

Experimental Data Acquisition System

CHEMISTRY SENSORS



pH

LW-C801

Range: 0~14

Resolution: 0.01

- Measure the pH value of solution



pH B

LW-C807

Range: 0~14

Resolution: 0.01

- Measure the pH value of solution
- Characteristic of quick response

**NEW**

Notes in Using pH Sensor:

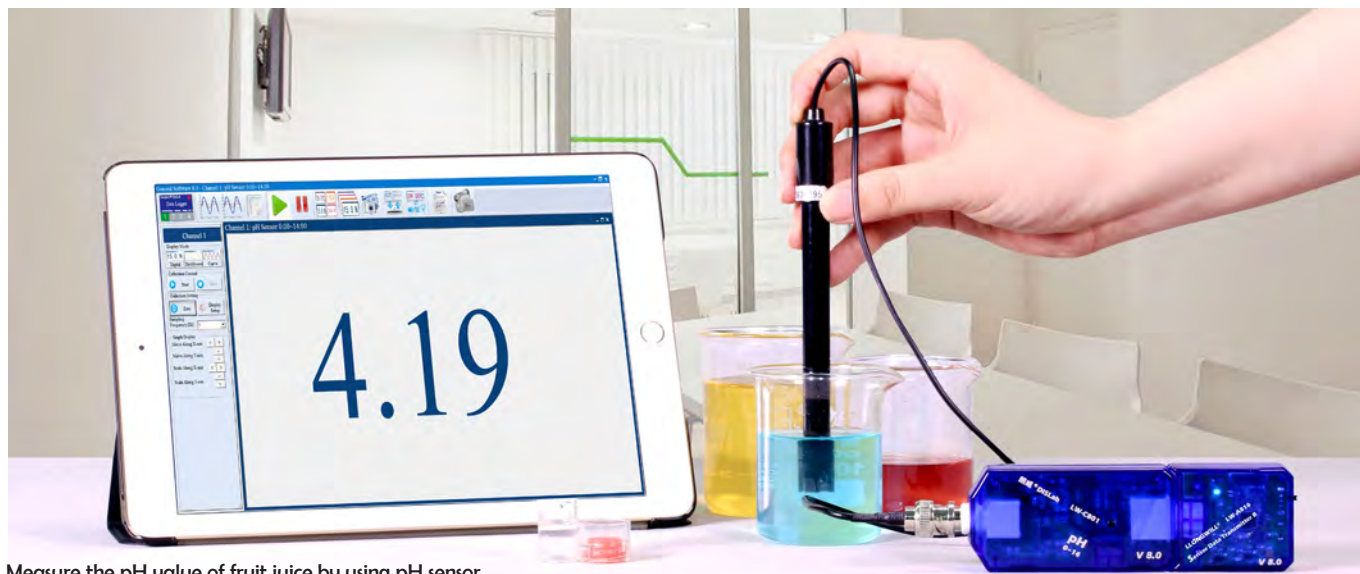
- The glass bulb of front end of electrode shall be immersed in the solution completely;
- Sensor electrode shall be rinsed before and after usage and before measuring different liquids. Cleaning method: wash electrodes with distilled water then gently dry the electrodes with absorbent tissues; No rubbing the electrode to avoid damaging;
- Ensure that there is sufficient activated fluid with ingredient of activated fluid is 3.3mol/L KCl solution, in the sealing cap. Users should fill regularly with self-prepared electrode activated fluid by themselves according to the ingredient.

Typical Applications:

Acid-base neutralization titration (as blow); determination of acetic acid ionization equilibrium constant; simulation of acid rain formation; pH measurement of different drinking water; effect of temperature on the ionization equilibrium of acetic acid; acid rain monitoring.



The results of Acid-base Neutralization Titration by using pH sensor



Measure the pH value of fruit juice by using pH sensor

Conductivity

LW-C802

Range: 0ms/cm~20ms/cm

Resolution: 0.001ms/cm

- Measure the conductivity of solution

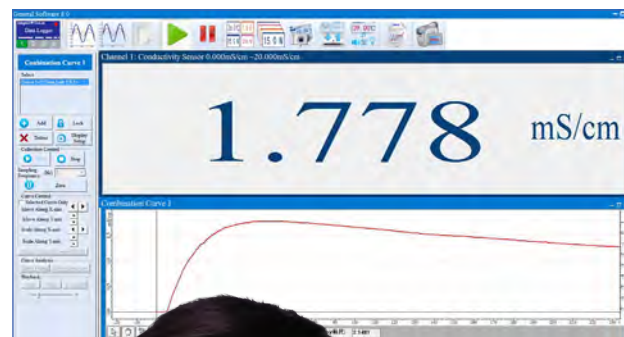


Typical Applications:

- Solution conductivity measurement
- Conductivity titration
- Concentration determination of strong electrolytes
- Effect of temperature on the acetic acid ionization equilibrium
- Effect of concentration on the ionization of electrolytes
- Study on the substance of ionic reaction
- Change of ion concentration during the dilution of glacial acetic acid



Glacial acetic acid dilution experiment (results as below)



Conductivity titration experiment



Chroma

LW-C803

Range: 0~100%

Resolution: 0.1%

- With build-in luminous tube and receiver
- can distinguish the light transmittance of 3 kinds of colors.
- light transmittance can be converted absorbency.
- Assorted with a cuvette



Typical Applications:

- Determination of a colored solution
- Determination of the protein content
- water quality measurement



Principle of Chroma Sensor:

Pure water is colorless and transparent. However, water would appear a certain color with dissolution of various substances. Chroma of water is the indicator used for color quantitative determination of water or various aqueous solutions. There are two methods in determining solution chroma: The colorimetric method and the dilution method. The unit of both methods is percentage. The transmittance of light penetrating through solutions is determined with the chroma sensor. There are luminous tube and receiving tube built in the sensor. Between them, there is a cuvette filled with solution samples. The receiving tube receives the transmission light after penetrating the cuvette and convert it to the transmittance of solution.

Turbidity

LW-C804

Range: 0NTU ~ 400NTU

Resolution: 0.1NTU

- NTU means the nephelometric turbidity unit
- 1NTU means the cloudiness or haziness caused by putting 1mg SiO_2 into 1L of water



Typical Applications:

- Effect of concentration on chemical reaction rate
- Water quality test



Principle of Turbidity Sensor:

Turbidity is the impeding degree of suspended solids in the water to the light penetration. A beam of parallel light is spreading in the transparent liquid. If there are not suspended particles in the liquid, the light beam would spread in the form of straight line and would not change its direction; if there are suspended particles, the light beam would form scattered light (that is the measured value at the 90 degree direction of incident light) when meeting the particles. The more the suspended particles in the solution (the more turbidity), the more fierce the scattering phenomenon is, and the larger the turbidity is. Turbidity unit is in NTU. Scattered light intensity is in direct proportion to the solution turbidity within a certain turbidity range under the condition that incident light is constant. Solution turbidity could be measured following this law.

High-temperature

LW-T802

Range: 0°C~1200°C

Resolution: 1°C



Be careful to protect the probe!

Typical Applications:

- Compare the temperature of different parts of alcohol lamp flame
- Compare the melting temperature of different metals
- Study on the conductivity of melted KNO_3

Experiment examples:

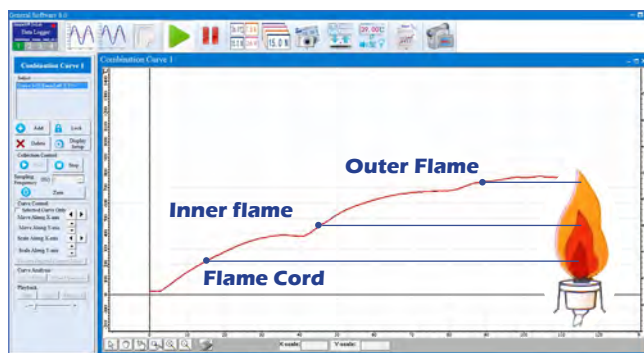
- ▶ Measure and compare melting temperatures of soldering tin, tin and lead etc.
- ▶ **Principle:** Melting point of soldering tin different from that of fine metal (tin and lead) which constitutes alloy.
- ▶ **Apparatus:** Data logger; high temperature sensor; copper sheet; soldering tin; tin; lead; alcohol lamp and iron stand.
- ▶ **Operation:** Put soldering tin, tin and lead on the copper sheet. Then light the alcohol lamp. When soldering tin, tin and lead starting to melt, record the temperatures individually.
- ▶ **Notes:** Three high temperature sensors could be parallel used to measure the temperatures of three metals individually in order to improve experimental efficiency and reduce operation processes. The experiment shall be carried out in the fuming cupboard since harmful gas will be distributed in melting of tin.



Melting point of soldering tin



Measure the temperature of different parts of alcohol lamp flame, results as below



Measure and compare melting temperatures of soldering tin, tin and lead

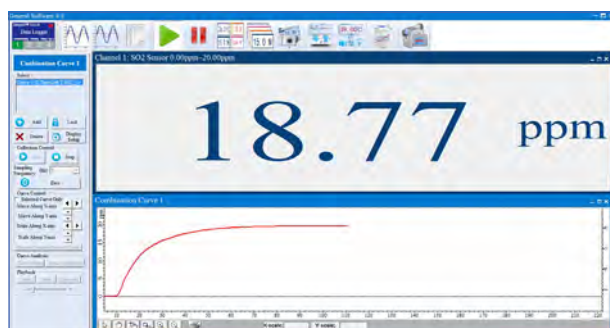
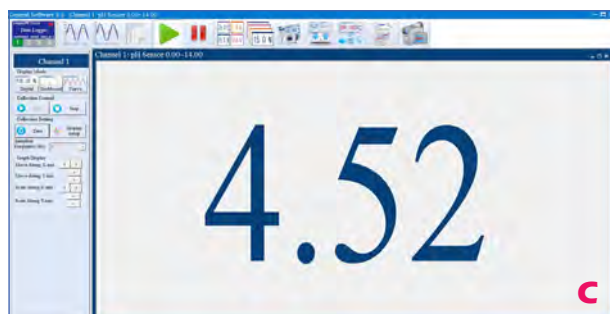
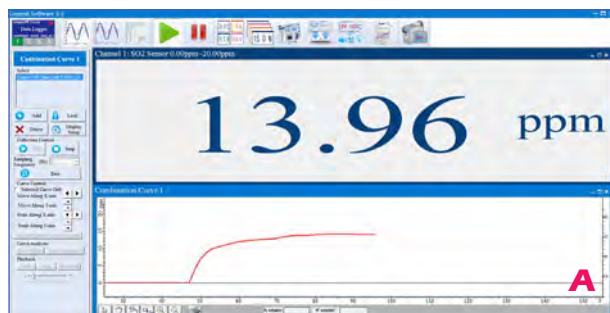
SO₂

LW-C841

Range: 0ppm~20ppm

Resolution: 0.01ppm

- Measure the SO₂ content in the air

Results of measuring content of SO₂ in cigarette smoke**Experiment Example:**

► **Principle:** Rainfall with pH less than 5.65 is called acid rain. Acid rain is mainly caused by a large number of acidic materials, mainly SO₂ and tail pipe exhaust that come out of vehicles.

► **Apparatus:** Data Logger, SO₂ sensor, pH sensor, 250mL gas bottles, rubber stoppers, 5mL syringes.

► **Operation:**

① Inject prepared SO₂ into the 250 mL gas bottle with a 5mL syringe. It can be observed that readings of SO₂ increases obviously (graph A on the left);

② Inject distilled water into the same 250 mL gas bottle with the 5mL syringe and shake the gas bottle properly. As SO₂ is water-soluble, it can be observed that readings of SO₂ decreases obviously (graph B on the left);

③ Pour the solution in the gas bottle into a beaker. Test the pH and you will find that the solution is acidity (graph C on the left).

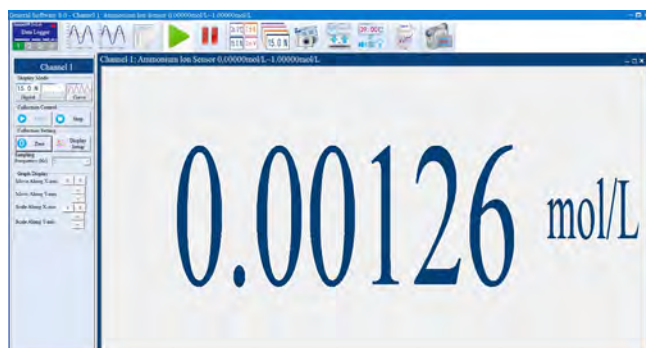
Measurement of SO₂ contents in cigarette smokeMeasurement of SO₂ contents in the air around power plant



LW-C834

Range: 0~1 mol/L

- Used to measure the NH_4^+ concentration in solution

Experiment results of measuring the content of NH_4^+ in fertilizer

Typical Applications:

Concentration testing of NH_4^+ in the chemical fertilizer;
determining of ammonium hydroxide ionization constant;
influence of temperature to ammonium hydroxide ionization;
determining of ammonium salt solution concentration, etc.

Concentration determination of NH_4^+ in chemical fertilizer

LW-C832

Range: 0~1 mol/L

- Used to measure the K^+ concentration in the solution



Typical Applications:

- Measure the K^+ content in vegetable and fruit
- Measure the K^+ content in the solution,
- Measure the K^+ content in the cell sap
- Measure the K^+ content in the chemical fertilizer etc.

Experimental device for measuring potassium ion content in milk
(See the right picture)



NO_3^-

LW-C836

Range: 0~1 mol/L

- Used to measure the NO_3^- concentration in solution



Experiment results of determination of NO_3^- concentration in the fruit juice

Typical Applications:

Determination of NO_3^- concentration in drinking water; food and waste water; changes of NO_3^- concentration in the oxidation-reduction reaction.



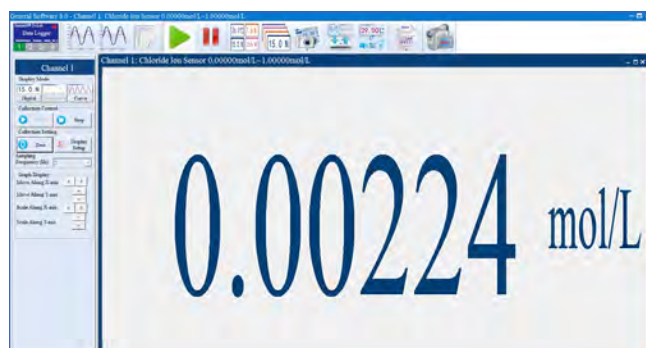
Determination of NO_3^- concentration in the fruit juice

 Cl^-

LW-C835

Range: 0~1 mol/L

- Used to measure Cl^- concentration in solution



Experiment results of Cl^- content in table salt.

Typical Applications:

Residual Cl^- in tap water; testing of AgCl ion product constant; testing of Cl^- content in blood; testing of Cl^- content in disinfectant.



Experiment of Cl^- content in table salt by using chloride ion sensor

NO₂

LW-C822

Range: 0~200ppm

- Used to measure NO₂ content in gas

**Typical Applications:**

Testing of NO₂ content in vehicle exhaust and waste gas from power plant; study of acid rain formation by NO₂; measurement of N₂O₄ equilibrium constant generated by NO₂



Experiment of testing of NO₂ content in vehicle exhaust with NO₂ sensor and digital display module



Experiment results of testing of NO₂ in vehicle exhaust

CO

LW-C826

Range: 0~1000ppm

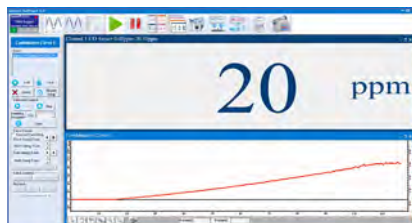
- Used to measure CO content in gas

**Typical Applications:**

Testing of CO content in cigarette; CO content in air; CO content during candle combustion; study on water solubility of CO.



Experiment of CO content generated during cigarette combustion measured by using CO sensor



Experiment of CO content generated during cigarette combustion

CH₄

LW-C824

Range: 0~5%

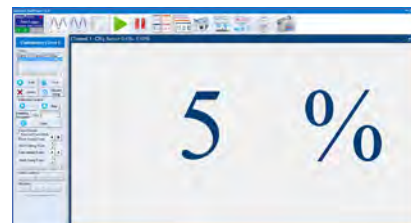
- Used to measure CH₄ content in gas

**Typical Applications:**

Testing of CH₄ content in air; inquiry of reaction condition of CH₄ and Cl₂; inquiry of CH₄ generation regular in our surroundings; detection of leakage.



Detection of gas composition by using CH₄ sensor



Experiment results of detection of gas composition

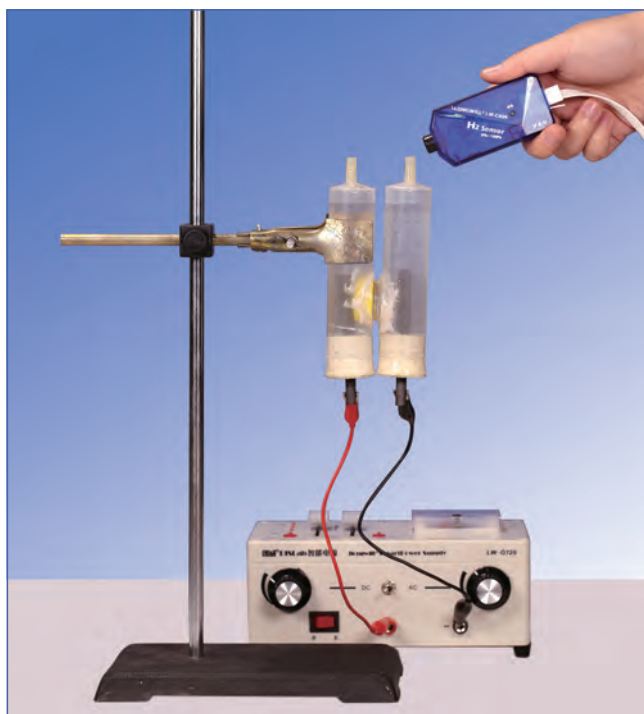
H₂

LW-C806

Range: 0~100% LEL

· Measure H₂ content in air**Typical Applications:**

Study on products from the electrolysed water; testing of H₂ content in air; inquiry of gas component in balloon; inquiry of products from metal and hydrochloric acid reaction.

Inquiry experiment of products from electrolysed water by using H₂ sensor**NH₃**

LW-C823

Range: 0ppm~100ppm

· Measure NH₃ content in gas**Typical Applications:**

Testing of NH₃ content in public toilet; verification of existence of NH₄⁺ in solution by heating it.

Detection of NH₄⁺ with NH₃ sensor**Experiment Example:**

Inquiry of mixed product of 84 disinfectant and toilet cleaner

► **Principles:** Main component of 84 disinfectant is NaClO, while main component of toilet cleaner is HCl. Oxidation-reduction reaction may occur in the mixture of 84 disinfectant and toilet cleaner and Cl₂ may be produced. Cl₂ is a poisonous, yellow green gas with strong and pungent smell. It may stimulate eyes and respiratory tract, making people have uncomfortable feelings such as shedding tears and cough.

► **Apparatus:** Cl₂ Sensor, stand support, baker.

► **Conclusion:** 84 disinfectant cannot be used together with toilet cleaner. If mixed unintentionally, open windows immediately for ventilation and move to a place with fresh air quickly.

Cl₂

LW-C821

Range: 0ppm~20ppm

· Used to test Cl₂ content in gas

Electrical Conductivity for Glass Items

LW-6328

- Used to study on the glass conductivity when heated.
- Used with Micro Current Sensor.

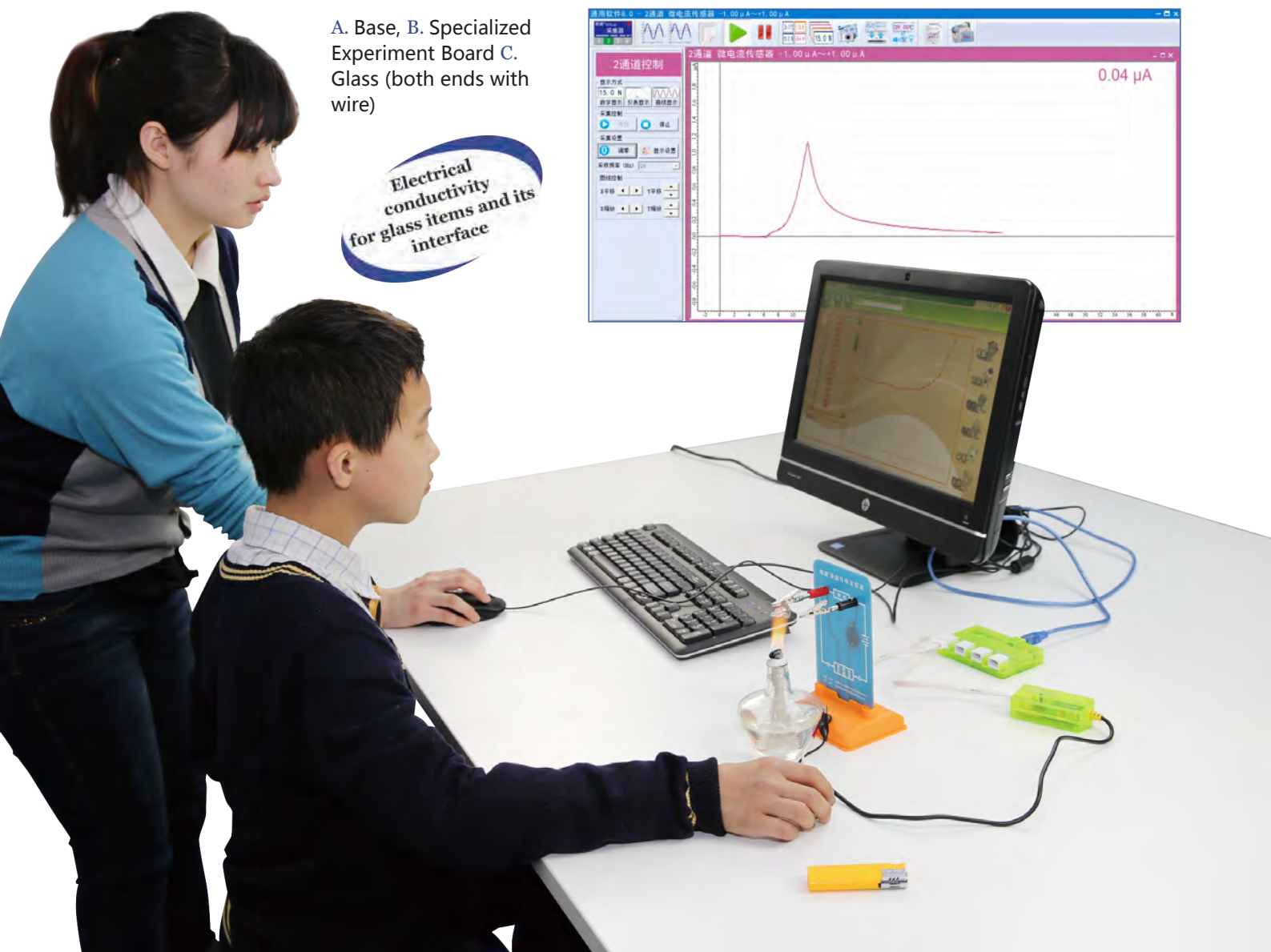


Components:

A. Base, B. Specialized Experiment Board C. Glass (both ends with wire)

Electrical conductivity for glass items and its interface

Electrical conductivity for glass items (mobile terminal)



General Power Supply V2.0

LW-Q708

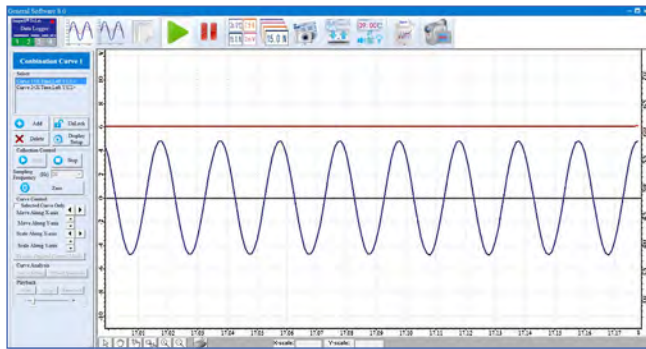


Specifications

Input: AC 220V $\pm$ 10% 50Hz

DC Output: 1.5V~20V continuously adjustable, rated current 1A

AC Output: 0V~9V continuously adjustable, 50Hz, rated current 1A



AC and DC signals output from General Power Supply

Low Frequency Signal Generator V2.0

LW-Q710



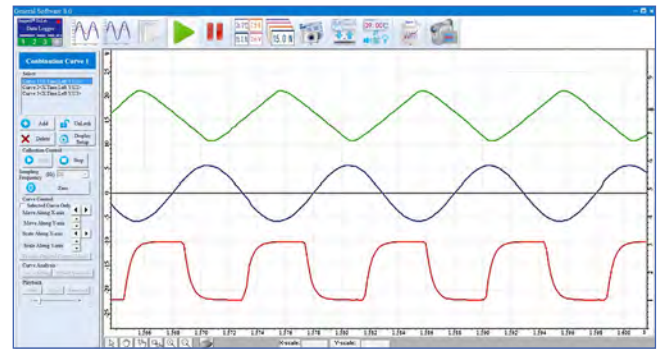
Specifications

Input Power: AC 220V $\pm$ 10% at 0.6A, 50Hz

Waveforms: Sine, Square, Triangle. By pressing the Adjuster, select the waveform output orderly.

Frequency Range: DC to 1Hz, AC waveform output retains its form to 2kHz. By turning the adjuster, adjust the output frequency.

Voltage Output: 0~9V continuously variable by turning the voltage adjuster.



Triangular, Sine and square wave output from Frequency Signal Generator

Smart Power Supply V2.0

LW-Q820

Smart power supply is the key corollary equipment of Faraday's Law Apparatus II.



Components:

a model shifting switch button, the ascending and descending slope adjust slider, RUN button, LCD unit, power switch, power output ports and power Jack.

Specifications:

Power: 220V AC at 1A

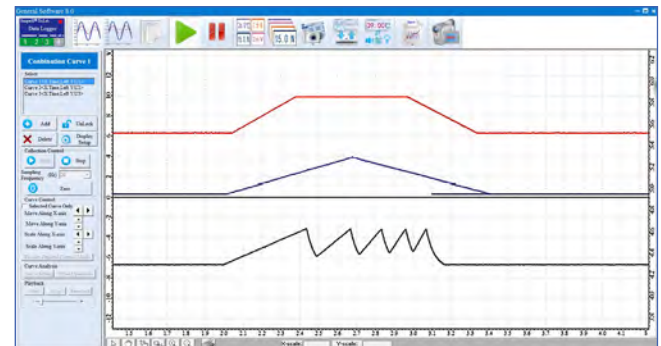
DC Output: 1.5V~18V, continuously adjustable at 1A

AC Output: 0V~6V, continuously adjustable at 1A 50Hz

Utility Model Patent No.: ZL201120057646.5

Waveforms:

1. trapezoidal wave
2. triangle wave
3. multi-periodic triangle wave.

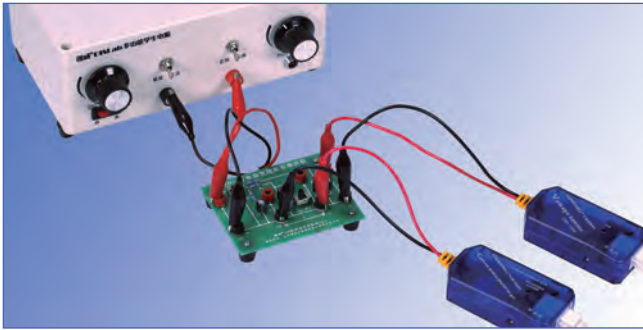


Voltage signals output from Smart Power Supply

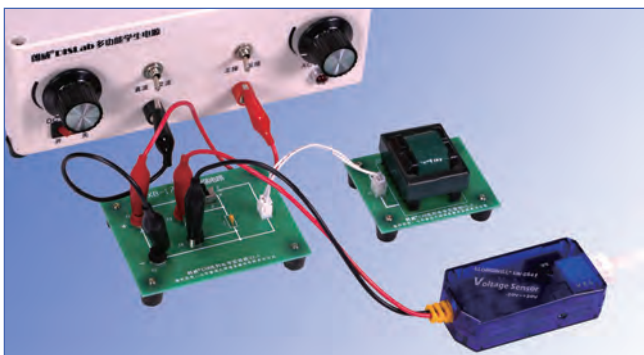
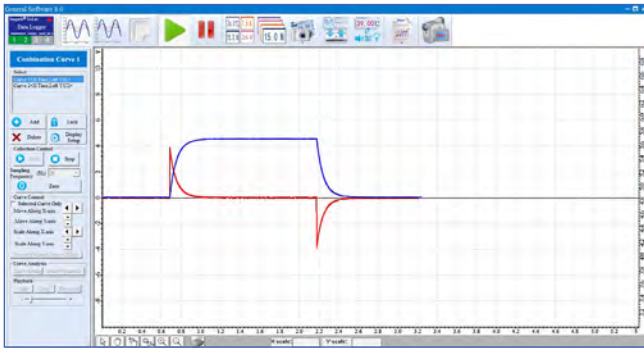
EXB Series Circuit Board V2.0

LW-6337

- Including 23 kinds of standardized experiment circuits.
- Used for more than 30 kinds of Electricity experiments.



Experiment results of capacitor charge-discharge & series-parallel (below)

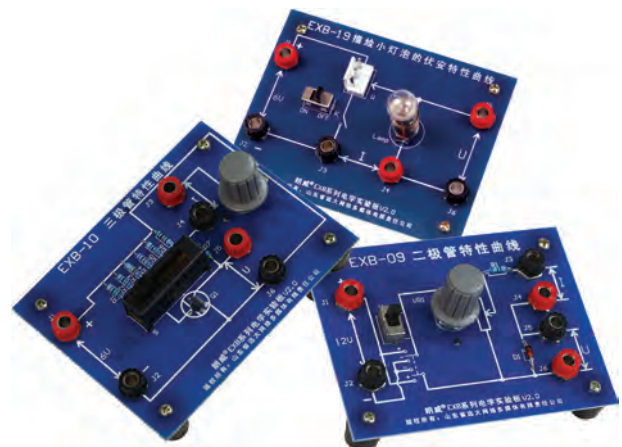


Experiment (above) and its results (below) of Multi-harmonic Oscillation



SPECIFICATION

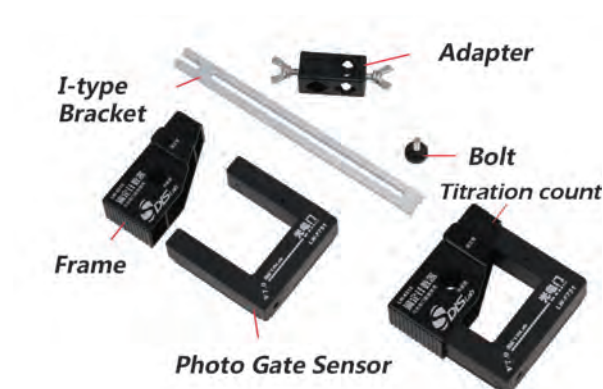
- EXB-01 · Half-wave Rectification & Wave Filtering
- EXB-02 · Full-wave Rectification & Wave Filtering
- EXB-03 · Analysis of Complex Circuit
- EXB-04 · RC & RL Phase Shift
- EXB-05 · Measurement of EMF and Internal Resistance of the Battery with Voltammetry
- EXB-06 · Measure EMF of the Battery with Compensation Method
- EXB-07 · Partial Pressure and Current Limited Circuit
- EXB-08 · Measure Resistance & Resistivity of the Resistance Wire with Voltammetry
- EXB-09 · Diode Characteristic Curve
- EXB-10 · Triode Characteristic Curve
- EXB-11 · Triode Amplifying Circuit
- EXB-12 · Constant Pressure Source
- EXB-13 · Constant Current Source
- EXB-14 · Bistable Circuit
- EXB-15 · Multi-harmonic Oscillation
- EXB-16 · Charge-discharge & Series-parallel
- EXB-17 · LC Oscillatory Circuit
- EXB-18 · Self Inductance
- EXB-19 · VA Characteristic Curve of a Miniature Bulb
- EXB-20 · AND Gate Circuit
- EXB-21 · OR Gate Circuit
- EXB-22 · NOT Gate Circuit
- EXB-23 · Ohm's Law
- EXB-24 · UI Characteristic of a Conductor
- EXB-25 · Series and Parallel Circuits of Resistances
- EXB-26 · Study on Conductors and Insulators
- EXB-27 · Inductance Module (circuit board accessories)



Neutralization Titration Apparatus

LW-6212

Utility Model Patent No.:ZL200920019408.8



Operation Instruction:

Before application, put Photo Gate Sensor into Frame, then these two parts make up a titration counter.

During application, adjust the titration counter to make sure there is a effective light blocking when the droplets pass the Photo Gate Sensor.

Open the software automatic record function; input the droplet volume and then record the number of droplets. Therefore the volume of titration can be calculated and the titration process is graphed on the software.

Design Concept:

Neutralization Titration Apparatus is developed based on the light blocking principle of Photo Gate Sensor. Because every droplet has similar volume, therefore the titration volume can be calculated after obtaining the number of the droplets.

Neutralization Titration Apparatus should be used with pH Sensor or Conductivity Sensor.



Use CH_3COOH solution to titrate with $\text{NH}_3\cdot\text{H}_2\text{O}$ solution

Dilution Vessel

LW-Q739

Utility Model Patent No.:201320572799.2



Product Structure:

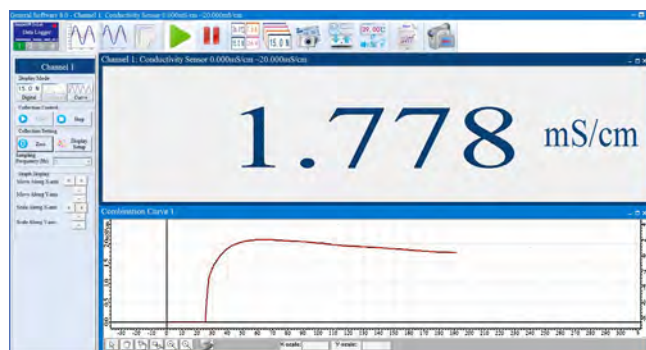
It looks like upside-down conical beaker, with a small bottom and big open.

Experimental operation using the Dilution Vessel (is shown as image A).

Design Concept:

Dilution Vessel is specially designed to research the glacial acetic acid dilution.

Doing this experiment requires to measure the conductivity changes with the sensor during the glacial acetic acid dilution process, therefore the change of the ion concentration can be obtained.



The graph shows the experimental results of the glacial acetic acid dilution

Multifunctional Support

LW-Q731/LW-Q743

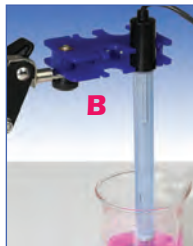
Design Patent No.:ZL201330383519.9

Utility Model Patent No.:201320487473.X

Composition and Typical Applications:

As shown in the figure on the right, multifunctional support is composed of mechanical arm **A**, the sensor electrode holder **B**, and aluminum clip **C**. The mechanical arm is fixed at the edge of the experiment table without occupying any table space. It can be folded and expanded. It can be moved flexibly and accurately located in the three-dimensional space with good stability.

The electrode clips are installed at the front end of the arm, whose diameter adapts to the electrodes of various biology and chemistry sensors. The multifunctional support can fix the electrodes of biology and chemistry sensors effectively, which is convenient for the operation of biology and chemistry experiments.



Experiment with multiple sensors using the Multifunctional Support

® Pocket Sealing Apparatus

LW-Q716

Components:

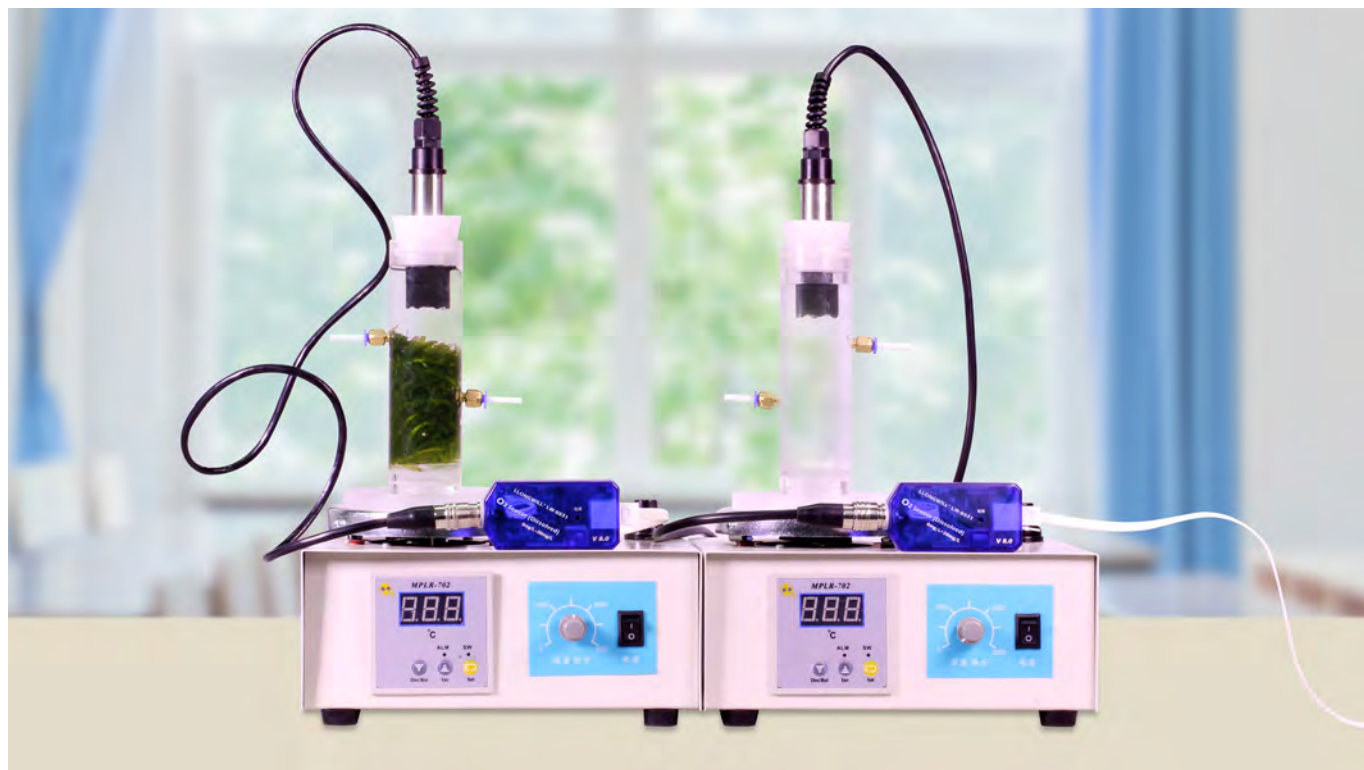
- Sealing Container
- Double-pass
- Double-pass Valves
- Sealing Plug

Typical Applications:

- Study photosynthesis of a single leaf
 - Study capillarity action of plant root
- Expand more experimental functions according to teaching requirements



Study on the photosynthesis of aquatic plants (as shown below)

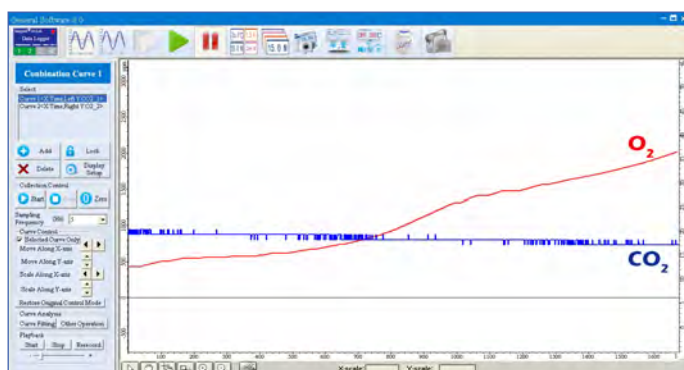


Sealing Apparatus

LW-Q749

Typical Applications:

- Photosynthesis and respiration of terrestrial plants
- Respiration of animals
- Seed Germination
- The characteristics of enzyme
- Burning characteristics
- Transpiration



Experiment results of plant photosynthesis

Study on photosynthesis using sealing apparatus (as shown below)



This apparatus can load liquid, plants, other vessels and even some small animals. It creates a relative sealing experiment condition, by which some environment parameter can be controlled.

