AUTOTRONICS

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AUTOMOTIVE ELECTRONIC TECHNOLOGY

The electronic technology has strongly entered the automotive flied and is currently influencing the main characteristics of the people working for the maintenance and the improvement of the vehicle operation.

In fact, automotive industry is since a long time heading toward a change of the functionalities of the electric systems, with a special attention not only to the efficiency and the power of the engine, but in particular to the comfort of the passengers, to their safety in terms of accident prevention and minimization of the possible damages, to the energy saving through a reduction of fuel consumption and to the control of the gas emissions in order to reduce the contribution to environment pollution due to discharge gases. This has implied the use of new devices, the substitution of mechanically controlled systems with electrical or electronic systems, and the use of microprocessor based technologies and of advanced techniques for malfunction diagnosis.

New systems for air conditioning, ABS braking, antitheft devices and others have been regularly added to the traditional electrical systems for lighting, power and ignition/ injection.

Therefore, the main educational need is to make easier the training of people in garages, electronic repair shops, maintenance and wheel setup and management of fuel injection. To achieve this goal, DE LORENZO has realized a laboratory that allows the theoretical study and the practical analysis of the problems related to the field of electrical and electronic technology applied to automobiles.

The laboratory consists of a series of trainers, each one provided with educational manuals that cover the study of the operation of all the main electrical/electronic systems and components, through the use of various teaching techniques suitable for different educational needs. This allows the teacher to schedule a gradual and complete training course, highly efficient and easy to realize.

Furthermore, the trainers are complete with a series of dedicated software for self-learning the theoretical part and for inserting simulated faults through personal computer.

It is obvious that the creation of well trained technicians in the automotive field will produce a number of direct and indirect benefits, such as a better operation of the vehicle, a higher level of safety for driver and passengers, a better comfort and an improved control of gas emission, with positive impacts an environment.

DE LORENZO proposal consists of the following:

- A set of modules for the study of basic electricity and main electric circuits
- A set of simulation panels for electric and electronic systems in modern automobiles, complete with dedicated software for demonstration of the relevant theory and introduction of simulated faults.
- A set of panels with real components for demonstration
- A set of sectioned components

AUTOTRONICS

MODULES FOR THE STUDY OF BASIC ELECTRICITY

The section of the laboratory is composed of four printed circuit boards with, on the upper side, the graphical simplified representation of electric circuits and components of both general type, for the study of basic electricity, and specific type, relevant to the electric circuits found in automobiles.

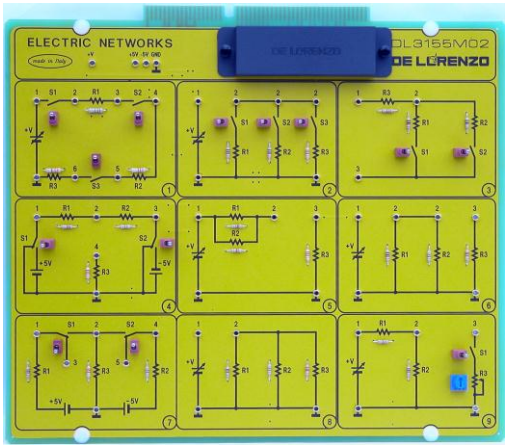
The student must study a circuit, understand theory, analyze the operating conditions and verify, by means of suitable instrumentation, the situation at the various test points of the circuit. Once completed the experiment, the student must identify some simulated malfunction conditions on the basis of measurements and tests.

The modules can be inserted in a base frame able to provide:

- Power supply to the modules
- Connecting interface to a PC to allow the use of a dedicated CAI software that provides the theoretical background, introduces simulated faults, interrogates the student through tests and evaluates his learning progress.

The modules in this section are relevant to:

ELECTRIC NETWORKS

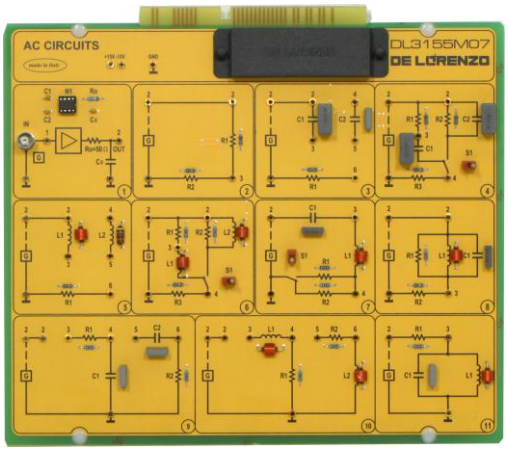


DL 3155M02

- Elements of an electrical network: node, arm, mesh
- First Kirchoff principle
- Second Kirchoff principle
- Series resistances
- Parallel resistances
- Series-parallel connection
- Voltage dividers
- Theorem of the effect superposition
- Thevenin theorem
- Norton theorem
- Millman theorem
- Fault simulation

AUTOTRONICS

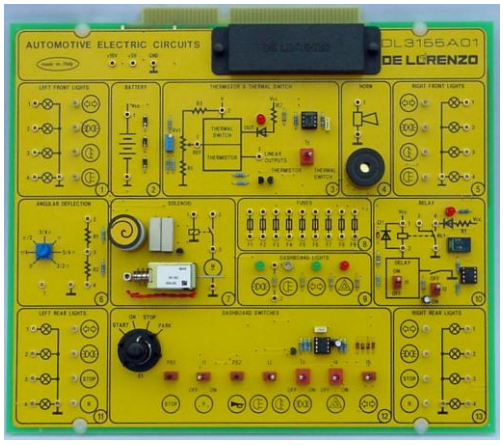
AC CIRCUITS



DL 3155M07

- Sinusoidal alternating currents and voltages
- Vector and symbolic representation of the sinusoidal electric quantities
- Product of a sinusoidal quantity by a constant
- Sum and difference of sinusoidal quantities
- Product of two sinusoidal quantities
- Product of a sinusoidal quantity by a complex number
- Elementary bipoles: R, L, C
- Series and parallel of the bipoles: R-L, R-C, R-L-C
- Oscillating circuits: frequency response of the ac circuits
- Low-pass filter, high-pass filter, pass-band filter
- Fault simulation

AUTOMOTIVE ELECTRIC COMPONENTS AND CIRCUITS

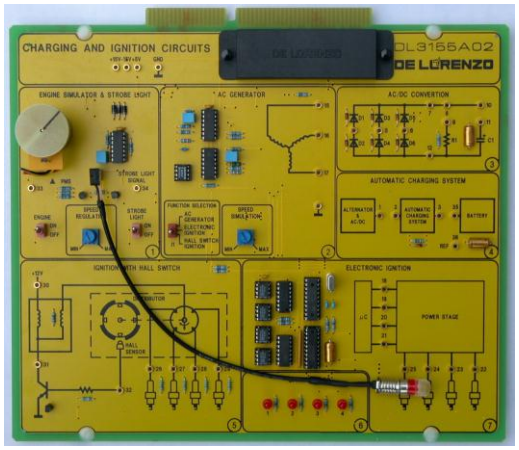


DL 3155A01

- Voltage drop in series connection
- Lamps
- Automotive lights circuits
- Relay operating principles
- Circuits with relays
- Delay circuits with relay
- Stop lights circuits (brakes)
- Flash light circuits (direction indicators)
- Diodes in light circuits
- Diodes for circuit separation
- Thermistors in automotive circuits
- Thermal switches
- Angular deflection measurement using potentiometer
- Fault finding

AUTOTRONICS

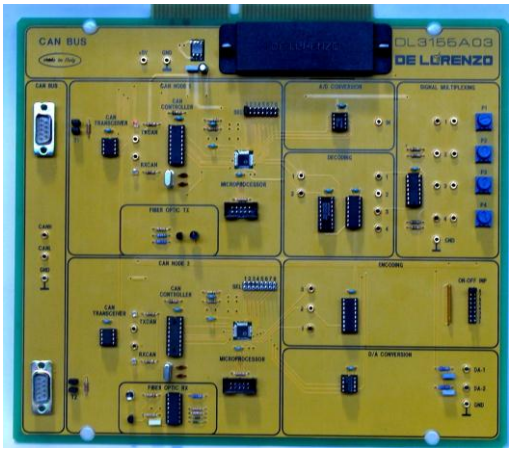
CHARGING AND IGNITION CIRCUITS



DL 3155A02

- AC generator (alternator)
- Tachogenerator
- AC to DC conversion
- Automatic charging system
- Hall effect switch
- Strobe lights
- Ignition excitation circuit with Hall switch
- Induction coil
- Ignition system
- Fault finding

CAN BUS



DL 3155A03

- Logic gates
- Signal multiplexing by using switches
- Coding and decoding of addresses
- Signal observation in twisted pair CAN Bus
- A/D and D/A conversion and data transfer in CAN bus
- Practical applications
- Connection to fibre optics

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BASE FRAME WITH POWER SUPPLY AND INTERFACE TO PC

DL 3155AL2

Power supplies:

- 0/+15 Vdc, 1 A
- 0/-15 Vdc, 1 A
- +15 Vdc, 1 A
- -15 Vdc, 1 A
- +5 Vdc, 1 A
- -5 Vdc, 1 A
- 6 – 0 – 6 Vac, 1 A

Features:

- Interface board for connection to PC.
- Robust structure and modern design.
- Voltage regulation and protection against over voltage or short circuit.
- Complete with a set of connecting cables.

SIMULATION PANELS

This section of the laboratory consists of a set of panels for the simulation of the electrical and electronic systems that can be found in modern automobiles and industrial vehicles.

Each panel analyzes a specific subject and reproduces, by means of a colour synoptical diagram, the mechanical part and the electrical /electronic circuits.

In this way, the panel allows the analysis of the real operation of both the components and the circuits, by simulating their behaviour on the basis of the controls and the operating conditions that the student and the teacher choose, directly operating on the panel or through the personal computer.

Each component of the synoptical diagram can be easily found thanks to a clear list on the panel.

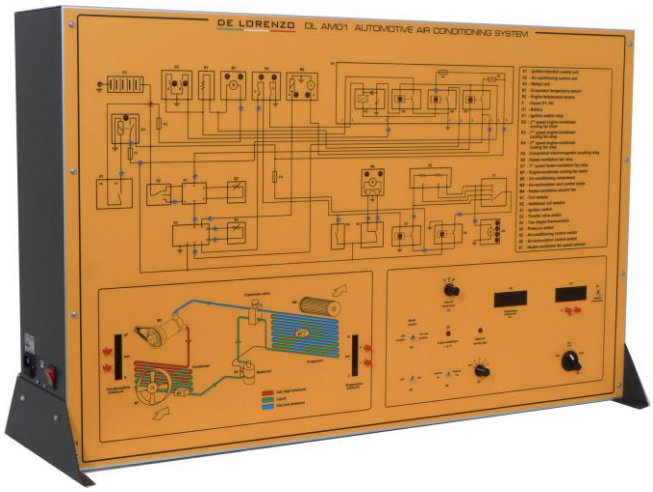
The simulation is constantly kept under control by the personal computer and is visualized on the panel by means of analog / digital indicators; the student, through suitable tests and measurements, can proceed on a troubleshooting.

The connection to the personal computer through a USB port, allows a quick setup on any PC without additional boards in the computer.

External dimensions: 1041 x 690 x 150 (470 with the base) mm.

AUTOTRONICS

AIR CONDITIONING FOR AUTOMOBILES

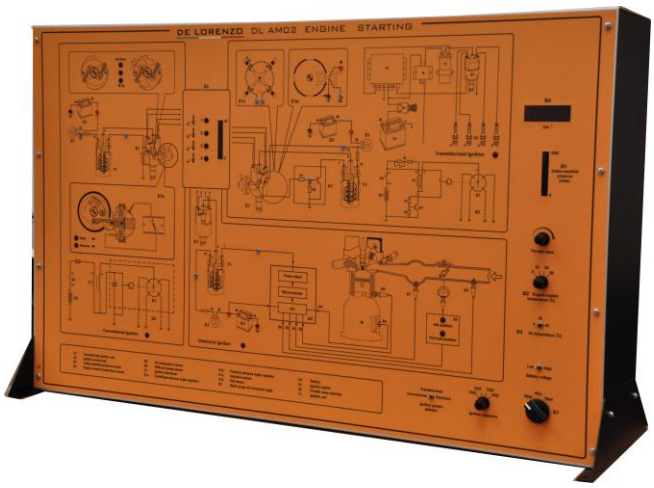


DL AM01

To cool the external air refrigerating compressor based systems are exclusively used.
The compressor activated by the engine compresses the refrigerant which consequently warms up; in the condenser the working fluid is cooled until it reaches the liquid phase. The cooling is obtained by giving heat to the exterior in the zone around the compressor. The cooled fluid expands in the expansion valve and in the evaporator and is transformed in gas. The heat necessary for such transformation is subtracted from the entering cool air.
The simulator analyzes all the phases of the refrigeration cycle. In particular:
- Relations between temperature and pressure in the refrigerant
- Operation of the compressor
- Operation of the condenser
- Pressure switches
- Temperature regulation

The panel is complete with CAI software.

ENGINE STARTING



DL AM02

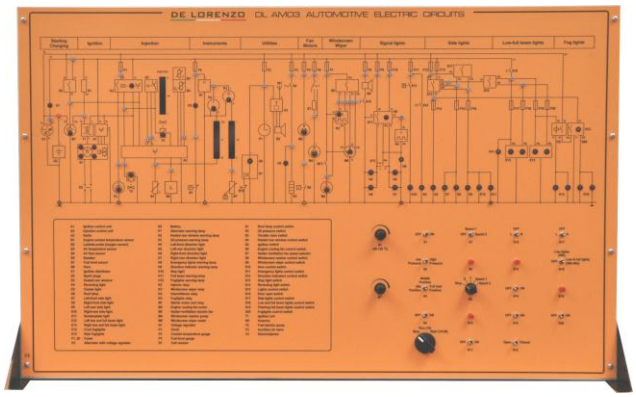
This simulation panel deals with the study of the starting techniques used in the Otto cycle motors. The main types of starting are here analyzed: conventional with coil, with transistors and electronic starting.
As a first starting system, the simulator analyzes the conventional starting with coil in which the system is controlled by contacts. This means that the current which flows through the starting coil is inserted or de-inserted mechanically through a contact in the starting distributor.

Then, the simulator analyzes the starting system with transistors, where the starting contact-breaker does not have to control any more the current of the primary, but only the control current of a transistor which takes care of the switching of the current of the primary. In addition for the starting system with transistors and control through contacts also the versions of transistor starting system with priming system through Hall transducer or through inductive transducer are here analyzed in detail. Finally, the simulation panel studies also the electronic starting in which the mechanical regulator of the spark advance is eliminated and the same spark advance is calculated by the electronic control panel.

The panel is complete with CAI software.

AUTOTRONICS

ELECTRIC CIRCUITS



DL AM03

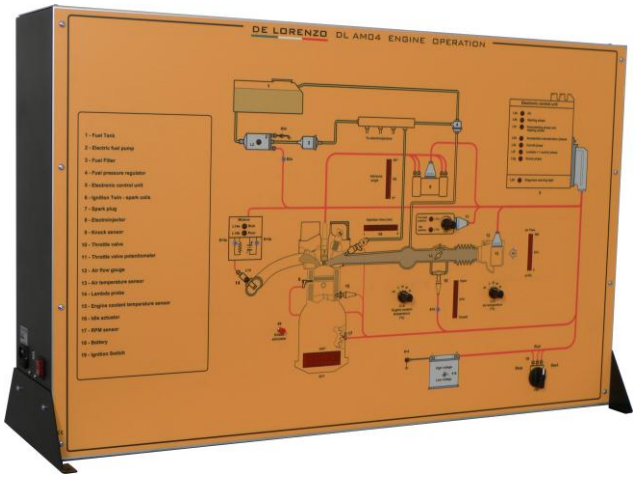
The following sections of the electric plant of the car are reproduced on the panel:

- Electrical supply
- Starting
- Ignition
- Fuel injection
- Various end users (radio, defrosting, etc.)
- Indicators
- Cooling and aeration
- Windshield wipers
- Signalling system
- Lighting system
- Head lights
- Anti-fog lights

The scheme utilizes the symbols specified by the DIN regulations.

The panel is complete with CAI software.

ENGINE OPERATION



DL AM04

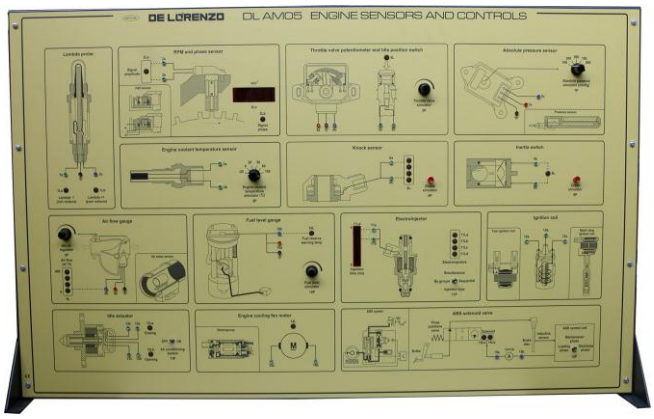
The simulator takes into consideration all these aspects by performing the following functions:

- Ignition phase
- Heating phase
- Lambda regulation
- Quick acceleration/deceleration phases
- Cut-off phase
- Regulation of the injection time
- Regulation of the advance angle
- Regulation of the minimum rpm
- Regulation of the knock
- Limitation of the rpm

From just one electronic control panel all the regulations on the Otto cycle based engines are performed.
The measurement sensors at the engine detect the operating data and adapt them for the use of a microprocessor, which elaborates them, recognizes the operating status of the engine and calculates accordingly the regulation signals for the control of the suitable actuators.
In this way it is possible to obtain the best interconnection among injection, fuel preparation and ignition point as a function of the various operating situations of the engine.
The panel is complete with CAI software.

AUTOTRONICS

ENGINE SENSORS AND CONTROLS



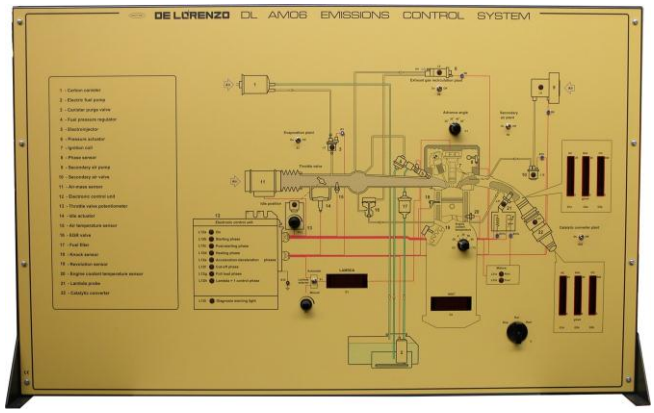
DL AM05

The extensive use of sensors and actuators comes from the need of the electronic control panels to know in real time the actual values of the physical parameters to be controlled or which influence the behaviour of the car.
The simulator takes into consideration all these components, by analyzing their behaviour and their structure.
In particular, the following components are analyzed:

- Temperature sensors
- Pressure sensors
- Air flow rate sensors
- Position sensors
- Rpm/reference point sensors
- Oxygen sensors (Lambda probe)
- Knock sensors
- Level! Sensors
- Inertial sensors
- Electro pumps and geared motors
- Servomotors
- Electro-valve
- Electro injectors
- Coils

The panel is complete with CAI software.

EMISSION CONTROL



DL AM06

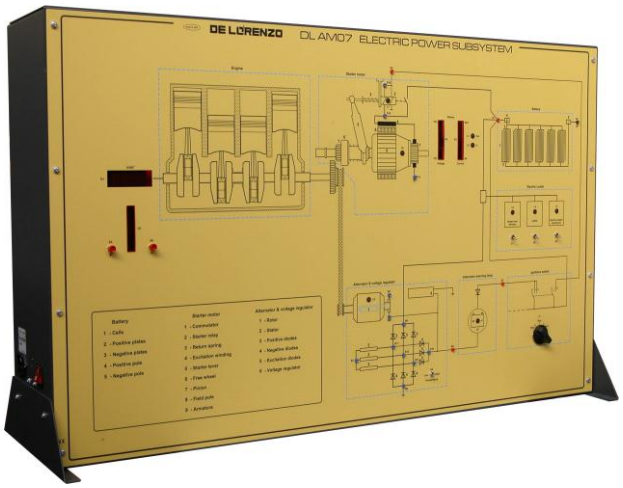
The combustion of the fuel inside the cylinders of an engine is, usually, incomplete. The more it is incomplete, the bigger is the emission of noxious components which can be found in the exhaust gases from the engine.
To reduce environmental pollution it is necessary to improve the efficiency of the engine for what concerns the exhaust gases.
This simulator takes into consideration all the relevant subjects and in particular:

- Composition and control of the exhaust gases in the Otto cycle based engines
- Combustion products
- Preparation and control of the fuel and operating conditions
- Adaptation to the operating conditions
- Lambda regulation
- Recirculation of the exhaust gases
- Anti-evaporation of the fuel
- Catalytic thermal post-combustion
- Analysis of the exhaust gases in the Otto cycle based engines: test cycles

The panel is complete with CAI software.

AUTOTRONICS

ELECTRIC POWER



DL AM07

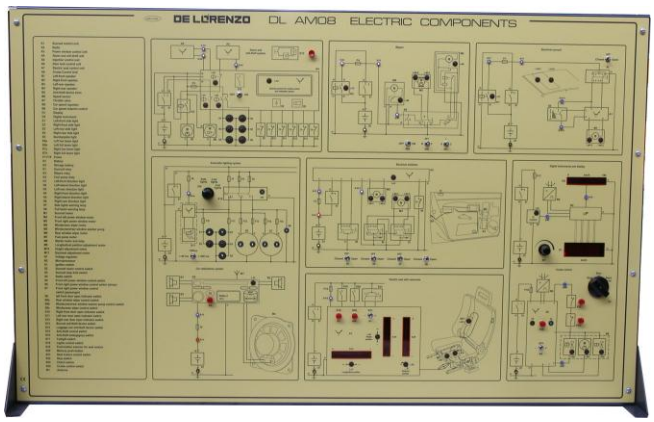
The simulator analyzes in detail all the different phases relevant to the starting transistors, the conditions of standard operation, the recharging and the situations or variation of the electric loads.
The combustion engines must be started with a special device because, differently iron the electric motors or the steam engines, they cannot start by themselves.
The simulator takes into consideration all the devices, circuits and systems for the starting and the recharging.

In particular the following components are analyzed:

- Battery
- Starter
- Alternator
- Connecting circuits

The panel is complete with CAI software.

ELECTRIC COMPONENTS



DL AM08

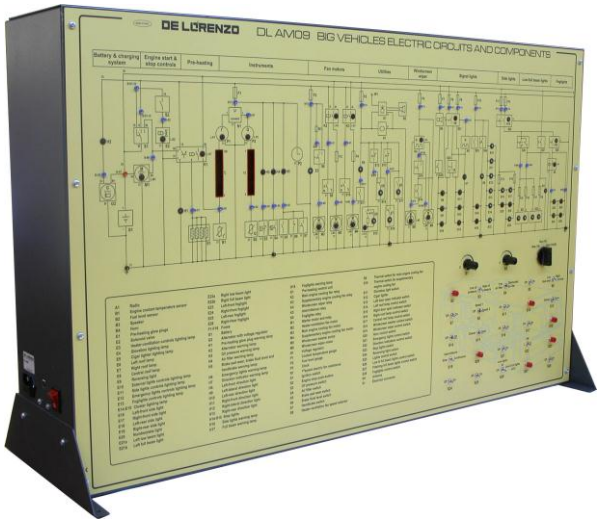
This simulator deals with the electrical auxiliary plants used in modern automobiles such as:

- Alarm and anti-theft system
- Electrical windows
- Electrical regulation of the car seats
- Automatic regulation of the lighting
- Car radio/stereo system
- Cruise control
- Electrical sunroof

The scheme utilizes the symbols specified by the DIN/IEC regulations.
The panel is complete with CAI software.

AUTOTRONICS

BIG VEHICLES ELECTRIC CIRCUITS AND COMPONENTS



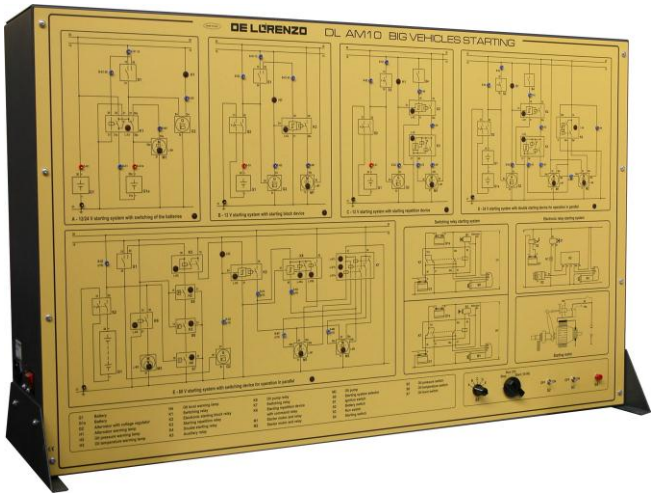
DL AM09

This simulation panel deals with the circuits and the electric components used in the industrial vehicles (buses, lorries, etc.).
The following sections of the electric plant are reproduced and analyzed:

- Electrical supply
- Starting
- Fuel injection
- Auxiliary plants (doors opening/closing, defrosting, anti-theft system, etc.)
- Indicators
- Cooling and aeration
- Windshield wipers
- Signalling system
- Lighting system
- Head lights
- Anti-fog lights

The scheme utilizes the symbols specified by the DIN regulations.
The panel is complete with CAI software.

BIG VEHICLES STARTING



DL AM10

The term "industrial vehicle" is normally used for the vehicles which are made for the transport of more than 9 people, for the transport of goods and/or for the haulage of trailers.
This category basically includes: buses, lorries of various dimensions, special lorries, haulers.
According to the great variety of industrial vehicles also the starting systems are always adapted to the structure and type of motor of the vehicle on which they must be put.
This simulator mainly takes into consideration the 12V and the 24V starting systems with switching of the batteries and the starting systems with the device for starting block.
The simulator analyzes also the starting systems with the device for starting repetition, those with the relay for double starting for operation in parallel and those with the switching relay for the operation in parallel.

The panel is complete with CAI software

AUTOTRONICS

HYDRAULIC BRAKES

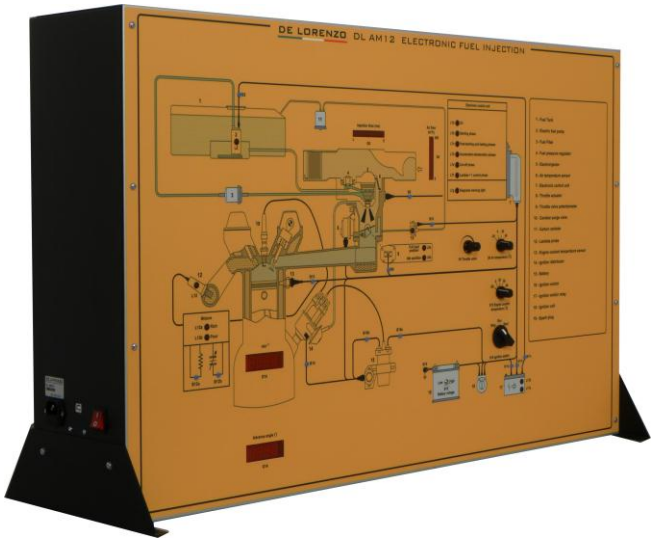
DL AM11

This demonstration panel comprises a disk brake in the front wheel and a drum brake in the driving wheel.
Both wheels can be rotated slowly. When the brake is activated both wheels will stop.
The cylinder can be moved hydraulically.
The system covers the following subjects:

- Back wheel bind (lock), pressure does not drop after releasing pedal
- Vacuum loss
- Back brakes failure
- Front brakes failure
- Hand brakes
- Brake light failure

The panel is complete with CAI software.

ELECTRONIC FUEL INJECTION



DL AM12

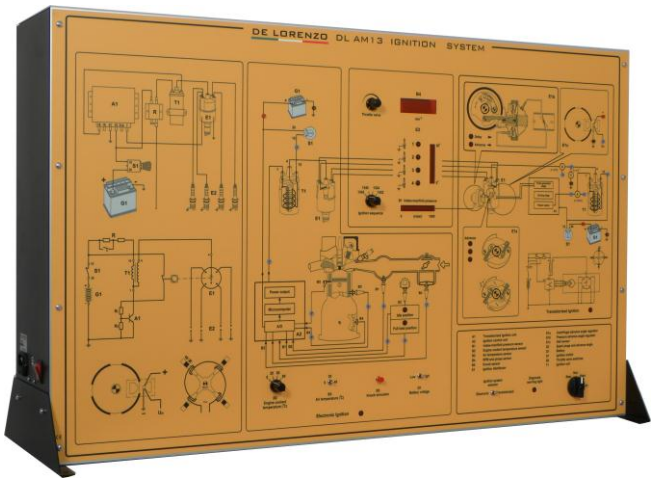
This simulator shows how modern cars injection systems operate.
The experiments covered by the panel are:

- Relationship between the duration of injector opening to the quantity of injected fuel
- Air temperature effect on the quantity of injected fuel
- Signal analysis with oscilloscope
- Injection time calculation with oscilloscope
- Injection time calculation with tachometer and dwell meter
- MAF sensor operation
- Valve position switch output signals
- Valve position sensor output signals
- Study of injector activation signal at various conditions
- Injection duration at various speeds, temperatures and engine loads
- Oxygen sensor operation

The panel is complete with CAI software

AUTOTRONICS

IGNITION SYSTEM



DL AM13

This simulator shows how modern car's ignition systems operate.
All relative signals, such as the output of Hall sensor, knock sensor output, engine speed, the refrigerator temperature, MAP output, A/D input, voltage and current of initial and secondary ignition, stroboscope trigger, end to test points.
The experiments covered by the system are:

- Direct ignition activation system
- Different spark types analysis
- Dwell timing and control
- MAP sensor characteristics
- Cooling sensor operation
- Knock sensor characteristics
- Constant current for various engine speeds
- Ignition system operation at various conditions of speed, load and engine temperature
- Ignition time and dwell measurements
- Operation of the ignition system with fuel electronic injection

The panel is complete with CAI software.

ANTI-LOCK BRAKING SYSTEM (ABS)

DL AM14

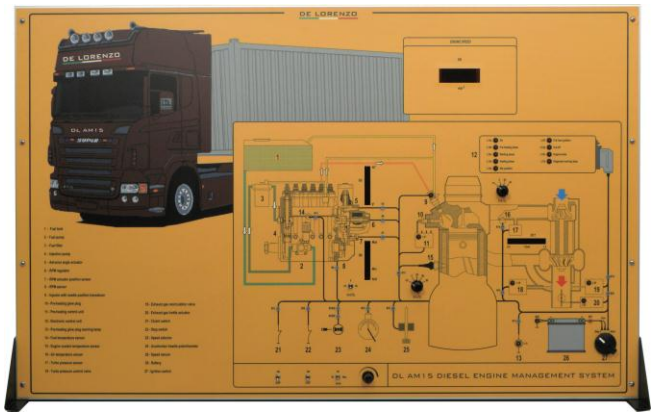
Designed to show how modern car ABS systems are designed to operate.
The experiments covered by the system are:

- ABS operation when wheels are rotated at different speeds
- ABS operation when wheels are rotated at same speed
- Pressure measurement during operation
- Hydraulic ABS valve operation
- Self diagnostic control
- Fault diagnosis procedure
- Various control signals measurements in the ABS system
- Low fluid level detection
- ABS operation with one wheel speed sensor disconnected
- ABS operation with destroyed hydraulic valve
- Brake system operation when the electronic brake unit is disconnected
- Brakes operation when there is leakage
- System operation with different relative rotation speed of wheels
- ABS operation with hydraulic valve stuck

The panel is complete with CAI software.

AUTOTRONICS

DIESEL ENGINE MANAGEMENT SYSTEM



DL AM15

This panel trainer provides realistic fault finding facilities using heavy vehicle schematic diagrams. An easily understood schematic system represents the starting and fuel injection systems of a typical heavy vehicle.

The student is able to see the exact operation of the various circuits as used in trucks and buses and is able to gain a hands-on introduction to each of the components and devices found in typical heavy vehicle systems.

All practical activities are carried out using the electrical/electronic circuits and devices mounted on the panel trainer.

It includes a panel trainer and a software and it enables the study of the following topics:

- Heavy vehicle wiring diagrams
- Heavy vehicle Electronics Control Module (ECM)
- Heavy vehicle electronic fuel injection systems
- Heavy vehicle sensors
- Heavy vehicle exhaust gas analysis and emission control
- Heavy vehicle turbo chargers and blowers
- Heavy vehicle cold start systems
- 12 V circuits
- Electronic control of vehicle performance and speed
- Engine protection
- Tamper resistance
- Fault finding

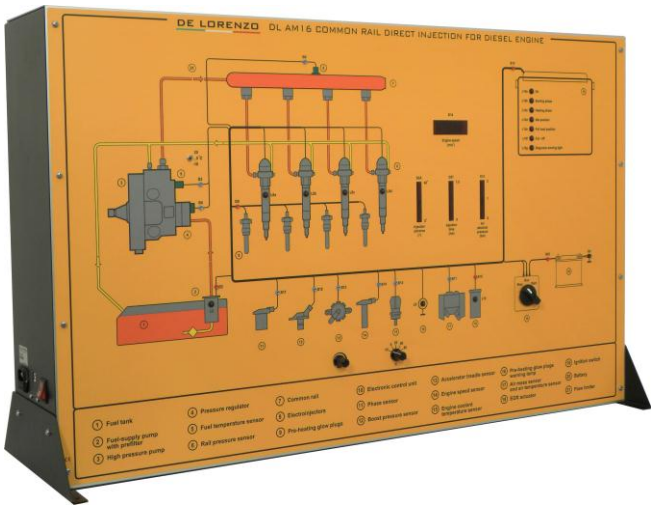
Appropriate heavy vehicle components and circuit mimics are screen printed into the trainer to aid students understanding of the system under investigation.

It provides facility to insert faults into the various circuit elements under the control of a computerized workstation linked to the management system.

The panel is complete with CAI software.

AUTOTRONICS

COMMON RAIL DIRECT INJECTION FOR DIESEL ENGINE



DL AM16

This simulator allows the study, the testing and the troubleshooting on HDI (CDI - CR) injection systems for diesel engines that, similarly to what happens for the traditional injection petrol engines where, however, the pressure of the fuel is only few bars, use a high pressure (up to 1500 bar) electric pump and a single manifold (common rail) to connect the pump to the electro-injectors, which are electronically and individually controlled for what concerns the start and the duration of the injection.

In the conventional diesel engine the rotation speed of the engine controls the pressure to the injectors and, furthermore, pressure and injection are strictly correlated, because only when the pressure exceeds a given threshold there is the mechanical opening of the injector.

Therefore, the advantages of the common rail are rather evident:

- High pressure also at low regimes;
- Excellent atomization and dispersion of the fuel;
- Increase of the torque;
- Reduction of the noise;
- Reduction of the consumptions and of the emissions.

The results that have been obtained with the common rail direct injection diesel engines are such that it is foreseeable that within ten years the pre-chamber diesel engines will disappear.
The whole plant, for a common rail direct injection diesel engine, is reproduced on the panel through a synoptical diagram that allows a complete analysis of the circuit of the fuel, of the electrical/electronic control circuit and of all the relevant components.
It is possible to simulate the behaviour of components and circuits, on the basis of operating conditions that students and teachers can control directly on the panel or through the personal computer.
The latter keeps constantly under control the simulation, by visualizing its behaviour by means of signals and analogue and digital meters; in this way the student, through suitable measurements and tests, can proceed to the fault finding activity.
The software is organized in lessons suitably balanced among theory, practical experiences, troubleshooting and tests.

The main components that characterize a common rail direct injection diesel engine are the following:

- fuel tank with pre-filter;
- high pressure electro-pump;
- flow limiter:
- common rail with electro-injectors, fuel pressure limiting valve and relevant pressure sensor;
- electronic control board for the management of the whole plant;
- engine rpm sensor;
- accelerator pedal position sensor;
- over-supply pressure sensor;
- air temperature sensor;
- engine temperature sensor;
- air mass sensor;
- pneumatic actuator for the variable geometry turbine;
- computerized workstation linked to the management system.

The panel is complete with CAI software.

AUTOTRONICS

PASSIVE SAFETY DEVICES FOR MOTORCARS

DL AM17

This simulator allows the study, the testing and the troubleshooting on the devices which have been developed for the purpose of increasing the safety of driver and passengers inside motorcars.

The simulator considers all those systems that allow to reduce the consequences of accidents; in particular, the following devices are analyzed:

- air-bag (driver-bag, passenger-bag, side-bag, window-bag)
- safety belts tension relay
- fuel shut-off inertial switch
- multi-function valve in the fuel tank

The different not-acting safety devices are reproduced on the panel through a synoptic diagram that allows a complete analysis of the components and, in case, of the relevant electrical/electronic control circuit.

It is possible to simulate the behaviour of components and circuits, on the basis of operating conditions that students and teachers can control directly on the panel or through the personal computer.

The latter keeps constantly under control the simulation, by visualizing its behaviour by means of signals and analog and digital meters; in this way the student, through suitable measurements and tests, can proceed to the fault finding activity.

The panel is complete with CAI software.
The software is organized in lessons suitably balanced among theory, practical experiences, troubleshooting and tests.

AUTOTRONICS

HYBRID SYSTEM

DL AM20

With the simulator DL AM20 it is possible to study all the operating characteristics of a hybrid system that uses a parallel coupling between an internal combustion unit and a three-phase electric motor.

This simulator is an educational system designed in vertical frame, bench-top, so the students have the capability to watch the theoretical and practical study of the automotive systems. It includes colour mimic diagram that clearly shows the structure of the system and allows the location of components on it.
The simulator consists of a panel operating by PC with mimic diagram for the clear positioning of the components. The various zones of the mimic diagram are presented with different colours and shades to emphasize the peculiar characteristics of the system. The mimic diagram is fitted with light indicators so as to enable the observation of the control.

The display of the information available at the PC monitor allows the continuous monitoring of the educational system.

The operational conditions are entered by the students. The insertion of faults is carried out by the PC.

The simulator is accompanied by relevant software to enable the student to follow step-by-step the theory and the exercise. The whole exercise procedure is carried out on the simulator. The system is accompanied by technical manuals for theory and exercises.

The subsystems that form the hybrid solution and that are analyzed by means of the simulator and shown on the synoptical panel are the following:

Gasoline Unit, including:

- Gasoline Engine, with a bank of 4 cylinders and multipoint sequential injection
- i-DSI: Intelligent Double Sequential Ignition
- i-VTEC : Intelligent Variable-valve Timing and Electronic-lift Control
- Engine ECU (electronic control unit for managing the thermal motor)

Electric Unit, composed of:

- Synchronous Three-phase Electric Motor / Generator with permanent magnets
- Eco Assist System

Continuously Variable Transmission (CVT)

Dual-Scroll Hybrid A/C Compressor

Intelligent Power Unit, that includes:

- Battery Module, composed of Ni-MH cells
- Battery ECU, electronic control unit for managing and controlling the charging state (SOC) of the Battery Module
- Cooling Fan, for cooling the battery module
- Motor Control Module, for the synchronization of the electric motor with the petrol engine
- Electric Power Unit, with inverter for power supplying the electric motor and AC/DC converter for the current supplied by the motor operating as a generator
- DC Unit, it regulates the quantity y of direct current at 12 V supplied by the DC-DC converter
- A/C Driver, for managing the Dual-Scroll Hybrid A/C Compressor

The simulator is provided complete with Training Software and Control Software.
The Training Software guides the student through the following phases: learning, simulation and experiments performance, tests and troubleshooting.

AUTOTRONICS

LIGHTWEIGHT ELECTRIC VEHICLES

DL AM21

Bench-top educational system for the simulation and the theoretical and practical study of the main circuits and components that are used in lightweight electric vehicles.

The simulator is divided in three sections, relevant, respectively, to electric bicycles, scooters and cars and it allows learning their operation through light signaling. By means of a selector it is possible to choose the vehicle that you want to analyze.

By connecting the panel to a computer it is possible to visualize on the screen the available information during the operation of the system.

The operating mode and the insertion of the faults are through computer. The simulator is complete with a software that allows students studying the theory and performing the exercises.

For all three vehicles, the simulator analyzes the normal drive operation and those that depends on the slope of the road. Furthermore, both domestic and public battery recharging systems are also dealt with.

The insertion of the faults is through computer and is relevant to the malfunctioning of the components of each vehicle.
The system is complete with a technical manual for theory and exercises.

Electric bicycle:

- Description of the E-bike system (electric bicycle)
- Description of the Pedicel system (electric bicycle with pedal assist system)
- The controller
- The braking system with suppressant of the motor supply
- Acceleration function for the E-bike (Twist and Go)
- Acceleration function for the Pedicel system
- PAS (Pedal Assist System)
- PAS/TAG system
- The torque sensor
- The batteries (types and performances)
- The motors (types and performances)
- Braking and regenerative deceleration
- Safety devices
- Battery recharging

Electric scooter:

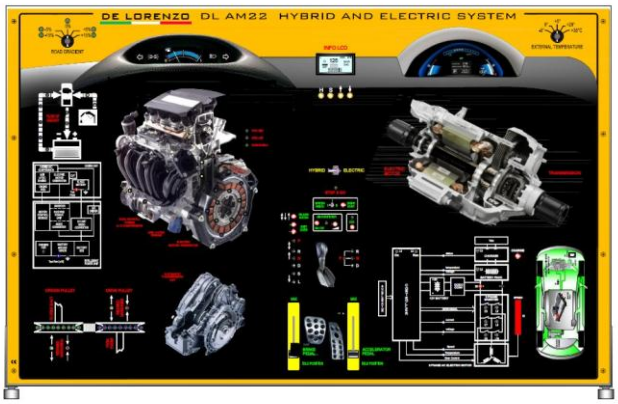
- Description of the electric scooter
- Functions and controls
- The motor
- The controller
- The DC/DC converter
- The interface module (ICM)
- The braking system
- Braking and regenerative deceleration
- The batteries (types and performances)
- Safety devices
- Battery recharging

Electric car:

- Description of the electric car
- Main functions and controls
- The DC motor
- The controller for the DC motor
- The brushless motor
- The controller for the brushless motor
- The asynchronous motor
- The inverter
- The DC/DC converter
- The interface module (EVMS)
- The batteries (types and performances)
- The control of the batteries (BMS)
- The braking system

AUTOTRONICS

HYBRID AND ELECTRIC SYSTEMS



DL AM22

With this simulator it is possible to study all the operating characteristics of an automobile with a hybrid system (internal combustion engine and electric motor) or totally electric.
The simulator consists of a panel operated by PC with a mimic diagram for the clear positioning of the components. The different zones of the mimic diagram are presented with different colours and shades to emphasize the peculiar characteristics of the system. The mimic diagram is also fitted with light indicators so as to enable the observation of the operation of the system.
It is possible to visualize on the screen of the PC the available information and this allows a continuous monitoring of the system. The operating conditions are entered by the students. The insertion of faults is carried out through the simulator or from an external PC.
The simulator is provided with a software to enable students to follow step-by-step the theory and the exercises. The whole exercise procedure is carried out on the simulator. The system is also provided with technical manuals for theory and exercises.

Hybrid system
Gasoline Unit, including:

- Gasoline Engine, with a bank of 4 cylinders and multipoint sequential injection
- i-DSI: Intelligent Double Sequential Ignition
- i-VTEC: Intelligent Variable-valve Timing and Electronic-lift Control
- Engine ECU (electronic control unit for managing the thermal motor)

Electric Unit, composed of:

- Synchronous Three-phase Electric Motor / Generator with permanent magnets
- Eco Assist System

Continuously Variable Transmission (CVT)
Dual-Scroll Hybrid A/C Compressor
Intelligent Power Unit, that includes:

- Battery Module, composed of Ni-MH cells
- Battery ECU, electronic control unit for managing and controlling the charging state (SOC) of the Battery Module
- Cooling Fan, for cooling the battery module
- Motor Control Module, for the synchronization of the electric motor with the petrol engine
- Electric Power Unit, with inverter for power supplying the electric motor and AC/DC converter for the current supplied by the motor operating as a generator
- DC Unit, it regulates the quantity y of direct current at 12 V supplied by the DC-DC converter
- A/C Driver, for managing the Dual-Scroll Hybrid A/C Compressor

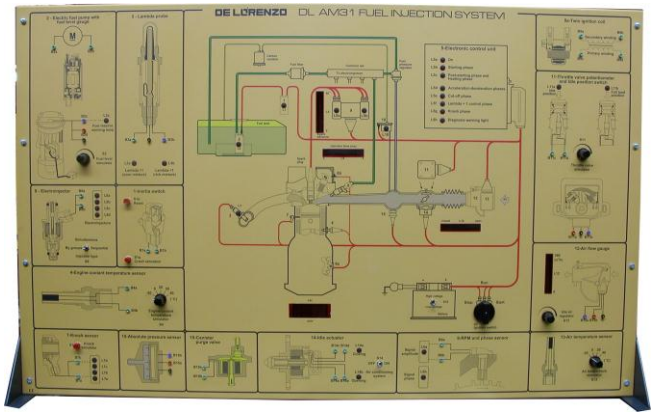
Electric System
The sub-systems that form the fully electric solution, that are analyzed through the simulator and that are represented on the synoptical panel are the following:

- High-voltage battery module, made of Li-ion cells
- Recharging system with external alternate voltage
- 12 Volt battery and its recharging
- Electric motor control system
- Three-phase inverter for controlling the electric motor
- Inverter control signals and voltage and current measurement sensors
- Three-phase AC motor with integrated transmission system
- Integrated sensors in the AC three-phase motor

The simulator is complete with Training Software and with Control Software. The Training Software guides the student through the following phases: learning, simulation and experiments performance, tests and troubleshooting.

AUTOTRONICS

FUEL INJECTION SYSTEM



DL AM31

The simulator takes into consideration all these aspects by performing the following functions:

- Ignition phase
- Heating phase
- Lambda regulation
- Quick acceleration/deceleration phases
- Cut-off phase
- Regulation of the injection time
- Regulation of the advance angle
- Regulation of the minimum rpm
- Regulation of the knock
- Limitation of the rpm

In particular, also the following components are analyzed:

- Rpm/reference point sensors
- Level sensor
- Inertial sensor
- Electro-pump
- Idle actuator
- Electro-injectors and coils.

The panel is complete with CAI software.

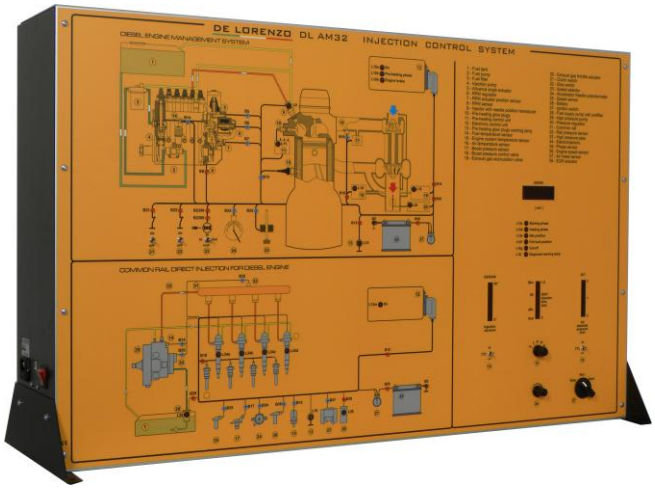
With the simulator it is possible to study engine operation, engine sensors and controls and electronic fuel injection.

The simulator covers the following topics:

- Oxygen sensor, temperature sensor, MAP sensor, MAF sensor, knock sensor, operation.
- Pressure, flow, position sensors.
- Injection time - calculation.
- Ignition pulses effect on main switch, ignition timings.
- Engine efficiencies, horsepower and engine torque, valve position switch output signals and valve position sensor output signals.
- Signal analysis, injector activation signal at various conditions, air injection control, injection duration at various speeds, temperatures and engine loads.
- Air temperature effect on the quantity of injected fuel.
- Fuel cut-off, relationship between the duration of injector opening to the quantity of injected fuel.
- Solenoids, open and close loop controls and exhaust gas circuit.

AUTOTRONICS

INJECTION CONTROL SYSTEM



DL AM32

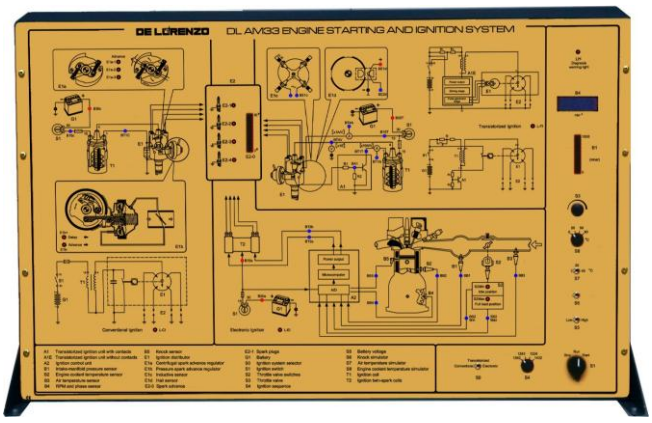
With the simulator it is possible to study the control (diesel engine management) and the diesel engines direct injection (common rail direct injections).

The simulator covers the following topics:

- Heavy vehicle wiring diagram
- Heavy vehicle Electronics Control Module (ECM)
- Heavy vehicle electronic fuel injection systems
- Heavy vehicle sensors
- Heavy vehicle exhaust gas analysis and emission control
- Heavy vehicle turbo chargers and blowers
- Heavy vehicle cold start systems
- 12 V circuits
- Electronic control of vehicle performance and speed
- Engine protection
- Fuel tank with pre-filter
- High pressure electro-pump
- Flow limiter
- Electronic control board for the management of the whole plant
- Engine rpm sensor
- Accelerator pedal position sensor
- Over-supply pressure sensor
- Air temperature sensor, engine temperature sensor, air mass sensor.

The panel is complete with CAI software.

ENGINE STARTING AND IGNITION SYSTEM



DL AM33

With this simulator the main types of ignition systems are analyzed: conventional with coil, transistorized with Hall or inductive sensor, and electronic ignition.

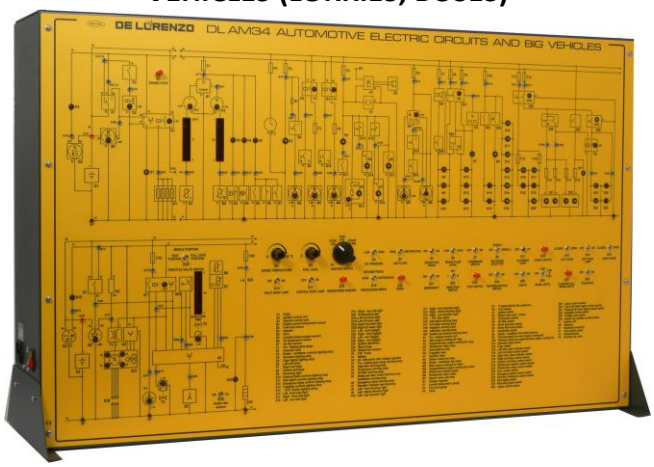
The simulator covers the following topics:

- Instruments (meter) operation
- Voltage/resistance measurement
- Starter operation
- Ignition system
- Operation and control of electronic circuits
- Fuel system/operation
- Electronic ignition
- Direct ignition activation system
- Different spark types analysis
- Dwell timing and control
- MAP sensor characteristics
- Cooling sensor operation
- Knock sensor characteristics
- Constant current conservation for various engine speeds
- Ignition system operation at various conditions of speed, load and engine temperature
- Ignition time and dwell measurements
- Operation of ignition system with fuel electronic injection

The panel is complete with CAI software

AUTOTRONICS

AUTOMOTIVE ELECTRIC CIRCUITS AND BIG VEHICLES (LORRIES, BUSES)



DL AM34

The simulator covers the following topics :

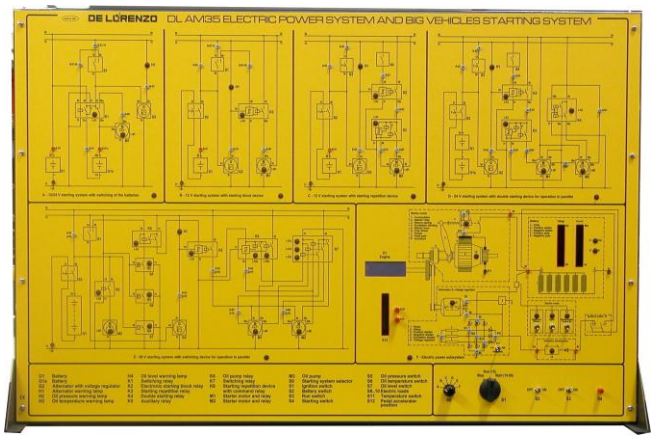
- Electrical components in cars,
- Electrical circuits in cars,
- Electrical circuits faults, short-circuits, open circuits, bad components in cars,
- Electrical components and their symbols in cars,
- Automotive electrical wiring diagrams,
- 12V circuits
-
- Electrical components in big vehicles,
- Electrical circuits in big vehicles,
- Electrical systems in big vehicles,
- Electrical components and their symbols in big vehicles,
- Lorries electrical wiring diagrams,
- Practical exercise on fault recognition and malfunction repair (troubleshooting).

The following sections of the electric plant are reproduced and analyzed:

- electrical supply
- starting
- ignition
- fuel injection
- auxiliary plants (doors opening/closing, defrosting, anti-theft system, radio, etc.)
- indicators
- cooling and aeration
- windshield wipers
- signalling system
- lighting system
- head lights
- anti-fog lights

The scheme utilizes the symbols specified by the DIN regulations.
The panel is complete with CAI software

ELECTRIC POWER SYSTEM



DL AM35

This simulator mainly takes into consideration the 12 V and the 24 V starting systems with switching of the batteries and the starting systems with the device for starting block.
The simulator analyzes also the starting systems with the device for starting repetition, those with the relay for double starting for operation in parallel and those with the switching relay for the operation in parallel.

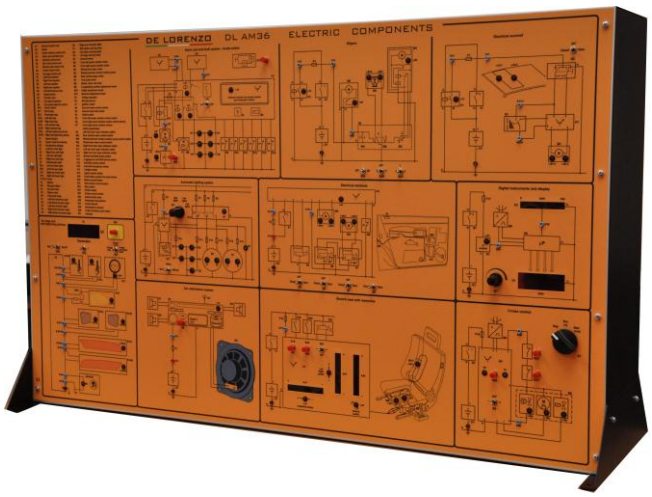
The simulator covers the following subjects that are relevant to both cars and big vehicles:

- Battery and power cables,
- Converter (alternator),
- Voltage regulator,
- Starting system,
- Fuses and connections (fusible links),
- Multiplier,
- Digital meter operation,
- Ammeter operation,
- Battery voltage in terms of load and temperature
- Battery charging and testing procedure,
- Cranking system,
- Charging procedure control system,
- Methods of recognizing faults,
- Repair practical techniques.

The panel is complete with CAI software.

AUTOTRONICS

ELECTRIC COMPONENTS



DL AM36

The simulator covers the following topics:

- Digital instruments and display,
- Electrical sunroof,
- Cruise control,
- Safety belts tension relay,
- Radio/stereo system,
- Automatic lighting system,
- Electric seats regulation,
- Fuel shut-off inertial switch,
- Electric (power) windows,
- Alarm system,
- Multi-function valve in the fuel tank,
- Air-bag (driver-bag, passenger-bag, side-bag, window-bag),
- Wipers.

The panel is complete with CAI software

CAI SOFTWARE

DL NAV

Each software, installed on a PC, in addition to keeping under control the simulation progress, provides a set of lessons consisting of a theoretical description of the relevant subject and of a guide to the performance of the simulation.

Each software is subdivided in lessons.
Therefore, it is easy for the teacher to plan the whole training course as well as to repeat one particular lesson or only part of it (theory, experiments, fault finding).
The hypertexts help in analyzing the proposed subjects in a personal way as a function of the knowledge of each student.

Through a set of questions with multiple choice answer it is possible to verify the learning progress of the student.

A panel supervision software facility, where in real time all the system variables are displayed, makes easier the control of the operation of the simulator and the prompt understanding of the current state of the simulation.

DEMONSTRATION PANELS

This section of the laboratory consists of a set of demonstrators composed of real components mounted on panels showing the interconnections and the operation of some of the most important electric and electronic systems found in the automotive field.

Each panel includes the components relevant to the subject under study, the control circuits provided with test points and the instruments necessary for performing the experiments.

The panels are complete with user manuals that will allow teachers to develop their own experiments.

The panels cover some of the most important subjects dealing with electric and electronic technology in the automotive field.

AUTOTRONICS

IGNITION AND INJECTION CONTROL TRAINER

DL DM12

This trainer allows studying the modern systems used for the setting up of internal combustion engines through the computerized management of the ignition and injection.
The main functionalities of the trainer are:

- TO SURVEY the working curves of the engine in different running conditions.
- TO OPTIMIZE the operation of the engine in a particular running condition, by modifying in real time the spark advance and/or the stoichometric ratio.
- TO HIGHLIGHT the effects connected to the choice of an advanced spark or to an incorrect stoichometric effect.
- TO UNDERSTAND the operation of a modern gear case for engine management, where the calculus algorithms permit, in all the engine working range, an accurate and repeatable control of the ignition and injection.
- TO VISUALIZE on a PC all the operating parameters, engineering data and the test values by using a modern software, configurable and user friendly.

Prearrangement to the interface with a computer.
The trainer is supplied already complete with a series of transducers interfaced to the ECU (Engine Control Unit), which provides to their processing and send them through CANBUS to the control software to be installed on a PC for the visualization with tables and graphs of the results.
The calibration of the injection-ignition system happens with specific functions implemented in the software in execution on the PC, it interacts in real time with the ECU without doing any reset or ON-OFF operation.

Thanks to the sensors present on the system it is possible either the survey or the calculation and the visualization on a PC monitor of all the engine operating parameters, such as:

- rotation speed
- torque
- delivered power
- opening angle of the throttle
- absolute pressure of the air in the aspiration duct
- barometric pressure
- temperature of carburant air
- engine temperature
- lambda value or stoichiometric rate
- sequential or semi-sequential type of running
- advance spark
- injection time
- injection phase
- battery voltage
- ECU working temperature

Moreover, by modifying the throttle position and the load through the dynamometric brake it is possible to control the rotation speed and the torque of the engine in order to do experiments by modifying both the speed and the torque.

Instrumentation. All the sensors present on the group send the relevant signals to the electronic control unit, which can be interfaced to a PC to visualize all the measurements through a graphic interface that can be personalized by the user.

List of experiments:

1. Rotation number regulation
2. Volumetric efficiency
3. Total fuel consumption per hour at constant power
4. Fuel specific consumption
5. Combustion air consumption
6. Brake horsepower at variable speed
7. Torque developed at brake
8. Air/fuel ratio
9. Variation of the stoichiometric ratio
10. Variation of the spark advance
11. Variation of injection corner
12. Variation of the running strategies (SEQUENCY-SEMI-SEQ.)
13. Thermal balance

AUTOTRONICS

CAR LIGHTING SYSTEM TRAINER

DL DM20

The trainer allows studying and testing the parameters of the vehicle lighting system subassemblies.

The trainer includes the following systems:

- Direction indicators, hazard lights
- Passing lights, driving lights and parking lights
- Fog lights
- Brake and reversing lights
- Headlight lift regulator
- Vehicle interior lighting
- Wiper equipment
- Vehicle horn sound
- Window wash system

The trainer allows learning the marks and graphic symbols of the electrical installation elements according and testing the resistance, the voltage and the power in the vehicle installation system.
Complete with user manual that will allow teachers to develop their own experiments.

VEHICLE SENSOR SYSTEM

DL DM21

This demonstration panel enables learning in terms of combination, test and evaluation of the parameters of the vehicle system subassemblies. It can be configured in different ways.

The trainer includes the following systems:

- Mass and volume air flow meters check system
- MAP sensor check system
- Knock sensor
- Engine and air temperature sensor
- Lambda sensor
- Rotation speed active sensor
- Speedometer sensor
- Acceleration sensor
- Rotation direction sensor
- Set of the main vehicle system sensors
- Differential pressure sensor
- Oil pressure sensor
- Fuel level sensor

Training includes the learning of the marks and graphics symbols of the sensors and testing the sensors with measuring instruments.
Complete with user manual that will allow teachers to develop their own experiments.

COMMON RAIL DIESEL ENGINE MANAGEMENT SYSTEM

DL DM22

This demonstration panel shows the operating of the electronic, mechanic and hydraulic elements that constitute the control and fuel feed system of the contemporary CR/EDC ignition diesel engine.

The system is composed of two main modules:

- Common rail pump and injector control system for demonstration of its working and for the study of the electric and hydraulic parameters of the high-pressure pump and electro-injector control system. The module can work autonomously or together with the Diesel Common Rail engine electronic control unit.
- Diesel Common Rail engine control unit, equipped with a microprocessor controller used for the demonstration of the high-pressure pump and electro-injector control system. The module can only work with the pump and injector control module.

The fuel system enables presentation of the subassemblies' working and a change of the fuel dose.

The measuring panel enables easy installation of the check meters for all the system sensors and working subassemblies.

The pump drive control allows the simulation of the full rotational speed range from the start phase to full capacity.

The fault simulation console enables creating of breaks in chosen circuits and observing the reaction of the control system to the occurred position.

It is possible to install the diagnostic device to the relevant socket and observe the parameters of the system.

Complete with user manual that will allow teachers to develop their own experiments.

SRS AIRBAG SYSTEM

DL DM23

This demonstration panel represents the AIRBAG system construction allowing evaluation of its parameters. The elements of a typical SRS system are: a system controller, a frontal airbag, a passenger's airbag, side airbags, tensioners and sensors of side crashes.

These elements enable diagnosing of the system.

- The fault simulation console enables the creation of breakdowns in selected circuits and the observation of the reaction of the control system to the occurred conditions.
- The used subassemblies enable the diagnosis of the SRS system and of the modern control panel where the SRS airbag system warning lamp is located.
- The panel is equipped with an engine diagnostic connector for the installing of the diagnostic device, which enables the reading and the erasing of breakdown codes and current parameters plus the control of the control panel's indicators and many other functions

Complete with user manual that will allow teachers to develop their own experiments.

AUTOTRONICS

D-JETRONIC COMPACT

DL DM24

This demonstration stand is designed to reproduce the performance of the D-Jetronic mono-point injection engine system and the MULTEC electronic determination of the advance angle, as well as the representation of the control of the engine system in changes of the fuel dose and the advance angle, as far as the temperature, the rotational speed, the load and many more related parameters.

- The simplified fuel system allows observation of the pressure parameters and others.
- The microprocessor type distributor ignition system enables observation of a change of the advance angle in a stroboscopic way or by comparing the signal of the crank position with other signals.
- The measuring console allows easy installation of the check meters for all the system sensors and working subassemblies.
- The system enables observation of the fuel injection impulse and measurement of its duration while changing the basic parameters.
- The system enables preservation of breakdowns in chosen circuits and the observation of the reaction of the control system in the occurred condition.
- The system allows self-diagnosis with the aid of the flash code of the system control.
- It is possible to install the diagnostic device through relevant socket and observe the parameters of the system.

Complete with user manual that will allow teachers to develop their own experiments.

ABS/ASR POWER CONTROL SYSTEM

DL DM28

This demonstration panel presents the working of the automatic brake power system ABS and the anti-slip regulation system ASR in motor vehicles with the aid of a microprocessor controller. The system allows measurement of the following signals:

- The tension of four different rotational speed sensor
- The characteristics of the tension from the sensors depending on the rotational speed of the toothed ring.
- The characteristics of the tension from the sensors depending on the gap width for the specified rotation speed
- The depth of the amplitude modulation of the sensors' signal being a result of the whipping of the toothed ring in the function of the gap width
- The pressure value in the hydraulic circuits (in the brake master cylinder or after a correction made by the ABS/ASR system)

Complete with user manual that will allow teachers to develop their own experiments.

AUTOTRONICS

CAN BUS IN THE COMFORT SYSTEM

DL DM30

This demonstration panel presents the functioning of the comfort system based on data transfer performed with the aid of CAN BUS.
The system consists of:

- Heated side mirrors equipped with position adjustment mechanism
- Electric motors used to wind down and up the glasses
- Electric door locks
- A set of switches for the control of the actuators
- Alarm
- Simulators of hood and tailboard locks
- Vehicle interior lighting
- The comfort system controller

The stand allows the performing of a diagnosis of the system through the OBD2 connector, that is connected to the main comfort controller. The electric input and output signals are transmitted through banana plugs for quick measurement of their parameters.
There is the possibility to change the lock and alarm mode through a new controller coding.
Complete with user manual that will allow teachers to develop their own experiments.

CAR AIR CONDITIONING SYSTEM

DL DM31

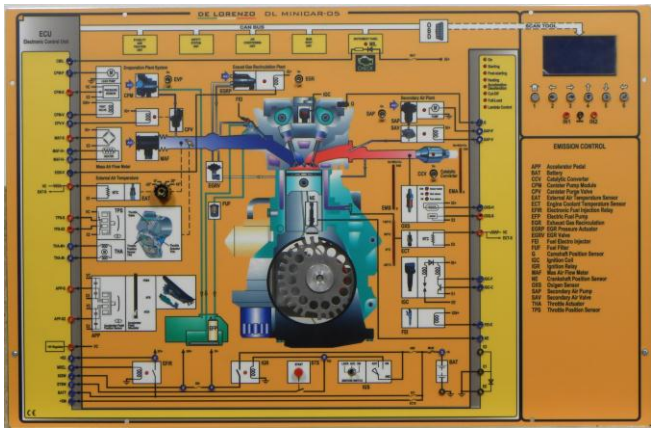
After market unit mounted on a chassis. Ideal for training in the operation, maintenance, repair and troubleshooting.

Main features:

- Max. power 2 kW
- Cooling liquid 400gt Freon R134a
- Piston compressor
- Condenser
- Dehydrating filter
- Pressure switch
- Expansion valve
- Evaporation unit
- Resistor
- Thermostat
- Troubleshooting device for simulation of 4 faults
- Nomenclature table

AUTOTRONICS

EMISSIONS CONTROL



DL MINICAR-05

This Trainer studies the devices and the systems used for controlling and reducing the emissions of gasoline engines. In fact, the combustion of the fuel inside the cylinders of an engine is incomplete. The more it is incomplete, the higher the emission of noxious components that are present in the exhaust gas of the engine.
The trainer illustrates the operation, the electric signals and all the sensors and the actuators that are used in modern automobiles to reduce the emission of noxious gases.
The Trainer covers the following study and experiment subjects:

- General structure of the management system for a gasoline engine
- Composition of the exhaust gases in Otto cycle engines
- Preparation and control of the fuel
- Lambda regulation
- Re-circulation of the exhaust gases, anti-evaporation of the fuel and thermal post-combustion
- Sensors and actuators used in the systems for reducing the exhaust gas
- Control unit (ECU) and CAN-BUS
- Analysis of the electric signals of sensors and actuators
- Troubleshooting with traditional instruments
- Troubleshooting with OBD self-diagnosis

Main features

• Autonomous operation

The trainer is able to operate autonomously, without connection to PC. Moreover, it is provided with a USB interface to connect to a computer for data acquisition, graphic visualization, eTraining.

• Use of some real components

The trainer is provided with an electric motor, with phonic wheel and magnetic sensor for position and rotation speed. The electric motor 'simulates' the operation of the real engine (all the operations are made at a speed 10 times lower than the real one of the engine: between 80 and 600 rpm). This allows visualizing on LED the operation of the different devices: spark plugs, injectors, etc. On the LCD display the actual speeds are visualized (rpm from 800 to 6000). All the signals (on LED and terminals) are synchronized with the rotation of the phonic wheel and this makes 'real' the operation of the trainer.

• 'Real' signals

All the signals at the test points are real. They are equal in value, shape, time to the signals found in a real automobile.

• Graphic Display and Keyboard

The trainer uses a graphic display and a keyboard for the visualization of the interesting parameters during the operation and for the selection of quantities and functions to be visualized.

'Integrated' Instrumentation

The Trainer contains the Instruments that are normally used on the field for the operation of troubleshooting in automobiles, both the 'traditional' ones, such as the multimeter, and the 'new' ones, such as the ScanTool for the OBD diagnosis.

• Digital voltmeter

It allows performing all the voltage measurements on the system, without the need for external instrumentation.

• Digital oscilloscope

It allows checking the waveforms at all the Test Points of the system and to operate in the same modes of a real oscilloscope.

• Tester OBD-II (SCANTOOL)

It allows operating in the activities of fault finding in the same modes of a Scantool connected to an automobile through the OBD socket.

AUTOTRONICS

CUT AWAY MODELS

This section of the laboratory offers a wide and articulated range of demonstration models and operating or sectioned groups/components in the automotive field.

Among the offered products we remind:

- Sectioned internal combustion and diesel engines
- Car frames with engine and accessories
- Models of internal combustion and diesel engines
- Sectioned agricultural machines
- Working interned combustion and diesel engines
- Educational models and cut-away:
    - Ignition systems
    - Starters
    - Alternators
    - Dynamos
    - Batteries
    - Distributors
    - Coils,
    - Magnets
    - Injection pumps
    - Injectors
    - Carburetors
    - Feeding circuits
    - Fuel pumps
    - Oil pumps
    - Turbo compressors
    - Heat exchangers
    - Air conditioning systems
    - Steering boxes
    - Power steering
    - Gearboxes
    - Clutches
    - Transmission shafts
    - Differential gears
    - Brakes and power brakes