AlecopGroup

Didactic Equipment

general catalogue

Integral equipment for the classroom-workshop

Our in-depth knowledge of the educational world allows us to design classroom-workshops configured down to the last detail and ready to use straight away.

automotion

renewable energies

electricity

electronics

The flame of knowledge

For the last 45 years Alecop has offered technological material with maximum benefits which has led to the most important educational organisations opening their doors to us.

HUMANITY AT WORK

We belong to the educational department of MONDRAGON Corporación: A cooperative project of world renown which contributes a human component to the business world. A different work method which seeks the integral development of people and respect for the environment.

www.mondragon-corporation.com

telecom

mechanics

building

index

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automotive engineering

The Alecop offer shows the vehicle divided into independent systems for a deep knowledge of each part: electricity, electronics, brakes, transmission, motor, engine, softwares and equipments.

The main objective is that the student becomes familiar with the real vehicle mechanisms in order that his subsequent insertion into the working market becomes the most successful possible.

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classroom-workshop

CLASSROOM

We introduce the elements that constitute a study classroom. Here, we will pass on basic concepts of electricity and electronics applied to the car. The student will exercise with equipments of the ADA SERIE.

Auxiliary equipment

polyvalent classrooms

Furniture, spotlights, multimedia blackboard, cupboards, etc...

workshops

Working benches, engines support, weldins equipment, several tools.

WORKSHOP

Here, we create an educational structure around the world of the car industry in which we could find all the systems of a real vehicle (the EAU SERIE), as well as practising with real car components.

EAU962 multiplex electronic systems

EAU963 ABS/EDS/ESP trainer

EAU964 air-conditioning trainer

EAU961 direct diesel injection

EAU960 gas injection

XENON headlight trainer

electromechanics

Auxiliary mechanic equipment, frame, steering alignment system, balancing machines, dismantle tyres, etc.

bodywork

Painting and drying cabins. Preparation areas, mounting support, meters, several tools, cleaning cabins, protection equipment.

laboratory

Diagnosis instruments, tests bank, fumes extractor...

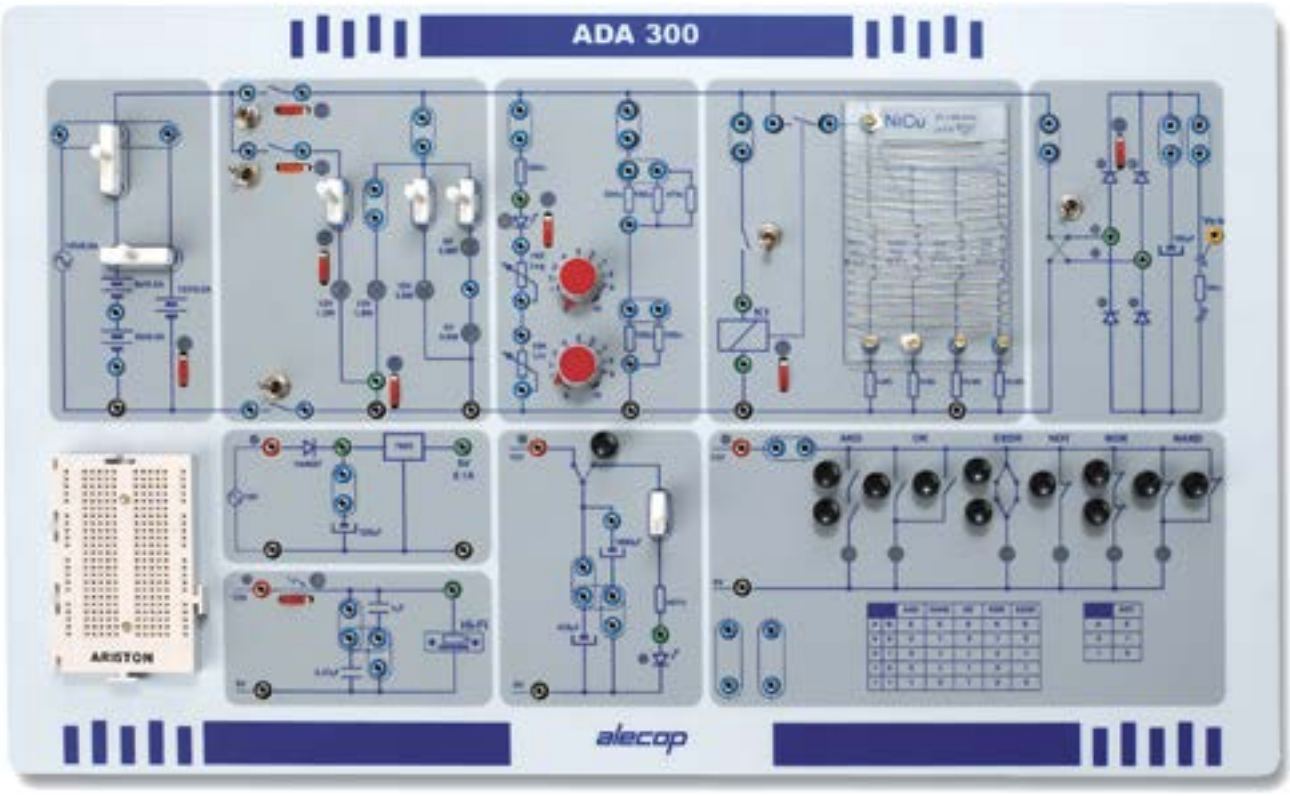
ADA 300

Application of electricity for automotive

Equipment to study basic automotive electricity.

Ref.: 9EQ300AA6C - 230 V

Ref.: 9EQ300AA3C - 115 V



The purpose of this equipment is to familiarise students, in a flexible way, with basic electricity in general and, more specifically, its application in cars. The application can be used to analyse and check different basic electric circuits as well as their components without wasting any time on assembly and dismantling. The configuration of the circuit to be analysed is carried out quickly by means of connection bridges. The equipment enables also the generation of faults in several of the circuit's components. However, if you want to extend some activities, the application has a complementary circuit assembly board. This board enables electric/ electronic elements to be interconnected (resistances, capacitors, diodes, etc.) in a quick and easy way without the need to solder the components, making it possible to reuse the components for several different assemblies.

Technical specifications

- Incorporates the following components/circuits:
  - Power circuit: Alternating current (AC) and direct current (DC).
  - Circuit with lamps: Parallel, series, mixed, lamps with different powers.
  - Circuit with resistances: Parallel, series, mixed, linear and logarithmic potentiometer.
  - Circuit with relay.
  - Circuit with different conductor materials: copper, nichrome and constantan.
  - Full wave/half wave rectifier circuit.
  - Circuits with capacitors: filter, power store.
  - Circuit with logic gates.
- Test points to take measurements on the different circuits.
- Accessibility to all components for analysis under voltage or without voltage.
- Possibility of generating disfunctions in components of the equipment.
- Possibility of doing different electric/electronic assemblies on a proto-board.
- Measurements: 446 x 270 x 100 mm.

Skills to be developed

- Using equipment to measure electric/electronic components and circuits and interpret the data obtained with the multimeter and the oscilloscope.
- Checking electric/electronic components not undervoltage and under voltage.
- Analysing basic electric/electronic circuits and linking them to car components.
- Assembling basic electric/electronic circuits.
- Running diagnostics and repairing simple faults in car electric/electronic systems.

Contents to be studied

- AC/ DC power supply.
- Batteries: Characteristic. Association of batteries in series and in parallel.
- Lamps. Identification. Association of lamps.
- Ohm's law: voltage, current, resistance.
- Association of resistances in series and in parallel.
- Characteristics of linear and logarithmic potentiometers.
- Electric power.
- Conductor materials: Copper, nichrome and constantan.
- Study of capacitors in DC: Filter, power store.
- Binary logic: AND, OR, EXOR, NOT, NOR and NAND.
- Full wave/Half wave rectification, filtering with capacitor.
- Components: Resistances, capacitors, diodes, leds, potentiometers, lamps, relays.

Equipment composition

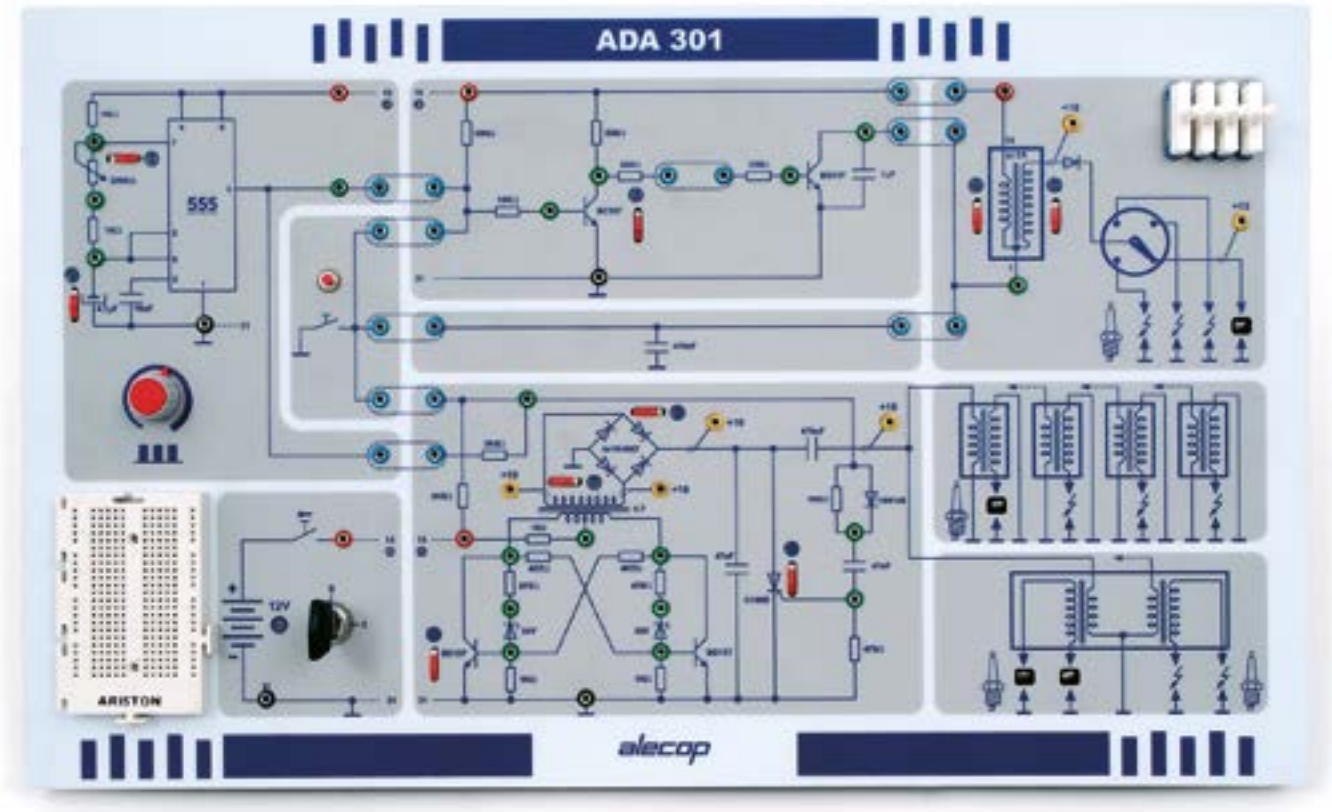
- ADA300 panel.
- User's manual.
- Manual of practical activities.
- Wires with different conductor materials.
- Electric/electronic components to assemble complementary circuits.
- Accessories store.

ADA 301

Application of electronics for automotive

Equipment to study the electronics applied in automobiles.

Ref.: 9EQ301AA6C - 230 V Ref.: 9EQ301AA3C - 115 V



The ignition circuit has been taken as the common theme throughout the process of teaching applied electronics in the automobile. This circuit has undergone significant improvements throughout history until reaching the current solutions which are largely derived from the use of electronics. This has been one of the reasons why we have decided to base part of the study of electronics for the car industry on this real automobile application. The application has different electronic circuits which can be combined together to assemble the different systems used in designing ignition circuits:

- Ignition spark generation using a switch.
- Ignition spark generation using a transistor circuit.
- Ignition spark generation using a condenser discharge system.

Technical specifications

- Incorporates the electronic blocks which are necessary to analyse the following circuits:
  - Power pack
  - Circuit to generate sparks using a switch
  - Multi-vibrator circuit or square signal generator.
  - Circuit to generate sparks using a transistor.
  - Circuit to generate sparks using a condenser discharge system.
  - Power circuit for a CC motor.
  - Circuit to vary the speed of a CC motor
  - Circuit to vary the luminosity in the lights.
- Test points to take measurements on the different circuits.
- Accessibility to all the electronic components for analysis under voltage or without voltage.
- Possibility of generating disfunctions in different components of the equipment.
- Possibility of doing different electronic assemblies on a proto-board.
- Measurements: 446 x 270 x 100 mm.

Skills to be developed

- Using equipment to measure electronic components and circuits and interpret the data obtained with the multimeter and the oscilloscope.
- Checking electronic components not under voltage and under voltage.
- Analysing general electronic circuits and linking them to car components.
- Assembling basic electronic circuits.
- Running diagnostics and repairing simple faults in car electronic systems.

Contents to be studied

- Study and checking the operation of different electronic components: Diode, transistor, zener diode, thyristor.
- Basic study of the different ignition systems used in cars.
- Circuit which inverts the polarity of the current in the transistor ignition circuit.
- Current amplifying circuit.
- Integrated circuit: NE555 Multi-vibrator.
- Rectifier circuit.
- Generation of variable time signals.
- Generation of high voltages starting from low voltage.
- Condenser discharge circuit on coil primer.
- Voltage variation applied to a device (engine, lamp, and valve).

Equipment composition

- ADA301 Panel.
- User's manual.
- Manual of practical activities.
- 12V cc motor.
- 12V/6w light.
- Electronic components to assemble complementary circuits.
- Accessory store.

ADA 303

Application of sensors for automotive

Equipment for the study of sensor in a car.

Ref.: 9EQ303AA6C - 230 V Ref.: 9EQ303AA3C - 115 V

Equipment conceived to study different sensors, depending on technologies, types of regulation, capturing parameters and means of transmission of information used in the different electrical electronic systems which can be found at present in a vehicle. Thanks to these sensors the electronic systems receive information of the physical and or chemical magnitudes necessary through the ECU in order to make the calculations required to start the different actuators working. The actuators will be in charge of producing the physical variations which make the different electromechanical components of the vehicle work. The equipment has 12 sensors, similar to those actually used in the car (CKP-CMP-MAF- MAP etc.) through which and thanks to the combination of different technologies used in their construction a high number vehicle sensors can be studied. Some of the signal reception elements can be connected to the UCE ADA304 application, and along with the ADA305 actuator they make the equipment form a complete electronic control system.

Technical specifications

- Autonomous equipment for the study of sensors in a car.
- The equipment includes sensors using different types of technology:
  - Crankshaft position sensor: inductive.
  - Camshaft sensor: Hall.
  - Steering column sensor (position, speed): Optical.
  - Light sensor: Optical.
  - Parking distance sensor: Ultrasound.
  - MAP collector absolute pressure system: Piezoresistive.
  - Lateral acceleration sensor for electronic stability control: Capacitive.
  - Air quality sensor: MOS (Metal Oxide Semiconductor).
  - Accelerator pedal position sensor APP: inductive.
  - KS Knock sensors: Piezoelectric.
  - Air mass sensor MAF: Hot wire.
  - IAT air temperature admission sensor: NTC Resistive.
- The communication of the sensors with the outside is carried out by different means:
  - Digital output.
  - Analogue Output.
  - Communication by CAN bus.
  - Communication by LIN bus.
- Each sensor has information printed on it about:
  - The technology used.
  - Type of output generated.
  - Physical shape of the sensor in the vehicle.
- Testing points protected against possible incorrect manipulations, for carrying out measurements at the different points of the circuit.
- Possibility of generating faulty situations in the signal sent by the sensors to the ECU, enabling the analysis of malfunction in the system.
- Possibility of connecting various sensors to the ECU control unit panel ADA304.
- Measurements: 446 x270 x100 mm.

Training to be carried out

- Analysis of the working of the different sensors and their association in the different automobile systems.
- Testing electrical/electronic signals without voltage and under voltage.
- Diagnosis of faults in the sensors: Lack of supply, broken sensor, short circuit to mass or to positive of the sensor, failure in the bus of communication of the sensor (CAN-LIN) etc.
- Instrumentation handling: Oscilloscope, Polymeter.

Equipment composition

- ADA303 Panel.
- User manual.
- Practise activity manual.
- Accessories: Syringe and plastic tubes.
- Accessory store.

Contents to be studied

- Technologies used in sensor design.
- Types and characteristics of sensors.
- Types outputs (analogue, digital, CAN bus, LIN bus).

ADA 304

ECU electronic control unit

Equipment for the study of electronic control systems in a car

Ref.: 9EQ304AA6C - 230 V

Ref.: 9EQ304AA3C - 115 V

Equipment to study how the electronic control unit (ECU) of a petrol engine works with a multipoint sequential injection system and static ignition. The equipment enables, by means of a series of potentiometers, different operation conditions to be simulated (amount and air mass, temperature, rpm, cooling temperature etc.) which the ECU, depending on the programming, uses to carry out the necessary calculations and make the different system actuators work (injectors, coils, air flow valve, electrofan, etc). Input and output signals can be adjusted independently. Nevertheless, to avoid malfunctions (unlikely) on the injected system, an AUT mode has been implemented where the sensor signals evolves depending on the programmed algorithm thus allowing the student to quickly begin to understand how the injection system works. Similarly, it incorporates the auto-diagnosis system which alongside the DD-Car software allows the student to become familiar with auto-diagnosis techniques.

Technical specifications

- Stand-alone equipment that incorporates the simulation of the following sensors and actuators:
  - SENSORS: Air mass sensor, air admission temperature, crankshaft position, camshaft position, accelerator pedal position, coolant temperature, wide band Lambda sensor, absolute pressure sensor and vibration sensor.
  - ACTUATORS: Gas injectors, gas valves, spark plugs, Turbo electrovalve and MAL (Malfunction Indicator Lamp).
- Sensor and actuator communication with the ECU by different types of signal; analogue, digital, multiplexing buses CAN and LIN.
- Testing points protected against possible incorrect manipulations, for carrying out measurements at the different points of the circuit.
- Possibility of generating malfunctions in the signal sent by the sensors to the ECU.
- Automatic or individual operation of the sensors (AUT/IND).
- Reprogramming function (Flash) of the ECU as a Turbo motor or Atmospheric.
- Auto-diagnosis function implemented in the ECU.
- Possibility of disconnecting the sensors/actuators simulated in the panel and of connecting the real sensors/ actuators of the ADA303 and ADA305 applications
- Measurements: 446 x270 x100 mm.

Training to be carried out

- Analysis of how the electronic injection control unit works on an ECU- Motor.
- Analysis of the ECU input signals.
- Analysis of the ECU output signals.
- Testing electrical/electronic signals with without voltage and under voltage.
- Handling of auto-diagnosis tools: DD-Car.
- Fault Diagnosis: Broken sensor, failure in the communication bus (CAN-LIN), etc.
- Testing of sensors and actuators using an autodiagnosis tool.
- Instrumentation handling: Oscilloscope, Polymeter.

Equipment composition

- ADA304 Panel.
- User manual.
- Practise activity manual.
- DD-Car auto-diagnosis software.
- Accessory Store.

Contents to be studied

- CU Sensor inputs: types, characteristics etc.
- Actuator outputs from the ECU: types, characteristics etc.
- Internal architecture of an electronic control unit.
- Working of an electronic injection control unit, injection control algorithms.
- Injection time and ignition time (ignition angle and DWELL angle).
- Types and characteristics of sensor/actuator signals: Analogue, digital, multiplexing buses (CAN and LIN).
- Auto-diagnosis in electronic injection systems, failure EOBD codes.
- Reprogramming (Flash) of the electronic control unit.
- Digital /Analogue and Analogue/ Digital conversion.

DD-Car

AUTO-DIAGNOSIS SOFTWARE

DD-Car is a Diagnosis Teaching Tool prepared to work with the ADA304. Working with DD-Car will allow the student to become familiar with the operation of auto-diagnosis consoles on the market allowing their adaptation to any of them to be quicker and easier, in addition testing can be carried out without the risk entailed on working directly on the systems of the vehicles. The following functions can be made:

- Reading and deleting the breakdown code.
- Reading of values and analysis in real time of the operation of the system.
- Activation of the actuators.
- ECU Programming (flash).
- Carrying out basic adjustments in the system.

ADA 305

Actuator application for the automotive industry

Equipment for the study of actuators in a car

Ref.: 9EQ305AA6C - 230 V

Ref.: 9EQ305AA3C - 115 V

Equipment conceived to study different actuators, depending on technologies, types of regulation and means of control used in the different systems which can be found at present in a vehicle. These actuators are controlled from the electronic control unit ECU based on control algorithms programmed on the unit, which are responsible for making the system respond to the variation required for the behaviour of the vehicle. The equipment has 10 actuators, similar to the ones in use at present in a car (spark plug, injector, step motor, canister valve, etc.), through which, and thanks to the combination of different technologies they use and of the different means of control, they allow a high number of vehicle actuators to be studied. Some of the equipment actuators can be controlled from application UCE ADA304, and can together with the ADA303 sensor equipment form a complete control system.

Technical specifications

- Autonomous equipment for the study of actuators in a car .
- The actuators included in the equipment are:
  - Ignition coil with incorporated spark.
  - Electromagnetic injector .
  - DC Motor: Open loop speed control and closed loop control position potenciometre on the shaft.
  - Cooling fan: Analogue or series resistance speed control.
  - Electrovalve: All/Nothing Control (ON/OFF) and linear control by means of Pulse Width Modulation (PWM).
  - Electromagnet: ON/OFF Control.
  - Windscreen washer motor pump: Motor pump control in both directions.
  - Step Motor: Two working speeds.
  - Actuators related with lighting: Position-brake light, emergency warning lights, lights on warning.
  - Acoustic actuator, piezoelectric buzzer: Actuation of the same with two different tones.
- The control technologies implemented are:
  - Digital control.
  - Analogue Control.
  - Control by CAN bus.
  - Control by pulse width modulation PWM.
- Testing points protected against possible incorrect manipulations, for carrying out measurements at the different points of the circuit.
- Possibility of controlling various actuators from the control unit ECU-ADA304.
- Measurements: 446 x270 x100 mm.

Skills to be developed

- Analysis of how the different actuators work.
- Testing electrical/electronic signals with without voltage and under voltage.
- Diagnosis of faults in the actuators: Lack of supply, actuator broken, short circuit to mass or to actuation positive, failure in the communication bus of the actuator (CAN-LIN).
- Instrumentation handling: Oscilloscope, Polymeter.

Equipment composition

- ADA305 Panel.
- User manual.
- Practise activity manual.
- Accessory store.

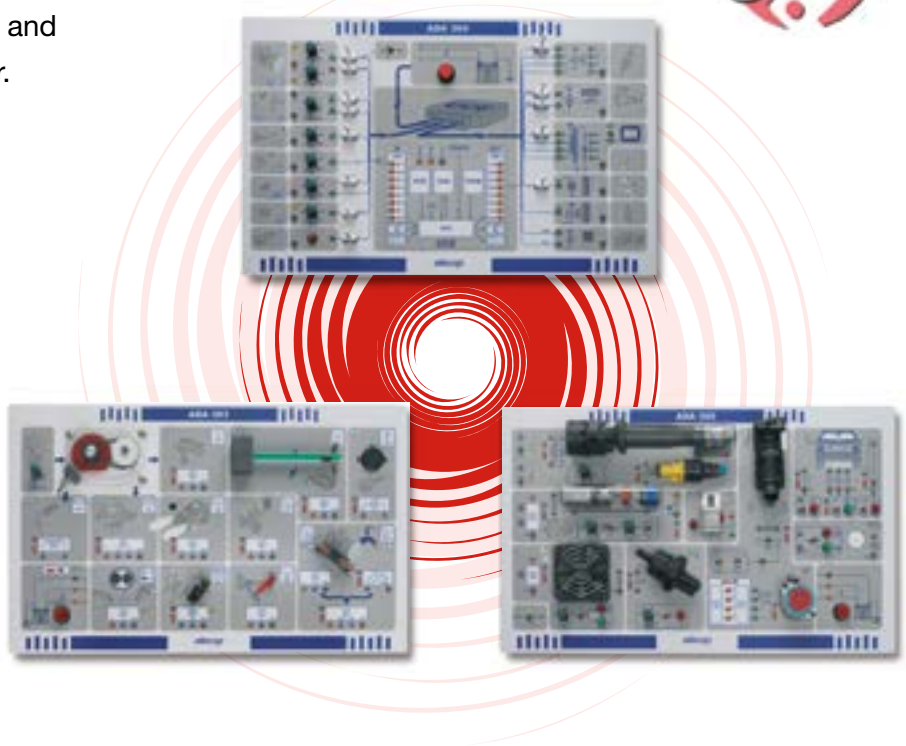
Contents to be studied

- Technologies used in the actuator design.
- Types and characteristics of actuators.
- Types actuator control systems (analogue, digital, CAN bus, LIN bus).

ADA Engine

With Auto-diagnosis

Auto-diagnosis in electronic injection systems EOBD. Study of the sensors, power units and actuators applied to the car.



By means of connecting the **ADA303** application sensors and the **ADA305** actuators to the UCE **ADA304**, the injection system of a basic atmospheric or turbo engine can be simulated. Then, in this engine we can observe, through the auto-diagnosis DD-Car, how the engine parameters process is changing in a real time. One of the main features of this set of equipments is that it can be adapted to all the formative requirements and needs, as required. On one hand, the individual acquisition of each equipment allows us to work and study each group of components on an individual basis; ADA 303 study of the sensors, ADA 304 study of the control unities with auto-diagnosis and ADA 305 study of the car actuators. Developing in each case the analysis abilities, checking and diagnosis. The acquisition of the three equipments, in which all the components are accessible and very easy to recognize (sensors, UCE, actuators), and where the student himself will have to assemble and operating the fuel injection system in an interconnected way, carrying out manually the electrical-electronical association of all the components required (sensors, UCE, actuators). So that the student is a very active element in the learning process, aware at every moment of the steps he has to carry out to make the system operate correctly, so that the student himself checks very rapidly, directly and visually the work he has done. A very important point to underline is that the student will be able to carry out a very fast and real introduction to the auto-diagnosis through the DD-CAR software, seeing in real time the variation of the parameters of the sensors, the reading and deleting of the breakdown code, the activating, programming and basic adjustments, all of which controlled by the current EOBD norm. The work with DD-CAR will allow that the student get accustomed with the running of auto-diagnosis consoles of the market, so that he can adapt to any one of them very rapidly after having worked with the above-mentioned software.

Technical specifications

- Set of equipments that allows working with real or simulated sensors applied to the current car, making possible a rapidly and visually observation of the running as a whole of many electrical-electronical components of a generic injection system (fuel or current diesel).
- Sensor and actuator communication with the ECU by different types of signal; analogue, digital, multiplexing buses CAN and LIN.
- Testing points protected against possible incorrect manipulations, for carrying out measurements at the different points of the circuit.
- Possibility of generating malfunctions in the signal sent by the sensors to the ECU.
- Reprogramming function (Flash) of the ECU as a Turbo motor or Atmospheric.
- Auto-diagnosis function implemented in the ECU.
- Possibility of disconnecting the sensors/actuators simulated in the panel and of connecting the real sensors/ actuators of the ADA303 and ADA305 applications.
- Measurements: 446 x 270 x 100 mm.

Equipment composition

- Sensor application, ADA303.
- ECU application, ADA304.
- Actuator application, ADA305.
- User manual.
- Practise activity manual.

Contents to be studied

- Technologies used in the sensor design.
- Types and characteristics of sensors.
- ECU Sensor inputs: types, characteristics, etc.
- Technologies used in the actuator design.
- Types and characteristics of actuators.
- Actuator outputs from the ECU: types, characteristics, etc.
- Internal architecture of an electronic control unit.
- Working of an electronic injection control unit, injection control algorithms.
- Injection time and ignition time (ignition angle and DWELL angle).
- Types and characteristics of sensor/actuator signals: Analogue, digital, multiplexing buses (CAN and LIN).
- Auto-diagnosis in electronic injection systems, failure EOBD codes.
- Reprogramming (Flash) of the electronic control unit.
- Digital /Analogue and Analogue/ Digital conversion.

Software de AUTO-DIAGNOSIS

DD-Car is a Diagnosis Teaching Tool prepared to work with the ADA304. Working with DD-Car will allow the student to become familiar with the operation of auto-diagnosis consoles on the market allowing their adaptation to any of them to be quicker and easier, in addition testing can be carried out without the risk entailed on working directly on the systems of the vehicles.

The following functions can be made:

- Reading and deleting the breakdown code.
- Reading of values and analysis in real time of the operation of the system.
- Activation of the actuators.
- ECU Programming (flash).
- Carrying out basic adjustments in the system.

Skills to be developed

- Analysis of the working of the different sensors and their association in the different automobile systems.
- Testing electrical/electronic signals without voltage and under voltage.
- Diagnosis of faults in the sensors: Lack of supply, broken sensor, short circuit to mass or to positive of the sensor, failure in the bus of communication of the sensor (CANLIN) etc.
- Analysis of how the electronic injection control unit works on an ECU-Motor.
- Analysis of the ECU input signals.
- Handling of auto-diagnosis tools: DD-Car.
- Testing of sensors and actuators using an auto- diagnosis tool.
- Instrumentation handling: Oscilloscope, Polymeter.

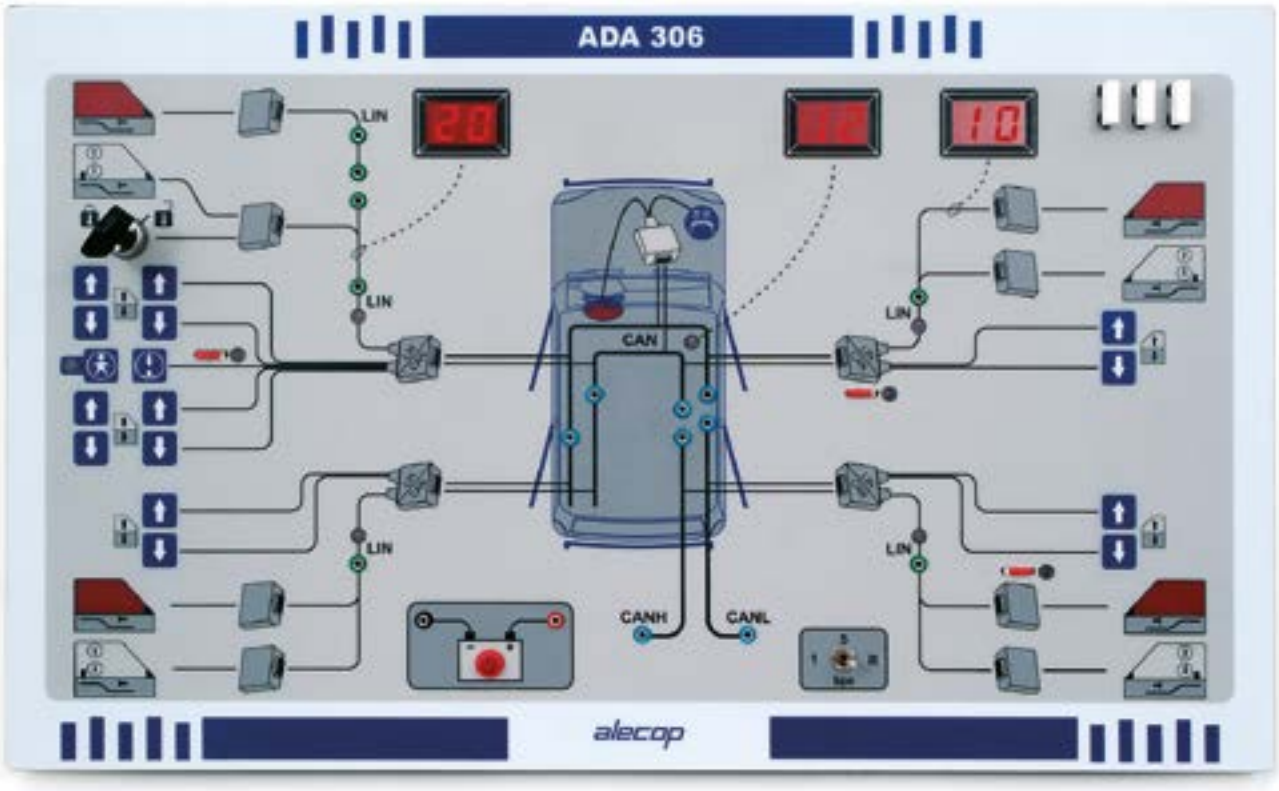
ADA 306

Automotive multiplexed CAN-LIN buses

Equipment for conceptual study of the data networks and multiplexing in the car.

CENTRAL LOCKING • ELECTRIC WINDOWS • AIRBAG

Ref.: 9EQ306AA6C - 230 V Ref.: 9EQ306AA3C - 115 V



The objective of this equipment is to familiarise the student with data and multiplex networks. The information is transmitted by means of two buses: CAN (Controller Area Network, ISO 11898-3 or ISO 11519-2 specification) and LIN (Local Interconnect Network).
The equipment allows the operation of the two buses implemented in real mode and in slow mode to be analysed. This latter mode allows analysis how the series data transmission, employed in all multiplexed buses, operates in a simple and very didactic way. In the real mode the two buses operate at real speed (125 Kbits/sec for the CAN and 19200 bits/sec for the LIN) whilst the slow mode can operate at 1 bits/sec or at 5 bits/sec. while makes it easy to analyse the data which has been sent.

Technical specifications

- Implementation of multiplexed comfort bus with CAN ISO 11898-3 line which is tolerant to faults at 125 Kbits/sec.
- Implementation of switch and electric window control in the vehicle doors with LIN bus at 19200 bits/sec.
- Test points in the different lines of the buses.
- Possibility of generating dysfunctions in the different buses:
  - Short circuits to battery and to earth.
  - Short circuits between the lines.
  - Cuts in the lines.
  - Simulation of faults in the control units I.
- Real or slow operation selection switch. It allows analysis of operation with an oscilloscope (real operation) or using a multimeter (slow operation).
- In slow mode, display of the different frames which are circulating in the buses on alphanumerical displays in hexadecimal notation.
- Possibility of CAN communication using optical fibre. It substitutes the conventional wiring with optical fibre in the CANH or CANL lines.
- Measurements: 446 x 270 x 100 mm.

Skills to be developed

- Analysis of multiplexed systems.
- Handling instrumentation for checking and diagnosis.
- Running diagnostics and repairing faults in multiplexed systems.

Contents to be studied

- Binary logic.
- Numerical systems (Binary, hexadecimal).
- Transmission of information in series.
- Layouts of data networks (Multi-Master, Master-Slave).
- CAN Bus (Transmission of differential data, voltage levels, frames, fault tolerance, etc.).
- LIN Bus (Transmission of differential data, voltage levels, LIN frames, etc.).
- Transmission of data by optical fibre.

Equipment composition

- ADA306 Panel.
- User's manual.
- Manual of practical activities.
- ACCFI306ZX: accessory to transmit data by optical fibre.
- Accessories store.

ADA 307

Hybrid vehicle application

Tool used in conceptual studies of combined cycle hybrid vehicles.

Ref.: 9EQ307AAZC

The goal of this equipment is to get students to know hybrid vehicle technology. The application uses the most efficient system on the market: the plug-in hybrid electric vehicle (PHEV).
The application consists of a panel showing all the parts of a hybrid vehicle and a virtual instrument panel with advanced functions for data generation, acquisition, and analysis.
This system is used to:

- Make conceptual studies in combined cycle PHEVs simulating the operation of a real vehicle on different journeys and contexts.
- Assess high-voltage electricity flows.
- Analyse the power combination of an internal combustion engine and an electric motor/generator.

It includes an application developed with MATLAB/Simulink, the user manual, and practical exercises.

Interactive panel

The interactive panel has the same devices as a vehicle: start switch, accelerator, brakes, speed selector, A/C switch, and off-board battery charge button (plug-in).
It reproduces the different stages in an engine operation cycle (electric motor, internal combustion engine) as well as the battery pack status (charged, depleted, generator).
Two measuring positions, V1/V2, to check the parameters selected with the software:

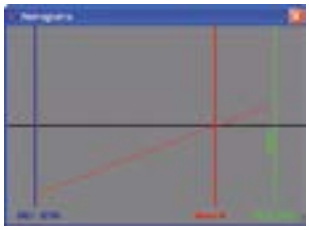
- Battery pack charge level.
- Battery voltage.
- Battery charging current.
- Electric motor work voltage.
- Vehicle speed.

Virtual model

The hardware trainer is a driving simulator (gear, speed, battery charge, fuel gauge). All the actions performed on the panel are represented in the software instrument panel.

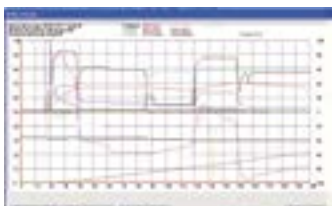
The ADA307 software provides information on vehicle performance in figures, graphics, and gauges. The user can choose to view the numerical data screen, the nomogram screen, or the synoptic chart screen.

Nomogram



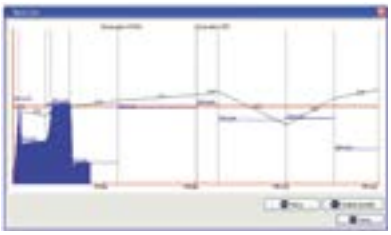
Synoptic graphic

Data acquisition



The effect of various situations on hybrid vehicle performance can be assessed by programming journeys and carrying out tests. The data can be exported to Excel.

Programming journeys



The virtual model shows all operating stages:
- Electric motor.
- Internal combustion engine.
- Electric motor + internal combustion engine and overlapping mode.
- Energy restoration and battery charging.

Modelling with MATLAB Simulink®

simulHyb

It is delivered as executable software to be used with no need of a MATLAB licence, including sources.

SimulHyb offers:
- Vehicle operating simulation (considering weight, fuel level, vehicle power, etc.)
- Energy distribution simulation:
  - in acceleration mode (consumption).
  - in braking mode (recharge).

MATLAB SIMULINK

MATLAB and Simulink® sources included

EAU-960

Petrol Injection Motor Trainer

Teaching equipment for studying motors with Integrated Systems for Sequential Digital Electronic Petrol Injection, Direct Ignition Systems, and double Lambda regulators. The teaching equipment will include the latest generation in-line 4 cylinder motor (1.6L Duratec 16V 100CV) mounted on a functional mobile support, in running order, and with all of the components and accessories necessary for its operation in conditions similar to those of a car.

Ref.: 9EQ960EAZC

Teaching application

The teaching model is based on activities with genuine car parts arranged to facilitate the student's learning process:

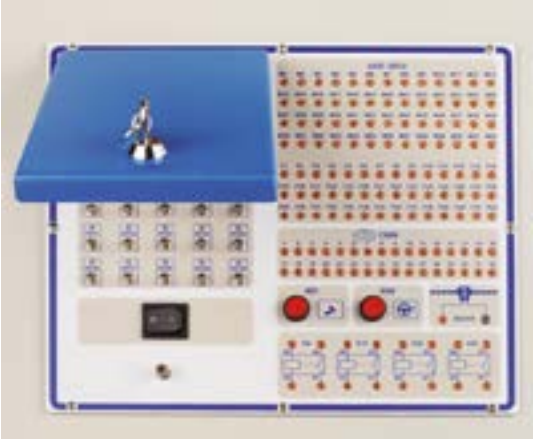
- The application is real, with all of the parts of the motor to be learned about effectively integrated (verification of the injection system operating parameters, analysis of gases, starter and charging circuits, reading diagrams, etc.).
- Help in significantly reducing procedural activities learning time, thanks to the easy accessibility to the components, connectors and verification points. In addition, the characteristics of a car mounted motor are preserved.
- The instructor has the possibility of demonstrating the various systems and how to check the symptoms of different malfunctions.
- It enables students to develop diagnostic capabilities using professional tools and to repair break-downs.
- It is motivational for the students.

Teaching characteristics

The student will develop many skills using this equipment:
1. Motor and system maintenance.
2. Instrument operation for verification and diagnosis.
3. Simulation of malfunctions, verification and symptom recognition.
4. Diagnosis and repair of break-downs.
5. Circuit Analysis.
6. Diagram interpretation.
7. Verification and analysis of components and systems.
8. Use and interpretation of technical documentation.
9. Finding and identifying components.
10. Maintenance of starter and charging systems.

Teaching features

Integrated into the control panel, there is a system enabling the measurement of static and dynamic signals from the injection and starter systems, as well as the relays used by the system, analysis, diagnostics and repair of break-downs, including:
- Terminal plate for the analysis and diagnosis of the electrical-electronic signals used in the system.
- Module to generate malfunctions and breakdowns representative of those that could really appear in a vehicle, including the starter and injection systems as well as others which control the operation of the motor.
- Equipment usage authorization switch.
- Indicators for batteries, alarm groups, etc.
- Adjustable accelerator, ignition key, instrument panel, safety switch, ON-OFF switch.



Classroom management and student evaluation via SIRVAUT software integrated in the equipment.

TEACHING SUPPORT

User Manual.

Contains the standards of use for the equipment, characteristics, maintenance, etc.

Practice Activities Manual.

The manual proposes different types of activities that can be done using the trainer. It includes answers and appropriate solutions to the problems presented in order to make the teaching process easier. Identification of individual components, identification of systems, verification of sensors and actuators, verification of E.C.U. input signals, verification of the E.C.U. output signals, reproduction and identification of breakdown symptoms, breakdown search and find, reading diagnostic codes, proposals for defect resolution, virtual repair, etc.

Wiring diagram manual.

This is a manual of diagrams similar to that used in automobile repair workshops that will help in the activities where circuits are followed, in locating and identifying installations, and in determining the breakdowns that have been initiated in the trainer.

Technical specifications

- Systems for Sequential Digital Multipoint Injection with an Electronic Control unit (ECU) and an EOBD diagnostic connection.
- Emission control system with: Catalytic converter, precatalytic and post-catalytic Lambda sensors, vapour purge valve (Canister).
- Charging system composed of an alternator with incorporated regulator, intelligent regulation control system and charging indicator on the instrument panel.
- Accelerator and electronic butterfly valve.
- Electronic starter system with passive antitheft (PATS) and a status indicator.
- Fuel tank with a level indicator on the instrument panel.
- Complete cooling circuit.
- Standard EOBD (EOBDII) connection.
- Battery.
- Instrument and Control function panel with:
  - RPM indicator.
  - Motor temperature indicator.
  - Coolant temperature.
  - Fuel level indicator.
  - Oil pressure indicator.
  - Battery charge indicator.
  - Motor malfunction warnings.
- Safety systems made up by::
  - Starter block switch.
  - Emergency switch.
  - Protection with bornier tests for possible short circuits.
  - Low oil pressure triggers an alarm and the motor stops.
  - Belt guard with a safety micro-interrupter.
  - Moving parts and hot areas are protected.
- Sensor for measuring starter current and battery charge.
- The equipment is mounted on wheels.
- Dimensions and weights:
  - Equipment dimensions: 1.150 x 1.260 x 1.420 mm.
  - Package dimensions: 1.400 x 1.500 x 1.650 mm.
  - Package weight: 370Kgs.

Breakdowns

Using a repair program system, the trainer can introduce malfunctions or break downs to the motor.
There are two options:

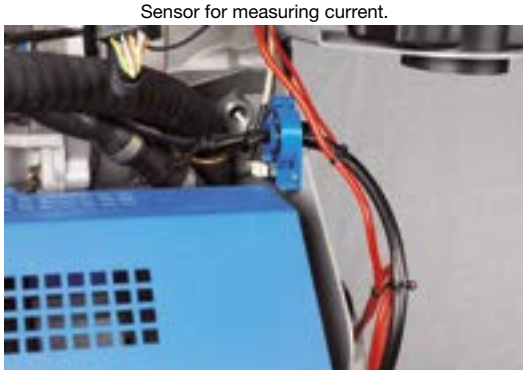
- Interactive computer-aided virtual repair system for breakdowns (SIRVAUT) which enables not only breakdown analysis but also virtual repair generating a history log for evaluation by the instructor.
- Manual breakdown repair system (using switches).

New original components

An original new motor (not rebuilt).

Relays, fuses, and an anti-start (PATS) employed in the system.

Sensor for measuring current.



petrol injection motor trainer

- Genuine new motor.
- Emission control system.
- Ignition System.
- Starter and charging system.
- Security System.
- Diagnosis.
- Breakdown repair.

EAU-961

Diesel Injection Engine Training Unit

With particle filter

Didactic equipment for studying the operation of direct diesel injection engines with a common rail electronic control system and particle filter. The equipment incorporates the latest generation of common rail 4-cylinder in line diesel engine (1.6L Duratorq TDCi 110CV) with particle filter, mounted on a mobile functional support in running order, equipped with all the components and accessories necessary for its correct operation under similar conditions to those in a vehicle. Engine developed by FORD and PSA.

Ref.: 9EQ961EAZC

Teaching application

The teaching model is based on activities with genuine car parts arranged to facilitate the student's learning process:

- The application is real, with all of the parts of the motor to be learned about effectively integrated (verification of the injection system operating parameters, analysis of gases, starter and charging circuits, reading diagrams, etc.).
- Help in significantly reducing procedural activities learning time, thanks to the easy accessibility to the components, connectors and verification points. In addition, the characteristics of a car mounted motor are preserved.
- The instructor has the possibility of demonstrating the various systems and how to check the symptoms of different malfunctions.
- It enables students to develop diagnostic capabilities using professional tools and to repair break-downs.
- It is motivational for the students.

Teaching characteristics

The student will develop many skills using this equipment:

1. Motor and system maintenance.
2. Instrument operation for verification and diagnosis.
3. Simulation of malfunctions, verification and symptom recognition.
4. Diagnosis and repair of break-downs.
5. Circuit Analysis.
6. Diagram interpretation.
7. Verification and analysis of components and systems.
8. Use and interpretation of technical documentation.
9. Finding and identifying components.
10. Maintenance of starter and charging systems.

Teaching features

Integrated into the control panel, there is a system enabling the measurement of static and dynamic signals from the injection system, as well as the relays used by the system, analysis, diagnostics and repair of break-downs, including:

- Terminal plate for the analysis and diagnosis of the electrical-electronic signals used in the system.
- Module to generate malfunctions and breakdowns representative of those that could really appear in a vehicle, including the starter and injection systems as well as others which control the operation of the motor.
- Equipment usage authorization switch.
- Indicators for batteries, alarm groups, operating hours, etc.
- Adjustable accelerator, ignition key, instrument panel, safety switch, ON-OFF switch.

Classroom management and student evaluation via SIRVAUT software integrated in the equipment.

TEACHING **SUPPORT**

User manual.

Contains equipment usage rules, characteristics, maintenance, safeties, and a theoretical description of the operation of the different systems that are incorporated in said trainer.

Practice activities manual.

Proposes the different types of practical that can be carried out on the trainer by students. Individual identification of components, identification of systems, verification of sensors and actuators, verification of U.C.E. input signals, verification of U.C.E. output signals, reproduction and identification of fault symptoms, fault seeking and location, reading of diagnostic codes, proposed defect resolution, virtual repairs, etc.

Teachers manual.

A specific manual for the teacher, which indicates potential faults that can be generated on the trainer, its usage, and which components or systems it affects. This manual also includes solutions for student's practical activities, in addition to presenting additional complementary activities.

Wiring diagram manual.

This is a manual of diagrams similar to that used in automobile repair workshops that will help in the activities where circuits are followed, in locating and identifying installations, and in determining the breakdowns that have been initiated in the trainer.

Technical characteristics

- Direct Diesel Injection system with common rail electronic control at a pressure of 1600 bar, equipped with pre-injection, injection and post injection.
- Complete anti-pollution system with: Catalyser, FAP particle filter and FAP system additive tank.
- Intercooler for cooling intake air.
- Variable geometry turbocompressor with electronic control cap.
- The engine incorporates the following sensors:
  - Hot wire air measurement sensor.
  - Antiparticle filter pressure sensor.
  - After catalyser exhaust gas temperature sensor.
  - Boost pressure sensor.
  - Intake air temperature sensor and post-turbo air intake temperature sensor.
  - Revolution and crankshaft position sensor.
  - Camshaft position sensor.
  - Ramp high-pressure sensor.
  - Diesel oil temperature sensor.
  - Vehicle speed sensor.
- Charging system composed of an alternator with incorporated regulator, intelligent regulation control system and charging indicator on the instrument panel.
- Accelerator electronic.
- Electronic starter system with passive antitheft (PATS) and a status indicator.
- Fuel tank with a level indicator on the instrument panel and fuel cap opening sensor.
- Complete cooling circuit.
- Electronic Control unit and standard diagnosis EOBD (EOBDII) connection.
- Battery.
- Instrument and Control function panel with:
  - RPM indicator
  - Motor temperature indicator
  - Coolant temperature
  - Fuel level indicator
  - Oil pressure indicator
  - Battery charge indicator
  - Motor malfunction warnings
- Safety systems made up by:
  - Starter block switch.
  - Emergency switch.
  - Internal protection of test terminal strip against potential short-circuits to safeguard the electronics in the systems.
  - Low oil pressure triggers an alarm and the motor stops.
  - Belt guard with a safety micro-interrupter.
  - Moving parts and hot areas are protected.
- The equipment is mounted on wheels.
- Dimensions and Weights:
  - Equipment dimensions: 1.150 x 1.290 x 1.425 mm.
  - Package dimensions: 1.400 x 1.500 x 1.650 mm.
  - Package weight: 430 Kgs.

Breakdowns

Using a repair program system, the trainer can introduce malfunctions or breakdowns to the motor.

There are two options:

- Interactive computer-aided virtual repair system for breakdowns (SIRVAUT) which enables not only breakdown analysis but also virtual repair generating a history log for evaluation by the instructor.
- Manual breakdown repair system (using switches).

New original components

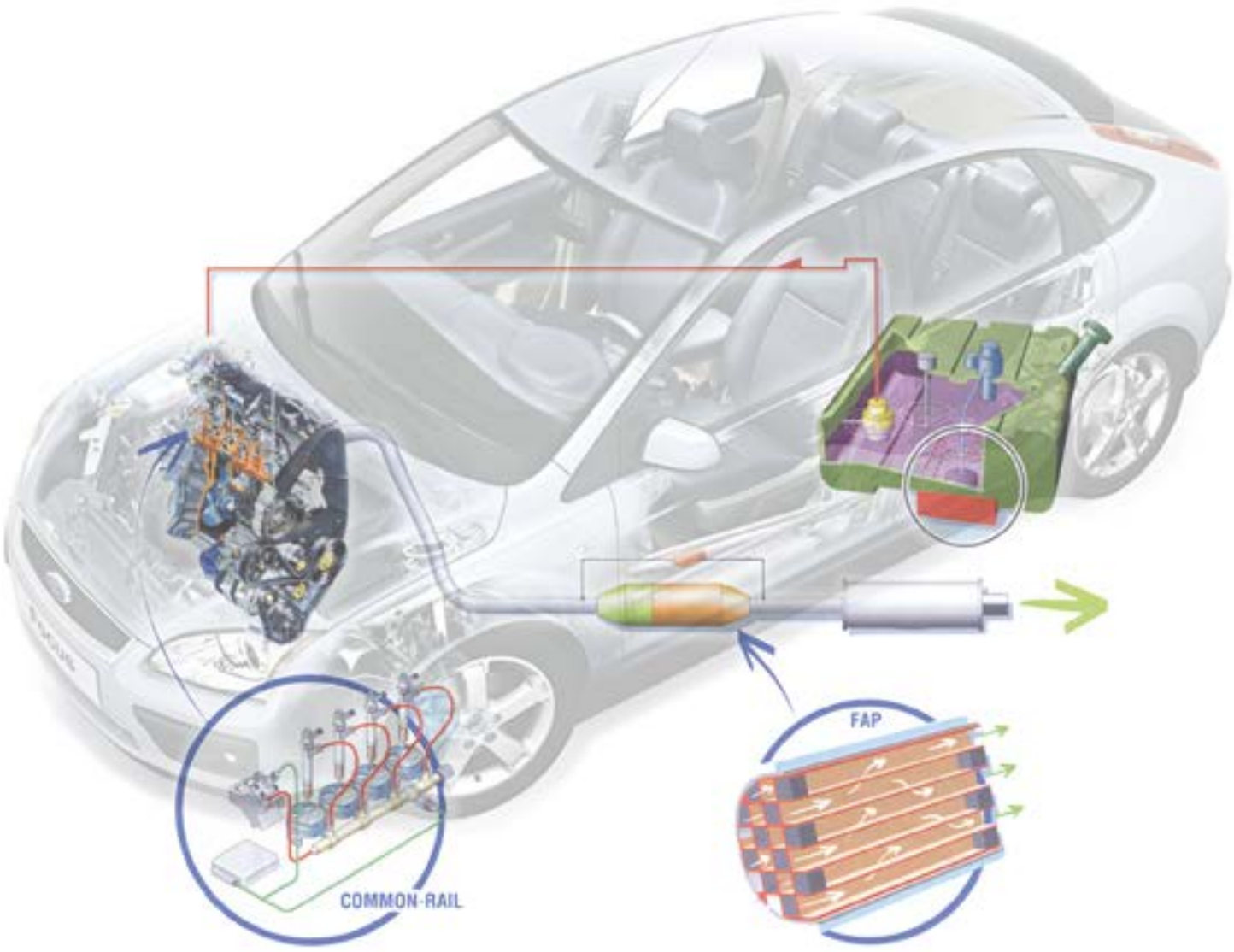
An original new motor (not rebuilt).

Relays, fuses, and an anti-start (PATS) employed in the system.

Operating hours timer.

direct diesel injection engine trainer

- Genuine new motor.
- Antipollution system (with particle filter).
- Power supply system.
- Starter and charging system.
- Security System.
- Diagnosis.
- Breakdown repair.



EAU-963

ABS / EDS / ESP Trainer

This trainer is designed to aid in the training of subjects related to new technologies being applied to combination anti lock braking systems (ABS-EBD), electronic differential lock systems (EDS traction control) and electronic stability programs (ESP) with genuine components, the same as used in the latest generation of the Ford Focus.
The trainer is equipped with all of the components and accessories necessary to simulate the real conditions experienced with a car.

Ref.: 9EQ963EA6C - 230 V

Ref.: 9EQ963EA3C - 115 V

Teaching application

The teaching model is based on activities with genuine car parts arranged to facilitate the student's learning process:

- The application is real, with all of the pieces of the vehicle that are to be learned about effectively integrated (electrical installations, connections, cabling, components, circuits, etc.)
- Help in significantly reducing procedural activities learning time, thanks to the easy accessibility to the components, connectors and verification points. In addition, the characteristics of a car mounted motor are preserved.
- The instructor has the possibility of demonstrating the various systems and how to check the symptoms of different malfunctions.
- It enables students to develop diagnostic capabilities using professional tools and to repair break-downs.
- It is motivational for the students.

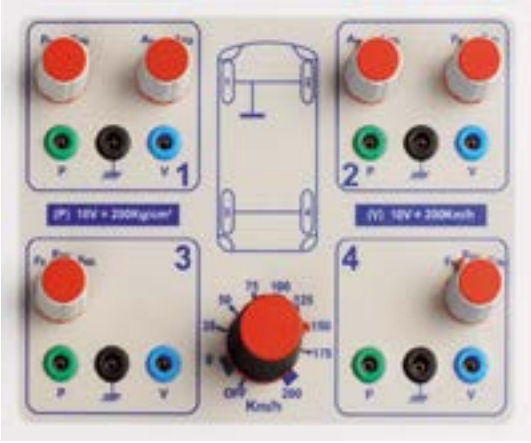
Teaching characteristics

The student will develop many skills using this equipment:
1. Traction and brake system maintenance.
2. Verification and analysis of components and systems.
3. Brake circuit analysis.
4. Component analysis.
5. Reading of diagrams.
6. Operation of instruments.
7. Diagnosis and repair of breakdowns.
8. Simulation of malfunctions, verification and symptom recognition.

SIRVAUT Software integrated into the equipment.

Teaching features

The training system can be adjusted to test the reactions of the ABS/EDB as well as the EDS in any possible operational situation.
- Different braking situations can be generated through the use of 4 switches; normal braking, sudden braking causing ABS activation, and rear axle braking activating the EBD.
- Conditions of low traction at acceleration causing the EDS to activate can be generated through the use of 2 switches.



Breakdowns

Using a repair program system, the trainer can introduce malfunctions or breakdowns to the motor.

There are two options:
- Interactive computer-aided virtual repair system for breakdowns (SIRVAUT) which enables not only breakdown analysis but also virtual repair generating a history log for evaluation by the instructor.
- Manual breakdown repair system (using switches).

TEACHING SUPPORT

User manual.

Contains information about how the equipment operates, standards for using it, characteristics, maintenance, electrical diagrams, list of breakdowns and their symptoms, etc.

Practice activities manual.

The manual proposes different types of activities that can be carried out using the trainer. It includes answers and appropriate solutions to the problems presented in order to make the teaching process easier. Individual identification of components, system identification, signal verification, reproduction and identification of breakdown symptoms, search and locate breakdowns, defect resolution proposals, virtual repair, etc.

Technical specifications

- On / Starter switch.
- ABS module.
- ABS-EBD/EDS control unit.
- Tandem brake master cylinder.
- Hydraulic control unit.
- Brake switch.
- Brake indicator light.
- Instrument panel with multiplex network:
  - ABS indicator light.
  - ESP indicator light.
- System fuse box.
- Four crowns with fully independent speed regulation.
- Four new automobile active receivers (magnetoresistant).
- Four switches for simulating the possible braking conditions of a car, both normal and sudden.
- Two switches for simulate low traction at acceleration in order to activate the EDS traction control.
- Five gauges incorporated into the panel in order to read the pressure of the servo and each wheel.
- Accelerator pedal.
- Brake pedal.
- Standard EOBD (EOBDII) connection.
- Module to general 16 breakdowns (8 for the ESP), through switches protected by a cover and lock, or through a virtual breakdown repair software.
- The equipment is mounted on wheels.
- Accessories for studying the electronic stability program ESP (Optional):
  - Direction position sensor.
  - Skid direction sensor (with multiplex).
  - Electronic Control Unit (ECU) motor.
  - Switch to disconnect the ESP.
  - Steering wheel.
  - Car body.
  - Control Panel.
- Dimensions and weights:
  - Equipment dimensions:830 x 875 x 1.770 mm.
  - Package dimensions: 1.025 x 1.080 x 1.955 mm.
  - Package weight: 190 Kgs.

Optional accessory

STABILITY CONTROL ESP

Electronic stability control accessory (ESP) for cars, a feature of and **only applicable to trainer**: EAU-963 ABS / EDS Braking systems.

Adjusting the equipment enables all the reactions, both of the ESP and the ABD as well as the EDS to be checked during possible operating situations for these systems.

A breakdown generation module, by means of switches protected with a cover and a key, or using the virtual breakdown separation software built into the EAU-963 trainer.

Technical characteristics:

- Column sensor.
- Vertical axle and transversal acceleration sensor.
- ESP disconnection switch.
- Steering wheel simulator.
- The equipment enables the different pressure curves and deceleration or acceleration of the system to be viewed using an oscilloscope.

Teaching support:

- User manual.
- Practice activity manual.
- SIRVAUT software:
  - Breakdown control (8 x 3 levels of difficulty) and virtual repair of the same.
  - Tool provides classroom management and student assessment.
  - Communication connector.

Ref.: 9EQ963AAZC

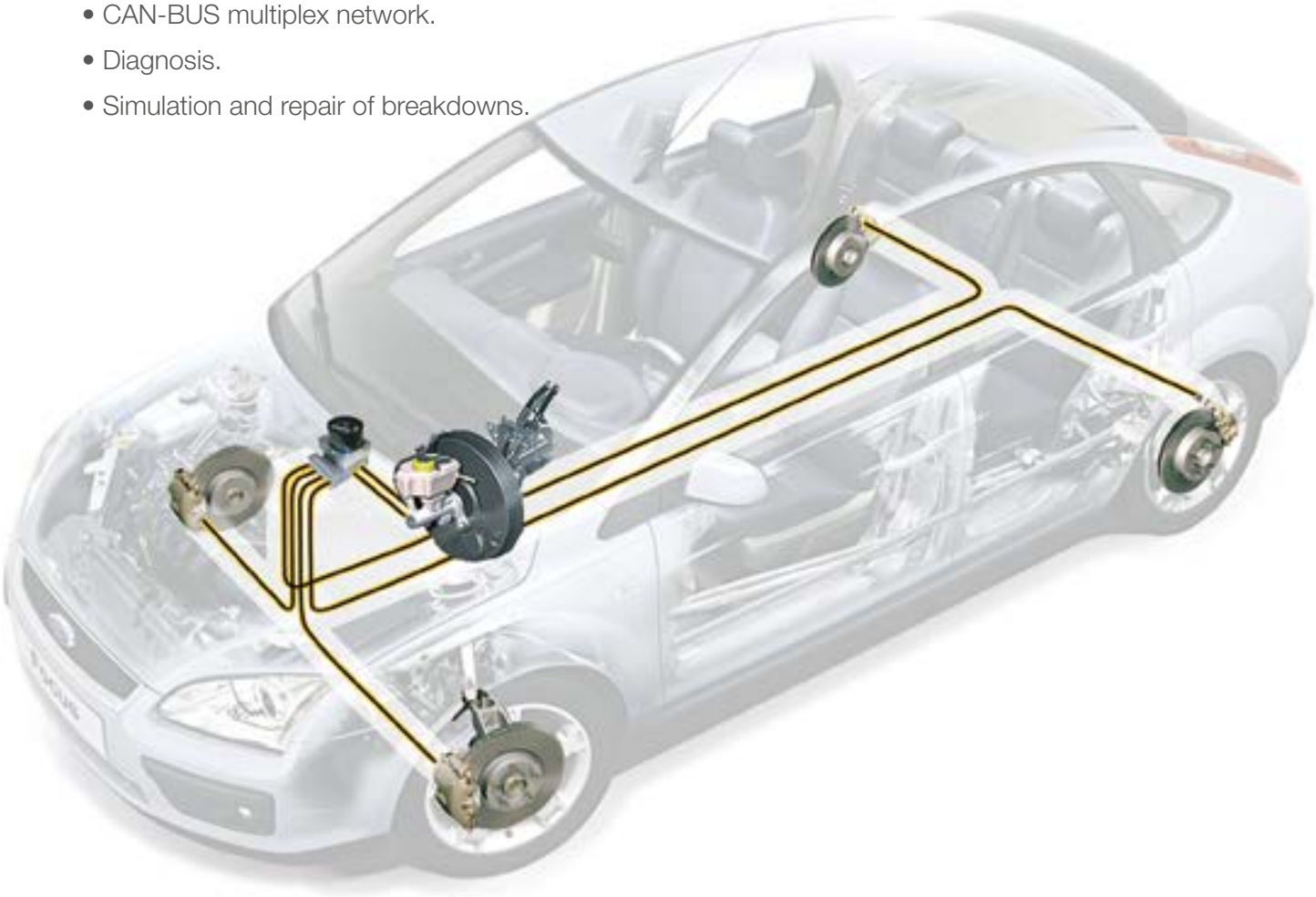
New original components

The components he components used to build the trainer are original, new from the manufacturer, so that the difference between training practice and a real workshop will be minimal.

Fuses, EOBD connector, SIRVAUT and ESP connector.

ABS / EDS / ESP trainer

- Genuine components.
- Antilock brake system ABS-EBD.
- Electronic differential-lock system EDS (traction control).
- Electronic stability program ESP (Optional).
- Servo-brake system.
- CAN-BUS multiplex network.
- Diagnosis.
- Simulation and repair of breakdowns.



Using the trainer's oscilloscope, the different pressure, acceleration and deceleration curves can be viewed.

A system enabling analysis, diagnosis and repair of breakdowns is incorporated into the control panel.

- Terminal plate enabling the measuring of all static and dynamic signals involved in the ABS-EBD / EDS system.
- Breakdown generation module, through the use switches protected with a cover and lock, or through virtual breakdown repair software.
- Equipment usage authorization switch.

EAU-964

Air conditioning trainer

The trainer incorporates all the components and accessories required for operation under conditions very similar to those found in motor vehicles, but with a number of additional pressure gauges and thermometers to facilitate students understanding of the working of the system. It is mounted on a trolley with wheels for easy transportation and a braking systems for ensuring stability once in place.

It incorporates the following real components, arranged in the logical sequence in which they would be found in a vehicle, motor cavity, front interior and rear interior.

Ref.: 9EQ964EAFC - Trif. 380 V

Ref.: 9EQ964EACC - Trif. 230 V

Educational application concept

The learning model is based on the development of activities involving real vehicle elements, arranged according to strict teaching principles in order to facilitate the training process. They aim to:

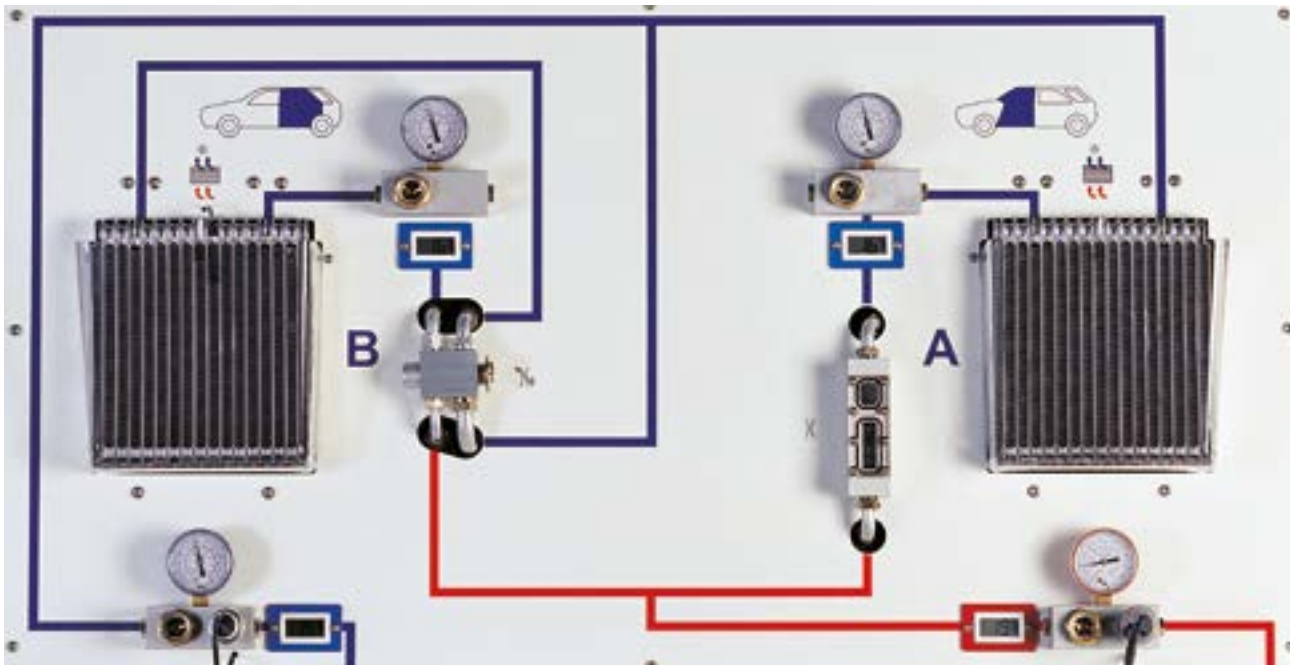
- Be motivating for students.
- Have a real application, combining all aspects of air conditioning systems (components, circuits, loading/ unloading of gas, etc.) logically and effectively.
- Enable the reversal of the classic learning sequence, replacing the component – circuit – application process with that of application – circuit –component.
- Enable students to develop their malfunction diagnosis and repair skills.

Didactic characteristics

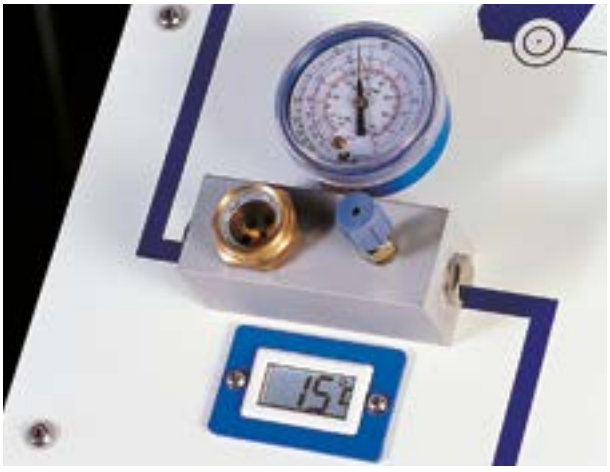
This system enables students to develop the following skills:

1. Analysis of the operating principle of air conditioning systems.
2. Analysis of air conditioning circuits.
3. Interpretation of diagrams.
4. Component control.
5. Malfunction diagnosis and repair.
6. Carrying out of coolant gas loading and unloading processes.
7. Control of air tightness. Leak detection.
8. Use of controls.
9. Use of technical documents.

The system consists of a group of elements that combine to form an air conditioning facility with a double low pressure circuit (A, B). Low pressure circuit A incorporates the fixed calibrated tube system while circuit B encompasses the expansion valve.



The trainer has a series of visual pressure gauges and thermometers that aid the analysis and comprehension of the behaviour of the coolant.



The system is also designed to carry out coolant loading, unloading and recycling operations. The circuit is loaded with coolant R-134a.

Teaching features

The control panel incorporates a system designed and patented by Alecop, which enables the analysis, diagnosis and repair of malfunctions.

- Condenser speed adjustment control (0 to 4000 rpm).
- Terminal block for measuring voltage and current in the system's components.
- Module for generating failures or malfunctions similar to those that may occur in a real vehicle.
- Circuit A or B selector switch.
- Battery ON-OFF switch for carrying out continuity tests.

TEACHING **SUPPORT**

User manual.

Contains information about how the equipment operates, standards for using it, characteristics, maintenance, electrical diagrams, list of breakdowns and their symptoms, etc.

Practical activities manual.

Manual containing the various practical activities that can be carried out using the trainer, complete with the corresponding answers or solutions to make the teacher's job easier. Activities include: individual component identification, identification of systems, signal checking, reproduction and identification of malfunction symptoms, search for and location of malfunctions, proposal of solutions and virtual repair, etc.

Technical specifications

- Variable volume compressor.
- Condenser and double-speed power fan.
- High pressure pressostat.
- Calibrated expansion tube.
- Expansion valve.
- Thermostat.
- 2 evaporators and 2 triple-speed power fans.
- Low pressure pressostat.
- Drier filter.
- Keyswitch.
- A/D drive switch.
- Speed adjustment controls for evaporator air thrusters.
- Condenser speed adjustment control.
- Electric motor with speed variation for driving the condenser.
- 6 coolant status displays, located at the input and output of each component.
- 6 pressure gauges in low and high pressure circuits, for displaying the various pressure levels.
- 6 digital thermometers at the input and output of each component.
- Digital thermometer showing room temperature.
- Specific electrical installation for the A/A system.
- Relay and fuse box.
- Control panel.
- Malfunction generation module.
- Condenser access protection system, with safety microswitch.

Breakdowns

The trainer enables you to generate failures or malfunctions in the various components by means of a programming-repair system.

There are two options:

- Manual malfunction generation system (using switches).
- Intelligent computer-aided virtual malfunction generation system (SIRVAUT), whose interactive software enables students not only to analyse the malfunction, but to repair it virtually as well.

Software SIRVAUT integrado en el equipo.

EAU-962

Auxiliary Electrical Systems with Multiplexing

The trainer is designed to aid the study of new technologies applied to the Auxiliary Electrical Systems incorporated into vehicles, those systems which carry out additional functions (i.e. other than producing movement).

The parts used in the trainer are genuine and found in the most recent generation of the Ford Focus, which uses the Multiplex CAN-BUS network, a system with ultrasound parking sensors, an interior rear-view mirror with automatic darkening and anti-dazzle light sensors, and a combined rain / luminosity sensor to automatically switch on the lights and start the windscreen wipers.

The trainer has the components and accessories necessary for its performance to be similar to those systems contained in a vehicle.

Ref.: 9EQ962EA6C - 230 V

Ref.: 9EQ962EA3C - 115 V

Teaching application

The teaching model is based on activities with genuine car parts arranged to **facilitate the student's learning process**:

- The **application is real**, with all of the pieces of the vehicle that are to be learned about effectively integrated (electrical installations, connections, cabling, components, circuits, etc.).
- Help in **significantly reducing** procedural activities **learning time**, thanks to the easy accessibility to the components, connectors and verification points. In addition, the characteristics of a car mounted motor are preserved.
- The instructor has the possibility of **demonstrating** the various systems and how to check the symptoms of different malfunctions.
- It enables students to develop **diagnostic** capabilities using **professional tools** and to repair break-downs.
- It is **motivational** for the students.

Teaching characteristics

The student will develop many skills using this equipment:

1. Diagram interpretation.
2. Circuit Analysis.
3. Identification of symbols, connectors, cable coding and component location.
4. Verification and analysis of components and systems.
5. Maintenance and regulation of the auxiliary electrical systems.
6. Use and interpretation of technical documentation.
7. Instrument operation for verification and diagnosis.
8. Diagnosis and repair of break-downs.
9. Simulations of malfunctions, verification and symptom recognition.

Teaching features

A system enabling analysis, diagnosis and repair of breakdowns in different circuits is incorporated into the control panel, and includes:

- A terminal plate for measuring the tension and intensity of current in system components.
- Module to generate malfunctions and breakdowns representative of those that could really appear in a vehicle.
- Equipment usage authorization switch.
- Switch to disconnect the multiplex network on the instrument panel.

TEACHING **SUPPORT**

User manual.

This manual contains explanations regarding the workings of different circuits, diagrams of basic principles, real related reference diagrams, fuse characteristic, relays, lamps and electrical boxes, standards regarding light installation, operating standards for the equipment, characteristics, maintenance, etc.

SIRVAUT software integrated in the equipment.

Practice activities manual.

The manual proposes different types of activities that can be carried out using the trainer. It includes answers and appropriate solutions to the problems presented in order to make the teaching process easier. Identification of individual components, identification of systems, verification of sensors and actuators, verification of signals, re-creation and identification of breakdown symptoms, breakdown search and find, proposals for defect resolution, virtual repair, etc.

Wiring diagram manual.

This is a manual of electrical diagrams similar to that used in automobile repair workshops and will help in the activities where circuits are followed, in locating and identifying installations, and in determining the breakdowns that have been initiated in the trainer.

Technical specifications

- Light system with switch and panel illumination:
  - Automatic front headlights with running lights and turn signal, headlight stabilizer in case of braking.
  - Electrical headlight balancing system.
  - Rear lights.
  - Back and front anti-fog lights.
  - Turn signals.
  - Emergency light.
  - Interior light.
  - Hatchback light.
  - Number plate light.
  - Third break light.
  - Backup lights.
- Door and Hatchback opening and closing systems with a remote control:
  - Centralized locking.
  - Fuel tank lock.
  - Hatchback lock.
- Motors and buttons for the front electric windows openers integrated in the multiplex network.
- Rear-view mirrors:
  - Adjustable heated exterior mirrors.
  - Interior mirror with automatic darkening and light sensor based dazzle control.
- Ultrasound parking sensors.
- Rain and luminosity sensor for automatic headlights and windscreen wipers.
- Front and back windscreen wipers.
- Pump for windscreen cleaning liquid.
- Horn with a button incorporated on the steering wheel.
- Accessories plug-in socket.
- Fuel level sensors.
- Motors for automatic closing of fuel tank.
- Switch for brake, hatchback and backup lights.
- Illuminated instrument panel indicating:
  - Lighting and signalling system.
  - Fuel level.
- Emergency light switch.
- Steering wheel with light and windscreen wiper switches.
- Central Electrical Box and battery, fuse, relay unions.
- Standard EOBD (EOBDII) connection.
- Power Supply (battery substitute).
- Back window heating simulator.
- Terminal plates enabling the measurement of signals in different components of the system for analysis, diagnostics and breakdown repair.
- Module for generating breakdowns.
- Safety systems made up by:
  - Function permission button.
  - Protection with bornier tests.
- The equipment is mounted on wheels.
- Dimensions and weights
  - Equipment dimensions: 1.250 x 1.080 x 1.900 mm.
  - Package dimensions: 1.465 x 1.230 x 2.080 mm.
  - Package weight: 300 kg.

INCLUDED ACCESSORIES:
Safety connectors, test points, fuses and screwdrivers.

Breakdowns

Using a repair program system, the trainer can introduce malfunctions or breakdowns to the motor.

There are two options:

- Interactive computer-aided virtual repair system for breakdowns (SIRVAUT) which enables not only break-down analysis but also virtual repair generating a history log for evaluation by the instructor.
- Manual breakdown repair system (using switches)

New real components

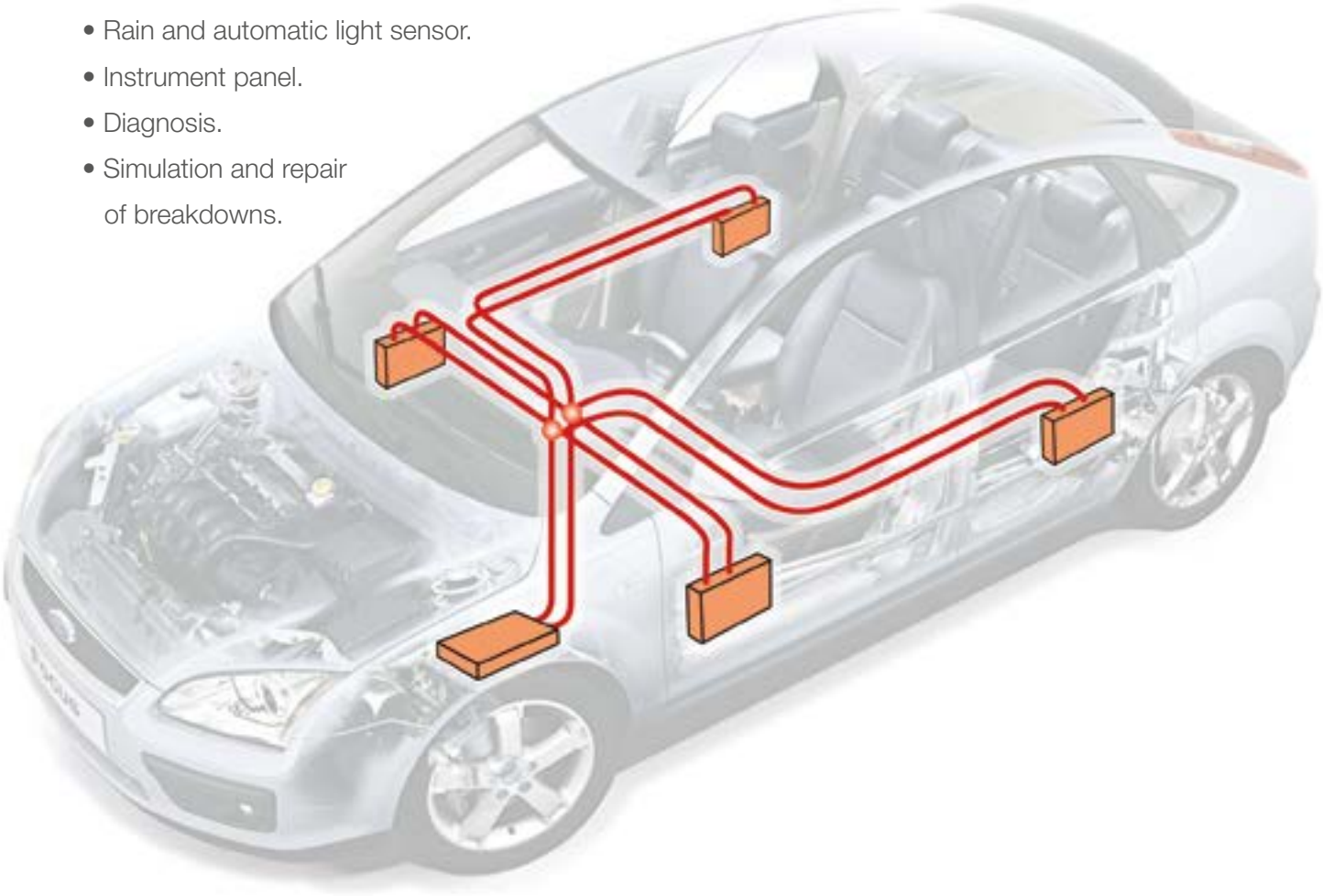
The components used to manufacture the trainer are original and new from the manufacturer, so that the difference between training practice and work in a real workshop will be minimal. Some of the equipment details are presented below:

The components are easily removed with a quick fixing system.

Allows component verification.

auxiliary electrical systems

- Genuine removable components.
- Multiplex CAN-BUS network.
- Lighting and signalling system.
- Door control system.
- Electronic window control.
- Windscreen wiper system.
- Ultrasound parking sensors.
- Rain and automatic light sensor.
- Instrument panel.
- Diagnosis.
- Simulation and repair of breakdowns.



Allows making adjustment to the head-lights and anti-fog lights.

Fuse and relay box (GEM module).

Ultrasound parking sensors.

XENON headlights trainer

Ref.: 9EQXENON6C - 230 V

Ref.: 9EQXENON3C - 115 V

The equipment incorporates a system of bi-xenon headlights assembled with their electrical installation, sensors, actuators and vehicle controls.
To illuminate the full headlights, use the xenon lamp accompanied by a halogen lamp and for dipped headlights only use the xenon lamp as its luminosity is limited by means of a diaphragm in order not dazzle other drivers.
Automatic checking for the height of the lights is used to maintain the lights well adjusted when the bodywork ilts. This adjustment is done using an electrical motor which is controlled by the UCE, based on the bodywork position information, which is transmitted by the front and rear sensors.
The trainer is equipped with all the components and accessories which are necessary for correct operation in conditions which are similar to that of a vehicle.

Didactic application

The learning model is based on developing activities with real vehicle components, available in a didactic medium to ease the student's learning process, so that:

- It has real application, integrating effectively all the target contents for learning about lighting.
- It helps to significantly reduce learning time in the procedure-related activities thanks to the easy accessibility of the components and checking points. Furthermore it maintains the characteristics of the equipment assembled on the vehicle.
- It is motivating for the student.

Didactic characteristics

The student uses this equipment to develop the following skills:

1. Analysis of the operating principle for xenon headlights.
2. Interpretation of diagrams.
3. Circuit analysis.
4. Identifying and locating components.
5. Checking and analysing components.
6. Handling and interpreting technical documentation.
7. Handling instrumentation for checking and diagnosis.
8. Diagnosis and repair of faults.

There is a system designed by Alecop, integrated into the control panel, which makes it possible to measure the signals of all the components within the lighting system, the analysis, diagnosis and repair of faults including:

- Terminal plate for analysis and diagnosis of all the signals in the system.
- Module to generate dysfunctions or faults which are similar to what can really be produced in vehicles.
- Operation authorisation and equipment use switch.
- Indicators for correct battery operation, safety alarm, etc.
- Start up key, battery ON-OFF switch, light panel and instrument panel simulator.
- Shaft sensors, for the system which automatically regulates the height of the headlights with vehicle simulation.

Technical specifications

- Complete bi-xenon light.
- Ignition amplifier.
- Electronic ballast.
- Actuator motor to adjust the height of the focus.
- Front module sensor.
- Rear sensor.
- Headlight cleaner simulator.
- Light control box.
- Ignition key.
- Potentiometer to simulate the vehicle speed.
- Diagnosis connector which is standard EOBD (EOBDII).
- Relays and fuses used in the system.
- Module to generate faults.
- RS-232C series line connector.
- Safety systems made up of:
- Operation permission press button.
- Safety micro-switch for access to headlight components.
- Checking terminal protection.
- Equipment dimensions: 900 x 555 x 355 mm.
- Approx. weight: 16 Kg.

TEACHING SUPPORT

User manual.

This incorporates the total description of the equipment containing the features,usage standards, installation and set up, maintenance, safety measures, wiring diagrams, list of fault generation and their symptoms, etc.

Manual of practical activities.

This is a manual which proposes the different types of practical which can be done with the trainer with the correct answer or solution for the activities to make the teacher's job easier. Individual identification of components, identification of systems, checking sensors and actuators, checking signals, reproduction and identification of fault symptoms, looking for and locating faults, diagnosis code reading, proposal to resolve defects, virtual repairs, etc.

Real car components

Bi-xenon headlight.

Front sensor with integrated module and rear sensor.

Breakdowns

The equipment has the possibility of introducing dysfunctions or faults in its operation by means of a programming-repair system.

There are two options:

- Manual fault repair system (using switches).
- Intelligent system for virtual computer aided fault repair (SIRVAUT), which by using interactive software allows not only analysis of the fault but also virtual repair of the fault generating a report to be evaluated by the teacher.

Relays, fuses, RS-232C and EOBD II connectors.

SIRVAUT Software integrated into the equipment.

Sirvaut

Interactive system of breakdowns Virtual Repair for the automotive

- It allows the teacher to control detailed data and activities of the students in the courses.

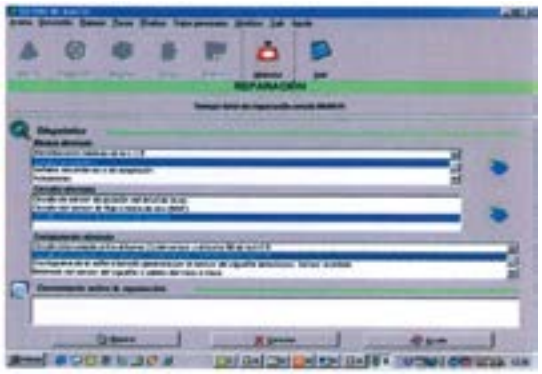
- It allows the student to broach the break down analyse and diagnosis systematically and iteratively.

Access with password

The student may access by entering its personal password. The teacher has access to the exclusive use restricted area by means of a personal password.

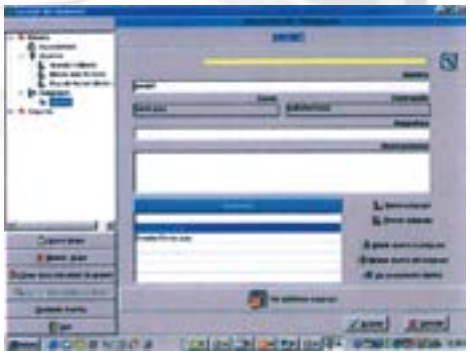
Virtual repair of breakdowns

- Causes breakdowns and malfunctions in the trainers of the automotive industry.
- Different levels of breakdowns repair and indications.
- Guided repair through the authorization option.
- Checking of the individual repair process through historics.
- Introduction of breaks in the repair process.



Classroom management

- Management of the students groups and their individual data.
- Possibility of creating subgroups within a class.
- Data export and import to floppy disk.
- Printing of historic in different formats.



Individual work and teamwork

- Its database stores very useful information for the assessment of the work carried out by each student and by group.

Connecting any trainer of automotive industry to a PC is possible when the SIRVAUT program is installed with list of trainers.

EAU960	fuel injection
EAU961	direct diesel injection
EAU962	multiplexed electrical systems
EAU963	trainer ABS/EDS/ESP
EAU964	air conditioning trainer
XENON	xenon headlights trainer

2 mechanical manufacturing

Our mechanical manufacturing is an outstanding programme, making it possible to design software/ hardware learning environments adaptable to all requirements:

- Machines of different sizes and features.
- Control of machines via PC, using multi-panel software.
- Software for CNC programming and simulation.
- Control of machines via industrial CNC.
- Virtual machines.

All this equipment has the following educational aims::

- CNC Programming.
- Operator skills.
- Implementation and maintenance of CNC MH.

index

customised classroom-workshop

Our mechanical manufacturing is an outstanding programme, making it possible to design software/hardware learning environments adaptable to all requirements:

CONVENTIONAL MACHINES

Babyplast

INJECTION OF PLASTICS

Armoni plus

Apolo plus

PC CONTROL MACHINES

Eclipse

Odisea

Atenea

Hermes

INDUSTRIAL CONTROL MACHINES

Characteristics:

- Machines of different sizes and features.
- Control of machines via PC, using multi-panel software (Fanuc, Fagor, Siemens).
- Software for CNC programming and simulation in different programming languages.
- Control of machines via industrial CNC.
- Virtual machines.

As well as our trainers, we distribute all the necessary material and equipment to complete your classroom/workshop.

PC CONTROL

Wincontrol

Virtool

VIRTUAL MACHINES

Winunisoft

CNC PROGRAMMING

Integral equipment:

- Adjustment
- Bench grinders
- Sharpeners
- Welding drills
- Saws
- Tracing table
- Pneumatics
- Cad
- ...
- Safety equipment utensils and tools

Training goals:

- CNC Programming
- Operator skills
- Implementation and maintenance of CNC MH

Apolo plus

CNC didactic lathe controlled from PC

Multi CNC.
Programming and display of FAGOR, SIEMENS and FANUC simulators.

This is an important step forward for Alecop S. Coop. in the development of educational machines, offering a solution which is tailored to the needs of technical training.

As the result of an analysis of requirements and the adaptation of new technologies applicable to technical training, Alecop S. Coop. opens its doors to this new addition to the family of didactic CNC lathes.

Technical characteristics

Swing diameter	230 mm
Distance between centres	530 mm
Longitudinal Z travel	275 mm
Transversal X travel	96 mm
Spindle motor	Three-phase asynchronous 1,5 Kw
Spindle rotation speed	100 - 4000 rpm
X, Z axes motors	Step 200 s/rev
Quick advance	2500 mm/min
Tool holder turret	8 pos (12 x 12 mm)
Electronic resolution	0,0025 mm
Door opening	Manual
Power supply	220 V 50/60 Hz
Installed power	1,9 KW
Dimensions	1190 x 615 x 700 mm
Approximate weight	300 Kg

Standard configuration

- Integral casing with built-in safety devices.
- Manual 125 mm diameter chuck.
- Conventional tool holder turret.
- Set of user and programming manuals.
- Control software for PC.

Optional accessories

- Manual 60 mm tailstock travel, CM2 morse taper.
- Cooling system.
- Pneumatic 110 mm diameter chuck.
- Tool holder turret with VDI quick change system.
- Automatic access door operated by pneumatic cylinder (for use in CFF).
- Tool holders and carbide inserts.
- Support table for the machine and the PC.
- Winunisoft editing and simulation software.

Wincontrol multi-CNC PC control software

The program allows the user to simulate and execute the machining of a CNC programme, ISO code edited or defined by a CAD/CAM system, analysing the errors that may occur in this.

The machine control is carried out through a realistic simulation of the control panel (FAGOR, SIEMENS, FANUC) with which the user is working.

The main features of the programme are:

- Assisted creation of new projects customised for the chosen control.
- Graphic help menu for programming all ISO functions supported by the chosen control.
- Control of the machine drives.
- Execution of programs in automatic mode or single block.
- Simulation of different tool geometries.
- Simulation in various 3D views of the work-piece, tool and paths.
- Section of the work-piece from different angles.
- Selection of different colours for the different tools.
- Collision detection of the tool and the handle with the part and the jaw chuck.
- Printing of all the data, the CNC programme and the graphic representations.

To all of these features we must also include the high quality graphics that contribute to the speedy understanding of the simulated machining and to the clear detection of errors.

Hermes

Industrial CNC training lathe with integrated PC control

Multi CNC.
Programming and display of FAGOR, SIEMENS and FANUC simulators.
Includes PC, touchscreen and keyboard.

The Hermes lathe with integrated PC and the control program on the machine itself brings the experience of using a PC-controlled industrial machine closer to reality.

Its touch screen and the interactive interface simulation on each ensure the sense of working with the real control, in addition to the advantage of using software designed to form part of the teaching/learning process.

Axes

- Rectified spindles with double nut, prestressed, IT5 quality.
- Linear guide rails with ball recirculation.
- 1.8º step motor

Head

- High precision bearings with 2 rows of angular contact balls.
- Max. torque.: 7Nm a 2000 rpm

Technical characteristics

Swing diameter	230 mm
Distance between centres	530 mm
Longitudinal Z travel	275 mm
Transversal X travel	96 mm
Spindle motor	Three-phased asynchronous 1,5 Kw
Spindle rotation speed	100 - 4000 rpm
X,Z axes motors	step 200 s/rev
Quick advance	2500 mm/min
Tool holder turret	8 pos (12 x 12 mm)
Electronic resolution	0,0025 mm
Door opening	Manual
Power supply	220 V 50/60 Hz
Installed power	1,9 KW
Dimensions	1350 x 600 x 1540 mm
Approximate weight	330 Kg

Standard configuration

- Integral casing with built-in safety devices.
- Manual 125 mm diameter chuck.
- Conventional tool holder turret.
- Set of user and programming manuals.
- Control software for PC.

Optional accessories

- Manual 60 mm tail stock travel, CM2 morse taper.
- Cooling system.
- Pneumatic 110 mm diameter chuck.
- Tool holder turret with VDI quick change system.
- Automatic access door operated by pneumatic cylinder (for use in CFF).
- Tool holders and carbide inserts.
- Support table for the machine and the PC.
- Winunisoft editing and simulation software.

Wincontrol multi-CNC PC control software

The program allows the user to simulate and execute the machining of a CNC programme, ISO code edited or defined by a CAD/CAM system, analysing the errors that may occur in this.

The machine control is carried out through a realistic simulation of the control panel (FAGOR, SIEMENS, FANUC) with which the user is working.

The main features of the programme are:

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- Printing of all the data, the CNC programme and the graphic representations.

To all of these features we must also include the high quality graphics that contribute to the speedy understanding of the simulated machining and to the clear detection of errors.

Eclipse

Didactic Lathe with Numerical Control

Quality and commitment to improve are the allies of our long experience in creating educational solutions. They allow us to be pioneers in offering didactic resources and machines that combine the benefits of productive environment equipment with the sensitivity for training people, the future stars of the productive fabric.

Industrial CNC. There are different CNC options adaptable to the machine, according to requirements.

Coolant system

Manual tailstock (optional)

Flexible Configuration

When configuring the machine, it is possible to choose different options, thereby adapting to the specific needs of each case.

Conventional

VDI.

Indexable turret

The VDI disc turret allows working with pre-set tools which is particularly useful when the same machine is used by different groups of students.

Manual

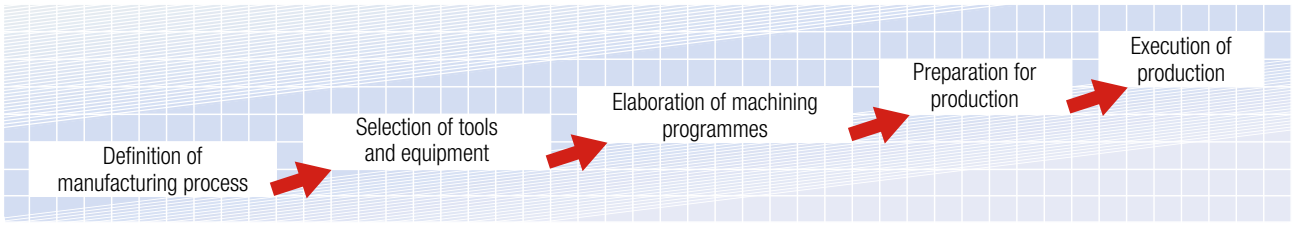
Pneumatic

Jaw chuck

The pneumatic jaw chuck is essential for integrating the lathe in computer-integrated manufacturing systems (CIM). When we choose this option, the automation device for the opening and closing of the jaw is incorporated simultaneously.

Educational solution

We have designed this machine based on requirements geared toward the achievement of educational goals, which in turn respond to the development of specific professional skills.



We have an impact on the learning environment and the ergonomics, taking into account the need to combine individual activities with those of the group. With optional accessories and complements, the machine is integrated into different environments such as:

- Classroom for preparing production.
- Machining manufacture classroom-workshop.
- Computer-integrated manufacturing systems (CIM) classroom.

Electronic controls (optional)

Emergency button

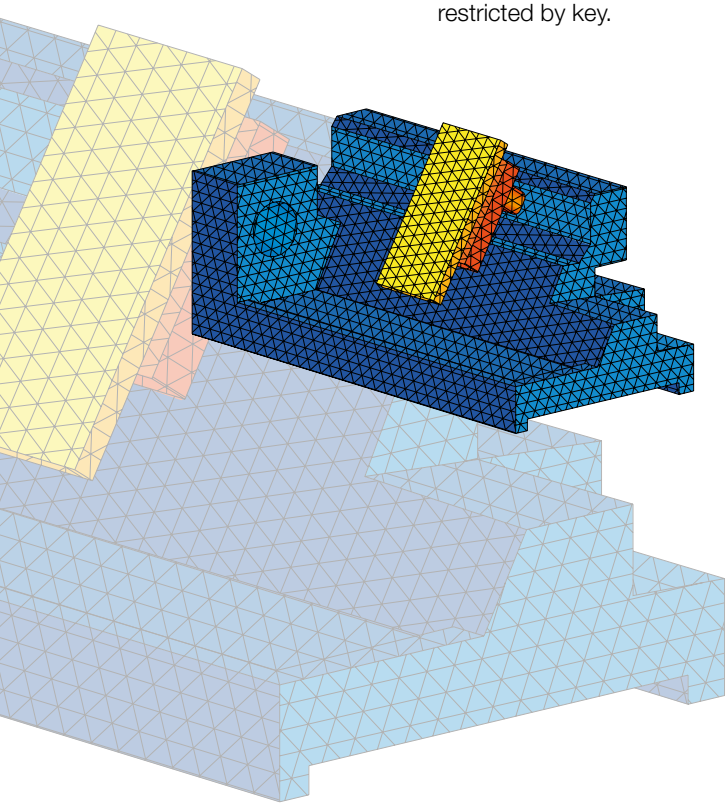
Certified electronic devices

Work tools area

Safety

We think of the safety of people who, in the learning process, start off with a low level of experience in handling machines.

Equipped with access door to areas in movement with locking device which eliminates unnecessary risks when the machine is operating in automatic mode. High resistance integral casing which avoids projection of swarf and coolant. Access to appropriately signalled areas with electrical hazard restricted by key.



Design

Compact. Design integrated into a single body, easy to transport within the Classroom-workshop.

Rigid. Cast iron bed sized using modern CAE calculation tools by finite elements.

Resistant. High cutting capacity valid for coolant.

Coolant tank

Machining manufacturing classroom-workshop

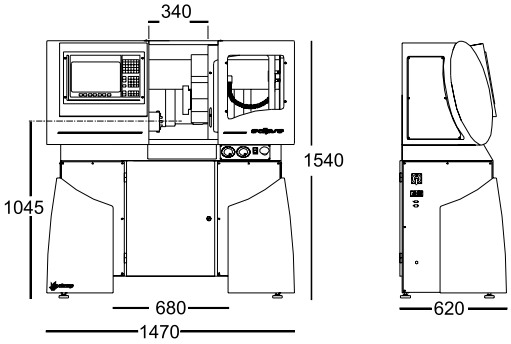
Winunisoft CNC simulator

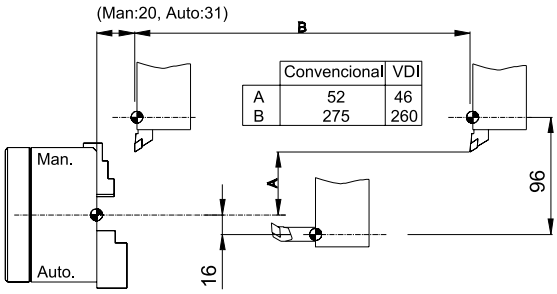
Machining with coolant

Technical characteristics

Material:	Steel F1100
Cutting speed:	200 m/min
Progress:	0.15 mm/pass
Depth of cut:	1.5 mm

Material:	Aluminium alloy COBRAL 11 T3
Cutting speed:	250 m/min
Progress:	0.2 mm/pass
Depth of cut:	2 mm





Swing diameter over bed	230 mm
Distance between centres	530 mm
Longitudinal Z travel	275 mm
Transversal X travel	96 mm
Spindle motor	Three-phase asynchronous 1.5 Kw
Spindle rotation speed	100 - 4000 rpm
Axes activation motors	C.C. (1.44 Nm)
Quick advance	5000 mm/min
Tool holder turret 8 positions (12 x 12 mm)	
Electronic resolution	0,001 mm
Monophase power supply	220 V 50/60 Hz
Dimensions	1470x620x1540 mm
Approximate weight	400 Kg

Armoni plus

CNC didactic machining centre controlled from PC

Multi CNC.
Programming and visualization of FAGOR, SIEMENS and FANUC simulators.

Vertical milling machine controlled by PC ARMONI PLUS, an industrial concept adapted to the educational world. Because safety is a vital factor, with this product we offer an extremely safe option, adapted to the needs of the training process. The optional incorporation of the suitable accessories makes it possible for the equipment to become a complete machining centre, which can be integrated into a flexible system.

Technical characteristics

Longitudinal X travel	200 mm
Transversal Y travel	200 mm
Vertical Z travel	200 mm
Measurements of the work table	450 x 180 mm
Maximum spindle-table distance	320 mm
Spindle motor	Three-phase asynchronous 1,5 Kw
Spindle taper	ISO 30
Spindle motor rotation speed	100-4000 rpm
Axes advance motors	Step 200 ppv
Maximum advance of axes	2500 mm/min.
Electronic resolution	0,0025 mm.
Opening of door	Automatic
Supply voltage	220 V 50/60 Hz
Dimensions of machine	970 x 750 x 900 mm
Approximate weight	310 Kg

Standard configuration

- Vertical milling machine with built-in safety devices.
- Set of user and programming manuals.
- Control software for PC.

Optional accessories

- 8 position tool changer.
- Parts securing device. (Manual jaws, corrected or pneumatic jaws).
- ISO-30 tool holder cones. Clamps and cutters.
- Support table for the machine and the PC.
- Cooling system.
- Silent compressor.
- Winunisoft editing and simulation software.

Wincontrol multi-CNC PC control software

The program allows the user to simulate and execute the machining of a CNC programme, ISO code edited or defined by a CAD/CAM system, analysing the errors that may occur in this.

The machine control is carried out through a realistic simulation of the control panel (FAGOR, SIEMENS, FANUC) with which the user is working.

The main features of the programme are:

- Assisted creation of new projects customised for the chosen control.
- Graphic help menu for programming all ISO functions supported by the chosen control.
- Control of the machine drives.
- Execution of programs in automatic mode or single block.
- Simulation of different tool geometries.
- Simulation in various 3D views of the work-piece, tool and paths.
- Section of the work-piece from different angles.
- Selection of different colours for the different tools.
- Collision detection of the tool and the handle with the part and the jaw chuck.
- Printing of all the data, the CNC programme and the graphic representations.

To all of these features we must also include the high quality graphics that contribute to the speedy understanding of the simulated machining and to the clear detection of errors.

Atenea

CNC industrial machining centre for training with integrated PC control

Multi CNC.
Programming and display of FAGOR, SIEMENS and FANUC simulators.
Includes PC, touch screen and keyboard.

A vertical milling machine, controlled by an integrated PC, **ATENEA goes one step further in bringing our training equipment closer to today's industrial world.**

The integrated PC controlling the machine has multi-control software and a touch screen to provide a close-to-reality experience while remaining a safe, informative training solution for students. Optional inclusion of relevant accessories can turn the unit into a full machining centre that can be integrated into a flexible system.

Axes
- Double-nut, pre-tensioned ground spindles, IT5 quality
- Linear guide rails with ball recirculation.
- 1.8º step motor.

Head
- High precision bearings with 2 rows of angular contact balls.
- Max. torque: 7 Nm at 2000 rpm.

Guard
- Pneumatically operated.

Technical characteristics

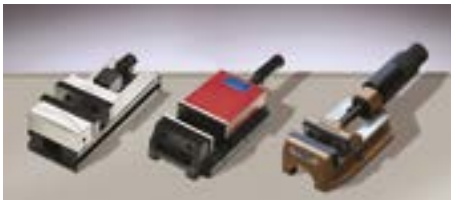
Longitudinal X travel	200 mm
Transversal Y travel	200 mm
Vertical Z travel	200 mm
Measurements of the work table	450 x 180 mm
Maximum spindle-table distance	320 mm
Spindle motor	Three-phase asynchronous 1,5 Kw
Spindle taper	ISO 30
Spindle motor rotation speed	100-4000 rpm
Axes advance motors	Step 200 ppv
Maximum advance of axes	2500 mm/min.
Electronic resolution	0,0025 mm.
Door opening	Automatic
Supply voltage	220 V 50/60 Hz
Dimensions of machine	1460 x 910 x 1870 mm
Approximate weight	400 Kg

Standard configuration

- Vertical lathe with incorporated safety devices.
- PC, touch screen and keyboard (Wincontrol software installed).
- User's and practical manuals.
- Control software for PC.

Optional accessories

- 8 position tool changer.
- Part securing devices (manual or pneumatic jaws).
- ISO-30 tool holder cones. Collets and mills.
- Support table for the machine and the PC.
- Cooling system.
- Silent compressor.
- Edition and simulation Software: Winunisoft.



Wincontrol multi-CNC PC control software

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- Section of the work-piece from different angles.
- Selection of different colours for the different tools.
- Collision detection of the tool and the handle with the part and the jaw chuck.
- Printing of all the data, the CNC programme and the graphic representations.

To all of these features we must also include the high quality graphics that contribute to the speedy understanding of the simulated machining and to the clear detection of errors.

Odisea

Numeric Control Didactic machining centre

Industrial CNC. There are different CNC options adaptable to the machine, according to requirements.

Flexible Configuration

The modular concept makes it possible to configure the equipment based on the selection of different optional devices, going from basic configuration to a completely automatic solution, ready to be integrated in advanced FMS or CIM systems.

Cooling system (optional)

SYSTEM FOR GRIPPING PARTS

High precision manual vice | **Manual operation vice** | **Pneumatic operation vice (3kN)**

Divider chuck for horizontal axis (optional)

Tool changer

- Automatic 8 tool changer.
- Activation by DC gear motor.
- Detector of presence of tool.
- Protected from swarf and coolant.

Conception

Design optimised for agile and reliable operation, integrated in a single body which provides it with the stability and rigidity needed to obtain high machining capacity.

- **Linear recirculating ball bearing guides.**
- **Precision spindles with double ground nut.**
- **High precision bearings in the spindle axis.**

Safety

Because safety is a vital factor, with this product we offer an extremely safe option, adapted to the needs of the training process.

The electromechanical locking system of the protection guard, together with the emergency button and the approved safety modules, stop the user from coming into contact with the moving parts.

Clean work area thanks to integral protective casing which gathers the swarf and coolant without blocking visualisation and access for loading, unloading and verification operations.

Electronic controls (optional)

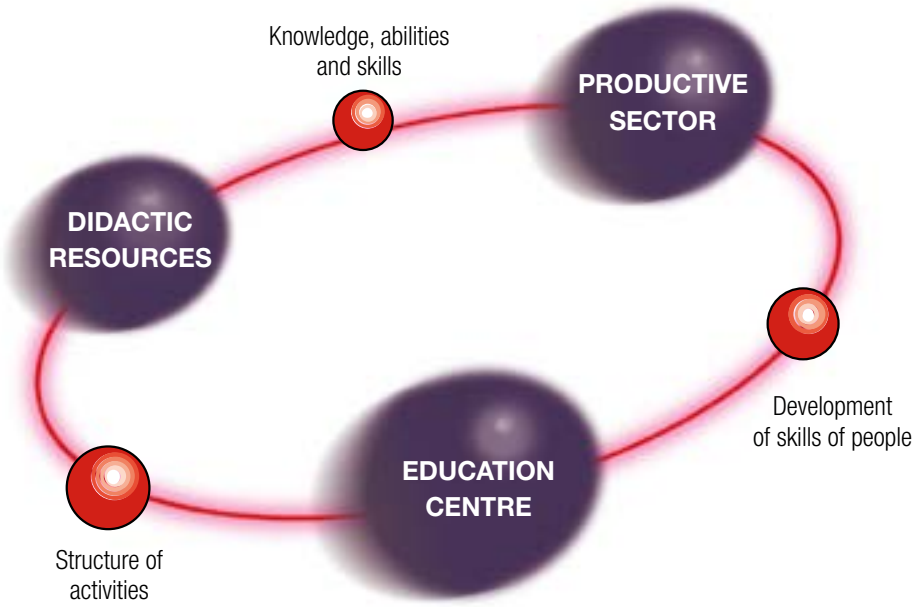
Chucks and tools

Emergency button

Certified electronic devices

Training for the future

People's professional development must be based on activities which allow the transfer of the acquired knowledge to other contexts similar to those used during the learning/ teaching process.



Our equipment provide excellent educational resources thanks to their capacity to induce real work situations on which to contextualise the learning process. We offer the perfect instrument to orchestrate training activities which lead to the development of future professionals.

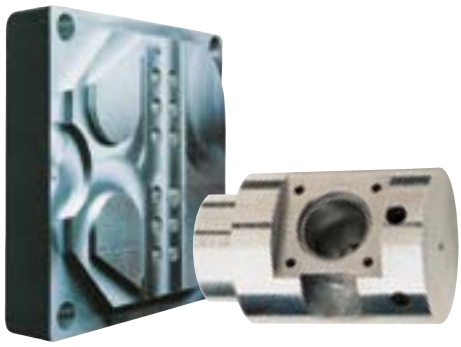
Manufacturing classroom-workshop

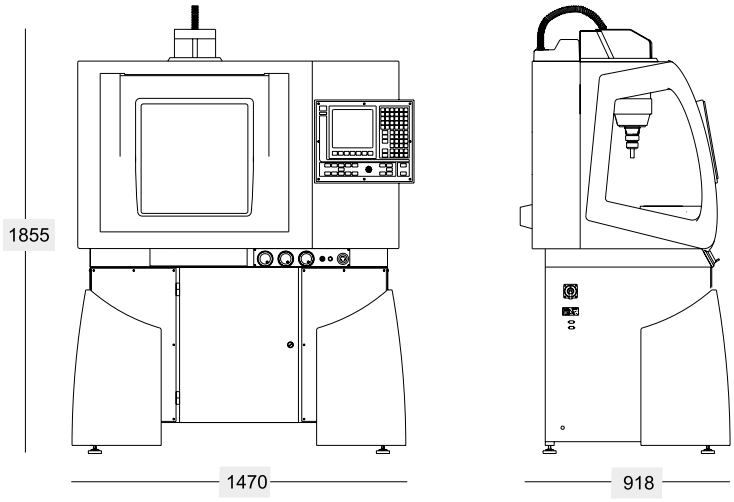
Machining with coolant

Winunisoft CNC Simulator

Cooling equipment (optional)

Technical characteristics





Longitudinal X axis travel	200 mm
Transversal Y axis travel	200 mm
Vertical Z axis travel	200 mm
Measurements of the work table	450x180 mm
Maximum spindle-table distance	320 mm
Spindle taper	ISO 30
Spindle motor	Three-phase asynchronous 1,5 kW
Spindle rotation speed	from 100 to 4000 rpm
Spindle taper	ISO 30
Axes activation motors	CC (1.44 Nm)
Quick advance	5000 mm/min
Electronic resolution	0,001 mm
Door opening	Automatic
Monophase power supply	230V 50/60Hz
Measurements	1470x 918x 1855 mm
Approximate weight	550 Kg

WinUnisoft

Training software for CNC programming

SIMPLIFYING LEARNING.

The Alecop commitment to develop training materials finds its highest expression in the training software for editing and simulating **WinUnisoft** CNC programs. This product, leader in its sector, is an easy to handle tool but with effective results and allows the user to experiment, on a single platform, with the programming of the different numerical controls which are on the market.

Universal concept

WinUnisoft consists of a series of independent modules which give the program the necessary flexibility to adapt to the requirements of each training environment. These are some of its most outstanding features.

AVAILABLE FOR THE FOLLOWING MODELS:

SIEMENS
- SINUMERIK 810-T/M
- SINUMERIK 840D-T/M

FANUC
- GE FANUC Series 21i T/M
- GE FANUC Series 0i T/M

FAGOR
- FAGOR 8025 T/M
- FAGOR 8050-55 T/M

To access the list of functions simulated for each CNC refer to: **www.alecop.com**

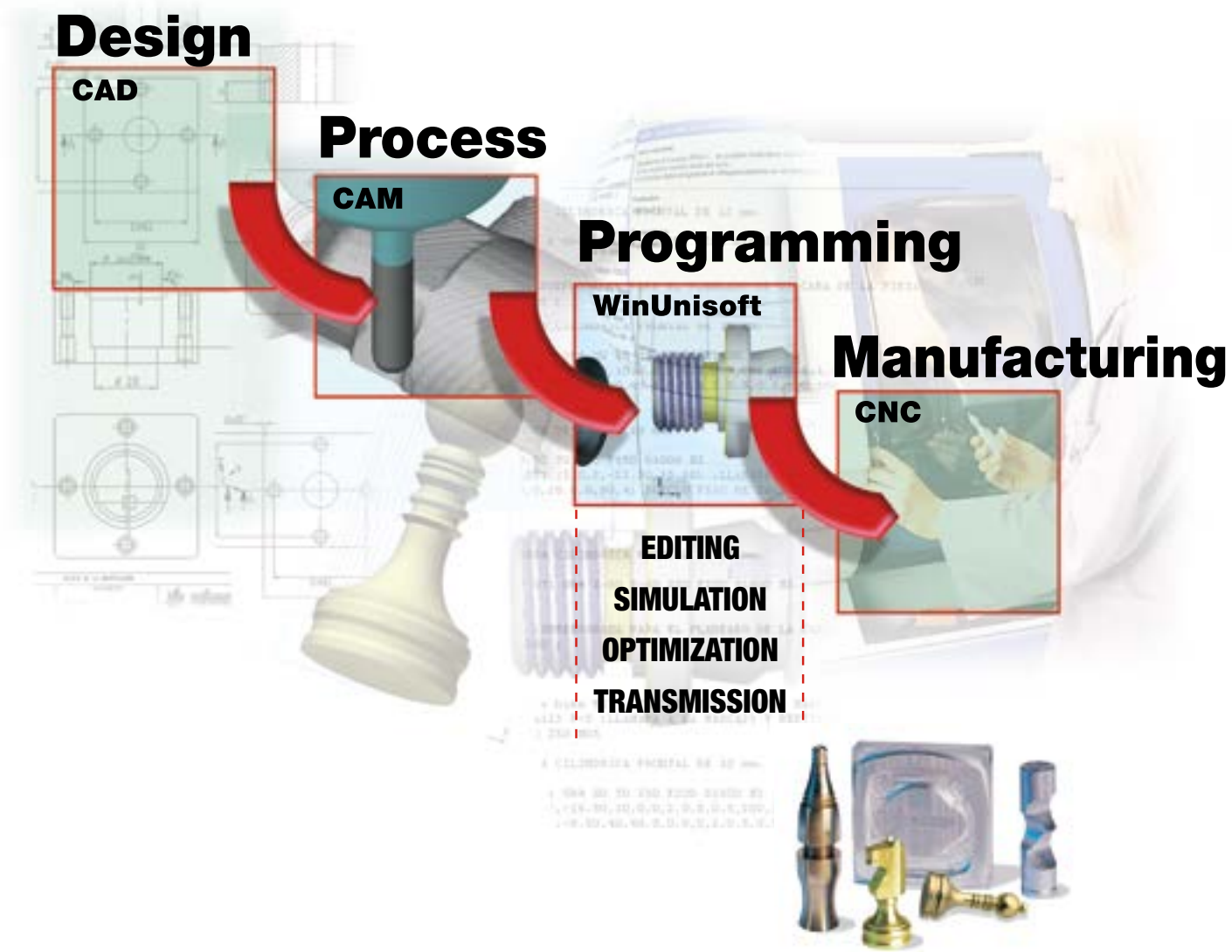
- A common platform for learning the different programming languages used by the major manufacturers of CNC.
- In the same programme the user works, simultaneously, with lathe and milling machine exercises.
- Wide range of exercises suggested for turning and milling that allows the programme to be adapted to the different educational levels.
- The acquisition of the licenses for the various programming languages can be made gradually. Each license includes the lathe and milling machine version.

Integrated in the process

In the teaching and learning process it is essential to have tools that simulate and adapt the machining programmes before execution in order to avoid risks and reduce the time of machine use.

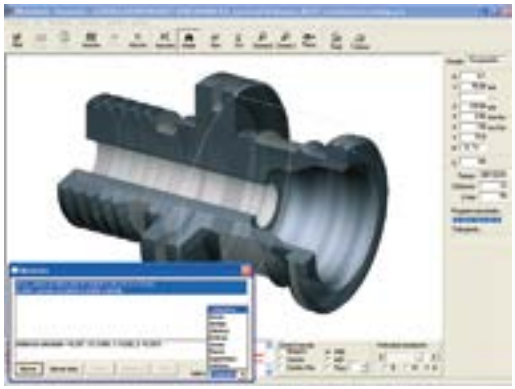
By using the WinUnisoft software, the student is able to:

- Know, understand and master the various programming languages used by the different CNC.
- Perform modifications of programmes generated by CAD/CAM tools.
- Create their own machining programmes.
- Transfer programmes directly to the machine.



Designed for learning

WinUnisoft was designed specifically to be used in the learning-teaching process. Without neglecting the technological content, the programme has been equipped with specific provisions to aid the student in a fast acquisition of knowledge.



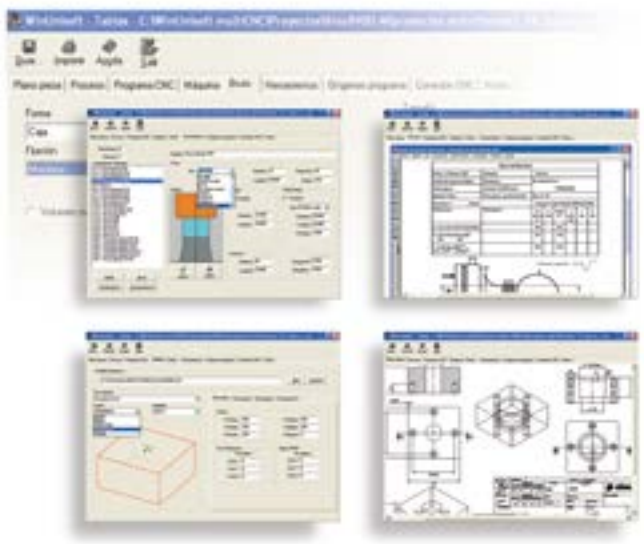
- Graphic help menu for programming all ISO functions.
- Adaptation of the software parameters to any tool machine (industrial or didactic).
- Definition of different types of parts and holding systems.
- Simulation in various 3D views with representation of the tool and paths.
- Graphic editor of cutting tools with a wide range of predefined shapes.
- Sectioned display of the work-piece from different angles.
- Calculation of machining time.
- Collision detection of the tool and the handle with the part and the jaw chuck.
- Inspection and measurement of the shape of the part. Detection of basic shapes (arcs, angles,...).
- Printing of the CNC programme and the graphic simulation.
- Connection via DNC with the numerical controls (sending, receipt and execution of programmes from the PC).

Work organised by projects

Unlike the industrial simulators, where work is performed only with the machining programme, in the **WinUnisoft** software, the exercises are developed based on what is called “Machining project”. Each machining project has the following information, configurable by the user:

- Angle of the finished part (in GIF, JPG, BMP or WMF format).
- Machining process (in TXT or PDF format).
- Tool machine technical sheet and type of CNC.
- Dimensions of the raw work-piece.
- Tools table.
- Programme source table.
- CNC Programme.

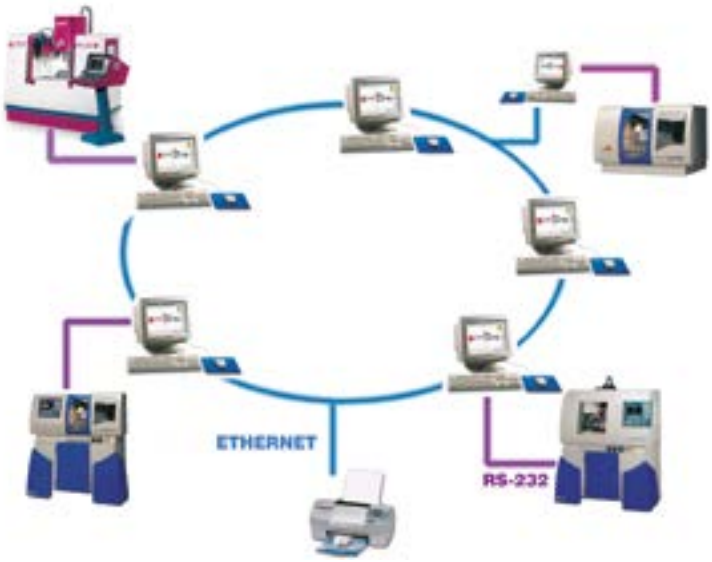
For each project, by combining the different documents described above, we can define multiple types of work exercises, which allow the teacher to establish the didactic curriculum for the students to develop analysis, deduction and execution skills, among others.



CNC Classroom

The WinUnisoft software is included in a CNC Classroom configuration which makes it possible to easily yet efficiently share the resources available at the centre.

This classroom, based on the use of a local network (Win98/2000/XP), allows the communication of all programming posts with all the CNC and printers. The main advantages of this configuration are:



- Unlimited number of programming posts.
- Industrial and didactic machines can be combined in a single classroom, with different numeric controls.
- Programmes from all the machines connected to the classroom can be sent and received from any computer.
- The programme is compatible with remote control and access applications.
- The classroom does not require specific devices, which makes it possible to use it for other applications such as CAD- CAM, Management IT, etc.

Configure your own CLASSROOM

Configure your training classroom according to your needs at any given time. Quickly and cheaply as a complement to the USB key protection version, incorporating a new protection system via the internet, **WinUnisoft** is available in three models of web license:

- **Temporary 4 month license.**
- **Temporary 1 year license.**
- **Unlimited license.**

- In this way you can adapt your resources to your needs at all times and offer your students the possibility to acquire the product for their training period, freely selecting the different modules according to the type of machines and numeric control.
- The programme is downloaded via the download section of the Alecop S. Coop. Web page.
- When using the programme it is necessary to have internet connection. Access is temporary and of very short duration.

Wincontrol

Software for the editing, simulation and control of machines from PC

Wincontrol is distributed with the Alecop PC machines and allows the user to edit the ISO code, simulate the execution of programmes and control machines by using the control simulator of their choice:

- **FAGOR**
- **SINUMERIK**
- **FANUC**

Main characteristics

- Assisted creation of new projects.
- Editing with graphic help menu for programming all ISO functions.
- Editing using the Copy-cut-Paste functions of Windows.
- Customisation of the characteristics of the machine which is going to be used.
- Simulation of different tool geometries for lathe and milling machine.
- Simulation in various 3D views with representation of the tool and paths.
- Representation of the jaw and the chuck.
- Selection of different colours for the different tools.
- Calculation of machining time.
- Collision detection of the tool and the handle with the part and the jaw chuck.
- Preparation of the machine for executing the machining. Control of axes, speeds, tool setting, pre-selection of sources.
- Control of machining of the part in the machine, with continuous execution or block by block.
- Printing of all the data, the CNC programme and the graphic representations.

To all of these features we must also include the high quality graphics that contribute to the speedy understanding of the simulated machining and to the clear detection of errors.

Work process

WinControl allows the user to learn the processes necessary to define the machining of a work-piece through practical exercises of this, starting from the plan and the manufacturing process and finishing with the control and execution in the machine.

Choose numerical control

- Choose the type of control simulator with which we are going to work. Hereinafter, the code editing and the screen display of the control are those chosen by the user.

Elaboration of the CNC programme (with the programming help menu)

- Use of the help menu to choose the appropriate code and define it parameters.
- Detection of syntactical errors while writing or via the Analyse option to verify the complete programme.

Definition of the data of the machine, part, tools and origin of work-piece

- Definition of the machine data to determine the possibility of machining the part on the machine.
- Representation of the jaws and the chuck to detect tool collisions.
- Definition of the tool with its geometry and corrector.

Machining simulation

- Different graphical representations of the part (zoom, number of views, sections, angle, etc.) and the type of simulation (solid, trajectory with or without compensation).
- Detection of programming, syntactical and trajectory errors.

Machining on the machine by handling of the chosen control panel

- Execution of the machining of the part on the machine with stoppage control, block by block execution, MDI programming, speed control, device control, etc.
- The machine handling is carried out through the simulation of the control panel or with a generic representation.

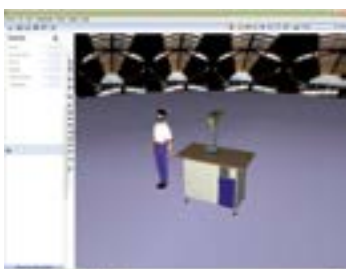
VIRTOOL

Interactive virtual environment for training in the use of tool machines.

System based on interactive 3D graphs and virtual reality techniques which offer innovative possibilities for training.

VIRTOOL Machine is a software designed and developed for training in the preparation and use of swarf start up machines, both conventional and CNC.

With VIRTOOL Machine, students can carry out initial training with a virtual machine which will considerably reduce necessary work time when they move on to a real machine and will help them acquire and reinforce the basic concepts for preparation and machining on conventional and CNC machine-tool.



The virtual machines work just like the real machines. Each virtual machine, in 3D, is distributed with practice cases or case studies supported by a full set of theoretical content.

Learning by doing

The application is based on problem-based learning and enables independent study. Its advanced educational design is a result of the latest studies conducted in this field and the most up-to-date technology. (PBL Problem Based Learning, Self-Training, Learning by Doing).

Machines available 24 hours

It makes it possible to work on machines with low availability for an unlimited time.

Safe and indestructible machines

Reduces the risk of accidents and damage to the equipment during the training process.

Reduces the cost of the learning process

Reducing the time needed at machines and allowing a truly efficient learning process with less need for support from a teacher.

One machine, one student

It makes the work in the classroom and workshop more flexible, difficult to achieve when working in classrooms where there are only real machines.

Working with a VIRTOOL Machine

The practical activity library, distributed with every virtual machine, is divided into case studies. The classification of cases dealt with is very complete and ranges from the identification of tools to the machining of complex parts, covering the handling of CNC controls.

With VIRTOOL Machine, the user/student performs the learning activities by solving case studies in a virtual environment. Users have all the information required for the case studies for each machine:

- A full description.
- Back-up materials.
- Instructions are constantly provided and errors notified, helping students to successfully solve all the case studies.
- Online reports can be obtained for student assessment by the tutors.

Interaction with the machine

It is performed through a series of operations which allow the student to machine complex parts:

> **Select:** It allows user to identify elements.
> **Assemble:** It allows the user to assemble an element on the machine or on another element shown in the scenario window.
> **Dismantle:** It allows the user to dismantle, dismount or release an element from the scenario.
> **Close:** It allows the user to tie or fix an element to another on the machine, using a tool if necessary.
> **Open:** It allows the user to release or loosen an element on the machine, using the appropriate manual tool.
> **Move:** To move the mobile elements sequentially or continuously.
> **Machining.**
> **Turn the part.**
> **Dimension viewer:** Activates a dimension viewer that works like the real thing.
> **CNC:** Activates the numerical control simulator for CNC machines. This control is handled and interacts with the machine in the same way as the real control.

Moving in the 3d world or scenario

It is very simple and intuitive. It even includes pre-set displays to resort to if in need of a specific element.

Licences system

Configure your own CLASSROOM

Configure your training classroom according to your needs at any given time. Choose and combine from the different protection methods available:

> **Hardware protection via USB key.**
> **Web protection with three models.**

- **Temporary 4 month license.**
- **Temporary 1 year license.**
- **Unlimited license.**

- In this way you can adapt your resources to your requirements at all times and offer your students the possibility to acquire the product for their training period.
- Each machine is licensed separately.

ECLIPSE Lathe numerical control FAGOR 8055T

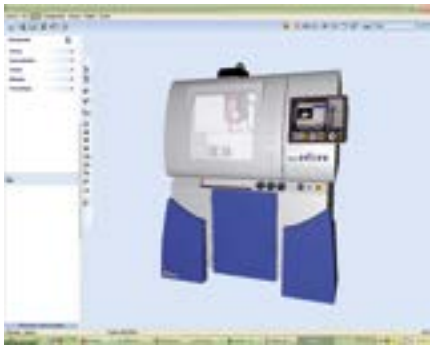
ECLIPSE is the Alecop CNC lathe. It exists as a real machine and a virtual machine, both operating in the same way.

It is currently distributed exclusively with the FAGOR 8055T control simulator.

With its complete set of exercises, or case studies, the student can study everything from the machine components to the virtual performance of complex machining, highlighting:

- Identification of the machine parts.
- Handling of the machine (movement of carriages, spindle movements).
- Identification and assembly of tools and tool holders (VDI disk).
- Types of fastenings, selection and assembly of parts.
- Safety elements.
- Identification and performance of machining processes.
- Execution of machining programmes.
- Basic handling of a CNC:
  - > Search for 0.
  - > Establishing speeds of carriages and spindle.
  - > Working in MDI mode.
  - > Working in automatic mode.
  - > Working in manual mode.
  - > Modification of tool correctors.
  - > Execution of programmes.

ODISEA milling machine numerical control FAGOR 8055M



ODISEA is one of the Alecop CNC milling machines. Odisea exists as a real machine and a virtual machine, both operating in the same way.

It is currently distributed exclusively with the FAGOR 8055M control simulator.

With its complete set of exercises, or case studies, the student can study everything from the machine components to the virtual performance of complex machining, highlighting:

- Identification of the machine parts.
- Understanding the dynamics of the machine.
- Types of fastenings and their elements. Assembly and adjustment of components.
- Identify and assemble tool holders, tools and auxiliary elements in an automatic tool storage system.
- Basic handling of a CNC:
  - > Preparation for machining.
  - > Working in MDI mode.
  - > Working in manual mode.
  - > Modify tool correctors.
  - > Execution of programmes.
  - > Execution of machining processes. Complex machining processes.

VIRUFRE universal milling machine

It is the VIRTOOL machine milling machine and with its set of exercises or case studies the student will be able to develop certain skills.

Each case study has a specific aim, studying everything from the machine components to the virtual performance of complex machining processes, highlighting:

- Identification of the machine parts.
- Understanding the dynamics of the machine.
- Types of fastenings and their elements.
- Assembly and adjustment of components.
- Identify and assemble tool holders, tools and auxiliary elements.
- Preparation for machining.
- Handling of the machine.
- Perform basic machining processes.
- Execution of machining processes.
- Complex machining processes.

VIRUTOR Parallel lathe

Virutor is the VIRTOOL conventional parallel lathe.

With this and the library of case studies it includes, the following is covered:

- Identification of the machine parts.
- Handling of the machine (movement of carriages, spindle movements).
- Identification and assembly of tools and tool holders.
- Types of fastenings, selection and assembly of parts.
- Calculation and establishment of cutting conditions.
- Safety elements.
- Identification and performance of machining processes.
- Execution of machining processes.

Babyplast 610P

Plastics injection machine

An industrial machine adapted for training. Ease in implementation, simple programming via touch screen, proportional control on all axes, highly reliable and low maintenance.

Babyplast is the result of over 10 years' experience in the field of micro-injection. It is specially adapted for training.

- Very easy programming through menus identifiable by icons.
- Synoptics, indicating the status of the sensors and actuators in real-time, allowing the monitoring of production.
- Compact, silent and clean.
- Easy to maintain: modular conception.

Technical characteristcs

Piston diameter (mm):	10	12	14	16	18
Injection pressure (KG/cm):	2650	1830	1340	1030	815
Closing force: 62,5 KN					
Opening force: 4 KN					
Opening travel: 30 -110 mm					
Expulsion Force: 7,5 KN					
Expulsion travel: 45 mm					
Hydraulic Pressure: 130 bar					
Oil tank capacity: 16 litres					
Cycle on empty: 2,4"					
Installed power: 2,95 Kw					
Mould thickness: 70:135 mm					
Memorisation of parameters: 100 moulds					
Refrigeration open water circuit					
Refrigeration (optional): closed table-cooling circuit					
Weight: 125 Kg					
Dimensions: 1100 x 500 x 700 mm					
Supply: 3x 380 Vac (3 phases+neutral+earth)					

An industrial machine

- BABYPLAST 610 is a bench press which makes it possible to inject the majority of thermoplastic materials on the market: PP, PA, ABS, PS, PBT, POM, PPS.
- Totally hydraulic machine with supply unit, pump and deposit built in.
- Display manometers: injection pressure, mould closing pressure.
- Microprocessor of the control unit with colour touch screen.
- USB Connectivity and Ethernet.
- Five piston sizes for perfect adaptation to planned production.
- Control of all movements in closed loop by proportional control.
- It has two programmable outlets for managing cores, air streams, etc.
- Four heating areas with digital PID regulators.
- Control of cooling of four areas by flow meter.

An original mould system

- The housing and plates system is an integral part of the machine.
- Only the imprint block is interchangeable.
- The traditional structure of the mould is respected.
- The advantages of this device are:
  - Reduced cost of moulds.
  - Low production cost.
  - Precision of the parts produced.

Maximum security

- Emergency stop using push-button.
- Protective screen with detectors.
- Hydraulic safety which blocks any risk of movement when the guard is open.
- Protection of hot areas.
- Part recovery box and ramp for purge outlet.
- CE and CEM certification.

3

analog electronics, digital and microprogrammers

index

The teaching dice system

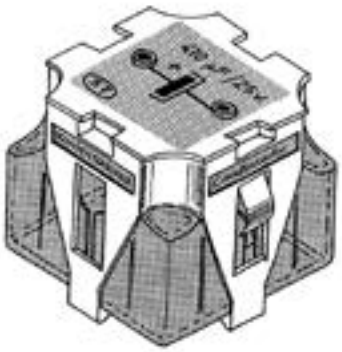
A modular arrangement that allows the design and analysis of circuits as per the user's needs. The dice are mounted onto a circuit board, which is also modular and has unlimited possibilities for working horizontally or vertically.

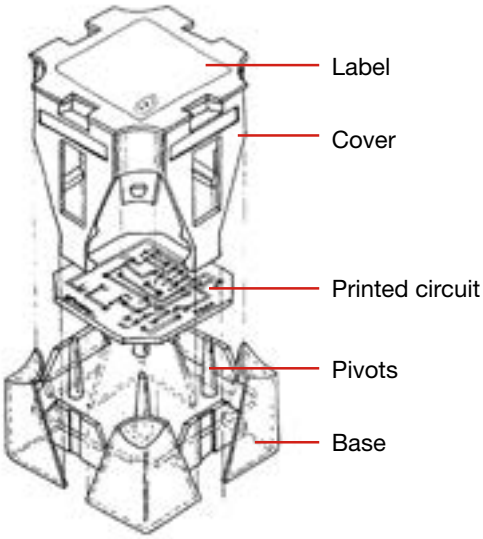
The entire system can be fitted on the tabletop frame, permitting combined assemblies involving fully compatible modules and panels. They are also suitable for demonstration purposes.

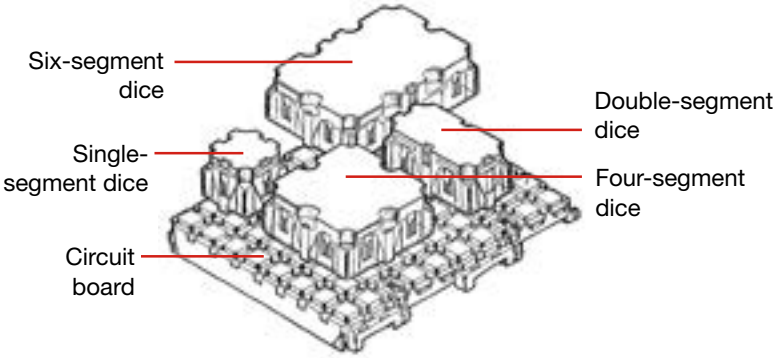
The design of the dice ensures the system is extremely versatile: they are ergonomic, stackable and made of strong shockproof material. Their transparent base protects the component or circuit, whilst providing a clear view of the inside.

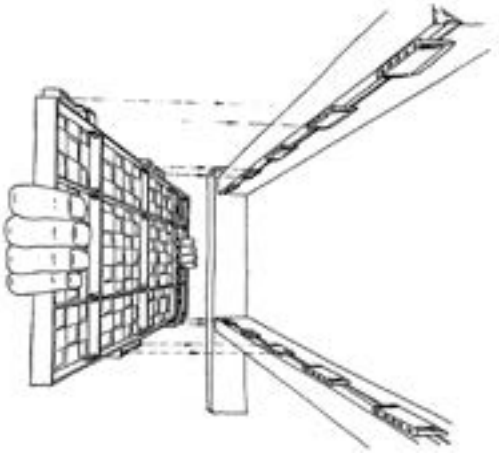
Further highlights:

- It has a side conductor panel that transmits the current to the adjacent dice, avoiding the need for multiple wiring.
- It includes a recess for the attachment of labels (included) with the name of the component or circuit in several languages.
- The connection is made through extremely robust 2 mm eye bolts.
- The component's symbol is printed on the upper part of the dice in accordance with European regulations and the International Electrotechnical Commission (IEC).




Label
Cover
Printed circuit
Pivots
Base


Six-segment dice
Double-segment dice
Single-segment dice
Four-segment dice
Circuit board



Educational analog electronics equipment

Ref.: 9EQBTELG5A

It is based on a set of electronic elements mounted on modular frames (block) which enable you to analyse and design analog electronics circuits in a quick, convenient and reliable way.

CONTENTS

- 2 no. 201 blocks: open connection.
- 1 no. 208 block: 1-component frame.
- 2 no. 210 blocks: 4-pin component support.
- 1 no. 213 block: 1 circuit/2 position Commutator.
- 6 no. 220 blocks: support resistance (simple).
- 3 no. 221 blocks: support resistance (double).
- 2 no. 223 blocks: 10 ohm / 4W Resistance.
- 1 no. 224 block: 47 ohm / 4 W Resistance.
- 2 no. 225 blocks: 100 ohm / 4 W Resistance.
- 1 no. 226 block: 470 ohm / 2 W Resistance.
- 2 no. 229 blocks: resistance 10 K / 0.5W.
- 3 no. 238 blocks: electric condenser support (simple).
- 2 no. 240 block: support capacitor (simple).
- 1 no. 247 block: 100 nF Condenser.
- 1 no. 252 block: 100 uF Condenser.
- 2 no. 253 blocks: 470 uF Condenser.
- 1 no. 254 block: 1000 uF Condenser.
- 1 no. 263 block: 2 Kohm potentiometer.
- 1 no. 264 block: 5 Kohm potentiometer.
- 1 no. 265 block: 10 Kohm potentiometer.
- 1 no. 266 block: 50 Kohm potentiometer.
- 1 no. 267 block: 100 Kohm potentiometer.
- 1 no. 268 block: 500 Kohm potentiometer.
- 4 no. 270 blocks: 1N4007 diode.
- 1 no. 273 block: BZY97C10V Zener diode.
- 1 no. 276 block: photodiode.
- 1 no. 279 block: phototransistor.
- 1 no. 280 block: BC337 transistor.
- 2 no. 282 blocks: BD137 transistor.
- 1 no. 283 block: BD138 transistor.
- 1 no. 288 block: unijunction transistor 2N2646.
- 1 no. 294 block: DB3 diac.
- 1 no. 295 block: thyristor C106D.
- 1 no. 296 block: SC141D triac.
- 1 no. 314 block: large fixture.
- 1 no. 333 block: bridge rectifier.
- 1 no. 350 block: Operational E. Connect.
- 1 no. 351 block: Operating with connected inputs.
- 1 no. 358 block: Red LED.
- 1 no. 363 block: 12 + 12V transformer.
- 2 no. 372 blocks: 100 mH inductance.

Standard accessories included:

- Base Plates circuit assembly.
- Set of parts / consumables.
- Connectors.
- Storage Boxes.
- Field Manual.

Optional accessories:

- Desktop Chassis.
- Instrumentation (oscilloscope, multimeter ...)
- Manual of theoretical.

Advanced analog electronics complement

Ref.: 9EQANALAVA

Given set of plug-in that allows zener study, regulators, optocouplers, resistance NTC, PTC, LDR etc.

CONTENTS

- 1 no. 228 didactic block: 4.7 Kohm resistance / 0.5.
- 1 no. 246 didactic block: 47 nF capacitor.
- 1 no. 251 didactic block: 10 mF capacitor.
- 1 no. 262 didactic block: 1 Kohm potentiometer.
- 1 no. 272 didactic block: BZY97C5V1 Zener diode.
- 1 no. 274 didactic block: BZY97C12V Zener diode.
- 1 no. 285 didactic block: FET 2N5486.
- 1 no. 286 didactic block: Transistor FET 2N5460.
- 1 no. 287 didactic block: PUT 2N6027.
- 1 no. 330 didactic block: regulator 7805.
- 1 no. 331 didactic block: 7905 controller.
- 1 no. 332 didactic block: LM317 regulator.
- 1 no. 335 didactic block: H11A1 Optocoupler.
- 1 no. 336 didactic block: 6N136 optocoupler.
- 1 no. 341 didactic block: NTC resistance.
- 1 no. 342 didactic block: PTC.
- 1 no. 343 didactic block: LDR resistance.
- 1 no. 345 didactic block: 2 relay contacts / 2 positions.

Educational digital electronics equipment

Ref.: 9EQBTELD5A

It is based on a set of electronic elements mounted on modular frames (block) which enable you to analyse and design digital electronic circuits in a quick, convenient and reliable way.

CONTENTS

- 3 no. 220 block: resistance mount.
- 2 no. 240 block: condenser mount.
- 1 no. 282 block: BD 137 transistor.
- 1 no. 212 block: NA button.
- 1 no. 311 block: small D.C. motor.
- 1 no. 340 block: quartz crystal.
- 1 no. 345 block: 2c 2p relay.
- 3 no. 400 block: 4 2-input AND gates.
- 4 no. 401 block: 4 2-input NAND gates.
- 2 no. 402 block: 4 2-input OR gates.
- 4 no. 403 block: 4 2-input NOR gates.
- 2 no. 404 block: 4 2-input XOR gates.
- 2 no. 406 block: 6 inverters.
- 4 no. 411 block: J-K weighgear and R-S inputs.
- 2 no. 412 block: 2 type J-K weighgears.
- 1 no. 413 block: D weighgear and R-S inputs.
- 1 no. 414 block: type D weighgear.
- 2 no. 422 block: 4-bit adder with carry.
- 2 no. 423 block: 4-bit comparator.
- 1 no. 425 block: shift register.
- 1 no. 426 block: 4 Tri-state power dividers.
- 1 no. 427 block: 4-output demultiplexer.
- 3 no. 428 block: 4-input Tri-state.
- 1 no. 429 block: 8-output decoder.
- 1 no. 430 block: decimal BCD decoder.
- 1 no. 431 block: 7-segment decimal decoder.
- 1 no. 432 block: 7-segment display.
- 1 no. 433 block: 7-segment display with BCD input.
- 3 no. 434 block: 4-bit counter.
- 1 no. 435 block: 4-bit counter.
- 1 no. 436 block: BCD programmable counter.
- 1 no. 437 block: 4-bit counter/discounter.
- 1 no. 441 block: 2 4-input NAND gates.
- 3 no. 445 block: 4 logic output commutators.
- 2 no. 446 block: 8 LED with amplifier.
- 2 no. 450 block: 14-pin DIL footing.
- 1 no. 451 block: 16-pin DIL footing.
- 1 no. 455 block: arithmetic logic unit (ALU).
- 1 no. 461 block: oscillator.
- 2 no. 463 block: 555 integrated circuit.
- 1 no. 490 block: 5V supply source.

Accessories supplied as standard:

- Base plates for assembling circuits.
- Set of consumable components/material.
- Connectors.
- Storage cases.
- A manual of practical exercises.

Optional accessories:

- Tabletop frame.
- Instrumentation (oscilloscope, multi-purpose tester...).

Advanced digital electronics complement

Ref.: 9EQDIGIAVA

CONTENTS

- 1 Educational block no. 213: 1 circuit/2 positions commutator.
- 1 Educational block no. 245: 10 nF condenser.
- 2 Educational block no. 271: 1N4148 diode.
- 1 Educational block no. 399: analog digital converter.
- 1 Educational block no. 348: analog digital converter.
- 1 Educational block no. 444: 8 OR/NOR gate.
- 1 Educational block no. 460: timer.
- 1 Educational block no. 462: motor simulator.
- 1 Educational block no. 464: PLL unit.

Basic electronics training devices

800 Series

The training cube system optionally includes the 800 Series training devices for studying the basic analogue and digital electronics circuits. They are supplied in the form of training panels on which a series of cards are placed with electronic circuits already mounted for analysis.

Analogue electronics training device ANG-800

Ref.: 9EQAN8006C

Training device for studying the basic analogue electronics circuits. It consists of a base module to which ready-mounted circuits can be fitted for analysis and on which activities can be carried out on a protoboard.

It includes the following elements:

- ANG-800 base module:
  - Power source +/-15 volts DC/0.5A
  - Transformer with medium socket 12-0-12 volts AC/0.3A
  - Two variable voltage sources +/-10 volts DC/0.1A
  - One AC voltage source with variable amplitude (0 - 10 volts) and frequency (1Hz - 1KHz)
  - Protoboard
- ANG-801 rectification and filtering application card.
- ANG-802 circuit to transistor application card.
- ANG-803 operational amplifier application card.
- Storage drawer with connectors, accessories and electronic components.
- CD with User Manual, Practical Manual and information (datasheets) on the main electronic components used on the device.

Digital electronics training device DIG-800

Ref.: 9EQDI8006C

Training device for studying the basic digital electronics circuits. It consists of a base module to which ready-mounted circuits can be instantly fitted for analysis and on which activities can be carried out on a protoboard.

It includes the following elements:

- DIG-800 base module:
  - Power source +5 volts DC/1A
  - Variable frequency oscillator, 1Hz - 100KHz (0-5V TTL)
  - Digital signal generator via push-button with debouncing circuit
  - Protoboard
- DIG-801 gate and logic function application card
- DIG-802 combinational circuit application card
- DIG-803 sequential circuit application card
- Storage drawer with connectors, accessories and electronic components
- CD with User Manual, Practical Manual and information (datasheets) on the main electronic components used on the device

Step-by-step motor card DIG-805

Ref.: 9EQMPPARG2

It is increasingly common to find step-by-step motors in industrial products, whether as a result of their affordability, reliability – they have greatly improved as regards both features and variety of choice - or simplicity of operation and control. These motors are used in robotics and positioning systems, for example, or in small computer disk drives.

Alecop has developed the DIG-805 card for study and analysis of the characteristics of these motors.

The card functions with an independent external power source with a 0 and +5V output, or it can be powered from the Alecop DIG-800 Panel, as this panel already has 2 mm socket type outputs.

Controls and characteristics

Speed control	Half step/full step
Change of rotation direction	Zero search
Internal or external control (automaton)	Continuous or pulse control
Resolution 0.45º	Pins for signal capture by oscilloscope
Binary or BCD pulse counter from external control	

A CD user manual for the training device is delivered with the unit.

Circuit analysis, simulation and design software

TINA

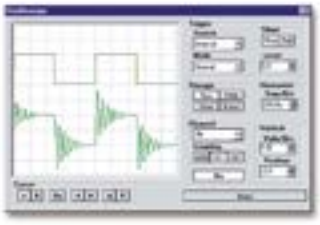
Tina is a design and simulation program for analogue, digital and programmable (VHDL) electronic circuits, MCU micro controllers and PCB printed circuit design. It also allows programmed inclusion of failures in components, to facilitate the electronic circuit analysis and diagnosis stage. It includes a manual in English.

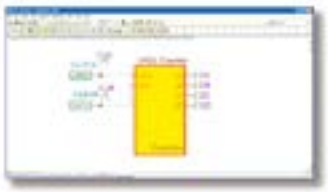
INCLUDES LIBRARIES WITH THOUSANDS OF COMPONENTS:

- Passive components: resistors, coils, potentiometers, capacitors, diodes, etc.
- Active components: transistors, thyristors, triacs, diacs, operational amplifiers, etc.
- Sources: current sources, voltage sources, current and voltage generators, controlled sources, digital pulse sources, digital clock, etc.
- Ports: AND, OR, NAND, NOR, XOR.
- Scales: D, RS, JK, etc.

INCLUDES A SET OF VIRTUAL MEASUREMENT ELEMENTS:

- Voltmeters, ammeters, watt meter.
- Impedance meter.
- Digital multimeter.
- Function generator.
- Storage oscilloscope.
- Signal analyser.
- Digital signal generator.
- Logic analyser.





Enables analysis of digital circuits with VHDL simulation and with PIC micro controllers

TINA includes a powerful VHDL simulation motor. With TINA, any digital circuit can be automatically converted to VHDL code and analysed as a VHDL design. A wide variety of hardware available in VHDL can also be analysed and its own components defined in VHDL. Once these are defined, they can automatically take on the form of programmable logic devices such as FPGA or CPLD.

Enables PCB design (option only available on DESIGN-SUITE version)

TINA includes all the necessary tools for advanced PCB design, including automatic placement and routing, “follow me” and manual trace placement, DRC (Design Rule Check), forward and back annotation, pin and gate swapping, keep-in and keep-out areas, thermal relief, fanout function, plane layers, Gerber file output, etc.

4

electrical engineering

There follows a presentation of the teaching aids for the study of electrical engineering from both an experimental and an analytical perspective, with the focal point or mainstay of the work being the “Analysis of Electrical Circuits”, addressing other blocks of content (Electromagnetism, Transformation, etc.) as and when they become important and relevant to the student’s teaching-learning process.

index

the electrical engineering laboratory approach

Teaching activities

These activities permit the instructor to organise different types of activities (demonstrations, explanations, etc.) for small or large groups. This means removing the traditional gap between classroom theory and workshop practice, integrating the entire process within a single physical setting.

Electrostatics

Magnetic fields

Electric fields

Current transformation

Documentation

A full array of documents, which in addition to the required user manuals for the equipment includes:

- The Teaching Guide: a description of the syllabus with the definition of goals, activities, scheduling, etc.
- The Handbook of Practical Activities, catering for the comprehensive use of the equipment in this catalogue.
- The Handbook of Content, as an introduction to the basics of electricity.

Safety

All the equipment within the field of three-phase systems, transformation and the introduction to electrical machinery has been designed to operate at 22/38 V, with an assurance of safety for users that should be considered within its proper context: the operating voltages are 1/10th of the real ones (220/380 V).

There follows a presentation of the teaching aids for the study of electrical engineering from both an experimental and an analytical perspective, with the focal point or mainstay of the work being the “Analysis of Electrical Circuits”, addressing other blocks of content (Electromagnetism, Transformation, etc.) as and when they become important and relevant to the student’s teaching-learning process.

Learning activities

These enable the student to undertake activities for analysing and experimenting with circuits, machinery and components. They include a series of technological features on a range of media that prepare the ground for the analysis and quick and reliable building of the circuits.

DC and AC circuits

Three-phase systems

Electric machinery

Instruments

Modularity

Each item of equipment in this catalogue has a modular arrangement in order to fulfil teaching requirements as per the user’s needs.

For further information, please contact your local distributor.

Ancillary equipment

The laboratory can be fully fitted out with ancillary equipment, such as furniture, whiteboards, projectors, commercial instruments (multimeters, oscilloscopes, function generators) etc.

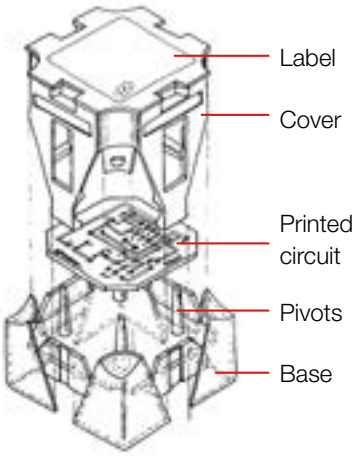
The ancillary equipment distributed by Alecop appears in full in the online catalogue (www.alecop.com)

Circuit analysis

TABLETOP TEACHING FRAME
An upright structure used to hold dice, modules and panels for demonstration purposes.
It provides a ±15 V supply from the ALI-700 module to any other module that so requires.

SET OF CONNECTION TEACHING DICE
They provide a graphic portrayal of the circuit and simplify the wiring arrangement. The set includes dice for open connection, lines, angles, crossovers... Recommended for demonstration purposes.

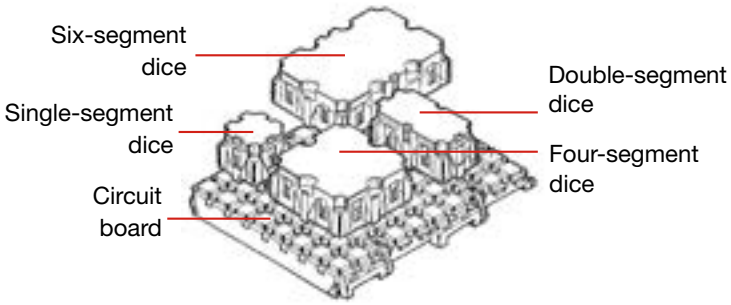
The teaching dice system



A modular arrangement that allows the design and analysis of circuits as per the user's needs. The dice are mounted onto a circuit board, which is also modular and has unlimited possibilities for working horizontally or vertically.

The entire system can be fitted on the tabletop frame, permitting combined assemblies involving fully compatible modules and panels. They are also suitable for demonstration purposes.

The design of the dice ensures the system is extremely versatile: they are ergonomic, stackable and made of strong shockproof material. Their transparent base protects the component or circuit, whilst providing a clear view of the inside.

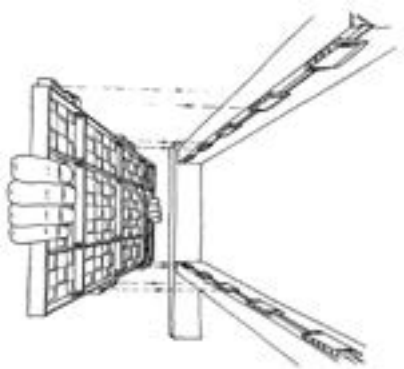


SET OF EDUCATIONAL CIRCUIT ANALYSIS BLOCK

These are electrical elements fitted onto a block framework which provides an easy way for the analysis and the rapid and reliable construction of D.C. and A.C. currents. The blocks give a visual access to the component/circuit, incorporating electrical contacts, standard silk-screening and identification labels.

Further highlights:

- It has a side conductor panel that transmits the current to the adjacent dice, avoiding the need for multiple wiring.
- It includes a recess for the attachment of labels (included) with the name of the component or circuit in several languages.
- The connection is made through extremely robust 2 mm eye bolts.
- The component's symbol is printed on the upper part of the dice in accordance with European regulations and the International Electrotechnical Commission (IEC).



Contents:

Accessories supplied as standard:
- Base plates for creating circuits.
- Batteries and light bulbs.
- Lighter.
- Connectors.
- Storage boxes.

Recommended optional accessories:
- Tabletop frame.

Required instrumentation:
- Oscilloscope.
- Voltmeter and ammeter (or multimeter).

Recommended optional elements:
- Desktop frame.
- Power module ALI-700 source of + 15 V.
- DRV-120 Educational unit: power driver.
- MIM-700 Educational unit: magnetic induction measurer.
- Function generator.

Electrostatics and electromagnetism

Didactic electrostatics kit

KEL-120

Carrier case for analysing electrostatic phenomena, which contains the following items:

- A cat-skin cloth
- A cork ball frame
- A PVC stick
- A perspex stick

Standard accessories included:
- User manual

Recommended Optional Accessories:
- Coulombimeter COL-120.

Didactic electrical field kit

KCE-120

This consists of a set of elements which are assembled by the user on a perspex base, which enable the force of a charge on an electric field, the principle of the workings of the condenser, etc., to be analysed. The phenomena can be observed on a screen with the aid of an over-head projector.

The elements included in the briefcase are:

- A base plate
- 2 specific charge parts
- 2 straight condenser parts
- 1 cup part
- 1 jar of semolina
- 2 wires
- 1 steel ball

Standard accessories included:
- User manual

NECESSARY accessories:
- FAT-120 high voltage source

Didactic magnetic field kit

KCM-120

This is a set of elements which, once they have been assembled on a perspex base, allow the force lines of a magnetic field generated by different types of conductor elements to be analysed. The resulting phenomena can be visualised on a screen with the aid of an over-head projector. The various parts supplied with the briefcase include:

- A magnet base plate
- A plain base
- A straight-line current wire base
- A spire plate
- A coil plate
- 4 20 x 40 mm magnets
- 4 pieces of iron, 20 x 40 mm
- 4 pieces of aluminium, 20 x 40 mm
- 4 pieces of plastic, 20 x 40 mm
- 1 jar of iron filings
- 6 magnetised needles
- 1 magnetised needle with frame

Standard accessories included:
- User manual

NECESSARY accessories:
- FAC-120 high voltage source

High voltage source for teaching purposes

FAT-120

A high voltage source that is fully protected to ensure user safety. It provides a direct voltage of up to 7500 V that can be regulated by means of a potentiometer control, with a maximum current of 100 µA.
It has a digital display with a voltage reading. The power supply is 110-230 V / 50-60 Hz depending on the model.

Standard accessories included:
- User manual

Didactic high current supply

FAC-120

A source of high current set into a panel which can be placed on a frame or on a tabletop. It provides a current of up to 100 amp A.C. in the founder. Direct and alternating output, via separate sockets. A potentiometer allows you to vary the current. It has a visual display and special connectors for connecting different types of metal wires (for the analysis of heating, melting, etc).

Standard accessories included:
- User manual
- Conductor materials: copper, nichrome and constantan.
- Fuses

Three-phase systems

Educational unit

RNC-120

uncontrolled single-three-phase rectification

There is a series of rectifier bridges incorporated onto a 6 power diode base (10A/600W) which are interconnectable and individually insulated against over voltage.

With the use of set of templates and connectors, it is possible to select and configure the various types of rectifier bridges which are under analysis:

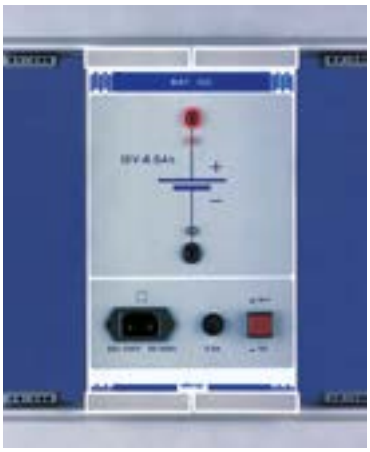
- RNC-121 Template: medium wave single phase rectifier
- RNC-122 Template: single phase bridge rectifier
- RNC-123 Template: medium wave two-phase rectifier
- RNC-124 Template: medium wave three phase rectifier
- RNC-125 Template: three phase bridge rectifier

The unit is designed to work on both standard as well as low voltage (22/38). There are high security 4mm bushes and 2m bushes provided for this, which also allow you to be able to measure the voltages and the currents of the circuits.

The unit s supply inputs are protected by 10A ultra-rapid fuses.

Standard accessories included:
- User manual.
- Connection bridges.

NECESSARY accessories
- TRI-120 teaching module: three-phase transformer (for low voltage operation, if required).



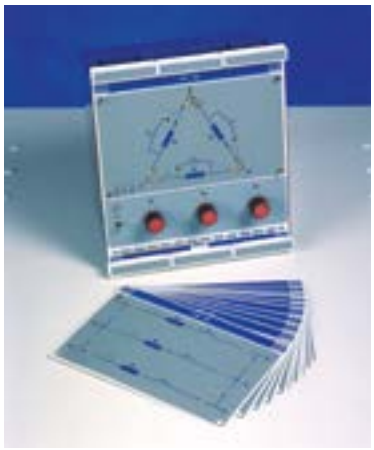
Educational unit

BAT-120

battery module

Modular item for simulating a back electromotive force, consisting of a 12 V, 6.5 Ah battery. The battery is charged internally by connecting the module to the power supply (110-230 V / 50-60 Hz depending on the module) and turning on the light switch. Safety bushings included.

Standard accessories included:
- User manual



Educational unit

CIR-120

resistive-inductive charge

This a triple unit with three groups of R-L charges. Each group is composed of a 150mH/1A inductance and a 33 ohm/35W resistance in series with a rheostat of the same value. There is protection against over current measured at 1A for each group. The maximum charge applicable is 50Vef.

Using a different multi-template and jumpers, you can select the type of connection charges and the desired work. The use of cables in the assembly is minimal.

The template collection includes:

- CIR-121 Template: Charge R free connection
- CIR-122 Template: Charge L free connection
- CIR-123 Template: Charge R-L free series connection
- CIR-124 Template: Charge R-L free parallel connection
- CIR-125 Template: Charge R triangle connection
- CIR-126 Template: Charge L triangle connection
- CIR-127 Template: Charge R-L triangle series connection
- CIR-128 template: parallel RL load delta connection
- CIR-129 template: Charging R star connection
- CIR-130 template: Cargo L star connection
- CIR-131 template: Load RL series star connection

Standard accessories included:
- User manual
- Connection bridges

NECESSARY accessories:
- TRI-120 teaching module: three-phase transformer

Educational unit

CRC-120

capacitive charge

This a triple modular frame which incorporates a series of condensers grouped electrically into three groups: C1, C2, and C3. By means of a set of templates (3) and connectors (no more than three), it is possible to configure:

- CRC-121 Template: Free connection
- CRC-122 Template: Star connection
- CRC-123 Template: Triangle connection

Each group of condensers can adopt capacities of 1, 5, 10, 25, 50 and/or 100(F which can be selected by means of a change-over switch. The maximum working voltage of each group is 63V.

Standard accessories included:
- User manual
- Connection bridges

Recommended Optional Accessories:
- Instrumentation: voltmeter, ammeter, phase meter, ...

NECESSARY accessories:
- TRI-120 teaching module: three-phase transformer.

Transformation of electric current

Didactic monophase transformer kit

KTM-120

A kit for assembling and studying different types of single phase transformers. It enables you to analyse the principles of electromagnetism: the functioning of a relay, of a bell, ...

It consists of a triple unit for a assembly base and a briefcase which contains the various construction elements such as:

- A U nucleus
- An I nucleus with an air gap variation control
- 2 x 500-spire coils
- 2 x 250-spire coils
- 2 x 100-spire pendulum coils
- Pendulum sheet (relay, bell, etc.)
- Bell ringer
- 2 frames (relay contact)
- Pendulum arm (Foucault)
- Magnets
- Various parts (pieces of iron, aluminium, etc.)

Standard accessories included:
- User manual.

Educational unit

TRI-120

three-phase transformer 230/400-22/38V

This is a three-phase transformer which, depending on the model (TRI-122 or TRI-123), has a transformation ratio of either 220V to 22/38V or 380V to 22V-38V, with an apparent power of 300 VA.

The output voltage is 22V between phases (12.7V neutral phase) and 4 Amperes or 38V between phases (22V neutral phase) and 3.75 Amperes which can be selected by means of a commutator on the front template.

The output is by both 4mm and 2mm bushes and they are protected against overcurrent and shortcircuit with a light indicator per phase. They are thermally insulated with resetting being produced automatically after the protective elements have been cold for a period of time.

The frontal light display shows the order of phases (L1-L2-L3 or L1-L3-L2).

The transformer primary is protected by 2A fuses with a light indication if any should blow (pilot light out).

Standard accessories included:
- User manual

Teaching module

AUT-120

single-phase autotransformer

Single-phase autotransformer with 230 V / 50-60 Hz input voltage and variable output adjusted by a potentiometer control.

- Maximum output voltage: 250 V
- Maximum output load: 1 A
- Protection: 1 A fuse
- Safety bushings

Standard accessories included:
- User manual

Educational unit

ETT-120

threephase transformer study

Equipment for analysing the different types of connections on three-phase transformers.

It is composed of an ETT-120 three-phase transformer multitemplate unit and a set of 12 templates.

The unit incorporates three single phase transformers, each of which has two secondaries of an identical transformation ratio (0.5/1). The nominal voltage for the primary windings is 22v and 11V for the secondary ones.

By means of the templates (12), and connectors (never more than 9), the following three-phase transformer configurations may be obtained:

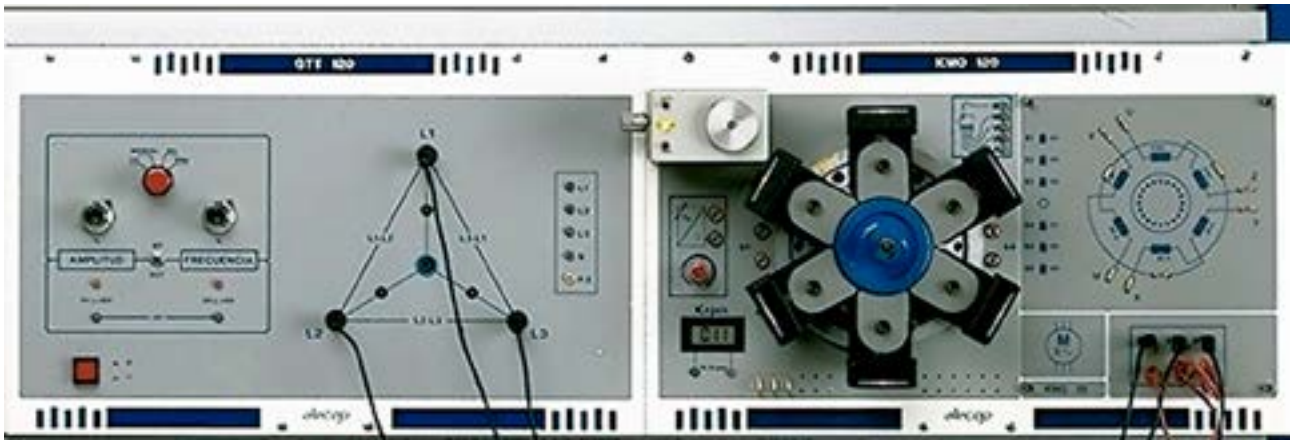
- T-E-1 Template: Triangle-Startime phase difference 1
- T-E-5 Template: Triangle-Startime phase difference 5
- T-E-11 Template: Triangle-Startime phase difference 11
- T-2E Template: Triangle-Double Star
- T-T-0 Template: Triangle-Triangle-time phase difference 0
- T-Z-0 Template: Triangle-Zig/Zag-time phase difference 0
- E-E-0 Template: Star-Star- time phase difference 0
- E-E-6 Template: Star-Star- time phase difference 6
- E-T-5 Template: Star-Triangletime phase difference 5
- E-T-11 Template: Star- Triangletime phase difference 11
- E-Z-5 Template: Star-Zig-Zagtime phase difference 5
- E-Z-11 Template: Star-Zig-Zagtime phase difference 11

The input/output terminals are printed on all the labels. Each one of the six secondary windings is fitted with a thermal protection circuit with a light indicator, set at 0.65 A.

Required accessories:
- TRI-120 three phase transformer didactic module.

KMQ-120

Kit of rotary electric machines

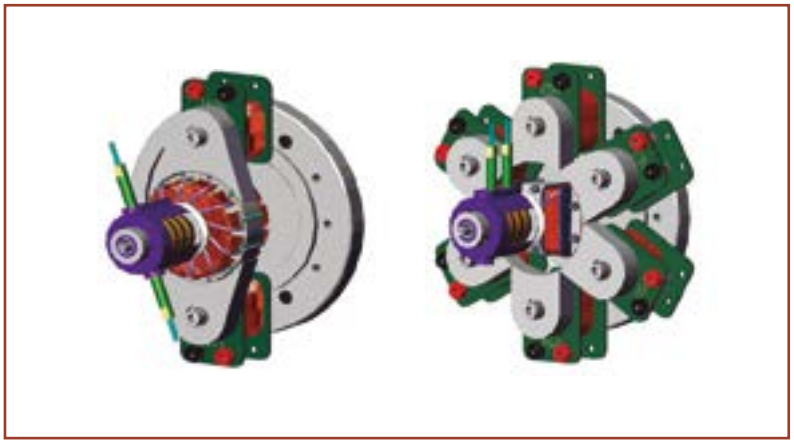


Fast assembly kits and testing of electric machinery at low tension.

This equipment is meant for the study of the constitutive parts and fundamentals of the functioning of the most common rotary electric machines.

In an easy way and with a reduced amount of parts, the following types of machines can be studied:

- Independent excitation generator
- DC serial generator
- DC shunt generator
- Independent excitation motor
- DC serial motor
- DC shunt motor
- Three-phase asynchronous alternator
- Three-phase synchronous motor
- Single-phase motor
- Universal motor
- Single-phase induction motor
- Repulsion motor
- Wound-rotor three-phase motor
- Squirrel cage three-phase motor
- Dahlander motor



This equipment consists in:

Panel

this can be placed on the work surface or on a vertical frame. The support disc is attached to the panel, being used for screwing on the various field poles. The shaft protrudes from the centre of the disc and this is where the different rotors are attached.

An area has been set aside on the upper left-hand corner of the panel for the attachment of a drive motor that will allow experiments to be conducted with generators or provide a braking torque for the motors.

The right-hand side of the panel has the area for electric connections, using interchangeable labels. These allow the quick and clear interconnection of the various windings on the rotary machine subject to the experiment, providing the necessary information for its assembly. The areas the label is subdivided into make it easy to distinguish the electric connections both inside and outside the machine (connection board), without losing the perspective of a real machine.

The panel includes a 0-10 Vcc/2 A adjustable power supply for the excitation of the machines, as well as a tachometer for measuring the motor's velocity during the different types of tests.

Suitcase

It includes a series of parts (rotors, brush holders, windings, polar parts, etc), which allow configuring different rotary machines on a panel in a fast and easy way. The parts are the following:

- 1 Two-pole rotor
- 1 Three-pole rotor
- 1 Twelve-pole rotor
- 1 Squirrel cage rotor
- 1 Shaft
- 6 Narrow field poles
- 3 Wide field poles
- 6 Windings of 240 turns
- 4 Windings of 1400 turns
- 5 Brushes
- 1 Brush holder
- 6 Light poles
- 1 Drive motor with belts
- Tools and screws

Power supply

The machines built are powered by a low voltage supply - 22/38 V AC/DC -, which ensures the students' safety. Hence, there are available (depending on choice) a TRI-120 transformer or a GTT-120 three-phase generator.

Standard accessories included:
- *Practical and user's manual*
- *Connexion wires*

Necessary accessories not included:
- *Three-phase generator GTT-120, or as an alternative:*
- *Three-phase transformer TRI-120 + power supply 0-15 Vcc/5 A.*

KMQ-100

BASIC kit of rotary electric machines

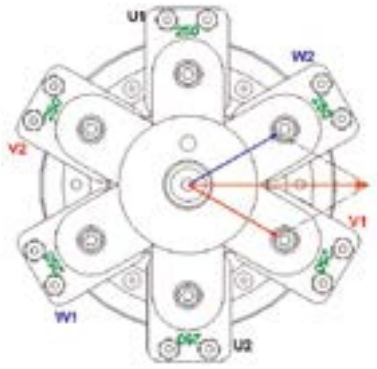
This is a “reduced” version of the dissectible machine, designed as a student work station.

Although it has fewer options than the full kit, it may be a valid option, depending on the nature of the practical activities to be held. Basically, the differences are as follows:

The assembly panel is smaller and can only be placed on the tabletop. It does not include the drive motor, tachometer, power source or connexions area neither. In this way, the result is a compact assembly panel.

The set of machinery construction, which is more reduced, fits in a suitcase that contains the following:

- 6 Windings of 250 turns
- 2 Windings of 1400 turns
- 1 Twelve-pole rotor
- 1 Squirrel cage rotor
- 1 Brush holder
- 5 Brushes
- 2 Wide field poles
- 6 Narrow field poles
- 1 assembly support base
- 1 assembly shaft



Standard accessories included:

- *Practical and user’s manual*
- *Connexion wires*

Necessary accessories not included:

- *Three-phase generator GTT-120, or as an alternative:*
- *Three-phase transformer TRI-120 + power supply 0-15 Vcc/5 A.*

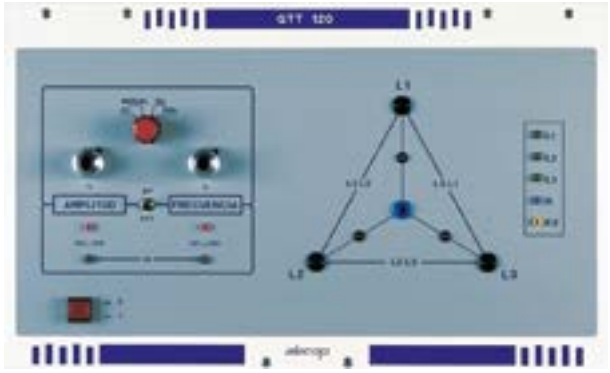
TRAINING SUPPORT MATERIAL

User's manuals.

Their content includes the use, maintenance and safety norms, as well as the description of the parts and characteristics of the equipment.

Practical manuals.

This is a proposal of different activities that can be carried out , with the list of the necessary components, assembly and wiring instructions and the solutions for the teacher.



Three-phase generator

GTT-120

This panel, which is mounted either on the frame or tabletop, incorporates a low voltage variable frequency three-phase generator with a single-phase mains supply of 110-230 V / 50-60 Hz (depending on the module). It has the following specifications:

- Phase-neutral voltage: 0-22 V variable strength adjusted by a potentiometer control.
- Phase-Phase: 0-38 V strength.
- Maximum current per phase: 5 A.
- Protection against current surges and short circuits.
- Frequency variation: 1-100 Hz in two scales and potentiometer control.
- Instant value output from the three-phase network, variable between 0-360º.
- 3 simultaneously variable 0-30 V / 5 A DC outputs
- Option of independent control of the value of the amplitude and frequency.
- User's manual.

Three-phase transformer

TRI-120

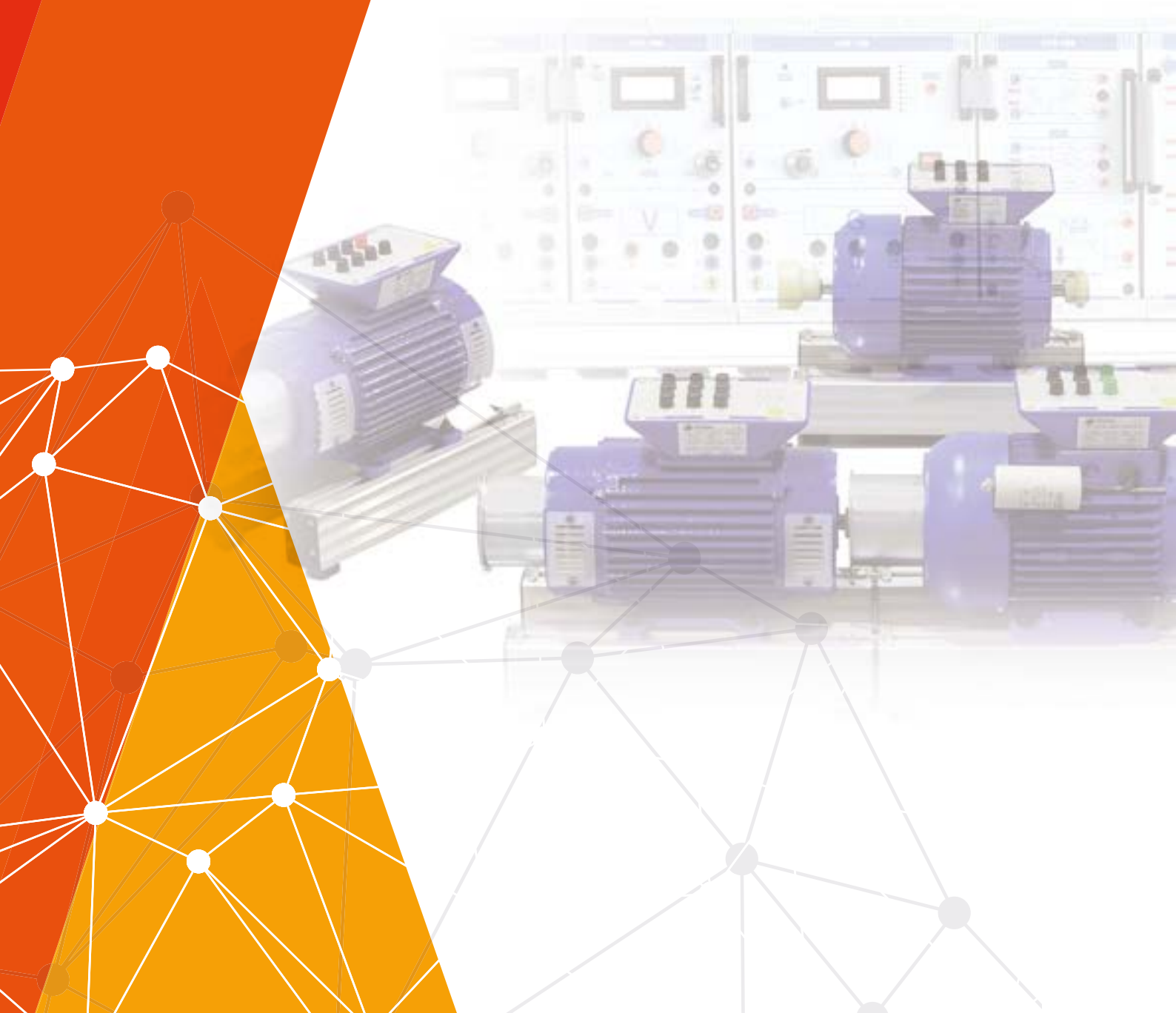
This is a three-phase transformer which, depending on the model (TRI-122 or TRI-123), has a transformation ratio of either 220V to 22/38V or 380V to 22V-38V.

- Apparent power of 300 VA.
- The output voltage is 22V between phases (12.7V neutral phase) and 4 Amperes or 38V between phases (22V neutral phase) and 3.75 Amperes which can be selected by means of a commutator on the front template.
- 4 and 2 mm simultaneous output sockets.
- Over-current and short-circuit output protection with phase light indicators.
- The outputs are thermally insulated, with the resetting being produced automatically after the protective elements have been cold for a period of time.
- The frontal light display shows the order of phases (L1-L2-L3 or L1-L3-L2).
- The transformer's primary is protected by 2A fuses with a light indication if any should blow (pilot light out).
- User's manual.

5

electrical machines

Our lab proposal includes everything needed for the study at different levels of static and rotating electrical machines.



index

Proposal for a Laboratory of electrical machines

WORKSHOP
Electrical machines

TESTING **AUTOMATION** **MAINTENANCE**

Documentation

Each resource has a set of supporting documents to facilitate the teacher's work:

- User Manual: contains instructions for the implementation and operation of equipment, its technical features and information about precautions to be taken into account for proper operation.
- Workbook: Defines the objectives, sequence of implementation and an answer key for each of the practice sessions.

Modularity

The equipment allows a modular configuration according to the available equipment and the training needs of the user.

Educational resources for the study of electrical, static and rotary machines. Ranging from the operating principles to the construction of automatic devices and the maintenance operations of the machines.

CLASSROOM-WORKSHOP

Safety

The resources presented in this catalogue have been designed to meet European directives on the safety of machinery, low voltage and electromagnetic compatibility.

Economics

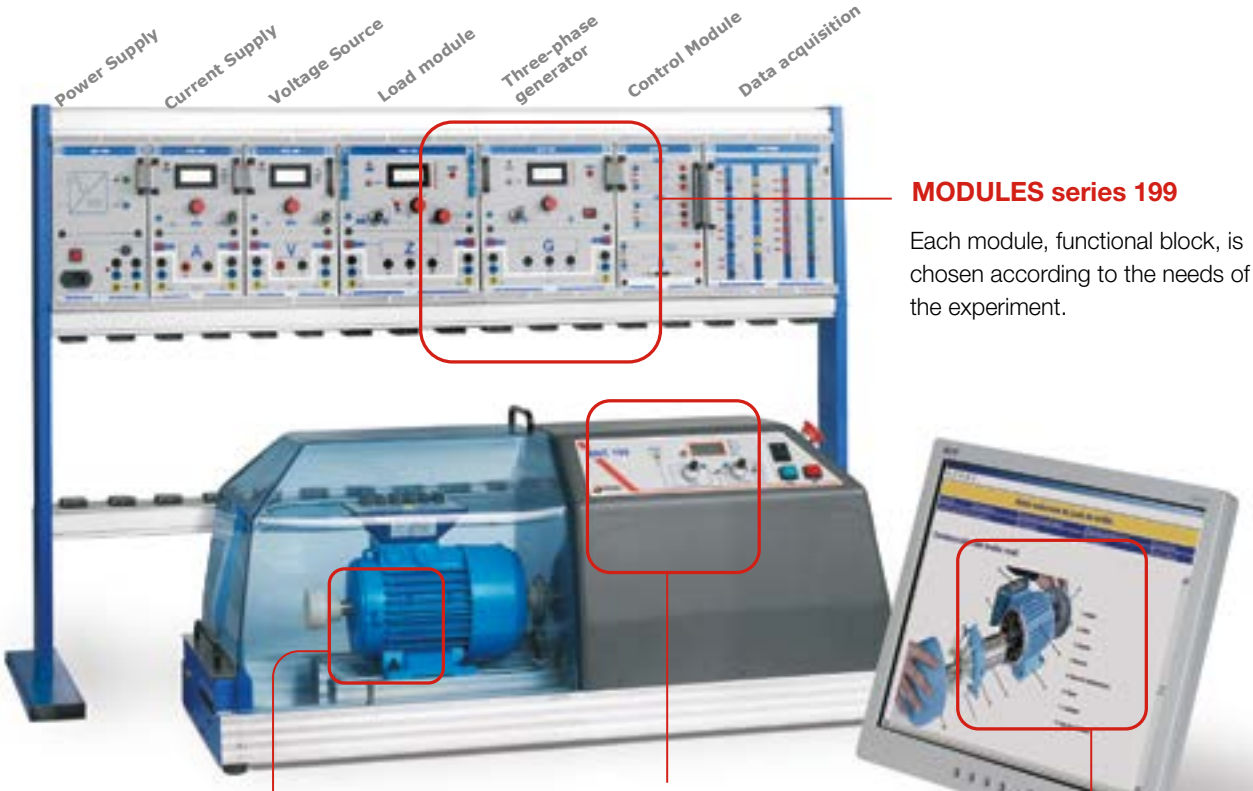
The scalability of the teaching resources and the potential for use in the classroom, allows a considerable reduction in the investment to be made for a specific program of electrical machines.

ProLAB

Modular test bench

Ref: 9EQBNCMD6C

The ProLAB provides the most modern and cost effective approach to teaching the theory and practice of Electrical Machines. Operating from a single phase supply, producing its own dc and 3-phase, there is now no need to provide a dedicated laboratory for testing Electrical Machines; the experiments can be performed in any classroom. The ProLAB can be used as a traditional stand-alone system, with its comprehensive range of modules, but its full potential is only realised when used with the powerful DIANA software package in a networked environment. No longer is it essential for each group of students to have an individual test bench and range of machines. Not only can the ProLAB be used for demonstration but each student on the network can have access and control of the hardware to perform their own tests supervised by the instructor. Familiarisation with the equipment and post experiment analysis of data and report writing can be performed outside the laboratory. In addition DIANA includes comprehensive simulations for each machine. Safety, to protect both the equipment and the student, is paramount and to protect the environment power is returned to the grid when the system is acting as a load.



MODULES series 199

Each module, functional block, is chosen according to the needs of the experiment.

BENCH

Allows you to work safely with rotating machines of different types and power.

SOFTWARE

For carrying out real and simulated testing. from the configuration to the analysis of the results.

rotating machine

Adapted to classroom needs

The BEM system enables students to learn concepts and procedures of the operation of static and rotating electrical machines.

Scalability

The modular system makes it possible to acquire the components that best meet the needs of its centre, for both curriculum and budget. The BEM is compatible with conventional elements in your classroom/ workshop (resistors, inductors, capacitors, rectifier bridges...)

Time and motion economy

One machine per class is sufficient, reducing acquisition and maintenance costs.

The “199” module series, designed for this system has standard instrumentation built in.

The most complex assembly takes only a few minutes and with few cables.

ENVIRONMENTALLY FRIENDLY PRODUCT

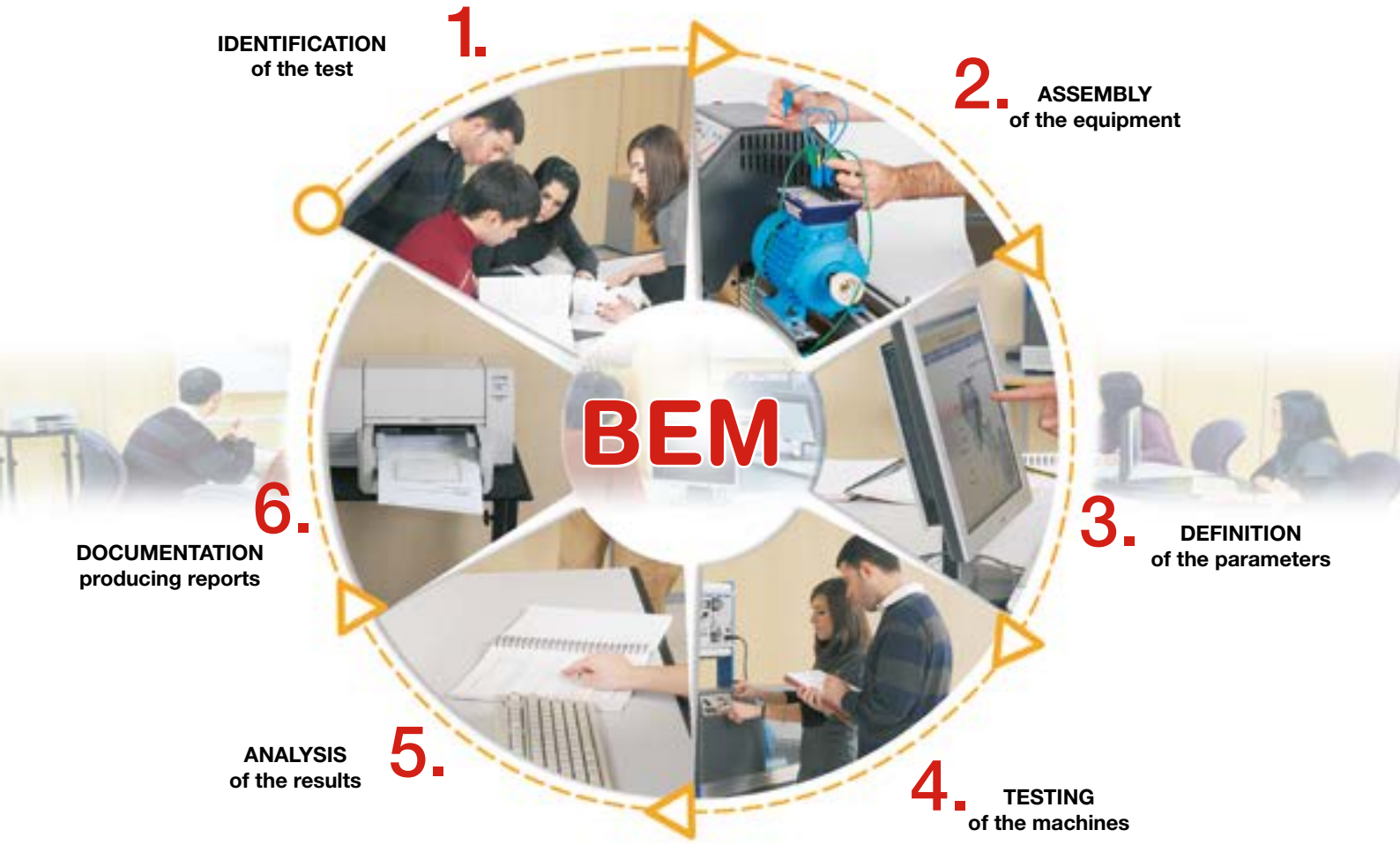
The equipment returns the energy to the grid that is traditional dissipated into heat. In addition to reducing consumption, it implies the reduction of the size of the modules and bench, and the elimination of potentially dangerous hot spots.

SAFETY

This equipment goes beyond the current regulations relating to safety, implementing a series of added protection to prevent accidents in the field of education.

Work process

The BEM allows the student to put into practise the basic concepts learnt in the theory related to the operation of electrical machines. The putting into practise is by testing, whether real or simulated. Each test is performed following these 6 steps:



Classroom work

Manual
Testing with the modules and the bench. Fieldwork. Manual demonstrations.

Mixed
Combines the use computer to prepare exercises and sending the manual application, to the machine bench.

Simulation
Enables the entire work process to be carried out through the software. The library has the most significant test activities to achieve global learning.

Configuration

Students in the class are kept active thus avoiding, as far as possible, waiting times.
Classroom connectivity completes the work:

simple — non-networked, students work individually on their computers and run the test manually or from the teacher's computer.

in network — Having a local area network enables tests to be carried out from any computer and enables the DIANA monitoring options.

internet — If Internet is added, the users who are not physically in the classroom, may access the test bench thus facilitating distance learning.

Bench

Ref: 9EQBNC199A

Independent bench for testing rotating electrical machines.

Lets you set the machine under test conditions easily in the test bench, under safety standards that prevent the incorrect operation of the bench.

The control of the bench is carried out by potentiometric dials with variable torque or speed, or by external signals that allow SAD and computer control.

Power, speed and torque exerted on the shaft of the bench, signals available on the external connector can be seen at all times.

In the face of any malfunction on the bench (high or insufficient voltage, excessive torque applied, high speed, etc) the protection activated is indicated by the display.

The bench absorbs energy from the single phase power supply when operating as a traction motor and returns power to the grid when operating as a brake.

FUNCTION
Test traction motor and machine brake.

Technical specifications

GENERAL
Dimensions: 950 x 360 x 420 mm
Weight: 41 Kg
Power supply: Single phase network 190 to 250Vac- 5,25 Amp.- 50/60Hz
Machines type to be tested: - Foot height type 71, 80 and 90 mm. - 80 and 90 mm height on Alecop profiles.
The testing machine is attached using elastic coupling

OPERATING AS A TRACTION MOTOR
Speed: 0 to 2000 rpm
Rated: 800 w
Maximum torque: 9,7 Nm

OPERATING AS A BRAKE
Maximum speed: 2450 rpm
Torque: 0 to 10 Nm
Rated: 800 w

PROTECTIONS
Mobile protection with electric anchor.
Emergency stop button on the bench.
4mm safety terminals for the connection of the machine under testing.
Internal protections: internal temperature, torque, speed, insufficient voltage, excessive over voltage and grid over-current.

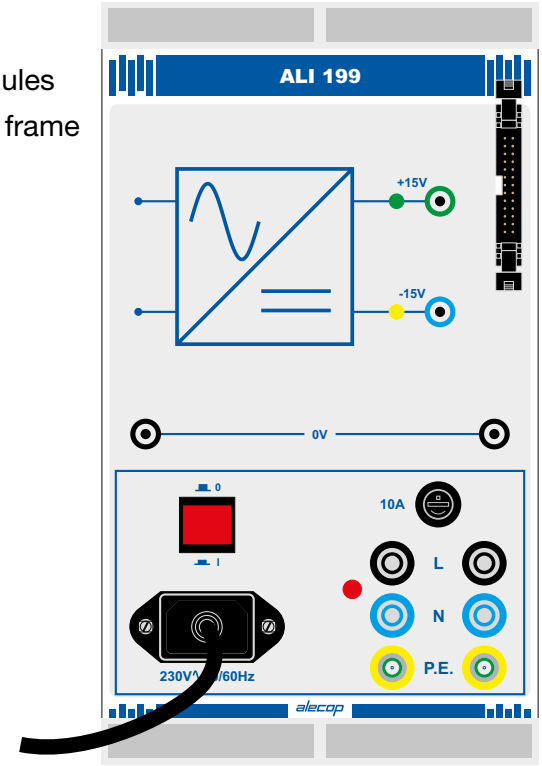
Module

ALI-199

Ref: MDULALI199

Power supply module of the rest of the other modules of the ProLAB equipment using the profiles of the frame where it is housed.

Controls the power supply to other equipment modules providing single-phase voltage via safety terminals.



Functional description

The support comprises a double-size training module: 250 x 144 x 130 mm.

The power required for its operation is:

- Voltage: 190 ÷ 250 Vac 50/60Hz.
- Maximum power: 1 Kw.

Includes serigraph identifying the functional blocks and components symbols.

Uses 2 mm. in diameter safety sockets which serve as testing points and 4 mm safety sockets diameter for the power supply (red).

Technical specifications

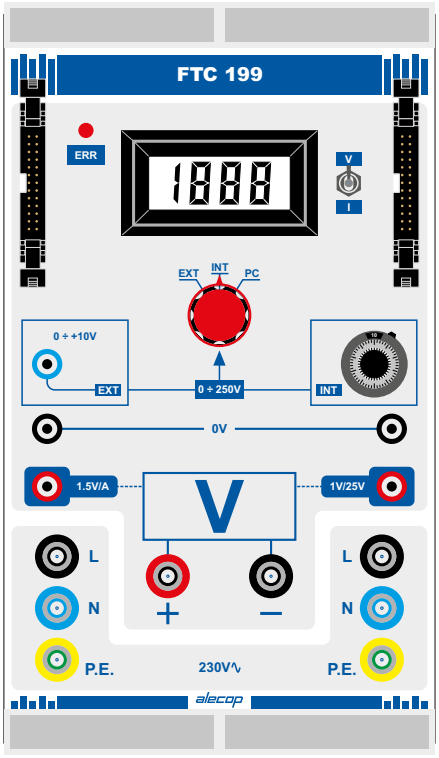
Input supply voltage	Single-phase 190 to 250VAC using a socket.
Mains Frequency	50Hz / 60Hz.
Output voltage	±15V c.c.
Maximum current	2 Amp.
Protections	Input: using 10amp fuse. Output: Thermal Protection calculated at 2 Amp.
Outputs from the source	Using the frame chassis and 2mm safety plugs.
Indications	On light to indicate main supply and outputs from the active source.

Module

FTC-199

Ref: MDULFTC199

Adjustable DC voltage for power induced current machines.



Functional Description

The support comprises a double-size training module: 250 x 144 x 130 mm.

The power required for its operation is:

- ± 15 V., 15 V, by plugging into the ALECOP support frame.
- Voltage: 190 ÷ 250 V.
- Maximum power: 1 Kw.

Includes serigraph identifying the functional blocks and components symbols.

Uses 2 mm. in diameter safety sockets which serve as testing points and 4 mm safety sockets diameter for the power supply (red).

Technical specifications

The module includes a continuous voltage source whose characteristics are:	
Output voltage variation	0 ÷ 250 V.
Output current	6,6 A max.
Types of settings	- Interior: with a dial. - Exterior: Using a DB26 with a safety socket of 2mm.
Accuracy	1%.

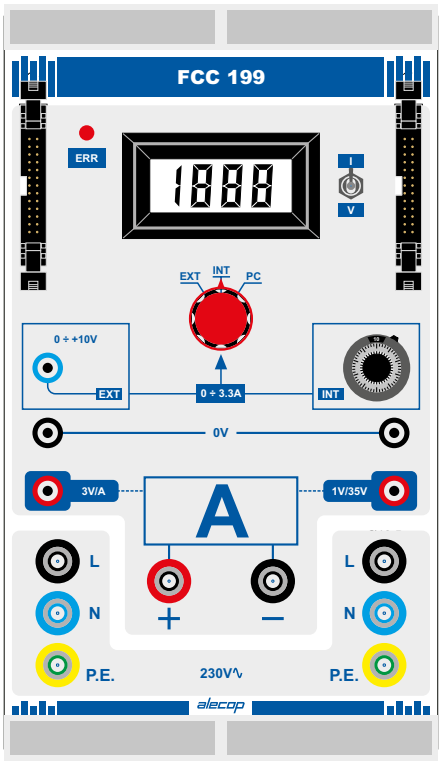
Physical Measurements:	
Magnitude display	- Magnitudes displayed: Current and voltage output (can be selected using a switch) on the 3½ dígit display. - Voltage Range / Precision: 0 ÷ 250 V c.c. 1% F.E. - Current Range / Precision: 0 ÷ 6,6 A < 1% F.E.
Magnitude signal capture	- Analogue signals in the DB26 connector: Output voltage and current. - Analogue signals in the sockets: output voltage and current. - Voltage range / precision: 0 ÷ 250 V c.c. (0 ± 10 V) 1% F.E. - Precision current range: 0 ÷ 6,6 A c.c. (0 ± 10 V) 1% F.E.
Incorporates electronic protection, protecting the module against overloads and short circuits.	

Module

FCC-199

Ref: MDULFCC199

Adjustable DC power supply for inductors of alternating and direct current machines.



Functional Description

The support comprises a double-size training module: 250 x 144 x 130 mm.

The power required for its operation is:

- ± 15 V., by inserting into the ALECOP support frame.
- Voltage: 190 ÷ 250 V.
- Maximum power: 1 Kw.

Includes serigraph identifying the functional blocks and components symbols.

Uses 2 mm. in diameter safety sockets which serve as testing points and 4 mm safety sockets diameter for the power supply (red).

Technical specifications

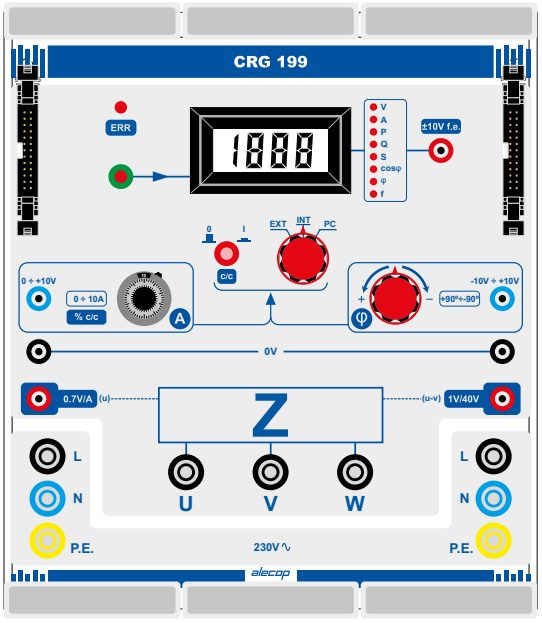
The module includes a voltage source whose characteristics are:	
Output voltage variation	0 ÷ 310 V.
Output current	0 ÷ 3,3 A.
Types of settings	- Interior: with a dial. - Exterior: Using a DB26 connector with a safety socket of 2mm.
Accuracy	1%.

Physical Measurements:	
Magnitude display	- Magnitudes displayed: output voltage and current. (Switch selectable) in a 3½ digit display. - Voltage range / precision: 0 ÷ 310 V c.c. 1% F.E. - Current range / Precision: 0 ÷ 3,3 A c.c. < 1% F.E.
Magnitude signal capture	- Analogue signals in the DB26 connector: Output voltage and current. - Analogue signals in the sockets: output voltage and current. - Voltage range / precision: 0 ÷ 350 V c.c. (0 ± 10 V) 1% F.E. - Precision current range: 0 ÷ 3,5 A c.c. (0 ± 10 V) 1% F.E.
Incorporates electronic protection, protecting the module against overloads and short circuits.	

Module

CRG-199

Ref: MDULCRG199



Electronic power load teaching module for power transformers and A.C. and D.C. rotary machines (single-phase and three-phase).

Ability to capture and control magnitudes by PC via a data acquisition system and DIANA software. The incorporated controls allow it to operate in accordance with the various types of passive loads:

- Direct current resistive load.
- Inductive load - resistive – single-phase capacitive.
- Inductive load - resistive –three-phase capacitive.
- Power factor variable between 0 and 1 (inductive and capacitive).

Functional Description

The support comprises a triple-size training module: 250 x 216 x 130 mm.

It operates installed in a desktop vertical rack from where it gets its ± 15 V power required for operation. Interconnection with other modules in the test bench BNC-199 and DIANA software with a fast 26-pin connector.

2 mm sockets for external measurements and set values. 4 mm safety terminals input power (mains connection). Includes serigraph identifying the functional blocks. Has many advantages over other traditional load types (resistors, capacitor banks, inductances, etc.), Including the following:

- Reduced volume: all possible load types in one module.
- Improved Performance: Incorporates electronic circuitry which returns the energy to the power supply.
- Safety: Incorporates protection against overloads and short circuits, as well as safety terminals for user protection.
- Accuracy and resolution: Electronic control of electrical magnitudes (current amplitude and power factor).
- Instrumentation built into the module itself.
- Interconnection with other elements of the Test Bench BNC-199 tests and control from the PC with DIANA software.
- Possibility of autonomous operation with manual or computer assisted control (general purpose data acquisition system).

Technical specifications

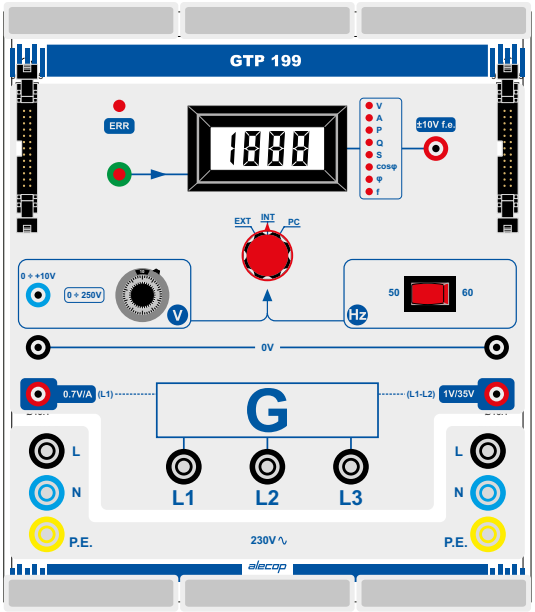
Power supply	- Control: ± 15 VDC from the ALECOP support frame. - Power: Single phase 190 to 250 Vac across safety terminals.
Maximum power	- 1 CV Direct Current - 1 CV single phase alternating current - 1 KW three-phase alternating current
Power factor	Variable between 0 and 1 (inductive and capacitive)
Maximum input voltage	- 250 V Direct Current - 280 V AC single and three phase
Maximum intensity	10 A
Short-circuit switch	Current variation between 0 and 100%
Module with integrated Instrumentation through LCD display and magnitude selector push button	- Voltmeter - Ammeter - Wattmeter (active, reactive and apparent) - Power Factor Meter - Phase angle meter to measure the angle between voltage and current - Frequency

Module

GTP-199

Ref: MDULGTP199

Three-phase power generator teaching module for power transformers and A.C. and D.C. rotary machines (single-phase and three-phase).



Works autonomously or is able to capture and control magnitudes by PC via a data acquisition system and DIANA software.

Functional Description

The support comprises a triple-size training module: 250 x 216 x 130 mm.

It operates installed in a desktop vertical rack from where it gets its ± 15 V power required for operation.

Interconnection with other modules in the test bench BNC-199 and DIANA software with a fast 26-pin connector. 2 mm sockets for external measurements and set values. 4 mm safety terminals input power (mains connection).

Includes serigraph identifying the functional blocks. Has many advantages over other types of variable voltage (auto-linear drive frequency, etc...), Among which are the following:

- Reduced volume: Single and three-phase generator with its instrumentation in a single module.
- Improved performance: incorporates power electronic circuits returning power to the mains.
- Safety: Incorporates protection against overloads and short circuits, as well as safety terminals for user protection.
- Accuracy and resolution: electronic control of electrical quantities (voltage amplitude).
- Instrumentation built into the module itself.
- Interconnection with other elements of the BNC-199 Test Bench and control from the PC with DIANA software.

Possibility of autonomous operation with manual or computer assisted control (data acquisition system for general use).

Technical specifications

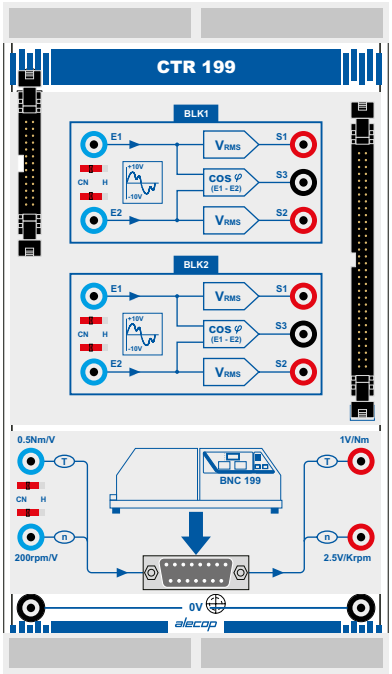
Power supply	- Control: ± 15 VDC from the ALECOP support frame. - Power: Single phase 190 to 250 Vac using safety terminals.
Maximum power	1 KW
Power factor	Variable between 0 and 1 (inductive and capacitive)
Maximum output voltage	250 V AC
Maximum intensity	10 A
Module with integrated Instrumentation through LCD display and magnitude selector push button	- Voltmeter - Ammeter - Wattmeter (active, reactive and apparent) - Power Factor Meter - Phase angle meter to measure the angle between voltage and current - Frequency
Incorporates electronic protection, protecting the module against overloads and short circuits.	

Module

CTR-199

Ref: MDULCTR199

This module should perform three functions in the system ProLAB.



Union between BNC-199 bench and test bench, allowing set values to be applied to the bench and their signals to be read.

- Two blocks are available to calculate the true efficient values of two signals and the power factor between them.
- Organizes the analogue inputs and outputs of the SAD450 DIANA as needed by the DIANA software for automatic configuration of the test.

Functional Description

The support comprises a double-size training module: 250 x 144 x 130 mm. The power required for its operation is:

- ± 15 V, by inserting into the ALECOP support frame.

Includes serigraph identifying the functional blocks and components symbols. Use safety sockets 2 mm. in diameter that serve as test points.

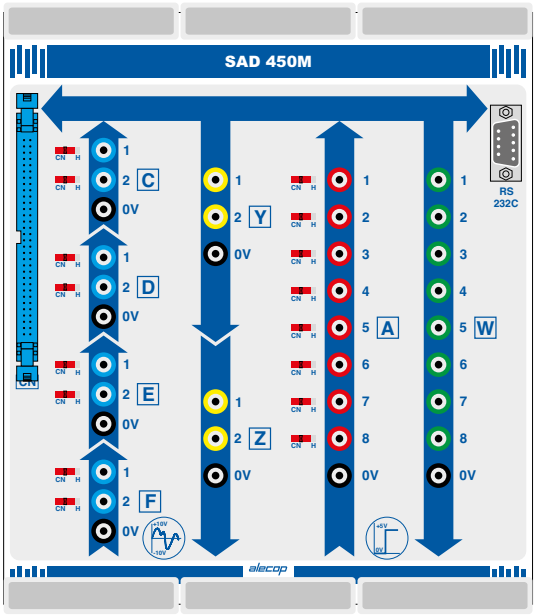
Technical specifications

True effective value block	- Number of inputs: 2 (Two effective values). ± 10V. - Number of outputs: 3 (Two effective values 0 to +10V, and an out of phase Cosine ± 10V). - Bandwidth: >500Hz. - Accuracy: 1% f.e. (RMS), 2% f.e. (power factor).
BNC-199 connection	- Number of active signals: 6. - Number of outputs (default value): 2 (Torque and speed) - Number of inputs (measurements): 2 (Torque and speed) - Number of control signals: 2 (Error and Control) - 2 mm safety plugs for set point control or testing.
Input-output control	- Number of modules to control: 4 + BNC199 Test benches + 2 RMS blocks. - Number of combinations: 128.

Module

SAD450M

Ref: MDULSAD450



Along with the DIANA software it is part of a test bench governed from a computer which enables tests to be performed on real machines (transformers, DC rotary machines, and AC single and three phase rotary electrical machines. This module requires a desktop chassis with power supply (ALI -700 or ALI-199) for its operation.
It has inputs / output connections in 2 mm sockets to connect quickly with the equipment to be analyzed. In addition to the sockets, all connections are available in a 64-way connector.

Along with the SAD-450 a module a cable for a line connection to a PC USB is incorporated. The SAD450 module is divided into 8 blocks or channels, each with a determined I / O type and with different nomenclature based on whether they are inputs or outputs.

Each analogue or digital input channel has a switch to select whether the input comes from the socket (position H) or a 64-way connector (CN). Based on this switch the origin of the signal to be acquired by the data acquisition system will be determined.

The outputs have no switch and will be accessible both from the socket and from the connector at all times.

Technical specifications

Communication via ASCII commands	
Consumption	+15V – 162mA.
Physical Measurements	215x250x147 mm. (W x H x D)
External connections	- PC connection: USB wire. - Power Supply Connector to the frame - I/O Connector: 64-way connector.
Conversion times	- 1 channel analogue Fmax 200 Khz. - Fmax 1 digital channel 333 Khz.
60K of RAM for data	
8 Analog Inputs	12 bits of resolution.

DIANA

Software

Interactive Learning Design for electrical machines.

Diana is the ProLAB software part. It simulates tests and offers interesting possibilities either as a standalone component or part of a computer network.

- Visual configuration of the test with real elements.
- Analysis functions of test results and report creation for the user.
- It can work with the other ProLAB elements or alone, thanks to its full simulators.
- Includes advanced communication capabilities.
- Monitoring of PCs in a classroom and online.

Conducting a test

Description of the test
You can enter a title and description that includes images about the practice.

Definition of assembly
The items chosen as part of the test, their interconnection and instrumentation through a block diagram.

Real elements
The block diagram is translated to real elements DIANA offers various possibilities for each element and shows how to do the actual connection.

Document
A DIANA wizard generates personalised reports on the work carried out with graphic and numerical information.

Analysis of the results
In each test a set of signals are collected a signal that is stored in the results. With DIANA signals can be viewed, compared, operations can be carried out among them and filters can even be applied.

Test bench Network
The test is applied and transmitted to a ProLAB through the local network or Internet.

Local test bench
The BEM is connected to the PC directly.

Simulated test bench
Advanced machine simulators incorporated by DIANA offer a result tightly adjusted to reality without the need for any hardware.

Classroom application

- The teacher/student can carry out demonstrations and students can see them on their own screen.
- Users can work offline when the BEM is busy setting up and simulating tests.
- The teacher can see the work being done by their students and take control of their PCs.
- Anyone can perform a test of a fixed duration or continuously from their PC on the real ProLAB.
- The teacher may interrupt a test and block access to the ProLAB.
- Users can share information through libraries and the network.

Chronogram
The signals which are sent and received from and to the test elements are configured in this section (units, signal shape and its timer).

Includes a comprehensive library of activities

It is not necessary to start from scratch to set up the tests. DIANA is distributed with a complete library of activities designed and developed by experts, including:

- Headings.
- Configuration of items.
- Definition of the diagram.
- Results analyzed with comments.

Tests for AC, DC electric machines and transformers.

DIANA is full of content on electrical machines!

Performing the test
Once the definition of the test is complete it can be launched and the status of the signals of interest can be monitored.

Licensing system

DIANA licenses can be hardware or Internet licenses:

- **USB keys**
- **Web Licenses**
  - Undefined
  - 1 year
  - 4 months

Automation

Control and testing with electrical machines CM-281

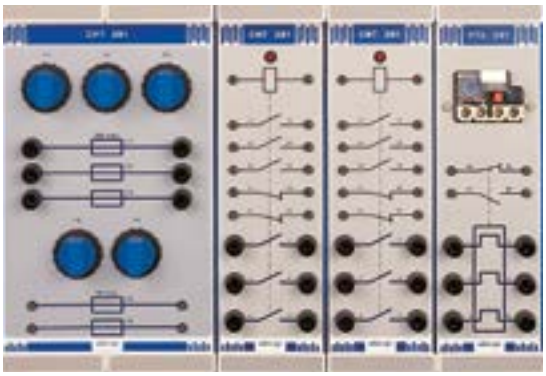
Designed to study the operating principles of electric machines, allows for commissioning, testing on empty and loaded to obtain curves, etc.

Instrumentation training modules

- Module “AMMETER 281”: 0,5-2,5-5 A. In A.C./D.C.
- Module “AMMETER 282”: 5-10-25 A. In A.C./D.C.
- Module “VOLTMETER-281” 100-250-500 V. In A.C./D.C.
- Module “VOLTMETER-281Q: 1KW. 220 V./5 A.

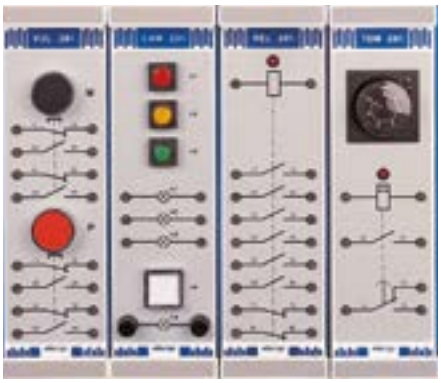
Supply training modules

- Module “ALI-24”: 24V power supply.
- Module “CNM-281”: 3-way switch/3 positions.
- Module “SIN-281”: synchronism light.
- Module “REC-281”: 200 Vcc rectifier. / 10 A.
- Module “CON-281”: condenser.



Power training modules

- Module “CPT-281”: fuse protection circuit 6 and 20 A.
- Module “CNT-281”: energy meter.
- Module “RT-281”: thermal relay.



Control training modules

- Module “PUL-281”: 2 buttons.
- Module “LAM-281”: 4 different coloured lamps.
- Module “RELÉ-281”: manoeuvre relay with auxiliary contacts.
- Module “TEM-281” : timed from 0 to 60 sec.

Rheostats

Set of resistive loads equipped with 4 mm safety terminals for a fast connection to electrical machines under study. The electrical parts are protected from shock by electrically insulated metal casing.

RHEOSTATS	D.C.START-UP	EXCITATION	THREE-PHASE LOAD	THREE-PHASE START-UP
0.5 CV. MODELS. References	150/500 9EQR150500	1500/250 9EQR1K5250	3250 9EQR325000	347 9EQRTR3470
FEATURES	150 ohm. 500W. 1,83 A.	1.500 ohm. 250W 0,41 A.	3 x 470 ohm. 3 x 250 W. 3 x 1,45 A.	3 x 47 ohm. 3 x 300 W. 3 x 2,4 A.

Mains voltage electrical automatic devices

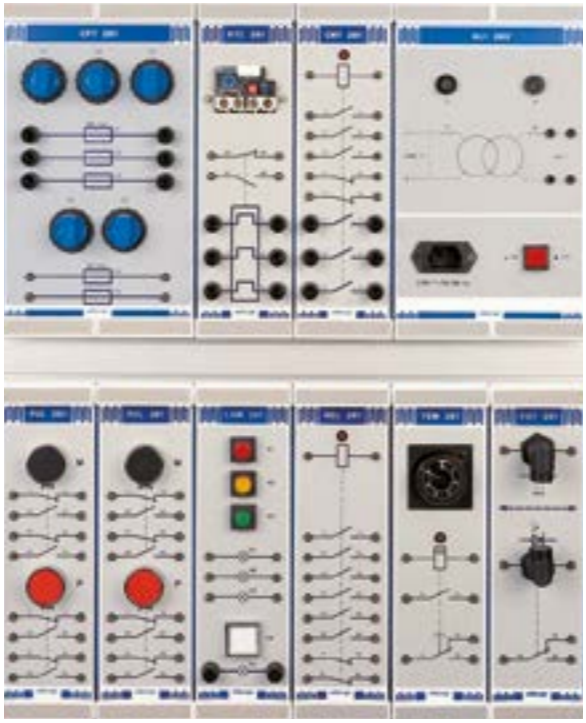
Teaching equipment for the study of different types of operations with single and three phase electric motors. Allows electric automatism practices and exercises to be carried out: commissioning and typical operation, interlocks, rotation inversions, protection, etc. They also allow the simulation and testing of any type of automation.

MT-332 electrical automation training equipment

The equipment comprises:

- 1 desktop frame.
- 1 modular set of elements: protection modules and control and signalling modules.
- 1 set of accessories: operating practices, safety plugs, fuses, spare parts, etc.

Ref: 9EQMT332SE



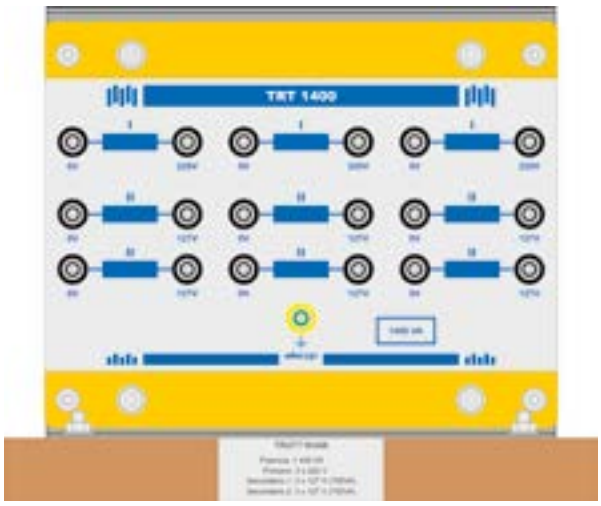
Educational Transformers

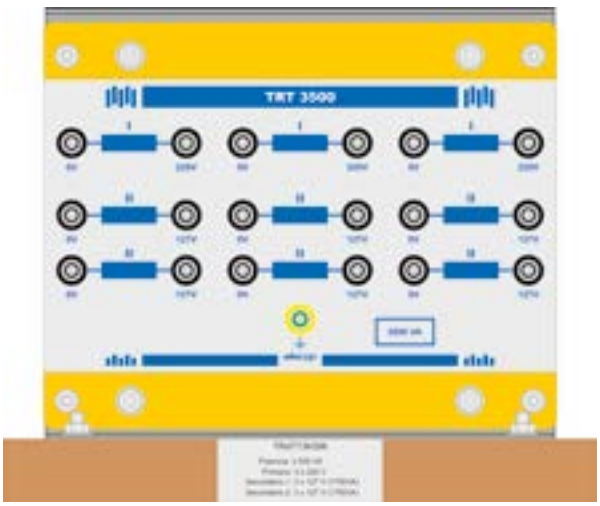
For the study and interconnection of different types of three-phase and single-phase transformers.

They have the following general characteristics:

- E-shaped or U-shaped oriented grain magnetic core.
- Set of standard coils for the 127/220 V.
- Safety terminals.

REFERENCES	MODEL	NAME-FEATURES
9EQTM1K596	TM-1K5	1.5 KVA single-phase transformer
9EQTT1K496	TT-1K4	1.4 KVA three-phase transformer
9EQTT3K596	TT-3K5	3.5 KVA three-phase transformer





Three-phase autotransformer AT-3822

Three-phase functional autotransformer 1 KVA 380 - 220 V. Output available in safety terminal and power socket. Pilot lights indicating the presence of phases. Protection of phase using fuse.

Ref: 9EQAT38221

Machines

A.C. / D.C. Electrical machines

The machines are designed to work under safety standards, and can work coupled with other machines or independently.

To prevent user access to moving parts, the machine has built-in protectors in both axis outputs. The handling of the protectors is defined in the manual of each machine. They also incorporate a printed terminal block with safety terminals.

All electric machines are mounted on an aluminium bench with hooks at their ends so they can be quickly and easily fitted together without tools.

- The system is compatible with BNC-199 bench.
- Machines are available for 50 and 60 Hz.

A.C electrical machines.

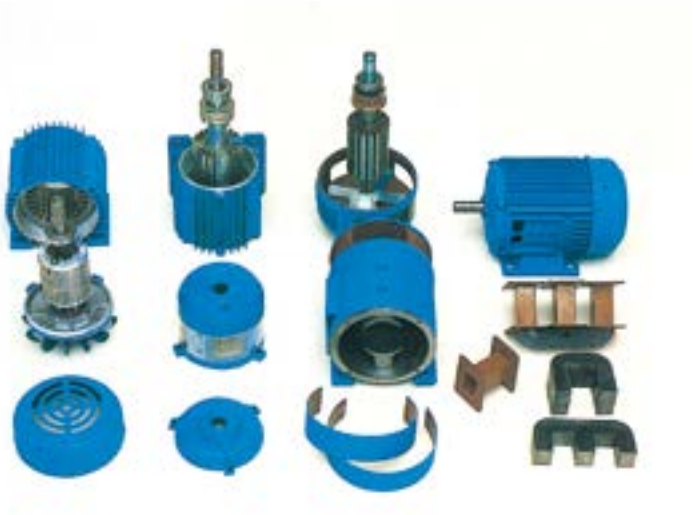
MODEL	NAME-FEATURES	REFERENCE
AL-106	Educational single-phase asynchronous motor. Permanent capacitor 0.5 CV.	(50 Hz) 9MAK01064C (60 Hz) 9MAK01065C
AL-205	Three-phase asynchronous motor, 2-speed and separate windings 200W-500W.	(50 HZ) 9MAK0205GC (60 Hz) 9MAK0205HC
AL-206	Dahlander educational three-phase 2-speed asynchronous motor (Constant torque) 0.5 C.V.	(50 Hz) 9MAK0206AC (60 Hz)9MAK0206BC
AL-207	Dahlander educational three-phase 2-speed asynchronous motor (Fan torque) 0.5 C.V.	(50 Hz) 9MAK0207AC (60 Hz) 9MAK0207BC
AL-208	Dahlander educational three-phase 2-speed asynchronous motor (Constant Power) 0.5 C.V.	(50 Hz) 9MAK0208AC (60 Hz) 9MAK0208BC
AL-306	0.5 CV Three-phase asynchronous motor rotor winding.	(50 Hz) 9MAK0306GC (60 Hz) 9MAK0306HC
AL-406	Educational synchronous rotor winding machine 0.5 CV.	(50 Hz) 9MAK0406GC (60 Hz) 9MAK0406HC
AL-1106	Asynchronous three-phase squirrel cage motor 0.5. C.V.	(50 Hz) 9MAK1106GC (60 Hz) 9MAK1106HC

D.C electrical machines

MODEL	NAME-FEATURES	REFERENCE
AL-506	DC educational independent excitation machine 0.5 CV	9MAK0506ZC
AL-606	DC. educational excitation machine series 370W	9MAK0606ZC
AL-1006	DC. educational excitation machine series Compound 0.5CV	9MAK1006ZC
AL-1305	Pendular dynamic brake 600W	9MAK1305ZC

Electrical machines without winding

The number of machines is available in 0.5 CV version without winding. Mechanical assemblies are provided (housing, rotor, bearings, etc ...) for the implementation and testing of electrical machines. They have the same power features, speed, etc. than machines.



DESCRIPTION	REFERENCES
Single-phase motor winding Kit AL-106 / 0.5 CV.	9MAK01S6ZC
Three-phase motor winding Kit AL-206 / 0.5 CV.	9MAK02S6ZC
Three-phase motor winding Kit AL-306 / 0.5 CV.	9MAK03S6ZC
Three-phase synchronous machine kit for winding AL406 /0.5 C.V.	9MAK04S6ZC
Separately excited DC machine Kit AL506 /0.5 CV.	9MAK05S6ZC
Separately excited DC machine Kit AL-606/0.5CV	9MAK06S6ZC
Separately excited compound machine Kit AL1006 /0.5 C.V.	9MAK10S6ZC
Three-phase motor winding Kit AL1106 / 1 CV.	9MAK11S6ZC
Three phase synchronous training motor assembly AL-1106-D / 50Hz	9MAK11D64C
Three phase synchronous training motor assembly AL-1106-D / 60Hz	9MAK11D6HC

Construction of transformers

Equipment designed to develop skills of analysis, design, construction and testing of different types of processors, both single and three phase.

The materials are in bags or boxes, including all the necessary elements for the construction of actual processors, with the help of complete educational documentation, including the practical solutions proposed.

Single-phase transformers Kit

KMF-128

Allows the following practical activities to be carried out:

- Analysis of static windable devices.
- Construction of a simple single-phase transformer (design, documentation, construction and verification).
- Construction of a bi-voltage single-phase transformer (design, documentation, construction and verification).
- Construction of a double output single-phase transformer (design, documentation, construction and verification).
- Construction of a single-phase autotransformer (design, documentation, construction and verification).
- Analysis of the construction techniques and means for transformers.
- Development of transformers manufacturing plans.

CONTENTS
4.1 Kg magnetic sheet RC-36-MA.
4.1 kg of grain-oriented electrical steel.
Reels of different types.
Shell-type transformer.
Insulating paper.
Cover of different diameters.
4 angular profiles.
1 symmetric DIN profile.
Straight edge.
Stackable terminals.
Safety terminals.
Screws, bolts, washers, etc.
Wooden blocks for setting up pieces for the winder.
Field Manual.
Case (depending on model).

Ref: 9EQKITMAMF IN A CASE

Ref: 9EQKITMNFS NO CASE

Three-phase transformers

KMF-128

Allows the following practical activities to be carried out:

- Analysis of static windable devices.
- Construction of a simple three-phase transformer (design, documentation, construction and verification).
- Construction of a secondary multiple three-phase transformer (design, documentation, construction and verification).
- Construction of a single-phase autotransformer (design, documentation, construction and verification).
- Analysis of the construction techniques and means for transformers.
- Development of transformers manufacturing plans.

CONTENTS
7,3 Kg magnetic sheet EI-30 TRIF.
7,3 Kg of grain-oriented electrical steel.
Reels of different types.
Insulating paper.
Cover of different diameters.
4 angular profiles.
1 symmetric DIN profile.
Straight edge.
Stackable terminals.
Safety terminals.
Screws, bolts, washers, etc.
Wooden blocks for setting up pieces for the winder.
Field Manual.
Case (depending on model).

Ref: 9EQKITMATR IN A CASE

Ref: 9EQKITTRIF NO CASE

Enamelled copper wire for winding

Enamelled copper wire for winding, weighing approximately 1 kg/coil.

REFERENCES	TYPE
SINGLE-PHASE TRANSFORMER KIT	
FUNG068	Enamelled wire bobbin diameter 0.6 mm
FUNG072	Enamelled wire bobbin diameter 0.8 mm
FUNG073	Enamelled wire bobbin diameter 0.85 mm
FUNG075	Enamelled wire bobbin diameter 1 mm
FUNG076	Enamelled wire bobbin diameter 1.2 mm
FUNG078	Enamelled wire bobbin diameter 1.7 mm
FUNG079	Enamelled wire bobbin diameter 2 mm
THREE-PHASE TRANSFORMER KIT	
FUNG073	Enamelled wire bobbin diameter 0.85 mm
FUNG075	Enamelled wire bobbin diameter 1 mm
FUNG076	Enamelled wire bobbin diameter 1.2 mm
FUNG078	Enamelled wire bobbin diameter 1.7 mm
FUNG079	Enamelled wire bobbin diameter 2 mm

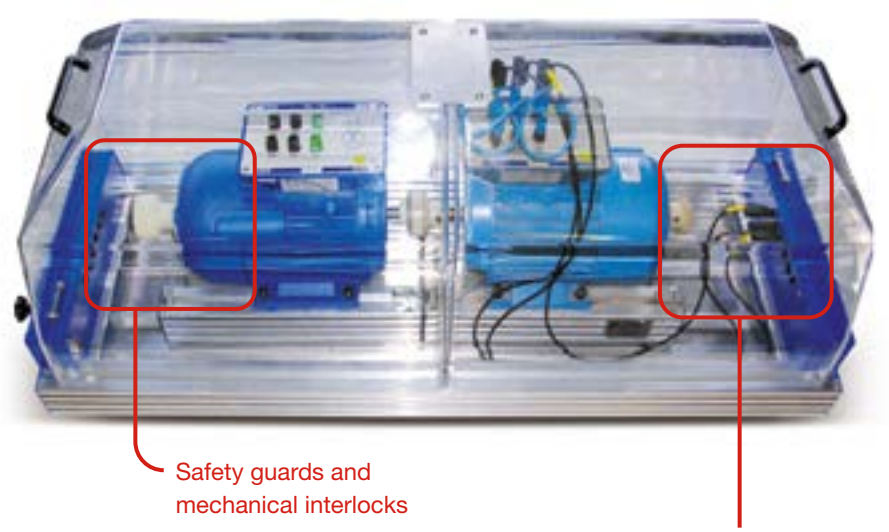
Segumac

Safety bench for electrical machines

Training equipment designed to work according to safety standards with electrical machines that do not incorporate mechanical and/or electric protection devices.

Allows any type of equipment available to be used, either the Alecop brand or any other manufacturer.

If the electrical machines have moving parts or electrical connections available, this bench is the ideal solution for carrying out activities safely, complying with current legislation.



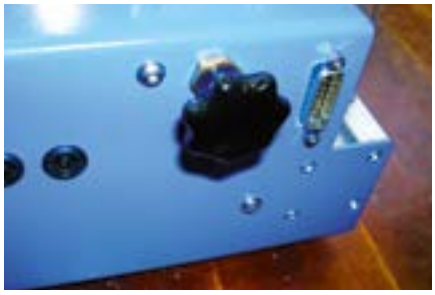
Avoids the risk of mechanical and electrical accidents

Protection elements incorporated:

Guard with approved safety interlocks. Prevents access to moving parts and electrical connections in the bench. As it is transparent, the inside of the bench can be seen, with the machines electrics and it connections visible.

Side safety terminals

Has two groups of twelve safety terminals, six internal and six external, on either side of the bench. This allows the connection of electrical devices to power sources and/or external control.



Mechanical interlocks

One on each side of the bed, blocking the opening of the guards and in turn giving orders to activate the contactors that connect the interior terminals with the external terminals, leaving the electrical machines in operation.

Auto stop

Disabling either of the two side interlocks the power supply is cut off, causing the shutdown of the electrical machines.

Signal pilot

It includes red indicating bench light connected to the mains, and a green indicator light indicating that the guard is closed and locked.

Possible combinations of electrical machines:

The size and the number of side terminals available enable the safety bench to be used with the following combinations of Alecop electrical machines:

- A single motor running independently.
- A traction motor and generator unit (dynamo or alternator).
- A motor and dynamo tachometer unit.

Technical specifications

Power supply: 230V-50Hz
Maximum current side terminals: 20 Amperios
Dimensions: 1.000 x 360 x 400 mm
Package dimensions: 1.020 x 370 x 415 mm
Weight: 16 Kgs.
Weight with packaging: 18Kgs.

Equipment composition

SAFETY BENCH | USER MANUAL | POWER CABLE

Ref.: 9EQSEGUMAC

VIRTOOL VirMaq

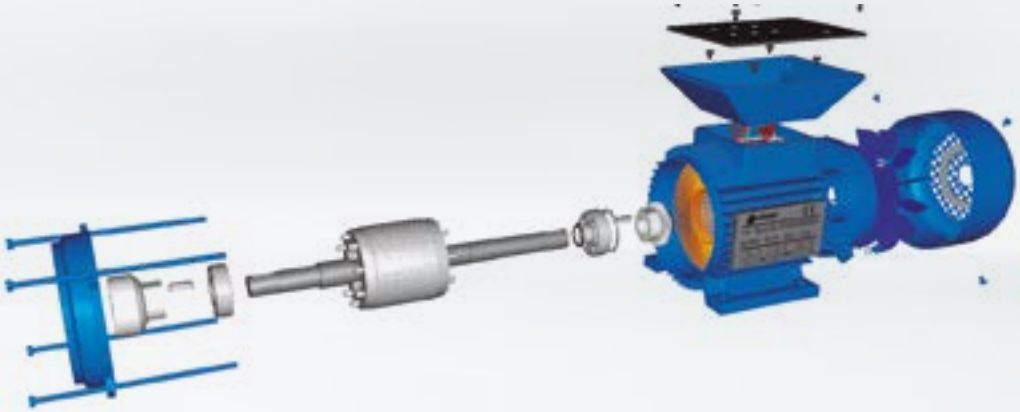
Interactive 3D system for electric machine analysis and assembly

VIRTOOL VirMaq is a software application developed for users to identify the different parts of a three-phase asynchronous motor and assemble its entire structure.

Interaction

The simulator enables the following:

- Component selection and identification
- Assembling and mounting the different machine parts
- Dismantling components
- Assembly, bolting or fixing of components with bolts, studs, washers, etc.
- Using hand tools or machines that function as in real life



Activities

- Identifying the motor parts.
- Simple wiring of the terminal block.
- Assembly of the different components using all the necessary tools, including a hydraulic press for assembling and pressing bearings.

12 HOURS OF SELF-TRAINING (APPROX.)

VirMAQ Licences

This product has an online system and must be installed on a PC with a permanent internet connection.
SOFEVIR50X

6

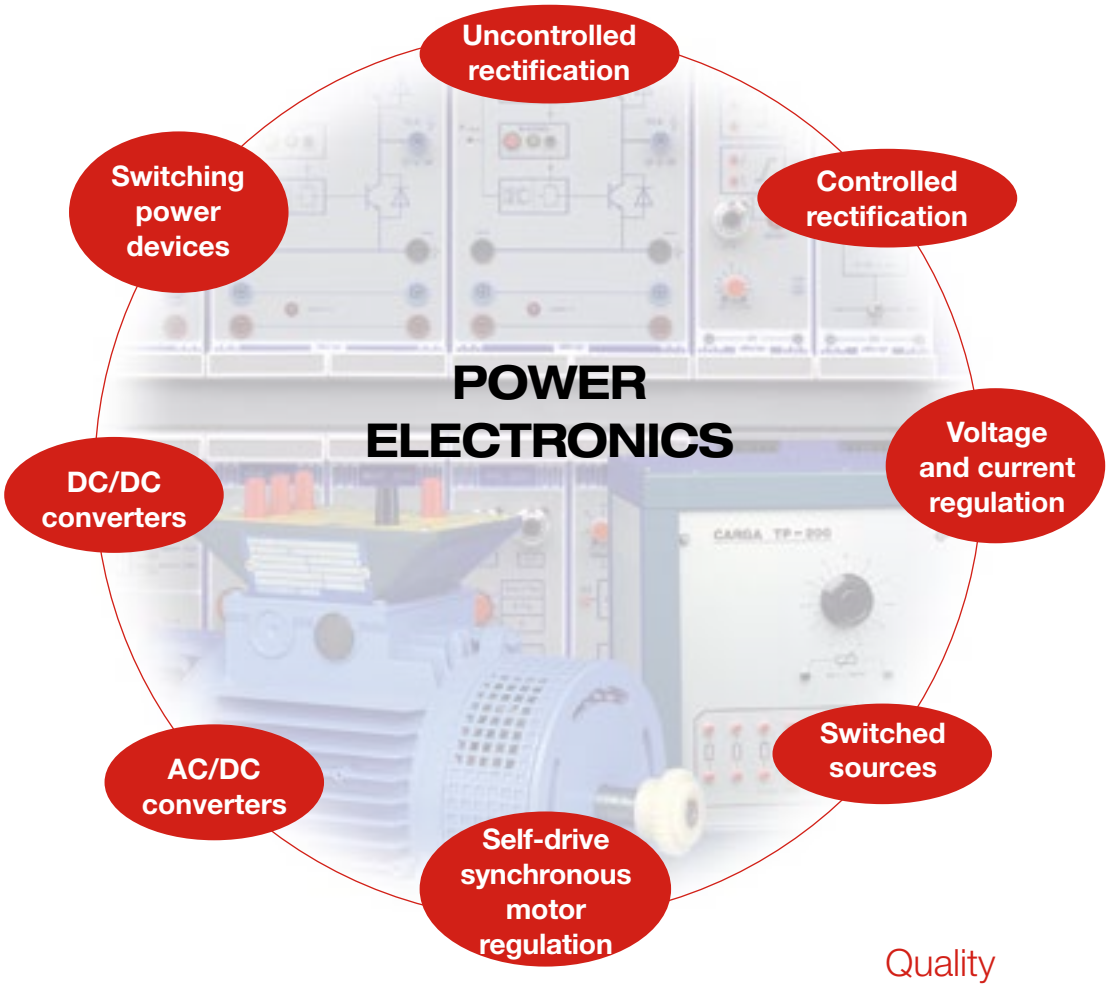
power electronics

This training equipment takes the form of a modular programme for study through analysis of the four types of power converters used in industrial applications (rectifiers, choppers, inverters/undulators and AC regulators) and the power devices forming the basis for the design of these applications. The equipment includes a specific switched power source study section.

index

Power electronics: industrial electronics

This training equipment takes the form of a modular programme for study through analysis of the four types of power converters used in industrial applications (rectifiers, choppers, inverters/undulators and AC regulators) and the power devices forming the basis for the design of these applications.



Safety

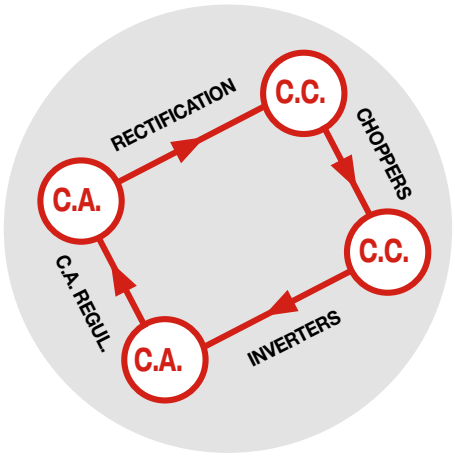
Safety connections at voltage points exceeding 30 V (connectors and sockets).

Quality

Compliant with the European low voltage and electromagnetic compatibility directives. Elements stamped in accordance with the IEC (Electrotechnical Commission) standard.

MODULAR PROGRAMME

The system is based on a “module” support, which can be configured according to user needs and can be added to as required.



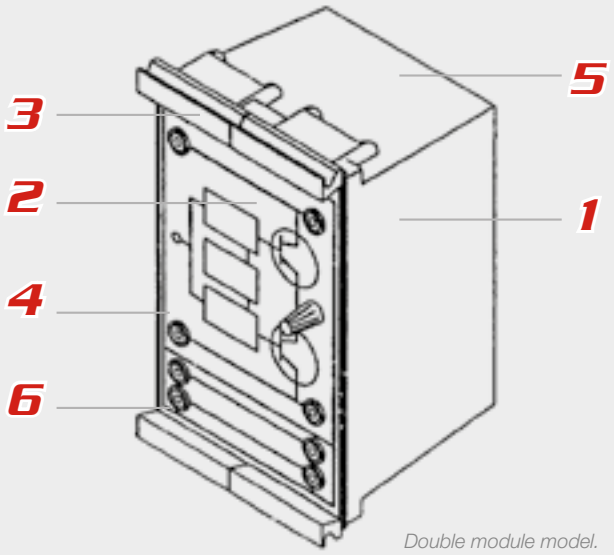
Back-up resources

This equipment includes a set of back-up elements to aid the trainer, e.g.:

- Training Guide, or trainer’s class work guide, which defines goals, activities, sequencing, etc. and proposes a course outline. The activities and use of the different available resources (training devices, instruments, etc.) are structured on the basis of this guide.
- Practical Manual, which contains a series of units describing goals, teaching sequence, materials required, assessment criteria, etc.
- User Manual, with a technical description and information on the equipment.
- Theory Manual.

The module support

The module is a physical support with the following dimensions: 250 x 72 mm for the single module, 250 x 144 mm for the dual module and 250 x 216 mm for the triple module. These sizes make it easy to handle and suitable for work on panels or vertical frames. The figure shows a model of the module and indicates its main structural features.



Double module model.

1

The support consists of two elements: the front panel and the box. The front panel is made of recyclable shockproof polystyrene plastic, whose main features are its excellent surface finish, high dielectric strength and rigidity. The box is made of transparent polycarbonate, a rigid material with a high thermal and electric resistance and weatherproof. Both the polystyrene and the polycarbonate are free of cadmium, a substance classified as carcinogenic.

2

The printed information is a vital communication support and an element of great didactic value, associating each industrial component or circuit with the corresponding symbol in accordance with the IEC (International Electrotechnical Commission) standard.

3

Name: all the modules have a name printed on the front panel to facilitate identification and storage.

4

Electrical connection points: fixed to a socket type terminal for connection via a banana plug. The socket diameter depends on the type of electrical connection at each point: 4 mm for power connections using safety sockets, and 2 mm for control connections.

5

The rear connectors facilitate mounting the module on the vertical panels, and supply the voltage required for the internal circuits to function. For this purpose, the vertical frames and in general all the Alecop cabinets designed to house the modules are equipped with small interwired connectors.

6

The handles on the top and bottom of the devices enable the module to be fitted to and removed from the different frames, panels and cabinets designed for this purpose.

These characteristics make the module an ideal working element for students, as the basis of their practical training, and also for the trainer as a demonstration device for presenting the theory and practical methodology.

Assembly and power supply system

The assembly frame and the ALI-700 power supply module form the basis of the modular programme and are required for all training module configuration requiring an electronic power supply.

Table-mounted training frame

- This is a physical support for the modules, blocks and panels used for the practical activities.
- It transmits the electrical supply from the power supply modules to all the modules requiring it.

The frame dimensions are selected in accordance with the equipment to be mounted on the frame. Its horizontal structure consists of an aluminium section and the rectangular side supports are oven-dried painted iron sections.

As regards locating the frame on the work tables, it may be fixed (the frame can be fixed to the tables) or mobile (in which case it is supplied with removable legs with non-slip feet).

The module power supply and fixing systems consist of a series of connectors, into which the connection points located on the rear of the modules are inserted, exerting a slight pressure.

All the frame connectors are interwired in order to share a common voltage, guaranteeing a suitable power supply to the modules installed. The power is supplied via the ALI-700 module.

Ref.: 9EBxPxxCP

x: 1,2: frame height in tiers.
xx: 10, 14, 18, 20, 22, 28, 36, 44: nº of insertable single modules.

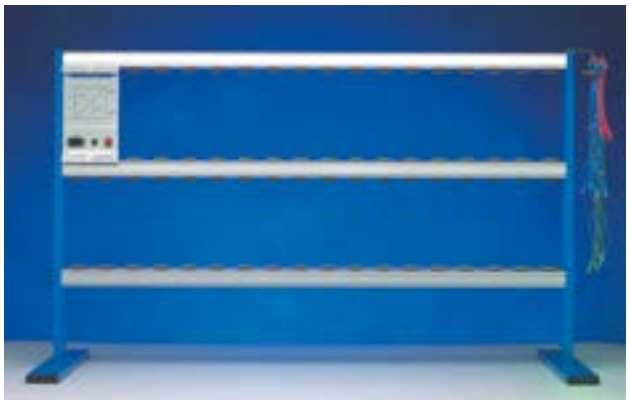
Training Module

±15 V. SUPLLY

A supply source of ± 15 V. The power supply is transmitted via the table-mounted frame, and these voltages are also available at 2 mm terminals.

It includes the corresponding pilot LEDs to indicate correct output functioning, providing a nominal current of 2 A. It includes thermal and short-circuit protection, with automatic reset after a few seconds.

Ref.: MDULALI700



Controlled and uncontrolled rectification

EP1/EP2

Equipment for studying uncontrolled rectification (EP1), controlled rectification and alternating current regulation (EP2). It can be used at either low voltage (22/38 VAC, with CIR-120 and CRC-120 charges) or mains voltage.

Training module RNC-120

UNCONTROLLED RECTIFICATION

It enables the study of power diode-based rectifiers and their applications: single-phase, two-phase and three-phase half wave and full wave rectifiers.

- Based on the multi-panel concept.
- Includes the base module and five panels for study of the different bridges.
- Operating range: 22 VAC - 380 VAC.
- Safety connections and over-voltage and overload protection.

Ref: MDULRNC120

Training module RTC-120

CONTROLLED RECTIFICATION

It enables the study of power thyristor based controlled rectifiers and their applications: semi-controlled and fully controlled single-phase, two-phase and three-phase half wave and full wave rectifiers.

- Based on the multi-panel concept.
- Includes the base module and eight panels for study of the different bridges.
- Operating range: 22 VAC - 380 VAC.
- Safety connections and over-voltage and overload protection.

Ref: MDULRTC120

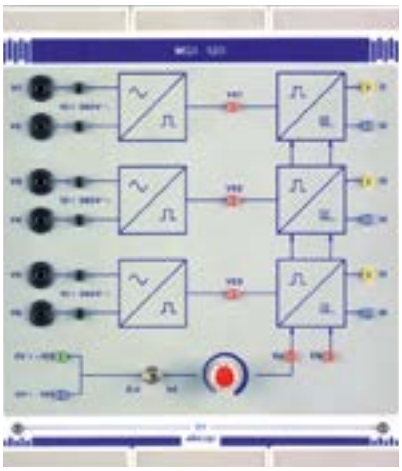
Training module MGI-120

PULSE GENERATOR

Sync and pulse train generator for ignition of the RTC-120 module thyristors.

- Control of up to 6 thyristors in three-phase bridge configuration.
- Three separate sync inputs, 10 – 380 VAC.
- Six pulse outputs, simultaneous and electrically insulated in pairs.
- Time-shifted pulse train according to external or internal set point.
- Input terminal for enabling/inhibiting pulse outputs.
- Requires ALI-700 ±15 V power supply module and table-mounted frame.

Ref: MDULMGI120



Training module **TRI-120**

THREE-PHASE TRANSFORMER 220/380-22/38 Vac

Phase transformer, depending on the model has a ratio of 220 V. to 22/38 V. or 380 V. a 22/38 V, with an apparent power of 300 VA. It is required for obtaining a low-power three-phase system, supplying the RNC/RTC-120 modules.

- Selection of 22/38 V output voltage by selector switch.
- Successive phase indicator light.
- Overload and over-voltage protection.
- Requires ALI-700 ±15 V power supply module and table-mounted frame.

Ref: MDULTRI120

Training module **CIR-120**

RESISTIVE-INDUCTIVE CHARGE

Charge module for low-power rectifier bridge work.

- Multi-panel system.
- Twelve panels for configuring different charge connection types.
- Charges: Y/A, R, L, R-L, free connection, etc., up to 50 Vef.
- Self-powered fan.

Ref: MDULCIR120

Training module **BAT-120**

RECHARGEABLE BATTERY

Module for simulating counter-electromotive force (DC motor), with single-phase 230 VAC mains supply. Charging circuit 12 V/6.5 Ah.

Ref: MDULBAT120

Training module **CRC-120**

RESISTIVE-CAPACITIVE CHARGES

Charge module for low-power rectifier bridge work.

- Multi-panel system.
- Three panels for configuring different types of charge connection.
- Charges: Y/A, free connection, etc., up to 63 Vef.

Ref: MDULCRC120

Given set of teaching materials for the study of pulse generators

Trainer for the study of the different circuits used in the pulse generation for thyristors and triacs, based on devices such as: UJT, DIAC, TCA-758, etc. Composed by:

1 Block nº 363: transformer 12+12 V.
1 Block nº 393: pulse generator.
1 Block nº 333: B250 rectification bridge.
1 Block nº 355: pulse transformer.
1 Block nº 288: uni-junction transistor.
1 Block nº 296: triac.
1 Block nº 294: diac.
1 Block nº 265: potentiometer 10 K.
1 Block nº 268: potentiometer 500K.
6 Blocks nº 208: support for components.
1 Block nº 314: lamp holder.
2 Base plates for the assembling of the educational blocks.

Ref: 9EQCNJDAEP

Switching power devices

EP3

Set of modules enabling practical analysis of the behaviour, advantages, disadvantages and problems of control of switching mode power devices.

Each module includes a block with the circuit's most significant voltage and current measurements, at reduced voltage and measured at the same point. The modules also include an electronic overcurrent and short-circuit protection system.

Training module
TRS-200

BIPOLAR TRANSISTOR

For studying the bipolar switching power transistor. It includes a PWM signal generator circuit for transistor control, which generates the input signal to the basic circuit (DRIVER), obtaining a 4 KHz rectangular signal with a variable duty cycle according to the user-accessible PWM potentiometer and Ton selector incorporated.

Equipped with a switching aid circuit via an anti-saturation diode.

Ref: MDULTRS200

Training module
GTR-200

IGBT

Didactic module to study the switching behaviour of the IGBT (insulated gate bipolar transistor), included on the power IGBT module, as well as its control circuitry. To control the IGBT, a PWM signal generator is used which generates the input signal to the gate circuit (DRIVER), the latter is a rectangular 8 KHz. signal with a variable Ton of between 25 and 100 µsec, depending on the accessible potentiometer.

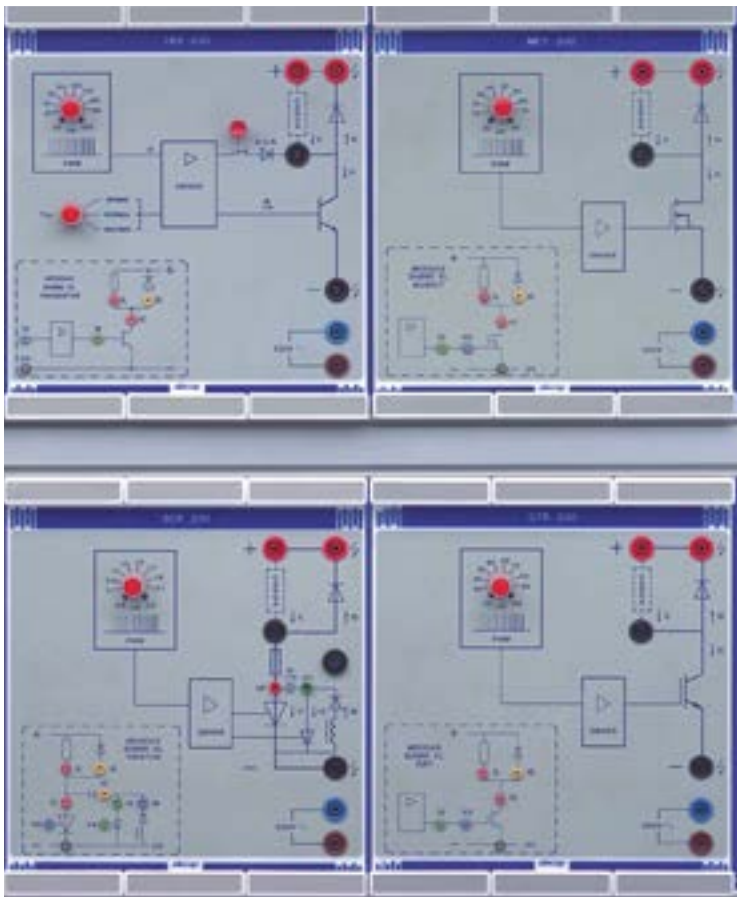
Ref: MDULGTR200

Training module
MTF-200

MOSFET

Didactic module to study the switching behaviour of the MOSFET power transistor, including a MOSFET module, as well as its control circuitry. To control the MOSFET, a PWM signal generator is used which generates the input signal to the gate circuit (DRIVER); the latter is a rectangular 10 KHz. signal with a variable Ton of between 25 and 80 µsec, depending on the PWM potentiometer.

Ref: MDULMFT200



Training module

THYRISTOR

Didactic module to study the switching behaviour of the power thyristor, including a thyristor module, as well as its control circuitry. To control the thyristor, a PWM signal generator is used which generates the input signal to the gate circuit (DRIVER); the latter is a rectangular 350 Hz. signal with a variable Ton of between 0.6 and 2.3 µsec, depending on the PWM potentiometer.

The DRIVER block generates pulses for the power thyristor gate, as well as for the auxiliary thyristor of the integrated forced commutation circuit.

Elements REQUIRED:
- Table-mounted frame
- ALI-700 supply module
- ALI-200 supply module
- TRF-200 transformer module

Ref: MDULSCR200

DC/DC and AC/DC converters, choppers and inverters

EP4/EP5

A set of modules that can be configured differently for studying DC/DC and AC/DC converters (inverters or undulators), the various modulation techniques and their different applications such as the regulation and control of DC and AC motors, uninterruptable power systems, etc.

POWER MODULES

Training module

ALI-200

CONTINUOUS POWER BUS

This didactic module contains a power supply of 310 V. continuous voltage, and can provide as far as a 10 A current. This is the constant direct voltage source for supplying the different convertors, and it distributes the mains voltage to the other power modules.

It incorporates 10 A fuses on the alternate and continuous side, protecting the module against line surges and short circuits.

The module disposes of a voltage sampling on the continuous bus; this signal is used as a protection measurement against possible high voltages on the BUS.

Ref: MDULALI200

Training module

TRF-200

ISOLATION TRANSFORMER

230/230 VAC transformer isolating the ALI-200 module network. It has primary and secondary protection by means of 10 A fuses.

Ref: MDULTRF200

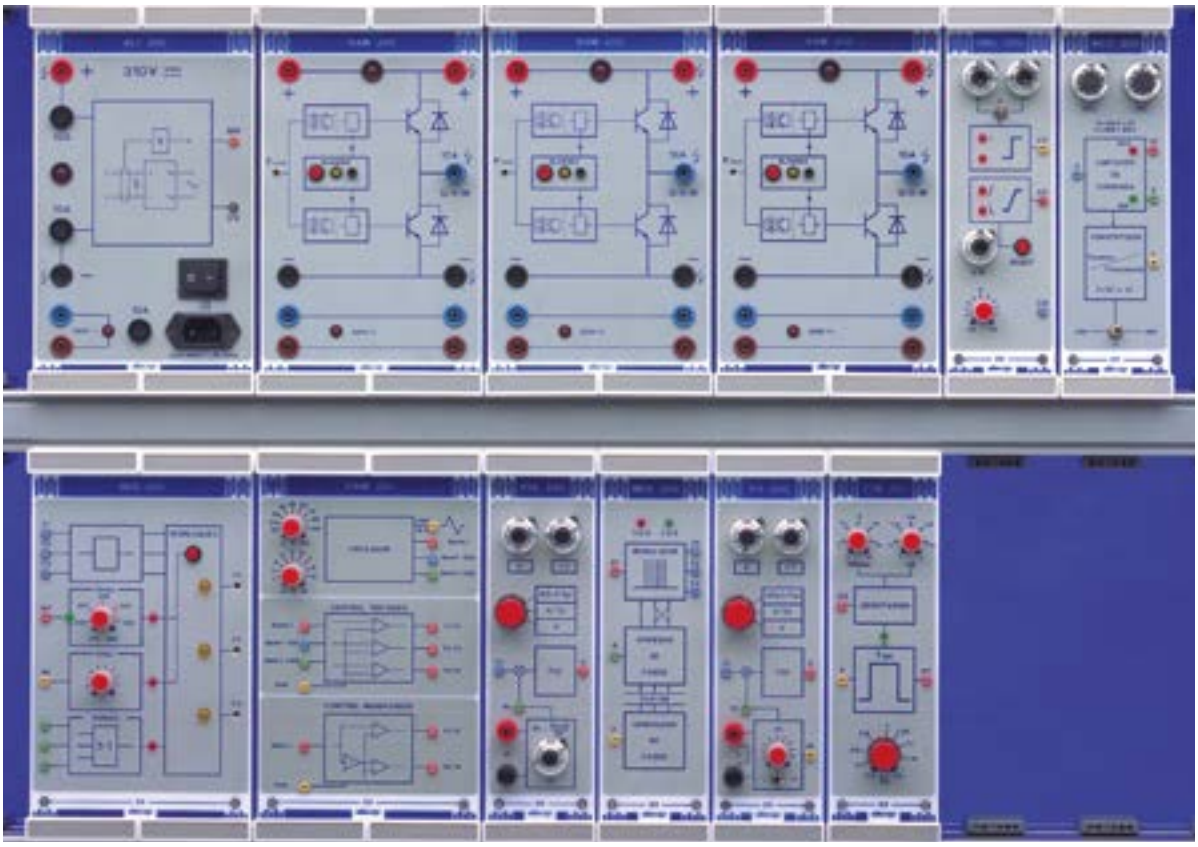
Training module

SEG-200

SAFETY DEVICE CENTRALISATION

This is a safety stage that must be included in all converters. It is a centralised protection block that protects the various convertor circuits against bus overvoltage and overloads. It also adapts the control signals to be sent to the RAMA modules of the converter in question in both amplitude and impedance, to act on the transistor base drivers.

Ref: MDULSEG200



Training module RAMA-200

BRANCH OF BIPOLAR TRANSISTORS

These modules allow configuring of the power blocks of any type of transistorised converter, each of them forming one of the branches of the converter. The number of modules to use depends on the type of circuit which will be implemented (two for DC/DC converters and three for DC/AC converters).

Each module includes two power transistors as well as base DRIVER circuits required for control purposes.

It includes a JACK-type connector where the control signals from the SEG-200 module are received. These signals are optocoupled allowing a complete separation of the circuits from the power circuits.

Inside the module, a logic processor has been integrated which is responsible for detecting any error in the RAM operation. If an error occurs, the processor blocks automatically and remains inoperative. The factors why the protection system lock the operation of the module are:

- Instantaneous intensity by transistors greater than 25 A with a longer duration than 4 msec.
- BUS voltage below 120 V.
- Network supply failure.
- Internal defects of circuit.

Elements REQUIRED:
- Table-mounted frame
- ALI-700 supply module
- ALI-200 supply module
- TRF-200 transformer module

Ref: MDULRAM200

POWER MODULES

Training module

SNG-200

SET POINT GENERATOR

This module generates three types of control set points: step, ramp and a set point that can be varied manually through potentiometric control.

Ref: MDULSNG200

Training module

VCO-200

VOLTAGE-FREQUENCY CONVERTER

It converts the set point voltage applied at the input into a frequency using a voltage-controlled oscillator. It forms the control part of the transistorised inverter together with the TON-200 and MDX-200 modules, for asynchronous machine speed variation.

Ref: MDULVCO200

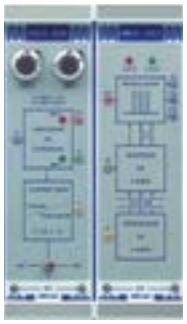
Training module

TON-200

TON DRIVER

The TON-200 module is in charge of the pulse width modulation coming from the voltage-frequency converter (VCO-200) for the control of the transistorised ondulator. It includes a pulse width adjustment circuit (Ton) and an overdrive circuit.

Ref: MDULTON200



Training module

MDX-200

GENERATOR-INVERTER-PHASE MODULATOR

This module generates the control signals to be applied to the six transistors that make up the inverter bridge. It has a phase generator, a phase inverter in accordance with the set point sign and a modulating circuit.

Ref: MDULMDX200z

Training module

PWM-200

PULSE WIDTH MODULATOR

It generates pulse width-modulated signals, providing the control commands to the power converters. It includes an oscillator block, which generates a triangular voltage and three 120° out -of-phase sinusoidal voltages, a “three-phase control” unit, for control of three-phase inverters, and a “single-phase control” unit for the single-phase inverters.

Ref: MDULPWM200

Speed and current regulation accessories

EP6

A small set of two modules that can complement the sets of converters to enable study of closed loop speed regulation.

Training module

PII-200

CURRENT LOOP IP CORRECTOR

Equipped with a current sensor, based on a Hall-effect cell, with an incorporated adjustable gain conditioner and three possible user-selectable control actions (proportional, integral and proportional-integral).

Ref: MDULPII200

Training module

PIV-200

PI CORRECTOR SPEED LOOP

Provided with an adjustable gain conditioner circuit for tachometer, comparator of set point with feedback voltage, and three possible control operations (proportional, integral and proportional-integral).

Ref: MDULPIV200

Self-drive synchronous motor regulation accessories

EP7

The set of elements described below complements the converter equipment to enable study of speed regulation in self-drive synchronous motors.

Training module
CRR-200

CORRECTION

Didactic module for regulation of current of a three-phase load. It has been fitted with three current sensing devices, based on LEM cells with integrated conditioner circuit and three proportional-integral controllers with a PWM modulator at the output.

Ref: MDULCRR200

Training module
CSI-200

ADAPTER SIGNAL ENCODER

Didactic module responsible for generating the three current set points required to control the converter that supplies the self-steering synchronous motor AL-906.

Ref: MDULCSI200

Training module
REC-200

RECTIFIER BRIDGE

Training module which incorporates a monophase bridge rectifier.
Needs 230 V. supply, monophase network voltage, providing 220V continuous voltage in the output. It can provide a maximum current of 7 A.

It has two ultra rapid fuses of 7 A. each, for protection of high currents and short circuits.

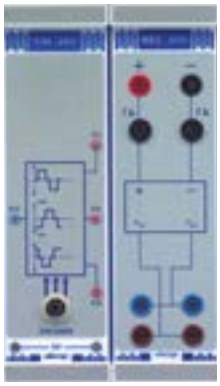
Ref: MDULREC200

Training module
AL-906

SELF-DRIVE SYNCHRONOUS MOTOR

This motor has an absolute encoder coupled to its shaft with three optical sensors enabling detection of rotor position every 60°. Mounted on a bedplate that can be quickly and easily coupled to other machines, tacho, brake, etc. Its technical characteristics are as follows:

CHARACTERISTICS	AL-906
Reference	9MAK0906ZC
Power	370W
Nominal voltage	230V
Nominal speed	1500rpm
Shaft height	80



Electrical machines, charges and braking system

All the electrical machines are mounted on an aluminium bedplate, with their corresponding end connections for quick, easy coupling to other machines, brakes or tacho dynamos. They also include a printed terminal block with safety terminals and protection guards on the shafts.

DC training motor

AL-506 / AL-1006

Model AL-506 is an independent excitation motor.
Model AL-1006 is an excitation and compound machine.

CHARACTERISTICS	AL-506	AL-1006
Reference	9MAK0506ZC	9MAK1006ZC
Power	370W	370W
Supply voltage	220V	220V
Maximum speed	2500rpm	2500rpm
Axis height	80	80

Asynchronous training motor

AL-1106

Single-speed three-phase asynchronous squirrel-cage motor.

CHARACTERISTICS 50Hz	AL-1106
Reference	9MAK1106GC
Power	400W
Supply voltage	230/400V
Maximum speed	1420rpm
Axis height	80

CHARACTERISTICS 60Hz	AL-1106
Reference	9MAK1106HC
Power	400W
Supply voltage	230/400V
Maximum speed	1690rpm
Axis height	80

Didactic tachodynamo **REO-444**

CHARACTERISTICS	REO-444-80	REO-444-90
Reference	9EQDINTQ80	9EQDINTQ90
Constant	60 V/1000 r.p.m.	60 V/1000 r.p.m.
Maximum speed	1000 r.p.m.	1000 r.p.m.
Axis height	80 mm	80 mm

Braking system - bank

Lets you set the machine easily into the bed, under safety standards that prevent the operation of the bank improperly.

The control of the bed is made by potentiometric dials variable torque or speed, or by external signals that allow for SAD and control by computer.

Viewing every moment of the power, speed and torque exerted on the shaft of the bench, signals available on external connector.

FUNCTION

Drive motor and brake of the machine under test.

Technical specifications

GENERIC

Supply: single-phase net 190 to 250Vac 5.25 Amp. - 50/60Hz

Type machines to be tested: - Type foot high 71, 80 and 90 mm.
- Height 80 to 90 mm on Alecop profiles.

Securing the machine under test by coupling.

OPERATING AS MOTOR DRIVE

Speed: 0 to 2000 rpm

Rated: 800 w

Maximum torque: 9.7 Nm

WORKS AS A BRAKE

Maximum speed: 2450 rpm

Par: 0 to 10 Nm

Rated: 800 w

System **TP-200** rolling loads

Transportable loads unit which disposes of a 100 Ohm./1000W rheostat, six 72 Ohm./200W resistances independent from each other (series, parallel or mixed connection), three inductances of 30mH./5 A and a condenser of 25 µF./450 V.

Ref: 9EQCATP200

7

regulation and control systems

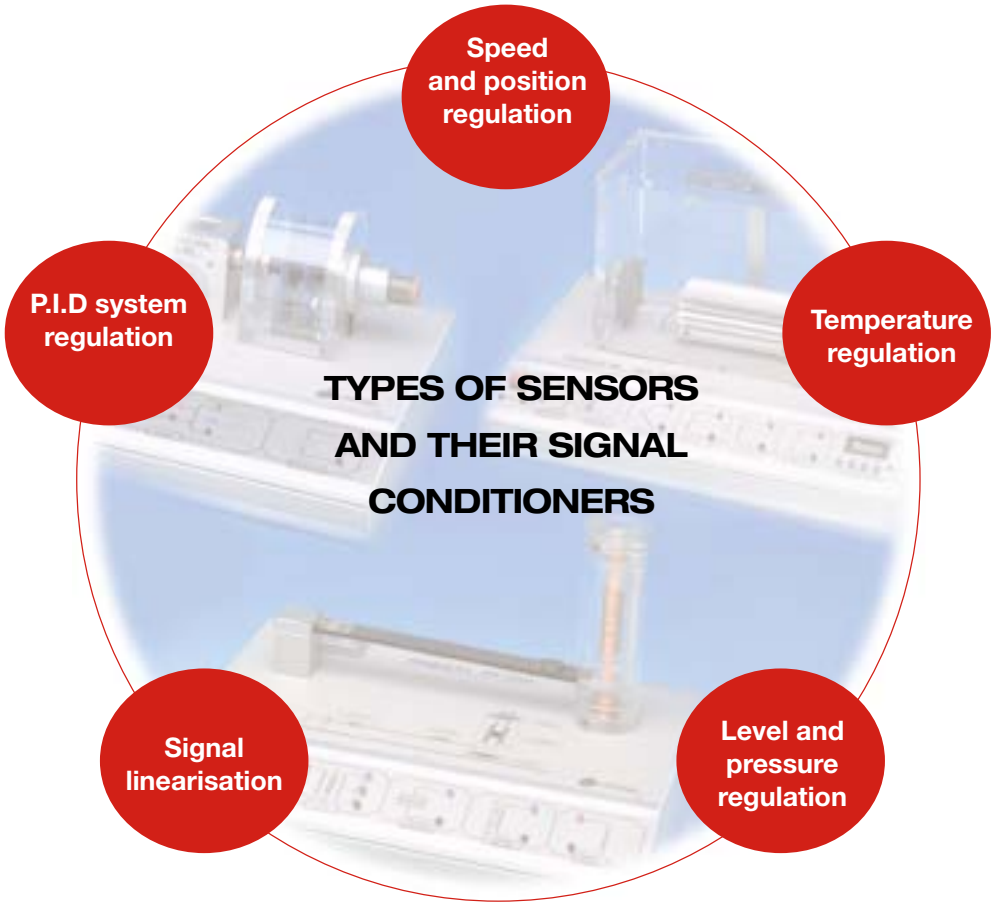
SENSORS, PROCESS REGULATION AND PROGRAMMABLE AUTOMATONS

The training equipment designed for this area consists of a modular programme enabling study through the analysis and design of different measurement and regulation systems. Functional models with integrated industrial sensors are used to study both these sensors and closed loop regulation systems for different processes.

index

Proposed laboratory regulation and control systems

The training equipment designed for this area consists of a modular programme enabling study through the analysis and design of different measurement and regulation systems. Functional models with integrated industrial sensors are used to study both these sensors and closed loop regulation systems for different processes (speed, temperature and level).



Simplicity

Process models with ready-to-work integrated actuators and sensors. 2 mm sockets for quick connection and multi-point measurement.

Quality

Compliant with the European low voltage and electromagnetic compatibility directives. Elements printed in accordance with the IEC (Electrotechnical Commission) standard.

Back-up resources

This equipment includes a set of back-up elements to aid the trainer, e.g.:

- Practical Manuals
- Theory Manuals
- Data collection and display software
- Technical instruments, etc.

MODULAR PROGRAMME

The system is based on a “module” support, which can be configured according to user needs. The 540 series enables all the content to be studied, with high function integration on each module.

Assembly and power supply system

The basis of the modular programme consists of the assembly frame and the ±15 V power supply module (ALI-700 module), which is required for all training module configuration requiring an electronic power supply.

Table-mounted training frame

- This is a physical support for the modules, blocks and panels used for the practical activities.
- It transmits the electrical supply from the power supply modules to all the modules requiring it.

The frame dimensions are selected in accordance with the equipment to be mounted on the frame. Its horizontal structure consists of an aluminium section and the rectangular side supports are oven-dried painted iron sections.

As regards locating the frame on the work tables, it may be fixed (the frame can be fixed to the tables) or mobile (in which case it is supplied with removable legs with non-slip feet). The module power supply and fixing systems consist of a series of connectors, into which the connection points located on the rear of the modules are inserted, exerting a slight pressure.

Ref.: 9EBxPxxCP

x: 1,2: frame height in tiers.
xx: 10, 14, 18, 20, 22, 28, 36, 44: nº of insertable single modules.

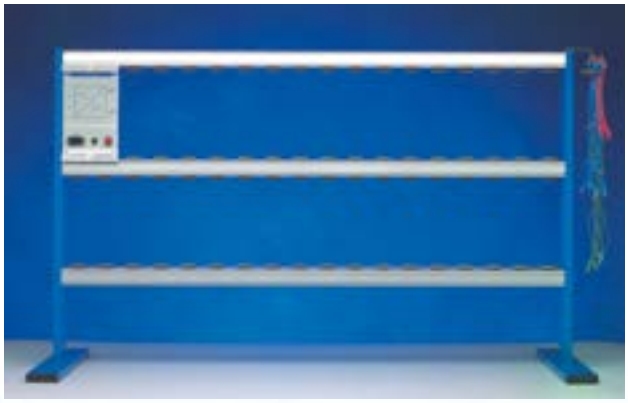
Training module

ALI-700

±15 V. POWER SUPPLY

Power source: ± 15 V. It transmits the power supply via the table-mounted frame. These voltages are also available at 2 mm terminals.
It provides a nominal current of 2 A, and includes thermal and short circuit protection with automatic reset after a few seconds.

Ref.: MDULALI700



Study of speed and position control processes

Series 540

Didactic unit

MV-541

SPEED AND POSITION IN A D.C ENGINE

It consists of a model that incorporates a rotation axis powered by a DC motor, including the sensors, which are arranged in an accessible form to facilitate understanding by the student.

In associated with the motor axis, is available:

- A tacho speed for capturing
- An absolute encoder and an incremental angular displacement uptake.
- A speed reducer indicating the angle of its axis reduced
- A potentiometric angular position sensor.

The printed connection terminals are located on the front panel of the model, between the different sensors and the motor, with the conditioning and control models.

Training module

CONSIGNA-547

SETTING AND DRIVER

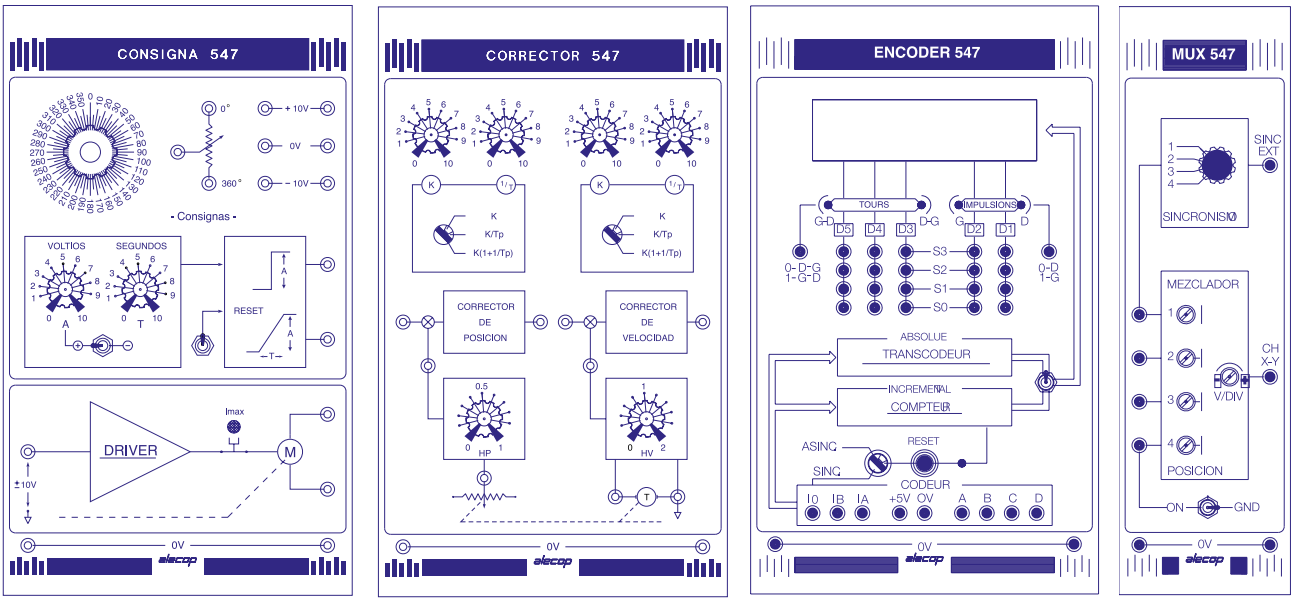
- This contains the signal generator for the speed setting (step or ramp) and the position setting.
- Power driver acting on the DC motor, with overvoltage protection calibrated to 1 A.

Training module

ENCODER-547

ENCODER CONDITIONER

- Display panel containing 7-segment displays of the number of pulses and turns from the absolute or incremental encoders.
- Pilot lights for right-left pulses and right-left or left-right turns, with their corresponding terminals.
- Terminals with BCD output for the value of each digit on the display.
- Selection of counter for incremental encoder and decoder for absolute encoder.
- Reset is manual or synchronised with the incremental encoder signal.



Training module

CORRECTOR-547

SPEED AND POSITION CORRECTOR

- These are speed and position correctors which may be either proportional, integral or proportional-integral, selectable via rotary switch.
- Corrector parameters adjustable via potentiometric controls.
- Includes conditioners for the tacho dynamo and the potentiometric sensor.
- Includes analogue comparator and adder.

Training module

MUX-547

4-CHANNEL MULTIPLEXER

- Enables up to four analogue and/or digital signals to be viewed on an oscilloscope.
- The four input channels have offset adjustment control and actuator switch or reset to zero.
- It is equipped with a selector switch for sync with respect to any of the inputs and another selector for alternate or chopped display.
- Outputs for connection to the oscilloscope channel and for connection to its external sync.

Ref.: 9EQCAMV541

Standard components included:
- *Table-mounted frame.*
- *ALI-700 power supply module.*
- *Series 540 model and specific control modules.*

Standard accessories:
- *Mains connection cable and 2 mm connectors.*
- *User Manual and Practical Manual.*

Optional elements recommended:
- *FPB training module: Low pass filter.*

Study of temperature control processes
Series 540

Didactic unit

MT-542

A FURNACE TEMPERATURE

The model consists of a simulator of a furnace in which are located inside the heating (equipped with aluminium radiator) and the different temperature sensors.

On the left side of the oven is located a fan whose window can be closed by a lid, available on the reverse side of a ventilation window also with a lid.

The sensors contained on the model are:

- 1 integrated temperature transducer AD-590.
- 1 type J thermo-couple.
- 1 positive temperature coefficient resistance transducer PTC.
- 1 platinum resistive transducer PT-100.

The last three sensors above are in heat contact with another three integrated transducers AD-590 installed, and which serve as reference thermometers for these. Readings are taken from these transducers on the digital thermometer placed on the front panel of the model.

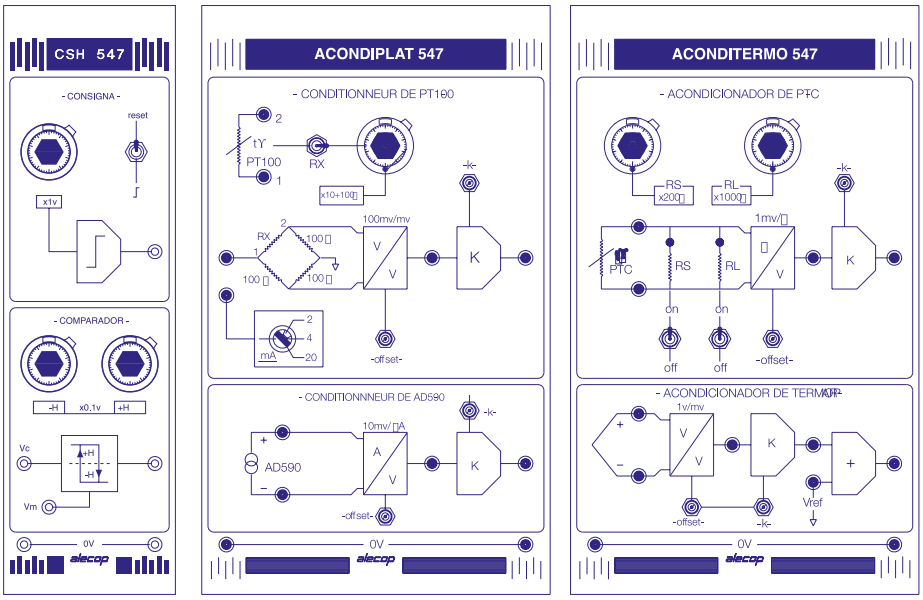
Printed connection terminals between the heater and the different sensors are included with the conditioning and control modules.

Training module

CSH-547

SET POINT AND HYSTERESIS CONTROL

- Set point signal generator, adjustable via potentiometric control.
- Comparator with hysteresis, with adjustable strip and pilot light indicating output level (0 or 1).



Training module
ACONDITERMO-547

THERMOCOUPLE AND PTC CONDITIONER

- PTC temperature sensor and thermocouple conditioners.
- Offset adjustment and gain controls.

Training module
CONDIPLAT-547

AD-549 AND PT100 CONDITIONER

- Platinum resistance conditioner (PT100).
- AD-590 conditioner.
- Offset adjustment and gain controls.

Ref.: 9EQCAMT542

Standard components included:

- *Table-mounted frame.*
- *ALI-700 power supply module.*
- *Series 540 model and specific control modules.*

Standard accessories:

- *Mains connection cable and 2 mm connectors.*
- *User Manual and Practical Manual.*

Study of level processes and flow

Series 540

Didactic unit

MD-544

LEVEL AND FLOW OF A DEPOSIT

The model has a water-tight tank with two compartments, one to control the level and the other for drainage; there is a motorised pump which transfers the liquid from one place to another, and a set of sensors:

- For levels, using a float with linear potentiometer.
- For levels, by variable capacity.
- For levels, by ultrasound.
- For flow, by differences in hydrostatic pressure.
- For flow, by turbine.
- For hydrostatic pressure.

Printed connection terminals between the pump motor and the different sensors are included with the conditioning and control modules.

Training module

CSS-547

SETTING AND DRIVER FOR PUMP MOTOR

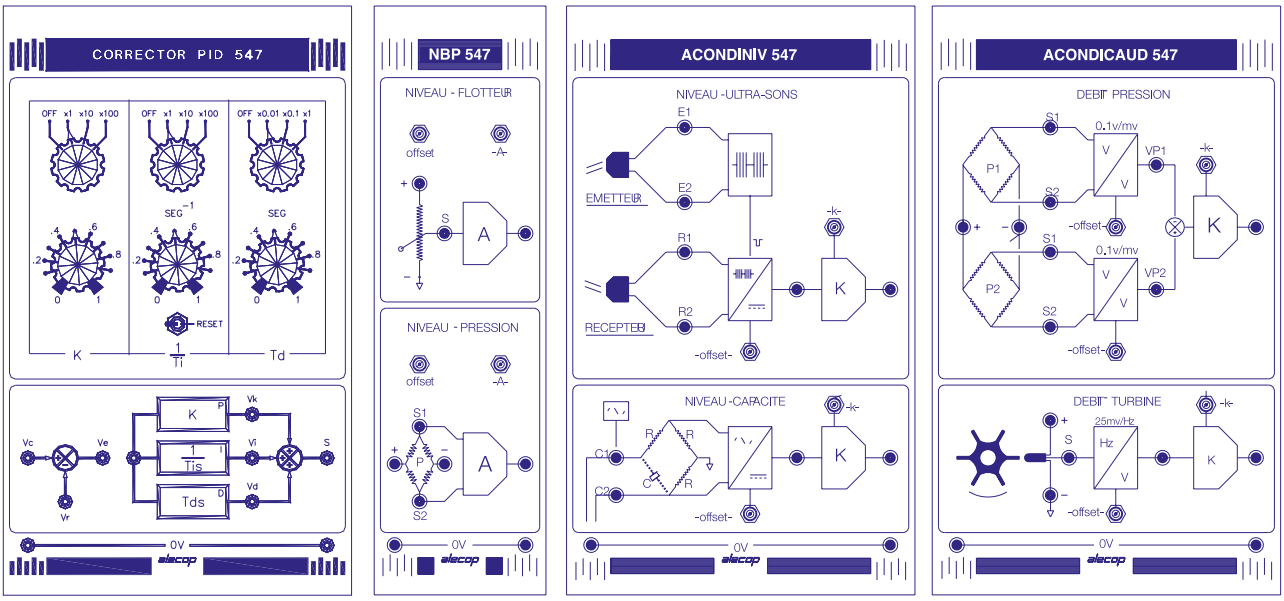
- Set point generator (adjustable ramp and step)
- Power amplifier for the motor pump.
- Overcurrent protection circuit calibrated to 1 A with automatic disconnection.

Training module

PID-547

PID CORRECTOR

- Adjustment of corrector parameter values via potentiometric controls.
- Selection of P, I, D correctors or any combination of the same.
- Reset switch.



Training module

NBP-547

FLOAT AND HYDROSTATIC PRESSURE CONDITIONER

- Hydrostatic pressure sensor conditioner.
- Float type sensor conditioner.
- Offset and gain adjustment.

Training module

ACONDICAUD-547

FLOW CONDITIONER

- Pressure-difference flow sensor conditioner with offset and gain adjustment.
- Turbine flow sensor conditioner with frequency/ voltage converter and gain adjustment.

Training module

ACONDINIV-547

ULTRASONIC AND CAPACITIVE LEVEL CONDITIONER

- Ultrasonic level sensor conditioner with oscillator and offset and gain adjustment.
- Capacitive level sensor conditioner with oscillator and offset and gain adjustment.

Ref.: 9EQCAMD544

Standard components included:

- *Table-mounted frame.*
- *ALI-700 power supply module.*
- *Series 540 model and specific modules.*

Standard accessories:

- *Mains connection cable and 2 mm connectors.*
- *Manual and Practical Manual.*

Study of physical magnitude sensors
Series 540

Didactic unit

MF-540

PHYSICAL MEASURES

The MF-540 unit is designed to make a real, practical study of physical magnitude sensors, such as movement, linear speed and acceleration and buckling forces on a plate.

The model is made up of a vibrating cantilever consisting of two plates firmly fixed at either end to a fixed mount on the model, and to a vertical rod. As collectors items containing:

- An LVDT (linear variation differential transformer) as the sensor for movement.
- An inductive speed sensor.
- A piezoelectric acceleration sensor
- Four strain gauges, 2 working by traction and 2 by compression, to collect the buckling forces.

The drive device for the vibrating cantilever is a coil, which when excited by an oscillating signal, will make the cantilever vibrate.

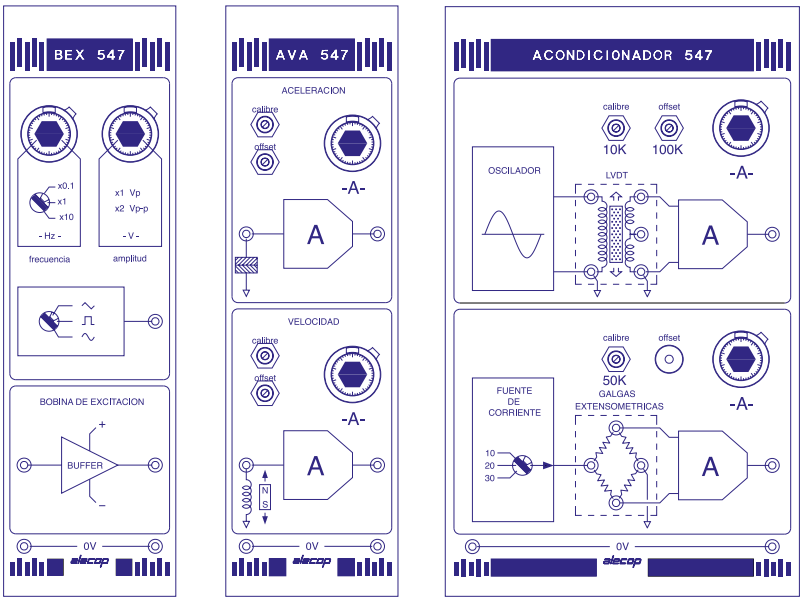
The connecting terminals from the various sensors and the drive coil to the modular control cabinet is on the front panel.

Training module

BEX-547

OSCILLATOR COIL DRIVER

- Oscillator with variable amplitude and frequency, from 0 - 10 V and 0.1 Hz - 100 Hz.
- The signal is amplified by a current buffer providing up to 0.3 A.



Training module

AVA-547

SPEED AND ACCELERATION CONDITIONER

- Conditioners for the speed and acceleration sensor signals.
- Preamplifier and internal bandpass filter to eliminate mains noise.
- Adjustable amplifier and offset.

Training module

ACONDICIONADOR-547

LVDT CONDITIONER AND GAUGES

- Conditioners for displacement sensor signals (LVDT) and bending stresses (strain gauges).
- Adjustment controls for zero displacement and for calibre and gain for the LVDT.
- Gauge conditioner with rotary selector switch for setting Wheatstone bridge current.
- Controls for correction of offset and calibre and gain adjustment.

Ref.: 9EQCAMF540

Standard components included:

- *Table-mounted frame.*
- *ALI-700 power supply module.*
- *Series 540 model and specific modules.*

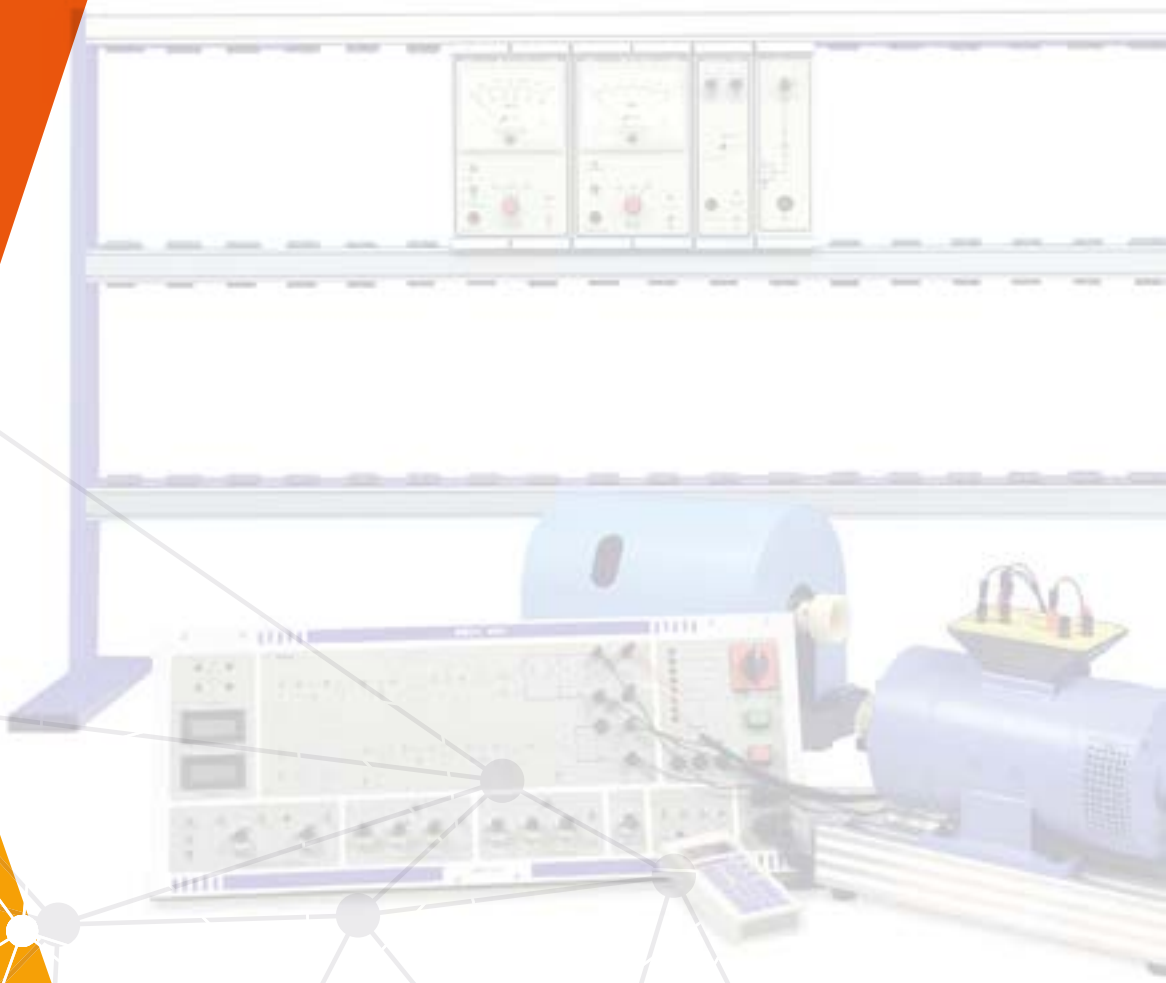
Standard accessories:

- *Mains connection cable and 2 mm connectors.*
- *User Manual and Practical Manual.*
- *Micrometer.*
- *Weights.*
- *Allen key and adjustment screwdriver.*

8

electronic control of electrical machines

The electronic motor speed regulation training devices presented in this catalogue are the result of having converted the corresponding industrial regulators into training devices, reproducing their construction and operating principles while providing major educational and functional advantages.



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Equipment proposal

The electronic motor speed regulation training devices presented in this catalogue are the result of having converted the corresponding industrial regulators into training devices, reproducing their construction and operating principles while providing major educational and functional advantages.

Basic content that can be worked on using this equipment:

Block diagram representation of control systems.
Speed control in both rotation directions.
Four-quadrant operation.
Operation at constant torque and power.
Current and speed regulation, types of feedback and correctors.
Speed regulation, P and PI correctors.
Torque and speed regulation. Feedback loops and correctors.
Torque regulation: detection of rotor position and set point generation.
Dissipative braking: crowbar circuit.
Analytic corrector tuning in accordance with the symmetric optimum criterion.
Adjustment and tuning techniques.
Asynchronous motor speed variation. Voltage/frequency ratio.
Failure diagnosis and repair.

Functions

- Panel support, for use in either vertical position (frame) or table-mounted.
- Wireless equipment configuration.
- Power and control circuit symbols printed according to the IEC (International Electronic Commission) European standards.
- Test points in 2 mm sockets for control signal measurement.
- External set points may be worked with, to enable actuation from an automaton or other control element.
- Motor operating conditions (voltage, current, speed, etc.) can be viewed on a display on the panel, with no need for additional instruments.
- One single supply for all the equipment.

Safety

Both the control panels and the electrical machines have safety terminals at voltage points exceeding 30 V, in compliance with the European Low Voltage Directive.

Failures

The training devices enable students to develop failure diagnosis and repair skills: they can analyse and diagnose the failures and repair them virtually.

ELECTROTECHNICAL POWER SYSTEMS

DC motor speed regulation

RMCC-900

AC motor speed regulation

RMCA-900

Brushless motor speed regulation

RMBR-900

Back-up resources

This equipment includes a set of back-up elements to aid the trainer, e.g.:

- User Manual, containing the instructions for start-up and operation of the equipment, its technical characteristics and detailed information on the failure repair system.
- Practical Manual, describing goals, teaching sequence and solutions for each of the practical activities.
- Theory Manual.

Electronic speed regulation of DC SCR motors

Equipment designed for studying the functioning, adjustment and repair of the speed regulation systems of DC motors, based on double thyristor bridge technology, and the different associated control options.

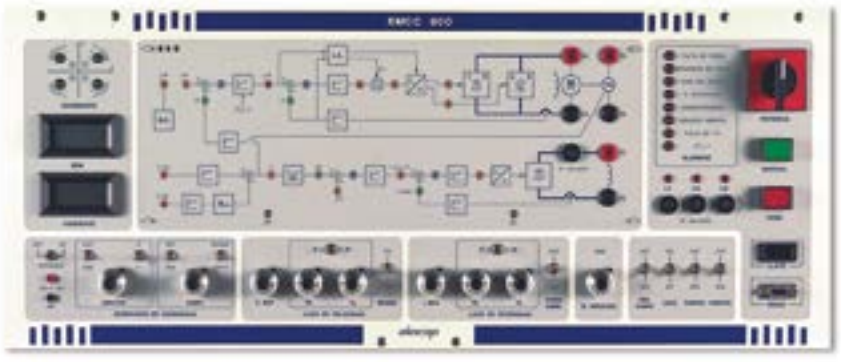
The following basic content may be worked on:

- Block diagram representation of control systems.
- Current and speed regulation, types of feedback and correctors.
- Four-quadrant operation.
- Constant torque and power operation.
- Adjustment and tuning techniques.
- Failure diagnosis and repair.

Didactic DC engine regulation unit

RMCC-900

A multi-panel system which enables different types of controls to be set up. It has six panels, each with unit diagrams printed on it, which are automatically recognised by the equipment when they are fixed in place. This allows for the following setups:



- Torque regulator in a single quadrant.
- One-way speed regulator, with feedback via tachodynamo.
- Speed regulator with feedback via f.c.e.m.
- One-way speed regulator, with operation at a constant torque and power.
- Four quadrant torque regulation.
- Speed regulator in both spin directions, with regenerative braking. The board controls allow selection of the working mode of the controller and adjusting the system parameters:
- Slogans external, internal, manual, ramps, ...
- Parameters of the different weightings.
- Limitations of current and speed.
- Etc.

The panel incorporates two LCD displays which enables the speed and current to be displayed, as well as indicator lights for the functioning quadrant of the motor.

The unit is equipped with a set of protection devices and alarms to facilitate analysis of any occurrence, guaranteeing total safety:

- Phase loss.
- Incorrect phase sequence.
- Control supply failure.
- Excitation current loss.
- Maximum current limitation.
- Open armature circuit.
- I2 x t protection.

Accessories supplied:
- *User's manual and practical activities.*

NECESSARY elements which are not supplied:
- *AL-506 or 1006 motor (page 176).*
- *Braking system (page 177).*

Optional elements:
- *Failure programming console (page 175).*
- *Theory Manual.*
- *Data collection and display system.*
- *380-220 Triphasic autotransformer.*

TECHNICAL CHARACTERISTICS	RMCC-900
Reference	9EQRMCC900
Supply	Three-phase 230 V- 50/60 Hz
Armature output	0 to 230 V- 3 A
Excitation output	0 to 230 V- 0,6 A
Power	0,6 KW
Regulation range at constant torque	0 to 1500 r.p.m.
Regulation range at constant power	0 to 3000 r.p.m.

Didactic transformer 380-220 triphasic AT-3822

An autotransformer for various applications in which it is necessary to have a 220 V triphasic voltage, with the following characteristics:

- Supply: triphasic 380 V - 50 Hz.
- Output: triphasic 220 V - 50 Hz.
- Power: 1 KVA.
- Output available as safety terminals and power points.
- Pilot lights indicating presence of phases.
- Fused protection in each phase.

Electronic speed regulation of alternating current motors

Equipment designed for studying the functioning, adjustment and repair of asynchronous motor speed regulation systems, based on frequency converter technology.

The following basic content may be worked on:

- Block diagram representation of control systems.
- Asynchronous motor speed variation. Voltage/frequency ratio.
- Dissipative braking: crowbar circuit.
- Speed control in both rotation directions: four-quadrant operation.
- Operation at constant torque and power.
- Adjustment and tuning techniques.
- Failure diagnosis and repair.

Didactic AC engine regulation unit

RMCA-900

The panel incorporates a frequency converter designed to supply an asynchronous motor of up to 1 kW power. It consists of a triphasic invertor based on IGBTs and all of the circuitry necessary for their control.

It enables a triphasic output voltage, variable in amplitude and frequency, to be obtained, by means of the PWM modulation. The frequency may be increased to double the nominal frequency in the constant power mode, which enables a control to be obtained above and beyond the nominal speed of the motor. Sine or trapezoidal PWM modulation can be selected.

The controls incorporated enable the work mode of the converter to be selected, as well as the parameters of the system to be adjusted:

- External, internal, manual commands, ramps.
- Parameters at constant torque and power.
- Low speed torque compensation.
- Etc.

The effective voltage and frequency may be displayed alternately on the panels LCD display, and additionally there are lights indicating the quadrant of the functioning of the motor and the activation of energy devolution system (braking).

The unit is equipped with a set of protection devices and alarms to facilitate analysis of any occurrence, guaranteeing total safety:

- Maximum current.
- Maximum temperature.
- Maximum bus voltage.
- Minimum bus voltage.
- Control supply failure.
- I2 x t protection.

Accessories supplied:
- *User's manual and practical activities.*

NECESSARY elements which are not supplied:
- *AL-1106/06 motor (page 176).*
- *Tachodynamo (page 177).*
- *Braking system (page 177).*

Optional elements:
- *Failure programming console (page 175).*
- *Theory Manual.*
- *Data collection and display system.*

TECHNICAL CHARACTERISTICS	RMCA-900
Reference	9EQRMCA900
Supply	Single-phase 230 V- 50/60 Hz
Output voltage	Three-phase 0 to 220 V
Output frequency at constant torque	0 to 50 Hz or 0 to 60 Hz
Regulation range at constant power	0 to 100 Hz or 0 to 120 Hz
Power	1 KW

Electronic regulation of Brushless motor speed

Equipment designed for studying the functioning, adjustment and repair of AC brushless motor speed regulation.

The following basic content may be worked with:

- Block diagram representation of control systems.
- Torque regulation: detection of rotor position and set point generation.
- Speed regulation, P and PI correctors.
- Dissipative braking: the crowbar circuit.
- Adjustment and tuning techniques.
- Failure diagnosis and repair.

Didactic Brushless engine regulation unit

RMBR-900

The power circuit is made up of a rectifier bridge, a filter condenser and a triphasic invertor based on IGBTs. In addition to this, it incorporates a crowbar circuit for protecting the equipment when the voltage in the bus increases through braking energy devolution.

The controls incorporated enable the function mode of the converter to be selected, in addition to enabling the parameters of the system to be adjusted:

- External, internal, manual commands, ramps,...
- Corrector parameters.
- Regulation in current or in speed.
- Limitation of maximum speed.

The speed and current may be displayed on the panel s LCD display, and additionally there are lights indicating the quadrant of the functioning of the motor and the activation of energy devolution system (braking).

The unit is equipped with a set of protection devices and alarms to facilitate analysis of any occurrence, guaranteeing total safety:

- Maximum current.
- Maximum temperature.
- Maximum bus voltage.
- Minimum bus voltage.
- Control supply failure.
- I2 x t protection.

Accessories supplied:

- *User's manual and practical activities.*

NECESSARY elements which are not supplied:

- *Brushless motor (page 177).*
- *Braking system (page 177).*

Optional elements:

- *Failure programming console (page 175).*
- *Data collection and display system.*

TECHNICAL CHARACTERISTICS	RMBR-900
Reference	9EQRMBR900
Supply	Single-phase 230 V- 50/60 Hz
Output voltage	0 to 196 V
Output frequency	0 to 200 Hz
Power	1 KW

Failure programming and repair system

The RMCC, RMCA and RMBR-900 regulation panels have a system for failure diagnosis and virtual repair, based on a micro processor in the panel which communicates with the user via a failure programming console with a 4 x 24 character LCD display and a 21-key membrane keyboard.

An electronic key, inserted in a slot in the panel, allows access to the trainer menu to change the codes that generate the failures.

UNIT	Nº OF FAILURES PROGRAMMABLE	Nº OF FAILURES PROGRAMMABLE
RMCC-900	31	Set point failures, tacho dynamo failures, thyristor triggering failures, etc.
RMCA-900	14	Set point failures, rotation reversal failures, crowbar failure, etc.
RMBR-900	26	Set point failures, corrector failure, failure in the encoder processing circuit, etc.

Electrical machines and braking systems

All the electrical machines are mounted on an aluminium bedplate, with their corresponding end connections for quick, easy coupling to other machines, brakes or tacho dynamos. They also include a printed terminal block with safety terminals and protection guards on the shafts.

DC training motor

AL-506 / AL-1006

Model AL-506 is an independent excitation motor.
Model AL-1006 is an compound excitation machine.

CHARACTERISTICS	AL-506	AL-1006
Reference	9MAK0506ZC	9MAK1006ZC
Power	370W	370W
Nominal voltage	220V	220V
Nominal speed	2500rpm	2500rpm
Shaft height	80	80

Three-phase asynchronous training motor AL-1106

Single-speed three-phase asynchronous squirrel-cage motor (50Hz/60Hz).

CHARACTERISTICS 50Hz	AL-1106
Reference	9MAK1106GC
Power	400W
Nominal voltage	230/400V
Nominal speed	1420rpm
Shaft height	80

CHARACTERISTICS 60Hz	AL-1106
Reference	9MAK1106HC
Power	400W
Nominal voltage	230/400V
Nominal speed	1690rpm
Shaft height	80

Asynchronous didactic motor

BRUSHLESS AC

CHARACTERISTICS	AL-BRU80
Reference	MTRALBRU80
F.c.e.m.	150 V
Nominal intensity	4 A
Nominal torque	2,5 Nm
Maximum speed	4000 r.p.m.
Encoder	2000 impulses/turn
Shaft height	80 mm

AC Servomotor, associated to the corresponding regulator, it behaves as a high prestation's DC motor (high nominal speed, low inertia, small,...), without needing of brushes . It is composed by an inducted winding placed in the stator, permanent magnets in the rotor and solidary encoder.

Didactic tachodinamo

REO-444

CHARACTERISTICS	REO-444-80
Reference	9EQDINTQ80
Constant	60 V/1000 r.p.m.
Maximum speed	10000 r.p.m.
Axis height	80 mm

Braking system - bank

This machine can be easily coupled to the bedplate, in accordance with safety standards preventing bedplate malfunctioning.

The bedplate is controlled by potentiometric dials for torque and speed, or by means of external signals enabling it to be controlled by DAS and computer.

Constant display of power, speed and torque exerted on the bedplate axis, signals available at an external connector.

FUNCTION

Drag motor and braking of machines for testing.

Technical characteristics

GENERAL

Supply: Single-phase mains 190 – 250 VAC – 5.25 Amp.- 50/60Hz

Type of machines tested: - Free-standing, heights 71, 80 and 90 mm.
- Heights 80 and 90 mm on Alecop sections.

Machine fixed for testing by elastic coupling

FUNCTIONING AS A DRAG MOTOR

Speed: 0 - 2000 rpm

Nominal power: 800 W

Maximum torque: 9.7 Nm

FUNCTIONING AS A BRAKE

Maximum speed: 2450 rpm

Torque: 0 - 10 Nm

Nominal power: 800 w

9

advanced building systems

Alecop's product for this area is the SIVODAC environment, ideal for incorporating methodology such as project work and efficiently enabling students to apply their knowledge in real-life situations.

index

SIVODAC: Training environment for Advanced Building Systems

A COMPREHENSIVE LEARNING SYSTEM

SIVODAC allows innovative methodologies to be used within the Advanced Building Systems teaching and learning process, helping students to develop professional skills in the following areas:

Skills in

ANALYSIS AND DESIGN
Developing projects responding to previously identified needs.

CONFIGURATION AND INSTALLATION
Creating the installations, programming the electronic devices and making the relevant adjustments.

DIAGNOSIS AND REPAIR
Determining the causes of the failures and restoring system functioning.

Telecommunications

All transmission, emission or reception of signs, signals, writings, images, sounds or information of any nature by wire, radio, optical or any other electromagnetic systems.

Easy integration of industrial elements

The design of the equipment facilitates the integration of Alecop's own elements and any other commercial element that could be of interest for the teaching and learning process.

The SIVODAC range of products form a complete training environment for the area referred to as Advanced Building Systems: Telephony Systems, Telematic Systems, Digital Home, Home Systems, etc.

An aid for trainers

SIVODAT can be adapted to different work modes, greatly aiding the organisation of training/learning activities:

Practical mode

Each work station is configured to solve a particular problem.

Project mode

Each group makes their own configuration, and the complete project is made up by interconnecting the different stations.

Remote Mode

Students and teachers interact with remote labs via the Internet.

MR LAB

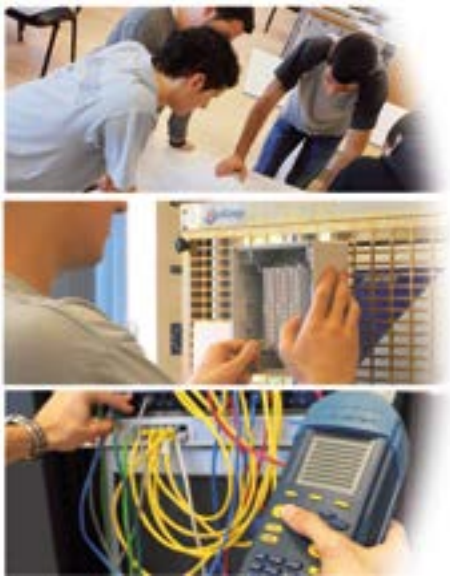
Real-life situations for training

Learners are motivated by solving real-life problems. The SIVODAC work proposals are therefore based on real-life contexts, depicted on interchangeable panels representing rooms in different buildings. This realistic approach allows the problems to be focused on from different levels of difficulty, making the learning process progressive and meaningful.

SIVOTEL

Integral learning system

Orientated towards all of telephony world, SIVOTEL is a trainer for the SIVODAC family of products, that allows professional competence to be developed in the fields of:



ANALYSIS AND DESIGN

To draw up designs of telephony facilities that respond to previously identified needs.

CONFIGURATION AND INSTALLATION

To construct telephony installations, programming the electronic devices and making the relevant adjustments, based on the design plan and current regulations.

DIAGNOSIS AND REPAIR

To determine the causes of faults in the telephone systems and to re-establish the relevant operating set-up, using for this purpose methods and instruments appropriate for each situation.

Real situations for learning

Student motivation is achieved through the resolution of real problems. For this purpose SIVOTEL bases its work proposals in a context called “University Campus” materialized in interchangeable screens that represent each of their offices. This strategy of approaching reality manages to focus the presentation of the problem from various degrees of difficulty, making student learning become progressive and significant.

Measurements and interconnection

Prewired panel: rapid set up

Interconnection of stations (optional)

Digital telephony options

Dect technology
Relay card and intercom
Analogue phones

Personalised configuration

The same rack allows up to two workstations to be set up. Each workstation will be formed by the panel and the required optional components.

TELEPHONE PBX

The analysis panel can be equipped with professional telephony systems in their two versions:

ANALOGUE TELEPHONY

- Automatic operator and fax discriminador
- Intercom
- Call metering system

DIGITAL TELEPHONY

- DECT Technology
- Relay Card and intercom
- Analogue phones

ADAPTATION KIT

Allows the integration of any type of PBX

PERFORATED MESH

In it real wiring assemblies can be carried out.

Analogue telephony options

Automatic operator and fax discriminator
Intercom
Call metering system

Faults simulator: Incorporated in the SIVOTEL trainer

Practical mode for individual work

Project mode for interconnected stations

SIVODAT

Telematics system for buildings

Focusing on the field of data network installations, SIVODAT is a training device integrated within the SIVODAC advanced building systems learning environment, which allows professional skills to be developed in the following areas:

ANALYSIS AND DESIGN

Developing data network installation projects responding to previously analysed needs.

CONFIGURATION AND INSTALLATION

Building data network installations, creating the infrastructures, integrating and parametrising the components and making the relevant adjustments, on the basis of the project and current legislation.

DIAGNOSIS AND REPAIR

Determining the causes of failures in the data network infrastructure and restoring the service, using suitable methods and instruments for each situation.

Real-life situations for learning

The SIVODAT work proposals are therefore based on a context called the “University Campus”, which consists of interchangeable cover sheets representing each of its buildings. This realistic approach allows the problems to be focused on from different levels of difficulty, making the learning process progressive and meaningful.

Measurements and interconnection

Pre-wired panel: quick configuration

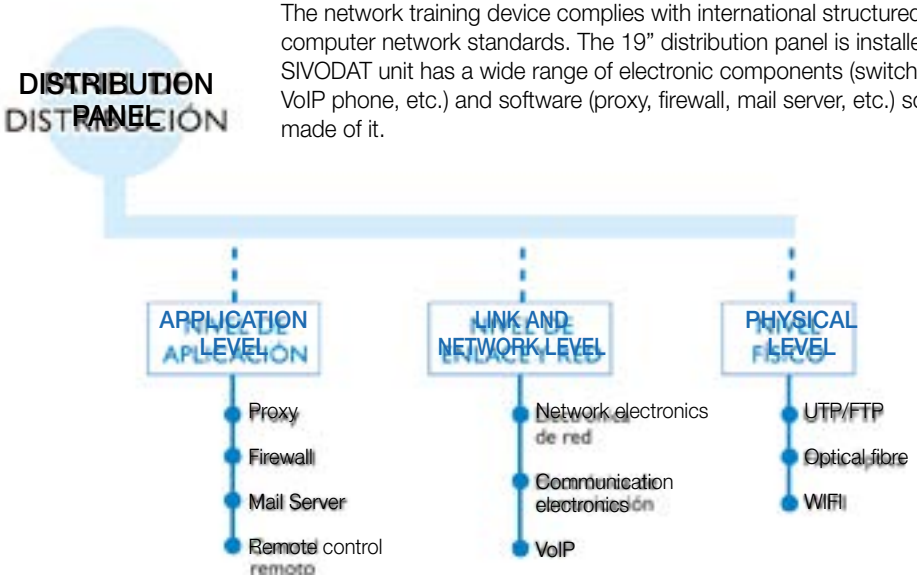
Interconnected stations (optional)

Hardware and software (optional)

Custom configuration

Located on either the same frame as the analysis panel or on a different one, the distribution panel contains commercial network electronics and communication components.

The network training device complies with international structured cabling and computer network standards. The 19" distribution panel is installed on a frame. The SIVODAT unit has a wide range of electronic components (switch, router, gateway or VoIP phone, etc.) and software (proxy, firewall, mail server, etc.) so that full use can be made of it.



Resources (optional)

WIFI

OPTICAL FIBER

Faults simulator: Incorporated in the SIVOTEL trainer

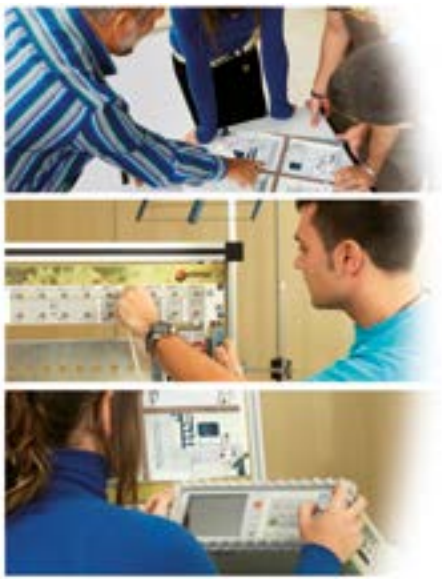
Practical mode for individual work

Project mode for interconnected stations

SIVOTV

TV Antennas

Geared to the TV installation field, SIVOTV is the training device integrated within the SIVODAC advanced building systems learning environment that allows professional skills to be developed in the following areas:



ANALYSIS AND DESIGN

Developing projects for radio and television signal reception and distribution, responding to previously identified needs and current legislation (ICT 2003).

CONFIGURATION AND INSTALLATION

Creating installations for radio and television signal reception and distribution, positioning the reception devices and adjusting the electronic amplification devices, on the basis of the project and current legislation.

DIAGNOSIS AND REPAIR

Determining the causes of failures in radio and television signal reception and distribution systems and restoring the relevant functioning mode, using suitable methods and instruments for each situation.

Real-life situations for learning

Learners are motivated by solving real-life problems. The SIVOTV work proposals are therefore based on two specific contexts: the individual home and the community building, which are depicted on interchangeable cover sheets, each representing a building and a type of radio and television signal distribution. This realistic approach allows the problems to be focused on from different levels of difficulty, making the learning process progressive and meaningful.

Detail of wheels (optional)

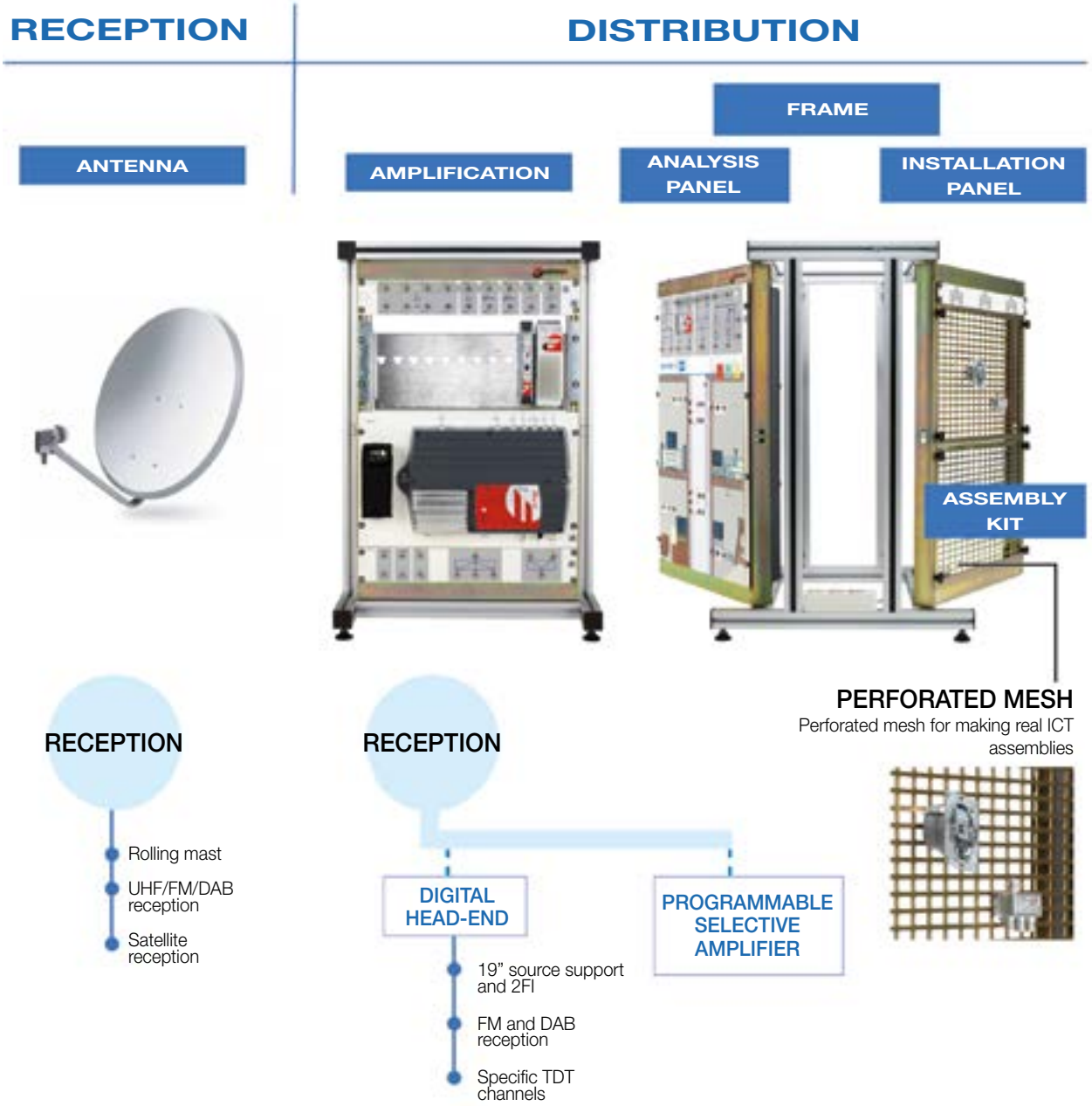
Quick connection

ICT cabling kit

Reception system option (Antennas)

Custom configuration

The analysis panel, which contains the most basic elements for a house distribution study, may be extended with a range of reception, amplification and assembly elements enabling custom configuration.



Amplification option (selective)

Analysis panel cover sheets

Practical mode for individual work

Project mode for interconnected stations

SIVOCP

Digital Home

Geared to the home systems/digital home field, SIVOCP is the training device for the SIVODAC advanced building systems learning environment that allows professional skills to be developed in the following areas:

ANALYSIS AND DESIGN

Developing projects for carrier current-based home systems installations responding to previously identified needs (Security, Power Management, Comfort, Communication).

CONFIGURATION AND INSTALLATION

Creating home systems installations, programming the incorporated electronics devices and making the relevant adjustments, on the basis of the project and current legislation.

DIAGNOSIS AND REPAIR

Determining the causes of failures in carrier current-based home systems and restoring the relevant functioning mode, using suitable methods and instruments for each situation.

Real-life situations for learning

Learners are motivated by solving real-life problems. The SIVOCP work proposals are therefore based on a specific context: the individual home, depicted on interchangeable cover sheets representing each room in a house and a series of detector and actuator identification elements. This realistic approach allows the problems to be focused on from different levels of difficulty, making the learning process progressive and meaningful.

Home systems applications

Telephone switchboard

Home systems kit for household appliances

Spy module and display software

Custom configuration

User comfort, household appliance control, detection and the control of technical or intruder alarms are individual functions available as part of the different options for the home systems management panel.

ANALOGUE. For line generation. Required for parametrising the Fagor Maior Domo control unit and enabling alarm communication management and realisation of telephone remote control functions.

MAINTENANCE TOOL

- Software and spy module

This is the maintenance tool for the carrier current-based digital home installation. It provides information on the signal power at each point of the installation and the entire grid. It allows a grid to be generated to check for the presence of the home systems components, e.g. washing machine, controls, etc.

HOME SYSTEMS APPLICATIONS

- Roller blind control
- Electronic component management
- Water leakage management
- Alarm management

Each one is assigned a special home systems function. These modules can be used on a support panel or directly mounted on the table.

Household appliance

Analysis panel cover sheets

Practical mode for individual work

Project mode for interconnected stations

SIVOMEG

PA systems

Focusing on PA and speaker systems in the home-geared building environment, SIVOMEG is a trainer forming part of the SIVODAC range of products which allows professional skills to be developed in the following fields:

ANALYSIS AND DESIGN

Developing PA and speaker installation projects responding to previously identified needs and functions.

CONFIGURATION AND INSTALLATION

Creating PA and speaker installations, configuring the electronic devices (control units, control devices, power amplifiers, etc.) and making the relevant adjustments, on the basis of the project and current legislation.

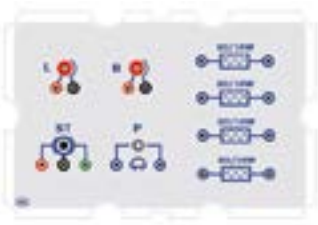
DIAGNOSIS AND REPAIR

Determining the causes of failures in the PA and speaker installations and restoring their functioning, using suitable methods and instruments for each situation.

Working with real elements

The front part of the panel is equipped with the key components of a typical PA/interphone installation: central audio unit, control device, auxiliary module, power amplifier, and the reproduction elements (speakers). The electrical connections of these components are located on the panel surface in 2 mm sockets to facilitate connection. A set of diverter switches enables simulation of different loud speaker impedances, for studying their different modes of association. It includes a failure generation system and a bus expansion connector to facilitate future extensions of the system.

Measurements and interconnection



Pre-wired panel: quick configuration

Intercom extension (optional)

Interphone extension (optional)

Custom configuration

There are two frame support options for the panels: front frame and double-sided frame. Up to two work stations can be configured on one single frame. Each work station consists of the frame, the PA panel and the optional components as required.

FRAME
PA PANEL
INSTALLATION PANEL
EXTENSIONS
INSTALLATION KIT

PERFORATED MESH
Perforated mesh for making real cabling assemblies

Detail of wheels (optional)

Failure simulator: Incorporated to the SIVODAT training device

Practical mode for individual work

Project mode for interconnected stations

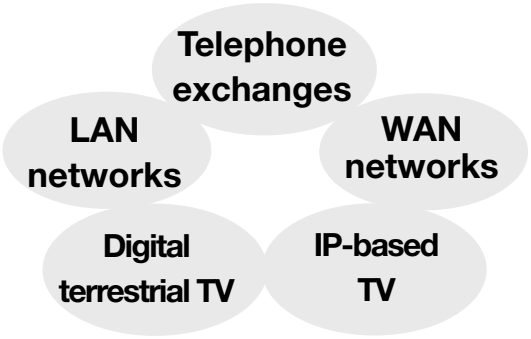
MRLAB

Remote Laboratories for experimentation

The use of new technologies means students and teachers can work with real equipment: all they need is an Internet connection.

The MRLABs consist of real professional equipment for developing experimental practices of different types through internet access. Before now, the students' hands-on presence was required for access and use of the equipment.

REMOTE LABORATORIES FOR STUDYING DIFFERENT TECHNOLOGIES



The students and teachers can access the equipment remotely from wherever they happen to be, 24 hours a day, 7 days a week. The system has a TURN MANAGEMENT web application for students and teachers to programme their access days and times.

In addition to the experimental practice, the laboratories may also have the backing of MULTIMEDIA CONTENT, enabling them to acquire conceptual and procedural knowledge that can be integrated with hands-on, semi-hands-on and online training processes.

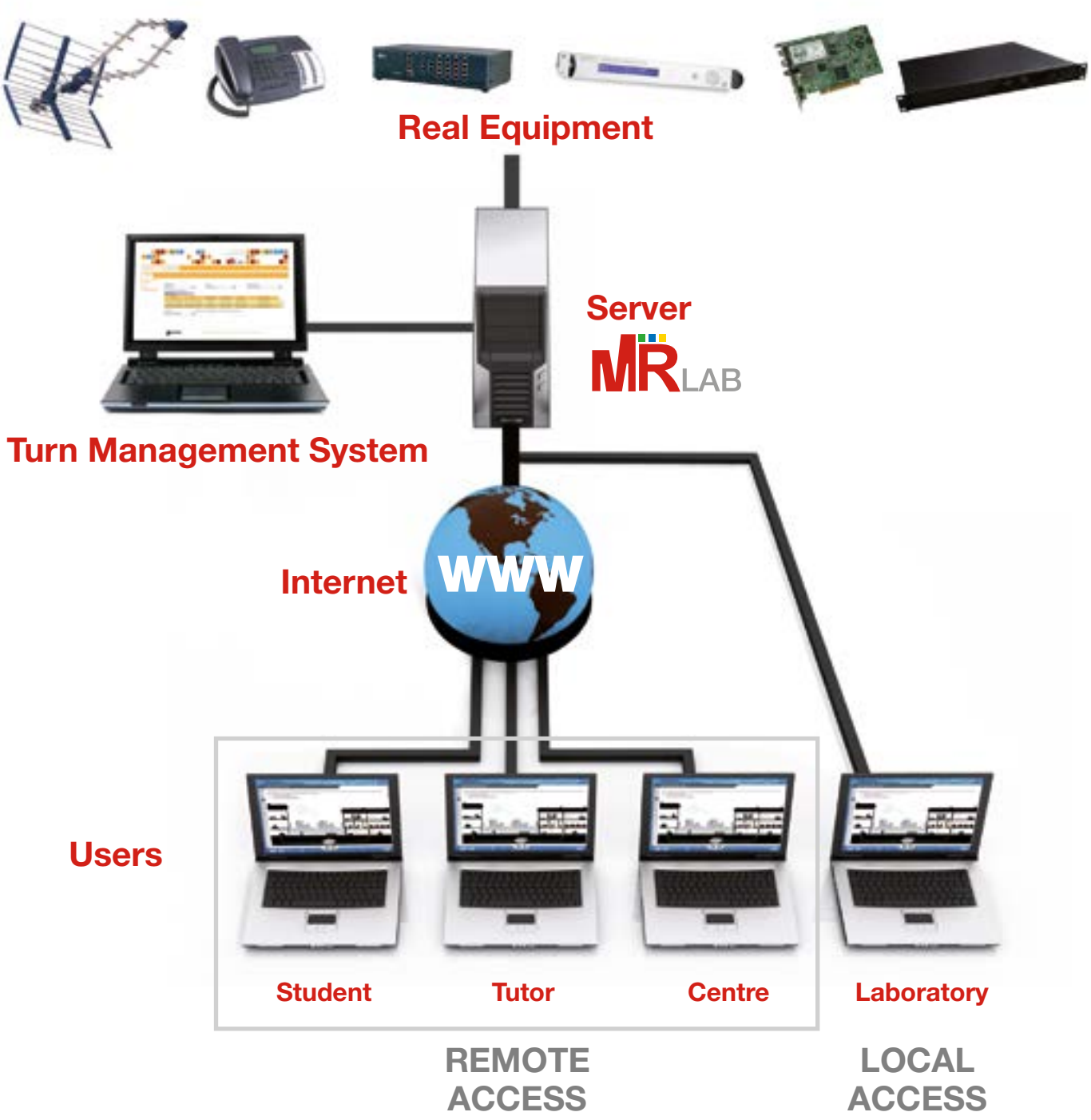
Visit the website **www.icteduca.com** to access the list of digital content available on:
*RADIO AND TV ANTENNAS *TELEPHONY SYSTEMS *TELEMATICS *IP-BASED TELEPHONY *DIGITAL TERRESTRIAL TV *IP-BASED TV *ICT PROJECT DEVELOPMENT *STRUCTURED CABLING INSTALLATION PROJECT DEVELOPMENT.

Pay-as-you-go

The pay-as-you-go system is a different way for the training centre to invest in laboratories and workshops, as it is now a services concept.

The experimentation continues to be carried out at the Remote Laboratories using real equipment but with less maintenance, management and investment in the training centre's labs and workshops, plus a reduction in the time the students actually need to spend at the laboratories.

With the pay-as-you-go system the centre can purchase HOURS OF USE of the laboratories for providing the training. During this time students and teaching staff can book to access the laboratory and carry out the practical activities.



10

KAPTORIS Data acquisition system

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Kaptoris

Data acquisition system

Acquiring data from a prototype.

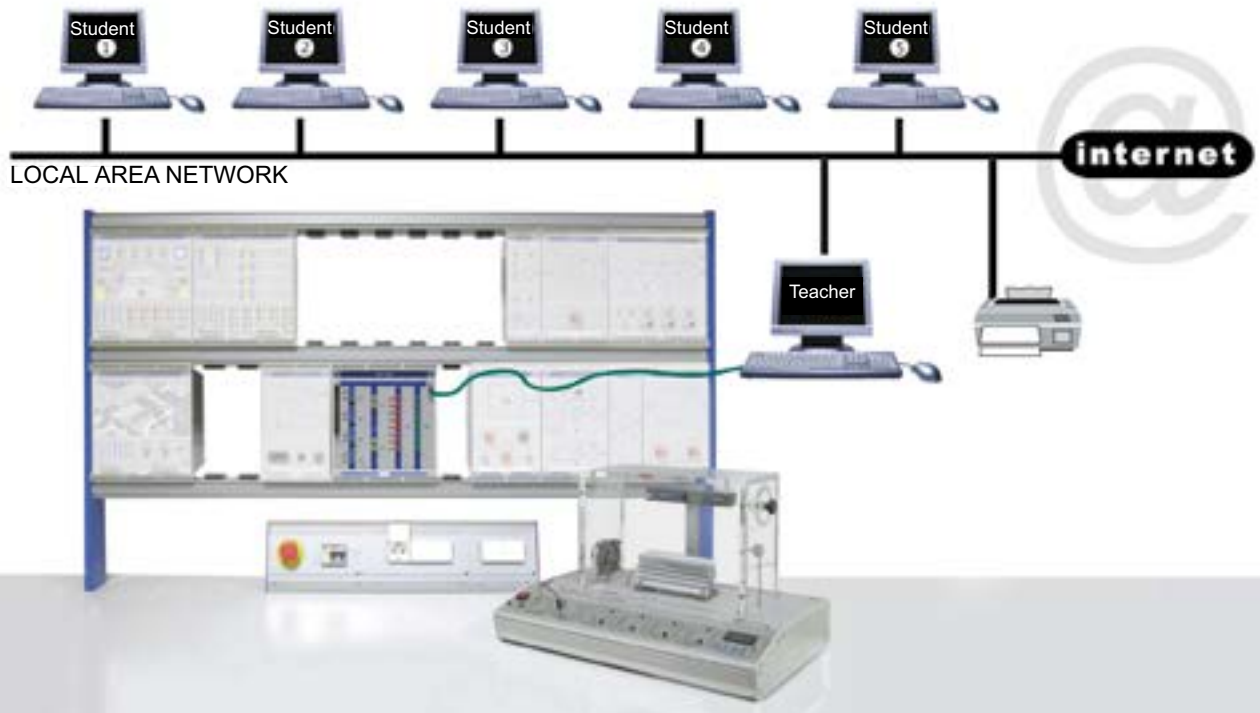
Versatile and powerful

Two features which make the KAPTORIS data acquisition system a general purpose tool indispensable for the analysis of teaching applications in laboratories of electricity, electronics, etc.

Team work

Using the KAPTORIS data acquisition system in a network facilitates group learning through tools, which allow:

- Teaching resources to be shared among several stations within the classroom: while one student captures the data, the others can analyse the obtained results.
- Monitoring the screen of any PC: while the teacher captures data on a real unit, the students can observe how he performs this task.
- Carry out e-learning, on real units available in the classroom.



Ease of use

Because the KAPTORIS data acquisition system is so simple to use, the students are able to start working with it very quickly. There are only 5 steps needed to make the acquisitions, display and data processing.

1

CONFIGURATION

This consists of defining the channels, which form part of the acquisition, the characteristics belonging to each of them and the parameters that define the acquisition.

2

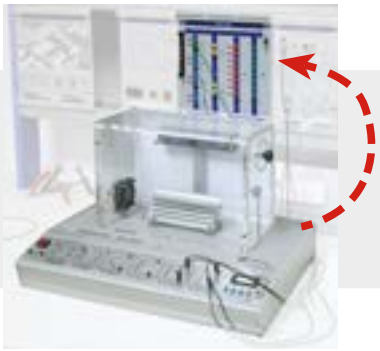
PROGRAMMING

This consists of communicating the configuration decided on above, to the data acquisition unit.

3

ACQUISITION

Capturing and storing data is done automatically by the data acquisition unit, and a computer is not needed for this.



4

DISPLAY

Once capturing has been completed, the data memorised in the unit must be transferred to the PC in order that they may be displayed graphically.

5

SIGNAL PROCESSING

- Signal calculator (arithmetical operations, filters, etc.).
- Comparison of signals.
- Generation of reports.
- Exporting data (TXT, BMP, WMF) etc.

SAD450 (desktop) 9EQKAPTORI

This system is made up of three components that enable it to be adapted easily to the requirements of the various systems to be analysed.

Data acquisition unit SAD450

ALECOP RS232-USB adapter available

It is connected to the PC via serial interface RS232C or USB (by adapter) and is controlled by an open protocol using ASCII commands, thus enabling made to measure software to be designed.

ANALOGUE INPUTS:
- 8 inputs of 12-bit resolution.
- Variable input voltage range between ±0.2V, ±0.5V, ±1V, ±2V, ±5V, ±10V programmable by software.

ANALOGUE OUTPUTS:
- 4 outputs of 9-bit resolution (8bits+Sign).
- Output voltage range ±10V.

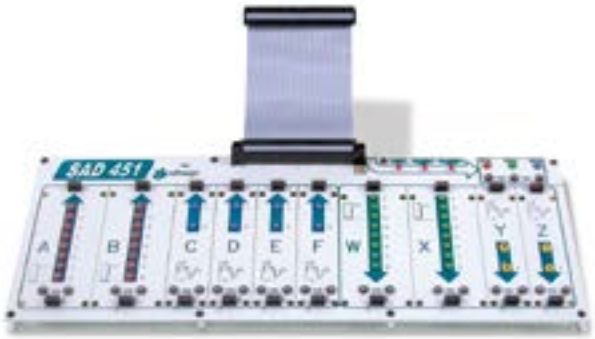
DIGITAL OUTPUTS:
- 16 digital outputs TTL (0-5V).

DIGITAL INPUTS:
- 16 digital inputs TTL (0-5V).
- 2 rapid counting inputs.

CONVERSION TIMES:
- Fmax 1 analogue channel 200 Khz.
- Fmax 1 digital channel 333 Khz.

Connecting interface SAD451

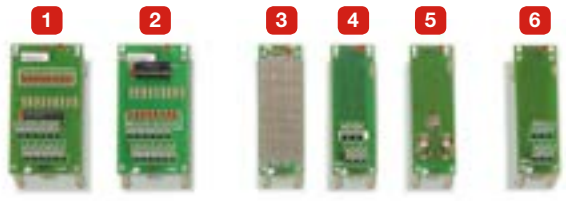
This interface is a 2mm socket adaptor for all the inputs/outputs on the data acquisition system. It is divided into blocks according to the type of input/output.



Signal conditioners

These are connected directly to the SAD451 and enable signals from outside to be conditioned to both the physical and electrical characteristics on it.

Conditioners included with the unit:
1 **SAD430:** Screw connection for 8 digital inputs.
2 **SAD431:** Screw connection for 8 digital outputs.
3 **SAD460:** Perforated plate for prototypes (2 analogue inputs).
4 **SAD461:** Screw connection for 2 analogue inputs.
5 **SAD462:** BNC connection for 2 analogue inputs.
6 **SAD463:** Screw connection for 2 analogue outputs.



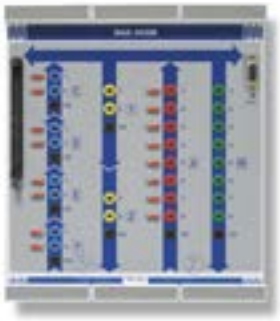
Case for the unit

The SAD unit (desktop) is supplied with a case for better protection, handling and use. All the components for the unit and the KAPTORIS software are housed in this case.

SAD450M (module) MDULSAD450M

The SAD450M has the same technical features as the SAD450 but is in module format, and facilitates data acquisition with Alecop units in module format.
A frame and an ALI700 mains supply source are needed to operate. These are not included with the unit.

Kaptoris software included.



SOFTWARE

General purpose tool for acquiring, displaying and processing signals, both analogue and digital

Features of the software

- Simple data analysis, very easy to use.
- Graphic display of signals.
- Real time monitoring of the data as it is acquired.
- Programming by level or by time the start of the acquisition.
- Comparative analysis of signals.
- Operations between signals: Integration, derivation, arithmetical operations, filters.
- Generation of reports and data tables.
- Exporting data to TXT format.
- Exporting graphics to BMP, WMF format.
- Data acquisition from a unit with a remote connection through a local network. (Internet).
- Monitoring the screen of any PC connected to the network.


System configuration


Data processing


Display of results

MINIMUM REQUIREMENT OF THE SYSTEM

- PC with Windows operating system.
- USB communication line.
- Local network, only if wishing to make remote acquisitions.

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renewable energy and energy efficiency

index

EFT-900

Solar photovoltaic training devices

Simulates an autonomous photovoltaic system with real and educational components

This trainer implements a low Eproduction photovoltaic installation. Allows the analysis and study of the elements and components production, storage and transformation of energy. The system includes:

- A training panel with all the elements that take part in electric energy transformation process.
- Solar panel.
- Battery on training support and with battery charging circuit.
- LabView virtual instrumentation software application.
- Includes a data acquisition system for measuring solar radiance, temperature and electric variables (voltage, current and power) at the different points of the circuit from a PC.

EFT-900 photovoltaic training panel

Ref.: 9EQEFTAVZZ

With main solar photovoltaic installation components: solar controller, AC/DC inverter and consumables.

Solar controller characteristics:

- Battery charge controller with micro processor.
- Connections to photovoltaic panel and to battery training module.
- Digital display showing:
  - Battery voltage.
  - Charging current and 12VDC consumption current.
  - Button-selectable.
- Two 12VDC lamp holders.
- Bridges for connection and disconnection of circuit components.
- Load resistor for solar panel testing.

Inverter characteristics:

- AC/DC converter: 12VDC input. 220V 50Hz output.
- Output power: 150W (300W peak).
- Schuko socket for external charging.
- Two 220VAC lamp holders.
- Bridges for connection/disconnection of circuit components.
- Load resistor for testing the AC/DC converter included with the accessories.

EFT-901 battery training module with charging circuit

- For connection to the EFT-900 photovoltaic training panel.
- The module has a battery charging system using mains voltage.
- Includes protective fuse. The battery is powered whether or not the charging circuit is functioning.

Accessories and manuals

- Two 12V lamps, two 220V lamps, one variable load resistor, a set of cables and safety connection bridges.
- User manual and practical manual (on CD-ROM).

LabVIEW virtual instrumentation application

The photovoltaic training devices with virtual instrumentation include a data acquisition system and an application developed in LabView enabling monitoring of the photovoltaic system's main variables via PC and different types of testing to be performed, and control of the installation from the PC.

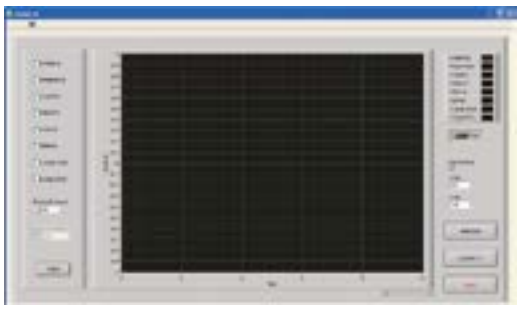
The application includes the following functions:

- **"Activities" windows:** The activities windows help the students to carry out the exercises in the training device practical manual. When the student accesses a specific activity, the diagram of this activity is shown with its associated virtual instrumentation. Also, the training device is configured automatically via the internal relays, as shown in the diagram.

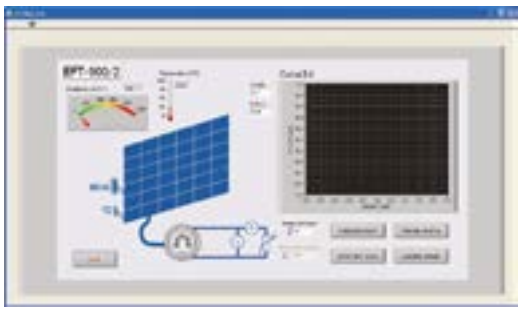
- **"Measurements" windows:** For measuring variables in the different components or points on the circuit. The variables are presented in numerical and graphic form. Measurements on solar panel, battery, 12V charge and inverter.

- **"Control" window:** For controlling the training device's internal relays via virtual buttons for opening and closing the different points of the circuit. For configuring the training panel from the PC, according to the particular test to be performed.

- **"Tests" windows:** For performing testing and obtaining characteristic curves (e.g. I-V curve for the solar panel). They include configuration functions for the signals to be received and testing times, results analysis functions, exporting data, printing and saving images, creating X-Y graphs, etc.



- **"Monitors" window:** This window shows the electrical variables at the different points of the circuit (voltage, current and power) on a single screen, together with the irradiance and temperature on the photovoltaic panel.



OPTIONAL ACCESSORIES (not included in standard version)

SOLAR PHOTOVOLTAIC PANEL WITH FIXED SUPPORT AND COLLECTORS

Ref.: 9EQMFTBA02

- Number of cells in series: 36. Power: 40W.
- Current at maximum power (Imp) = 2.10A.
- Voltage at maximum power (Vmp)= 16.80V.
- Short-circuit current (Isc): 2.35A. Open circuit current (Voc): 20.55V.
- Blocking diode.
- Dimensions: 637 x 527 x 35 mm.
- Support for external and internal assembly of panel, with adjustable tilt.
- Irradiance and temperature collector.

SOLAR PHOTOVOLTAIC PANEL WITH WHEELED SUPPORT AND COLLECTORS

Ref.: 9EQMFTAV02

- Number of cells in series: 36. Power: 40W.
- Current at maximum power (Imp) = 2.10A.
- Voltage at maximum power (Vmp)= 16.80V.
- Short-circuit current (Isc): 2.35A.
- Open circuit current (Voc): 20.55V.
- Blocking diode.
- Dimensions: 637 x 527 x 35 mm.
- Support with castors for easy transportation.
- Adjustable tilt, with graduated scale.
- Irradiance and temperature collector.

FLOODLIGHT ACCESSORY WITH FIXED SUPPORT

Ref.: ACCFOBA6Z

- Two halogen floodlights, 500W (lighting) and 400W (electric) each one (efficiency class C).
- Mast with support stand to hold floodlights.
- Rotatable, height-adjustable, and floodlight tilt can be adjusted with respect to the solar panel.
- Light intensity can be varied via a 1000W electronic controller.

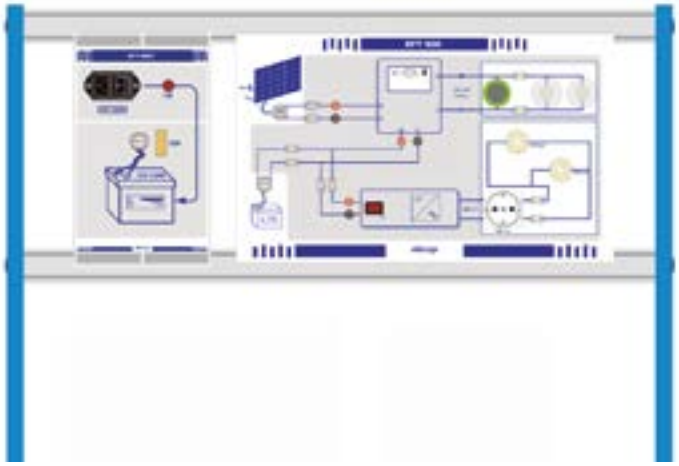
FLOODLIGHT ACCESSORY FOR WHEELED SUPPORT

Ref.: ACCFOCAV6Z

- Two halogen floodlights, 500W (lighting) and 400W (electric) each one (efficiency class C).
- Rotating mast with graduated scale for measuring the angle of incidence.
- Rotatable, height-adjustable, and floodlight tilt can be adjusted with respect to the solar panel.
- Light intensity can be varied via a 1000W electronic controller.

MODULE SUPPORT TRAINING FRAME

Ref.: 9EQB1P10CP



- Bench-mounted single-deck frame, for 10 recesses.
- Constructed in iron and extruded aluminium, used for fitting blocks, modules and panels.

EOL-900
Wind power training system

Simulates an autonomous wind power system with real and educational components

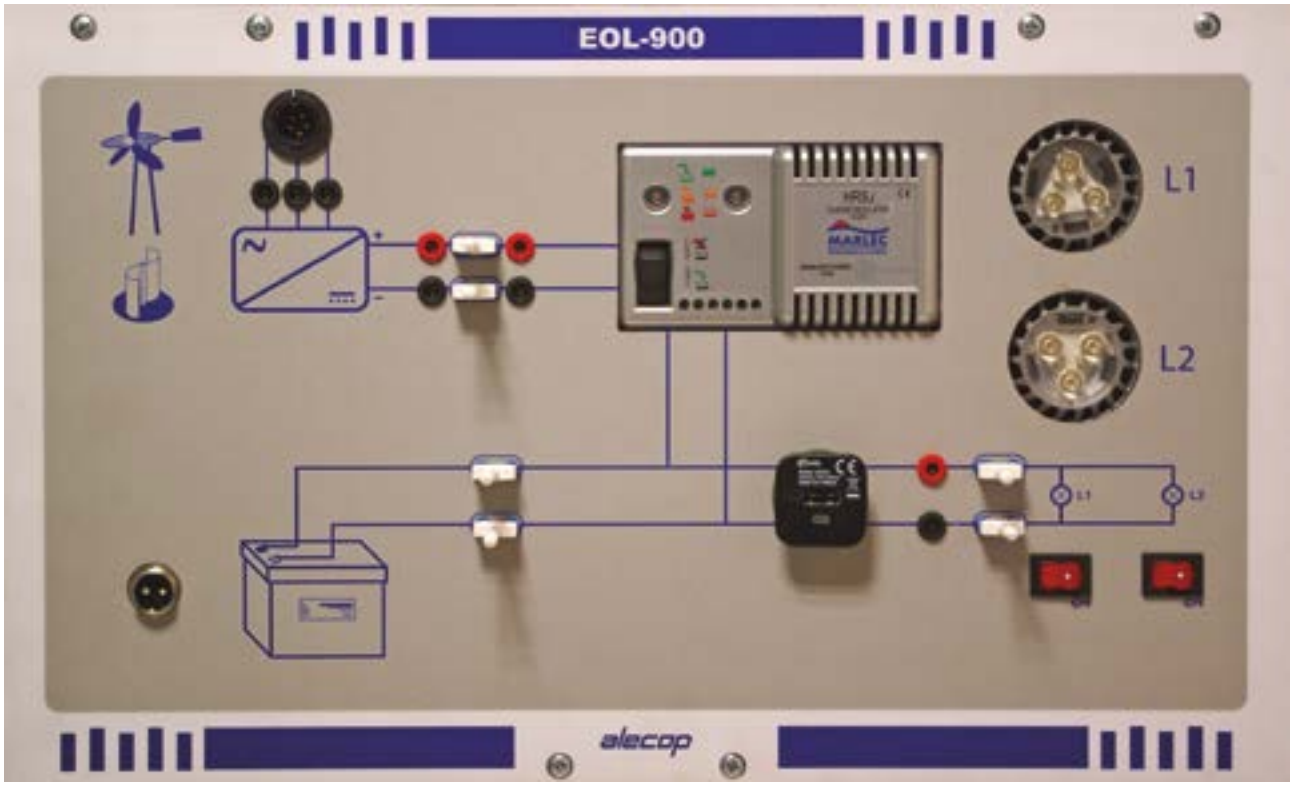
Ref.: 9EQEOL906Z

- Allows the analysis and study of the elements involved in the production, storage and transformation of wind power with wind simulation independent of the external climatic conditions.
- Activities can be performed using conventional instrumentation or virtual instrumentation on connection to the PC.
- Includes a data acquisition system and a LabView software application for measurement and control of the system from the PC.
- The software application EOL-900 LAB and its automatic setup features, make simple working with the different activities supplied with the equipment.

Vertical wind generator EOL-900

- Wind Mini-generator(12V/20W). Three phase output voltage.
- The generator drag by a c.c. electric motor (24V-8A). Power transmission by pulleys and belt with 1:2 relation
- Electronic regulator(10A) for the motor speed variation from 0 to 2000rpm
- Manual speed control , through potentiometer, or automatically, through an external setpoint with a nominal value from 0 to 10Vcc.
- Electrical and mechanical protection, with a transparent guard.
- Outputs, protected by a three phase magnetothermal circuit breaker (2A).
  - 5 Pin plug (three phase output of the generator and nominal value of the motor) for connection to the EOL-900 panel.
  - Drag system power supply: 100 - 240Vac, 47 - 63Hz. Fuse protection (1A).
  - Consumption: 150VA at full Charge.
- Dimensions: 450 x 450 x 550mm.
- Weight: 20Kg.

EOL-900 wind power system training panel



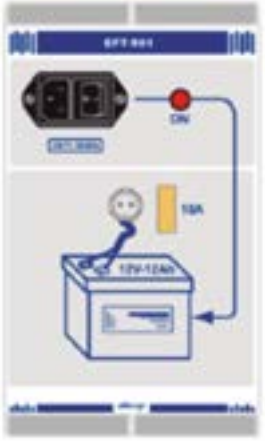
Incorporates the real elements of an isolated wind power system. Includes the data acquisition system and the connection with the PC.

Features:

- The serigraphy represents the circuit.
- Sockets and bridges for manual connection of circuit elements and doing measurements with conventional instrumentation.
- Wind regulator for battery overload protection, with the following incorporated functions:
  - LED indication of battery charge status (very low, low, medium, full)
  - LED indicator of the battery charge regime: (loading, regulating and loading, regulating).
  - Temperature compensation for an optimal load of the batteries.
  - Multistage loading for an optimal loading regime.
  - Stop switch for installation and maintenance.
- Two LED (12V/5W) lamps with control switches
- Car lighter plug to connect other types of charges to the system.
- Data acquisition system incorporated inside the panel, with the following features:
  - USB interface for PC connection
  - Conditioning circuits for the measurement of wind generator three phase voltages, output frequency of the wind generator, voltage and current at three phase rectifier output, voltage and current per battery, voltage and current on 12Vcc charge, and the 0-10V output for the generator drag system external nominal value.
- Relays (12V/8A) for disconnect/connect the electric generator and the lamps from the PC.

EFT-901
battery training module with charging circuit

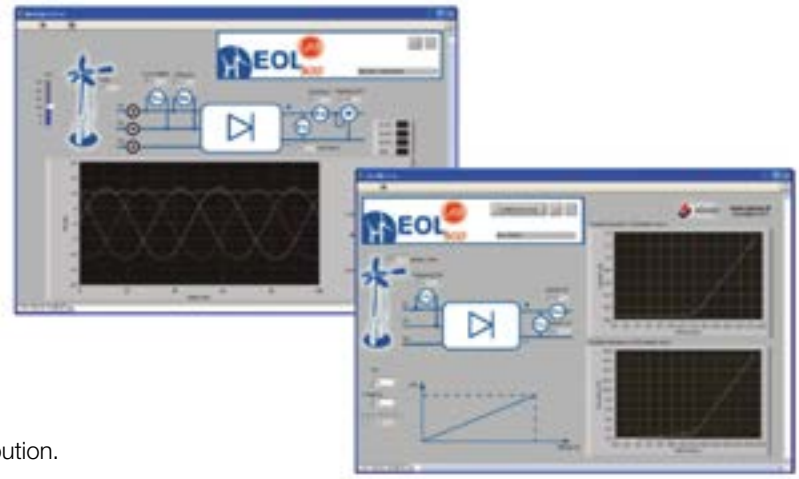
- For connection to the EFT-900 Photovoltaic Training System and the Wind Energy Training System EOL-900.
- Characteristics: 12V / 12A / 20HR
- The module has a battery charging system using mains voltage.
- Includes protective fuse. The battery is powered whether or not the charging circuit is functioning.



EOL-900 LAB Virtual instrumentation and control software

Virtual instrumentation software application developed in LabView, enabling monitoring and control the wind power system from the PC.

The application includes the following functions:

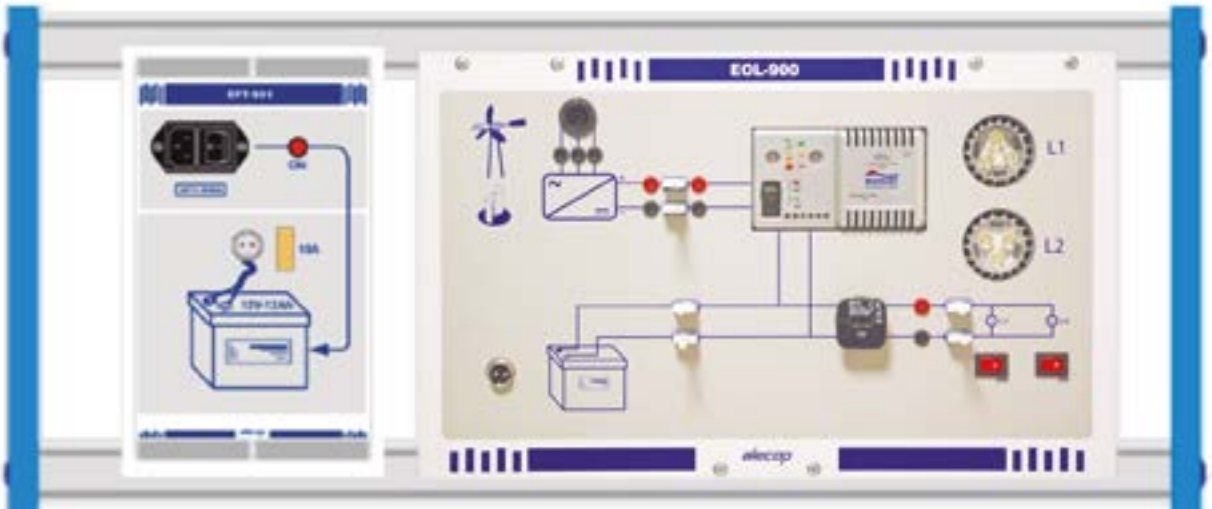


- **Activities:** The activities window helps the students to carry out the activities in the manual. When the student accesses a specific activity, the diagram of the activity is shown with its associated virtual instrumentation. Also, the training device is configured automatically via the internal relays.
  - **EOL-900/1:** Wind generator characteristics in vacuum.
  - **EOL-900/2:** Wind regulator characteristics in charge.
  - **EOL-900/3:** Battery charging.
  - **EOL-900/4:** Battery discharging.
  - **EOL-900/5:** Wind regulator currents distribution.
  - **EOL-900/6:** Wind regulator charge stages.

- **Measurements:** For measuring variables in the different components or points on the circuit. The variables are presented in numerical and graphic format.
  - **Wind generator measurements:** wind speed in m/s, wind generator rotation speed in rpm, voltages and frequency at generator outupt, voltage, current and power at the rectifier output.
  - **Battery measurements:** Voltage, current and battery power.
  - **Charge measurements of 12Vcc:** Voltage, current and charge power.
  - **Wind regulator measurements:** Voltages, currents and powers in the regulator inputs and outputs.
  - **All the windows have implemented a speed regulator for the drag motor.**

- **Control:** For controlling the training device's internal relays via virtual buttons for opening and closing the different points on the circuit. For configuring the training panel from the PC, according to the particular test to be performed.

- **Tests:** For performing testing and obtaining characteristic curves (e.g. I-V curve for the solar panel). They include configuration functions for the signals to be received and testing times, results analysis functions, exporting data, printing and saving images, creating X-Y graphs, etc.



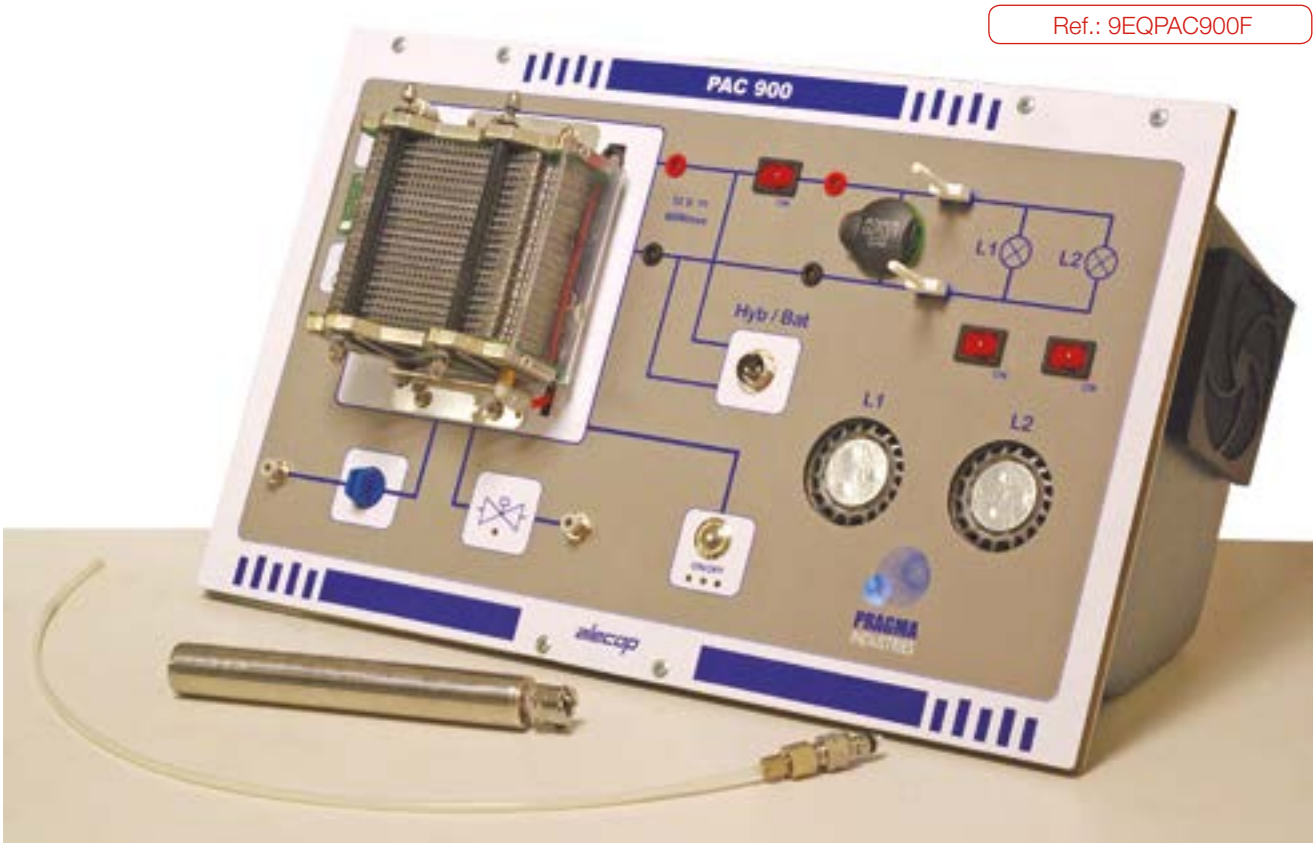
**Mounted training frame not included*

Fuel cell trainer

PAC-900

with virtual instrumentation

Ref.: 9EQPAC900F

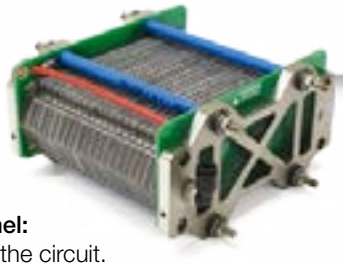


Training equipment for the study of the operation and characteristics of fuel cells. The proposal is based on a small panel on which a real proton exchange membrane (PEM) hydrogen fuel cell system is being implemented, together with a catchment system and monitoring of variables controlled from the PC.

The system makes it possible to:

- Discover the technology of hydrogen fuel cells, their advantages and disadvantages, and their energetic possibilities.
- Become familiar with the elements which make up a fuel cell system and the role played by each one.
- Execute the necessary operations in order to start up a hydrogen fuel cell, following the relevant security measures and instructions at all times when handling the hydrogen required for its operation.
- Assess, in a practical and simple manner, the technical characteristics and provisions of a fuel cell system via data acquisition and the subsequent analysis of the performed tests and measurements.

PAC-900 training panel



Elements included in the panel:

- Representative serigraph of the circuit.
- Open-cathode PEMFC system. Includes the fuel cell stack and its corresponding management circuit.
- Hydrogen intake and shut-off valve.
- Drain valve outlet with an indicator LED of the valve activation.
- ON/OFF switch for turning the fuel cell on and off and indicator LEDs indicating the status of the system.
- Two 12V/5W LED lights with control switches.
- Cigarette lighter-type outlet for connecting other kinds of charges.
- Room temperature and relative humidity collectors for monitoring the values form the PC.
- Integrated data acquisition system.
- Eye screws and bridges for connecting-disconnecting the elements of the circuit manually and measuring with conventional instrumentation.
- USB connector for connecting the equipment to the PC.

It includes a fuel cell with the following characteristics:

- Fuel cell with 20 18 cm^2 stacks.
- Power: 50 W – 4.24 A (12-19 V).
- Fan, pressure reducer, and drain electrovalve.
- Dimensions: 116 x 115 x 75 mm.
- Weight: 900 gr.

The control card of the fuel cell governs the following scales:

- 12 V fan speed control.
- Temperature control.
- 12 V electrovalve control.
- Voltage and current control.
- Status of the drain valve.

Data acquisition system via the PC:
The integrated data acquisition system, together with its software application developed in LabVIEW, allows the user o study the fuel cell from a functional perspective as well as carry out an energetic assessment by obtaining its characteristics automatically from the PC, with no need for additional consumption elements or instrumentation.

Control and monitoring software

Virtual instrumentation VI software application developed in LabView which makes it possible to monitor the main scales of the fuel cell system, perform different types of tests and control the system, all from the PC. The application includes the following main functions:

- **“Activities” windows:** These facilitate the execution of the exercises proposed in the practices manual. When the student accesses a specific activity, the diagram of this activity is shown with its associated virtual instrumentation. Also, the training device is configured automatically via the internal relays, as shown in the diagram.
  - PAC Start-up.
  - Running in empty.
  - Running in load.
  - I-V curve.
  - Characteristic curve.

- **“Measurements” windows:** For measuring variables in the different components or points on the circuit. The variables are presented in numerical and graphic form.
  - Status of the system: Status of the drain valve and operational mode of the management card.
  - External physical variables: Temperature, relative humidity.
  - In the Stack: Voltage, current, power, internal temperature, hydrogen consumption.
  - In the Management Card: Voltage, current, power.

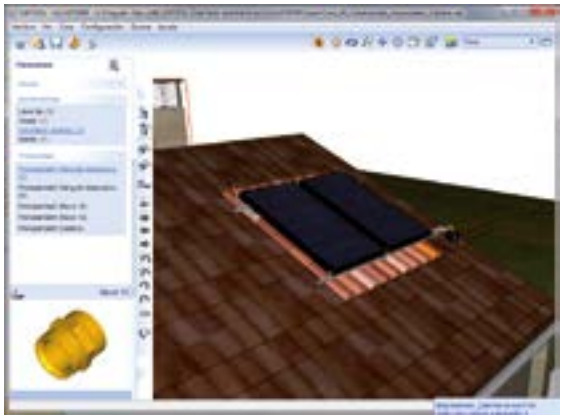
- **”Control” window:** For controlling the training device’s internal relays via virtual buttons for opening and closing the different points of the circuit. For configuring the training panel from the PC, according to the particular test or practice to be performed.

- **“Tests” windows:** For performing tests and obtaining characteristics curves. They include configuration functions for the signals to be received and testing times, results analysis functions, exporting data, printing and saving images, creating X-Y graphs.

VIRTOOL Solarterm

Interactive virtual environment for DHW system installation training

VIRTOOL SolarTerm provides users with DHW system installer skills and includes detailed basic system assembly and start-up procedures



Working with VIRTOOL

The practical activity library is divided into study cases.

With VIRTOOL SolarTerm, the user/student performs the learning activities by solving case studies in a virtual environment. Users have all the information required for the case studies:

- A full description
- Back-up materials
- Instructions are constantly provided and errors notified, helping students to successfully solve all the case studies
- Online reports can be obtained for student assessment by tutors

It is a software application designed and developed for training purposes, including practical activities/case studies and a full range of content. It is a virtual model that functions just as in real life.

LEARNING BY DOING

The application is based on problem-based learning and enables independent study. Its advanced educational design is a result of the latest studies conducted in this field and state-of-the-art technology. (PBL Problem Based Learning, Self-Training, Learning by Doing).

SAFE, INDESTRUCTIBLE INSTALLATIONS

Reduces the risk of accidents and damage to equipment during the training process.

LOWER TRAINING COSTS

The time spent working at real installations is shorter, and genuinely effective learning is provided with less need for tutor support.

ONE INSTALLATION, ONE STUDENT

Each student works on their own separate installation.

INSTALLATIONS AVAILABLE 24 HOURS A DAY

Interaction

The simulator is used to practise the following:

- Component selection and identification.
- Assembling the different parts of the installation on a roof and inside a model home.
- Determining the installation position of the various components.
- Assembling, bolting or fixing the components in place using the necessary tools.

Activities

- Identifying the parts of a DHW system
- Assembling each component.
- Fully assembling the entire system.
  - Assembling the sections.
  - Assembling the solar collectors.
  - Connecting the collectors and pipe casing.
  - Connecting the pipe casing and the water tank.
  - Connecting the water tank and the boiler.

SolarTerm Licences

Virtool SolarTerm is sold with web licences of different duration:

- SOFEVIR60X (unlimited)
- SOFEVIR61X (4 months)
- SOFEVIR62X (1 year)

Back-up resources

VIRTOOL has a wide range of back-up resources for these activities:

- Thermal solar power
- DHW installation components
- Solar collectors
- Adjustment and control
- Tools
- Hydraulic pump units
- Pipes and insulation
- Structures

12

laboratory furniture

Configurable modular fixtures.

We adapt our equipment to new designs and proposals arising from our customers' requirements.

index

Laboratory units

The provision of laboratories and workshops equipped with appropriate teaching the purposes of such spaces, necessarily includes the furniture. The carefully designed modular nature of the ideas presented in this catalogue enables endless combinations to be tailor made to suit ever y kind of requirement: useful space, shelving space, drawers, power supplies, didactic equipment storage unit system, etc.

Functionality

- Tables which are either fixed or which can be pushed around.
- Power supply channel for electricity and/or electronics.
- Drilled top surface to which different elements can be attached.
- Frames which are designed to be used for placing equipment in different formats: die, modules, panels...

Robustness

- Highly resistant metal structure with epoxy finish.
- Surface tops which are resistant to water, damp, corrosive agents such as acids, alkalis, solvents, ...).
- Withstand all abrasions and temperatures of up to 180 ºC.

Modularity

- Modular table programme.
- Modular power supply system programme, with safety terminals.
- Modular support programme (frames, storage units, ...) for didactic equipment.

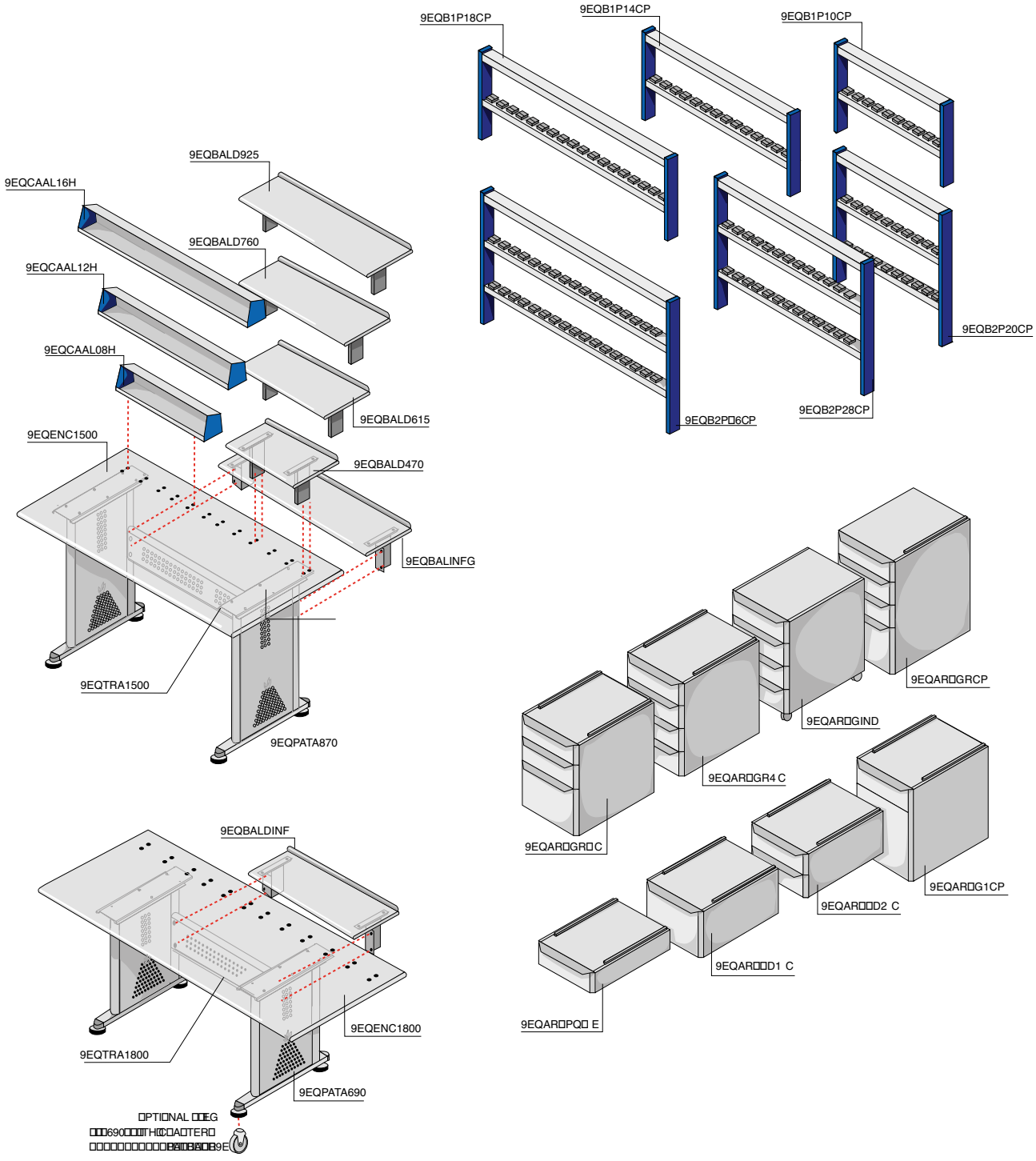
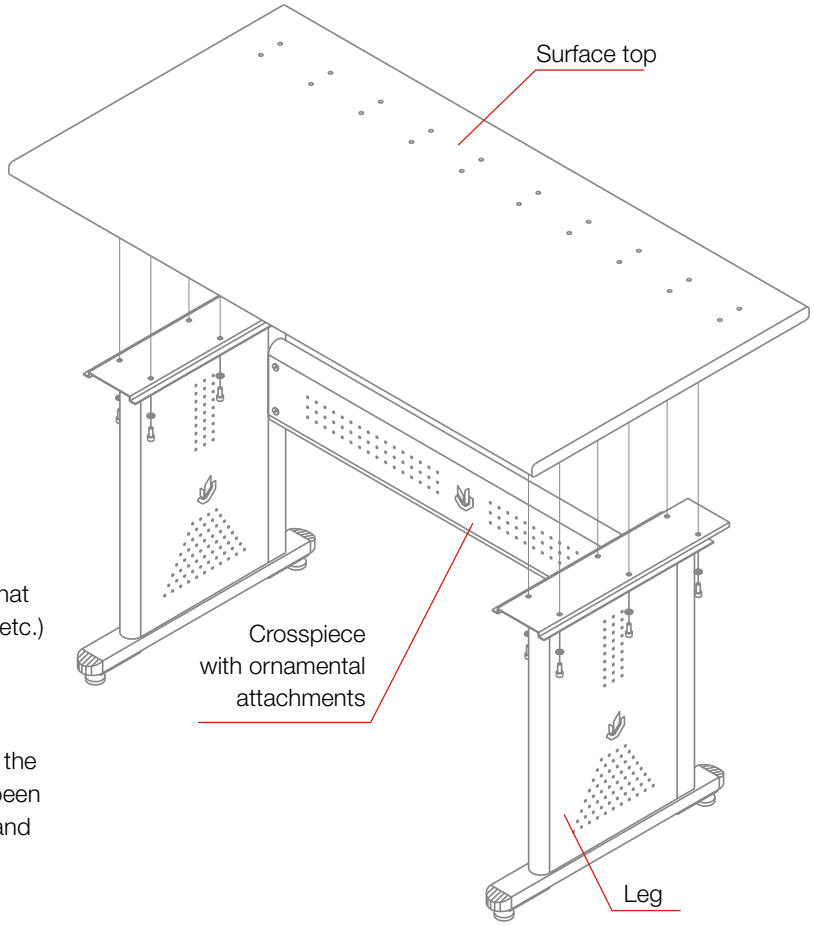

9EQB1P18CP
9EQB1P14CP
9EQB1P10CP
9EQB2P20CP
9EQB2P□6CP
9EQB2P28CP
9EQBALD925
9EQCAAL16H
9EQBALD760
9EQCAAL12H
9EQCAAL08H
9EQBALD615
9EQENC1500
9EQBALD470
9EQBALINFG
9EQTRA1500
9EQPATA870
9EQBALDINF
9EQENC1800
9EQTRA1800
9EQPATA690
9EQAR□GRCP
9EQAR□GIND
9EQAR□GR4 C
9EQAR□GR□C
9EQAR□G1CP
9EQAR□□D2 C
9EQAR□□D1 C
9EQAR□PQ□ E

Table settings

A modular programme which enables different table options to be put together, depending on the needs of the user at the time. The minimum composition of a table is as follows:

1 Surface top
2 Legs
1 Crosspiece



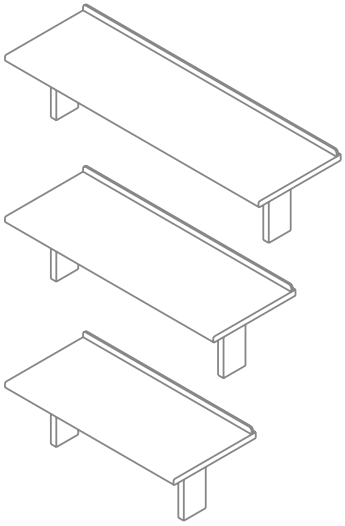
Tables

The **surface tops** have been manufactured out of post-formed 30 mm boards with PVC edges, into which holes and inserts have been drilled in order that the rest of the system's elements (shelves, frames, etc.) may be assembled onto them.

The **legs** are the supports which, together with a crosspie **crosspiece**, give all necessary stability to the table. Both elements are made of metal and have been epoxy coated, which guaranteed their robustness and durability.

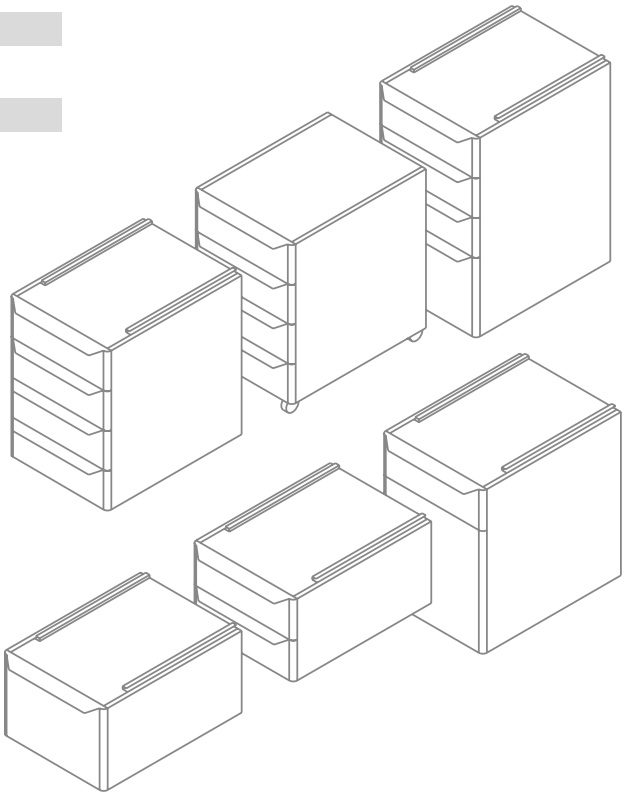
REFERENCE	DESCRIPTION
9EQMES1569	Table classroom / lab of 1500 mm and fixed legs of 690 mm height.
9EQMES1587	Table classroom / lab of 1500 mm and fixed legs of 870 mm height.
9EQMES156R	Table classroom / lab of 1500 mm and rolling legs.
9EQMES1869	Table classroom / lab of 1800 mm and fixed legs of 690 mm height.
9EQMES1887	Table classroom / lab of 1800 mm and fixed legs of 870 mm height.

Shelves



There is a series of shelves which can be fixed in position either on the surface or below between the table legs. The shelves are made of posformed laminate with a buffer at the rear.

REFERENCE	DESCRIPTION
9EQBALD470	Upper shell 470 x 300 x 20 mm.
9EQBALD615	Upper shell 615 x 300 x 20 mm.
9EQBALD760	Upper shell 760 x 300 x 20 mm.
9EQBALD925	Upper shell 925 x 300 x 20 mm.
9EQBALDINF	Lower shell for 1800 mm table.
	Dimensions: 840 x 300 x 30 mm.
9EQBALINFG	Lower shell for 1500 mm table.
	Dimensions: 1130 x 300 x 30 mm.



Storage units

The selection of STORAGE UNITS or drawer units made of bonded melamine and post formed drawers which are positioned below the surface. The handles are made of aluminium. Except for the model which is fitted with coasters, the rest are steadied by means of the corresponding accessories below the surface top.

REFERENCE	DESCRIPTION
9EQARMPQUE	1 body 1 drawer storage unit. Hanging. 400 x 530 x 140 mm.
9EQARMMD1C	2 body 1 drawer storage unit. Hanging. 400 x 530 x 280 mm.
9EQARMMD2C	2 body 2 drawer storage unit. Hanging. 400 x 530 x 280 mm.
9EQARMG1CP	4 body 1 drawer and 1 door storage unit. Hanging. 400 x 530 x 560 mm.
9EQARMGR3C	4 body 3 drawer storage unit. Hanging. 400 x 530 x 560 mm.
9EQARMGR4C	4 body 4 drawer storage unit. Hanging. 400 x 530 x 560 mm.

Consult compatibility table on page 221 before choosing the right combination.

Didactic power supply systems

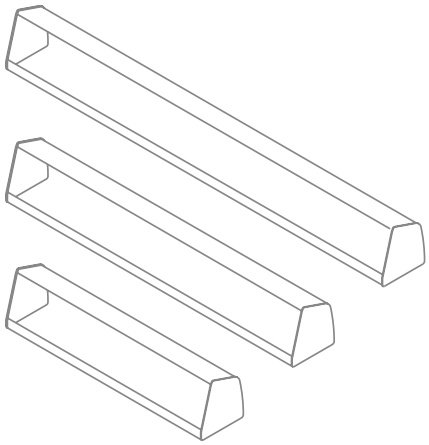
This is a modular programme which enables different electrical or electronic supply system options to be put together.

It consists of a supply channel which is to be screwed into the holes which are in the surface top, and a series of electrical modules which are assembled onto the channel.

The channel is made of extruded aluminium and is available in different lengths. All channels need to be equipped with an electrical supply module plus a set of modules selected by the user according to their needs.

Channels

REFERENCE	DESCRIPTION
9EQCAAL16H	16 space Didactic supply channel.
	Length 1023 mm.
9EQCAAL12H	12 space Didactic supply shannel.
	Length 914 mm.
9EQCAAL08H	8 space Didactic supply channel.
	Length 624 mm.



Standard electrical supply channel

Supply channels with two holes for easy adaptation to any other table type. Their general characteristics are:

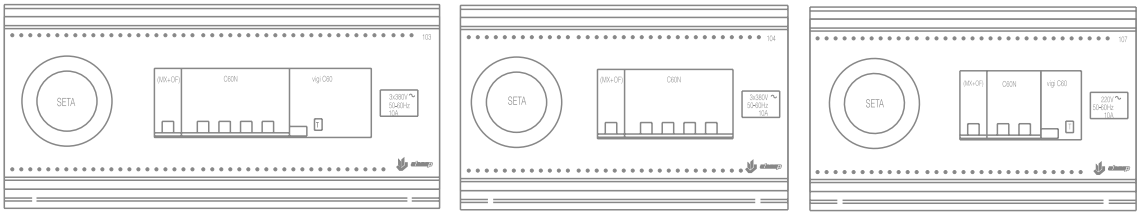
- Compliant with European low voltage Directives.
- Manufactured in extruded aluminium.
- Modular and extendable.
- Includes a 4-metre connection hose.
- Supplied ready-assembled.

We present three models (other models available).

REFERENCE	9EQCA08H6Z	9EQCA12HCZ	9EQCA12HFZ
Model	**230 Vac single-phase**	**230 Vac three-phase**	**380 Vac three-phase**
Protection	Overload	Overload and earth leakage	Overload and earth leakage
230 Vac plug sockets	yes (3 sockets)	yes (3 sockets)	yes (3 sockets)
Three-phase plug socket	no	yes (1 socket)	yes (1 socket)
Safety terminal sockets	yes (L1,L2,PE)	yes (L1,L2,L3,N,PE)	no
Length in mm.	624 mm	914 mm	914 mm

Before choosing the configuration, see the compatibility table on page 221

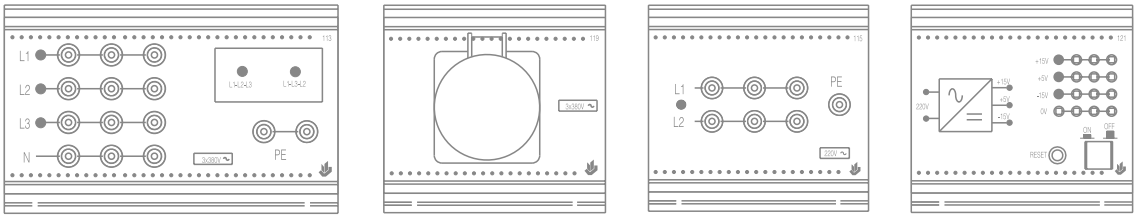
Main supply modules



REFERENCE	DESCRIPTION
MODMES1010	Three-phase 380/400V. Overload protection. Length 2 spaces.
MODMES1020	Three-phase 380/400V. Overload and earth leakage protection. Length 3 spaces.
MODMES1030	Three-phase 380/400V. Overload and earth leakage protection. Emergency shut-off. Length 4 spaces.
MODMES1040	Three-phase 380/400V. Overload and earth leakage protection. Emergency shut-off. Length 3 spaces.
MODMES1090	Three-phase 220/230V. Overload protection. Length 2 spaces.
MODMES1100	Three-phase 220/230V. Overload and earth leakage protection. Length 3 spaces.
MODMES1110	Three-phase 220/230V. Overload and earth leakage protection. Emergency shut-off. Length 4 spaces.
MODMES1120	Three-phase 220/230V. Overload and earth leakage protection. Emergency shut-off. Length 3 spaces.
MODMES1050	Single-phase 220/230V. Overload protection. Length 2 spaces.
MODMES1060	Single-phase 220/230V. Overload and earth leakage protection. Length 2 spaces.
MODMES1070	Single-phase 220/230V. Overload and earth leakage protection. Emergency shut-off. Length 3 spaces.
MODMES1080	Single-phase 220/230V. Overload and earth leakage protection. Emergency shut-off. Length 3 spaces.

Electrical modules

Consult the 110 V supplies and electrical modules.

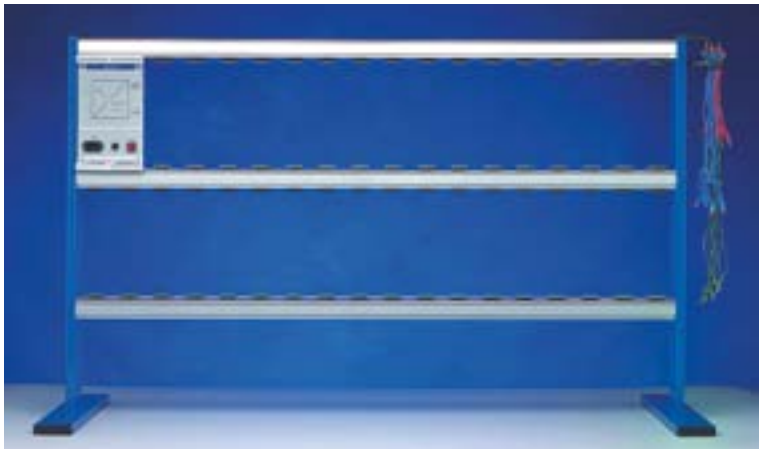


REFERENCE	DESCRIPTION
MODMES1130	Three-phase 400V. 4mm safety sockets. Length 3 spaces.
MODMES1140	Three-phase 230V. 4mm safety sockets. Length 3 spaces.
MODMES1150	Bi-phase 230V. 4mm safety sockets. Length 2 spaces.
MODMES1160	Single-phase 230V. 4 mm safety sockets. Length 2 spaces.
MODMES1170	Single-phase. 3 Schucko sockets. Length 3 spaces.
MODMES1180	Single-phase. 2 Schucko sockets. Length 2 spaces.
MODMES1190	Three-phase 400V power socket (CEE socket). Length 2 spaces.
MODMES1220	Three-phase 230V power socket (CEE socket). Length 2 spaces.
MODMES1200	2 x 12V. / 2 A. 220V AC/DC Converter. Length 2 spaces.
MODMES1210	15V, + 5V; 1A power supply. Length 2 spaces.
MODMES1240	0,4 diameter air supply. Length 1 space.
MODMES1350	Phone jack supply. Length 1 space.
MODMES1370	Computer plugs module, 2 Schucko sockets. Length 2 spaces.
MODMES1000	Module for covering empty spaces. Length 1 space.
MODMES1001	Module for covering empty spaces. Length 2 spaces.
MODMES1002	Module for covering empty spaces. Length 3 spaces.
MODMES1003	Module for covering empty spaces. Length 4 spaces.
MODMES1004	Module for covering empty spaces. Length 5 spaces.
MODMES1005	Module for converting empty spaces. Length 6 spaces.

Table-mounted frames and fixtures

This system has two main functions:

- It serves as a physical support for the modules, blocks and panels used in the practical activities.
- It transmits the electrical supply from the supply modules to all the modules requiring it.



Frames

The frame dimensions are selected in accordance with the equipment to be mounted on the frame. Its horizontal structure consists of an aluminium section, and it has quadrangular iron side supports.

As regards locating the frame on the work table, it may be fixed (the frame can be fixed to the tables) or mobile (if it is to be used as a mobile frame, it is supplied with removable legs with non-slip feet).

The module power supply and fixing systems consist of a series of connectors into which the connection points located on the rear of the modules are inserted, exerting a slight pressure. All the frame connectors are interwired in order to share a common voltage, guaranteeing a suitable power supply to the modules installed.
The power is supplied from the frame via a specific supply module.

REFERENCE	DESCRIPTION
9EQB2P36CP	Table-mounted training module for 36 single modules in 2 tiers.
9EQB1P18CP	Table-mounted training module for 18 single modules in 1 tier.
9EQB1P14CP	Table-mounted training module for 14 single modules in 1 tier.
9EQB2P20CP	Table-mounted training module for 20 single modules in 2 tiers.
9EQB1P10CP	Table-mounted training module for 10 single modules in 1 tier.
9EQPCBLBSM	Cable holder accessory for training frame.

Compatibility tables

Depending whether a fixed table top frame is going to be used, there are several dimension conditions which prevent certain elements from being attached such as some models of shelves or supply channels.

These tables show which elements may NOT be used on the table top, based on the choice of the frame.

1500 TABLE

FRAMES	SHELVES				CHANNELS		
	470 mm	615 mm	760 mm	925 mm	8 spaces	12 spaces	16 spaces
2 tier 36 modules	no	no	no	no			
Single tier 18 modules	no	no	no	no			
2 tier 28 modules	no	no	no	no			no
Single tier 14 modules	no	no	no	no			no
2 tier 20 modules			no	no		no	no
Single tier 10 modules			no	no		no	no

1800 TABLE

FRAMES	SHELVES				CHANNELS		
	470 mm	615 mm	760 mm	925 mm	8 spaces	12 spaces	16 spaces
2 tier 36 modules	no	no	no	no			
Single tier 18 modules	no	no	no	no			
2 tier 28 modules			no	no			no
Single tier 14 modules			no	no			no
2 tier 20 modules						no	no
Single tier 10 modules						no	no

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