



ELECTROCHEMISTRY TEST BENCH

DL MK3



The DL MK3 is a multifunction bench developed for the study of the main aspects of electrochemistry, starting from basic topics such as the operation of a battery or the galvanic bath, up to more complex topics such as cathodic protection or accelerated corrosion.

The test bench provides a full didactic experience, providing the fundamental concepts behind the most common applications of electrochemistry and putting them to the test through a complete set of experiences.

An innovative data acquisition system collects all the experimental values from the different instruments included in the test bench and uses a web-based interface to make them available through a data network. The use of this type of application allows simple and immediate access to the data from any device equipped with a web browser and a WiFi connection, ensuring compatibility across multiple platforms and devices such as PCs, tablets, smartphones, and even smart TVs.

*Tablet not included



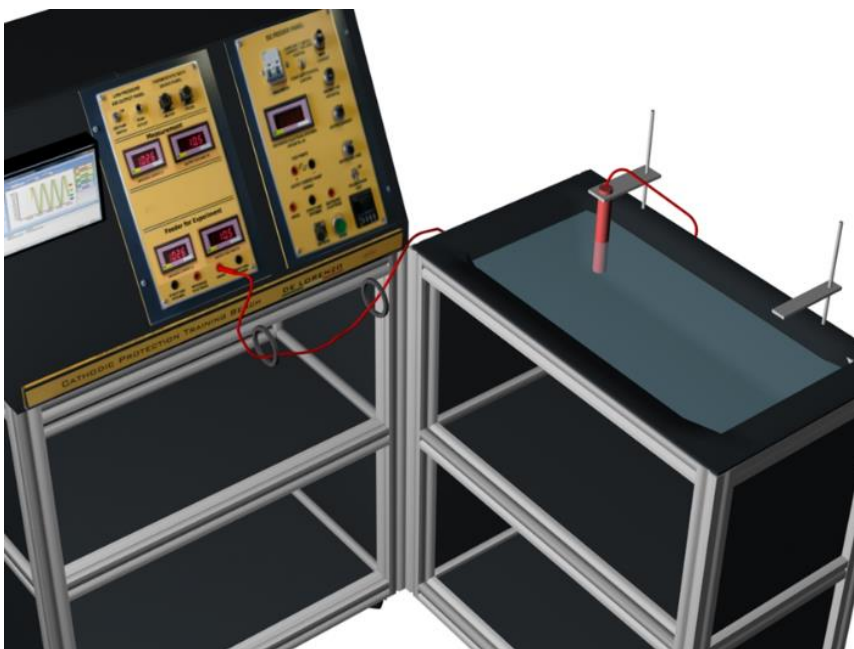
TEST BENCH STRUCTURE

The test bench consists of two main blocks joined together with a hinge: the control unit, which includes all electronic equipment, and the secondary unit that includes a basin for carrying out the practical tests.

When closed, the test bench can store all the accessories avoiding the spread of teaching material. Its compact size makes the trainer portable and thanks to the wheels mounted on the base, it can be easily moved from the teaching classroom to the appropriate laboratory to execute the more complex experiments.



The control unit has a convenient cable holder to pass all the test leads, making the workplace safe and clutter-free.



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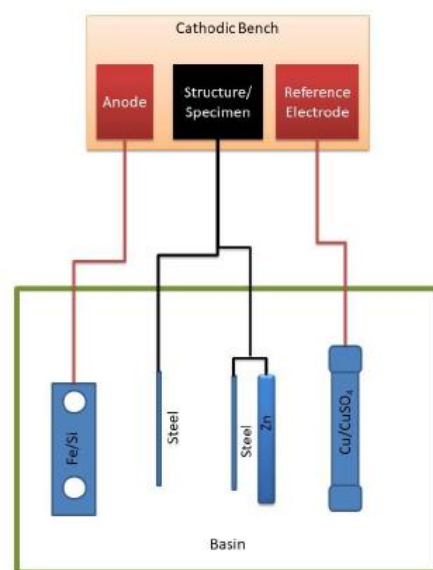
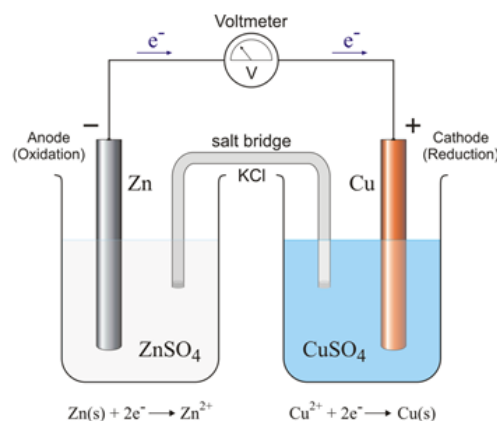
DIDACTIC EXPERIENCE

The test bench is built to provide a complete teaching experience. The theoretical-practical manual was developed to introduce the concepts related to the world of electrochemistry and validate them through practice.

The gradual structure of the course starts with the study of the basic concepts of electronics, with particular attention to the relationship between resistance, potential, current, and current density, and then moves on to the electrochemical tests on materials.

Practical experiments:

- Electronic basics: the use of voltmeter and introduction to resistance.
- Introduction to electrochemistry:
 - o 1st and 2nd type conductors
 - o Resistance concept, a circuit for the 1st and 2nd type conductors.
 - o Specific resistance.
 - o Redox reaction: Corrosion processes.
 - o Potential difference measurement and reference electrodes.
- Conventions and electrochemical cells:
 - o Anode/Cathode Conventions
 - o Potential standard, Nernst Equation
 - o Galvanic cell / Daniell cell
 - o Electrolytic cell, electroplating, and spontaneous deposition.
- Influence of external conditions (temperature, air, and salinity) on the potential.
- Polarization and overpotential concept (Tafel equation).
- Cathodic protection:
 - o NACE criteria
 - o Galvanic Anode
 - o Impressed current compared to the galvanic anode
 - o Impressed current with the consumable anode
 - o Impressed current with the lower consumable anode
 - o Tafel law, Evans diagrams, and corrosion rate.
- Stray currents.
- Coating, oxidation protection: coating influences on current density.
- Electrodeposition processes.



Through practical tests, it will be possible to observe the effects of these principles on different materials, how they behave when put in contact with other agents, how they react under certain conditions, and how to protect them using various techniques.



SOFTWARE OVERVIEW

The test bench is supplied with an innovative data acquisition software that uses a microcomputer to allow remote access through the laboratory's internet network. The software has a multi-device interface to properly display data on PCs, tablets, smartphones, and smart TVs.

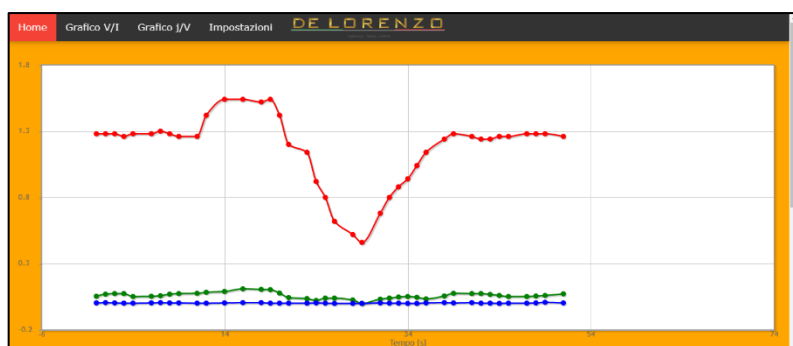
The microcontroller and the acquisition boards are quickly accessible and removable for easy replacement and maintenance.

The software is simple and intuitive with a learning curve suitable for all types of users. There are no configurations, hidden menus, or driver installation to complicate its use.

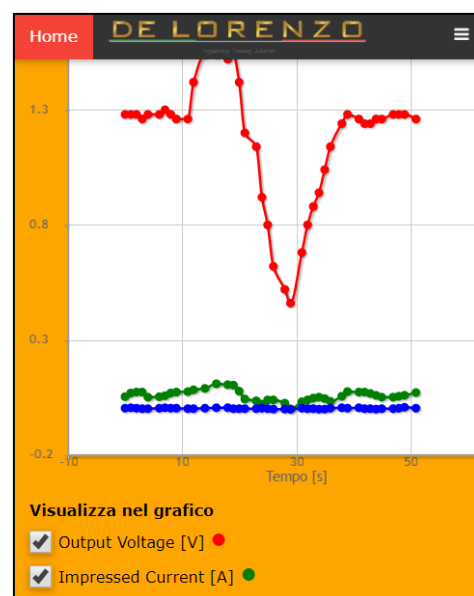
Everything is designed to perform what is required for the experiments and the primary needs of the discipline.

It is possible to use the acquired data to create Cartesian graphs, as a function of time or other values, needed to do a complete analysis of the element under study.

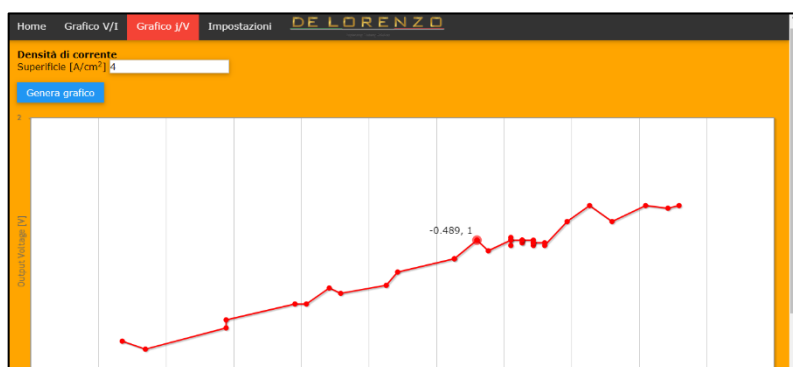
The acquired data can be downloaded directly on a PC for further analysis, or to use in student projects, papers, publications, or thesis.



Desktop version Graph 1



Mobile version Graph



Desktop version Graph 2



TECHNICAL SPECIFICATIONS

- Foldable test-bench with a waterproof top surface and internal shelves mounted on wheels.
- Potentiostat/galvanostat with 2 DC outputs (configurable as constant voltage, constant current, or constant potential). Max Voltage 30V, max. Current 1A.
- Electrical measurement panel with digital voltmeter and ammeter.
- Thermostatic bath panel with heater and temperature probes.
- Low-pressure air output.
- 4 channel data acquisition interface with USB and WiFi connectivity. (16bit, max. voltage 50V, max. current 3A). Provided with PC interface and software for data acquisition.
- Power supply: 230Vac 50Hz

LIST OF MATERIALS

- 10 Aluminium electrodes;
- 10 Bare Carbon steel electrodes;
- 10 Coated Carbon steel electrodes (coated with epoxy compound);
- 10 Copper electrodes, 12x100mm, thickness 1mm;
- 10 Magnesium electrodes diam 20x100 mm;
- 10 Zinc electrodes diam 10x100 mm;
- 4 Fe/Si Anode 25mmx150mm;
- 2 Cu/CuSO₄ portable reference electrode;
- 2 Ag/AgCl portable reference electrode;
- 4 metal wire diam 1mm, lenght 0,5m (Cu, Ag, Fe, Fe/Cr/Ni);
- Reagents (AlSO₄, CuSO₄, HCl, MgSO₄, NaCl, NaOH, NH₃, ZnSO₄) in plastic containers (0,25kg or 0,100 kg/each);
- Salt bridge;

ACCESSORIES

- Multimeter;
- Electronics pH-meter;
- Black and Red 4mm cables;
- Water Heating resistance;
- Temperature probe;
- Fluid resistivity cell;
- Solid rod resistivity cell;
- Test circuit with lamp;
- Adjustable resistor 10 Ω ;
- Set of transparent basins and graduated pitchers.
- Protection glasses and set of latex gloves;
- Plastic tube for pressured air with diffuser;
- User and experiments manuals;