

TECHNICAL SPECIFICATIONS

- Panel with different plant schemes
- Configurable heating regulator with the following characteristics:
 - n. 6 universal inputs
 - n. 2 analog outputs
 - n. 5 digital outputs

- Extension module with the following characteristics:

- n. 4 universal inputs
- n. 1 analog output
- n. 5 digital outputs

- PC - regulator interface module
- Potentiometers to simulate the analog inputs
- Bar led to simulate the analog outputs
- Switches to simulate the digital inputs
- Led to simulate the digital outputs
- System supervision software
- Holes and cables for the electric wiring among inputs, outputs and regulator

Power supply: 230 Vac 50 Hz single-phase - 220 VA
(Other voltage and frequency on request)

Dimensions: 80 x 40 x 12 cm

Net weight: 18 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



HOT WATER PRODUCTION SIMULATOR

Mod. SIM-HH/EV

INTRODUCTION

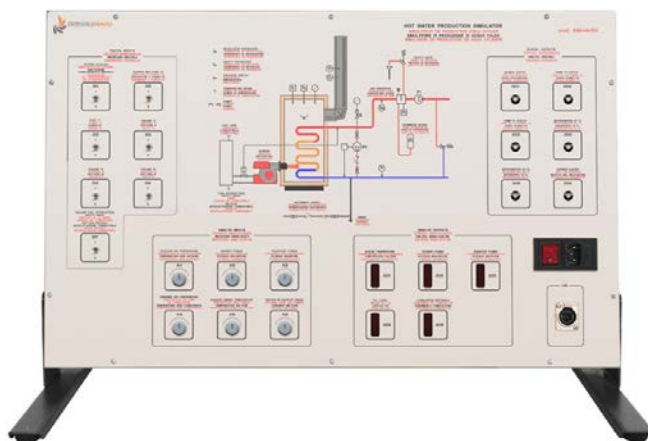
Educational simulator mod. SIM-HH/EV is designed for the study of the operation of the components of a heating plant for hot water production with oil fired boiler. This heating plant is equipped with all the safety devices stated by the rules in force and it enables to introduce some faults onto the safety and protection systems. The simulator enables to analyze the system response versus the thermal power required by dissipators, as well as the boiler combustion efficiency versus the set operating parameters. This simulator must necessarily be connected with a PC (supplied on demand).

TRAINING PROGRAM

- Protection devices of a heating plant
- Safety devices of a heating plant
- ON/OFF control: analysis of the operation of the thermostat for controlling the hot water production temperature: recirculation pump operation
- Outdoor reset control: variation of hot water production temperature versus outdoor air temperature
- Analyzing the combustion efficiency of a boiler

TECHNICAL SPECIFICATIONS

- Colour panel reproducing the heating plant
- Board for data acquisition and control of output signals from actuators
- Connection with PC via USB cable
- 6 potentiometers for simulating the following analog inputs:
 - outdoor air temperature (that determines the hot water production temperature)
 - flow rate of oil feeding the burner
 - level of thermal power dissipated by radiator
 - combustion air temperature
 - combustion products temperature
 - oxygen percentage in the combustion products
- 5 bargraph LEDs for simulating the following analog outputs:
 - boiler water temperature
 - level of thermal power supplied to the boiler
 - level of thermal power supplied to radiators
 - level of CO₂ in the combustion products
 - boiler combustion efficiency
- 7 switches for simulating the following digital inputs:
 - system operation enabling
 - burner starting
 - pump for feeding radiators starting
 - control thermostat break
 - safety thermostat break
 - safety pressure switch break
 - fuel shut-off valve break
- 6 LEDs for simulating the following digital outputs:
 - burner starting
 - radiators pump state
 - recirculation pump state
 - safety thermostat intervention
 - safety pressure switch intervention
 - burner lockout



- Program for simulating the operation of the hot water production unit control system
- Creation software that can be used to modify the application programs according to one's own needs

Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 65 x 40 x 12 cm

Net weight: 5 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



THERMAL POWER DISTRIBUTION SIMULATOR

Mod. SIM-ED/EV

INTRODUCTION

Simulator mod. SIM-ED/EV has been specifically designed for educational aims: it simulates the operation of a set of power distribution systems for residential buildings heating or cooling. In detail it includes:

- a central heating system with radiators and water delivery temperature outdoor reset control
- an underfloor heating system with proportional controller
- a fan-coil heating/cooling system with outdoor reset control
- a zone heating system with radiators for two rooms.

The simulator enables to check the system behaviour and to assess the values of the involved parameters, after the reference variables set points have been fixed.

It must necessarily be connected with a PC (supplied on demand).

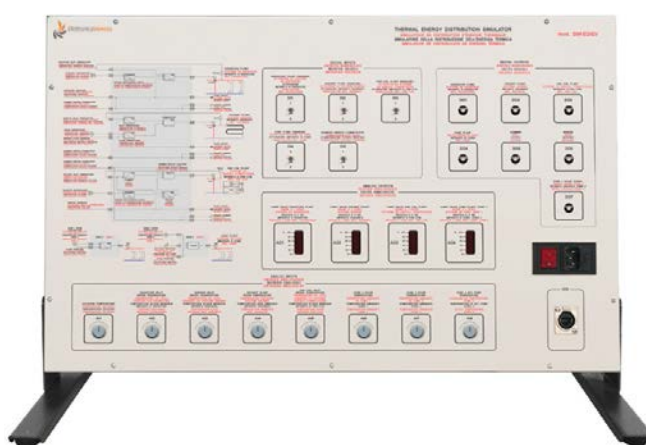
HS

TRAINING PROGRAM

- Analyzing the operation of an outdoor reset controller
- Studying the emission curve of a heating element, the characteristic curve of a three-way mixing valve and the emission of a heating element versus the position of the valve shutter
- Open-loop and closed-loop control
- Analyzing the operation of a controller for radiant systems with limit function
- Correlation between room parameters and water delivery temperature for cooling systems with radiant panels
- Studying the performance of a fan coil
- Proportional and ON/OFF control
- Analyzing the operation of a controller for zone distribution system with continuously controlled 2-way valve
- Analyzing the operation of a room thermostat

TECHNICAL SPECIFICATIONS

- Colour panel reproducing the available circuits
- Board for data acquisition and control of output signals from actuators
- Connection with PC via USB cable
- 8 potentiometers for simulating the following analog inputs:
 - outdoor air temperature
 - radiator plant water delivery temperature
 - radiant plant water delivery temperature
 - radiant plant room air temperature
 - fan-coil plant water delivery temperature
 - zone plant room air temperature – zone 1
 - zone plant room air temperature – zone 2
 - zone 2 room air temperature set-point
- 4 bargraph LEDs for simulating the following analog outputs:
 - control signal for the motor of the radiator plant 3-way valve
 - control signal for the motor of the radiant plant 3-way valve
 - control signal for the motor of the fan-coil plant 3-way valve
 - control signal for the motor of the zone plant 2-way valve – zone 1
- 5 switches for simulating the following digital inputs:
 - radiator plant enabling
 - radiant plant enabling
 - fan-coil plant enabling
 - zone plant enabling
 - seasonal summer/winter switching
- 7 LEDs for simulating the following digital outputs:
 - radiator plant state



- radiant plant state
- fan-coil plant state
- zone plant state
- summer
- winter
- zone 2 solenoid valve control signal
- Application program developed in NI LabVIEW™

Power supply: 230 Vac 50 Hz single-phase - 200 VA
(Other voltage and frequency on request)

Dimensions: 65 x 40 x 12 cm

Net weight: 5 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK





WORKSHOP EQUIPMENT

BASE UNIT FOR HOT WATER PRODUCTION	MOD. A/EV	HS 27
BASE UNIT FOR HEAT DISTRIBUTION	MOD. B/EV	HS 28
BASE UNIT FOR HEATING ELEMENTS	MOD. C/EV	HS 29
EDUCATIONAL SYSTEM FOR THE STUDY OF HEATING SYSTEMS	MOD. CTR/EV	HS 30
ASSEMBLY KIT OF HOT WATER PRODUCTION	MOD. HW/EV	HS 31
ASSEMBLY KIT OF ENERGY CONTROL AND DISTRIBUTION	MOD. DW/EV	HS 32
ASSEMBLY KIT OF HYDRO-SANITARY SYSTEMS	MOD. PL/EV	HS 33
WATER SOFTENING UNIT	MOD. AD-E/EV	HS 34
ASSEMBLY KIT OF WATER SOFTENING	MOD. AD/EV	HS 35

BASE UNIT FOR HOT WATER PRODUCTION

Mod. A/EV

INTRODUCTION

This training unit is designed for the study of the coupling between boiler and burner, of the behaviour of the burner versus the nozzle potentiality and of the ratio between fuel and combustive agent.

It includes a water boiler, an oil burner, the relevant safety devices and utilities, as well as a set of pipes for distributing the water to the users.

TRAINING PROGRAM

- Procedures for:
 - water filling and air bleeding from the system
 - draining and checking system tightness
 - starting the plant and checking the operation of control, protection and safety devices
 - replacing the nozzle and checking burner-boiler coupling
- With optional item flue-gas analyzer:
 - evaluation of boiler combustion efficiency
 - determination of the optimum boiler operating conditions

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Floor-installed boiler: working pressure of 3 bar, 15 kW oil burner, control, protection and safety systems, inspection window for checking flame shape and colour
- Fuel tank with level
- Heating circuit with air separator, expansion vessel, circulation pump, distribution manifolds with on-off valves and quick connections
- Test points for measuring water temperature
- Digital thermometer
- Volumetric counter
- Recirculation pump controlled by minimum temperature thermostat
- Automatic feeding unit with pressure gauge
- 2-m long stainless steel insulated chimney, provided with opening for the flue gas analysis and drain for condensate
- Power switchboard and switchboard for connection with the external units

Power supply: 230 Vac 50 Hz single-phase - 315 VA
(Other voltage and frequency on request)

Dimensions: 180 x 73 x 199 cm

Net weight: 270 kg



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at 1 bar min.
- Chimney for flue gas exhaust – Ø = 145 mm
- Water drain

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

FLUE-GAS ANALYZER MOD. FGA-1



FLUE-GAS ANALYZER - BASIC VERS. MOD. FGA-E

As an alternative to mod. FGA-1

GAS BURNER - MOD. BGRG As an alternative to light oil burner



BASE UNIT FOR HEAT DISTRIBUTION

Mod. B/EV

INTRODUCTION

This training unit includes two separate heat distribution sets having the following characteristics: distributed temperature control with thermostatic valves on each radiator and zone control with solenoid valves controlled by room thermostats.

TRAINING PROGRAM

- Procedures for water filling and air bleeding from the circuits
- Studying the operation of zone valves
- Studying the operation of a thermostatic valve
- With optional items portable thermometer and electronic flowmeter evaluation of:
 - the radiators thermal power output
 - the speed of water crossing the pipes
 - the radiator heat emission curve
 - the interaction between heat distribution system and temperature control system

TECHNICAL SPECIFICATIONS

- Very high resistance steel vertical structure mounted on wheels
- Pierced steel fore panel
- Heating system with distributed control consisting of 2 steel radiators provided with thermostatic valves and lockshield valves
- Zone heating system including 4 steel radiators, 2 room thermostats, 2 zone solenoid valves, manual valves, lockshield valves
- Venturi type flow rate metering device provided with needle connections to be coupled to the measuring instrument
- Test points to measure the temperature at the circuits inlet and outlet
- Quick-connection flexible pipes for the connection with the heat source
- On-off valves
- Power switchboard and switchboard for connection with the other units of this group

Dimensions: 180 x 73 x 195 cm

Net weight: 200 kg



REQUIRED

- **MOD. A/EV - NOT INCLUDED**
Base unit for hot water production
- **OR (PROVIDED BY THE CUSTOMER)**
 - Hot water
 - Power supply: 230 Vac 50 Hz single-phase - 48 VA
(Other voltage and frequency on request)

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

**PORTABLE THERMOMETER
WITH IMMERSION PROBE
MOD. THRN**



**ELECTRONIC FLOWMETER
MOD. FLOW-1**

BASE UNIT FOR HEATING ELEMENTS

Mod. C/EV

INTRODUCTION

This training unit is designed for the study of heating elements identified by shape, size, material, heat emission mode versus water and room temperature.

TRAINING PROGRAM

- Procedures for filling circuits and bleeding the air from the system
- Studying heat emission modes of heating elements
- With optional items portable thermometer and electronic flowmeter determination of:
 - the radiators thermal power output
 - the trend of the heating elements emission curves
 - the fan coil heat balance

TECHNICAL SPECIFICATIONS

- Very high resistance steel vertical structure mounted on wheels
- Pierced steel fore panel
- Venturi type flow rate metering device provided with needle connections to be coupled to the measuring instrument
- Steel radiator
- Cast iron radiator
- Aluminium radiator
- Radiant plate
- Fan coil controlled by room thermostat
- Quick-connection flexible pipes for the connection with the heat source
- On-off valves
- Test points to measure the temperature at the inlet and outlet of each heating element
- Switchboard for connection with the other units of this group

Dimensions: 180 x 73 x 195 cm
Net weight: 190 kg



REQUIRED

- **MOD. A/EV - NOT INCLUDED**
Base unit for hot water production

OR (PROVIDED BY THE CUSTOMER)

- Hot water
- Power supply: 230 Vac 50 Hz single-phase - 48 VA
(Other voltage and frequency on request)

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

PORTABLE THERMOMETER WITH IMMERSION PROBE MOD. THRN



ELECTRONIC FLOWMETER MOD. FLOW-1

EDUCATIONAL SYSTEM FOR THE STUDY OF HEATING SYSTEMS

Mod. CTR/EV

INTRODUCTION

This educational system can be used for technical and professional exercises on plants descriptions, operation and control. The equipment represents a heating system for civil applications including an oil burner powered boiler and radiators of different shape and material. Boiler, radiators, pipes, checking, control and measuring devices are mounted on a vertical panel that clearly shows position, connections and assembly of all the apparatuses. This system is equipped with castors and is prearranged for the connection with possible external users.

TRAINING PROGRAM

- Procedures for:
 - water filling and air bleeding from the system
 - draining and checking system tightness
 - starting the plant and checking the tripping of boiler safety and protection devices
- Protection and safety devices of a heating plant
- ON/OFF control: boiler thermostat, room thermostat, recirculation pump thermostat
- Modalities for counting and calculating the used thermal energy
- With optional item flue-gas analyzer:
 - evaluation of boiler combustion efficiency
 - variation of air and fuel flow rate to the burner and verification of the effects on the combustion efficiency
 - assessment of the quality of the coupling between burner and boiler

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Cast iron floor-installed boiler with forced draught oil burner:
 - completely automatic operation
 - equipped with safety and operation thermostats
 - flue-gas collection and exhaust system including thermometer
 - thermal power: 20 kW
 - provided with switchboard, pushbuttons and warning lights
- Metallic fuel tank
- Automatic water filling device
- Air separator, expansion vessel, automatic bleed valves, pressure gauge
- Anti-condensation by-pass circuit including recirculation pump, check valve, on-off valves, control thermostat
- Fuel shut off valve, safety pressure switch, safety valve
- Delivery and return manifolds
- Water circulation pump with insulation valves
- Four radiators of proper power: one of aluminium, one of cast iron and two of steel, provided with valves, lockshield valves, bleed valves; all these radiators are connected, operating and fixed onto the main panel; the accessories installed on each radiator enable the complete system control and balancing
- Flowmeters
- Room thermostat
- Switchboard with thermomagnetic - earth leakage control button



Power supply: 230 Vac 50 Hz single-phase - 300 VA
(Other voltage and frequency on request)

Dimensions: 180 x 73 x 195 cm

Net weight: 245 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at 1 bar min.
- Chimney for flue gas exhaust ($\varnothing = 145$ mm)
- Water drain

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

FLUE-GAS ANALYZER MOD. FGA-1



**FLUE-GAS ANALYZER - BASIC VERS.
MOD. FGA-E**
As an alternative to mod. FGA-1

ASSEMBLY KIT OF HOT WATER PRODUCTION

Mod. HW/EV

TRAINING PROGRAM

Refer to the available diagrams in order to carry out the following operations:

- assembly of floor-installed boiler, chimney, fuel circuit, hot water and cold water circuits, protection and safety devices, so to build a central heating plant
- assembly of wall-mounted boiler, of the delivery and return water circuit, of gas feeding circuit, of sanitary circuit
- assembly of electric system
- filling the circuit with water and bleeding the air from the system
- starting the plant and checking the tripping of safety and protection devices

With optional item flue-gas analyzer:

- combustion control and check with flue-gas analysis
- combustion efficiency determination

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Central heating system including:
 - Cast iron floor-installed boiler with thermometer, control thermostat and safety thermostat
 - 17 kW oil burner
 - Fuel tank with level indication
 - Flue-gas collection and exhaust system with thermometer
 - Air separator, expansion vessel, bleed valves
 - Fuel shut off valve, safety pressure switch, safety valve
 - Delivery and return manifolds, on-off valves, pressure gauge
 - 2 auxiliary pumps
- Independent heating system including:
 - wall-mounted gas fired boiler
 - gas feeding line with pressure gauge and volumetric counter
 - zone valves
- Automatic water filling device including:
 - pressure reducer
 - check valve
 - stop valve
 - filter
 - pressure gauge for reading system pressure
- Pipes painted with different colours
- Switchboard
- Emergency button
- Quick connections for connection with dissipators

Power supply: 230 Vac 50 Hz single-phase - 500 VA
(Other voltage and frequency on request)

Dimensions: 200 x 70 x 210 cm

Net weight: 216 kg

INTRODUCTION

This kit has been specifically designed for educational aims and it consists of a framework where two different hot water boilers can be installed: the first device is a wall-mounted gas fired boiler with atmospheric burner, being suitable for systems of small potentiality and used for independent heating systems; the second boiler is installed on the floor and includes an oil burner: it is used in heating plants with central heat distribution.



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at 1 bar min.
- Fuel for wall-mounted boiler: natural gas or LPG (specify before ordering)
- Water drain
- Chimney $\varnothing = 145$ mm (for oil boiler)
- Flue-gas exhaust duct $\varnothing = 100$ mm (for wall-mounted boiler)
- Air intake duct $\varnothing = 145$ mm (for wall-mounted boiler)

SUPPLIED WITH

EXPERIMENTAL HANDBOOK



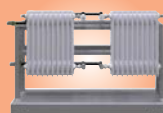
OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

FLUE-GAS ANALYZER MOD. FGA-1



FLUE-GAS ANALYZER - BASIC VERS. MOD. FGA-E As an alternative to mod. FGA-1

POWER DISSIPATION KIT MOD. DW-E/EV



POWER DISSIPATION KIT WITH RADIATORS MOD. DW-R/EV

ASSEMBLY KIT OF ENERGY CONTROL AND DISTRIBUTION

Mod. DW/EV

HS

THERMOTRONICS

www.elettronicaveneta.com

27C-E-HS-DW-2

INTRODUCTION

This kit has been specifically designed for educational aims so that students can deal with the issues concerning the correct installation and laying of heating elements, of their accessories and of the pipes for the connection with hot water production source. This kit consists of two separate heating systems: a radiant system controlled by a proportional control thermostatic mixer and a coplanar manifolds heating system with 5 different lines: 3 lines feed 3 radiators provided with thermostatic valves, a line feeds the fourth radiator via a 4-way thermostatic valve for single-pipe systems, and a line feeds the fan coil.

The operation of thermostatic valve depends on room temperature.

TRAINING PROGRAM

Refer to the available diagrams in order to carry out the following operations:

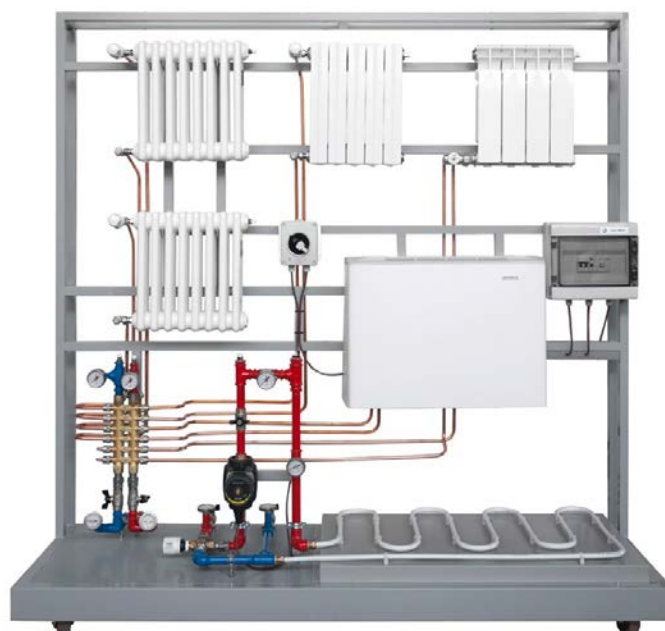
- assembly of the coplanar manifolds heating system
- assembly of the radiant heating system
- check of the heating elements correct installation
- filling the circuit with water and bleeding the air from the system

Analysis of the operation of:

- coplanar manifold
- proportional control: thermostatic mixer, thermostatic valve
- 4-way valve for single-pipe systems

TECHNICAL SPECIFICATIONS

- Steel structure mounted on wheels, painted and treated in the oven
- Heating system with manifolds including:
 - 6+6 coplanar manifolds
 - On-off valves, thermometers, pressure gauges, manual bleed valves
 - Steel (2) and of cast iron (1) radiators: each radiator is equipped with thermostatic valve, lockshield valve, manual bleed valve
 - Aluminium radiator with 4-way thermostatic valve for single-pipe systems
 - Fan coil
 - Connection pipes of copper



- Radiant heating system including:
 - Radiant panel
 - Three-speed circulation pump
 - Thermostatic mixer
 - On-off valves, manual bleed valve
 - Thermometers, pressure gauge
- Switchboard
- Emergency button
- Quick connections for connecting with the module of hot water production

Dimensions: 200 x 70 x 195 cm

Net weight: 180 kg

REQUIRED

- **MOD. HW/EV - NOT INCLUDED**
Assembly kit of hot water production
- OR (PROVIDED BY THE CUSTOMER)**
 - Hot water
 - Power supply: 230 Vac 50 Hz single-phase - 100 VA
(Other voltage and frequency on request)

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



ASSEMBLY KIT OF HYDRO-SANITARY SYSTEMS

Mod. PL/EV

INTRODUCTION

This kit enables students to acquire some experience in sanitary systems, fittings, valves, traps, ventilation network, geometric layout of drains, overall dimensions and standards regulating the inside arrangement of bathroom fittings. Analogous importance is reserved to the preparation of the connections of cold and hot feeding water that must be set at certain heights and at certain distances so that installation becomes fast and correct besides complying with the mutual distances between the various fittings.



HS

THERMOTRONICS

www.elettronicaveneta.com

27C-E-HS-PL-0

TRAINING PROGRAM

- Connection of the various fittings with the hot water and cold water source
- Studying the operation of pressurization system
- Filling the system and checking its correct operation
- Studying the main elements of a ventilation and draining network: draining pipe, horizontal manifold, branch, main fume pipe, ventilation pipe, branch of secondary ventilation
- Verifying the minimum hot and cold water flow rates for each apparatus
- Assessing the pump flow rate according to the contemporary index

TECHNICAL SPECIFICATIONS

- Steel framework suitable to bear various types of cocks, bathroom fittings, wash basin, bidet, toilet bowl, shower
- Hot and cold water distribution network
- Water pressurization system
- Draining network ventilation system
- Bathroom fittings, cocks and accessories, traps, unions
- Measuring instruments, thermostatic mixers, etc...

Power supply: 230 Vac 50 Hz single-phase - 1600 VA
(Other voltage and frequency on request)

Dimensions: 250 x 100 x 200 cm

Net weight: 400 kg

REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at 1 bar min.

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



WATER SOFTENING UNIT

Mod. AD-E/EV

INTRODUCTION

Training unit featuring all the necessary elements for water treatment. This unit enables students to learn about:

- How water softeners work
- Water softener settings (regeneration cycle, water hardness...)
- Aim of each component
- Various methods of analysis of water (test strips and colorimetric analysis)

TRAINING PROGRAM

- Study of a water softening unit
- Assembling and disassembling the kit and connection with water network
- Checking the system correct operation
- Aim of each component
- Verifying the minimum water flow rates for each apparatus according to the desired level of water hardness
- Practical exercises for managing the softener, pouring water on ion exchange resins, resin regeneration; sending the water to salt tank
- Adjusting the control device of regeneration cycles
- Servicing the softener
- Checking the efficiency of water filters
- Water softener settings (regeneration cycle, water hardness...)
- Various methods of analysis of water (case analysis)
- Flow measurement of various circuits
- Computation of volumes to be treated

TECHNICAL SPECIFICATIONS

- Inlet multi-turn control valve with float flow meter
- Pressure reducer with inlet and outlet pressure gauges
- General water volumetric counter
- Cartridge filter
- Volumetric water softener with programmable electronic control system:
 - Max. flow rate: 1,8 m³/h
 - Resin volume: 15 l
 - Max. pressure: 8,6 bar
 - Min. pressure: 1,5 bar
 - Standard exchange capacity: 65 ÷ 105 degrees/m³
- Bypass branch with multi-turn control valve with float flow meter (for residual water hardness control)
- Salt tank for resin regeneration
- Softened water volumetric counter
- Pressure gauge at softener outlet
- Sampling valves at unit key points

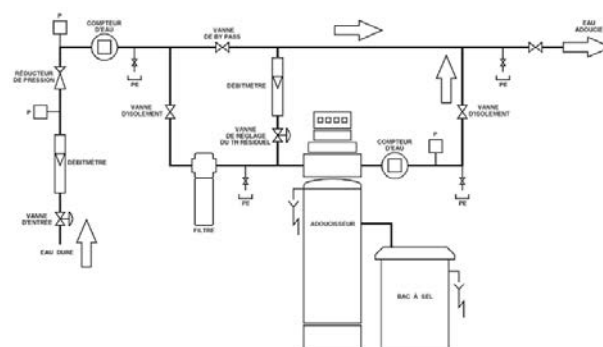


Power supply: 230 Vac 50 Hz single-phase
(Other voltage and frequency on request)

Dimensions: 180 x 80 x 170 cm

Net weight: 149 kg

Operation diagram



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



ASSEMBLY KIT OF WATER SOFTENING

Mod. AD/EV

INTRODUCTION

This kit enables students to learn how to install the equipment enabling water treatments in heating systems for civil and industrial applications. The aim consists in preserving the systems, minimizing energy consumptions, improving the operation of auxiliary devices (valves, thermostats, pressure switches, etc...). These treatments especially concern heating systems using hot water or superheated water, heating systems with low-pressure steam and sanitary hot water production systems. Students can carry out exercises on assembly, starting and testing of the system proposed.

TRAINING PROGRAM

- Assembling and disassembling the kit and connection with water network
- Checking the system correct operation
- Verifying the minimum water flow rates for each apparatus according to the desired level of water hardness
- Practical exercises for managing the softener, pouring water on ion exchange resins, resin regeneration; sending the water to salt stock
- Adjusting the control device of regeneration cycles
- Servicing the softener
- Checking the efficiency of water filters

TECHNICAL SPECIFICATIONS

Steel framework suitable to bear:

- Water softener and various types of filter
- Water distribution network
- Components for connection with the water under pressure
- Components for connection with the users
- Pressure gauge

Power supply: 230 Vac 50 Hz single-phase - 50 VA
(Other voltage and frequency on request)

Dimensions: 90 x 70 x 130 cm

Net weight: 130 kg



REQUIRED

UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water at 1 bar min.

SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



HS

27-C

THERMOTRONICS

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27 C-E-HS





ACCESSORIES

OPTIONAL ACCESSORIES

PORTABLE VACUUM AND CHARGING STATION	MOD. VACU-2	AI3
RECOVERY-RECYCLING UNIT	MOD. RERE	AI3
ELECTRONIC BALANCE	MOD. RECH	AI3
MANIFOLD	MOD. MFLD	AI3
GAS BURNER	MOD. BGRG	AI4
INDOOR LIGHTING DEVICE	MOD. SS-1/EV	AI4
POWER DISSIPATION KIT	MOD. DW-E/EV	AI4
POWER DISSIPATION KIT WITH RADIATORS	MOD. DW-R/EV	AI4

OTHER ACCESSORIES

RECOVERY UNIT	MOD. RECO	AI5
VACUUM PUMP	MOD. VACUP	AI5
FLEXIBLE PIPES	MOD. FLEXP	AI5
WELDING CART	MOD. TW	AI5
CHARGING CYLINDER (W/O REFRIGERANT)	MOD. CYL	AI5

OPTIONAL ACCESSORIES



PORTABLE VACUUM AND CHARGING STATION Mod. VACU-2

Description:

Portable vacuum and charging station for refrigerants R22, R134a, R404A, R407C, R410A, R32, including:

- 2-stage vacuum pump
- 2 4-way manometric groups
- Flexible pipes
- Electronic balance, 100 kg



ELECTRONIC BALANCE Mod. RECH

Description:

Programmable Electronic balance for loading operations up to 100 kg.

- Indication on display
- High accuracy filling operations programmable via microprocessor
- Set data storage in case of stop



RECOVERY-RECYCLING UNIT Mod. RERE

Description:

- Suitable for CFC, HCFC, HFC and HFO (included R32 and R1234ze)
- Distillation device with liquid refrigerant flow check
- Self evacuation system (PURGE)
- Unit automatic stop when no refrigerant is available in the system
- Safety device for max pressure
- Two cut-off valves to prevent refrigerant discharge
- Pulse free gauges with regulation screw



MANIFOLD Mod. MFLD

Description:

Manometric group for refrigerants R22, R134a, R404A, R407C with flexible pipes for measuring the gas pressure in Refrigeration / Air Conditioning units.

For refrigerant R410A, R32 - Mod. MFLD-A



GAS BURNER **Mod. BGRG**

Description:

Single-stage gas burner with low polluting emissions below the limits stated by European standards (Nox < 80 mg/kWh, and CO < 60 mg/kWh).

- Aluminium body and soundproof hood
- Air adjustment by external mechanical transmission without hood removal
- The digital control unit detects the faults during the ignition as well as malfunction reasons
- Easy electric connections
- It also includes the feeding ramp



POWER DISSIPATION KIT **Mod. DW-E/EV**

Description:

Kit mod. DW-E/EV consists of a wheeled supporting framework including a fan coil that can be easily connected with the Assembly kit of Hot Water Production mod. HW/EV via quick-connection flexible pipes (included in the equipment). It can dissipate into the air part of the thermal power output of a boiler.



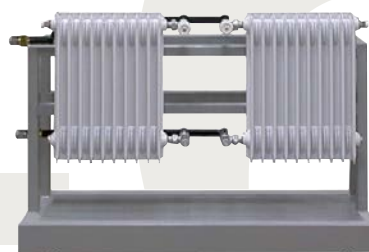
INDOOR LIGHTING **DEVICE**

Mod. SS-1/EV

Description:

Device for the indoor operation of solar thermal and/or photovoltaic equipment.

- Light source: six 1.000 W spotlights.
- Stainless steel wheeled structure with telescopic fixing to ensure the maximum stability of the system.
- Straight and inclined support rods, adjustable in height.



POWER DISSIPATION KIT **WITH RADIATORS** **Mod. DW-R/EV**

Description:

Kit mod. DW-R/EV consists of a wheeled supporting framework including two radiators that can easily be connected with the Assembly kit of Hot Water Production mod. HW/EV via quick-connection flexible pipes (included in the equipment). It can dissipate into the air part of the thermal power output.

OTHER ACCESSORIES



RECOVERY UNIT Mod. RECO

Description:

- Suitable for CFC, HCFC, HFC and HFO (included R32 and R1234ze)
- Self evacuation system (PURGE)
- Unit automatic stop when no refrigerant is available in the system
- Safety device for max pressure
- Two cut-off valves to prevent refrigerant discharge
- Pulse free gauges with regulation screw



VACUUM PUMP Mod. VACUP

Description:

46 l/min 2-stage high vacuum pump with electromagnetic valve and vacuum gauge.



FLEXIBLE PIPES Mod. FLEXP

Description:

Set of 3 flexible pipes with intermediate valve

- Length 1500 mm
- Straight coupling x 45° 1/4" SAE



WELDING CART Mod. TW

Description:

This cart is equipped with the following accessories:

- 1 14-l acetylene cylinder (empty)
- 1 14-l oxygen cylinder (empty)
- 1 pressure reducer with pressure gauges and safety valve for acetylene
- 1 pressure reducer with pressure gauges and safety valve for oxygen
- 1 handgrip provided with welding torch
- 1 40 l/h welding tip
- 2 3m-long rubber pipes
- lighter
- glasses



CHARGING CYLINDER (W/O REFRIGERANT) Mod. CYL

Description:

Rechargeable cylinder (w/o refrigerant), with two cocks (liquid and vapour)

- Capacity: 12 liters
- Couplings: 1/4" SAE



INSTRUMENTS

OPTIONAL INSTRUMENTS

ELECTRONIC REFRIGERATION ANALYZER	MOD. REFA-1	AI7
ELECTRONIC LEAK DETECTOR	MOD. AHLD-1	AI7
PORTABLE VANE ANEMOMETER	MOD. THAN	AI7
PORTABLE THERMOHYGROMETER WITH REMOVABLE PROBE	MOD. THHY	AI7
PORTABLE THERMOMETER WITH IMMERSION PROBE	MOD. THRN	AI7
PORTABLE THERMOMETER WITH PROBE FOR SURFACES	MOD. THRM	AI8
FLUE-GAS ANALYZER	MOD. FGA-1	AI8
FLUE-GAS ANALYZER - BASIC VERSION	MOD. FGA-E	AI8
SOLAR IRRADIANCE METER	MOD. SORM	AI8
ELECTRONIC FLOWMETER	MOD. FLOW-1	AI8
PORTABLE DIFFERENTIAL PRESSURE GAUGE	MOD. MAND	AI8

OTHER ACCESSORIES

PORTABLE ANEMOMETER	MOD. THAM	AI9
PORTABLE THERMOHYGROMETER WITH FIXED PROBE	MOD. THEH	AI9
PEN-TYPE THERMOHYGROMETER	MOD. THYP	AI9
INFRARED THERMOMETER	MOD. THIR	AI9
THERMAL IMAGER	MOD. THCM	AI9
HEAT FLOW METER	MOD. THFL	AI9

OPTIONAL INSTRUMENTS



ELECTRONIC REFRIGERATION ANALYZER Mod. REFA-1

Description:

Instrument for measuring the parameters of the refrigeration cycle: it is useful in servicing operations of refrigeration and heat pump systems. The pressure measured by two pressure sensors is immediately converted into temperature values, according to the selected refrigerant, and then it can be read on the display.

- Calculation of superheat and undercooling in real time
- 2-way valves block with 3 couplings
- Couplings: 3 x 1/4" SAE
- 3 inputs for pipes and sight glass.
- 2 crocodile temperature probes
- 60 memorized refrigerants
- Wide backlit display
- Carrying case



PORTABLE VANE ANEMOMETER Mod. THAN

Description:

Compact anemometer for measuring air speed, flow rate and temperature, provided with fixed vane probe (ø 100 mm).

- Flow rate can directly be read on the display
- Accurate calculation of flow rate by a simple insertion of duct area
- Calculating the average in time and by points will supply information on the average value of air flow rate, speed and temperature
- Min./max. values can be read on the display
- Hold function will freeze the measure under examination on the display



ELECTRONIC LEAK DETECTOR Mod. AHLD-1

Description:

Electronic leakage detector with the following characteristics:

- Sensitivity: < 3 g/yr
- Visual and acoustic leakage signal
- 2 Sensitivity levels
- Carrying case



PORTABLE THERMOHYGROMETER WITH REMOVABLE PROBE Mod. THHY

Description:

Air humidity / temperature compact measuring instrument, with plug-in humidity probe head. When measuring at hard-to-access points, the humidity probe can be easily removed and attached to the handle via the probe cable.

- Displaying temperature and relative humidity / wet-bulb temperature / dew point
- Min./max. values
- Hold button to freeze readings
- Backlit display
- Automatic switching off



PORTABLE THERMOMETER WITH IMMERSION PROBE Mod. THRN

Description:

Instrument for measuring temperature: it can be connected with thermocouple probes.

- Continuous display of max/min. values
- Hold button for freezing the instantaneous measure on the display
- Backlit display
- Immersion / penetration probe



PORTABLE THERMOMETER WITH PROBE FOR SURFACES Mod. THRM

Description:

Temperature measuring instrument connectable with thermocouple probes.

- Continuous display of min./max. values
- Hold button to freeze the instantaneous measure on the display
- Backlit display
- Fast-action probe for plane and uneven surfaces



ELECTRONIC FLOWMETER Mod. FLOW-1

Description:

This electronic flowmeter, provided with quick-connection unions, enables to measure the pressure drop in a device mounted in the hydraulic circuit, and to transform it into a flow rate measure. Parameters graphic display.



FLUE-GAS ANALYZER Mod. FGA-1

Description:

Flue-gas analyzer for measurements on heating systems. The rechargeable battery life lasts up to 10 hours. The test reports are thorough and easy to understand, and can be printed via bluetooth. It includes:

- Compact flue gas probe (160 mm, Ø 6 mm)
- 10 spare filters
- Bluetooth printer, including spare paper
- Software
- Power supply
- Instrument case

Available on demand version with NOx cell.



FLUE-GAS ANALYZER - BASIC VERSION Mod. FGA-E

Description:

Flue-gas analyzer for measurements on heating systems. The rechargeable battery life lasts up to 10 hours. The test reports are thorough and easy to understand, and can be printed with the supplied IR printer. It includes:

- Flue-gas analyzer (O₂ and CO) with 180 mm probe
- Cone for fixing
- IR printer, including spare paper
- USB power supply with cable
- Replacement filters, pressure measurement tube, instrument and accessory case, calibration certificate



SOLAR IRRADIANCE METER Mod. SORM

Description:

This solar irradiance meter is the ideal instrument for professional uses in the field of installation of photovoltaic and solar heating systems. The measure that can be read on this instrument is expressed in W/m² or in Btu/(ft² h).

Typical applications:

- Detection of the best incidence angle during the installation of solar collectors
- Measurement of filtering power of glasses or of solar shields
- Measurement of solar radiation
- Measurement of solar transmission through transparent films and glasses



PORTABLE DIFFERENTIAL PRESSURE GAUGE Mod. MAND

Description:

Portable compact pressure gauge provided with pressure sensors that ensure a very accurate detection of pressure and of differential pressure.

- Liquid-Crystal Display (LCD)
- Selectable measuring unit
- Automatic switching off
- Storage of maximum/minimum value

OTHER ACCESSORIES



**PORTABLE
ANEMOMETER**
Mod. THAM

Description:

Compact anemometer for measuring air speed, flow rate and temperature, provided with telescopic handgrip.

- Flow rate can directly be read on the display
- Accurate calculation of flow rate by a simple insertion of duct area
- Calculating the average in time and by points will supply information on the average value of air flow rate, speed and temperature
- Min./max. values can be read on the display
- Hold function will freeze the measure under examination on the display



**PORTABLE
THERMOHYGROMETER
WITH FIXED PROBE**
Mod. THEH

Description:

Air humidity / temperature compact measuring instrument, with plug-in humidity probe head.

- Displaying temperature and relative humidity / wet-bulb temperature / dew point
- Min./max. values
- Hold button to freeze readings
- Backlit display
- Automatic switching off



PEN-TYPE THERMOHYGROMETER
Mod. THYP

Description:

Compact instrument for measuring temperature and relative humidity simultaneously.

- Min./max. values
- Hold button to freeze readings



**INFRARED
THERMOMETER**
Mod. THIR

Description:

Infrared thermometer with laser pointer and sound warning signal, provided with case. It is designed for a quick check of food temperature without contact so that package is not damaged.



THERMAL IMAGER
Mod. THCM

Description:

- Detector size 160x120 pixels
- Field of view 32° x 23°
- Wide 3,5" display
- Software for images analysis and thermographic report creation
- SD card
- Case



HEAT FLOW METER
Mod. THFL

Description:

Portable multifunction instrument with thermal flow probe and temperature probes, provided with case and data acquisition software, for measurements of thermal transmittance and conductance.

PRODUCTS INDEX

SORTED ALPHABETICALLY BY MODEL

THERMOTRONICS
CATALOGUE No. 27-C

RE

REFRIGERATION

CV

AIR-CONDITIONING AND VENTILATION

HS

HEATING AND SANITARY SYSTEMS

AI

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VACU-2	PORTABLE VACUUM AND CHARGING STATION	AI 3
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VENB/EV	MODULE FOR THE STUDY OF AEREAULIC NETWORKS BALANCE	CV 21
WCT/EV	TRAINER FOR WATER CONDENSING UNITS	CV 20



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