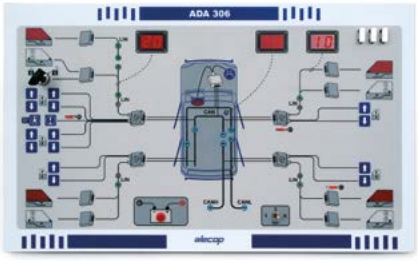
ELECTRICITY ELECTRONICS - **ADA SERIES**

The ADA series of self-contained training modules covers all aspects of electronic and electrical circuits and systems used on modern automobiles.

ADA 300: electricity application

ADA 308: electric vehicle application

ADA 307: hybrid vehicle application



ADA 306: multiplexed CAN-LIN buses application

Auxiliary equipment

classrooms

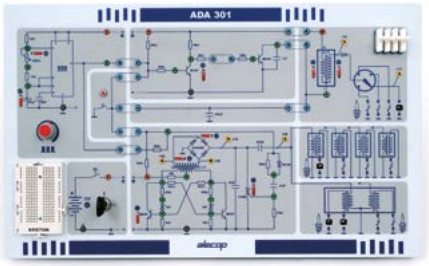
Furniture, spotlights, multimedia blackboard, cupboards, etc.

workshops

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

electromechanics

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



ADA 301: electronics application

ADA 303: sensors application

ADA 304: electronic control unit application

ADA 305: actuators application

bodywork

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

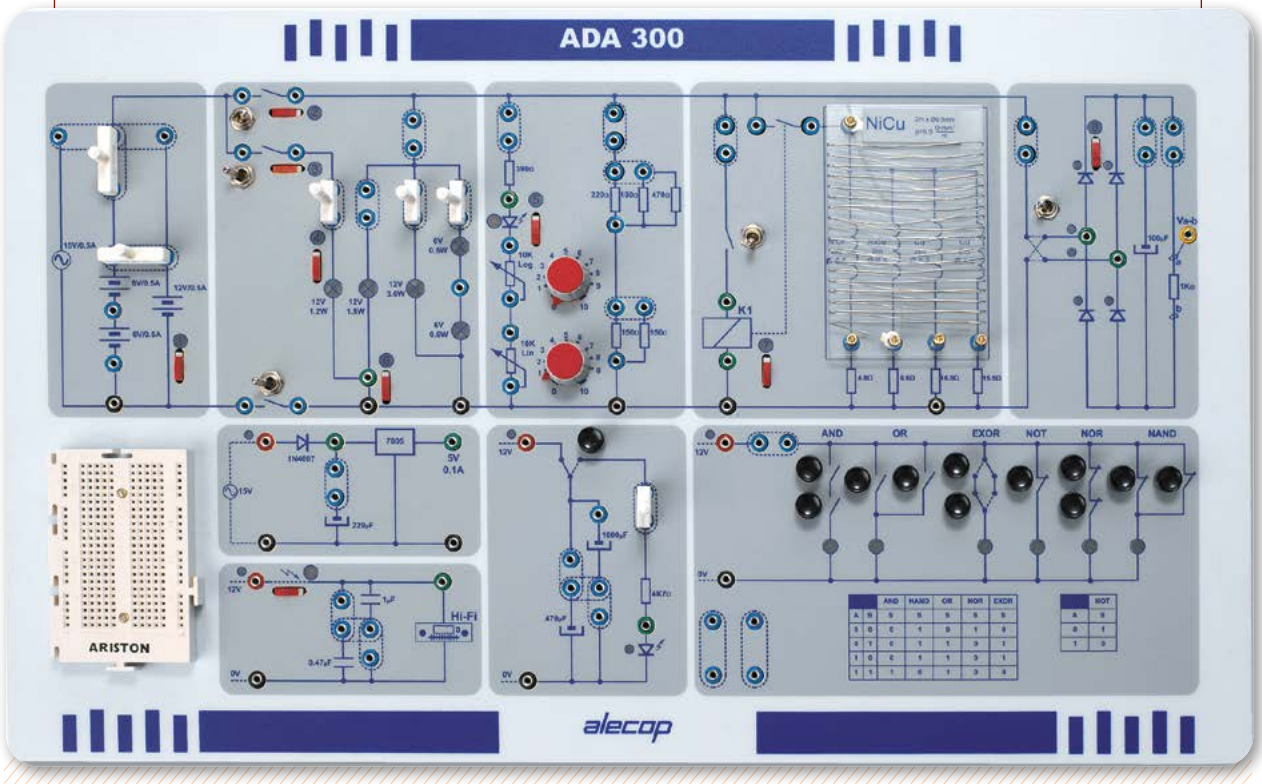
laboratory

Diagnostic instruments, tests bank, fumes extractor, etc.

ADA 300

Application of electricity for automotive

Equipment to study basic automotive electricity.



Ref.: 9EQ300AA6C - 230 V

Ref.: 9EQ300AA3C - 115 V

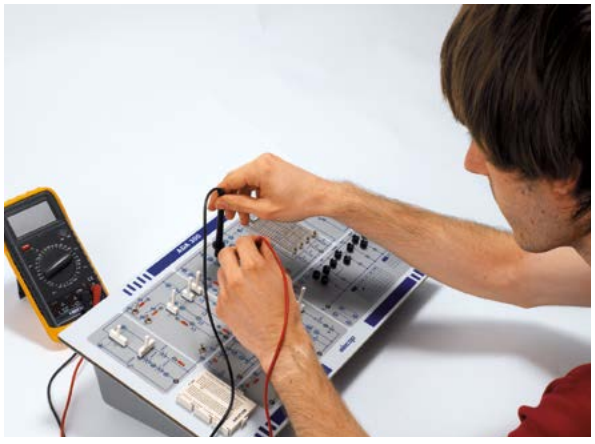
The purpose of this equipment is to familiarise students, in a flexible way, with basic electricity in general and, more specifically, its application in cars. The application can be used to analyse and check different basic electric circuits as well as their components without wasting any time on assembly 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.



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.

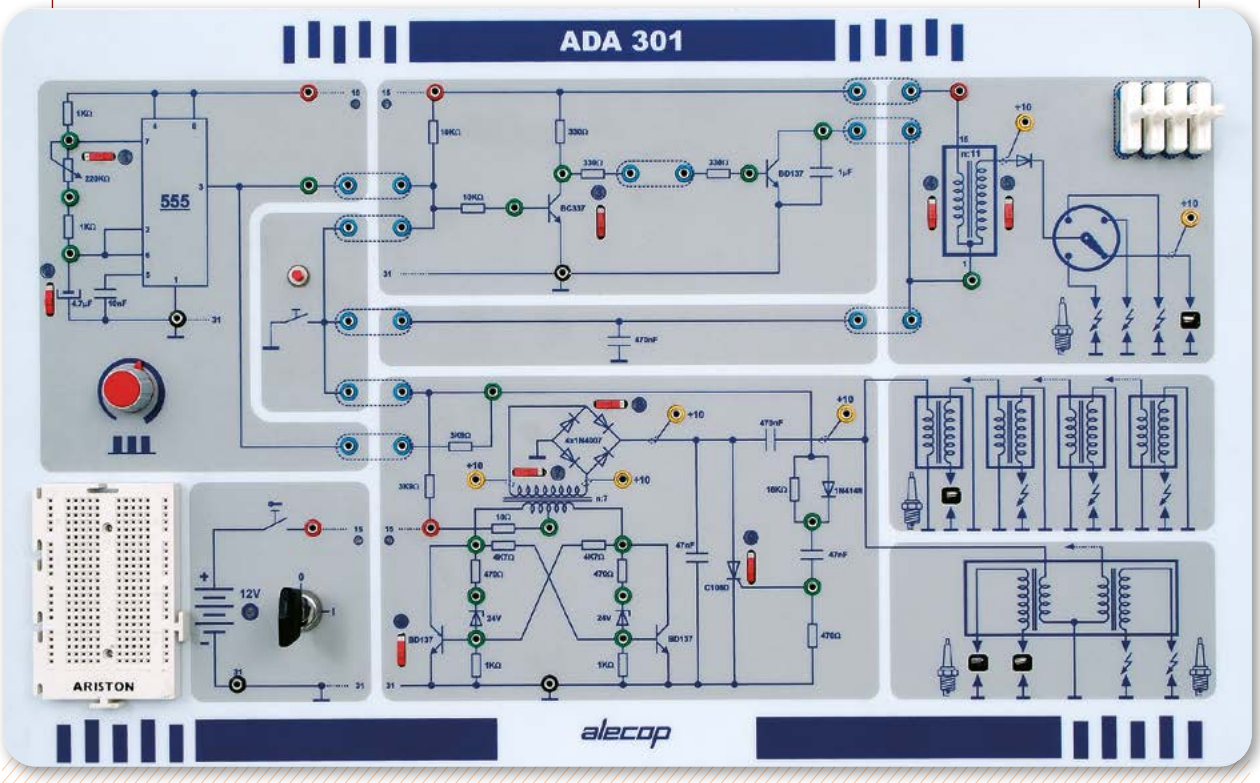
Contents to be studied

- 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.

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

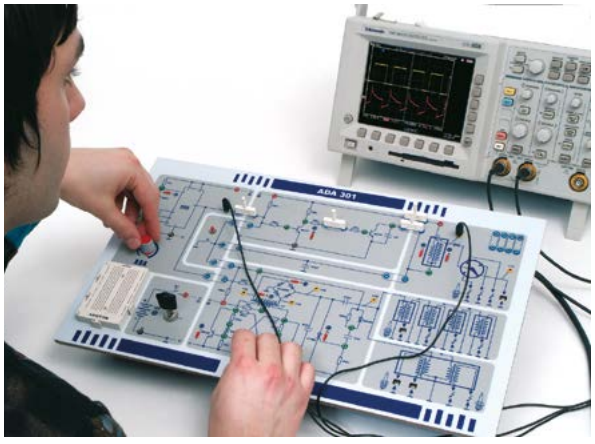
- Incorporates the electronic blocks which are necessary to analyse the following circuits:
  - Power pack.
  - Circuit to generate sparks using a switch.
  - Multi-vibrator circuit or square signal generator.
  - Circuit to generate sparks using a transistor.
  - Circuit to generate sparks using a condenser discharge system.
  - Power circuit for a DC motor.
  - Circuit to vary the speed of a DC 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.

Equipment composition

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



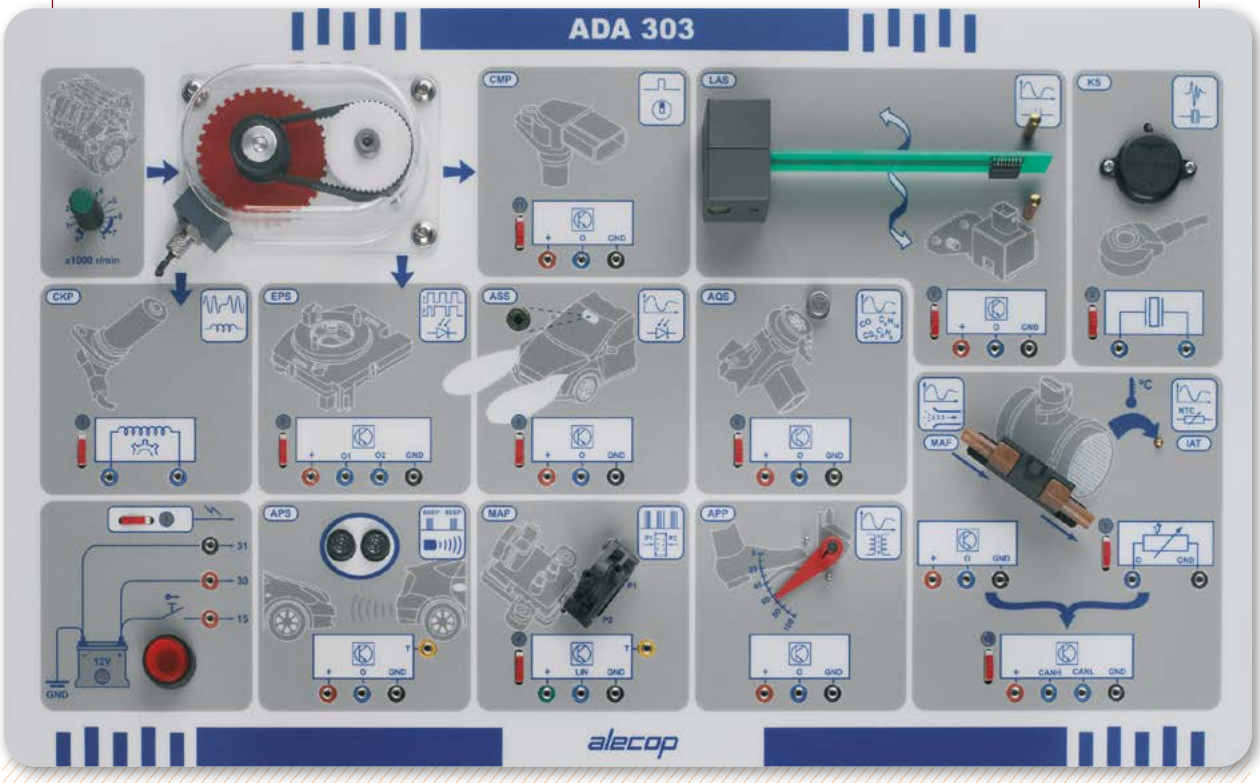
Contents to be studied

- 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).

ADA 303

Application of sensors for automotive

Equipment for the study of sensors 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

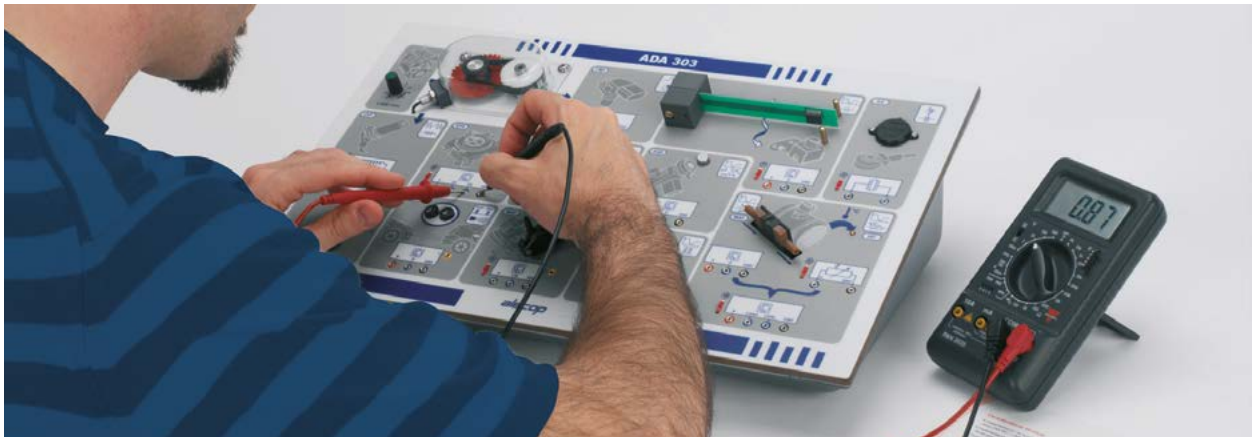
- Analysis of the working of the different sensors and their association in the different automobile systems.
- Testing electrical/electronic signals without voltage and under voltage.
- Diagnosis of faults in the sensors: Lack of supply, broken sensor, short circuit to mass or to positive of the sensor, 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

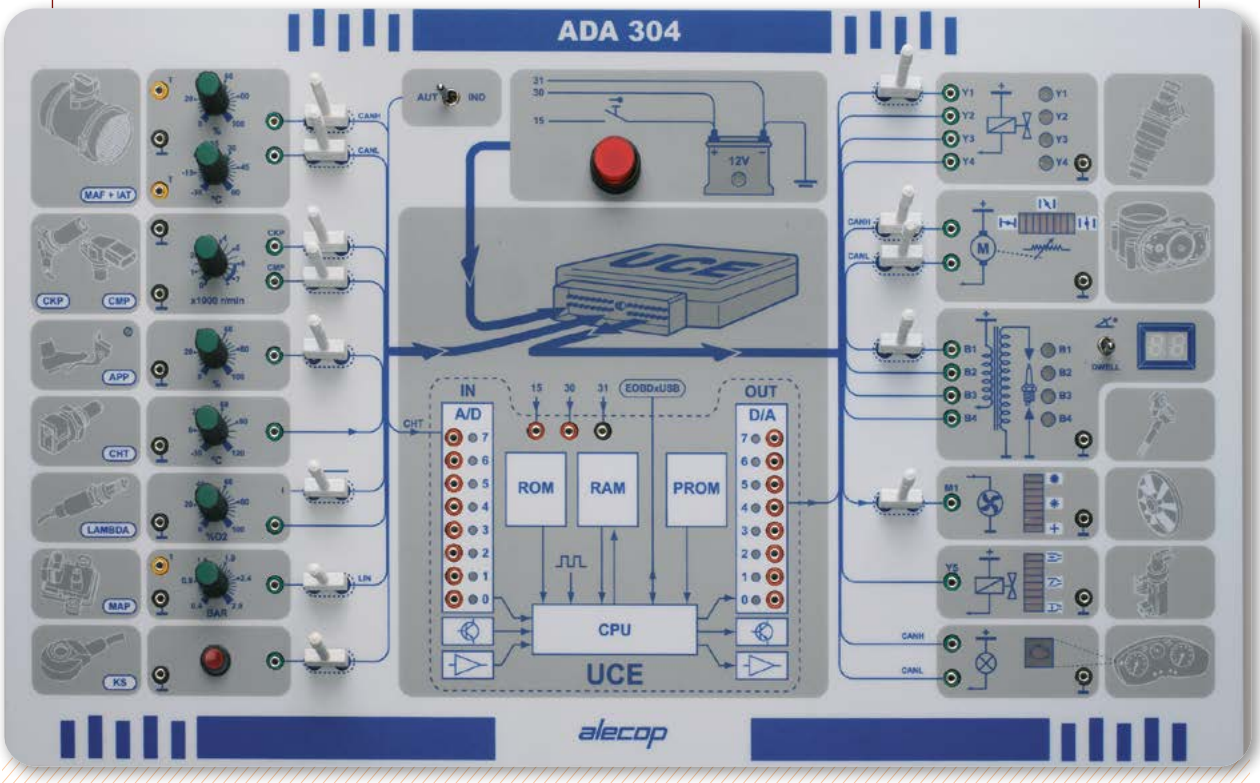
- Technologies used in sensor design.
- Types and characteristics of sensors.
- Types outputs (analogue, digital, CAN bus, LIN bus).



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.

Equipment composition

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

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.

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 applications 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.

Equipment composition

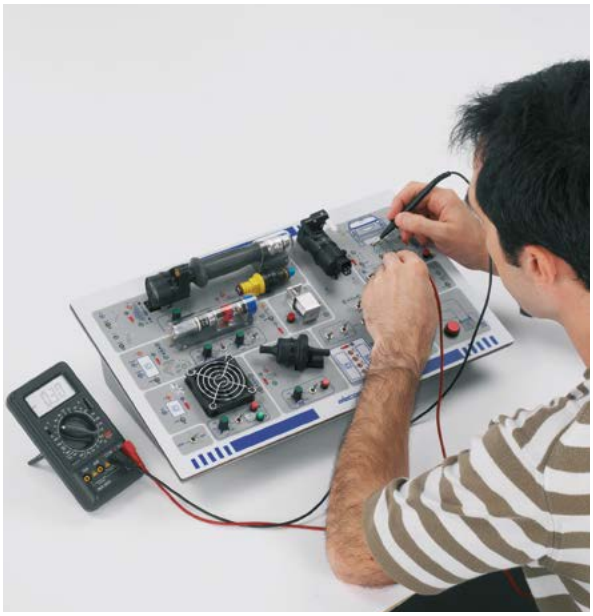
- ADA305 Panel.
- User manual.
- Practise activity manual.
- Accessory store.

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.

Contents to be studied

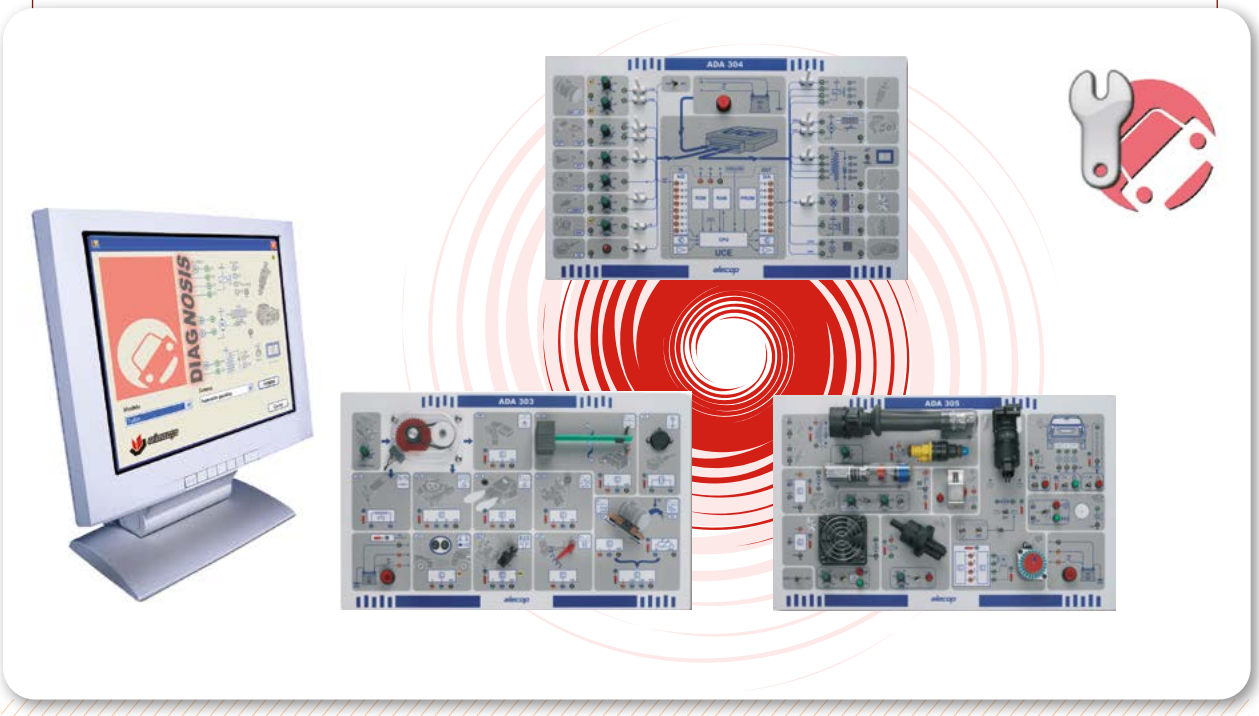
- Technologies used in the actuator design.
- Types and characteristics of actuators.
- Types actuator control systems (analogue, digital, CAN bus, LIN bus).



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.

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.

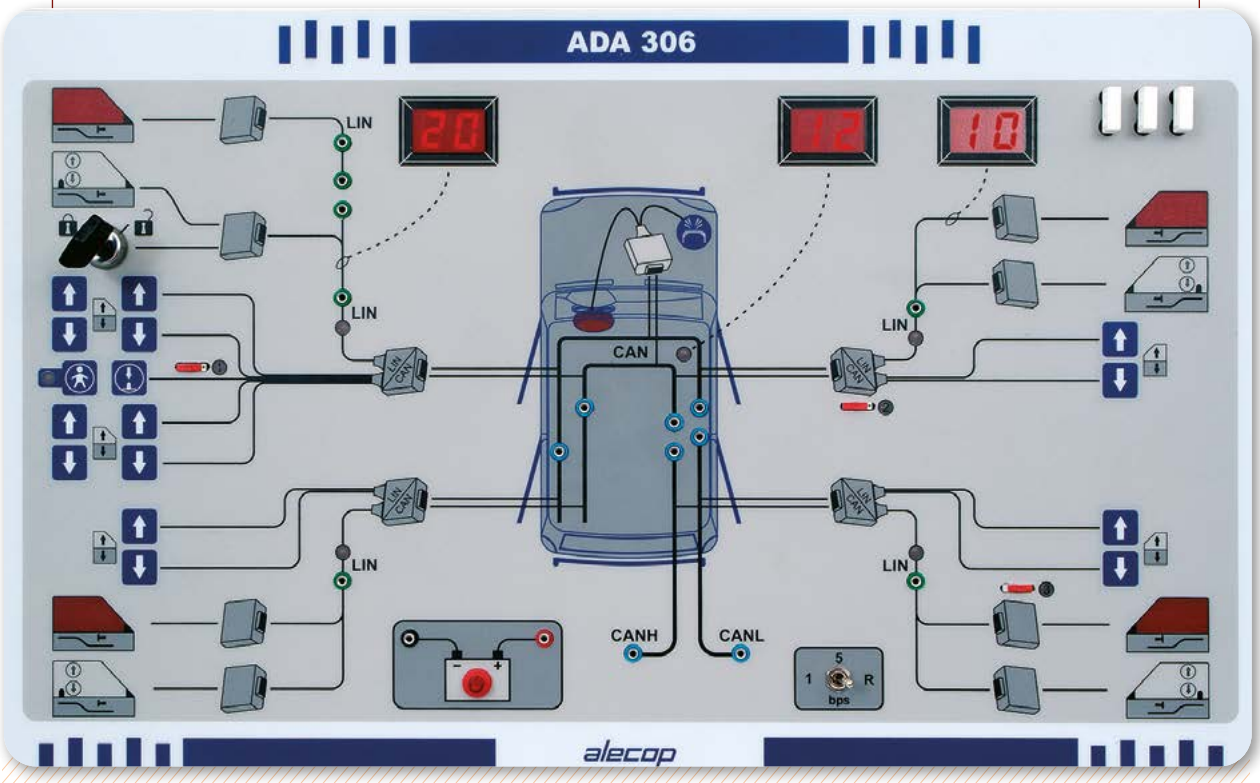
Skills to be developed

- 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.



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 19.200 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 19.200 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.

Equipment composition

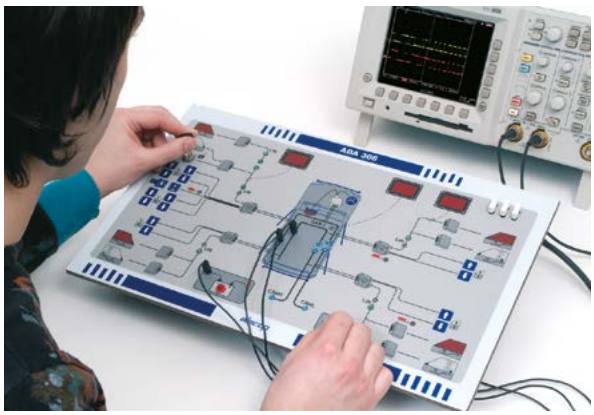
- ADA306 Panel.
- User's manual.
- Manual of practical activities.
- ACCFI306ZX: accessory to transmit data by optical fibre.
- Accessories store.

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

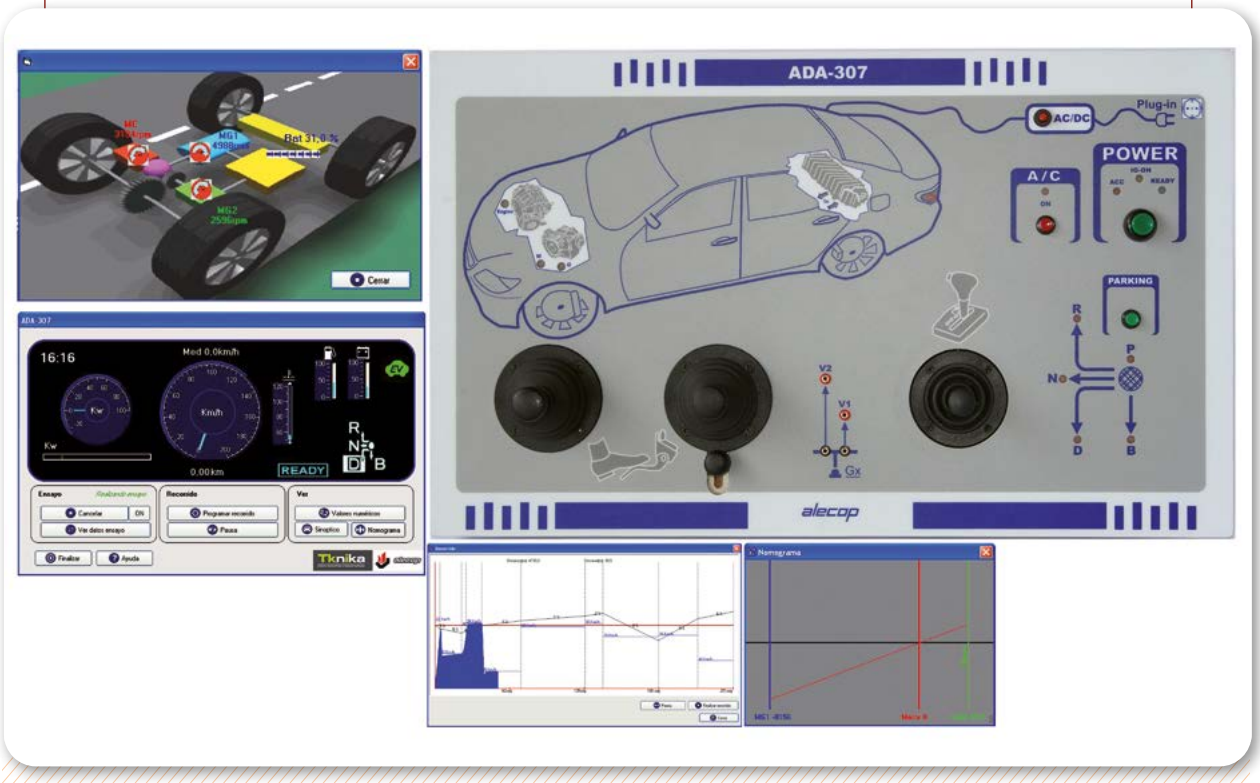
- Binary logic.
- Numerical systems (Binary, hexadecimal).
- Transmission of information in series.
- Layouts of data networks (Multi-Master, Master-Slave).
- CAN Bus (Transmission of differential data, voltage levels, frames, fault tolerance, etc.).
- LIN Bus (Transmission of differential data, voltage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



ADA 307

Hybrid vehicle application

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.

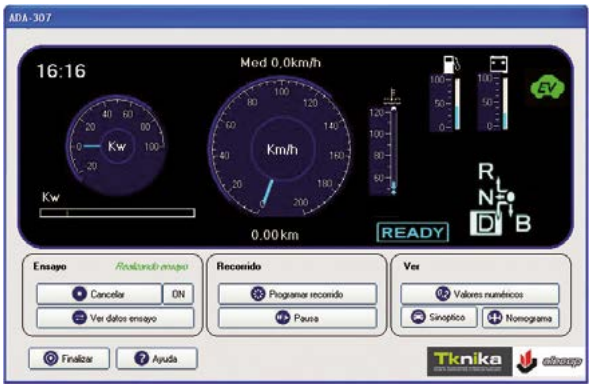
It includes an application developed with MATLAB/Simulink, the user manual, and practical exercises.

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

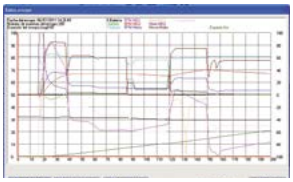


The hardware trainer is a driving simulator (gear, speed, battery charge, fuel gauge). All the actions performed on the panel are represented in the software instrument panel.

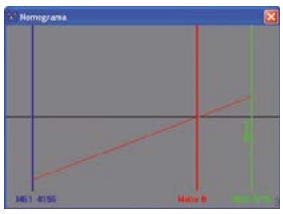
The ADA307 software provides information on vehicle performance in figures, graphics, and gauges. The user can choose to view the numerical data screen, the nomogram screen, or the synoptic chart screen.

Synoptic graphic

Data acquisition

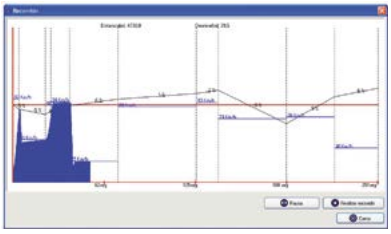


Nomogram



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.

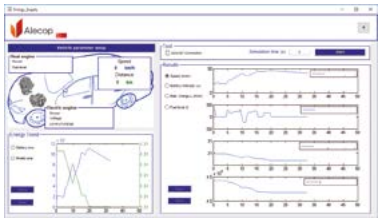
Modelling with MATLAB Simulink®

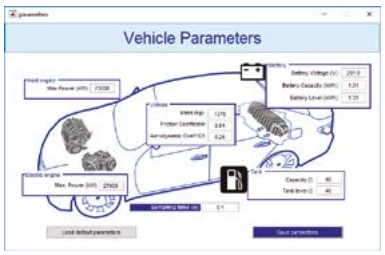
simulHyb

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

ADA 308

Electric vehicle application

Conceptual study of electric vehicles.

Ref.: 9EQ308AAZC

The goal of this equipment is to get students to know electric vehicle technology and main parts currently used in electric vehicles as well as the behaviour depending on the route and type of driving. This system is used to:

- Make conceptual studies in electric vehicles simulating the operation of a real vehicle on different journeys and contexts, defining the duration and speed by sections.
- Carry out tests by capturing data on the main parameters that affect an electric vehicle during its operation.
- View the computer graphic representation of the battery values, performance, and variation of various vehicle elements.
- Analyse the high voltage current flows through a synoptic diagram.
- Analyse the force combination between electric motor / generators, measure and record the actual values (rpm, torque, HV battery current, vehicle speed etc.).

Four different models of electric vehicles can be selected with their real parameters: motorcycle, quadricycle, car and van based on the commercial models LEM, Renault Twizy, Nissan Leaf and Mercedes Vito respectively. Their parameters can be modified.

The application is interactive with the software through the different joystick components (accelerator, brake, automatic gear) and allows that different measurements can be made.

Interactive panel

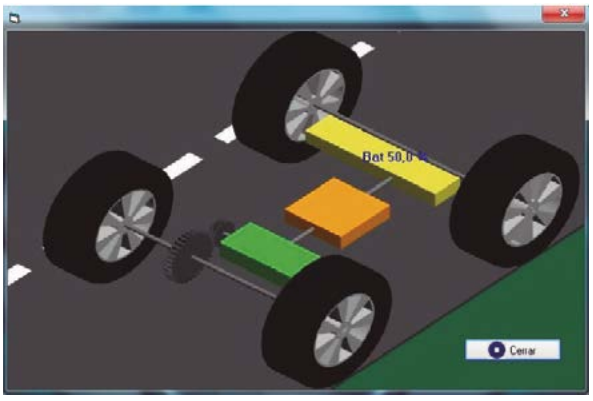
It integrates the commands of the vehicle:

- Start / Stop switch.
- Plug-in battery charging switch.
- Light indicators of the status of the vehicle and the parts that are working.
- Parking mode switch.
- Gear with position indicators.
- Test or measurement points.
- Accelerator with locking control.
- Brake.
- Activation/deactivation of air conditioning switch.

The two test points V1/V2 allow the measurement of the parameters selected from the software:

- Battery charge level.
- Speed in km/h.
- % Accelerator pedal.
- % Brake pedal.
- Engine RPM.
- Slope of the road.
- Battery voltage.
- Battery current.

It includes User's and Practical manuals in digital format.



Synoptics

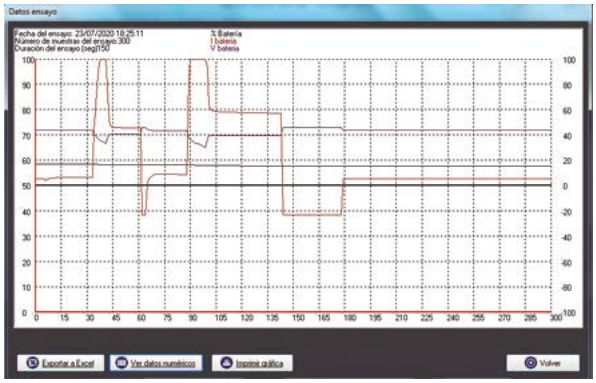
Control and analysis software

It includes different functions:

- Dashboard.
- On-board computer.
- Definition of driven conditions.
- Equipment for the diagnosis of the different parameters.

On the screen you can simulate the operation, supervise the possible measures to be taken, program the routes, visualize and read the operation parameters.

Dashboard



Parameters analysis