Christiani

Technical Institute for Vocational Training

SINCE 1931

Your Partner for Technical Education

School | Vocational Training | University | Further Training

Physics teaching materials 2017

General education

85 Years of technical education

Single-source provider for science and technical education

christiani-tvet.com

Our international team is pleased to advice you

INTERNATIONAL NETWORKS & INSTITUTIONS

CONTACT

Markus Milwa
International Affairs
Mobile: + 49 151 261 084 88
Fax: + 49 7531 5801-85
milwa@christiani.de
www.christiani-international.com

ASIA-PACIFIC

CONTACT

Lisa Kuner
Team Leader Export
Phone: + 49 7531 5801-54
Fax: + 49 7531 5801-85
kuner@christiani.de
www.christiani-international.com

NORTH AMERICA, MEXICO

CONTACT

Ferdinand Ganser
Export Manager
Mobile: + 49 151 186 177 16
Fax: + 49 7531 5801-85
ganser@christiani.de
www.christiani-international.com

NEAR-MIDDLE EAST/NORTH AFRICA

CONTACT

Fathi Jamal
Export Manager
Mobile: + 49 151 121 251 47
Fax: + 49 7531 5801-85
jamal@christiani.de
www.christiani-me.com

LATIN AMERICA, SPAIN, PORTUGAL

CONTACT

Maiken Kayser
Export Manager
Phone: + 49 7531 5801-945
Fax: + 49 7531 5801-85
kayser@christiani.de
www.christiani.es

AFRICA, RUSSIA, CENTRAL ASIA

CONTACT

Nadja Parcsami
Export Manager
Phone: + 49 7531 5801-38
Fax: + 49 7531 5801-85
parcsami@christiani.de
www.christiani-international.com

EUROPE

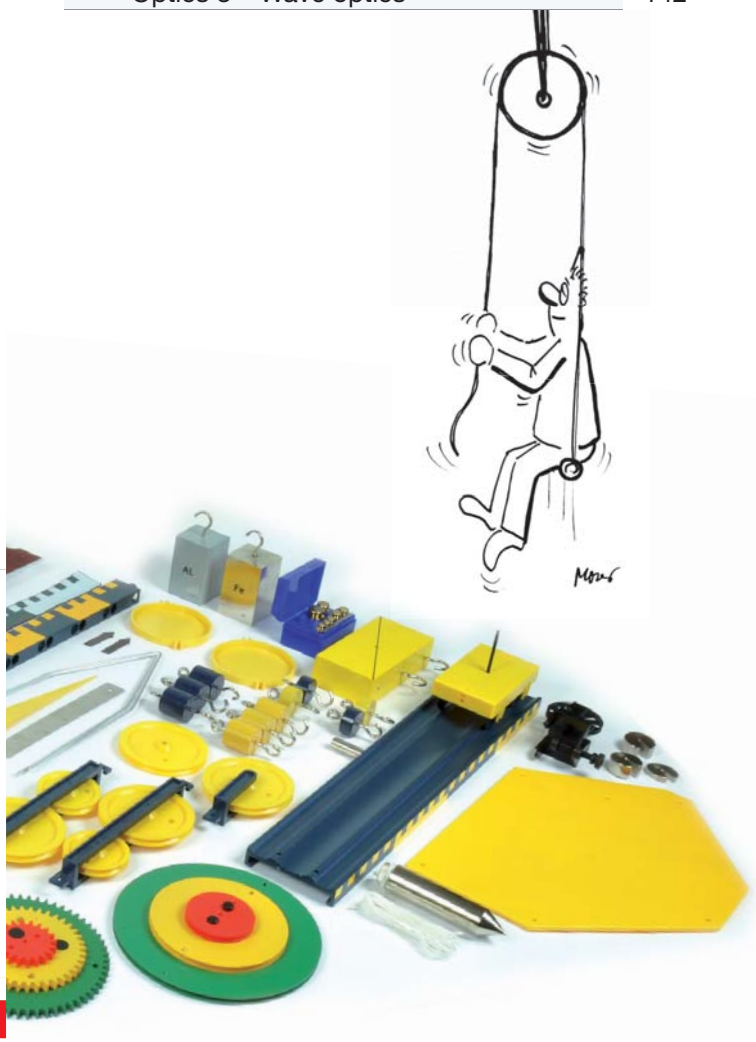
CONTACT

Sandra Strobel
Export Manager
Phone: + 49 7531 5801-9904
Fax: + 49 7531 5801-85
strobel@christiani.de
www.christiani.eu

Content

Demonstration devices

Student experiments



Christiani – your expert in technical training and hands-on learning

Hands-on learning is a fundamental aspect of technical training – it helps learners to acquire knowledge, skills and competences which are essential in working life since they are close to the needs of industry. With its products and activities Christiani is promoting and implementing this learning model. Christiani has been active in the field of technical vocational training for over 80 years and stands for high-quality, hands-on training and continuing education. Christiani is further expanding its business abroad – our products are already used in more than 70 countries.

As a consequence the number of teaching materials in foreign languages is steadily growing thus supporting hands-on learning abroad based on the German dual system and its action-based didactic methods.

Services and products:

- Developing of teaching materials
- Manufacturing of learning systems
- Publishing of books & multimedia products
- Providing of examination materials
- Train-the-Trainer, consulting
- Textbooks
- Didactic teaching material
- Interactive learning programs
- Project works, cutaway models
- Teaching systems, training stands
- Laboratory furniture

Important facts & figures:

- Over 15 000 products
- Delivery to over 70 countries
- In the market for more than 80 years
- Global sales network
- Over 50 000 customers
- 150 employees

Our company has been firmly anchored in Constance since 1936 and we wish to contribute with our daily work to make Constance with its universities an important knowledge center. With over 150 employees, we have become one of the most important ‘job providers’ in the region.

Strong together: Industry and didactics, hand in hand

In developing our innovative products, we work closely with well-known partners from industry and trade. This enables us to combine the technical expertise of the industry with our didactic skills, in order to create unique offers. Our joint aim is to bring young people up to speed in technology matters and to enable them to achieve a successful start to their careers.

Lasting learning success through an overall didactic concept

Media	Hardware	Services
Specialised books	Training stands	Analysis & consultation
Interactive Learning Programmes	Teaching systems	Didactic concepts
Training Software	Workstation systems	Educational services
Tasks for exam preparation	Training lab equipment	Planning of training labs
Distance learning courses	Cut away models	Train-the-trainer
	Material kits	Seminars & workshops
	Projekt Works	In-house production

Mechanics | Electronics | Automation | Automotive | Renewable Energy | School/Physics

85 years experience in technical education

2010
UNIVERSITY
Offering training systems for universities

2009
General & Secondary Schools
Offering teaching aids for technics and physics

2008
Christiani Sharpline Technical Training
An Indo-German Joint Venture, founded 2008 in Mumbai, India

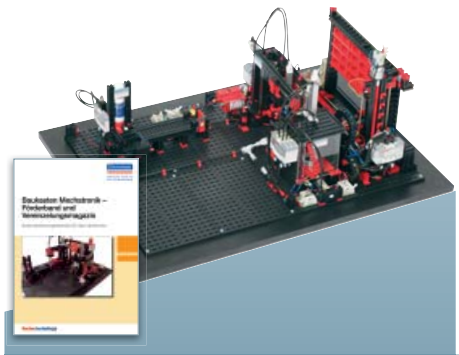
2001
International Business
Opening up to international markets

1971
Vocational Training
Entering the field of vocational training and developing examination tasks

1931
Further Training
Founded as correspondence college in Frankfurt, Germany

Learning example: Mechatronics

This example shows the continuous training concept applied by Christiani. In school, the pupils set up a factory simulation – it's fun and simple. Training continues in a practical and realistic manner in vocational training and in universities. Finally, the further professional training offerings from the Christiani Academy provide your employees with the opportunity to increase their level of specialisation while continuing in full employment.



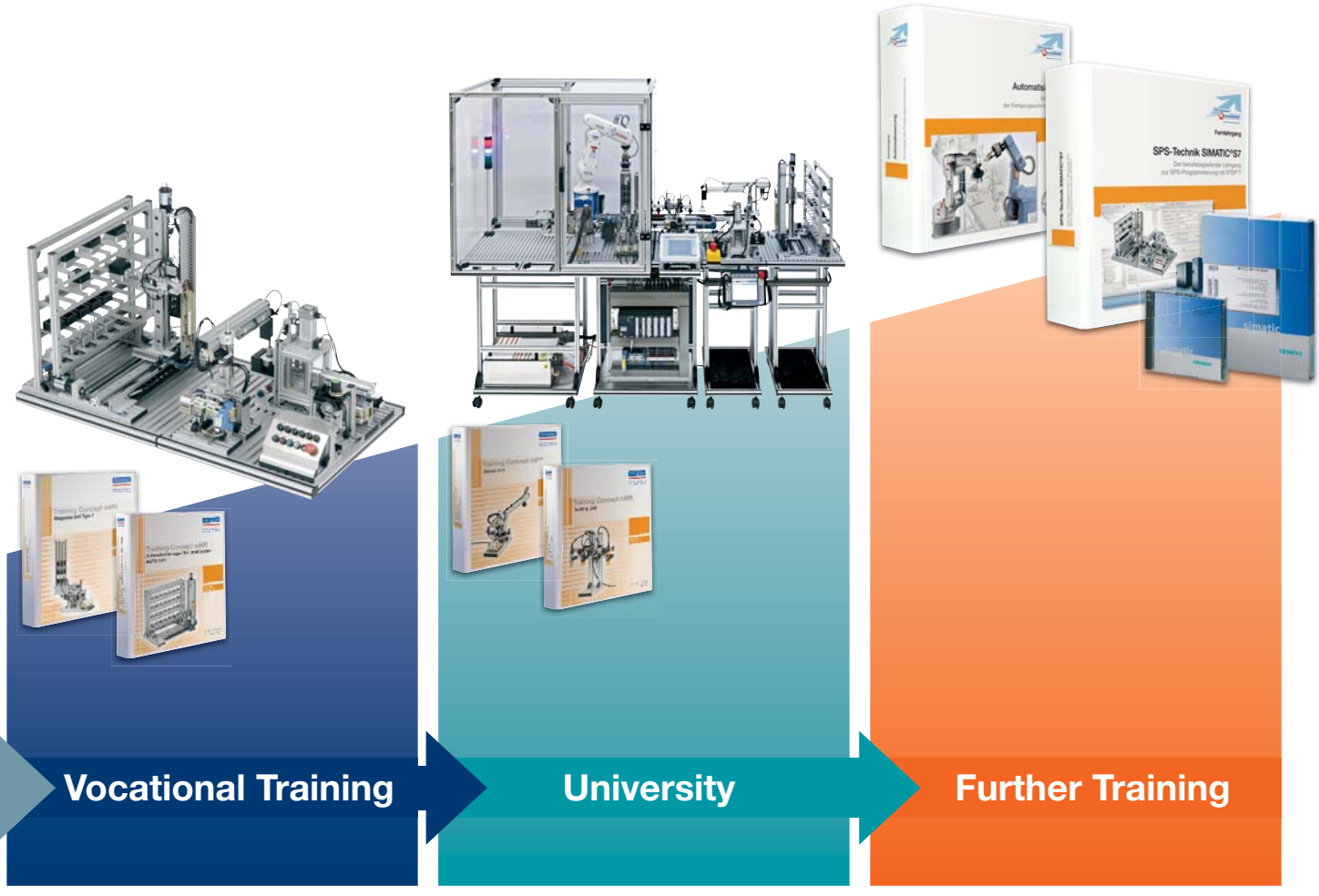
General & Secondary Schools

mMS modular Mechatronic System „junior“

Life-long learning:
Didactics and practice from a single source

Technical training from the outset and life-long learning – that‘s what Christiani and its teaching materials and service offering stand for. After all, the subject of training is not only relevant for schools and vocational training these days, but rather it accompanies people throughout every phase of their lives.

Christiani has been actively involved in the training and education sector for over 80 years. Our expertise: We are a complete provider of all aspects of technical training as well as innovative offers for all training levels – from pre-school, school and vocational training to universities and further professional training. By combining didactic documents and hardware, and by cooperating with partners from schools, industry and trade, we can assure absolute practical relevance.



mMS modular Mechatronic System Cube Assembly Mini V5

mMS modular Mechatronic System Cube Assembly Compact Endless

Courses and distance learning for automation technology and PLC-technology

Christiani international: Technical training throughout the world

We offer an extensive portfolio of teaching materials for vocational training and further professional training for international training markets. We support companies in providing training and qualifying personnel according to German standards abroad too: with a wide range of teaching systems and foreign language teaching media, seminars, workshops and complete technical training labs.

Christiani projects international

BRAZIL
Christiani equipped the State University in Rio de Janeiro with a mechatronic system, incl. training for professors.

CHINA
Training stands for the training in the field of automotive technology, incl. training the trainers.

ETHIOPIA
In 2015 in Ethiopia, six automotive training centres are being equipped. Christiani is substantially involved in this project by supplying numerous high-quality training stands.

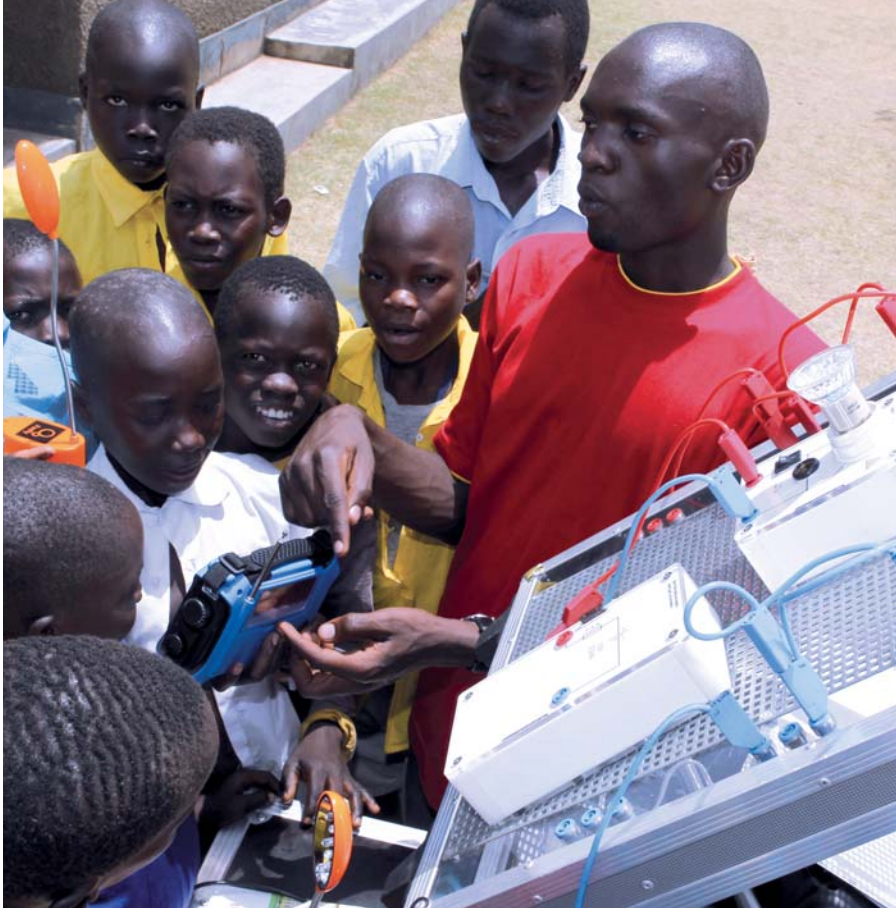
INDIA
Joint venture CSTT: Together with Sharpline, Christiani maintains a training centre in Mumbai, Courses are conducted mainly in the fields of CNC, PLC and mechatronics.

IRAQ
Christiani supplied training stands for the automotive sector to the University of Salahaddin in Erbil, northern Iraq. In addition to this, Train-the-Trainer courses.

LEBANON
Successful setup of an examination system in cooperation with the MEHE (Ministry of Education and higher Education).

LUXEMBOURG
Creation of a mechatronics training concept for the Luxembourg Ministry of Education.

MALAYSIA
Mechatronics teaching systems for five polytechnical colleges, incl. training the trainers.



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Entering the world of technical training: by cklicking on the desired region you will be re-directed to the website or contact of your national representative.

MEXICO

Equipping a training centre in Mérida with automotive mechatronics equipment, incl. training the trainers.

MONGOLIA

Christiani is a partner in a GIZ project in Mongolia, which involves a 3-year training project in the industrial mechanics, electrotechnical and construction sectors.

MOROCCO

In 2014 in Morocco, Christiani contributed to equipping of a renewable energies training centre by supplying training stands.

PERU

Establishment of an automotive training centre at the technical educational institute TECSUP, incl. training the trainers.

ROMANIA

Seminars for teachers and trainers in mechatronics about the basics of the action-oriented training, incl. didactical documents and teaching systems.

RWANDA

„Energy Explorers“ campagne for renewable energy with Christiani products.

SWITZERLAND

Equipment of four solateur schools (solarthermic profession) with teaching systems for the sector renewable energy.

TUNISIA

Equipping training centres in Kebili and Ariana, with training stands for the automotive and renewable energy sectors.

Physics lessons out of a case
Student experiment instruments neatly arranged and safely stored

Students at secondary level can perform many basic electromagnetism, electrics, optics and mechanics experiments using our robust and high-quality sets. Our device sets are now neatly and safely organised in plastic cases with device-shaped foam inserts. Our cases can be stored in a well organised and space-saving manner and enable quick and easy distribution of the sets, even for large classes. The corresponding experiment manuals will help your students to perform the experiments and will help you with preparation.

Further electrics devices from page 86

Electrics – Electronics

The plug-in box system enables experiments to be set-up quickly and clearly. Students simply have to plug the active components into the appropriate clearly labelled switching paths of the plug-in boxes and can thus investigate various aspects of electrical circuits from simple, basic circuits to complicated electronics experiments.

31 devices and set-up parts in sturdy, high-quality plastic case with device-shaped foam insert

Consisting of:

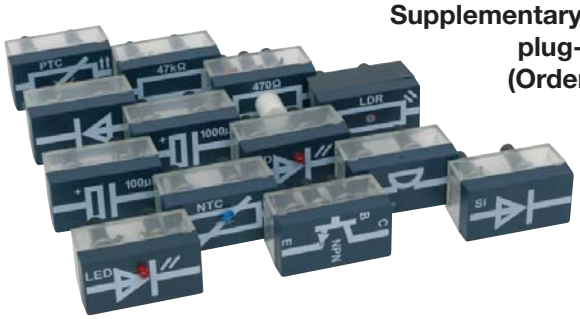
- Lamp sockets
- Resistors
- Battery holders
- Switches
- Plug-in connectors

and much more
in a high-quality plastic case
with device-shaped foam insert, dimensions:
53 x 40 x 12.5 cm

Exact details and matching accessories from page 125

Accessories:

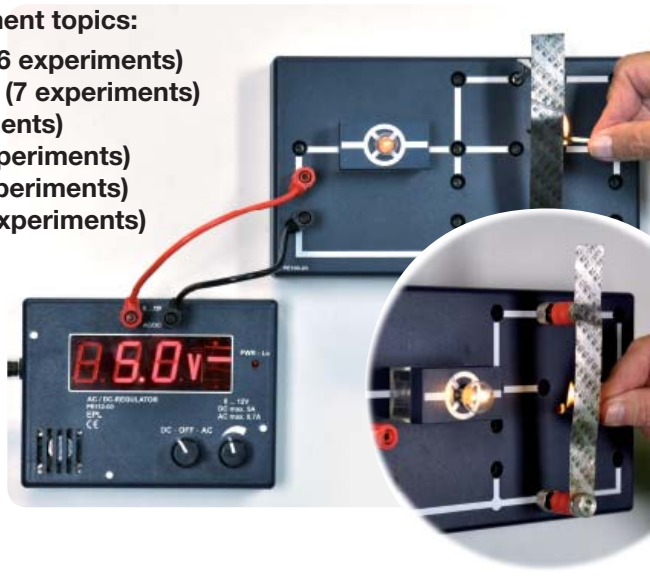
Supplementary electronics plug-in elements (Order-No. 95497)



For experiments on the following topics:

Electronics experiment topics:

- Semiconductors (6 experiments)
- Photovoltaic cells (7 experiments)
- Diodes (9 experiments)
- Transistors (12 experiments)
- Capacitors (11 experiments)
- Logic circuits (3 experiments)



Electrics experiment topics:

- Electrical resistance (20 experiments)
- Heat effect of electric current (7 experiments)
- Work and power (4 experiments)
- Chemical effect of electric current (6 experiments)

Electromagnetism

The electromagnetism device set enables you to investigate the link between magnetic and electric forces. With the help of various plug-in boxes, it is possible to demonstrate the technical applications of electromagnetism. The plug-in boxes have a transparent structure, so that the main aspects of the electric circuits can be clearly revealed in a way that is easy to understand.

Device set and set-up components in sturdy, high-quality plastic case with 34 devices

Consisting of:

Coils
Magnets
U-core
Ferrite core
Light bulbs
Chimes
and much more
in a high-quality plastic case
with device-shaped foam insert,
dimensions: 45 x 33 x 11 cm

Exact details and matching accessories from page 129

ELECTROMAGNETISM

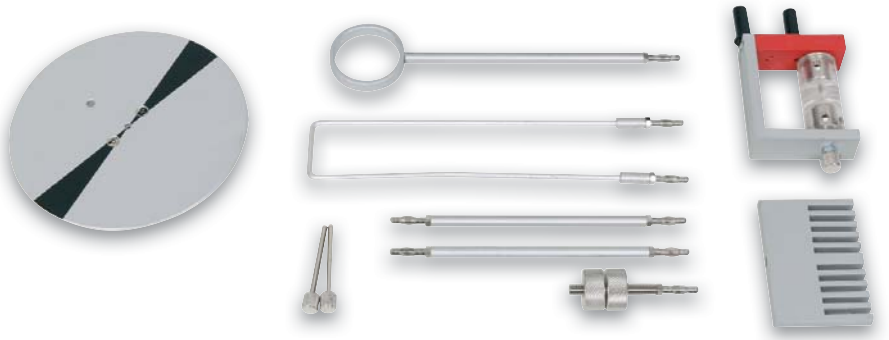
Order-No.
96965

NEW

Supplementary device set

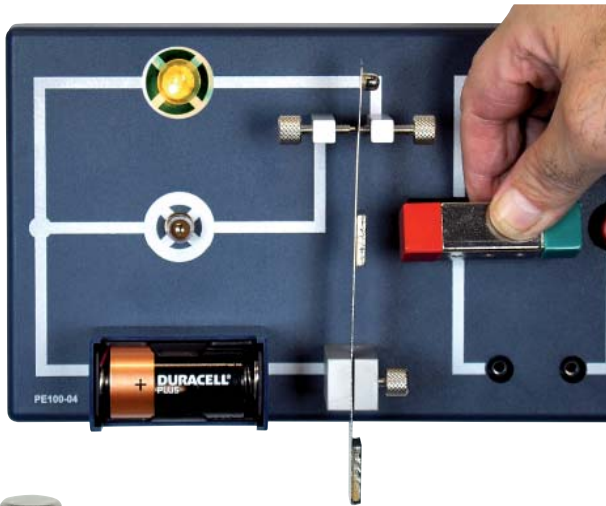
Consisting of:
1 x contact box
1 x taring weight on plug
1 x additional weight
1 x distributor bridge
1 x conductor loop on plug
2 x bearing pin
1 x Lenz ring on rod
1 x Waltenhofen plate
1 x eddy current disc with lip
1 x eddy current ring
2 x rod with plug

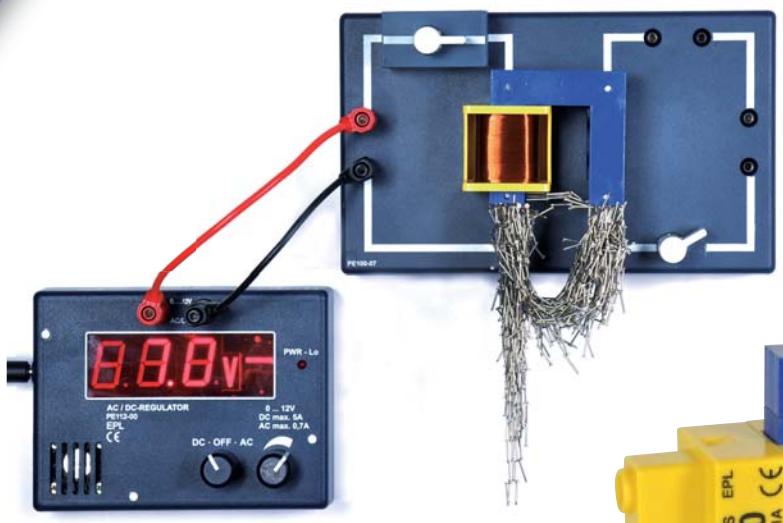
Order-No.
92161



For experiments on the following topics:

- Magnetic effect of electric current (7 experiments)
- Relay, electric bell, buzzer (3 experiments)
- Electric motor (4 experiments)
- Generator (7 experiments)
- Electromagnetic induction (9 experiments)
- Eddy currents (4 experiments)
  (require supplementary contact box,
  Order-No. 92161)





Electrostatics

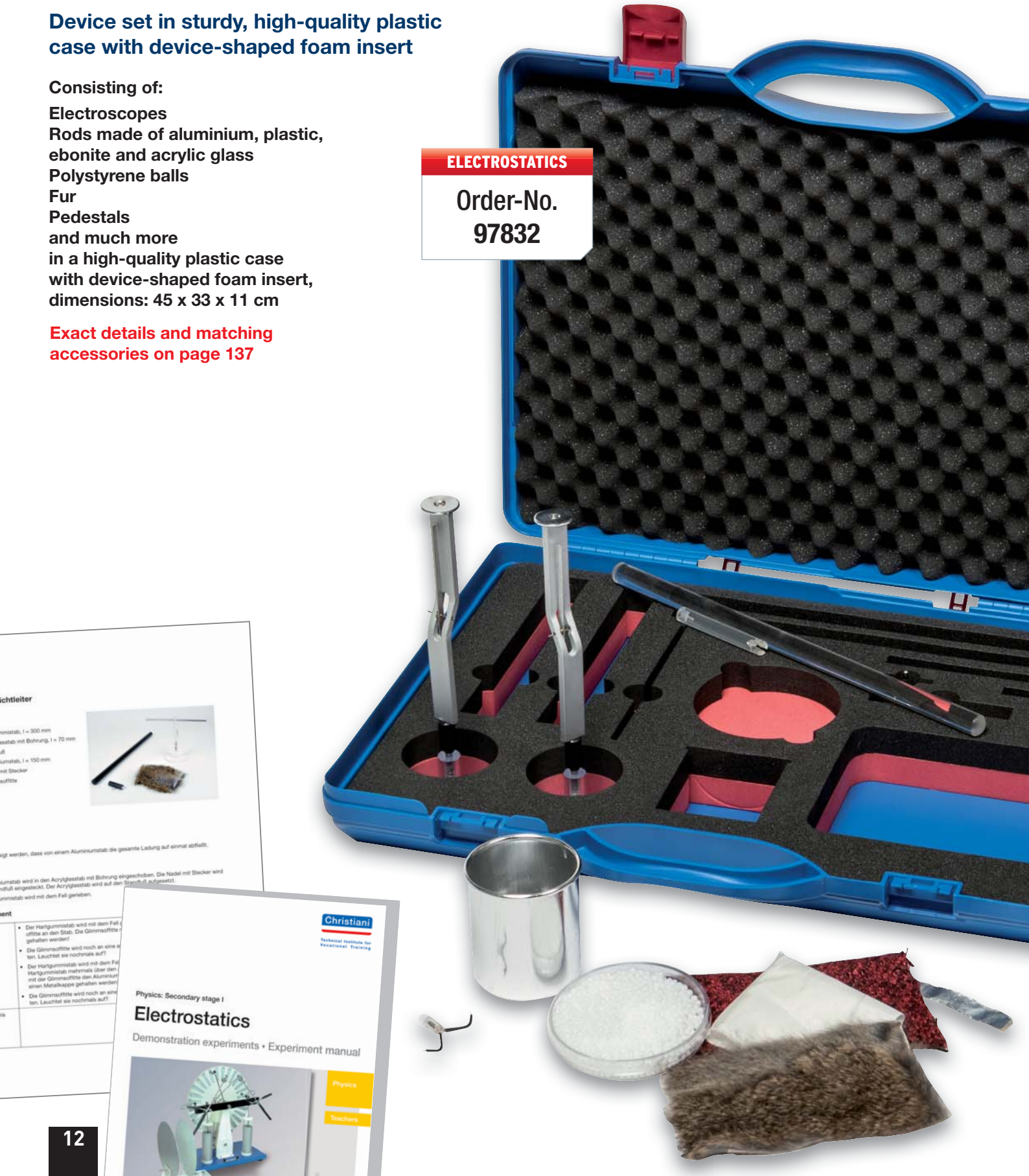
This electrostatics device set contains all of the neatly organised individual parts students need to independently investigate the fascinating aspects of electrostatics. The handy foam insert means all the required parts for setting up an experiment can be removed quickly and easily and combined in any number of ways.

Device set in sturdy, high-quality plastic case with device-shaped foam insert

Consisting of:

Electroscopes
Rods made of aluminium, plastic, ebonite and acrylic glass
Polystyrene balls
Fur
Pedestals
and much more
in a high-quality plastic case with device-shaped foam insert, dimensions: 45 x 33 x 11 cm

Exact details and matching accessories on page 137



For experiments on the following topics:

Contact electricity

- Rubbed ebonite rod and acrylic glass rod
- Discharging via a neon lamp
- Plus/minus sign of an electric charge
- Conductors – Non-conductors

Electrostatic interaction

- Action of force between charged objects
- Model experiment for electroscope
- Electroscope

Electrostatic induction – Polarisation

- Electroscope in an electric field
- Charge equalisation
- Separation of charge by electrostatic induction and neutralisation
- Faraday cage
- Insulators in an electric field – Polarisation

Further electrostatics devices from page 101

Magnetostatics

This magnetostatics device set offers the possibility of investigating the various forces of magnetic systems through a range of impressive experiments. The well-organised storage of the individual parts makes it easier to set up experiments and allows students to research individual aspects of magnetism in a focused manner.

Device set in sturdy, high-quality plastic case with device-shaped foam insert

Consisting of:

Magnets
Magnetic field probe
Compass
Magnet holder
Magnetic and non-magnetic materials
Globe for Earth's magnetism
Stand tube for floating magnet
and much more
in a high-quality plastic case with device-shaped foam insert,
dimensions: 45 x 33 x 11 cm

Exact details and matching accessories on page 138

MAGNETOSTATICS

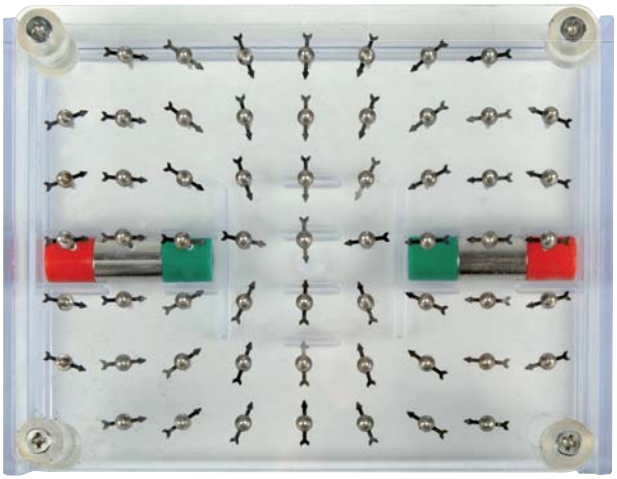
Order-No. 98441

Further magnetostatics devices from page 105

NEW

Accessories:

Magnetic needle model (Order-No. 86887)
59 freely rotating magnetic needles between two acrylic glass plates to be placed on:
Magnetic support plate (Order-No. 86889)
for non-slip mounting of small bar magnets



For experiments on the following topics, amongst others:

Contact electricity

- A magnet as a compass
- Magnetic and non-magnetic materials
- A floating magnet
- Action of force due to magnets
- Interaction between magnets and iron
- A floating paper clip
- Magnetic induction
- Repulsion through electrostatic induction
- Elementary magnets
- Magnetic field between two magnets
- The magnetic field
- Field pattern of a bar magnet
- The Earth's magnetic field

Optics

For student experiments involving optics, we offer three cases designed for geometric optics, lens equation and wave optics. All devices are neatly organised in plastic cases with device-shaped foam inserts. The components in the three cases can be advantageously combined to enable a wide range of different experiments. The high-quality foam insert also protects fragile components and enables clear organisation.

NEW

Optics 1
Geometric optics

With this case, exciting and impressive geometric optics experiments can be carried out. The powerful halogen lamp offers the possibility of observing the course of individual or multiple light beams clearly. The matching model bodies make it possible to achieve a range of beam paths in a simple manner.

Device set in sturdy, high-quality plastic case with device-shaped foam insert

Consisting of:

Halogen lights
Various model bodies
Various mirrors
Optical disc
Earth/moon model
and much more

in a high-quality plastic case with device-shaped foam insert, dimensions: 53 x 40 x 12.5 cm

Exact details and matching accessories from page 139

Accessories:

Additive/subtractive colour mixture (Order-No. 92166)
Additive tricolour filter as well as sets with deflection mirror and subtractive colour filter
Can be stored safely in the Optics 1 case.

For experiments on the following topics:

- **Light propagation**
- **Mirror**
- **Refraction**
- **Lenses**
- **Eye**
- **Mixture of colour**

Further optics devices from page 70

Optics 2
Optical bench

This case, with its optical bench, makes it possible to perform many interesting experiments with a range of lenses. This makes it easy for students to see the connections between lens properties and images. The individual parts also help students to understand how optical equipment works, such as a microscope, telescope or camera.

Device set in sturdy, high-quality plastic case with device-shaped foam insert

Consisting of:

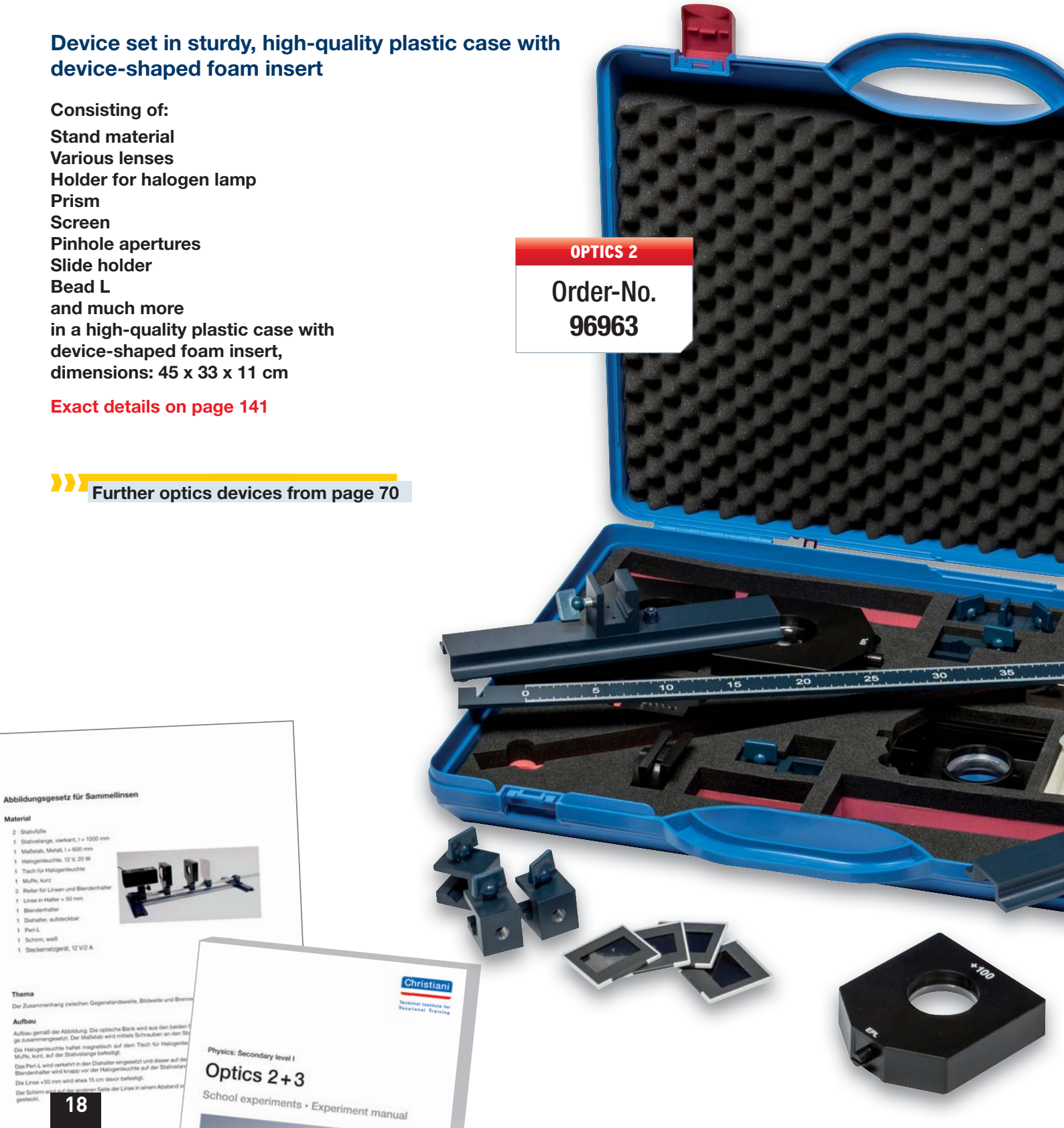
Stand material
Various lenses
Holder for halogen lamp
Prism
Screen
Pinhole apertures
Slide holder
Bead L
and much more
in a high-quality plastic case with device-shaped foam insert,
dimensions: 45 x 33 x 11 cm

Exact details on page 141

Further optics devices from page 70

OPTICS 2

Order-No.
96963



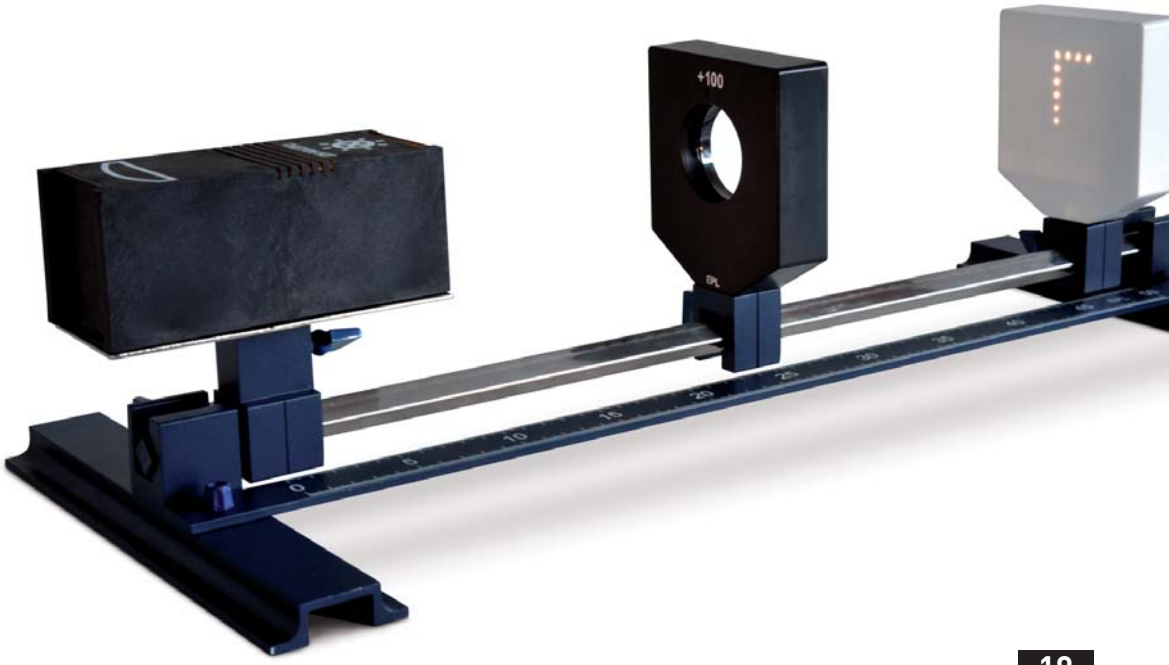
NEW

Accessories:

If the Optics 1 case (Order-No. 96962) is not available, you will need a halogen light 12 V/20 W (Order-No. 92733) and a plug-in power supply (Order-No. 91889)

For experiments on the following topics:

- Light propagation
- Lens equation
- Optical instruments
- Eye



Optics 3
Wave optics

With the additional material contained in this case compared with the Optics 2 case, students can investigate the wave properties of light. The handy and clearly organised storage offered by the foam insert means the many experiments can be carried out quickly and with great precision. The corresponding experiment manuals are grouped together in one volume.

Device set in sturdy, high-quality plastic case with device-shaped foam insert

Supplement to Optics 2 case (Order-No. 96963)

Consisting of:

Iris diaphragm
Polarisation filter with holder
Holder and body for photoelastic object
Quartz, grid, circular diaphragm and disc, as well as slit, as slide
Colour filter
Support rod
in a high-quality plastic case with device-shaped foam insert, dimensions: 45 x 33 x 11 cm

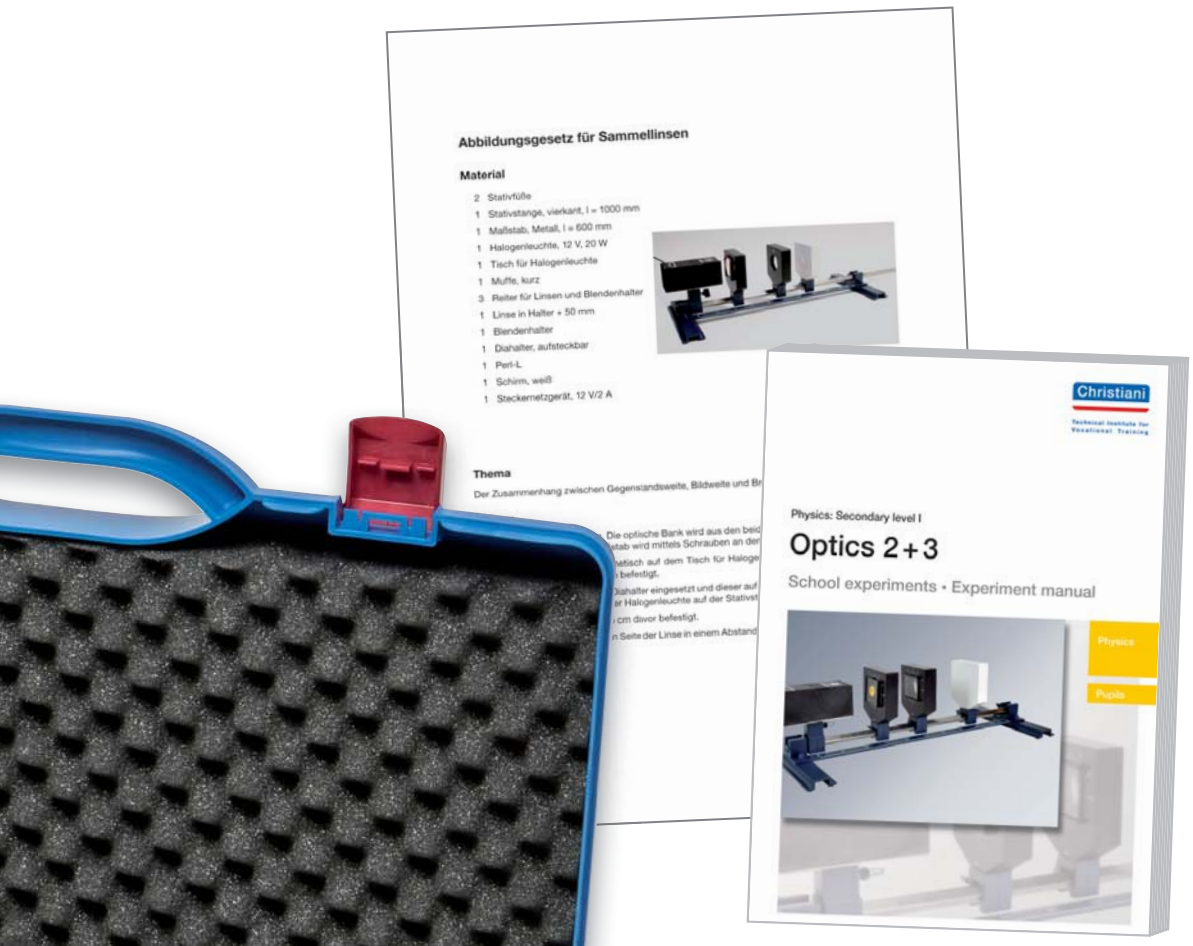
Exact details on page 142

OPTICS 3

Order-No.
96964

Further optics devices from page 70

NEW



For experiments on the following topics:

- Spherical lens error
- Chromatic aberration
- Diffraction at the grid
- Wavelength determination
- Polarisation with filters
- Rotation of the polarisation plane by the placement of solids
- Saccharimeter – Model
- Photoelastic object

Mechanics

For mechanics experiments for students, we offer cases designed for basic mechanics, simple machines and linear movement. These enable students to learn about the nature of solid and liquid materials and can investigate Newton's laws. All devices are neatly organised in plastic cases with device-shaped foam inserts. The corresponding experiment manuals for mechanics make it easier to prepare for and perform the experiments.

Further mechanics devices from page 36

NEW

Mechanics 1

Numerous basic mechanics experiments can be carried out using the Mechanics 1 case. The wide range of experiments on lever rules, hydromechanics and much more offers a perfect entry into the diverse and exciting world of mechanics.

Device set in sturdy, high-quality plastic case with device-shaped foam insert

Consisting of:

Stand material
Lever rod
Weights
Helical springs
Roller
Dynamometer
Tanks

Submersible shapes
and much more
in a high-quality plastic case with
device-shaped foam insert, dimensions:
45 x 33 x 11 cm

For exact details and matching accessories, see page 131

Accessories:

Heat source and accessory set
(Order-No. 92180)

For experiments on the following topics:

- Measuring physical parameters
- Forces
- Simple machines
- Hydrostatics

Mechanics 2
Simple machines

Designed to supplement the Mechanics 1 case, this case extends the range of experiments to the areas of simple machines, lever rules, pulley blocks and other aspects of hydrostatic systems. This means an even deeper understanding of the connections within classical mechanics and the interactions of machines can be achieved.

Device set in sturdy, high-quality plastic case with device-shaped foam insert

Supplement to Mechanics 1 case (Order No. 97830)

Consisting of:

Inclined plane
Cart
Slotted weights
Dynamometer holder
Gear wheels and stepped gear
Pulleys for pulley block
Submersible probes
U-pipe manometer
in a high-quality plastic case with device-shaped foam insert,
dimensions: 45 x 33 x 11 cm

For exact details, see page 133

NEW

Accessories:

Gyro set

**For demonstrating the properties of a free gyro and its precession movement.
Gyro diameter: 50 mm
(Order No. 86845)**

Further mechanics devices from page 36

For experiments on the following topics:

- Inclined plane
- Resolution of a force on an inclined plane
- Determination of the coefficient of friction
- Wheel and axle
- Gear transmission
- Pulley block with four rolls
- Work on an inclined plane
- Measuring the hydrostatic pressure
- Capillary action

Mechanics 3
Linear motion

This case provides the basis for succesful experiments on linear motion and for investigation of various conservation of momentum experiments. The high-quality parts are clearly organised, so that the students can perform a number of experiments effectively.

Device-set in sturdy, high-quality plastic case with device-shaped foam insert

Consisting of:
Trackway
Various weigths
Measuring cart
Springs
Solar cart
and much more
In a high-quality plastic case with device-shaped foam insert,
dimensions: 45 x 33 x 11 cm

For exact details, see page 134

MECHANICS 3

Order No.
98443

(Image shows case mechanics 3 with additional timer set)

NEW

Accessories:

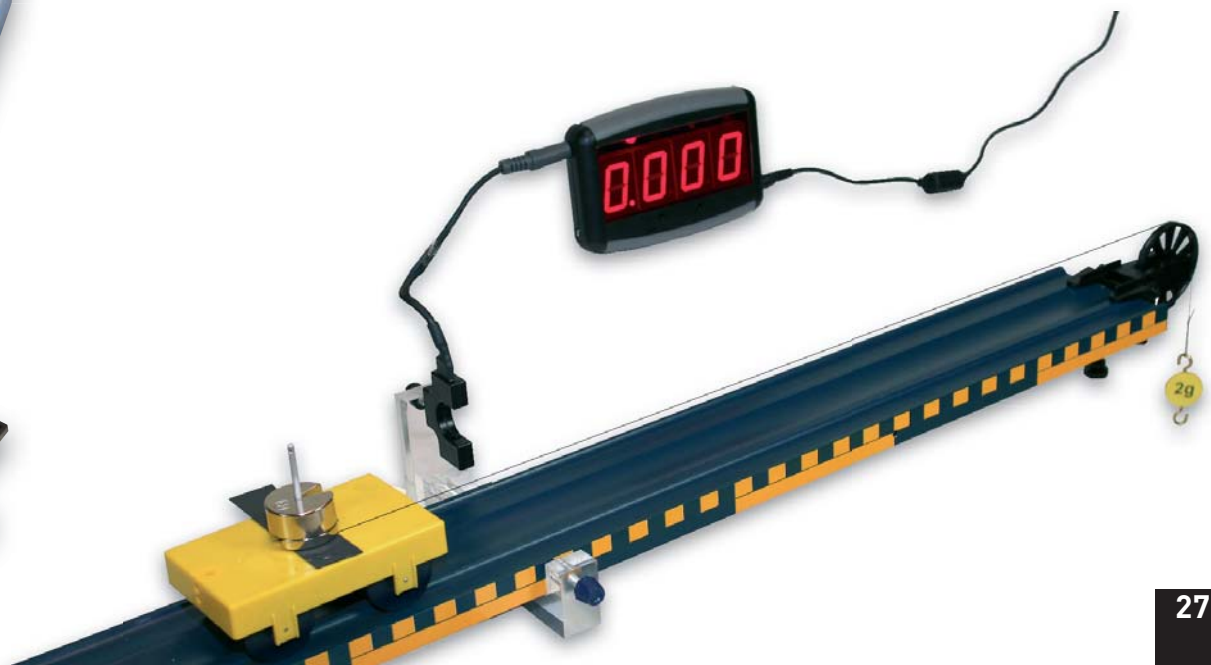
Timer set

Magnetic timer with fork light barriers and special connecting cables
Matching plug-in power supply (Order-No. 92732)

Further mechanics devices on page 36

For experiments on the following topics:

- Uniform movement
- Average and currend speed
- Uniform accelerated motion
- Basic equation of the dynamics and Newton´s Laws
- Impact experiments - Momentum set
- Energy and conservation of momentum
- Dynamic determination of mass
- Potential and kinetic energy

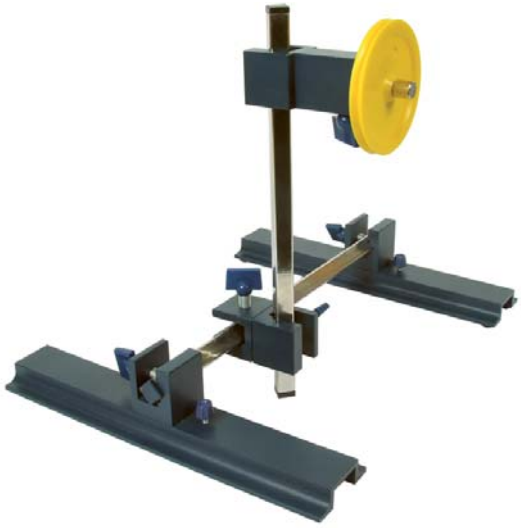


The new case set Mechanics

For mechanics experiments for students, we offer cases designed for basic mechanics, simple machines and linear movement. These enable students to learn about the nature of solid and liquid materials and can investigate Newton's laws. All devices are neatly organised in plastic cases with device-shaped foam inserts. The corresponding experiment manuals for mechanics make it easier to prepare for and perform the experiments.

Article	Order No.
Case set Mechanics 1-3 with timer set	44582
Case set Mechanics 1-3 without timer set	44580

Experimental set-up



Sample stand set-up with H-base

Disc base –
Pressure and bearing surface

Mounting the heat protection net on the square frame of the assembly plate

Stand material set

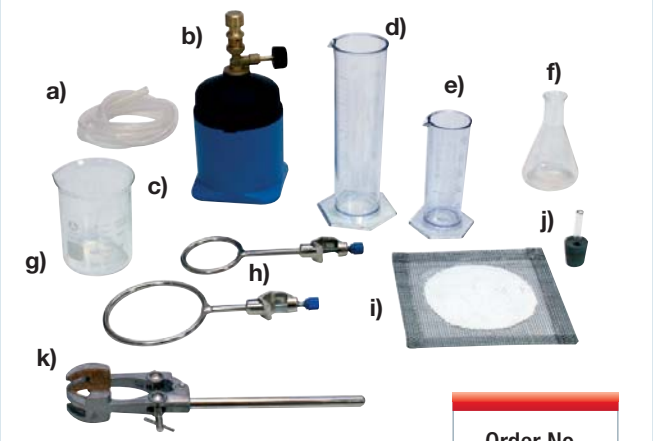
Order No.
92621

Consisting of:

1 x H-base, 300 mm
2 x bosshead, short
2 x bosshead right angle
2 x bosshead, long
2 x bosshead with bearing pin
1 x round bosshead
2 x half bosshead on shaft, 3 mm
2 x half bosshead on shaft, 10 mm
1 x shaft with hook
1 x round rod, L = 150 mm
2 x round rod, L = 250 mm
2 x round rod, L = 450 mm
1 x square rod, L = 150 mm
2 x square rod, L = 300 mm
2 x square rod, L = 600 mm
1 x square rod, L = 1000 mm

For information on these items, see page 29.

Heat source set



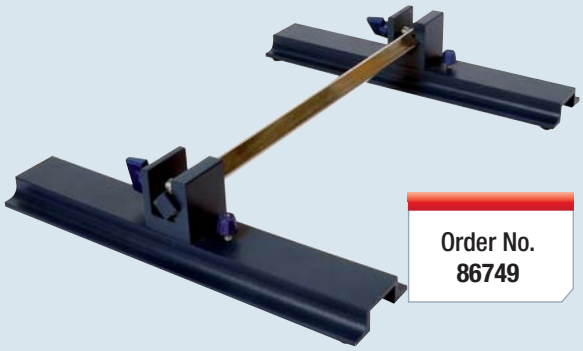
Order No.
92656

The set consists of the following items, which can also be ordered individually:

Article	Order No.
a) 1 x silicone hose, L = 1 m, I-D = 7 mm	89857
b) 1 x cartridge burner	89841
c) 1 x valve cartridge	92657
d) 1 x 250 ml measuring cylinder, plastic	93685
e) 1 x 100 ml measuring cylinder, plastic	92615
f) 2 x 100 ml Erlenmeyer flask, narrow neck	89853
g) 1 x 250 ml beaker, tall	89855
h) 1 x stand ring on bosshead, set of 2 pcs D = 100/60 mm	89851
i) 1 x heat protection net with ceramic, 150 x 150 mm	89844
j)1 x rubber stopper with glass tube	89854
k) 1 x universal sleeve	92616

H-base, 300 mm

Flexible stand base, 2 aluminium axle stubs connected to a square rod, L = 300 mm for bearing all bosshead types in any position, length of axle stub = 250 mm. Replacing the square rod makes it possible to extend the H-base by up to 1 m. Can be used as a stand bench or optical bench



Order No. 86749

Stand base – A-shape

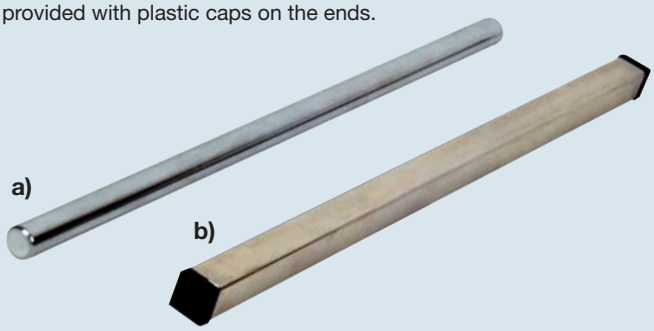
A-shaped cast iron fixed stand base for clamping 2 round rods up to D = 14 mm, 2 levelling feet, shaft length: 23 cm, mass: 2.3 kg

Order No. 93678

Round rods and square rods

a) Solid support rods, nickel-plated, D = 10 mm

b) Square steel tube, stainless steel, rust-proof, 12.7 x 12.7 mm, provided with plastic caps on the ends.



Article	Order No.
Round rod, L = 150 mm	86753
Round rod, L = 250 mm	86754
Round rod, L = 450 mm	86755
Round rod, L = 750 mm	86756
Round rod, L = 1000 mm	86757
Square rod, L = 150 mm	86763
Square rod, L = 300 mm	86764
Square rod, L = 600 mm	86765
Square rod, L = 1000 mm	86766

Disc base, 500 g

Metal cylinder, nickel-plated, with central bore and clamping screw for mounting round material up to max. 10 mm. Can be used for stability experiments and as a stand base (barrel foot). D = 56 mm, H = 30 mm

Order No. 86840

Bossheads

Aluminium special profiles for clamping on square and round material and for holding support rods:

a) Bosshead right angle
Dimensions: 64 x 32 x 32 mm

b) Round bosshead
up to max. 10 mm, L = 70 mm, D = 18 mm

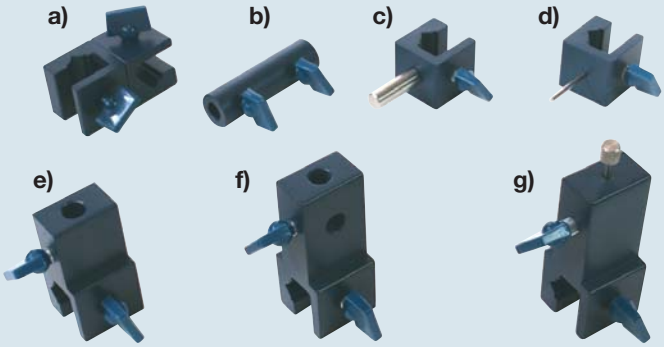
c) Half bosshead on shaft
Width: 28 mm, D = 10 mm

d) Half bosshead on shaft
Width: 28 mm, D = 3 mm

e) Bosshead, short
Height of the attachment = 32 mm

f) Bosshead, long
Height of the attachment with cross hole = 48 mm

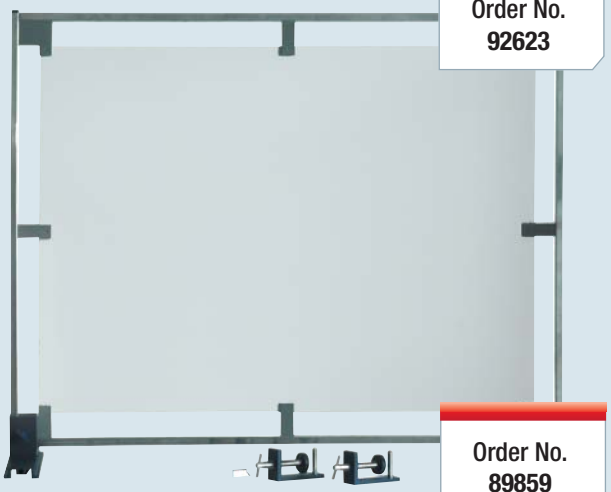
g) Bosshead with bearing pin
Height of the attachment = 48 mm



Article	Order No.
a) Bosshead right angle	86759
b) Round bosshead	86761
c) Half bosshead on shaft, D = 10 mm	93679
d) Half bosshead on shaft, D = 3 mm	86752
e) Bosshead, short	86750
f) Bosshead, long	86760
g) Bosshead with bearing pin	86751

Assembly plate

Grey/white-coated metal plate secured in square frame for the vertical assembly of devices that come with magnets. Boss-heads for holding square and round material, as well as devices, can be mounted on the square frame.
Included in the scope of delivery: 2 pedestals, L = 300 mm
Dimensions: Approx. 850 x 650 mm



Order No. 92623

Order No. 89859

Table clamps, pair

For clamping the assembly plate onto tabletops up to a thickness of 50 mm

Magnetic board set

Consisting of:

2 x magnetic base
1 x magnetic base with scale
1 x bosshead, long
1 x bosshead with bearing pin
1 x bosshead right angle
2 x supporting rod
2 x bosshead on shaft, 10 mm

Order No. 92622

Three-leg

For attaching the heat protection net with ceramic (order no. 89844) in conjunction with a gas burner, nickel-plated steel, D = 14 cm, H = 22 cm

Order No. 93680

Laborboy

steel plate, nickel-plated, height-adjustable using large knurled screw of 80 to approx. 260 mm
Dimensions of the supporting plate: 150 x 150 mm

Order No. 89860

Accessories

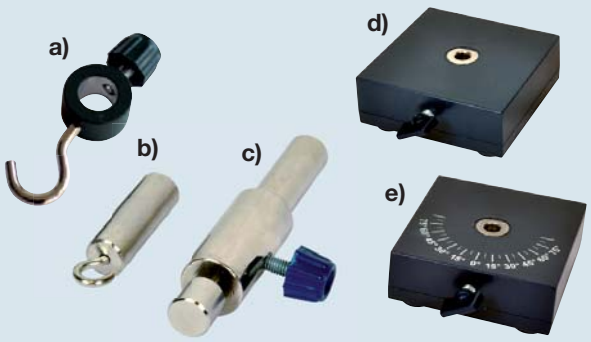
a) Ring with hook
For suspending and mounting on shafts with a diameter of 10 mm

b) Shaft with hook
Solid steel rod, nickel-plated, with hook, L = 35 mm, D = 10 mm

c) Supporting rod
Solid steel column, nickel-plated, with bearing pin and clamping screw for insertion into magnetic base for holding rolls, lever rods, coil springs, etc.
Column height: 32 mm, shaft D = 10 mm

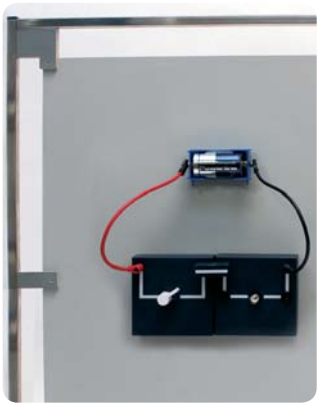
d) Magnetic base
Plastic module with integrated clamping column and retaining screw for holding round material with a diameter of 10 mm. Four inserted, strong neodymium magnets in the base plate and four rubber feet for non-slip adhesion to the metal table.
Dimensions: 100 x 100 x 38 mm

e) Magnetic base with scale
Plastic module with magnetic base (Order No. 86767), but with imprinted white scale of 90-0-90

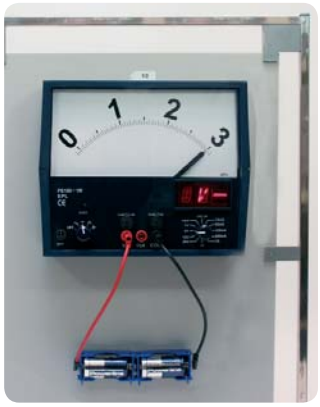


Article	Order No.
a) Ring with hook	89862
b) Shaft with hook	92625
c) Supporting rod	86771
d) Magnetic base	86767
e) Magnetic base with scale	86762

Experimental set-up



"Simple electric circuit"
Magnetic board set-up with switching boxes



Magnetic board set-up:
"Series connection of batteries"

Magnetic board set-up:
"Conductors and non-conductors"

Mono battery cell holder, magnetic

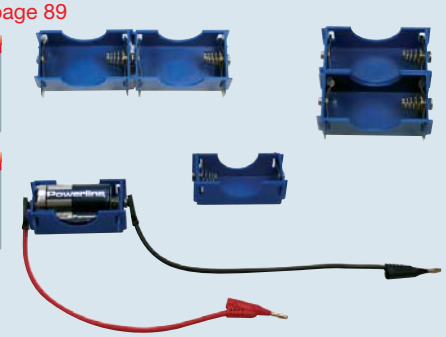
Battery holder for mono battery cells
plastic, with contacts for series and parallel connection of other mono battery cell holders, set of 2 pcs

Special connecting cables
Red/black, with 4 mm plugs for connecting to a mono battery cell holder
Set of 2 pcs
Length: 250 mm

Switching boxes, see page 89

Order No. **93849**

Order No. **93850**



Battery holder, 6 V

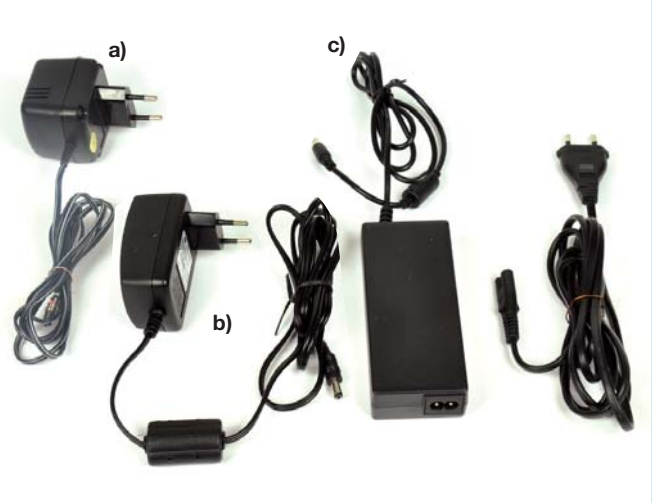
Battery holder, plastic, magnetic, for attaching four mono battery cells, 1.5 V
Five 4 mm sockets for voltage reduction
Dimensions: 166 x 118 mm

Mono battery cell 1.5 V – Superpower/18 ampere hours
Set of 4 pieces

Order No. **93851**

Order No. **93852**

Power supplies



Article	Order-No.
a) Plug-in power supply 6 V/500 mA, 5.5 mm DC barrel connector Supply voltage: 230 V~	**89949**
b) Plug-in power supply 12 V/2 A, 5.5 mm DC barrel connector Supply voltage: 230 V~	**91889**
c) Fixed voltage power supply 12 V/6 A, 5.5 mm DC barrel connector Supply voltage: 230 V~	**91893**

Experimental set-up

"Displaying the negative load of a ground ebonite rod"

"Induction voltage in a conductor loop"

Analogue multimeter

Robust servo measuring instrument, magnetic

Point position:
Zero point to the left and central zero point
4 double dial gauges 1/3, 10/30, 100/300
Central zero point: 5-0-5/15-0-15
Scale arc length: 200 mm
Height of digits: 26 mm
LED display height: 20 mm for displaying the units of measurement and type of power: mV-/ ~ V-/~/ µA-/~mA-/~/A-/~

Measurement ranges:
Direct current voltage: 1 to 30 V,
1 mV final value range for displaying induction voltages without preamplifier, AC voltage: 1 to 30 V
DC and AC voltages: 100 µA to 10 A
Wire fuses that are accessible from the outside in fuse holders (F3.15 A/F10 A)

Back panel with 6 strong neodymium magnets for magnetically holding the device on metal boards
Power supply: 4 batteries 1.5 V Mignon (not included in the scope of delivery)

Option to have an external power supply via integrated 5.5 mm DC hollow socket with plug-in power supply 6 V/500 mA (Order-No. 89949), 5.5 mm DC barrel connector, supply voltage: 230 V~

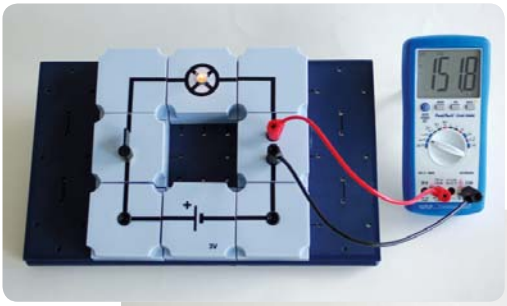
Order-No. 92528

Electrometer amplifier box, magnetic

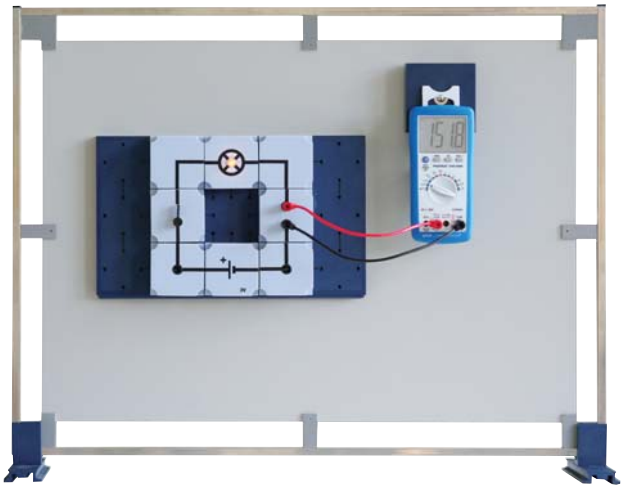
Magnetic, amplifier box for connecting to an analogue multimeter (Order-No. 92528) for displaying positive and negative charging with measurement ranges 3 V or 3 mA and measurement range scale 5-0-5, 1 conductor ball, D = 25 mm, included in the scope of delivery. Integrated 5.5 mm DC hollow socket for connection AC adapter (12 V/2 A supply voltage: 230 V~, Order-No. 91889).

Order-No. 92576

Experimental set-up



Digital multimeter used as a student's measuring instrument (or demo measuring instrument)



Digital multimeter used on the demonstration magnetic board.

Panel meter, magnetic

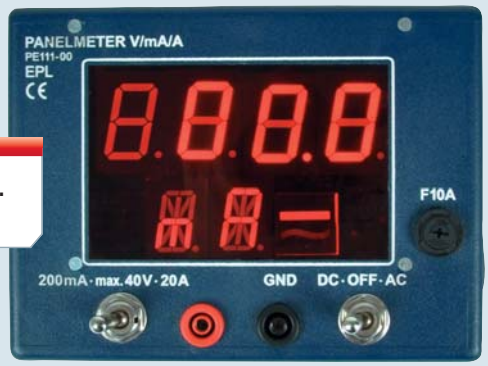
Digital demonstration measuring device with large display for measuring power and voltage

Display: LED display, red, 3 1/2 digits
Height of digits: 26 mm
Measurement input: 4 mm safety sockets
Measurement ranges: DC/AC 40 V/200 mA/20 A
Wire fuses that are accessible from the outside
Power supply: 4 batteries 1.5 V Mignon
(not included in the scope of delivery)

Dimensions: 160 x 120 x 45 mm

Option of an external power supply via integrated 5.5 mm DC hollow socket with power supply 6 V / 500 mA (input voltage 230 V ~, Order No. 89949).

Order-No. 92532



Hand-held measuring devices – Analogue – Digital

Voltmeter – Analogue DC

Simple student measuring device with 2 measurement ranges
0 to 1.5 V, 0 to 15 V, accuracy: 2.5 %
Three 4 mm safety sockets
Support bracket
Dimensions: 94 x 150 x 34 mm

Order-No.
93737

Ammeter – Analogue DC

Simple student measuring device with 2 measurement ranges
0 to 1 A, 0 to 10 A, accuracy: 2.5 %
Three 4 mm safety sockets
Support bracket
Dimensions: 94 x 150 x 34 mm

Order-No.
93738

Desktop DC voltmeter

2 measuring ranges: 0 to 3 V, 0 to 15 V
Accuracy: 2.5%
Zero point pointer position: Halfway to the left, galvanometer operation possible
Three 4 mm sockets
Dimensions: 100 x 120 x 40 mm

Order-No.
93741

Desktop DC ammeter

2 measuring ranges: 0 to 0.6 A, 0 to 3 A
Accuracy: 2.5%
Zero point pointer position: Halfway to the left, galvanometer operation possible
Three 4 mm sockets
Dimensions: 100 x 120 x 40 mm

Order-No.
93742

Mechanics – Device set

Order-No. 92619

Experiments with the mechanics device set on the following topics:

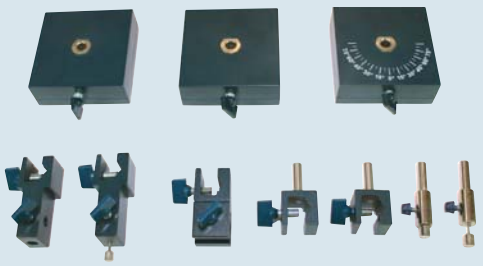
- Measuring physical parameters
- Centre of mass
- Simple machines
- Force – Pressure
- Friction
- Mass
- Pendulum
- Density
- Leverage

Consisting of:

1 x measuring rod, magnetic	1 x leaf spring
1 x 60 cm lever rod	1 x submersible shape, Al, 100 cm^3
2 x pointer, magnetic	1 x submersible shape, FE, 100 cm^3
2 x scale pan with hoop	1 x roll, yellow plastic, D = 75 mm
1 x pointer for lever rod	1 x loose roll, with hook
1 x scale on shaft	2 x pulley for pulley block
1 x 100 g weight set	1 x cog wheel set, 3 pcs
1 x taring pellets	1 x wheel and axle
2 x hooked weight, 50 g, yellow	1 x centre of mass plate
2 x hooked weight, 50 g, blue	1 x plumb-bob with cord
4 x hooked weight, 100 g, yellow	1 x cord for rolls, 5 m
4 x hooked weight, 100 g, blue	1 x inclined plane, L = 400 mm
1 x demo dynamometer, 1 N	1 x dynamometer holder
1 x demo dynamometer, 5 N	1 x deflection roller
2 x torsion dynamometer, 2 N	1 x cart
1 x torsion dynamometer, 5 N	1 x slotted weight, 20 g
1 x coil spring, 3 N/m	2 x slotted weight, 50 g
1 x coil spring, 20 N/m	1 x friction block
1 x object of the same mass, set	1 x friction plate

For information on these items, see pages 38-45.

For setting up mechanical devices on the magnetic board:
See magnetic board set (Order-No. 92622), page 30



Christiani-Tip

Case Mechanics 1

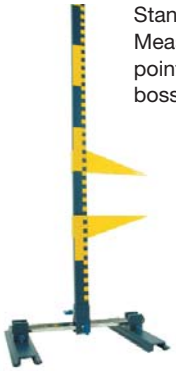
Student experiments for basic mechanics

Order-No. 97830

NEW

More information on page 130

Experimental set-up

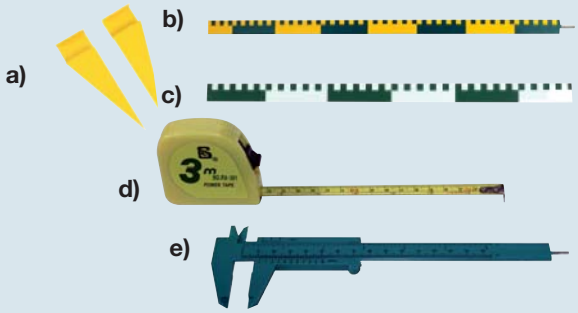


Stand set-up:
Measuring rod on shaft with pointer on H-base with bosshead, short

Stand set-up:
"Hooke's Law"
Measuring rod on shaft with pointer and half bosshead on shaft with support rod

Measuring rod

a) Pointer for measuring rod
Plastic pointer, yellow, for clamping and continuous movement on measuring rod on shaft, L = 160 mm
b) Measuring rod on shaft
Aluminium square profile, 30 x 15 mm, painted blue-yellow with clearly structured block scale in dm-cm graduation and millimetre graduation on the rear
Length 1000 mm (without shaft), shaft length 30 mm, D = 10 mm
c) Measuring rod, magnetic
Rubber magnetic tape with imprinted block scale in dm-cm graduation, total length 60 cm



Article	Order-No.
a) Pointer for measuring rod	86774
b) Measuring rod on shaft	86773
c) Measuring rod, magnetic	86775
d) Measuring tape, 3 m	92724
e) Sliding calliper, plastic, L = 150 mm	92725

Stopwatch, digital

a) Stopwatch
Plastic case with 6-digit LCD display, height of digits: 26 mm, start/stop/reset, time of day/date, dimensions: W = 130 mm, H = 180 mm
b) Hand-held stopwatch
Similar design to the stopwatch (Order No. 93690), but with different digit height: 9 mm

a)

Order-No. 93690

b)

(Image similiar)

Order-No. 93691

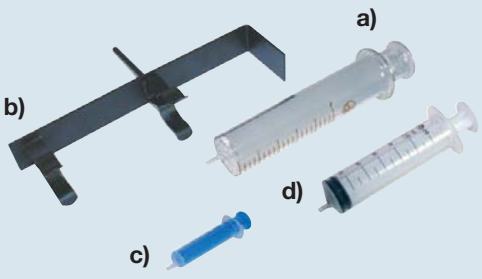
Tanks

a) Measuring cup
Plastic with graduation, spout and handle, capacity: 2000 ml
b) Plastic trough
Transparent, dimensions: 250 x 170 x 150 mm
c) Measuring cylinder, 100 ml
Plastic with spout and graduation
d) Measuring cylinder, 250 ml
Plastic with spout and graduation
e) Overflow tank
Acrylic glass with overflow tube for determining the volume of solid objects, height: 145 mm, capacity: 500 ml

Article	Order-No.
a) Plastic measuring cup with graduation	93683
b) Plastic trough	93684
c) Overflow tank	86805
d) Measuring cylinder, 100 ml	92615
e) Measuring cylinder, 250 ml	93685

Syringes

a) Gas syringe holder
2 spring clips on a metal bracket with shaft for holding the 100 ml gas syringe
b) Gas syringe
With ground glass plunger and straight adaptor
Volume: 100 ml, scale graduation: 1 ml
c) 10 ml plastic syringe
d) 50 ml plastic syringe



Article	Order-No.
a) Gas syringe holder	93687
b) Gas syringe	93686
c) 10 ml plastic syringe	93688
d) 50 ml plastic syringe	93689

Experimental set-up

Model experiment: "Diver's bell"

"Density object"

Magnetic board set-up:
"Buoyancy of objects with different densities"

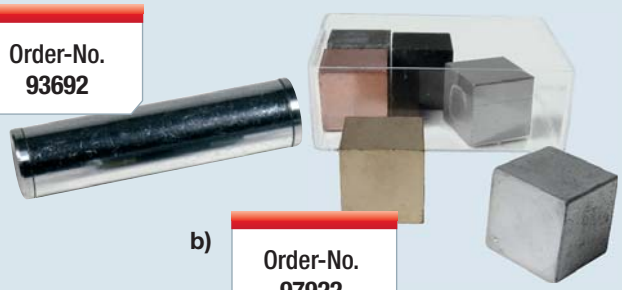
Density object – cm³ cube

a) Density objekt

To analyse the different densities of cold and warm water. The object floats in cold water (15 °C), but sinks when the temperature rises above 50 °C. L = 76 mm, D = 16 mm

Order-No. 93692

a)



b)

Order-No. 97922

b) cm³ cubes, set of 6 pcs

For determining the density of different materials with the same volume by comparing their masses. Material: Al/Cu/Fe/Pb/Zn/Me, Size: 8 cm³

Diver's bell

Cylindrical acrylic glass tank with stopper, 3 retaining screws with disc weight, height: 250 mm, 1 polystyrene ball, D = 60 mm, included in the scope of delivery.

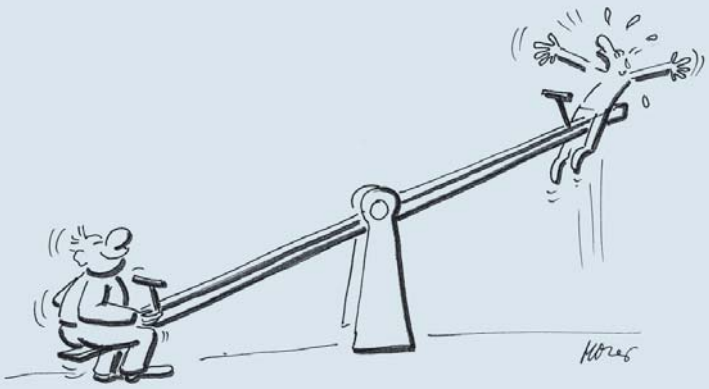
Order-No. 93694

Objects of the same volume

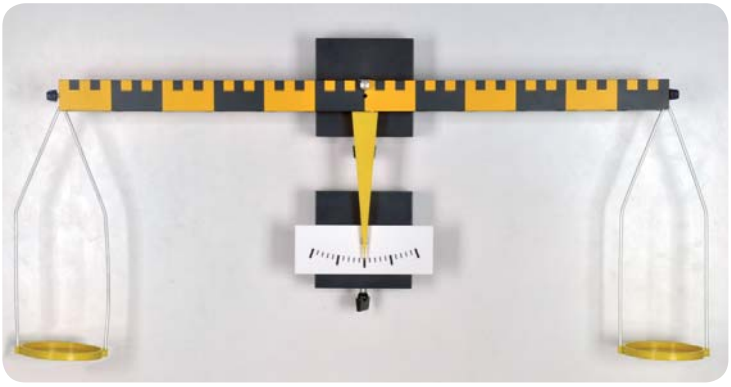
Submersible shape, Al, 100 cm³
Aluminium cuboid with hook for measuring buoyancy and for determining the density of solid objects. Weight: 285 g
Submersible shape, Fe, 100 cm³
Iron cuboid with hook for measuring buoyancy and for determining the density of solid objects. Weight: 790 g

Order No. 86804

Order-No. 86803



Experimental set-up



Magnetic board set-up: „Beam Balance“

Objects of the same mass, set

4 metal cylinders with hooks,
Pb, Cu, Fe, Al, each 100 g
for experiments on density

Order-No.
86802

Lever rod

Aluminium square profile, 30 x 15 mm, with holes on both sides for hanging hooked weights or dynamometers. Clearly structured block scale; the block scale is only printed across half of the rear side in order to clearly show the "single-sided lever". 2 holes in the centre for the rotatable mounting of the lever rod on the bosshead with bearing pin or supporting rod for magnetic base. One weighing device on each end of the lever rod.

Front view

Rear view

Article	Order-No.
Lever rod, L = 60 cm	86782
Lever rod, L = 40 cm	86783

Lever rod – Accessories

a) Weight set 100 g
Weight set in plastic storage box with lid,
Contents: 1 x 50 g, 1 x 20 g, 2 x 10 g, 1 x 5 g, 2 x 2 g, 1 x 1 g

b) Scale pans with hoop
Set of 2 pcs, yellow plastic pans, D = 80 mm, with metal bracket

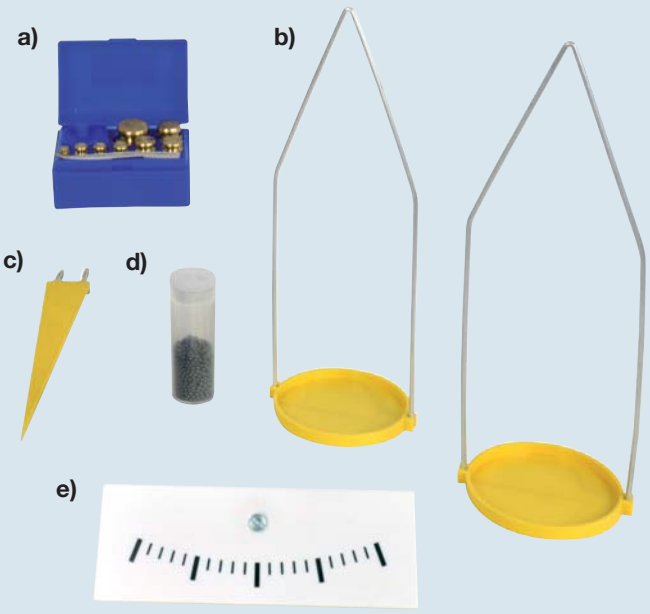
c) Pointer for lever rod
Plastic pointer, yellow, with 2 plug pins for inserting the pointer into the lever rod in order to display scales. Length: 150 mm

d) Taring pellets 50 g

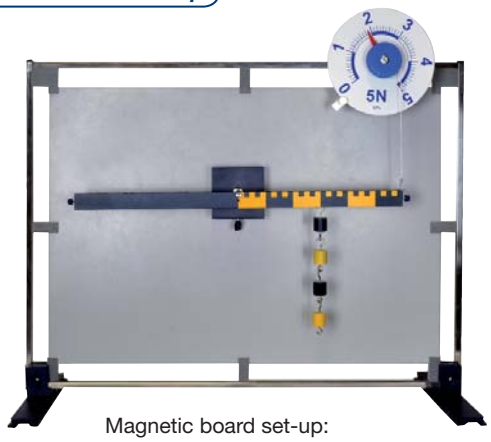
e) Scale on shaft

White plastic with printed black scale, shaft D = 10 mm for mounting on the long bosshead or magnetic base

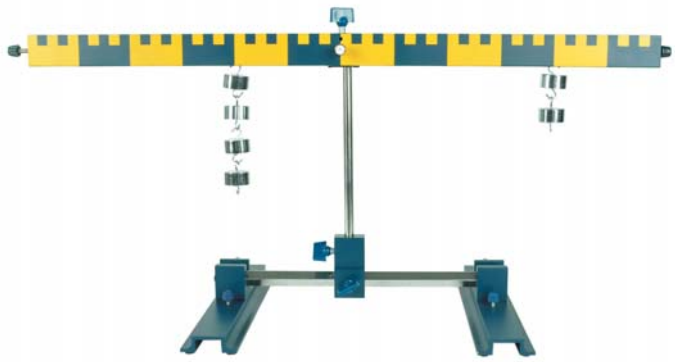
Article	Order-No.
a) Weight set 100 g	92604
b) Scale pans with hoop	86776
c) Pointer for lever rod	86777
d) Taring pellets 50 g	92605
e) Scale on shaft	89863



Experimental set-up



Magnetic board set-up:
"Single-sided lever"

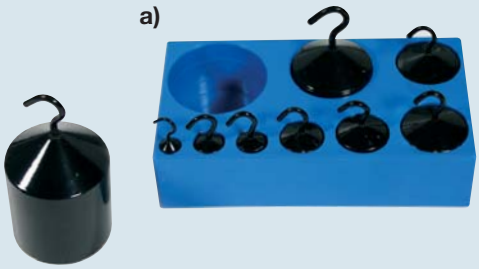


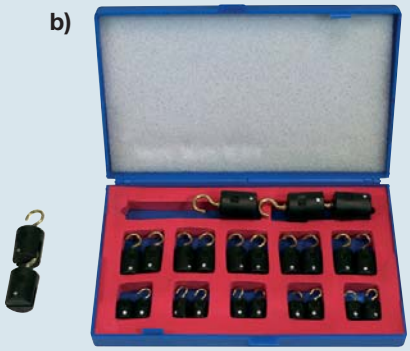
Stand set-up: "Two-sided lever"

Weight sets

a) Weight set with hooks
Steel, painted black, comes in storage box, 10 g - 1100 g
Contents: 10 g; 2 x 20 g; 50 g; 100 g; 2 x 200 g; 500 g - 1000 g

b) Weight set with hooks
Material: Plastic, comes in storage box, 1 g - 55 g
Contents: 10 x 1 g; 10 x 2 g; 5 x 5 g





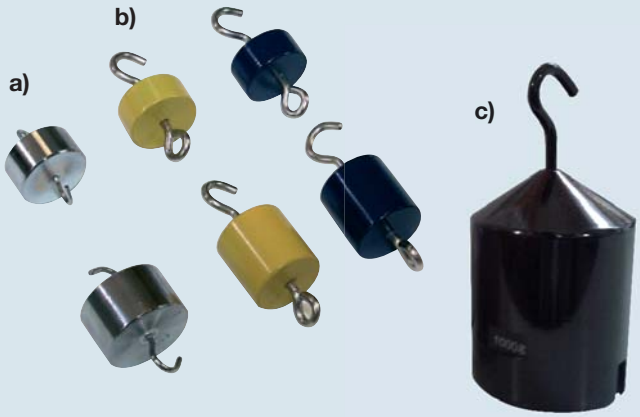
Article	Order-No.
a) Weight set with hooks, steel	93699
b) Weight set with hooks, plastic	93700

Hook weights

a) Steel, nickel-plated, with double hook for hanging several weights from each other

b) Steel, painted, with hook and loop for hanging several weights from each other, tolerance +/- 1%

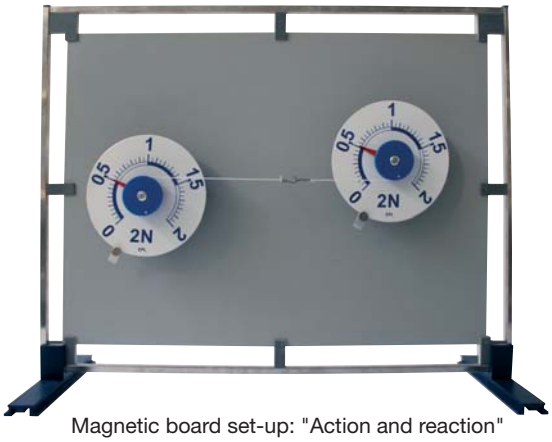
c) Hooked weight 1 kg, painted steel, slot on the underside with lug for hanging a second weight



Article	Order-No.
a) Hooked weight, 50 g, bare	86778
Hooked weights, 50 g, bare set of 10 pcs	86779
Hooked weight, 100 g, bare	86784
Hooked weights, 100 g, bare set of 10 pcs	86785
b) Hooked weight, 50 g, yellow	86780
Hooked weight, 50 g, blue	86781
Hooked weight, 100 g, yellow	86786
Hooked weight, 100 g, blue	86787
c) Hooked weight, 1 kg	86788

Experimental set-up

Magnetic board set-up:
"Loose roll" –
"Simple pulley block"



Magnetic board set-up: "Action and reaction"

Torque measuring device

Torsion dynamometer on shaft,
D = 10 mm, scale diameter: 200 mm,
Height of digits: 22 mm
Measurement precision: 3%
For magnetic board set-up with magnetic base (Order-No. 86767)

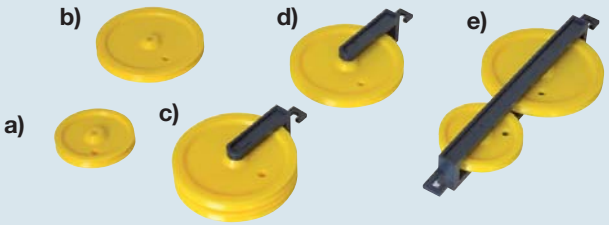
a) 

b) 

Article	Order-No.
a) Torsion dynamometer, 2 N	**86796**
b) Torsion dynamometer, 5 N	**86797**

Rolls

Plastic rolls with string groove, yellow, for rotatable mounting on the bosshead with bearing pin or supporting rod for magnetic base.



Article	Order-No.
a) Roll, D = 50 mm	**86806**
b) Roll, D = 75 mm	**86807**
c) Double roll 2 plastic rolls with brackets and hooks D = 75 mm, mass: 45 g	**86808**
d) Roll, loose Plastic roll with bracket and hook D = 75 mm, mass: 26 g	**86813**
e) Pulley for pulley block 2 plastic rolls in brackets with 2 hooks D = 50/75 mm, mass: 45 g (2 pcs required for pulley block)	**86814**
f) Cord for roll (5 m), not shown.	**92607**

Coil springs – Spring balances

a) Coil spring, 3 N/m
Coil spring for tensile and vibration experiments,
3 N/m, D = 35 mm

b) Coil spring, 20 N/m
Coil spring for tensile and vibration experiments,
20 N/m, D = 12 mm

c) Dynamometer – Spring balances
Precision dynamometer with coloured block and fine scale in newtons, over-stretching protection and zero-point correction, coloured aluminium
clamp, suspension and load hooks.
Measurement precision: 0.5%
Total length: Approx. 245 mm
Scale length: Approx. 130 mm
Diameter: 18 mm

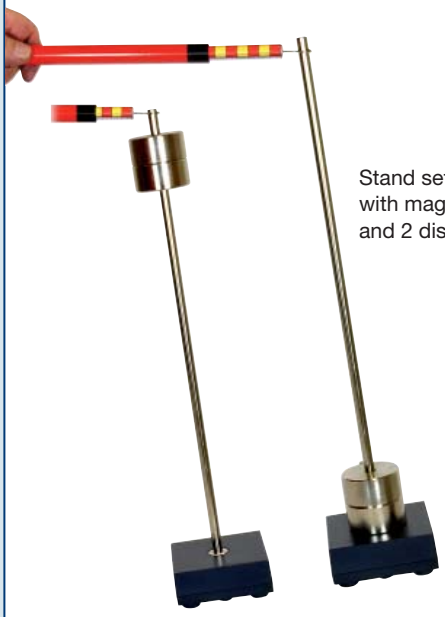
a) 

b) 

c) 

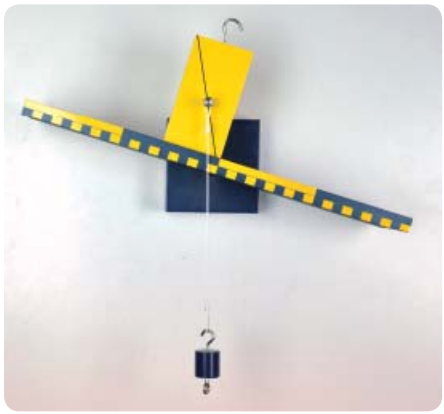
Article	Order-No.
a) Coil spring, 3 N/m	**86798**
b) Coil spring, 20 N/m	**86799**
c) Dynamometer 0.1 N, grey	**89864**
Dynamometer 0.2 N, light-blue	**86789**
Dynamometer 1 N, red	**86790**
Dynamometer 2 N, yellow	**86791**
Dynamometer 5 N, blue	**86792**
Dynamometer 10 N, green	**86793**
Dynamometer 20 N, orange	**86794**
Dynamometer 100 N, black	**86795**

Experimental set-up



Stand set-up: "Stability"
with magnetic base with support rod
and 2 disc bases, 500 g

Magnetic board set-up:
"Stability on
an inclined plane"



"Tilting work"

Plumb-bob with cord

Metal cylinder with tip and cord
L = approx. 100 mm

Order-No.
86812

Moment disc

Plastic disc, yellow, for analysing the torque balance. Holes on printed, centrally arranged circles. Set of retaining pins with cords of low mass included in the scope of delivery. D = 300 mm

Order-No.
86817

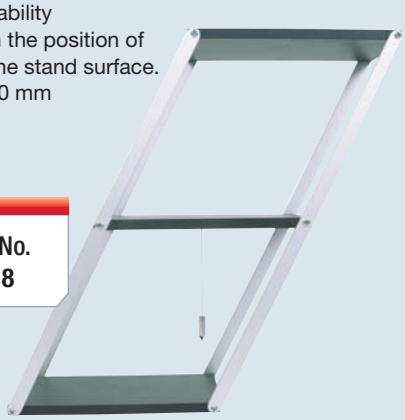
Balance device

For demonstrating types of balance, plastic half-ball shape with shaft and weight with retaining screw, D = 80 mm

Order-No.
89865

Stability device

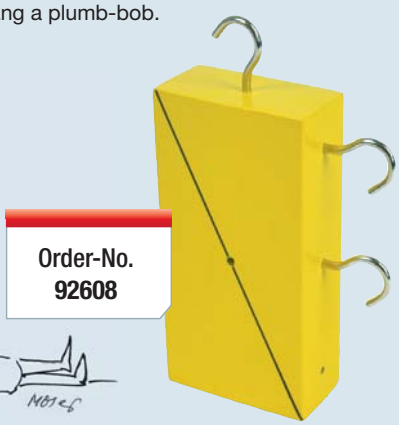
Device for analysing the stability of an object, depending on the position of the centre of gravity over the stand surface. Dimensions: 150 x 80 x 300 mm



Order-No.
86818

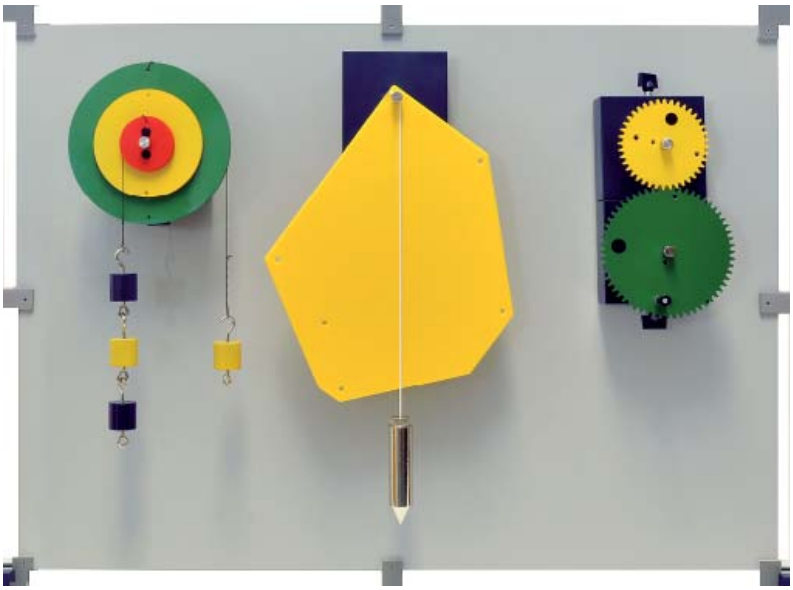
Friction block

Aluminium cuboid, yellow, with 3 threaded hooks for hanging a dynamometer. For experiments on static, sliding and rolling friction, and on stability. A central hole for mounting a bearing pin in order to hang a plumb-bob.



Order-No.
92608

Experimental set-up



Magnetic board set-up: "Wheel and axle", "Centre of mass plate with plumb-bob", "Gear drive"

Cog wheel set

3 different-coloured acrylic glass cog wheels for demonstrating the forms of movement of a simple gear drive, central holes for rotatable mounting using a bosshead bearing pin with bearing pin or retaining shaft for magnetic base.

Cog wheel, 20 teeth, D = 42 mm
Cog wheel, 40 teeth, D = 82 mm
Cog wheel, 60 teeth, D = 123 mm

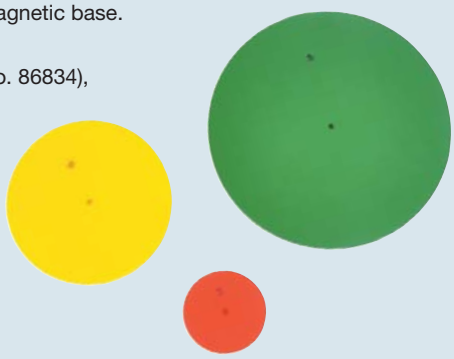
Order-No. 89886

Belt pulley set

3 different-coloured plastic discs with string groove, central holes for rotatable mounting using a bosshead bearing pin with bearing pin or retaining shaft for magnetic base.
D = 150/100/50 mm

Drive belts (Order-No. 86834), (not shown)

Order-No. 86809



Wheel and axle

3 different-coloured acrylic glass cord pulleys, rigidly connected, central hole for rotatable mounting using a bosshead bearing pin with bearing pin or retaining shaft for magnetic base.
D = 150/100/50 mm

Order-No. 86816

Crank pin

Metal pin with thread and plastic roll,
L = 25 mm, D = 10 mm

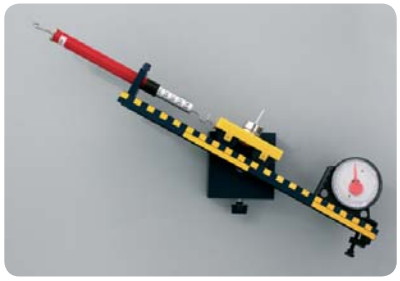
Order-No. 86810

Centre of mass plate

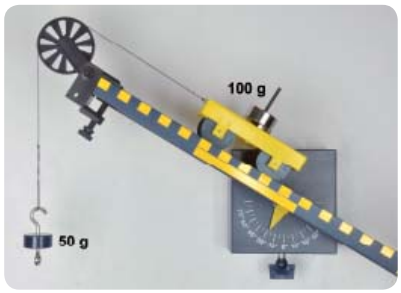
Irregular shaped plastic plate, yellow, with holes on the corners for hanging on a bosshead with bearing pin or retaining shaft for magnetic base
Dimensions: Approx. 310 x 235 x 4 mm

Order-No. 86811

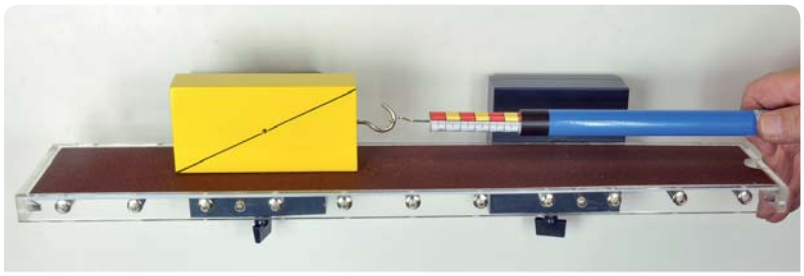
Experimental set-up

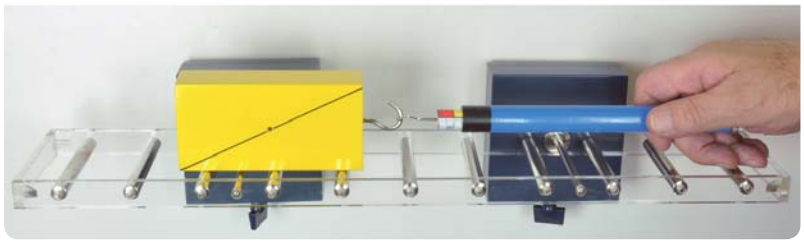


Magnetic board set-up: "Inclined plane" with dynamometer on magnetic base with protractor



Magnetic board set-up: "Inclined plane" with deflection roller on magnetic base with scale





Magnetic board set-up: "Uniform movement"

Cart with weights, **see page 54**

Inclined plane

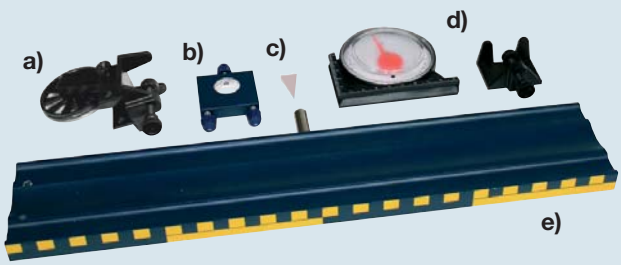
a) Deflection roller
Precision deflection roller in black plastic, ball-bearing-mounted, extremely easy to move, height-adjustable, for mounting on the end of the trackway or inclined plane. D = 50 mm

b) Dynamometer holder
Aluminium clamp for mounting on an "inclined plane" and holding dynamometers up to a diameter of 18 mm

c) Pointer for "inclined plane"
Plastic pointer, yellow, for connecting under the "inclined plane"

d) Protractor with clamp mounting
D = 76 mm

e) Inclined plane
Special aluminium profile with guide rails for cart, shaft fixed rigidly on the side, D = 10 mm, for securing on a stand or magnetic base with scale. L = 400 mm



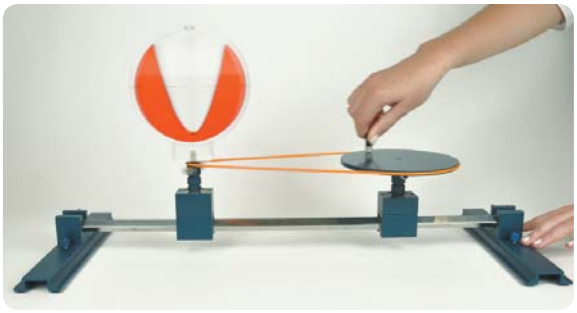
Article	Order-No.
a) Deflection roller	86822
b) Dynamometer holder	86829
c) Pointer for "inclined plane"	86830
d) Protractor with clamp mounting	93702
e) Inclined plane	86827

Friction plate

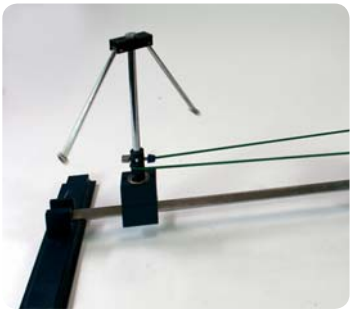
Static, sliding and rolling friction plate; acrylic glass frame on 2 shafts for holding it in place in stand material. 11 steel rollers are low-friction mounted in the acrylic glass frame, a plate with rough and smooth surface, can be used in the acrylic glass frame. Length: 500 mm, width: 90 mm

Order-No. 86824

Experimental set-up



Stand set-up: "Flyweight governor"

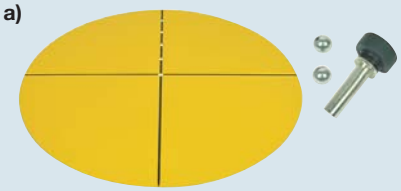


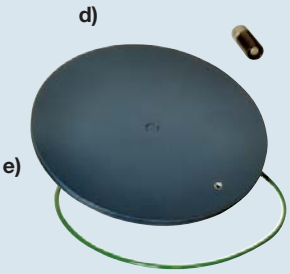
Stand set up: „Centrifugal force“

Dynamics – Device set

6 experiments on rotary motion with the dynamics device set on the following topics:

- Centrifugal force
- Centrifugal trough
- Flexible hoops
- Flyweight governor
- Rotating liquids
- Centrifugal force





Dynamics – Device set
Available as a complete set or as individual components.

Order-No. 92620

a) Disc with diametrical holes
Device for experiments on centrifugal force.
Metal disc, D = 300 mm, powder-coated, yellow, with 4 holes with distances of 30/60/90/120 mm with central hole for retaining shaft for storing steel balls.
2 steel balls, D = 12.7 mm included in the scope of delivery.

b) Short bearing unit
Rotatable clamping column, double ball bearing with string groove on bosshead for clamping shafts with a diameter of 10 mm, primarily the belt pulley for setting up a centrifugal machine.

c) Long bearing unit
Rotatable clamping column, double ball bearing with string groove on bosshead for clamping shafts with a diameter of 10 mm, cross hole.

d) Belt pulley
Aluminium disc with string groove, D = 150 mm, on shaft, D = 10 mm, with detachable crank pin.

e) Drive belt
Plastic belt, D = 3 mm, for centrifugal machine, scope: Approx. 80 cm

f) Flexible hoop ring
Device for demonstrating the flexible hoops, ring diameter: 150 mm, shaft diameter: 10 mm

g) Flyweight governor
Flyweight governor model on shaft, length of pendulum: 150 mm
Shaft diameter: 10 mm

h) Centrifugal trough
Device for demonstrating the proportionality of the centrifugal force to the mass. Acrylic glass circular cell on support rod, D = 10 mm, 2 balls (plastic/steel) included in the scope of delivery. Can also be used as a centrifugal cell for analysing the relationship between the surface shape of rotating liquids and their angular velocity
Diameter of the cuvette: 150 mm

Article	Order-No.
a) Disc with diametrical holes	86837
b) Short bearing unit	86831
c) Long bearing unit	86832
d) Belt pulley	86833
e) Drive belt	86834
f) Flexible hoop ring	86835
g) Flyweight governor	86839
h) Centrifugal trough	86836

Experimental set-up

Precession movement

"Retaining the angular momentum" (Gyro hung on a cord)

"Bicycle wheel gyro"

Gyro set

For demonstrating the properties of a free gyro and its precession movement.
Gyro diameter: 50 mm

Order-No. 86845

Gyroscope

Gyro with precisely rotating brass rotor, D = 60 mm
Frame with gimbal, separate pendulum frame, driving cord, rotor running time up to 5 minutes

Order-No. 93704

Bicycle wheel gyro – Rotating stool

a) Rotating stool
Rotary stool with shaped seat and footrests mounted on a turntable, height-adjustable

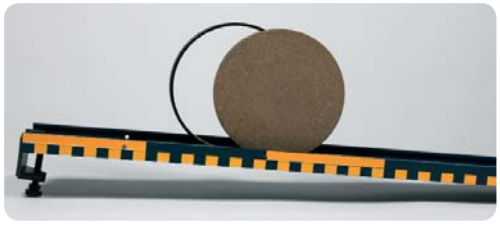
b) Bicycle wheel gyro
For demonstrating the conservation of angular momentum Spoked wheel with 2 handles, D = 57 cm

c) Dumbbells, pair
Material: Steel, plastic-coated
Mass: 2 kg each

(Image similar)

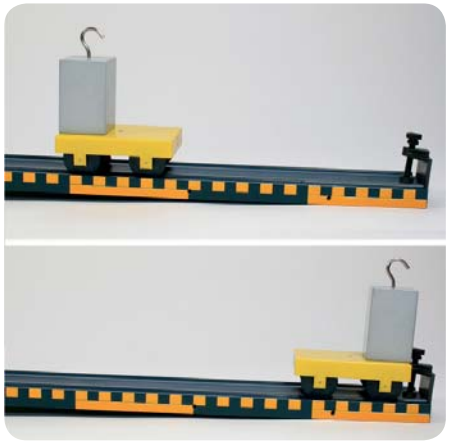
Article	Order-No.
a) Rotating stool	93706
b) Bicycle wheel gyro	93705
c) Dumbbells, pair	93707

Experimental set-up



"Different moments of inertia for the same mass"

"Inertia of the mass"



"Inertia of mass"

Solid and hollow cylinder

Solid and hollow cylinder for demonstrating the different moment of inertia for the same mass, D = 110 mm
Mass: 120 g

Order-No. 93889

Inertia – Device set

a)

b)

c)

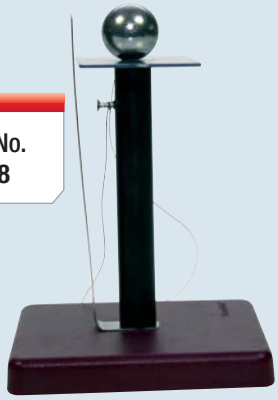
d)

Article	Order-No.
a) Trackway 1 m	86825
b) Clamp, 2 pcs	93797
c) Submersible shape, Al, 100 cm³	86803
d) Cart	86819

Device for the inertia of mass

Ball diameter: 20 mm, H = 125 mm

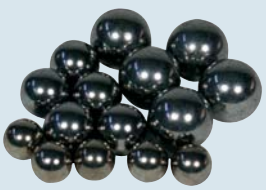
Order-No. 93708



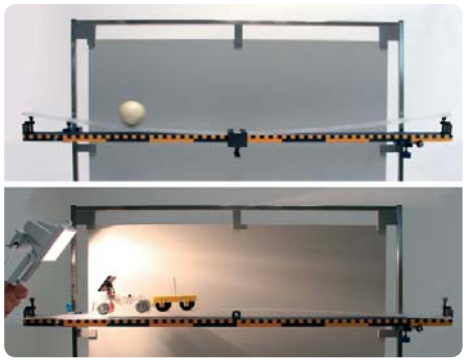
Steel balls

Set of 20 pcs
6 x 12 mm, 7 x 16 mm, 7 x 20 mm

Order-No. 93709



Experimental set-up



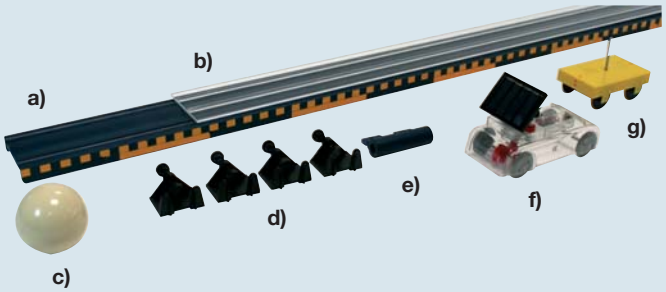
Magnetic board set-up:
"Potential – Kinetic energy"
"Mobile solar unit moves a cart over a slope"

Magnetic board set-up:
"Rotation energy"

Stand set-up:
"Position – Tension energy"

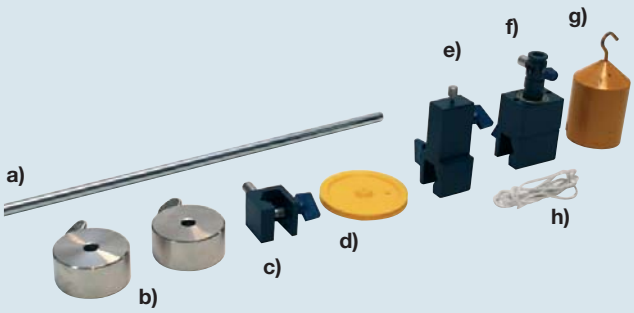
Trackway – Flexible trackway

Acrylic glass rail, L = 1 m, flexible



Article	Order-No.
a) 1 x trackway, 1 m	86825
b) Trackway, flexible	93821
c) Plastic ball, D = 60 mm	89880
d) 2 x terminals, plastic	93797
e) 1 x round bosshead	86761
f) 1 x mobile battery unit with solar top piece	92655
g) Cart	86819

Energy conservation



Article	Order-No.
a) 1 x round rod, L = 450 mm	86755
b) 2 x disc base	86840
c) 1 x half bosshead on shaft, 10 mm	93799
d) 1 x roll, D = 75 mm	86807
e) 1 x bosshead with bearing pin	86751
f) 1 x bearing unit, long	86832
g) 1 x hooked weight, 1 kg	86788
h) 1 x cord for rolls, 5 m	92607

Looping track

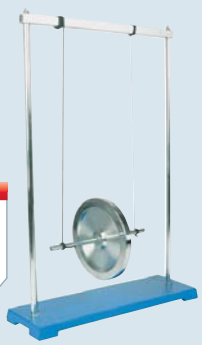
Looping track for demonstrating the conversion of potential energy into kinetic energy, D = 25 cm, 2 steel balls

Order-No. 93803

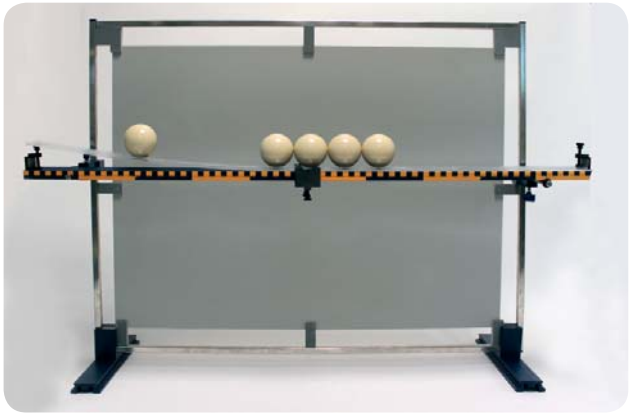
Maxwell's wheel

Complete device for demonstrating energy conversion. Metal wheel, solid, on an axle with holes for hanging on cords, D = 125 mm. Hanging frame with metal plate base included in the scope of delivery.

Order-No. 86841



Experimental set-up



Magnetic board set-up:
"Law of action and reaction"

"Rocket launch"

„Recoil“

Set of balls

5 plastic balls, white, D = 60 mm

Order-No. 89881

Rocket model

The missile sits on a two-part launching device. With just one push of the compressor pipe, the missile can fly up to 15 metres away. Functional principle: Alpha-recoil caused by exhaust air

Missile: L = 25 cm, D = 3 cm
Launching device: L = 75 cm, D = 4 cm

Order-No. 93807

Mobile action-reaction unit

Mobile action-reaction unit for demonstrating the alpha-recoil caused by an air stream. Battery-operated motor (Battery not included), detachable recoil plate. Dimensions of the carriage plate: 140 x 72 mm

Order-No. 93806

Newton's cradle

Newton's cradle for demonstrating the conservation of energy and momentum, ball diameter: 2 cm, frame dimensions: 28 x 17.5 x 28 cm

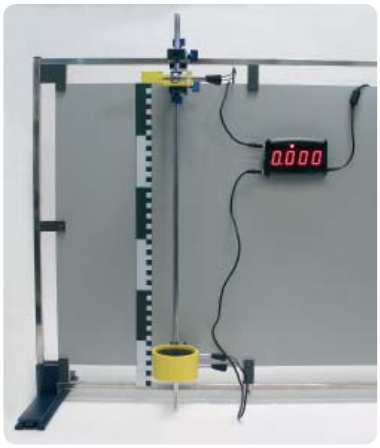
Order-No. 93804

Mobile recoil unit

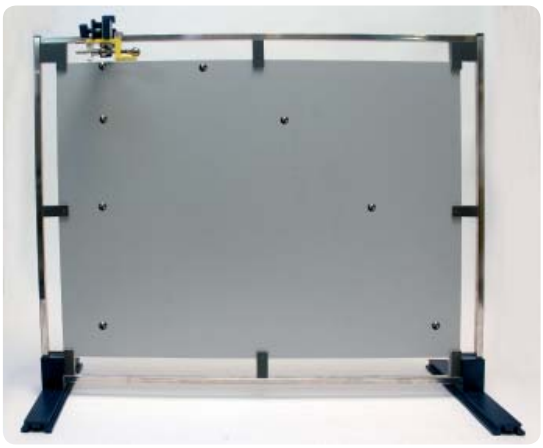
Mobile unit with one-way stopcock for demonstrating the recoil caused by exhaust air.
Carriage plate: 140 x 72 mm, balloon, set of 3 pcs

Order-No. 93805

Experimental set-up



Magnetic board set-up: "Free fall"



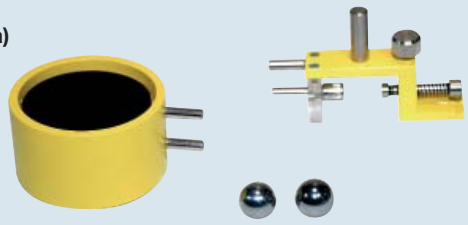
Magnetic board set-up: "Principle of independence"

Falling sphere device

Consisting of:
Ball holder on shaft, D = 10 mm, with two 4 mm connecting sockets
Impact plate on shaft in collecting vessel with two 4 mm connecting sockets, 2 steel balls, D = 19 mm, Special jack cable, L = 1 m,
Power supply via plug-in power supply 6 V/500 mA

Not included in the scope of delivery:
Display via timer (Order-No. 93816)

a)



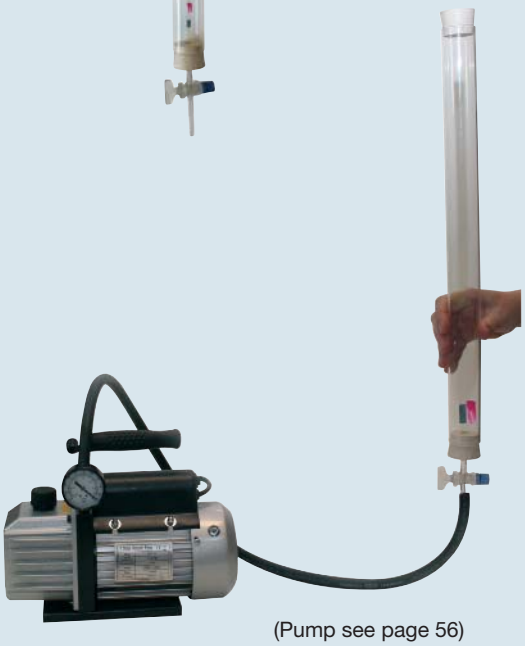
b)

Article	Order-No.
a) Falling sphere device, complete	93808
b) Plug-in power supply	89949

Drop tubes

a)

b)

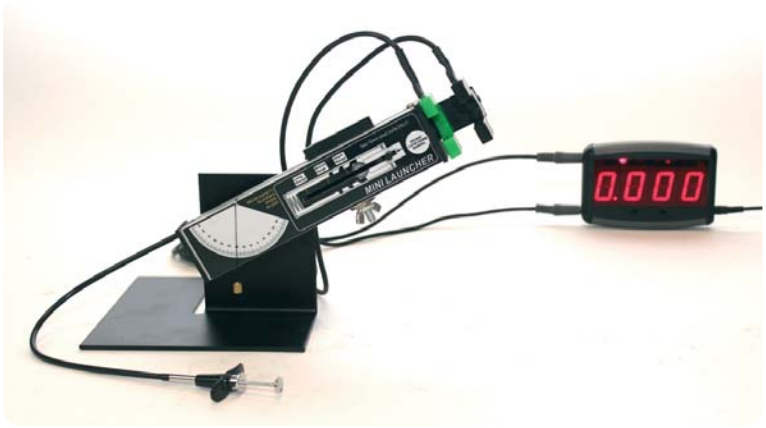


(Pump see page 56)

Article	Order-No.
a) Glass drop tube L = 1 m	93810
b) Short drop tube, glass L > 50 cm	93811

Experimental set-up

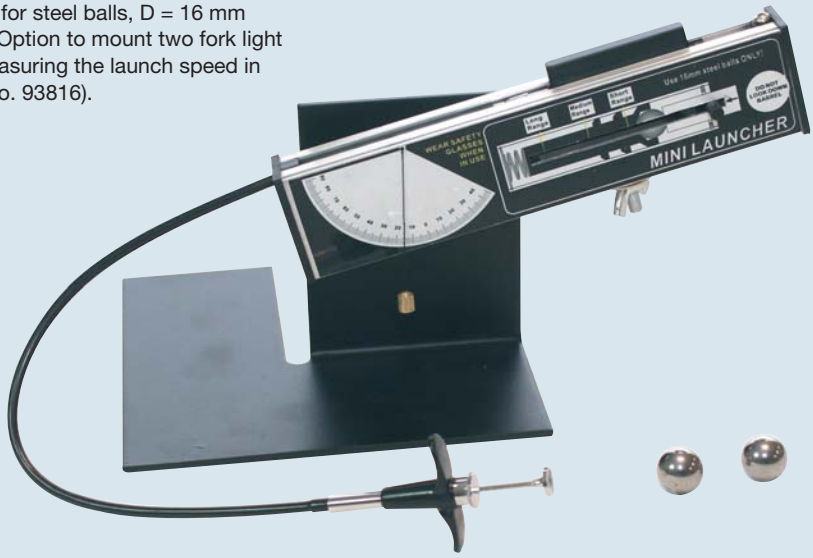
Magnetic board set-up: "Water projection"



"Inclined projection with projection cannon"

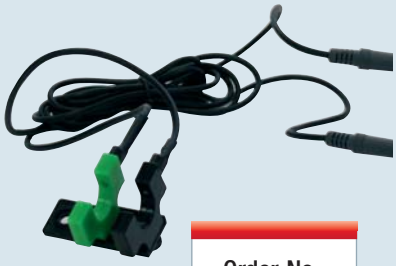
Projection cannon

Launching device with protractor for steel balls, D = 16 mm
Three adjustable launch speeds. Option to mount two fork light barriers (Order-No. 93814) for measuring the launch speed in conjunction with a timer (Order-No. 93816).



Fork light barrier

One pair on holder
Fork light barrier in plastic case for timer (Order-No. 93816)



Order-No. **93814**

Timer, magnetic

Universal timer and counter for mechanics experiments in demonstration and student lessons.

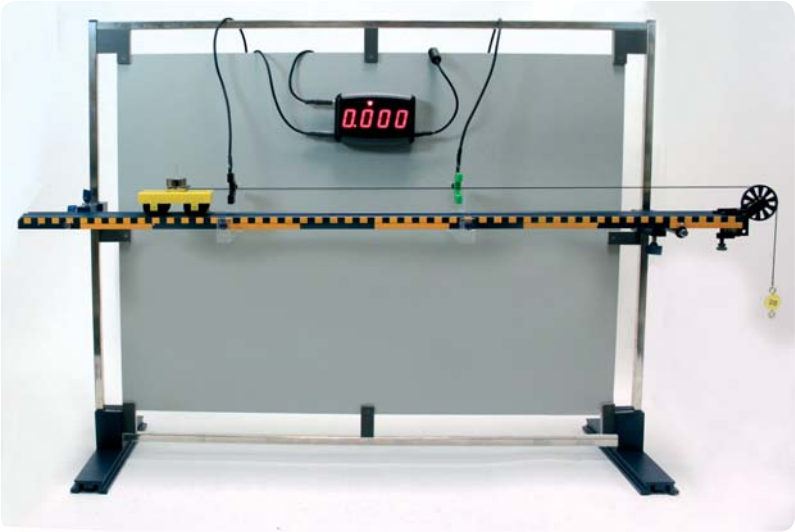
Order-No. **93816**

Power supply provided by 6 V/3 W plug-in power supply with DC connector 2.5/5.5 mm (Order-No. 89949, not included in scope of delivery).

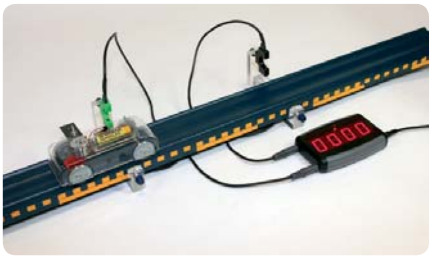
Goggles, transparent

Order-No. **93815**

Experimental set-up



Magnetic board set-up: "Accelerated linear motion"



„uniform movement“

„uniform accelerated motion“

Case Mechanics 3 – Linear motion

This case provides everything you need for successful experiments on linear motion and for investigation of various conservation of momentum experiments. The high-quality individual parts are clearly organised, so that students can perform a number of experiments effectively.

Devices and set-up parts in sturdy, high-quality plastic case with device-shaped foam insert

Contains the following devices and set-up parts:

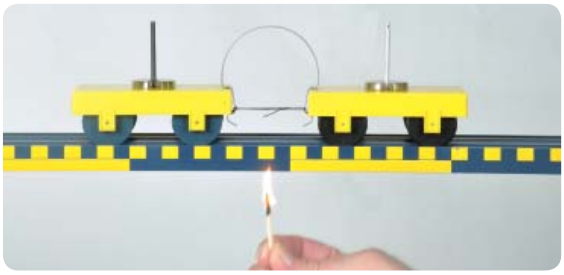
1 trackway, 1m
1 deflection roller
1 start – buffer stop
2 carts
1 2 g hook weight
1 5 g hook weight
1 cord, roll
2 20 g slotted weights
4 50 g slotted weights
1 battery cart with solar attachment
1 impact spring
1 impulse spring
1 high-quality plastic case with device-shaped foam insert, dimensions: 53 x 40 x 12.5 cm

For experiments on the following topics:

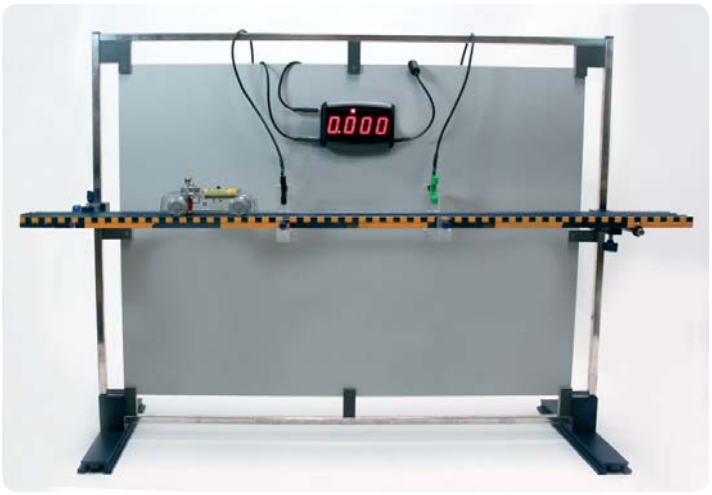
- **Uniform motion**
- **Average and current speed**
- **Uniform accelerated motion**
- **Basic equation of dynamics and Newton‘s Laws**
- **Impact experiments – Momentum set**
- **Energy and conservation of momentum**
- **Dynamic determination of mass**
- **Potential and kinetic energy**

Article	Order No.
Case Mechanics 3 (including timer set)	98443
Case Mechanics 3 (without timer set)	96961

Experimental set-up



"Equality of mass – Interaction"



Magnetic board set-up: "Uniform movement"

Timer set, magnetic

Consisting of:
1 timer, magnetic
2 fork light barriers
2 special connecting cables
1 power supply

- Universal timer and counter for mechanics experiments in demonstration and student lessons.
- Four-digit, red, 26 mm numeric LED display
- 4 x individual LEDs for the function display „Start/ Stop“, „Gate“, „Count“ and „Falling sphere device“ Black ABS casing, 117 x 79 x 24 mm
- 2 x 3.5 mm jack cables – Stereo for connecting one or two light barriers or the falling sphere device
- 2 x operating button „On/Function“ and „Off/ Reset“Scope of display: 9,999 s or 9999 counts

Order-No. 92737

Stand up material for linear movment

Stand up material for linear movment experiments with the assembly plate. The stand up material can be placed in the case mechanics 3.

Consisting of:
1 bosshead with bearing pin
1 bosshead, long
1 Bearing pin, long
1 Support rod
with clamp ring

Order-No. 97889

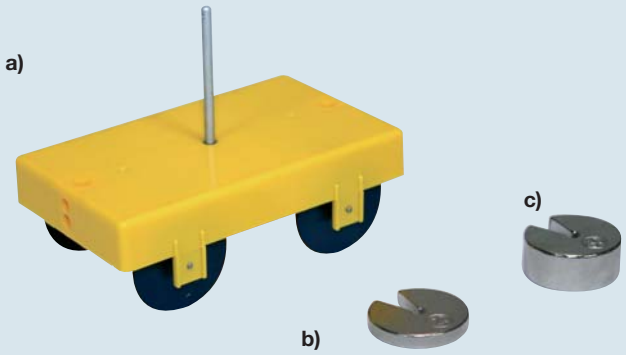
Mobile battery unit with solar top piece

Transparent mobile plastic unit with drive motor for experiments on uniform movement, sliding switch for 2 speeds, swivelling solar top piece for setting on top of the mobile battery unit. Battery: Mignon 1.5 V (included in the scope of delivery)

Order-No. 92655

Cart

Plastic mobile experiment unit with tower for holding slotted weights as additional mass, low-friction-mounted wheels, 4 mm holes on both ends. Mass: 30 g, dimensions of the carriage plate: 100 x 60 mm



Article	Order No.
a) Cart	86819
b) Slotted weight, 20 g, nickel-plated steel	86820
c) Slotted weight, 50 g, nickel-plated stell	86821

Springs

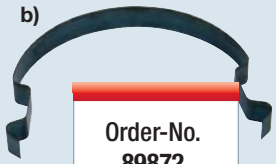
a.) Impact spring set

2 pcs, steel leaf spring on 4 mm plug pin for pushing on to a cart (Order-No. 86819), mass: 10 g

b) Spring for cart

Steel leaf springs with specially shaped ends for attaching to 2 carts (Order-No. 86819) for experiments on the conservation of momentum and dynamic mass determination

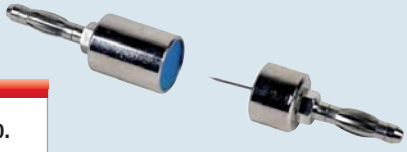
Order-No. 89871



Order-No. 89872

Cart top piece

"Inelastic collision"



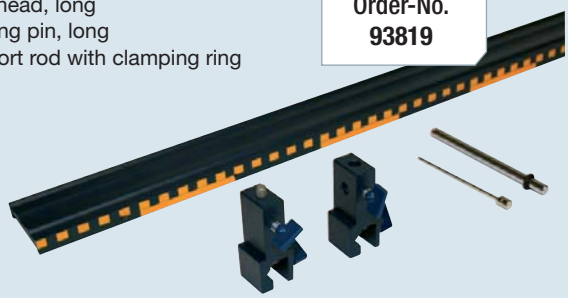
Order-No. 89882

Trackway – Device set

Special aluminium profile with guide rails for linear motion of carts, mobile battery units or balls up to a diameter of 60 mm, block scale printed on the side,
Width: 77 mm, length: 1000 mm

Consisting of:
1 x trackway, 1 m
1 x bosshead with bearing pin
1 x bosshead, long
1 x bearing pin, long
1 x support rod with clamping ring

Order-No. 93819



Article	Order-No.
Trackway device set	93819
Trackway, 1 m	86825
Magnetic base	86767
Supporting rod	86771
Bearing pin, long	86866

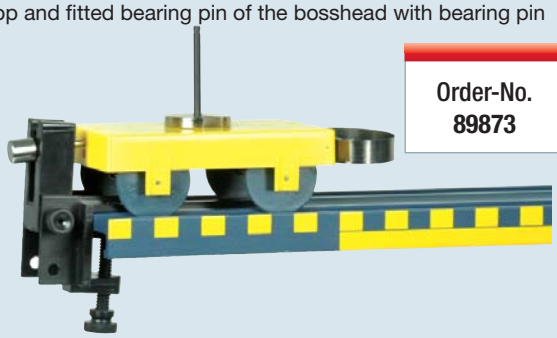
Deflection roller

Precision deflection roller in black plastic, ball-bearing-mounted, extremely easy to move, height-adjustable, for mounting on the end of the trackway or inclined plane. D = 50 mm

Order-No. 86822

Start and buffer stop

For mounting at the start and end of the trackway
Holding the cart at the start of the trackway with a start and buffer stop and fitted bearing pin of the bosshead with bearing pin



Order-No. 89873

Effect of air pressure – Device set

Order-No.
93891

For experiments on the effects of air pressure

1 x vacuum pump, two-stage
1 x vacuum hand pump with pressure gauge
1 x container, V = 7 liter, H = 260 mm, D = 200 mm
1 x air pump plate with rubber plate, large
1 x container, small, 1 litre, weight of air globe
1 x air pump plate with rubber plate, small
1 x buoyancy scales on base
1 x set Magdeburg hemispheres, cast iron
1 x set Magdeburg hemispheres, rubber
1 x bubble burster
1 x cellophane film
1 x rubber ring
1 x tin can with stopper
3 x balloons
1 x vacuum hose, 1 m (not shown)
1 x buzzer

Christiani-Tip

Vacuum physics – Device set

For experiments on

- **Effects of air pressure**
- **Magdeburg hemispheres**
- **Expansion of air balloon in a vacuum**
- **Buoyancy in air**
- **Bubble burster**
- **Sound propagation in a vacuum**
- **Drop tube**

Order-No.
93866

More information on page 136

Experimental set-up

"Effect of air pressure"

"Effect of air pressure"

"Weight of displaced air 1 litre: 1.3 grams"

Two-stage vacuum pump

Final pressure: 0.003 hPa
Pressure gauge: 0 – 1000 hPa
Hose olive: D = 10 mm
Oil volume: 180 ml
Supply voltage: 230 V
Dimensions: 308 x 124 x 228 mm
Mass: 7.5 kg

Order-No. 93867

Buoyancy scale

To analyse buoyancy in air
Polystyrene ball, D = 70 mm and counterweight with small volume

Order-No. 93717

Containers

a) Container, large

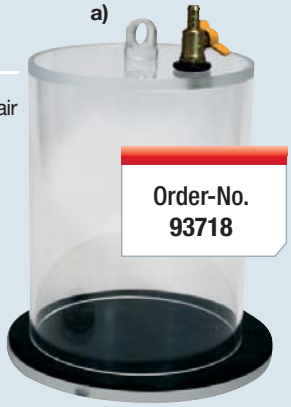
Acrylic glass cylinder, volume = 7 litres
H = 260 mm, D = 200 mm
With air pump plate and rubber plate

b) Container, small

For determining the weight of displaced air
Acrylic glass cylinder, volume = 1 litre
With air pump plate and rubber plate

a)

Order-No. 93718



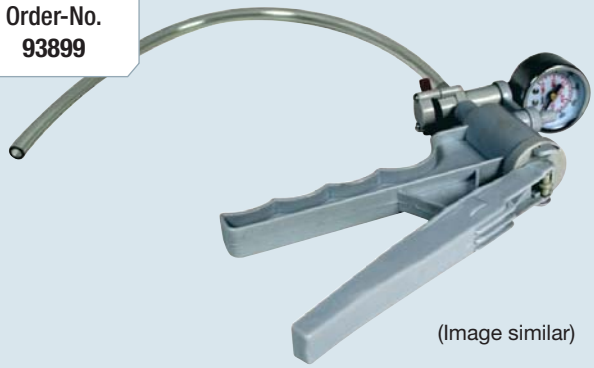
Order-No. 93719

b)

Hand vacuum pump

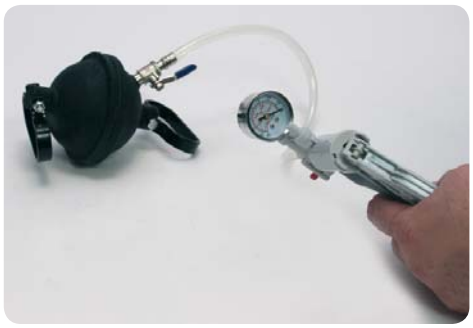
Vacuum pump with dial pressure gauge
Pumping speed: 35 ml/stroke
Final pressure: Approx. 120 mbar

Order-No. 93899



(Image similar)

Experimental set-up



"Effect of air pressure"

„Suction power“

"Helium balloon"

Suction handle – Bubble burster

a) Suction handle

For demonstrating the principle of Magdeburg hemispheres. When the handle is folded down, suction makes the rubber round plate stick to a smooth surface. D = 120 mm

b) Bubble burster

Acrylic glass cylinder, open on one side, with slot and hose attachment. D = 110 mm, H = 60 mm, for demonstrating the external air pressure. Included in the scope of delivery: 1 rubber ring and 1 set of cellophane film

a)

Order-No. 93720

b)

Order-No. 93721

Buzzer

Module with integrated buzzer and ON/OFF switch, along with rubber coating to prevent the transmission of sound.
Dimensions: 76 x 76 mm

Order-No. 93724

Boyle-Mariotte – Device

For demonstrating the relationship between pressure and volume of a gas at a constant temperature.
Dial pressure gauge and gas syringe on base plate.
Dimensions of the base plate: 200 x 120 mm
Dial pressure gauge, D = 100 mm

Order-No. 93725

Magdeburg hemispheres

a) Magdeburg hemispheres, rubber

Two cast iron hemispheres with handle. One hemisphere with hose sleeve and stopcock. D = 100 mm

a) Magdeburg hemispheres, rubber

Two half-shells with rubber handle, D = 80 mm

a)

Order-No. 93722

b)

Order-No. 93723

Helium bottle – Tin can

a) Helium bottle with valve

Bottle content is sufficient for approx. 15 -25 balloons (depending on the diameter of the balloon).
Included in the scope of delivery: 10 balloons
Balloon diameter: Approx. 25 cm
Load-bearing capacity approx. 3 g
(depending on the balloon volume).

b) Tin can with stopper

H = 160 mm, D = 100 mm
A small volume of water is brought to the boil in the can and the can is then sealed. If the can cools down quickly (cold water), the external air pressure is deformed.

Order-No. 93727

a)

b)

Order-No. 93726

Aerodynamics – Device set

For experiments on the following topics:
- Aerodynamic paradox
- Bernoulli effect
- Aerofoil model
- Buoyancy on the aircraft model
- Measuring the drag coefficient on different flow bodies
- Vortex formation on different flow bodies

Order-No.
93893

Consisting of:

Radial fan, 230 VAC
Hand-held blower, 230 VAC
Cone for hand-held blower
Polystyrene ball, D = 80 mm
Polystyrene ball, D = 60 mm
Arched aluminium plates, pair
Aircraft model
Support rods for aircraft model, pair
Flow bodies, set
Pendulum rod
Holder for pendulum rod
Comb of threads
Dynamometer, 0.2 N
Cord, roll
Deflection roller on shaft

Required stand material:

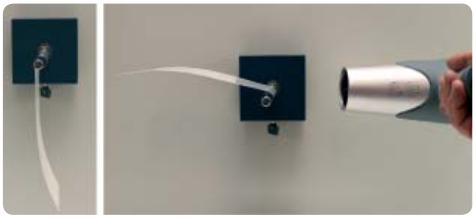
Article	Order-No.
1 x H-base	86749
1 x Square tube, L = 1000 mm	86766
Bosshead right angle	86759
2 x bosshead, long	86760
1 x shaft with hook	92625

Experimental set-up

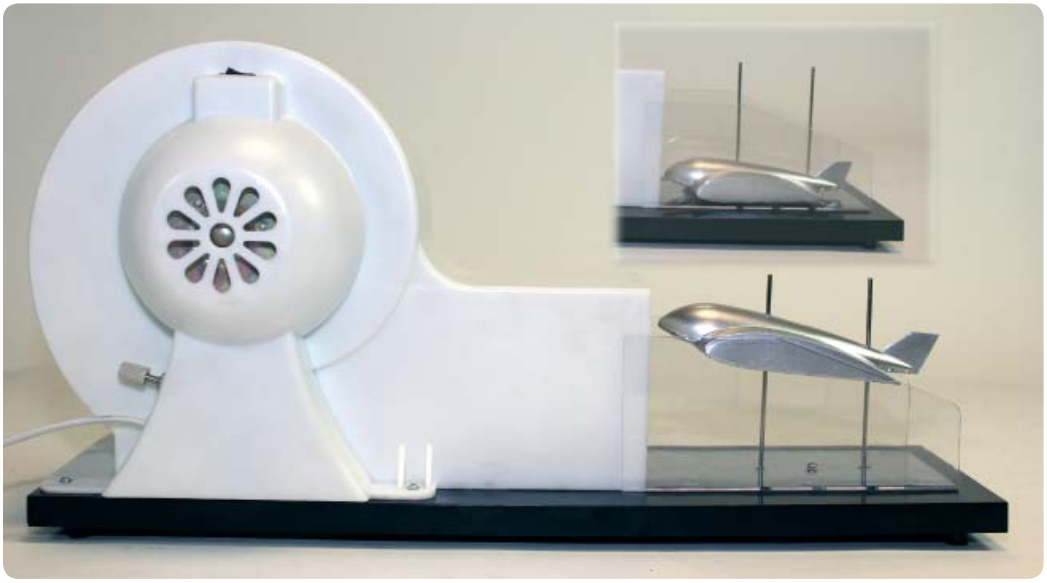
"Aerodynamic paradox"

"Bernoulli effect"

"Aerodynamic paradox"



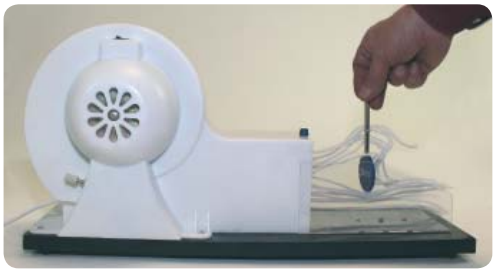
"Aerofoil model"



"Aerodynamic buoyancy on the aircraft model"

"Measuring the drag coefficient of a hemisphere"

"Wind tunnel: Irrotational streamlined body"



"Wind tunnel: Vortex formation on a circular plate"

Hydromechanics – Device set

Order-No.
44490

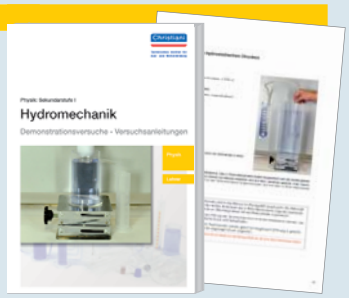
16 experiments with the hydromechanics device set on the following topics:

- Density measurement
- Communicating tanks
- Measuring buoyancy
- Buoyancy in liquids
- Archimedes‘ principle
- Measuring the hydrostatic pressure
- Pressure can according to Hartl
- Buoyancy
- Pressure distribution in liquids
- Swimming, floating, sinking
- Lateral pressure
- Discharge speed
- Water projection
- Alpha-recoil
- Capillary effect
- Adhesion

Consisting of:

Jar
Large jar
Discharge jar
Buoyancy device
Hollow and solid cylinder
Segner turbine
Submersible probes, set
Cartesian diver-set
U-tube pressure gauge
Including 1 instruction manual
Hartl pressure can
Communicating tanks
Overflow tank
Pressure propagation device
Discharge vessel
Adhesion plates
Capillary tube device
Glass tube with tip
Coloured powder

Instruction manual:



Experimental set-up

Magnetic board set-up:
"Archimedes' principle"

"Measuring the buoyancy of a polystyrene ball"

"Buoyancy in water"

Discharge jar

Device for demonstrating the liquid pressure on the side wall of a vessel; 3 lateral outlet openings at different heights with stoppers, filler hose olive on the upper edge.
Height: 460 mm, diameter: 55 mm

Laboratory lifting table and plastic tray not included in the scope of delivery.

Order-No. **86846**

Jars

Rectangular acrylic glass water tank for experiments on hydromechanics

a) Jar

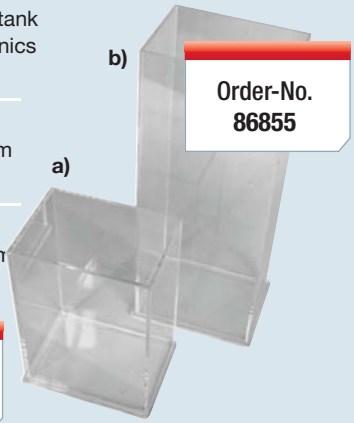
Filling volume: Approx. 2400 ml
Dimensions: 140 x 100 x 200 mm

b) Jar – large

Filling volume: Approx. 4300 ml
Dimensions: 140 x 100 x 360 mm

Order-No. **86855**

Order-No. **86847**



Segner turbine

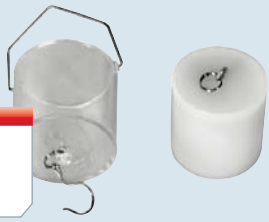
Acrylic glass model for demonstrating the alpha-recoil principle.
Rod-bearing-mounted rotatable, cylindrical water tank with 4 attached, sealed tubes with lateral holes for water discharge.
Total height: 280 mm

Order-No. **86853**

Hollow and solid cylinder

Device for demonstrating buoyancy in liquids ("Archimedes' principle")
Acrylic glass beaker with holder and hook along with a fitted plastic cylinder with ring.
Volume: 100 ml

Order-No. **86852**

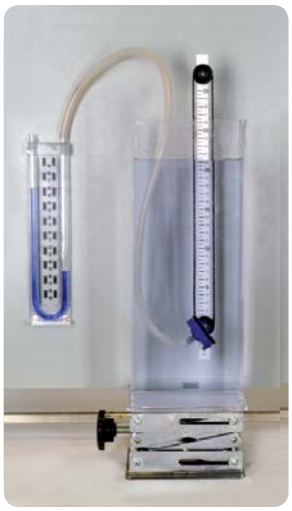


Buoyancy device

Acrylic glass cylinder with scale, disc and holder cord, for demonstrating buoyancy in water. Pressure bar for loading the disc under water using slotted weights.
Height: 240 mm,
diameter: 40 mm

Order-No. **86848**

Experimental set-up



Magnetic board set-up:
"Measuring the hydrostatic pressure"

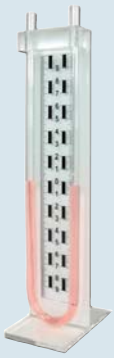
„Swimming, floating, sinking“

„Measuring the hydrostatic pressure“ with submersible probes

U-tube pressure gauge with scale

Standing device for measuring pressure or determining the density of liquids;
U-tube with acrylic glass base plate
Height: 260 mm

Magnetic (not shown here)
Version as above but without base plate,
4 strong magnets on the rear.

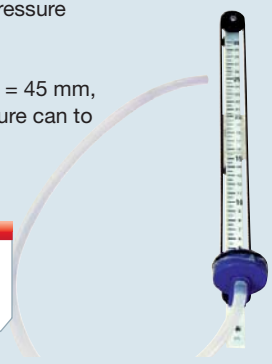


Article	Order No.
Standing device	86859
Magnetic	86860

Hartl pressure can

Device for demonstrating hydrostatic pressure depending on immersion depth and independence from direction.
Pressure can with rubber membrane, D = 45 mm,
Clamp mounting for securing the pressure can to the wall of the jar.
Scale for reading the immersion depth.
Total length: 390 mm.

Order No. **86854**



Submersible probe set

Acrylic glass probes for demonstrating the hydrostatic pressure depending on the immersion depth and its independence from direction,
length of the individual probes: 250 mm
Set of 4 pieces

Order No. **86856**

Cartesian diver, set

Consisting of:

- Cartesian diver
- Standing cylinder, acrylic glass cylinder with base plate, filling volume: Approx. 800 ml, Inner diameter: 55 mm, height: 350 mm
- Stopper with tube
- Plastic gas syringe, 60 ml, with hose

Article	Order No.
Cartesian diver, set	92597
Cartesian diver	92598
Standing cylinder	86851
Stopper with tube	92599
Plastic gas syringe	92600

Pressure propagation device

Unit for illustrating the uniform pressure distribution in liquids.
Acrylic glass cylinder with base and 4 laterally attached ascending tubes;
Total height: 260 mm
Rubber stopper and gas syringe, plastic, included in the scope of delivery.

Order No. **86862**

Experimental set-up

"Overshot turbine"

"Hydrostatic paradox"

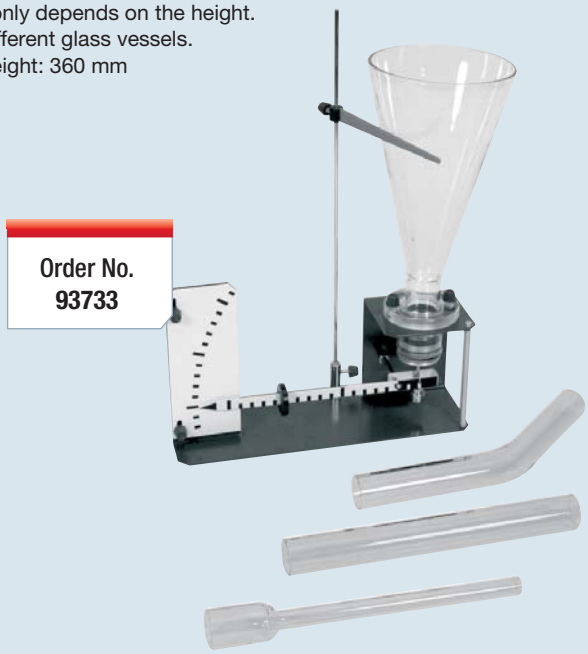
Hydraulic press, acrylic glass

Acrylic glass working model for demonstrating the hydraulic power transmission. Clearly visible pump ram and press ram, and the valve clearance. Area ratio: 1:12, usable action of force up to 550 N. Height: 270 mm, water tank included in the scope of delivery.

Order No. 86849

Ground pressure unit

For demonstrating the hydrostatic pressure of a liquid, which only depends on the height.
Four different glass vessels.
Total height: 360 mm



Order No. 93733

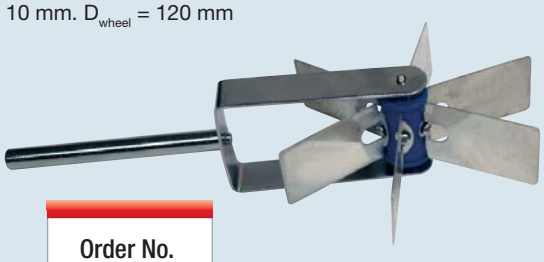
Communication tanks

To demonstrate the principle of connected vessels and a watering can model
Height: 165 mm

Order No. 86800

Turbine

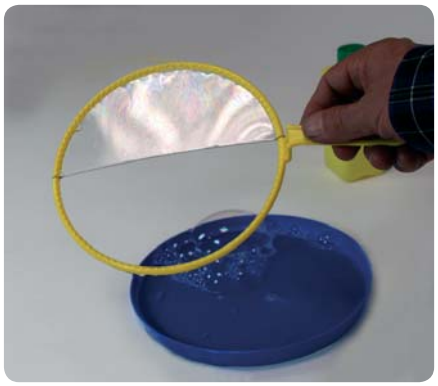
6-blade metal wheel, easy to turn, with fork on shaft,
D = 10 mm. D_{wheel} = 120 mm



Order No. 93732

Experimental set-up

"Measuring the surface tension of water" with the 0.1 N dynamometer



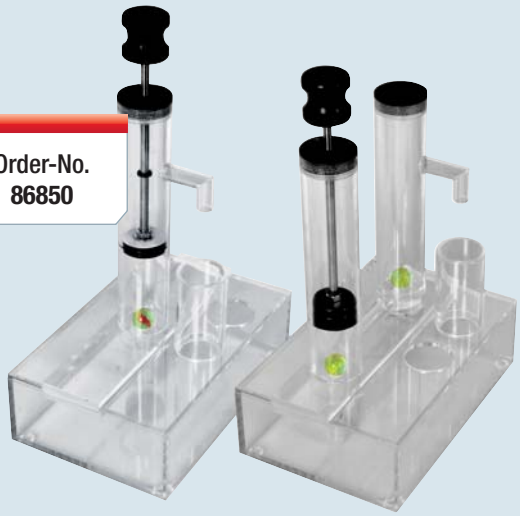
"Soap film"

"Adhesion"

Pump model set

Working model of a lift pump and a force pump in acrylic glass with clearly visible ball valves for detecting the functions of a lift pump and a force pump.
Height of the lift pump: 230 mm
Height of the force pump: 220 mm
A water tank for the pump model. Rectangular acrylic glass vessel for placing on the lift or force pump. 1 tube socket for inserting in the water tank under the drain cock of the force pump.

Order-No. 86850



Pair of adhesion plates

2 x acrylic glass discs with finger grip, for demonstrating adhesion. Diameter: 150 mm

Order-No. 86858

Ring for surface tension

Aluminium ring with knife edge and thread for hanging.
For measuring the surface tension of liquids, D = 60 mm

Order-No. 92610

Soap film device

Plastic ring with handle in plastic tray for forming large soap films.
Included in the scope of delivery: 1 x bottle of soapy solution, 250 ml

Order-No. 93894

(Image similar)

Capillary tube unit

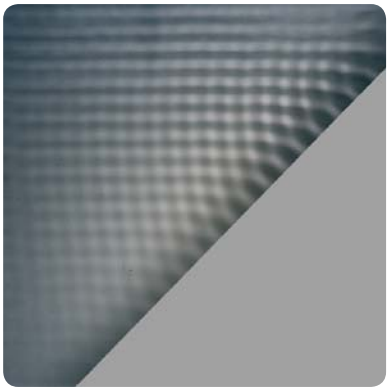
Device for demonstrating the capillary effect.
Acrylic glass vessel with tank and filling tube, along with 4 capillary tubes with different diameters.
Dimensions: 115 x 30 x 200 mm

Order-No. 86861

Experimental set-up

"Circular wave"

"Interference of three circular waves"



"Reflection"

Water wave device

For experiments of the following topics:

- **Huygens‘ principle**
- **Wave propagation**
- **Reflection**
- **Diffraction**
- **Interference**
- **Dispersion**
- **Refraction**

Order-No.
93892

Easy set-up

Wave tray with LED stroboscope
Light white LED light (10 W)
45° deflection mirror and acrylic glass front plate
Simple control unit that can be used to actuate two wave dippers.
Dipper frequency regulated between 30 and 100 Hz in 0.01 Hz intervals.
Operating modes: Synchronous (stationary waves)
Asynchronous (moving waves)

Extensive range of accessories:
Simple dabber for concentric waves
Double and triple dabber for interference experiments
Dabber for plane waves
Acrylic glass prism, convex lens and concave lens for demonstrating the wave propagation in various media
Simple structure

Experimental set-up

Stand set-up:
"Coupled pendulum"

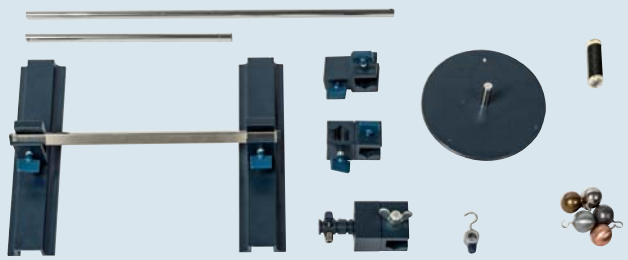
Stand set-up:
"Foucault pendulum" with:
Bearing unit, long, and belt pulley

Stand set-up:
„Pendulum with different lengths“

Foucault Pendulum – Device set

This set includes all materials and desriptions for a Foucault-Pendulum

Order-No. 44491

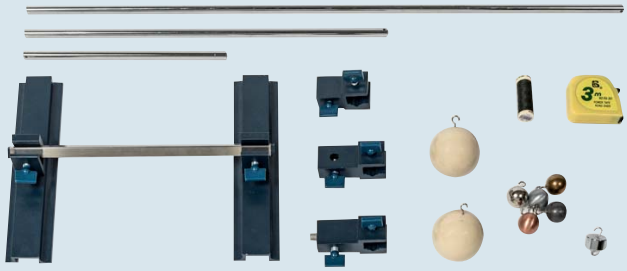


Pendulum – Device set

This device set includes all materials and desprictions for the following experiments:

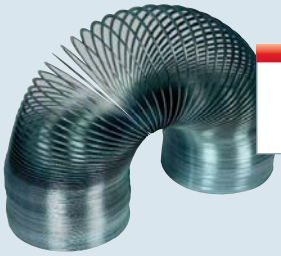
- Pendulum with different masses
- Period and amplitude
- Period and pendulum length
- Coupled pendulum

Order-No. 44492



Slinky spring

For demonstrating mechanical oscillations and waves.
D = 80 mm, can be stretched up to 10 metres



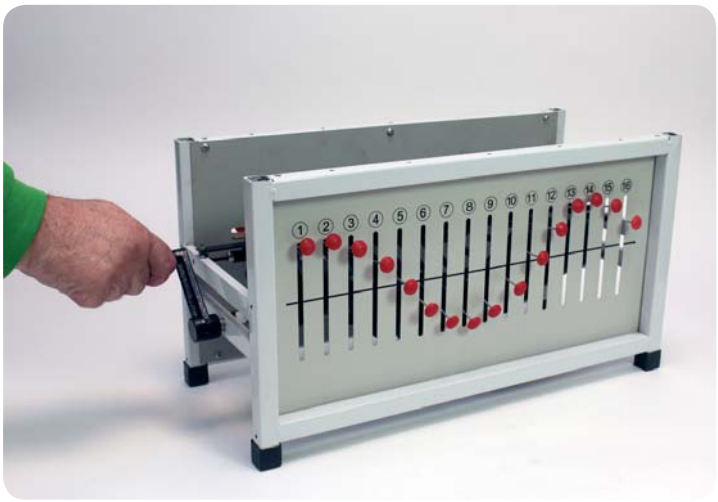
Order-No. 93728

Coil spring

Propagation and reflection of transverse waves
Length: 2000 mm, D = 12 mm

Order-No. 93729

Experimental set-up

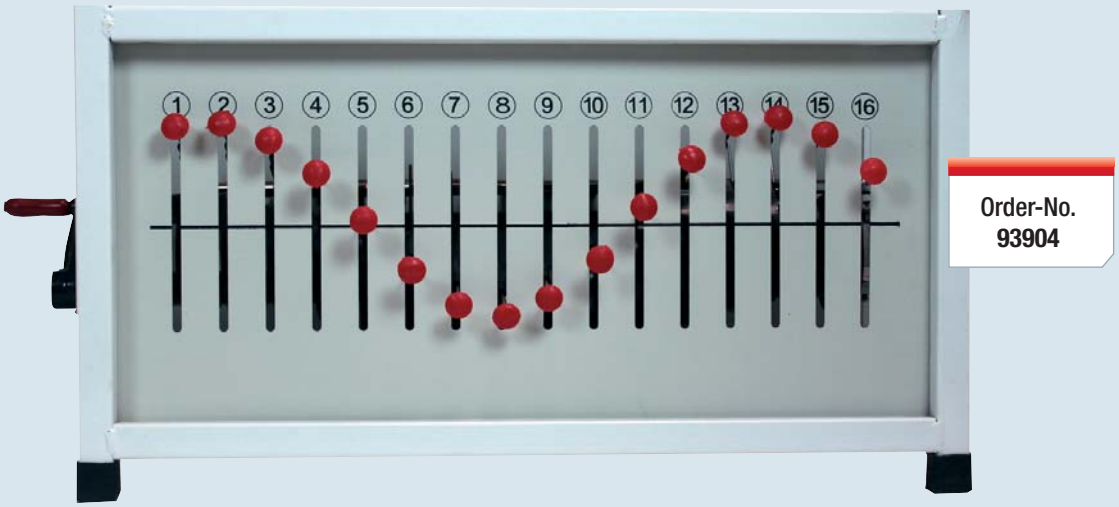


„Transverse wave“

„Longitudinal wave“

Wave machine with manual drive

Device for displaying the wave propagation of a coupled pendulum Pendulum rods (15/16 pcs) on drive mechanism, operated by hand crank. In square frame. Dimensions: 50 x 22 x 27 cm



Order-No.
93904

Pendulum balls

a) Pendulum balls, set
6 pendulum balls with hooks
Material: Al/Me/Cu/Fe/Pb/Zn
Diameter: 1 inch (25.4 mm)

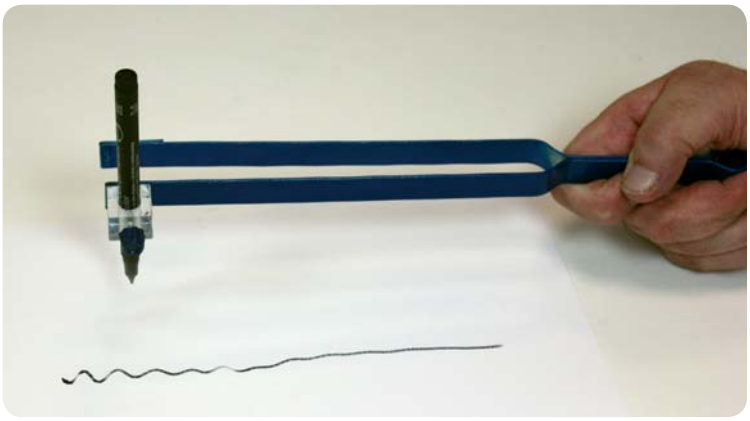
b) White pendulum ball
Plastic ball with hook, white, D = 60 mm, ca. 220 g

c) Black pendulum ball
Polystyrene ball with hook, black, D = 60 mm, ca. 5 g

Article	Order-No.
a) Pendulum balls, set	86801
b) White pendulum ball	89866
c) Black pendulum ball	89867

Experimental set-up

Stand set-up: „Siren disc“



„Tuning fork with pencil attachment“

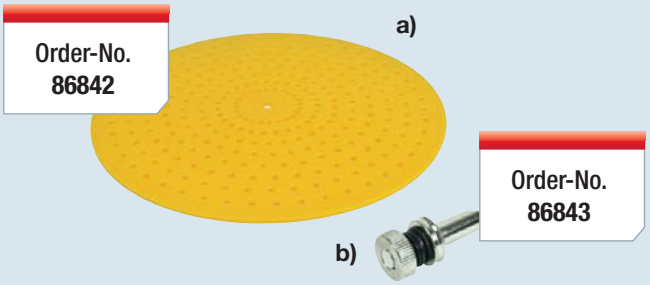
Perforated disc

a) Yellow plastic disc, D = 300 mm

With 8 rows of holes for setting up a siren disc. By using a hose to blow on the individual rows of holes on the rotating disc, you can create sounds.

b) Disc holder

For holding by the central 10 mm hole, for example, perforated disc, metal shaft with cord pulley and securing nut, shaft diameter: 10 mm



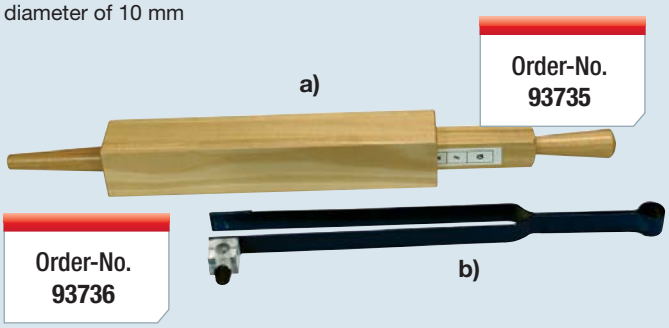
Whistle – Tuning fork with pencil attachment

a) Whistle

Wooden model with sliding resonator box and tone scale.
Length: 370 mm

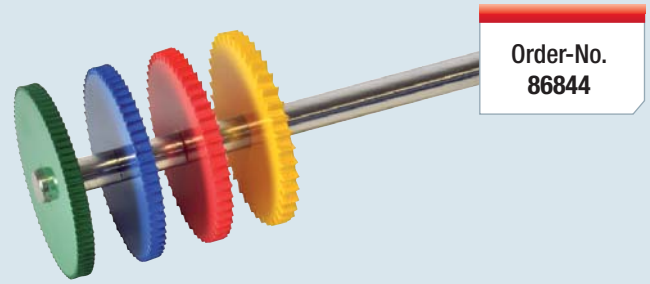
b) Tuning fork with pencil attachment

for recording oscillations.
Clamp mounting for holding a pencil (or pen) up to a max. diameter of 10 mm



Siren wheel

4 coloured acrylic glass wheels, D = 60 mm (40/50/60/80 teeth) on a shaft, D = 10 mm, fixed. Touching the individual rotating wheels with a cardboard strip creates tones. Length: 150 mm



Tuning forks 440 Hz, pair

On resonators with rubber striking hammer, sliding weights

zortrax M200

Ideas brought to life!

3D printer for professional use in schools

What is 3D printing and what is it for?

With a 3D printer, you can use additive manufacturing to create technical models, figures, components and assemblies. With the Zortrax M200, plastic filaments are melted and joined together, layer by layer, to form a model. This process is called fused deposition modelling (FDM). The data for component creation can be provided by any CAD program and transferred directly to the 3D printer.

ONLINE
VIDEO

Find out about our functions and potential areas of application in our detailed product video.

Order-No.
98895

NEW

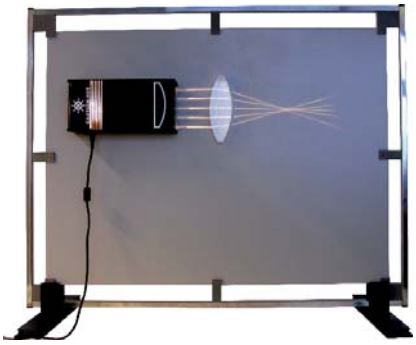
3D printers in schools – What's the benefit?

Anyone who studies 3D printing can …

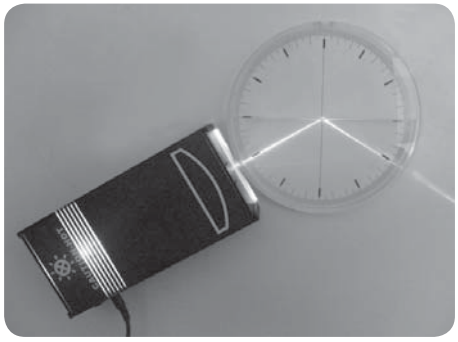
… train their powers of spatial imagination,
… understand additive manufacturing,
… understand manufacturing-oriented design,
… use CAD design programs for motivation,
… independently produce assemblies and understand their function,
… produce models for chemistry, biology, mathematics and technology,
… independently realise technical or creative ideas and designs,
… manufacture spare parts.

www.christiani-international.com/98895

Experimental set-up



Position of the combustion point with a converging lens



Total reflection in water

Magnetic board optics – Box 1

Box 1 – 30 experiments
- **Light propagation (5 experiments)**
- **Mirrors (13 experiments)**
- **Lenses (12 experiments)**

Model body and mirror, magnetic: Height 140 mm, thickness 20 mm

Consisting of:

- 1 x wide-beam light 12 V/50 W
- 1 x model body, biconvex
- 1 x model body, biconcave
- 2 x model body, planar-convex
- 1 x model body, planar-concave
- 2 x mirror, planar
- 1 x mirror, concave/convex
- 1 x mirror, flexible
- 1 x earth-moon model
- 2 x arrows, L = 80 mm
- 2 x arrows, L = 40 mm
- 1 x device-shaped storage box with transparent lid

Inclusive instruction manual

Magnetic board optics – Box 2

Box 2 – 30 experiments
- **Refraction (14 experiments)**
- **Eye (4 experiments)**
- **Optical instruments (6 experiments)**
- **Colours (6 experiments)**

Model body, magnetic: Height: 140 mm, thickness: 20 mm

Consisting of:

- 1 x attachable lamp, 12 V/20 W
- 1 x model body, triangular
- 1 x model body, trapezoidal
- 1 x model body, semi-circular
- 1 x circular cell, D = 200 mm
- 1 x optical disc, D = 200 mm
- 1 x light conductor, c-shaped
- 1 x light conductor, wound
- 1 x prism holder
- 1 x prism, optical flint
- 1 x colour filter, blue
- 1 x colour filter, red
- 1 x three-colour filter, additive mixture of colour
- 1 x subtractive colour filter, set of 3 pcs
- 1 x deflection mirror, 50 x 50 mm, set of 3 pcs
- 1 x device-shaped storage box with transparent lid

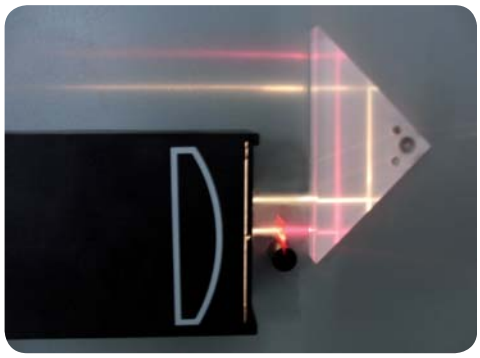
Inclusive instruction manual

Instruction manual:

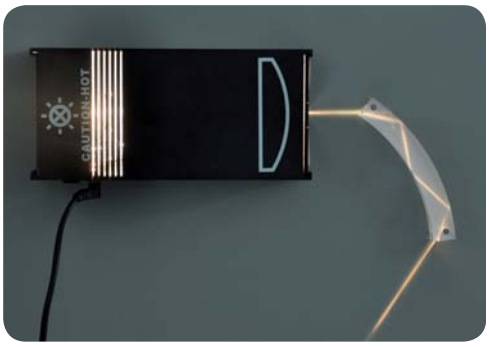
For student experiments on „Optics“, see from **page 139**
Required power supply Order-No. 91893 **see page 31-32**

Article	Order-No.
Magnetic board optics, complete	**44495**
Box 1	**44493**
Box 2	**44494**

Experimental set-up

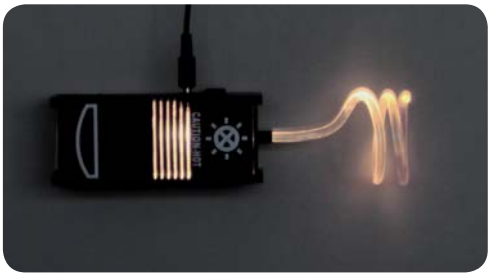


The deflecting prism



Light conductor

Additive mixture of colour



Light conductor – wound acrylic glass rod

Assembly plate

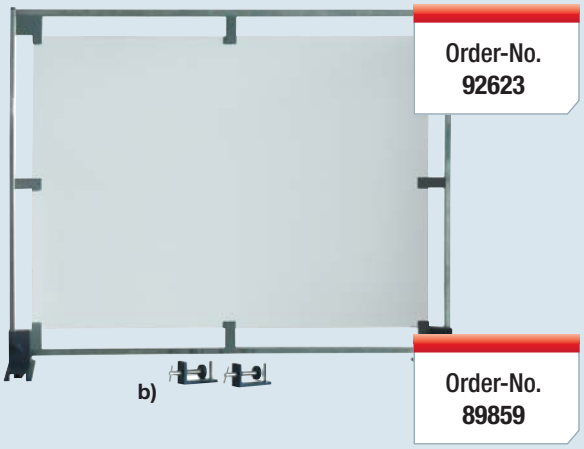
a) Assembly plate

Metal plate, coated grey/white and fastened in a rectangular frame for vertically setting up devices which are provided with magnets. Bossheads can be fitted to the rectangular frame for holding square and round material, as well as devices.
Included in the scope of delivery: 2 pedestals, L = 300 mm
Dimensions: approx. 850 x 650 mm

b) Table clamps, pair

For clamping the assembly plate onto tabletops up to a thickness of 50 mm.

a)



b)

Order-No. 92623

Order-No. 89859

Fixed voltage power supply

12 V/6 A, supply voltage 230 V
In addition, there are two 4 mm safety sockets on the lamp for supplying power (12 V/50 W) with connection lines with 4 mm plugs.

Order-No.
91893

Experimental set-up

„Subtractive mixture of colour“

„Coloured shadows“

„Additive mixture of colour“

Device for additive mixture of colour

Powerful equipment for additive mixture of colour. The powerful LEDs enable projection even in daylight. The brightness of the three LEDs is individually adjustable and the bulbs can be balanced individually.

RGB: Red: 670 nm, yellow: 560 nm, blue: 460 nm. Power supply: 5 V (power pack included in scope of delivery) 160 x 245 x 95 mm

NEW

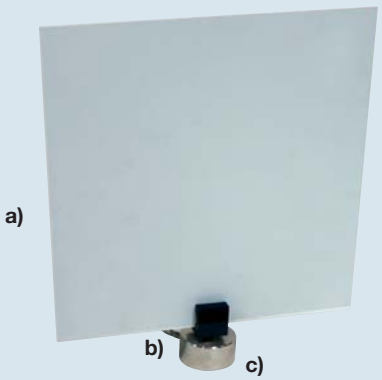
Order-No. 97890

Colour screens

For demonstrating subtractive mixture of colour
Acrylic glass discs in cyan, yellow and magenta.
D = 195 mm, set of three pcs

Order-No. 92858

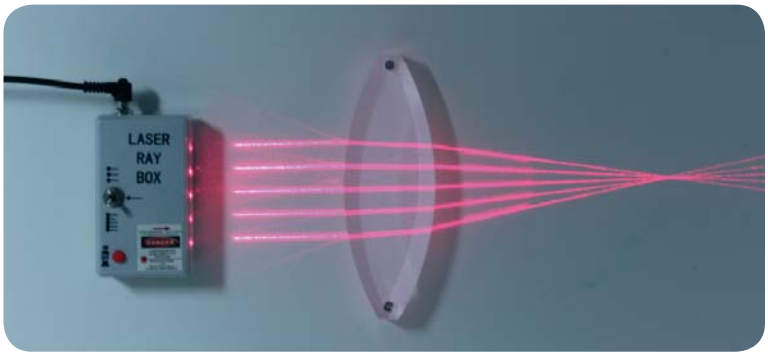
Accessories



Article	Order-No.
a) Screen, white, 300 x 300 mm	93791
b) Screen supported in half bosshead on shaft, 10 mm	93792
c) Disc base	86840

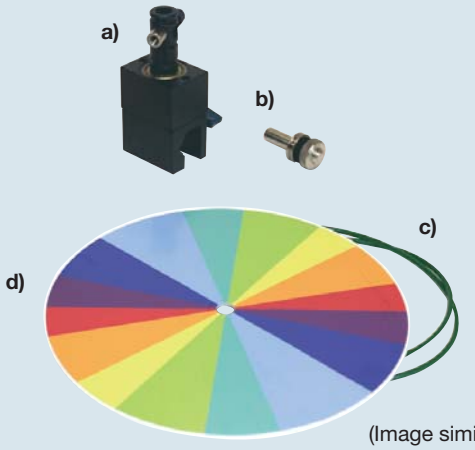
Experimental set-up

„Refraction with laser ray box“



„Beam path through a biconvex lens“

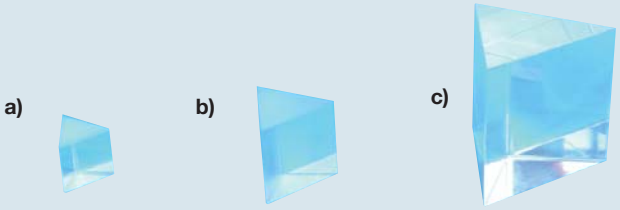
Colour disc



(Image similar)

Article	Order-No.
a) Bearing unit, long	86832
b) Retaining shaft	86838
c) Drive belt, set	86834
d) Plastic disc, D = 200 mm, with hole for support on retaining shaft The colour segments are based on the distribution in the spectrum	93902

Glass prisms



(Image similar)

Article	Order-No.
Prism, equilateral	
a) optically pure, S = 25 mm	93860
b) optical flint, n = 1.62, S = 32 mm	92650
c) optically pure, 70 x 70 x 20 mm	93861

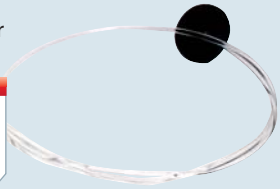
Laser ray box, magnetic

Diode laser (safety class 2) with 1/3/5 parallel beams for use on the magnetic board
Number of beams can be selected by selector switch
Wave length λ = 635 nm
Power supply via plug-in power supply 6 V DC (included in the scope of delivery)

Order-No. 93794

Flexible light conductor

Optical fibre, D = 3 mm, L = 300 mm
One end with black attachment cap for placing on Magnetic lamp

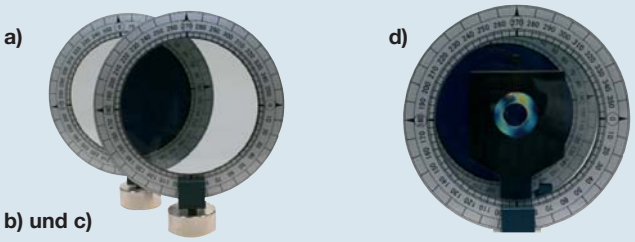


Order-No. 93862

(Image similar)

Polarisation filter

a) Polarisation filter with 360° scale
For experiments with linearly polarised light. D = 210 mm
b) Support in half bosshead on shaft, D = 10 mm
c) Support in disc base
d) Photoelastic object, D = 50 mm, in holder



Article	Order-No.
a) Polarisation filters, pair	93863
b) Half bosshead on shaft, D = 10 mm	93679
c) Disc base	86840
d) Photoelastic object	93864

Thermodynamics – Device set

Experiments with thermodynamics – Device set on the following topics:

- **Heat propagation**
- **Changing the aggregate state**
- **Solar energy**

Consisting of:

2 digital thermometer, magnetic
2 thermometer, -10 to 110 °C
2 acrylic glass tubes, L = 300 mm
1 holder for tubes, D = 8 mm
1 bimetal strips with handle
1 aluminium tube for linear expansion
1 iron tube for linear expansion
1 rotating-shaft pointer
1 scale on shaft
1 absorption box, set, magnetic
1 thermal bracket, set
1 clamping connector, pair
1 simple thermocouple
1 ball with ring
1 pin shearing apparatus with bolts
1 heat conduction device with handle
1 joule – calorimeter
1 small aluminium beaker
1 wheel
1 plug with needle on support rod
1 glass tube, L = 250 mm

More information: www.christiani-international.com/92614

Recommended additional equipment

Solar energy device set

Consisting of:

2 magnetic modules – photovoltaic cell
1 magnetic module – solar motor
2 connector

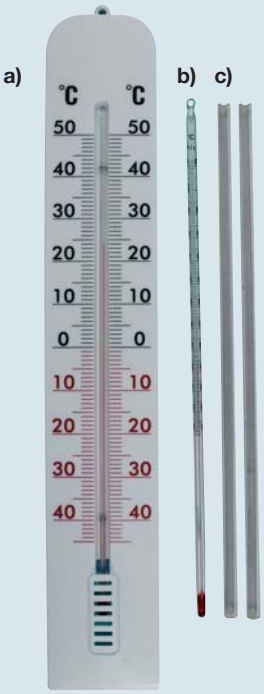
Experimental set-up

Magnetic board set-up:
"Volume change at a constant pressure"

„Temperature in a candle flame“

Thermometer

a) Wall thermometer
-45 ... +50 °C
b) Graduated thermometer
-10 to +110 °C
c) Acrylic glass tube
L = 300 mm, pair for setting up a U-tube pressure gauge



Article	Order-No.
a) Wall thermometer	93897
b) Graduated thermometer	89892
c) Acrylic glass tube, 2 pcs	89893

Digital thermometer, magnetic

3 ½ digit, digit height: 16 mm
Temperature range: -50 ... +400 °C, +/-3 %
+400 ... +1200 °C, +/-0,75 %
Temperature sensor: K-type

Order-No.
93896

Experimental set-up

Stand set-up:
"Thermal conduction in different metal bars"

Stand set-up:
"Pin shearing apparatus"

Holder for tubes

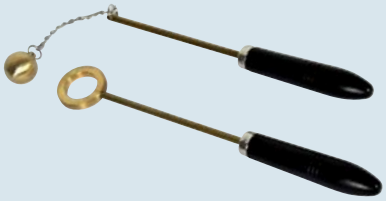
E.g. E 6022 acrylic glass tubes for setting up a U-tube pressure gauge, 2 clamping screws, 1 shaft, diameter: 8 mm

Order No. **89894**

Ball with ring on shaft with handle

For demonstrating the thermal expansion of solid metal objects. Brass ball, D = 25 mm, on chain with handle and brass ring

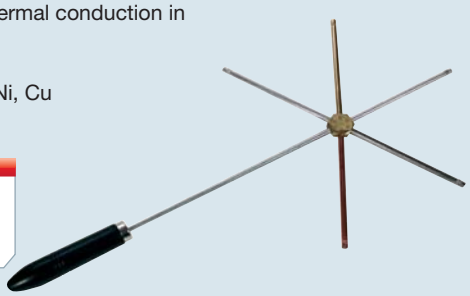
Order No. **89901**



Heat conduction device

For demonstrating thermal conduction in different metal rods.
Length = 100 mm
Material: Al, Me, Fe, Ni, Cu

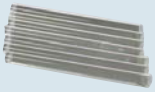
Order No. **89898**



Pin shearing apparatus

Device for demonstrating the thermal expansion of solid objects during heating.
Included in the scope of delivery: Glass rods, D = 8 mm, set of 10 pcs

Order No. **89897**



Required accessory:
Disc base
(Order No. 86840)

Bimetal strips

Bimetal strips
Length = 140 mm, width: 20 mm

Order No. **92664**

Bimetal strips with handle
Riveted brass/iron plate
Length = 210 mm, width: 20 mm

Order No. **93838**

Hand-held alembic

For demonstrating the increase in vapour pressure as the temperature increases.
The warmth of your hand increases the vapour pressure and the liquid moves from the lower sphere to the upper sphere.

Order No. **93839**

Experimental set-up

Magnetic board set-up:
„Linear expansion of metal tubes“

Magnetic board set-up:
„Thermal conduction in solid objects“

Stand set-up:
„Thermal convection“

Linear expansion

a) Device set for the linear expansion of solids

Consisting of:

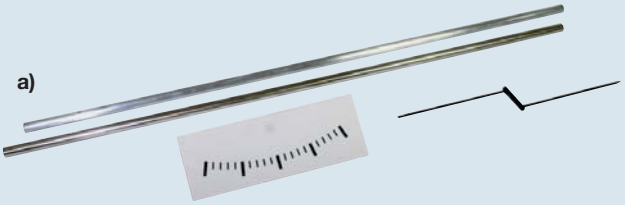
Aluminium tube, L = 500 mm
Iron tube, L = 500 mm
Rotating-shaft pointer, total length: 200 mm
Scale on shaft, D = 10 mm

b) Device set for holding the test tubes on the magnetic board

Consisting of:

3 x magnetic base
2 x half bosshead on shaft, 10 mm
1 x hooked weight, 100 g, blue, for hanging on a test tube to improve the friction of the rotating-shaft pointer

a)



b)

Article	Order No.
a) Device set for the linear expansion of solids	92618
b) Device set for holding the test tubes on the magnetic board	92628

Thermal rod set

For demonstrating the different thermal conductivity of solid objects and for determining the coefficients of thermal conductivity
Material: Al/Fe/Cu/glass
Length of the rod: 180 mm

Order No. 92653

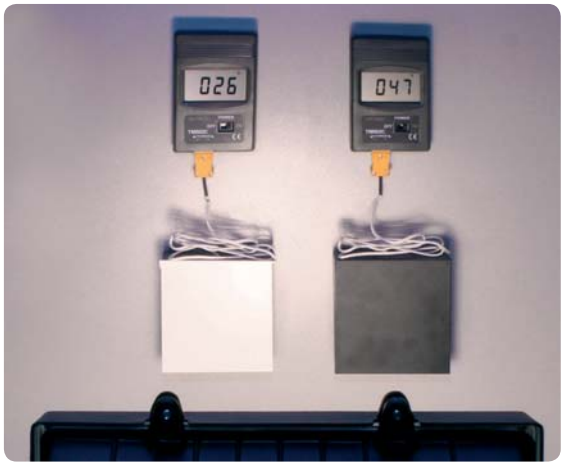
Device set for thermal convection

Consisting of:
Glass tube, L = 250 mm, D = 40 mm
Shaft with hole, L = 150 mm
Plug with needle for mounting the wheel
Wheel, plastic

Order No. 93870

Experimental set-up

Stand set-up: "Thermal convection in water"



Magnetic board set-up: "Absorption of thermal radiation"

Circulation tube

For demonstrating the thermal convection of liquids
– Model of a gravity central heating system.
Rectangular glass tube with filler pipe
Dimensions: 300 x 200 mm

Order-No. 93841

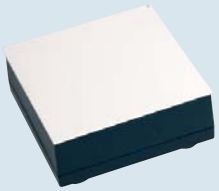
Leslie radiation cube

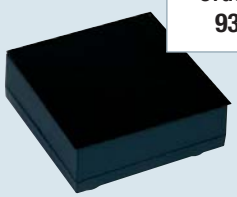
For demonstrating the different thermal radiation of different surfaces.
Hollow metal cube with different side surfaces: black, white, matt and bare
Cover with opening
Dimensions: 130 x 130 x 130 mm

Order-No. 93842

Absorption boxes – Set

2 x plastic boxes, magnetic, one with a black metal surface and one with a white metal surface, holes for a temperature sensor.
Dimensions: 100 x 100 mm





Order-No. 93840

Halogen spot light, 1000 W

Powerful mobile halogen spot light for performing experiments on conversion of radiation energy into thermal energy.

Order-No. 93895

IR thermometer

Radiation thermometer for contactless temperature measurement.
LCD display, 22 x 22 mm
Temperature range: -18 °C to +200 °C
Measurement accuracy: 0.5 °C

Order-No. 93898

Experimental set-up

Stand set-up:
„Reflection of thermal radiation“

Stand set-up:
„Conversion of thermal energy into electric energy“

Parabolic mirror

For demonstrating the focusing of thermal radiation in the focal point of the mirror.
Plastic mirror, D = 300 mm
On shaft with joint for mounting on a round base or stand material
Metal tank for heating substances is located in the focal point of the mirror

Order-No. 93843

Thermal generator

For demonstrating the Seebeck effect and the Peltier effect.
Black cooling plate with integrated Peltier element and motor with windmill spinner for displaying the electrical energy.
Two 4 mm safety sockets for connection to DC voltage, max. 8 V.
Selector switch for optional demonstration of the Seebeck or Peltier effect.
Dimensions: 180 x 75 x 30 mm

Order-No. 93844

Aluminium beaker – small

Calorimeter
Capacity: Approx. 150 ml

Order-No. 89900

Joule – calorimeter

For determining the thermal capacity of solid and liquid substances. 2 aluminium beakers with insulation trim, insert with heating coiland stirrer, 2 x 4 mm sockets for determining the electrical equivalent of heat,
Capacity: 150/500 ml

Order-No. 92181

Energy conversion – Device set

Order-No.
93901

For experiments on the following topics:
- Solar energy
- Serial parallel connection of photovoltaic cells
- Wind power
- Energy storage
- Discharging the energy storage
- Converting mechanical energy to electrical energy

Consisting of:

1 E10 lamp socket box, magnetic
2 box for plug-in elements
2 photovoltaic cell box
2 connector
1 motor plug-in element with windmill spinner
1 5 F capacitor plug-in element
1 mobile battery unit with solar top piece
1 wind generator
1 generator with manual drive, including special connection cable with 4 mm plugs and 2 light bulbs, 6 V
1 clamping plug, set
1 thermocouple, simple
1 halogen spot light, 150 W on shaft with detachable handle
1 hand-held blower, 2000 W, 2 fan levels

For information on these items, see pages 81-82

Christiani-Tip

Car fuel cells – Device Set

In just a few simple steps, a fuel cell can be built on to a car. The fuel cell is a reversible PEM fuel cell which functions in both ways: As an electrolyte for creating hydrogen from water, and as a power source for creating power from hydrogen.

More information an page 84

Experimental set-up

Magnetic board set-up: „Converting thermal energy to electrical energy“

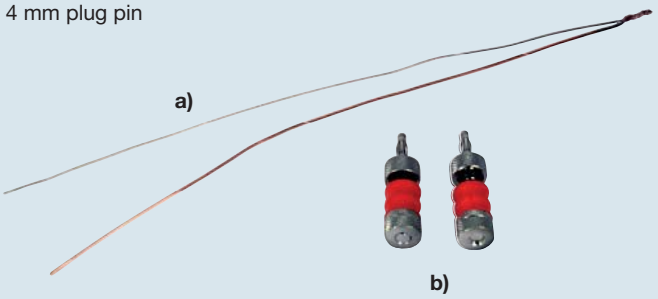
„Operating the solar motor with the photovoltaic cell“

Magnetic board set-up: „Series connection of photovoltaic cells – Measuring the voltage“

Simple thermocouple

Constantan and copper wire tightly twisted and welded on one end. Length: Approx. 300 mm

Set of screw-terminal plugs
Holder for wires with tension spring, insulated handle and screw, 4 mm plug pin

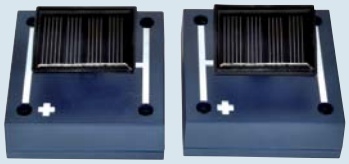


Article	Order-No.
a) Simple thermocouple	89925
b) Set of screw-terminal plugs	89926

Magnetic module - Photovoltaic cell set

Plastic module with 4 sockets and tightly mounted, swivelling photovoltaic cell, 2 V/80 mA, 4 magnets and 4 rubber feet integrated into the base plate.
Dimensions of the module: 100 x 100 x 38 mm

a)



b)

Connector set
Strapping plug for the electrical connection of two magnetic modules, photovoltaic cell for series and parallel connection and for connecting to the magnetic module – solar motor

Article	Order-No.
a) Magnetic module – Photovoltaic cell set	89923
b) Connector set	89922

Box for plug-in elements

Plastic box, magnetic
Dimensions: 100 x 100 x 38 mm

Order-No. 93768

Motor plug-in element with windmill spinner

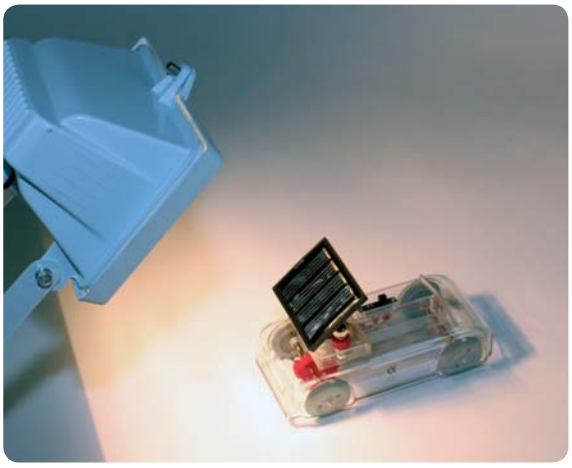
Plug in modul on box (Order-No. 93768)

Order-No. 93845

Experimental set-up

Magnetic board set-up:
„Wind power“

Magnetic board set-up:
„Energy storage“



„Mobile solar unit“

Mobile battery unit with solar top piece

Transparent mobile plastic unit with drive motor for experiments on uniform movement, sliding switch for 2 speeds, swivelling solar top piece for setting on top of the mobile battery unit.
Battery: Mignon 1.5 V (included in the scope of delivery)
Length: Approx. 165 mm

Order-No. **92655**

Generator with manual drive

Converting „mechanical energy to electrical energy“

Order-No. **89935**

Wind generator

Gear motor with manual drive and windmill spinner as a wind generator in acrylic glass casing, a second motor (generator) with windmill spinner is fitted close to the other spinner and this is actuated by the wind that is created by the first motor. 1 LED, red, for displaying the voltage that is created. Base plate: 115 x 110 x 8 mm

Order-No. **86894**

Hand-held blower – Halogen spot light, 150 W

a) Hand-held blower
Hand-held blower, 2000 W, 2 fan levels
Supply voltage: 230 V

b) Halogen spot light
150 W on shaft with detachable handle
White die-cast aluminium casing
Supply voltage: 230 V

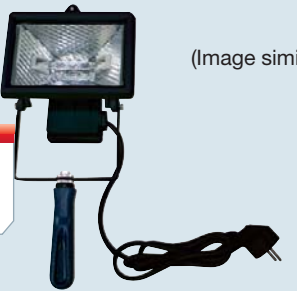
a)

Order-No. **93846**

b)

(Image similar)

Order-No. **93847**



Experimental set-up

"Heating of air when compressed"

Model: "Internal combustion engine"

Internal combustion engine model

Acrylic glass cylinder with base plate and lateral opening for inserting a Piezo igniter.
A polystyrene cone as a "model piston" (included in the scope of delivery.)
We recommend using commercially available hairspray as a propellant.
Dimensions of the cylinder:
D - internal = 55 mm,
H = 350 mm

Order-No. 89931

Accessory:
Piezo igniter

Order-No. 89932

Compressed-air lighter

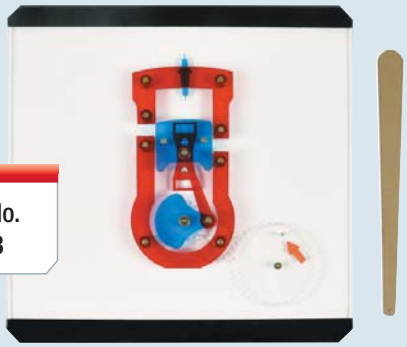
Applying compression quickly to heat up air causes a small cotton ball to ignite.
Height: 190 mm

Order-No. 93848

Transparent moving parts

Acrylic glass devices for displaying how different motor models function on an overhead projector, control rod included in the scope of delivery.

Two-stroke engine



Order-No. 86863

Four-stroke petrol engine

Order-No. 86864

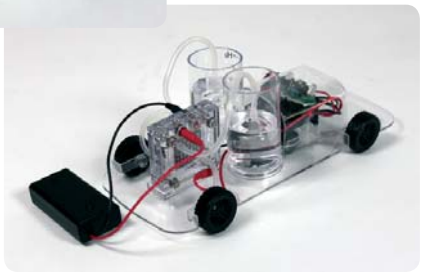
Four-stroke diesel engine

Order-No. 86865

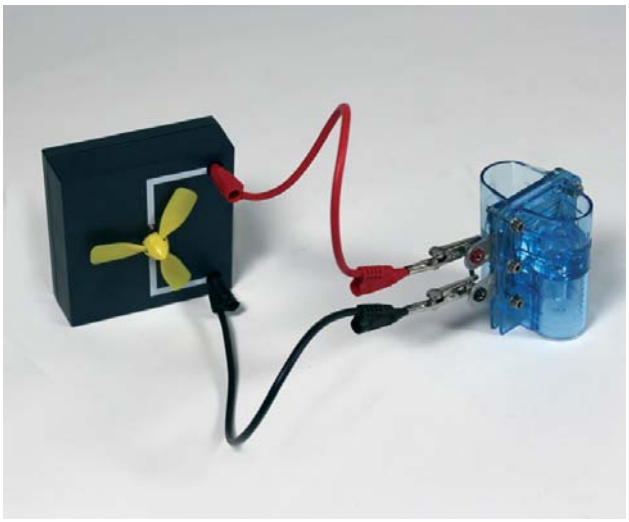
Complete Set

Order-No. 99489

Experimental set-up



„Charging the fuel cell“



„Fuel cell as an energy source“

Car fuel cells – Device set

Order-No.
95406

In just a few simple steps, a fuel cell can be built on to a car.
The fuel cell is a reversible PEM fuel cell which functions in both ways: As an electrolyte for creating hydrogen from water, and as a power source for creating power from hydrogen. After producing the hydrogen, the fuel cell converts the hydrogen into electrical energy.
The PEM fuel cell can be charged either by using a solar panel (included in the scope of delivery) or a 3 V battery.
The oxygen or hydrogen tank is connected to the fuel cell using hoses. After a charging time of less than 10 minutes, the car can be operated for approx. 5 minutes.
CD with detailed manual on the theory and use of fuel cells.

Experimental set-up

Magnetic board set-up: "Conversion of thermal energy into electric energy"

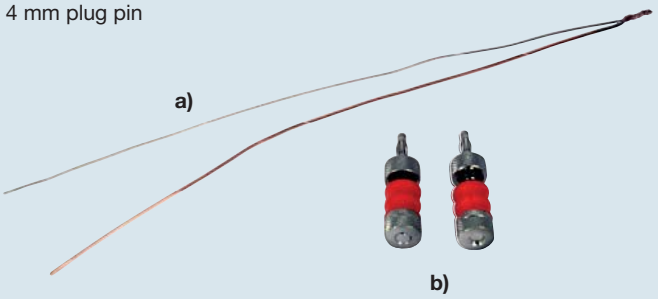
"Operation of the solar motor with the photovoltaic cell"

Magnetic board set-up: "Connecting photovoltaic cells in series – Voltage measurement"

Simple thermocouple

Constantan and copper wire tightly twisted and welded on one end.
Length: Approx. 300 mm

Set of screw-terminal plugs
Holder for wires with tension spring, insulated handle and screw, 4 mm plug pin

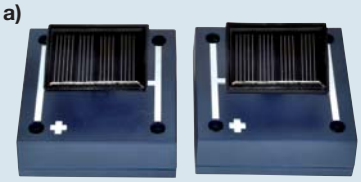


Article	Order-No.
a) Simple thermocouple	89925
b) Set of screw-terminal plugs	89926

Magnetic module – Photovoltaic cell set

Plastic module with four sockets and fixed mounted swivelling photovoltaic cell 2 V/80 mA, with four inserted magnets and four rubber feet in the base plate. Module dimensions: 100 x 100 x 38 mm

a)



b)

Connector set
Strapping plug for the electrical connection of two magnetic modules, photovoltaic cell for series and parallel connection and for connecting to the magnetic module – solar motor

Article	Order-No.
a) Magnetic module – Photovoltaic cell set	89923
b) Connector set	89922

Box for plug-in elements

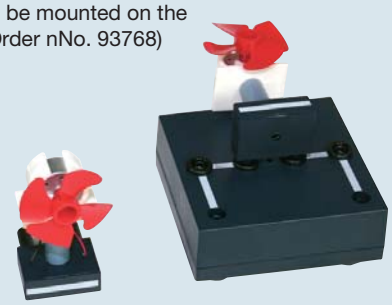
Plastic box, magnetic closure
Dimensions: 100 x 100 x 38 mm

Order-No. 93768

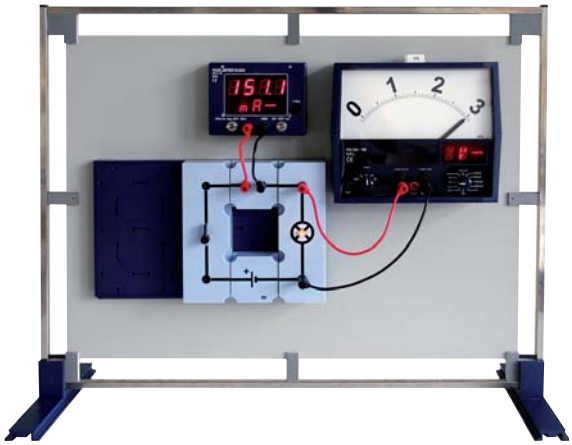
Motor plug-in element with windmill spinner

Plug-in element, which can be mounted on the box for plug-in elements (Order nNo. 93768)

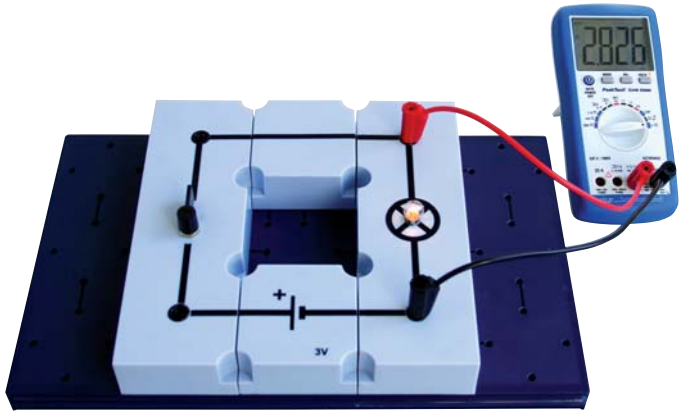
Order-No. 93845



Experimental set-up



Magnetic board set-up:
„Measuring current and voltage“



Student experiment:
„Measuring voltage“

Electrics/Electronics plug-in module device set complete

Range of experiments for the clear and illustrative set-up of electrical and electronic circuits for introductory and more advanced physics lessons.

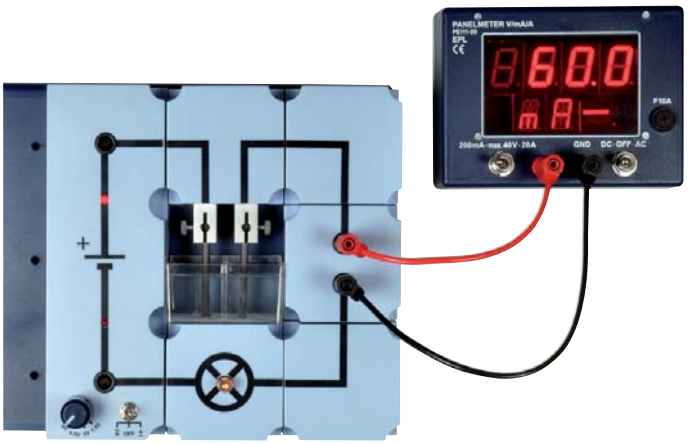
For demonstration and student experiments
Same plug-in system for teacher and students
Magnetic plug-in board for demonstrations experiments on metal-plate

Order-No.
44498

Plug-in elements:
76 x 76 x 38 mm

Touch-safe insulated plug attachments

Experimental set-up



Magnetic board set-up:
„Electrical conduction in liquids“

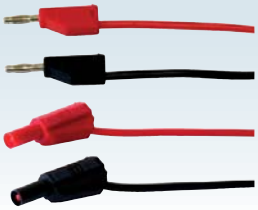
Student experiment:
„Electrical conduction in liquids“

Complete device set consisting of:

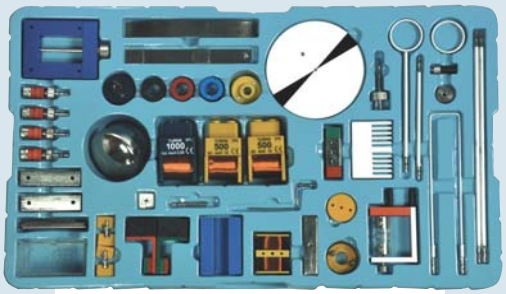
Inclusive instruction manuels electric (Order-No. 96356) and eletronic (Order-No. 95855)
Description on page 88.

Box 1, Basic circuits

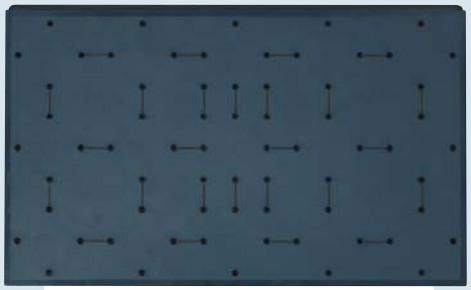
Box 3, Special modules



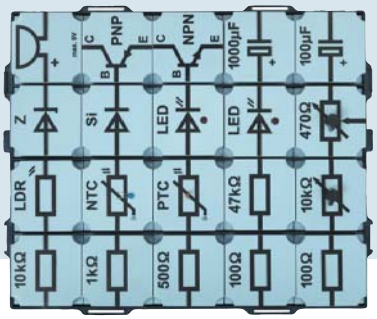
Connection lines, set



Box 5 – devices

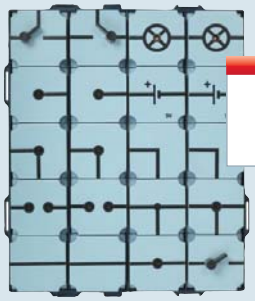


Basic plug-in board



Box 2, Resistors, electronics

Box 1 – Basic circuits

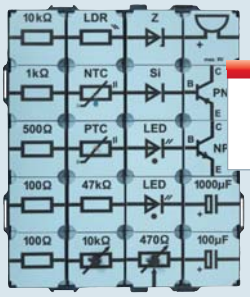


Order-No. 44496

20 modules: Wires, switches, lamp sockets, batteries
In plastic box with transparent lid

Inclusive instruction manual

Box 2 – Resistors, electronics



Order-No. 44497

20 modules: Resistors, diodes, semi-conductors, capacitors, transistors
In plastic box with transparent lid

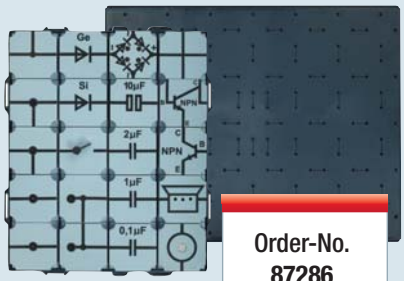
Inclusive instruction manual

Box 3 – Special modules

Order-No. 87283

18 modules: Coil modules, relays, automatic safety switch, gear motor, motor, photovoltaic cells, solar motor
In plastic box with transparent lid

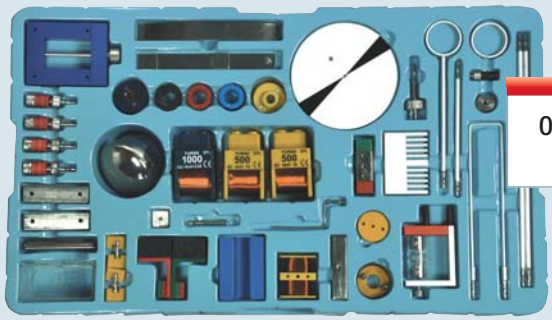
Box 4 – Electronics II supplement



Order-No. 87286

20 modules: Wires, loudspeaker, microphone, bridge rectifier, capacitors, transistors (in plastic box)
1 x plug-in board, large, magnetic, (7 x 5 component slots)

Box 5 – Devices



Order-No. 87285

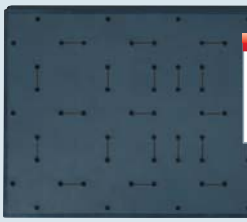
More than 50 pieces for eletric/elektronic experiments with the Boxes 1-4. Including: coils, magnets, gong, clapper, ferrit core, Lenz ring, Waltenhofen plate, eddy current disc, bimetallic strip, eletrolyse trough, commutator, light bulbs, conductor and non-conductor materials etc.

Accessories

Order-No. 92749

Light bulb set E10

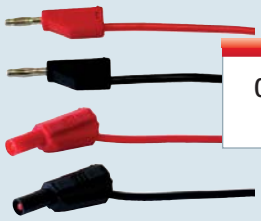
- 3 Light bulb 1,5 V/50 mA
- 3 Light bulb 3,5 V/200 mA
- 3 Light bulb 6 V/500 mA
- 3 Light bulb 6 V/50 mA
- 1 Light bulb 6 V/2,5 A



Order-No. 86908

Basic plug-in board, magnetic

For all experiments with Box 1, 2, 3 and 5
1 plug-in board, magnetic,
(5 x 3 component slots)



Order-No. 86911

Connection lines, red/black

Set of 8 lines
4 lines – 4 mm plugs
4 lines – Safety plugs

Plug-in modules, three items

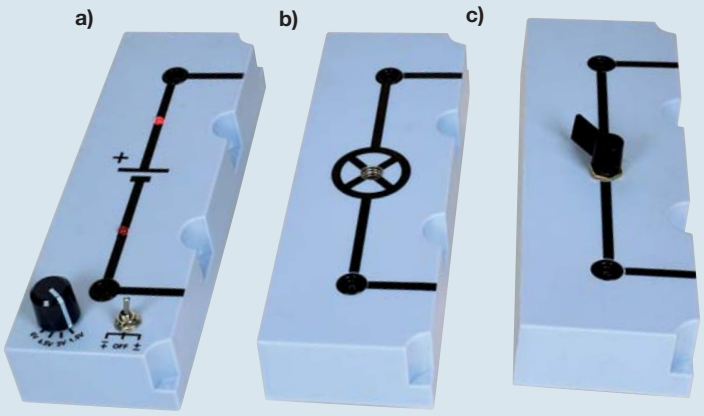
Special plug-in modules, three items
Dimensions: 232 x 76 x 38 mm

a) Battery module, switchable
Can be used in a large number of experiments, particularly on the magnetic board or for student experiments. Voltage: 1.5/3/6 V, ON - OFF selector switch for polarity, display via red LEDs

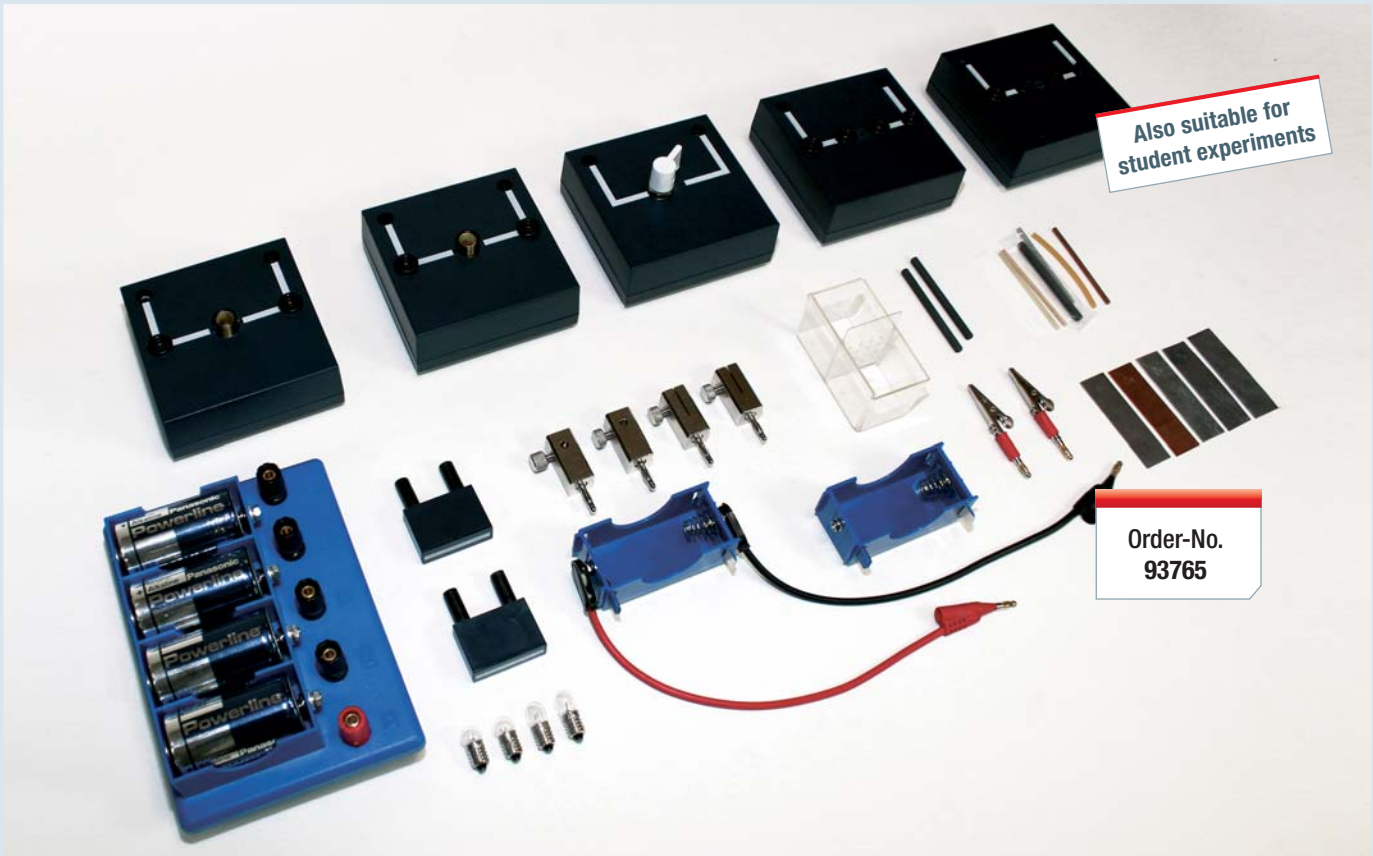
b) E10 lamp socket

c) ON–OFF switch

Article	Order-No.
a) Battery module, switchable	92568
b) E10 lamp socket	92569
c) ON–OFF switch	92570



Basic electrical circuits – Set



For the following experiment topics:

- **Basic electric circuit**
- **Conductors and non-conductors**
- **Conductors in liquids**
- **Measuring the voltage**
- **Measuring the current**
- **Parallel connection of batteries**
- **Series and parallel connection of light bulbs**
- **Electrochemistry**

Magnetic – also suitable for student experiments.

Consisting of:

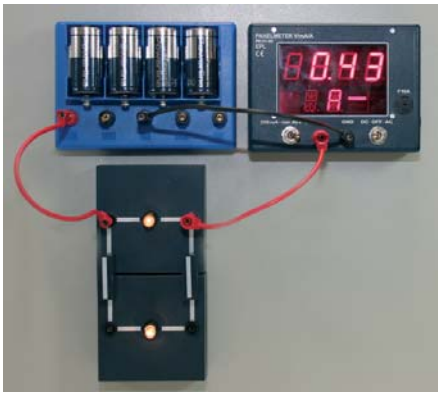
2 E10 lamp socket box
1 ON/OFF switch box
2 box for plug-in elements
2 connector
2 bracket with slot
2 bracket with hole
1 electrolysis trough
2 carbon electrode
1 conductors, non-conductors, set
1 set of electrodes
2 crocodile clip with plug pin
2 mono battery cell holder, set, magnetic
1 special connecting line, pair
2 E10 light bulb, 1.5 V/50 mA
2 E10 light bulb, 6 V/50 mA
1 6 V battery holder, magnetic
4 Superpower mono battery cell 1.5/18 Ah,

More information:
www.christiani-international.com/93765

Experimental set-up

"Toggle switch" – "Selector switch"

"Volta element"

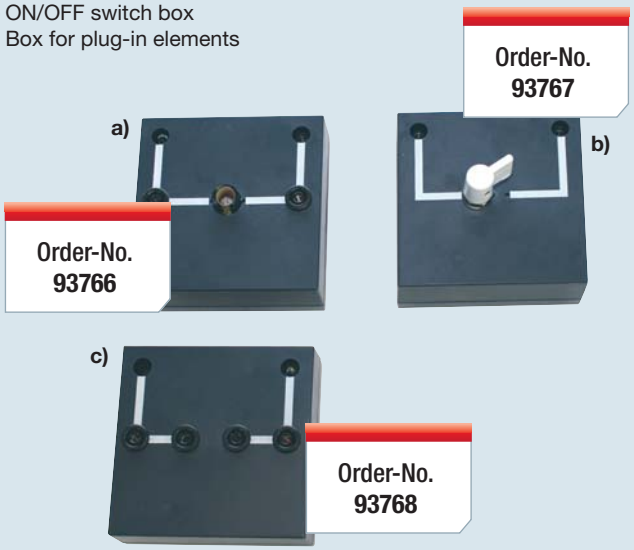


"Parallel connection of light bulbs"

Switching boxes, magnetic

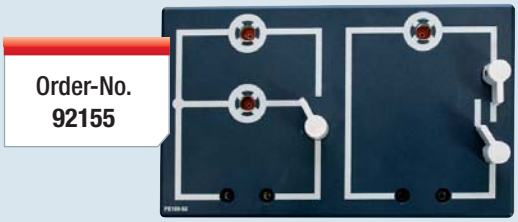
Plastic boxes, magnetic
Dimensions: 100 x 100 x 38 mm

a) E10 lamp socket box
b) ON/OFF switch box
c) Box for plug-in elements



Switch box, magnetic

Representation of a "toggle switch" and a "selector switch"
Hard-wired:
3 x E10 lamp sockets, 3 x selector switches
Dimensions: 232 x 142 x 43 mm



Accessories for the switch box:

Plug-in elements for electrics consumables set

Consumables/accessories consisting of:

1 x safety wire, D = 0.1 mm, roll, red
1 x resistance wire, D = 0.2 mm, roll, blue
1 x copper wire, D = 0.2 mm, roll, black
2 x E10 light bulb, 1.5 V/50 mA
2 x E10 light bulb, 6 V/50 mA
1 x E10 light bulb, 6 V/0.5 A
1 x E10 light bulb, 6 V/2.5 A
Connection lines, red/black
Set of 8 lines, 4 x 4 mm plug,
4 x safety plug

Storage in plug-in elements box for electrics

a) b)

c)

Article	Order-No.
a) Battery holder for 'C' battery cell with 4 mm plug pins	93770
b) 1.5 V 'C' battery cell	93771
c) E10 light bulbs, 1.5 V/50 mA, set of 3 pcs	93772

Experimental set-up

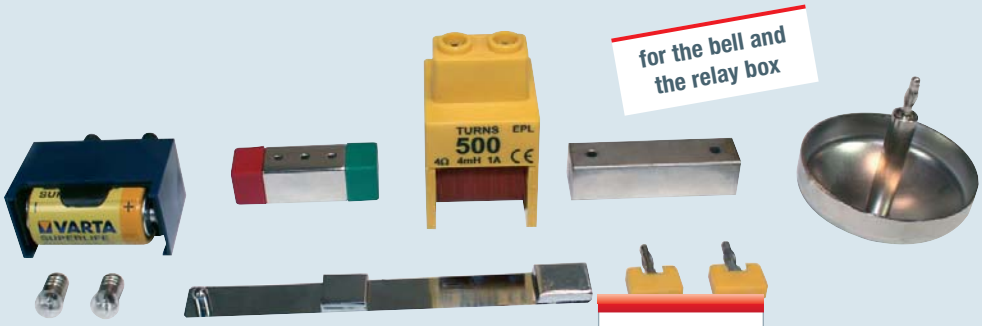
"Electric bell"

"Magnetically actuated switch with permanent magnet"

"Relay – Normally open and normally closed contact"

Electromagnetism – Device set

Consisting of:
1 x coil with 500 windings
1 x ferrite core, L = 70 mm
2 x flat plug
1 x gong
1 x clapper
1 x bar magnet, right-angled
1 x battery holder with ‚C' battery cell
2 x E10 light bulb, 1.5 V/50 mA



Order-No. 93778

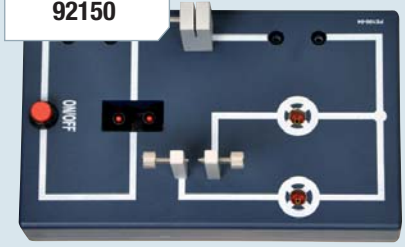
Bell box

For the simple and quick set-up of an electric bell
Permanently built-in: 1 holder for clapper and 1 contact screw,
1 button, 1 recess with 2 insulated plug pins for inserting a coil
Dimensions: 232 x 142 x 45 mm

Order-No. 92152

Relay box

For the simple and quick set-up of a complete electromagnetic relay
Permanently built-in: 2 E10 lamp sockets, 1 button, 1 holder for
clapper and 2 adjustable contact screws,
4 touchsafe sockets and one recess with 2 insulated plug pins for inserting a coil
Dimensions: 232 x 142 x 45 mm



Order-No. 92150

Base plate with magnets

For replacing the base plate of a box
For use on the magnetic board

Order-No. 92138

Experimental coils

Coloured plastic casing with built-in, touch-safe 4 mm safety sockets for sliding onto ferrite cores with a cross section of up to max. 30 x 30 mm
Dimensions of the coil body (without socket attachment) 68 x 68 x 68 mm

a) Coil with 75 windings
Green plastic housing
Max. current: 15 A
Effective resistance: 0.4 Ohm
Inductance: 0.1 mH

b) Coil with 300 windings
Yellow plastic housing
Max. current: 5 A
Effective resistance: 1.1 Ohm
Inductance: 2.5 mH

c) Coil with 600 windings
Blue plastic housing
Max. current: 2 A
Effective resistance: 3.6 Ohm
Inductance: 8.5 mH

d) Coil with 1200 windings
Black plastic housing
Max. current: 1 A
Effective resistance: 20 Ohm
Inductance: 30 mH

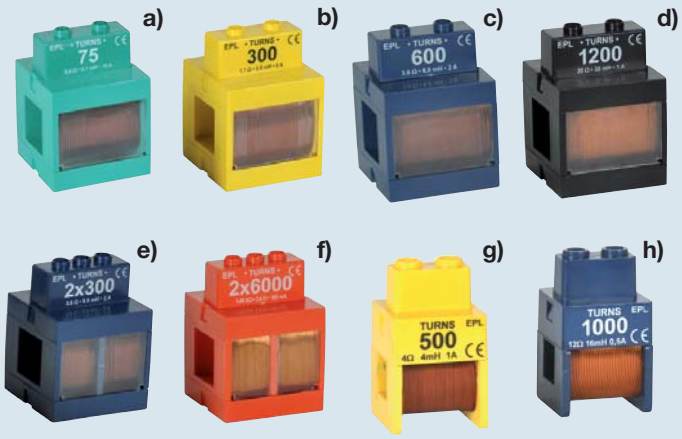
e) Coil with 2 x 300 windings
Coil with 600 windings and tap, blue plastic housing
Max. current: 2 A
Effective resistance: 3.6 Ohm
Inductance: 8.5 mH

f) Coil with 2 x 6000 windings
Coil with 12,000 windings and tap, red plastic housing
Max. current: 100 mA
Effective resistance: 1.45 kOhm
Inductance: 3.4 H

g) Coil with 500 Windings
Yellow plastic housing
Max. current: 1 A
Effective resistance: 4 Ohm
Inductance: 4 mH

h) Coil with 1000 windings
Blue plastic housing
Max. current: 0,5 A
Effective resistance: 12 Ohm
Inductance: 10 mH

i) Built-up transformer, complete
Consisting of:
Coil with 500 windings,
coil with 1000 windings,
laminated iron core,
set-up plate



Article	Order-No.
a) Coil with 75 windings	92084
b) Coil with 300 windings	92085
c) Coil with 600 windings	92087
d) Coil with 1200 windings	92088
e) Coil with 2 x 300 windings	92086
f) Coil with 2 x 6000 windings	92089
g) Coil with 500 windings	92131
h) Coil with 1000 windings	92132
i) Built-up transformer, complete	92134

Accessories

a) U-core, laminated
Laminated ferrite core, U-shaped, for assembling a built-up transformer, blue powder-coated, face-ground,
Cross section: 30 x 29 mm,
Distance between legs: 47 mm
Dimensions: 107 x 112 x 30 mm

b) Ferrite core, laminated
Laminated ferrite core, bar-shaped, for use as a yoke for U-core, blue powder-coated, ground on one side,
Cross section: 30 x 29 mm,
Length: 107 mm

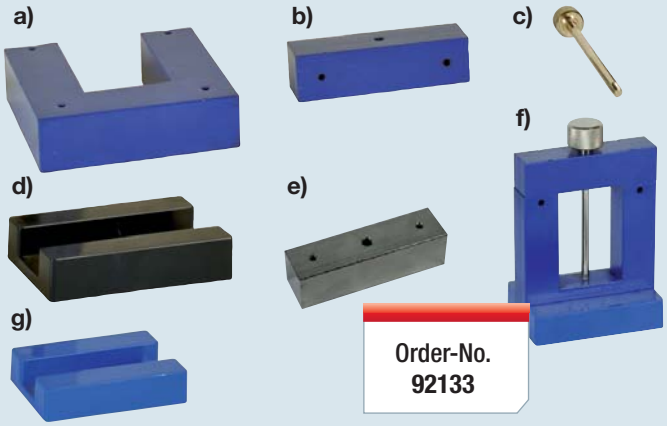
c) Clamping screw
M6 screw with knurled head
for securely connecting the ferrite core or set-up plate to the U-core

d) Set-up plate, large
Preformed plastic plate, blue
for securely setting up the U-core,
length: 107 mm

e) Ferrite core, solid
Ferrite core, nickel-plated, bar-shaped,
Cross section: 30 x 29 mm, length: 107 mm

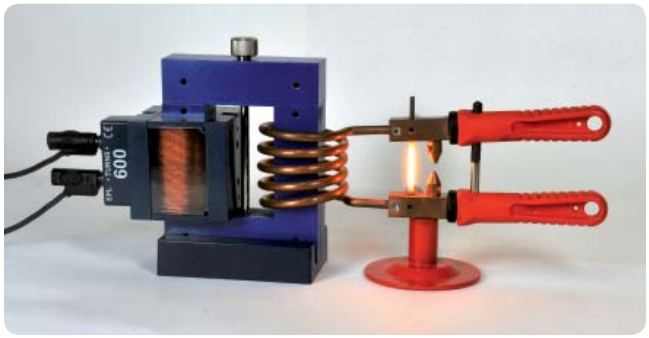
f) U-core with yoke and clamping screw
Laminated ferrit-core for set-up plate, small.
Cross section: 18 x 18 mm
Dimensions: 70 x 70 x 18 mm

g) Set-up plate, small
Preformed plastic plate, blue, for securely setting up the U-core with yoke and clamping screw
Length: 70 mm



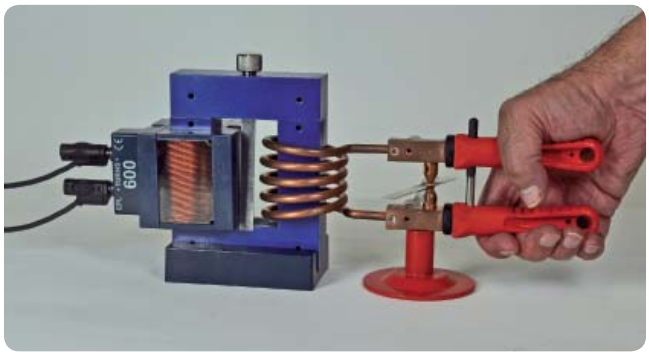
Article	Order-No.
U-core, complete (consisting of a) bis d))	92133
a) U-core, laminated	92079
b) Ferrite core, laminated	92080
c) Clamping screw	92081
d) Set-up plate	92082
e) Ferrite core, solid	92083
f) U-core with yoke and clamping screw	92135
g) Set-up pl ate, small	92136

Experimental set-up

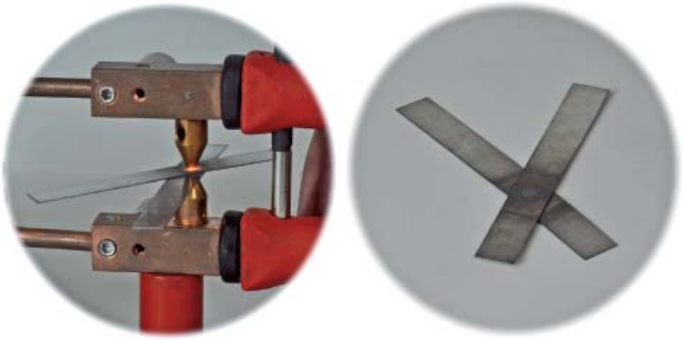


Model experiment: "Induction melting through current heat"

Model experiment: "High-current melting with the melting ring"



Model experiment: "Spot welding"



End product:
"Welded sheet metal strips"

Accessories

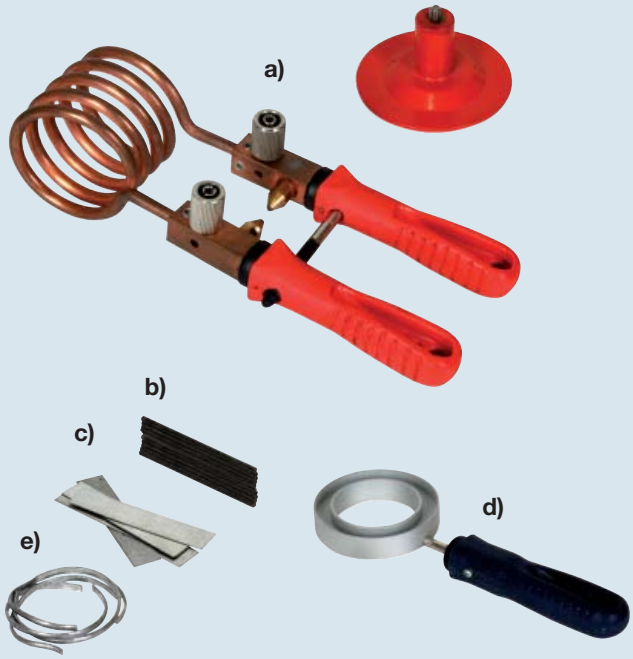
a) High-current coil with 5 windings
Coil for producing very high current, for induction melting through current heat, spot welding sheet metal, two 4 mm sockets, two clamping screws with sockets for fixing iron bars. Coil mounting on threaded round base
(included in the scope of delivery.) Current: Max. 120 A

b) Iron bars
For induction melting with the high-current coil,
length: 80 mm
Set of 10 bars

c) Sheet metal strips
For experiments in spot welding with the high-current coil
Set of 10 strips

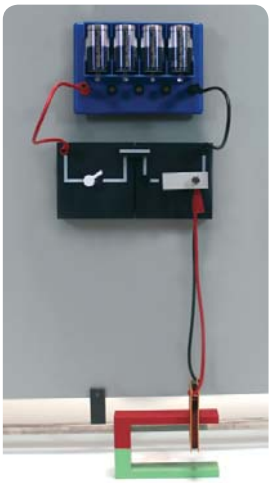
d) Melting ring
For use with the built-up transformer as a secondary coil with 1 winding for high-current melting experiments, aluminium ring with recess and plastic handle

e) Rings of tin
Material for melting experiments with the melting ring
Set of 5 rings



Article	Order-No.
a) High-current coil with 5 windings	92090
b) Iron bars	92091
c) Sheet metal strips	92092
d) Melting ring	92535
e) Rings of tin	92536

Experimental set-up



"Current-carrying coil in the magnetic field of a U-magnet"

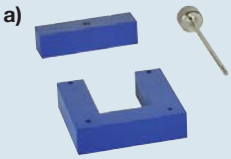
"Conductor swing"

"Lenz's Law"

Induction and eddy current – Device set

Adapted for following experiments:
- Induced voltage
- Lenz's law
- Eddy current
- Waltenhof pendulum
- Lorentz force
- Conductor swing

Order-No. **93773**


a)


b)


c)

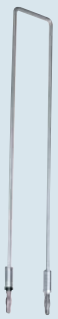

d)

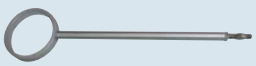

e)


f)


g)


h)


i)


j)


k)


l)


m)

Consisting of:

Article	Order-No.
a) 1 U-core with yoke and clamping screw	92135
b) 2 Bearing pin	92698
c) 1 Eddy current ring	92680
d) 1 Bar magnet, rectangular	92687
e) 1 Block magnets, pair	89955
f) 1 ON/OFF switch box	93767
g) 1 box for plug-in elements	93768
h) 1 additional weight on plug	93776
i) 1 conductor swing with 4 mm plug	93777
j) 1 Lenz ring on bar with 4 mm plug	93782
k) 1 Distributor bridge	92675
l) 1 flat coil with connection lines, 4 mm plug	93775
m) 1 Waltenhofen plate on shaft with 4 mm plug pins	92677

Experimental set-up

Experiment:
„Braking effect
on a rotating
aluminium ring
in the magnetic field
of a U-magnet“

Experiment:
„Waltenhofen
pendulum“

Contact box

Contact box

Retaining plate for experiments on the Lorentz force (conductor swing), Lenz‘s Law, Waltenhofen pendulum. Permanently built-in: 1 x button, 4 x touch-safe sockets, 1 x holder for U-core used as a U-magnet with pair of block magnets, U-core with yoke and clamping screw (order no. 92135), dimensions: 232 x 142 x 45 mm

Base plate with magnets

Exchange base plate for contact plate to be used for magnetic panel mounting

Article	Order-No.
Contact box	92137
Base plate with magnets	92138

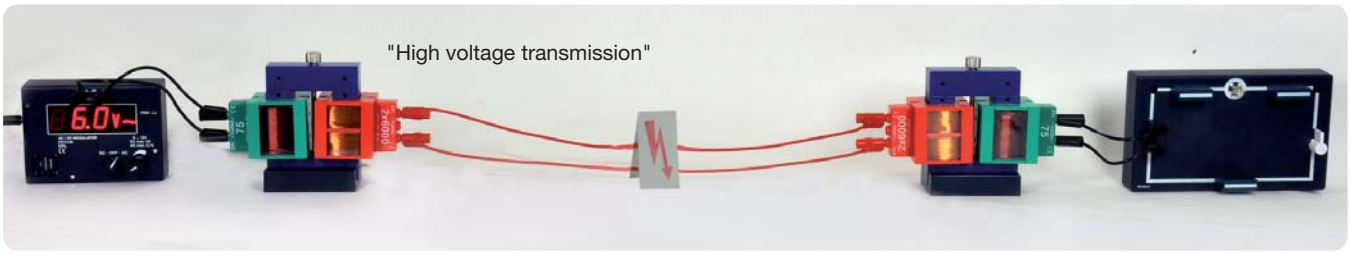
Lenz ring on bearing unit

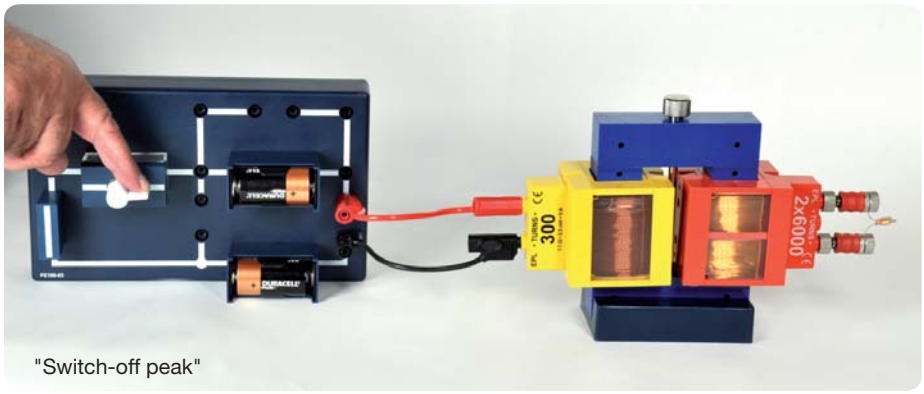
Two aluminium rings, D = 50 mm, mounted on aluminium bar.
One of the two rings with slot. For resting on bearing unit

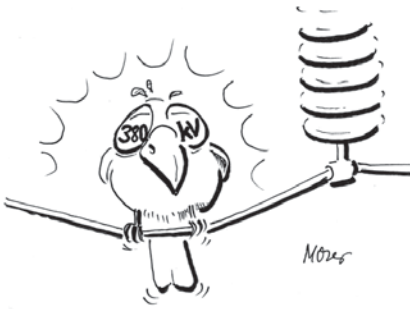
Electromagnet

Powerful electromagnet with two steel plates,
operated with a 1.5 V mono battery cell.
High magnetic lifting capacity
Included in the scope of delivery: 1 x mono battery cell, 1.5 V

Experimental set-up





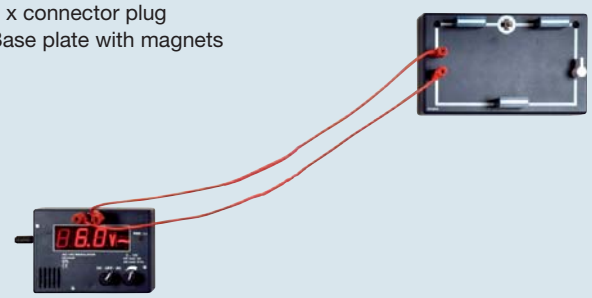


Electric circuit box, magnetic

Integral lamp socket E10 and ON/OFf switch.

Suitable to it:

92713	E10 light bulb, 6 V/0.5 A
89922	3 x connector plug
92138	Base plate with magnets

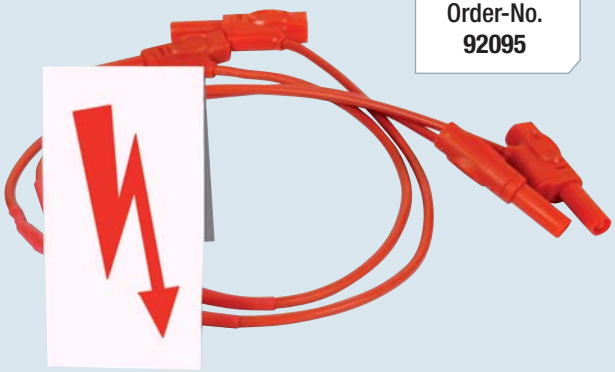


Order-No. 92096

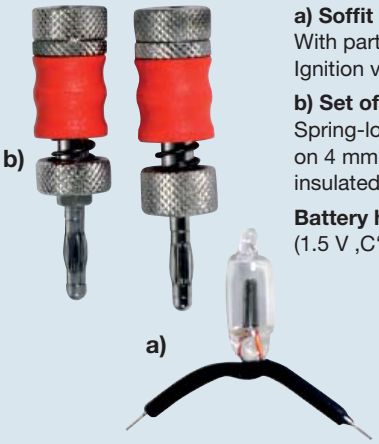
Long-distance lines, pair

Flexible resistance lines, red, with built-in 100 Ohm resistors and safety plug, length: 500 mm

Order-No. 92095



Accessories



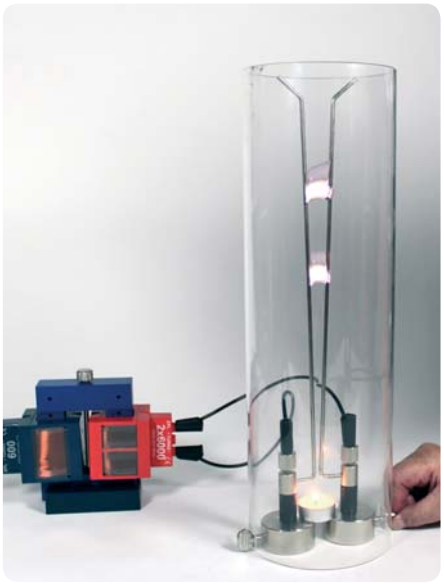
a) Soffit lamp
With partially insulated wires
Ignition voltage 70 V

b) Set of screw-terminal plugs
Spring-loaded clamping arrangement on 4 mm plug pin for clamping wires, insulated slide-on sleeve

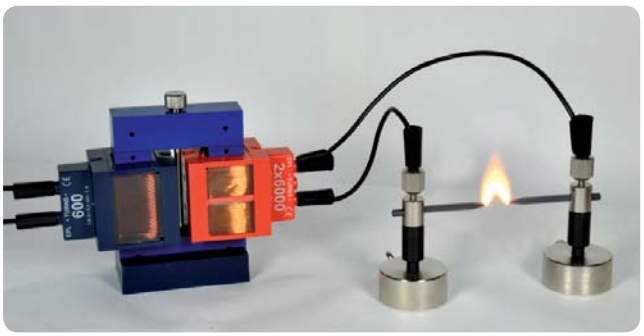
Battery holder
(1.5 V ‚C' battery cell required)

Article	Order-No.
a) Soffit lamp	89940
b) Set of screw-terminal plugs	89926
c) Battery holder (without image)	89934

Experimental set-up

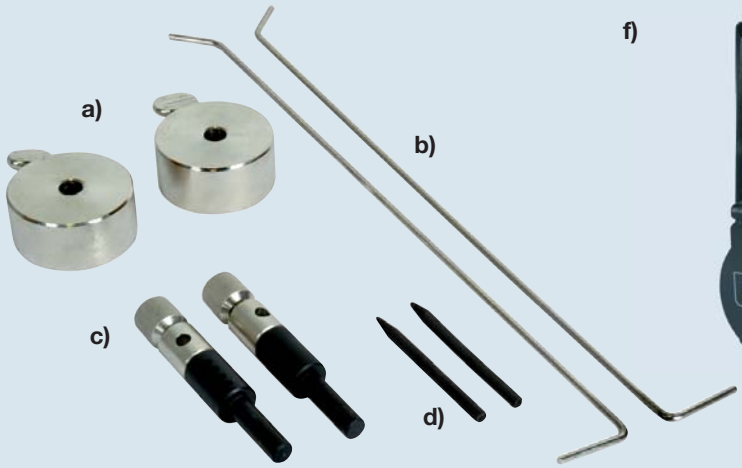


"Climbing sparks" in a guard tube



"Electric arc"

Accessories



(image smiliar)

a) Disc base (2 pieces required for the experimental set-up)
Metal cylinder, nickel-plated, with central drilled hole and clamping screw for accepting round material up to max. diameter of 10 mm
D = 56 mm, H = 30 mm

b) Electrodes for climbing sparks
Pair of wire electrodes for demonstrating an electric arc between the electrodes.
Length: 400 mm

c) Clamping shaft, set
For the insulated clamping of rods up to a diameter of 6 mm, insulating shaft made of plastic, clamping screw with socket for accepting 4 mm plugs
D = 18 mm, length: Approx. 120 mm

d) Homogeneous carbon rods, set
Carbon electrodes for „electric arc“ experiments, 2 pieces
D = 5 mm, length: 120 mm

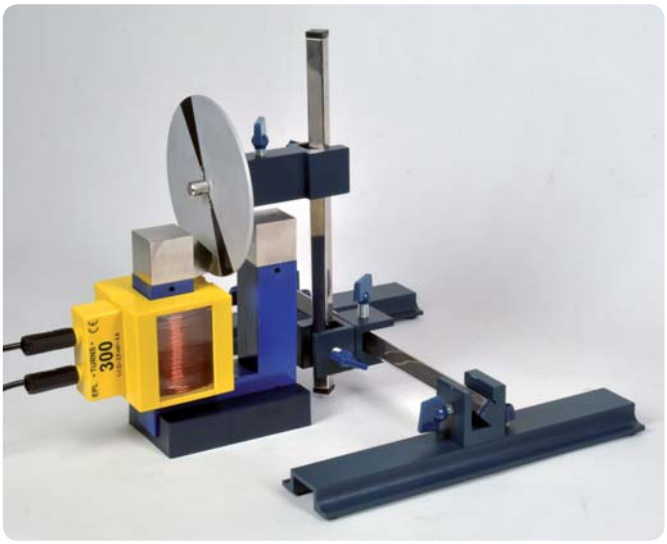
e) Acrylic glass guard tube, H = 480 mm, D = 150 mm

f) Intermediate plug for personal protection
Where there are life-threatening error currents (such as damaged mains cables, faulty wiring, etc.), the intermediate plug immediately interrupts the power supply. Operating voltage 230 V/50 Hz, rated current 16 A, max. connected load 3680 W, response time 30 ms, rated differential current 30 mA, 2-pole disconnection from the mains

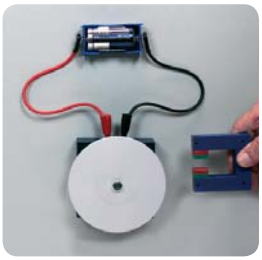
g) Laboratory adapter
Laboratory plug for connecting laboratory cable with 4 mm safety plugs.

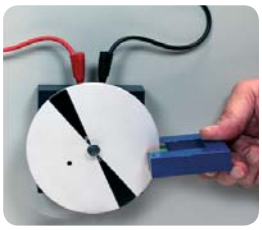
Article	Order-No.
a) Disc base, 500 g, single	86840
b) Electrodes for climbing sparks	92540
c) Clamping shaft, set	92542
d) Homogeneous carbon rods, set	92541
e) Acrylic glass guard tube	93785
f) Intermediate plug for personal protection	92538
g) Laboratory adapter	92539

Experimental set-up



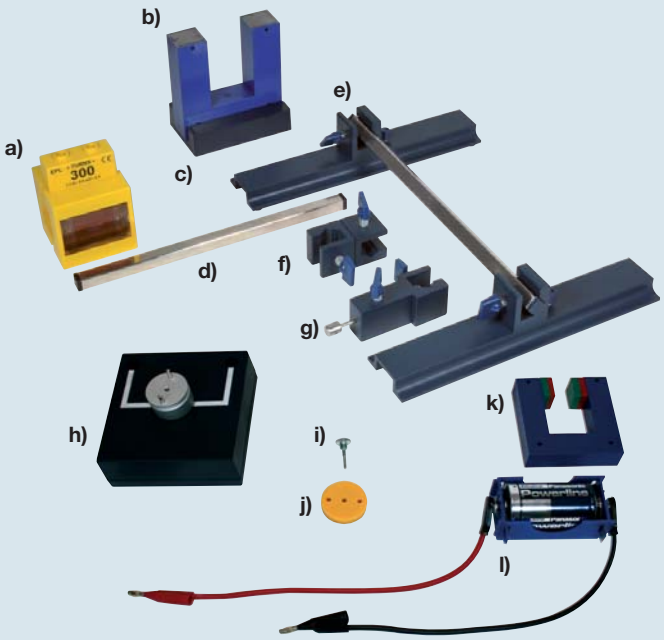
„Eddy current brake“





„Eddy currents“

Supplies – Eddy current brake



Consisting of:

Article	Order-No.
a) Coil with 300 windings	92085
b) U-core, laminated	92079
c) Set-up plate	92082
d) Square rod, L = 300 mm	86764
e) H-base, 300 mm	86749
f) Bosshead right angle	86759
g) Bosshead with bearing pin	86751
h) Motor with cord pulley, box	93786
i) M3 retaining screw	93788
j) Contact plate	93787
k) U-magnet	89956
l) Mono battery cell holder with special connecting lines and mono cell battery	93774

Pole shoes, pair

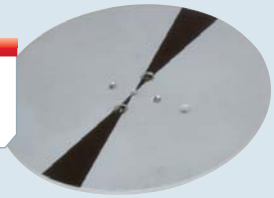
Ferrite cores with small, planar faces for placing on U-core, laminated, (order no. 92079) for producing a homogeneous magnetic field, cross section: 30 x 30 mm, length: 50 mm

Order-No. 92537

Eddy current disc

Aluminium disc for experiments on the braking effect of a rotating disc in a magnetic field or „mains AC current meter“, D = 120 mm

Order-No. 92140



Experimental set-up

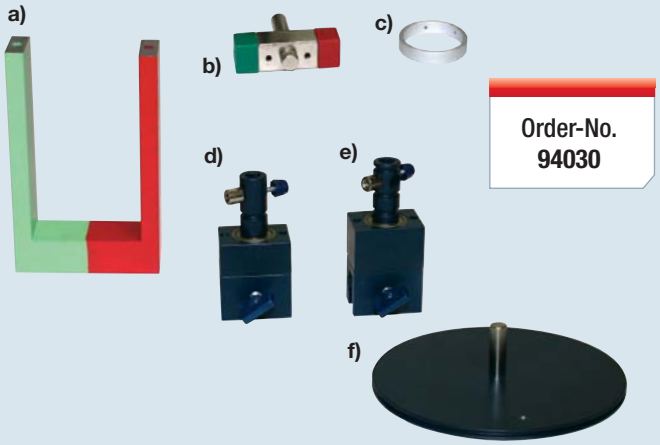
„Alternating current asynchronous motor“

„Synchronous motor“

„Asynchronous motor“

„Thomson cannon“

Motor model – Device set



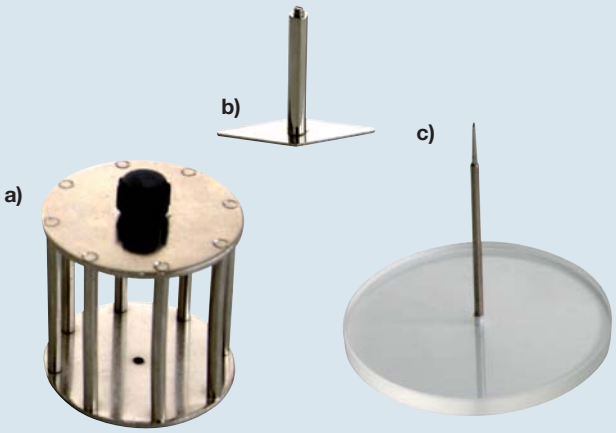
Consisting of:

Article	Order-No.
a) 1 x U-magnet	89953
b) 1 x bar magnet, rectangular, on shaft, D = 10 mm	93789
c) 1 x aluminium hanging ring, D = 50 mm	93790
d)1 x bearing unit, short	86831
e) 1 x bearing unit, long	86832
f) 1 x belt pulley	86833

Rotating field – Device set

Consisting of:

a) Cage anchor
Squirrel-cage rotor with the AC asynchronous motor, height: 45 mm
b) Magnetic needle for rotating field
for demonstrating the AC synchronous motor, length: 40 mm
c) Bearing needle on base
For rotatable mounting of the cage anchor or magnetic needle for rotating field



Article	Order-No.
Rotating field – Device set	92534
a) Cage anchor	92143
b) Magnetic needle for rotating field	92144
c) Bearing needle on base	89958

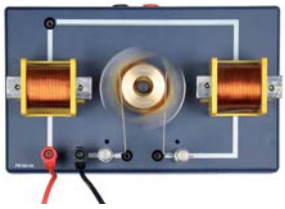
Thomson ring

Aluminium tube as projectile with the „Thomson cannon“
Inner cross section: 30 x 30 mm

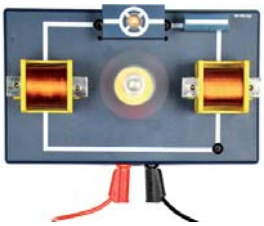
Order-No.
92142

Experimental set-up

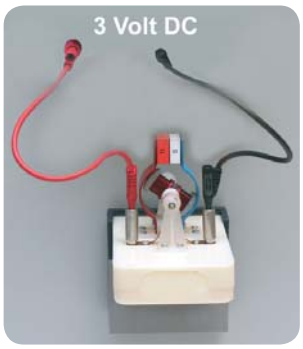
„Electric motor“



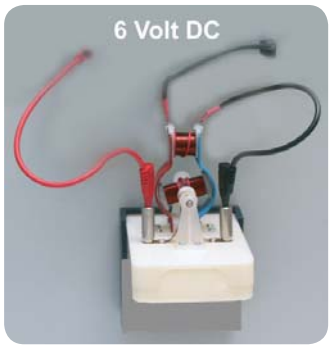
„Series motor“



„Internal pole generator“



„Electric motor“



„Series motor“

Motor box, magnetic

For the simple and quick set-up of electric motors and generators. In the box, there is a built-in electric motor which is used for motor experiments as a bearing unit with fitted flywheel. For generator experiments, the „bearing unit“ can be supplied with voltage via two external safety sockets fitted at the side.
Clearly visible switching paths thanks to high-contrast, white screen printing

Dimensions: 232 x 142 x 55 mm

Order-No. **92151**

May we recommend:

Base plate with magnets, to replace the base plate to be used for magnetic board set-up.

Order-No. **92138**

Motor box – Device set

Order-No. **44499**

Consisting of:

1 Holder for magnets, red/green, pair
2 Coil 500 windings
4 Flat plug
2 Iron core, solid
1 Connection plug
2 Light bulb 1,5 V/50 mA
1 Commutator
1 Support plate for bar magnet
1 Iron core for rotor coil
1 Screw small
1 Screw long
1 Drive belt
1 Wire brush
2 Brushholder
1 Bar magnet, pair
1 Roll on axle
1 Supporting rod
1 Roll, D = 75 mm
1 Crank pin
1 Bar magnets, square
1 Instruction manual motor box

More information: www.christiani-international.com/44499

Electric motor

(image similiar)

Electric motor, magnetic
Model with permanent magnet, and coil as electromagnet. For operation as a basic electric motor, series and shunt motor, external pole generator

Dimensions of the base plate: 130 x 105 mm

Article	Order-No.
Electric motor	**93858**
Electric motor magnetic adhesion	**93856**

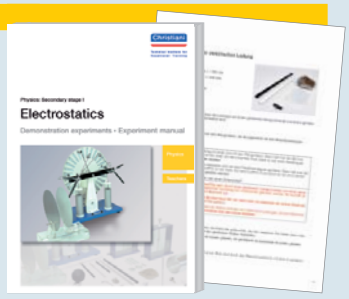
Electrostatics – Device set

Order-No.
44501

Experiments for following topics:

- **Electrostatic charge**
- **Eletrostatic interaction**
- **Induction and polarisation**
- **Farady-cage**
- **Charge distrubation**

Instruction manual:



Consisting of:

1 x electrophorus
1 x assembly electroscope
2 x Kolbe-type electroscope
1 x capacitor plate with thread, pair
1 x discharger
1 x capacitor plate on plug
1 x threaded adaptor
1 x pointed rod, angled
1 x needle on shaft
1 x pedestal
1 x bearing unit
1 x plastic rod
1 x soffit lamp
1 x Faraday beaker
1 x material for rubbing
1 x small polystyrene ball, box
1 x insulating shaft
1 x pendulum ball, light
1 x plate capacitor

Inclusive instruction manual

For information on these items, see pages 102-104.

More information: www.christiani-international.com/44501

Christiani-Tip

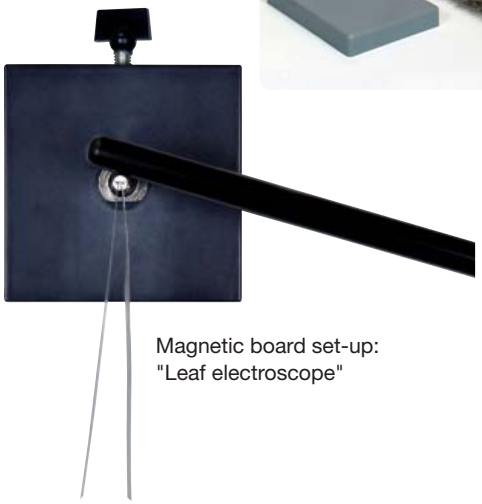
Case Electrostatics

For students experiments on the following topics:
- Contact electricity
- Electrostatic interaction
- Induction and polarisation

More information on page 137

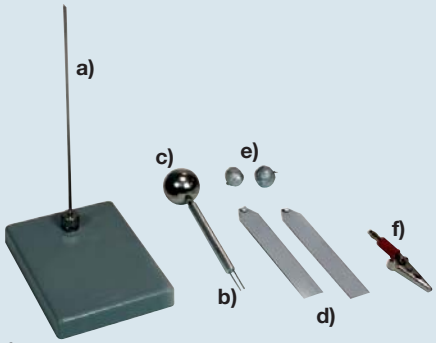
Experimental set-up

Stand set-up:
"Leaf electroscope"



Magnetic board set-up:
"Leaf electroscope"

Assembly electroscope



Consisting of:

Article	Order-No.
Assembly electrosope set complete	95434
a) Insulated base plate with retaining shaft	93743
b) Suspension fork	89936
c) Conductor ball	89938
d) Leaf electroscope, L = 120 mm, pair	89937
e) Elder pith balls on cord, pair	93746
f) Crocodile clip with plug pin	93747

Bearing unit

Ball-bearing-mounted acrylic glass holder on base for easily rotatable mounting of rods

Order-No.
93748

Kolbe-type electroscope

For experiments on static electricity;
metal casing with earth socket,
glass covers with printed
scale, suitable for projection.
Dimensions: 170 x 50 x 180 mm

Order-No.
92578

Set of materials for rubbing

Order-No.
86875

For experiments on static electricity

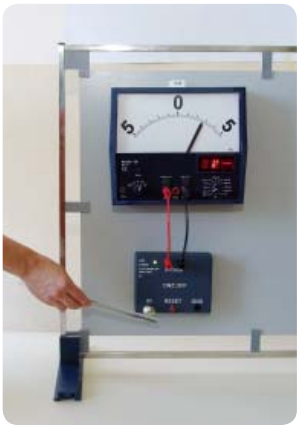
Consisting of:
Ebonite rod, L = 300 mm
Acrylic glass rod, L = 300 mm
Plastic rod, L = 300 mm
Set of cloths for rubbing
Wool cloth, silk cloths, rabbit fur
Box of small polystyrene balls

Soffit lamp

For displaying electrostatic charges
Ignition voltage approx. 70 V
Free, insulated wire ends
Height: Approx. 15 mm

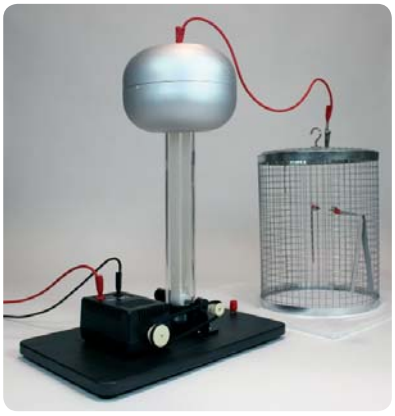
Order-No.
89940

Experimental set-up



Magnetic board set-up:
"Displaying the positive charging of an acrylic glass rod using an electrometer amplifier"

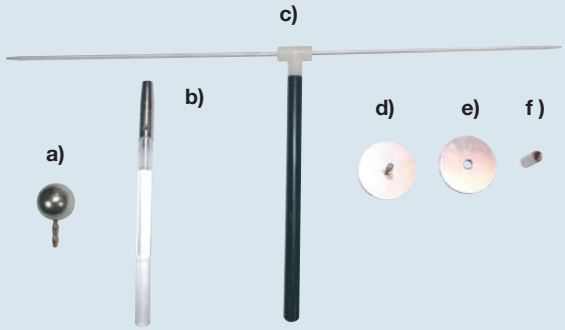
"Charge distribution to a metallic hollow object"



"Charge distribution to the Faraday cage"

Discharger – Accessories

Insulated, retained aluminium rod on plastic handle, length of the aluminium rod: 300 mm



Article	Order-No.
a) Conductor ball	89938
b) Insulating shaft, L = 180 mm	93749
c) Discharger	89951
d) Capacitor plate with plug	89944
e) Capacitor plate with thread	89945
f) Threaded adaptor	89943

Faraday beaker – Faraday cage

Aluminium beaker on 4 mm plug pin for experiments on charge distribution on a metallic hollow body
H = approx. 140 mm,
D = approx. 88 mm

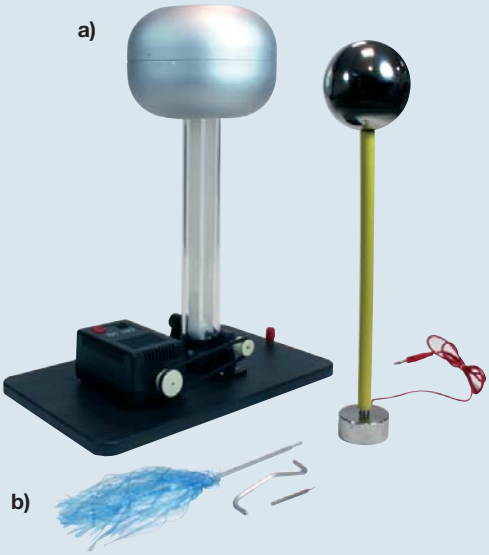
FARADAY BEAKER
Order-No.
86876

FARADAY CAGE
Order-No.
93750

Metal gauze cylinder closed on one side for shielding electro-magnetic fields
D = 240 mm, H = 320 mm

Van de Graaff generator

Van de Graaff generator for creating high electrical DC voltage.
Motor drive: 10 V_{max}
Detachable conductor ball with 4 mm socket, D = 180 mm
Base plate: 380 x 230 mm
Total height: 470 mm
Included in the scope of delivery:
1 conductor ball, D = 150 mm on shaft, L = 450 mm with disc base, connection cable with 4 mm plug

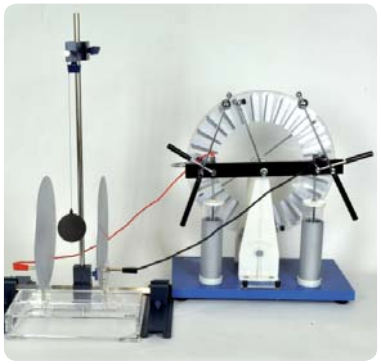


Accessories:

1 x foil bunch on shaft
1 x needle on 4 mm shaft
1 x pointed rod, angled

Article	Order-No.
a) Van de Graaff generator	93751
b) Accessories	93752

Experimental set-up



"Action of force in a homogeneous electrical field"

"Dancing balls"

"Charge escaping at the tips"

Electrophorus

Wimshurst machine
For creating high DC voltages, sparking distance: Approx. 70 mm, disc diameter: 300 mm

Order-No. 86871

Plate capacitor

2 aluminium discs, D = 200 mm, with 4 mm sockets on moving acrylic glass base, 2 retaining screws, millimetre scale printed on the base.
Base dimensions: 225 x 125 x 45 mm

Order-No. 86877

Ball conductor – Cone conductor

a) Ball conductor
Hollow metal ball that opens on one side on insulated shaft with base, 4 mm socket, D = 100 mm

b) Cone conductor
For demonstrating the enhanced distribution of charge on the tip of the cone. Metal cylinder with fitted cone on insulated shaft with base, 4 mm socket, D = 70 mm

a)

Order-No. 93753

b)

Order-No. 93754

Electrostatics cylinder

For demonstrating the action of force on charged objects in an electrical field. Plate capacitor with glass cylinder on base,
D = 95 mm, H = 310 mm
Included in the scope of delivery:
1 pack of small plastic balls

Order-No. 93755

Pendulum ball, black

Metallised polystyrene ball
With hook, low mass, D = 60 mm

Order-No. 89867

Magnetostatics – Device set

Order-No. 44502

Consisting of:

1 x U-magnet, large
2 x bar magnet, large, cylindrical
2 x bar magnet, rectangular
1 x bar magnet, small, pair, with yoke
1 x ring magnet, pair
1 x base for ring magnets
1 x magnetic field probe
1 x globe for earth's magnetism
1 x ferrite core
1 x tube for Oersted
1 x wind rose
1 x bearing needle on base
1 x magnetic needle
1 x pocket compass
1 x threaded rod, set
1 x magnetic and non-magnetic materials
1 x nails, box
1 x collector for nails and iron chippings
2 x paper clip, large
1 x magnetic support plate
1 x magnetic needle model

For information on these items, see pages 106-109.

Student experiments on „Magnetostatics", see page 138

Inclusive instruction manual

More information:
www.christiani-international.com/44502

Christiani-Tip

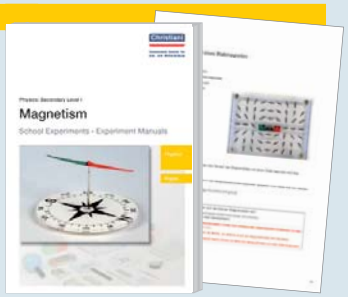
Case Magnetostatics

For Student experiments:
- Magnetic interaction
- Magnetic induction
- Magnetic field
- Elementary magnet

Order-No. 98441

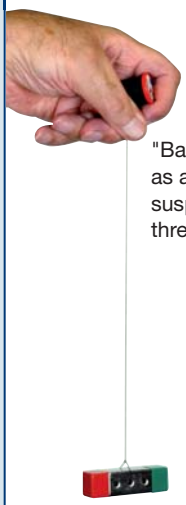
More information on page 138

Instruction manual:



Experiments on the following topics:
- **Magnetic force**
- **Magnetic attraction and repulsion**
- **Magnetic field**
- **Compass**
- **Earth's magnetic field**
- **Magnetic induction**
- **Magnetic and non-magnetic materials**
- **Magnetic shielding**

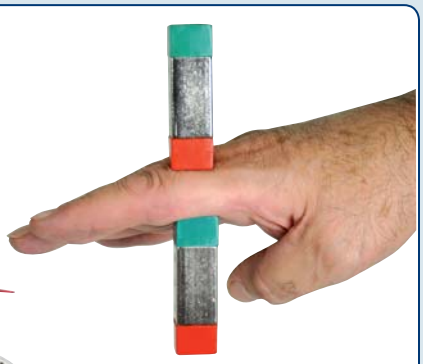
Experimental set-up



"Bar magnet as a compass" suspended on thread

"Floating magnets" with ring magnets, pair or bar magnets, cylindrical

"Assembled compass with magnetic needle or bar magnet, cylindrical"



"Action of force of the neodymium magnet"

Magnets

a) Ring magnets, pair
Strong ferrite magnets in red/green plastic shells
D = 64 mm, ID = 29 mm

b) Bar magnet, cylindrical
Material: Neodymium
Coloured plastic pole covers.
Hole in the centre for rotatable mounting on the needle base, L = 82 mm, D = 18 mm

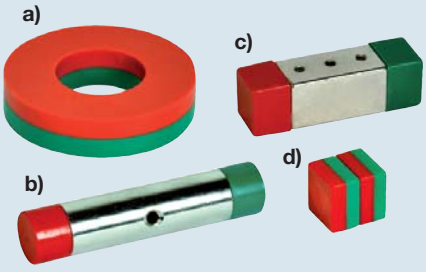
c) Bar magnet, rectangular
Material: Neodymium
Coloured plastic pole covers.
Central continuous hole for suspending the magnets on a cord.
Dimensions: 60 x 18 x 18 mm

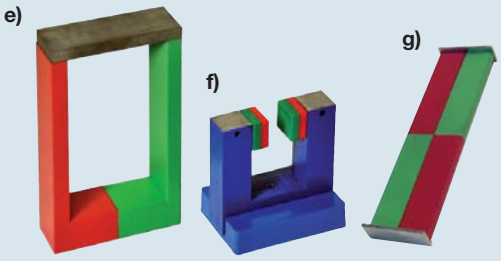
d) Block magnets, pair
Material: Neodymium
Coloured plastic pole covers.
Block magnets for forming a U-magnet with the U-core from U-core with yoke and clamping screw (order no. 92135).
Dimensions: 18 x 18 x 10 mm

e) U-magnet, large with yoke
Material: AlNiCo, red/green pole
Length: 130 mm, pole distance: 60 mm

f) U-magnet
Consisting of a U-core (order no. 92135) block magnets, pair (order no. 89955) and set-up plate, plastic (order no. 92136)

g) Bar magnets, pair
Material: AlNiCo
Red/green pole marking
Dimensions: 150 x 20 x 7 mm





Article	Order-No.
a) Ring magnets, pair	86880
b) Bar magnet, cylindrical	86882
c) Bar magnet, rectangular	92687
d) Block magnets, pair	89955
e) U-magnet, large with yoke	89953
f) U-magnet	89956
g) Bar magnets, pair	89957

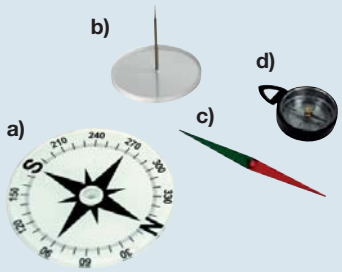
Wind rose

a) Wind rose
For assembling a compass with needle base and magnetic needle or bar magnet, cylindrical plastic disc with printed angle scale and wind rose,
D = 90 mm

b) Bearing needle on base
Steel needle on acrylic glass disc for rotatable mounting of a magnetic needle or bar magnet, cylindrical, height: 55 mm

c) Magnetic needle
Coloured pole marking, L = 100 mm

d) Pocket compass
Magnetic needle low-friction-mounted in plastic casing, with wind rose and angle scale, D = 40 mm

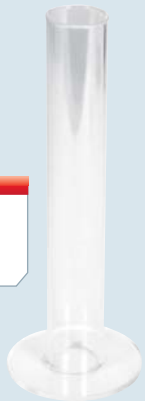


Article	Order-No.
a) Wind rose	92590
b) Bearing needle	89958
c) Magnetic needle	89988
d) Pocket compass	89987

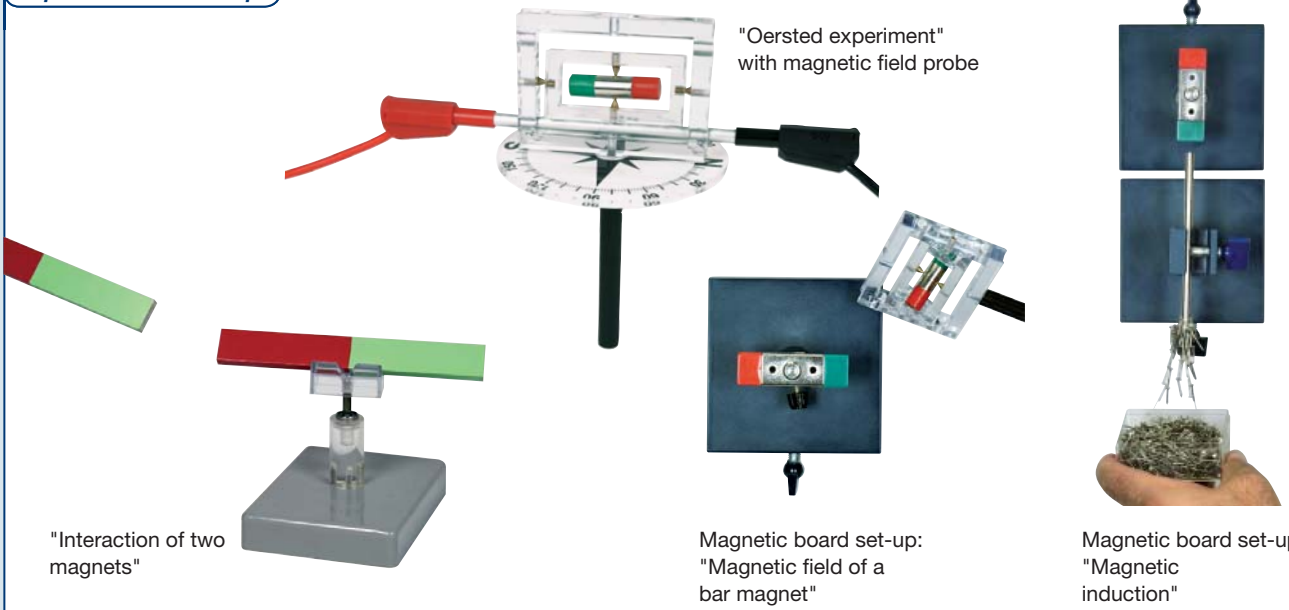
Base for ring or bar magnets

Acrylic glass cylinder with base for attaching ring magnets (order no. 86880) or cylindrical bar magnets (order no. 86882)
H = 160 mm, D = 25 mm

Order-No.
01017



Experimental set-up



"Interaction of two magnets"

"Oersted experiment" with magnetic field probe

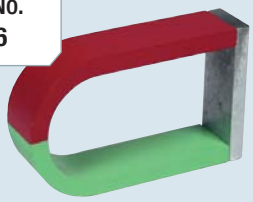
Magnetic board set-up: "Magnetic field of a bar magnet"

Magnetic board set-up: "Magnetic induction"

U-magnet, small

Material: AlNiCo
with yoke
Dimensions: 80 x 52 x 21 mm

Order-No. **93756**



Magnetic/ non-magnetic materials

Metal discs, D = 25 mm, set of 6 pcs
Material: Cu, Me, Fe, Zn, Al, Pb

Order-No. **93779**

Bearing unit

Ball-bearing-mounted acrylic glass holder on base for easily rotatable mounting of rods

Order-No. **93748**

Collector for iron nails and iron chippings

To easily pick-up iron nails, iron powder and iron chippings using a strong ferrite magnet, height: 180 mm, D = 70 mm

Article	Order-No.
a) Collector	89989
b) Iron nails in plastic box	89999

Magnetic field probe

For 3-dimensional scanning of magnetic fields. Gimbal-mounted, strong neodymium magnet with coloured plastic covers on the poles,
L = 38 mm, D = 10 mm,
2 acrylic glass frames,
outer dimensions: 80 x 60 mm
Shaft length: 94 mm

Order-No. **86885**

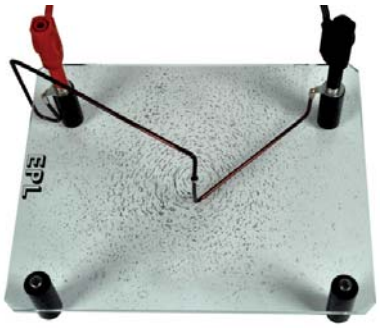
Tube for Oersted

Aluminium tube for Oersted experiment combined with the magnetic field probe, inner diameter: 4 mm for 4 mm plug pins, L = 140 mm

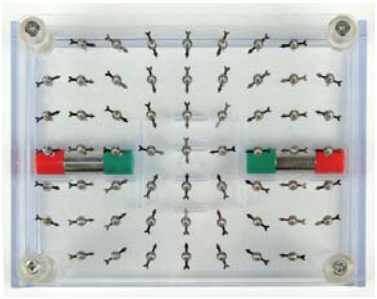
Order-No. **86886**

Experimental set-up

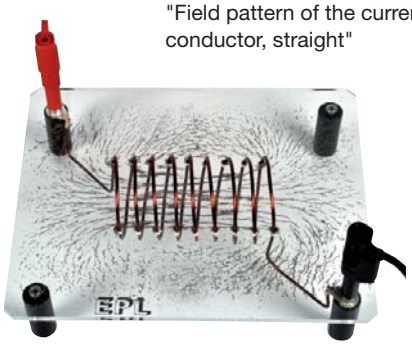
"Field pattern of a bar magnet"
(Suitable for overhead projection)



"Field pattern of the current-carrying conductor, straight"



"Field pattern between two like poles of two bar magnets"



"Field pattern of the current-carrying coil"

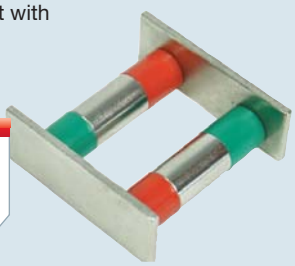
Magnetic needle model

For illustrating the magnetic field lines. 59 fully rotating magnetic needles fitted between 2 acrylic glass plates and for mounting on the magnetic needle plate (Order-No. 86888)
Dimensions: 125 x 200 mm

Order-No. 86887

Small bar magnets, pair

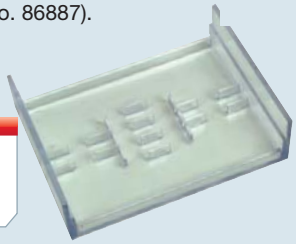
Strong cylindrical neodymium magnet with coloured plastic covers on the poles, 2 pole plates, L = 38 mm, D = 10 mm



Order-No. 86889

Magnetic support plate

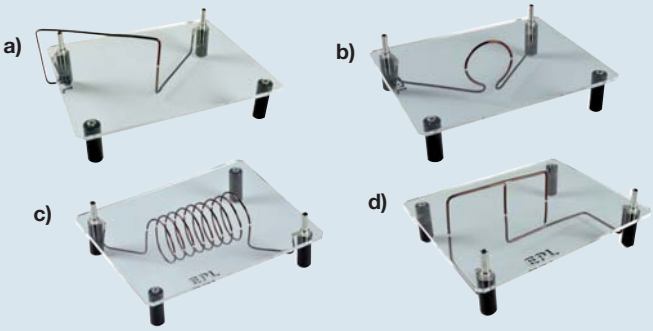
Acrylic glass trough for positioning the bar magnets and mounting the magnetic needle model (Order-No. 86887).
Dimensions: 130 x 97 x 35 mm



Order-No. 86888

Conductor model on acrylic glass

For overhead projection.
Devices for presentation of the magnetic field from current carring conductor. Necessary current > 10 A. Dimensions: 158 x 150 mm. Connection with 4 mm plug pins.



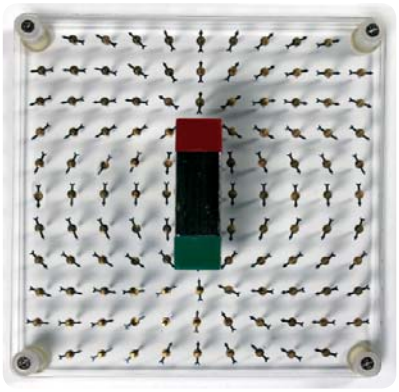
Article	Order-No.
a) Conductor, straight	86890
b) Conductor loop	86892
c) Conductor, coil	86893
d) Conductor, straight, parallel	86891

Iron filings

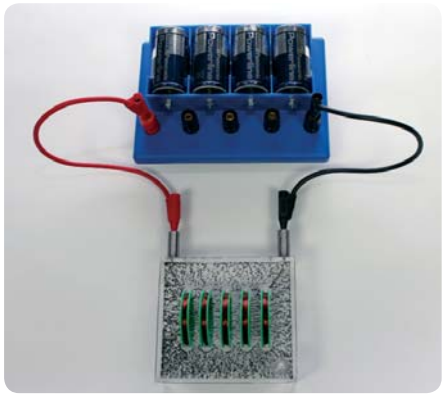
150 g In shaking can, plastic

Order-No. 91887

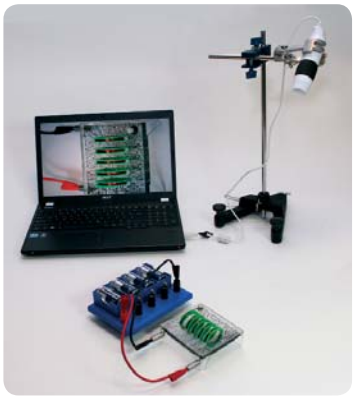
Experimental set-up



"Field pattern of a bar magnet"



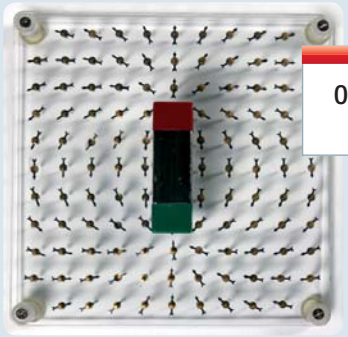
"Field pattern of a current-carrying coil"



"Field pattern of a current-carrying coil – Projection with video camera and computer"

Magnetic needle model, large

For illustrating and/or projecting magnetic fields
117 fully rotatable mounted magnetic needles, L = 11 mm
Dimensions: 150 x 150 mm



Order-No. 93757

(Bar magnet Order No 92687 not included)

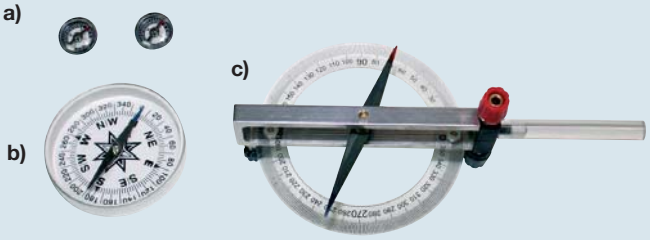
Conductor model in silicone oil

Conductor model in silicone oil with iron filings for illustrating the magnetic fields of current-carrying conductors. Necessary current >10A
Conductor models with 4 mm connecting sockets, set of 3 pcs:
Straight conductor, conductor loop, coil

Order-No. 93759

Compass

a) Drawing compass, D = 20 mm, 2 pcs
For point-by-point recording of magnetic field lines
b) Pocket compass, large
D = 77 mm
c) Dipping needle compass Rotatable mounted magnetic needles for analysing the magnetic field lines of the Earth. On shaft, D = 10 mm



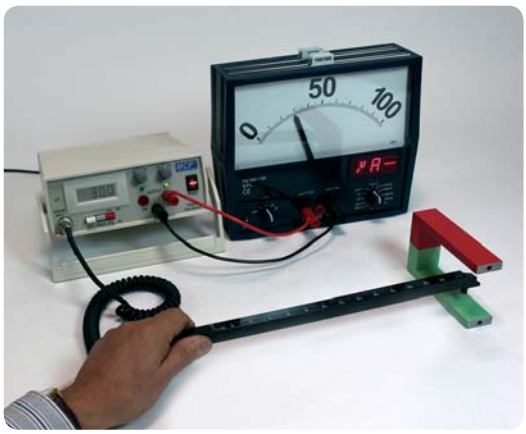
Article	Order-No.
a) Drawing compass	93760
b) Pocket compass	93761
c) Dipping needle compass	93762

Video camera

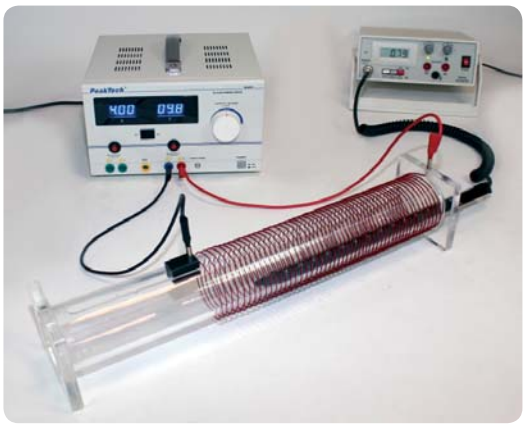
1.3 megapixels
Up to 200 x magnification possible
USB connection for use with a computer
Included in the scope of delivery:
Software for installation and saving pictures
Universal clamp for holding the camera

Order-No. 93758

Experimental set-up



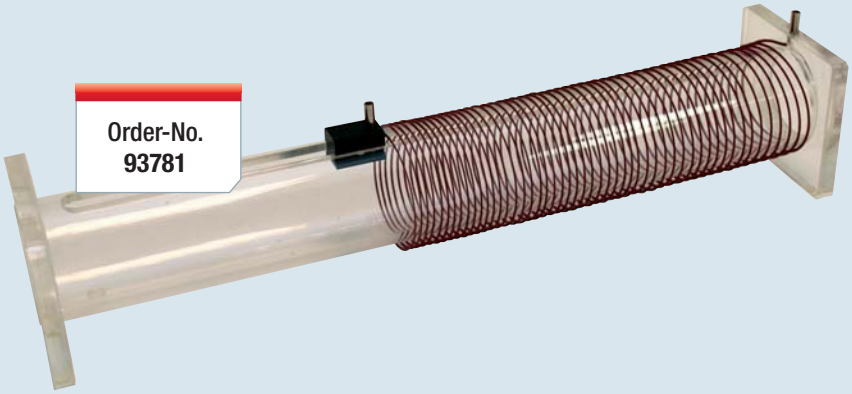
"Measuring the magnetic field using U-magnets"



"Measuring the magnetic field of a coil with variable turns"

Coil with 50 windings

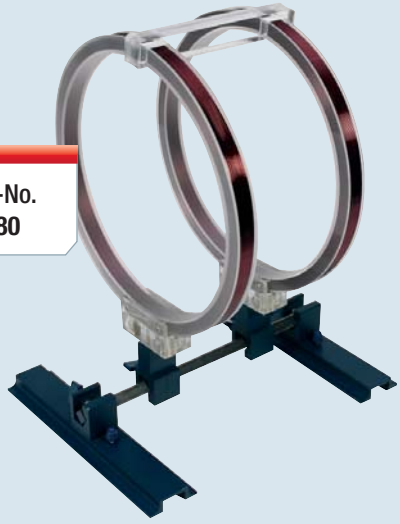
Coil on acrylic glass tube with variable turns.
Cursor with 4 mm socket
Current strength: 10 A_{max}
Length: 495 mm



Order-No.
93781

Helmholtz coils

Helmholtz coils for creating a homogeneous magnetic field. Coils, D = 300 mm, 145 turns on shaft with 4 mm sockets, load capacity: 5 A
Included H-base and two bosshead, long.



Order-No.
93780

Induction coil

Coil with tap on base plate
Tap: 100, 200, 300, 400, 500 windings
4 mm sockets
Load capacity: 400 mA

Order-No.
93764

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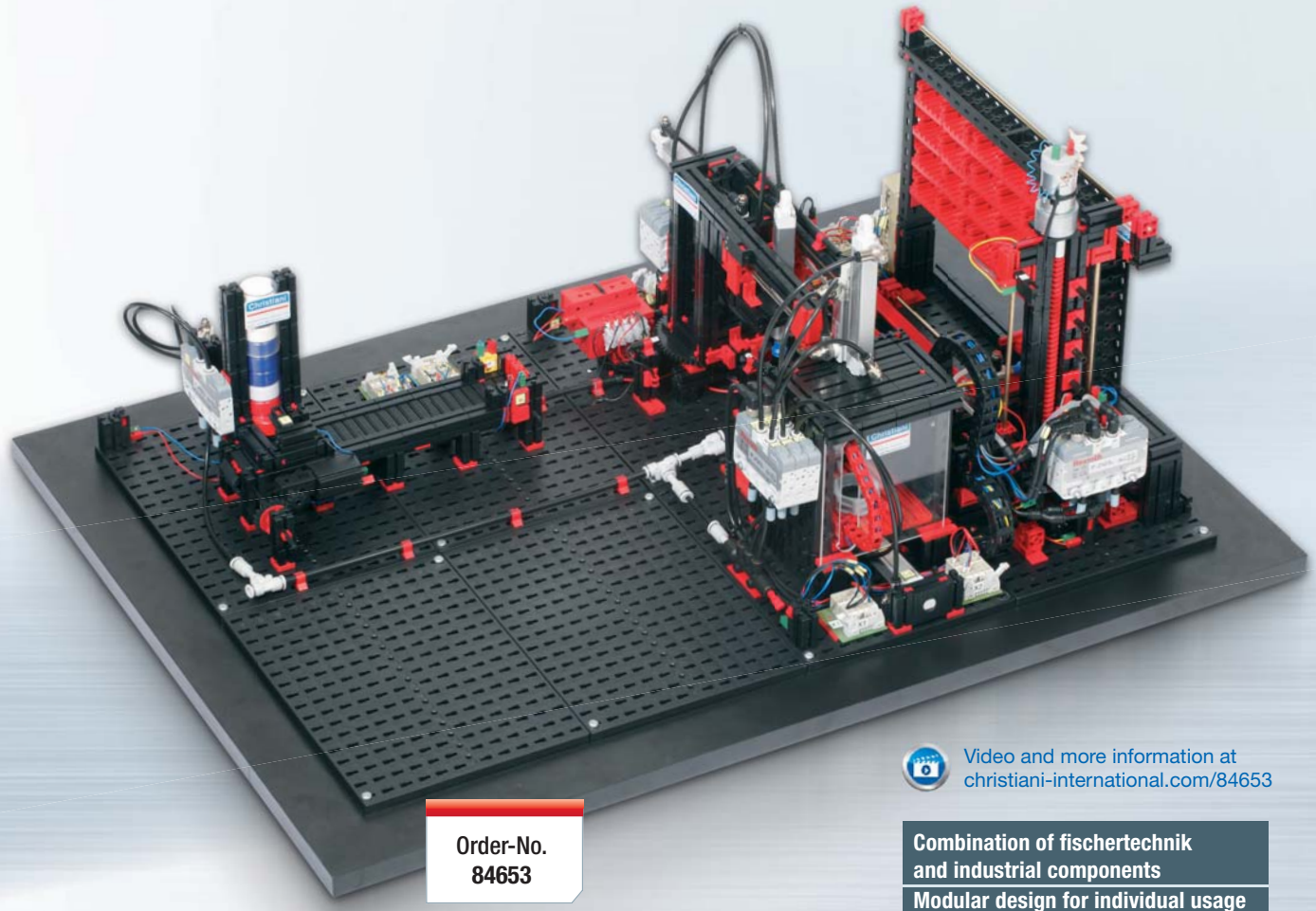
modular Mechatronics System junior

The perfect introduction to mechatronics. First of all, students and trainees are effortlessly made familiar with the key elements of a mechatronics system: electric motors, gears, pneumatic valves, pneumatic cylinders, photoelectric barriers, solenoid switches. In later advanced stages, they learn about electronic control technology.

At the same time they acquire knowledge of mechanics, electrical engineering, electronics, magnetism, pneumatics and information technology. These parts together form interconnected modules, which together constitute the essential elements of a modern factory.



Order-No.
84653

Video and more information at
christiani-international.com/84653

- Combination of fischertechnik and industrial components
- Modular design for individual usage
- Practical simulation of real industrial workflows

Use the mMS junior assembly kit to teach:

- Mechanical engineering
- Electronics
- Digital signal processing
- Robotics
- Programming
- Electrical engineering
- Communication technology

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Basic circuits with Box 1

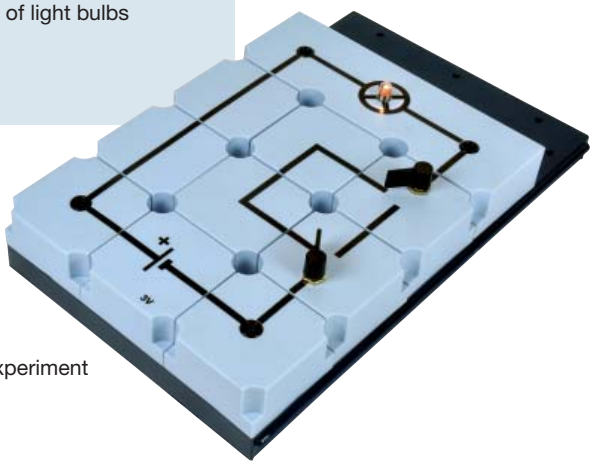
Experiment topics:

- Simple electric circuit
- Selector switch
- Toggle switch
- Conductors and non-conductors – Solids
- Electrical voltage
- Series connection of voltage sources
- Parallel connection of voltage sources
- Voltage drop on the light bulb
- Terminal voltage
- Electrical current strength
- The light bulb is a PTC conductor
- Series connection of light bulbs
- Parallel connection of light bulbs

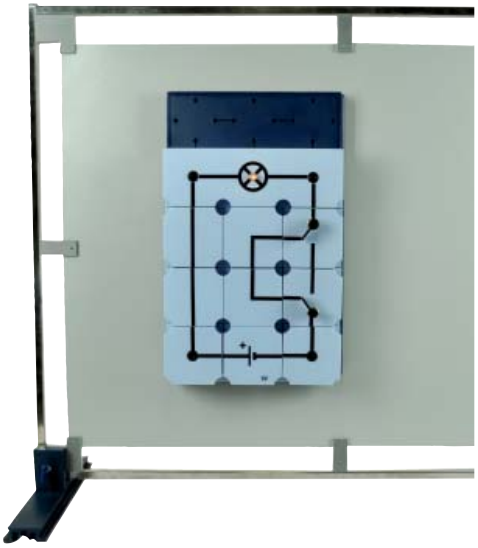
"Toggle switch"

You will need:

1 basic plug-in board (Order-No. 86908)
1 triple plug-in module E10 lamp socket (Order-No. 92569)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 5 – Devices (Order No.-87285)



As a student experiment

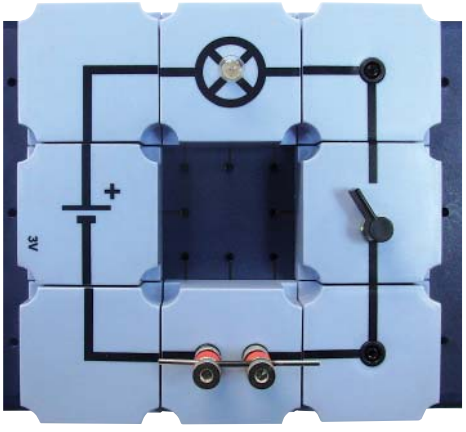


As a magnetic board set-up

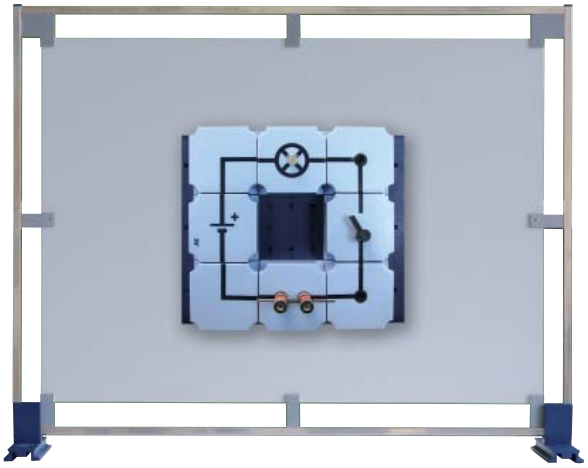
"Conductors and non-conductors"

You will need:

1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 5 – Devices (Order-No. 87285)
1 panel meter, magnetic (Order-No. 92532)
1 connection line (Order-No. 86911)



As a student experiment



As a magnetic board set-up

Electrical resistor

Experiment topics:

- Conductors and non-conductors – Liquids
- Human beings are electrical conductors
- Human beings are conductors of electricity when they are in contact with water

Electrical resistor

- Ohm's law
- Applying Ohm's law
- The resistance of wires
- The specific resistance of wires
- Series connection of ohmic resistors
- Parallel connection of ohmic resistors
- Mixed connection of ohmic resistors
- Voltage divider
- Adjustable resistance
- Potentiometer model
- Controlling lighting with a potentiometer
- Model of a fader (bridge circuit)
- Unloaded potentiometer
- Loaded potentiometer
- Wheatstone bridge circuit
- Kirchhoff's 1st law
- Kirchhoff's 2nd law

Heat effect on the electric current

- Electrical energy is converted into heat energy
- Electrical energy is converted into light energy
- Copper wire and resistance wire
- Heat generation in different wire cross sections
- Short-circuit – Risk of fire – Lead fuse
- Bimetal thermostat
- Bimetal fire alarm

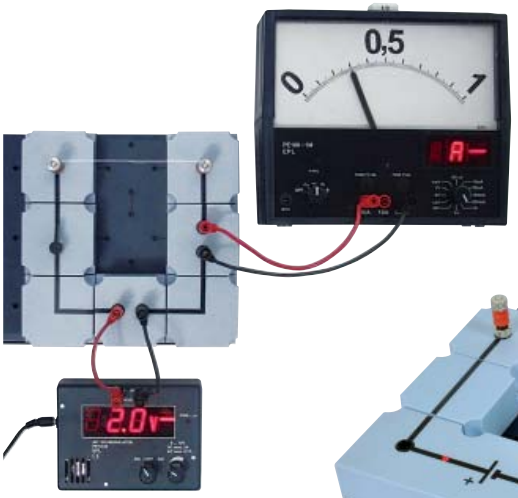
Chemical effect of the electrical current

- An electrochemical element
- Volta element
- Electrolysis
- Galvanising
- Lead-acid accumulator
- Electrochemical series

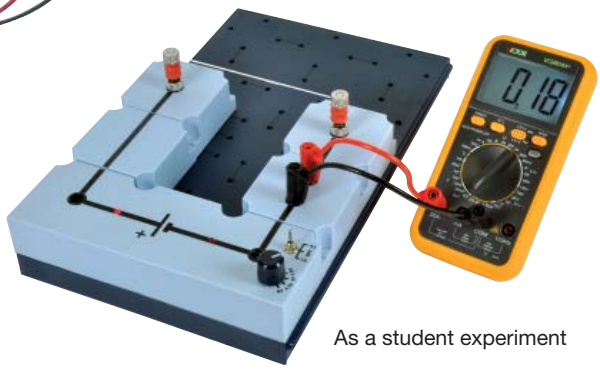
"Ohm's law"

You will need:

1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 5 – Devices (Order-No. 87285)
1 analogue instrument, magnetic (Order-No. 92528)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)



As a magnetic board set-up

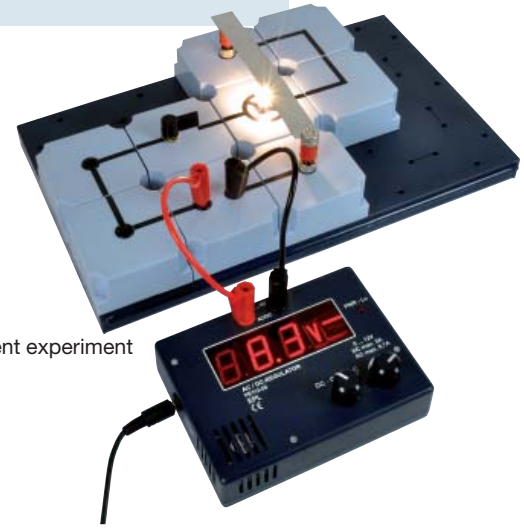


As a student experiment

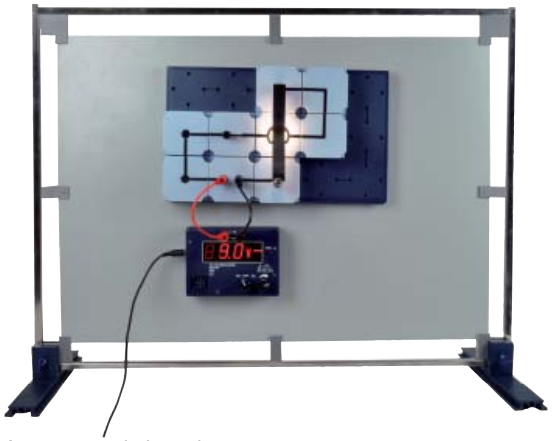
"Bimetal thermostat"

You will need:

1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 5 – Devices (Order-No. 87285)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)



As a student experiment



As a magnetic board set-up

Electromagnetism

Experiment topics:

Magnetic effect of the electrical current
- Magnetic field of a current-carrying coil
- Interaction between an electromagnet and permanent magnet
- Magnetic force of a current-carrying coil
- Coil with and without ferrite core
- Magnetic force and current strength
- A bar magnet switches an electric circuit

Applying electromagnetism
- Relay with normally open and normally closed contact
- Electric bell
- AC buzzer
- Magnetic fuse

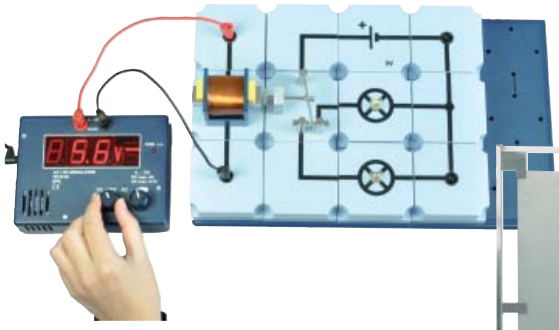
Electromagnetic induction
- Induction voltage in a conductor loop
- Induction voltage in a conductor swing
- Induction
- Induction voltage in a coil
- What induction voltage depends on
- Induction voltage and iron yoke
- Energy transmission by induction

Self-induction
- Coil under DC voltage
- Braking effect through self-induction
- Switch-off peaks through self-induction
- Voltage delay during switch-on
- Coil under AC voltage

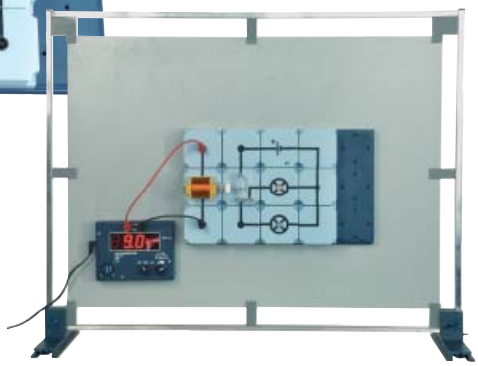
Transformer
- How a transformer works
- Voltage ratio on an unloaded and loaded transformer
- Transformer 1:1 dependency on the iron yoke
- Primary current strength on an unloaded and loaded transformer
- Transformation of current strength

„Relay with normally open and normally closed contact“

You will need:
1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 3 – Special modules (Order-No. 87283)
1 Box 5 – Devices (Order-No. 87285)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)



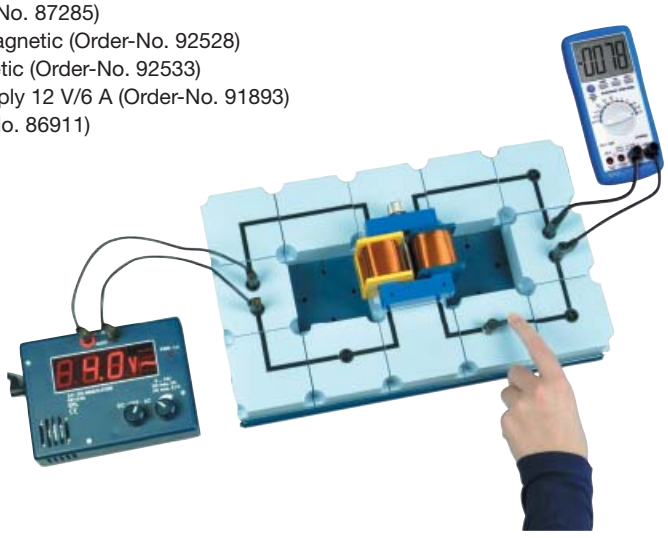
As a student experiment



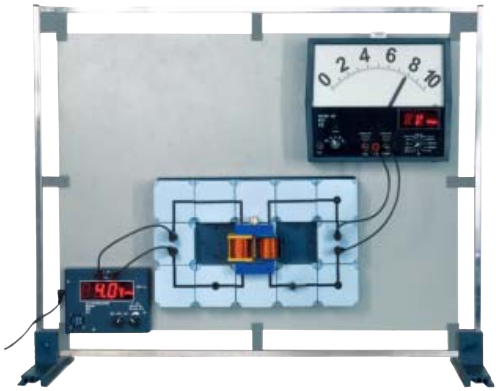
As a magnetic board set-up

„Voltage ratio on the unloaded transformer“

You will need:
1 basic plug-in board (Orde-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 3 – Special modules (Order-No. 87283)
1 Box 5 – Devices (Order-No. 87285)
1 analogue instrument, magnetic (Order-No. 92528)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)



As a student experiment



As a magnetic board set-up

Motor – Generator

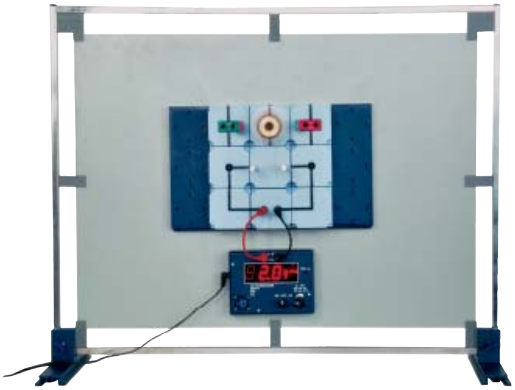
Versuchsthemen:

Elektromotor
- Prinzip des Elektromotors
- Wirkungsweise des Kommutators
- Elektromotor mit Zweipolrotor
- Hauptschlussmotor
- Nebenschlussmotor

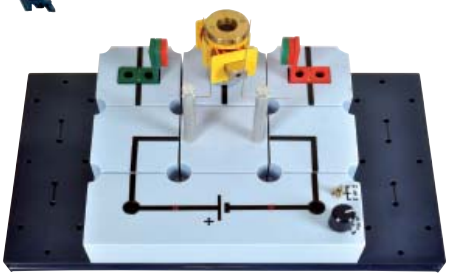
Elektromagnetische Induktion
- Elektromagnetische Induktion – Periodische Magnetfeldänderung
- Wechselwirkung zwischen rotierendem Magnet und rotierender Spule
- Generator – Arbeit und Leistung
- Innenpolgenerator
- Außenpolgenerator
- Gleichstromgenerator
- Gleichstromgenerator bei Belastung

Arbeit und Leistung
- Leistung eines Elektromotors
- Elektrische Arbeit
- Wärmeäquivalent
- Mechanische Arbeit und Leistung des elektrischen Stromes
- Leistung von Glühlampen bei Reihenschaltung
- Leistung von Glühlampen bei Parallelschaltung

„Electric motor“

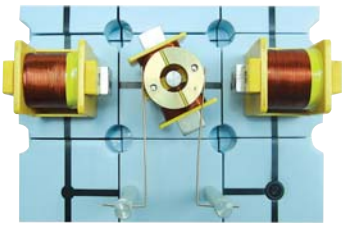


As a magnetic board set-up

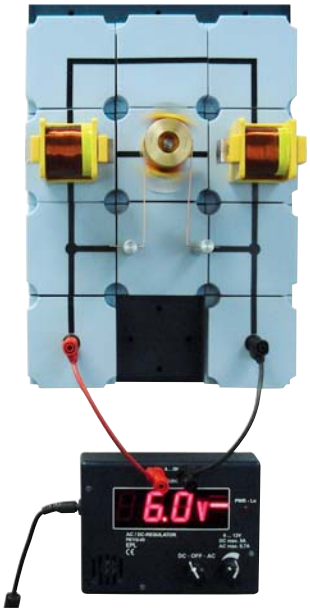


As a student experiment

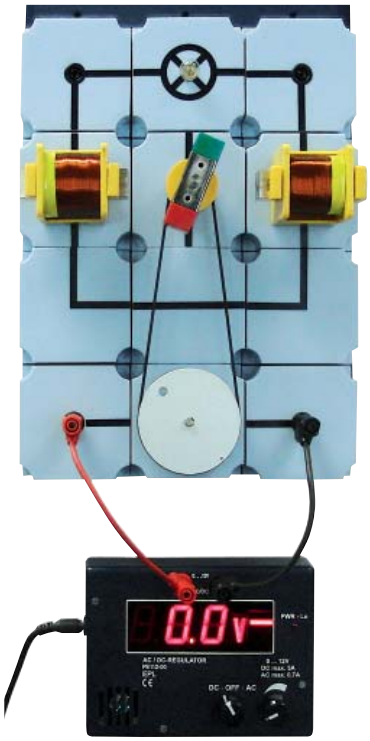
„Shunt motor“



Magnetic board set-up/ student experiment



„Internal pole generator“



Magnetic board set-up/ student experiment

For the individual sample experiments, you will need:
1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 3 – Special modules (Order-No. 87283)
1 Box 5 – Devices (Order-No. 87285)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)

Current-carrying conductor in the magnetic field Lorentz force – Eddy currents

Experiment topics:

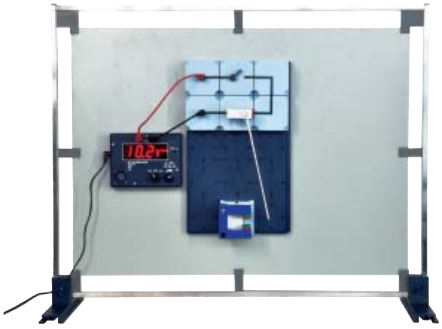
Kinetic energy from electrical energy
- Action of force on a current-carrying conductor in the magnetic field – Conductor swing
- Current-carrying coil in the magnetic field

Electromagnetic induction
- Application of Lenz's Law
- Eddy currents prevent rotary motion
- Braking effect of eddy currents
- Waltenhofen pendulum
- Eddy current brake

„Lorentz force"

You will need:
1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 5 – Devices (Order-No. 87285)
1 plug-in module, battery module, switchable (Order-No. 92568)

As a student experiment



As a magnetic board set-up

„Waltenhofen pendulum"

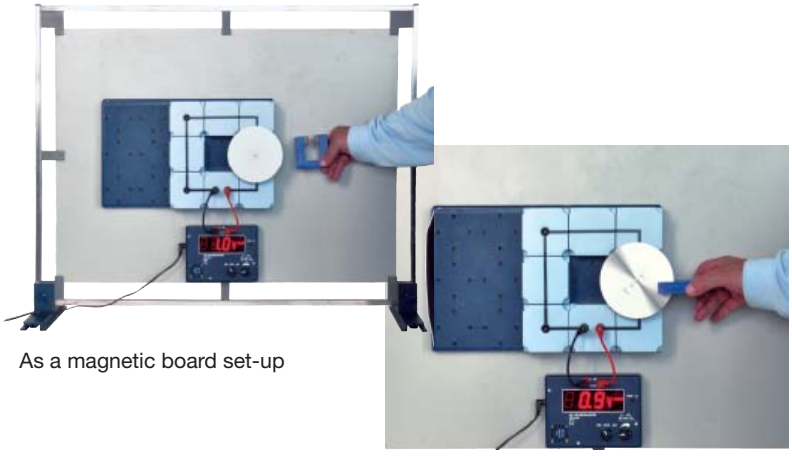
You will need:
1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 5 – Devices (Order-No. 87285)

As a magnetic board set-up

As a student experiment

„Eddy current brake"

You will need:
1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 3 – Special modules (Order-No. 87283)
1 Box 5 – Devices (Order-No. 87285)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)



As a magnetic board set-up

Electronics 1

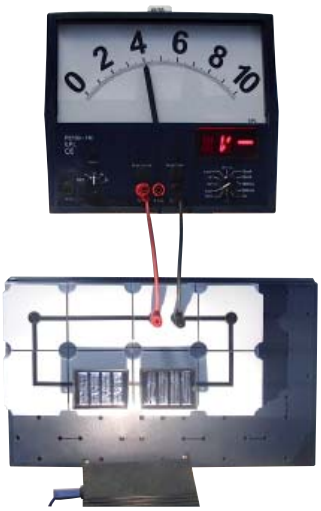
Experiment topics:

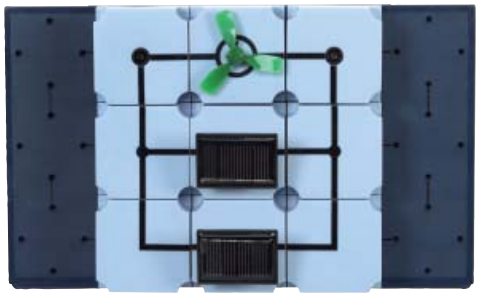
- Semiconductors – 6 experiments
- Diodes – 11 experiments
- Transistors – 15 experiments
- Logic circuits – 3 experiments
- Solar energy – 7 experiments

„Series connection of photovoltaic cells“

You will need:

1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 3 – Special modules (Order-No. 87283)
1 analogue multimeter (Order-No. 92528)
1 connection line (Order-No. 86911)





„Parallel connection of photovoltaic cells“

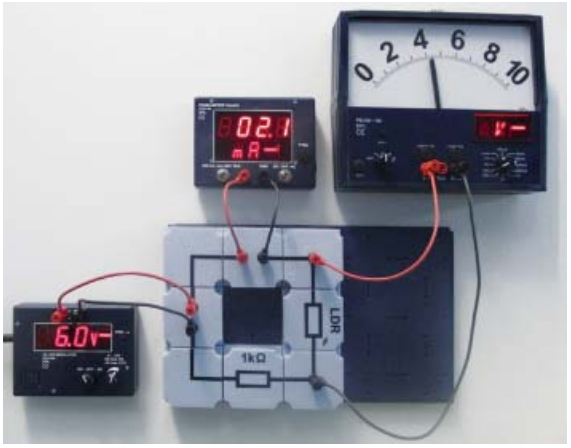
You will need:

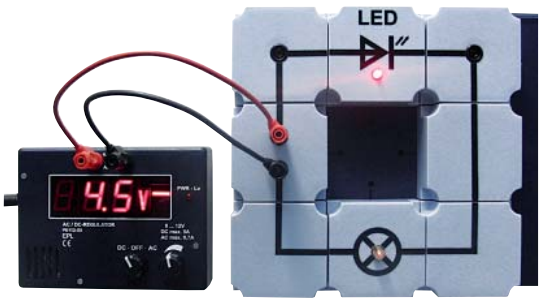
1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 3 – Special modules (Order-No. 87283)

„Semi-conductor: LDR – light dependent resistor“

You will need:

1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 2 – Resistors, electronics (Order-No. 44497)
1 analogue multimeter (Order-No. 92528)
1 panel meter, magnetic (Order-No. 92532)
1 plug-in module, battery module, switchable (Order-No. 92568)





„Forward direction of the LED“

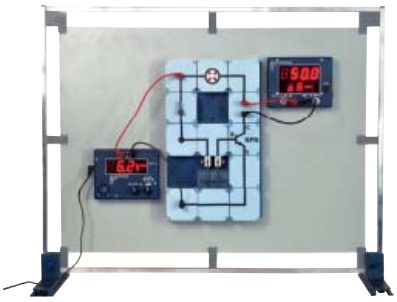
You will need:

1 basic plug-in board, magnetic (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 3 – Electronics (Order-No. 44497)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply (Order-No. 91893)
1 connection line, set (Order-No. 86911)

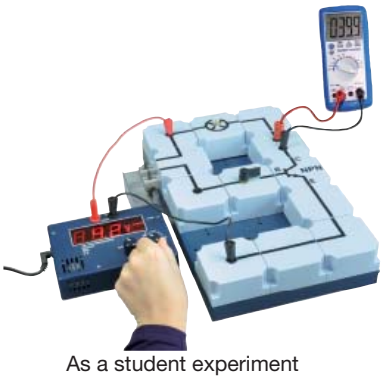
Electronics

„Transistors as amplifiers“

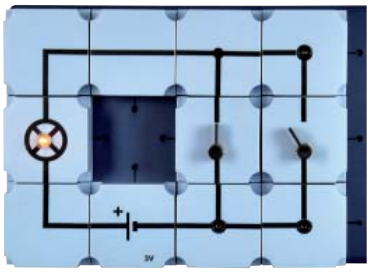
You will need:
1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 2 – Resistors, electronics (Order-No. 44497)
1 Box 3 – Special modules (Order-No. 87283)
1 Box 5 – Devices (Order-No. 87285)
1 panel meter, magnetic (Order-No. 92532)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)



As a magnetic board set-up



As a student experiment



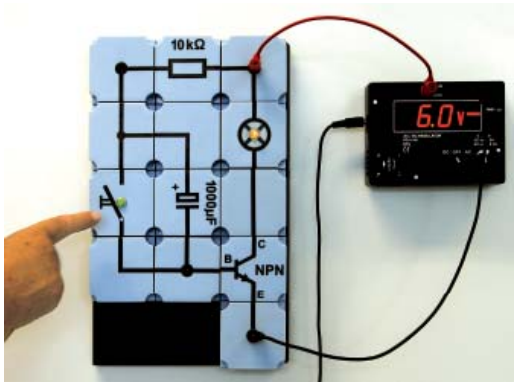
Demonstration and student experiment

„Logical operation ‚OR‘“

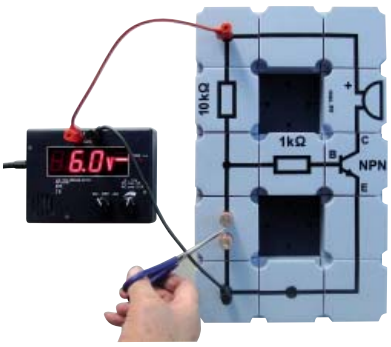
You will need:
1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)

„Time-delay switch (stairwell lighting)“

You will need:
1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 2 – Resistors, electronics (Order-No. 44497)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)



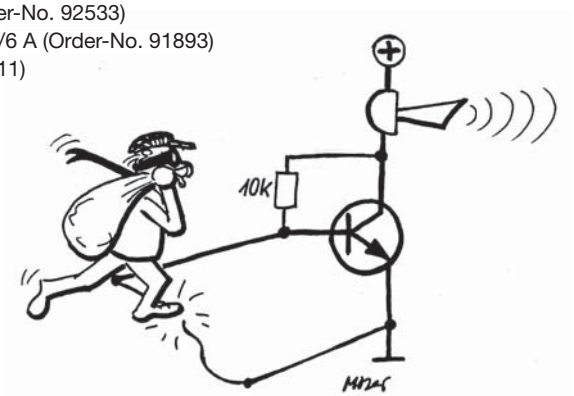
Demonstrations- und Schülerversuch



Demonstration and student experiment

„Burglary protection using a trip wire“

You will need:
1 basic plug-in board (Order-No. 86908)
1 Box 1 – Basic circuits (Order-No. 44496)
1 Box 2 – Resistors, electronics (Order-No. 44497)
1 Box 5 – Devices (Order-No. 87285)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection lines (Order-No. 86911)



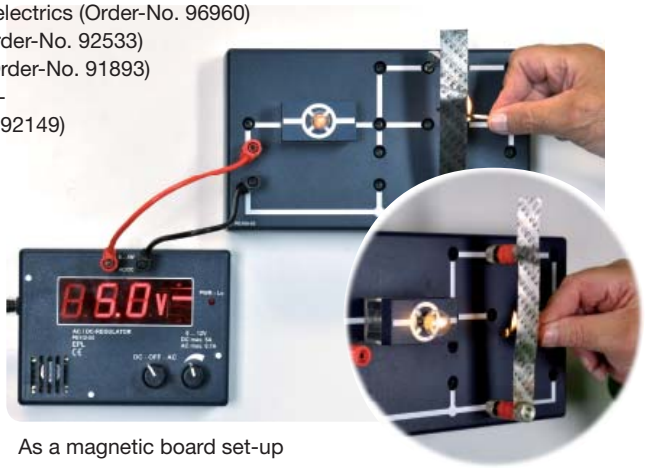
Electrics – Experiments with universal plug-in box

Experiment topics:

- Electrical basic circuits, conductors and non-conductors (15 experiments)
- Electrical resistance (20 experiments)
- Heat effect of electric current (7 experiments)
- Work and power (3 experiments)
- Electrochemistry – Chemical effect of electric current (6 experiments)

„Bimetallic switch“

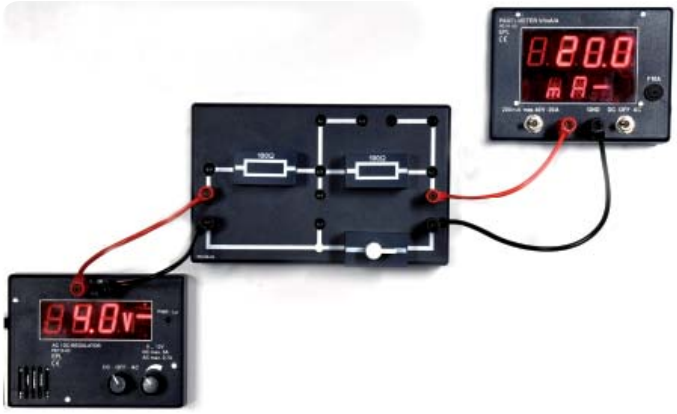
You will need:
Plug-in elements suitcase for electrics (Order-No. 96960)
AC/DC regulator, magnetic (Order-No. 92533)
Fixed voltage power supply (Order-No. 91893)
Plug-in elements for electrics – Additional material (Order-No. 92149)



As a magnetic board set-up

„Series connection of ohmic resistors“

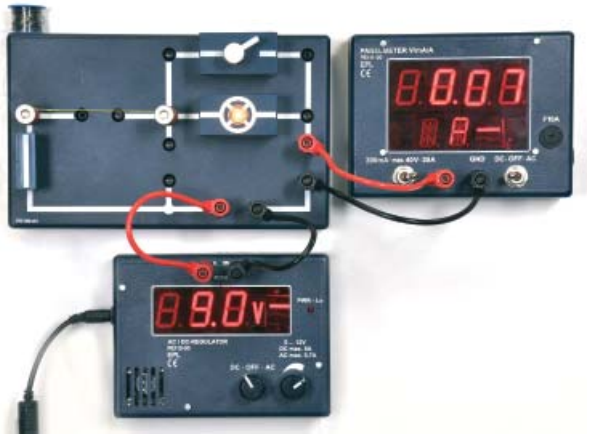
You will need:
1 plug-in elements suitcase for electrics (Order-No. 96960)
1 panel meter, magnetic (Order-No. 92532)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply (Order-No. 91893)
1 plug-in elements for electrics – Additional material (Order-No. 92149)



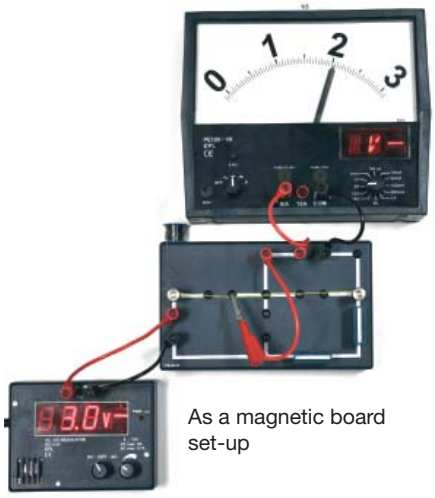
As a magnetic board set-up

„Short circuit and lead fuse“

You will need:
1 plug-in elements suitcase for electrics (Order-No. 92146)
1 panel meter, magnetic (Order-No. 92532)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply (Order-No. 91893)
1 plug-in elements for electrics – Additional material (Order-No. 92149)



As a magnetic board set-up



As a magnetic board set-up

„How a potentiometer works“

You will need:
Plug-in elements suitcase for electrics (Order-No. 96960)
Analogue multimeter (Order-No. 92528)
AC/DC regulator, magnetic (Order-No. 92533)
Fixed voltage power supply (Order-No. 91893)
Plug-in elements for electrics – Additional material (Order-No. 92149)

Electronics
Experiments with universal plug-in box and transistor box

Experiment topics:

- Semiconductors (6 experiments)
- Photovoltaic cells (7 experiments)
- Diodes (9 experiments)
- Transistors (12 experiments)
- Capacitors (11 experiments)
- Logic circuits (3 experiments)

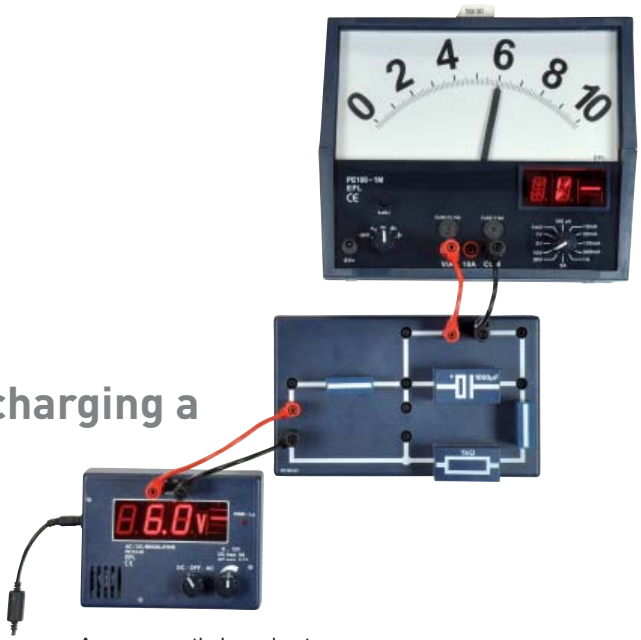
„NTC resistor“

As a magnetic board set-up

„LDR resistor“

As a magnetic board set-up

„Charging and discharging a capacitor“



As a magnetic board set-up

For the individual sample experiments, you will need:

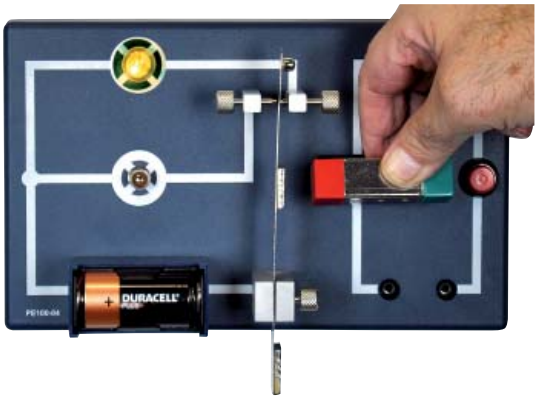
1 universal plug-in box (Order-No. 92527)
1 plug-in elements suitcase for electrics (Order-No. 96960)
1 plug-in elements for electronics (Order-No. 92147)
1 panel meter, magnetic (Order-No. 92532)
1 analogue multimeter (Order-No. 92528)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)

Electromagnetism
Experiments with relay box and bell box

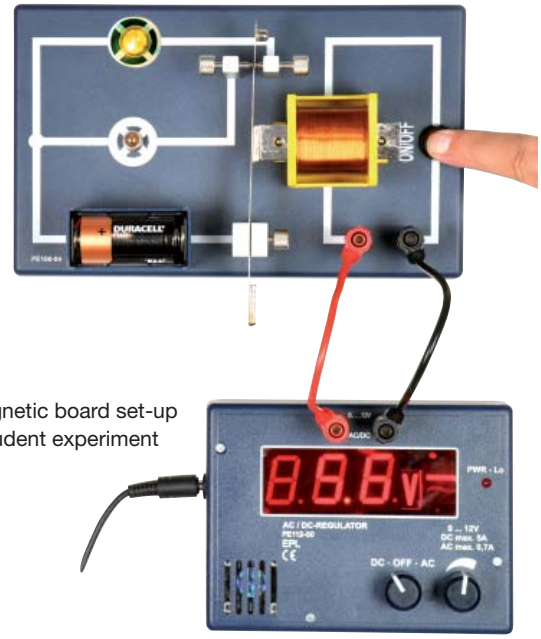
Experiment topics:

- A bar magnet switches an electric circuit
- Electromagnetic relay with normally open and normally closed contact
- Electric bell
- AC buzzer

„Bar magnet switches an electric circuit“



as magnetic board set-up and student experiment



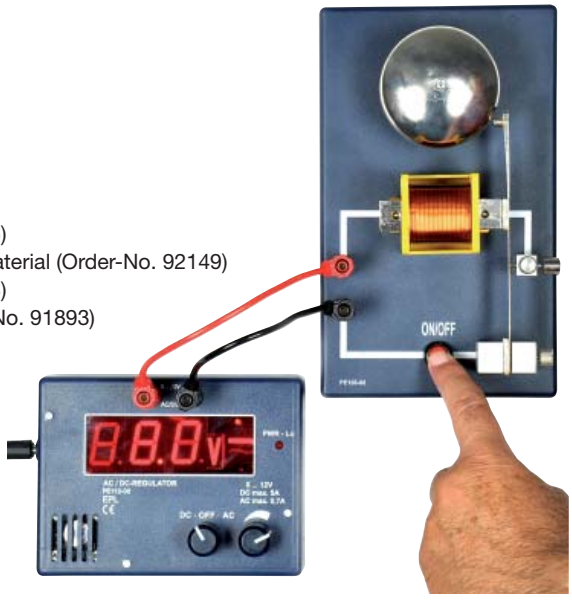
as magnetic board set-up and student experiment

„Electromagnetic relay“

For the individual sample experiments, you will need:
1 relay box (Order-No. 92150)
1 plug-in elements suitcase for electrics (Order-No. 96960)
1 electromagnetism suitcase (Order-No. 96965)
1 plug-in elements for electrics – Additional material (Order-No. 92149)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)

„Electric bell“

You will need:
1 bell box (Order-No. 92152)
1 electromagnetism suitcase (Order-No. 96965)
1 plug-in elements for electrics – Additional material (Order-No. 92149)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)



as magnetic board set-up and student experiment

Moving coil – Motor – Generator
Experiments with motor box

Experiment topics:

- Current-carrying coil in a magnetic field – moving coil

Electric motor

- How a commutator works
- Electric motor with dual pole rotor
- Series motor
- Shunt motor

Generator

- Electromagnetic induction – Periodic change in magnetic field
- Interaction between rotating magnet and rotating coil
- Internal pole generator
- External pole generator
- DC generator
- DC generator under load

Eddy currents

- Eddy current brake

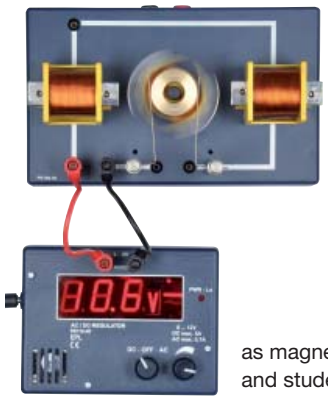
„Moving coil“

as magnetic board set-up
and student experiment

„Electric motor“

as magnetic board set-up
and student experiment

„Series motor“



as magnetic board set-up
and student experiment

„Internal pole generator“

as magnetic board set-up
and student experiment

„Eddy current brake“

as magnetic board set-up
and student experiment

For the individual sample experiments, you will need:
1 motor box (Order-No. 92151)
1 electromagnetism device set (Order-No. 96965)
1 plug-in elements suitcase for electrics (Order-No. 96960)
1 plug-in elements for electrics – Additional material (Order-No. 92149)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)

Electromagnetic induction – Transformer
Experiments with transformer box

» Experiment topics:

- Magnetic effect of electric current:
- Magnetic field of a current-carrying coil
- Magnetic force of a current-carrying coil
- Coil with and without ferrite core
- Magnetic force and current strength

Electromagnetic induction:

- Induction voltage in a conductor loop
- Induction
- Creation of induction voltage in a coil
- What induction voltage depends on
- Induction voltage and iron yoke
- Energy transmission by induction

Self-induction:

- Coil under DC voltage
- Switch-off peaks through self-induction
- Voltage delay during switch-on
- Coil under AC voltage

Transformer:

- How a transformer works
- Voltage ratio on an unloaded transformer
- Voltage ratio on an unloaded and loaded transformer
- Transformer 1:1
- Primary current on an unloaded and loaded transformer
- Transformation of current strength

„Magnetic force of a current-loaded coil“

You will need:

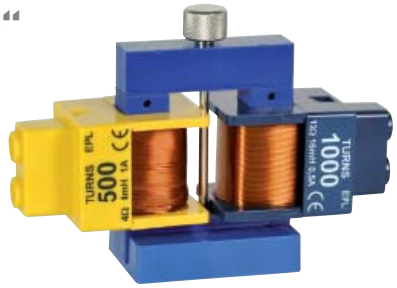
1 transformer box (Order-No. 92154)
1 electromagnetism suitcase (Order-No. 96965)
1 iron nails in plastic box (Order-No. 89999)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)

as magnetic board set-up
and student experiment

„Set-up – Transformer“

You will need:

1 electromagnetism suitcase (Order-No. 96965)



„Creation of induction voltage in a coil“

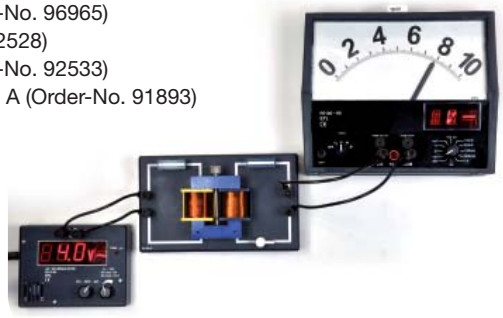
You will need:

1 electromagnetism suitcase (Order-No. 96965)

„Voltage ratio on an unloaded transformer“

You will need:

1 transformer box (Order-No. 92154)
1 electromagnetism suitcase (Order-No. 96965)
1 analogue multimeter (Order-No. 92528)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)



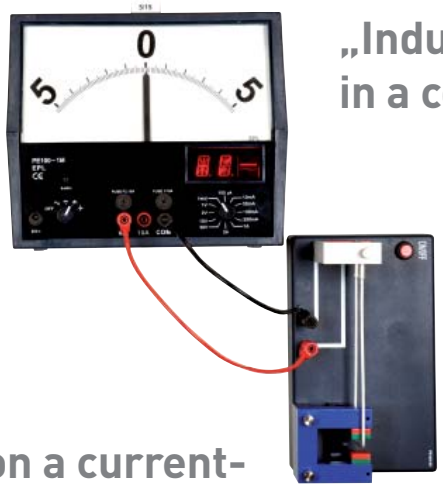
As a magnetic board set-up

As a student experiment

Lorentz force – Lenz's Law – Waltenhofen pendulum
Experiments with the contact box

Experiment topics:

- Action of force on a current-carrying conductor in a magnetic field – conductor swing
- Action of force on a current-carrying conductor in a magnetic field – Lorentz force
- Induction voltage in a conductor swing
- Lenz's Law
- Application of Lenz's Law
- Waltenhofen pendulum



„Induction voltage in a conductor loop"

As a magnetic board set-up

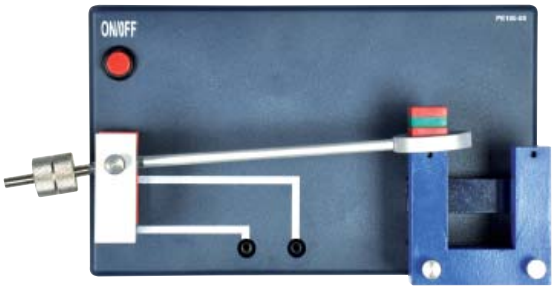
„Action of force on a current-carrying conductor in a magnetic field – conductor swing"

As a student experiment

„Waltenhofen pendulum"

as magnetic board set-up or student experiment

„Lenz's Law"



as magnetic board set-up or student experiment

„Application of Lenz's Law"

as magnetic board set-up or student experiment

For the individual sample experiments, you will need:
1 device set for the contact box (Order-No. 92161)
1 electromagnetism device set (Order-No. 92529)
1 analogue multimeter (Order-No. 92528)
1 AC/DC regulator, magnetic (Order-No. 92533)
1 fixed voltage power supply 12 V/6 A (Order-No. 91893)
1 connection line (Order-No. 86911)

Case Electrics plug-in elements

Electrics plug-in elements case with supplementary electronics plug-in elements and accessory material set

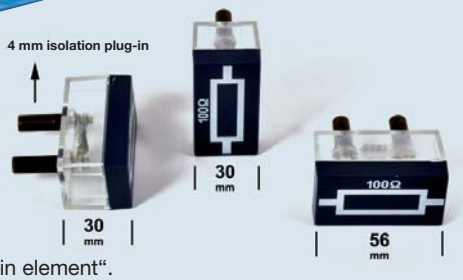


Illustration of a „plug-in element“.
Built-in components are clearly visible, all plug elements with insulated 4 mm plug pins (STEL = plug-in element)

Experiment topics on electrics:

- **„Electrical resistance“ (20 experiments)**
- **„Heat effect of electric current“ (7 experiments)**
- **„Work and power“ (4 experiments)**
- **„Chemical effect of electric current“ (6 experiments)**

Experiment topics on electronics:

- **Semiconductors (6 experiments)**
- **Photovoltaic cells (7 experiments)**
- **Diodes (9 experiments)**
- **Transistors (12 experiments)**
- **Capacitors (11 experiments)**
- **Logic circuits (3 experiments)**

For sample experiments, see **pages 119-124**

31 devices in sturdy, high-quality plastic case

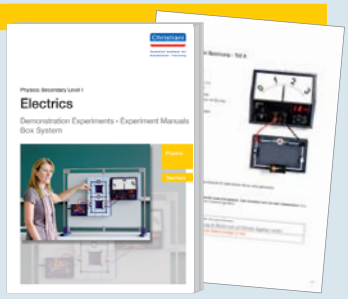
Case Electrics plug-in elements (Order No. 96960) consisting of:

2 plug-in E10 lamp socket
2 plug-in ON/OFF switch
2 plug-in battery holder (‚C‘)
2 plug-in resistor, 100 Ω
1 plug-in resistor, 500 Ω
1 plug-in resistor, 1 k Ω
1 plug-in resistor, 10 k Ω
1 plug-in potentiometer, 10 k Ω
2 plug-in connection plug with socket
2 plug-in connection plug
2 clamping plug, set
1 electrolysis tank with separation screen
2 bracket with hole
2 bracket with slot
1 conductor and non-conductor, set
1 bimetallic strip
1 set of electrodes
2 crocodile clip with plug pin
1 crocodile clip, bare
1 high-quality plastic case with device-shaped foam insert, dimensions: 53 x 40 x 12.5 cm

Instruction manual:

Only available in Sets of 6:
Order-No. 97923

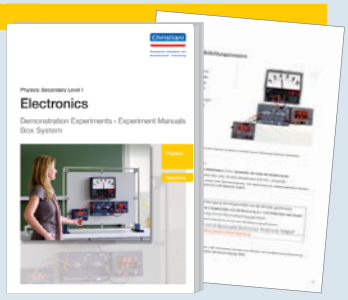
Incl. solutions



Instruction manual:

Only available in Sets of 6:
Order-No. 97924

Incl. solutions



Article	Order-No.
Case Electrics plug-in elements, with supplementary plug-in elements for electronics and accessories	**98442**
Case Electrics plug-in elements, without supplementary plug-in elements for electronics and accessories	**96960**
Supplementary plug-in elements for electronics	**92147**
Accessories for plug-in elements	**92149**

For asseccories, see **page 127**

Plug-in elements system for students

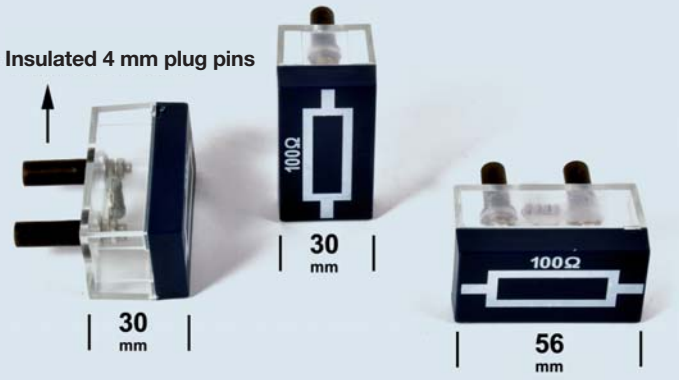


Illustration of a „plug-in element“.
Built-in components are clearly visible, all plug-in elements with insulated 4 mm plug pins.

Clear: with proper switching paths and signs

Our unique plug-in element system with the corresponding boxes results in an extremely clear way to conduct experiments in the field of electrics and electronics. Both the individual plug-in elements and the individual boxes are printed with well visible switching paths and signs. Thus, the students learn directly and intuitively the right circuit diagrams and can always reflect them correctly. By default location for the plug-in elements, it makes it easy for the students to realize the corresponding circuits. You can concentrate fully on assembly the physical fundamentals.

Innumerable: combinations with our boxes

With the help of different boxes and the numerous plug-in elements diverse experiments can be realized: from basic simple circuits to complex electronic circuits. The instruction manuals (sold separately) include comprehensive and didactically build on each other instructions for the individual experiments.

Magnetic: as demonstration experiment

The additionally available magnetic base allows for using the box system and the plug-in elements as demonstration experiments on a magnetic board. By using the same system in demonstrations on the blackboard and student experiments the students can follow the links much easier.

„Measurement of the current upstream of a consumer“

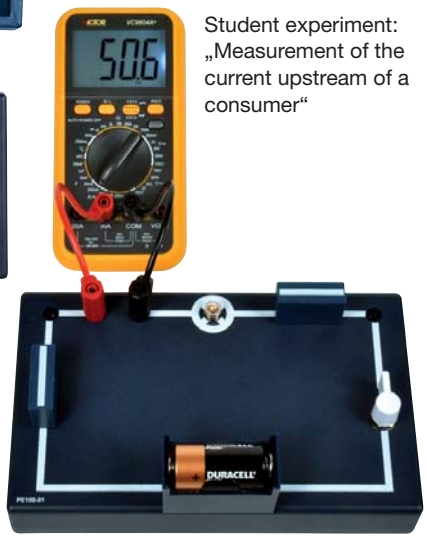
„LDR resistor“

Experimental set-up

„Basic electric circuit“

„Conductors and non-conductors among solids“

Magnetic board set-up:
„Measurement of the current upstream of a consumer“



Student experiment:
„Measurement of the current upstream of a consumer“

Basic electric circuit – Device set

Consisting of:

(Contained in plug-in elements box for electrics (Order No. 92146))

- 1 battery holder for housing a 1.5 V ‚C‘ battery cell
- 2-4 mm insulated plug pins
- 3 connection plug
- 1 conductor and non-conductor, set
- 2 crocodile clip with plug pin
- 2 E10 light bulb 1.5 V/50 mA

Order-No. 92156

Electric circuit box

Permanently built-in E10 lamp socket and ON-OFF switch

Order-No. 92096

Base plate with magnets

To replace the base plate of 40-92096 electric circuit board to be used for magnetic board set-up

Order-No. 92138

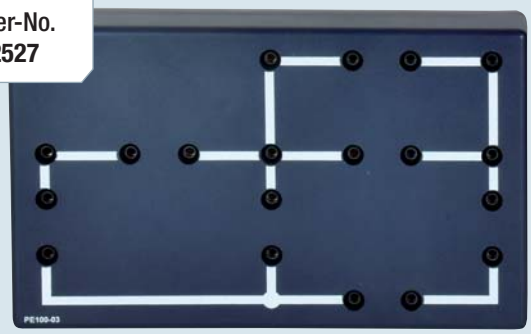
Required accessory

Universal plug-in box

Plug-in box for all basic experiments as well as some experiments from the field of electromagnetism and electronics. 19 built-in touch-safe sockets, combined with clearly visible current paths thanks to high-contrast, white screen printing.

Dimensions: 232 x 142 x 45 mm

Order-No. 92527



Transistor box

For carrying out all electronics experiments with the NPN transistor and the electrics experiments with the 470 Ω potentiometer.

21 built-in touch-safe sockets, combined with clearly visible current paths thanks to high-contrast, white screen printing

Dimensions: 232 x 142 x 45 mm

Order-No. 92148

Supplementary plug-in elements for electronics

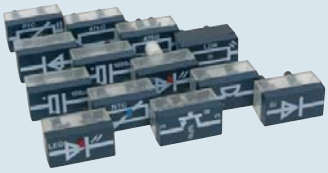
13 plug-in elements to supplement device set for plug-in elements for electrics. Storage in plug-in elements box (order no. 40-92146)

For carrying out:

6 experiments: Semiconductors
9 experiments: Diodes
13 experiments: Transistors
11 experiments: Capacitors
3 experiments: Logic circuits

Set of devices consisting of:

1 STEL PTC Widerstand
1 STEL NTC Widerstand
1 STEL LDR Widerstand
2 STEL LED rot
1 STEL Si-Diode
1 STEL Z-Diode
1 STEL Kondensator 100 µF
1 STEL Kondensator 1000 µF
1 STEL Transistor NPN, Basis links
1 STEL Summer
1 STEL Widerstand 47 kΩ
1 STEL Potentiometer 470 Ω

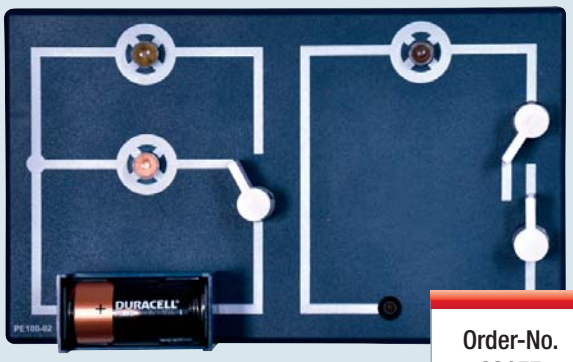


Order No.
92147

Switch box

Representation of a „toggle switch“ and a „selector switch“
Permanently built-in: 3 x E10 lamp sockets, 3 x selector switches

Dimensions: 232 x 142 x 45 mm



Order-No. 92155

Plug-in elements for electrics accessories set

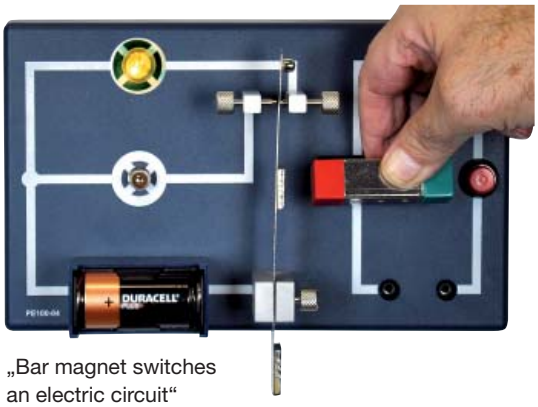
Accessories consisting of:

1 x safety wire, D = 0.1 mm, roll, red
1 x resistance wire, D = 0.2 mm, roll, blue
1 x copper wire, D = 0.2 mm, roll, black
2 x E10 light bulb, 1.5 V/50 mA
2 x E10 light bulb, 6 V/50 mA
1 x E10 light bulb, 6 V/0.5 A
1 x E10 light bulb, 6 V/2.5 A
Connection lines, red/black
Set of 8 lines, 4 x 4 mm plug,
4 x safety plug

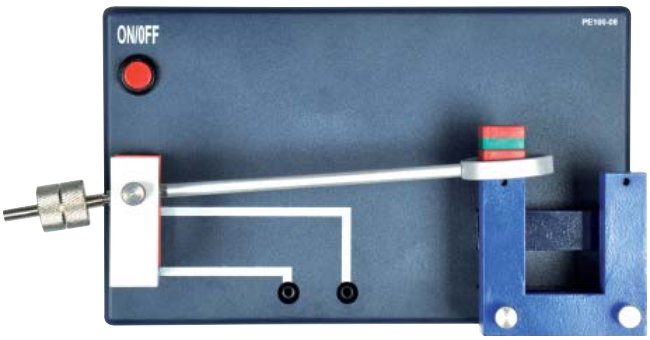
Storage in plug-in elements box for electrics

Order-No. 92149

Experimental set-up



„Bar magnet switches an electric circuit“



„Lenz‘s Law“

Case Electromagnetism

Device set and set-up parts in sturdy, high-quality plastic case with 34 devices

2 coil with 500 windings
1 coil with 1000 windings
1 U-core, laminated, with yoke and clamping screw
1 E10 lamp socket with plug, blue
1 bar magnet, neodymium, 60 x 18 x 18 mm
1 clapper
1 gong
4 flat plug
1 set-up plate for U-core
1 rotor coil
1 ferrite core for rotor
1 commutator
1 brush holder, pair
1 wire brush, pair
1 pointer
1 E10 lamp socket, yellow, for rotor coil
1 magnet holder, pair
2 block magnet, neodymium, 18 x 18 x 10 mm
1 contact plate for bar magnet
1 screw, long, black head
1 screw, short, bare head
1 plate with hook
1 connector with hook
1 plug-in E10 lamp socket
1 plug-in ON/OFF switch
2 connector
1 high-quality plastic case with device-shaped foam insert, dimensions: 45 x 33 x 11 cm

Experiment topics:

- **Magnetic effect of electric current**
- **Relay, electric bell, buzzer**
- **Electric motor**
- **Generator**
- **Electromagnetic induction**
- **Eddy currents**

For sample experiments, **see pages 121-124**

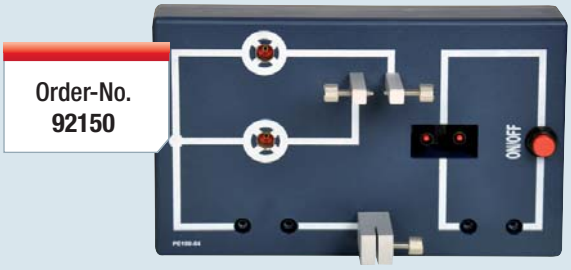
Required accessory

Relay box

For the simple and quick set-up of a complete electromagnetic relay.

Permanently built-in: 2 E10 lamp sockets, 1 button, 1 holder for clapper and 2 adjustable contact screws, 4 touch-safe sockets and one recess with 2 insulated plug pins for inserting a coil

Dimensions: 232 x 142 x 45 mm



Motor box

For the simple and quick set-up of electric motors and generators. In the box, there is a built-in electric motor which is used for motor experiments as a bearing unit with fitted flywheel. For generator experiments, the „bearing unit“ can be supplied with voltage via two external safety sockets fitted at the side.
2 recesses, each with 2 insulated plug pins, for accommodating the magnet holders or coils.
Clearly visible switching paths thanks to high-contrast, white screen printing

Dimensions: 232 x 142 x 55 mm

Bell box

For the simple and quick set-up of an electric bell.

Permanently built-in: 1 holder for clapper and 1 contact screw, 1 button, 1 recess with 2 insulated plug pins for inserting a coil

Dimensions: 232 x 142 x 45 mm

Transformer box

For building up a transformer

6 built-in, touch-safe 4 mm sockets, 2 recesses, each with 2 insulated plug pins, for accommodating coils, 1 permanently built-in , ON/OFF switch, clearly visible switching paths

Dimensions: 232 x 142 x 45 mm

Supplement to device set with contact box

For experiments on the Lorentz force, Lenz‘s Law, eddy currents and Waltenhofen pendulum

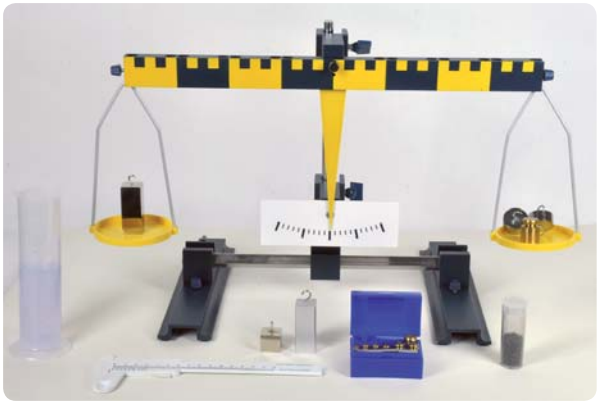
Consisting of:

1 x contact box
1 x taring weight on plug
1 x additional weight
1 x distributor bridge
1 x conductor loop on plug
2 x bearing pin
1 x Lenz ring on rod
1 x Waltenhofen plate
1 x eddy current disc with lip
1 x eddy current ring
2 x rod with plug

Experimental set-up

„Archimedes‘ principle“

„Overflow tank“



„Determination of the density of solids with built-up scales“

Case Mechanics 1

Numerous basic mechanics experiments can be carried out using the Mechanics 1 case. The wide range of experiments on lever rules, hydromechanics, thermodynamics (in connection with the thermodynamics accessories) and much more offer a perfect entry into the diverse and exciting world of mechanics.

Experiment manual on the following topics:

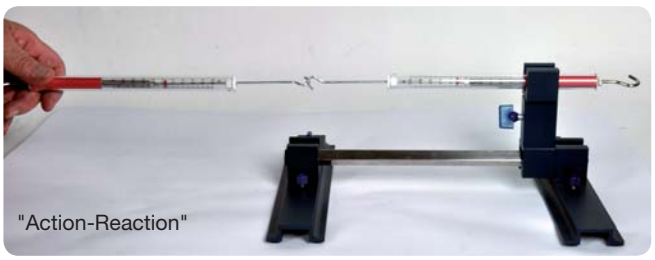
- **Measuring physical parameters**
- **Forces**
- **Basic machines**
- **Hydrostatics**
- **Changing the aggregate state**

Consisting of:

1 H-base, L = 300 mm
1 bosshead, short
2 bosshead, long
2 bosshead with bearing pin
1 round bosshead
2 half bosshead on shaft
1 round rod, L = 150 mm
1 round rod, L = 250 mm
2 round rod, L = 450 mm
1 sliding calliper, plastic
1 tape, 3 m
1 lever rod, L = 40 cm
2 scale pan with hoop
1 pointer for lever rod
1 scale on shaft
1 weight set, 50 g
1 taring pellets
6 hook weight, 50 g
1 coil spring, 3 N/m
1 coil spring, 20 N/m
2 dynamometer, 2 N, transparent
1 leaf spring
2 acrylic glass tube, L = 300 mm, ID = 7 mm
2 stopper with hole
1 acrylic glass tube, L = 120 mm, ID = 12 mm
1 roller, plastic, D = 75 mm
1 roller, loose, with hook, plastic, D = 75 mm
1 cord for rolls, 5 m
1 overflow tank
1 Archimedes‘ hollow cube
1 submersible shape, iron
1 submersible shape, aluminium
1 submersible shape, iron, small
1 100 ml measuring cylinder, plastic
1 100 ml plastic beaker
1 wax
1 high-quality plastic case with device-shaped foam insert, dimensions: 53 x 40 x 12.5 cm

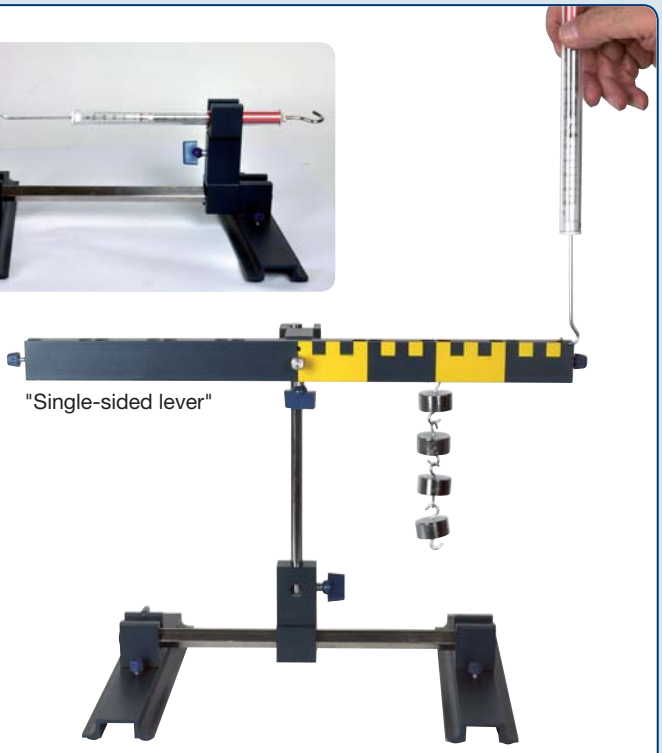
Experimental set-up

"Fixed roller"

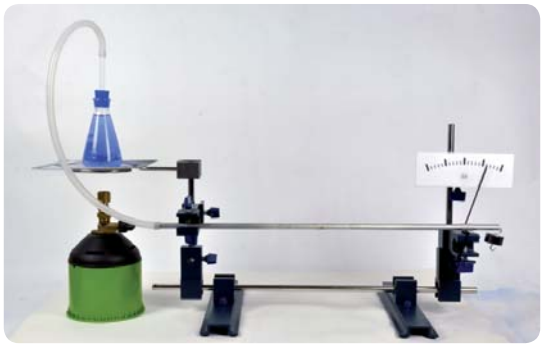


"Action-Reaction"

"Thermal radiation"



"Single-sided lever"



"Linear expansion of solids"

"Heat conduction"

Heat source and accessory set

Order-No. 92180

Consisting of:

1 x cartridge burner
with valve cartridge, 230 g
1 x heat protection net with ceramic
1 x stand ring on bosshead, set
1 x 100 ml Erlenmeyer flask, SB 19
1 x silicon stopper with glass tube
1 x 250 ml beaker, tall
1 x silicone hose, L = 1 m, D-I = 7 mm

Joule calorimeter

For determining the thermal capacity of solid and liquid substances.
2 aluminium beakers with insulation trim, insert with heating coil and stirrer,
2 x 4 mm sockets for determining the electrical equivalent of heat

Capacity: 150/500 ml

Order-No. 92181

Consumables – Thermodynamics

1 x scented paraffin, 50 ml
1 x sodium thiosulphate, 200 g
1 x colouring powder, tin

Order-No. 92182

Experimental set-up

„Measuring hydrostatic pressure“

„Wheel and axle“

„Pulley block with 4 rolls“

„Inclined plane“

Case Mechanics 2

Designed to supplement the Mechanics 1 case, this case extends the range of experiments to the areas of simple machines, lever rules, pulley blocks and other aspects of hydrostatic systems. This means an even deeper understanding of the connections within classical mechanics and the interactions of machines can be achieved.

Experiment manual on the following topics:

- **Inclined plane**
- **Resolution of a force on an inclined plane**
- **Determination of the coefficient of friction**
- **Wheel and axle**
- **Gear transmission**
- **Pulley block with 4 rollers**
- **Work on an inclined plane**
- **Measuring hydrostatic pressure**
- **Capillary action**

Supplement to Case Mechanics 1 (Order-No. 97830)

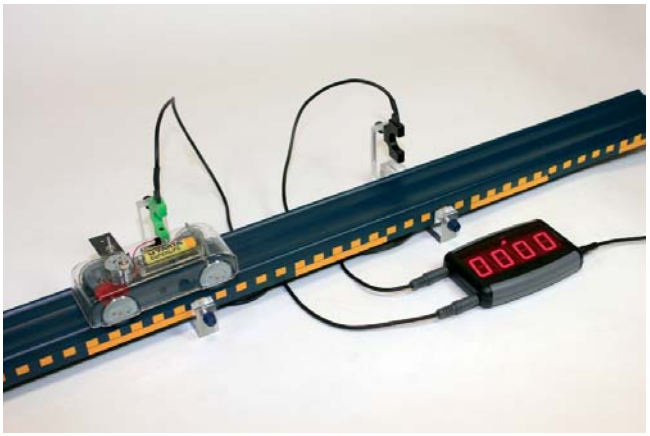
Consisting of:
1 inclined plane, L = 40 cm
1 cart
1 slotted weight, 20 g
2 slotted weight, 50 g
1 dynamometer holder
1 gearwheel, set of 2 pcs
1 step wheel
2 pulley for pulley block
1 submersible probe, set of 4 pcs
1 U-tube pressure gauge
1 high-quality plastic case with device-shaped foam insert, dimensions: 45 x 33 x 11 cm

More information:
www.christiani-international.com/97831

Suitable to that:

Gyro-Set
For demonstrating the properties of a free gyro and its precession movement.
Gyro diameter: 50 mm

Experimental set-up



„Uniform movement“

„Uniformly accelerated movement“

Case Mechanics 3

This case provides the basis for successful experiments on linear motion and for investigation of various conservation of momentum experiments. The high-quality individual parts are clearly organised, so that the students can perform a number of experiments effectively.

Experiment manual on the following topics:

- **Uniform movement**
- **Average and instantaneous speed**
- **Uniformly accelerated movement**
- **Basic equation of the dynamics and „Newton“ definition**
- **Impact experiments - Momentum set**
- **Energy and conservation of momentum**
- **Dynamic determination of mass**

Consisting of:
1 trackway, 1 m
1 deflection roller
1 start buffer stop
2 cart
1 hooked weight, 2 g
1 hooked weight, 5 g
1 cord, roll
2 slotted weight, 20 g
4 slotted weight, 50 g
1 mobile battery unit with solar top piece
2 buffer spring
1 impulse spring
1 high-quality plastic case with device-shaped foam insert, dimensions: 45 x 33 x 11 cm

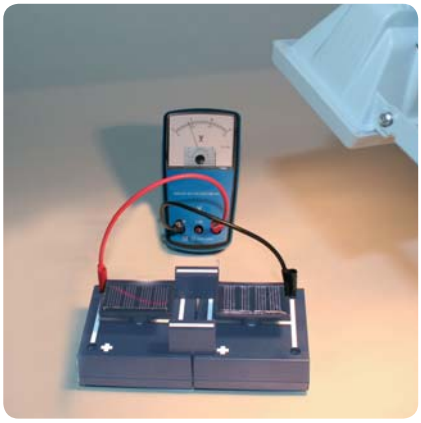
More information:
www.christiani-international.com/96961

(Image shows case mechanics 3 with additonal timer set)

May we recommend:
Timer set
Consisting of:
1 timer, magnetic
2 fork light barriers, pair with
2 special connecting cables
Matching plug-in power supply

Article	Order No.
Case Mechanics 3 (including timer set)	98443
Case Mechanics 3 (without timer set)	96961

Experimental set-up

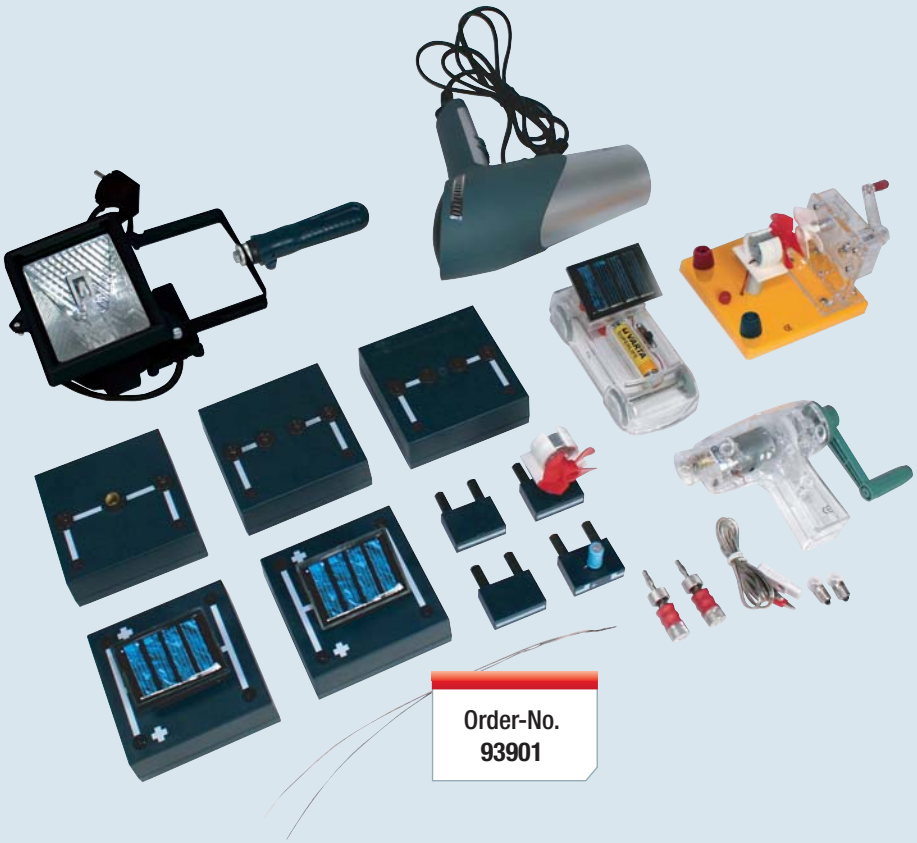


"Series connection of photovoltaic cells"

"Wind generator"

"Capacitor"

Energy conversion – Device set



Experiment manual on the following topics:

- **Solar energy**
- **Series/parallel connection of photovoltaic cells**
- **Wind power**
- **Energy storage device**
- **Discharging an energy storage device**
- **Converting mechanical energy to electrical energy**

Consisting of:

1 E10 lamp socket box, magnetic
2 box for plug-in elements
2 photovoltaic cell box
2 connector
1 motor plug-in element with windmill spinner
1 5 F capacitor plug-in element
1 mobile battery unit with solar top piece
1 wind generator
1 generator with manual drive, including special connection cable with 4 mm plugs and 2 light bulbs, 6 V.
1 clamping plug, set
1 thermocouple, simple
1 halogen spot light, 150 W on shaft with detachable handle
1 hand-held blower, 2000 W, 2 fan levels

The high-quality individual parts can be combined in a variety of ways, so that students can perform increasingly complex experiments independently and can understand the principles and different aspects of renewable energy technologies. The clearly structured modules enable clear experiment set-up.

Experimental set-up

„Magdeburg hemispheres“

„Expansion of air balloon in a vacuum“

„Buoyancy in air“

Vacuum physics – Device set

Experiment manual on the following topics:

- **Effects of air pressure**
- **Magdeburg hemispheres**
- **Expansion of air balloon in a vacuum**
- **Buoyancy in air**
- **Bubble burster**
- **Sound propagation in a vacuum**
- **Drop tube**

Consisting of:

1 vacuum hand pump with pressure gauge
1 container, small
1 air pump plate with rubber plate, small
1 bubble burster
1 buoyancy balance, small
1 Magdeburg hemispheres, rubber
1 air balloons, set
1 drop tube, L = 500 mm
1 buzzer
1 vacuum hose (not shown)

For information on these items, **see pages 56-57**

Order-No.
93866

Experimental set-up

Model experiment: „Faraday cage“

„Separation of charge by electrostatic induction“

Case Electrostatics

Consisting of:

2 electroscope, basic
1 aluminium rod, L = 150 mm
1 polystyrene balls in plastic box
1 plastic rod with drilled hole, L = 150 mm
1 ebonite rod, L = 300 mm
1 acrylic glass rod, L = 300 mm
1 plug pin with needle
1 Faraday beaker
1 aluminium strip
1 acrylic glass rod with drilled hole
1 hare skin
1 polyethylene cloth
2 pedestal
1 soffit lamp
1 high-quality plastic case with device-shaped foam insert, dimensions: 45 x 33 x 11 cm

Experiment manual on the following topics:

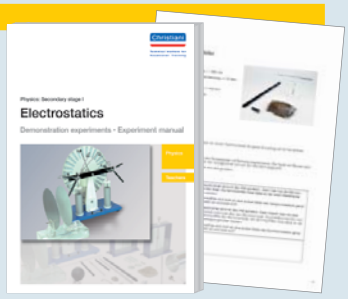
Contact electricity
- **Rubbed ebonite rod and acrylic glass rod**
- **Discharging via a neon lamp**
- **Plus/minus sign of an electric charge**
- **Conductors – Non-conductors**

Electrostatic interaction
- **Action of force between charged objects**
- **Model experiment on electroscope**
- **Electroscope**

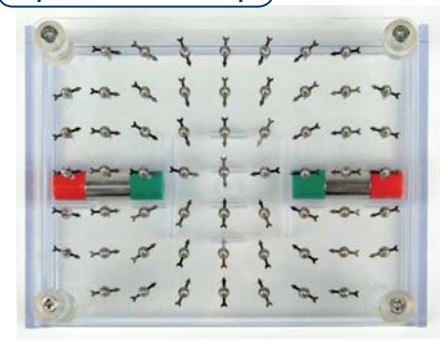
Electrostatic induction – Polarisation
- **Electroscope in an electric field**
- **Charge equalisation**
- **Separation of charge by electrostatic induction and neutralisation**
- **Faraday cage**
- **Insulators in an electric field – Polarisation**

Instruction manual:

Only available in Sets of 6:
Order-No. 97930



Experimental set-up



Magnetic bearing plate with magnetic needle model "Magnetic field between two identical magnetic poles"
Also suitable for overhead projection.

"Model of a compass with bar magnet"

"Floating magnet"

"Earth's magnetic field" (scanning the magnetic field with magnetic field probe)

Case Magnetostatics

Consisting of:

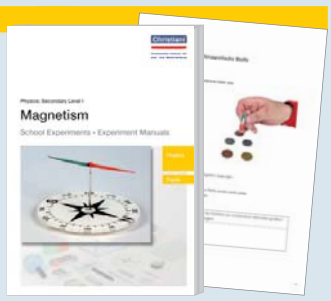
1 globe for earth‘s magnetism
1 stand tube for floating magnet
1 small bar magnets, pair
1 magnetic and non-magnetic material
1 cord, roll
1 connector with hook
2 plug pin with needle
1 magnetic field probe
1 threaded pins, set of 3 pcs
2 pedestal
1 iron nails in holder
1 wind rose
1 paper clips, set of 6 pcs
1 pocket compass
2 magnet holder on plug
1 high-quality plastic case with device-shaped foam insert, dimensions: 45 x 33 x 11 cm

For experiments on the following topics, amongst others:

- **The magnet as a compass**
- **Magnetic and non-magnetic materials**
- **Floating magnet**
- **Action of force from magnets**
- **Interaction between magnet and iron**
- **Floating paper clip**
- **Magnetic induction**
- **Repulsion through electrostatic induction**
- **Elementary magnets**
- **Magnetic field between two magnetic poles**
- **The magnetic field**
- **Field pattern of a bar magnet**
- **Earth‘s magnetic field**

Instruction manual:

Only available in Sets of 6:
Order-No. 97929



Recommended accessories:

Magnetic needle model
59 fully rotating magnetic needles between two acrylic glass plates for placing on:
Magnetic bearing plate
for non-slip mounting of the small bar magnets (Order-No. 86889) (without magnets)

Article	Order-No.
Case incl. magnetic needle model and bearing plate	**98441**
Case without magnetic needle model and bearing plate	**97833**
Magnetic needle model	**86887**
Magnetic bearing plate	**86888**

Case Optics 1 – Geometric optics

For student experiments involving optics, we offer three cases designed for geometric optics, lens equation and wave optics. All devices are neatly organised in plastic cases with device-shaped foam insert. The components in the three cases can be advantageously combined to enable a wide range of different experiments. The high-quality foam insert also protects fragile components and enables clear organisation.

Device set in sturdy, high-quality plastic case with device-shaped foam insert

Consisting of:

1 halogen light, 12 V/20 W
1 model body, biconvex
1 model body, biconcave
2 model body, planar-convex
1 model body, planar-concave
1 model body, triangular
1 model body, trapezoidal
1 model body, semi-circular
1 circular cell
2 mirror, planar
1 mirror, convex/concave
1 optical disc
1 earth-moon model
1 high-quality plastic case with device-shaped foam insert, dimensions: 45 x 33 x 11 cm

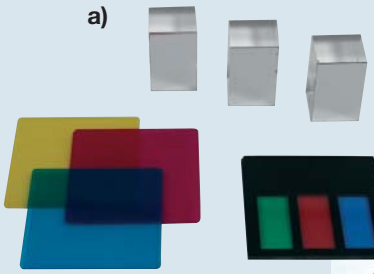
Experiment topics:

- **Light propagation: Shadow**
- **Mirrors**
- **Refraction**
- **Lenses**
- **Eye**
- **Mixture of colour**

Instruction manual:

Only available in Sets of 6:
Order-No. 97931

a)



b)

Recommended accessories:

a) Mixture of colour, additive/subtractive

Supplement – kept in Optics 1 box

Consisting of:

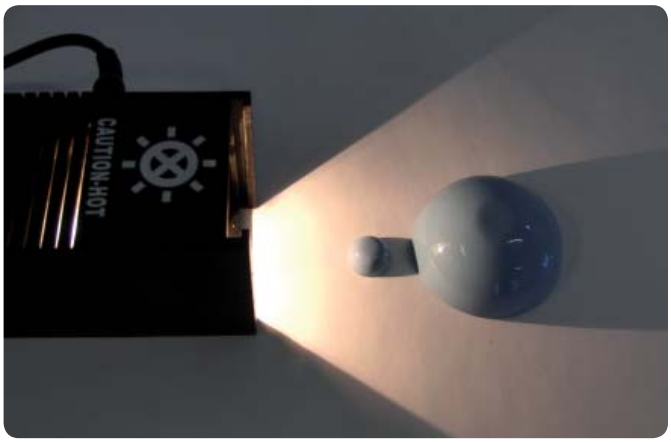
1 x three-colour filter, additive
1 x deflection mirror, set of three pcs
1 x colour filter, subtractive, set of 3 pcs
Kept in Optics 1 box (order no. 92165)

b) Plug-in power supply 12 V/2 A

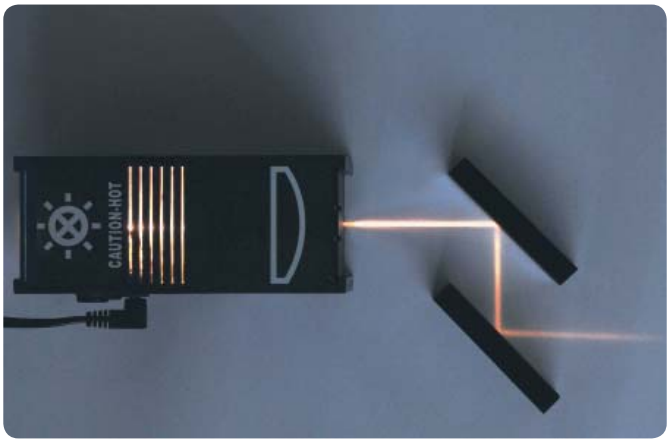
Also with two 4 mm safety sockets for connecting connection lines to 4 mm plugs

Article	Order-No.
Case incl. mixture of colour additive/subtractive	98444
Case without mixture of colour additive/subtractive	96962
a) Mixture of colour	92166
b) Plug-in power supply	91889

Experimental set-up



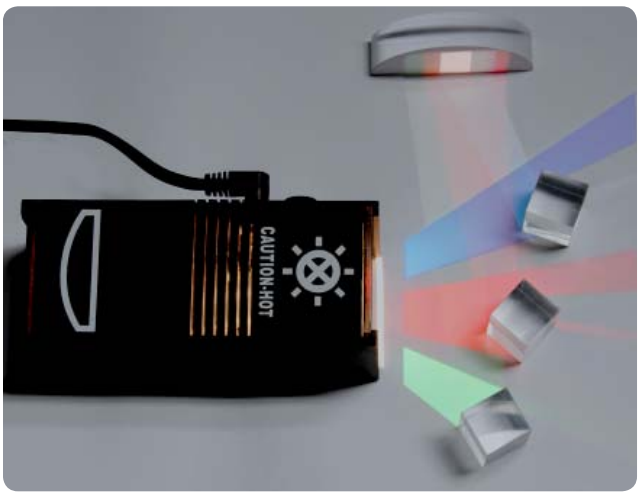
"Solar eclipse"



"Periscope"

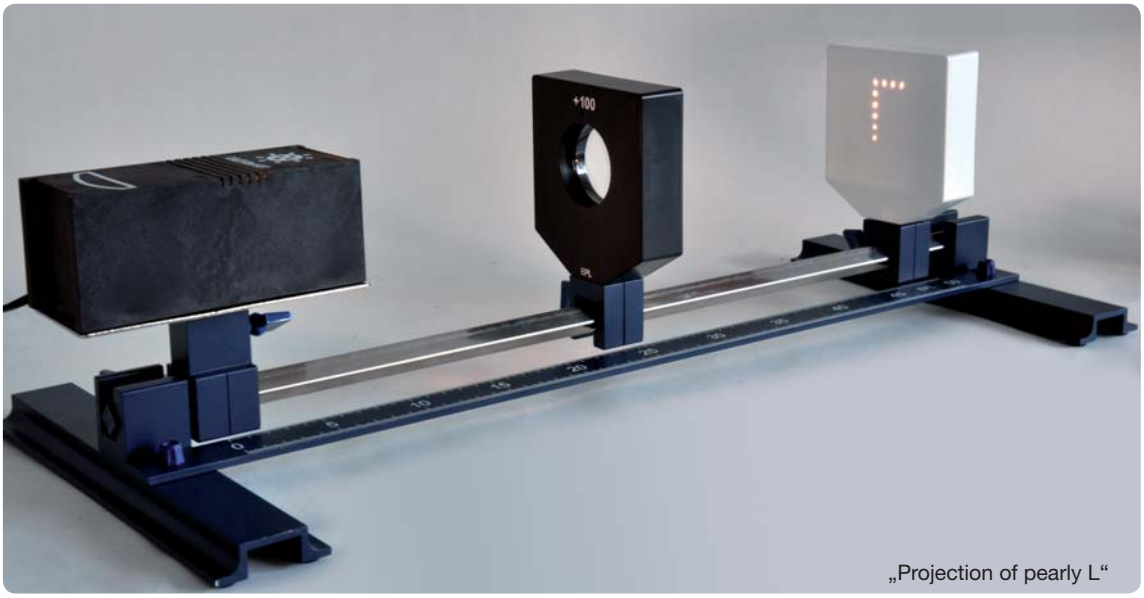
"Refraction during transition from air into water" (use of the circular cell)

"Inverting prism"



"Additive and subtractive mixture of colour"

Experimental set-up



„Projection of pearly L“

Case Optics 2 – Optical bench

Device set in sturdy, high-quality plastic case with device-shaped foam insert

Consisting of:

2 support feet
1 support rod, square, L = 600 mm
1 measuring rod, metal, L = 600 mm
6 slider for lens and screen holder
2 bosshead, short
1 table for halogen light
1 lens holder + 50 mm
1 lens holder + 100 mm
1 lens holder + 300 mm
1 lens holder – 100 mm
1 convex and concave mirror in holder
1 screen holder
2 slide tray, attachable
1 screen, white
1 screen, transparent
1 table on shaft
1 prism, optical flint
1 pearly L
1 perforated screens, set
1 slide
1 high-quality plastic case with device-shaped foam insert, dimensions: 53 x 40 x 12.5 cm

Order-No.
96963

! If the student experiment box Optics 1(Order-No. 92165) is not available, the following is additionally required:Halogen light 12 V/20 W (Order-No. 92733) Recommended power supply: Plug-in power supply 12 V/2 A (Order No. 91889)

Experiment manual on the following topics:

- **Light propagation**
- **Mirrors**
- **Lenses**
- **Optical instruments**
- **Eye**
- **Colour dispersion**

Instruction manual:

Only available in Sets of 6:
Order-No. 97932

Experimental set-up

„Polarisation with filters“

Case Optics 3 – Wave optics

With the additional material contained in this case compared with the Optics 2 case, students can investigate the wave properties of light. The handy and clearly organised storage offered by the foam insert means the many experiments can be carried out quickly and with great precision. The corresponding experiment manuals are grouped together in one volume.

Supplement to Case Optics 2 (Order-No. 96963)

Device set in sturdy, high-quality plastic case with device-shaped foam insert

Consisting of:

1 iris diaphragm, attachable
2 holder for polarisation filter
2 polarisation filter 50 x 50 mm, glass
1 holder for photoelastic object
1 photoelastic object
1 cuvette
1 quartz crystal, slide
1 diffraction grating 300 lines, slide
1 circular diaphragm, slide
1 disc with diametrical holes, slide
1 slit, slide
1 colour filters, set of 3 pcs
1 support rod, square, 1000 mm
1 high-quality plastic case with device-shaped foam insert, dimensions: 53 x 40 x 12.5 cm

Instruction manual:

Only available in Sets of 6:
Order-No. 97932

Experiment manual on the following topics:

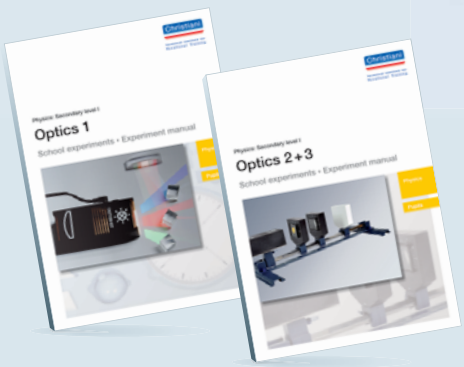
- **Spherical aberration**
- **Chromatic aberration**
- **Diffraction at a grid**
- **Determination of wavelength**
- **Polarisation with filters**
- **Rotation of the polarisation plane by the placement of solids**
- **Saccharimeter model**
- **Photoelastic object**

The new case set Optics

Student experiment devices for classic experiments

For student experiments involving optics, we offer three cases designed for geometric optics, lens equation and wave optics. All devices are neatly organised in plastic cases with device-shaped foam inserts. The components in the three cases can be advantageously combined to enable a wide range of different experiments. The high-quality foam insert also protects fragile components and enables clear organisation.

Set incl. one instruction manual for Optics 1 and Optics 2+3



Article	Order-No.
Case set Optics 1-3	44578

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Technical Institute for
Vocational Training

SINCE 1931

The new case set Mechanics

For mechanics experiments for students, we offer cases designed for basic mechanics, simple machines and linear movement. These enable students to learn about the nature of solid and liquid materials and can investigate Newton's laws. All devices are neatly organised in plastic cases with device-shaped foam inserts. The corresponding experiment manuals for mechanics make it easier to prepare for and perform the experiments.

Article	Order No.
Case set Mechanics 1-3 with timer set	44582
Case set Mechanics 1-3 without timer set	44580

Dr.-Ing. Paul Christiani GmbH & Co. KG
Hermann-Hesse-Weg 2
78464 Konstanz, Germany
Phone: +49 7531 5801-210
Fax: +49 7531 5801-85
E-Mail: info@christiani-tvet.com
www.christiani-tvet.com