Lab Equipment

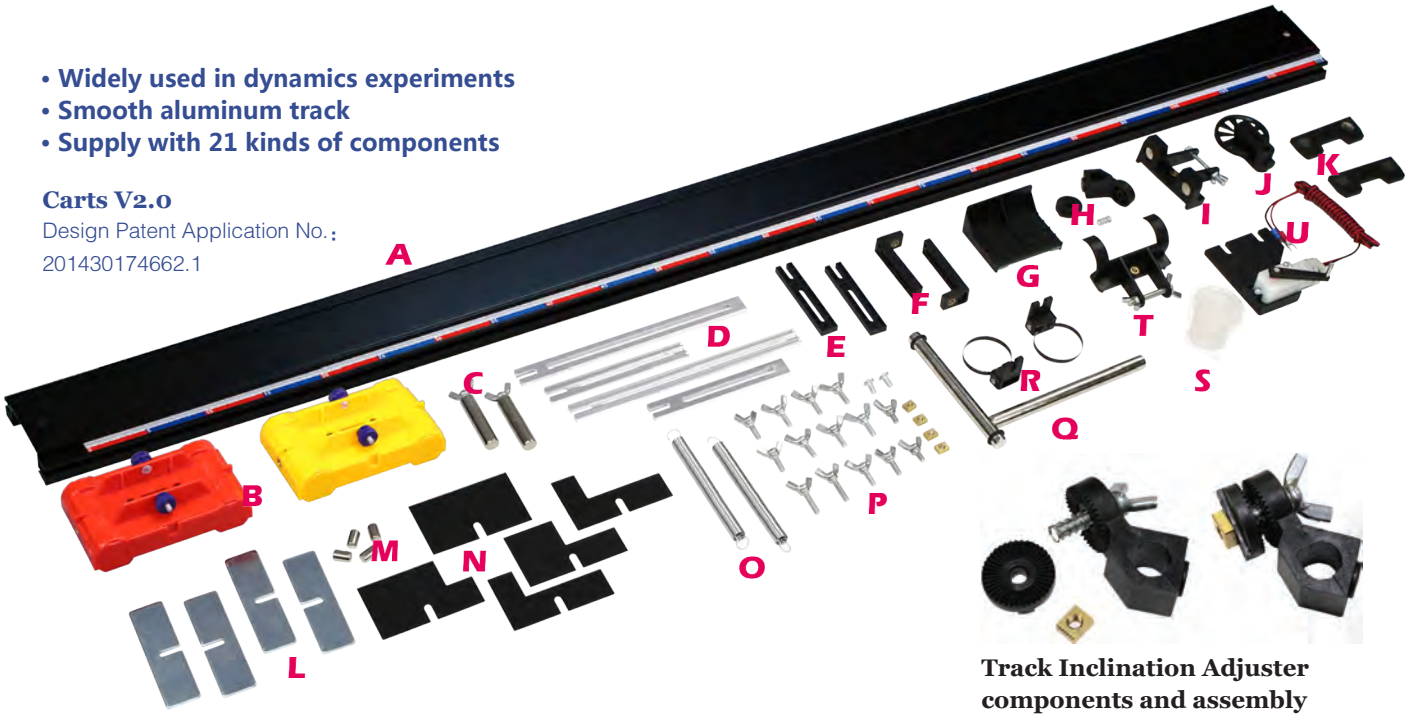
PHYSICAL LAB EQUIPMENT

NEW TECHNOLOGY FILLS UP GAPS IN EXPERIMENTS AND SOLVES EXPERIMENTAL PROBLEMS

Our Multi-purpose Mechanical Track System V2.0 LW-Q730

- Widely used in dynamics experiments
- Smooth aluminum track
- Supply with 21 kinds of components

Carts V2.0
Design Patent Application No.:
201430174662.1



Track Inclination Adjuster components and assembly

System Composition of Multi-purpose Mechanical Track:

A. Track, B. Carts (red, yellow), C. Fixed Rod, D. I-type Bracket (Aluminum), E. I-type Bracket (Plastic) , F. L-type Bracket, G. Friction Block, H. Track Inclination Adjuster, I. Magnetic Bumper, J. Pulley, K. Magnetic Sheet, L. 50g Weight Block, M. 5g Weight Block, N. Light Blocking Sheet in width of 20,40,60,80mm O. Springs, P. Fasteners, Q. T-type Track Support, R. Elastic Metal Ring, S. Bucket with String, T. Cart Absorber, U. Motor for forced vibration.

Typical Applications:

Research uniform linear motion; measurement of instantaneous velocity; measuring acceleration from *v-t* figure; Newton's Second Law; comparison of kinetic energies; theorem of momentum of variable force working; measurement of average velocity; relation between average velocity and instantaneous velocity; measurement of acceleration; theorem of momentum (constant force); work and energy; momentum conservation law; kinetic energy in the collision; conservation of mechanical energy (inclined track method), forced vibration and electromagnetic damping, etc.

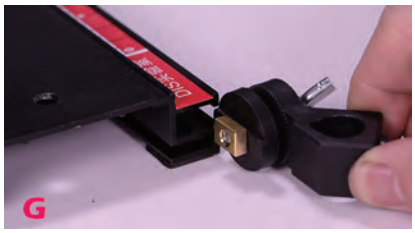
Installation and Use of track carts V2.0:

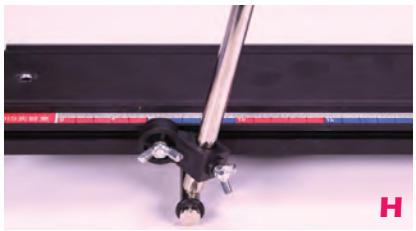
Track cart is the key equipment of mechanical track system. Refer to image below about its installation specifications.

A. The cart wheels are above the bottom bodywork of, so it is only applicable to This track; B. Fix the emitter of displacement sensor (separated) on cart by using butterfly bolt through the hole reserved in the cart; C. Install light blocking sheet on the side of the cart, then tighten the bolt; D. Install the weight block on cart-insert the weight block on the side of cart, then tighten the bolt; E. Install magnetic sheet on the front or end of the cart by using screwdriver; F. Install the elastic metal ring on the front or end of cart by using screwdriver.

Installation and Use of T-type Track Support, Pulley and Fixed Leg:

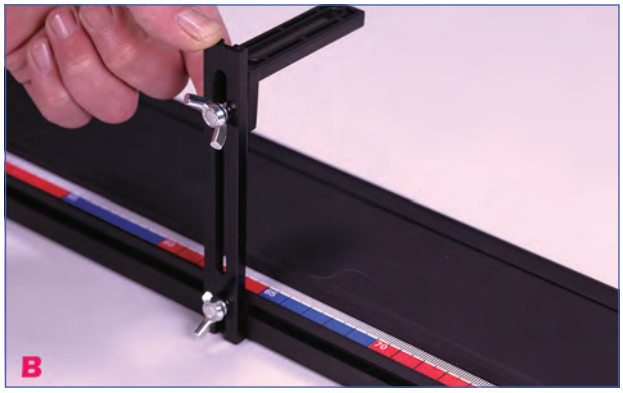
G. the first step for assemblling T-type track support is to install track inclination adjuster, and it will be longitudinally inserted into guide slot from track port through the rectangular copper nut in the frond end of butterfly bolt of regulator teeth; H. To Assemble the track inclination adjuster, and then insert the rectangular copper nut of it into the guide slot on one side of the track; l. Install the cart absorber onto the end of the track, then install the pulley onto it; J. Install the fixed rod at the other end of the track to fasten spring or force sensor.

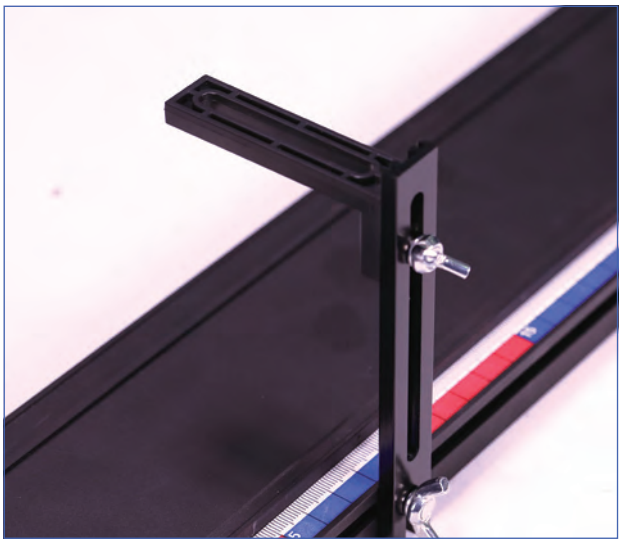




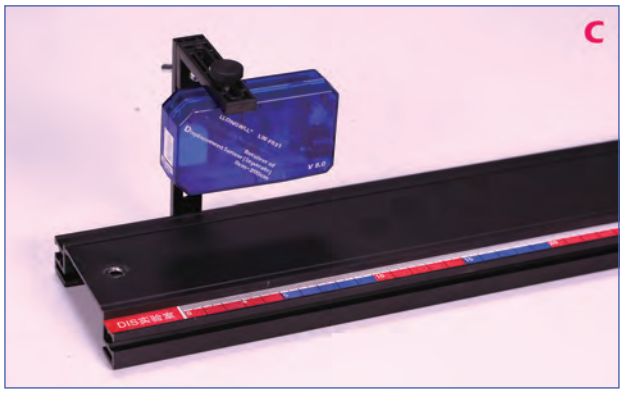
Assembly of Accessories:

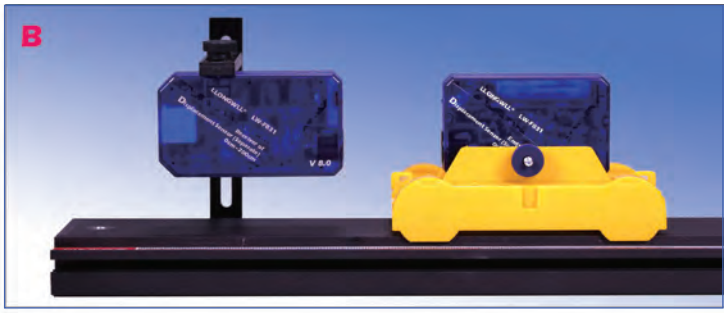
A. Mount I-type bracket on track. Many experimental facilities can be installed based on this bracket;
B. Mount L-type btacket onto I-type bracket;
C. Hoist the receiver of displacement sensor (separated); The ultrasonic export of receiver and emitter shall be aligned;

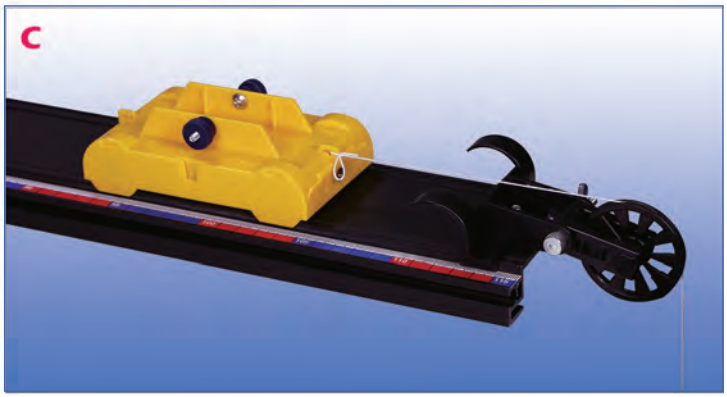


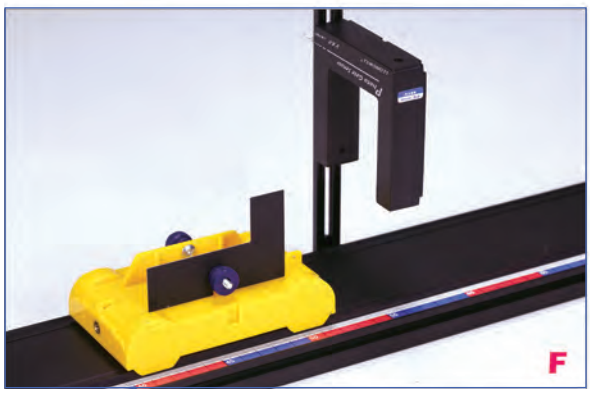


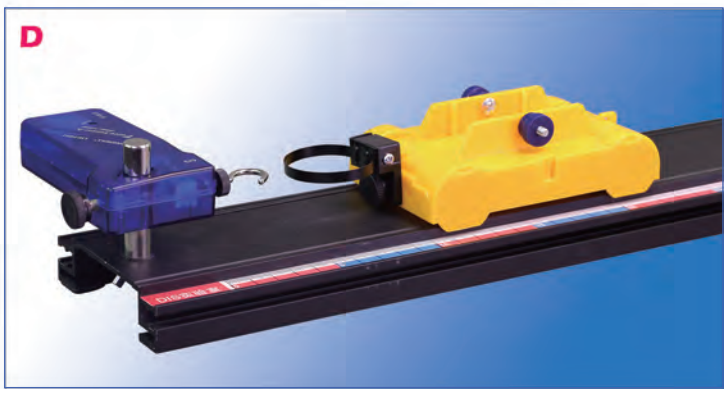
E. Mount force sensor onto fixed leg. The hook should be kept in a straight line with a spring or rope hanging from the hook;
F. Mount the photo gate sensor onto I-type bracket, and adjust the height of photo gate, ensuring the cart with light blocking sheet can go through it smoothly.





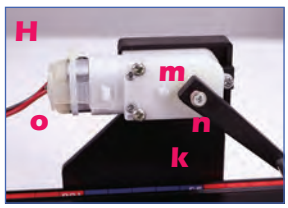


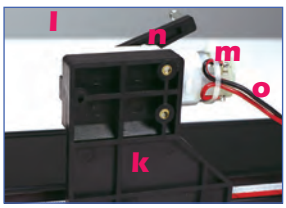


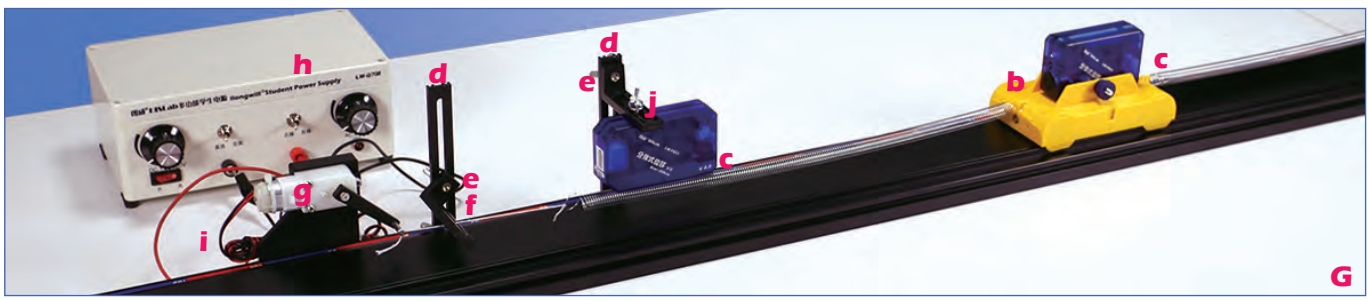


Assembly and applications:

A. B. The application of displacement sensor (separated); C. “Newton's Second Law”; D. The momentum theorem experiment under variable force; E. Damped vibration experiment— separately connect the two ends of cart with two springs fastened in the fixed rods on track; F. Determination experiment of instantaneous velocity by using light blocking sheet on cart; G. Composition of forced vibration experiment: a. Track, b. Cart, c. Spring, d. I-type bracket, j. Displacement sensor (separated); H. I. Components of forced vibration driving system (motor)—k.Assembly plate for motor; m.9V motor, n. Rocker arm, o. Power cable.







Centripetal Force Apparatus V2.0

LW-Q859

- **Study the centripetal force and angular velocity in circular motion**
- **Using Force Sensor and Photogate Sensor (H,I in below figure)**

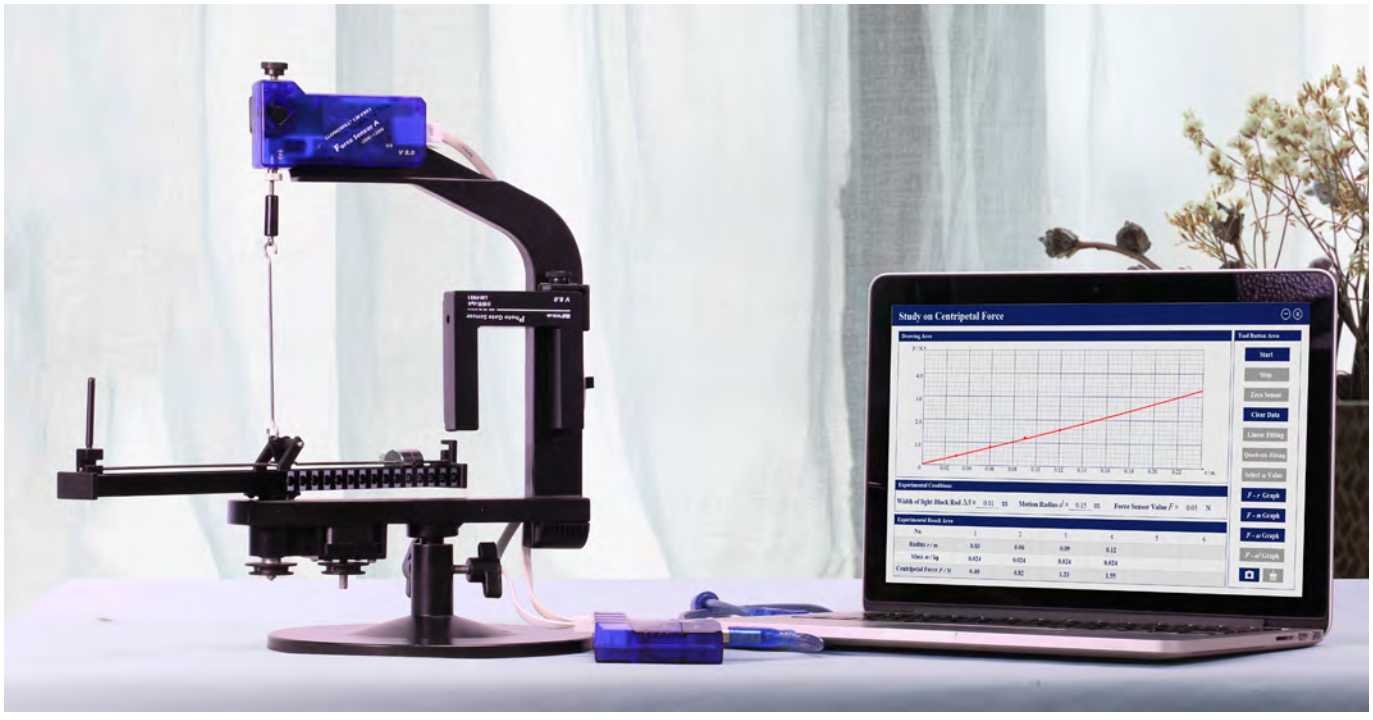
Utility Model Patent No.: ZL200720017884.7

Curve of relationship between centripetal force *F* and angular velocity ω

Experiment fitting curve (*F-m*) between the centripetal force and the mass

Components of Centripetal Force Apparatus:

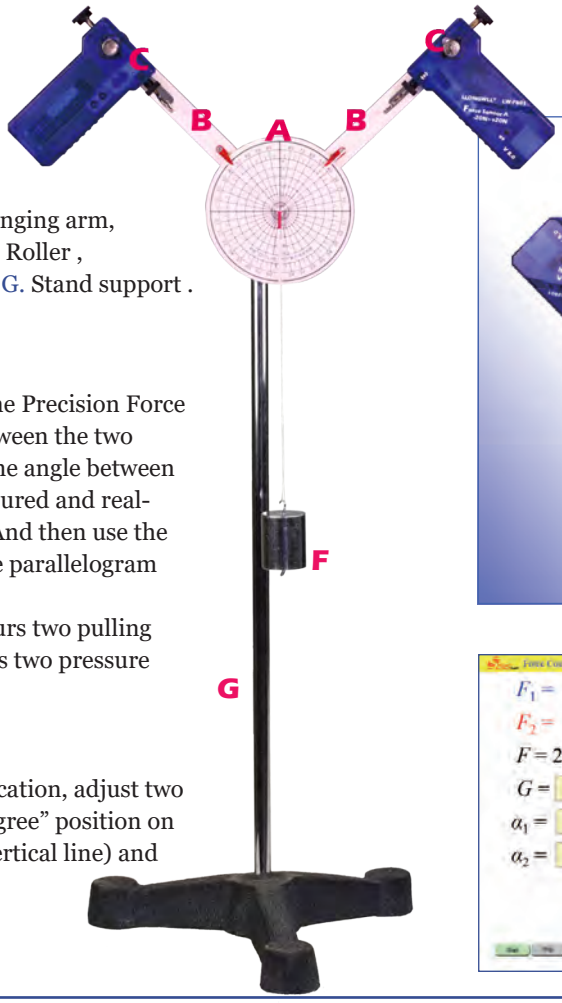
A. Main Frame, B. Base, C. Rotating Arm, D. Connecting Device (a bolt connected with the force sensor, a vertical rod and a horizontal rod), E. Weight , F. Light Blocking Rod, G. Fasten bolt: a bolt connected with the force sensor.

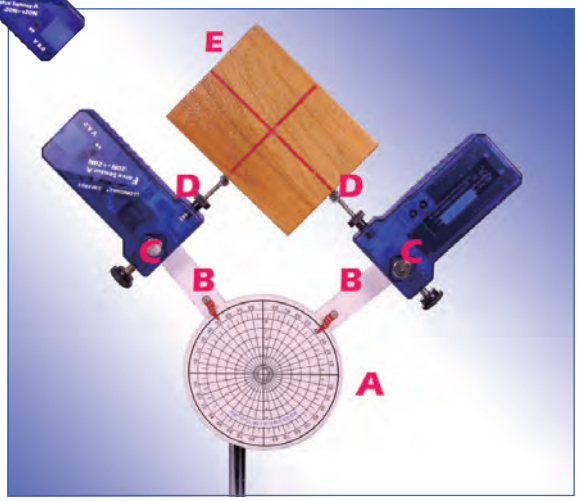


Force Resolution and Composition Apparatus

LW-5305

Utility Model Patent No.：ZL200920226468.7





Components:

A. Precision Force Disc, B. Hanging arm,
C. Force Sensor Fixed Rod, D. Roller ,
E. Standard Block, F. Weight, G. Stand support .

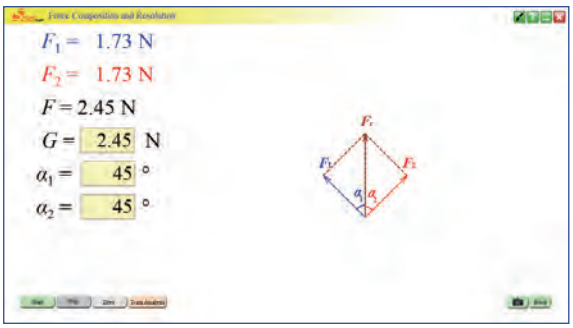
Working Principle:

Mount two force sensors on the Precision Force Disc, and adjust the angle between the two force sensors. The force and the angle between two force sensors can be measured and real-time displayed by computer. And then use the calculation result to verify the parallelogram rule.

The device on the left is measurs two pulling force. The right one is measurs two pressure force.

Notes:

Zero Calibration: before application, adjust two stern brackets to the “Zero degree” position on the Force Disc (parallel to a vertical line) and click “Calibration” button.



Smart Force Disc V2.0

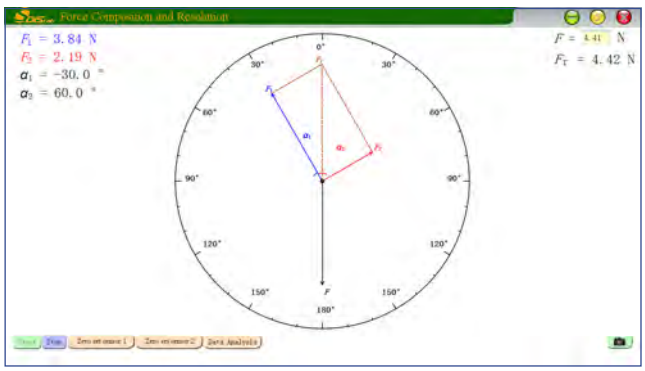
LW-Q836

Utility Model Patent No.:ZL201220020063.X

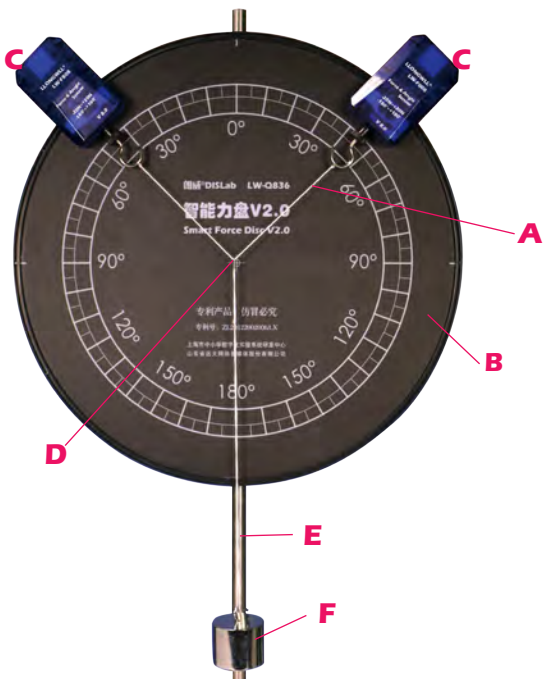
• Intelligent apparatus used with Force&Angle Sensor.
• Real time obtain the angle data automatically, instead of manual input operation

Components:

A. String, B. Precision Force Disc, C. Force&Angle Sensors,
D. Fixed Sheath for string , E. Stand support, F. Weight .



Experiment interface of force decomposition by using Smart Force Disc



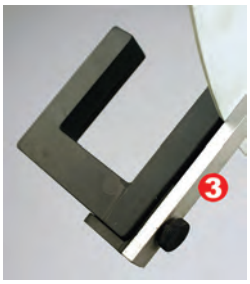
Conservation Law of Mechanical Energy Apparatus I

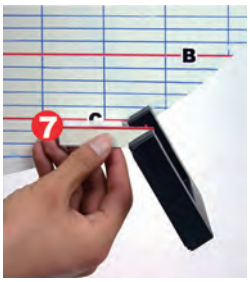
LW-5304

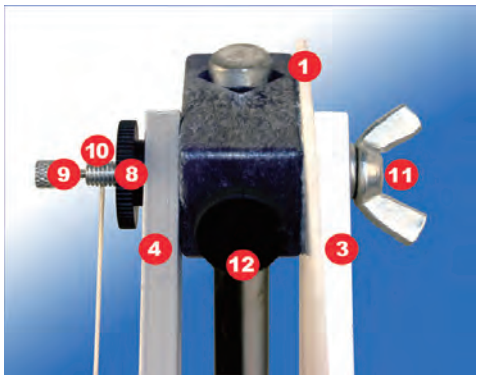
IUtility Model Patent No.: L200720017881.3

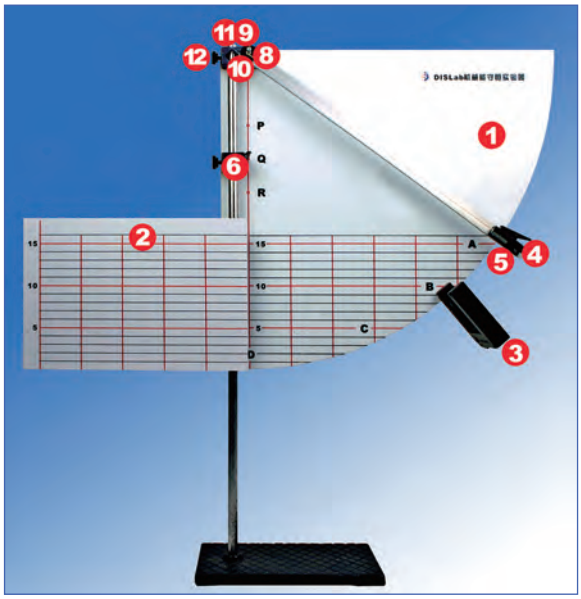
- **Verify the Conservation Law of Mechanical Energy.**
- **Using Photogate Sensor.**

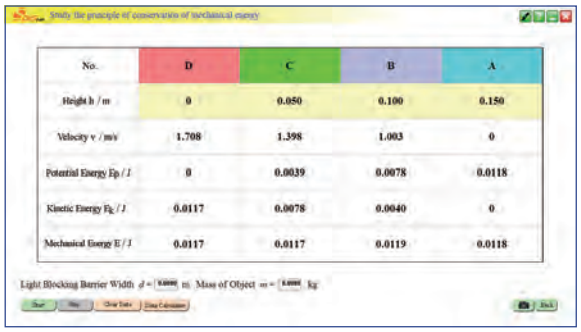
1 · Main Board
2 · Subboard
3 · Fixed Arm for Photo Gate
4 · Fixed Arm with magnetic clamp
5 · Pendulum Bob (include cord)
6 · Position Stop
7 · Planometer
8 · Central Nut
9 · Central Bolt
10 · Fixed Bolt for Pendulum String
11 · Butterfly Bolt
12 · General Bolt





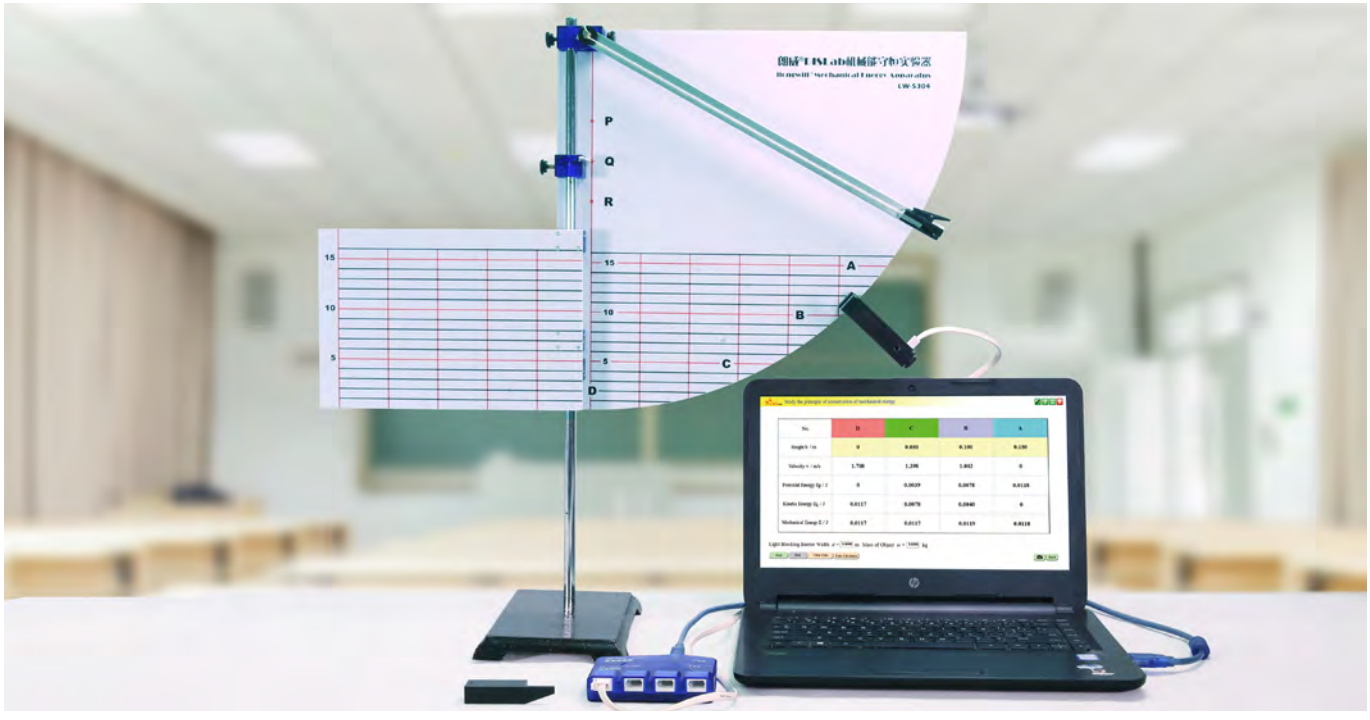






No.	D	C	B	A
Height h / m	0	0.050	0.100	0.150
Velocity v / m/s	1.708	1.398	1.003	0
Potential Energy Ep / J	0	0.0039	0.0078	0.0118
Kinetic Energy Ek / J	0.0117	0.0078	0.0040	0
Mechanical Energy E / J	0.0117	0.0117	0.0119	0.0118

Verification of the Conservation Law of Mechanical Energy



Force Resolution on Inclined Plane

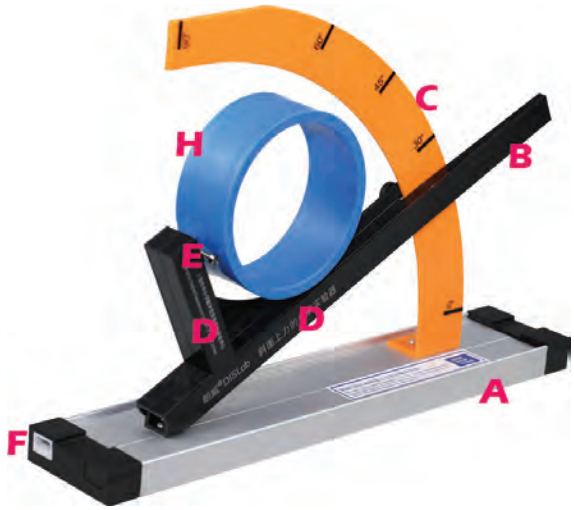
LW-Q721

Utility Model Patent No.:ZL200720017883.2

- **Sensors built-in design**
- **Simplify the study on force resolution obviously**

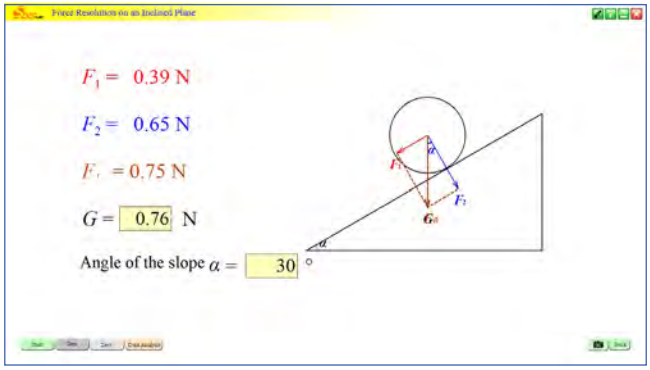
Components:

A. Base
B. L-type Rotating Arm,
C. Angle Scale
D. Build-in Force Sensors —one in the long arm and the other in the short arm
E. T-type Rollers assembled on the top of force sensors
F. Cable Port for connecting with data logger
H. Plastic ring used as a measured object

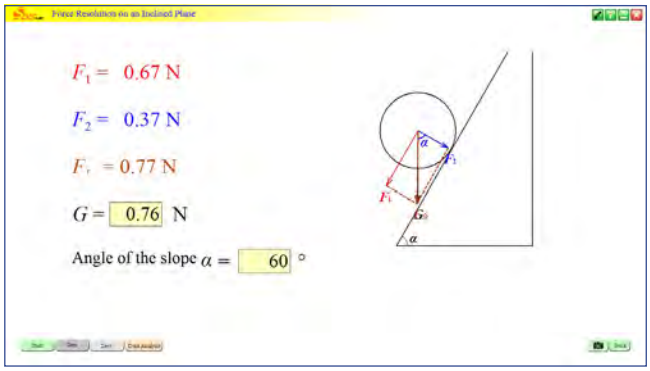


Principle and Operation:

Lay the plastic ring on the T-type rollers on the top of two force sensors stably; change the inclined angle between L-type rotating arm and base; then the change of the readings of two force sensors can be observed. Parallelogram rule can be verified by substituting sensors data and the angle of any position during 0°~90° process into the formula.

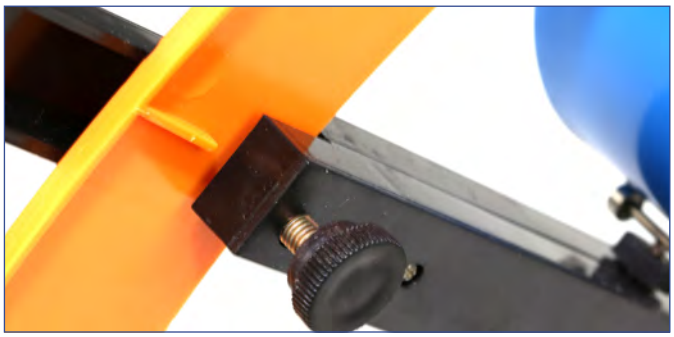


The readings of two force sensors at 30°angle

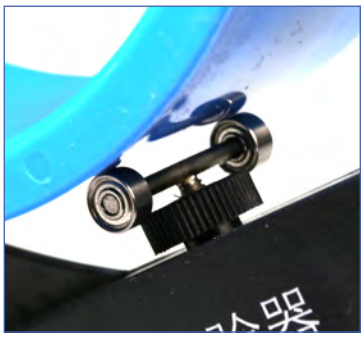


The readings of two force sensors at 60°angle

Notes:
when the angle between spiral arm and base is greater than 0°, the bolt shall be tighten and fasten the rotating arm on the angle scale.



T-type roller collected in L-type rotating arm shall be vertical with rotating arm, and the horizontal side of T-type shall keep level with rotatingl arm where it locates and to completely touch to ring pieces.

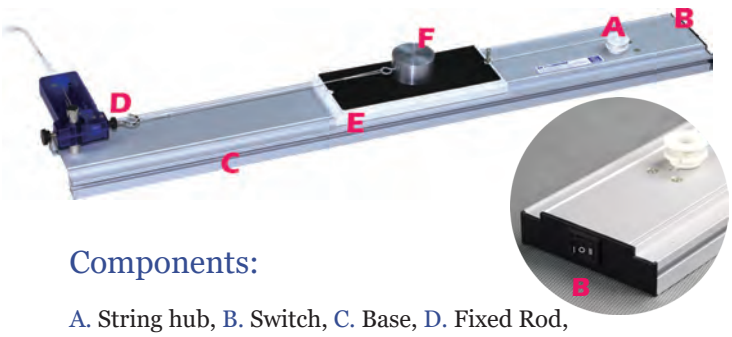


Friction Apparatus

Utility Model Patent No.:ZL200720017883.2

LW-6341

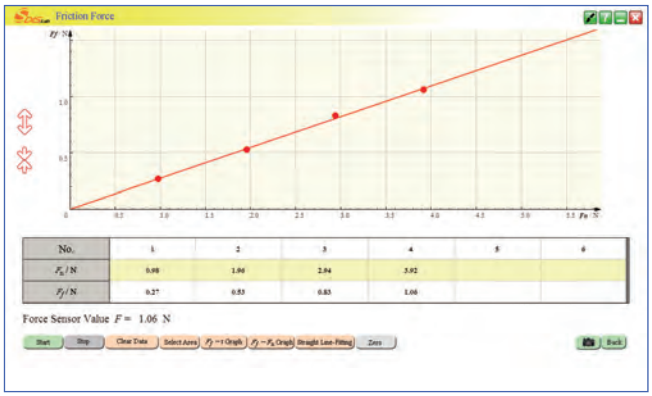
- **Study the static friction and sliding friction.**
- **Built-in traction motor**



Components:

A. String hub, B. Switch, C. Base, D. Fixed Rod, E. Friction Layer, F. Friction Block.

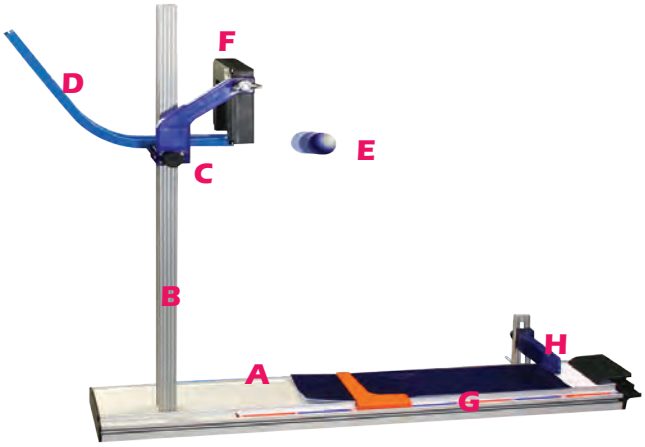
Study on the Maximum Static Friction Force



Relationship curve between friction force F and positive pressure of friction block

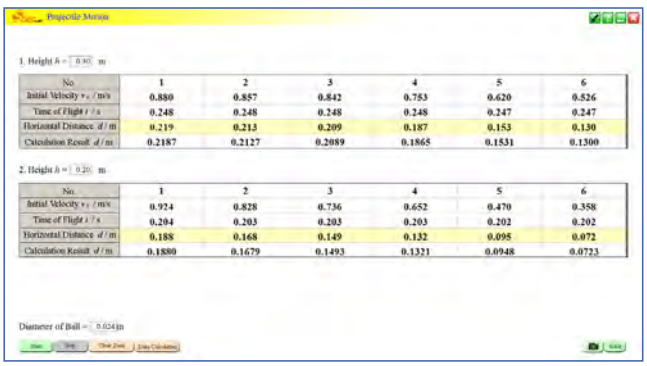
Projectile Motion Apparatus

LW-Q722



Components:

A. Base, B. Bracket, C. Adapter, D. Track, E. Ball, F. Photo gate, gives the signal of timing end, G. Built-in touch sensor-gives the signal of timing end,H. Magnetic Absorber—with built-in magnet, used to absorb the falling ball, I. Cable port for touch sensor built-in the base.



1. Height h = 0.30 m

No.	1	2	3	4	5	6
Initial Velocity v_x / m/s	0.880	0.857	0.842	0.753	0.620	0.526
Time of Flight t / s	0.248	0.248	0.248	0.248	0.247	0.247
Horizontal Distance d / m	0.219	0.213	0.209	0.187	0.153	0.130
Calculation Result d / m	0.2187	0.2127	0.2089	0.1865	0.1531	0.1300

2. Height h = 0.20 m

No.	1	2	3	4	5	6
Initial Velocity v_x / m/s	0.924	0.828	0.736	0.652	0.470	0.358
Time of Flight t / s	0.204	0.203	0.203	0.203	0.202	0.202
Horizontal Distance d / m	0.188	0.168	0.149	0.132	0.095	0.072
Calculation Result d / m	0.1880	0.1679	0.1493	0.1321	0.0948	0.0723

Diameter of Ball = 0.024 m

Experiment results of Horizontal Projectile Motion

Operation:

As shown in the above figure, when the ball is released from the same height for several times, if the flying time of it in each fly is quite close, it means that the experiment operation is quite good, and the motion of the ball in horizontal direction is the uniform linear motion can be verified.

The quantitative relationship between flying time and the height of the track end will be found out by changing the height of the track and comparing the experiment results, the motion of the ball in vertical direction is the free fall motion can be verified too.

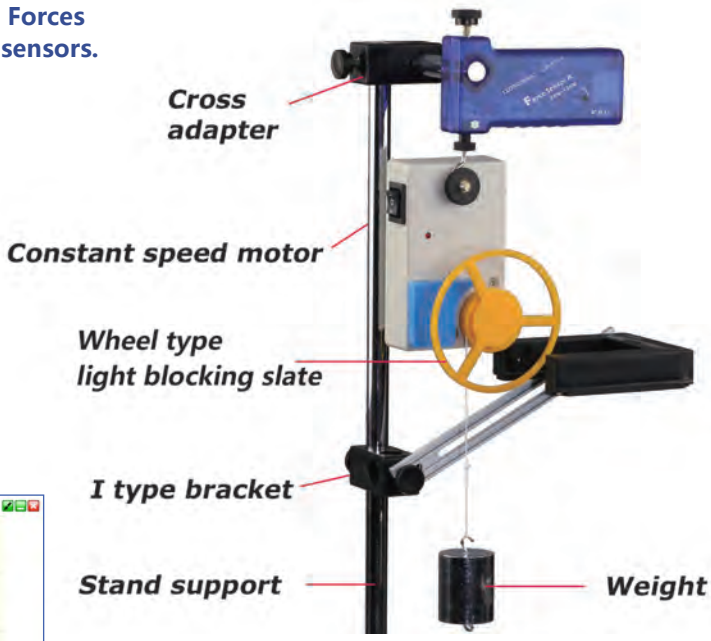
Equilibrium of Two Forces Apparatus

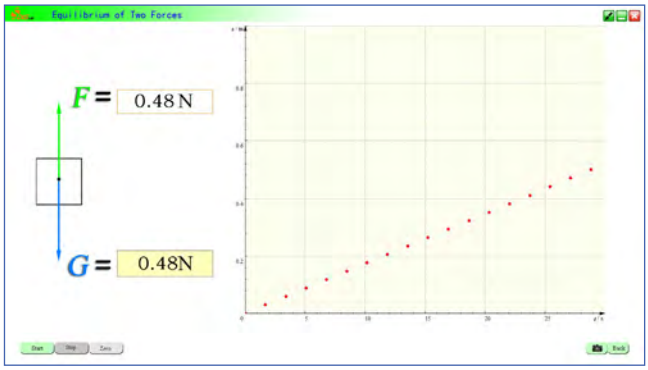
LW-Q725

- **A standard physics model of Equilibrium of Two Forces**
- **Work with stand support, photo gate and force sensors.**

Working Principle:

Fix the constant speed motor under the force sensor; it will drive the weight to go up and down. During working, it drives the wheel-type light blocking sheet rotating through the photo gate, and the speed of the weight can be measured. If the reading of the force sensor and the speed of weight going up and down keep constant, the Law of Equilibrium of Two Forces can be verified.





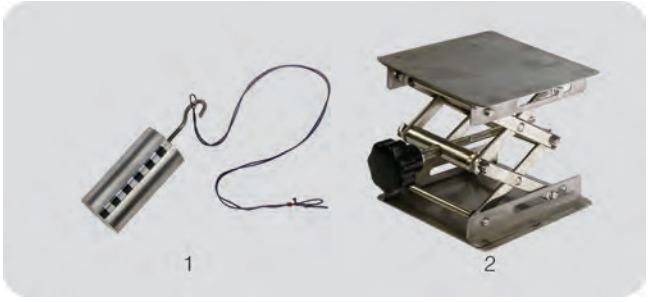
Experiment result of equilibrium of two forces

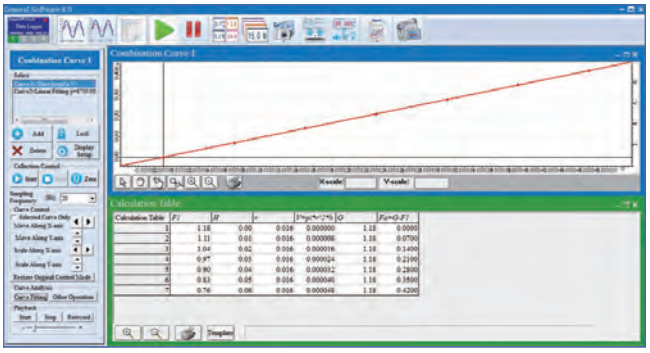
Archimedes' Law Apparatus

LW-6327

•To measure the buoyancy acted on the sinking object

Archimedes' Law apparatus is a typical physical model, consisting of an aluminum cylinder with scale, a beaker, an adapter, a leveling rod and a stepless adjustable lifting platform. The rising and falling of liquid level in container can be accurately controlled by adjusting the lifting platform. The change of Buoyancy can be measured by using the force sensor.



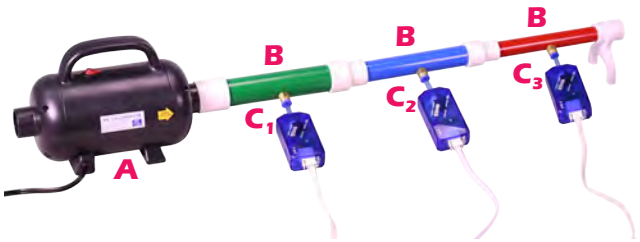


Real-time Experiment results of Archimedes' Law

Fluid Pressure Apparatus

LW-Q733

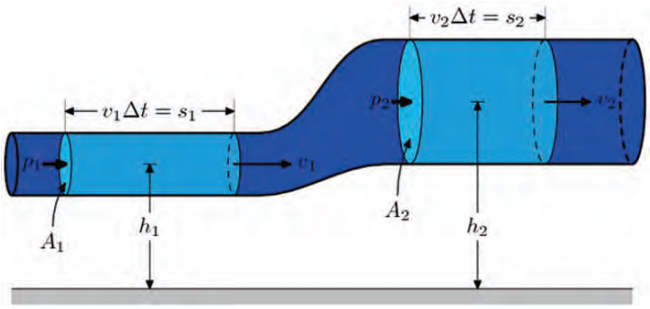
Utility Model Patent No.:201310572342.1



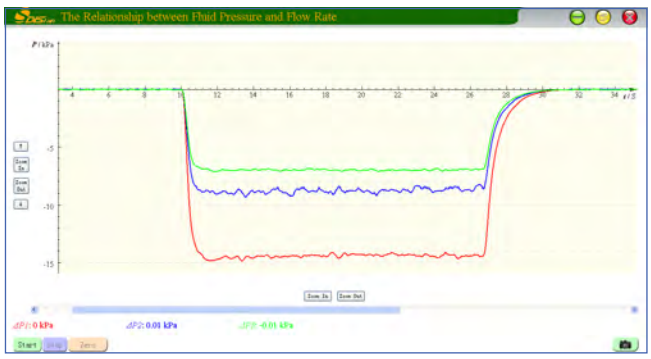
As shown in image above, this apparatus consists of A) gas pump and three-pieces of B) rigid pipes with same length and different diameters, connected in air pump and bayonets with C) locking devices, which can be used to connect with the flexible pipe of relative pressure sensors.

Design Concept:

Fluid Pressure Apparatus is also called "Bernoulli Apparatus".
It is specially designed for demonstrating the Bernoulli's Principle by using with three Relative Pressure Sensors.

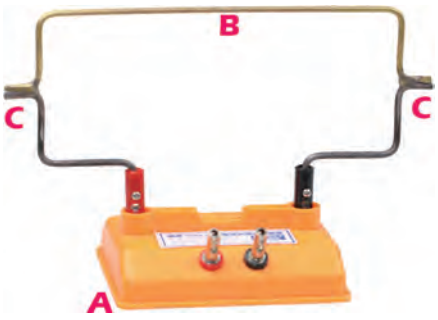


Connect these three relative pressure sensors to the apparatus; run the air pump; set up three " relative pressure-time" curves through "Combination Curve" function in the program; after the gas pump runs stablely , then the experiment result as shown in image below can be obtained. Bernoulli's principle can be primarily verified accordingly.



Thermocurrent Apparatus

LW-6329

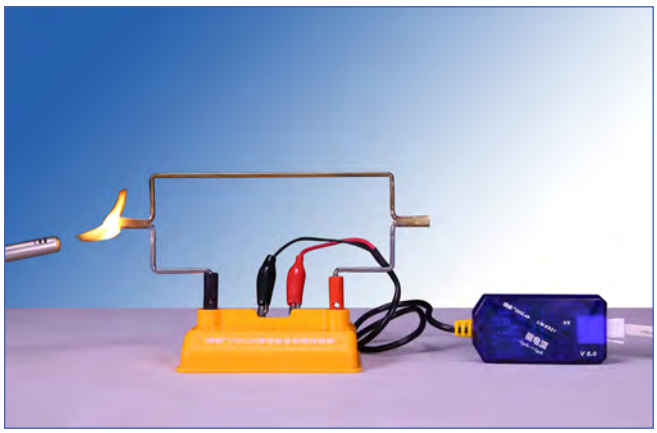


Components:

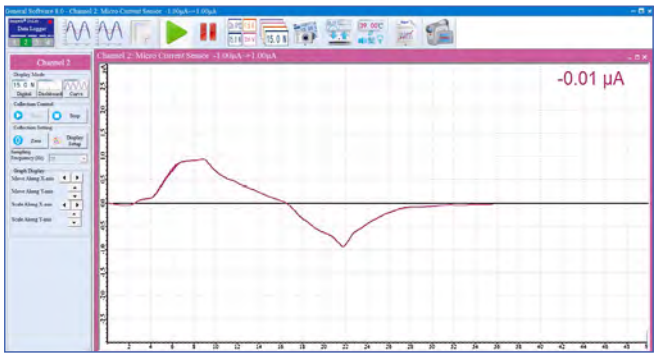
A. Base
B. Wire Frame (2 kinds of metals)
C. Metal Junctions

Working Principle:

By heating one of the metal junction, the change of temperature will produce micro current in wire frame. By using the micro current sensor, the “Heat-Electricity” energy transfer can be verified (see below).



Thermocurrent apparatus



Experiment result of thermocurrent

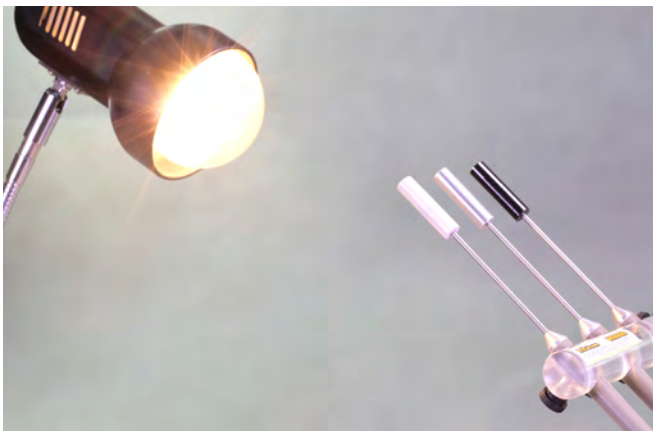
Thermal Radiation Absorption Apparatus

LW-Q723

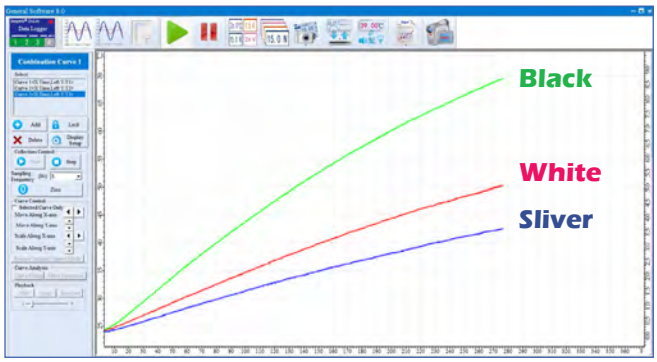
Components:

A1~A3. Block: white, sliver and black
B. Bracket
· It should be used with three temperature sensors.

Different color blocks have different thermal absorption ability. Under the same lighting condition, they will show three different readings.



Thermal radiation absorption apparatus



Experiment result of thermal radiation absorption

Far-infrared Heater

LW-5311

Utility Model Patent No.: ZL200720017882.8

Notes:

· Please use it for no more than 15 minutes
· Turn the power off after use

Components:

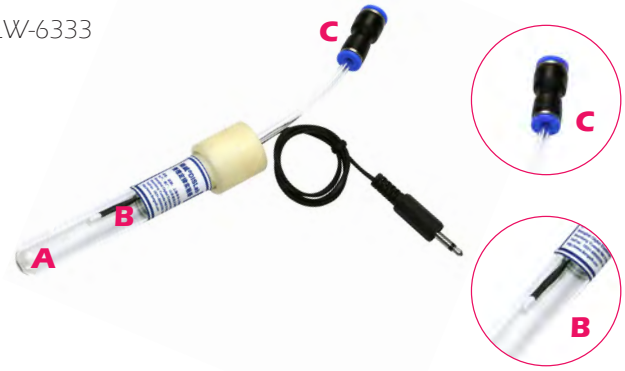
A. Base, B. Far-infrared Ceramic Unit, C. Outer Cover, D. Switch, E. Indicator, F. Power Jack, G.Fuse Tube.

Typical Applications:

· The relationship between ideal gas pressure and temperature
· Specific Heat Capacity (see below)
· Crystal melting and solidification
· Green house effect caused by CO_2

Charles' Law Apparatus

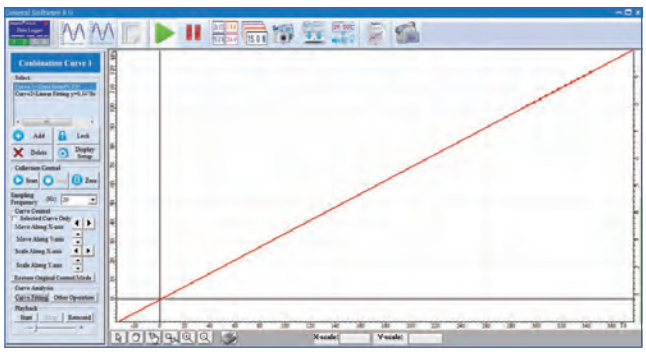
LW-6333



Components:

A. Tube, B. Fast-response Temperature Probe, C. Pressure Sensor Connector.

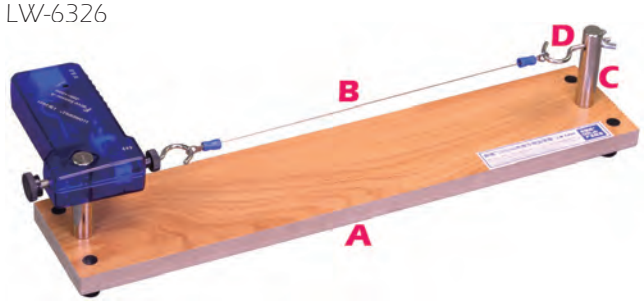
Experiment operation of Charles' Law



Curve of the relationship between Pressure and Temperature.

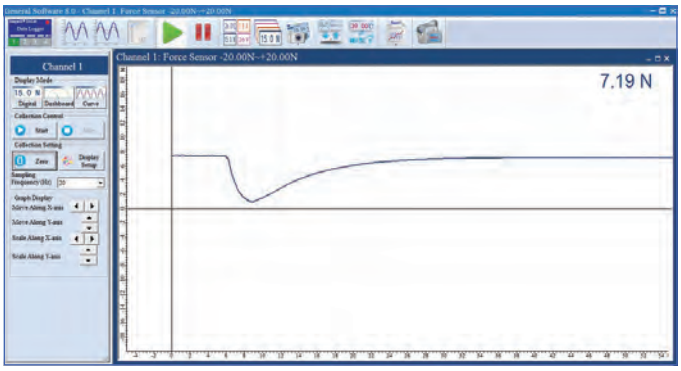
Thermal Expansion and Contraction Apparatus

LW-6326



This apparatus can be used as a platform for quantitative study of thermal expansion and contraction. As shown in the right image, it consists of base A, metal wire B, fixed rod C and tension bolt D, force sensor. Pull the metal wire close to the tension bolt in the experiment and observe the reading of sensor; heat the mental wire with the heater, then the declined readings of sensor can be observed; when stop heating, the readings of sensor will rise again. Control the heating time and change metal wires, many parallel experiment curves can be obtained for comparison, which is helpful for teachers to introduce the concept of “thermal expansion coefficient of the metal”.

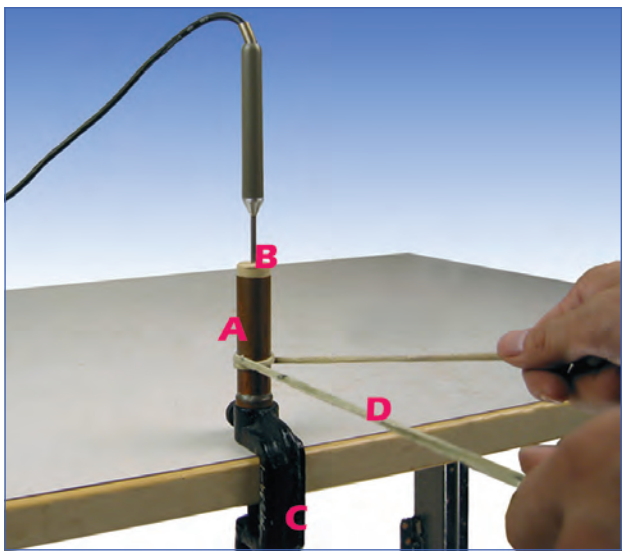
Experiment of thermal expansion and contraction of metal wire



The force curve declined during the wire being heated. It demonstrates the wire's expansion.

Frictional Heat Apparatus

LW-6340

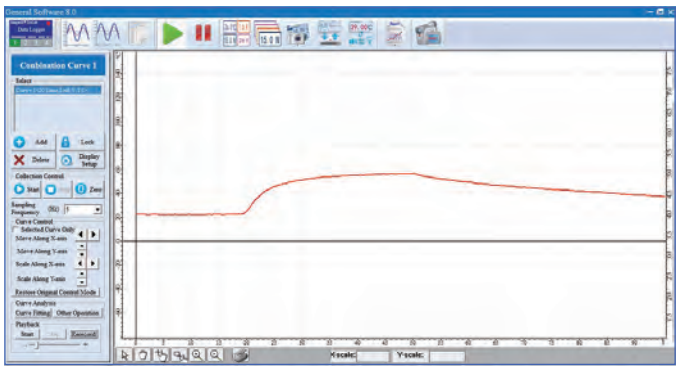


Components:

A. Copper Tube, B. Rubber Plug, C. Clamp, D. Cotton Cord

Working Principle:

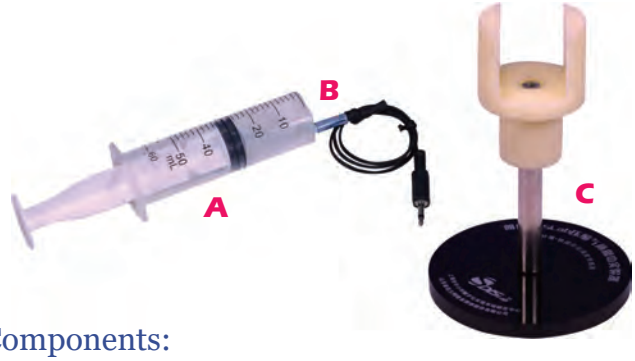
Use cord to rub the copper tube quickly, then the temperature in the copper tube will increase. With the temperature sensor, the real-time temperature change can be obtained. It demonstrates the frictional work transfer into the thermal energy.



Experiment results of frictional heat to raise the temperature

Work by Compressed Gas Apparatus

LW-6334

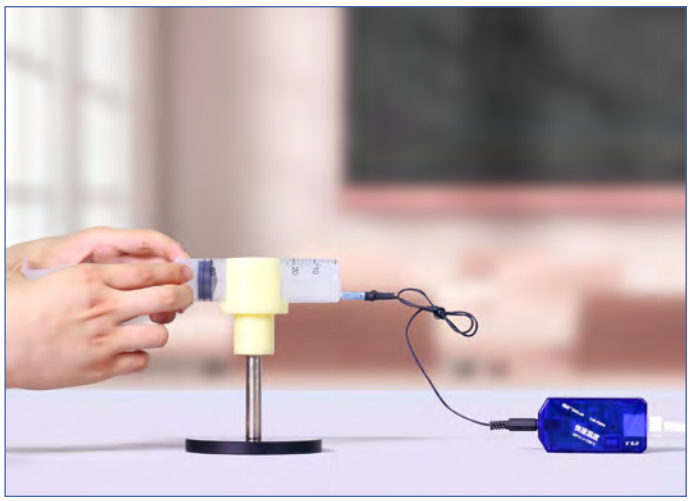


Components:

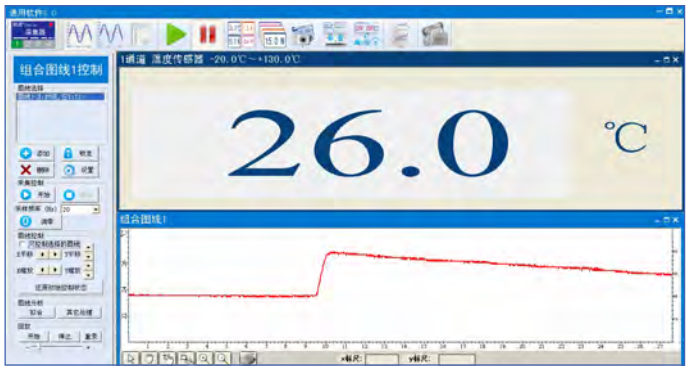
A. Large Size Syringe, B. Fast response temperature sensor probe, C. Base.

Working Principle:

Work by compressed gas apparatus is a combination of a large syringe A + a fast response temperature sensor, using a special base C, so that the experiment can be carried out on the desktop.



Work by compressed gas apparatus



Experiment interface of the work by comppressed gas

Thermal Radiation Apparatus

LW-6330

• Used to study on the energy transfer between heat and electricity.
•Used with Micro Current Sensor

Components:

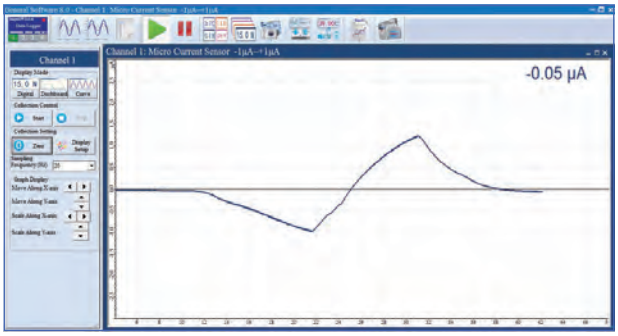
A. Thermoelectric Sensing Component
B. Specialized Experiment Board
C. Base

Working Principle:

Thermal radiation apparatus is used with the micro current sensor.

The micro current curve increases when the palm is positively facing to the "thermal-electric"core element; the micro current curve decreases and turns to negative, when the palm is positively facing to the other side of the core element.

Thermal radiation apparatus



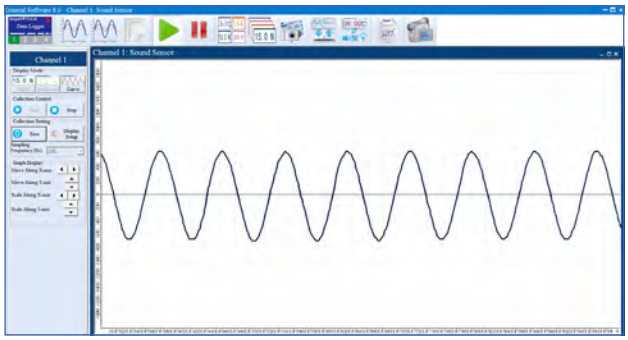
The current changes when the thermal source faces different side of thermoelectric sensing component

Audio Signal Generator V2.0

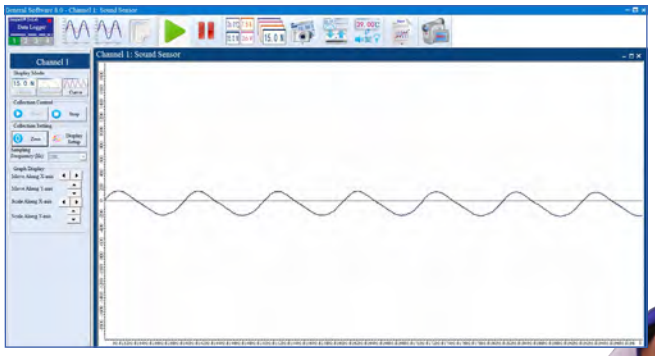
LW-Q709

- Emits soundwave through the build-in loudspeaker with frequency of the soundwave is 200Hz~2kHz.
- The loudness can be adjustable with 10Hz division. Resolution: 10Hz

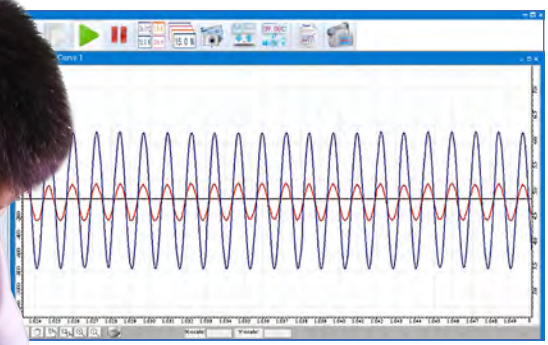
Sound waves measurement of audio signal generator



Curve of 400Hz soundwave



Curve of 200Hz soundwave



The superposition of two acoustic images with the same frequency but different amplitudes

Applications of audio signal generator

Optics Kit

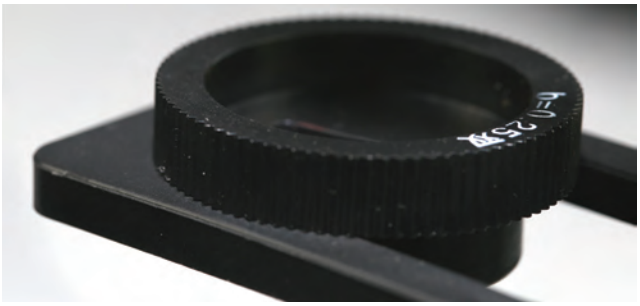
LW-5211

Components:

A. Laser Source, B. Single Slit 0.08mm, C. Single Slit 0.1mm, D. Double Slit 0.25mm, E. Polarizer
F. Special Bracket

Typical Applications :

· Light Interference
· Double-slit diffraction
· Grating diffraction
· Polarized phenomenon



0.25mm double slit on the specialized bracket

used with relative Illumination distribution Sensor

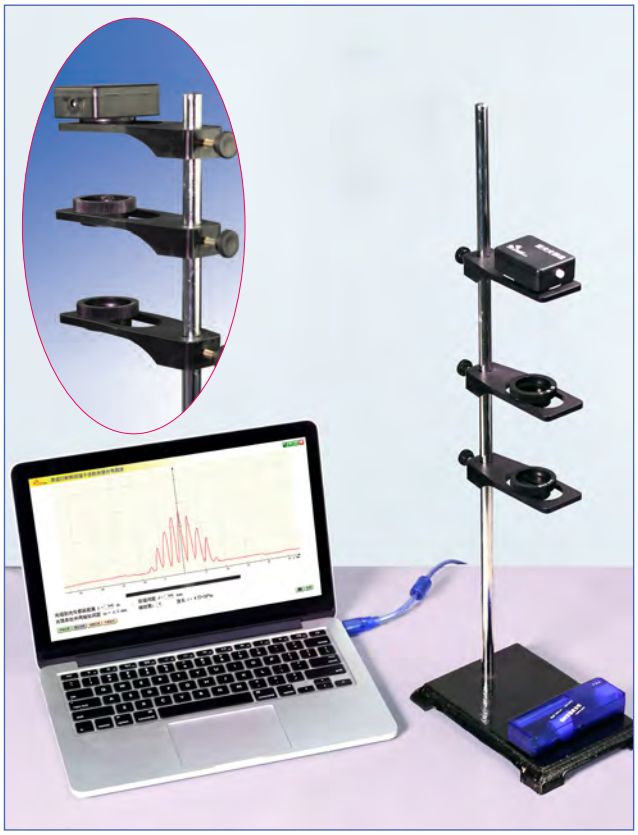
Operation Instruction:

Before application, install the bracket on the stand support; put the laser source on the top of the bracket; put the polarizer on the middle bracket, and put the slit on the bottom bracket.

The distance between top and middle bracket, middle and botom bracket should be within 100mm.

During the application, put the sensor at the bottom plate of the stand support.

Turn on the Laser source and adjust its position to make sure the laser beam can go through the light slit.

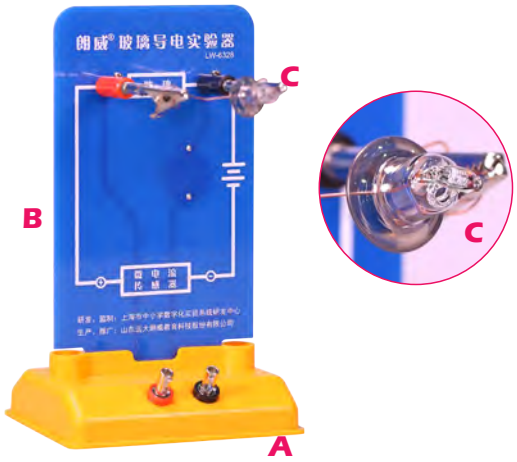


Single-slit Diffraction experiment

Electrical Conductivity for Glass Items

LW-6328

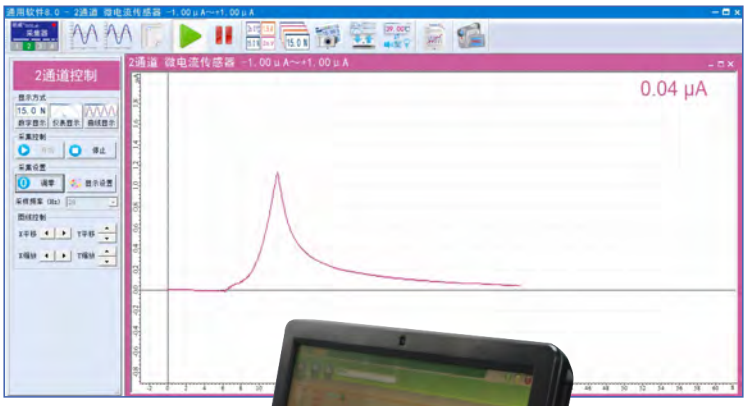
- Used to study on the glass conductivity when heated.
- Used with Micro Current Sensor.



Electrical conductivity for glass items (mobile terminal)

Components:

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



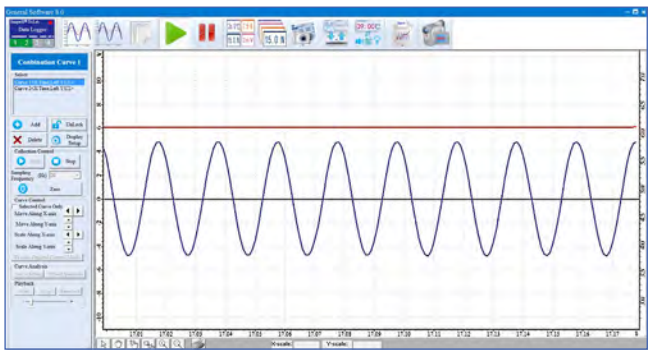
Electrical conductivity for glass items and its interface

General Power Supply V2.0

LW-Q708

Specifications

Input: AC 220V±10% 50Hz
DC Output: 1.5V~20V continuously adjustable, rated current 1A
AC Output: 0V~9V continuously adjustable, 50Hz, rated current 1A



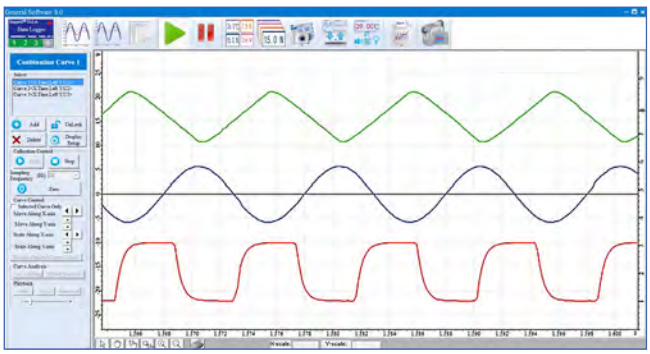
AC and DC signals output from General Power Supply

Low Frequency Signal Generator V2.0

LW-Q710

Specifications

Input Power: AC 220V ±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 requency.
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

Utility Model Patent No.: ZL201120057646.5

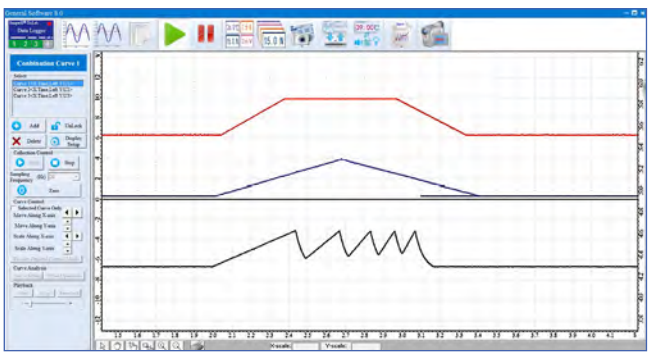
LW-Q820

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

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

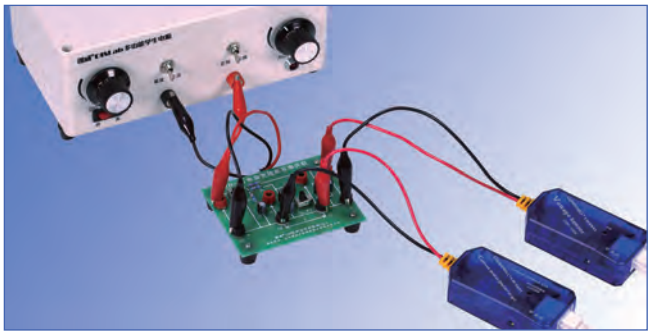


Voltage signals output from Smart Power Supply

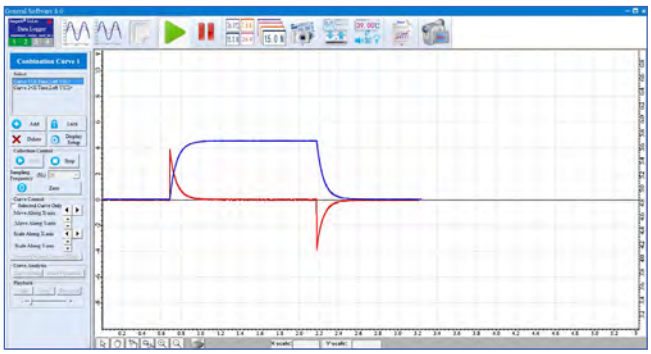
EXB Series Circuit Board V2.0

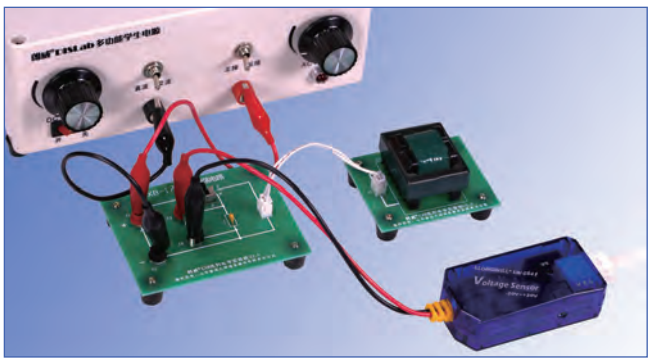
LW-6337

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

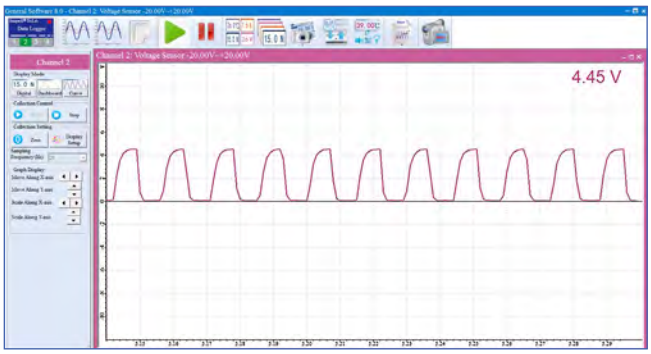


Experiment results of capacitor charge-discharge & series-parallel (below)





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



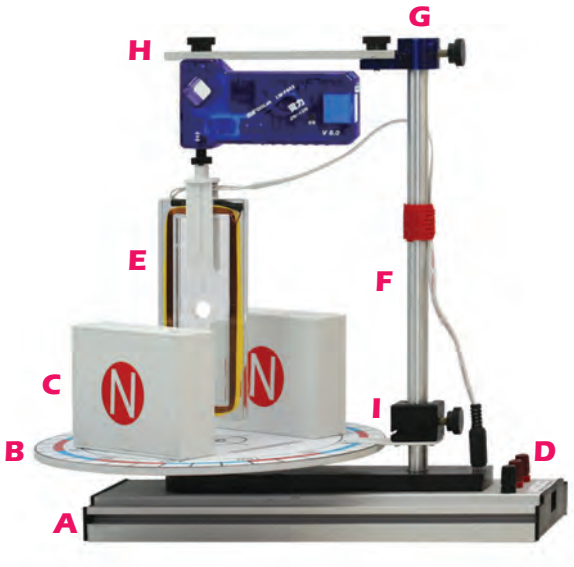
SPECIFICATION

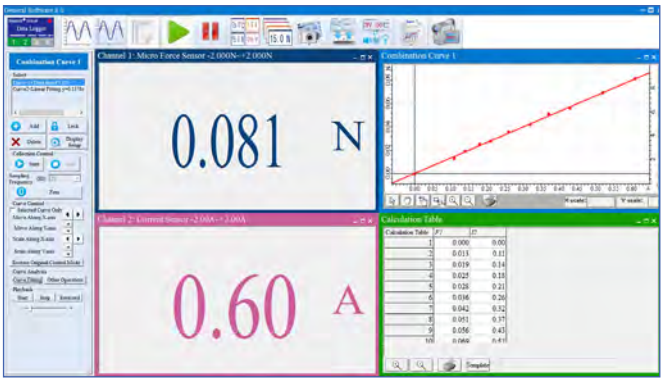
EXB-01 · Half-wave Rectification & Wave Filtering
EXB-02 · Full-wave Rectification & Wave Filtering
EXB-03 · Analysis of Complex Circuit
EXB-04 · RC & RL Phase Shift
EXB-05 · Measurement of EMF and Internal Resistance of the Battery with Voltammetry
EXB-06 · Measure EMF of the Battery with Compensation Method
EXB-07 · Partial Pressure and CurrentLimited 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)

Ampere Force Apparatus V2.0

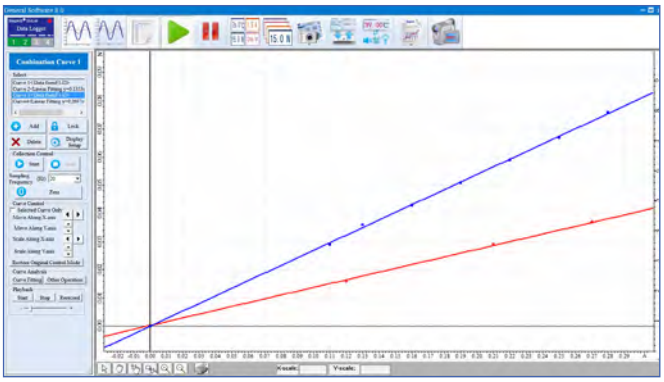
LW-Q735

Utility Model Patent No.: ZL201320517121.4





Experiment curve on the relationship between Ampere Force and current



Experiment curve on the relationship between Ampere Force and the length of the wire

Components:

A. Base, B. Disc C. Scale D. Terminal E. Wire Frame (Length-width ratio is 2:1) F. Stand Support G. Adapter H. I-type Bracket I. Pointer.

Typical Applications:

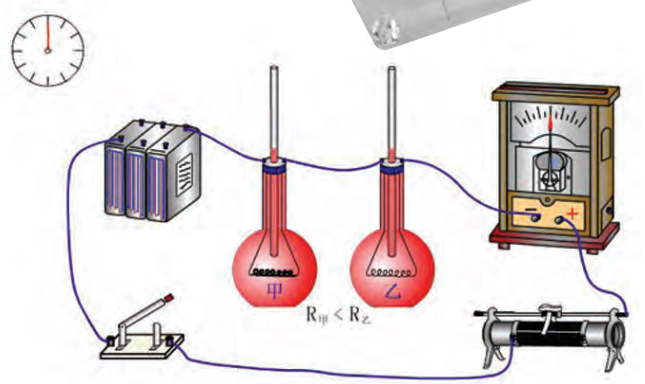
· Measurement of Ampere Force
· The effect of magnetic field on electrical wire
· Study the relationship of Ampere Force F, current flowing through the conductor I,length of conductor L,and magentic field intensity B.

Joule's Law Apparatus

LW-Q726

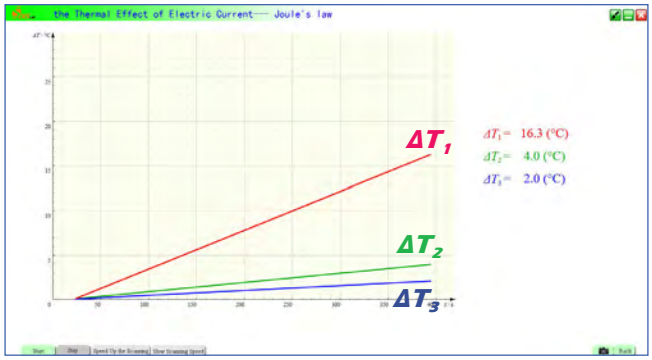
Typical Applications:

· Verify the Joule's Law
· Study on the heat effect of electric current



The classical model to verify Joule's law

Joule' law apparatus



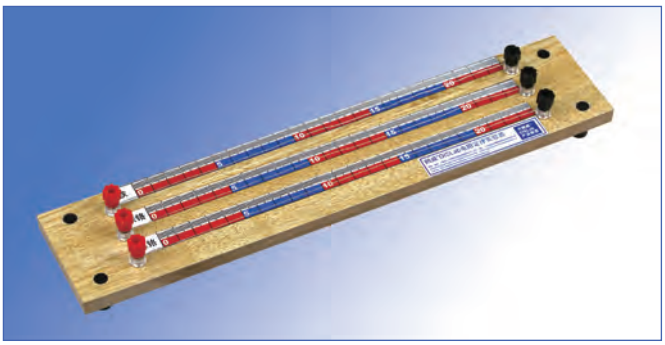
Experiment results of Joule's Law

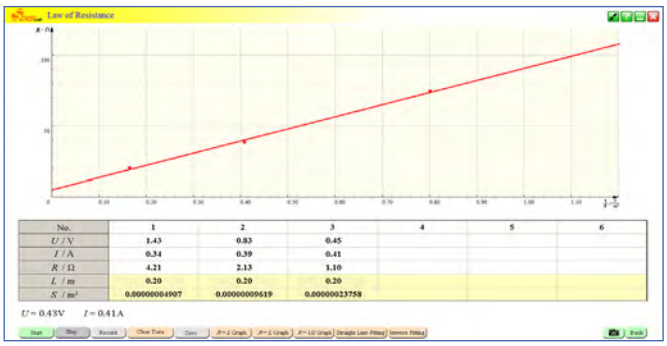
Resistance Law Apparatus

LW-6343

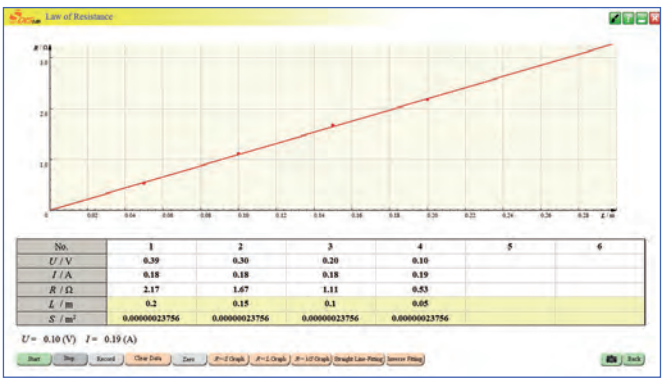
Design Concept:

Comparing with traditional instrument, Resistance Law Apparatus improves the measuring method by using current sensor and voltage sensor. It can accurately determine the relationship among metal resistivity, material, length and diameter. Therefore it can verify the Resistance Law.





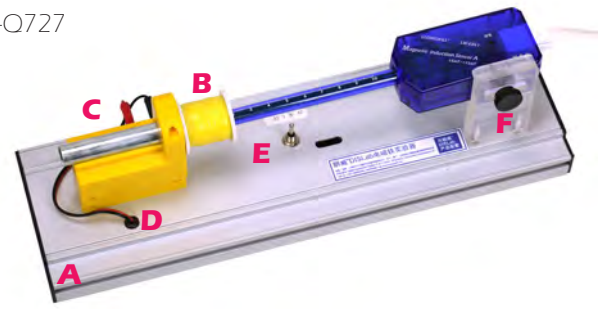
Relationship between resistance of metal wire and the reciprocal of its cross section



Graph of the resistance of a wire to its length

Electromagnet Apparatus

LW-Q727

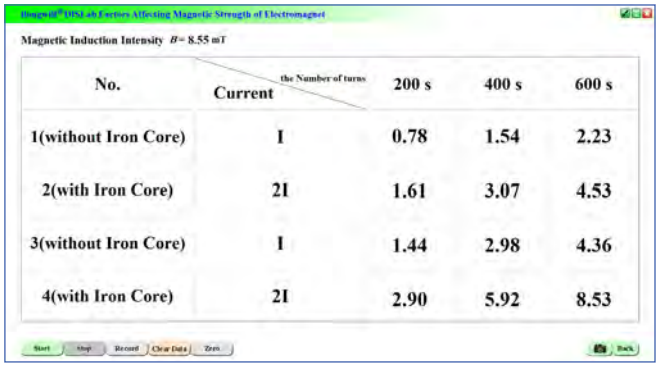


Components:

A. Base, B. Multiturn Coaxial Coils (turns: 200,400,600) C. Iron Core, D. Power Supply, E. Bilateral Switch, F. Dedicated Bracket.

Operation Instruction:

· Electromagnet Apparatus should be used with magnetic induction sensor.
· During application, fix the magnetic induction sensor on the base. The measuring point of the sensor (Hall element on the top end of the probe) is just on one side of the coil's axis.
· There is a coil options and voltage switch; turn the switch to create a certain experimental condition.


Magnetic Induction Intensity B= 8.55 mT

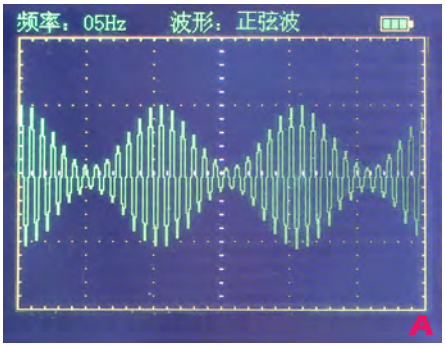
No.	Current \ the Number of turns	200 s	400 s	600 s
1(without Iron Core)	I	0.78	1.54	2.23
2(with Iron Core)	2I	1.61	3.07	4.53
3(without Iron Core)	I	1.44	2.98	4.36
4(with Iron Core)	2I	2.90	5.92	8.53

Experiment result of factors affecting the magnetic induction of a electromagnet

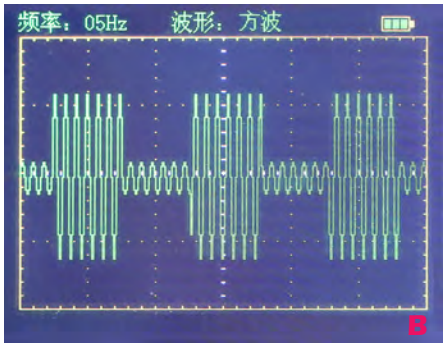
Propogation of Electromagnetic Wave Apparatus

LW-Q745 & LW-Q746

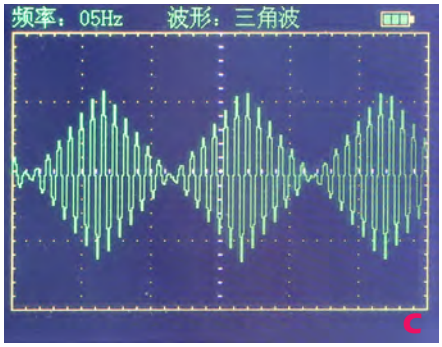
Propagation of electromagnetic wave apparatus consists of electromagnetic waves transmitting module and receiving module. The transmitting module emits the carrier frequency of 800Hz and owns the function of amplitude modulation. The modulation wave has three modes: sine wave, square wave and triangular wave, and the waveforms can be displayed through the transmitting module screen (see A, B and C below). The receiving module receives the modulation waves and displays them in the PC software (see D and E below). The above three waveforms can be converted by the button on the receiving module for demodulation demonstration (see F below).



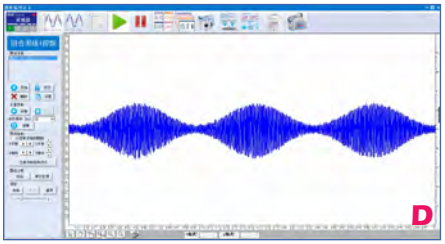
Transmitting module output signal—sine wave



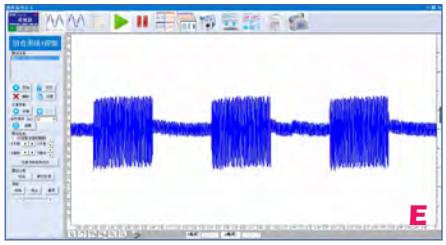
Transmitter output signal—square wave



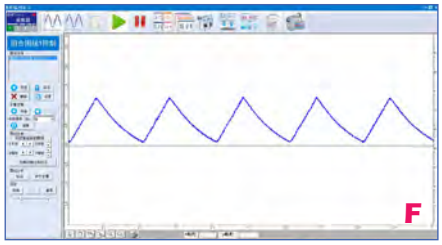
Transmitter output signal—triangular wave



Sine wave before demodulation



Experimental interface of square wave



Triangular wave after demodulation

High-sensitivity Coils

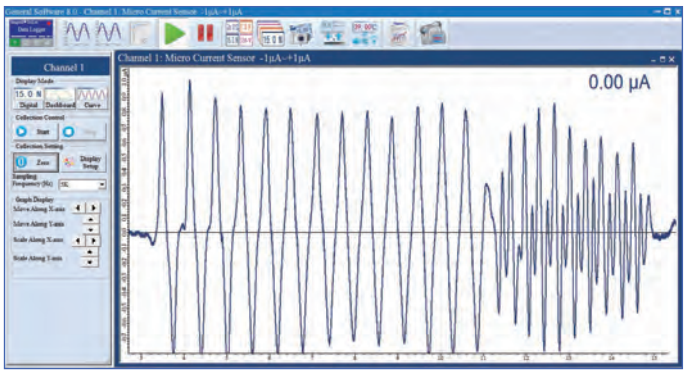
LW-Q813

Features:

· By using with Micro Current Sensor, hold high-sensitivity coils and rotate, then the induced current produced by cutting geomagnetic field lines can be measured with the micro current Sensor.

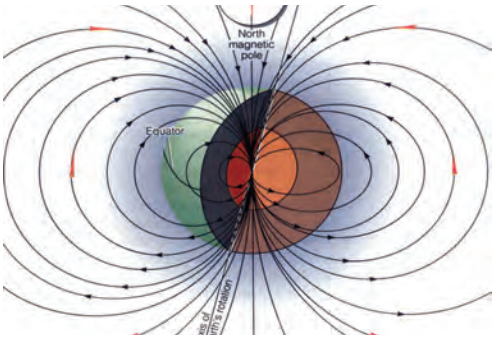
Typical Applications:

· Obtain induced current by cutting the geomagnetic field lines
· Measure the electric radiation intensity of electric appliances



The induced current measured by Micro current Sensor from the High-sensitivity Coils

Using High-sensivity coils and Micro Current Sensor in experiment



Geomagnetic Field

Geomagnetic Field Generator

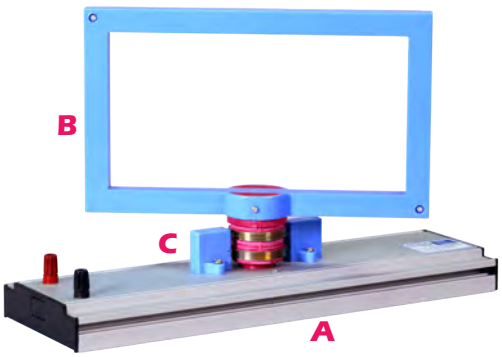
LW-6332

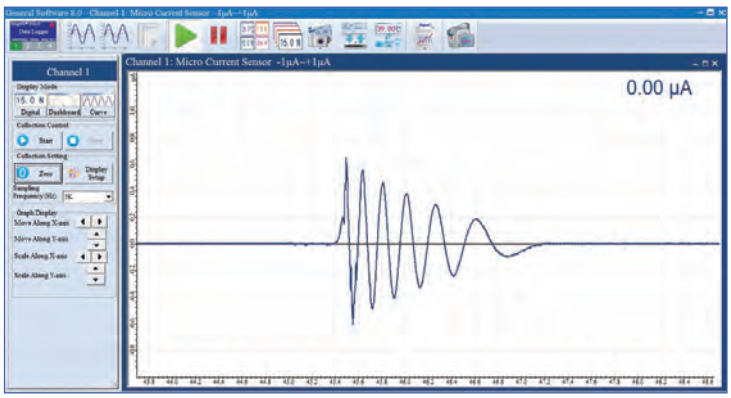
Components:

A. Specialized Base, B. Rectangular Coils, C. Connecting Bearing

Features:

·It is a standard physics model of power generator. Rotate the coils frame, and the induced current will be produced by cutting the geomagnetic field and measured by the micro current sensor.





Curve of induced current produced by geomagnetic field Generator

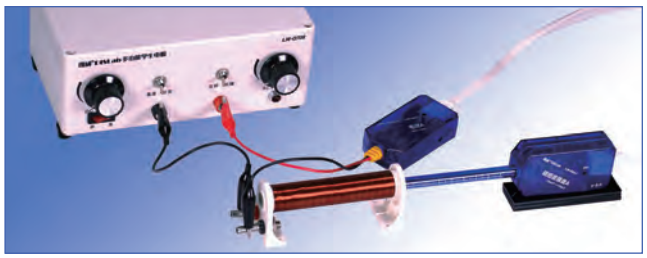
Study the geomagnetic generation

Uniform Magnetic Field Solenoid

LW-5308

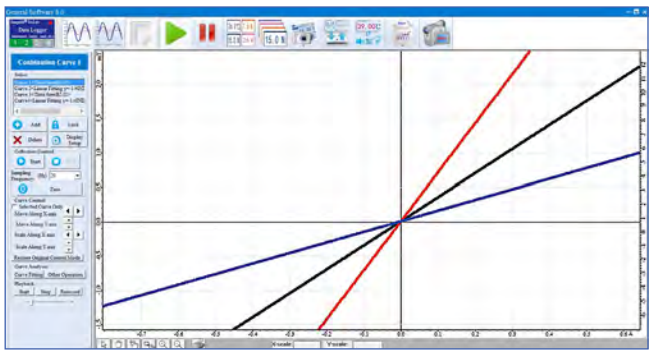
Experiment Example:

Study on the relationship between magnetic induction intensity of electric solenoid and current.



Apparatus: Data logger, general power supply, solenoid, magnetic induction sensor, wires, etc (refer to the image above).

Procedures: Connect the current sensor, solenoid and general power supply in series circuit. Then insert the probe of magnetic induction sensor into the middle of the solenoid; Click "Combination Curves", and add curve "magnetic induction intensity-current"; adjust the output of general power supply to change the current. A curve will be obtained (red); Move the probe outward, until 1 cm of the probe still in solenoid, and repeat the operation; Continue to move the probe outward, until 0.5 cm of the probe still in solenoid, and repeat the operation again, then another two curves will be obtained (blue and black).



Coordination curves of magnetic induction-current

Components:

1. The curve of "magnetic induction intensity and current" is a straight line through the coordinate origin, which indicates that there is a liner relationship between them in the solenoid;
2. The slopes of three curves are different because there are obvious difference of the magnetic induction intensity at different part of the solenoid.

Features:

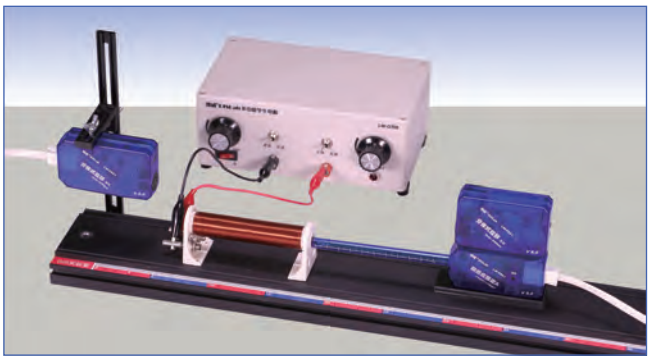
· More thinner and longer than traditional solenoid.
· Well-designed after calculating its diameter and coil turns.
· It can produce a uniform magnetic field, which covers 3/5 length area of the solenoid.

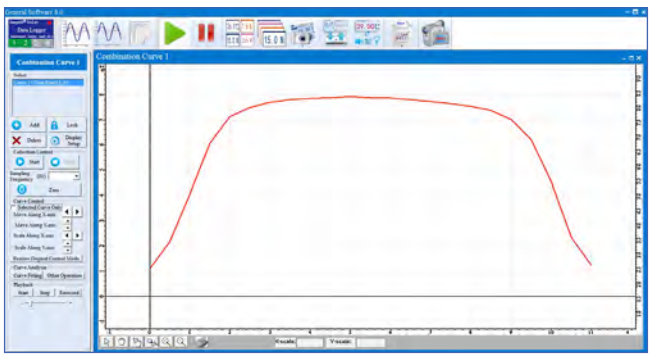
Experiment Extension of Solenoid:

A study of the distribution of magnetic induction intensity in a solenoid with displacement sensor (separated).

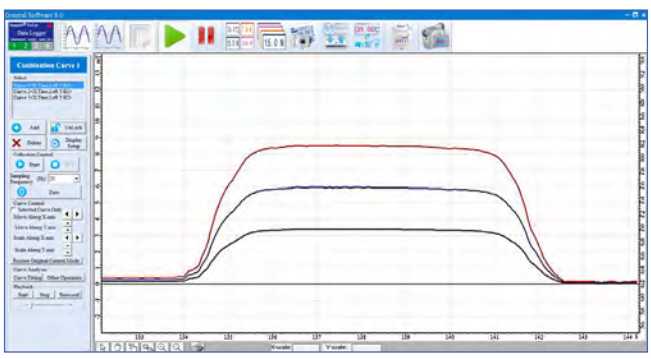
Apparatus: data logger, general power supply, solenoid, magnetic induction sensor, wires, etc (refer to the image below).

Procedures: By moving the combination of magnetic





induction sensor and a displacement sensor, the magnetic probe will pass through the uniform magnetic solenoid; the curve of the magnetic induction intensity and displacement can be obtained. Change the current in the solenoid; repeat the above operation; another two curves can be obtained (as shown below).



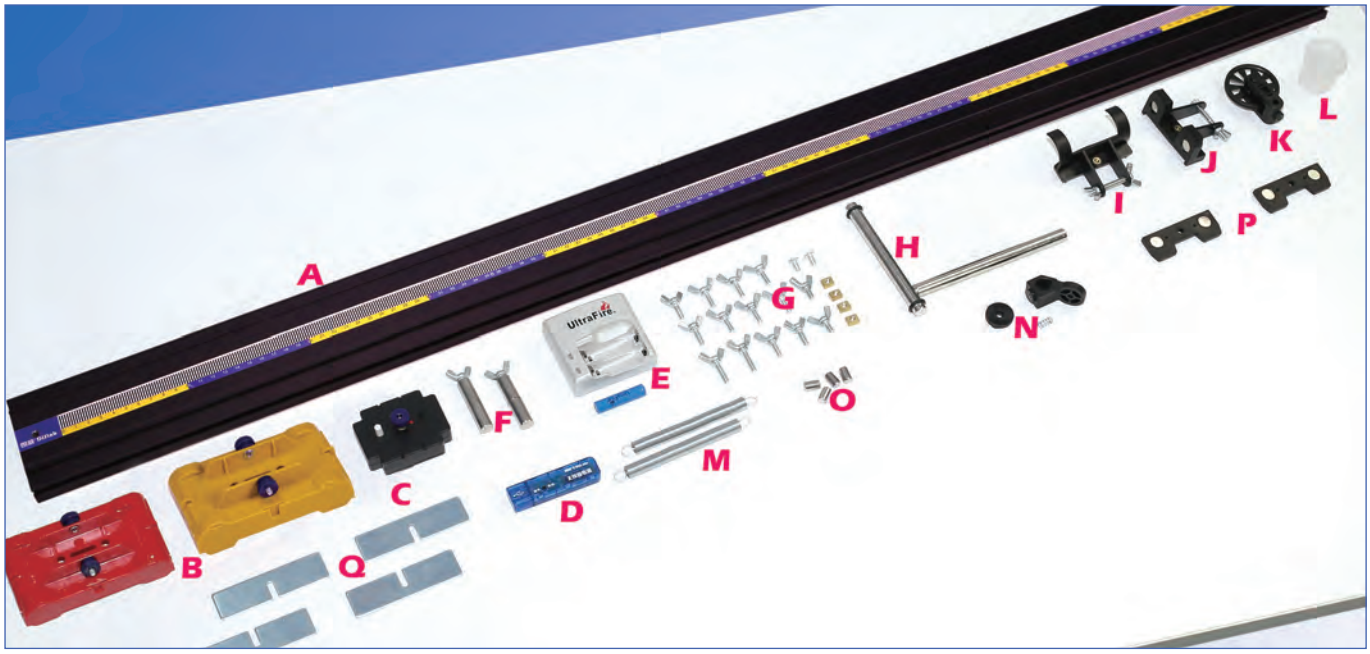
Intelligent Lab Apparatus

NEW TECHNOLOGY FILLS UP GAPS IN EXPERIMENTS AND SOLVES EXPERIMENTAL PROBLEMS

Digital Photoelectric Track System

LW-Q732
Range: 0 ~110cm

Utility Model Patent No.: ZL201220075995.4



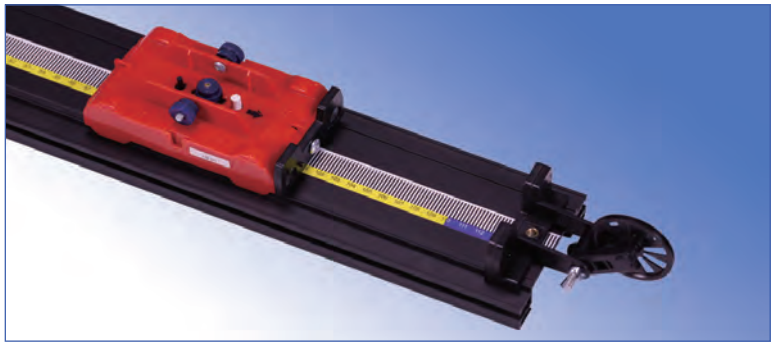
The Digital Photoelectric Track System is composed of 18 kinds of components as below

Typical Applications:

Research uniform linear motion, measure acceleration from *v-t* figure, Newton's Second Law, comparison of kinetic energies, kinetic energy conservation in the collision, curve features of *s-t* figure under different states of motion, forced vibration and electromagnetic damping etc.

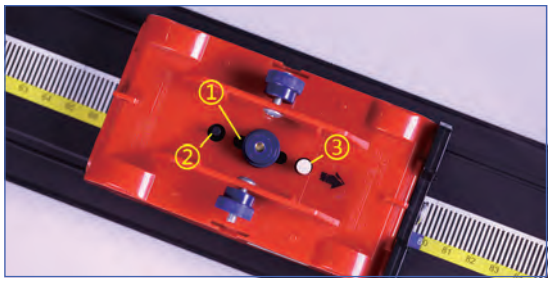
System Composition of Digital Photoelectric Track:

A. Digital Track; B. Carts; C. Scanner; D. Wireless Receiver; E. Charger and Batteries; F. Fixed Rods; G. Fasteners; H. T-type Track Support; I. Cart Base; J. Magnetic Bumper; K. Pulley; L. bucket with string; M. Springs; N. 5g Weight; O. Adjustable Inclination Unit (used with T-type Track Support); P. Magnetic Sheet (assembled on the cart); Q. 50g Weight.

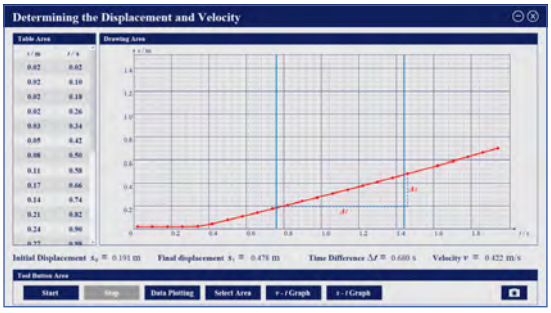


Measure the displacement and velocity by using our digital photoelectric track

Assemble the scanner into the cart



① · Power Indicator ② · Reset Button ③ · Power Switch



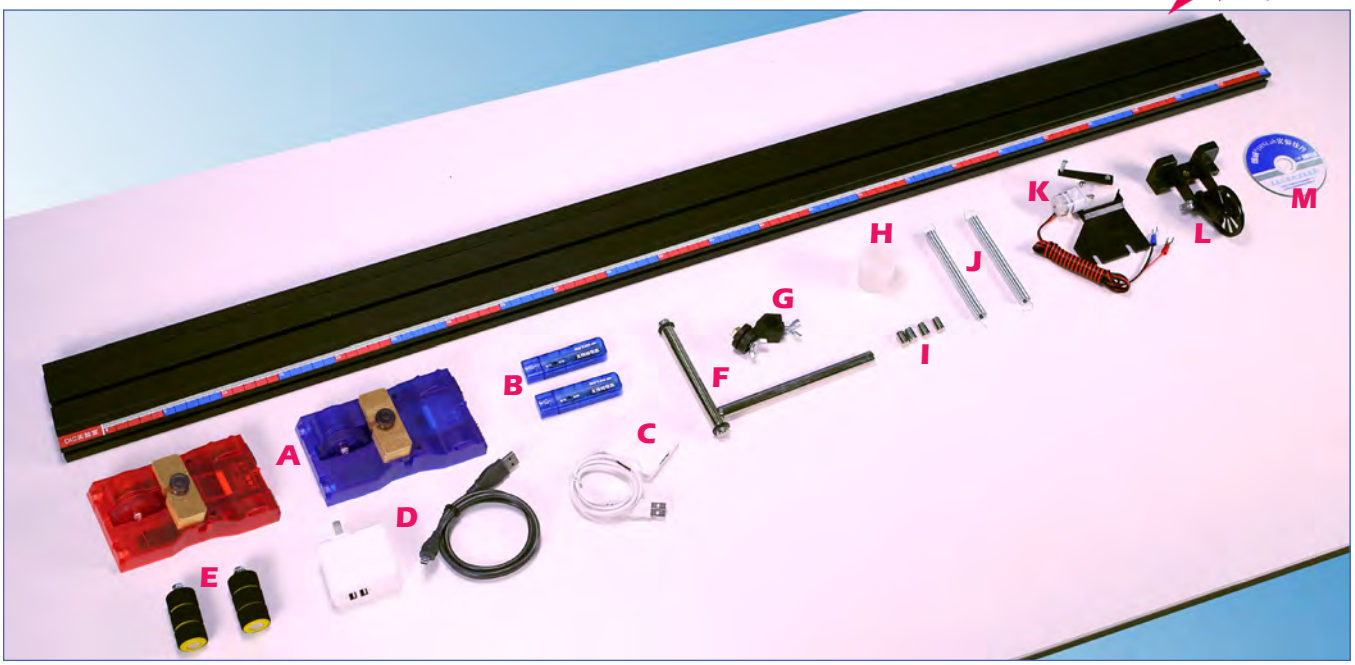
The experiment results of measurring the displacement and velocity by using our digital photoelectric track

Photoelectric Range Finder (π System)

NEW

LW-Q756

Invention Patent No.: ZL201210413579.5



Components:

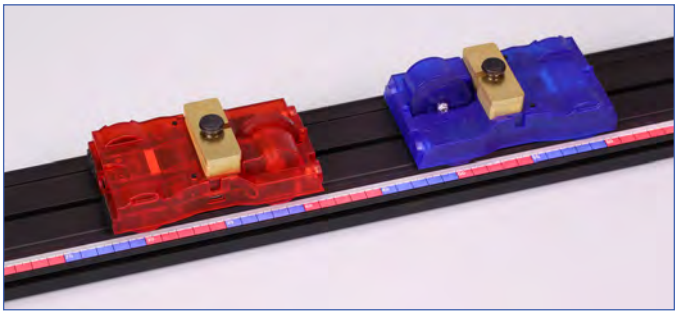
Photoelectric range finder(π System) includes: A. Photoelectric Range Finder device(including 1 red cart, 1 blue cart, 2 lithium batteries, two 100g weights, two 200g weights and two M5×30 plastic cap bolts), B. Wireless Receiver, C. USB Hub, D. Charger, Track Accessories (including E. Bumper, F. T-type Track Support, G. Track Inclination Adjuster, H. Bucket, I. Weight, J. Spring, K. Motor, L. Magnetic Bumper(including pulley)), M. Special Software, N. Special Track.

Design Concept:

Photoelectric Range Finder(π System) transmits data through wireless communication mode, whose main wheel embedded with self contained grating encoding disk is used to collect its own velocity according to the grating distance measurement principle. The relevant kinematics experiments can be performed by using the special software, and the trackless acquisition can be carried out without the special track.

Typical Applications:

Displacement and velocity measurement, the acceleration obtained from the *v-t* graph, Newton's Second Law, vibration image of spring oscillator, forced vibration, elastic collision and inelastic collision(figures below), etc.



Experiment result of elastic collision(figure above) and inelastic collision(figure below

Wireless Centripetal Force Apparatus

LW-Q711 Invention Patent No.:201210013683.5

worlddidac AWARD 2014

THIS PRODUCT WON THE 16TH WORLDDIDAC INNOVATION AWARD FOR EQUIPMENT GROUP

- **An integrate system with the functions of data collection, data processing and wireless communication**
- **No need of data logger**
- **Study on the centripetal force at any arbitrary angle by adjusting the inclination of the bracket**

A. Base
B. Connecting Rod
C. Rotating Arm Base
D. Rotation Arms
E. Weights
F. Force Sensor(build-in)
G. Photo Gate Sensor (build-in)
H. Wireless Transmitter
I. Wireless Receiver
J. Light Blocking Rod

Application of Wireless Centripetal Force Apparatus

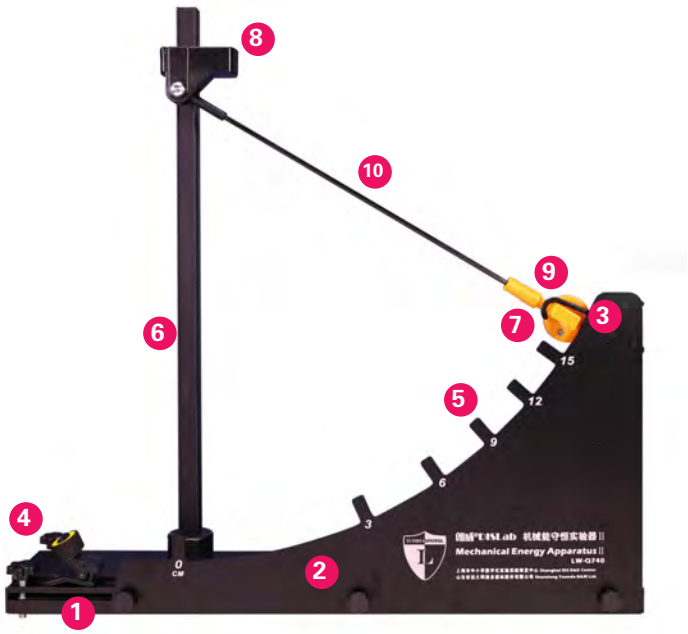
Experiment results of the relationship between the centripetal force *F* and angular velocity *ω*

Experiment fitting cure *F-r*) on the centripetal force and radius

Conservation Law of Mechanical Energy Apparatus Ⅱ

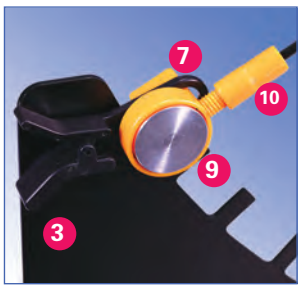
LW-Q740 Invention Patent Application No.:201410233893.4

- **Verify the Conservation Law of Mechanical Energy.**
- **Using Photo Gate Sensor**



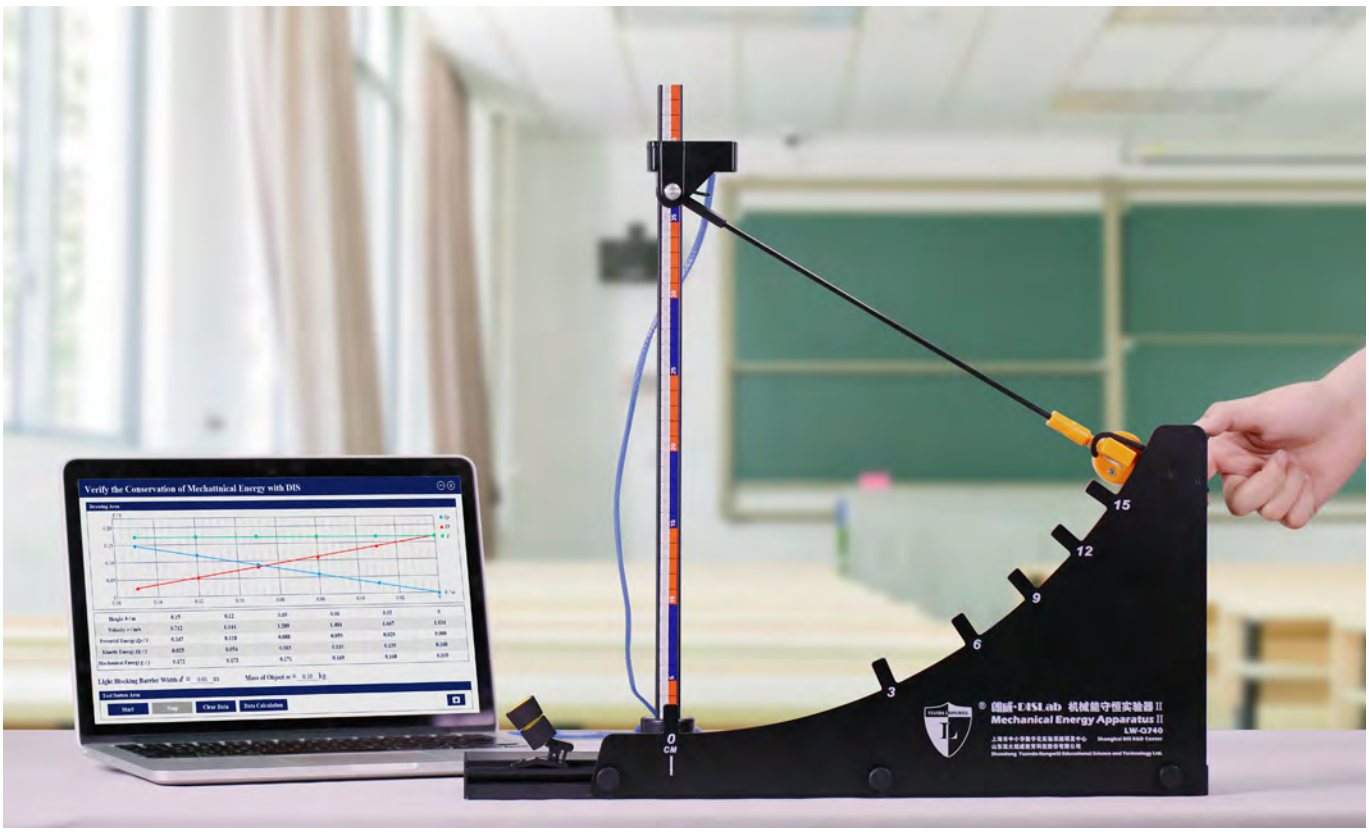
Components:

① · Base; ② · Scale plate; ③ · Releaser; ④ . Absorber ⑤ · Light Blocking Sheet; ⑥ · Standing support; ⑧ · data processing and communication circuit with USB port; ⑨ · Pendulum bob (⑦. Photo Gate and weight); ⑩ · Pendulum Rod.



Operations:

Release the pendulum embedded with a photo gate sensor, which passes through six light blocking sheets at different heights one time; the system automatically records the speed of the pendulum through each light blocking sheet, and calculates the kinetic energy and potential energy of each point by clicking the “Data Calculation”. The three lines represent the changing trends of kinetic energies, potential energies and mechanical energies at different heights.



2-D Projectile Motion Device

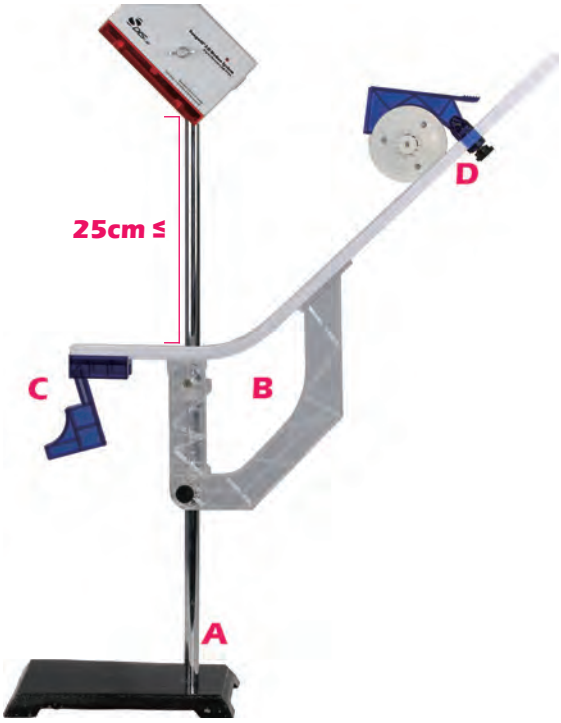
LW-Q701

Assembly:

Mount the 2-D motion receiver onto the stand support (image A), at least 25 cm higher than the fixed point of the projectile track (image C). Adjust the corner cut of the receiver to horizontal level (image B); make sure the receiver in the same plane with the infrared emission port of the emitter, ensuring the signal transmission smooth.

Operation:

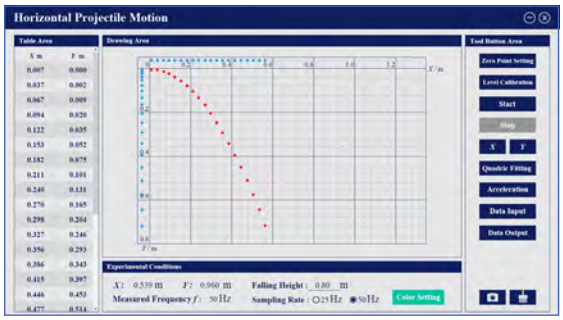
Zero setting is one important step before 2-D projectile motion experiment. Switch on the 2-D motion emitter, as shown in image D; place it at the edge of the projectile track and keep it closed to zero setting unit. Then click program zero setting and clockwise - horizontally move the emitter back about 3~6 cm on the projectile track; click horizontal alignment and complete the zero setting. Operation steps as shown in image E.



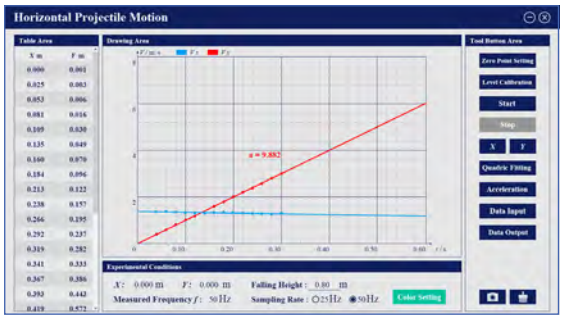
2-D Motion System, which is composed of 2-D Projectile Motion Device and 2-D Motion Sensors, is the representative of lab equipment supporting 2-D motion series.

Components:

A. Stand Support, B. Projectile Track, C. Zero Setting Device, D. Releasing Device.



To describe the track of horizontal projectile motion based on the measured data



Calculate the acceleration in vertical direction of the horizontal projectile motion; compare it with the local gravity acceleration value.

2-D Motion Resolution and Composition Apparatus

LW-Q705

Components:

A. Stand support, B. Horizontal beam, C. Traction motor and switch, D. Horizontal movement slot, E. Limit frame in vertical direction, F. Horizontal bracket of receiver, G. 2-D motion receiver, H. emitter, pulling strings and fasteners, etc.

2-D Simple Pendulum

LW-Q702

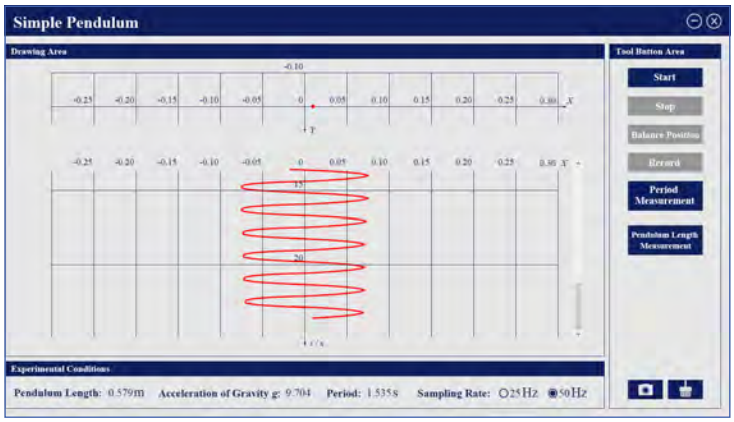
- **Describing the motion trajectory of simple pendulum in 2-D plane.**
- **Used with 2-D Motion Emitter and 2-D Motion Receiver.**

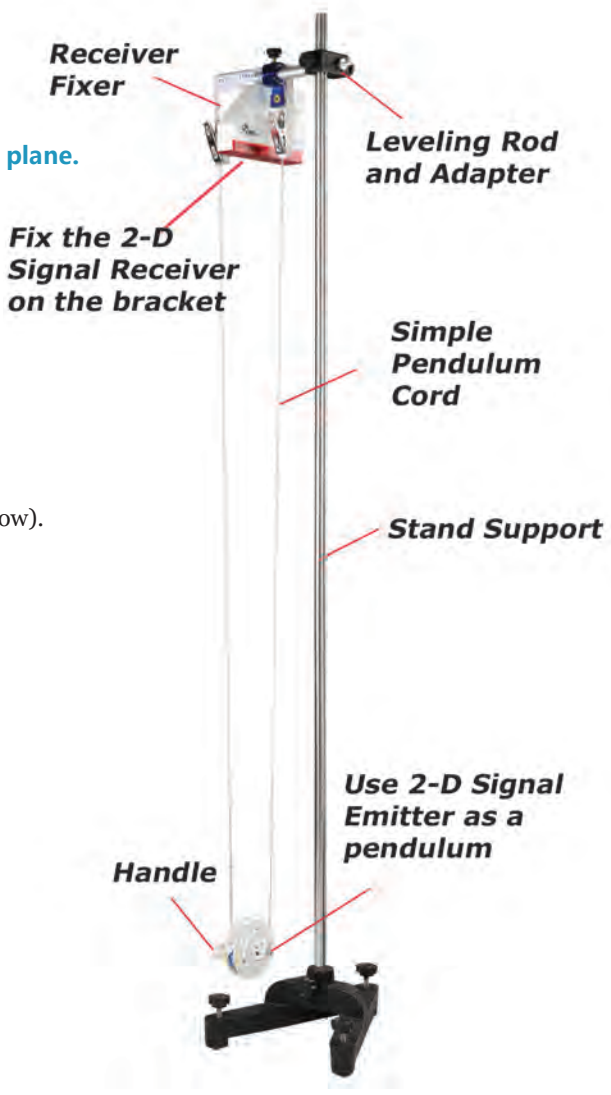
The Background:

The movement of simple pendulum is also a 2-D motion. Its trajectory can be described by the 2-D motion system.

Typical Applications:

· Measure the gravity acceleration by the simple pendulum period.
· Describe the motion trajectory of simple pendulum in 2-D plane (below).

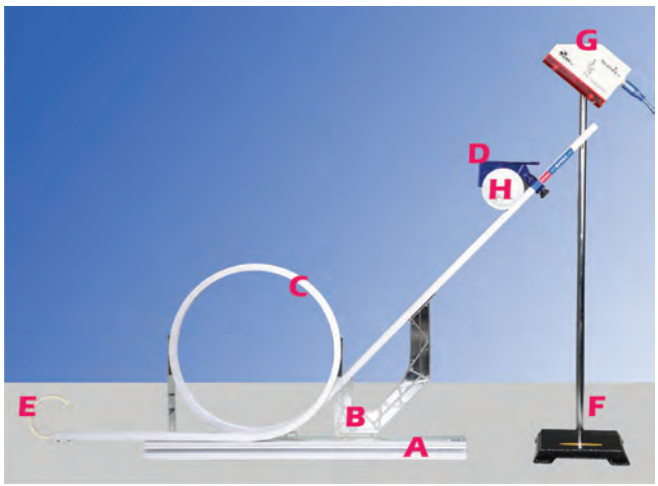




2-D Centrifugal Track

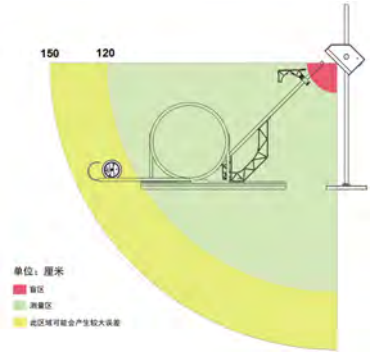
LW-Q704

•To describe the centrifugal motion trajectory.
• Use with stand support, 2-D Motion Receiver and Emitter



Components:

2-D Simple Pendulum System consists of 2-D Simple Pendulum Device and 2-D Motion Sensors. This equipment contains an iron stand A, a crossbar and a cross adapter B, a 2-D motion receiver fixing device C, a single pendulum string D, a 2-D motion transmitter fixing screw E, a releasing rod F, etc. It is used in conjunction with 2-D motion receiver G and transmitter H.

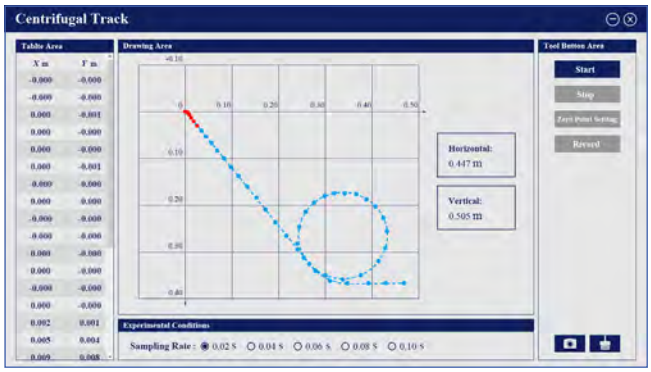


Working principle:

The 2-D Motion System emitter can be used as the moving object to make it move on the centrifugal track, and the trajectory of the object to do the centrifugal motion can be described (figure below). The light green area is the effective receiving area of the 2-D motion system.

Inferences:

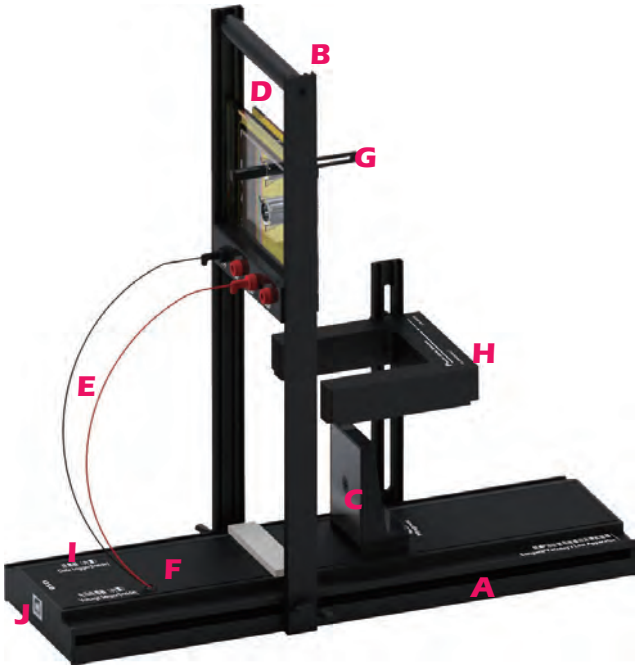
When releasing height H≤2.5R, the emitter can't reach the highest point of track ring.



Faraday's Law Apparatus I

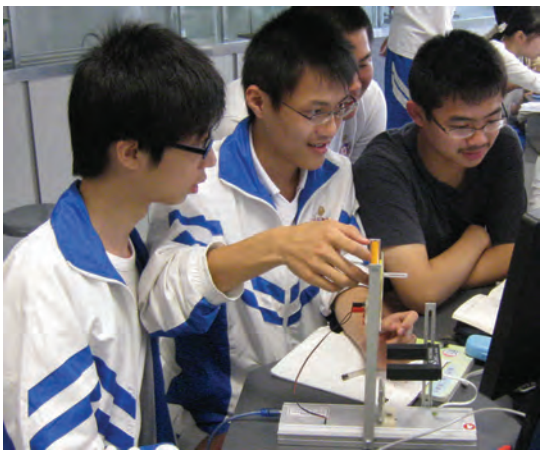
LW-Q812

Utility Model Patent No.: ZL201020569120.0



Components:

A · Base
B · Vertical Track
C · The Horizontal magnet field direction from the rectangular magnet
D · Coils
It can fall down with different heights
E · Thin wire
F · Build-in voltage Sensor
G · Light Blocking Sheet
H · Photo Gate Sensor
I · Data Logger Circuits
J · USB Port

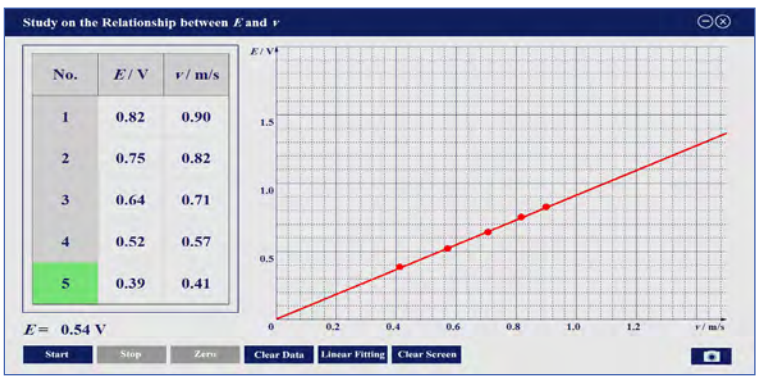


Working Principle:

It is a physics model of “conductor falling and cutting the magnetic field". By measuring the features of conductor, the relation of four physics quantities: E, the motional electromotive force; v, the falling speed of the conductor; n, the turns of coil in the conductor; and L, the length of the conductor, can be shown as $E \propto nBLv$.

Experiment Example:

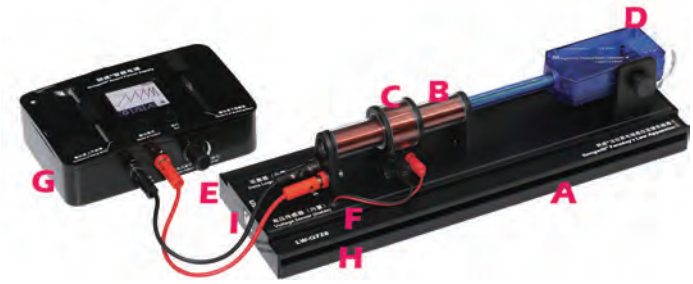
In this experiment, the three curves show the relation of motional electromotive force and the falling speed of conductor of different coil turns (100 turns, 200 turns and 300 turns) respectively. Each curve shows that the motional electromotive force is liner relationship with the falling speed of conductor; When the speed is certain, the ratio of the three values of motional electromotive force is close to 1:2:3, which is the turns ratio of three coils.
The experiment verifies $E \propto nv$, when the value of B and L is certain, the formula of $E \propto nBLv$ can be deduced.



Faraday's Law Apparatus Ⅱ

LW-Q828 Invention Patent No.: ZL201110053949.4

Components:



A· Base, B· Primary Coil, C· Secondary Coil
D· Magnetic Induction Sensor, E· Thread, F· Built-in Voltage Sensor, G· Smart Power Supply, H· Build-in Data Logger, I· USB Port.

The Faraday's Law II should be used with Magnetic Induction Sensor and Smart Power Supply.

Working Principle:

The primary coil generates a magnetic field by using the smart power supply. The internal magnetic field of the primary coil can be regarded as a uniform magnetic field and can be measured by the sensor. The external magnetic field of the primary coil passes through the secondary coil which is nested outside of the primary coil. If we adjust the smart power supply, the induced electromotive force will be produced in the secondary coil because the magnetic field of the primary coil has been changed. The induced electromotive force can be measured by the voltage sensor.

Therefore, *B*, the magnetic induction intensity of the primary coil, and *E*, the induced electromotive force produced in the secondary coil because of the change of the magnetic induction intensity of the primary coil, can be measured by sensors. The change ratio of *B* in a certain duration namely slope *K* can be calculated based on the data of *B-t*, i.e. $K=\Delta B/\Delta t$.

Figure 1 shows the initial interface of the software of this experiment, there are three partsfrom top to bottom, including *B-t* line area, *E-t* line area and calculation table area;

Figure 2 shows the *B-t* and *E-t* lines obtained by using the trapezoidal wave output mode of smart power supply. It indicates that the value of *E* is related to the change ratio of *B*.

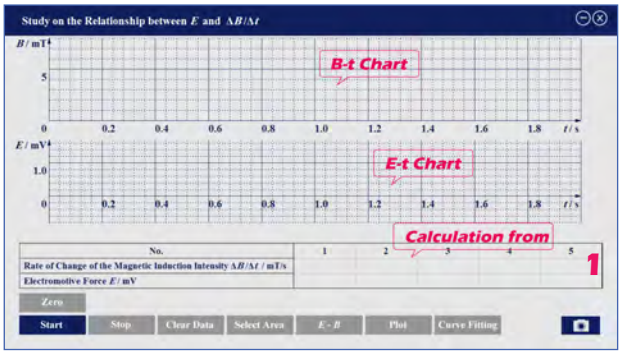
Figure 3 shows the continuously changing *B-t* and *E-t* lines obtained by using the Combined saw tooth wave output modeof smart power supply. Thus, we can obtain a set data of slope *K* of *B-t* line, and the corresponding *E* value.

Figure 4 is the "*E-K*" line based on the data obtained from

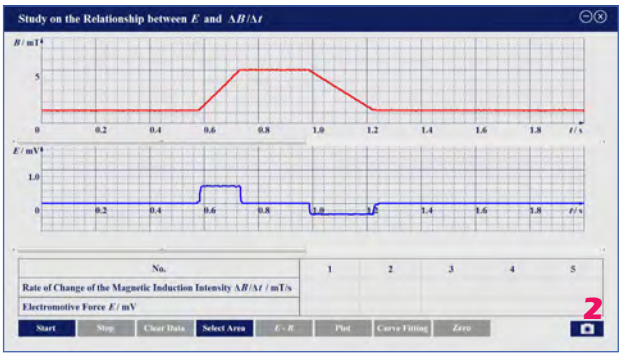
It can be inferred from Figure 4 that $E \propto K$, i.e. $E \propto \Delta B/\Delta t$.

According to the magnetic flux $\varphi=BS$, when *S* is constant, $\Delta\varphi \propto \Delta B$, So:$E \propto \Delta\varphi/\Delta t$.

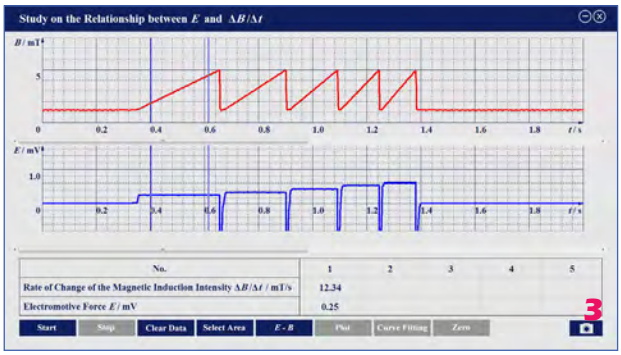
This is the ultimate expression of Faraday's law of electromagnetic induction.



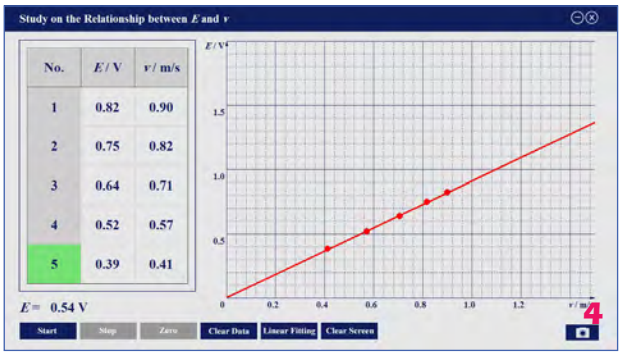
Software interface



Obtain the graph of "*B-t*" and "*E-t* " under the output of trapezoidal wave



Under the output of triangle wave, changing the ratio of B, the rising slope of *B-t* curve is increasing and E also increases



Fitting curve of "*E-K*" passes through the origin and illustrates the E is propotential to *ΔB/Δt*

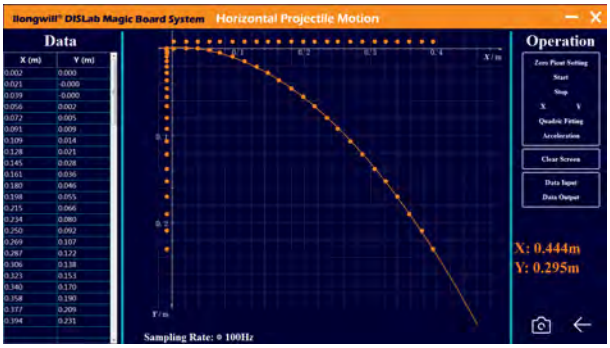
Magic Board System

LW-Q858

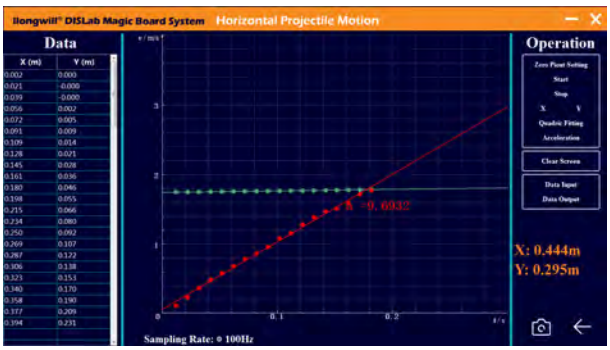
Invention Patent No.: 201610074750.2
Utility Model Patent No.: 201620107722.1

Typical Applications:

By using the Magic Board (Electromagnetic Positioning System), the projectile motion, single pendulum, oblique projectile motion, centrifugal track, Galileo's inclined plane experiment(2D), direction of circular motion velocity, free fall motion, conservation law of mechanical energy, projection of circular motion, damping vibration and motion synthesis can be completed.



Projection and fitting curve of projectile motion trajectory



Experiment result of the acceleration in vertical direction of projectile motion

Components:

A. Locating board, B. Catapult, C. Signal transmitter,
D. Horizontal and, E. Lengthways buffer slot,
F. Support frame, Fixed pieces and accessories.