DE LORENZO

Engineering Training Solutions

Introduction

De Lorenzo S.p.A. is an Italian Company, which designs, manufactures and distributes training laboratories since 1951. We focus on hands on training to prepare students for Industry.

With our wide product lines, we fulfill all Engineering disciplines at University level as well as Colleges. We also have specific product lines for Elementary, Middle and High Schools. In addition, we have customized projects for Vocational Schools, Military Schools, Corporate Training Centers and Government Vocational Training Facilities.

One of the key elements in our philosophy of production is the term “modular”. Utilizing modular components helps us breakdown our products in order to customize them and cover special curriculum needs. This modular architecture format also helps update our products without needing to change the complete system.

We are proud of our Italian heritage in combination with our more than 60 years of experience that has touched 120 countries worldwide which at the same time helped us grow and develop a true multicultural Group of Companies always with one vision, EDUCATION.

De Lorenzo S.p.A. manufactures in its factory of Rozzano, in the outskirts of Milan, all the didactic equipment that it supplies and the reliability and long duration of its equipment are obtained through the use of first grade material and components and the study of safety systems and protections to avoid overloads and short circuits.

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Factory in Italy

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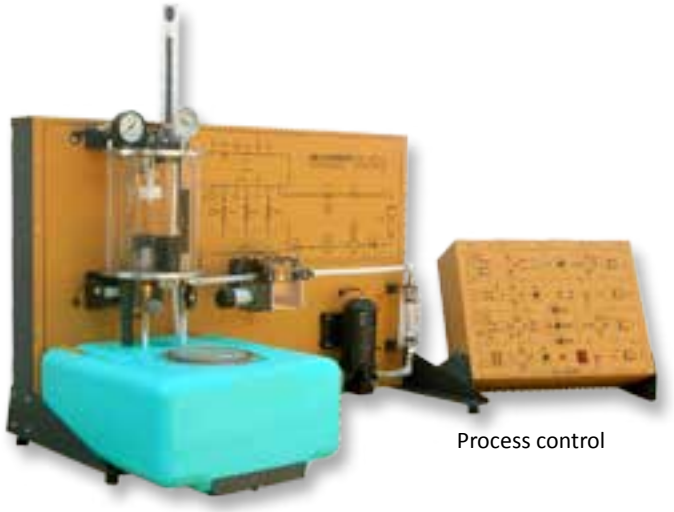
Automation



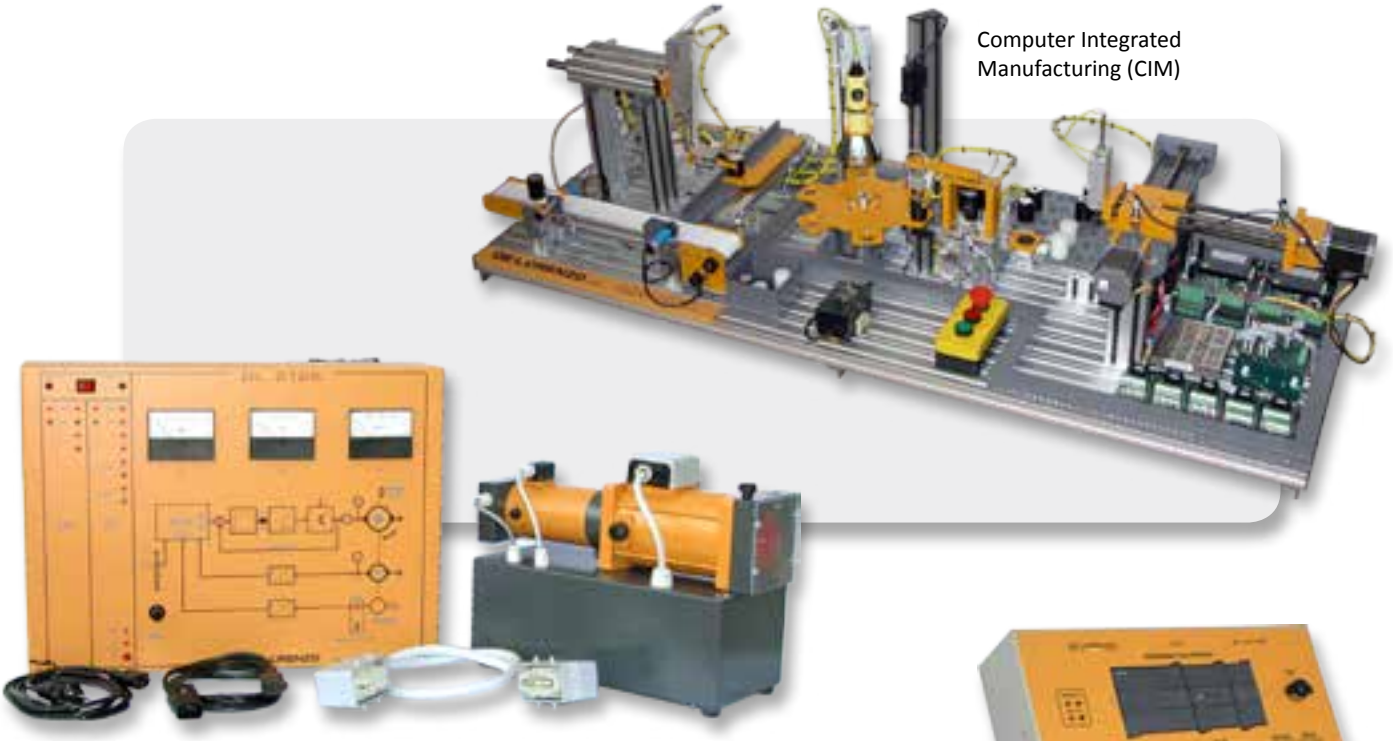
Process control

Automation is the use of control systems to control industrial machinery and processes. Our laboratory starts from the study of PLCs to allow students the analysis and the acquisition of the techniques related to programming a PLC and to its use in control technology.

The laboratory then includes a set of real situations simulation panels to facilitate, in a user-friendly and stimulating way, the study and the programming of the PLC: programmable traffic lights, automated parking garage, three-floor elevator, etc.

Our proposal continues with the study of the control of alternate and direct current motors and with the application of the PLC programming techniques to processes where to control level, pressure, temperature and flow of a typical industrial process plant.

The laboratory is, then, completed with a pneumatic and electro-pneumatic trainer and with a modular system representative of the automation techniques for industrial production (CIM, Computer Integrated Manufacturing), a very topical subject, the latter, basis for modern industry.



Computer Integrated Manufacturing (CIM)

DC motor control

Programmable Logic Controller (PLC)

Model of an elevator

In detail, the products that we propose for the Automation laboratory are the following:

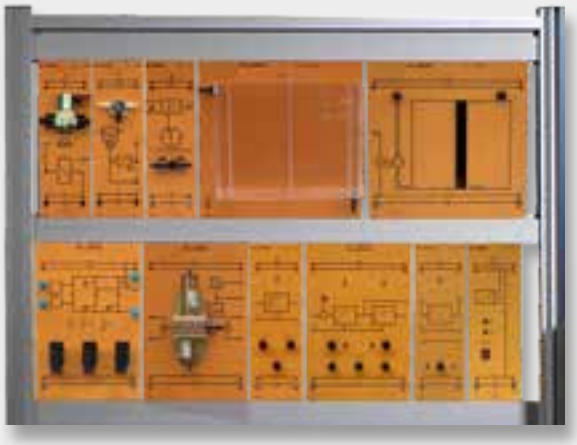
PLC:	Programmable logic controller, 36 IN, 28 OUT	(DL 2210B)
	Programmable logic controller, 26 IN, 22 OUT	(DL 2210A)
	PLC trainer	(DL 2110-131K)
	Interactive trainer for industrial processes	(DL 2110ITS)
Simulators:	Analogue input/output simulator	(DL 2112)
	Digital input simulator	(DL 2113)
	Two-storey parking garage simulator	(DL 2120)
	Smart traffic light simulator	(DL 2121)
	Model of an elevator	(DL 2122M)
	Simulator of an elevator	(DL 2122)
	Belt conveyor simulator	(DL 2124)
Electric controls:	Electromechanical components module	(DL 2104G)
	Squirrel cage motor control	(DL 2123)
	DC motor speed control	(DL 2125)
	Brushless motor control	(DL 2131)
Process controls:	Process control trainer	(DL 2314)
	Process control simulation software	(DL 2314SIM)
	Sensors and transducers trainer	(DL 2312HG)
Pneumatics:	Pneumatics	(DL 8161/ DL 8110P)
	Electro-pneumatics	(DL 8171/DL 8115EP)
	Hydraulics and electro-hidraulics	(DL 8110H)
CIM:	Computer Integrated Manufacturing	(DL CIM-A, -B, -C, -S)
	Industrial control system	(DL 2611MP)

Brushless motor control

Electro-mechanics components

Process control simulation software

Automatic Control Technology

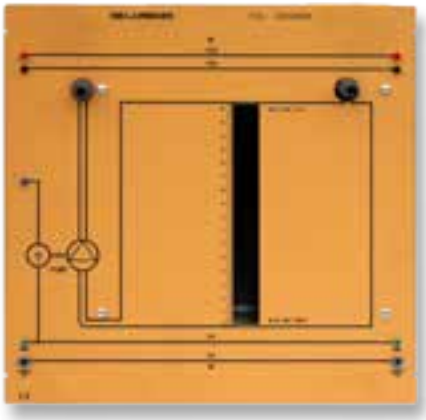


This laboratory has been designed to introduce the fundamentals of automatic control technology. The main functions of processes, controllers and controlled systems are shown on a simulated controlled system, as well as the interactions between the transfer elements of a control loop.

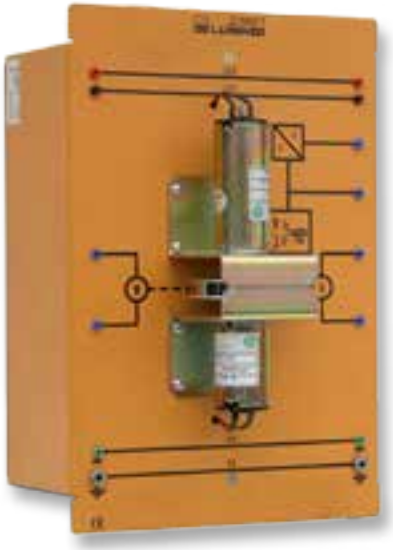
In the first section of the laboratory we study the basic principles of the theory of automatic control, the processes, the controllers and the continuous and discontinuous automatic controls.

In the second section we suggest some practical applications, such as the control of a dc motor or the control of temperature, light, level and flow.

The laboratory is modular and includes about 30 panel type elements, that can be purchased also gradually, starting from the most interesting subjects, to reach the integration of the full laboratory at a later time.



Receptacle with pump



Motor - Generator set

Second order transfer element

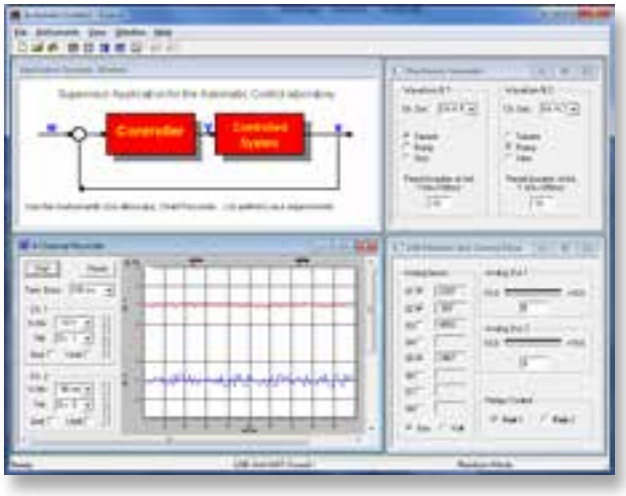
Simulated controlled system

In detail, the laboratory is composed of the following modules:

DC Power Supply (DL 2613)	Voltage Reference Generator (DL 2614)	PID Controller (DL 2622)
P Controller (DL 2670)	Integral-Action Element (DL 2671)	Derivative-Action Element (DL 2672)
Summing Point - 2 Inputs (DL 2673)	Summing Point - 5 Inputs (DL 2674)	Simulated Controlled System (DL 2675)
Dead Time Element (DL 2676)	Second Order Transfer Element (DL 2677)	Manual/Automatic Switch (DL 2678)
Two Position Controller (DL 2679)	Sample and Hold Element (DL 2680)	Motor - Generator Set (DL 2681)
Load Switch (DL 2682)	Gain and Offset Adjust (DL 2683)	Power Amplifier (DL 2684)
Temperature Control System (DL 2685)	Light Control System (DL 2686)	Test Function Generator (DL 2687)
Receptacle with pump (DL 2688)	Filling Tank (DL 2689)	Differential Pressure Transducer (DL 2690)
Turbine Flow Meter (DL 2691)	Solenoid valve (DL 2692)	Single Pole Switch (DL PS-Mod)
Single Pole Pushbutton (DL PP-Mod)	Data acquisition software (DL ACT SW)	PC interface (DL 1893)

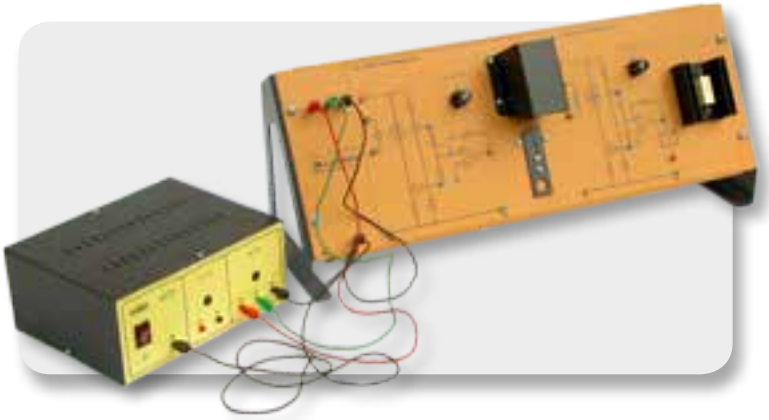
Turbine flowmeter

Derivative - action element



Software

Basic Electronics



The study of basic electronics, propaedeutic to all the following studies relative to the applications, in different technology fields, of the principles of electronics, is proposed in this laboratory through the use of a set of dedicated modules for general subjects.

With the modules of the laboratory it is possible to perform practical guided experiences that allow acquiring the theoretical principles that are the basis for all the most common electronic circuits made of analogue and digital, active and passive components.

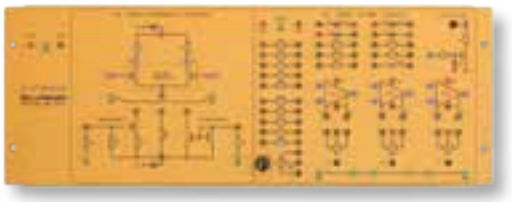
Special characteristics of the modules of the laboratory are their sturdiness and their user-friendly approach. The connections among the different points of the circuits are obtained by means of safety connecting leads and the exercises are explained in the manual with a lot of details.

The modules that we propose for the Basic Electronics laboratory are the following:

Basic electronics (DL 2152 with DL 2152AL)

Discrete components linear electronics

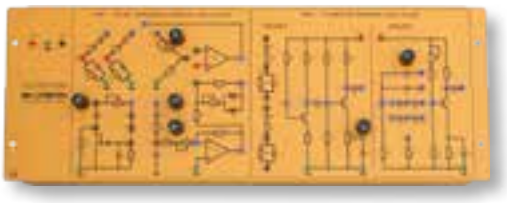
BJT voltage amplifiers (DL 2155AT)	BJT power amplifiers (DL 2155APT)
BJT feed-back amplifiers (DL 2155ART)	FET-MOSFET (DL 2155FET)
Transistor based voltage regulators (DL 2155RTD)	High frequency oscillators (DL 2155OSA)
Low frequency oscillators (DL 2155OSB)	Quartz oscillators (DL 2155OSX)



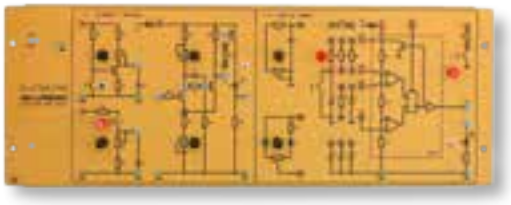
Operational amplifiers

Integrated components linear electronics

Transistor multivibrators (DL 2155MVB)	Schmitt trigger and NE 555 (DL 2155TRG)
Operational amplifiers (DL 2155AOP)	Active filters (DL 2155FIL)
Function generators (DL 2155GEF)	Differentiators, integrators, S&H and peak detectors (DL 2155DIS)
Comparators (DL 2155COM)	AC amplifiers and DC instrument amplifiers (DL 2155AMP)
Analogue switches and multiplexers (DL 2155SMA)	Voltage regulators with integrated circuits (DL 2155RTI)



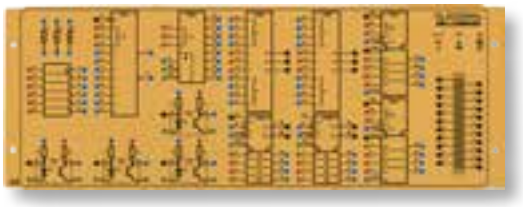
Low frequency oscillators



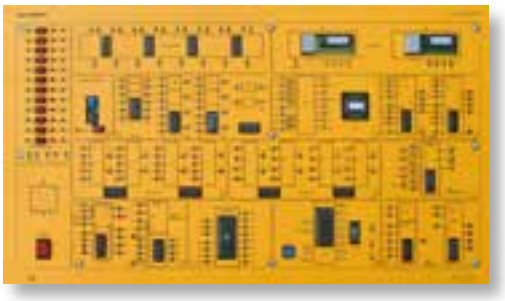
Schmitt trigger and NE 555

Digital electronics

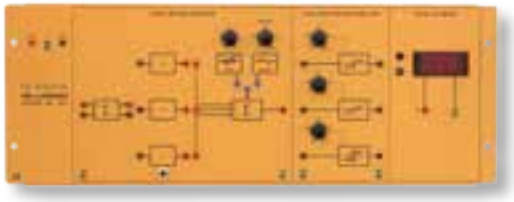
Combinatory logic (DL 2203C)	Sequential logic (DL 2203S)
HCT-ECL-CMOS (DL 2203SFL)	Advanced sequential logic (DL 2205INL)
Programmable logic (DL 2205PRL)	Digital Electronics (DL 2203SR)



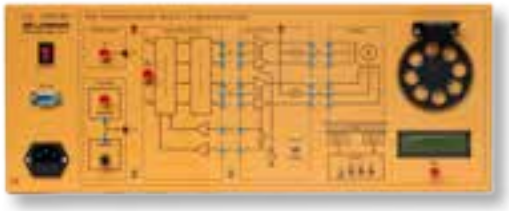
Advanced sequential logic



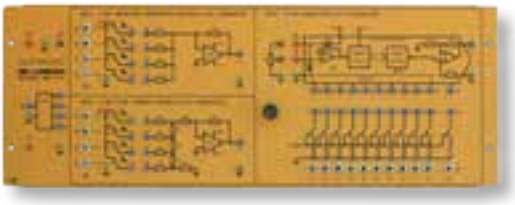
Digital electronics



Process simulator for PID control



Step motor control



Digital-to-analogue converters

Applications

Digital-to-analogue converters (DL 2155DAC)	Analogue-to digital converters (DL 2155ADC)
Switching power supplies (DL 2155AC)	Thyristors, triacs and their applications (DL 2316)
Temperature control (DL 2155RGT)	Speed control of a dc motor (DL 2155RGM)
Step motor control (DL 2208)	Process simulator with PID control (DL 2330)
Power electronics (DL 2317SR)	Motor board (DL 2318SR)

Motor board

System for the Study of Electronics (TIME)

Base with power supply, interface to PC and virtual instrumentation

Set of experiment modules for the study of electronics and its applications.

Characterized by its versatility and adaptation to the continuous evolution of technology, is able to stimulate the skill and the logic capabilities of the students, through both individual and group applications. The student can test, explore, directly experiment and easily assimilate what he is studying.

Each module is provided with a Teacher Manual and a Student Manual, strictly interconnected, to allow students a simple and gradual learning and teachers an efficient guide for planning and performing the courses.

The TIME system is composed of: power supply base with interface to PC, a set of boards for the study of electronics, CAI (Computer Assisted Instruction) software and supervision software.

In detail, the study modules that we propose for the TIME laboratory are the following:

Power supplies

Base with power supply (DL 3155AL5)	Base with power supply and interface to PC (DL 3155AL2)	Base with power supply, interface to PC and virtual instrumentation (DL 3155AL2RM)
DC power supply, ±5V, ±15V, 0/+15V, 0/-15V (DL 2555ALF)	DC power supply, ±5V, ±15V (DL 2555ALG)	AC power supply, 24V (DL 2555ALA)

Electricity and Electromagnetism

DC fundamentals (DL 3155E01)	DC circuits (DL 3155M01R)	Electric networks (DL 3155M02)
Power and electric energy (DL 3155M03)	Electric field (DL 3155M04)	Magnetic circuits (DL 3155M05R)
Electromagnetism (DL 3155M06)	AC circuits (DL 3155M07)	Electric power in alternating current (DL 3155M08)
Single-phase transformer (DL 3155M09)	DC motor and generator (DL 3155M10)	Three-phase systems (DL 3155M29)

Power electronics and controls

CAI Software

Electronic Devices

Electronic devices (DL 3155M11)	Diode applications (DL 3155M12)	Transistors (DL 3155M13)
Transistor feedback circuits (DL 3155E16)	FET fundamentals (DL 3155E18)	Power electronics (DL 3155E22)
SCR TRIAC power control (DL 3155E29)		

Amplification

Amplification (DL 3155M14)	Transistor amplifier circuits (DL 3155E14)	Types of amplifiers (DL 3155M15)
Transistor power amplifiers (DL 3155E15)	Operational amplifiers (DL 3155M16)	Power amplifiers (DL 3155R17)
Operational amplifier (DL 3155E19)	Filter circuits (DL 3155R23)	

Digital Electronics

Logic fundamentals 1 (DL 3155E20)	Logic fundamentals 2 (DL 3155E21)	Logic circuits (DL 3155M18)
Digital circuits (DL 3155M19R)	Memories (DL 3155M20)	Multivibrators (DL 3155M22)
Oscillators (DL 3155R22)	DSP - Digital Signal Processor (DL 3155E26)	

Regulations and Controls

Motors, generators and controls (DL 3155E10)	Power electronics and controls (DL 3155E10R)	Machine control (DL 3155R10, R10A)
Power supply regulation circuits (DL 3155E17)	Power supply regulators (DL 3155E17R)	Conversion (DL 3155M21)
Transducers fundamentals (DL 3155E25)	Sensor experiment set (DL 3155E25T)	Regulation and control (DL 3155M33, M33A, M33B, M33C, M33D)
Regulation systems (DL 3155R33)		

Telecommunications

Cellular telephony (DL 3155M31)	Analogue signal transmission (DL 3155M60)	Analogue signal processing (DL 3155M60R)
Digital modulation-demodulation (DL 3155M61)	Digital signal transmission (DL 3155M62, M62A)	Fibre optics (DL 3155M63)
Transmission line (DL 3155M64)	Opto-electronics (DL 3155M70)	

Development module with sub-modules

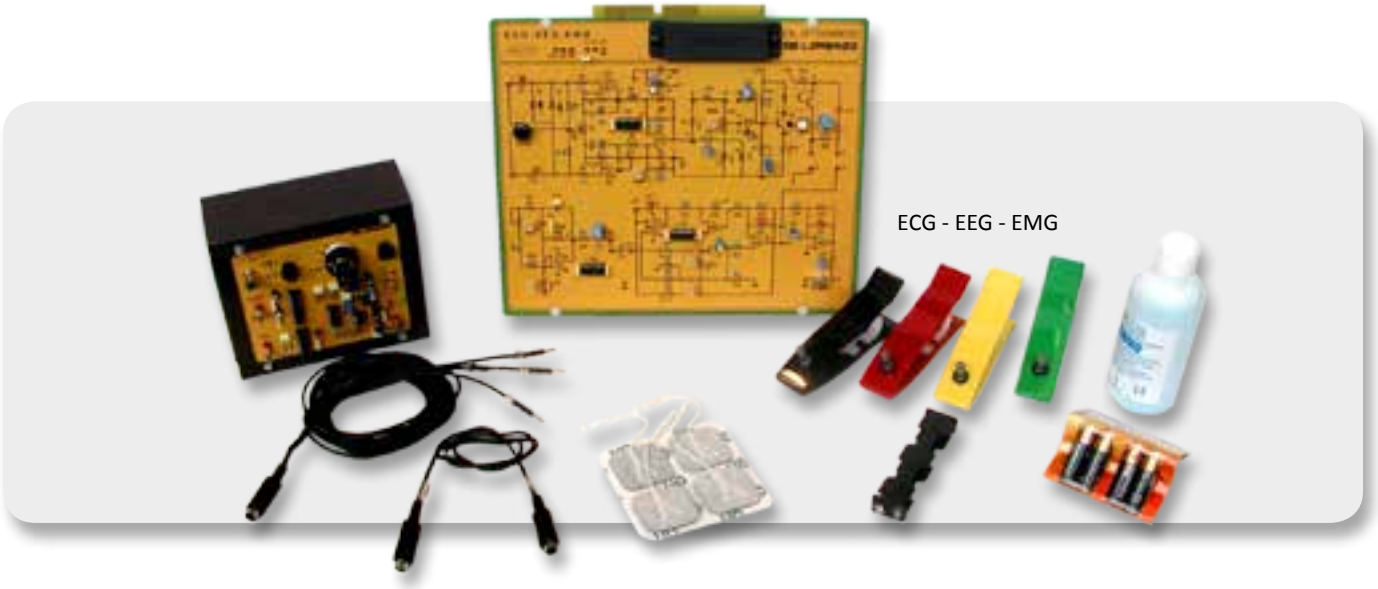
Base module with set of sub-modules for the study of: photovoltaic solar energy, analogue electronics, digital electronics, programmable systems, microprocessors (DL 3155BRS).

Software e Breadboard

CAI software (DL NAV)	Laboratory Management Software (DL LAB)
Breadboard module (DL 3155DES)	

Development module with sub-modules

Biomedical



Within the more general environment of the electronic instrumentation, the biomedical instrumentation is characterized by some peculiar elements, that are correlated to the particular field of application, due to the fact that it has to be interfaced to the human body.

This laboratory deals with the design and operating principles of the most common biomedical instrumentation in the field of diagnosis, therapy and rehabilitation.

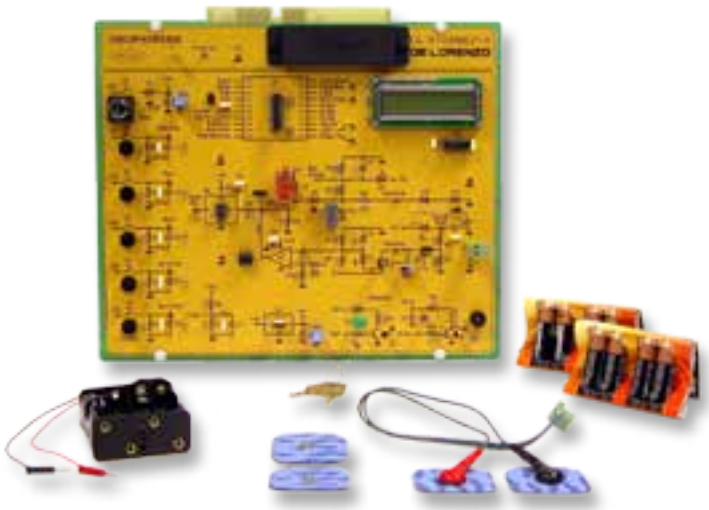
The objective is that of studying in detail different circuits that are commonly used in the clinic practice, by means of propaedeutic and application modules.

Special attention is paid to the problems related to the electrical safety of the patient.

This laboratory has been designed to train in particular two types of professionals:

- Biomedical engineers, that take care of the design and of the development of the equipment.
- Biomedical laboratory technicians, that deal with the operation and the maintenance of the equipment.

Ionophoresis



Laser therapy

Audiometer

Galvanic skin resistance

CAI Software

The biomedical laboratory is composed of 16 didactic modules, composed of electronic boards with real components and CAI (Computer Assisted Instruction) software:

Propaedeutic Modules

Transducers (DL 3155BIO1)	Amplifiers (DL 3155BIO2)
Filters (DL 3155BIO3)	Pulse conversion indicator (DL 3155BIO4)

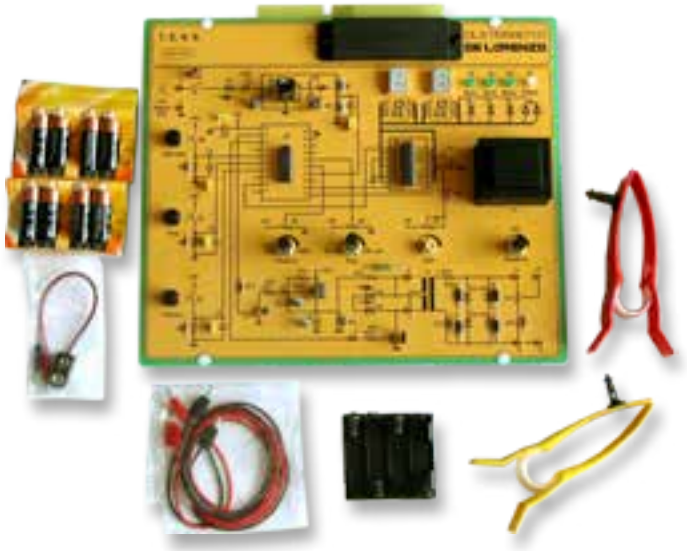
Application modules

ECG – EEG – EMG (DL 3155BIO5)	Pulse rate (DL 3155BIO6)
Temperature and respiration (DL 3155BIO7)	Galvanic skin resistance (DL 3155BIO8)
Audiometer (DL 3155BIO9)	T.E.N.S. (Transcutaneous Electrical Nerves Stimulation) (DL 3155BIO10)
Magneto-therapy (DL 3155BIO11)	Electro-stimulation (DL 3155BIO12)
Laser therapy (DL 3155BIO13)	Ionophoresis (DL 3155BIO14)
Ultrasound therapy (DL 3155BIO15)	Blood pressure monitoring (DL 3155BIO16)

Power Supplies

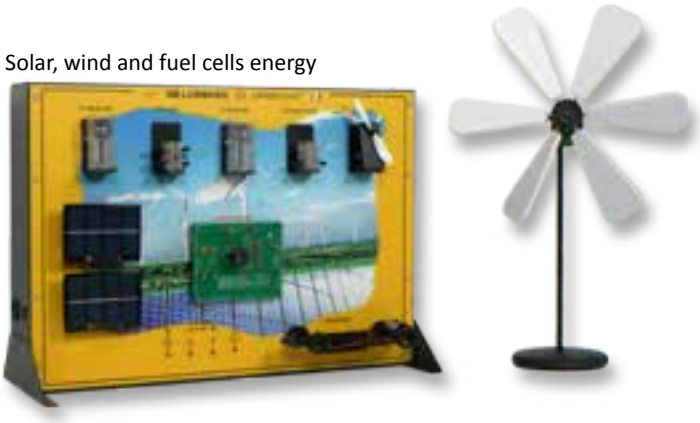
Power supply (DL 3155AL5)	Power supply with PC interface (DL 3155AL2)
Power supply with PC interface and virtual instrumentation (DL 3155AL2RM)	

T.E.N.S. (Transcutaneous Electrical Nerves Stimulation)



Renewable Energies and Energy Efficiency

Solar, wind and fuel cells energy



The laboratory for the study of renewable energies is composed of a set of didactic trainers dedicated to the most common technologies that are currently available in this field for the production of electric energy from sources other than hydrocarbons. In particular, the laboratory deals with subjects related to the solar energy, in both the photovoltaic and thermal form, the wind energy, the hydrogen fuel cell technology, the production of biodiesel from vegetable oils, etc.
The laboratory also deals with an equally important subject, that of the energy efficiency, to reduce the need for energy in both the civil and industrial fields.

The trainers that we propose for the Renewable Energies laboratory are the following:

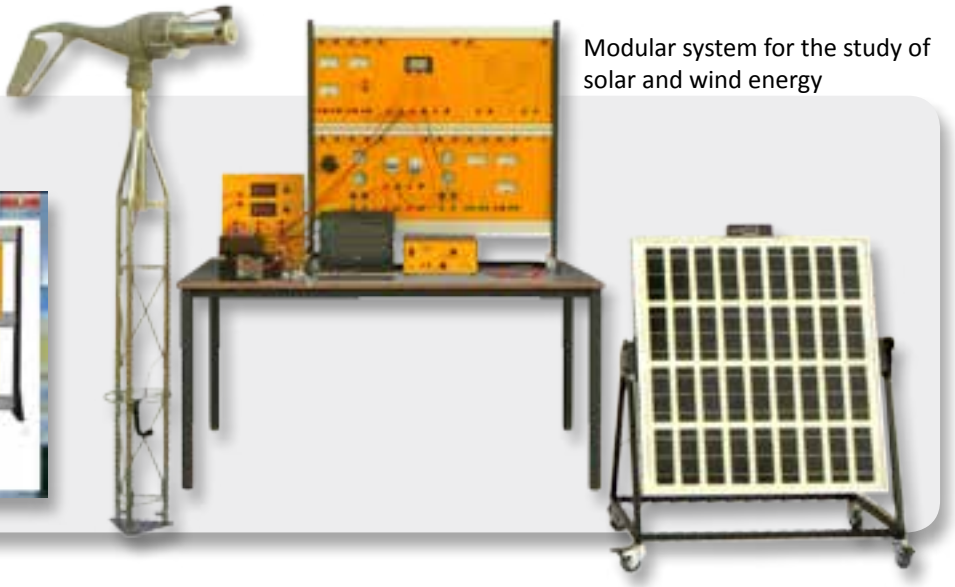
Solar photovoltaic energy

- Kit of sub-modules for the study of solar photovoltaic energy (DL 3155BRS-PSE)
- Basic module for the study of solar photovoltaic energy (DL SOLAR-C)
- Modular trainer for the study of solar photovoltaic energy (DL SOLAR-B)
- Modular trainer for the study of solar photovoltaic energy with connection to mains (DL SOLAR-D1)
- Lamps for lighting the solar photovoltaic panels (DL SIMSUN)
- Thermal and photovoltaic panels simulator (DL TM11)

The trainers are also available with a data acquisition and processing system.

Modular system for the study of solar and wind energy

Software



Solar thermal energy

- Trainer for the study of solar thermal energy with simulated solar panel (DL THERMO-A1)
- Trainer for the study of solar thermal energy with real solar panel (DL THERMO-A2)

Wind energy

- Modular trainer for the study of wind energy (DL WIND-A)
- Modular trainer for the study of wind energy with motor for indoor utilization (DL WIND-A1)
- Modular trainer for the study of wind energy with wind tunnel (DL WIND-B)

Hybrid systems

- Modular trainer for the study of solar and wind (DL SUN-WIND)
- Modular trainer for the study of solar and wind energy with master/slave inverter (DL SUN-WIND24V)

Study of hydrogen fuel cells

Hydrogen fuel cells

- Study of fuel cells (DL HYDROGEN-A)
- Modular trainer for the study of fuel cells (DL HYDROGEN-B)

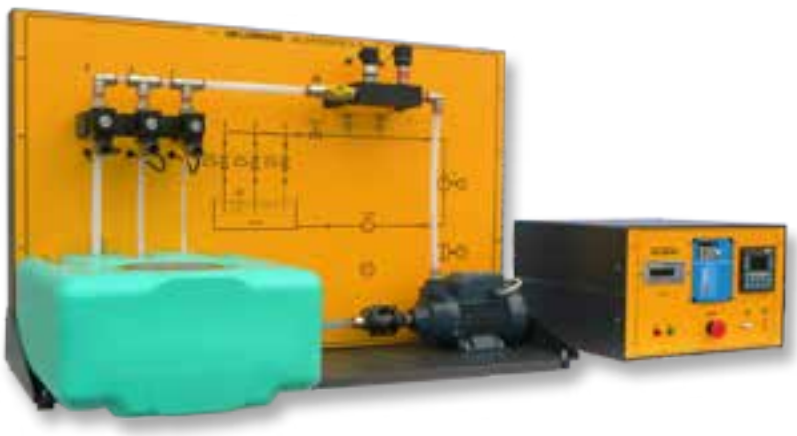
Smart Energy

- System for the study of solar, wind and hydrogen fuel cells energy (DL GREENKIT)

Biomasses

- Pilot plant for the production of biodiesel (DL BIO-30)
- Pilot plant for the production of ethanol (DL ETAL-15)

Study of thermal solar energy



Efficiency in electric motors

Energy efficiency

- Energy efficiency in electric motors (DL EFFICIENCY-A)
- High efficiency universal ac/dc motor (DL 2130B)

Smart Grid

The Smart Grid is a system for the “intelligent distribution” of the electric energy, able to compute the energy consumptions of the different end users and to manage the generation and the electric energy as a function of the demand.
Therefore, it has the task of sharing the electricity generated by different sources, both public and private, traditional and renewable, and of guaranteeing that the electric devices use the electricity in the most efficient way.

The didactic laboratory for the study of the concepts related to the Smart Grid system proposed by De Lorenzo is composed of a set of equipment and modules and of a SCADA type software that allow performing practical experiences on the techniques of generation, transmission, protection and utilization of electric energy in a new generation “intelligent” network.

The laboratory considers the simulation of the generation of energy from three different sources:

- a traditional energy (coal, gas or other sources)
- a hydroelectric source
- a wind energy source

The transmission and the distribution of electric energy are reproduced through the simulation of high voltage lines and step-down transformers for the transmission voltage.
In the section relevant to the utilization of the electric energy there are resistive, inductive and capacitive loads and systems for the generation of photovoltaic solar energy with grid type inverter for the injection of the excess energy generated by the photovoltaic panels.
Line protection relays and instruments for data acquisition are placed in suitable spots of the system. A SCADA type software provides to the acquisition of the data coming from the measurement instruments and to the control of the actuators in order to perform an intelligent management of the whole electric system.

Feeder manager relay

Three-phase power supply

Brushless motor

In detail, the laboratory is composed of the following modules:

Three-phase power supply (DL 2108TAL-SW)	Three-phase transformer (DL 1080TT)	Feeder manager relay (DL 2108T23)
Line model, 360 km (DL 7901TT)	Line model, 100 (DL 7901TTS)	Maximum demand meter (DL 2109T29)
Power circuit breaker (DL 2108T02)	Generator synchronizing relay (DL 2108T25)	Motor driven power supply (DL 1067S)
Electrical power digital measuring unit (DL 10065N)	Brushless motor with controller (DL 2108T26)	Three-phase synchronous machine (DL 1026A)
Resistive load (DL 1017R)	Inductive load (DL 1017L)	Capacitive load (DL 1017C)
Slip ring three-phase asynchronous motor (DL 1022)	Communication MODBUS (DL HUBRS485F)	SCADA software (DL SCADA2)
Circuit breaker (DL 9031)	Inverter Grid (DL 9013G)	Photovoltaic panel (PFS-85)
Panel with lamps (DL SIMSUN)	Base for 2 electric machines (DL 1013A)	Switchable capacitor battery (DL 2108T20)
Reactive power controller (DL 2108T19)	Kit of connection leads (DL 1155SGWD)	Double 3 level frame (DL 2100-3M-AS2)
Work table (DL 1001-1-AS)	Personal Computer (DL PCGRID)	Set of sockets (DL PRGRID)

Software

Generator synchronizing relay

In addition to the above basic configuration, it is possible to add more equipment to complement the existing ones.
Further information on additional configurations are available in the relevant section of the website.

SCADA software

Civil Installations

The laboratory for the study of civil electric installations is composed of a set of real components mounted on isolated panels, that, in turn, can be assembled on a work frame to allow performing the electric connections and carrying out all the experiences described in the didactic manual in a simple and effective way from the learning point of view.

The modules that we propose for the Civil Installations laboratory are the following:

Single-phase power supply (DL 2101ALA)	Single-phase power supply (DL 2101ALF)	Single-phase power supply (DL 2101ALW)
Switches and commutator (DL 2101T02RM)	Intermediate switch (DL 2101T04)	Intermediate switch and two-way switches (DL 2101T04RM)
Light pushbutton (DL 2101T05)	Bell/door opener pushbuttons (DL 2101T07RM)	Marked pushbuttons (DL 2101T08)
Single-phase mains socket (DL 2101T10)	Halogen lamps (DL 2101T11RM)	Low consumption fluorescent lamps (DL 2101T11RM2A)
Single-phase transformer (DL 2101T13A)	Latching relays (DL 2101T14)	Stepping relay (DL 2101T15)
Staircase light timer (DL 2101T16)	Incandescent and fluorescent lamps (DL 2101T17RM)	Bells (DL 2101T2020)
Bell and buzzer (DL 2101T2021)	Display signaling (DL 2101T23)	Electric lock (DL 2101T24)
Entryphone (DL 2101T26)	Outdoor entryphone (DL 2101T26E)	Power supply (DL 2101T27C)
Emergency light (DL 2101T28)	Stand-by battery (DL 2101T29)	Fire, intrusion and gas alarm control unit (DL 2101T30/40)
Smoke detector (DL 2101T31)	Thermal detector (DL 2101T32)	Emergency push button (DL 2101T33)
Alarms (DL 2101T34RM)	Gas detector (DL 2101T38RM)	Signaling lamps (DL 2101T39)
Microwave sensor (DL 2101T41)	Passive infrared sensor (DL 2101T42)	Perimeter sensors (DL 2101T43)
Blinker (DL 2101T44)	Video camera-monitor power supply (DL 2101T50)	Video camera and outdoor station (DL 2101T51-52)
Indoor monitor/intercom (DL 2101T53)	Nurse board (DL 2101T60)	Patient room board (DL 2101T61)
Dimmer (DL 2101T100)	Pushbutton light regulator (DL 2101T101)	Twilight switch (DL 2101T111)
Presence and twilight switch (DL 2101T112)	Timer switch (DL 2101T113)	

Indoor monitor / intercom

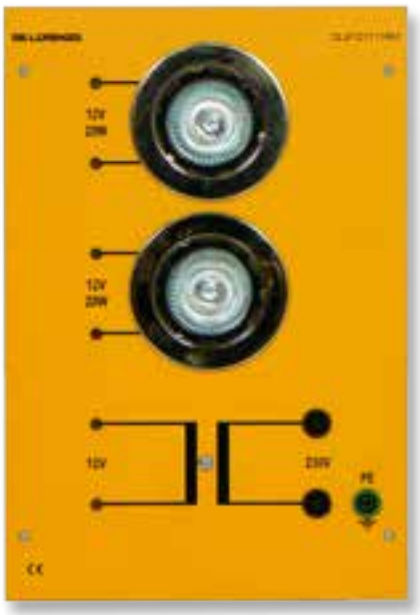
The modules can be grouped in a set of standard configurations for the study of specific subjects, such as, for example:

- Lighting
- Signaling
- Entryphone
- Hotel/hospital
- Fire alarm
- Anti - theft
- Video entryphone

Incandescent and fluorescent lamps

To the above mentioned modules it is, then, necessary to add a two level (DL 2100-2M) or three level (DL 2100-3M) work frame, according to the number of modules that form the selected configuration, and a set of connecting leads (TL 2101T).

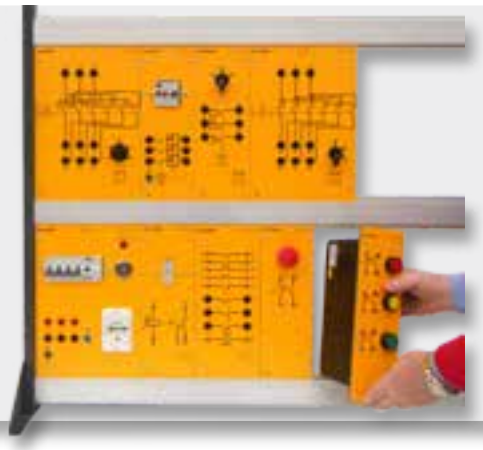
Timer switch



Low consumption fluorescent lamps

Perimeter sensor

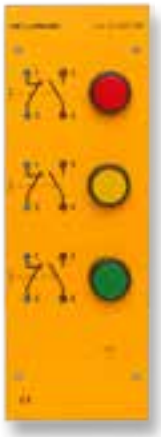
Industrial Installations



The laboratory for the study of industrial electric installations is composed of a set of real components mounted on isolated panels, that, in turn, can be assembled on a work frame to allow performing the electric connections and carrying out all the experiences described in the didactic manual in a simple and effective way from the learning point of view.

The modules that we propose for the Industrial Installations laboratory are the following:

Three-phase power supply (DL 2102AL)	DC power supply (DL 2102ALCC)	Emergency pushbutton (DL 2102T01)
Three pushbuttons (DL 2102T02)	Three pilot lamps (DL 2102T03)	Contactor (DL 2102T04)
Thermal relay (DL 2102T05)	Time relay (DL 2102T67)	Isolator (DL 2102T09)
Position sensor (DL 2102T11)	Star delta starter (DL 2102T12)	Direct starter with inversion Direct starter with inversion (DL 2102T15)
Capacitive proximity sensor (DL 2102T17)	Photoelectrical barrage sensor (DL 2102T18)	Photoelectrical reflecting sensor (DL 2102T19)
Level magnetic sensor (DL 2102T20)	Flooding probe (DL 2102T20RMB)	Star/delta starter with inversion (DL 2102T24)
Pole switching for Dahlander motors (DL 2102T25)	Pole switching with inversion (Dahlander) (DL 2102T26)	Level control (DL 2102T30RM86)
Pulse counter (DL 2102T31V)	Programmer (DL 2102T38)	Single-phase transformer (DL 2101T13)
Three-pole switch (DL 2109T04)	Three-phase induction motor (DL 2102A)	Dahlander motor (DL 2102D)
Asynchronous squirrel cage motor (DL 10115AV)		



Push buttons

Position sensor

Programmer

Trhree-phase induction motor

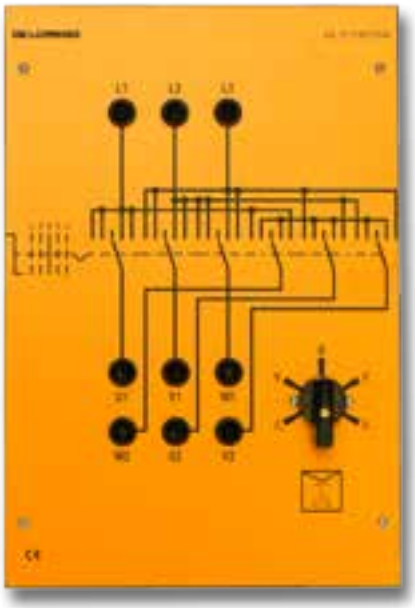
Level magnetic sensor

Thermal relay

The modules can be grouped in a set of configurations with growing complexity for the study of the different aspects of industrial installations, such as, for example:

- Basic experiences with industrial type electric components
- Experiences for starting a three-phase asynchronous motor
- Experiences for starting induction motors and Dahlander motors
- Experiences for star/delta starting and pole switching
- Experiences on sensors

Photoelectrical reflecting sensor



Start/delta starter with inversion

Pulse counter

To the above mentioned modules it is, then, necessary to add a two level (DL 2100-2M) or three level (DL 2100-3M) work frame, according to the number of modules that form the selected configuration, and a set of connecting leads (TL 2102T).

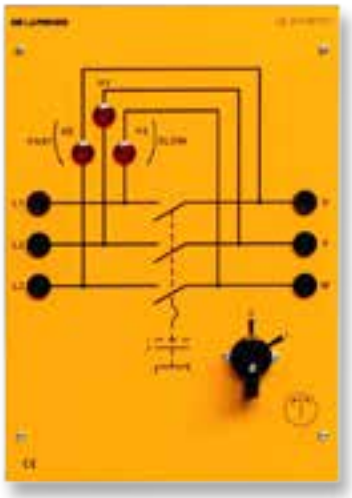
Electric Measurements

The laboratory for the study of the electric measurements is composed of a set of real instruments and components mounted on isolated panels, that, in turn, can be assembled on a work frame to allow performing the electric connections and carrying out all the experiences described in the didactic manual in a simple and effective way from the learning point of view.

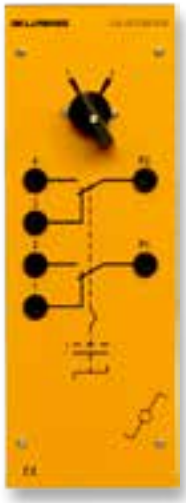
The modules that we propose for the Electric Measurements laboratory are the following:

Power supply (DL 1013M2)	Resistive load (DL 1017R)	Inductive load (DL 1017L)
Capacitive load (DL 1017C)	Transformer (DL 2101T13)	Synchronoscope (DL 2109T01)
Phase sequence indicator (DL 2109T02)	Static rectifier (DL 2109T03)	Variable resistance (DL 2109T04R)
Double change-over switch (DL 2109T06)	Micro-ammeter (DL 2109T10)	Milli-ammeter (DL 2109T11)
Ammeter (3 off) (DL 2109T12)	Voltmeter 25/50 V (DL 2109T14)	Voltmeter 250/500 V (DL 2109T15)
Frequency meter (DL 2109T16)	Single-phase wattmeter (DL 2109T17)	Single-phase phase meter (DL 2109T18)
Three-phase phase meter (DL 2109T19)	Direct current motor, shunt excitation (DL 1023P)	Three-phase synchronous machine (DL 1026A)
Base (DL 1013A)		

Synchronoscope



Double change-over switch



Three-phase phase meter

Single - phase wattmeter

The modules can be grouped to perform the following tests:

- DC current measurement
- AC current measurement
- DC voltage measurement
- AC voltage measurement
- Ohm's law
- Bridge circuit
- Capacitive reactance
- Power in DC circuit
- Power in single-phase circuit
- PF measurement in single-phase circuit
- Inductive reactance
- One-wattmeter method
- Two-wattmeter method
- PF measurement in three-phase circuit
- Four-reading method
- Six-pulse bridge circuit
- Synchronization of the three - phase alternator

Voltmeter

Resistive load

Three - phase
synchronous machine

The same laboratory can be also provided in the 300 W version, instead of the suggested 1.1 kW version.

To the above mentioned modules it is, then, necessary to add a two level (DL 2100-2M) or three level (DL 2100-3M) work frame and a set of connecting leads (TL 2109TM).

Work Benches for Electric Installations

Four place work bench with 4 independent supplies

Two place work bench with 2 independent supplies

The main feature of these work benches is their high flexibility and autonomy; they do not need a main distribution control panel, but just a cable to supply them the mains voltage.

Designed to allow the performance of wiring experiments in the area of civil and industrial installations, they offer the maximum work versatility in the laboratory. Thanks to the fast hook-up system for the panels on which the student makes his circuit, it is possible to store all the works that have not been completed in a single lesson and leave the frame free for other students.

The supporting structure is made of tubular, fire varnished and rustproof steel, while a large bi-laminated wooden surface can be used for tools and wiring accessories. Furthermore, the workbench is provided with compensator feet to offset unevenness of the floor. The power supplies are provided by means of a vertical module placed by the side of the work panels and all the supplies are protected according to current regulations.

On request, it is possible to add to the bench a series of accessories, such as: drawers, chest of drawers, central cabinets, socket-holders, work panels and containers to house the panels.

Industrial electric installations

Strip panel

In detail, the work benches and the kits of components that we propose in this laboratory are the following:

Work benches

Two place work bench with 2 independent supplies (DL 1101)	Four place work bench with 4 independent supplies (DL 1103)	Four place work bench with 2 independent supplies (DL 1104)
Two place wall work bench with 1 supply (DL 1106)	Single place bench-top work frame with 1 supply (DL 1107)	

Accessories

Drawer (DL 1001A2)	Chest of two drawers (DL 1001C2)	Chest of three drawers (DL 1001D2)
Socket holder (DL 1001F2)	Tool kit (DL 1100A)	Wooden panel (DL 1100B)
Twelve junction boxes panel (DL 1100C)	Six junction boxes panel (DL 1100C6)	Grid panel (DL 1100D)
Strip panel (DL 1100E)	Cabinet (DL 1100H)	Panel housing cabinet (DL 1100N)
Junction box (DL 1100SD)	Squirrel cage three-phase asynchronous motor (DL 10115AV)	Slip ring three-phase asynchronous motor (DL 2102A)
Dahlander two speed motor (DL 2102D)		

Kits for civil installations

Civil installations (DL 2101)	Lighting installations (DL 2101A)	Signaling installations (DL 2101B)
Intercom systems (DL 2101C)	Hotel signaling systems (DL 2101D)	Civil and hotel signaling systems (DL 2101E)

Kits for industrial installations

Basic industrial electric installations (DL 2102B)	Advanced industrial electric installations (DL 2102C1)	Complete industrial electric installations (DL 2102C2)

Squirrel cage three-phase asynchronous motor

Home Automation

Home Automation deals with technologies, devices and systems that provide, in a house or, more generally, in public and private buildings, increased quality of life and safety, energy saving, lower installation and maintenance costs for the electrical devices and simplified maintenance for the electrical system.

The system that we propose needs just a single bipolar conductor through which all the end users connected to the “bus line” communicate among them.

The products are compatible and interoperating among them, even if they come from different manufacturers. The system is then controlled and managed by a software package, through which the single components, all connected in parallel to the single bipolar line, gain their “individuality” through an identification address and are programmed for the type of function and for the system where they are installed.

The study subjects include the following categories: lighting systems, shutter control systems, safety systems and heating/air conditioning systems.

For all the above categories the manuals include practical exercises by using standard components. Each experiment describes step by step the design, the configuration and the commissioning of the system.

In detail, the modules that we propose for the Home Automation laboratory are the following:

Single phase power unit (DL 2101T70)	Bus power supply (DL 2101T71)	Push-button interface (DL 2101T72)
Movement detector (DL 2101T73)	Double push-button (DL 2101T74)	Smoke detector (DL 2101T75)
Ambient thermostat (DL 2101T76)	Brightness controller (DL 2101T77)	Binary output (DL 2101T80)
Universal dimmer (DL 2101T81)	Shutter actuator (DL 2101T82)	Valve actuator (DL 2101T83)
Infrared transmitter/receiver (DL 2101T84)	Scenery module (DL 2101T85)	Display unit (DL 2101T89)
USB interface (DL 2101T90)	Sockets with lamps (DL 2101T91)	Venetian drive (DL 2101T92)
2-channel clock switch (DL 2101T94)	Touch panel (DL 2101T95)	PLC LOGO! and communication module (DL 6BK1)
Programming software (DL SW-ETS)		

Smoke detector

The modules can be grouped in a set of standard configurations for the study of specific subjects, such as, for instance:

- Lighting
- Shutter control
- Safety
- Heating
- Scenery module
- Monitoring and Control

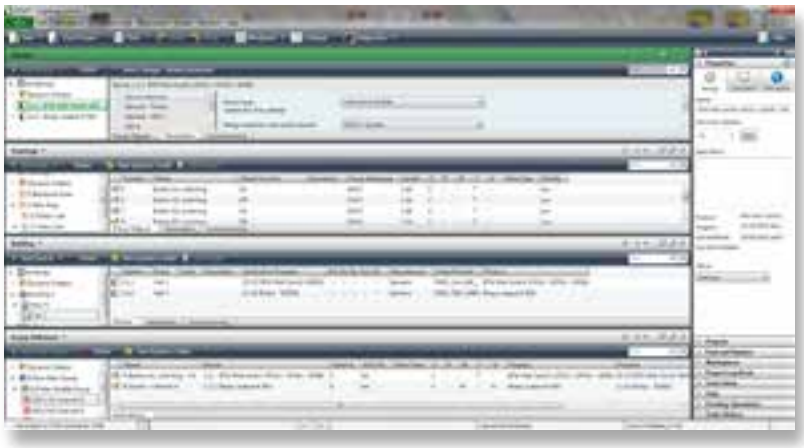
It is also possible to use a PLC for the control of the modules.

It is then necessary to add to the above mentioned modules a work frame with 2 or 3 levels, according to the number of modules forming the selected configuration, and a set of connecting leads.

Push-button interface

Sockets with lamps

Software

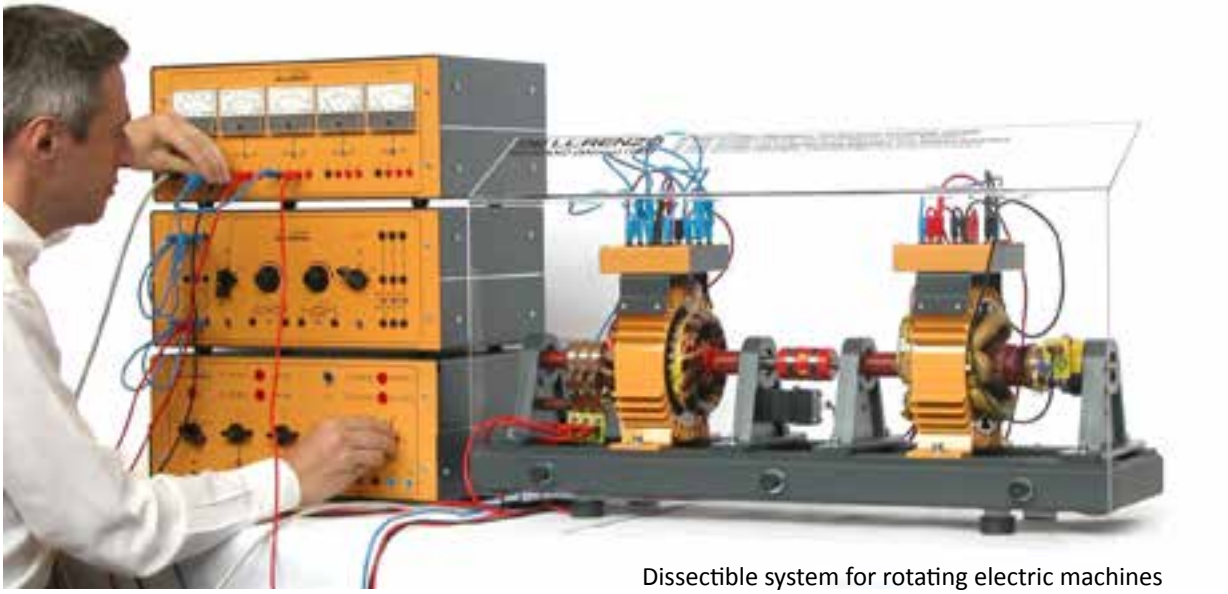


PLC

Valve actuator

Brightness controller

Electric Machines

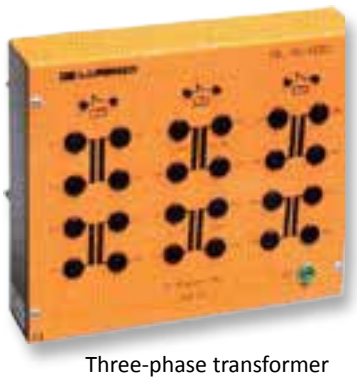


Dissectible system for rotating electric machines

The laboratories that we propose are equivalent for what concerns their general characteristics, but differ in the power of the electric machines:

- MICROLAB: 0.2 kW (with safe power supply at 24/42 V)
- OPENLAB: 0.2 kW ("open" type assembly system)
- EUROLAB: 0.3 kW
- UNILAB: 1.1 kW
- UNIPLAN: 3.5 kW

Electric power digital measurement module



Three-phase transformer

Squirrel cage three-phase asynchronous motor

Shunt excitation dc motor

Data acquisition and control software

Each laboratory is composed of:

- **Power supplies** able to provide all the voltages, fixed and variable, in dc and ac and rectified that are necessary for supplying the machines of the laboratory;
- **Bases** to fix the machines directly on the work bench;
- A complete set of **motors, generators, transformers, brakes, RLC loads, measurement modules and the necessary accessories** to be able to perform all tests on electric machines;
- **Data acquisition boards and software** for manual, semi-automatic and fully automatic data acquisition, processing and drawing of the characteristic curves in LabVIEW environment.

Each electric machine is provided with a comprehensive didactic manual that illustrates all the tests that it is possible to perform on that machine at no load and load conditions and coupled to the other machines of the laboratory.

The **OPENLAB** system is composed of: a coupling base, 2 stators (in ac and dc), 3 rotors (slip ring, squirrel cage and dc), a power supply module, a loads and rheostat module, an electric and speed measurement module and the necessary accessories for performing the tests on electric machines.

This system allows studying the magnetic field, the principles of the electromagnetic induction, the compound, series and shunt dc motors/generators, the three-phase induction motors (slip ring and squirrel cage) and the single-phase induction motors (repulsion and with capacitor), the Dahlander motor, the three-phase synchronous motor, the alternator, the universal motor and the permanent magnet motor.

Multifunction Digital System

Electro-mechanics

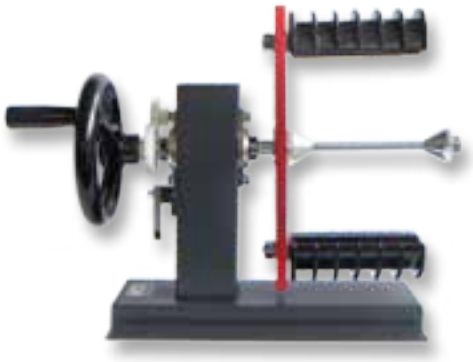
Kit for the construction of 4 asynchronous motors

The Electro-mechanics laboratory has been designed to introduce the design and the production of electric machines in a practical way, on the basis of the theory that the teacher has explained in its classroom. In this laboratory we propose a set of kits for the construction of motors and transformers, the winding machines for the realization of the copper coils and some necessary accessories for completing and testing the electric motors assembled by the students.

In detail, the equipment that we propose for this laboratory are the following:

Kit for the construction of an asynchronous motor (DL 2105)	Kit for the construction of 4 asynchronous motors (DL 2107)
Kit for the construction of 2 transformers (DL 2106)	Kit for the construction of 6 transformers (DL 2108)
Manual winding machine (DL 1010B)	Reel stick column with thread tightening device (DL 1010D)
Manual/automatic winding machine for transformers and motors (DL 1012Z)	Impregnating tank (DL C20)
Arc welder (DL 1010F)	Support for rotors (DL 1010C)
Dielectric strength tester (DL 1018)	Rotor tester (DL 1010E)
Bracket for motor kits (DL 2107BA)	Power supply (DL 1013M2)
Electric power measurement module (DL 1031)	Digital tachometer (DL 2026)
Electromagnetic brake (DL 1019M)	Base for 2 machines (DL 1013A)
Software for the design of electric machines (DL EMV)	

Manual winding machine



Manual/automatic winding machine for transformers and motors

Arc welder

Telecommunications

Communication protocols

Superheterodyne AM receiver

The laboratory of Telecommunications is composed of a set of modules for the study of the electronics used in telecommunications and of a set of trainers that deal with the most recent technologies in the field of Digital Communications and Networking, such as transmission through electromagnetic waves, Networking techniques and digital telephony.

Networking

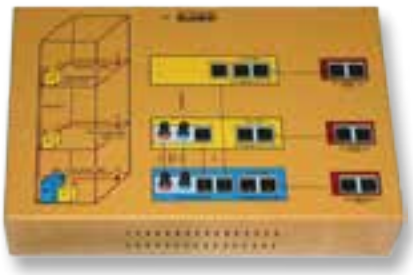
Communication protocols: HDLC, SDLC, X.25, Frame Relay, ATM (DL TC72)	Local Area Network and Intranet (LAN) (DL TC74)	Wide Area Network and Internet (WAN) (DL TC75)
Voice over IP (VoIP) (DL TC77)	Wireless LAN (WLAN) (DL TC78)	

Other products

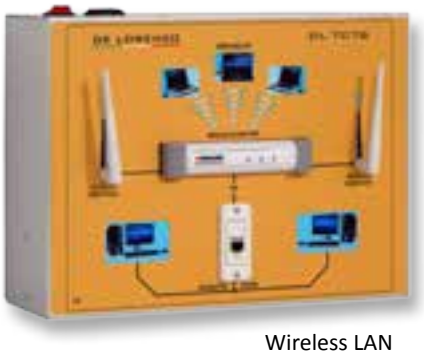
Digital telephone exchange trainer (DL 2156D2)	Microwaves trainer (DL 2594N)	Antenna trainer (DL 2595)

Electronics for telecommunications

Basic telecommunications trainer (DL 2153)	PLL circuits (DL 2530)
Frequency synthesizers (DL 2531)	Fourier synthesizer (DL 2520)
HI-FI amplifiers (DL 2155ST)	Amplitude modulation (DL 2500)
Frequency modulation (DL 2501)	SSB amplitude modulation (DL 2502)
FDM multiplexing (DL 2550)	AM transmitter (DL 2511)
AM super heterodyne receiver (DL 2510A)	FM transmitter (DL 2513)
FM receiver (DL 2512A)	SSB transmitter (DL 2514)
SSB receiver (DL 2515)	DELTA modulation (DL 2542)
PWM-PPM modulation (DL 2543)	Differential PCM modulation (DL 2545)
PAM multiplexing (DL 2540)	PCM multiplexing (DL 2541)
Base band data transmission (DL 2560)	ASK modulation (DL 2561)
FSK modulation (DL 2562)	PSK modulation (DL 2563)
Transmission lines (DL 2597)	Fiber optics (DL 2570)

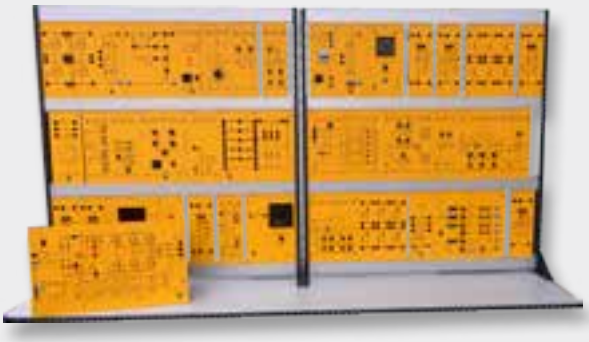


Local Area Network (LAN) and Intranet



Wireless LAN

Power Electronics



The objective of power electronics is the control of the power flow through the conversion of the mains voltages by means of power semiconductors able to perform the functions of switching, control and conversion of electric energy in an efficient and reliable way.

De Lorenzo has realized a laboratory for the study of power electronics that provides to the student a practical learning based on the performance of guided exercises.

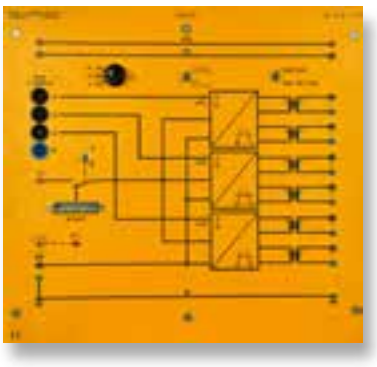
The study subjects include the following categories:

- AC/DC conversion
- AC/AC Conversion
- DC/DC conversion
- DC/AC conversion
- DC motors drives
- AC slip ring motors drives
- AC squirrel cage motors drives

The laboratory is modular and includes more than 60 elements, panel type and bench type, that can be purchased also gradually, starting from the most interesting subjects, to reach the integration of the full laboratory at a later time.

In detail, the laboratory is composed of the following modules:

Selenium rectifier (DL 2601)	Silicon diode (DL 2602)	Group of diodes (DL 2603)
SCR (DL 2604)	Group of SCR (DL 2605)	TRIAC (DL 2607)
MOSFET (DL 2608)	IGBT (DL 2609)	Group of IGBT (DL 2610)
Bridge three-phase rectifier (DL 2611)	SCR with turn off circuit (DL 2612)	DC power supply (DL 2613)
Voltage reference generator (DL 2614)	Trigger point limiter (DL 2615)	Two pulse control unit (DL 2616)
Six pulse control unit (DL 2617)	PWM, PFM and TPC control unit (DL 2619)	Run-up control unit (DL 2620)
PID controller (DL 2622)	Absolute value generator (DL 2623)	Adaptive PI controller (DL 2624)
Matching amplifier (DL 2625)	Mains transformer (DL 2626)	Capacitors (DL 2627)
Super-fast fuses (DL 2628)	Switching transformer (DL 2629)	Current transformer (DL 2630)
Trigger pulse switch (DL 2631)	Switching logic (DL 2632)	Function generator (DL 2633)
Voltage divider 20:1 (DL 2634)	Load (DL 2635)	Sockets with lamps (DL 2636)

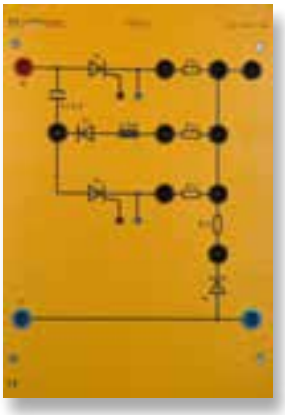


Six pulse control unit

Software

Shunt excitation DC motor

Stabilized power supply (DL 2637)	Phase control fault simulator (DL 2639)	EMI filter (DL 2640)
Isolation amplifier (DL 2642)	Support with 3 shunts 1 Ω (DL 2643)	Support with 3 shunts 0,1 Ω (DL 2644)
Frequency converter (DL 2646)	PWM control unit (DL 2648)	PC interface (DL 2650)
Power electronics software (DL 201SW)	Induction motor control software (DL 205.3SW)	Variable three-phase transformer (DL 2655)
Battery stack (DL 12B12)	Tachometer (DL 2025DT)	Single-phase supply unit (DL 2108SAL)
Three-phase supply unit (DL 2108TAL)	Power meter (DL 2109T26)	True RMS meter (DL 2109T33)
Moving iron voltmeter (DL 2109T3PV)	Moving iron ammeter (DL 2109T2A5)	Squirrel cage 3-phase asynchronous motor (DL 10115A1)
Slip ring 3-phase asynchronous motor (DL 10120A1)	Rotor starter (DL 10120RA)	Shunt excitation DC motor (DL 10200A1)
Shunt excitation DC generator (DL 10250A1)	Powder brake (DL 10300P)	Load cell (DL 2006D)
Powder brake control unit (DL 10300PAC)	Base (DL 10400)	Flywheel (DL 10410)
Electronic stop clock (DL CRON)		

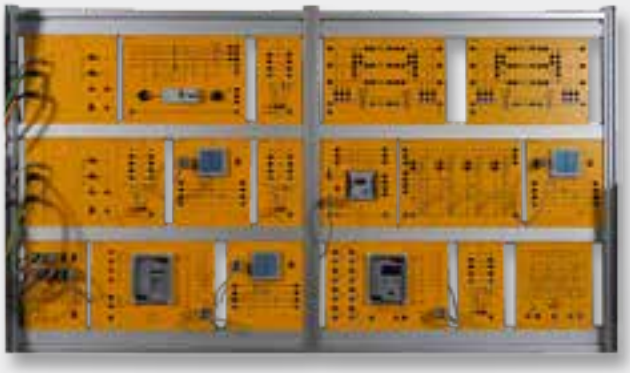


SCR with turn off circuit

True RMS meter

Stabilized power supply

Electrical Power Engineering



The Electrical Power Engineering laboratory deals in a complete and systematic way the subject of the electric energy cycle, from its generation to its transmission and distribution over high voltage lines, with relevant protection relays, and its utilization by the end users.

Therefore, the laboratory is divided in four main sections:

- Energy generation, where we study a bipolar alternator driven by a dc motor and different synchronization circuits.
- Energy transmission and distribution, where we analyze a three-winding transformer and a line model to study its characteristics at different load conditions.
- Protection techniques, where we study the measurement transformers and the relays that are most frequently used for the protection of the lines.
- Energy utilization, where we discuss the problems relevant to the compensation of the reactive energy and the methods with the devices needed for the measurement of the electric energy in alternate current and in three-phase networks.

The laboratory is modular and includes more than 60 elements, panel type and bench type, that can be purchased also gradually, starting from the most interesting subjects, to reach the integration of the full laboratory at a later time.

Double voltmeter

Three - phase power meter

Earth fault control relay

In detail, the laboratory is composed of the following modules:

Variable three-phase power supply (DL 1013T1)	Variable DC power supply (DL 1013T2)	Line model (DL 7901TT)
Three-phase transformer (DL 1080TT)	Resistive load (DL 1017R)	Inductive load (DL 1017L)
Capacitive load (DL 1017C)	Shunt DC motor (DL 1023PS)	Three-phase synchronous machine (DL 1026A)
Three-phase squirrel cage asynchronous motor (DL 1021)	Magnetic powder brake (DL 1019P)	Brake control unit (DL 1054TT)
Load cell (DL 2006E)	Optical transducer (DL 2031M)	Universal base (DL 1013A)
Electronic tachometer (DL 2025DT)	Experiment transformer (DL 1055TT)	Three-phase power supply (DL 2108TAL - SW)
Variable DC power supply (DL 2108T01)	Power circuit breaker (DL 2108T02)	Double busbar with two disconnectors (DL 2108T02/2)
Double busbar with four disconnectors (DL 2108T02/4)	Line capacitor (DL 2108T03)	Petersen coil (DL 2108T04)
CT load (DL 2108T10)	VT load (DL 2108T11)	Under/over-voltage time relay (DL 2108T12)
Inverse time over-current relay (DL 2108T13)	Definite time over-current relay (DL 2108T14)	Combined over-current and earth-fault (DL 2108T15)
Single-phase directional relay (DL 2108T16)	L/C loads (DL 2108T17)	Earth fault control relay (DL 2108T18)
Reactive power controller (DL 2108T19)	Switchable capacitor battery (DL 2108T20)	Differential transformer relay (DL 2108T21)
Distance protection relay (DL 2108T22)	Feeder manager relay (DL 2108T23)	Generator protection differential relay (DL 2108T24)
Moving coil ammeter, 1 A (DL 2109T1A)	Moving coil ammeter, 2.5 A (DL 2109T2A5)	Moving iron ammeter, 5 A (DL 2109T5A)
Moving iron voltmeter, 600 V (DL 2109T1PV)	Moving iron voltmeter, 125-250-500 V (DL 2109T3PV)	Synchronization indicator (DL 2109T1T)
Phase sequence indicator (DL 2109T2T)	Double frequencymeter (DL 2109T16/2)	Double voltmeter (DL 2109T17/2)
Single-phase current transformer (DL 2109T21)	Three-phase current transformer (DL 2109T22)	Single-phase voltage transformer (DL 2109T23)
Three-phase voltage transformer (DL 2109T24)	Summation current transformer (DL 2109T25)	Power meter (DL 2109T26)
Power factor meter (DL 2109T27)	Three-phase power meter (DL 2109T29)	Three-phase active and reactive energy meter (DL 2109T34)
Synchronoscope (DL 2109T32)	Moving coil ammeter (DL 2109T1AB)	Moving coil voltmeter (DL 2109T2VB)
Acoustic continuity tester (DL BUZ)	Electronic stop clock (DL CRON)	Connecting leads (DL 1155GTU)
Three-level frame (DL 2100-3M)		

Autotronics

Hybrid and electric systems

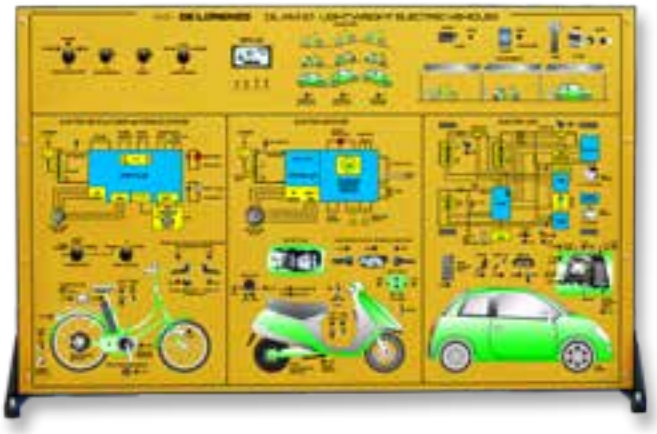
Electronic technology has strongly entered the automotive field and is currently influencing the main characteristics of the people working for the maintenance and the improvement of the vehicle operation.

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.

To fulfill the training needs of the automotive industry, DE LORENZO has realized a multidisciplinary 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 set of simulation panels for the study of the electrical and electronic systems and sub-systems that are used in modern motor vehicles and of a set of demonstration trainers with real components for a more direct and practical approach to the automotive subject.

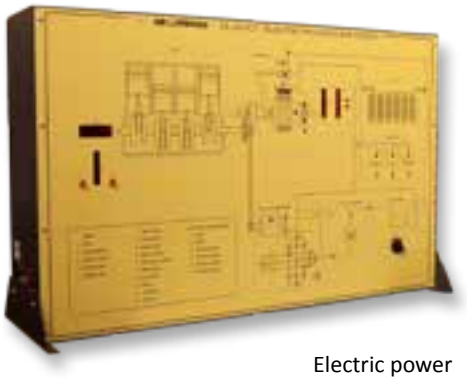
The simulators are provided with a CAI (Computer Assisted Instruction) software and can be connected in a local network with a control software for the teacher. The possibility to insert simulated faults increases the flexibility of these didactic systems and make them well suited for training a modern engine mechanic.



Lightweight electric vehicles

ABS/ASR brake power control system

Control software



Electric power

Ignition system

In detail, the trainers that we propose for the Autotronics laboratory are the following:

Simulation panels

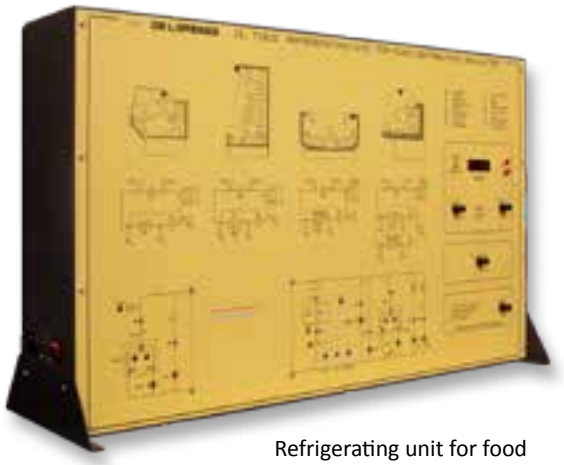
Air conditioning for automobiles (DL AM01)	Engine starting (DL AM02)
Electric circuits (DL AM03)	Engine operation (DL AM04)
Sensors and controls (DL AM05)	Emissions control system (DL AM06)
Electric power system (DL AM07)	Electric components (DL AM08)
Electric components of big vehicles (DL AM09)	Big vehicles starting system (DL AM10)
Hydraulics brakes (DL AM11)	Electronic fuel injection (DL AM12)
Ignition system (DL AM13)	ABS braking system (DL AM14)
Diesel engine management system (DL AM15)	Common rail direct injection for diesel engine (DL AM16)
Passive safety devices for motorcars (DL AM17)	Hybrid systems (DL AM20)
Light electric vehicles (DL AM21)	Hybrid and electric systems (DL AM22)

Demostration panels

Ignition and injection control trainer (DL DM12)	Car lighting system trainer (DL DM20)
Vehicle sensor system (DL DM21)	Common rail diesel engine management system (DL DM22)
SRS airbag system (DL DM23)	D-JETRONIC compact (DL DM24)
ABS/ASR brake power control system (DL DM28)	CAN BUS in the comfort system (DL DM30)
Car air conditioning system (DL DM31)	Emission control (DL MINICAR-05)

Emission control

Thermotronics

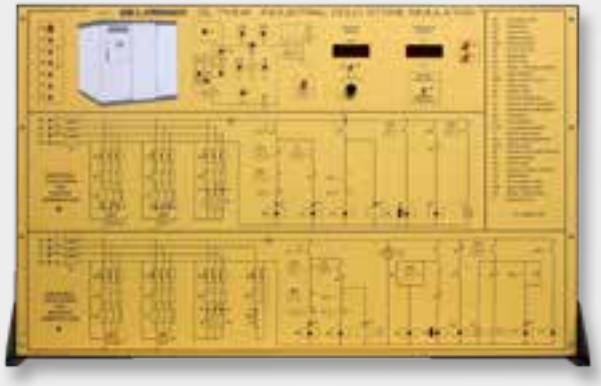


Refrigerating unit for food distribution simulator

The Thermotronics laboratory, that studies the subjects related to the refrigeration cycles and to the air conditioning, heating and sanitary water production systems, is composed of simulation and demonstration panels.

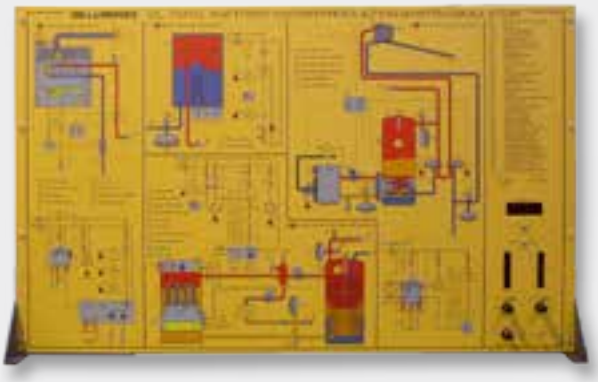
The simulators are provided with a CAI (Computer Assisted Instruction) software and can be connected to a LAN network with a teacher control software. The possibility to insert simulated faults increases the flexibility of these didactic systems that are suitable for the training of present-day installation technicians.

Air - conditioning system simulator

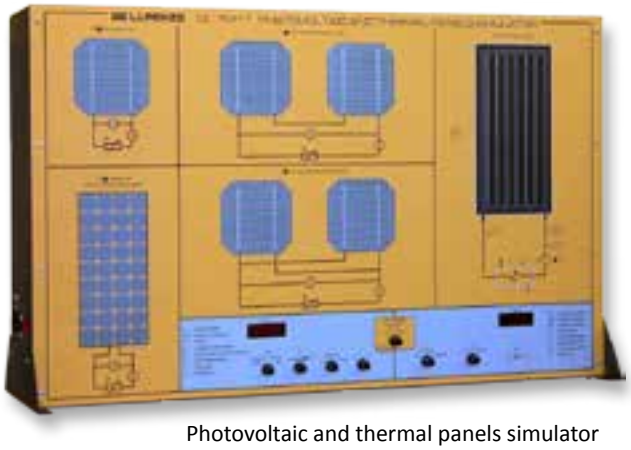


Industrial cold store simulator

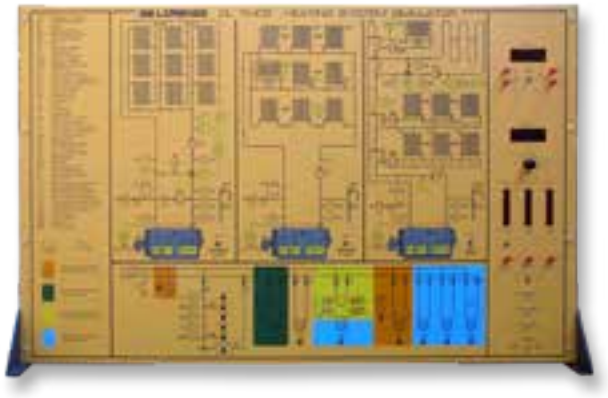
CAI Software



Sanitary water production system simulator



Photovoltaic and thermal panels simulator



Heating system simulator

In detail, the trainers that we propose for the Thermotronics laboratory are the following:

Refrigeration

Refrigerating cycles simulator (DL TM01)	Domestic refrigerating systems simulator (DL TM02)	Refrigerating unit for food distribution simulator (DL TM03)
Industrial cold store simulator (DL TM04)		

Air conditioning

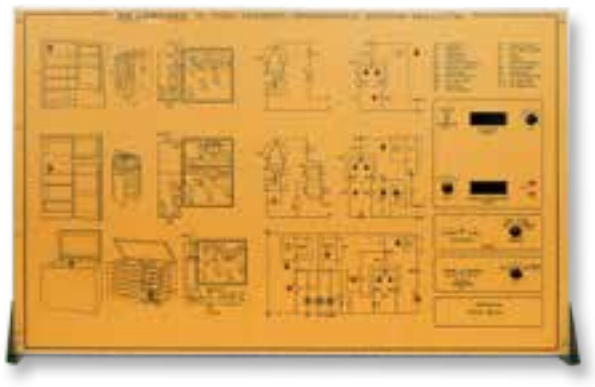
Air-conditioning system simulator (DL TM05)	Mixed air-conditioning system simulator (DL TM06)	Domestic air-conditioning system simulator (DL TM07)
Heat pump air-conditioning system simulator (DL TM08)	Air conditioning for automobiles (DL AM01)	

Heating

Heating system simulator (DL TM09)	Sanitary water production system simulator (DL TM10)

Solar energy

Photovoltaic and thermal panels simulator (DL TM11)



Domestic refrigerating systems simulator

Oil & Gas and Industrial Chemistry

Water treatment

The chemical energy is a manifestation of energy. In particular, it is an aspect of the internal energy of a body: even if it is always present in the matter, it manifests itself only when there is an alteration in the matter itself.

Chemical energy is the one that moves cars, ships and planes and, in general, millions and millions of machines. Both the combustion of coal, wood or oil in steam machines and the combustion of petroleum derivatives in the narrow space of the cylinders of an internal combustion engine are chemical reactions.

Mankind has always used the chemical reactions to produce energy, from the most rudimentary, such as burning of wood or coal, to the most sophisticated, which occur in the engines of modern aircraft or spacecraft.

In our laboratory, we study the basic processes, such as absorption, desorption, adsorption, liquid-liquid and solid-liquid extractions, chemical reactions, etc., water treatment and gas treatment.

Particular attention is paid to the equipment and chemical processes used in the petroleum industry, particularly those that are most commonly used in refineries for processing crude oil into finished products.

Chemical reactions

PH control

Absorption-Desorption

The laboratory of chemical and petrochemical engineering is also involved in studying the types of equipment that find within a refinery a distributed and intensive use, such as compressors, various types of pumps, fans, heat exchangers, etc.

Finally, a topic of particular interest in the oil industry, but not only, is the study of the phenomenon of corrosion of metal structures and of the methods to combat it. In particular, in the laboratory we can test the techniques for the prevention of the corrosion by the method of the cathodic protection, both of the type with sacrificial anodes and of the impressed current.

Some of the products proposed for the study of chemical and petrochemical engineering are the following:

Absorption/desorption (DL CH11)	Combined chemical reactor (DL CH12)	Continuous distillation (DL CH13)
Gas purification (DL CH14)	Liquid-liquid extraction (DL CH15)	Solid-liquid extraction (DL CH16)
Heat exchangers (DL PH02)	Process control (DL 2314BR)	Air compressors (DL LSM-C)
Series/parallel pumps (DL 8H402)	Centrifugal fan (DL FA75)	Pressure vacuum breaker (DL OG10)
Single-stage compressor (DL OG11)	8 pumps demonstration test stand (DL 9010)	Cathodic protection training bench (DL MK1)
Single-station cathodic protection training bench (DL MK2)		

Study of cathodic protection

Study of chemical reactions

Food Technology

Multi-function bench for jam, marmalade, tomato sauce and sauces

The laboratory of Food Technology allows studying the technologies used for the processing of fruit, vegetables and milk, both in manual and automatic mode with the PLC.

The laboratory consists of individual machines or complete systems, including pilot plants for small production units and for research centers in Universities and schools.

These pilot plants allow, in fact, treating small inlet quantities of raw material.

The laboratory is composed of single machines or plants for the preparation of:

- Jams and preserves
- Fruit puree, juices and nectars
- Tomato paste
- Candied fruit
- Fruit and vegetables, dried
- Vegetables and canned food in oil or vinegar
- Liqueurs and infused herbal and fruit
- Milk
- Yogurt and cheese

Secondary Education

Industrial control system

This laboratory includes all those products that are used for the learning of basic technologies in various sectors such as electrical engineering, electronics, renewable energy, automation, physics, chemistry, etc.

Science, Technology, Engineering and Mathematics are considered worldwide fundamental topics for the development of a nation. For this reason, they are given special attention and commitment on the part of all educational institutions.

Some of the products of the laboratory:

Kit for the study of electricity and electromagnetism (DL 2160)	Kit for the study of basic electronics (DL 2152)	Industrial control system (DL CIM-S)
Kit for the study of solar, wind and hydrogen fuel cells energy (DL SOLAR-L, DL WIND-L, DL HYDROGEN-L)	Platform for experiments of electricity, electronics, thermodynamics, biology, chemistry, mobile telephony, time measurement (DL 2150)	System for the study of physics (DLE PHYSICS)

IQNet

THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

CISQ/IMQ-CSQ

DE LORENZO SPA

VIALE ROMAGNA 20 - 20085 ROZZANO (MI)

has implemented and maintains a

Quality Management System

which fulfills the requirements of the following standard

ISO 9001:2008

Registration Number: IT - 13308

President of IQNet

President of CISQ

LL-C (Certification)

De Lorenzo Spa

ISO 14001:2004

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