general catalogue

DEMONSTRATION EQUIPMENT

PHYSICS




Only action ...

... results in satisfaction

P1409

International

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People who experiment buy NTL

'NTL' is an abbreviation for 'Naturwissenschaftliche-Technische-Lehrmittel' (Scientific and Technical Teaching Aids). Our group of companies develops, manufactures and markets high-quality experiment equipment and systems for physics. The first NTL item was designed in 1985. This was the yellow 'plug-in block' on which the logo is based as well.

Our range for physics currently includes around 2300 items, some 1900 (82.6%) of which are internal developments that arose in collaboration with experienced teachers.

The overall aim is to explain scientific laws and phenomena to all the students of this world by means of experiments.

This goal can be achieved through:

- actual experiments – no simulations!
- that are easy to set up
- are fast to run
- and produce guaranteed results.

Books and teachers can impart theoretical knowledge.
Combining this with NTL experiment equipment makes it easier to apply this knowledge in practice.

Help awaken this interest through the joy of experimenting

simple – fast – safe

The NTL - family

Fruhmann GmbH, NTL Manufacturer und Wholesaler

NTL main offices at the Technology Centre, Neutal, Austria

Development, marketing and global sales of NTL products

The spacious, well-equipped exhibition and training room at the Technology Centre

Training room for continued teacher education and seminars in experimenting

Participation in international trade fairs in cooperation with our distribution partners

Didaktik

Plant complying with EU quality levels,
about 170 employees, ISO certified

Manufactures approx. 1300 NTL – products

High-performance laser

High-precision metalworking machinery is the basis for a high-quality finished product

NTL – Logistik

Production control, quality assurance, logistics facility and shipping department for the entire NTL line

After quality control checks, NTL equipment is...

...commissioned and arranged

...vacuum-sealed and packed in plastic containers (NTL storage boxes)

...and despatched in sturdy boxes

Please visit our homepage for additional detailed information

www.ntl.at

There you will find:

- Images of equipment from various angles
- Technical manuals for power supply units and measuring equipment
- Layout plans for sets of equipment
- Experiment configurator
- New developments
- Forthcoming trade shows

table of contents

DS600-00 Lab table "NTL", mobile

Table for laboratory and transport purposes;
thanks to the large casters high door sills are no problem;
thick plastic edges serve as protection against impacts.
Plastic plates in green; 2 shelves for power supplies, measuring devices or small parts; bottom plate for experiment kits or larger items.
Rack made of aluminium and silver-coated; shelves and bottom plate are easily removable, and can be taken apart and rearranged.
Working space: 750 x 500 mm
Shelf space: 750 x 244 mm and 750 x 123 mm
Bottom plate: 750 x 385 mm
Total height: 900 mm
4 pulleys (D = 75 mm), two can be locked in position

DS600-10 Assembly for lab table "NTL"

This assembly enables more elevated experimenting;
this makes experiments easier for students to view.
Heavy power supplies or measuring devices can be placed beneath the experiment.
Two fixed NTL special rail profiles allow fast, safe assembly of rail stand materials; can be placed on the instructor's table or portably on the lab table and fixed in position with screw clamps; cable holders are attached to the side.
Working space: 750 x 375 mm
Total height: 305 mm (excluding rail profile)

DS500-1G Screw clamp demo, jaw width approx. 50 mm

For mounting NTL rail bases (special aluminium profile) or assembly for lab table DS600-10 on tables with a maximum thickness of 48 mm; aluminium profile with steel pin, robust screw with M10 thread and pressure plate.

- Magnetic set-up on the mobile lab table
- For all subjects
- Very clearly structured and easily visible – even for seated students
- Very quick to assemble/dismantle

MECHANICS

Experiment: Inclined plane

THERMODYNAMICS

Experiment: Elongation of solids

OPTICS

Experiment: Angles of incidence and refraction in water

One device for everything

ELECTRICITY "inno"

Experiment: Ohm's law – application

ELECTRICITY – plug-in system demo (PIBD)

Experiment: Electromotor with two-pole rotor

RADIOACTIVITY

Experiment: Exposure to Beta radiation (external)

Mobile assembly panel

The easiest way to set up experiments in mechanics, thermodynamics, electricity, electronics and optics

DS101-1G Support base, large

DS600-6G Board holders, pair, magnetic

L = 600 mm

DS103-1P Panel, green / white

One side green, one side white,
dimensions: approx. 90 x 62 cm

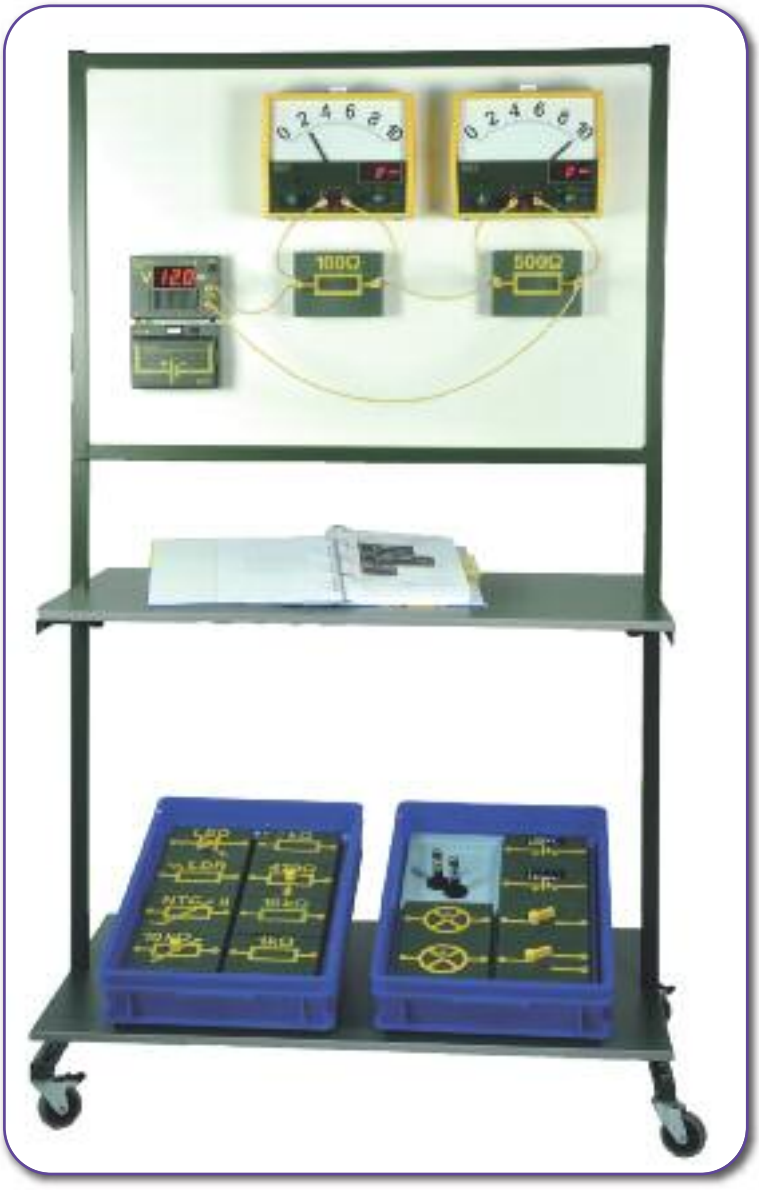
Portrait

Front + Back (Landscape format)

This portable, two-colour experiment board with an integrated workspace makes you mobile.

DS610-1T Experiment board, two colour

Steel rack, green powder-coated;
Metal plate green/white;
Dimensions: 100 x 70 cm;
Height: 193 cm;
4 pulleys, two can be locked in position;
horizontal storage and working plate.
Dimensions: 106 x 65 cm, height: 93 cm



Back

Front

All components such as light bulb sockets, switches, power supplies, measuring instruments etc. may simply be stuck to the board. This is made possible by neodymium magnets with an exceptionally strong magnetic force that **does not weaken.**

Magnetic bases

Rubber-encased metal base with embedded neodymium magnet; for fast assembly of round rods of max. 10 mm in diameter; normal or parallel to a metal panel; rubber jacket protects the table surface from scratches; this also makes the base non-slip; a newly-developed clamp set with a bearing pin enables elements to be fixed onto the plate surface at variable distances; holding force on bearing pin as a point of application; as measured parallel to the table:
Magnetic base D=43 mm: 10-25 N
Magnetic base D=66 mm: 20-70 N
(the holding force is dependent on the strength (thickness) of the metal panel

DS110-43 Magnetic base, D = 43 mm, with tube and pin

DS110-66 Magnetic base, D = 66 mm, with tube and pin

DS110-1M Magnetic base, D = 43 mm, with bosshead

Rubber-encased metal base with embedded neodymium magnet; with clamp for fast assembly of round or square rods and plates; normal or parallel to a metal panel;
D = 43 mm, H = 36 mm

Rail claws

Two rail claws attached to a special NTL rail profile provide a support base or stabilise the track or optical bench;
Fibre glass reinforced plastic with rubber feet;
length = 220 mm

DS112-1E Rail claw, simple

DS112-1G Rail claw, adjustable

With metal cylinders and levelling screws

DS112-1M Rail claw, magnetic

With strong neodymium magnets (D = 22 mm, H = 10 mm)

Rail bases – NTL

Special aluminium profile; silver-coated; creates a support base with two rail claws, or for holding NTL universal rails using clamp saddles; hole on side for optional attachment to tables using the screw clamp demo.

DS102-12 Stand rail base, L = 125 mm

DS102-25 Stand rail base, L = 250 mm

DS102-50 Stand rail base, L = 500 mm

Universal stand rails – NTL

Special aluminium profile; silver-coated;
can be used as a stand rail, rail track, ball track or optical bench;
side screws at ends for connecting two rails or attaching rail bases using a clamp saddle

DS101-75 Stand rail, L = 750 mm

DS101-50 Stand rail, L = 500 mm

P7210-5C Stand rail, 300 mm, NTL - SE

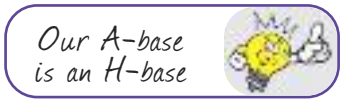
P5310-1S Rail bond SE, universal

For connecting NTL rail profiles (stand rail, track, optical bench);
NTL special aluminium profile, anodised, L = 80 mm

DS100-1R Round base with stand tube

DS090-1K Claw base simple, L = 200 mm

Simple support base for quick set-ups;
special aluminium profile (NTL rail base profile);
silver coated, with mounted rail claws;
drill hole with screw for mounting rods of max. D = 10 mm;
surface dimensions: 265 x 220 mm



DS090-1M Claw base, magnetic, L = 200 mm

Simple magnetic support base for quick set-ups; special aluminium profile (NTL rail base profile), with mounted rail claws including neodymium magnets; drill hole with screw for mounting round support material with a diameter of max. 10 mm; surface dimensions: 265 x 220 mm

DS100-1H Support base, L = 250 mm

Compact H-shaped support base; special aluminium profile, silver-coated, screw-fixed, with 2 levelling screws; rubber-coated legs; drill hole on front for optional attachment to tables using the screw clamp demo;
sliding saddles required for additional assembly;
surface dimensions: 260 x 200 mm

DS101-1G Support base, large

Stable H-shaped universal support base;
special aluminium profile, green powder-coated, screw-fixed, with 2 levelling screws; rubber-coated legs; drill hole on front for optional attachment to tables using the screw clamp demo;
sliding saddles required for additional assembly;
surface dimensions: 500 x 325 mm

DS500-1G Screw clamp demo, jaw width approx. 50 mm

For mounting NTL rail bases (special aluminium profile) or assembly for lab table DS600-10 on tables with a maximum thickness of 48 mm;
aluminium profile with steel pin, robust screw with M10 thread and pressure plate.

DS501-1S Jaw vice with table clamp

For attaching heavy parts such as stand rails, square support rods, panels or screens at any angle;
sturdy metal vice;
table clamp with rubber cushion and metal screw;
metal ball joint with metal set screw;
adjustable metal jaws with rubber cushion.
Table clamp range: 3 - 54 mm
Clamping jaw range: 0 - 54 mm

DS141-1R Sliding saddle with bosshead

For mounting and fixing on rail bases or stand rails;
special aluminium profile, green powder-coated,with boss head clamp;
for a quick set-up of round and square rods and plates

DS103-3G Sliding saddle, H = 34 mm

For mounting and fixing on rail bases or stand rails;
special aluminium profile, green powder-coated, clamp socket with longitudinal bore and screw
for holding rods of max. D = 10 mm

DS103-7G Sliding saddle, H = 70 mm

For mounting and fixing on rail bases or stand rails;
special aluminium profile, green powder-coated, clamp socket with longitudinal and transverse bore and screw for holding rods of max. D = 10 mm

DS504-2K Sliding saddle, height adjustable

To be mounted onto stand rails or stand rail bases;
Special aluminium profile, green powder-coated;
Clamp socket on sliding saddle, for fine height adjustment by as much as 25 mm for equipment mounted on a support with a diameter of 10 mm

DS200-04 Stand tube, H = 40 mm

For extending the height of sliding saddles; round aluminium profile, green powder-coated; with longitudinal and transverse bore for holding rods of max. D = 10 mm

P7230-1M Boss head universal, SE

For mounting round rods of max. D = 10 mm, bearing pins or flat springs; the threaded ends of the screws are rounded, ensuring that the components are held very firmly in place; square aluminium profile, anodised;
dimensions: 65 x 20 x 20 mm (without screws)

DS400-2K Boss head cross-pattern, SE

For mounting round rods of max. D = 15 mm or square rods with a max. s = 12.5 mm;
cross, parallel or T-connection possible;
die-cast aluminium, black coating;
2 large-headed screws, D = 25 mm;
dimensions: 57 x 34 x 34 mm (without screws)

The cheapest

DS400-3K Boss head cross-pattern, demo

For mounting round rods of max. D = 16 mm, or square rods with a max. s = 12 mm, or plates of max. 14 mm;
cross, parallel or T-connection possible;
sturdy screws with rounded threaded ends ensuring that the components are held very firmly in place;
die-cast aluminium; green powder-coated; 2 x M8 wing screws;
dimensions: 68 x 36 x 36 mm (without screws)

P7230-1K Boss head round, SE

For extension and T-connection of round rods with a diameter of 10 mm, as well as as mounting two manometer tubes with a diameter of 8 mm;
the threaded ends of the screws are rounded, ensuring that the components are held very firmly in place;
aluminium profile, anodised;
dimensions: 80 x 20 mm
(without screws)

DS400-1V Extension coupling, squared

For extending round rods of max. D = 18 mm or square rods with a max. s = 12 mm; sturdy screws with rounded threaded ends ensuring that the components are held very firmly in place;
aluminium profile;
green powder-coated;
2 x M8 wing screws;
dimensions: 80 x 35 x 35 mm (without screws)

DS402-2G Boss head on support

For clamping round rods of max. D = 18 mm, or square rods of max. s = 12 mm; sturdy screw with a rounded end ensures that components are held very firmly in place; aluminium profile, green powder-coated with support rod D = 10 mm, L = 40 mm; with M8 wing screw

DS404-1G Plate clamp on support

For clamping plates of max. 10 mm thickness; rubber-coated clamping jaw ensures safe yet surface-protective footing;
aluminium profile, green powder-coated;
with support rod
D = 10 mm, L = 40 mm;
with M8 wing screw and clamping jaw

DS500-1H Holder for plates

For clamping plates of max. 35 mm thickness; rubber-coated clamping jaw ensures safe yet surface-protective footing;
aluminium U-profile; silver-coated;
with support rod
D = 10 mm, L = 40 mm;
with M8 wing screw and clamping jaw

C7002-2A Universal clamp 0 - 80 mm

For mounting material with a maximum diameter of 80 mm;
two adjustable, corklined clamping jaws on support ensure a safe but surface-protecting footing;
die cast clamp jaws, capstan head screw,
on support rod D = 10 mm, L = 100 mm

C7007-1F Clamp, flexible

For mounting pipes, rods or other small components in any position;
flexible metal shaft, one end with 10 x 40 mm support rod, other end has a metal clamp;
holding force of approx. 300 g on an angle;
metal clamp: length = 150 mm, jaw width = 5 - 40 mm;
total shaft length: approx. 530 mm

Rail holders

For mounting stand rails, rail stand material or devices equipped with sliding saddles with a special aluminium profile; sliding saddle with a special aluminium profile;
green powder-coated; with clamping screw

DS103-1S Rail support, parallel, short

DS103-1G Rail support, parallel, H = 150 mm

DS103-1F Rail support, parallel, H = 300 mm

DS103-1W Rail support, normal, short

DS102-2G Clamp saddle

For crosswise connection of stand rails or rail bases with stand rails;
special aluminium profile, green powder-coated;
with clamping screw;
L = 42 mm

DS103-1H Holder for ball track

For mounting and fixing on stand rails or for mounting stand rails for use as ball track;
special aluminium profile, green powder-coated;
with clamping screw;
with support rod:
D = 10 mm, L = 40 mm

DS103-2H Holder for stand rail universal

For mounting and raising stand rails for use as a rail track or optical bench;
special aluminium profile, green powder-coated; with support rod:
D = 10 mm, L = 40 mm

DS400-2R Clamp on saddle

For mounting and fixing on stand rails:
open clamp on the side with a clamping screw for holding round rods of max. D = 18 mm and square rods with a max. s = 12 mm, or plates of max. 15 mm thickness;
special aluminium profile, green powder-coated, with clamping screw and wing screw

Support rod, solid metal, nickel-plated

DS201-00 Support rod, round, L = 1000 mm, D = 12 mm

DS201-75 Support rod, round, L = 750 mm, D = 12 mm

P7240-1G Support rod, round, L = 500 mm, D = 10 mm

P7240-1C Support rod, round, L = 250 mm, D = 10 mm

P7240-1F Support rod, round, L = 150 mm, D = 10 mm

DS201-10 Support rod, round, L = 100 mm, D = 10 mm

P7240-1B Support rod, round, L = 60 mm, D = 10 mm

Square steel tubing, nickel-plated, with end caps

Square rods are very light and cannot be twisted sideways

DS300-00 Support rod, squared, 12 x 12 mm, L = 1000 mm

DS300-75 Support rod, squared, 12 x 12 mm, L =750 mm

DS300-50 Support rod, squared, 12 x 12 mm, L =500 mm

DS300-25 Support rod, squared, 12 x 12 mm, L =250 mm

DS300-15 Support rod, squared, 12 x 12 mm, L =150 mm

P7230-4E Bearing pin

To mount lever rods, pulleys, coil springs, hooks and threads;
steel pin, nickel-plated;
axis: 45 x 3 mm; total length: 55 mm

DS204-2L Bearing pin with clamp insert

For mounting the bearing pin in boss head clamps or rail saddles; this newly developed clamp insert enables elements to be held by the bearing pin at a variable distance from the front side of the boss head clamp;
clamp insert made of fibre-glass reinforced plastic;
with slit and flat section for using a clamping screw;
bearing pin axis: D = 3 mm, L = 45 mm
clamp insert: D = 10 mm, L = 40 mm

DS203-1S Support with hook

Solid steel rod; nickel-plated;
with hook; D = 10 mm,
length: 35 mm

DS202-1R Ring with hook

Aluminium ring with hook for mounting on rods with a diameter of up to 10 mm, one clamping screw

DS204-1S Support with thread, L = 60 mm

DS102-3S C-hook, threaded

P7250-1T3 Support-ring, D = 102 mm

For supporting and fixing wire gauzes or plates;
stainless steel;
end of rod with metal cylinder D = 10 mm, L = 30 mm;
ring-D = 102 mm; length (end of rod - centre of ring): 150 mm

P7250-1T2 Support-ring, D = 62 mm

For supporting or locking beakers or erlenmeyer flasks;
steel nickel-plated;
end of rod with metal cylinder D = 10 mm, L = 30 mm;
ring-D = 62 mm; length (end of rod - centre of ring): 150 mm

P7250-1T1 Support-ring, D = 30 mm

For supporting and locking erlenmeyer flasks;
steel nickel-plated;
end of rod with metal cylinder D = 10 mm, L= 30 mm;
ring-D = 30 mm; length (end of rod - centre of ring): 150 mm

Support rings with support clamp

Open support ring, nickel-plated, permanently mounted on support clamp, one M8 wing screw

DS502-30 Support ring on support clamp, D = 30 mm

DS502-62 Support ring on support clamp, D = 62 mm

DS502-02 Support ring on support clamp, D = 102 mm

Tripods

For supporting wire gauzes
or ceran plates
diameter of ring approx. 125 mm;
steel, painted hammer finish

C7230-1A Tripod, H = 200 mm

C7230-1C Tripod, H = 250 mm

C7235-2B Lab jack small

Stainless steel surface, height may be adjusted using a large knurled-head screw, with plastic legs;
height adjustable
from 80 to max. 260 mm
Surface size: 150 x 150 mm

C7235-2S Lab jack large

Stainless steel surface, with a central rubber pad for a better footing of glassware;
height may be adjusted using a large knurled-head screw, with plastic legs;
height adjustable from
85 to max. 340 mm;
surface size: 250 x 250 mm

C7227-1U Shim blocks, set of 4

Wooden blocks of varying thickness,
approx. 8 to 40 mm,
dimensions: 150 x 150 mm

DS103-1T Table on stand, small

To raise and fix magnetic "inno" measuring devices;
metal plate;
green powder-coated;
rod: D = 10 mm, L = 30 mm;
dimensions: 165 x 125 mm

DS103-2T Table on stand, large

To raise and fix magnetic "inno" power supplies or "inno" measuring devices;
metal plate; green powder-coated; rod: D = 10 mm, L = 30 mm;
dimensions: 260 x 230 mm

P3120-5G Assembly platform, large

To raise and fix magnetic "inno" power supplies or "inno" measuring devices to NTL - aluminium rail-profile;
metal plate L-shaped, on saddle;
green powder-coated;
dimensions: 260 x 230 mm

DS402-3B Pivot bearing on saddle, long

Pivoting clamp socket, mounted on double ball bearings, takes supports with a diameter of up to 10 mm, with transverse hole, includes clamping screw and counterweight, mounted on sliding saddle; can be placed and fixed at stand rails and rail bases; aluminium, green powder-coated; height of pillar: 70 mm

DS402-4B Pivot bearing on saddle, short

Pivoting clamp socket, mounted on double ball bearings, takes supports with a diameter of up to 10 mm, includes clamping screw and counterweight, mounted on sliding saddle; can be placed and fixed at stand rails and rail bases; green powder-coated; height of pillar: 64 mm

DS402-3D Drive pulley

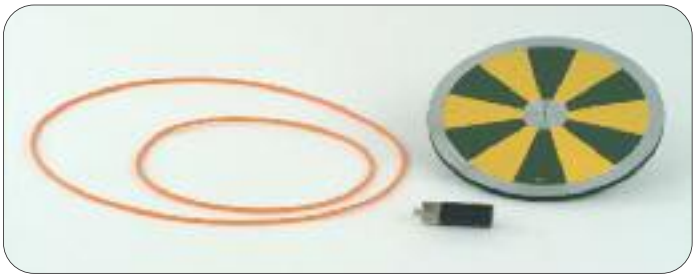
Used with pivot bearings DS402-3B and DS402-4B to assemble a momentum machine powered by hand. Aluminium disc with groove (for cord) mounted on support, D = 10 mm, green powder-coated, printed with circle sectors in yellow, an M6 tapped hole for the hand-crank pin DS402-2N; D = 160 mm, thickness = 6 mm

DS402-2N Crank pin, L = 50 mm

Solid metal pin with M6 thread and plastic roller used as a handle, 15 mm in diameter, length: 50 mm

DS401-1A Drive belts, set of 2

Plastic belts, 3 mm in diameter; Range: approx. 80 cm and 60 cm



DS401-1B Driving cord, loose, 500 cm

Make your own fitted drive belt; driving cord can be cut to the desired length; they can be attached together by heating the ends up with a flame (e.g. lighter), and leaving to cool; L = 500 cm, D = 3 mm

DE451-2K Pivot bearing on support

Pivoting, ball bearing holder on support, D = 10 mm; hole for accommodating round rods with a diameter of up to 10 mm; two wing screws; two holes 19 mm apart for mounting devices having 4 mm plug pins; groove for drive belt

C7447-1F Tray plastic, 2.0 litre

Transparent tray made of impact-resistant plastic (PP); dimensions (top): 210 x 130 x 95 mm

C7447-1B Tray plastic, 2.5 litre

Transparent tray made of acrylic glass; dimensions (top): 260 x 160 x 100 mm

C7447-1A Tray plastic, 6.5 litre

Transparent tray made of impact-resistant plastic (PP); dimensions: 300 x 180 x 150 mm

Span clamps

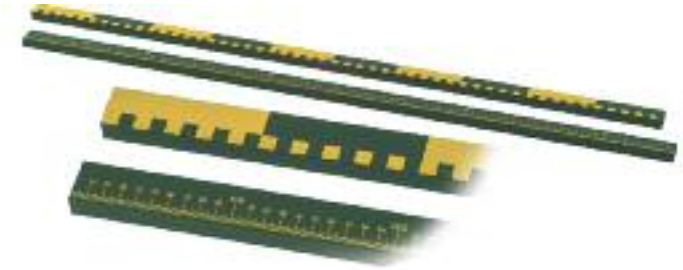
Quick-action clamp for fast, one-handed clamping or splaying; sturdy metal guide rod; fixed and movable fibre glass reinforced plastic jaw, with soft grip cushioning to prevent damage to surfaces; fast release trigger for fast positioning or releasing

DS500-2D Span clamp, 0 - 100 mm

DS500-4D Span clamp, 0 - 200 mm

DG101-00 Ruler, metal, L = 1000 mm

With three highly readable graduated scales: dm and cm graduations as well as mm graduations on the back; rectangular aluminium tube profile, 30 x 15 mm, green powder-coated



DG110-2G Pointers for ruler, pair

For continuously variable adjustment to any position on the metal ruler; large plastic pointers, yellow, with metal spring; length of pointer = 120 mm

DG110-1G Pointers for rods, pair

To mount on support rods round or squared;
large plastic pointers, yellow, with special aluminium profile and wing screw M8;
length of pointer: L = 120 mm

Measuring tapes, adhesive

Adhesive plastic tape with scale, red-yellow graduation in 1 cm blocks, minor graduations of 0.5, 5 and 10 cm; 10 m roll

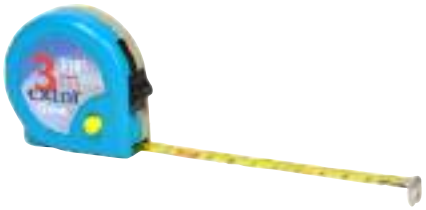
DS909-10 Measuring tape, transparent, W = 10 mm

DS910-10 Measuring tape, white, W = 10 mm

DS910-16 Measuring tape, white, W = 16 mm

P1100-1E Measuring tape, 3 m

Steel measuring tape with cm and mm graduations, in plastic case, with locking mechanism;
case dimensions:
approx. 60 x 60 mm



DG100-1R Measuring tape, 30 m

Steel measuring tape with cm and mm graduations, in case with fold-in crank; case dimensions: approx. 110 x 120 mm

P1100-2B Vernier callipers, plastic

For measuring outside, inside and depth dimensions;
measuring range: 0 - 150 mm;
scale: mm graduations with vernier for 0.1 mm

DG100-1L Vernier calipers, metal

For measuring outside, inside and depth dimensions;
measuring range: 0 ... 150 mm;
scale: mm graduations with vernier for 1/0.05 mm

DF120-1S Vernier callipers, OFM

To demonstrate how to read a vernier scale on callipers;
overhead functioning model (OFM);
consisting of an acrylic plate and a sliding vernier scale;
dimensions: 200 x 100 mm

DG100-2S Spherometer

Demonstration model for measuring the thickness and radius of curvature of spherical surfaces
Measuring range: -10 - 0 - +10 mm
Measuring accuracy: 0.01 mm
Diameter: 50 mm
Height: 70 mm

DG100-2T Micrometer screw gauge, 0 - 25 mm

For precise thickness measuring;
measuring range: 0 - 25 mm,
graduations: 0.01 mm;
dimensions: 135 x 55 mm

DG101-1S Clinometer

For measuring inclination or declination as well as indirectly determining the height of a tree, a building or the relative height of a mountain;
manual clinometer made of sturdy plastic;
large pointer; sighting device;
transparent cover enables the stop mechanism to be observed;
length of pointer: 90 mm;
dimensions: approx. 280 x 150 x 15 mm

DM100-25 Graduated cylinder, with suspension, 250 ml

Graduated standing cylinder, plastic;
with chain handle for hanging on scales or dynamometers
(e.g. for measuring density of fluids);
dimensions: D = 54 mm, H = 193 mm

DG110-1B Measuring beaker plastic, 1000 ml

Graduated plastic container with pouring lip and handle;
D = 115 mm, H = 140 mm

C1000-1G Beaker glass 600 ml, squat form

Dimensions: D = 90 mm; height: 125 mm

C1010-1H Beaker glass 1000 ml, tall form

D = 95 mm, H = 180 mm

DM340-8B Balloons, set

Set of 10 coloured balloons

C6100-2A Syringe 120 ml, plastic

For measuring gas and liquid volumes;
robust plastic cylinder with scale; with the possibility of connecting hoses with a dia (int.) of 3 to 9 mm;
syringe with ring grip;
filling volume: 120 ml

C6100-2G Syringe 120 ml, plastic, for vacuum experiments

Gas syringe made of robust plastic; well sealed yet smoothly running piston with solid grip; incl. 2 adapter pieces for connecting plastic vacuum tube D = 6 mm (outer dimension); clearly readable printed scale; filling volume: 120 ml

DM114-1S Syringe 60 ml, with loop for suspending

D = 30 mm, L = 160 mm

Overflow beakers

Glass beakers with a downward-sloping drainpipe for determining the volume of solid bodies, used together with a graduated cylinder

DM110-1A Overflow beaker 600 ml

Glass beaker, D = 90 mm, H = 125 mm, drainpipe L = 100 mm

P1410-1U Overflow beaker 250 ml

Glass beaker, D = 60 mm, H = 120 mm, drainpipe L = 50 mm

DG123-1A Hand stopwatch, analogue

Additive stopwatch with starting, stopping and resetting functions;
measuring range: 15 min;
graduation: 0.1 s;
metal case, D = 50 mm

P1150-1D Handheld stopwatch, digital, SE, 1 / 100 s

LC display, time and date display, measurement of starting, stopping and intermittent times.
Division: 1 / 100 sec up to 30 min.,
1 sec to 24 h, with alarm, supplied with battery

DG122-1D Handheld stopwatch, digital, demo

Quartz-controlled, big buttons;
with LC display, time and date display, measurement of starting, stopping and intermittent times.
Accuracy: 0.01 s,
supplied with battery

DE722-1W Stopwatch "inno"

Digital stopwatch, easy to operate, magnetic.
Measurement can be started and stopped using the switches on the device itself or the remote control switch DE722-2W.
The 26 mm LED display allows readings to be taken from a distance.
Functions: START / STOP: starts or stops measurement
LAP: stores interim times
RESET: resets display to zero

Measuring ranges:	Measuring range	Maximum	Precision
	10^2 s	99.99 s	0.01 s
	10^3 s	999.9 s	0.10 s
	10^4 s	9999 s	1.00 s

Power supply: 4 x 1.5 V mignon cells (included) or external power supply 6 V / 500 mA, P3120-6N
Case: plastic, ABS
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 670 g

Recommended accessories for "inno"-measuring instruments:

P3120-5B S-shaped assembly platform

For supporting magnetic "inno" components in an elevated position; metal bracket, S-shaped; green powder-coated;
height: 240 mm

P3120-6N Mains transformer 6 V DC / 500 mA

Especially for use as an external power supply for magnetically mounted "inno" measuring instruments, connected by means of 5.5-mm hollow DC plugs

Voltage source: 230 V AC / 50 ... 60 Hz
European Schuko mains-plug

DE722-2W Remote control for stopwatch "inno"

Connecting cord (L = approx. 150 cm); dimensions: 21 x 80 mm

P3120-2Z Universal timer "inno"

Digital timer for universal use, magnetic, can be connected to light gate P1320-3LR and to falling body apparatus DM340-1F; with 26 mm LED display; resolution: 1 ms

Functions:
- time measurement during free fall (OFF-OFF)
- time measurement in dynamics (L1 start - L2 stop)
- counting pulses (L1 count)
- time measurement of pendulum (L1 start – stop)
- measurement of transit time (L1 – gate)
- L1 start – automatic stop after 10 s
  (for measuring rotational speeds e.g.)

Reset button, LED display for pulse and second mode
Signal input by way of two 5-pin DIN jacks
Power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V / 500 mA, P3120-6N
Case: plastic, ABS
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 425 g

P1320-3LR Light gate, demo

Precision light gate with generous intermediate space; infrared light source; for controlling external timing devices; variable control with LED indicator for adjusting intensity to surrounding lighting conditions; with hole and capstan head screw for fixing on rods of up to 10 mm in diameter; measuring accuracy: 0.1 mm.

Signal output and power supply by way of 3-pin DIN jack; for the direct connection with the universal counter P3120-2Z or digital counter universal DR260-1D.
Internal gate width: 74 mm; external dimensions: 175 x 130 mm

P1320-3M Magnetic holder for light gates, demo

For fastening the light gates to a steel board, using strong magnets; Magnetic base: D = 43 mm, support: D = 10 mm, L = 70 mm

P1325-9S Counter with 2 light gates, set

Solid, handy counter with LC display, digit height 12.5 mm; accurancy 10 ms; battery powered.

Modes:
- stop watch
- Start – Stop
- Gate

2 light gates,
internal gate width: 78 mm
2 connection cables,
L = approx. 135 cm each

P1324-1K Counter, intelligent, set

Compact, intelligent time-measurement device; thanks to the precise resolution of 0.1 ms and the easy-to-use menu with storage options, experiments in dynamics and motion are easy to measure and calculate; the light gate and wheel with spokes enable results for speed and acceleration to be displayed as well.

Time mode:
- with one light gate
- wheel with spokes (measures and stores 10 interruptions)
- with two light gates
- pendulum movement (measures the first and third interruption)
- stopwatch

Speed mode:
- 1 slit (average speed)
- impulse experiments (with 1 or 2 trolleys)
- pulley (rad / s)
- pulley (rev / s)

Acceleration mode:
- with one light gate
- with two light gates
- pulley for linear or angular movements

Counter mode (event counting):
- for 30, 60 or 300 seconds or manually

2 measurement inputs; rechargeable battery, 3.7 V / 1100 mAh (incl. charger); operation time: approx. 40 hrs (when fully charged); dimensions: 200 x 80 x 35 mm; weight: approx. 265 g

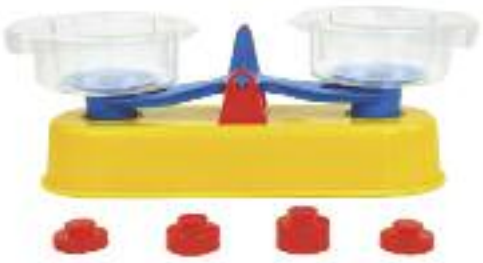
P1311-2H Ticker tape timer

For recording sequences of linear motion on a track or during free-fall experiments, by means of markings on metallic paper P1311-2G;
selection switch:
10 ms - off - 100 ms;
two coloured LEDs indicating "active" or "standby";
voltage source: 12 V DC or AC;
dimensions: 84 x 84 x 66 mm

P1311-2G Metallic paper, roll

Recording paper for ticker tape timer P1311-2H, one side metallised;
length: approx. 30 m, W = 15 mm

DM124-2S Two-pan balance, simple



For approximate determination of the mass of a solid or fluid body by comparison with standard weights;
two-pan plastic balance, with attached plates and two removable, transparent pans;
incl. 4 non-determined weights of differing mass;
scale pans: D = 110 mm; filling volume: approx. 300 ml;
weighing range: approx. 250 g; accuracy: approx. 0.5 g;
dimensions: 330 x 125 x 125 mm

DM124-1A Two-pan balance, precision

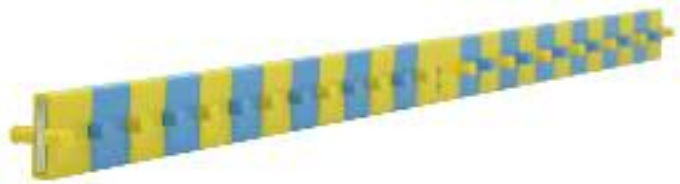
Precision scales with knife-edge bearing of hardened steel;
2 removable metal pans, D = 125 mm; arresting screw; base plate with adjustment screw; perpendicular for precise vertical positioning; weighing range: 500 g; accuracy: 0.005 g;
dimensions: 460 x 250 x 410 mm

DM221-4W Beam balance 2, demo

Consisting of:

P1220-3A	1x	Lever rod demo, L = 520 mm
DM221-4Z	1x	Pointer for lever 520, metal
DM220-3B	2x	Scale pan with handle, demo
DS204-2L	1x	Bearing pin with clamp insert
DS400-2K	1x	Boss head cross-pattern, SE
P7240-1G	1x	Support rod, round, L = 500 mm

P1220-3A Lever rod demo, L = 520 mm



Solid aluminium profile with plastic elements and protrusions for suspending weights or scale pans;
two drilled holes for stable and instable equilibrium

DM221-4Z Pointer for lever 520, metal

Broad and widely visible pointer;
to be attached to the lever rod P1220-3A; L = approx. 155 mm

DM220-3B Scale pan with handle, demo

Plastic pan, D = 80 mm;
with removable aluminium handle,
L = approx. 250 mm

DM725-ND Newtonmeter "inno" 20 N / 2000 g

Featuring force measurement over a minimum of distance, yet with a high degree of precision, and a 26 mm digital display, making this device especially

simple – fast – safe

Demonstration instrument with magnets, for measuring force (in newtons) or mass (in grams).

The easy-to-read LED display (H = 26 mm) and the external sensor in a rugged case of rectangular tubing make it an ideal instrument for mechanics experiments, particularly when used with a magnetic panel.
Both tension and pressure can be measured.
By means of a support rod (D = 10 mm) the sensor can be fastened to common stands.

TECHNICAL DATA:

Measuring range N:	± 20 N,	resolution: 0.01 N
Measuring range mN:	± 2000 mN,	resolution: 1 mN
Measuring range kg:	± 2 kg,	resolution: 1 g
Measuring range g:	± 200 g,	resolution: 0.1 g

Zero compensation (tare): manual, by means of push button
Accuracy: better than 0.5 %

Power supply: 4 x 1.5 V mignon cells (included) or external power supply 6 V / 500 mA, P3120-6N
Dimensions: approx. 160 x 120 mm

DM125-1C Balance mechanical

Balance with one pan, magnetic damping, beams with four sliding weights and scales, equipped with sliding weights that are impossible to misplace, zero adjustment, accessory for determining density.
Pan diameter: 90 mm, with pouring lip
weighing range: 311 g; accuracy: 0.01 g
dimensions: 380 x 140 x 280 mm

DM126-1A Triple-beam balance, 2610 g / 0.1 g

Balance beam with magnetic damping, three sliding weights with scales, additional neutral tare-scale upto 250 g, incl. additional weights (1 x 500g, 2 x 1000g).
Weighing range: 2610 g
sensitivity: 0.1 g
pan diameter: 150 mm
dimensions: 450 x 150 x 160 mm

DM125-3A Digital balance, 200 / 0.01 g

– easy to use with 4 buttons
– fast operation thanks to quick self-calibration after switching on
– tare and zeroising function
– switch between gram, ounce, grain and carat
– unit counter function
– automatic turn-off and continuous operating mode possible
– easily readable display with blue backlight
– battery driven (2 x AAA batteries included)
– incl. two transparent protective lids (also serve as scale pans)

Dimensions:
Weighing plate: 100 x 94 mm
Scale pan, small: 100 x 105 x 8 mm
Scale pan, large: 130 x 110 x 21 mm
Housing dimensions: 125 x 105 x 17 mm

DM125-3C Digital balance, 2000 / 0.1 g

– easy to use with 4 buttons
– fast operation thanks to quick self-calibration after switching on
– tare and zeroising function
– switch between gram, ounce, grain and carat
– unit counter function
– automatic turn-off and continuous operating mode possible
– easily readable display with blue backlight
– battery driven (2 x AAA batteries included)
– incl. two transparent protective lids (also serve as scale pans)

Dimensions:
Weighing plate: 100 x 94 mm
Scale pan, small: 100 x 105 x 8 mm
Scale pan, large: 130 x 110 x 21 mm
Housing dimensions: 125 x 105 x 17 mm

DM125-3E Digital balance, 6000 / 1 g

– easy to use
– LCD display, number height: 16 mm
– fast operation thanks to quick self-calibration after switching on
– tare and zeroising function
– automatic turn-off
– modern design with protective glass in silver
– battery driven (2 x CR2032 batteries included)

Weighing plate dimensions: 230 x 165 mm
Housing dimensions: 230 x 165 x 20 mm

DM125-3P Digital balance, 150 kg / 50 g

– easily turned on by tipping the weighing plate
– extra large and easily readable display (H = 25 mm)
– weighing plate made of protective glass in silver
– 4 anti-slip pads underneath
– battery driven (CR2032 battery included)

Weighing plate dimensions: 300 x 300 mm
Housing dimensions: 300 x 300 x 21 mm

Slotted weights SE

Slotted mass pieces, for holder for slotted weights SE;
the tapered slit ensures a quick and simple attaching to the holder; the central drilling guarantees a stable position on the support; mass values are pressed in;
Material: steel, nickel-plated, Tolerance: ±2 %, D = 28 mm

P1120-2B Slotted weight, 5 g, SE

P1120-2D Slotted weight, 10 g, SE

P1120-1E Slotted weight, 20 g, SE

P1120-2F Slotted weight, 50 g, SE

P1120-2C Holder for slotted weights, 10 g, SE

Holder for slotted weights with support and hook to hold slotted weights, SE; Material: steel, nickel-plated;
Dimensions: D = 16 mm, H = 110 mm

Weights on hooks, profi

Colour-coated weights with two hooks for suspending from one another; with screen-printed weight information visible from a distance; ideal for demonstration experiments;
tolerance: ±1 %; powder-coated, yellow

	D (in mm)
DM120-1A Weight on hook 2 g	20
DM121-1A Weight on hook 5 g	22
DM121-2A Weight on hook 10 g	30
DM121-3A Weight on hook 20 g	30
DM121-4A Weight on hook 50 g	40
DM121-5A Weight on hook 100 g	40
DM121-6A Weight on hook 500 g	80
DM121-7A Weight on hook 1 kg	80
DM121-8A Weight on hook 2 kg	80

P1120-1B Balance weights set, 1 - 50 g

Set of precision weights in plastic storage box with lid; incl. forceps

Contents:
1 x 50, 1 x 20, 2 x 10, 1 x 5, 2 x 2, 1 x 1 g

Weights on hooks, simple

Weights with hook and loop to stick close

DM121-4B Weight on hook 50 g, nickel plated

D = 25 mm

DM121-5B Weight on hook 100 g, nickel plated

D=25 mm

DM120-1D Balance weights set, 10 mg - 200 g

Set of precision weights in plastics storage box with lid; incl. forceps
Contents:
1 x 200, 1 x 100, 1 x 50, 1 x 20, 2 x 10, 1 x 5, 2 x 2, 1 x 1 g
1 x 10, 2 x 20, 1 x 50, 1 x 100,
2 x 200, 1 x 500 mg

DM120-2D Balance weights set, 10 mg - 500 g

Precision weights in plastics storage box with lid; incl. forceps
Contents:
1 x 500, 1 x 200, 2 x 100, 1 x 50, 1 x 20, 2 x 10, 1 x 5, 2 x 2, 1 x 1 g,
1 x 10, 2 x 20, 1 x 50, 1 x 100, 2 x 200, 1 x 500 mg

DM120-1E Balance weights set, 1 g - 1000 g

Precision weights in plastics storage box with lid; incl. forceps
Contents:
1 x 1000 g, 1 x 500 g, 1 x 200 g, 2 x 100 g, 1 x 50 g,
1 x 20 g, 2 x 10 g, 1 x 5 g, 2 x 2 g, 1 x 1 g

Lead (tare) shot

Lead shot used as weights for taring;
d = approx. 1.5 mm; in plastic bottle

P1120-1S Lead (tare) shot, 50 g

DM115-1A Lead (tare) shot, 250 g

DM372-5G Flat weight, 500 g

Additional mass for vibration experiments in combination with a support rod; nickel-plated metal cylinder, D = 56 mm, H = 30 mm; with hole for rod with max. diameter of 10 mm and fastening screw M8

DM375-1G Weight, 1 kg

For explaining the concept of pressure and for demonstrating the magnitude of air pressure;
Nickel-plated steel cylinder with centre hole and clamping screw for fitting on steel rod;
one end of the steel rod shaped as a cube with 1 cm² surface area;
cylinder: D = 45 mm, H = 77 mm;
rod: D = 10 mm, L = 210 mm

Experiment: 1 kg pressure on 1 cm² of hand surface area (1 bar)

Immersion weights

For measuring buoyancy and determining the density of solids;
metal cuboids with hook

DM112-1A Immersion weight Al, 100 cm³

DM112-1F Immersion weight Fe, 100 cm³

DM112-5A Immersion weight Al, 50 cm³

DM112-5F Immersion weight Fe, 50 cm³

DM140-1A Specific gravity cubes, each 1 cm³, set of

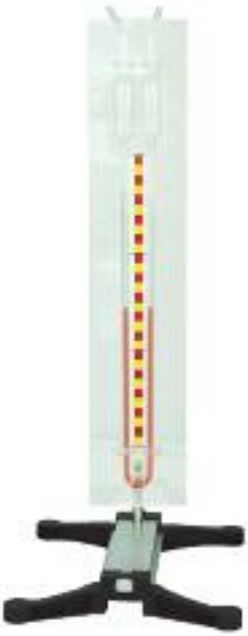
For determining the density of various materials by weighing;
materials:
Al / Cu / Fe / Pb / Zn / wood,
Set of 6;
dimensions:
10 x 10 x 10 mm each

DM140-2C Bodies of equal mass, set of 4

For density experiments;
metal cylinders with hook;
materials: Al / Fe / Cu / Pb;
weight: 200 g each;
D = 25 mm each

DM450-1M U-tube manometer

For determining the density of liquids or measuring pressure in liquids; glass u-tube connected to two expansion vessels with hose fittings; mounted on an acrylic panel 500 x 100 mm, with graduated scale (H = 300 mm) and stem (D = 10 mm), (base not included)



P7030-2A Petroleum, scented, 50 ml

To determine the specific gravity of liquids; stored in a glass bottle; with drop-sealing for an easy filling of pipes with a small diameter

P7050-1A Powder dye, red

Food dye in plastic container; dark red; contents approx. 5 g

C7445-7S Silicon hose, 7 / 10 mm, L = 100 cm

DM480-1D Density body

For demonstrating the varying density of water at high and low temperatures; tarred, hollow cylinder; floats in cold water, sinks in hot water;
dimensions:
approx. 70 x 20 mm

Hydrometer

For measuring the specific gravity of liquids, L = approx. 300 mm

C6501-1A Hydrometer 0.7 - 1.0 g / cm³

C6501-2A Hydrometer 1.0 - 2.0 g / cm³

C6501-3A Hydrometer universal 0.7 - 2.0 g / cm³

DM142-1P Specific gravity bottle, 50 ml

For measuring the specific gravity of liquids or solids or determining their volumes; after weighing the full and empty specific gravity bottle, the specific gravity of the filling can be calculated;
glass flask and glass stopper with capillary tube
Volume: 50 ml;
D = approx. 50 mm, H = approx. 95 mm

DM465-1V Discharge beaker with stopcock, 1000 ml

Beaker; volume 1000 ml; with one-way, glass stopcock and vertical drainpipe; used in hydromechanics as a water reservoir or with the diving bell - metal bar as an air bell

Dimensions: D = 94 mm, H = 275 mm

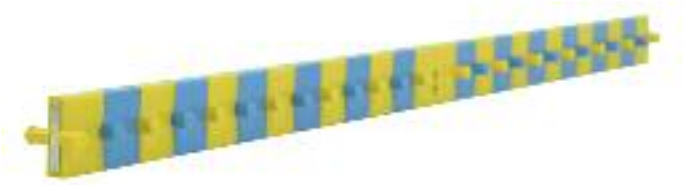
DM891-1T Diving bell - metal bar

To demonstrate how a diving bell works, in combination with the discharge beaker 1000 ml; the water level inside the bell is displayed by the floating ball; heavy body made of brass for a good flotation depth; with plastic screws to fix on the discharge beaker; with coloured ball for displaying the water level
Dimensions: 120 x 40 x 30 mm

DM221-1H Lever rod, metal, L = 1000 mm

Rectangular tube aluminium profile, 30 x 15 mm, green powder-coated,
with easy-to-read scale divided into blocks, dm and cm graduations along the entire length of the front side of the rod;
vertical double holes between yellow or green segments on both sides for suspending weights on hooks or holders for slotted weights or dynamometer;
two horizontal holes in the middle for mounting the rod on a bearing pin or sliding saddle or the magnetic base to ensure stable or neutral balance;
one metal taring screw at each end;
yet back side printed with precision scale in mm

P1220-3A Lever rod demo, L = 520 mm



Solid aluminium profile with plastic elements and protrusions for suspending weights or scale pans;
two drilled holes for stable and instable equilibrium

DM221-4Z Pointer for lever 520, metal

Broad and widely visible pointer;
to be attached to the lever rod P1220-3A; L = approx. 155 mm

DM220-3B Scale pan with handle, demo

Plastic pan, D = 80 mm;
with removable aluminium handle,
L = approx. 250 mm

DS204-2L Bearing pin with clamp insert

For mounting the bearing pin in boss head clamps or rail saddles; this newly developed clamp insert enables elements to be held by the bearing pin at a variable distance from the front side of the boss head clamp;
clamp insert made of fibre-glass reinforced plastic;
with slit and flat section for using a clamping screw;
bearing pin axis:
D = 3 mm, L = 45 mm
clamp insert:
D = 10 mm, L = 40 mm

DS400-2K Boss head cross-pattern, SE

For mounting round rods of max. D = 15 mm or square rods with a max. s = 12.5 mm;
cross, parallel or T-connection possible;
die-cast aluminium, black coating;
2 large-headed screws, D = 25 mm;
dimensions:
57 x 34 x 34 mm
(without screws)

Magnetic bases

Rubber-encased metal base with embedded neodymium magnet; for fast assembly of round rods of max. 10 mm in diameter; normal or parallel to a metal panel; rubber jacket protects the table surface from scratches; this also makes the base non-slip; a newly-developed clamp set with a bearing pin enables elements to be fixed onto the plate surface at variable distances; holding force on bearing pin as a point of application; as measured parallel to the table:
Magnetic base D = 43 mm: 10 - 25 N
Magnetic base D = 66 mm: 20 - 70 N
(the holding force is dependent on the strength (thickness) of the metal panel

DS110-43 Magnetic base, D = 43 mm, with tube and pin

DS110-66 Magnetic base, D = 66 mm, with tube and pin

DM223-1S Wheelbarrow - model

For realistic demonstration of lever laws, in particular the law of one-sided levers; schematic model of a wheelbarrow (push cart); for use in magnetic panel mechanics in combination with dynamometers and masses; metal pipe construction, grey powder-coated, with handle, incl. plastic wheel;
total length: approx. 550 mm

Coil springs and Flat spring steel

For experiments involving torsion and oscillation

		D (in mm)
P1810-2A Coil spring	3 N/m	35
P1810-2B Coil spring	20 N/m	12
P1810-1S Coil spring	5 N/m	16
P1810-2S Coil spring	10 N/m	16

P1810-1D Flat spring steel

Nickel-plated steel flat spring, for experiments in bending;
dimensions: 300 x 25 x 0.6 mm

DM135-1C Plate for dynamometer

For joining several dynamometers;
acrylic plate painted yellow, with 4 drill holes;
dimensions: 76 x 46 mm

P1130-2R Ring for parallelogram of forces

Wire ring for joining several dynamometers, when demonstrating the parallelogram of forces; D = 15 mm

Dynamometers, transparent

The most economic way to measure drag forces, therefore perfectly suitable for student use; accurate dynamometer with long and clearly visible Newton scale; zero-point correction; guard to prevent over-extension of the spring; the transparent case allows the functioning of the coil spring to be observed; with hooks for mounting the device and suspending weights.
Measuring accuracy: ± 2%; length of scale: 100 mm
Dynamometer case: L = 215 mm
Dimensions: D = 16 mm, total L = approx. 285 mm

	Reading	Colour
P1130-1S Dynamometer 0.1 N	0.001 N	blue
P1130-1A Dynamometer 0.2 N	0.002 N	grey
P1130-1B Dynamometer 1 N	0.01 N	yellow
P1130-1C Dynamometer 2 N	0.02 N	red
P1130-1L Dynamometer 3 N	0.03 N	khaki
P1130-1D Dynamometer 5 N	0.05 N	blue
P1130-1E Dynamometer 10 N	0.1 N	green
P1130-1F Dynamometer 20 N	0.2 N	orange
P1130-1H Dynamometer 100 N	1 N	black

Description as above, but with dimensions:
D = 20 mm, L = 350 mm

Important
Please be sure to note that dynamometers usually show the correct value ONLY when used vertically.
When pulled in other directions, depending on the angle of use, the mass of the coil spring and the shaft with hooks must be taken into consideration.

P1131-9A Storage for 7 dynamometers

Clearly arranged storage tray, made of foam; can store up to 7 dynanometers transparent
dimensions:
29 x 34 x 3.5 cm

Torsion dynamometer 02

Thanks to a very precise torsion spring, this dynamometer shows the correct value in all pull directions, not only vertically; due to the large scale, the displayed value can be seen from a distance, making this device is highly recommendable as a demonstration measuring device; torsion spring dynamometer with a rotatable pulley with a deep notch; easily visible red metal pointer; thanks to the rotatable metal scale the zero point can be quickly and easily adjusted; hooked cord
for suspending objects;
with support rod
D = 10 mm, L = 30 mm;
measuring accuracy:
approx. ±3%;
digit height on scale: 15 mm;
diameter of scale: 200 mm

DM132-1B Torsion dynamometer 1 N

DM132-1C Torsion dynamometer 2 N

DM132-1D Torsion dynamometer 5 N

DM132-1F Torsion dynamometer 10 N

Variants for holding the torsion dynamometer

...in a clamp

... attached to the inclined plane

... magnetically in the magnetic base

DS130-1T Holder for torsion dynamometer for inclined plane

For positioning the torsion dynamometer on an inclined plane;
metal frame on saddle and hole with screw;
green powder-coated;
L = 160 mm

DM725-ND Newtonmeter "inno" 20 N / 2000 g

Demonstration instrument with magnets, for measuring force (in newtons) or mass (in grams).
The easy-to-read LED display (H = 26 mm) and the external sensor in a rugged case of rectangular tubing make it an ideal instrument for mechanics experiments, particularly when used with a magnetic panel.
Both tension and pressure can be measured.
By means of a support rod (D = 10 mm) the sensor can be fastened to common stands.

TECHNICAL DATA:

Measuring range N:	± 20 N,	resolution: 0.01 N
Measuring range mN:	± 2000 mN,	resolution: 1 mN
Measuring range kg:	± 2 kg,	resolution: 1 g
Measuring range g:	± 200 g,	resolution: 0.1 g

Zero compensation (tare): manual, by means of push button
Accuracy: better than 0.5 %

Power supply: 4 x 1.5 V mignon cells (included) or external power supply 6 V / 500 mA, P3120-6N
Dimensions: approx. 160 x 120 mm

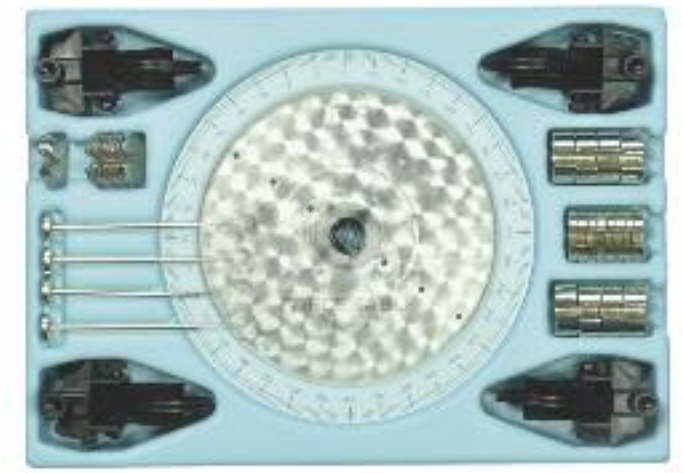
Recommended accessories:

P3120-6N Mains transformer 6 V DC / 500 mA

P3120-5B S-shaped assembly platform

P9902-4P SEK Forces and Torque

With the module SEK Forces and Torque the following experiments can be performed:
- Composition of several forces
- Force direction and application point
- Torque – equilibrium
- Torques with different application points
- Rotary motion – uniformly accelerated
- Moment of interia and angular acceleration



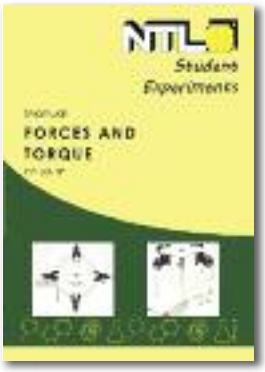
consisting of:

DM355-5A	1x	Force table
DM355-5S	4x	Pulley plastic, with very low friction
P1120-2C	4x	Holder for slotted weights, 10 g, SE
P1120-2F	8x	Slotted weight, 50 g, SE
P1120-1E	8x	Slotted weight, 20 g, SE
P1120-2D	8x	Slotted weight, 10 g, SE
P1120-2B	4x	Slotted weight, 5 g, SE
DM355-5M	1x	Torque accessory for force table
DM355-5Z	1x	Additional mass for torque accessory, D = 160 mm, mass: approx. 200 g

Storage:

P7906-4P	1x	Box insert Forces and torque, SE
P7806-1K	1x	Storage box II small, with cover, Box insert plan with 2 labels

P9160-1P Experiment manual "Forces and Torque"



DM355-5A Force table

For quantitatively demonstrating the decomposition of forces; metal working table, D = 200 mm, painted white, with precise graduations; support rod (D = 10 mm) fastened in the centre, the table is mounted on available support material; up to 4 guide pulleys can be fastened to the edge at any angle; weights (not included) can then be suspended from strings run along the pulleys

DM355-5S Pulley plastic, with very low friction

Pulley with very low friction thanks to an axle which is moving on two ball bearings;
with holder and fixing screw for mounting on tables and tracks;
the roll with bracket is continuously variable and fixable;
Span width: 20 mm
Pulley D = 50 mm

Experiment: Composition of several forces

DS130-1S Inclined plane, simple (02)

For demonstrating inclined plane experiments;
NTL rail profile, silver coated; two support rods for mounting, with large 0 - 90° metal scale; screw to fix the holder for the torsion dynamometer;
length of rail: 320 mm;
length of pointer on scale: 130 mm;
digit height on scale: 26 mm

Experiment: downward force on incline (magnet panel assembly)

DS131-1S Inclined plane, complete (02)

A complete demonstration set-up of the inclined plane;
incl. rail stand material, roller and torsion dynamometer

DM650-1R Roller

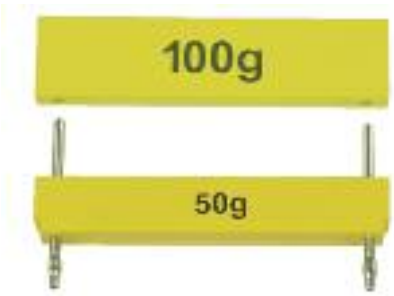
To be used as a body of mass / rolling weight at the inclined plane;
steel cylinder, D = 40 mm, with two hooks and acrylic wheels,
D = 67 mm,
weight: approx. 500 g

DM300-2A Dynamics trolley, demo, 50 g

Trolley body and wheels made of ABS plastic; very low friction;
4 mm holes at the face sides for attaching devices with 4 mm plugs;
4 mm holes on the top side for mounting additional weights;

dimensions: 120 x 66 mm
weight: 50 g

Additional weights for the Dynamics trolley, demo



DM325-50 Additional weight 50 g

DM325-01 Additional weight 100 g

DS107-1K Holder for dynamometer, demo

For fastening dynamometers in a parallel direction to NTL special aluminium rail profile;
saddle with a fixed ring with screw;
for dynamometers with a diameter up to 19 mm

DM610-1S Stability apparatus

For studying the stability of a body as a function of the position of its centre of gravity relative to the base area;
dimensions: 150 x 80 x 300 mm

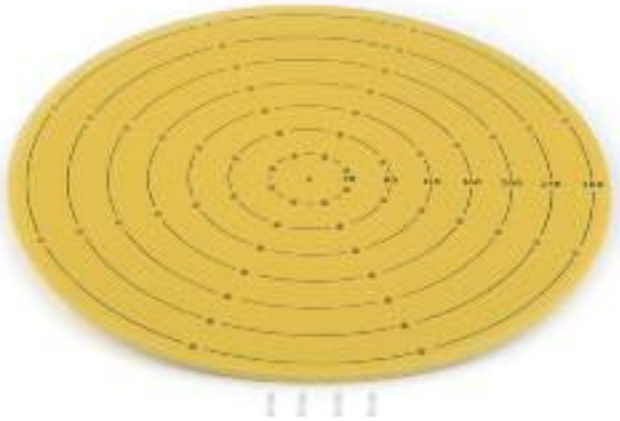
DM620-1S Plate for testing centre of gravity

For introducing the concept of centre of gravity;
irregularly shaped plastic plate, with holes for inserting a bearing pin;
dimensions: approx. 310 x 235 x 4 mm

DM600-1L Plumb line

Pointed metal cylinder, L = approx. 100 mm

DM355-1M Inertia wheel



For studying torque equilibrium;
Plastic wheel with centre hole for bearing pin;
holes along concentric circles for fastening pins with very low weight;
fastening pins, set of 4 pcs. (DM355-2M) are included;
diameter: 300 mm

DM630-1S Balance artist

For demonstrating varieties of balance;
Plastic hemisphere (D = 80 mm) mounted on a rod (10 x 135 mm);
with a sliding weight

DM637-1A Hovering eagle

Centre of gravity at the tip of the beak;
"floats" on a fingertip, any edge or on the supplied pyramid;
plastics eagle, wingspan approx. 160 mm

DM600-3W Bubble level, 225 mm

For arranging an object in an exact horizontal or vertical position; three small bubble tubes in plastic housing,
L = 225 mm

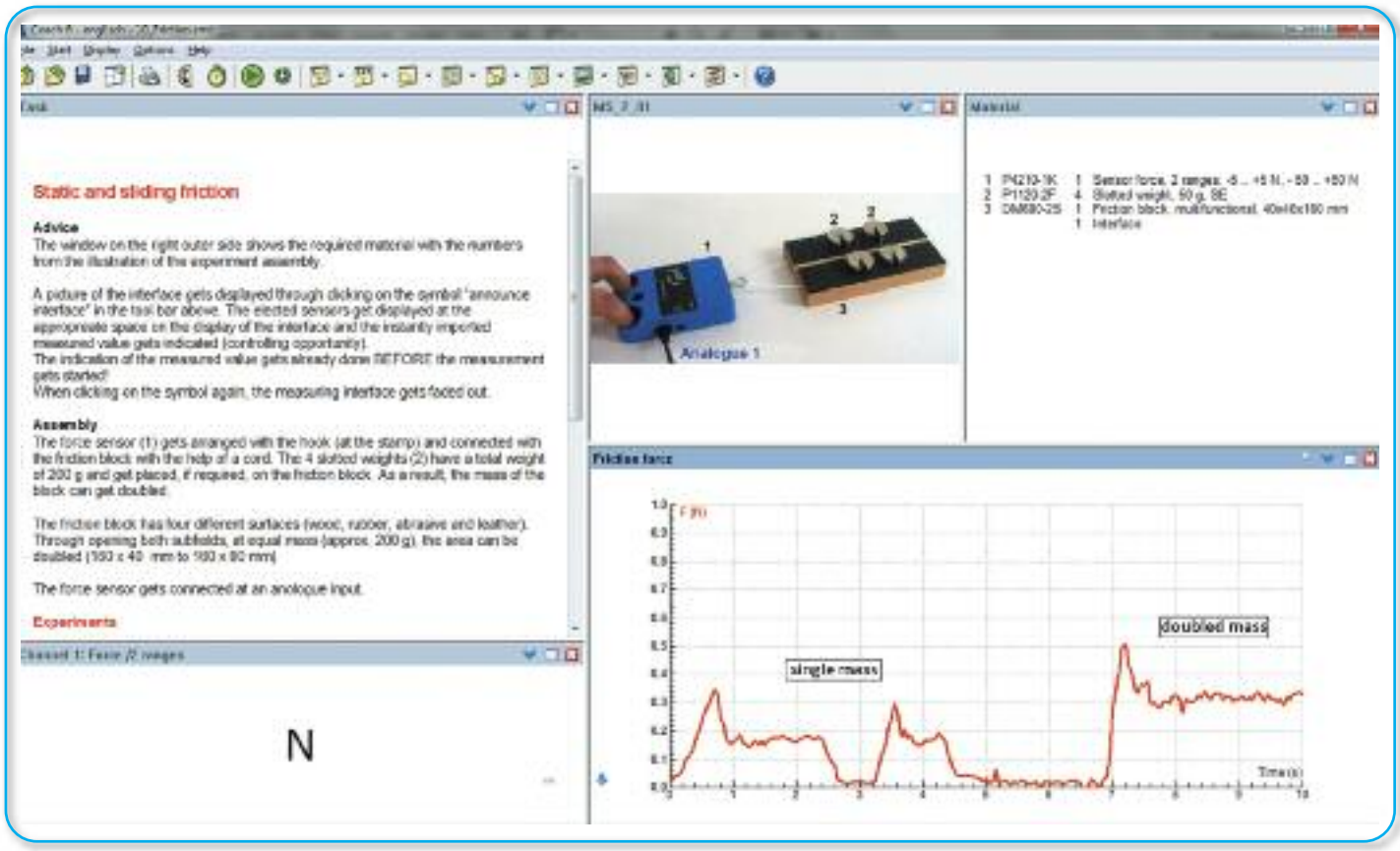
DM680-2S Friction block, multifunctional

For experiments on static, dynamic and rolling friction; wood friction surface can be doubled by unfolding the block; wooden block with four different surfaces: wood, rubber, leather and sand paper, string attached on one front face; dimensions: 40 x 40 x 160 mm; mass: approx. 200 g

To clearly show static and sliding friction, use of a force sensor in combination with readings recorded by computer is recommended. The peaks in static friction can be seen very clearly in the force-time diagram in the following screenshot.

Detail: Doubling the surface area by folding out the block

Detail: Doubling the mass by adding slotted weights



P4210-1K Sensor Force, 5 N / 50 N

For measuring tractive or compressive forces;
can be mounted on stand material or on moving objects like trolleys;
two ranges: ± 5 N or ± 50 N; resolution: 0.01 N;
provided with thread for bumper or hook (included),
with support rod, connection cable with BT-connection

DM682-1K Barge (boat)

For examining static and dynamic friction in water;
plastic boat with an easily accessible loading area;
loading volume: max. 700 ml; length: approx. 30 cm

DM682-1B Water basin, long

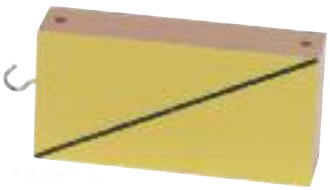
For examining static and dynamic friction in water; plastic tray with flanged rim for better stability;
dimensions: approx. 75 x 30 x 12 cm

DM680-2P Static, sliding and rolling friction board

Base plate for experiments on static, dynamic and rolling friction; acrylic base plate with frame on two supports with eleven virtually friction-free steel rollers on bearings and an additional panel with smooth and rough surfaces;
dimensions: 500 x 90 mm

DM680-2R Block for friction and stability

For experiments on static, dynamic and rolling friction;
varnished wooden block with hook, at one end a hook for attaching a dynamometer;
a centre hole for a bearing pin for attaching plumb line when doing experiments on stability;
dimensions: 160 x 80 x 40 mm, mass: approx. 350 g



DM680-3R Weight, 350 g, with hook

For doubling the mass of friction and stability block DM680-2R used for experiments with static, dynamic and rolling friction;
material: Fe, yellow powder-coated;
dimensions: 40 x 40 x 28 mm

DM683-1K Ball- and sleeve-bearing model

See 'from inside' how a ball bearing works;
ball bearing model with metal balls and demountable transparent housing; dimensions: D = 100 mm, W = 24 mm
demountable sleeve bearing model with metal axle

Pulleys SE

Pulley with deep groove, made of coloured plastic; central hole with brass sleeve for low-friction rotatable bearing on bearing pin; steel rod, nickel-plated

P1230-3B2 Pulley SE, red

P1230-3B3 Pulley SE, blue

P1230-3A Pulley with rod, red

P1230-3BD Double pulley with rod

Pulleys demo

Pulley with deep groove; made of ABS plastic, yellow; centre hole for mounting on bearing pin

DM210-1A Pulley, plastic, yellow, D = 50 mm

DM210-2A Pulley, plastic, yellow, D = 75 mm

DM210-3A Pulley, plastic, yellow, D = 100 mm

DM210-2B Bracket for pulleys D = 100 mm

For mounting one or two pulleys to rotate; aluminium L-profile; green powder-coated, with adjustable hook and hook for suspension as well as tapped socket for support DM210-9S; adjustable bearing pin; dimensions: 75 x 35 x 24 mm

DM210-9S Support for pulley bracket

Attached to the bracket, this makes a pulley with rod

DM210-2L Pulley, movable, with hook, D = 100 mm

weight: approx. 70 g

DM210-2D Block and tackle with 4 pulleys, D = 100 mm

Block and tackle for demonstration with two pulleys per block mounted on top of each other; plastic pulleys with grooves for cord; one block with one hook, the other with two hooks; pulley diameter: 75 and 100 mm, L = approx. 255 mm; weight per block: approx. 140 g

DM210-2P Parallel pulley block, D = 100 mm

Block and tackle for demonstrations with two pulleys per block mounted beside each other; plastic pulleys with grooves for cord; one block with one hook, the other with two hooks; pulley diameter: 100 mm, L = approx. 145 mm; weight per block: approx. 140 g

DM210-2K Pulley on rod, axial, ball bearing, D = 100 mm

Rod: D = 10 mm, L = 40 mm

DM210-4K Pulley on rod, very low friction

Pulley with very low friction thanks to an axle which is moving in two ball bearings; with metal rod
Rod: D = 10 mm, L = 40 mm
Pulley: D = 50 mm

DM215-1W Wheel and axle, demo

Three wheels of different colour connected together, each with groove; centre hole for rotating on bearing pin; two holes in each wheel for attaching cords;
diameter of the wheels:
150 / 100 / 50 mm

Circular discs and gears

Centre hole for rotating on bearing pin;
hole for crank pin as well as for coupling pin when connecting several gears or belt pulleys

DM210-50 Circular disc, D = 50 mm, red

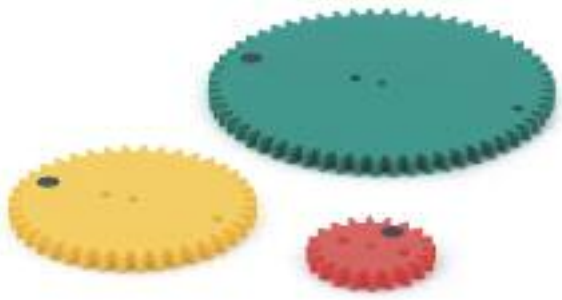
DM210-75 Circular disc, D = 75 mm, blue

DM210-10 Circular disc, D = 100 mm, yellow

DM210-15 Circular disc, D = 150 mm, green

DS402-2N Crank pin, L = 50 mm

DS401-1A Drive belts, set of 2



DM211-20 Gear with 20 teeth, red, D = 44 mm

DM211-40 Gear with 40 teeth, yellow, D = 84 mm

DM211-60 Gear with 60 teeth, green, D = 124 mm

Not shown:

DM208-1K Coupling pin for mechanics

For fastening together 2 - 3 belt pulleys or gears;
nickel-plated steel pins with 4 mm plug pin

DS204-2L Bearing pin with clamp insert

For mounting the bearing pin in boss head clamps or rail saddles; this newly developed clamp insert enables elements to be held by the bearing pin at a variable distance from the front side of the boss head clamp;
clamp insert made of fibre-glass reinforced plastic;
with slit and flat section for using a clamping screw;
bearing pin axis:
D = 3 mm, L = 45 mm
clamp insert:
D = 10 mm, L = 40 mm

Magnetic bases

Rubber-coated metal base with embedded neodymium magnet; for quick set-up of support rods round up to a diameter of 10 mm; normal or parallel to a metal panel; rubber coating prevents scratching of the panel surface, the base becomes slip-proof; a newly developed clamp insert with bearing pin enables the assembly of elements variable to the distance to the panel surface;
adhesive force on the bearing pin serves as contact point, measured parallel to the panel:
Magnetic base, D=43mm: 10 -25 N
Magnetic base, D=66mm: 20 -70 N
(The adhesive force depends on the thickness of the metal panel)

DS110-43 Magnetic base, D = 43 mm, with tube and pin

DS110-66 Magnetic base, D = 66 mm, with tube and pin

DM212-2G Worm gear on rod

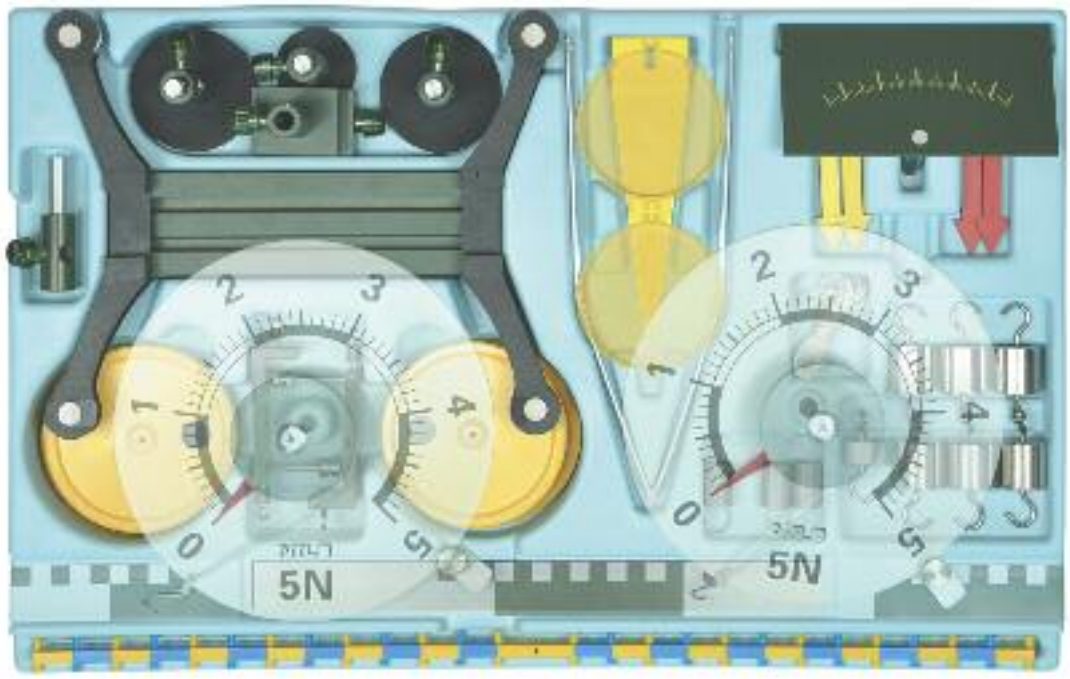
Gear ratio of 1:20 is obtained when used with 60-tooth gear DM211-60; worm: D = 30 mm, L = 60 mm;
rod: D = 10 mm, L = 60 mm

MECHANICS ON THE BOARD

Equipment set enabling experiments in mechanics to be demonstrated on metal panels in a clearly visible and understandable manner.

- Large amount of time saved through fast assembly/dismantling
- Describing the panels allows the experiment to be very clearly related to theory
- Torsion dynamometers provide precise measurements; the large scale allows the value to be seen from a distance
- Rubber-encased metal feet with embedded neodymium magnets prevent scratching of the table surface; this also makes the base non-slip

DM206-1M Kit Static mechanics 1 "inno"

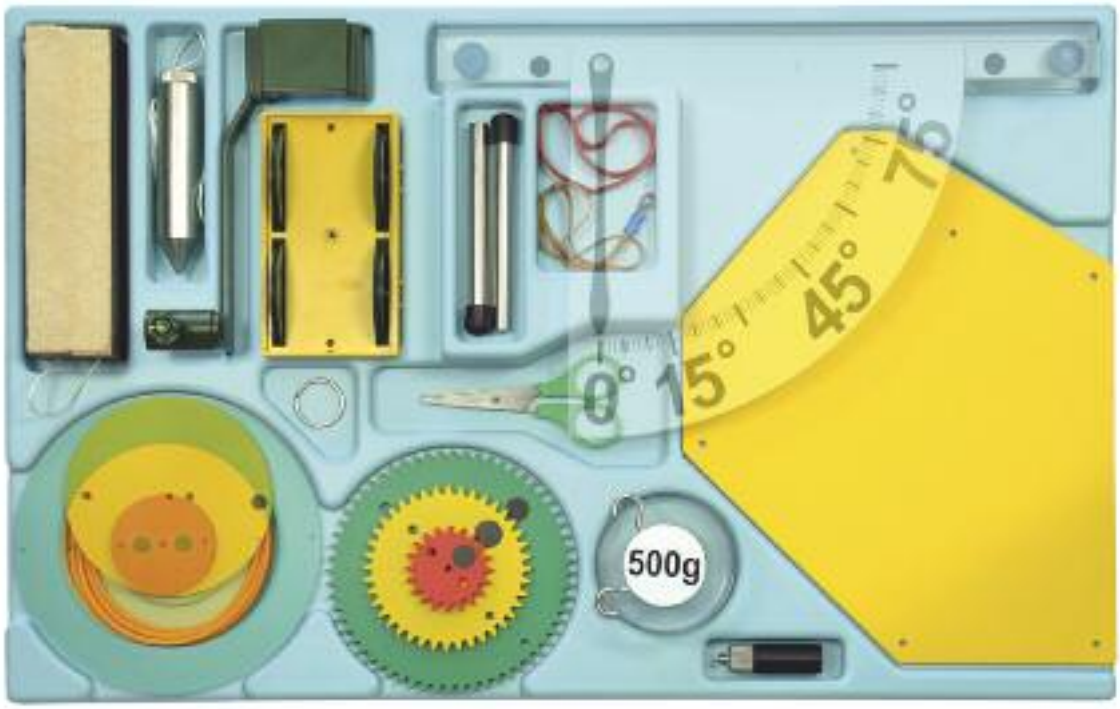


consisting of:

DS090-1M	1x	Claw base, magnetic, L = 200 mm
DS110-66	2x	Magnetic base, D = 66 mm, with tube and pin
DS110-43	1x	Magnetic base, D = 43 mm, with tube and pin
DS103-3G	1x	Sliding saddle, H = 34 mm
DS200-04	1x	Stand tube, H = 40 mm
DM132-1D	2x	Torsion dynamometer 5 N, (02)
DM121-5B	6x	Weight on hook 100 g, simple
DM121-3B	1x	Weight on hook 20 g, simple
P1810-2S	1x	Coil spring 10 N / m, D = approx. 16 mm
P1810-1S	2x	Coil spring, 5 N / m, D = approx. 16 mm
P1810-1D	1x	Flat spring steel, 0.6 mm, L = 300 mm
P1220-3A	1x	Lever rod demo, L = 520 mm
DM221-4Z	1x	Pointer for lever 520, metal
DS407-1S	1x	Scale on support
DM220-3B	2x	Scale pan with handle, demo
DM210-3A	4x	Pulley, plastic, D = 100 mm
DM210-2B	2x	Bracket for pulleys D = 100 mm
DG200-1S	1x	Cord, white, L = 5 m
DG100-6M	1x	Measuring tape with scale in blocks, magnetic
DL970-3A	2x	Arrow, red, magnetic
DL970-2A	2x	Arrow, yellow, magnetic
P7911-1M	1x	Box insert Static Mechanics 1
P7806-1G	1x	Storage box II big, with cover

Experiment: One-sided lever (magnetic)

DM207-1M Kit Static mechanics 2 "inno"



simple – fast – safe

consisting of:

DM620-1S	1x	Plate for testing centre of gravity
DM600-1L	1x	Plumb line
DS130-1S	1x	Inclined plane, simple (02)
DS130-1T	1x	Holder for torsion dynamometer for inclined plane
P1130-2R	1x	Ring for parallelogram of forces
DM530-2R	1x	Rubber band, wide
DM650-1R	1x	Roller
DM680-2S	1x	Friction block, multifunctional
DM215-1W	1x	Wheel and axle, demo
DS402-2N	1x	Crank pin, L = 50 mm
DS401-1A	1x	Drive belts, set of 2
DM211-20	1x	Gear with 20 teeth, red
DM211-40	1x	Gear with 40 teeth, yellow
DM211-60	1x	Gear with 60 teeth, green
P7502-1A	1x	Pair of scissors, SE
DM300-2A	1x	Dynamics trolley, demo, 50 g
DM210-10	1x	Belt pulley D = 100 mm, yellow
P7911-2M	1x	Box insert Static Mechanics 2
P7806-1G	1x	Storage box II big, with cover

Experiment: Inclined plane (magnetic)

The following experiments can be carried out with the static mechanic set:

MHM 01 Beam balance
MHM 02 Mass and force of weight
MHM 03 Linearity of force of weight and mass
MHM 04 Force causes deformation
MHM 05 Elongation of an elastic band

MHM 06 Hooke's Law (elongation of a coil spring)
MHM 07 Force and counterforce
MHM 08 Composition of parallel forces
MHM 09 Equilibrium of forces
MHM 10 Composition of non parallel forces

MHM 11 Inclined plane – downward force on incline
MHM 12 Decomposition of forces on an inclined plane
MHM 13 Two-sided lever
MHM 14 Direction of force and point of impact
MHM 15 One-sided lever
MHM 16 Centre of gravity
MHM 18 Static and dynamic friction
MHM 19 Friction, surface and mass
MHM 20 Rolling friction

MHM 21 Lifting work
MHM 22 Simple fixed pulley
MHM 23 Pulley
MHM 24 Simple block and tackle
MHM 25 Compound (parallel) block and tackle

MHM 26 Wheel and axle
MHM 27 Gear transmission
MHM 28 Belt drive

P5310-1A Track and optical bench, 1000 mm

For use as a rail track, ball track for balls of diameter 60 mm, stand rail or optical bench;
NTL special aluminium rail profile, silver anodised, with scale in cm and mm;
left end with drill hole and setting screw to adjust the inclination with a support rod;
right end with drill hole on the front to hold pulley with SE metal rod;
length = 1000 mm

DS101-4B Universal rail with scale and holes, L = 1000 mm

For use as a rail track, ball track for balls of diameter 60 mm, stand rail or optical bench;
NTL special aluminium rail profile, silver coated, with easy-to-read scale divided into blocks, dm and cm;
four vertical holes for inserting and fixing support rods to the flexible track; on both ends screws can be found to extend the track with the help of rail connector or to vertically mount round support rods

DS101-2A Flexible track, acrylic, L = 1000 mm

For use in experiments on non-uniform motion, conversion of "potential to kinetic energy" and "up- and downhill motion" of a trolley or ball;
flexible acrylic panel, 54 mm in width, with longitudinal grooves for dynamics trolley or balls 60 mm in diameter;
two rods to be coupled to the Universal rail with scale and holes

DS101-3A Supports for fastening flexible track, set of 2

Two rods with engraved graduations for infinitely variable adjustment of the angle of inclination of the ends of the flexible acrylic track on the universal rail with scale and holes;
dimensions: D = 10 mm, L = 110 mm

DS103-1H Holder for ball track

For mounting and fixing on stand rails or for mounting stand rails for use as ball track;
special aluminium profile,
green powder-coated;
with clamping screw;
with support rod:
D = 10 mm, L = 40 mm

DS103-2H Holder for NTL stand rails

For mounting and raising stand rails for use as a track or optical bench; special aluminium profile, green powder-coated;
with support rod: D = 10 mm, L = 40 mm

P7240-2B Support rod, T-shaped

By attaching to one end of the track, the track is slightly inclined and a uniform accelerated motion can be demonstrated with a trolley or a ball of D = 60 mm;
metal cylinder 15 x 60 mm,
with rod 10 x 45 mm

DM355-5S Pulley plastic, with very low friction

Pulley with very low friction thanks to an axle which is moving in two ball bearings;
with holder and fixing screw for mounting on tables and tracks;
the roll with bracket is continuously variable and fixable;
Span width: 20 mm
Pulley D = 50 mm

DM362-1E Bumper

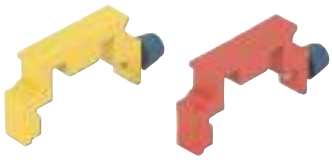
For a damped braking action of moving bodies (trolleys or balls);
soft cylinder with centric metal tube, to be slipped onto a support rod;
D(out) = 30 mm
D(in) = 10.2 mm
H =40 mm

P5310-1S Rail bond SE, universal

For connecting NTL rail profile (stand rails, track, optical bench);
NTL special aluminium profile, anodised, L = 80 mm

Marking sliders

For marking positions along NTL tracks, stand rail material or optical bench);
NTL special aluminium rail profile, coloured, with clamping screw;
width = 10 mm



DS105-1G Marking slider yellow

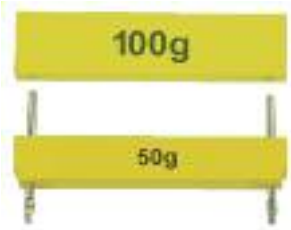
DS105-1R Marking slider red

DM300-2A Dynamics trolley, demo, 50 g

Trolley body and wheels made of ABS plastic; very low friction;
4 mm holes on the face sides for attaching devices with 4 mm plugs;
4 mm holes on the top side for mounting additional weights;

dimensions: 120 x 66 mm
weight: 50 g

Additional weights for Dynamics trolley, demo



DM325-50 Additional weight 50 g

DM325-01 Additional weight 100 g

DM281-1H Hook with plug

To hook threads or cords onto trolleys or gliders;
metal hook with 4 mm plug

Weights for dynamics (weights on hooks, profi)

Colour-coated weights with two hooks for suspending from one another; with screen-printed weight information visible from a distance; ideal for demonstration experiments;
tolerance: ±1 %; powder-coated, yellow

	D (in mm)
DM120-1A Weight on hook 2 g	20
DM121-1A Weight on hook 5 g	22
DM121-1N Weight on hook 1 N	

DM300-3A Trolley with variable speed, battery powered

Battery driven; for experiments involving uniform motion;
potentiometer for continuously variable speed adjustment;
mode switch: Forward / Off / Reverse;
sockets for external power supply (non-uniform motion);
battery (9 V) can be changed without opening the case;
dimensions: approx. 124 x 69 x 85 mm

Balls, D = 60 mm, for dynamics and conservation of momentum

DM360-5E Ball, steel, D = 60 mm

DM360-5H Ball, wooden, D = 60 mm

DM360-5R Ball, plastic, red D = 60 mm

DM360-5W Ball, plastic, white D = 60 mm

P1325-9S Counter with 2 light gates, set

Solid, handy counter with LC display,
digit height 12.5 mm; accuracy 10 ms; battery powered.

Modes:
- stop watch
- Start – Stop
- Gate

2 light gates,
internal gate width: 78 mm
2 connection cables,
L = approx. 135 cm each

P1324-1K Counter, intelligent, set

Compact, intelligent time-measurement device; thanks to the precise resolution of 0.1 ms and the easy-to-use menu with storage options, experiments in dynamics and motion are easy to measure and calculate; the light gate and wheel with spokes enable results for speed and acceleration to be displayed as well.

Time mode:
- with one light gate
- wheel with spokes (measures and stores 10 interruptions)
- with two light gates
- pendulum movement (measures the first and third interruption)
- stopwatch

Speed mode:
- 1 slit (average speed)
- impulse experiments (with 1 or 2 trolleys)
- pulley (rad / s)
- pulley (rev / s)

Acceleration mode:
- with one light gate
- with two light gates
- pulley for linear or angular movements

Counter mode (event counting):
- for 30, 60 or 300 seconds or manually

2 measurement inputs; rechargeable battery, 3.7 V / 1100 mAh (incl. charger); operation time: approx. 40 hrs (when fully charged); dimensions: 200 x 80 x 35 mm; weight: approx. 265 g

P3120-2Z Universal timer "inno"

Digital timer for universal use, magnetic, can be connected to light gate P1320-3LR and to falling body apparatus DM340-1F; with 26 mm LED display; resolution: 1 ms

Functions:
- time measurement during free fall (OFF-OFF)
- time measurement in dynamics (L1 start - L2 stop)
- counting pulses (L1 count)
- time measurement of pendulum (L1 start – stop)
- measurement of transit time (L1 – gate)
- L1 start – automatic stop after 10 s
  (for measuring rotational speeds e.g.)

Reset button, LED display for pulse and second mode
Signal input by way of two 5-pin DIN jacks
Power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V / 500 mA, P3120-6N
Case: plastic, ABS
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 425 g

Recommended accessories for "inno"-measuring instruments:

P3120-5B S-shaped assembly platform

For supporting magnetic "inno" components in an elevated position; metal bracket, S-shaped; green powder-coated; height: 240 mm

P3120-6N Mains transformer 6 V DC / 500 mA

Especially for use as an external power supply for magnetically mounted "inno" measuring instruments, connected by means of 5.5 mm hollow DC plugs

Voltage source:
230 V AC / 50 ... 60 Hz
European Schuko mains-plug

DR260-1D Digital counter, universal

Universal digital demonstration counter for measuring time, frequency and pulse rates;

Display: 7 segment LED display, 6 digits; digit height 26 mm

Time measurement: 4 measuring ranges from 10 - 10 000 s times the value displayed; measurement can be controlled using any signal source or light gate demo; the two time value inputs may be combined logically in every possible way; adjustable signal threshold of time value inputs using potentiometer; light-emitting diodes for monitoring operation

Frequency measurement: Fully automatic in 4 ranges from 10 - 10 000 Hz times the value displayed; signal may be monitored audibly by switching on loudspeaker

Pulse rate measurement: Input for Geiger-Müller tube; anode voltage may be set in 12 steps from 325 to 600 V; measurements scaled down by 1 : 100 possible; signal may be monitored audibly by switching on loudspeaker

ABS plastic case with 2 recessed handles
Dimensions: 260 x 150 x 210 mm
Voltage source: 230 V / 50 - 60 Hz

P1320-3LR Light gate, demo

Precision light gate with generous intermediate space; infrared light source; for controlling external timing devices;
variable control with LED indicator for adjusting intensity to surrounding lighting conditions;
with hole and capstan head screw for fixing on rods of up to 10 mm in diameter; measuring accuracy: 0.1 mm.
Signal output and power supply by way of 3-pin DIN jack; for the direct connection with the universal counter P3120-2Z or digital counter universal DR260-1D.
Internal gate width: 74 mm;
external dimensions:
175 x 130 mm

P1320-1H Rail holder for light gates, demo

For fastening a light gate demo to a rail track or ball track;
dimensions: 135 x 185 x 30 mm,
support: 10 x 40 mm

P1320-3M Magnetic holder for light gates, demo

For fastening the light gates to a steel board, thanks to strong magnets;
magnetic base: D = 43 mm,
support: D = 10 mm, L = 70 mm

P4210-7B Sensor Distance (Euromotion)

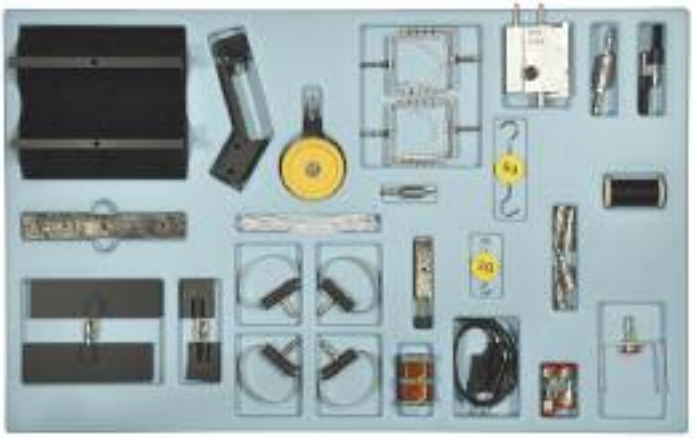
Ultrasonic motion detector with USB – port,
no additional interface or adapter is needed;
measures continuously the distance between the sensor and an object;
to be used for dynamics or pendulum movements e. g.;
measurement range: 20 ... 600 cm
(dependent on size, shape and surface of the object);
max. measuring frequency: 20 / sec.;
with support rod

An absolute "must have" for dynamics

DM280-1K Air track, basic set

consisting of:

DM280-1F	1x	Air Track (01), L = 2000 mm; Track with extraordinarily low friction, for experiments in linear motion, kinematics and dynamics of solid bodies; rhombic aluminium tube (cross-section: 55 x 55 mm), graduated on both sides, mounted on U-profile frame; two opposite rows of holes (D = 1 mm, spaced 20 mm apart) staggered by 1 cm on the upper surface of the aluminium tube; tube is closed at one end, while at the other end there is a receptacle for connecting the air supply (02) by means of the pressure hose; adjustable feet with levelling screws for horizontal height adjustment; means of alternatively fastening launcher DM281-1S, fork with plug DM281-1G or spring bumper P1311-2D at both ends. Dimensions: 2000 x 250 x 167 mm
DM282-1S	2x	Glider Glider for air track; material: plastic; pins mounted on the side for mounting additional weights; 4 mm hole on the upper edge for fixing screens, 4 mm hole at each end with inserted metal tip or for attaching forks or bumpers; dimensions: L = 125 mm, H = 60 mm; weight: 70 g
DM281-1Z	4x	Metal pin with plug, 10 g
DM282-2M	4x	Additional weight, 50 g, L = 124 mm
DM281-1S	1x	Launcher, mechanical Allowing consecutive launching at the same force; Aluminium block with tension spring and lever for fixing and releasing launching pin; spring tension may be varied repeatedly, two 4 mm plugs for fastening to the end receptacle of the air track. Dimensions: approx. 80 x 47 x 20 mm
DM280-1E	1x	End receptacle, firmly mounted at one end of the track
DM281-7E	1x	End receptacle, adjustable for setting the desired working distance variably to any point along the track
DM281-1G	4x	Fork with plug, with rubber band, 10 g used as bumper, may be plugged into end receptacle or glider
DM281-2G	1x	Rubber bands, set, replacement rubber bands for fork DM281-1G, set of 10
DM281-1P	2x	Plate with plug, reciprocal of fork with rubber band
DM281-2B	2x	Screen with plug, L = 100 mm, 10 g



DM280-1Z Air track, supplementary set

consisting of:

DM280-1R	1x	Pulley for deflection, with plug, ball bearing Special, virtually friction-free plastic pulley (D = 50 mm) with ball bearing, on bracket with 4 mm plug pin
DM281-1H	1x	Hook with plug
DM281-1B	2x	Screen with plug, L = 25 mm
P1311-2F	1x	Adapter for unelastic collision, set of 2
P1311-2D	4x	Spring bumper
DM281-2M	4x	Round magnet with plug, D = 13 mm
DM120-1A	1x	Weight on hook 2 g
DM121-1A	1x	Weight on hook 5 g
P7100-1A	1x	Cord, 30 m roll, high tensile strength

Electromagnetic launcher:

P3911-2G	1x	Iron core, slotted with screw
P3911-2V	1x	Coil with 800 turns, SE, blue
P3310-7S	2x	Connecting leads, 4/2 mm
DM281-1M	1x	Fork with magnet for retaining
P7911-2L	1x	Box insert Air track - supplementary set
P7806-1G	1x	Storage box II big, with cover

DM270-1G Air supply 02, with hose

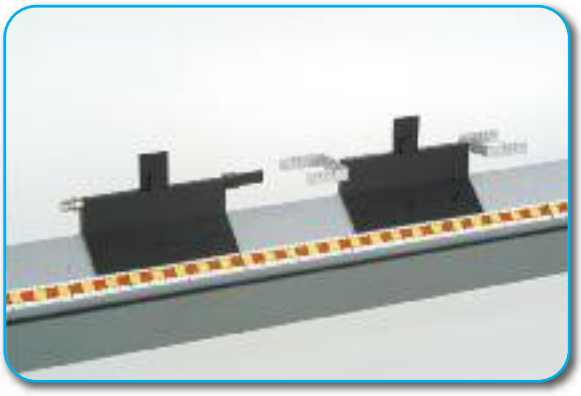
Blower with flexible hose for air track; low noise, but strong blower in metal housing on rubber-coated legs;
stepless adjustment of flow speed;
transparent, flexible hose (L = 150 cm),
with connection sleeve for the air track

Technical data:
Flow rate: max. 35 m³/h
Sound level: max. 60 dB
Motor power: 250 W
Operating voltage: 230 V / 50 - 60 Hz
Dimensions: D = 20 cm, H = 30 cm (40 cm with hose connector)
Weight: approx. 6 kg

DM283-1L Holder for light gates demo on air track

Holder to mount demo light gates
directly on air track (01);
support rod: 10 x 40 mm;
dimensions: 135 x 185 x 30 mm

Detail: Attaching the light gate holder with light gate demo to the air track



Detail: Elastic collision

Detail: Pulley for deflecting force and weight driving glider (experiment: uniformly accelerated motion)

Detail: Mechanical launching

DM810-1H Happy / Unhappy balls

Two look-alike balls of varying elasticity.
Diameter: 24 mm each

Experiment: When the two balls are dropped onto a hard surface, one of them bounces back while the other one does not

DM373-1T Handle with cord

For use in experiments on inertia;
metal rod, D = 10 mm,
L = 150 mm, nickel-plated;
cord fixed at the centre,
L = approx. 30 cm

Experiment: Inertia and mass; the cord on the handle tears when the weight is lifted suddenly

DM344-1S Projectile launcher 02

May be used as launcher allowing consecutive launching with the same force, for dynamics experiments involving a track;
Long pin with 8 numbered striations for adjusting and setting different speeds of launching, with tension spring, easily triggerable trigger cylinder as well as a finger grip for tensioning the spring;
may be fastened to NTL special aluminium rail profile;
Dimensions: 240 x 60 x 50 mm

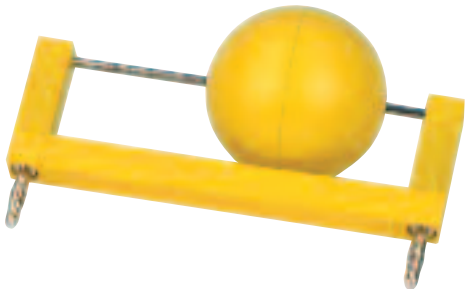
DM370-1A Plate for experiments with inertia

Acrylic disk, diameter: 100 mm,
with small recess at centre for holding ball

DM360-5W Ball, plastic, white, D = 60 mm

DM341-2A Ball holder for trolley demo

Accessory for demonstrating inertia;
acrylic frame with two 4 mm plug pins and runner for "inertia ball"; ball D = 48 mm;
Dimensions (without pins): 116 x 48 x 60 mm



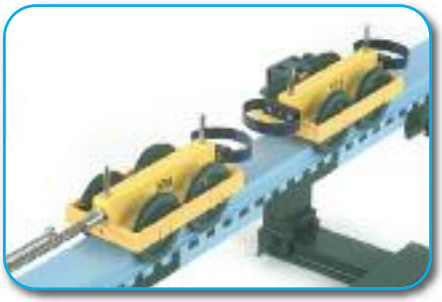
P1311-2E Flat spring for trolleys

For experiments on conservation of momentum and dynamic measurement of mass; steel flat spring, the ends of which are specially shaped to be inserted into the dynamics trolley demo; dimensions: 170 x 10 x 0.23 mm

Experiment: Interaction and mass

P1311-2D Spring bumper

For demonstrating the law of conservation of momentum; elliptically shaped steel flat spring with 4 mm plug pin, may be inserted into dynamics trolley demo; spring width: 10 mm; weight: 10 g



Experiment: Elastic collision

DM281-1G Fork with plug, with rubber band

Used as bumper; may be plugged into dynamics trolley demo; weight: approx. 10 g

DM281-1P Plate with plug

Reciprocal of fork with plug with rubber band; weight: approx. 10 g

Experiment: Elastic collision

P1311-2F Adapter for unelastic collision, set of 2

For demonstrating unelastic collision; adapter consisting of hollow metal cylinder filled with plasticine, second adapter with needle; each with 4 mm plug pin; may be inserted into dynamics trolley demo

Experiment: Unelastic collision

DM335-1S Momentum accessory

For demonstrating the law of conservation of momentum; metal pendulum bob on rod, mounted on wire bracket on ball bearings; acrylic panel with 4 plug pins for insertion into 2 dynamics trolleys;
pendulum L = 122.5 mm, pendulum D = 1" (25.4 mm);
dimensions: 282 x 55 x 160 mm

Experiment: Conservation of momentum under equal mass

DM343-1S Momentum cannon

Three rubber balls stacked one upon another on the plastic central axis, beginning with the bottommost ball, increase the momentum gathered when the device is dropped.
The total momentum is then transferred to a fourth ball (plastic) sitting loosely on the stack, causing it to be propelled upwards.
This "shot" can reach five times the distance dropped; supplied with two replacement balls.
Ball D: 47 / 36.5 / 26 / 21.5 mm
Total height: 165 mm

DM750-5S Ball collision assembly, small

5 steel balls, D = 22 mm,
bifilar suspension from two metal brackets, mounted on base;
dimensions: 180 x 120 x 180 mm

DM340-1A Segner's Wheel

Acrylic model for demonstrating the principle of jet propulsion;
cylindrical water vessel on pivot bearings, D = 36 mm, H = 255 mm;
equipped with 4 tubes, L = 58 mm, with drainage holes on the side;
total height: 280 mm

Recommended accessories:

DM340-2W Vat with drain connector

Acyrlic; D = 200 mm, H = 65 mm

DM718-MR Propulsion trolley

For demonstrating the principle of interaction, where effusing air from a balloon drives a small car;
small plastic car with balloon and effusion pipe;
dimensions: approx. 150 x 60 mm

DM311-2M Motor with propeller, on support

Extremely easy-to-turn motor with fan vanes for demonstrating conversion of wind to electrical energy and vice versa;
aluminium cylinder, 40 x 68 mm;
with built-in motor; with fan vanes (L = 130 mm) and two 4 mm safety jacks; on support:
D =10 mm, L = 62 mm

DM300-2K Rod support for trolley

For attaching round material up to D = 10 mm to the demo trolley;
base plate with powder-coated metal sleeve and set screw;
dimensions: 115 x 30 x 47 mm

DM300-2A Dynamics trolley, demo, 50 g

Trolley body and wheels made of ABS plastic; very low friction;
4 mm holes on the face sides for attaching devices with 4 mm plugs;
4 mm holes on the top side for mounting additional weights;

dimensions: 120 x 66 mm
weight: 50 g

Experiment: Force of propulsion created by wind generator

DM340-3B Cartridge adapter

For demonstrating propulsion due to escaping gas (CO_2) and for measuring the temperature of suddenly escaping gas (CO_2) using flexible thermo-sensor; acrylic block with recess for inserting carbon dioxide cartridge; screw cap with piercing pin and nozzle opening; may be attached to the dynamics trolley demo by means of two 4 mm plug pins;
Dimensions: 35 x 142 x 35 mm

DM340-3C CO_2-cartridges, set of 10

Dimensions: D = 18 mm, L = 62 mm

DM340-5A Rocket - model

"Rocket drive" by means of propulsion; plastic bottle with special valve and guide fins along with connecting hose and hand pump; the "pressure tank" is partially filled with water and sealed using the special valve; pumping causes a rise in pressure in the "pressure tank"; sufficient pressure causes the connecting hose to be ejected from the valve, water is forced through the valve at high velocity and the rocket rises.

Total height:
approx. 430 mm
Pump hose
L = approx. 145 cm

Ascent altitude: 5 - 40 m depending on water volume in tank

DM340-1F Falling body apparatus, demo

consisting of:

Ball holder with mechanical release
may be used for demonstrating "free fall" and the "principle of independence"; two special 4 mm jacks for connecting to timer DM341-1T (or Universal timer “inno“ P3120-2Z with two connecting cables P1323-9A);
support rod D = 10 mm, L = 30 mm

Collector with contact plate
Stops the timer on ball contact;
container D = 80 mm, H = 45 mm, with two 4 mm jacks for connecting to timer DM341-1T or P3120-2Z with connecting cables for counter "inno";
support rod D = 10 mm, L = 40 mm

Steel balls 3/4" (19 mm), set of 2

DM341-1T Timer for falling body apparatus

Easy-to-use timer, displaying the difference between start and stop in milliseconds; 26 mm LED display;
2 pairs of safety jacks; on-off switch,
reset switch for zero readjustment;
powered by batteries (4 x 1.5 mignon)
or mains transformer 6 V / 500 mA P3120-6N (not included)
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 385 g

P3120-2Z Universal timer "inno"

Digital timer for universal use, magnetic, can be connected to light gate P1320-3LR and to falling body apparatus DM340-1F; with 26 mm LED display; resolution: 1 ms

Functions:
- time measurement during free fall (OFF-OFF)
- time measurement in dynamics (L1 start - L2 stop)
- counting pulses (L1 count)
- time measurement of pendulum (L1 start – stop)
- measurement of transit time (L1 – gate)
- L1 start – automatic stop after 10 s
  (for measuring rotational speeds e.g.)

Reset button, LED display for pulse and second mode
Signal input by way of two 5-pin DIN jacks
Power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V / 500 mA, P3120-6N
Case: plastic, ABS
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 425 g

P1323-9A Connecting cable for counter "inno"

To connect the Falling body apparatus to the Universal timer "inno";
connecting cable from 3-pole DIN plug to 2x 4-mm safety jacks

Attention: to perform experiments two cables are required

DM345-1W Ballistics apparatus basic, demo

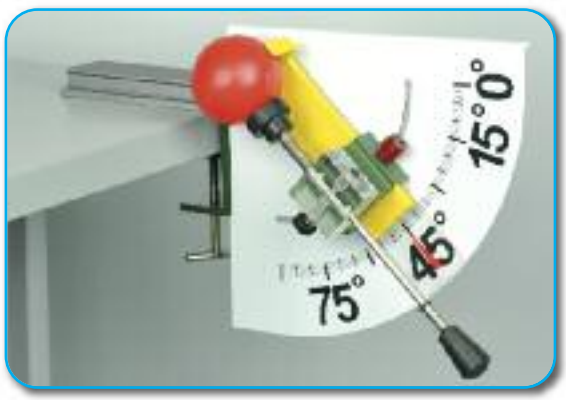
For demonstrating ballistics using solid bodies or liquids;
large metal scale with a coloured pointer, easily adjustable and lockable in position; hence readings can be taken from large distances; with the mounted table clamp and stand rail base profile the apparatus can be fixed to tables with a thickness of 48 mm; metal bracket for holding the launching ball;
digit height on scale: 26 mm; dimensions: 260 x 210 x 35 mm

Please note:
To perform the experiments, either a water throwing unit or a ball throwing unit is required!

DM345-2K Ball throwing unit

For demonstrating ballistics using a large ball;
long pin with three striations for setting different launch speeds, with tension spring, easily-triggerable trigger cylinder with finger grip for easy tensioning of the spring; may be fastened to the ballistics apparatus or NTL rail profiles;
incl. wooden ball and hollow plastic sphere, D = 60 mm each;
dimensions: 180 x 54 x 60 mm

Please note:
Ballistics apparatus required to perform the experiments!



Experiment: Inclinded discharge (with a big ball)

DM345-2W Water throwing unit

For demonstrating ballistics using liquids;
glass tube with jet on saddle,
with silicon hose (7 / 10 mm), L = 250 cm;
can be attached to ballistics apparatus or NTL rail profile.

Please note:
Ballistics apparatus required to perform the experiments!

Experiment: Inclined discharge (with water)

DS602-2R Magnetic markers, red, set

Magnetic disks, red, D = 16 mm, set of 12

DS602-2G Magnetic markers, yellow, set

Magnetic disks, yellow, D = 16 mm, set of 12

DM560-1F Free fall tube

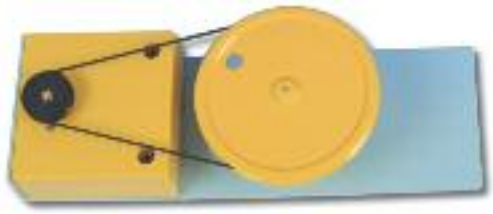
For investigating free fall in a vacuum glass tube;
open at one end with 2 falling objects of varying weight (chick's feather, small metal plate),
silicon stopper and stopcock with connecting tubes;
length (net falling distance): 1000 mm;
total length: 1130 mm; diameter: 46 mm

Detail: Free fall tube with stopcock and falling objects

P9901-4R SEK Circular motion

Equipment set
to perform experiments on the following subjects:

MEC 041 Centrifugal force
MEC 042 Centrifugal force – suspended balls
MEC 043 Regulator for centrifugal force
MEC 044 Centrifugal force – earth flattening rings
MEC 045 Rotating liquid
MEC 046 Rotating pendulum (Foucault pendulum)



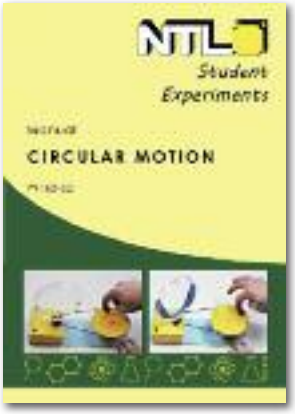
consisting of:

P1340-2E	1x	Centrifugal hoops “compact”
P1340-2Z	1x	Watt’s governor “compact”
P1340-2R	1x	Foucault’s pendulum “compact”
P1340-2D	1x	Rotating disk “compact”
P1340-2C	1x	Locking screw M3, small
P1340-2S	1x	Steel balls ½” (12.7 mm), set of 2
P1340-2K	1x	Rotational dynamics paradox/accelerometer “compact”
P1345-1D	1x	MBC Pivot bearing with transmission gear
P1345-1M	1x	Magnetic base for drive pulley “compact”
P3410-4A	1x	Drive pulley “compact”, D = 100 mm
P3410-5A	1x	Drive belt “compact”
P3410-1A	1x	Assembly platform for MBCs

Storage:

P7906-4R	1x	Box insert Circular motion, SE
P7806-1K	1x	Storage box II small, with cover
		Box insert plan with 2 labels

P9160-5D Experiment manual "Circular motion", SE



Experiment: Rotating liquid

DM352-9S Momentum apparatus, "retro"

2-stage hand-driven unit with chuck for mounting rotation objects; metal gear with two axles for differing rotating speeds; sturdy hand crank; hand grip and 2 support rods;
chuck for support rods with a diameter of 2 - 10 mm;
total length: approx. 290 mm
(supplied without support base)

DS402-4H Whirling table, demo, powered by hand

- Very large base: 500 x 325 mm, with levelling screws
- Drive pulley and rotating bearing adjustable to any position on support base
- Rods up to 10 mm D may be positioned vertically or horizontally in rotating bearing
- Both pivots with double ball bearings
- Transmission ratio 1:1 or approx. 1:9

consisting of:

DS101-1G	1x	Support base, large, L = 500 mm
DS402-4B	1x	Pivot bearing on saddle, short
DS402-3D	1x	Drive pulley
DS402-3B	1x	Pivot bearing on saddle, long
DS402-2N	1x	Crank pin, L = 50 mm
DS401-1A	1x	Drive belts, set of 2

DS403-1G Geared motor

Electric motor with metal gears and high torque in aluminium case; drive shaft with permanently mounted aluminium pulley with groove and M6 tapping for attaching crank pin when used as a generator.
Drive pulley diameter: 100 mm; green powder-coated printed with circle sectors in yellow;
case mounted on sliding saddle of special aluminium profile with clamping screw for mounting and fastening onto large support base rail support or stand rails

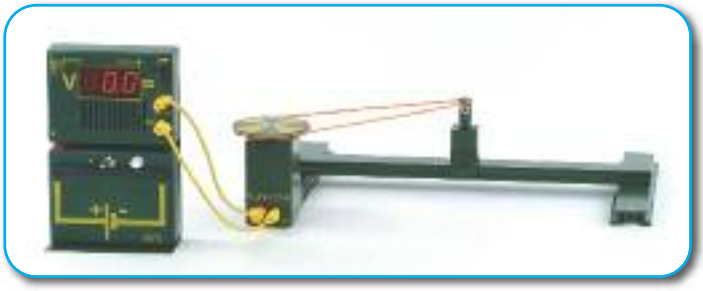
Nominal voltage: 6 V DC (3 - 12V);
Current consumption idling: 570 mA DC;
Speed: approx. 0 - 250 rpm
Case dimensions: 128 x 60 x 60 mm

DS403-2K Clamp socket adapter

Clamp socket on support for mounting on drive pulley of geared motor. The clamp socket, green powder-coated, is used to attach and fix in place devices on supports 10 mm in diameter.

DS403-3F Fixing screw M6

Used for the connection of the clamp socket to the geared motor



Set up: Whirling table used horizontally, driven by geared motor

DS403-2S Drive motor, demo

Electric motor with gears at angle in aluminium case (70 x 70 x 150 mm), green powder-coated, mounted on sliding saddle for setting directly on large support base and support rails, may be mounted horizontally or vertically; keyless chuck for attaching rods with a diameter of up to 10 mm,
switch for clockwise or counter-clockwise rotation, ON / OFF switch, button for continuously varying speed;
power supplied by way of two 4 mm safety jacks or hollow jack for connecting mains transformer 12 V / 6 A P3130-2P.
Speed: approx. 0 - 4000 rpm
Nominal torque: 20 N cm
Voltage source: 12 V DC
Dimensions: 70 x 150 x 155 mm

Set up: Whirling table used horizontally, powered by drive motor demo

DM352-1E Centrifugal hoops

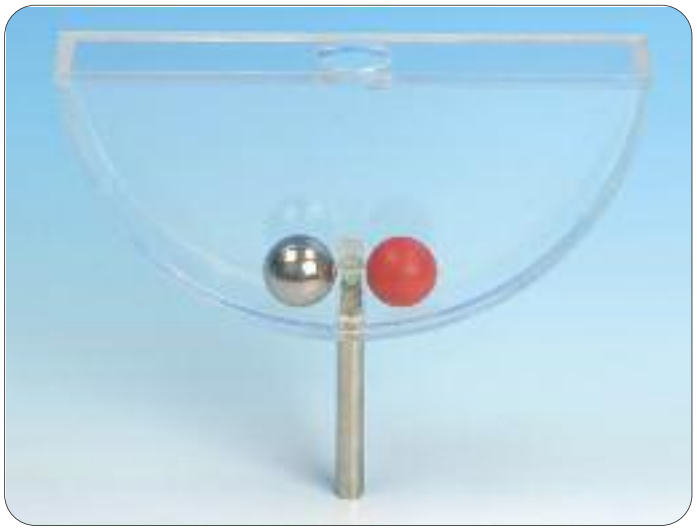
For demonstrating flattening at the poles of a deformable object under the influence of centrifugal force;
two crossing, elastic metal hoops with one pole fixed and the other sliding on a support rod, D = 10 mm;
diameter of rings: approx. 220 mm;
total height: 280 mm

Experiment: Flattening at the poles of a deformable object

DM352-1R Watt's Governor demo

Model of a centrifugal governor;
on support, D = 10 mm;
length of rods: 175 mm;
total height: 250 mm

DM358-1K Rotational dynamics paradox, demo



For demonstrating that centrifugal force is proportional to mass;
hollow hemispherical acrylic body (D = 200 mm, W = 37 mm) on support (10 x 70 mm);
with one plastic and one metal ball of the same diameter (D = 1")

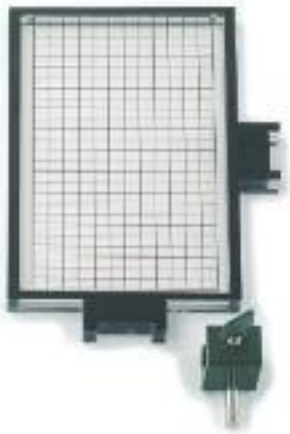
Experiment: Rotational dynamics paradox, Demonstration

DM358-1Z Centrifuge demo

Model of a centrifuge with support bridge (220 x 40 mm) and tilting holder for two test tubes 16 mm in diameter;
on support rod D = 10 mm, total height: 210 mm

DM353-1K Accelerometer

For investigating the relationship between the surface shape of rotating liquids and their angular velocity.
Acrylic cell with two adapters for mounting horizontally or vertically in clamp on support (included);
one side printed with cm grid (120 x 260 mm);
upper edge two openings with stoppers for filling;
dimensions: 155 x 280 x 15 mm



Experiment: Rotating liquid - demonstration

DM366-2P Centrifugal vessel

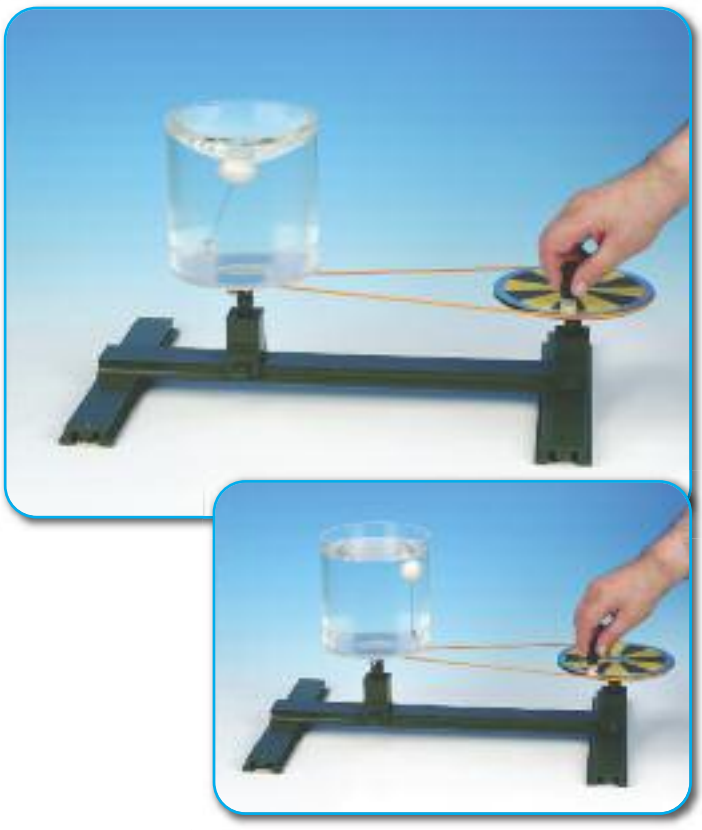
Acrylic cylinder on support, D = 10 mm, L = 30 mm, two protrusions on floor for inserting centrifuge insert DM367-2Z or for plugging in pins of Styrofoam ball DM366-3S
D = 150 mm, height (without support): 155 mm

DM367-2Z Centrifuge insert

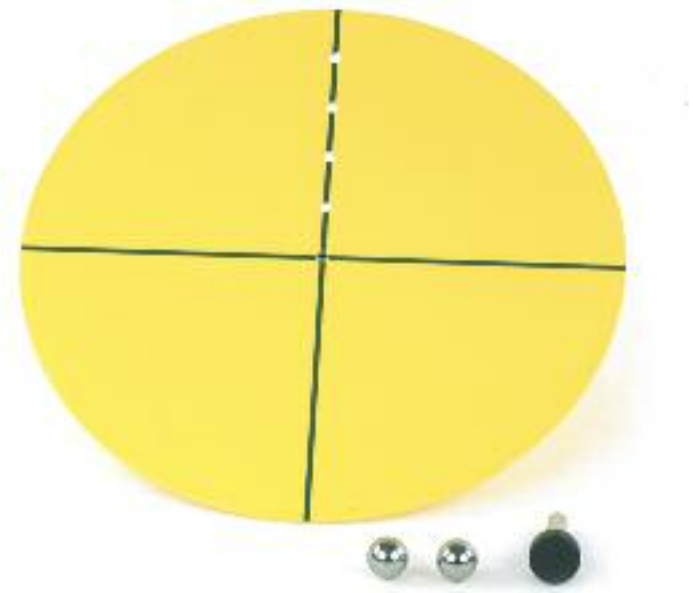
Acrylic cylinder for insertion in centrifuge vessel;
may be used as "centrifugal spinner" with wet cloth or sponge
D = 100 mm, H = 70 mm

DM366-3S Styrofoam ball on cord with plug

For demonstrating a physical paradox;
plug for attaching to floor of centrifuge insert;
ball D = 30 mm



Experiment: Centrifugal force - paradox
When the water in the cylinder is set in rotation, the heavier liquid is forced to the outside and the lighter stryofoam ball moves inwards



DM357-3K Rotating disk, demo

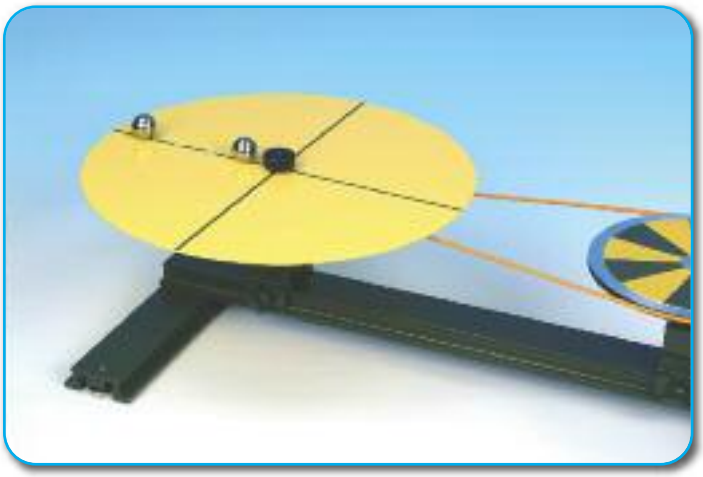
Metal disk; yellow powder-coated; with 4 holes spaced 30, 60, 90 and 120 mm from axis; centre hole for attaching to support rod DM357-3H;
D = 300 mm

DM357-3H Support rod for rotating disk demo

Metal rod with plastic nut for manual fastening; nut with recess in axis for setting ball in experiments with centrifugal force;
D = 10 mm, L = 40 mm

DM340-2S Steel balls ¾" (19 mm), set of 2

Steel balls for mounting on rotating disk demo for experiments in centrifugal force



Experiment: Centrifugal force - demonstration

For demonstrating that the plane of oscillation is maintained during rotation (Foucault's Pendulum), you additionally need:

DM357-3S Gibbet for suspending pendulum bob

Support rod with nut for attaching to rotating disk DM357-3K and cross piece with hook for suspending pendulum bob DM385-2S; max. pendulum length = 500 mm

DM385-2S Pendulum bob with eyelet, steel, D = 1" (25.4 mm)

Experiment: Rotating pendulum - demonstration

DM358-1P Rotating pendulum, electric, overhead model

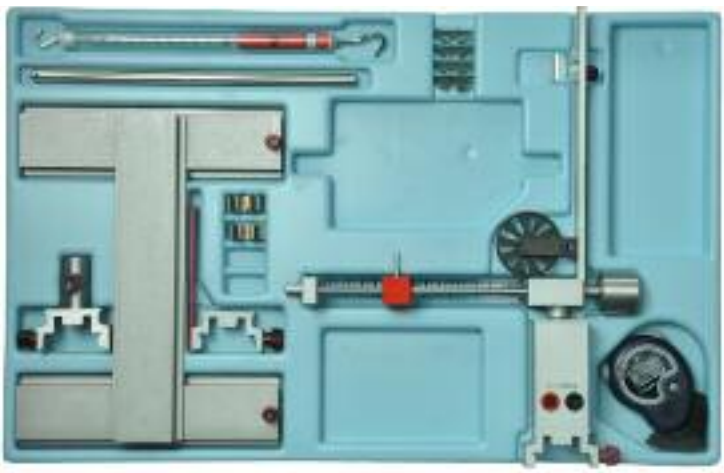
For demonstrating how "Foucault's Pendulum" works as well as the Coriolis effect; rotating acrylic disk for overhead projector, D = 225 mm; base plate with levelling screws; motor drive; voltage source: 0 - 6 V (12 V peaks possible);
rotation speed of the disk: 3.5 - 33 rpm;
runs clockwise or anticlockwise; ball runway ramp;
two steel balls D = ½" (12.7 mm)

Pendulum height: approx. 200 mm
Motor housing: 60 x 60 x 130 mm
Dimensions: 285 x 285 x 210 mm

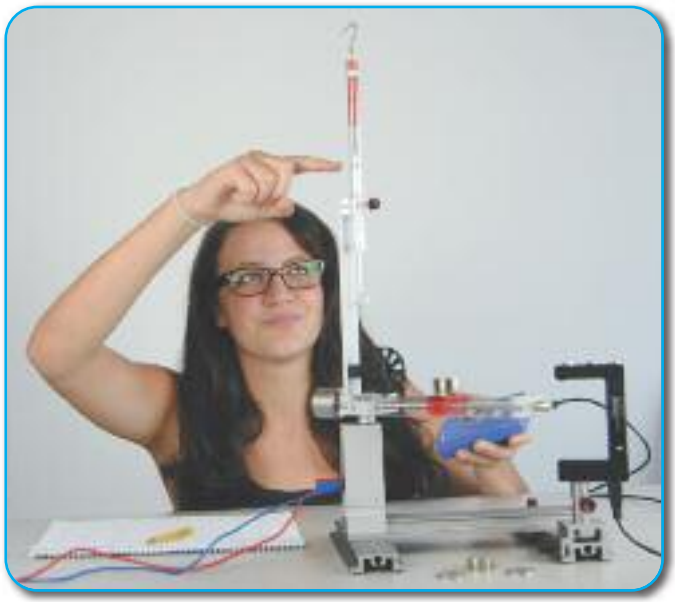
P9902-4Z SEK Centrifugal force

Equipment set
to perform experiments on the following subjects:

MRS 2.1 Determination of the centrifugal force as a function of the mass
MRS 2.2 Determination of the centrifugal force as a function of the radius
MRS 2.3 Determination of the centrifugal force as a function of angular velocity



Experiment: Determination of the centrifugal force as a function of the radius



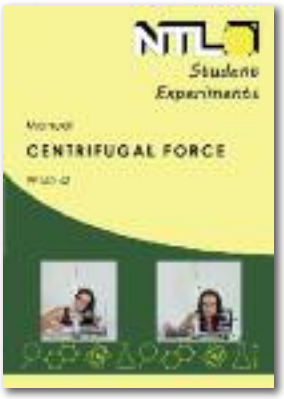
consisting of:

P1350-1Z	1x	Centripedal force apparatus with motor
DS100-1H	1x	Support base, L = 250 mm
DS103-04	1x	Sliding saddle, H = 40 mm
P7240-1C	1x	Support rod, round, L = 250 mm, D = 10 mm
P1350-1R	1x	Slider with gate for centripedal force apparatus
P1120-2F	2x	Slotted weight, 50 g, SE
P1120-2D	4x	Slotted weight, 10 g, SE
P1130-1C	1x	Dynamometer 2 N, transparent
P1150-1D	1x	Handheld stopwatch, digital, SE, 1 / 100 s

Storage:

P7906-4Z	1x	Box insert Centrifugal force
P7806-1G	1x	Plastic box II big, with cover Box-insert plan with 2 labels

P9160-4Z Experiment manual "Centrifugal force"



DM360-2R Rotating ring, D = 200 mm

For testing for varying moments of inertia with a constant mass; acrylic ring; metal axle with two adjustable weights that can be shifted within the cylinder;
dimensions: D = 200 mm, B = 39 mm

The following set-up is recommended for the subjects of moment of inertia and torque:

DM355-5A 1x Force table

For quantitatively demonstrating the decomposition of forces

DM355-5S 1x Pulley, plastic, very low friction

Pulley with very low friction thanks to an axle which is moving on two ball bearings;
with holder and fixing screw for mounting on tables and tracks;
the roll with bracket is continuously variable and fixable;
Span width: 20 mm, Pulley D = 50 mm

DM355-5M 1x Torque accessory for force table

For experiments with torque;
acrylic disk, D = 160 mm, with centre axis on ball bearings for mounting on the force table;
4 rows with 3 metal pins each at 90° to each other, 25, 50 and 75 mm from the centre point, for fastening the strings (included) and slotted weights;
wheel and axle D = 8 / 16 / 32 mm

DM355-5Z 1x Additional weight for torque accessory

For experiments with torque;
metal disc with a diamter of 160 mm, weight: 200 g

P1120-2F 6x Slotted weight, 50 g, SE

P1120-2C 1x Holder for slotted weights, 10 g, SE

P4210-7B 1x Sensor Distance (Euromotion)

Ultrasonic motion detector with USB – port

DM350-1D Rotating stool

For demonstrating the conservation of angular momentum;
stool mounted on virtually friction-free ball bearing; with 5 feet;
green powder-coated; with foot rest; solid wooden seat;
seat D = approx. 335 mm,
height = approx. 600 mm

DM351-1F Bicycle wheel gyroscope

For demonstrating the conservation of angular momentum;
wheel with spokes (24"); wheel rim with metal inlay;
two handles, one of which is removable; groove for cord;
metal bearing on one side with protruding ball for setting
in clamp socket with bearing cup or to attach at strings;
D = approx. 600 mm, handles: each 32 x 120 mm

DM352-2A Cord for spinning with handle

Length of cord:
approx. 150 cm

DM352-1H Clamp socket with bearing cup on saddle

Clamp socket column H = 310 mm, for mounting
on large support base DS101-1G;
with bearing cup for holding spherical metal
bearing of bicycle wheel gyroscope DM351-1F

Experiment: Bicycle wheel gyroscope on bearing cup

DM354-1K Gyroscope, complete set

For demonstrating the characteristics of a freely moving gyroscope as well as its precessional motion;
massive, cylindrical gyroscope suspended from gimbals; long duration of rotation due to beryllium-bronze axis bearings;
supplied with permanently mounted fork on small H-shaped base with levelling screws (for mounting when spun with cord);
flexible metal fork on support rod with double ball bearings;
round base; support rod with bearing cup and cone; cord for spinning with handle;
gyroscope: 100 x 30 mm, approx. 1400 g;
total dimensions: 195 x 140 x 210 mm

Experiment:
Gyroscope standing on point

DM351-1H Dumbbells, pair

Iron dumbbells for use in experiments with rotating stool DM350-1D;
dimensions: 195 x 60 / 25 mm, weight: approx. 2 kg each

DM372-5G Flat weight, 500 g

Additional mass for wave experiments in combination with a support rod;
nickel-plated metal cylinder, D = 56 mm, H = 30 mm; with hole for rod with max. diameter of 10 mm and fastening screw M8

DS201-40 Support rod, round, L = 400 mm, D = 10 mm

Nickel-plated steel rod

P1810-3S Coil spring for tensional energy

Coil spring made from hardened steel for experiments in "potential and tensional energy";
L = approx. 50 mm, D = approx. 13 mm

DG250-1P Plasticine, pack

Set of 5 plasticine blocks in various colours;
weight: approx. 120 g

DT604-GW Mechanical equivalent of heat apparatus

Compact apparatus to demonstrate the mechanical heat equivalent; powerful drive motor with transmission, drive shaft with adapter for accepting the hexagonal axle of an solid aluminium roller; two rolls of aluminium with a raised edge to mount and fasten a leather ribbon, which provides constant friction when operating the device;
each roll with a bearing and driving axis;
roll 1: D = 58 mm, L = 66.6 mm;
roll 2: D = 58 mm, L = 33.3 mm;
Sliding saddle with ball bearing mounting for solid rollers;
fixed stem with leather strap on this, W = 25 mm;
stand rail base profile with 2 screw clamps for firm attachment to table edges;
scale pan with handle for adding mass

Note:
For measuring the temperature of solid rollers, we recommend using a thermometer with a surface sensor, e.g. Thermometer differential "inno", and thermo-sensor DIN, with handle

DM800-1M Maxwell's Wheel

For demonstrating conversion of energy;
coloured metal wheel with axle; 2 holes through the axle for suspending from thread;
wheel D = approx. 125 mm;
axle L = 170 mm;
weight = approx. 750 g

Experiment: Friction and thermal energy

DM800-1S Support rods, pair

For holding and fastening cords or wires, e.g. cords for suspending Maxwell's wheel;
support rods D = 10 mm; L = 80 mm,
with metal nut on the front face

P3610-1T Turbine in case, SE

Pelton turbine in transparent housing; can be attached to MBC motor / generator; 4 pins for locking to the MBC motor / generator; small opening for water tap or air pump;
larger outlet on opposite side

P3610-1M MBC Motor / Generator, SE

Easy-to-turn motor (solar motor) with long shaft for attaching a Pelton turbine or propeller; 4 holes on top for locking the Pelton turbine; two 4 mm safety jacks on side;
ready to go at just 200 mV / 20 - 30 mA;
magnetic housing with transparent base plate;
dimensions: 84 x 84 x 39 mm

Use: The turbine in the housing can be quickly and easily attached directly onto the metal axle of the motor/generator. This optimises the level of efficiency.

C7445-1K Water hose ½", L = 1.5 m

Plastic hose, D = 15 / 11 mm; one end tapped for 3/4" faucet;
L = approx. 150 cm

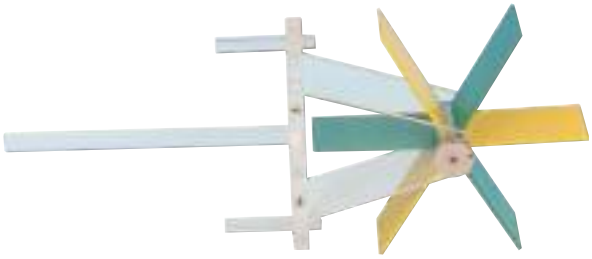
DT730-1P Pelton turbine with drive shaft

Impulse turbine model (D = 140 mm) built into an acrylic housing; drive shaft is permanently coupled with the turbine; ½" connecting piece for water hose C7445-1K and 1" drainage connector in the floor;
with support for fastening in place: 10 x 30 mm; D = 200 mm

DT730-1K Francis turbine

High pressure turbine (D = 68 mm) made of acrylic; drive shaft is permanently coupled with the turbine; with metal supply tube (may be used for mounting) and ½" hose fitting;
dimensions: 80 x 100 mm;
total height including supply pipe: 180 mm

DT730-1W Waterwheel



Acrylic model on support, D = 10 mm, L = 145 mm;
two hose connectors (D = 8 mm) for use as either over- or undershot waterwheel;
6 painted plastic vanes (70 x 40 mm each) with lateral pulley;
waterwheel D = 138 mm;
total dimensions: approx. 290 x 140 x 65 mm

Syringe samplers

For measuring gas and liquid volumes;
ground glass plunger; glass cylinder with scale

C6100-1A Syringe, 50 ml, glass

Plunger-D = 25 mm; total length = 240 mm; hose-D = 7 mm

C6100-1B Syringe, 100 ml, glass

Plunger D = 31 mm; total length = 280 mm; hose-D = 8 mm

Holders for syringe, "inno"

For magnetically mounting a 100 ml or 50 ml glass syringe on a metal panel; especially for experiments involving magnetic panel mechanics; acrylic design with plastic setting screw;
neodymium magnets and rubber-coated legs on bottom side;
dimensions: 180 x 50 x 50 mm

C6100-5F Holder for syringe 50 ml, "inno"

C6100-5H Holder for syringe 100 ml, "inno"

Experiment: Pressure on various surfaces

DM405-2P Hydraulic press, working model

Acrylic model for demonstrating how hydraulic force is transferred; this model can be used not only to show the movement of the pressure and press pistons and the valve clearance, even practical examples of use in real life can be demonstrated.

The ratio of the surface areas of the two pistons is 1:12, while the sturdy manner in which the press is built allows it to exert up to 500 N of press force!
Piston D = 16 mm and 56 mm
Free working height: 60 mm
Dimensions: 200 x 70 x 285 mm

Included:

DM405-1B Metal bracket with notches; dimensions: 40 x 40 x 20 mm
DE300-1F Iron nails, L = 80 mm, set of 20
DM366-1K Styrofoam ball, D=30 mm

This press cracks the hardest nut and bends even the thickest nail!

Required accessories:

DM340-2W Vat with drain connector

acrylic; D = 200 mm, H = 65 mm

DM420-1D Hartl capsule

For demonstrating that hydrostatic pressure is dependent on depth and is exerted in every direction.
Acrylic capsule sealed with a membrane on one side, connected to a metal tube by way of a silicon hose; capsule may be rotated by means of two pulleys connected by a plastic band;
L = 400 mm, capsule-D = 37 mm

DM425-2G Tower tank with scale

Used as a tall water tank for experiments in hydromechanics; acrylic cylinder with base and transparent scale;

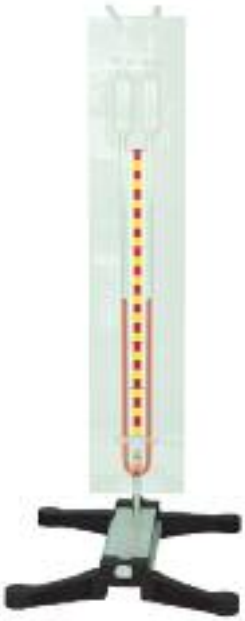
D = 150 mm, H = 250 mm

C1000-1K Beaker glass 2000 ml, squat form

With pouring lip and graduations; D = 130 mm, H = 193 mm

DM450-1M U-tube manometer

For determining the density of liquids or measuring pressure in liquids;
glass U-tube connected to two expansion vessels with hose fittings and mounted on an acrylic panel 500 x 100 mm,
with graduated scale (H = 300 mm) and stem (D = 10 mm)
(base not included)



DE722-2D Manometer differential, „inno"

Digital device for magnetic mounting, used to measure pressure differences in gases (under- and overpressure); the 26 mm LED display allows readings to be taken even from a distance; rotating knob for setting to zero.
Two different measuring ranges:
100 hPa - 0.1 hPa units for low pressures,
e.g. immersion probes, capsules, Pitot tube, Venturi tube
1000 hPa - 1 hPa units for higher pressures,
e.g. experiments in compression and expansion
Max. pressure: 2000 hPa; measurement error: max. 1.5%;
sensor inputs are not suitable for use with aggressive media;
power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V/500 mA, P3120-6N;
case: plastic, ABS;
dimensions: approx. 160 x 120 x 45 mm;
weight: approx. 405 g

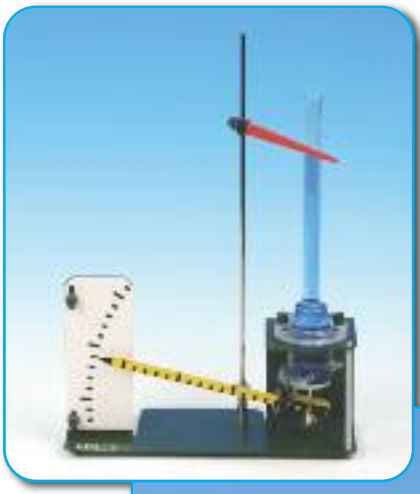
Experiment: Measuring the hydrostatic pressure

C6031-1M Manometer tube accessory, with stopper SB19

Simple manometer tube made of glass, H=150mm;
with silicon stopper 17 / 22 / 25 mm;
glass tube D = 8 / 5 mm

DM410-1B Pascal's Vases

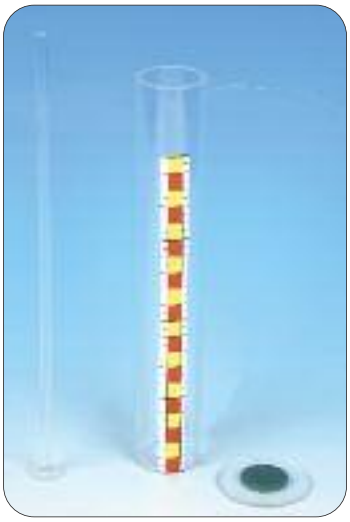
For demonstrating the hydrostatic paradox by means of a membrane deforming under pressure;
downwards hydrostatic pressure in the vessel is transferred to a 200 mm lever and displayed on a large scale;
4 glass vessels of various shapes, height: 220 mm each
D (bottom / inner) = 23 mm;
pointer may be adjusted in height to mark the level;
dimensions: 260 x 100 x 360 mm



Experiment:
Hydrostatic paradox

DM440-1A Upwards hydrostatic pressure apparatus

For demonstrating hydrostatic pressure in an upwards direction; acrylic cylinder with scale, disk with cord attaching it to the cylinder for closing the lower end of the cylinder, plastic rod with base in order to weigh the force with the Newtonmeter;
D = 40 mm, H = 240 mm



Experiment: Hydrostatic pressure in an upwards direction

DM430-1A Leaky vessel with 5 stoppers

For demonstrating fluid pressure on the sides of a vessel; with 5 outlets (with rubber stoppers) spaced 100 mm apart from each other; dimensions: 80 x 80 x 540 mm

DM430-2A Stoppers for leaky vessel

(Replacement) stoppers for leaky vessel, Set of 5 (not shown)

DM682-1B Water basin, long

For examining static and dynamic friction in water;
plastic tray with flanged rim for better stability;
dimensions: approx. 75 x 30 x 12 cm

DM401-1D Pressure flask 02

For illustrating the even distribution of pressure in fluids; glass bulb, 1000 ml, NS29, with 3 hose connections at different heights on the outer wall; 3 manometer hoses mounted on metal board; with silicon stopper and 120 ml plastic syringe to generate pressure; dimensions: 200 x 140 x 500 mm

A high visibility, easily understandable demo model, without 'flooding' the laboratory with water

Experiment: Distribution of pressure in fluids

DM466-1G Watering can, small

For showing the status of the water in a watering pot; transparent plastic pot with hollow handle; dimensions: approx. 200 x 60 x 150 mm

DM465-1K Communicating vessels and watering pot

Illustrates the principle of communicating vessels and shows how a watering pot works; glass vessel with two attachment tubes of different shapes (D = 12 mm); dimensions: approx. 310 x 100 x 180 mm

DM465-1V Discharge beaker with stopcock, 1000 ml

Beaker; volume 1000 ml; with one-way, glass stopcock and vertical drainpipe; used in hydromechanics as a water reservoir or with the diving bell - metal bar as an air bell

Dimensions: D = 94 mm, H = 275 mm

DM470-1S Hose levelling instrument

For comparing the relative height of two points; 2 cylindrical levelling tubes with connector tube and transparent scale, connected by a silicon hose; levelling tubes: 26 x 200 mm, hose L = 3 m

DT803-1B Barometer, demo unit

For a simple and fast explanation of air pressure and the movement of the pointer on a barometer. The barometer is placed in an air-tight, transparent plastic container. The air pressure changes by compressing and expanding the container, and the pointer indicates these changes.
Barometer 980 - 1040 hPa and plastic container with lid and suction pad.

simple – fast – safe

Experiment: Demonstrating high pressure with the barometer unit

DE722-2B Barometer "inno"

Digital device for magnetic mounting, used to measure gas pressure; the 26 mm LED display allows readings to be taken even from a distance; set screw for setting to actual air-pressure

Accuracy: 1 hPa
Max. pressure: 2000 hPa
Measurement error: max. 1.5%
Sensor inputs are not suitable for use with aggressive media
Power supply: 4 x 1.5 V mignon cells (included),
or external power supply 6 V / 500 mA
Case: plastic, ABS
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 400 g

DM551-1M Suction pad

When the two handles are pressed together, the rubber pad on the underside sticks to smooth surfaces - a device ideal for demonstrating the "force" of air pressure in an impressive way; two pads "sucking" against each other demonstrate the principle of the magedburg hemispheres;
dimensions: D = 118 mm, H = 105 mm

Experiment: Boyle/Mariotte's Law

P9902-4V SEK Air pressure

With the module SEK Air pressure the following experiments can be performed:

MELS 01 Evidence of air pressure
MELS 02 "Magdeburg Hemispheres"
MELS 03 Air pressure measurement
MELS 04 Air pressure effect – external pressure diminished
MELS 05 Air pressure effect – water boils at 60 degrees
MELS 06 Air pressure effect – internal pressure diminished
MELS 07 Free fall – free fall tube
MELS 08 Transmission of sound in a vacuum
MELS 09 Boyle – Mariott Law
MELS 10 Determination of the weight of air

consisting of:

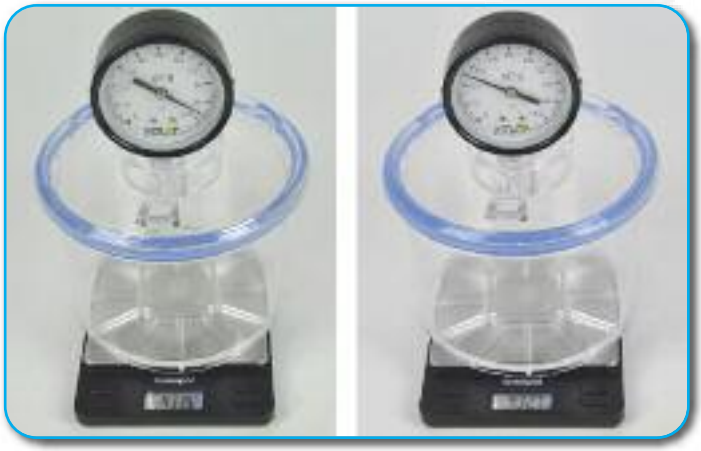
P1522-1S	1x	Signaller
P1522-1T	1x	Sound-absorbing pad
P1522-1M	1x	Magdeburg circler, SE, rubber, pair of
P1410-1L	1x	Balloons, set of 2
P1410-1K	1x	Clamp for balloons
P1530-1B	1x	Bubble burster, SE
P1530-1C	1x	Plastic film for bubble burster
C6008-5C	1x	Capsule plastics with cover, D = 75 mm
P1560-1F	1x	Free fall tube SE, L = 35 cm Tube made from acrylic glass; with gasket ring; for mounting the cover of the vacuum chamber P1520-2G; set of falling bodies (feather, wool, plastics and steel balls) included; dimensions: D = 50 mm, L = 350 mm
P1520-2G	1x	Vacuum chamber complete, 1000 ml, with manometer
C6100-2G	1x	Syringe plastics, 120 ml, for vacuum-experiments
C1520-1S	1x	Vacuum hose plastics, SE, 300 x 6 mm
P1515-1B	1x	Manometer SE, for Boyle-Mariotte experiment

That will keep the air right away from you!
...see, listen and learn what's going on

Storage:

P7906-4V	1x	Box insert Air pressure
P7806-1K	1x	Storage box II small, with cover Box-insert plan with 2 labels

P9160-4V Experiment manual "Air pressure"



Experiment: Determination of the weight of air

Vacuum chamber small, with manometer:

P1520-2G Vacuum chamber, 1000 ml, with manometer

Sturdy cylindrical vacuum chamber with silicon gasket ring; cover with integrated, transparent ventilation valve; attached vacuum meter 0 - 1000 hPa; easy-to-use inlet valve; volume: 1000 ml

C6100-2G Syringe 120 ml, plastic, for vacuum-experiments

Gas syringe made of robust plastic; well sealed yet smoothly running piston with solid grip; incl. 2 adapter pieces for connecting plastic vacuum tube D = 6 mm (outer dimension); clearly readable printed scale; filling volume: 120 ml

C1520-1S Vacuum hose, plastic, D = 6 mm, L = 30 cm

Plastic hose; suitable for over- and underpressure; highly flexible; D (outer) = 6 mm, D (inner) = 4 mm

Important note:
We recommend using an electric vacuum pump to fully prevent any sound from being transmitted from the acoustic signaller in the vacuum chamber.
The single-stage pump is sufficient for the small vacuum chamber. For a large vacuum chamber (volume 5 litres or more) we recommend the two-stage electric vacuum pump.

Vacuum pumps, electric

Pump type	**DM503-1A**	**DM503-2A**
Stages	1	2
Suction capacity	3.3 m³ / h	5.5 m³ / h
Ultimate vacuum	10 Pa	0.5 Pa
Suction connector	pressure hose plastic 6 / 4 mm	flange KF16 + tube clip 6 mm
Voltage source	220 (240) V / 50 (60) Hz (110 V / 60 Hz)	
Motor power	150 W	190 W
Dimensions	29 x 11 x 22 cm	31 x 13 x 25 cm
Weight	7 kg	10 kg

DM503-1A Vacuum pump, electric 12, one-stage

DM503-2A Vacuum pump, electric 12, two-stage

Connection for vacuum pump **DM503-1A**

C1520-1M Vacuum hose, plastic, D = 6 mm, L = 100 cm

Plastic tube; suitable for over- and underpressure; highly flexible;
D (ext.) = 6 mm, D (int.) = 4 mm

Connection for vacuum pump **DM503-2A**

1 DM502-1D Sealing and centring ring DN 16
Centring ring for a vacuum-tight connection of two DN 16 flanges with the clamping ring DN 16

2 DM502-1S Clamping ring DN 16
Clamping ring for a vacuum-tight connection of two DN 16 flanges with sealing and centring ring DN 16

3 DM502-2S Adapter flange DN 16, with straight hose
Connecting piece from DN 16 to vacuum hoses with a diameter (int.) of 5 - 6 mm

4 DM502-1T T-connector DN 16 with air bleed valve
T-connector for flanges DN 16;
with air bleed valve on one side

5 DM502-3S Adapter flange with 2 hose fittings
Connecting piece from flange DN 16 to vacuum hoses with a diameter (int.) of 3 - 4 mm and 5 - 6 mm

6 DM502-1B Blind flange DN 16
Vacuum-tight end piece for flange DN 16

7 DM502-1Z Vacuum gauge
For mounting on flange DN 16; with tube clip on one side for vacuum hoses with a diameter of 5 - 6 mm;
measuring range: 0 ... -100 kPa, D = 100 mm

Alternatively:

C7445-6V Vacuum hose,
D = 6 mm, L = 100 cm

DM500-1P Oil for vacuum pump, 500 ml

(Replacement) NTL vacuum pumps are generally supplied with oil, which has to be put into the pump before first use

DM520-2G Bell jar 7 l

To perform experiments in a high vacuum area without requiring a vacuum or air pressure plate;
thick acrylic vessel;
lid (210 x 10 mm) with seal;
sturdy tap, with connector for plastic hose and rubber hose adapter; air release valve;

Dimensions (inner):
D = 190 mm, H = 250 mm
Dimensions (outer):
D = 200 mm, H = 260 mm

DM522-1K Alarm bell with sound-absorbing plate

For experiments in the field of sound transmission and damping;
battery-driven alarm with loud bell;
foam plate (D = 150 mm, H = 30 mm) to absorb the vibrations of the alarm bell;
dimensions: 115 x 60 x 170 mm

Experiment: Transmission of sound in a vacuum

DM590-1D Metal can with stopper and tube

For demonstrating the effect of atmospheric pressure;
can D = 100 mm, H = 160 mm, with hole (D = 31 mm);
silicon stopper 30 / 38 / 37 mm; acrylic tube 80 x 8 / 5 mm

DM590-2D Metal cans, set

3 replacement cans for DM590-1D; D = 100 mm, H = 160 mm, without stoppers
and tube

DM530-1B Bubble burster, demo

For demonstrating the existence and effect of air pressure;
acrylic cylinder closed on one side; nut for rubber rings;
metal tube connector (D = 7 mm);
dimensions: D = 110 mm, H = 60 mm

DM530-1P Cellophane film, set of 10

10 pieces of cellophane film, approx. 25 x 25 cm

DM530-1R Rubber bands, wide, set of 2

2 Rubber bands, D = 80 mm, W = 10 mm

DM550-2M Magdeburg hemispheres, pair

For demonstrating the effect of atmospheric pressure (historical experiment by Guericke); 2 metal half-spheres with handles; wide lapped rims with nut; with stopcock and hose clip (D = 8 mm);
diameter: 104 mm

DM540-1A Dasymeter

For demonstrating buoyancy in air; beam balance with styrofoam ball (D = 70 mm) and adjustable counterweight;
with base;
dimensions: 160 x 80 x 190 mm

DM340-8B Balloons, set

Set of 10 coloured balloons

P1410-1K Clamp for balloons

This simple clamp allows fast, air-tight sealing of a balloon; this means that the balloon can be used more than once; L = approx. 50 mm

DE722-2B Barometer "inno"

Digital device for magnetic mounting, used to measure gas pressure; the 26 mm LED display allows readings to be taken even from a distance; set screw for setting to actual air-pressure

Accuracy: 1 hPa
Max. pressure: 2000 hPa
Measurement error: max. 1.5%
Sensor inputs are not suitable for use with aggressive media
Power supply: 4 x 1.5 V mignon cells (included),
or external power supply 6 V / 500 mA
Case: plastic, ABS
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 400 g

DE453-3R Vacuum discharge tube (Pohl type)

For demonstrating how pressure affects the glow in a gas discharge tube; thick glass tube with central suction pipe with GJ 19/26; disc electrodes mounted on metal caps are placed at both ends to supply high voltage; coupling piece of metal with flange DN 16 and ventilation valve; dimensions: L = approx. 650 mm, D = 36 mm

The supplied coupling piece enables direct attachment onto any vacuum pump using a DN 16 connection.
This optimises the tightness of the entire assembly.

P1515-BM Boyle-Marriotte apparatus, SE

For determining the relationship between pressure and volume of gases at a constant temperature;
manometer with suitable clear scale; attachable robust plastic gas syringe with scale;
well-sealed plunger with holding ring; volume of syringe: 120 ml;
manometer range: -1000 – +3000 hPa

Experiment: Boyle - Mariott Law - SE

Experiment: Boyle - Mariott Law - Demo

DM582-7P Model of a pump, simple

Demonstrates how a suction pump works;
transparent plastic housing;
coloured suction syringe and lever;
clearly visible ball valve;
total length = approx. 300 mm

Experiment: Suction pump – operating method

Model pumps

Large acrylic working models, each with a sturdy piston;
screw-on cylinder lid and an easily visible ball valve for clearly recognising the workings of the pump; for mounting on vat DM340-2W

DM580-2S Suction pump, demo

Working model, acrylic;
displacement: D = 32 mm, H = 90 mm;
dimensions: 200 x 45 x 220 mm

DM580-2D Pressure pump, demo

Working model, acrylic;
displacement: D = 32 mm, H = 120 mm;
dimensions: 200 x 45 x 220 mm

Required accessories:

DM340-2W Vat with drain connector

Acrylic; D = 200 mm, H = 65 mm

Demonstration of Archimedes' Principle

DM112-8A Bucket and cylinder

Acrylic cylinder with two metal handles and a fitting metal cylinder with hook; D = 32 mm, H = 62.25 mm

P1120-3E Hollow block (Archimedes)

Hollow plastic block with three suspension holes; can contain aluminium block P1120-3A; Inside dimensions: 20 x 20 x 50 mm

P1120-3A Aluminium block

Metal block with hook, for insertion into hollow block P1120-3E

Overflow beakers

Glass beakers with a downward-sloping drainpipe for determining the volume of solid bodies, used together with a graduated cylinder

DM110-1A Overflow beaker 600 ml

Glass beaker, D = 90 mm, H = 125 mm, drainpipe L = 100 mm

P1410-1U Overflow beaker 250 ml

Glass beaker, D = 60 mm, H = 120 mm, drainpipe L = 50 mm

DM480-2C Cartesian diver 02

For demonstrating sinking, floating and suspension in water; hollow coloured glass figure, handmade and free-blown, already tared; fits any bottle with a minimum inner diameter of 18 mm;
turns when diving;
height = approx. 55 mm

DM480-1U Model of a submarine boat

For explaining how a submarine dives and surfaces (submarine similar to a Cartesian diver with an unstable balance);
plastic model with transparent interior, with hose and syringe;
dimensions (sub): L = approx. 220 mm

DM481-2C Cylinder, 400 x 60 mm, acrylic

Virtually unbreakable acrylic cylinder with base and smooth upper edge;
H = 400 mm, D = 60 / 54 mm

Additionaly recommended:

C7320-8B Rubber stopper 50 / 60 / 45, with hole

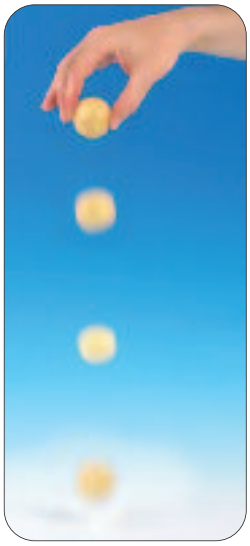
C6090-1G Tubing connector plastics, 6 - 8 mm, straight

DM820-1H Bouncing putty

50 g of silicon putty similar to plasticine, displaying a number of remarkable characteristics

It flows viscously like cold honey, ...

... tears like a brittle object ...



...and bounces like a rubber ball

DM860-1A Adhesive plates, pair

For demonstrating the principle of adhesion; two smooth acrylic disks with ring handles, D = 150 mm

Moisten the surfaces and push the plates together from one side to the other.

The two plates then "stick together" very strongly.

DM870-1K Wedge-shaped tank

Acrylic cell for demonstrating capillary action and for determining surface tension of liquids; angle of wedge: 10°; dimensions: 100 x 55 x 22 mm

DM875-1K Capillary tubes in holder

For demonstrating capillary action;
4 glass tubes of different diameters in an acrylic container with white rear panel;
tube for filling and container for liquid;
tube length: 250 mm;
inner diameter of capillary tubes:
0.36 / 0.50 / 0.90 / 1.50 mm;
dimensions: 120 x 30 x 260 mm

DM880-1R Ring for measuring surface tension

For measuring the surface tension of liquids;
aluminium ring with sharp edge, means of suspension; plastic container with lid, D = 90 mm, cord length: approx. 200 mm;
ring D = 60 mm, H = 7 mm; weight: 7 g

Suitable dynamometers:

P1130-1S Dynamometer 0.1 N, transparent

P1130-1A Dynamometer 0.2 N, transparent

DM725-ND Newtonmeter "inno" 20 N / 2000 g

DM885-3L Soap bubble trumpet

This item is used for demonstrating the principle of surface tension.
It can produce gigantic bubbles or, with the supplied insert, many small bubbles as well.

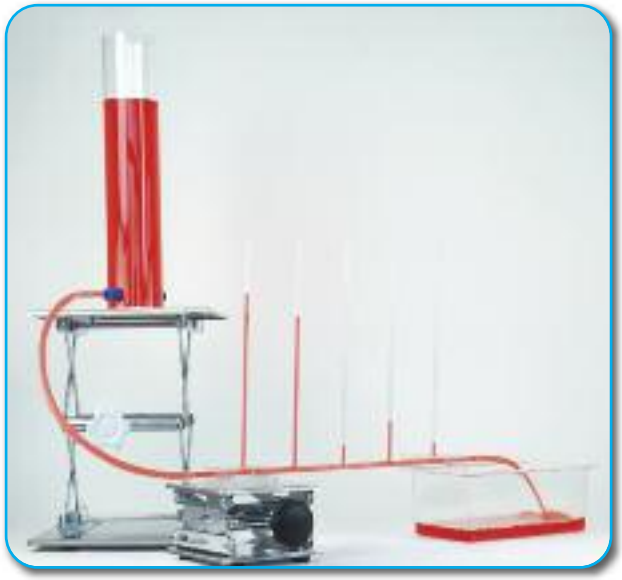
Material: plastic
Delivered with soap water 250 ml
Dimensions:
approx. 90 x 110 x 210 mm

DM462-1D Flow tube of constant diameter

For investigating pressure along the length of tube of constant diameter through which a liquid flows;
complete with 4 uptake tubes (D = 8 mm);
dimensions: 500 x 300 mm; flow tube D = 8 mm

DM462-2D Flow tube of varying diameter

For investigating pressure along the length of tube of varying diameter through which a liquid flows;
complete with 5 uptake tubes (D = 6 mm);
dimensions: 500 x 300 mm; flow tube D = 8 mm



Experiment: Pressure distribution in flowing liquids – flow tube of varying diameter

DM461-1A Acrylic tank with two orifices

Liquid reservoir for experiments in the field of hydrodynamics; stand cylinder made of acrylic glass with two outlets;
four matching silicon stoppers,
two with holes.
H = 400 mm, D = 80 mm

DM740-2Z Atomiser

For demonstrating how a low pressure region (suction force) occurs at points of high flow speed;
joined plastic tubes: 6 x 75 mm and 4 x 120 mm

Experiment: Measuring low pressure in an atomiser

DM555-1A Osmometer

For measuring osmotic pressure;
capillary tube with measuring scale mounted on an acrylic panel;
two glass bulbs mounted on the capillary tube;
one of the bulbs fitted with semi-permeable membrane and rubber ring;
total height: 480 mm

(Beaker glass not included in delivery)

DM555-1E Osmometer - membranes, 5 pcs

Set of 5 semi-permeable membranes;
can be clamped to the Osmometer Demo;
dimensions: D = 100 mm

AERODYNAMICS EQUIPMENT SET

Equipment set for demonstrating and quantitatively and qualitatively assessing important laws on aerodynamics.

- Easy to handle yet powerful blower
- Simple, fast demonstration of various aerodynamic paradoxes
- Visualisation of flow lines around objects of various shapes
- Quantitative detection of the air resistance of various objects

DM720-1A Aerodynamics equipment set 02

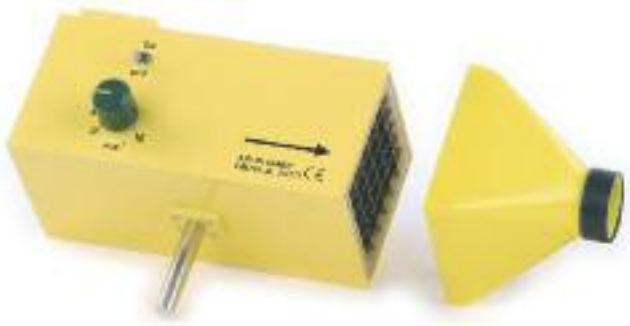
consisting of:

DM701-2L	1x	Blower 12 V
DM701-2K	1x	Tube adapter for blower
DM730-4S	1x	Disk with tube adapter
DM730-5S	1x	Disk with rim
DM730-3T	1x	Funnel with sleeve
DM360-5S	1x	Ball, styrofoam, D = 60 mm
DM710-2L	2x	Aluminium sheet, curved
DM385-2S	2x	Pendulum bob, steel, D = 1"
DM730-1A	1x	Venturi tube
DM710-2S	1x	Aerodynamic objects, set
DM712-1H	1x	Stand for aerodynamic objects
DM702-2L	1x	Streamline adapter
DM715-2S	1x	Adapter rail
DM712-1F	1x	Support rod with sliding saddle
P7251-2T	1x	Tube holder, simple
DM710-1K	1x	Dynamometer mount with pulley
DM714-1L	1x	Truck, model
DM714-1P	1x	Delivery van, model
DM714-1S	1x	Car, model
P7911-2A	1x	Box insert Aerodynamics
P7806-1G	1x	Storage box II large, with cover

The following experiments can be run using the aerodynamics set:

M 19.07 Dynamic pressure in an air stream
M 19.08 Pressure in a flow – Venturi tube
M 19.09 Aerodynamic paradox
M 19.10 Aerodynamic paradox – examples
M 19.11 Lift in an air stream
M 19.15 Aerodynamic experiments on various objects
M 19.16 Air resistance and cross-sectional area
M 19.17 Air resistance, shape and cross-section of a model car
M 19.18 Air resistance and the shape of an object
M 19.19 Air resistance and type of surface
M 19.24 Flow patterns over a house roof
M 19.25 Blowing the roof off a house

DM720-9VE Experiment manual "Aerodynamics 02"



DM701-2L Blower 12 V

Fan blower with electronic speed regulator for performing experiments in aerodynamics; continuously variable flow velocity 0 - max. 15 m/s, on/off switch; 12 V DC power supply connected by means of two 4 mm safety jacks or 2.5/5.5 mm hollow jack for mains transformer 12 V / 6 A P3130-2P; powder-coated aluminium housing with grating to allow airflow at both ends; with special NTL profile for attachment of rail with slots;
support rod D = 10mm, L = 80 mm
Dimensions: 170 x 80 x 80 mm (excluding support rod)

DM701-2K Tube adapter for blower

Plastic adapter for blower for performing experiments in aerodynamics requiring a concentrated air stream; may also be used as an adapter for other apparatus (e.g. Venturi tube, funnel), air outlet: D = 28 mm; Dimensions: 80 x 80 x 77 mm

Recommended power supply:

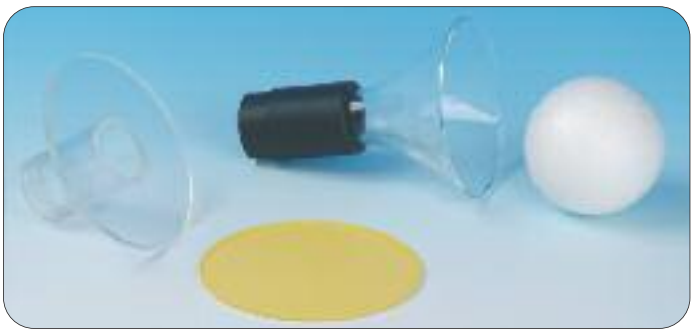
P3130-2P Fixed voltage transformer 12 V DC / 6 A

Output voltage: 12 V DC, max. 6 A;
supplied by 5.5 mm hollow DC plug;
plastic case
with power cord;
voltage source:
100 - 240 V AC /
50 - 60 Hz;
dimensions:
120 x 60 x 40 mm

DT816-2A Anemometer "inno"

Digital anemometer for magnetic mounting, with external measuring vane; the 26 mm LED display allows readings to be taken even from a distance;
measuring range: 0 - 20 m/s; display in 0.1 m/s intervals
accuracy: approx. 2 %
Power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V / 500 mA, P3120-6N
Case: plastic, ABS
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 500 g (with sensor)

Apparatus for demonstrating aerodynamic paradoxes



DM730-4S Disk with tube adapter

Flat acrylic disk with flow tube;
may be connected to tube adapter for blower DM701-2K;
additionally required: disk with rim DM730-5S;
disk D = 88 mm, tube D = 29 mm

DM730-5S Disk with rim

Flat plastic disk (D = 92 mm) with rim along edge;
additionally required: Disk with tube adapter DM730-4S

DM730-3T Funnel with sleeve

Funnel (D = 75 mm) with adapter;
may be connected to tube adapter for blower DM701-2K;
additionally required: Styrofoam ball DM360-5S

DM360-5S Ball, styrofoam, D = 60 mm

Experiment: Aerodynamic paradoxes

Experiment: Measuring flow velocity

DM385-2S Pendulum bob, steel, D = 1"

Steel pendulum bob, D = 1" (25.4 mm), with hook

DM710-2L Aluminium sheet, curved

For demonstrating lift in an air stream;
aluminium sheet, 100 x 200 mm, with one rolled end for mounting on rods max. 10 mm in diameter

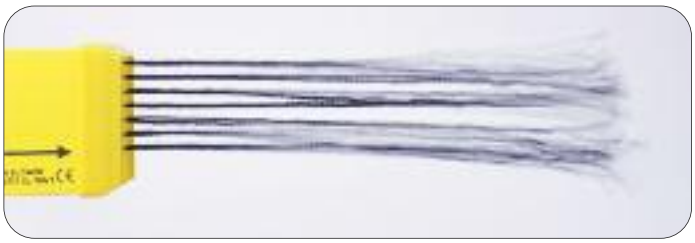
Experiment: Lift in an air stream

DM730-1A Venturi tube

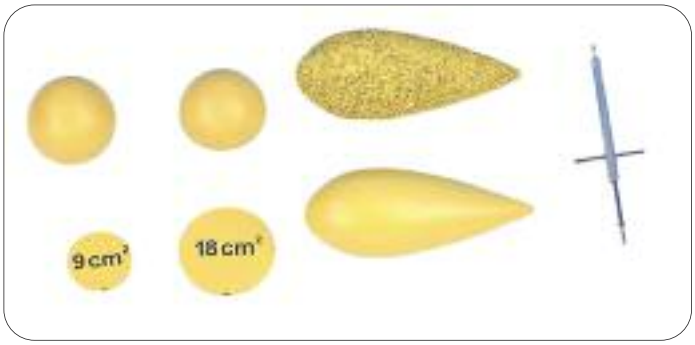
For investigating changes in pressure of air flowing through a tube containing a constriction; glass tube with constriction and 3 connectors; plastic sleeve at one end;
manometer tubes (L = 130 mm) made of acrylic glass with silicon hose connector;
dimensions:
L = 250 mm, D = 28 mm
(10 mm at constriction)

Experiment: Pressure within an air stream - Venturi tube

DM702-2L Streamline adapter



For visualising flow patterns and turbulence around an object in an airflow; plastic adapter for blower DM701-2L including two rows of streamers;
dimensions: 84 x 84 x 25 mm; streamer L = 240 mm



DM710-2S Aerodynamic objects, set

Six objects useful for investigating the relationship between aerodynamic resistance and the shape and type of surface of an object;
models with 2 mm hole for mounting in support DM712-1H.
1x Sphere, D = 48 mm
1x Hemisphere, D = 48 mm
1x Round disk, 9 cm², D = 34 mm
1x Round disk, 18 cm², D = 48 mm
1x Flow line profile, smooth, D = 48 mm, L = 125 mm
1x Flow line profile, rough, D = 48 mm, L = 125 mm

DM712-1H Support for aerodynamic objects

Metal rod (6 x 125 mm) with 2 mm plug pin for holding aerodynamic objects DM710-2S;
with crossbar for mounting in slit in rail DM715-2S

Experiment: Flow patterns and turbulence

DM715-2S Adapter rail with slits

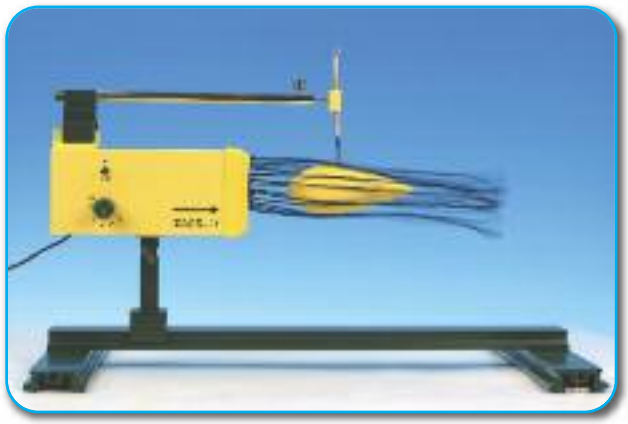
Special aluminium profile, powder-coated; for screwing onto blower DM701-2L and for holding aerodynamic objects;
L = 350 mm

DM712-1F Support rod for aerodynamic objects

Support rod with hole on the face for attaching tube holder P7251-2T; with sliding saddle for fastening to blower DM701-2L

P7251-2T Tube holder, single

Metal U-bracket with clamping screw, for securing tubes and thermometers of max. diameter 8 mm; bearing pin D = 3 mm; with plastic insert D = 10 mm



Experiment: Airflow around an aerodynamic object

DM710-1K Dynamometer mount with pulley

For measuring the flow resistance of objects or model cars using a dynamometer (not included);
support stand rod to be mounted on adapter rail DM715-2S; includes a clamp for mounting a dynamometer with a maximum diameter of 19 mm; low-friction pulley

P1130-1A Dynamometer 0.2 N, transparent

DM725-ND Newtonmeter „inno“ 20 N / 2000 g

Demonstration instrument with magnets for measuring force (in newtons) or mass (in grams).
Measuring range N: ± 20 N, resolution: 0.001 N
Measuring range g: ± 2000 g, resolution: 0.1 g

Model vehicles

Model vehicles of various designs for demonstrating flow lines (and turbulence) and measuring air resistance;
each fitted with a 2 mm metal bush so that they can be fastened to the support for aerodynamic objects DM712-1H

DM714-1L Truck, model

Cross-section: approx. 30 x 36 mm

DM714-1P Delivery van, model

Cross-section: approx. 30 x 36 mm

DM714-1S Car, model

Cross-section: approx. 35 x 26 mm

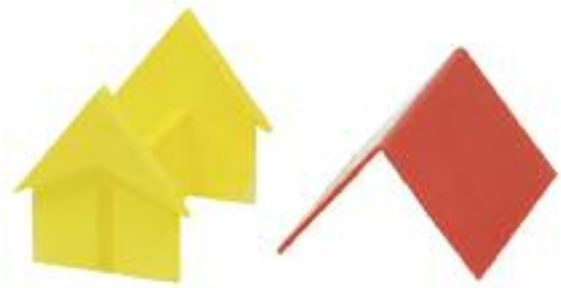
Experiment: Measuring the air resistance of various vehicles

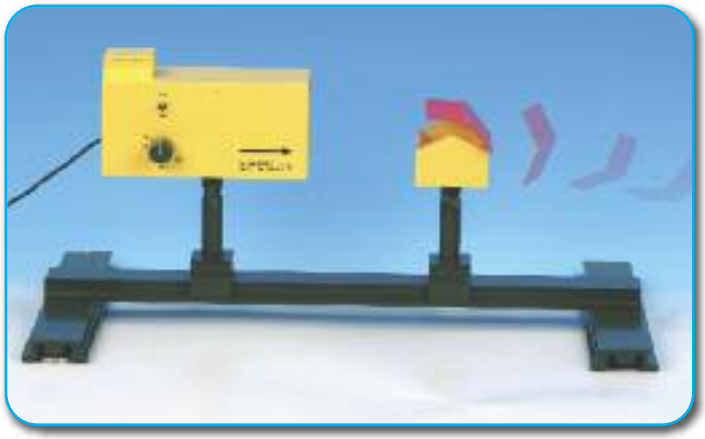
DM714-1D House, model

Model of a house for experiments in aerodynamics; plastic model on support rod (10 x 70 mm); removable, slightly sloped roof; dimensions: 80 x 60 x 45 mm, roof slope: 25°

DM714-2D Roof accessory for model house

Accessory for model house for experiments in aerodynamics; plastic model to be placed onto the model house with a removable pointed roof; dimensions: 80 x 60 x 65 mm, roof slope: 55°





Experiment: Slightly sloped house roof being blown off by a strong airflow (storm)

DM713-1S Pitot tube, apparatus set

For measuring dynamic, static and total pressure in gas flows; plastic cylinder with two metal tubes; may be mounted on tube adapter for blower DM701-2K; Y-connector for combining the two pressure values; silicon hose (L = 100 cm) 3 / 6 mm

Note:
With turbulence and vortices in the air flow of aerodynamics, we recommend using a fluid manometer to measure the pressure.
Sensitive digital manometers usually give highly fluctuating and hence unusable results.

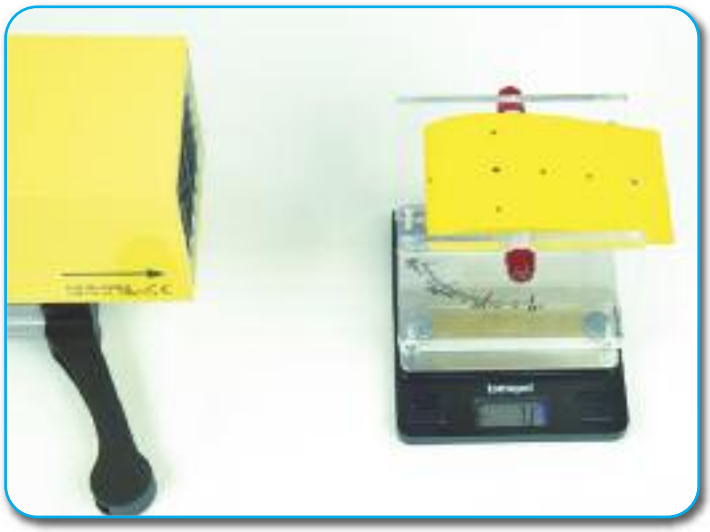
DM718-SM Manometer sensitive, Krell type

For displaying very fine differences in pressure; inclined tube glass manometer; angle of inclination of vessel and riser pipe can be adjusted; metallic base plate; powder-coated; with scale; pressure-hose connection: D = 5 mm; riser pipe: L = 250 mm; dimensions: 385 x 50 x 90 mm

Experiment: Measuring the dynamic pressure using the pitot tube and the manometer sensitive

DM711-2T Model of airofoil, with scale

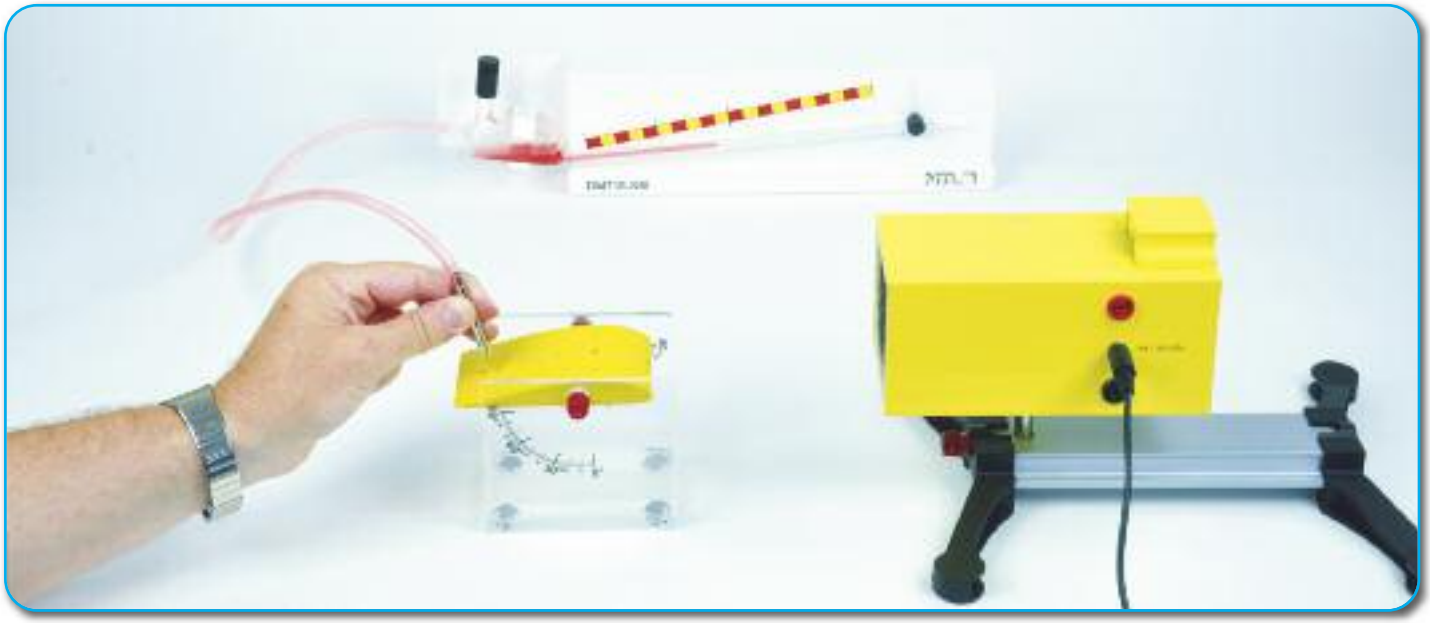
For examining flow resistance and lift at different angles of approach; section of an aeroplane wing made of wood; mounted on pivoting acrylic frame with double-sided scale; drill holes for measuring over- and underpressure with a DM710-2R probe



Experiment: Measuring lift on the aerofoil

DM710-2R Pipe probe with hose

For measuring over- and underpressure on the aerofoil model; metal probe, 5 x 60 mm, D (inner) = 1.5 mm, with hose for connecting to the manometer sensitive



Experiment: Measuring pressure on the aerofoil profile

P9901-4S SEK Vibrations and Waves

With the module SEK Vibrations and Waves experiments the following topics can be performed:

1. VIBRATIONS:

SWS 1.1.1	Oscillation period of a simple pendulum
SWS 1.1.2	Oscillation period of a coil spring pendulum
SWS 1.1.3	Oscillation period of a flat spring
SWS 1.2	Path time chart of harmonic oscillation
SWS 1.3	Measuring acceleration due to gravity
SWS 1.4.1	Resonance of a simple pendulum
SWS 1.4.2	Resonance of a coil spring pendulum
SWS 1.4.3	Resonance of a flat spring
SWS 1.5	Principle of a resonant vibrating-reed frequency meter
SWS 1.6	Dynamic measuring of a spring constant

2. WAVES:

SWS 2.1	Stationary transversal wave
SWS 2.2	Stationary longitudinal wave
SWS 2.3	Reflection of waves at their fixed and loose ends

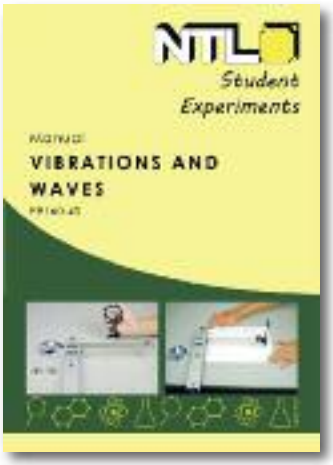
consisting of:

P1810-3A	1x	Rubber string, red, L = 300 cm
P1810-1D	1x	Flat spring steel, 0.6 mm, L = 300 mm
P1810-1F	1x	Holder for pencil
P1810-1G	1x	Threaded rod with butterfly nut for connecting the pencil holder to the steel flat spring
DM386-1H	2x	Pendulum ball with hook, wooden, D = 60 mm
DM386-1K	1x	Pendulum ball with hook, plastic, D = 60 mm
P1825-1A	1x	Motor with toggle for oscillation tests used to generate transverse and longitudinal waves; recommended as drive unit for function generator

Storage:

P7906-4S	1x	Box insert Vibrations and waves, SE
P7806-1S	1x	Storage box II mini with cover, Box insert plan with 2 labels

P9160-4S Experiment manual "Vibrations and Waves"



Experiment: Oscillation period of a simple pendulum

DM380-6E Ball, steel, D = 60 mm, with thread

Solid, M6 tapping for screwing in threaded hook DS102-3S; weight: approx. 900 g

DM380-6K Ball, plastic, D = 60 mm

Solid, M6 tapping for screwing in threaded hook DS102-3S; weight: approx. 220 g

DS102-3S C-hook, threaded

Stable metal hook with M6 threading

DG200-1S Cord, white, D = 1.7 mm, L = 5 m

DM385-1P Pendulum bobs, with hooks, D = 1", set

Six pendulum bobs of various materials with equal diameters; with hooks for suspension; material: Al, Brass, Cu, Fe, Pb, Zn; diameter (each): 1" (25.4 mm)

DS202-1R Ring with hook

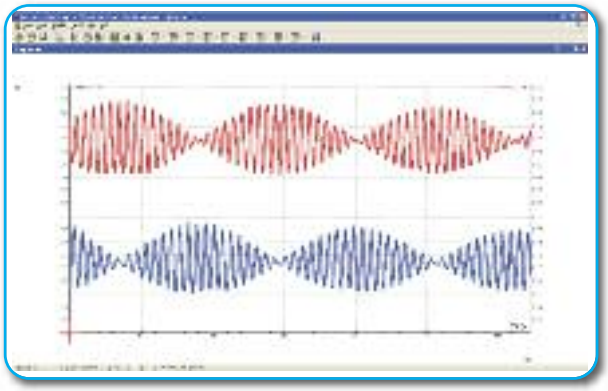
Aluminium ring with hook
for mounting on rods with a diameter of up to 10 mm, one clamping screw

DM386-1H Pendulum ball wooden, D = 60 mm

Solid, with metal bail; weight: approx. 80 g

DM386-1K Pendulum ball plastic, D = 60 mm

Hollow; with metal bail; weight: approx. 10 g



Recording with two motion sensors

Experiment: Coupled pendulum

DM375-1P Pendulum rod with mass bodies

Rigid pendulum with a weight that may be positioned as desired, used for demonstrating duration of oscillation in relationship to pendulum length and for determining gravitational acceleration (g); pendulum rod: L = 1100 mm, D = 10 / 7 mm;
weight of rod: 372 g, movable weight: 628 g;
total weight: 1,000 g

DE451-2K Pivot bearing on support

Pivoting, ball bearing holder on support, D = 10 mm;
hole for accommodating round rods with a diameter of up to 10 mm; two wing screws; two holes 19 mm apart for mounting devices with 4 mm plug pins;
groove for drive belt

Experiment: Oscillation period of a coil spring pendulum

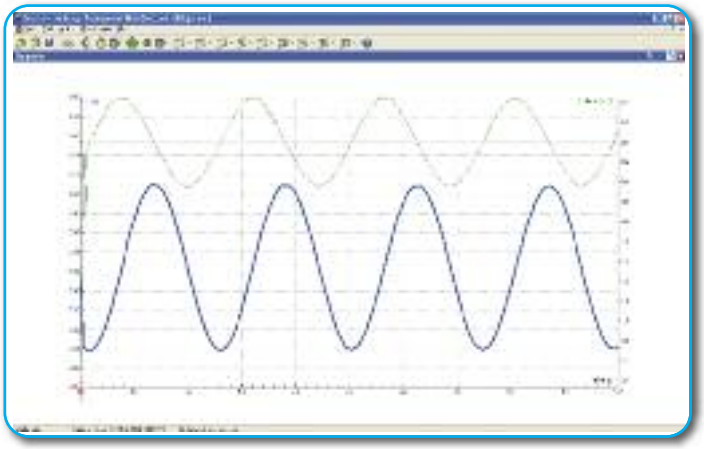
Coil springs and flat spring steel

For experiments involving torsion and oscillation

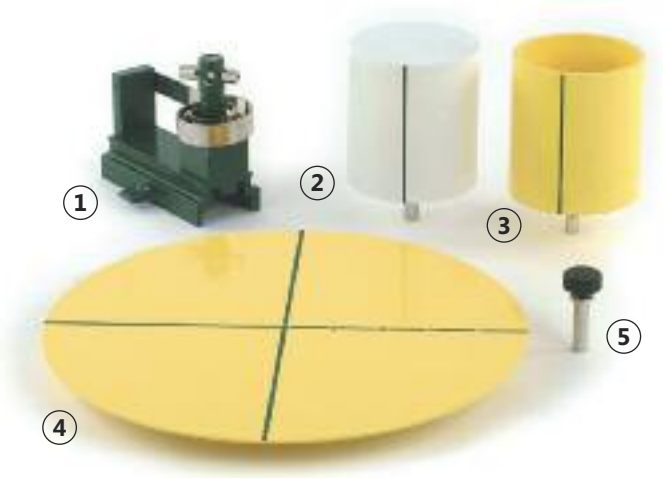
		D (in mm)
P1810-2A Coil spring	3 N / m	35
P1810-2B Coil spring	20 N / m	12
P1810-1S Coil spring	5 N / m	16
P1810-2S Coil spring	10 N / m	16

P1810-1D Flat spring steel

Dimensions: 300 x 25 x 0.5 mm



Recording with one motion sensor



1 DW357-1D Torsional oscillation apparatus

For investigating torsional oscillation and for determining the moment of inertia of various suspended objects based on the period of oscillation; special NTL aluminium profile including axle with torsion spring mounted on double ball bearings; rods up to a diameter of 10 mm may be fixed in the apparatus horizontally or vertically;
dimensions: L = 120 mm, total height: 70 mm

2 DW357-3V Solid roller for measuring torsional oscillation

For determining the moment of inertia of objects having almost the same mass yet with differing mass distribution; with a support through the axis (10 x 35 mm);
D = 90 mm, H = 100 mm, weight: approx. 500 g

3 DW357-3H Hollow roller for measuring torsional oscillation

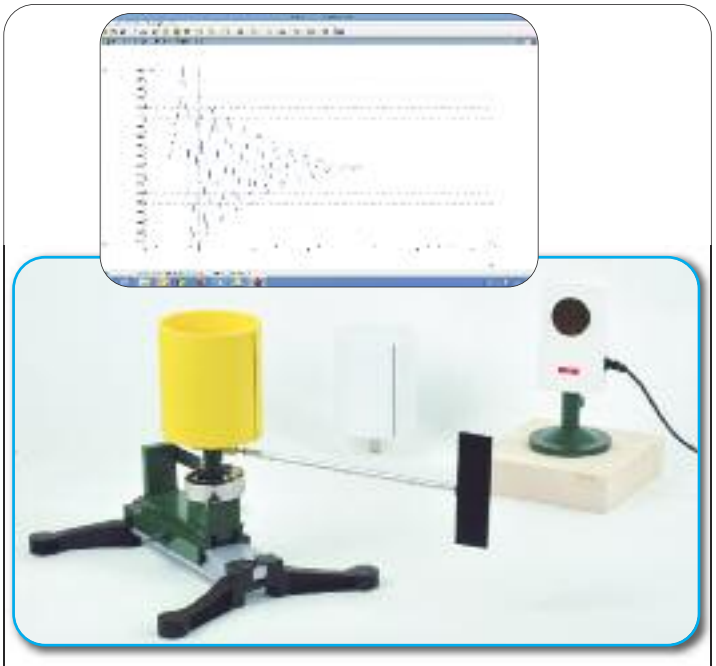
For determining the moment of inertia of objects having almost the same mass yet with differing mass distribution; with a support through the axis (10 x 35 mm);
D = 90 / 80 mm, H = 100 mm, weight: approx. 500 g

4 DM357-3K Rotating disk, demo

For measuring the moment of inertia, even when the axis of rotation is eccentric, and for experimentally verifying the parallel axis theorem; metal disk; yellow powder-coated;
with 4 holes spaced 30, 60, 90 and 120 mm from axis;
centre hole for attaching to support rod DM357-3H
D = 300 mm

5 DM357-3H Support rod for rotating disk demo

Metal rod with thread; plastic nut with recess in axis for setting ball in experiments with centrifugal force;
D = 10 mm, L = 40 mm



Experiment: Moment of inertia of hollow and solid bodies

Recommended for quantitative distance recording:

DE451-3A Aluminium rod with plug, L = 200 mm, D = 6 mm

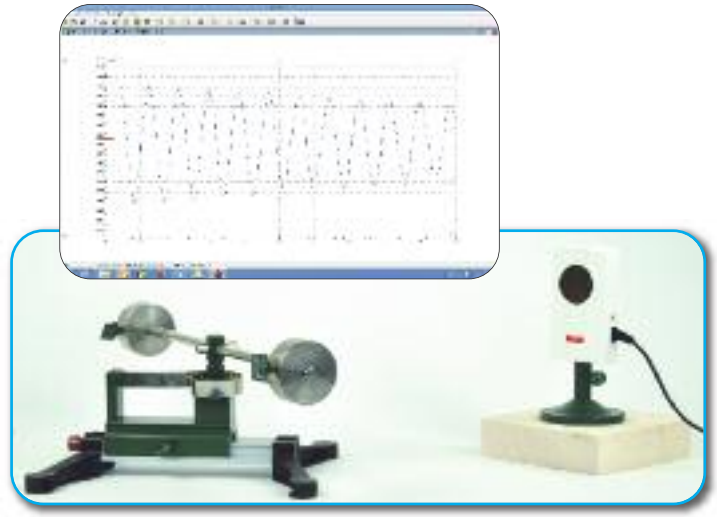
DM281-2B Screen with plug, L = 100 mm

DM372-5G Flat weight, 500 g

Nickel-plated metal cylinder, D = 56 mm, H = 30 mm, with hole for rod with max. diameter of 10 mm and fastening screw M8

DS201-40 Support rod, round, L = 400 mm, D = 10 mm

Nickel-plated steel rod



Experiment: Moment of inertia and period of oscillation

DW360-1P Rotary pendulum (Pohl's pendulum)

This apparatus is used to investigate oscillation as damping is varied. Free, forced and chaotic oscillation may be generated.

The resonator consists of a wheel with spokes, made of sheet copper and mounted on ball bearings, with a flat spiral spring. The resonator is excited by means of lever mechanics, using a drive motor connected to a cam.
Rough or fine adjustment of motor speed is possible.
Damping is provided by an eddy current brake.
Surrounding the resonator is a scale shaped like a ring.
Slits in the scale and pointers on the resonator and exciter lever can be used to project shadows for better visualisation of how the experiment works. Apparatus mounted on a base plate.

Motor power supply: 24 V DC, min. 600 mA
Damping unit power supply: 0 - 12 V DC, continually variable
Dimensions: 400 x 140 x 270 mm

Rotary pendulum, demo experiment:

Recommended accessory (equipment not shown):

P3139-1A Mains transformer 24 V DC

DP130-2A Adapter cable DC (hollow) to 4 mm plugs

Connecting cable red/black, from 2.5/5 mm hollow DC jack to 4 mm plugs, L = 500 mm

DW359-1M Chaos pendulum (magnetic pendulum)

Thanks to its great, adjustable length, the NTL chaos pendulum has a long oscillation period; in addition, it can be set up within a very short time. Even when the pendulum is consistently started from the same initial position, it is impossible to predict how it will oscillate – the pendulum behaves chaotically.
The four magnets in the base can be repositioned by means of knurled-head screws, allowing pendulum motion to be additionally influenced.
Pendulum bob (D = 1") with built-in neodymium magnet, eyelet for suspension and pendulum cord;
base (D = 125 mm) on support (10 x 35 mm),
with four adjustable neodymium magnets

DW380-1S Stroboscope

For observing rapid periodic motion and measuring rpm without contacts; 4-digit LED display; xenon white-light flash tube (6,500 °K); flash energy: 4 Ws (joules);
flash frequency: 100 - 10,000 flashes per minute, continuously variable, both rough and fine adjustment possible
Deviation: ± 0.05 %
Dimensions: 210 x 120 x 120 mm;
Weight: 1 kg;
Input voltage: 230 V / 50 - 60 Hz

DW471-1M Rolling magnet assembly 02

For experiments on longitudinal wave propagation (e.g sound waves) or elastic collision

Assembly consisting of:

7 x	DW470-1R Axle for ring magnets
14 x	DE420-1E Ring magnet, 63 / 30 mm

Experiment: Propagation of longitudinal waves (sound waves)

DW370-1S Standing waves, stand set

Table top assembly – equipment set for generating standing transverse waves, allowing nodes and anti-nodes as well as changes in their number at different excitation frequencies to be easily recognised.

Consisting of:

P1825-1A	1x	Motor with toggle for oscillation tests
DS100-1R	2x	Round base with stand tube
DS204-2L	1x	Bearing pin with clamp insert
DW451-2R	1x	Elastic string, white, L = 300 cm
P1810-3A	1x	Rubber string, red, L = 300 cm

DW370-1M Standing waves, magnetic set

Magnetic panel assembly – equipment set for generating standing transverse waves, allowing nodes and anti-nodes as well as changes in their number at different excitation frequencies to be easily recognised.

Consisting of:

P1825-1A	1x	Motor with toggle for oscillation tests
DS110-43	1x	Magnetic base, D=43 mm, with tube and pin
DS110-66	1x	Magnetic base, D=66 mm, with tube and pin
DW451-2R	1x	Elastic string, white, L = 300 cm
P1810-3A	1x	Rubber string, red, L = 300 cm

DS605-1T Metal plate on support, narrow

For use in assemblies on the magnetic panel or to provide background contrast; green powder-coated;
with edges folded over for greater rigidity;
with support (10 x 40 mm);
dimensions: 960 x 250 mm

P1825-1A Motor with toggle for oscillation tests

Used to generate transverse and longitudinal waves when controlled by a function generator; DC motor with grooved pulley for cord and handle with drill holes for attaching cords and strings;
built into an NTL block housing with support (10 x 70 mm);
two 4 mm jacks; max. input voltage: 3 V;
housing: 75 x 75 mm

DS403-1G Geared motor

Electric motor with metal gears and high torque
Nominal voltage: 6 V DC (3 - 12 V)
Speed: approx. 0 - 250 rpm;
Case dimensions: 128 x 60 x 60 mm

Experiment: Sine waveform resulting from rotational motion

DS403-2X Cam adapter

Used for generating linear, periodic motion, as when producing standing waves in a cord or the motion required by the particle motion model. Especially suitable where powerful drive at a high amplitude and low frequency is required. May be driven by geared motor DS403-1G by means of drive belts DS401-1A (set of 2). The piston is self-lubricating at work and is equipped with an M6 tapping to accommodate the threaded C-hook DS102-3S or the threaded impact plate DS102-4P. Length of piston stroke may be varied. The drive pulley, running on double ball bearings, is firmly mounted on a sliding saddle made of a special aluminium profile and includes a clamping screw for mounting and fastening onto the NTL stand rail profiles.

DS102-3S C-hook, threaded

Stable metal hook with M6 threading

DW427-1H Marking pen holder

Aluminium block, green powder-coated; with tapping for screwing onto the piston of cam adapter DS403-2X; lateral hole for inserting a marker up to 16 mm in diameter; dimensions: 20 x 20 x 30 mm

C7720-2F Marking pen, black

Fibre-tipped marking pen for writing on metallic or plastic surfaces, medium thickness, water-soluble ink

Experiment: Transverse standing waves (table assembly)

DW452-2S Vibration generator

For generating mechanical vibrations in combination with a function generator; horizontally positioned loudspeaker; protected but clearly visible, mounted in closed acrylic glass housing; central metal axis with 4 mm drill hole for holding various attachments; mechanical adjustment of the axis to safely change attachment accessories; two 4 mm safety jacks incl. holder for cord with 4 mm plug; support can be screwed in on the bottom, for fixing to standard rail stand material; replacement fuse;
max. input voltage: 6 V AC / 1 A; fuse: F 1 A;
D = approx. 90 mm, H = approx. 80 mm (+ axis: approx. 20 mm)

Accessories for vibration generator:

1 DW451-4R Metal reeds

Used for constructing a vibrating-reed frequency meter; metal reeds of various lengths mounted on 4 mm pin plugs; for resonating at 11, 15, 21, 36 and 50 Hz;
40 - 90 mm in length

2 DW451-3R Resonance wire hoop

For generating circular standing waves; steel wire hoop mounted on 4 mm pin plug; D = approx. 300 mm

3 DW451-2R Elastic string, white, L = 300 cm

4 P1810-3A Rubber string, red, L = 300 cm

5 P1810-2A Coil spring 3 N / m, D = approx. 35 mm

6 P1810-2C Coil springs 2 N, set of 2

7 DM121-4A Weight on hook 50 g

DW116-2R Chladni plate with plug, round

For demonstrating natural vibration patterns in plates; circular plate with 4 mm plug; may be attached to vibration generator DW452-2S; dimensions: D = 140 mm

DW116-2S Chladni plate with plug, square

For demonstrating natural vibration patterns in plates; Square plate with 4 mm plug; may be attached to vibration generator DW452-2S; dimensions: 140 x 140 mm

DW115-2S Dusting powder, 100 g

Sodium chloride (table salt) powder for use in revealing patterns on Chladni plates;
100 g in a plastic bottle with screw-on lid

Experiment: Chladni figures

DW171-1S Coil spring, long

For demonstrating transverse wave propagation and reflection;
D = 13 mm, L = 200 cm

DW170-1F Slinky spring

For demonstrating wave motion and conservation of momentum;
steel spring,
may be extended to up to 10 m;
D = approx. 75 mm,
H = approx. 100 mm

DW404-1A Wave demonstrator, simple

Manually-operated model for simultaneously demonstrating the motion of transverse and longitudinal waves;
24 rods with white markings at the upper end are moved transversely by a crankshaft with disks attached to it eccentrically; 8 of the rods are extended to show longitudinal motion; front side drive crank with angular scale for precisely displaying the phase angle; stable, easy-running plastic model with hand crank; dimensions: approx. 410 x 100 x 300 mm

Wave demonstrator, profi

The wave demonstrator reveals the principles and properties behind mechanical transverse waves. It is assembled using a modular system. Many experiments can be done just by using oscillation module I. Combining modules adds length to the assembly, making it easier to observe individual experiments.

Experiments

- Propagation of continuous waves
- Reflection at a fixed end
- Reflection at a loose end
- Standing waves
- Superimposition of waves
- Speed of wave propagation
- Damping waves

DW405-1A Oscillation module 1, with brake

21 double pendulums, 21.5 cm long each, mounted on a special aluminium profile. The aluminium pendulum weights are cylindrical and mounted 1.8 cm apart so as to be able to rotate horizontally. Adjacent pendulums are joined using two coil springs, allowing waves to be propagated. Built-in brake pads allow the wave motion to be stopped immediately, so that, for example, wavelength may be measured.
Supplied with two padded aluminium feet and a clamp for creating a fixed end.
Total length: approx. 41.5 cm

Experiment: Standing waves - brake activated

Experiment: Standing waves - powered by hand

DW405-2A Wave demonstrator, drive unit

While waves or pulses can be generated manually, an electric motor produces constant motion, generating waves that are easier to observe and compare.
A DC motor, attached to a cam, controls the speed of the exciter plate, which in turn causes the pendulum motion. Increasing or decreasing the amount of DC input voltage likewise affects the pendulum frequency of the exciter plate.
Aluminium case, 14 cm long, mounted on special aluminium profile with two 4 mm safety jacks, to be coupled to oscillation module 1, supplied with two coupling springs

Required accessories:
Power supply able to set variably
from 0 to 6 V DC, 0.5 A min. (e.g. P3130-3D)

DW405-1E Oscillation module 2 a with brake

Used to extend oscillation module 1, resulting in a unit with 42 double pendulums, which allows experiments to be observed more easily; technical data similar to module 1 DW405-1A; supplied with a rail connector and two long coupling springs for the total length of both modules;
total length: approx. 41.5 cm

DW405-2D Damping unit

This unit is mounted at the end of the wave demonstrator and, by means of a damping plate submerged in water, serves to prevent undesired reflection of waves.
The unit consists of one pendulum mounted so it can rotate, a water tub and two coupling springs

DW405-2E Oscillation module 2 b with brake

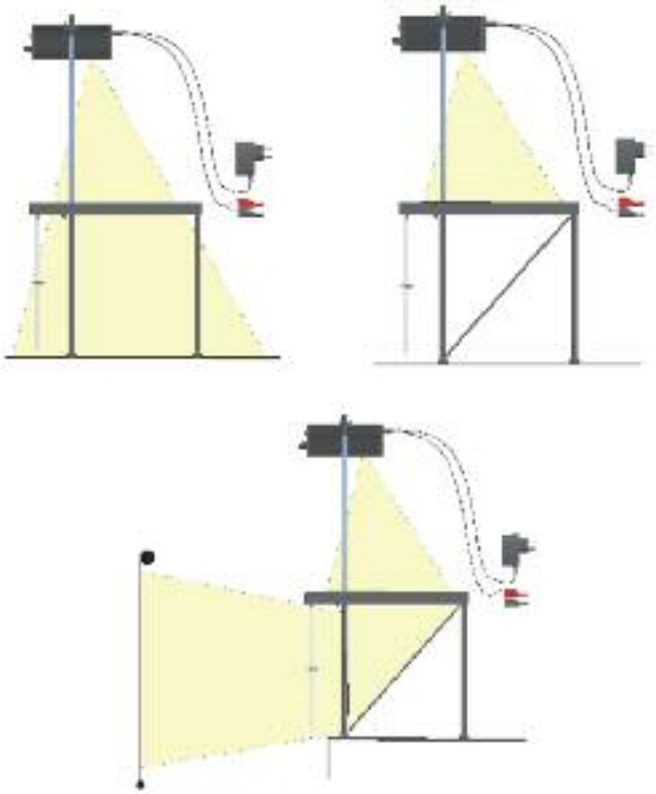
Used to extend ascillation module 1. Technical data similar to module 2a, except that the pendulums are lighter (made of plastic), making it possible to achieve other wave velocities; supplied with a rail connector and two long coupling springs for the total length of both modules;
total length: approx. 41.5 cm

Experiment: Damped waves
Consisting of:
oscillation module 1 + drive unit + oscillation module 2 a + damping unit

DW400-9W Ripple tank with legs and mirror

The phenomena of optical, electromagnetic, sound or other types of wave are comparable to the propagation of waves on the surface of water. Using a ripple tank, these phenomena can be very clearly shown on a screen in slow motion or as a still picture.
By using different wave sources, point-shaped, two-point and plane waves can be generated.
Experiments on reflection, refraction and diffraction can be demonstrated using various objects placed in the water tub.

This type of ripple tank enables a range of **projection options**:



... on the table top (ideal for student experiments)

... on the front screen (demonstrations in small labs)

... on projection surfaces (demonstrations in larger halls)

Experiments:

Reflection of plane waves
from a straight edge

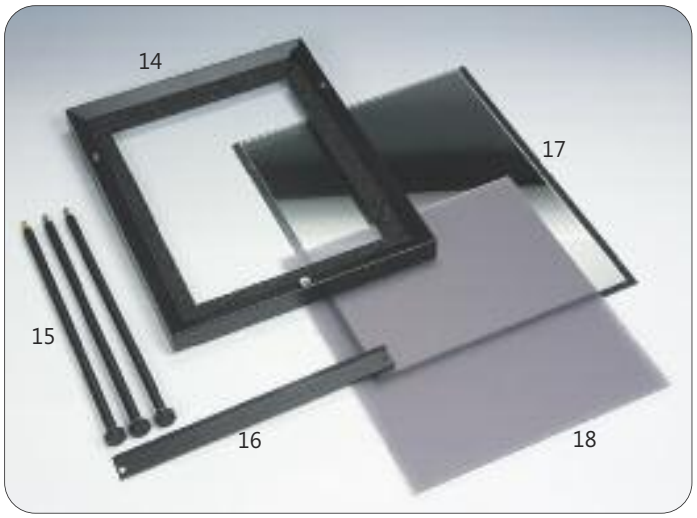
Diffraction
through one slit

Interference
of two circular waves

Propagation velocity
and water depth

Included in delivery:

1 Stroboscope unit:
Metal housing with super bright LED and function generator with digital frequency display, stepless regulation of frequency and amplitude, mode switches between “freeze” and “slow forward”; supply voltage of 12 V DC / 1.5 A is required
2 Power supply for stroboscope unit:
Mains adapter, input : 100 - 240 V,
Output: 12 V DC / 1500 mA
3 Support frame for stroboscope unit
4 Vibration generator:
For generating mechanical vibrations in combination with a function generator;
(see article DW452-2S for technical details)
5 Rocker arm
6 Rocker arm holder
7 Support rod for vibration generator
8 Height adjustment for vibration generator
9 Control cable
10 Remote button for stroboscope unit
11 Liquid for surface tension
12 Container with pathogens and barriers:
8 pcs. Pluggable point excitation
1 piece Narrow bracket (8 mm) for single point excitation
1 piece Medium bracket (35 mm) for two or multiple point excitation
1 piece Wide bracket (150 mm) for generating plane waves
1 set Set of metal barriers for diffraction at the edge, single or double slit
1 piece Dropper (spare)
13 Transparent barriers
1 piece Plano-concave barrier body, L = 100 mm
1 piece Plano-convex barrier body, L = 100 mm
1 piece Trapezoidal, coplanar barrier body, L=145 mm
14 Water tank (Ripple tank):
Free window area: 295 x 235 mm
15 Detachable feet for ripple tank
16 Spacers



17 Deflection mirror
18 Transparent front screen:
Dimensions: 300 x 330 mm

Not shown:

Water drainage hose with pinchcock
Storage box
Manual

DW400-2W Ripple tank for overhead projection

Acrylic tank, 260 x 260 mm; with chamfered foam edges; feet adjustable in height;
adjustable-speed, battery-powered wave generator

Accessories included:
3 Wave sources for concentric waves
1 Wave source for plane waves
1 Reflection panel, flexible
1 Diffraction panel, set of 3
1 Acrylic panel for refraction

Experiments::
- Reflection from a planar and a concave mirror
- Refraction of waves
- Elementary waves and refraction
- Interference of circular waves
- Wave sources in phase and out of phase
- Doppler effect

DW100-1S Tuning fork, 440 Hz, with resonance case

Heavy duty wooden case, with felt dampers; adapter for mounting the tuning fork; tuning fork, L = approx. 170 mm
resonance case: 174 x 97 x 53 mm

DW110-1A Tuning fork mallet

Rubber mallet with wooden handle;
total length: approx. 210 mm

DW110-1K Tuning fork rider

Used in experiments for slightly varying beat frequency;
bracket with knurled head screw;
to be fastened to the tuning fork 440 Hz (DW100-1S)

Experiment: Transmission of sound through air

DW101-1S Tuning forks, set of 8

Diatonic scale, c1 – c2
Frequencies: 256, 288, 320, 341.3, 384, 426.6, 480, 520 Hz
Length: approx. 140 – 180 mm
Stored in cardboard box with lid

Light metal tuning forks

With especially wide arms
for radiating sound;
used to generate standing waves in Kundt's tube

DW103-1S Tuning fork, 1000 Hz

Length: 120 mm

DW103-2S Tuning fork, 1700 Hz

Length: 104 mm

DW120-1S Tuning fork with stylus, glass plate

For recording low-frequency vibrations on a glass plate coated with soot; 128-Hz tuning fork with wooden handle, complete with stylus; total length (without stylus tip): approx. 295 mm; glass plate 120 x 50 mm included

Experiment: Acoustic vibrations generated by the tuning fork with stylus

DW120-1A Tuning fork with stylus, large

For making the vibrations of a tuning fork visible;
extra large, low frequency model of a tuning fork;
with screw-on holder for pencils;
length of tuning fork: approx. 63 cm; support length: 18 cm

Experiment: Recording vibrations with tuning fork with stylus, large

DW250-1M Monochord

For investigating the vibration of strings as well as the relationship between pitch and the length, tension and thickness of a string; wooden resonance case with a fixed bridge at each end and two movable bridges, two strings (e' and g') with tuning pegs and a pulley for redirecting the string so as to vary tension using weights with hooks, with 600 mm scale lengthwise;
dimensions: 700 x 90 x 65 mm

DW115-1G Bow 4/4

Used for stroking strings and Chladni plates; wooden bow with horsehair; total length: approx. 700 mm

DW115-2K Colophony

For bow DW115-1G; increases string friction and thus sound volume; natural resin in a cork and plastic dish;
dimensions: approx. 40 x 17 x 15 mm

DW260-2S String, e'

DW260-3S String, g'

DW300-1L Flue pipe, model

For investigating the relationship between pitch and the length of the resonating space; wooden model with movable piston and scale; dimensions: 40 x 40 x 370 mm

DW302-2X Xylophone, model

Simple model for generating notes from c' to c'';
eight metal plates of different colours mounted in a plastic frame; including mallet;
dimensions: approx. 240 x 105 mm

DW210-1Z Savart's Wheel set

Sounds are generated by touching the rotating wheels with a piece of cardboard;
four toothed wheels (40, 50, 60, 80 teeth) of acrylic glass;
permanently mounted on a single common axis (D = 10 mm),
dimensions: D = 60 mm, L = 150 mm

DW220-1L Perforated disc

Used as a siren disc; sounds are produced by directing a jet of air at the individual rows of holes on the disc as it rotates;
yellow plastic disc; 8 rows of holes; disc diameter: 300 mm

Recommended accessory: Disc spindle DW220-1H

DW220-1H Disc spindle

For mounting discs with a centre hole (minimum of 10 mm in diameter); metal spindle including small pulley with grooved edge and a fastening screw;
support: D = 10 mm, max. span width = 8 mm

Experiment: Disc siren - powered by whirling table demo DS402-4H

Required for this experiment:

C6030-1G Glass tube 7 - right-angled with tip

Glass tube no. 7; right angled;
50 + 50 mm, with tip;
D = 5 / 8 mm

P3160-3A Function generator with digital display demo

Frequency display on 6-digit, 7-segment LED display, 26 mm tall, with 1-Hz graduations.
Output signals: sine, triangle, square, sawtooth;
amplitude and frequency able to be modulated;
frequency range: 0.1 Hz - 100 kHz, may be set to one of six logarithmic scales with overlapping fine tuning;
output voltage: 0 - 10 Veff; max. load 2 Aeff;
permanent short-circuit and backlash potential protection;
4 mm safety output jacks; plastic case: yellow ABS with two recessed handles; voltage source: 230 V AC / 50 - 60 Hz;
dimensions: approx. 260 x 150 x 210 mm;
weight: approx. 3.9 kg

P3120-3F Function generator SE

Powerful function generator for experiments in electronics but also mechanics for driving motors or sound sources;
Output signals: sine, triangle and square
Frequency range: 0.1 Hz - 100 kHz
adjusted by variable controls (coarse, fine)
Output voltage: 0 - 4 Veff, max. 4 watts,
from 4 mm safety jacks;
with short-circuit and backlash potential protection;
input voltage: 12 V AC, (provided e.g. by mains transformer P3130-7A or student mains transformer P3130-3D or P3120-1N Fixed-voltage transformer, "inno"; green ABS plastic case;
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 400 g

MB270-2V LF amplifier "compact", magnetic

Used in amplifying weak audio signals for measurement purposes or for driving a loudspeaker;
Amplification factor:
1, 3, 10, 30, 100, 300, 1,000, 3,000, 10,000 times
Accuracy: better than 20 %
Frequency range: 25 Hz - 70 kHz
Output voltage: 2.8 Veff
(2.1 Veff rms at 4 Ohm)
two 4 mm output jacks, short-circuit protection
Input voltage: 2.8 Veff (max. 30 Veff)
Power supply: 12 V DC (hollow jack), supplied by
mains transformer P3130-1P e. g.
Dimensions: 84 x 84 x 39 mm

P3130-7A Fixed-voltage power supply 12 V AC / 20 W

Mains transformer for powering the light source SE or function generator SE
Output voltage:
12 V AC / 20 W
Connecting leads
with two 4 mm safety plugs
Voltage source:
230 V AC / 50 - 60 Hz
Dimensions:
approx. 83 x 58 x 58 mm

P3120-1G Function generator with digital display "inno"

Serves as a source of alternating current with variable frequency and voltage up to 4 Veff; (sine, triangle or square), when combined with 6 V / 10 Ah "inno" rechargeable battery P3120-1B or "inno" fixed-voltage transformer P3120-1N

It is particularly important to note this unit's usability with the "inno" 6 V / 10 Ah recharge-able battery, since there is often no mains out-let nearby when doing experiments on the metal panel!

Technical data:
Waveforms: sine, triangle and square
Frequency: 0.1 Hz - 100 kHz
Frequency display: 5-digit LED display
Digit height: 26 mm
Output voltage: 0 - 4 Veff
Voltage supply: 6 V DC, e.g. P3120-1N fixed voltage transformer "inno" or P3120-1B rechargeable battery "inno" 6 V / 10 Ah
Case: green ABS plastic
Dimensions: approx. 160 x 120 x 45 mm; weight: approx. 530 g

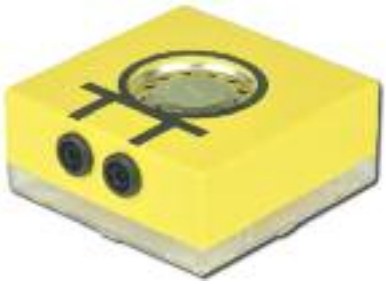
P3711-5A Carbon granule microphone, "compact" model

For demonstrating how a carbon granule microphone works; transparent, elastic, plastic case filled with carbon granules and sealed with a lid; two permanently mounted 4 mm jacks on the sides; dimensions: 65 x 47 x 22 mm

P3721-2C MBC Microphone

Carbon microphone capsule; max. load 40 mA;
Impedance: 80 - 250 Ohm;
two 4 mm jacks

Magnetic block from the "compact" - system, in yellow plastic housing ABS; dimensions:
84 x 84 x 39 mm



DW340-2M Measuring microphone "inno"

Measuring microphone with amplifier for qualitative and quantitative measurement of nearby acoustic events; measurements may be displayed using an AC voltmeter, an oscilloscope or frequency counter "inno" (DE722-1F).

Technical data:
Amplification factors: 1, 3, 10, 30, 100 times
Frequency range: 50 - 12,000 Hz (> 20 kHz when used for qualitative measurement)
Max. sound pressure: 110 dB
Output voltage: max. 2 Veff
Two 4 mm safety output jacks, short-circuit protection

Power supply: 4 x 1.5 V mignon cells (included) or external power supply 6 V / 500 mA, P3120-6N
Case: plastic, ABS
Case dimensions: approx. 160 x 120 x 45 mm
Microphone dimensions: 500 x 7 mm
Weight: approx. 380 g

1 DW340-1S Loudspeaker

Used in conjunction with function generators;
permanent dynamic system; connected by two 4 mm jacks;
thread on the outside for connecting directional cylinder DW340-1R;
power: 1 W; impedance: 8 Ohm; max. input voltage: 9 V;
D = 80 mm, support: 40 x 10 mm

2 DW340-1R Directional cylinder for loudspeaker

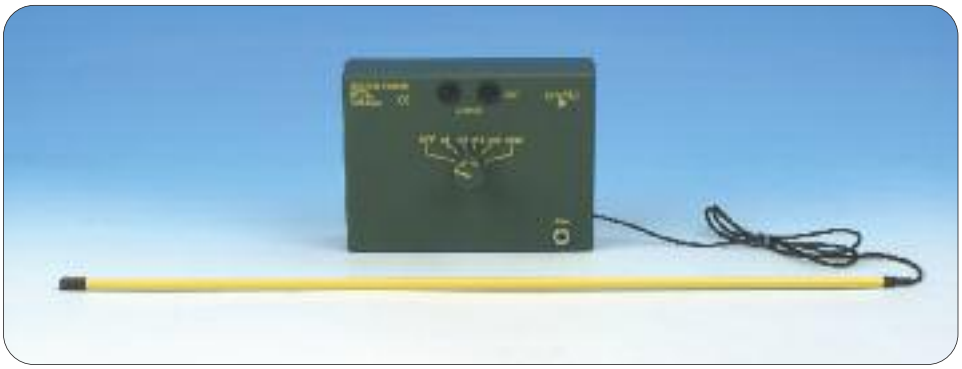
Acrylic cylinder with thread on the inside for screwing onto loudspeaker DW340-1S;
D = 80 mm, L = 150 mm

3 DW339-1O Dynamic capsule

Suitable for use with LF amplifier MB270-2V as a microphone.
Designed according to the principle of the dynamic transducer;
electrical connection by means of two 4 mm jacks;
impedance largely independent of frequency.
Frequency range: 200 Hz - 4 kHz
Impedance: 300 Ohm at 3,400 Hz
D = 55 mm; support: 153 x 10 mm

DM300-2K Rod support for trolley

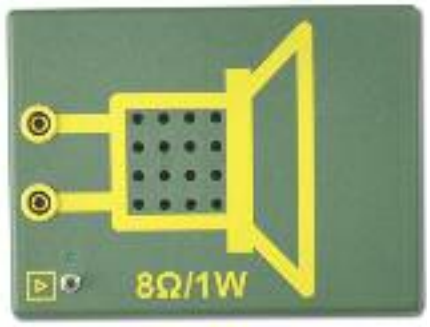
For attaching round material up to D = 10 mm to the demo trolley;
base plate with powder-coated metal sleeve and set screw;
dimensions:
115 x 30 x 47 mm



Experiment: Radiation of sound waves in the air

DE720-2L MBI Loudspeaker "inno"

Loudspeaker with integrated amplifier, 8 Ohm / 1 Watt,
two 4 mm safety jacks; on-off switch;
in green plastic housing ABS;
dimensions: approx. 160 x 120 x 45 mm



DW341-1L Loudspeaker "demo"

For use with function generators and LF amplifiers,
to broadcast signals acoustically; permanent dynamic system;
two separately mounted loudspeakers;
input impedance 8 Ohm / 3 W per speaker, when connected by means of separate pairs of 4-mm jacks;
may be wired parallel for 4 Ohm / 6 W, input through separate pair of jacks;
yellow ABS plastic case with two recessed handles;
dimensions: 260 x 150 x 210 mm

DE722-1F Frequency counter "inno"

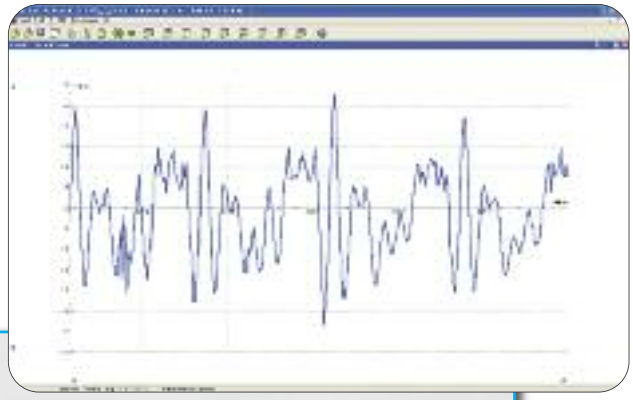
For quantitative measurement of countable events, e.g. in conjunction with measuring microphone "inno" DW340-2M;
4-digit LED display, 26 mm tall and digital range display.

Technical data:
Measurement modes: manual, auto, pulse
Intervals for manual and auto modes: 0.1, 1, 10 s
Input signal selection: AC / DC
Switch: start - stop / reset

Two 4 mm safety jacks for connecting to signal generation device; suitable for recording voltages from 300 mVeff upward;
monitoring LED displaying readiness to count incoming signals;
power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V / 500 mA, P3120-6N;
case: plastic, ABS;
dimensions: approx. 160 x 120 x 45 mm;
weight: approx. 490 g

Experiment: Measuring the frequency of a tuning fork

Instead of displaying sound waves using an oscilloscope, which is complicated, we recommend using a sound sensor with an interface.



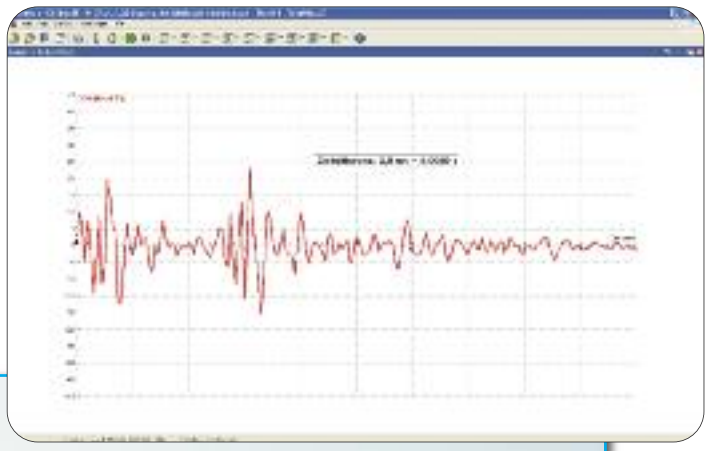
Experiment: Recording the human voice

DW282-1R Tube for measuring the speed of sound, simple

For determining the speed of sound by means of the echo method; cardboard tube with removable plastic end caps; L = 480 mm, D = 80 mm

DW282-1C Clicker (for measuring the speed of sound)

For determining the speed of sound by means of a tube (closed at one end) using the echo method.
By pushing the small metal plate with the finger, a very short but loud noise is generated. The measurement system can display this sound as a clearly visible peak. The reflected peak is also recorded. The time between these two peaks then gives the speed of sound.



Experiment: Measuring the speed of sound

DW280-2G Sound velocity meter "inno"

For a simple and fast measuement of sound velocity in gases;
4-digit, 26 mm LED display; signal is launched manually,
stop signal detected by encapsulated electret microphone
with waterproof membrane.

Technical data:
Measuring range: 99.99 ms
Accuracy: 10 µs
Dial for adjusting sensitivity
Reset switch

Power supply: 4 x 1.5 V mignon cells (included),
or external power supply 6 V / 500 mA, P3120-6N
Case: plastic, ABS
Case dimensions: approx. 160 x 120 x 45 mm
Length of probe leads: approx. 150 cm each

Experiment: Measuring sound velocity in air

DW280-2R Tube for measuring sound velocity

Closed measurement section, for determining the sound velocity in a gaseous or liquid medium in combination with the sound velocity meter "inno" DW280-2G;
acrylic tube, open at one end to accommodate a waterproof loudspeaker DW280-2L; opening and gasket at the other end allow the electret microphone for the sound velocity meter to be inserted; two conic openings for filling; includes a tube mount on support;
dimensions: 415 x 80mm (measurement section: 400 mm)

DW280-2L Loudspeaker, waterproof, on support

source of sound for determining sound velocity in various media; used together with tube for measuring sound velocity DW280-2R and meter DW280-2G;
Loudspeaker, D = 70 mm, 8 Ohm, 0.3 W, with water-resistant membrane; housing with gaskets and two 4 mm safety jacks, on a support

DW150-1T Drums, pair

Tambourine made of naturally finished wood, natural skin nailed in place; with mounting support, set of two;
for basic experiments in sound and in the radiation of sound;
diameter of drum: 220 mm, support: 40 x 10 mm

DW151-1S Drumsticks, pair

For beating the pair of drums DW150-1T,
set of two;
L = 190 mm

DM385-2T Pendulum bob, styrofoam, D = 1"

DW352-1K Resonance apparatus

For precisely determining the wavelength of sound waves in the air

consisting of:

P1350-2K Resonance tube "compact"

Sturdy acrylic glass tube with transparent scale;
L = 500 mm, D = 50 mm

P1350-2S Piston for resonance tube

Disc with felt layer, suitable for P1350-2K,
with plunger L = 550 mm

P1351-2H Holder for resonance tube, small

Plastic holder, suitable for P1350-2K,
easily moveable for marking maxima and minima;
designed for level surfaces

MB240-1LS MBC Loudspeaker with nose

Loudspeaker in plastic housing,
with tube to connect with P1350-2K resonance tube;
loudspeaker: 8 Ohm / 1 Watt; two 4 mm jacks

Experiment: Determining the wavelength at various frequencies (exact determination of the maxima and minima with a simple, analogue sound level meter)

DW275-1M Sound level meter "inno"

Digital device for magnetic mounting, used to measure acoustics; the 26 mm LED display allows readings to be taken even from a distance.
Measuring range: 30 - 120 dB, A or C weighting selectable
SLOW-FAST: response time adjustment
FLOAT-PEAK: peak value display, with reset button
Power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V / 500 mA
Case: plastic, ABS
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 450 g

DW270-1M Sound level meter digital, "handy"

Handheld precision device for measuring acoustics;
condenser microphone,
3½-digit LCD display, H = 18 mm,
2 weighting filters:
A (corresponding to the human ear)
and C (technical weighting)

Slow and fast response times,
recording of maximum value,
easy to calibrate

Measuring range:
30-80/50-100/80-130 dB (indicator displays when beyond or below range);
Resolution: 0.1 dB
Power supply: 9 V battery
Dimensions: 225 x 70 x 28 mm
Weight: 250 g

DW270-3M Sound level meter analogue

Easy-to-use instrument with pointer for measuring acoustics.

Measuring range:
50 - 126 dB (in 7 intervals)
2 weighting filters:
A (corresponding to the human ear)
and C (technical weighting)

Slow and fast response times

Power supply: 9 V battery
Dimensions: 170 x 63 x 40 mm;
Weight: approx. 185 g

P9901-4U SEK Ultrasonics

consisting of:

P1860-1B	1x	Ultrasonic control unit
P1860-1S	2x	Ultrasonic transmitter
P1860-1E	1x	Ultrasonic receiver
P1860-1G	1x	Ultrasonic goniometer
P1861-1R	3x	Slider with clamping post 40 mm
P1865-BS	1x	Ultrasonic screens, set of, with bracket
P1865-BR	1x	Ultrasonic screen frame for absorption experiments
P1865-1P	1x	Ultrasonic parabolic mirror

Storage:

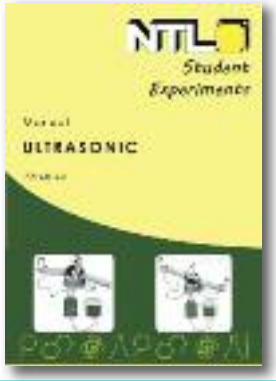
P7906-4U	1x	Box insert Ultrasonics
P7806-1G	1x	Storage box II large, with cover Box insert plan with 2 labels

Experiment: US 11 Diffraction at a double slit

With the module SEK Ultrasonic the following experiments can be performed:

US 00	Goniometer – introduction
US 01	Transmitter – radiation characteristics
US 02	Receiver characteristics
US 03	Bundling of waves - effect of a parabolic mirror
US 04	Receiver with parabolic mirror
US 05	Ambient noise
US 06	Superposition principle (Superposition of waves)
US 07	Reflection
US 08	Absorption
US 09	Diffraction at a barrier
US 10	Diffraction at a single slit
US 11	Diffraction at a double slit
US 12	Diffraction at a circular screen (round hole)
US 13	Diffraction at a circular plate
US 14	Diffraction at Fresnel lenses
US 15	Interference though two transmitters
US 16	Lloyd's interference pattern
US 17	Stationary waves through two transmitters
US 18	Stationary waves through reflection
US 19	Wavelength – speed of sound
US 20	Scattering and structure research

P9160-4U Experiment manual "Ultrasonic"



P1860-1B Ultrasonic control unit

Electronic control unit consisting of a quartz-controlled transmitter (40 kHz) with two outputs as well as one input with amplifier and commutator.

Modes:
- **CONTINUE:** Output signal is continuously transmitted (for diffraction, superposition, and absorption experiments)
- **IMPULSE:** Output signal is transmitted as a pulsation (for distance measurement, sonar principle, etc., in conjunction with an oscilloscope)
- **SHOT:** Non-recurring pulsation transmission when button is pushed (for time and distance measurements, in conjunction with an oscilloscope)
  Output and input ports have LEDs to indicate when a signal is transmitted or received as well as to indicate the battery status or overmodulation status of the receiver
- Analogue Output via two 4 mm safety jacks
- Data output for oscilloscope, counter or computer

Voltage supply:
Battery-powered (9 V battery included)
or external supply through mains transformer P3130-1P
Dimensions: approx. 160 x 120 x 40 mm
Weight: approx. 310 g

P1860-1S Ultrasonic transmitter
P1860-1E Ultrasonic receiver

Ultrasonic transmitter (red) and receiver (green) in housing with painted metal stand rod (D = 6/10 mm), shielded cable with RCA plug for connection to the control unit. To be fixed on the arms of the goniometer NTL sliders are required.

Operating frequency: 40 kHz (typ.)
Max. operating voltage: 20 Vpp
Axis height: 180 mm

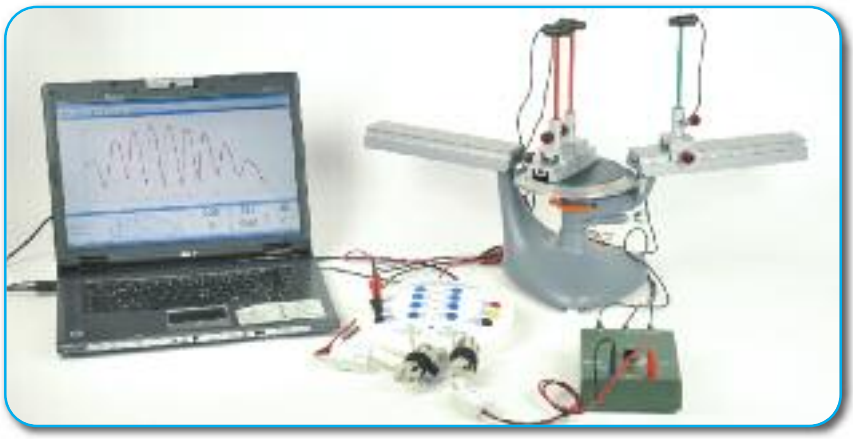
P1865-BS Ultrasonic screens, set of, with bracket

Acrylic screens, 30 x 30 cm:
- Full screen
- Screen with double slit
- Screen with single slit
- Half screen
- 2 Fresnel apertures
- Screen with hole
- Screen circular on support
- Bracket for mounting screens on the angle scale of goniometer

P1860-1G Ultrasonic goniometer

- Solid and durable metal base, one permanently mounted arm
- Second arm rotatable on low friction metal axis, with setting and fine adjustment screw
- Both arms with special NTL profile and mm-scale for the accurate positioning of sliders
- Angular scale, D = 170 mm, rotatable and fixable independent of the arm, vernier readings, usable angle: 70.0 - 310.0° min
- Angular scale-plate with special NTL profile for mounting screens or sliding saddles

Dimensions: approx. 68 x 22 x 19 cm
Weight: approx. 4130 g

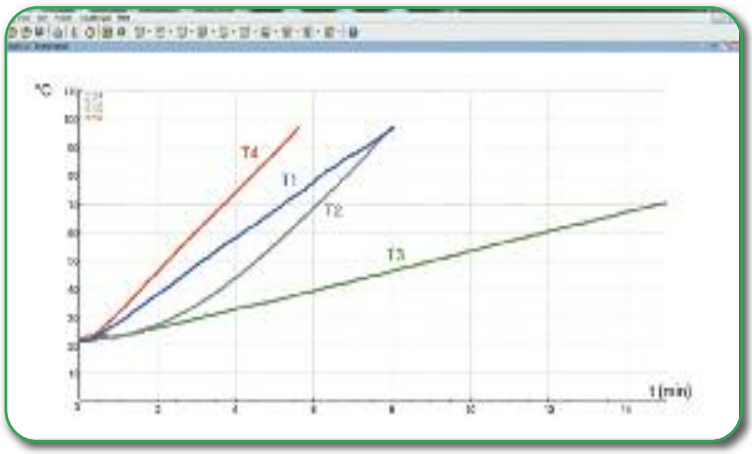


Experiment: US 15 Interference through two transmitters

An integrated gear-driven potentiometer enables evaluation of the angular position using a PC and suitable software (e. g. CMA/Coach)

Which burner is right for you?

We heated 200 ml of water in a Erlenmeyer flask using different heat sources.
The results have been summarised in the following temperature / time diagram:



T1 = **P2110-1A** Gas cartridge burner + Gas cartridge
T2 = **C7414-2B** Hot plate, small, 500 W
T3 = **DT427-1B** High-temperature spirit burner
T4 = **P2112-1R** Nozzle round, for cartridge with valve + gas cartridge with valve

P2110-1A Gas cartridge burner

Bunsen burner for use with pierced gas cartridges or with valve connector, includes needle valve and air regulator.
D = 110 (120) mm, H = 185 mm
(supplied without cartridge)

P2110-1C Gas cartridge

Propane-butane mixture in a safety tank, in acc. with the EN417 standard;
D = 87 (90) mm, H = 90 mm;
net filling weight: 190 g

P2110-1D Gas cartridge, leakage protected

Propane/butane mixture in a safety tank in acc. with standard EN417;
the new "gas stop system" can be used to remove the cartridge from the burner without leaking gas.
D = 87 (90) mm, H = 90 mm;
net filling weight: 190 g

P2112-1R Nozzle round, for cartridge with valve

Used to heat up media more quickly using a bigger flame field; attachable adapter for gas cartridges with valve, needle valve with large screw.

Metal adapter with wind protection and frames for directly positioning a wire gauze with ceramic centre or ceran plates.
Burner diameter: 50 mm
Adapter diameter: 150 mm
Height (with gas cartridge): 165 mm

P2110-1V Gas cartridge with valve

Propane-butane mixture in a safety tank in acc. with the EN417 standard

D = 100 (104) mm, H = 90mm
net filling weight: 190 g

C7414-2B Hot plate, small, 500 W

Electric hot plate, D = 93 mm, heat level variably adjustable, protection against overheating;
input voltage 230 V / 50 - 60 Hz; dimensions: D = appr. 140 mm, H = approx. 70 mm; weight: approx. 0.7 kg

DT427-1B High-temperature spirit burner

Safe, easy-to-use, powerful burner with an innovative design requiring no wick; a gasket in the lid allows pivoting;
flame temperature: approx. 800°C
max. volume capacity: 80 ml
height: approx. 80 mm
(supplied without contents)

C7411-1A Gas lighter, mechanical

Total length: approx. 155 mm

C7411-1E Replacement flints, set of 3

For gas lighter, mechanical C7411-1A;
L = approx. 20 mm

DT100-1A Immersion heater, 1000 W

Immersion heater made of high-quality stainless steel; with overheating protection and distance ring; power cord with grounded plug (Schuko);
input voltage:
230 V / 50 - 60 Hz; dimensions: 6 x 6 x 27 cm; weight: 0.2 kg

C7225-1M Protective, fire proofed working mat, 500 x 500 mm

Flexible, foldable working pad to protect table surfaces from glowing or hot parts; trimmed heat protection material, fire-proof up to 500°C; dimensions: 500 x 500 mm

C7412-HE Heating flask 250 ml, single

For generating steam in connection with a heating plate or a burner, consisting of:

1 x C3020-6D	Erlenmeyer flask, 250 ml, with SB 29
1 x C7320-4B	Stopper silicon, 26 / 32 / 30 mm, 1 hole (SB 29)
1 x P7422-2B	Glass tube 13, straight, D = 8 / 5 mm, L = 80 mm

C7415-5K Water boiler, 1.7 litre

For heating up larger volumes of water safely and quickly; the panorama glass cylinder allows students to clearly see the heated liquid – and therefore also the state of water when it reaches boiling point.

Output: 2200 W
Filling volume:
approx. 1700 ml
Input voltage:
230 V / 50 - 60 Hz

DT701-4F Hot air blower, 1200 W

Input voltage
230 V / 50 - 60 Hz

Support rings

Open support ring, permanently mounted on support clamp, one M8 wing screw;
Material: stainless steel (Ring D = 102 mm), steel nickel-plated (Rings D = 62 mm and D = 30 mm)

DS502-30 Support ring on support clamp, D = 30 mm

DS502-62 Support ring on support clamp, D = 62 mm

DS502-02 Support ring on support clamp, D = 102 mm

Support-rings SE

End of rod with metal cylinder D = 10 mm, L= 30 mm;

D = 102 mm (stainless steel):
For supporting and fixing wire gauzes or ceran plates

D = 62 mm (steel):
For locking and fixing beakers and erlenmeyer flasks

D = 30 mm (steel):
For locking and fixing erlenmeyer flasks, tubes or thermometers

P7250-1T1 Support ring SE, D = 30 mm

P7250-1T2 Support ring SE, D = 62 mm

P7250-1T3 Support ring SE, D = 102 mm

Tripods

For supporting
wire gauze P7125-1B
or ceran plate C7226-1B;
diameter of ring:
approx. 125 mm;
steel, painted hammer finish

C7230-1A Tripod, H = 200 mm

C7230-1C Tripod, H = 250 mm

C7226-1E Ceran plate support for burner P2112-1R

Stainless steel plate support for direct attaching to a P2112-1R circular burner - no additional stand material required;
crimped borders ensure that the glass plate or wire gauze does not slide when inserted;
dimensions: 160 x 160 mm

C7226-1D Plate holder for Ceran-plates, with rod

Steel plate support with handle;
crimped borders ensure that the glass plate or wire gauze does not slide when inserted;
handle: D = 10 mm;
dimensions: 160 x 160 mm

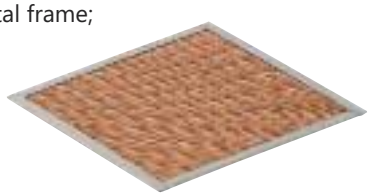
C7226-1B Ceran plate

Thermal shielding glass plate, with ground edges;
dimensions:
155 x 155 x 4 mm

C7223-1A Triangular wire support, ceramic collar, 60 mm

C7225-5K Copper wire mesh

Wire mesh of copper in a metal frame;
dimensions: 200 x 200 mm



P7125-1B Wire gauze with ceramic centre

Dimensions: 150 x 150 mm

DT200-1T Demonstration thermometer

Thermometer with clear,
easy-to-read, graduated scale; with
extended stem filled with dyed alcohol.
Scale: 160 x 14 mm; gradation: 1°C;
extended stem: L = 70 mm, D = 7.5 mm;
total dimensions: L = 270 mm, D = 17 mm

① **DT200-2T** Thermometer with big scale,
-10 to +110 / 1°C

Thermometer with easy-to-read,
graduated scale inside the glass body;
with diving shaft, filled with dyed alcohol
scale: 160 x 14 mm
graduation: 1°C
diving shaft: L = 70 mm, D = 7.5 mm
Total dimensions:
L = 270 mm, D = 17 mm

② **C6514-13** Thermometer, chemical, - 10 to + 110°C, alc.

Precision thermometer with gradated scale inside the glass body;
gradation 1°C; filled with dyed alcohol; with glass eye
L = 230 mm, D = 8 mm

Laboratory thermometers

Filled with dyed alcohol; with moveable silicon triangle
(thermometer cannot roll off table);
diameter: approx. 6 mm; length: 280 - 300 mm

Item No.	Range	Graduation
C6510-6C	-20 to+110 °C	1°C
P2220-1A	-10 to +110 °C	1°C
P2220-9A	-10 to +110 °C	not graduated

P7251-2T Tube holder, single

Metal U-bracket with clamping screw,
for securing tubes and thermometers
of max. diameter 8 mm;
bearing pin D = 3 mm;
with plastic insert D = 10 mm

P7251-3T Tube holder, double

Plate on support, D = 10 mm, green
powder-coated,
with two holes and fastening screws
for clamping in parallel to each other
two tubes or thermometers
with diameters of up to 8 mm

C4350-1G Thermometer for students, digital, 300° C, long

Digital pocket thermometer; metal probe L = 140 mm;
with protective cap; 10 mm high LCD;
measurement range: -50 to +300°C
accuracy: ± 2°C; resolution: 0.1°C;
splash water-proof;
battery driven,
automatic shutdown

C4350-1B Thermometer for students, digital, 200° C, short

Digital precision thermometer; metal probe L = 70 mm;
with protective cap; 7 mm high LCD;
measurement range: -40 to +200°C (-40 to +392°F);
accuracy: ± 0.8°C; resolution: 0.1°C;
functions: hold, maximum and minimum temperature;
water jet-proof; battery driven, automatic shutdown

C4360-1L Thermo pistol infrared, 200°C

For contactless and therefore
reliable measurement of surface
temperatures, with laser sight,
hold function, LED background
light;
measurement range: -20 to +200°C;
resolution: 0.1°C;
accuracy: 2.5%;
measuring distance: max. 130 cm;
battery-driven
(9 V block battery included);
dimensions:
approx. 160 x 80 x 50 mm;
weight: approx.
150 g

DE723-2T Thermometer, differential "inno", 150°C

This device is used for precisely measuring low temperatures.
Two sensors (C4120-1T or DT202-5S) may be connected simultaneously.
Switch for selecting the display of temperature 1 (t1), temperature 2 (t2) or the difference (t1-t2)

Technical data:
measuring range: -40.0 to +150.0°C
reading: 0.1°C
display: LED, 3 ½ digits
digit height: 26 mm
accuracy: type ±0.8°C (max. ±1.5°C)
throw switch: ON/OFF
DIN jacks for connecting thermo-sensors
power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V / 500 mA, P3120-6N
Case: plastic, ABS
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 400 g

Additionally required:
Sensor Type DIN: DT202-5S or C4120-1T

DE722-1T Thermometer "inno", 1100°C

For measuring high temperatures
using type K NiCrNi thermo-sensors (-80 to +1350°C),
e.g.: P4120-1T or P4120-2T

Technical data:
display: LED, 3 ½ digits
digit height: 26 mm
accuracy: type ±0.6°C (max. ±1.5°C)
linearity (incl. sensor): +2/-1% (0 to 1100°C), +0/-10% (0 to -80°C)
throw switch: ON / OFF
sensor jack: for connection of type K NiCrNi thermo-sensors
power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V / 500 mA, P3120-6N
case: plastic, ABS
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 400 g

Additionally required:
Sensor Type K: P4120-2T or P4120-1T

Recommended accessory:
P3120-6N Mains transformer 6V / 500 mA DC
P3120-5B S-shaped assembly platform

DT202-5S Thermo-sensor, with handle, DIN

Temperature sensor with DIN jack for connecting it to "inno" differential thermometer DE723-2T;
for measurements in gases, liquids or on surfaces;
tip length = 180 mm; measuring range: -40 to +150°C

C4120-1T Thermo-sensor with handle, glass, DIN

Temperature sensor with DIN jack for connecting it to "inno" differential thermometer DE723-2T;
for measurements in aggressive liquids; tip length = 180 mm;
measuring range: -40 to +150°C; precision: 0.1°C

P4120-2T Thermo-sensor with handle, Type K

NiCr-Ni thermocouple; for measurements in gases or liquids;
tip length: approx. 200 mm;
measuring range: -50 to +1100°C; response time: approx. 3 sec

P4120-1T Thermo-sensor flexible, Type K

Very flexible thermocouple wire; for measurements in gases, liquids or on surfaces; L = approx. 100 cm;
measuring range: -65 to +300°C;
response time: approx. 0.3 sec

C4355-1A Thermometer "handy", - 200 / + 1300°C

Microprocessor-controlled handheld thermometer with a wide measuring range; may be used with a variety of sensors: Pt 100 Ohm, J, K, R, E, T;
15-mm LCD display.

measuring range
(dependent on sensor):
-200.0 to +1300.0°C
(-328.0 to +2372.0°F)
accuracy: ± 0.5°C
precision: 0.1°C
response time: approx. 1 sec
functions: data hold, recording of minimum and maximum temperatures, REL button, RS232 interface, automatic shutdown,
battery-powered (9 V battery included)

Dimensions: 195 x 68 x 30 mm
Weight: 220 g

Additionally required:
Type K sensor:
P4120-1T, P4120-2T or
C4356-5T temperature sensor Pt100 Ohm

C4356-5T Thermo-sensor with handle, Pt 100 Ohm

Special temperature sensor for low temperatures, provides a high accuracy even at low temperatures below -10°C;
tip: D = 3 mm, L = 150 mm

Measuring range:
-200.0 to +850.0°C
(-328.0 to 1562.0°F);
with 4-pin DIN plug

DT400-1K Ball and ring

For demonstrating thermal expansion of solids;
brass ball on chain with handle and ring on support with handle;
diameter of ball: 25 mm

DT410-2B Bolt-breaking apparatus

For demonstrating the forces resulting from temperature changes in solid bodies; platform with cast iron clamping fork; steel rod with large clamping nut and holding ring, plus hole for clamping the bolts; container for combustion agent;
(bolts and combustion agent not supplied);
dimensions: approx. 280 x 80 mm

DT410-1E Replacement bolts, set of 10

Bolts of cast iron,
dimensions:
approx. 5 x 70 mm

DT430-1B Bimetallic strip with handle

Riveted brass and iron strip, with handle;
length: approx. 270 mm, width: 30 mm

DE320-1D Bimetallic strip, demo

Industrial crafted bimetallic strip;
length: 180 mm, width: 20 mm

DT402-1S Set for linear expansion of solids, table set-up

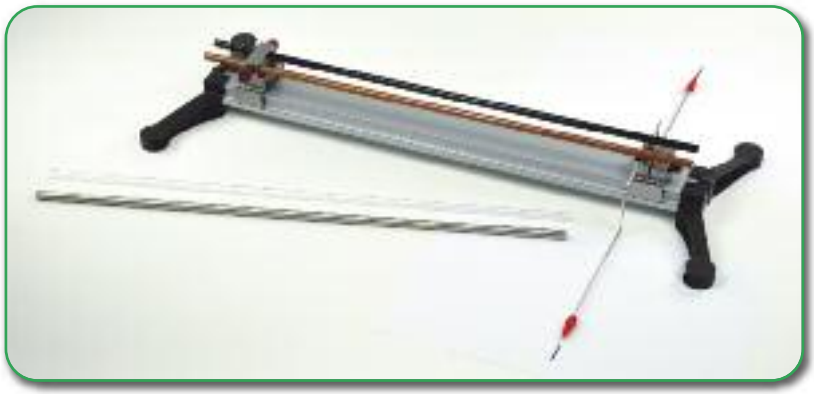
consisting of:

1. 1x **DS102-50** Stand rail base, L = 500 mm
2. 2x **DS112-1E** Rail claw, simple
3. 1x **P2400-2F** Slider with setting for heat expansion
4. 1x **P5310-3F** Slider for pointers for heat expansion
5. 1x **P2400-1A** Tube for heat expansion, aluminium
6. 1x **P2400-1B** Tube for heat expansion, iron
7. 1x **P2401-1C** Tube for heat expansion, copper
8. 1x **P2401-1G** Tube for heat expansion, glass
9. 2x **DT401-3Z** Pointer for heat expansion, demo

The same equipment set is available with magnet base.
The components are the same, only the rail claws are magnetic.

DT402-1M Set for linear expansion of solids, magnetic set-up

Simultaneous display of elongation of two tubes made of different materials



Experiment: Linear expansion of solid materials

Additionally recommended for DT402-1S:

C7412-HZ Heating flask 250 ml, double

For producing steam when connected to a heating plate or a burner, consisting of:

1 x C3020-6D	Erlenmeyer flask 250 ml, with SB 29
1 x C7320-4C	Stopper silicon, 26/32/30 mm, 2 holes (SB 29)
2 x P7422-2B	Glass tube 13, straight, D = 8 / 5 mm, L = 80 mm

C7445-7S Silicon hose, 7 / 10 mm

L = 100 cm

DT620-1P Franklin's palm glass

For demonstrating how vapour pressure increases with temperature.
Two glass bulbs connected by a curved tube; partially filled with coloured liquid; body heat from the hand is sufficient for increasing vapour pressure, resulting in liquid rapidly being conveyed from the lower bulb to the upper one; height = approx. 160 mm

DT390-1T Thermometer model apparatus, set

Model for investigating the expansion of the liquid in thermometers, consisting of:

DT390-1K Capillary tube

Glass tube, inside D = 0.8 mm, outside D = 6 mm, L = 400 mm

C3040-4A Flask, flat bottom, 50 ml, SB 19

C7320-2B Stopper silicon, 17 / 22 / 25 mm, 1 hole, SB 19

DT621-1H Hope's apparatus

Apparatus for observing the maximum density of water at 4°C;
flat-bottom metal cylinder on base; ring-shaped container at centre with drain and stopper for holding a freezing mixture; two hose fittings with silicon stoppers including holes for holding thermometers or thermo-sensors;
height: 250 mm

DT611-1Z Liquid convection apparatus

For demonstrating thermal convection in liquids;
glass tube bent at right angles with funnel;
tube D = 20 mm,
dimensions: 370 x 270 mm

Recommended accessory:

P7050-1A Powder dye, red

P7050-1A Powder dye, red

Food dye in plastic container; dark red;
contents: approx. 5 g

DT610-2N Needle bearing on support

Used as pivot for mounting the propeller when demonstrating thermal flow;
support D = 10 mm;
dimensions: 150 x 100 mm

DT610-3R Propeller for demonstrating thermal flow

For demonstrating the heat flow of gases and the conversion of energy; metal blade impeller; metal hub on one side for low-friction positioning on the needle bearing DT610-2N, or plastic hub on rear for firm attachment on the shaft of motor/generator P3610-1M; D = 120 mm

C3084-4A Reaction tube straight, 2 x SB19

Heat-resistant glass tube for demonstrating the chimney effect,
L = 200 mm

DL101-2K Candles, set of 5

Diameter:
approx. 20 mm
Length:
approx. 150 mm

DT620-1H Hot air balloon, model

Balloon made of lightweight paper, opening with metal ring,
H = approx. 80 cm,
D = approx. 60 cm

Recommended accessory:

DT620-2S Chimney with plate

DT620-2S Chimney with plate

Used as heat protection and device for guiding hot air into hot air balloon DT620-1H or as a "chimney" for the DT610-3R propeller;
metal plate with tube, set up on tripod or support rings;
dimensions: D = approx. 140 mm, H = approx. 150 mm

Experiment:
Model of a hot air balloon

P2714-1S Rods for thermal conduction, set of 4

For quantitative investigation of thermal conduction in solid bodies; 4 rods with front hole for supporting thermometers, with silicon stopper; for inserting in lid P2700-2ED;
material:
Al, Fe, Cu, glass;
dimensions:
150 x 8 mm each

P2700-2ED Lid with 4 holes

To carry the rods for thermal conduction; transparent lid suitable for attaching to the insulating flask P2700-3D, to a beaker 1000 ml squat form, or to a support ring

Additonally recommended:

C1000-1H Beaker glass 1000 ml, squat form

Experiment: Thermal conduction of solids

DT612-1W Thermal conduction apparatus on support

For demonstrating the varying degrees of thermal conduction in metals, used with melted wax or burning matches; metal support with four metal rods arranged in the shape of a star;
materials:
Al, Cu, Fe, brass

DT610-2W Wax slab, set of 4

4 Slabs of beeswax for use with thermal conduction apparatus DT610-1W or DT612-1W,
dimensions:
each 170 x 130 x 0.3 mm

DT609-1T Tyndall's apparatus, complete set

For making qualitative comparisons of the specific heat of metals; 4 metal cylinders with strings – Pb, Cu, Al, Fe; acrylic glass disc with 4 drill holes to insert sample bodies vertically;
mass: 25 g each

Additionally recommended:

DT610-2W Wax slabs, set of 4

Experiment:
specific heat of metals

DT612-1P Thermal conduction plates, demo

Simple, clear demonstration of heat conduction on solid surfaces. An ice cube is placed on each of 4 plates of different materials; the faster the ice cube melts, the better the heat conduction of the plate.
Materials: wood, iron, ceramic, polystyrene
Dimensions:
150 x 150 mm each

Test tubes coloured

For demonstrating the dependency of heat radiation on surface colour; test tube, L = 200 mm, SB 19, colour-coated

DT620-1R Test tube, 200 mm, black

DT620-2R Test tube, 200 mm, white

C6031-1M Manometer tube accessory, with stopper SB19

Simple manometer tube made of glass,
H = 150 mm;
with silicon stopper 17 / 22 / 25 mm;
glass tube: D = 8 / 5 mm

DT620-3R Crooke's radiometer

For converting radiation energy
into kinetic energy;
vanes, black on one side,
in an evacuated glass bulb;
bulb D = 90 mm, H = 200 mm

DT710-1P Parabolic mirror

For demonstrating how rays are concentrated; metal concave mirror including slotted clamping post with a knurled head screw, in which support rods and tubes with a maximum diameter of 10 mm can be inserted and fastened in place.
Focal length: 140 mm, Diameter: 460 mm

DT710-2H Holder for parabolic mirror, on support

Support:
L = 200 mm
D = 10 mm

DE312-1L Light bulb socket, E27, on support

E27 ceramic socket;
power cord with mains plug,
L = approx. 80 cm;
on support:
L = 160 mm, D = 10 mm

DT615-1W Heat emitter

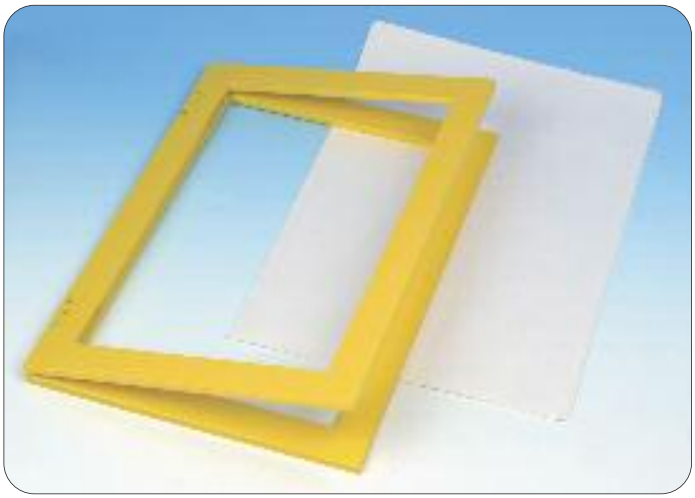
Infrared heat emitter with E 27 socket base;
ceramic housing (D = 90 mm);
power rating: 250 W;
area performance: 25 kW/m²,
surface temperature during
operation: approx. 500°C;
warm-up time: approx. 4 min.;
cooling time: approx. 2 min.;
input voltage: 230 V / 50 - 60 Hz

DT620-1F Thermal radiation screen

Wooden frame with two hinges,
for tautly securing thermal paper DT620-1G;
dimensions: 300 x 210 mm

DT620-1G Thermal paper, set

Heat-sensitive thermal paper, 10 sheets, DIN A4



Experiment: Demonstrating thermal radiation

P2720-1L Thermo - octagon

For investigating the thermal radiation from a body as a function of temperature and the kind of radiation surface. The coloured surfaces get swept outisde for heat radiation, and swept inside for absorption.
Hollow body with 8 surfaces, partially laminated in different colours;
heat source mounted on the cover: light bulb 12 V / 20 W;
surfaces: white, black, blue, yellow, red,
white - matt finished, nature polished, nature - matt finished;
dimensions: approx. 150 x 150 x 105 mm

Experiment: Thermo - octagon + Thermopile + Universal multimeter

MB241-2T Thermopile "compact"

Thermopile with amplifier to convert the optical power to a voltage value. Serves as a radiationpyrometer with a measuring device 0 - 10 V or 10 mA; ON / OFF switch;
zero point adjustment;
outputs are protected against short circuit;
LED indicator for operating state;
output voltage: max ±14 V; battery-driven (battery included) or external power supply 6 - 12 V DC, z.B.: P3120-6N;
dimensions: 84 x 84 x 39 mm

Heat absorbers "inno", magnetic

For demonstrating the degree of absorption of thermal radiation as a function of surface colour;
four strong neodymium magnets are set into the plastic base plate for securing it to metal panels;
includes thermometer holder with a fixing screw;
painted copper plates are fastened in place using fixing screws;
dimensions: 160 x 120 mm

DT661-1W Heat absorber, white "inno"

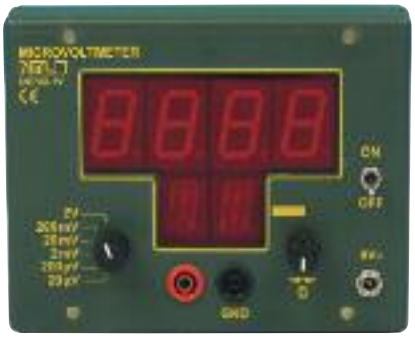
DT661-1B Heat absorber, polished metal "inno"

DT661-1S Heat absorber, black "inno"

DT662-1I Foam insulation insert

For inserting into the black heat absorber DT661-1S

DE722-1V Microvoltmeter "inno"



Demonstration instrument for measuring extremely small voltage levels;
the 26 mm LED display showing the measured value and the 20 mm LED display for the measurement unit allow readings to be taken easily even at a distance.

Technical Data:
Display: 3 ½-digit LED display; digit height 26 mm
Six measuring ranges: 0.02, 0.2, 2, 20, 200, 2000 mV
Turning knob: 10-turn potentiometer for setting to zero
Accuracy: above 2% (when precisely set to zero)
Input resistance: 100 Ohms
Input: 4 mm safety jacks
Throw switch: ON / OFF
Power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V / 500 mA, P3120-6N
Case: green ABS plastic
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 485 g

Recommended accessories:

P3120-6N Mains transformer 6 V / 500 mA
P3120-5B S-shaped assembly platform

DT601-1A Insulation flask 400 ml

Sturdy, double-walled metal insulating vessel with plastic handle and screw-on lid;
D = approx. 90 mm;
H = approx. 150 mm;
filling volume: 400 ml

P2700-3D Insulation flask with lid

Consists of 2 aluminium beakers, with an insulating container in between; transparent cover with stopper for inserting a thermometer; opening (D = 27 mm) with cover and single stirrer;
D = approx. 102 mm;
H = approx. 110 mm;
Filling volume:
approx: 150 and 700 ml

DT619-1D Thermal insulation set

Set consisting of:

1 Beaker aluminium, 150 ml
1 Beaker glass, 150 ml, squat form
2 Lid acrylic, with hole and stopper
1 Insulating beaker for 150 ml cup, EPS, wall thickness 14 mm

P2700-2D Joule's calorimeter universal

For determining the heat capacity of solids and liquids;
consists of 2 aluminium cups, 1 insulating container in between;
transparent lid with immersion heater cascade, 2/4/6 ohm, with safety jacks;
stopper for carrying a thermometer and a simple stirrer;
power supply: 6 V; D = approx. 102 mm, H = approx. 110 mm;
filling volume:
150 and 700 ml

DT598-1K Calorimetric cylinders, set

Three metal cylinders of equal mass, used for determining specific heat capacity;
hole for suspending from cord;
material: Pb, Cu, Fe;
weight: 200 g each

DT604-GW Mechanical equivalent of heat apparatus

Compact apparatus to demonstrate the mechanical heat equivalent; powerful drive motor with transmission, drive shaft with adapter for accepting the hexagonal axle of an solid aluminium roller; two rolls of aluminium with a raised edge to mount and fasten a leather ribbon, which provides a constant friction when operating the device;
each roll with a bearing and driving axis;
roll 1: D = 58 mm, L = 66,6 mm;
roll 2: D = 58 mm, L = 33,3 mm;
Sliding saddle with ball bearing mounting for solid rollers;
fixed stem with leather strap on this, W = 25 mm; stand rail base profile with 2 screw clamps for firm attachment to table edges;
scale pan with handle for adding mass

Note:
For measuring the temperature of solid rollers, we recommend using a thermometer with a surface sensor, e.g. Thermometer differential "innno", and thermo-sensor DIN, with handle

P1515-BM Boyle-Marriotte apparatus, SE

For determining the relationship between pressure and volume of gases at a constant temperature; manometer with suitable clear scale; attachable robust plastic gas syringe with scale; well-sealed plunger with holding ring; volume of syringe: 120 ml; manometer range: -1000 to +3000 hPa

P2710-GL Gay/Lussac apparatus, complete

For determining the relationship between pressure and temperature in a gas at a constant volume as well as determining the point of absolute zero.

Hollow metal ball with attached high-quality manometer; the metal adapter piece enables it to be mounted on the lid with 4 holes (P2700-2ED).

Metal ball: D = 60 mm
Manometer range:
840 - 1240 hPa

P2710-GK Gay/Lussac sphere

For determining the relationship between pressure and volume in a gas at a constant volume, as well as for determining the point of absolute zero using a measurement recording system. Hollow metal ball with hose connection.
Metal ball: D = 60 mm
Hose connection: D = 5 mm

Gases in pressure cans

When small amounts of pure gases or gas mixtures are required; easy to use thanks to a fine pressure regulation valve (supplied separately); a self-locking valve in the pressure can prevents gas from escaping unintentionally; filling volume: 10 l

C9010-1A Gas pressure can, oxygen

C9010-2A Gas pressure can, nitrogen

C9010-3A Gas pressure can, carbon dioxide

C9010-4A Gas pressure can, hydrogen

C9010-5A Gas pressure can, helium

C9010-9A Fine pressure regulation valve

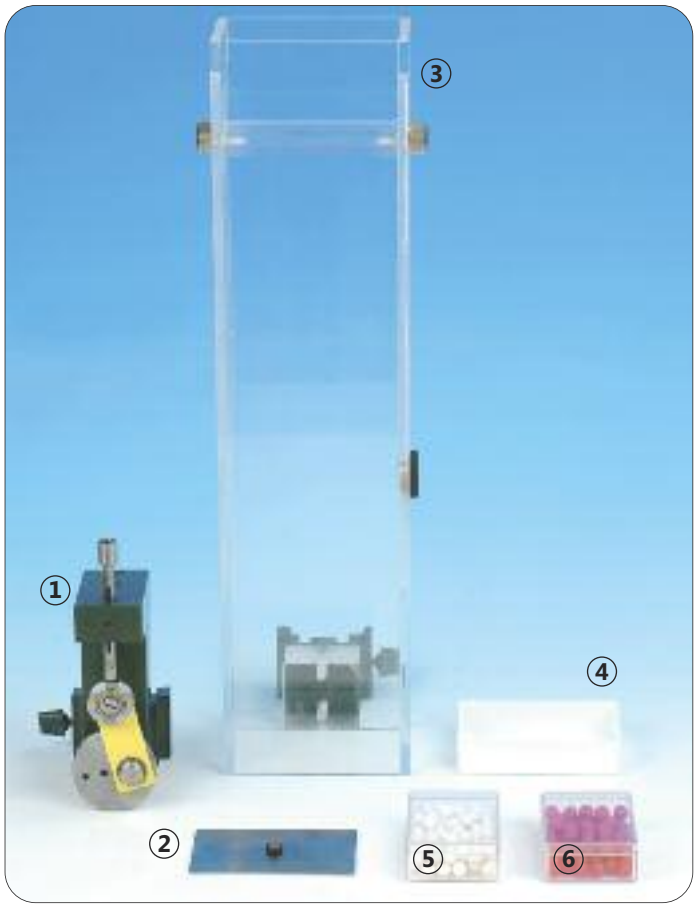
May be screwed onto a gas pressure can to regulate the amount of gas used

Experiment: Determining the absolute zero point

DM851-1T Particle motion, apparatus set

For experiments with models on the topic of "states and behaviour of matter".

Apparatus set consisting of:



① **DS403-2X** Cam adapter

Used for generating linear, periodic motion, as when producing standing waves in a cord or the motion required by the particle motion model. Especially suitable where powerful drive at a high amplitude and low frequency is required. May be driven by geared motor by means of a drive belt. The piston is self-lubricating at work and is equipped with an M6 tapping. Length of piston stroke may be varied. The drive pulley, running on double ball bearings, is firmly mounted on a sliding saddle made of a special aluminium profile and includes a clamping screw for mounting and fastening onto the NTL stand rail profiles.

② **DS102-4P** Impact plate

Metal plate with M6 tapping at centre, may be screwed onto the cam adapter when used as a plate for absorbing the impact of the balls used in the particle motion model;
dimensions: 84 x 52 x 1.5 mm

③ **DM851-1Z** Particle motion tube, rectangular

For experiments with models on the topic of "states and behaviour of matter"; acrylic tube mounted on sliding saddle; bolted opening on the side for inserting and removing contents; two grooves on the side for adjusting the ceiling and locking it into place in any position;
dimensions (inside): 90 x 60 x 400 mm

④ **DM851-1Y** Piston plate

For experiments with the particle motion model DM851-1T; low-weight plastic lid, fits into particle motion tube DM851-1Z; dimensions: 88 x 56 x 20 mm

⑤ **DM851-KW** Set of balls, white

Plastic balls for the apparatus set demonstrating particle motion; 100 white balls, 8 mm in diameter, in a box

⑥ **DM851-KR** Set of balls, red

Plastic balls for the apparatus set demonstrating particle motion; 100 red balls, 8 mm in diameter, in a box

Experiment: Illustrating molecular motion

Required accessories:

DS403-1G Geared motor

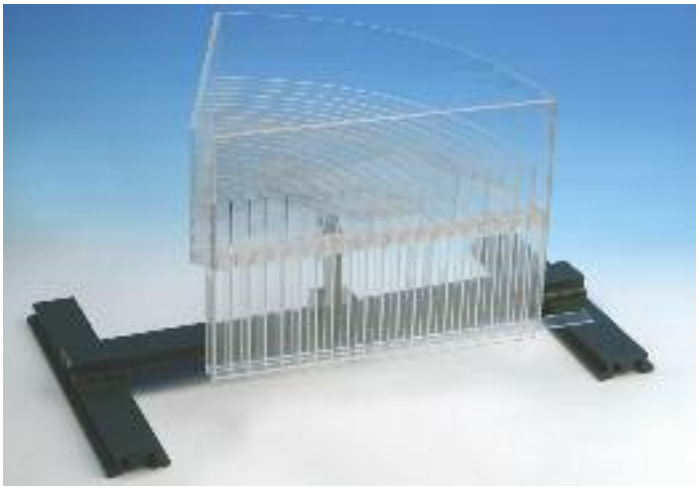
Electric motor with metal gears and high torque in aluminium case; drive shaft with permanently mounted aluminium pulley with groove and M6 tapping for attaching crank pin when used as a generator.
Drive pulley diameter: 100 mm; green powder-coated printed with circle sectors in yellow;
case mounted on sliding saddle of special aluminium profile with clamping screw for mounting and fastening onto large support base rail support or stand rails

Nominal voltage: 6 V DC (3 - 12V);
Current consumption idling: 570 mA DC;
Speed: approx. 0 - 250 rpm
Case dimensions: 128 x 60 x 60 mm

DS401-1A Drive belts, set of 2

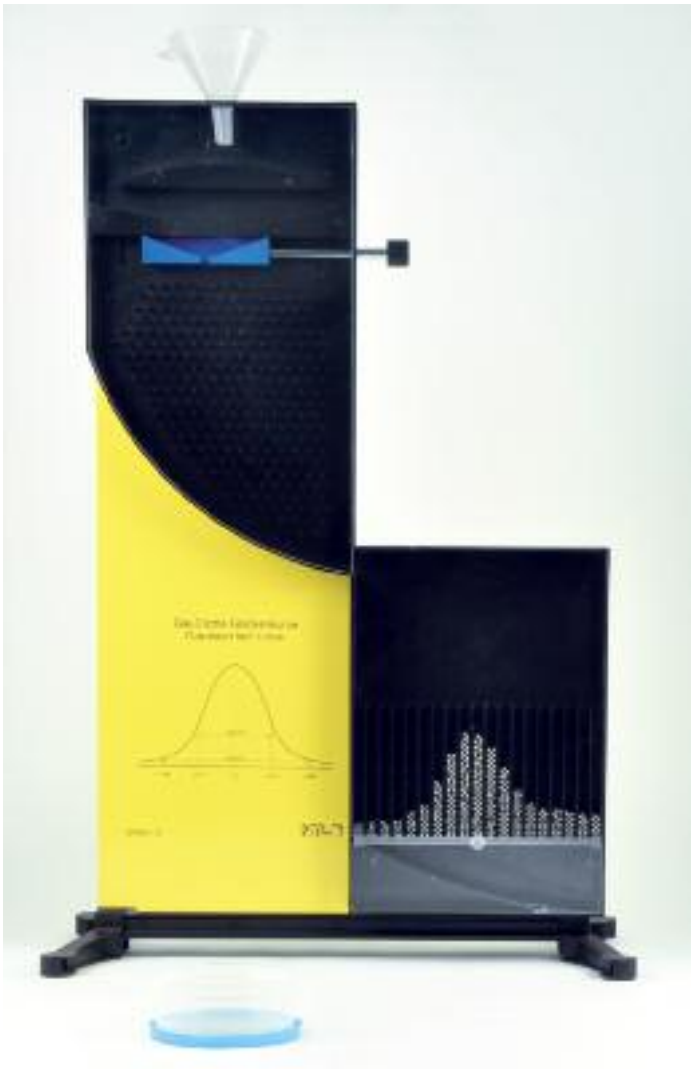
DM851-2K Recording chamber on support

For experiments on Maxwellian velocity distribution;
used to collect and record the plastic balls ejected from the side of the tube accessory in the particle motion apparatus during operation; container with radial sectors on support (D = 10 mm, L = 35 mm);
includes slider on the side for easily emptying the chamber;
No. of individual chambers: 20;
radius: 300 mm; angle: 70°; total height: 220 mm



Experiment: Maxwellian velocity distribution of a model gas

DM845-1G Apparatus for Gauss distribution



For simple, fast experimental proof of normal or Gaussian distribution.

Enables description of e.g.:
– Brownian molecular motion
– Probability of presence of certain particles or
– Random measurement errors or deviations from the nominal dimensions

Small metal balls are poured into a chamber with bars and distributed throughout it. In the second chamber, these are gathered up by a comb, enabling the bell curve to be displayed. A slider in the filling area of the upper chamber enables the distribution to be easily manipulated. As soon as the lock on the lower end of the comb is pulled out, the balls can be placed back in the filling can quickly and easily.

Two plastic chambers on the metal base plate, mounted on an aluminium profile with rail claw.
Dimensions: 44 x 22 x 64 cm

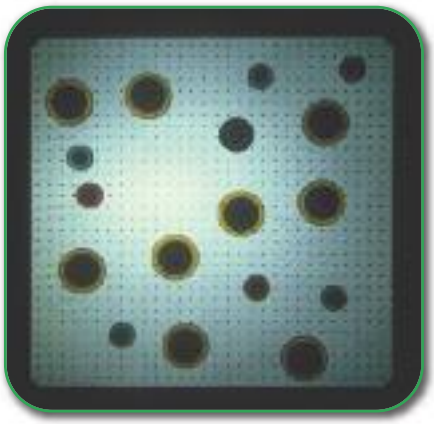
DM855-1L Air table, complete set

The air table allows experiments with various models to be performed and projected overhead, including molecular motion during the various states of matter, electron motion in electricity, atomic physics and mechanical motion. Basic apparatus consists of a transparent plate in a plastic frame with a grid of air holes and screws for adjusting the horizontal plane or creating any incline desired.

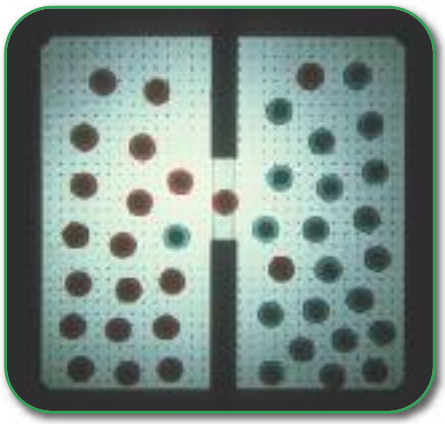
Accessories included:
- 1 Air table
- 1 Pressure hose with sleeve
- 1 Holder for the grid model
- 1 Grid model
- 1 Acrylic plate
- 7 Magnetic barriers
- 2 Electrodes
- 1 Rod
- 30 Floating discs, magnetic, red
- 25 Floating discs, magnetic, green
- 5 Floating discs, magnetic, aluminium
- 25 Floating discs, magnetic, orange
- 2 Floating discs, magnetic, blue
- 1 Magnetic plunger
- 1 Guide for the magnetic plunger
- 2 Knurled head screws for the grid model holder
- 1 Plastic tweezers
- 1 Experiment manual
- 1 Storage container

Required accessory:

DM270-1G Air supply 02, with hose



Experiment:
"Behaviour of various atoms" - on the overhead projector



Experiment:
"Diffusion" - on the over-head projector

DT740-1A Pressure cooker

For demonstrating the relationship between boiling point and pressure; pressure cooker with safety valve, thermometer gauge (0 - 200°C) and manometer gauge (-100 - 500 kPa)

Gauge diameter: 100 mm;
pot dimensions: D = approx. 220 mm; volume = approx. 4.5 l

DM590-1D Metal can with stopper and tube

For demonstrating the effect of atmospheric pressure; can D = 100 mm, H = 160 mm, with hole (D = 31 mm); silicon stopper 30 / 38 / 37 mm; acrylic tube 80 x 8 / 5 mm

DM590-2D Metal cans, set

3 replacement cans for DM590-1D; D = 100 mm, H = 160 mm, without stoppers and tube

P7020-4A Sodium thiosulfate, 200 g

For creating a freezing mixture; wide-neck bottle with plastic screw-on cap, volume: 200 g

DM400-1H Hero's engine

For demonstrating how steam causes propulsion; steam escapes from a glass vessel on a pivot through four curved jets;
glass vessel is mounted on a 100 ml flat-bottom flask by means of a silicon stopper;
D = 125 mm;
height incl. flask: approx. 220 mm

DL600-1G Glass plate, 300 x 200 mm

Bevelled glass plate;
dimensions: 300 x 200 x 4 mm

DM340-3B Cartridge adapter

For demonstrating propulsion due to escaping gas (CO_2) and for measuring the temperature of suddenly escaping gas (CO_2) using flexible thermo-sensor;
acrylic block with recess for inserting carbon dioxide cartridge; screw cap with piercing pin and nozzle opening; may be attached to the dynamics trolley, demo (DM300-2A) by means of two 4 mm plug pins;
dimensions: 142 x 35 x 35 mm

DM340-3C CO_2 cartridges, set of 10

Dimensions: D = 18 mm, L = 62 mm

DT740-1S Suffy duck

For demonstrating how heat is given off during evaporation.
Place the duck, which is suspended so as to be able to bob up and down, in front of a cup full of water and wet its head: the duck bends forward as if to drink. It continues to bob up and down as long as its bill touches the water.

DM555-1A Osmometer

For measuring osmotic pressure; capillary tube with measuring scale mounted on an acrylic panel; two glass bulbs mounted on the capillary tube; one of the bulbs fitted with semi-permeable membrane and rubber ring; total height: 480 mm

(Beaker glass not included in delivery)

DT900-1A Alternative Energy - Conversion, Pro

Kit consisting of:

P3600-2A	1x	MBC Double solar cell
P3601-2A	1x	Clinometer for double solar cell
P1314-1M	1x	Electric car, model
P3610-1T	1x	Turbine in casing, SE
P3610-1M	1x	MBC Motor / Generator
P3610-1P	1x	Propeller, SE
P3610-2P	1x	Propeller, large
P3821-1G	1x	Hand generator Profi, with cable
P3620-1S	1x	MBC Energy storage
P3710-2A	1x	MBC Lamp socket E10
P3320-1A	3x	Light bulb, 2.5 V / 70 mA (1.5 V / 50 mA), E10
DE309-4T	2x	Light bulb, 6 V / 1 A
P3310-1S	1x	Set of 6 cables, SE: 1 x 75 cm red, 1 x 75 cm blue, 1 x 50 cm red, 1 x 50 cm blue, 2 x 25 cm black
P2725-1B	1x	Thermo generator with shackle
P2725-2T	1x	Peltier element with 2 plugs
C4350-1B	2x	Student thermometer, digital, 200°C, short
P2825-1B	1x	Fuel cell - unit, reversible, NTL
P3118-1B	1x	Battery box 3 V, with 2 mm plugs
DG500-9A	2x	Double socket, 2 mm to 4 mm

Storage:

P7907-4W	1	Box insert Alternative energy - conversion, Profi
P7806-1G	1	Storage box II big, with cover, Box insert plan with 2 labels

With the module SEK Alternative energy conversion experiments to the following topics can be performed:

1.	Making energy sensible	(9 Experiments)
2.	Wind Power	(3 Experiments)
3.	Thermal Power	(3 Experiments)
4.	Hydro Power	(2 Experiments)
5.	Energy and temperature	(2 Experiments)
6.	Sun - Photovoltaics	(6 Experiments)
7.	Fuel cell	(3 Experiments)
8.	Energy storage	(3 Experiments)

More than 30 experiments !

DT720-2D Fire piston, demo

For demonstrating the principle of a diesel engine; a small amount of cotton is ignited due to high compression; solid acrylic cylinder on an anti-slip joint base; piston rod with sturdy pressure plate; cotton and spare gaskets; joint base diameter: 80 mm; height of stroke: approx. 90 mm

Experiment:
Igniting cotton batten via air compression

P2891-1F Stick lighter

Lighter with a long ignition stick, for safely igniting the mixture in the ignition cylinder

P2891-2Z Atomiser bottle glass, 20 ml

For measuring out the amount of fuel when sprayed into the ignition cylinder; this bottle allows unskilled persons to perform the experiment as well.
Supplied with 20 ml of benzoline in a separate glass bottle.

P2891-2B Benzoline, 200 ml

Easily ignitable mixture for spraying into P2890-1Z ignition cylinder with the help of the P2891-2Z atomiser bottle glass

DT202-1T Thermocouple element, simple

To convert heat into electrical energy; constantan and copper wires twisted and welded at one end; length: approx. 270 mm

P2890-1Z Ignition cylinder

For demonstrating the principle of a petrol engine; Ignition of a petrol-air mixture using a lighter; acrylic cylinder with ignition hole and soft lid (as a projectile); cylinder: H = 280 mm, D = 40 mm

The new articulated foot prevents the base of the acrylic cylinder from escaping!

P2725-2T Peltier element with 2 plugs

For converting heat into electrical energy and vice versa; element with 2 long cables and 4 mm plugs; Peltier element: max. 15 V / 3.5 A; dimensions: 40 x 40 mm

P2725-1T Thermal generator with clamp

For converting heat into electrical energy and vice versa; acrylic glass housing with centrally positioned Peltier element between two cubical aluminium vessels; fixed adapter with two safety jacks and thermometer holder; clamp for pressing the aluminium cubes onto the Peltier element.

Peltier element: max. 15 V / 3.5 A
Aluminium vessels: approx. 50 ml each
Dimensions: approx. 85 x 52 x 80 mm

2 x **C4350-1B** Thermometer for students, digital, 200° C, short

P1314-1M Electric car, model

Vehicle with motor; selection switch for battery or external power supply.
Dimensions: approx. 140 x 70 x 45 mm

P3821-1G Hand generator Profi, with cable

Simple DC power supply, conversion from mechanical to electrical energy;
high quality DC motor design with transmission in transparent housing;
sturdy drive crank;
cable with two 4 mm plugs;
voltage output: 0 - 4 V DC

P3820-1G Hand generator SE

A perfect and easy to operate working model for student experiments.
Simple DC power supply, conversion from mechanical to electrical energy;
DC Motor with gear and drive crank in transparent housing;
cable with two 4 mm plugs;
voltage output: 0 - 6 V DC

DE723-1W Wattmeter "inno"

Demonstration instrument for measuring power in low-voltage circuits; very easy to transport and magnetically mountable; the 26 mm LED display showing the measured value and the 20 mm LED display for the measurement unit allow precise readings to be taken even at a distance.

Technical data:
Display: 3 ½-digit LED display, digit height 26 mm
Input: 4 mm safety jacks (pair)
Types of measurement: true power (W), work/energy (Ws)
Measurement limits: 20 Veff, 2 Aeff
Accuracy: <1.5%
Power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm hollow DC jack for 6 V / 500 mA external power supply P3120-6N
Case: green ABS plastic with yellow labelling
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 450 g

P3620-1S MBC Energy storage, SE

Simple, fast and safe storage of energy; 10 F capacitor in housing with transparent bottom plate; with analogue display for charge status; all sockets are protected against short circuits and voltage reversal; **can be charged with hand generator P3820-1G or P3821-1G in approx. one minute!**
Housing is magnetic;
dimensions: 84 x 84 x 39 mm

P3610-1M MBC Motor / Generator, SE

Easy-to-turn motor (solar motor) with long shaft for attaching a Pelton turbine or propeller; 4 holes on top for locking the Pelton turbine;
two 4 mm safety jacks on side;
ready to go at just 200 mV / 20 - 30 mA!;
magnetic housing with transparent base plate;
dimensions: 84 x 84 x 39 mm

P3610-1T Turbine in casing, SE

Pelton turbine in transparent housing; can be attached to MBC motor / generator;
4 pins for locking to the MBC motor / generator;
small opening for water tap or air pump;
larger outlet on opposite side

P3610-1P Propeller, SE

Suitable to be blown on by mouth or with a narrow-focus fan;
plastic propeller, D = approx. 47 mm;
can be clipped onto the MBC motor/generator shaft

P3610-2P Propeller large, SE

Also suitable for wide air flows;
plastic propeller, D = approx. 90 mm; can be clipped onto the MBC motor/generator shaft

DT610-3R Propeller for demonstrating thermal flow, metal

For demonstrating the heat flow of gases and the conversion of energy;
metal blade impeller; metal hub on one side for low-friction positioning on the needle bearing DT610-2N, or plastic hub on rear for firm attachment on the shaft of motor/generator P3610-1M; D = 120 mm

P2885-1P Parabolic mirror 300 mm, plastic

High temperatures can be generated at the focal point of the mirror by concentrating heat radiation;
plastic parabolic mirror; small metal container fixed at the focal point for heating up different materials; large base plate, holder with support rod and movable joint for optimum setting of the angle of incidence

Experiment:
The sun as water boiler or popcorn-cooker

DT705-1S Stirling engine, transparent

With glass cylinder for demonstrating how a thermal engine works; one-cylinder engine on a base and a flywheel;
cylinder is heated using the flame
of a spirit burner (also included);
in less than a minute of igniting the small burner, the motor starts up with a small movement of the flywheel;
base plate dimensions: 180 x 90 mm;
height: approx. 80 mm

Cross-section models on bases

For illustrating the movement of the piston, valve control and fuel injection;
every model includes a flywheel, base with sectional drawing and names of parts; with built-in lamp for making ignition visible;
base dimensions: approx. 205 x 210 mm; height: approx. 350 mm

DF210-2T Two-stroke engine, cross-section model

DF210-4T Four-stroke engine, cross-section model

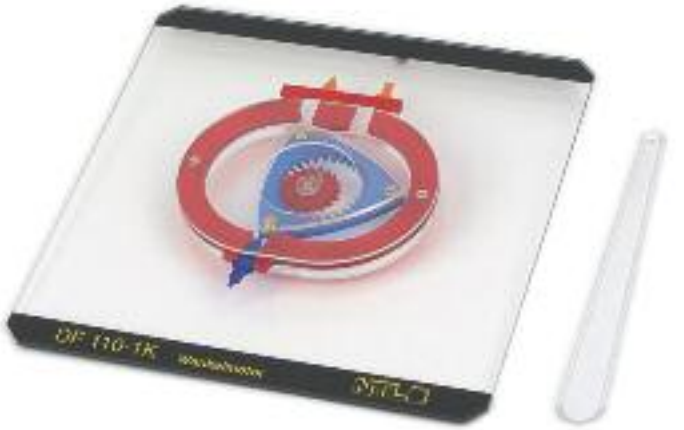
DF210-4D Four-stroke diesel engine, cross-section model

Overhead functioning model (OFM)

For demonstrating the movements involved in heat engines and explaining, how they work using an overhead projector; acrylic model with coloured parts, including drive shaft; base panel: 248 x 248 mm

DF110-2T Two-stroke engine, OFM

DF110-1K Wankel engine, OFM

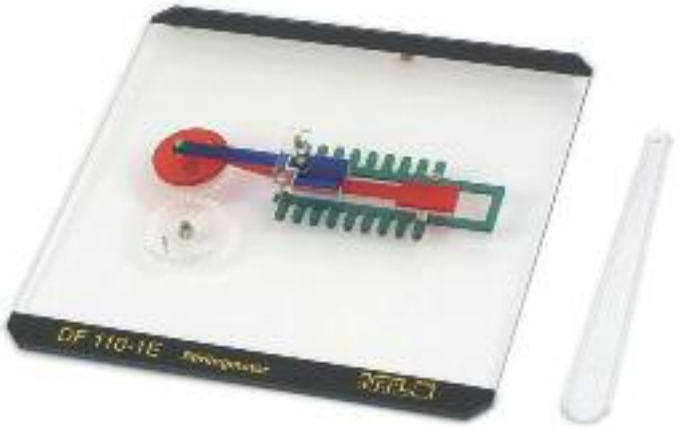


DF110-4T Four-stroke engine, OFM

DF110-1D Steam engine, OFM

DF110-4D Four-stroke diesel engine, OFM

DF110-1E Stirling engine, OFM



DT400-1P Heat pump, demo

A heat pump is a thermal engine.
When it is used as a heat pump, its function is to heat up a hot reservoir, e.g a living room. The cold reservoir can consist of cold water (ground water, river water etc.), soil or ambient air. However, if it is used as a fridge, its function is to cool down the cold reservoir, e.g. the freezer compartment. The hot reservoir is the air that surrounds the cooling device.

On/Off switch with background light, compressor,
2 manometers (D = 100 mm), overpressure protection switch, expansion valve, 2 water vessels (5 litres each); all parts are clearly visible and fixed on the wooden rack;
2 handles on the side, 4 rubber-coated legs

Technical data:
Compressor output: 120 W
Vaporising temperature: -10°C
Safety refrigerant: R134a, free of CFCs
Operating voltage: 230 V / 50 Hz
Dimensions (approx.): 82 x 37 x 74 cm

DE706-1E Energy - measuring device

Measuring device with large LCD for determining the energy consumption of devices that are plugged into the outlet.
By entering the current price of power, the resulting power or operating costs can be displayed.
The following parameters can be measured and displayed:
– Amperage (A)
– Voltage (V)
– Output (W)
– Minimum and maximum output (W)
– Energy consumption (kWh)
– Operating time
– Weekday
– Frequency (Hz)
– Power factor
– Energy cost in euros (where energy price has been entered)

Technical data:
Operating voltage:
230 V AC / 50 Hz
Max. load: 16 A / 3680 W
Current: 0 - 16 A
Accuracy: ± 2%
Internal consumption:
< 0.5 W
LCD (W) H = 13 mm
Display dimensions: 47 x 60 mm
Housing dimensions: approx. 72 x 157 mm

P9902-4S SEK Hot water

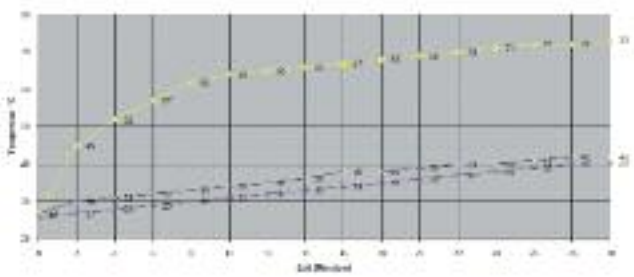
Complete working model of a solar unit; the water circulation is very clearly shown and is therefore easy to understand; temperatures measured in the collector, the heat exchanger and the flow system

Set consisting of:

P2750-1S	1	Solar collector SE
P2750-1W	1	Heat exchanger SE
P2750-1T	1	Circulating membrane pump
P2751-1T	1	Pyrometry chamber
P2220-1A	3	Laboratory thermometer -10 to +110 / 1°C
C7445-3ST	4	Tubing, silicon, D = 3 / 6 mm, L = 24 cm
C6100-2A	1	Syringe 120 ml, plastic

Storage:

P7906-5W	1	Box insert Hot water
P7806-1K	1	Storage box II small, with cover Box insert plan with 2 label



Temperature–time diagram

- in collector chamber
- in water cycle (primary)
- in heat exchanger (secondary)

P2750-1S Solar collector SE

Flat collector for converting radiation energy into heat energy; approx. 220 cm long copper tube coil on copper plate in the collector chamber, black coated; with removable transparent cover; port with silicon stopper for measuring the temperature inside; tube dia. = 6 mm, dimensions: 172 x 127 x 50 mm

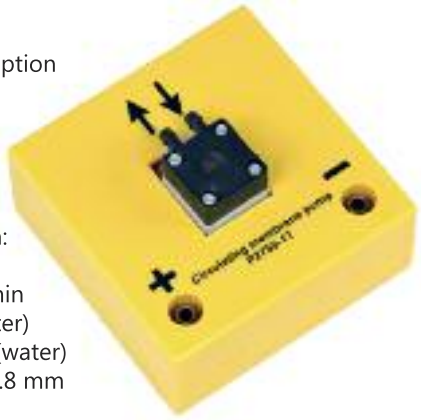
P2750-1W Heat exchanger SE

For transferring energy from a primary to a secondary water circulation system; copper tube coil in clear plastic container, length approx. 120 cm; removable cover with silicon stopper for measuring the water temperature; tube dia. = 6 mm, filling volume: approx. 400 ml; dimensions: 80 x 80 x 100 mm

P2750-1T Membrane circulation pump

– Self-absorbent
– Very low noise level
– Minimal power consumption
– Low weight
– Small housing
– Low vibration level

Operating voltage: 2 - 12 V DC
Max. power consumption: 20 - 150 mA
Free flow rate: 150 ml / min
Max. pressure: 6.0 m (water)
Max. suction lift: - 3.0 m (water)
2 hose connectors, D = 4.8 mm
Installed in magnetic housing: 84 x 84 x 39 mm



P2751-1T Pyrometry chamber

For measuring the temperature in a water cycle; acrylic cylinder with two metallic tube connectors; silicon stopper for holding a thermometer; rubber-coated metal base with embedded neodymium magnets

DT750-1S Solar collector, demo

Flat collector for converting radiation energy into heat energy; black absorber with parallel copper tubes, for conducting water through the unit, in an insulated frame with a glass covering; two hose connectors; an opening for inserting a thermometer or thermo-sensor in order to measure the internal temperature; two posts, permanently mounted on the frame, with knurled head screws for mounting on support rods (D = 10 mm); supplied with a suitable silicon hose and hose clamps; dimensions: 300 x 400 x 65 mm

DT750-1W Heat exchanger, demo

For transmitting the energy generated by the solar collector from a primary into a secondary water circulation system; spiral-shaped copper tube in an acrylic cylinder; including two hose connectors; lid with gasket and a silicon stopper with a hole; filling volume: approx. 650 ml; dimensions: D = 80 mm, H = 210 mm

DT750-1U Circulating pump, demo

Diaphragm pump with two hose fittings, mounted on a support clamp; motor can turn in either direction; power cord with two 4 mm plugs; max. capacity: 10 l / min; power requirements: 12 V / 1.5 A; D = 38 mm, L = 140 mm

P3600-2A MBC Double solar cell

2 solar cells in magnetic housing with a transparent base;
4 adjacent safety jacks enable simple, clear series or parallel wiring of both cells;

Open-circuit voltage/cell: approx. 3 V
Short-circuit voltage/cell: approx. 20 mA
Dimensions: 84 x 84 x 39 mm

P3601-2A Clinometer for double solar cell SE

For determining the capacity of a solar cell in relation to the angle of incidence; acrylic frame with double-sided angular scale, rotatable metal plate for mounting the MBC solar cell; dimensions: 100 x 96 x 72 mm

DM311-2S Solar module 3.6 V "inno"

Three sensitive tandem solar cells on a glass plate,
dimensions: 122 x 115 x 3 mm;
mounted in a magnetic case;
two 4 mm safety jacks;
open circuit voltage: 4.9 V;
short circuit current: 260 mA;
power: 624 mW;
dimensions: 160 x 120 x 45 mm

DM311-3S Solar module 8.4 V "inno"

Six sensitive tandem solar cells on a glass plate,
dimensions: 122 x 115 x 3 mm;
mounted in a magnetic case;
two 4 mm safety jacks;
open circuit voltage: 11.4 V;
short circuit current: 109 mA;
power: 713 mW;
dimensions: 160 x 120 x 45 mm

DM311-4S Solar module 1.5 V „inno"

Two solar cells in magnetic "inno"-housing with transparent bottom plate; thanks to 4 adjacent safety sockets, a fast and simple serial or parallel connection is possible;
open circuit voltage / cell: approx. 1.5 V;
short-circuit currenct / cell: approx. 350 mA;
dimensions: 160 x 120 x 45 mm

P3120-5U Metal bracket on support

For holding and pivoting two "inno" components, e.g. solar modules DM311-ff;
dimensions: approx. 245 x 160 mm

DT104-5S Halogen spot 500 W

Light- and heat-intensive, splash-proof floodlight; pivots on brackets; with support rod, power cable and plug; with lamps.

Light rod socket: R7S
Output: 500 W
Input voltage: 230 V / 50 - 60 Hz
Output aperture: 160 x 120 mm
Dimensions: approx. 180 x 120 x 150 mm

DT100-1H Halogen spot 1000 W

Safety lamp for video recording; with fan for cooling and thermostat providing protection against overheating;
handle on base support (D = 10 mm) may be pivoted 180°;
with ON-OFF switch and fuse;
1000 W, 3400 K halogen lamp.
Voltage source: 230 V / 50 - 60 Hz
Dimensions: 100 x 140 x 190 mm, Weight: 1300 g

Not shown:

DT100-1H1 Halogen replacement lamp, 1000 W

P2820-1S Hydrogen education kit

Complete set for demonstrating the principles of energy storage and energy conversion using a fuel cell; consisting of:

- Fuel cell, reversible
- Gas storage unit
- Solar panel
- Motor with propeller
- Battery compartment with switch
- Required consumables for operation
- Instruction sheet

Energy for hydrogen production is supplied by the solar panel or the battery compartment. The motor then can be driven by the fuel cell using the produced hydrogen. Please refer to item no. P2823-1R Fuel cell reversible for technical details.
This set can be combined with the module "Alternative energy - conversion".

P2840-1W Wind generator

Large working model of a wind turbine; conversion of wind energy into electrical energy;

- Generator with hub for the mounting of rotor blades of different shapes
- Sets of 3 rotor blades in 4 different shapes each, can be varied individually as well as the angle
- Stable base with metal insert
- LED voltage indicator included, along with music module as energy consumer (not shown)

Hub height: approx. 285 mm
Total height incl. rotor blades: approx. 440 mm

The wind turbine can be combined with the items in the module "Alternative energy - conversion" or with those from the Hydrogen education kit.

P2821-1R Hydrogen racer and station, set

The car engine of the future, demonstration of the complete process:
- Generation of hydrogen using solar power
- Hydrogen storage (filling station)
- Refuelling the car with hydrogen
- Operating the car using hydrogen from a fuel cell
- Operation of the car by remote control

Set consisting of:
- Solar cell
- Hydrogen filling station
- Hydrogen car
- Remote control
- Required consumables for initial operation
- Instruction sheet

Dimensions (car):
approx. 155 x 70 x 40 mm

Individual components for individualists

P2823-1E PEM* Electrolyser, SE

Unit for the production of oxygen and hydrogen from distilled water by adding energy; energy can be supplied by a solar cell, wind turbine, hand generator or a power supply; the gases produced can be collected in the gas storage unit.

Technical data:
Power supply: 1.7 - 3 V DC, 0 - 1 A
H_2 production: max. 7 ml / min.
Dimensions: approx. 54 x 54 x 17 mm

P2823-1B PEM* fuel cell, SE

Unit for the production of electrical energy by supplying hydrogen (and oxygen from the ambient air);
hydrogen is supplied by the gas storage unit or a gas pressure bottle; energy output via two 2 mm jacks.

Technical data: 0 - 0.6 V DC, 0 - 0.4 A (max. 240 mW)
Dimensions: approx. 32 x 32 x 10 mm

P2823-1R PEM* fuel cell reversible, SE

This unit combines the functions of the electrolyser and the fuel cell SE; electrical energy is supplied to produce gases from distilled water, or hydrogen is supplied to allow the output of electrical energy.
Technical data:
Electrolyzer functions:
Power supply: 1.7 - 3 V DC, 0 - 0.7 A
H_2 production: max. 5 ml / min.
Fuel cell functions:
Power output: 0 - 0.6 V DC, 0 - 0.3 A (max. 180 mW)
Dimensions: approx. 54 x 54 x 17 mm

P2823-1S Gas storage unit SE

For decomposing distilled water and for collecting the resulting gases (hydrogen and oxygen); may be operated together with the electrolyser or to supply fuel cell SE; two graduated acrylic cylinders with gas collecting unit; volume: approx. 30 ml each; on base plate; silicon tube with mini stoppers and syringe included;
dimensions with base plate: approx. 152 x 108 x 83 mm

*PEM = proton exchange membrane

P2825-1B Fuel cell - unit for electric car model

For demonstrating the principle of a full-hybrid car using an experimental model; reversible fuel cell with hydrogen and oxygen tank on block, incl. required cables and hoses;
can be attached to electric car model P3414-1M (not supplied);
output: approx. 150 - 200 mV;
dimensions: approx. 84 x 95 x 110 mm

P3118-1B Battery box 3 V, with 2 mm plugs

For producing oxygen and hydrogen safely and quickly;
battery power box with snap-on connection and ON / OFF switch;
cable with 2 mm plugs;
incl. two batteries 1.5 V (type LR 6 AA alkaline)

DG500-9A Socket connector 2 mm – 4 mm

To couple 2 mm to 4 mm plugs

DT775-1E Electrolyser unit "inno"

Powerful PEM electrolyser for generating oxygen and hydrogen from distilled water; gases can be fed directly to fuel cell unit "inno" DT775-1B by means of small silicon hoses;
mounted on magnetic "inno" component base; two safety jacks for energy input;
membrane surface: 25 cm²; working voltage: 1.4 - 1.8 V;
current: 0 - 4000 mA; H_2 production: approx. 28 ml / min;
gas storage volume: 65 ml each;
dimensions: 160 x 135 x 285 mm

DT775-1B Fuel cell unit "inno"

Double PEM fuel cell for generating electrical energy from oxygen and hydrogen; gases supplied by gas pressure cans C9010-ff or electrolyser unit "inno" DT775-1E; cells may be operated parallel or in series; unit mounted on a magnetic "inno" component base; two safety jacks for energy output.
membrane surface: 2 x 10 cm²;
parallel voltage: 0.4 - 0.9 V; series voltage: 0.8 - 1.8 V;
parallel current: max. 4000 mA;
dimensions: 120 x 125 x 160 mm

Note:
All of the thermometers in our range that contain liquid are **mercury-free!**

① ② ③ ④

① **DT200-2Z** Indoor and outdoor thermometer "800"

Very large thermometer with clearly visible scale;
metallic socket plate for wall-mounting, protected expansion vessel;
measurement range: -43 to +50°C; gradation: 1°C;
dimensions: 103 x 806 mm

② **DT200-1Z** Indoor thermometer „400"

With big scale for wall-mounting; plastic socket.
Measuring range: -30 to +50 °C
Graduations: 1°C
Dimensions: approx. 400 x 67 mm

③ **DT201-1F** Thermometer R/C/F

Simple indoor thermometer with three scales for °C, °F and °R; on wood rack to mount on wall.
Dimensions: approx. 250 x 57 mm

④ **DT202-1M** Maximum-minimum thermometer

Thermometer with reset knob; in a plastic frame and bracket.
Measuring range: -38 to +50°C
Graduations: 1°C
Dimensions: approx. 230 x 80 mm

DT800-2A Weather station "NTL"

Measuring device on metal socket, can be wall-mounted both horizontally and vertically;
Temperature: -16 to +56°C
Air pressure: 980 - 1040 mbar (hPa)
Humidity: 0 - 100%
Dimensions: approx. 320 x 120 mm

DT201-1B Window thermometer, bimetallic

For demonstrating the principle of a bi-metallic thermometer; can be placed on windows, so the outside temperature can be read easily from inside; the bi-metallic coil is clearly visible thanks to the transparent back panel.

Measurement range: -40 to +50°C
Diameter of the bi-metallic coil: 20 mm
Disk diameter: 150 mm

DT830-1W Cloud apparatus

Glass flask with rubber bulb, intake tube, hose and spring clamp; by the expansion of the rubber ball and the resulting reduction in the internal pressure, the air from the flask cools down.
The humidity condenses on previously drawn smoke particles, on the inner wall of the glass bulb a "cloud" is formed.

Flask-D = 80 mm,
Length: approx. 290 mm

DT820-1C Rain gauge 120

With a new, functional design:
– Large diameter for precise measurements
- Clearly visible even with light precipitation
– Less evaporation due to removable lid
– Holder can be placed directly in the ground or attached to a pole
– Easy to remove from the holder for draining
– Made of high quality, transparent, weather-proofed plastic

Scale: 0 - 70 mm / m² (l / m²)
Dimensions (funnel): D = 112 mm, H = 190 mm

DT803-1B Barometer, demo unit

For a simple and fast explanation of air pressure and the movement of the pointer on a barometer. The barometer is placed in an air-tight, transparent plastic container. The air pressure changes by compressing and expanding the container, and the pointer indicates these changes.

Barometer
980 - 1040 hPa
and plastic
container with lid
and suction pad

simple – fast – safe

DT803-1H Hygrometer, demo unit

For a simple and fast explanation of humidity and and pointer deflection in a hygrometer. The hygrometer is placed in an air-tight, transparent plastic box, with a small container of hot water. Once the box is closed the humidity increases, as is indicated by the pointer deflection.

Hygrometer
(0 - 100%) plus
large and small
plastic boxes

simple – fast – safe

DE722-2B Barometer "inno"

Digital device for magnetic mounting, used to measure gas pressure; the 26 mm LED display allows readings to be taken even from a distance; set screw for setting to actual air-pressure

Accuracy: 1 hPa
Max. pressure: 2000 hPa
Measurement error:
max. 1.5%
Sensor inputs are not
suitable for use with
aggressive media

Power supply: 4 x 1.5 V
mignon cells (included),
or external power supply
6 V / 500 mA
Case: plastic, ABS
Dimensions: approx. 160
x 120 x 45 mm
Weight: approx. 400 g

DT816-2A Anemometer "inno"

Digital anemometer for magnetic mounting, with external measuring vane; the 26 mm LED display allows readings to be taken even from a distance;
measuring range: 0 - 20 m/s; display in 0.1 m/s intervals
accuracy: approx. 2%
Power supply: 4 x 1.5 V mignon cells (included)
or external power supply 6 V / 500 mA, P3120-6N
Case: plastic, ABS
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 500 g (with sensor)

DT841-1A Altimeter and Barometer

For determining current altitude as well as for measuring altitude differences and weather forecasting (barometer);
heavy-duty instrument with dials
featuring easy-to-read, adjustable
altitude scale and fixed barometer scale,
no batteries needed!

Complete with case and cord.
Altimeter: 0 - 5000 m
Precision: 20 m
Barometer: 580 - 1040 mbar (hPa)
Precision: 5 hPa
Dimensions: 85 x 68 x 28 mm

DT816-1A Anemometer SE, digital

For measuring the current wind speed, with maximum and average values; temperature display and perceived temperature (wind chill); wind strength can be set as m/s, km/h, mph, knots;
Beaufort display with bar graph;
measurement range: 0.2 - 30 m/s;
resolution: 0.1 m/s;
accuracy: ± 5%;
temperature can be set as °C or °F;
measurement range:
-29.9 to +59.0°C; resolution: 0.1°C;
display with backlighting;
splash-proof casing;
battery-powered
(battery included);
dimensions: 50 x 137 mm

The "inno" system allows you to integrate a power supply and measuring instruments into your magnet board demonstration! This makes experiments very clear and easy to understand!

P3130-3M Low-voltage transformer
with digital display, "inno"

Continuously variable, stabilised DC voltage, level displayed on 20 mm digital display, and selectable AC voltage, with electronic overload protection;
10 strong neodymium magnets inset in the rear panel for mounting the device **magnetically**

Output terminals:
0 - 12 V DC, stabilised, continuously variable, max. 3 A;
3, 6, 9 or 12 V AC, variably selectable, max. 3 A

galvanic separation from mains source
output voltage taken from 4 mm safety jacks
ON / OFF switch
LED indicator for overloads and short circuits
T 630 mA fine wire fuse (primary)
voltage source: 230 V AC / 50 - 60 Hz
green ABS plastic case with yellow labelling
dimensions: approx. 160 x 120 x 45 mm

P3120-3N Low-voltage power supply "inno"

Continuously variable, stabilised DC voltage and selectable AC voltage, with electronic overload protection;
10 strong neodymium magnets inset in the rear panel for mounting the device **magnetically**
Output terminals: 0 - 12 V DC, stabilised, continuously variable, max. 3 A;
3, 6, 9 or 12 V AC, variably selectable, max. 3 A;
galvanic separation from mains source; output voltage taken from 4 mm safety jacks; ON / OFF switch with indicator lamp;
T 400 mA fine wire fuse (primary);
voltage source: 230 V AC / 50 - 60 Hz;
green ABS plastic case with yellow labelling;
dimensions: approx. 160 x 120 x 45 mm

P3120-1K DC Converter "inno"

May be combined with 6 V / 10 Ah "inno" rechargeable battery P3120-1B or "inno" fixed-voltage transformer P3120-1N

Technical data:
Output: 0 - 12 V DC, stabilised, continuously variable, max. 3 A

supplied by 4 mm safety jacks permanently protected against short circuiting
voltage indicator: **LED display; digit height: 26 mm**
potentiometer for adjusting output voltage
LED display indicating power supply status
case: ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 540 g

P3120-1W AC converter "inno"

May be combined with 6 V / 10 Ah "inno" rechargeable battery P3120-1B or "inno" fixed-voltage trans-former P3120-1N

Technical data:
Output: 0 - 12 V AC, continuously variable, max. 0.5 A

supplied by 4 mm safety jacks permanently protected against short circuiting
voltage indicator: **LED display; digit height: 26 mm**
potentiometer for adjusting output voltage
LED display indicating power supply status
case: ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 540 g

P3120-1N Fixed-voltage transformer, "inno"

This device has been specially designed for use with converters P3120-1K, -1W, -1G, -3D. With its **magnetic** case, it is particularly suited for all experiments done on a metal panel with the NTL inno system. The output voltage is taken from 4 mm safety jacks that are protected against short circuiting and overloading. The transformer shuts down in the event of an overload.

Technical data:
Output voltage: 6 V DC, stabilised, max. 7 A, and 7 V AC, max. 9 A

fuses: T 630 mA fine wire fuse (primary), electronic fuse (secondary)
voltage source: 230 V AC / 50 - 60 Hz
case: ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 1260 g

P3120-1B Rechargeable battery, "inno", 6 V / 10 Ah

This device has been specially designed for use with converters P3120-1K, -1W, -1G, -3D and for experiments with high current.
With its **magnetic** case, it is particularly suited for all experiments done with the NTL inno system on a metal panel.
A thermal security switch interrupts the output in high current experiments (short-circuit current >30 A) and thus protects the battery!

Technical data:
Output voltage: 6 V DC; short-circuit current: >30 A

LED indicator: displays operating mode
case: green ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 2.4 kg

P3120-4A L-shaped assembly platform

For supporting up to two magnetic "inno" components, e.g. "inno" rechargeable battery in combination with "inno" DC converter, for mounting the equipment in an elevated position;
metal platform,
green powder-coated,
dimensions: 240 x 160 mm

P3121-1L Battery charger, "inno"

Suited especially for 6V / 10Ah "inno" rechargeable battery, with protection against reversed polarity, char-ging status indicator.

Voltage source:
230 V AC / 50 - 60 Hz
case: plastic, green ABS, dimensions: approx. 160 x 120 x 45 mm

P3911-2H Battery holder with outlets, magnetic

For tapping the voltage of a mignon cell using 4 mm laboratory plugs; metal holder with strong neodymium magnet in the centre; two neodymium magnets on the bottom for mounting on metal panels; dimensions: 25 x 25 mm

DE312-1B Battery holder

For holding a 1.5 V C-size battery; plastic case mounted on an acrylic base, with two 4 mm plugs 40 mm apart (supplied without battery)

P3130-2P Fixed voltage transformer 12 V DC / 6 A

Output voltage: 12 V DC, max. 6 A;
supplied by 5.5 mm hollow DC plug;
plastic case
with power cord;
voltage source:
100 - 240 V AC /
50 - 60 Hz;
dimensions:
120 x 60 x 40 mm

P3130-1P Mains transformer 12 V DC / 2 A

Output voltage:
12 V DC / 24 VA supplied by 5.5 mm hollow DC plug;

voltage source:
100 - 240 V AC / 50 - 60 Hz
dimensions:
approx. 90 x 60 x 37 mm

DP130-2A Adapter lead DC hollow socket to 4 mm jack

Adapter leads red-black with 5.5 mm hollow DC socket and two 4 mm plugs,
L = approx. 500 mm

P3130-3D Low-voltage power supply with digital display

Continuously variable, stabilised DC voltage, level displayed on 20 mm digital display, and selectable AC voltage, with electronic overload protection.
Output terminals:
0 - 12 V DC, stabilised, continuously variable, max. 3 A;
and 3, 6, 9 or 12 V AC, variably selectable, max. 3 A;
galvanic separation from mains source; output voltage taken from 4 mm safety jacks;
ON / OFF switch; LED indicator for overloads and short circuits;
voltage source: 230 V AC / 50 - 60 Hz;
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 1200 g

P3130-7A Fixed-voltage power supply 12 V AC / 20 W

Mains transformer for powering halogen light sources SE as well as function generator SE;

Output voltage: 12 V AC / 20 W
Connecting leads
with two 4 mm safety plugs
voltage source: 230 V AC / 50 - 60 Hz
dimensions: approx. 83 x 58 x 58 mm

P3120-6N Mains transformer 6 V DC / 500 mA

Especially for use as an external power supply for magnetically mounted "inno" measuring instruments, connected by means of 5.5 mm hollow DC
plug;
voltage source:
230 V AC/50 - 60 Hz;
dimensions: approx.
60 x 50 x 42 mm

P3130-1A Power supply with digital display

Power supply for high load DC and AC voltages; overload protection by means of automatic thermal cut-outs (over-current protection switch)

Outputs:
0 - 25 V AC, continuously variable, max. 10 A
0 - 20 V DC, continuously variable, max. 10 A
6 V AC fixed, max. 6 A
12 V AC fixed max. 6 A

Galvanic separation from mains source; output voltage taken from 4 mm safety jacks; digital display showing outpult voltage setting: 7-segment LED display, three digits 26 mm in size
ABS plastic case with 2 recessed handles
voltage source: 230 V AC / 50 - 60 Hz
dimensions: 260 x 150 x 210 mm
weight: approx. 9.3 kg

P3130-4D High-power transformer, 1 - 12 V AC / DC, "SE"

Power supply for experiments briefly requiring a large amount of current, e.g. displaying field lines of conductors under current, but also suitable for most electricity experiments

Output voltage: 1 - 12 V AC or DC in 1 V increments
AC load capacity: 6 A, >20 A briefly (for approx. 5 sec.)
DC: 6 A;
when set at 1 - 6 V, 20 - 25 A briefly (for approx. 5 sec.)

LEDs display the various operating modes; protected against short circuits; automatic load reduction or shutdown under continued overload; galvanic separation from mains source

Output voltage supplied by 4 mm safety jacks;
ABS plastic case; voltage source: 230 V AC / 50 - 60 Hz;
dimensions: 210 x 96 x 200 mm; weight: approx. 3.2 kg

P3130-2B Universal transformer II with digital display

Universal power supply for DC and AC voltages;
overload protection by means of automatic thermal cut-outs (over-current protection switch)

Output terminals:
0 - 25 V AC, continuously variable, max. 6 A
0 - 20 V DC, continuously variable, max. 6 A
0 - 15 V DC, continuously variable, stabilised, max. 1 A, with current limiter
6 V AC fixed, max. 6 A
12 V AC fixed, max. 6 A

Galvanic separation from mains source; output voltage taken from 4 mm safety jacks; digital displays showing output voltage setting, 7-segment LED display, three digits 26 mm in size
ABS plastic case with 2 recessed handles
voltage source: 230 V AC / 50 - 60 Hz
dimensions: 260 x 150 x 210 mm
weight: approx. 8.3 kg

P3125-2H Constant current regulator, "inno", magnetic

Source of constant current, may be com-bined with 6 V / 10 Ah "inno" rechargeable battery P3120-1B or "inno" fixed-voltage transformer P3120-1N

Output: 0 - 11 A, variable in 1 A increments;
output current supplied by 4 mm safety jacks;
four LEDs display the various operating modes; stable under reactive loads; power supply: 6 V DC;
case: green ABS plastic with yellow labelling;
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 570 g

Recommended power supply:
P3120-1B 6 V / 10 Ah rechargeable battery "inno" or
P3120-1N Fixed voltage transformer "inno"

P3171-1A High-voltage power supply 10 kV with digital display, "demo"

Continuously variable high-voltage power supply for powering electron diffraction tubes.
Output: 0 to +10 kV, continuously variable, max. 3 mA, short-circuit protection; 6.3 V AC fixed, max. 5A
galvanic separation from mains source; output voltage taken from 4 mm safety jacks;
voltage indicator: 7 segment LED display, digit height 26 mm;
ABS plastic case with 2 recessed handles;
voltage source: 230 V AC / 50 - 60 Hz;
dimensions: 260 x 150 x 210 mm;
weight: approx. 3.3 kg

DG505-1H Connecting lead for high voltages

Extremely flexible silicon connecting lead with a double insulating jacket and two specially insulated 4 mm plugs;
cross-section: 1 mm²
jacket thickness: approx. 8 mm
length: 100 cm

DE523-1A Wimshurst machine

Electrical influence machine for generating very high DC voltages .
Spark length: max. 70 mm; voltage: max. 160 kV;
disc diameter: 300 mm;
dimensions: 350 x 200 x 390 mm

P3127-1V High-voltage power supply, 18 kV, "inno", magnetic

Continuously variable high-voltage power supply for experiments in electrostatics.
Output: 0 to + 18 kV, continuously variable, max. 0.5 mA
Voltage indicator:
7-segment LED display, digit height 20 mm;
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm hollow DC jack for 6 V / 500 mA external power supply P3120-6N.
green ABS plastic case labelled in yellow,
10 strong neodymium magnets are inset in the rear panel for mounting the device magnetically
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 970 g

Recommended accessory:

P3120-6N Mains transformer 6 V DC / 500 mA
P3120-5B S-shaped assembly platform

DE525-3B Van de Graaff generator II

Used for generating very high DC voltages in electrostatics experiments:

- Spark length up to 150 mm (even at high humidity)
- Conducting sphere with insulated handle included
- Motor- or hand-driven

Diameter of removable conducting sphere: 280 mm;
supplied with conductor sphere on support (D = approx. 100 mm, support L= approx. 300 mm), paper bush, pointed wheel and fixed-voltage transformer;
input voltage: 230 V AC / 50 - 60 Hz;
dimensions: 380 x 230 x 700 mm; mass: approx. 4.5 kg

P3160-3A Function generator with digital display "demo"

Frequency display on 6-digit, 7-segment LED display, 26 mm tall, with 1-Hz graduations;
Output signals: sine, triangle, square, sawtooth;
amplitude and frequency able to be modulated;
frequency range: 0.1 Hz - 100 kHz;
adjustable over six scales with overlapping fine tuning;
output voltage: 0 - 10 V_{eff}, max. load 2 A_{eff};
permanent short-circuit and backlash potential protection;
4 mm safety output jacks;
plastic case: yellow ABS with two recessed handles;
voltage source: 230 V AC / 50 - 60 Hz;
dimensions: approx. 260 x 150 x 210 mm;
weight: approx. 3.9 kg

P3120-1G Function generator with digital display "inno"

Serves as a source of alternating current with variable frequency and voltage up to 4 Veff; (sine, triangle or square), when combined with 6 V / 10 Ah "inno" rechargeable battery P3120-1B or "inno" fixed-voltage transformer P3120-1N

It is particularly important to note this unit's usability with the "inno" 6 V / 10 Ah rechargeable battery, since there is often no mains outlet nearby when doing experiments on the magnetic panel!

Technical data:
Waveforms: sine, triangle and square
Frequency: 0.1 Hz - 100 kHz
Frequency display: 5-digit LED display
Digit height: 26 mm
Output voltage: 0 - 4 Veff
Voltage supply: 6 V DC, e.g. P3120-1N fixed voltage transformer "inno" or P3120-1B rechargeable battery "inno" 6 V / 10 Ah
Case: green ABS plastic
Dimensions: approx. 160 x 120 x 45 mm; weight: approx. 530 g

P3120-3F Function generator SE

Powerful function generator for experiments in electronics but also mechanics for driving motors or sound sources;
Output signals:
sine, triangle and square
Frequency range:
0.1 Hz - 100 kHz
adjusted by variable controls (coarse, fine)
Output voltage: 0 - 4 Veff, max. 4 watts,
from 4 mm safety jacks; with short-circuit and backlash potential protection; input voltage: 12 V AC, (provided e.g. by mains transformer P3130-7A or student mains transformer P3130-3D or P3120-1N Fixed-voltage transformer, "inno";
green ABS plastic case;
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 400 g

P3130-3A Three-phase low-voltage transformer, "demo"

Low-voltage source of three-phase current providing two different levels of phase-to-phase and phase-to-ground voltage (star, delta); overload protection by means of thermal cut-outs (over-current protection switch);
Output terminals:
6 V / 10 V, three phases, max. 4 A and
23 V / 40 V, three phases, max. 4 A;
galvanic separation from mains source; output voltage taken from 4 mm safety jacks; ABS plastic case with 2 recessed handles;
voltage source: 230 / 400 V three-phase current 50 - 60 Hz;
dimensions: 260 x 150 x 210 mm; weight: 7.1 kg

P3120-3D Three-phase converter "inno"

When combined with 6 V / 10 Ah "inno" rechargeable battery P3120-1B or "inno" fixed-voltage transformer P3120-1N, serves as a three-phase power supply – **requires no three-phase mains connection!**
Technical data:
Output: four 4 mm safety jacks,
permanently protected against short circuiting,
3 x 23 V_{eff}, 500 mA, 70 Hz (in a delta connection),
3 x 13 V_{eff}, 500 mA, 70 Hz (in a star connection);
3 pcs. 3 mm LEDs indicate power supply status;
power supply: 6 - 15 V DC, stabilised, min. 5 A;
case: green ABS plastic with yellow labelling;
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 570 g

Recommended power supply:
P3120-1N Fixed voltage transformer "inno" or
P3120-1B 6 V / 10 Ah Rechargeable battery "inno"

P3210-1P Multi-Multimeter, analogue, automatic fuse

Moving-coil instrument
with automatic overload protection in all measuring ranges!
Meter for measuring voltage and current, can be used as galvanometer as well!
AC / DC voltage ranges: 1 mV, 100 mV - 30 V
AC / DC current ranges: 100 µA - 3 A and 10 A
Arc scale length: approx. 90 mm

- Electronic overload protection with indicator light (no more melting fuses)
- All measuring ranges (even for low current!) available in AC
- Exceptional frequency response (typically -1.5 db at 20 kHz) allowing direct measurement of resonant circuits
- Large, easy-to-read mirrored scale with clear labelling
- Extremely accurate, typically 1.5%
- Minimum power consumption – need not be shut down
- Durable selection switch
- 10 A range with separate input jack
- Zero at midpoint may be selected by switch
- 1 mV upper value range for measuring thermal voltage or induction without a preamplifier!

Dimensions: approx. 160 x 120 x 50 mm
Weight: approx. 480 g

P3245-1T Hand multimeter digital 07

An ideal multimeter for student experiments.
Auto-range; data hold function; automatic shutdown; temperature, frequency and capacitance measurement; handy; large LCD display; support bracket; sheath

	Measuring ranges	**Max. resolution**
DC V:	400 mV - 600 V	0.1 mV
AC V:	4 - 600 V	1 mV
DC A:	400 µA - 10 A	0.1 µA
AC A:	400 µA - 10 A	0.1 µA
Accuracy:	min. ± 1.5 %	
Resistance:	400 Ohm - 20 MOhm	0.1 Ohm
Frequency:	10 Hz - 5 MHz	0.01 Hz
Capacitance:	4 nF - 100 µF	10 pF
Temperature:	-20 to +750 °C	1°C
Conductance testing		
Diode testing		

Included:
2 test leads, temperature sensor, sheath, technical instruction manual
powered by 2 x 1.5 V batteries (included)
overload protection: fine wire fuse 250 mA / 250V
dimensions: 138 x 72 x 38 mm
weight: approx. 190 g

DE700-1M Demonstration measuring instrument, digital/analogue

I display digital and analogue values at the same time

An electronic multimeter for measuring current, voltage and resistance, that combines the advantages of analogue and digital displays in one device; selection of measuring ranges, current type and display by means of side-mounted switches; pointer is set electronically to zero at midpoint, also by means of a switch; the currently selected scale is indicated by the red diode within the particular scale lighting up;
measured values shown on a 7-segment LED display, 26 mm tall, and on a digital monitoring display on the rear panel

Voltage ranges: 9 ranges for AC and DC
100/300 mV / 1/3/10/30/100/300/1000 V
Amperage ranges: 11 ranges for AC and DC
100/300 µA / 1/3/10/30/100/300 mA / 1/3/10 A
Resistance ranges: 11 ranges
100/300 Ohm / 1/3/10/30/100/300 kOhm / 1/3/10 MOhm

internal resistance: >100 kOhm
accuracy: class 1.5
scale type: double scale (3 and 10 units) with mirror background and LED indicators
arc length of scale: 200 mm
connection: three 4 mm safety jacks
overload protection: fine wire fuses in sockets
ABS plastic case
voltage source: 230 V / 50 - 60 Hz
dimensions: 260 x 230 x 210 mm
weight: approx. 2.7 kg

DE712-00 Universal multimeter "inno", magnetic

Durable servo-controlled measuring instrument for use in any position, i.e. vertically or horizontally for projection;
pointer setting: zero at left or at midpoint;
four insertable double scales:
1/3 - 10/30 - 100/300 - -5 to +5/-15 to +15 (included);
arc scale length approx. 200 mm; digit height: 26 mm;
LED display indicates measuring units and type of current - visible from a distance.
Height: 20 mm;
measurement ranges:
DC voltage: 1 mV, 1 to 30 V,
AC voltage: 1 to 30 V
DC and AC amperage: 100 µA to 10 A
Protected against electronic overload by control LEDs (fuse will not melt!)
Neodymium magnets on the back for mounting magnetically and a battery compartment for easy changing of batteries;
power supply: four 1.5 V batteries (included) or
5.5 mm hollow DC jack for 6 V external power supply;
dimensions: approx. 265 x 75 x 230 mm;
weight (with scales): approx. 2070 g

① Thanks to the transparent rear the measured value can also be projected in large format using the transparent scales

② Electronically protected -
no more annoying changing of fuses

③ Zero point can be set on the left and at the midpoint

④ Can be used magnetically on the panel or standing on a table

DE712-1P Scales for Multimeter "inno", transparent, set of 8

Transparent inserting-scales; acrylic;
for universal multimeter „inno“ DE712-00;
Ranges: 0-1, 0-3, 0-10, 0-30, 0-100, 0-300, -5 to +5, -15 to +15

Recommended accessory:

P3120-6N Mains transformer 6 V DC / 500 mA

as external power supply

DE710-7A nA-Amplifier

Current-Voltage converter in plastic case, for connection to measuring instruments with ± 1 or ± 3 Volts final value;
measurement of very low current 1 nA - 10 µA / V;

ON / OFF switch; two safety sockets for connection to a measuring instrument; LED for indication of the mode;

power supply: 9 V battery (included)
or external power supply 12 V / 2 A, P3130-1P;
dimensions: 84 x 84 x 39 mm

DE710-7N Resistor 30 MOhm

For enlargement of the measuring range of the multimeter "inno" DE712-00
up to 300 Volt AC or DC

Sensors

P4210-2S Sensor Voltage differential, ± 10 V

With differential inputs, measurements can be done directly across circuit elements without the constraints of common grounding; to measure negative as well as positive potentials; input voltage range of ± 10 V for AC and DC; over-voltage protection up to ± 50V; housing with two 4-mm plugs and cable with BT-connection

P4210-3S Sensor Voltage differential, ± 500 mV

With differential inputs, measurements can be done directly across circuit elements without the constraints of common grounding; to measure negative as well as positive potentials; input voltage range of ± 500 mV for AC and DC;
over-voltage protection up to ± 50V;
housing with two 4-mm plugs and cable with BT-connection

P4210-4S Sensor Current, ± 5 A

For measuring currents in AC and DC circuits from - 5 and + 5 A; contains a sensing element and a signal conditioning amplifier; protected for currents up to 7 A;
housing with two 4-mm plugs and cable with BT-connection

P4210-5S Sensor Current, ± 500 mA

For measuring small currents in AC and DC circuits from - 500 and + 500 mA; contains a sensing element and a signal conditioning amplifier; protected by a multifuse (resistance of 0.9 Ω), the time to trip the multifuse to a high-resistant state is 0.1 sec. at 5 A;
housing with two 4-mm plugs and cable with BT-connection

MB270-2V LF amplifier "compact", magnetic

Used in amplifying weak audio signals for measurement purposes or for driving a loudspeaker; Amplification factor: 1, 3, 10, 30, 100, 300, 1,000, 3,000, 10,000 times
Accuracy: better than 20%
Frequency range: 25 Hz - 70 kHz
Output voltage: 2.8 Veff
(2.1 Veff rms at 4 Ohm), two 4 mm output jacks, short-circuit protection
Input voltage: 2.8 Veff (max. 30 Veff)
Power supply: 12 V DC (hollow jack), supplied by mains transformer P3130-1P (12 V / 2 A) e. g.
dimensions: 84 x 84 x 39 mm

DE751-1B Oscilloscope v3 "mini", with colour display

Digital pocket storage oscilloscope for measurement purposes in the classroom; thanks to the robust partially metallic housing, the small size and the resulting ease of use, this device is also suitable for students.

Technical data:
Colour LCD 320 x 240 px, 58 x 44 mm; 0 - 200 kHz analogue bandwidth; X-deflection: 1 µs - 2 s, Y-deflection: 10 mV - 10 V; max. input voltage: 80 Vpp; various trigger modes; auto-measurement, measurement cursor;
inbuilt test signal: 10 Hz - 1 MHz;
USB port for connecting to a PC or recharging battery;
includes measurement cable, protective sleeve and support;
dimensions: 91 x 61 x 12.5 mm; weight: approx. 100 g

DE750-3A Oscilloscope, two-channel, 30 MHz

For taking measurements during demonstrations and student experiments; monitor size: 80 x 100 mm, with measuring grid;
X deflection: 0.2 s - 20 ns / DIV, with fine adjustment;
Y deflection: 1 mV - 5 V / DIV, with fine adjustment;
triggering: auto, norm, TV-H, TV-V;
operating modes: Ch1, Ch2, Ch1 + Ch2, Ch1 - Ch2, XY display;
input impedance: 1 MOhm / 30 pF; coupling: DC, AC, GND;
max. input voltage: 400 V AC / DC;
voltage source: 230 V AC / 50 - 60 Hz;
dimensions: approx. 316 x 132 x 410 mm; weight: approx. 7.8 kg

Recommended accessory:

DG500-4A BNC to 4 mm socket adapter

Easy to use – handy – stable – magnetic

DE722-1P Panelmeter “inno“

Demonstration instrument
for measuring voltage and
amperage;
Technical data:
3 ½-digit LED display;
digit height 26 mm;
measuring ranges:
0 - 200 mA, 0 - 20 A;
0 - 40 V AC / DC;
accuracy: better than 1%;
fuses: F 10 A fine-wire fuse
(5 x 20 mm) in socket;
throw switch: DC / OFF / AC;
input: 4 mm safety jacks;
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm hollow
DC jack for 6 V/500 mA external power supply P3120-6N
case: green ABS plastic with yellow labelling;
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 540 g

DE722-1O Ohmmeter “inno“

Demonstration meter for
measuring resistance and for
testing diodes;
Technical data:
3 ½-digit LED display;
digit height 26 mm;
measuring ranges:
200 Ohm; 2, 20, 200 kOhm;
2 MOhm;
2 V (diode testing);
accuracy: better than
± 0.2 % (± 1 digit) for all ohmage ranges up to 200 kOhm,
diode testing: ± 20%;
throw switch: ON / OFF;
measurement input: two 4 mm safety jacks;
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm
hollow DC jack for 6 V/500 mA external power supply P3120-6N
case: green ABS plastic with yellow labelling;
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 450 g

DE722-1M Teslameter “inno“

Demonstration instrument
for measuring magnetic flux
density using an axial or
tangential magnetic field
sensor;
Technical data:
3 ½-digit LED display;
digit height 26 mm
measuring range: ±200 mT
accuracy: better than 1.5%
throw switch: ON / OFF
DIN jack: for connecting an axial or tangential sensor
button for setting to zero
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm
hollow DC jack for 6 V/500 mA external power supply P3120-6N
Case: green ABS plastic with yellow labelling
Dimensions: approx. 160 x 120 x 45 mm
Weight: approx. 400 g

DE722-1V Microvoltmeter “inno“

Demonstration instrument
for measuring extremely
small voltage levels;
Technical data:
3 ½-digit LED display;
digit height 26 mm
six measuring ranges:
0.02, 0.2, 2, 20,
200, 2000 mV
turning knob:
10-turn potentiometer for setting to zero
accuracy: better than 2% (when precisely set to zero)
input resistance: 100 Ohm
throw switch: ON / OFF
input: 4 mm safety jack
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm
hollow DC jack for 6 V/500 mA external power supply P3120-6N
case: green ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 485 g

DE723-1W Wattmeter “inno“

Demonstration instrument
for measuring power in low-
voltage circuits;
Technical data:
3 ½-digit LED display,
digit height 26 mm
types of measurement:
true power (W),
work/energy (Ws)
measurement limits:
20 V_{eff}, 2 A_{eff}
accuracy: better than 1.5%
input: 4 mm safety jacks (pair)
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm
hollow DC jack for 6 V/500 mA external power supply P3120-6N
case: green ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 450 g

Required accessories:

DE722-2A Magnetic field sensor, axial

DE722-2T Magnetic field sensor, tangential

DE722-1H Static voltmeter "inno"

Demonstration meter for measuring high electrostatic voltages; unlike mechanical electroscopes, **this instrument delivers exact and clear quantitative readings as well as the polarity of the charge**; the value measured can be frozen using the hold switch.

Technical data:
2 ½-digit LED display; digit height 26 mm
measuring range: 0 - 18.0 kV
reset button for resetting instrument to zero
accuracy: better than 2% for 0 - 10 kV
throw switch: ON / OFF
throw switch: measure (sample) - freeze measured value (hold)
measurement input provided by means of specially insulated 4 mm safety jack, 4 mm safety jack for ground connection
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm hollow DC jack for 6 V/500 mA external power supply P3120-6N
case: green ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 483 g

DE722-1C Coulomb meter “inno”

Demonstration meter used in electrostatics for measuring charges;

Technical data:
3 ½-digit LED display;
digit height 26 mm
measuring range: ±1999nC
reset button for resetting instrument to zero
accuracy: better than 1%
droop rate: better than 5 digits / min
throw switch: ON / OFF
4 mm safety jacks: measurement input (IN) and common ground (COM)
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm hollow DC jack for 6 V/500 mA external power supply P3120-6N
case: green ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 380 g

Recommended accessory for “inno” measuring devices

P3120-5B S-shaped assembly platform

Metal bracket, S-shaped,
green powder-coated;
height: 240 mm

P3120-6N Mains transformer 6 V DC / 500 mA

Especially for use as an external power supply

DE722-1L Conductivity meter "inno"

Demonstration instrument for measuring electrical conductivity of liquids;

Technical data:
3 ½-digit LED display;
digit height 26mm
measuring ranges:
20, 200 µs;
2, 20, 200, 2000 ms
accuracy: better than 1%
"Slope" adjustment knob for setting the display to zero
toggle switch: ON / OFF
4 mm safety jacks for connecting the conductivity electrode as external sensor for measurement (not included)
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm hollow DC jack for 6 V/500 mA external power supply P3120-6N
case: green ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 400 g

Required accessories:

C4500-5A Conductivity electrode

P3120-1P pH-Meter “inno”

Demonstration meter for measuring pH;

Technical data:
3 ½-digit LED display;
digit height 26 mm
measuring range:
0.00 - 14.00 pH
precision: 0.01 pH
accuracy: better than 0.5%
BNC jack
for connecting pH electrode
knobs for adjusting slope and zero point (pH 7)
knob for temperature adjustment
toggle switch: ON / OFF
external pH-sensor for measurement (not included)
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm hollow DC jack for 6 V/500 mA external power supply P3120-6N
case: green ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 400 g

Required accessories:

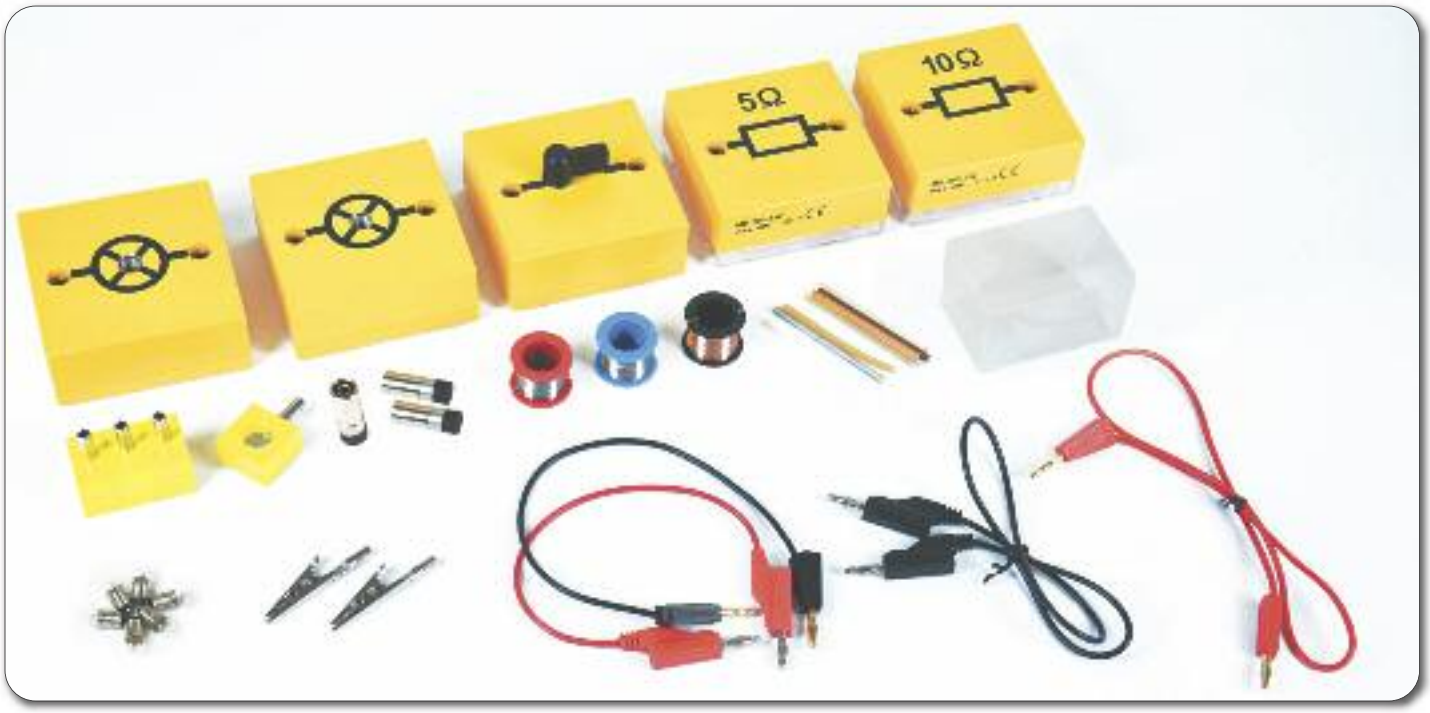
P4230-2P pH electrode, BNC connector

C4100-1F Buffer solution, pH 4, 100 ml

C4100-1G Buffer solution, pH 7, 100 ml

Magnetic block “compact“ – system (MBC)

- Sturdy plastic housing (ABS) with transparent base
- Printed circuit symbol (screen-printed)
- Jacks also suitable for 4 mm safety plugs
- Base with embedded neodymium magnets
- Dimensions: 84 x 84 x 39 mm



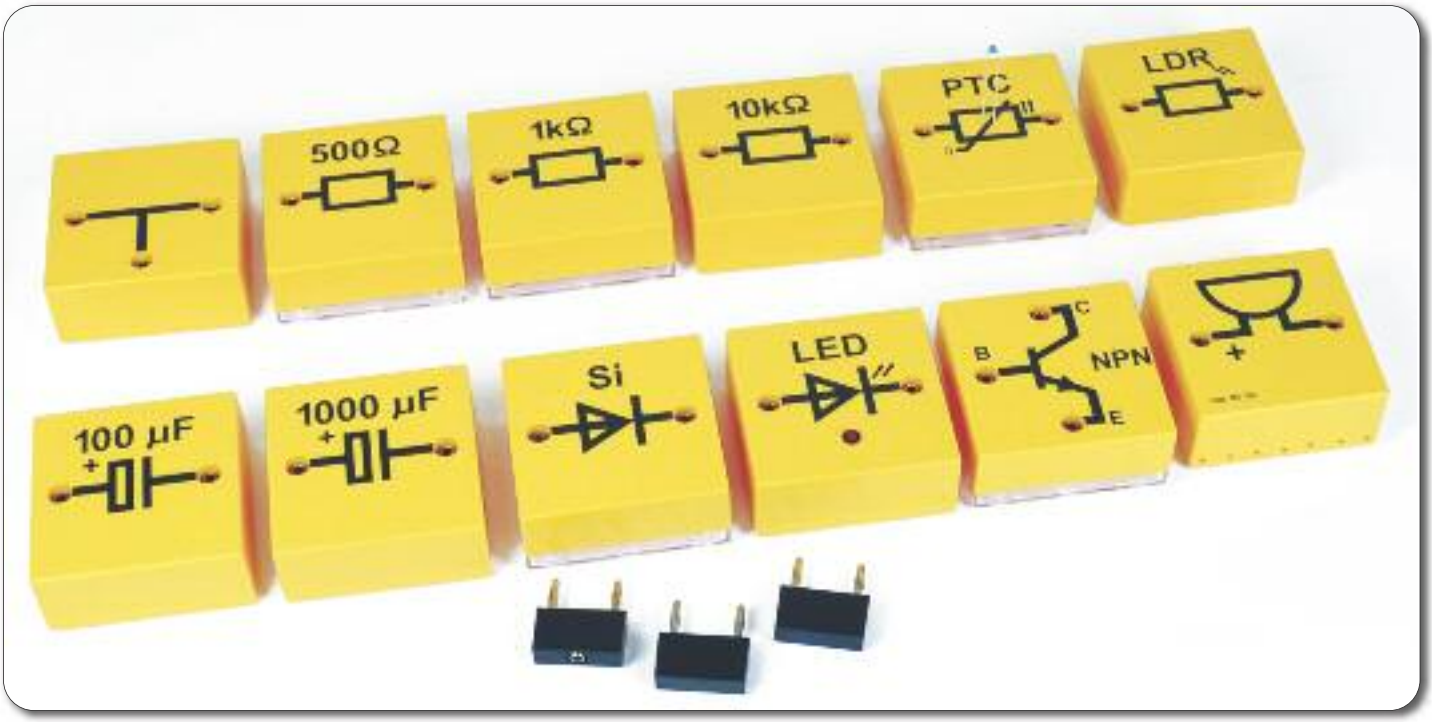
P3790-1A Electricity - base “compact“ (MBC)

consisting of:

P3710-2A	2	MBC Lamp socket E10
P3710-2R	1	MBC ON / OFF switch
MB200-1W	1	MBC Resistor, 5 Ohm
MB200-2W	1	MBC Resistor, 10 Ohm
P3911-2H	4	Battery holder with outlets, magnetic
P3711-4M	3	Clamp socket, magnetic, small
P3314-1A	1	Fuse wire, D = 0.1 mm, bobbin red
P3316-1C	1	Constantan wire, D = 0.2 mm, bobbin blue
P3316-1B	1	Copper wire, D = 0.2 mm, bobbin black
P3325-1A	1	Conductors and non-conductors, set
P3320-1A	3	Light bulb, 1.5 -2.5 V / 50 - 70 mA, E10
DE307-1B	3	Light bulb, 4 - 12 V / 40 - 70 mA, E10
P3310-1A	2	Crocodile clip, plain metal
P3325-2C	1	Electrolysis tank
P3310-2R	3	Connecting lead, 25 cm, red, SE
P3310-2E	3	Connecting lead, 25 cm, black, SE
P3310-3A	1	Connecting lead, 50 cm, red, SE
P3310-3R	1	Connecting lead, 50 cm, black, SE
P7806-1K	1	Storage box II small, with cover

Including manual for more than 20 experiments on the topics:

- Basics of electricity
- Electrical resistance
- Thermal energy derived from electrical energy
- Work and power



P3795-1A Electronics - base “compact” (MBC)

consisting of:

P3710-1T	1x	MBC Lead, T-shaped
P3710-3M	1x	MBC Resistor 500 Ohm
P3710-3O	1x	MBC Resistor 1 kOhm
P3710-3R	1x	MBC Resistor 10 kOhm
P3710-4E	1x	MBC PTC Thermistor
P3710-4J	1x	MBC Photo resistor (LDR)
P3710-6N	1x	MBC Capacitor 100 µF
P3710-6R	1x	MBC Capacitor 1000 µF
P3710-7A	1x	MBC Silicon diode
P3710-7K	1x	MBC LED red
P3710-8A	1x	MBC Transistor NPN, base left
P3711-2A	1x	MBC Buzzer
P3712-1S	2x	Jumper plug, black
P3712-2S	1x	Jumper plug with connector terminal, black
P7806-1K	1x	Storage box II small, with cover

Including manual for more than 20 experiments on the topics:

- Semiconductors
- Diodes
- Transistors
- Capacitors

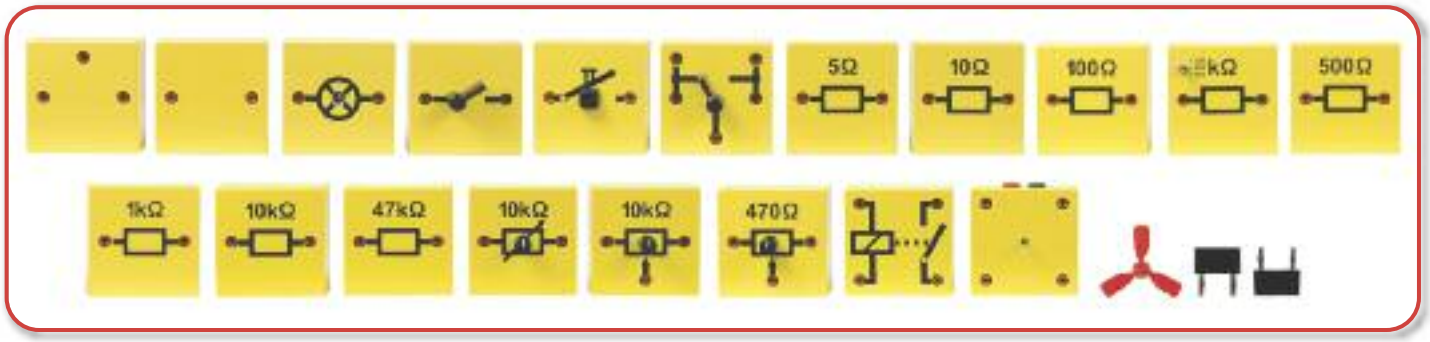
DS615-1P Metal plate for MBC system

Powder-coated metal plate for experiments in electricity or electronics as a “compact” system; free experimental area: approx. 50 x 33 cm

P3790-1G Electricity + Electronics base kit (MBC)

consisting of:
– All elements in the MBC Electricity base kit
– All elements in the MBC Electronics base kit
– DS615-1P Metal plate
– Storage box II, large, with cover
– Experiment manual

Magnetic block "compact" – system (MBC)

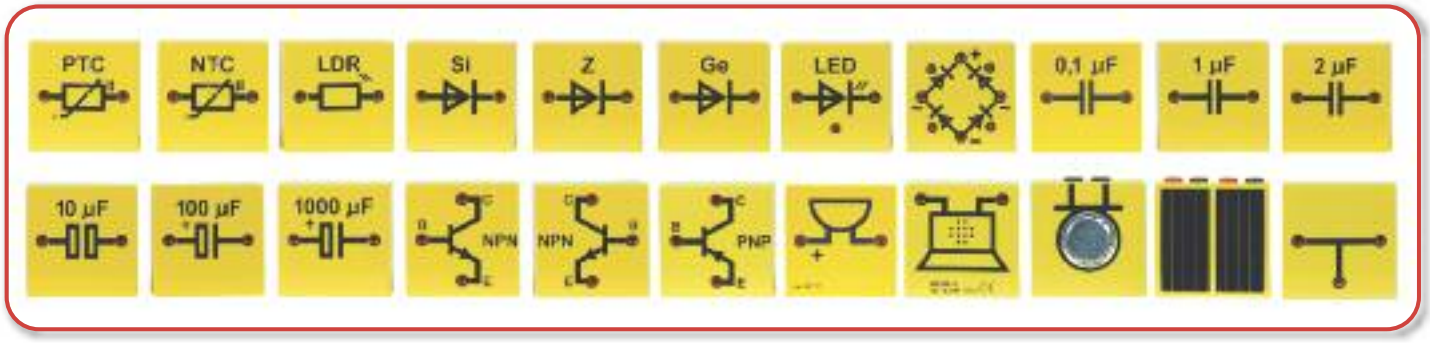


Individual components

P3700-02 MBC blank with 2 sockets
P3700-03 MBC blank with 3 sockets
P3710-2A MBC Lamp socket E10
P3710-2R MBC ON / OFF switch
P3710-2S MBC Push button
P3710-2T MBC Double-throw switch
MB200-1W MBC Resistor, 5 Ohm
10 W load capacity, tolerance: ±1%
MB200-2W MBC Resistor, 10 Ohm
10 W load capacity, tolerance: ± 1%
P3710-3G MBC Resistor 100 Ohm
P3710-3K MBC Resistance decade
300 / 600 / 900 kOhm
P3710-3M MBC Resistor 500 Ohm
P3710-3O MBC Resistor 1 kOhm
P3710-3R MBC Resistor 10 kOhm
P3710-3S MBC Resistor 47 kOhm
P3710-5A MBC Variable resistor 10 kOhm
P3710-5H MBC Potentiometer 10 kOhm
P3710-5F MBC Potentiometer 470 Ohm
P3710-4R MBC Relay
Operating voltage max. 12 V
P3610-1M MBC Motor / Generator, SE
P3611-1P Winged wheel for motor / generator
P3712-1S Jumper plug, black
Plugs 25 mm apart,
dimensions: 36 x 12 x 20 mm
P3712-2S Jumper plug with connector terminal, black
Plugs 25 mm apart,
dimensions: 36 x 12 x 20 mm

Individual components

P3710-4E MBC PTC Thermistor
P3710-4A MBC NTC Resistor
P3710-4J MBC Photo resistor (LDR)
P3710-7A MBC Silicon diode
P3710-7E MBC Zener diode
P3710-8G MBC Germanium diode
P3710-7K MBC LED red
P3710-7T MBC Bridge rectifier (with LEDs)
P3710-6D MBC Capacitor 0.1 µF
P3710-6G MBC Capacitor 1 µF
P3710-6H MBC Capacitor 2 µF
P3710-6J MBC Capacitor 10 µF
P3710-6N MBC Capacitor 100 µF
P3710-6R MBC Capacitor 1000 µF
P3710-8A MBC Transistor NPN, base left
P3710-8B MBC Transistor NPN, base right
P3710-8C MBC Transistor PNP
P3711-2A MBC Buzzer
MB240-1L MBC Loudspeaker
P3721-2C MBC Microphone
P3600-2A MBC Double solar cell
P3710-1T MBC Lead, T-shaped



I am the biggest!

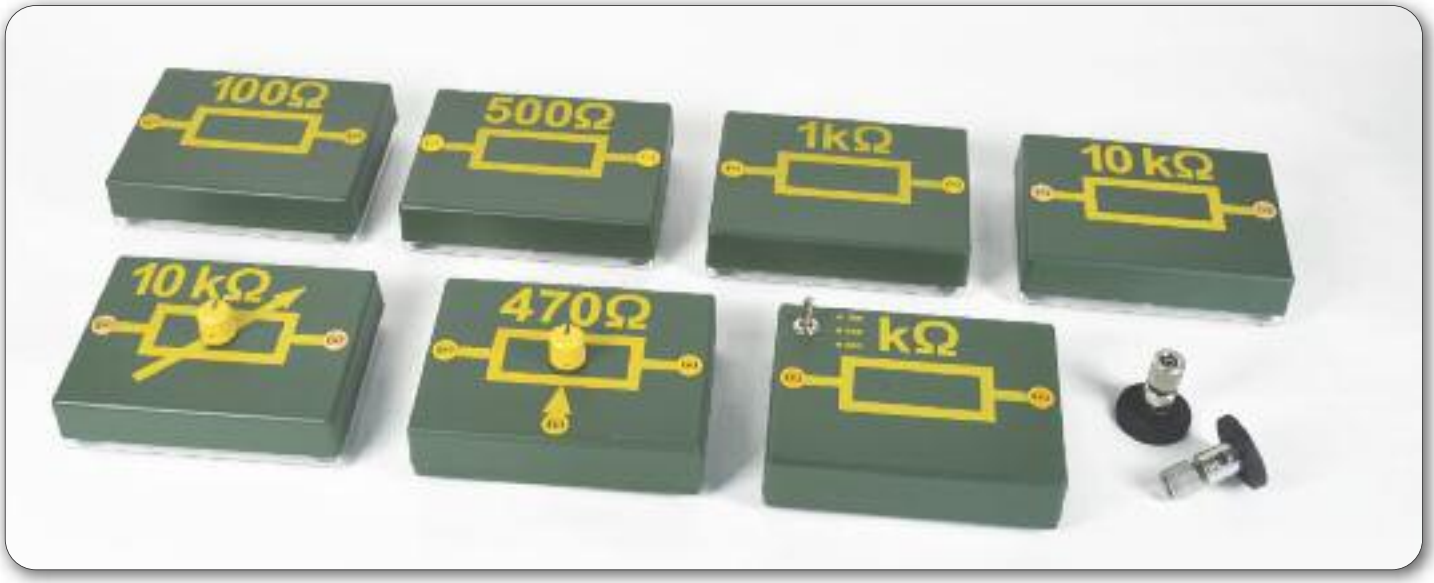
- Sturdy plastic housing (ABS) with transparent base
- Printed circuit symbol (screen-printed)
- 4 mm safety sockets
- Base with embedded neodymium magnets
- Rubber buffers on base prevent slipping or scratching of table top
- **Dimensions: 160 x 120 x 45 mm**

DE740-1E Electricity - basics "inno" (MBI)

consisting of:

DE720-2A	2x	MBI Light bulb socket, E10
DE720-1B	2x	MBI Battery 1.5 V
DE720-2R	1x	MBI Switch ON / OFF
DE720-2T	1x	MBI Double-throw switch
DE320-1M	2x	Clamp for wire, magnetic "nno"
P7840-1B	1x	Box insert MBI bottom
P7806-1G	1x	Storage box II large, with cover

Including manual for 15 experiments on the topics "Basics of Electricity"



DE740-2E Electricity – resistors „inno“ (MBI)

consisting of:

DE720-4W	1x	MBI Resistor 100 Ohm, 2 W
DE720-5W	1x	MBI Resistor 500 Ohm, 2 W
DE720-6W	1x	MBI Resistor 1 kOhm, 2 W
DE720-7W	1x	MBI Resistor 10 kOhm, 2 W
DE720-8W	1x	MBI Variable resistor 10 kOhm, 4 W
DE720-9W	1x	MBI Potentiometer 470 Ohm, 4 W
DE720-3W	1x	MBI Resistance decade 300 / 600 / 900 kOhm, 2 W
DE320-1M	2x	Clamp for wire, magnetic “inno“
P7840-1T	1x	Box insert MBI top

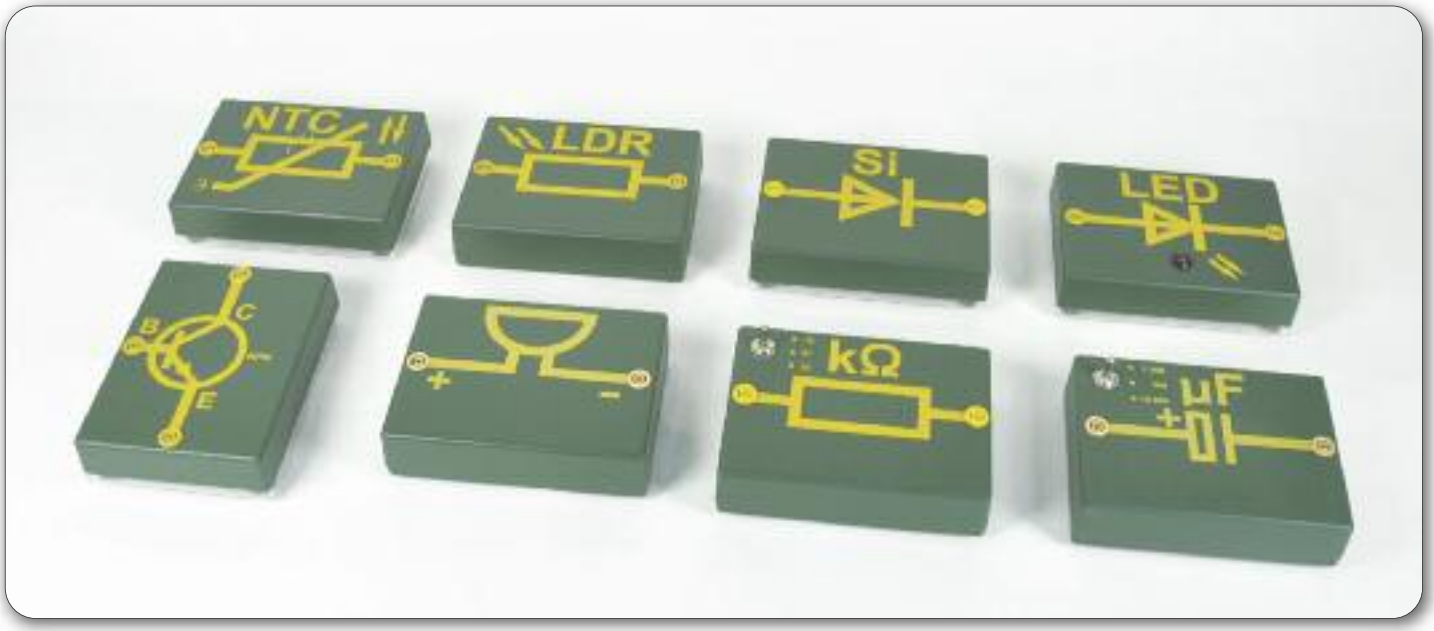
Including manual for 31 experiments on the topics “Electrical resistance“

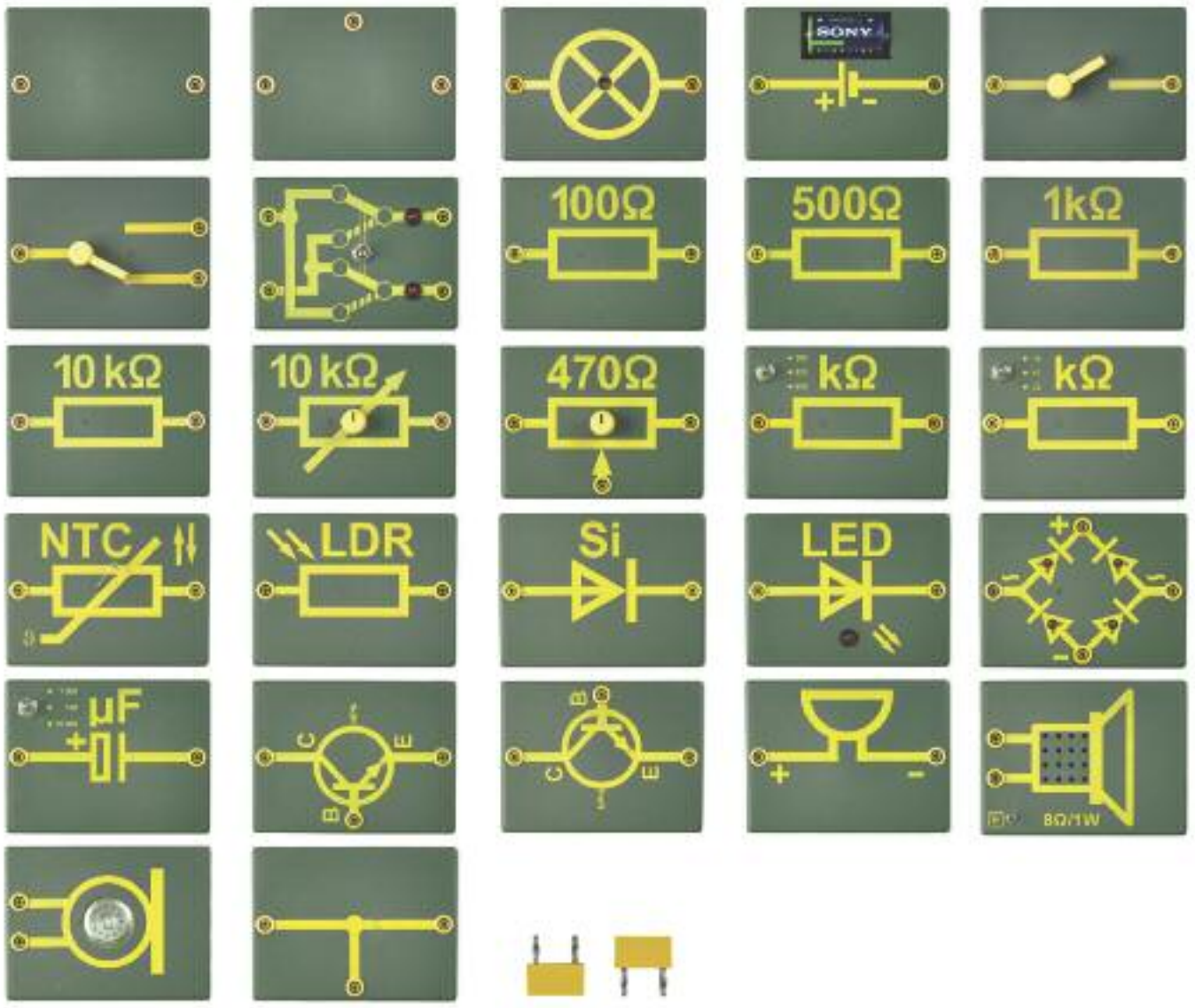
DE740-3E Electronics - base, "inno" (MBI)

consisting of:

DE730-1N	1x	MBI NTC - Resistor
DE730-1L	1x	MBI LDR
DE730-1S	1x	MBI Si-Diode
DE731-1L	1x	MBI LED
DE732-1L	1x	MBI Transistor NPN, Base left
DE730-2V	1x	MBI Buzzer
DE730-1W	1x	MBI Resistance decade, 10 / 22 / 47 kOhm
DE733-1K	1x	MBI Capacitance decade, 100/1000/10000 µF
P7840-1B	1x	Box insert MBI bottom
P7806-1G	1x	Storage box II large, with cover

Including manual for 31 experiments on the topics:
- Semiconductors
- Diodes
- Transistors
- Capacitors





Magnetic block "inno" system (MBI) - individual components

DE720-02 MBI blank with two sockets
DE720-03 MBI blank with three sockets
DE720-2A MBI Light bulb socket, E10
DE720-1B MBI Battery, 1.5 V
DE720-2R MBI ON / OFF switch
DE720-2T MBI Double-throw switch
DE720-1K MBI Four-way switch
DE720-4W MBI Resistor 100 Ohm, 2 W
DE720-5W MBI Resistor 500 Ohm, 2 W
DE720-6W MBI Resistor 1 kOhm, 2 W
DE720-7W MBI Resistor 10 kOhm, 2 W
DE720-8W MBI Variable resistor 10 kOhm, 4 W
DE720-9W MBI Potentiometer 470 Ohm, 4 W
DE720-3W MBI Resistance decade 2
300 / 600 / 900 kOhm
DE730-1W MBI Resistance decade 1
10 / 22 / 47 kOhm
DE730-1N MBI NTC - Resistor
DE730-1L MBI LDR
DE730-1S MBI Silicon diode

DE731-1L MBI LED
DE730-1B MBI Bridge rectifier with 4 LEDs
DE733-1K MBI Capacitance decade
100 / 1000 / 10000 µF
DE732-1L MBI Transistor NPN, Base left
DE732-1R MBI Transistor NPN, Base right
DE730-2V MBI Buzzer
DE720-2L MBI Loudspeaker
Loudspeaker with integrated amplifier, 8 Ohm / 1 Watt
DE720-2M MBI Microphone
Carbon microphone capsule,
max. load 40 mA, impedance: 80 - 250 Ohm
DE732-3T MBI Lead, T-shaped

DG500-5A Jumper plug, yellow
Plugs 25 mm apart, dimensions: 36 x 12 x 20 mm
DG500-5G Jumper plug with connector terminal, yellow
Plugs 25 mm apart, dimensions: 36 x 12 x 20 mm

Plug-in board modules “demo” (PIBD)

- Sturdy plastic housing (ABS)
- Printed circuit symbol (screen-printed)
- Recessed grips for easy removal of a component from a circuit
- Transparent base for visibility of the installed blank
- Screws on the base make replacing components easy

maximum operating voltage allowed: 42 volts
dimensions: 81 x 81 x 35 mm

Plug-in board module system “demo” (PIBD) for electricity and electronics

A laboratory system featuring vertical experiment set-ups; this facilitates clear and easy-to-understand demonstrations of the principles of electrical and electronic circuits at an introductory and advanced level.
Max. operating voltage allowed: 42 V
(protected extra-low voltage)

- Clear overview of circuits
- Easy to set up
- Reliable electrical connections
- Modules stick to the board well

More than **130 electricity experiments** along with **115 electronics experiments**

DE920-1A Plug-in panel, demo

Assembly panel for mounting and electrically connecting “demo” plug-in components (PIBDs);
63 socket clusters; grid spacing 40 mm;
back of the plug-in panel: metal panel, painted matt white;
used as a panel especially for optics, mechanics and thermodynamics experiments with magnets;
dimensions: approx. 800 x 632 x 34 mm

Support material for firm vertical mounting of demo plug-in panel DE920-1A

DS101-1G Support base, large, L = 500 mm

DS600-6G Board holders, pair, magnetic

Recommended accessory:

2 pcs. DS500-1G Screw clamp, jaw width approx. 50 mm

DE900-1A PIBD Electricity, set 1

Basic set for PIBD electricity and electronics, including 30 modules with built-in wiring, some of them with 4 mm jacks for connecting power supplies and measuring instruments, consisting of:

DE920-1D	2x	PIBD Wire, straight, with socket
DE920-1C	5x	PIBD Wire, straight
DE920-1G	5x	PIBD Wire, right-angled
DE920-1H	4x	PIBD Wire, right-angled, with socket
DE920-1F	2x	PIBD Wire, T-shaped, with socket
DE920-1E	5x	PIBD Wire, T-shaped
DE920-1K	1x	PIBD Wire, interrupted, right-angled
DE920-1J	2x	PIBD Wire, interrupted
DE920-1B	4x	PIBD Connector
P7910-1A	1x	Box insert PIBD
P7806-1G	1x	Storage box II large, with cover

Experiment example for electronics

DE900-2A PIBD Electricity, set 2

Supplementary set for PIBD electricity and electronics; a total of 30 modules consisting of:

DE920-3G	2x	PIBD Resistor 100 Ohm Load capacity: 2 W, tolerance: ±5%
DE920-3M	2x	PIBD Resistor 500 Ohm Load capacity: 2 W, tolerance: ±5%
DE920-3O	1x	PIBD Resistor 1 kOhm Load capacity: 2 W, tolerance: ±5%
DE920-3R	1x	PIBD Resistor 10 kOhm Load capacity: 2 W, tolerance: ±5%
DE920-3S	1x	PIBD Potentiometer 470 Ohm Load capacity: 4 W, tolerance: ±10%
DE920-3T	1x	PIBD Variable resistor 10 kOhm Load capacity: 4 W, tolerance: ±10%
DE927-1M	1x	PIBD Geared motor Slotted pulley for cord, 28:1 gear ratio
DE920-2K	3x	PIBD Battery, 1.5 V DC (C-size cells supplied)
DE920-2B	1x	PIBD Glow lamp
DE922-1L	1x	PIBD for coil, left
DE922-1B	1x	PIBD for coils with connector terminal
DE922-1A	1x	PIBD for coils
DE920-2S	1x	PIBD Push button
DE920-2R	3x	PIBD ON / OFF switch
DE920-2T	2x	PIBD Double-throw switch
DE920-2A	2x	PIBD Light bulb socket, E10
DE920-2F	3x	PIBD Light bulb socket, E14
DE920-2L	2x	PIBD with screw posts For securing a holder with solid pin
DE920-2M	1x	PIBD Holder for support rods Three holes and clamping screws for securing support rods up to 10 mm in diameter
P7910-1A	1x	Box insert PIBD
P7806-1G	1x	Storage box II large, with cover

DE900-3A PIBD Electricity, set 3

Supplementary set for PIBD electricity and electronics for electrochemistry, electromagnetism and induction, consisting of:

DE921-1D	1x	U-shaped core with yoke, laminated, flat core 30 x 16mm, coated, with fixing screw
DE921-1L	1x	Iron core, laminated, long dimensions: 163 x 30 x 16 mm
DE922-2B	1x	Coil with 800 turns, with plug pins, demo
DE922-2C	1x	Coil with 2 x 800 turns, with plug pins, demo
DE450-1D	1x	Moving coil with pointer For demonstrating the force of a magnetic field acting on a current-carrying moving coil, i.e. the principle of a moving coil measuring device; coil diameter: 90 mm
DE450-1E	1x	Conductor swing For demonstrating the force of a magnetic field acting on a current-carrying conductor
DE920-2C	1x	PIBD with ball bearing Pivot bearing for a moving coil or magnet holder
DE320-1E	3x	Plug pin clamp
DE451-1D	1x	Striker For bell and relay assemblies, L = 285 mm
DE451-1C	1x	Bell gong
DE920-2D	1x	PIBD with scale
DE930-2R	1x	Pulley with pointer For assembling a model hot-wire measuring instrument; pulley mounted on a pivot bearing and support; with a pointer, L = 160 mm
DE312-1B	2x	Battery holder
DE921-3U	1x	Heating element, plug-in, 2 parts
P3325-2A	1x	Electrodes, set of 9
P3911-3D	4x	Crocodile clip, plain metal with 4 mm plug pin
P3310-1A	2x	Crocodile clip, plain metal
P3325-1A	1x	Conductors and non-conductors, set
DE922-1D	1x	Platform with plug pins
P3325-2C	1x	Electrolysis tank
DE320-1C	1x	Contact pin with wolfram point, L = 100 mm
P1810-1D	1x	Flat spring steel, 0.6 mm, L = 300 mm
DE320-1D	1x	Bimetallic strip, demo, 180 x 20 mm
DE921-3B	2x	Holder with solid pin
DE921-3A	2x	Holder with plug pin
P7910-1B	1x	Box insert PIBD electricity set 3
P7806-1G	1x	Storage box II large, with cover

Electricity experiments (PIBD)

Theme	Number of
Conductors - Non-conductors	17
Measuring voltage - voltage sources	9
Ohm's law - resistor circuits	17
Electrical appliances - safety devices	13
Thermocouple element - electrochemistry	13
Electromagnetism	20
Electromagnetic induction	10
Transformers	16
Electric machines	20

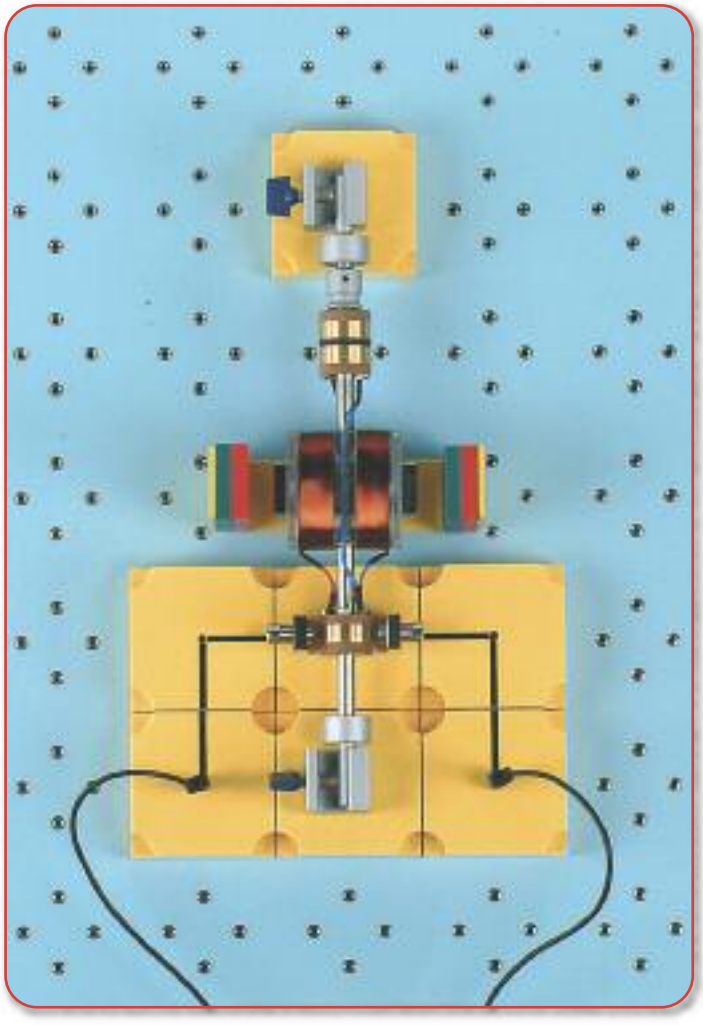
Ordering information for apparatus needed to perform the electricity experiments listed above with the "demo" plug-in system:

DE920-1A	1x	Plug-in panel, demo
DS101-1G	1x	Support base, large, L = 500 mm
DS600-6G	1x	Board holders, pair, magnetic
DE900-1A	1x	PIBD Electricity, set 1
DE900-2A	1x	PIBD Electricity, set 2
DE900-3A	1x	PIBD Electricity, set 3
DE900-4M	1x	Electric machines PIBD, set
P9103-4DE	1x	Experiment manual PIBD Electricity
DE330-9S	1x	Set of wires (PIBD)
DE310-9S	1x	Set of light bulbs (PIBD)
DG590-1S	1x	Connecting leads, set for PIBD

DE900-4M Electric machines PIBD, set

Supplementary set for PIBD electric machines consisting of:

DE925-1D	1x	PIBD Carbon brushes DC Adjustable, spring-mounted carbon rods in a holder, suitable for a commutator
DE925-1A	1x	PIBD Carbon brushes AC Adjustable, spring-mounted carbon rods in a holder, suitable for slip rings
DE920-1M	2x	PIBD with support clamp
DE922-1L	1x	PIBD for coil, left
DE922-1R	1x	PIBD for coil, right
DE922-2A	2x	Coil with 400 turns, with plug pins, demo
DE921-1I	2x	Iron core, laminated, short, flat
DE454-1F	2x	Flat plug
DE460-1C	1x	Magnet bracket For holding block magnets DE460-1E; dimensions: 150 x 40 x 90 mm
DE460-1H	1x	Magnet bracket adapter For fastening the magnet bracket to support rods; dimensions: 150 x 40 mm
DE460-1E	2x	Block magnet Ferrite magnet, embedded in a red-green plastic casing; dimensions: 82 x 42 x 17 mm
DE460-1M	1x	Magnet rotor For assembling a functioning generator model, L = 190 mm
DE460-1A	1x	Two-pole rotor For assembling functioning models of electric machines; double-T-shaped anchor piece with an iron core, mounted on a metal shaft with ball bearings; two solid, brass slip rings and two-piece brass collector (commutator); **total length: 356 mm**
DE460-1B	1x	Four-pole rotor For assembling functioning models of electric machines; four-pole anchor piece; with an iron core; mounted on a metal shaft with ball bearings; four-piece brass collector, including a belt pulley for a belt drive; **total length: 356 mm**
DE460-1L	1x	Conductor loop For demonstrating the effect of a wire loop rotating in a magnetic field; conductor loop mounted on a metal shaft with ball bearings; two solid, brass slip rings; two-piece brass collector, including a belt pulley for a belt drive; **total length: 356 mm**
P7910-1C	1x	Box insert PIBD electric machines
P7806-1G	1x	Storage box II large, with cover



Experiment: Electromotor with two-pole rotor

DE900-4A PIBD Electronics, set 1

Basic set for PIBD electronics; a total of 30 modules, consisting of:

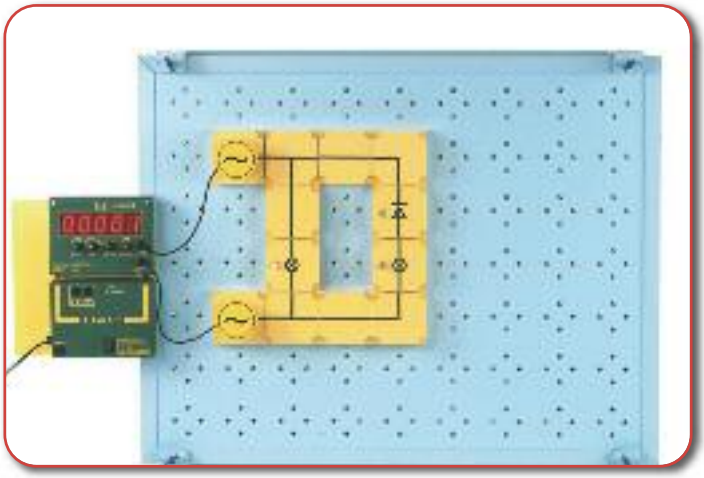
DE920-3R	1x	PIBD Resistor 10 kOhm Load capacity: 2 W, tolerance: ±5%
DE920-3U	1x	PIBD Resistor 47 kOhm Load capacity: 2 W, tolerance: ±5%
DE920-3T	1x	PIBD Variable resistor 10 kOhm Load capacity: 4 W, tolerance: ±10%
DE920-4J	1x	PIBD Photo resistor LDR Silicon photo resistor with PN junction
DE920-4E	1x	PIBD PTC Thermistor Base resistance: 110 Ohm, ±25%
DE920-4A	1x	PIBD NTC Thermistor Base resistance: 4.7 kOhm, ±10% Operating temperature: max. 125°C
DE920-4K	1x	PIBD Varistor Operating voltage: 14 V, max. 36 V Response time: approx. 50 ns
DE920-7A	2x	PIBD Silicon diode 1N4007 diode
DE920-7K	4x	PIBD LED red, D = 8 mm
DE920-7E	1x	PIBD Zener diode LN52 diode
DE920-7T	1x	PIBD Bridge rectifier with 4 LEDs
DE920-8A	1x	PIBD Transistor NPN, base left BD139
DE920-8B	1x	PIBD Transistor NPN, base right BD139
DE921-2A	1x	PIBD Buzzer Operating voltage: 4 - 9 V; sound pressure: approx: 70 dB
DE920-8C	1x	PIBD Transistor PNP BD140
DE920-6D	1x	PIBD Capacitor 0.1 µF
DE920-6G	1x	PIBD Capacitor 1 µF
DE920-6J	1x	PIBD Electrolytic capacitor 10 µF
DE920-6N	1x	PIBD Electrolytic capacitor 100 µF
DE920-6Q	1x	PIBD Electrolytic capacitor 1000 µF
P3721-2C	1x	MBC Microphone
DE921-2B	1x	PIBD Loudspeaker Impedance: 8 Ohm, power: 1W
DE920-1C	4x	PIBD Wire, straight
P7910-1A	1x	Box insert PIBD
P7806-1G	1x	Storage box II large, with cover

Electronics I experiments (PIBD)

Theme	Number of
Semiconductors - Resistors	9
Diodes	12
Transistors I	16
Capacitors	10
Multivibrator circuits	8
Rectifier Circuits	6

Ordering information for apparatus needed to perform the electronics experiments listed above with the "demo" plug-in system:

DE920-1A	1x	Plug-in panel, demo
DS101-1G	1x	Support base, large, L = 500 mm
DS600-6G	1x	Board holders, pair, magnetic
DE900-1A	1x	PIBD Electricity, set 1
DE900-2A	1x	PIBD Electricity, set 2
DE900-4A	1x	PIBD Electronics, set 1
P9103-4FE	1x	Experiment manual PIBD Electronics
DE310-9S	1x	Set of light bulbs (PIBD)
DG590-1S	1x	Connecting leads, set for PIBD



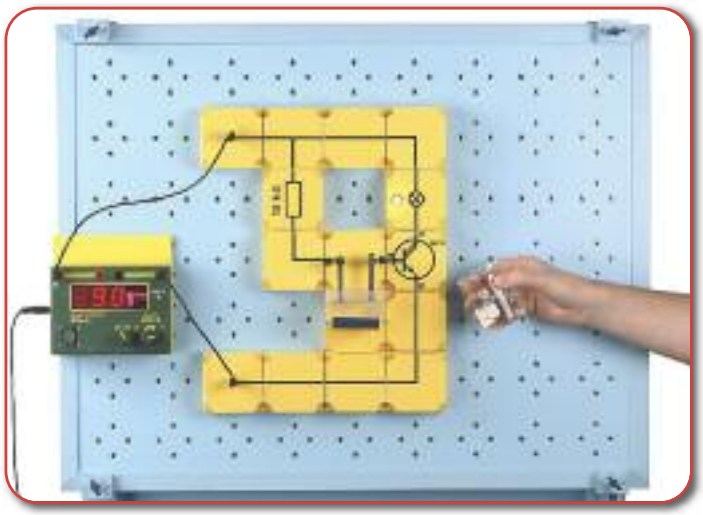
Experiment: Half-wave rectification

DE900-4E PIBD Electronics, set 2

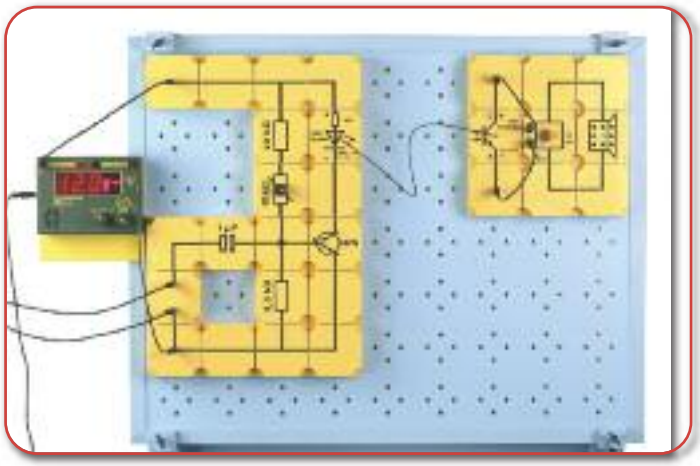
DE920-1C	1x	PIBD Wire, straight
DE920-1D	2x	PIBD Wire, straight, with socket
DE920-1F	1x	PIBD Wire, T-shaped, with socket
DE920-2X	1x	PIBD Four-way switch with polarity indicator
DE920-1N	1x	PIBD Wires, crossed
DE920-3P	1x	PIBD Resistor 3.3 kOhm
DE920-3Q	1x	PIBD Resistor 22 kOhm
DE920-3U	1x	PIBD Resistor 47 kOhm
DE920-3Y	1x	PIBD Resistor 1 MOhm
DE920-3Z	1x	PIBD Resistor 1.5 MOhm
DE920-3N	1x	PIBD Resistor 4.7 MOhm
DE920-3K	1x	PIBD Variable resistor 1 kOhm, 4 W
DE920-3L	1x	PIBD Variable resistor 2.5 kOhm, 4 W
DE920-6I	1x	PIBD Capacitor 1 µF, bipolar
DE920-6R	1x	PIBD Electrolytic capacitor 10000 µF
DE920-4S	2x	PIBD Solar cell
DE920-7G	1x	Germanium diode (raw)
DE920-7S	1x	Silicon diode (raw)
DE920-8E	1x	PIBD Thyristor, 5 A cathode gate
DE920-8F	1x	PIBD Thyristor, double gate
DE920-8G	1x	PIBD Triac 4 A
DE920-7R	1x	PIBD Current direction indicator
DE920-8D	1x	PIBD Darlington transistor
DE920-8P	1x	PIBD Phototransistor
DE920-8O	1x	PIBD Optocoupler
DE920-7U	1x	PIBD Overvoltage indicator
DE920-LS	1x	PIBD Optical fibre cable transmitter
DE920-LE	1x	PIBD Optical fibre cable receiver
DE926-3W	1x	PIBD Amplifier Miniature amplifier for loudspeakers with 8 - 16 Ohm; takes dynamic microphones with an impedance of 50 - 250 Ohm; 10 kOhm potentiometer controls volume
DE920-LW	1x	Optical fibre cable
DG500-1R	1x	Relay - box (in "inno"-case)
P7910-1A	1x	Box insert PIBD
P7806-1G	1x	Storage box II large, with cover

Electronics II Experiments (PIBD)

Theme	Number of
Transistors II	14
Thyristors	7
Photoelectronics	16
Transistor Circuits	17



Experiment: Gauging the level of a liquid using a Darlington transistor

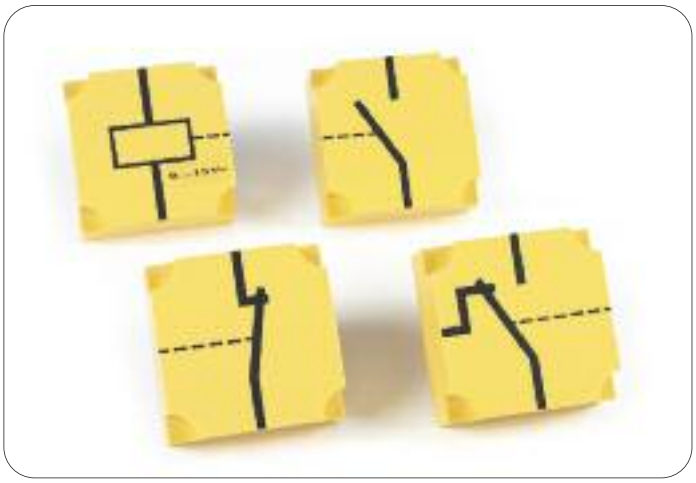


Experiment: Transmission of music using optical fibre cable

DE929-1Z PIBD Empty module
with transparent bottom panel

DE929-4S Plug pins for PIBD, set of 4

DE929-3S Phillips screws, set of 4

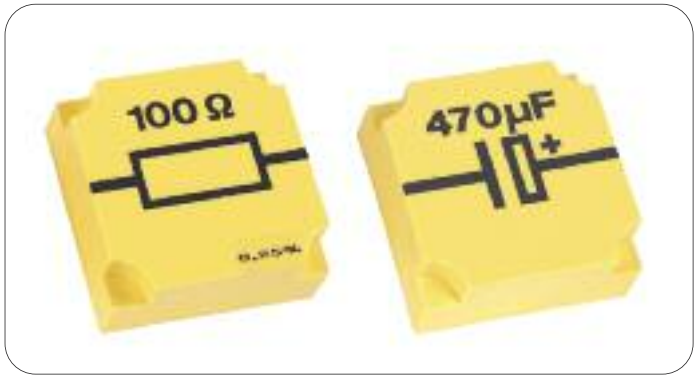


DE926-2R PIBD Relay

DE926-2O PIBD Break contact

DE926-2S PIBD Make contact

DE926-2W PIBD Changeover contact



PIBD Resistors: Max. load: 2 W
tolerance: ±5%

DE920-3D PIBD Resistor 10 Ohm

DE920-3E PIBD Resistor 20 Ohm

DE920-3F PIBD Resistor 50 Ohm

DE920-3H PIBD Resistor 200 Ohm

DE920-3W PIBD Resistor 100 kOhm

DE920-3X PIBD Resistor 470 kOhm

DE920-3V PIBD Potentiometer 10 kOhm

PIBD Capacitors: Voltage rating: 100 V
tolerance: ±20%

DE920-6A PIBD Capacitor 220 pF

DE920-6B PIBD Capacitor 2.2 nF

DE920-6C PIBD Capacitor 10 nF

DE920-6H PIBD Capacitor 2 µF

DE920-6O PIBD Capacitor 470 µF

DE920-7B PIBD Germanium diode

DE920-3C Holder for PIBD magnets

Holder with through hole and clamping screw;
accepting round apparatus up to 15 mm in diameter
(e.g. cylindrical magnet DE410-1L); two 4 mm plug pins,
19 mm apart, allow mounting on the PIBD with ball bearing

DE410-1L Bar magnet, AlNiCo, 80 x 15 mm

DE529-1S PIBD Plug-in symbols, set

For labelling connection- and measurement points within a circuit;
nine yellow plastic chips
(D = 62 mm)
with 4 mm plug pins

DE920-3A PIBD Light bulb socket, E10, with transistor amplification

A lamp lights up, indicating very low induction voltage levels (e.g. when used with a three-phase AC generator);
built-in ON-OFF switch;
LED battery level indicator;
9 V battery (supplied)

DE330-9S Set of wires (PIBD)

consisting of:
1 Roll of fuse wire, D = 0.1 mm, L = 30 m
1 Roll of constantan wire, D = 0.2 mm, L = 30 m
1 Roll of constantan wire, D = 0.5 mm, L = 15 m
1 Roll of iron wire, D = 0.2 mm, L = 30 m
1 Roll of copper wire, D = 0.2 mm, L = 30 m
1 pc. Storage container with lid

DE310-9S Set of light bulbs (PIBD)

consisting of:
5 pcs. Light bulbs 4V/40 mA, E10
5 pcs. Light bulbs 6V/50 mA, E10
5 pcs. Light bulbs 6V/500 mA, E10
5 pcs. Light bulbs 10V/50 mA, E10
2 pcs. Light bulbs 24V/25 W, E14
3 pcs. Light bulbs 12V/25 W, E14
1x Storage container with lid

DG590-1S Connecting leads, set for PIBD

consisting of:
4 pcs. Connecting leads, 50 cm, black
2 pcs. Connecting leads, 100 cm, black
2 pcs. Connecting leads, 100 cm, red
2 pcs. Connecting leads, 100 cm, blue

Metal platforms on clamp saddles (PIBD)

Metal platforms, yellow powder-coated, for mounting on the frame of demo plug-in panel DE920-1A and used to support a magnetic "inno" device

P3121-6A Metal platform PIBD, small, external

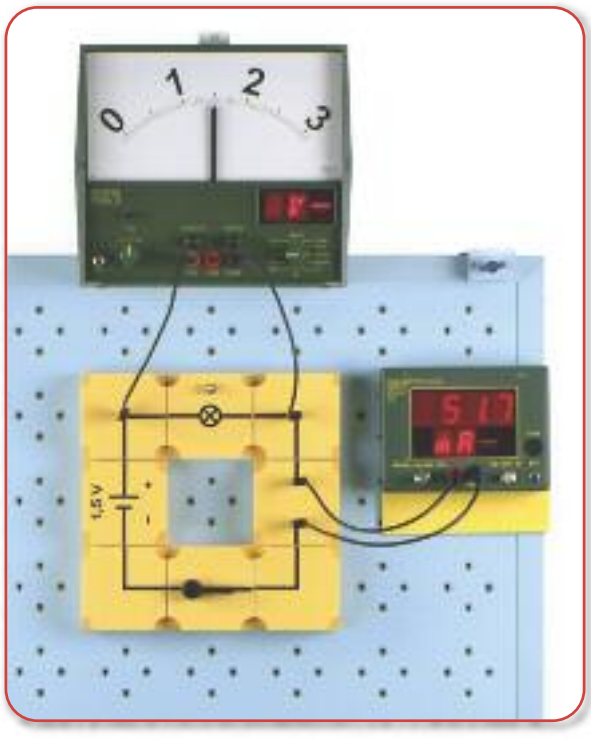
To mount "inno" devices outside of the plug-in panel; dimensions: 160 x 160 mm

P3121-6B Metal platform PIBD, small, internal

To mount "inno" devices within the plug-in panel; dimensions: 160 x 160 mm

P3121-7G Metal platform PIBD, large

To mount the "inno" universal multimeter outside of the plug-in panel; dimensions: 260 x 230 mm



Experiment: Measuring current and voltage

SE connecting leads

Copper wire insulated by a plastic sheath; load rating: 10 A;
gold-plated plug with axial socket

P3310-2R Connecting lead, 25 cm, red, SE
P3310-2E Connecting lead, 25 cm, black, SE

P3310-3A Connecting lead, 50 cm, red, SE
P3310-3B Connecting lead, 50 cm, blue, SE
P3310-3R Connecting lead, 50 cm, black, SE

P3310-4A Connecting lead, 75 cm, red, SE
P3310-4B Connecting lead, 75 cm, blue, SE

P3310-5A Connecting lead, 100 cm, red, SE
P3310-5C Connecting lead, 100 cm, black, SE

Demo connecting leads

Copper wire insulated by a plastic sheath;
load rating: 25 A;
plug with axial socket

DG510-1S Connecting lead, black, 10 cm

DG525-1R Connecting lead, red, 25 cm
DG525-1B Connecting lead, blue, 25 cm
DG525-1G Connecting lead, yellow, 25 cm
DG525-1S Connecting lead, black, 25 cm

DG550-1R Connecting lead, red, 50 cm
DG550-1B Connecting lead, blue, 50 cm
DG550-1G Connecting lead, yellow, 50 cm
DG550-1S Connecting lead, black, 50 cm

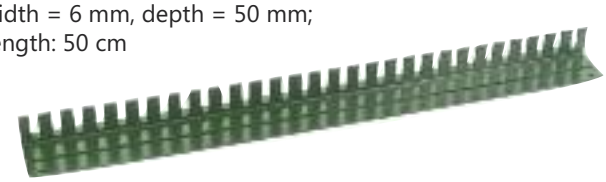
DG501-1R Connecting lead, red, 100 cm
DG501-1B Connecting lead, blue, 100 cm
DG501-1G Connecting lead, yellow, 100 cm
DG501-1S Connecting lead, black, 100 cm

DG501-5R Connecting lead, red, 150 cm
DG501-5B Connecting lead, blue, 150 cm
DG501-5S Connecting lead, black, 150 cm

DG502-1R Connecting lead, red, 200 cm
DG502-1B Connecting lead, blue, 200 cm
DG502-1S Connecting lead, black, 200 cm

DG500-5M Cable holder, metal

For well-organised storage of cables and leads;
rack with 29 slits; drill holes for wall-mounting the rack;
slits: width = 6 mm, depth = 50 mm;
total length: 50 cm



Safety connecting leads

Copper wire insulated by a silicon sheath;
load rating: 25 A; plug with axial socket

DG507-06 Safety connecting lead, yellow, 6 cm
DG504-09 Safety connecting lead, black, 9 cm
DG507-12 Safety connecting lead, yellow, 12 cm
DG504-17 Safety connecting lead, black, 17 cm

DG505-25 Safety connecting lead, red, 25 cm
DG504-25 Safety connecting lead, black, 25 cm
DG507-25 Safety connecting lead, yellow, 25 cm

DG505-37 Safety connecting lead, red, 37 cm
DG504-37 Safety connecting lead, black, 37 cm
DG507-37 Safety connecting lead, yellow, 37 cm

DG505-50 Safety connecting lead, red, 50 cm
DG504-50 Safety connecting lead, black, 50 cm
DG507-50 Safety connecting lead, yellow, 50 cm

DG505-75 Safety connecting lead, red, 75 cm
DG504-75 Safety connecting lead, black, 75 cm
DG507-75 Safety connecting lead, yellow, 75 cm

DG505-10 Safety connecting lead, red, 100 cm
DG504-10 Safety connecting lead, black, 100 cm
DG507-10 Safety connecting lead, yellow, 100 cm

DG505-20 Safety connecting lead, red, 200 cm
DG504-20 Safety connecting lead, black, 200 cm
DG507-20 Safety connecting lead, yellow, 200 cm

DG500-4F Cable holder, portable

For well-organised portable storage of cables and leads;
H-shaped base made of special aluminium profile, green powder-coated, with four permanently mounted swivel castors; metal rack with double cable holder; 2 x 29 slits (width: 6 mm, depth: 40 mm);
width: approx. 50 cm,
height: approx. 115 cm

Crocodile clips

Can be connected to 4 mm plugs

P3310-1A Crocodile clip, plain metal
P3911-3D Crocodile clip, plain metal with 4 mm plug pin
DG500-3R Crocodile clip, insulated, red
DG500-3S Crocodile clip, insulated, black

Double sockets

For joining two 4 mm plugs;
only for use with low voltages

DG500-4S Double socket, insulated, black
DG500-4R Double socket, insulated, red

DG500-3D Double pin plug

For joining two 4 mm sockets

DG500-4A BNC to 4 mm socket adapter

For connecting a 4 mm plug to a BNC socket

DG501-1F Power strip, 6 sockets

With illuminated rocker switch, 1.5 m power cord with integrated Schuko-type plug (16 A / 230 V AC)

DS406-2N Screw post

For insulated mounting of wires and rods up to 6 mm in diameter; plastic insulating capsule (D = 18 mm) on a plastic support (D = 10 mm); with a nickel-plated brass screw (including a 6 mm through hole) and a screw-on bushing with socket accepting a 4 mm safety plug;
total length: approx. 125 mm

P3711-4M Clamping socket, magnetic, small

Magnetic, insulated assembly for mounting wires on a steel panel; clamping screw with bush for holding 4 mm safety plugs; rubber-coated round neodymium magnet as a base;
D = 12 mm, H = 34 mm

Does not scratch!

DE320-1M Clamp for wire, magnetic

Magnetic, insulated assembly for holding wires and rods of a max. diameter of 6 mm on a metal panel;
clamping bolt with 6 mm transverse hole; grooved screw with bush for holding 4 mm safety plugs;
rubber-coated round metal base with neodymium magnets;
D = 43 mm, H = 77 mm

Does not scratch!

P3711-4K Clamping socket with plug

Clamping socket accepting 4 mm safety plugs, screwed on a clamping bolt with 4 mm plug,
4 mm through hole;
D = 12 mm, L = 48 mm

DE320-1E Plug pin clamp

For fastening pins and wires up to 4 mm in diameter;
quick-acting spring plug insulated by hard plastic; 4 mm banana plug with a transverse and an axial bushing

Light bulbs, socket E10

P3320-1A Light bulb, 1.5 - 2.5 V / 50 - 70 mA, E10
P3320-1B Light bulb, 2.5 V / 0.2 A, E10
P3320-4A Light bulb, 3.5 V / 0.2 A, E10
DE309-4A Light bulb, 4 V / 40 mA, E10
DE309-1S Light bulb, 4 V / 40 mA, E10, set of 5
DE309-2S Light bulb, 6 V / 50 mA, E10, set of 5
DE309-3S Light bulb, 6 V / 0.5 A, E10, set of 5
DE309-4S Light bulb, 6 V / 1 A, E10, set of 5
P3320-1I Light bulb, 10 V / 50 mA, E10
DE309-5S Light bulb, 12 V / 100 mA, E10, set of 5
DE309-6S Light bulb, 24 V / 100 mA, E10, set of 5

Light bulbs, socket E14

DE310-1B Light bulb, 6 V / 5 A, E14
DE310-1A Light bulb, 12 V / 25 W, E14
DE310-3D Light bulb, 24 V / 15 - 40 W, E14

Tubular lamps

P3320-2C Tubular lamp 12 V / 10 W

P3320-2D Tubular lamp 12 V / 18 W

Wires

For investigating the relationship between electrical resistance and type of material, length and cross-section area

P3314-1A Fuse wire, D = 0.1 mm, L = 50 m

P3316-1E Iron wire, D = 0.2 mm, L = 30 m

P3316-1B Copper wire, D = 0.2 mm, L= 30 m

P3316-1C Constantan wire, D = 0.2 mm, L = 30 m

DE330-1B Constantan wire, D = 0.5 mm, L = 15 m

Glass-tube fine wire fuses

Set of 10,
each packed in cardboard
dimensions (each):
L = 20 mm, D = 5 mm

DG323-15 Glass-tube fine wire fuse, F 3.15 A

DG329-10 Glass-tube fine wire fuse, F 10 A

DE309-1A Storage container, transparent

Plastic container for storing small items such as light bulbs, fuses, lengths of wire etc.; with lid; 10 compartments;
dimensions: 210 x 110 x 45 mm

P3325-2L Conductors and non-conductors, “demo” set

For experiments in electrical conductivity;
set of seven samples of materials (aluminium, carbon, copper, cotton, glass, rubber and wood); length: approx. 150 mm each

DE528-1T "Plus", "Minus", "Ground" signs, magnetic

Plastic film with magnets,
dimensions: each 50 x 50 mm

DE527-1H Warning sign "Caution - High Tension"

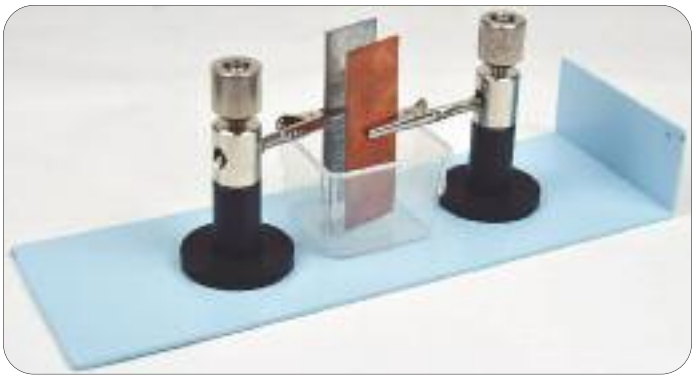
Plastic sheet, printed on both sides,
dimensions: 205 x 145 mm

DE720-1S Sliding resistor "inno"

Sliding resistor for demonstration purposes with an open housing, allowing easy observation of the position of the slider along the resistance coil;
resistance: 3.5 Ohm; load capacity: 8 A (10 A briefly);
voltage: max. 42 V;
length: approx. 330 mm

Electrolysis cell (small)

consisting of:



P3325-2A Electrodes, set of 9

C6008-1B Container with lid, 80 ml, plastics, 50 x 50 x 40 mm

Transparent, impact-resistant plastic container
with firmly closing lid

P3911-3D Crocodile clip, plain metal with 4 mm plug pin

DE320-1M Clamp for wire, magnetic

P3410-1A Assembly platform for MBCs

Metal bracket, L-shaped, dimensions: 255 + 40 x 84 x 2 mm

Electrode rods

Dimensions:
L = 150 mm, D = 8 mm

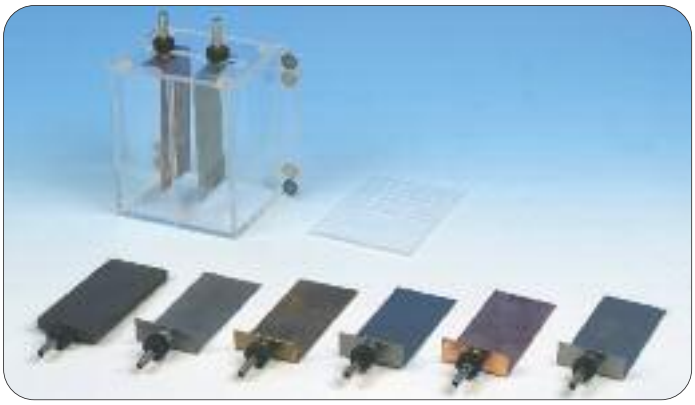
C7124-1A Electrode rod lead
C7124-2A Electrode rod iron
C7124-3A Electrode rod zinc
C7124-4A Electrode rod copper
C7124-5A Electrode rod carbon
C7124-7A Electrode rod brass
C7124-8A Electrode rod aluminium
C7124-6A Electrode rod nickel
(L = 130 mm, D = 3.2 mm)

C7118-2A Electrode rod holder

An insulated holder for connecting electrode rods up to 8 mm in diameter;
acrylic block with two insulated metal cylinders mounted on a support; six 4 mm holes; three 8.2 mm holes with fixing screws on the side;
support length:
120 mm

Recommended as a container for electrolyte:

C1000-1C Beaker glass 150 ml, squat form



Electrode plates "inno"

With special bush to accept 4 mm safety jacks
or 4 mm standard jacks;
knurled screw to fix firmly to the plate electrode holder;
dimensions: 100 x 45 mm

C7123-1A Electrode plate lead
C7123-2A Electrode plate iron
C7123-3A Electrode plate zinc
C7123-4A Electrode plate copper
C7123-5A Electrode plate carbon
C7123-6A Electrode plate brass

C7118-1B Plate electrode holder

Slotted acrylic plate, for securing electrode plates "inno";
dimensions: approx. 106 x 85 mm

C6115-1E Electrolytic tank "inno"

Acrylic tank, two grooves on the inside surface for inserting a separating sieve; four strong neodymium magnets on the rear panel for mounting the tank on a metal panel;
dimensions: 130 x 120 x 85 mm

C6115-2T Separating sieve

For insertion in electrolytic tank C6115-1E;
acrylic plate with holes, dimensions: 80 x 114 mm

Recommended as a container for electrolyte for the table:

C1000-1E Beaker glass 400 ml, squat form

DE740-4E Electrochemistry / Heat effect "inno"

consisting of:

C6115-1E	1x	Electrolytic tank "inno", 130 x 120 x 85 mm
C6115-2T	1x	Separating sieve, 80 x 114 mm
C7118-1B	1x	Electrode plate holder
C7123-1A	2x	Electrode plate lead, 100 x 45 mm
C7123-2A	1x	Electrode plate iron, 100 x 45 mm
C7123-3A	1x	Electrode plate zinc, 100 x 45 mm
C7123-4A	1x	Electrode plate copper, 100 x 45 mm
C7123-5A	2x	Electrode plate carbon, 100 x 45 mm
C7123-6A	1x	Electrode plate brass, 100 x 45 mm
DE330-1H	1x	Heating element "inno"
DE451-1F	1x	Flat spring, short, "inno"
DE451-2W	1x	Bi-metallic strip "inno"
DE451-3W	1x	Contact pin "inno"
DE320-1M	4x	Clamp for wire, magnetic
DT202-1T	1x	Thermocouple element, simple
P7910-4E	1x	Box insert Electrochemistry / Heat effect
P7806-1G	1x	Storage box II, large, with cover

C7120-1A Hoffmann apparatus

For the electrolysis of water;
two graduated glass tubes with stopcock and one glass tube with expansion vessel;
volume: 50 ml each;
length: approx. 560 mm

Electrodes for electrolysis apparatus

Pair of electrode rods with SB 19 stoppers and 4 mm jacks

C7120-3A Carbon electrodes for C7120-1A, pair of

C7120-3B Platinum electrodes for C7120-1A, pair of

DE798-1E Plasma globe

Glass bulb filled with gas under low pressure, the glow is caused by the strong electrical field generated by the high-voltage transformer in the plastic base;
diameter of the globe: approx. 190 mm;
power supply: 12 V DC (transformer included)

Experiment: Demonstrating the presence of an electrical field using a neon lamp

DE453-3S Cathode ray tube with slit

For demonstrating deflection of cathode rays in a magnetic field;
vacuum glass tube with electrodes mounted on metal caps;
slit diaphragm and fluorescent screen (approx. 75 x 35 mm);
two horizontally aligned electrodes for deflecting the electron beam; with plastic base;
operating voltage: approx. 2-3 kV;
glass-tube length: approx. 270 mm, diameter: approx. 40 mm

Recommended power supply:
P3171-1A High-voltage power supply 10 kV with digital display, "demo"

Experiment: Deflecting the cathode ray using a magnet

DE453-3K Cathode ray tube with shadow cross

For demonstrating the linear propagation of cathode rays;
vacuum glass tube with electrodes mounted on metal caps;
metal cross (may be folded down); with plastic base;
glass-tube length: approx. 230 mm, diameter: approx. 80 mm

Recommended power supply:
DE526-2F Spark coil 02

DE453-3R Vacuum discharge tube (Pohl type)

For demonstrating how pressure affects the glow in a gas discharge tube;
thick glass tube with central suction pipe with GJ 19/26;
disc electrodes mounted on metal caps are placed at both ends to supply high voltage; coupling piece of metal with flange DN 16 and ventilation valve;
dimensions: L = approx. 650 mm, D = 36 mm

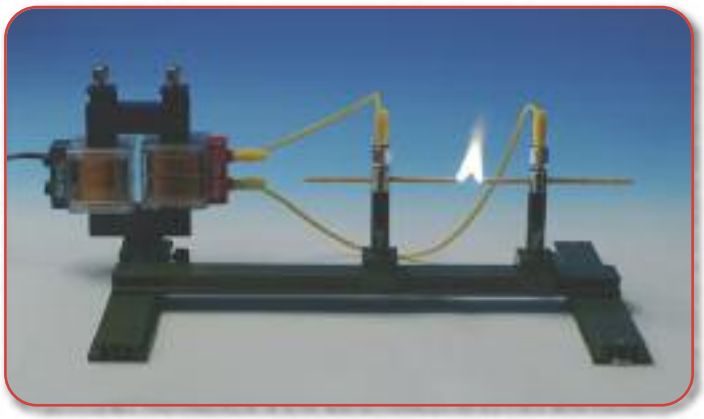
DE453-2E Electrodes for Jacob's ladder, pair

For demonstrating how an arc travels upwards along electrodes; may be mounted in screw posts DS406-2N;
length: 400 mm

DE453-2K Carbon electrodes, set

Carbon electrodes for the "arc discharge" experiment;
set of 10; L = 200 mm, D = 5 mm

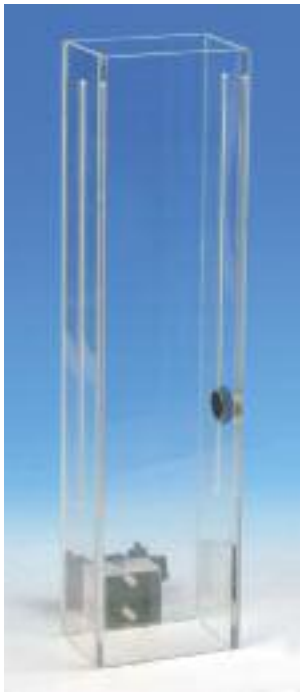
Experiment: An arc travelling upward between two electrodes



Experiment: Model of an arc lamp (arc discharge)

DM851-1Z Particle motion tube, rectangular

For experiments with models on the topic of "states and behaviour of matter";
acrylic tube mounted on sliding saddle; bolted opening on the side for inserting and removing contents; two grooves on the side for adjusting the ceiling and locking it into place in any position;
dimensions (inside):
90 x 60 x 400 mm



DE798-1B Funny ball

Intriguing fun: as soon as you touch the contact plates on the back of the ball with your fingers, the ball blinks and buzzes - the human body acts as a conductor!
Plastic ball with two contact plates; D = 40 mm

Frictional materials for electrostatics experiments

DE511-1K Rabbit fur

Of a non-endangered nature; size approx. 10 x 10 cm

DE511-1L Leather cloth

DE511-1S Silk cloth

DE540-2S Styrofoam beads in a plastic box

Rods for demonstrating frictional electricity; L = approx. 300 mm, D = approx. 12 mm

DE510-1H Hard rubber rod, demo

DE510-2L Hard rubber rod for pivot, demo

Axial hole allows pivoting on a needle bearing with a plug pin

DE510-3K Plastic rod, black, demo

DE510-4A Acrylic rod, demo

DE510-1G Glass rod, demo

Experiment: Two kinds of electrical charges - hard rubber rod pivoting on needle bearing with base

DE300-1D Pivot bearing on base

For rotatable mounting of friction rods and bar magnets;
plastic base with support mounted on low-friction needle bearing;
base diameter: 60 mm

P3911-3H Insulating block with socket

To be used as insulated base,
plastic block with 4 mm bush

DE520-1N Needle on plug pin

May be used as a needle bearing,
length: 80 mm

DE521-4S Insulating support

Supports and insulates apparatus with a 4 mm plug (conducting sphere, Faraday cup etc.);
plastic rod with metal head with an axial and a lateral hole for a 4 mm plug; D = 10 mm, L = 180 mm

DS406-2N Screw post

For insulated mounting of wires and rods up to 6 mm in diameter; plastic insulating capsule (D = 18 mm) on a plastic support (D = 10 mm); with a nickel-plated brass screw (including a 6 mm through hole) and a screw-on bushing with socket accepting a 4 mm safety plug; total length: approx. 125 mm

DE535-1K Capacitor plate on plug

Aluminium disc mounted on 4 mm plug, D = 40 mm

DE520-2I Conducting sphere, D = 25 mm

Metal sphere, D = 25 mm, mounted on 4 mm plug

MB550-2P Polarity tester, magnetic

The polarity of a charge is displayed by one of the LEDs lighting up;
diameter of the diodes: 8 mm,
incl. conducting sphere and battery;
Dimensions: 84 x 84 x 39 mm

DE520-9B Tubular fluorescent lamp, demo

For demonstrating electrostatic charges;
ignition voltage of approx. 250 V;
D = 15 mm;
L = approx. 70 mm

DE720-1G MBI Tubular fluorescent lamp, demo

For verifying electrostatic charges;
if a charged rod is placed nearby, one of the two electrodes will flash for a short period; thanks to the size of the tubular lamp and the dark background, this flash is clearly visible from a distance; removable fluorescent lamp on "inno" magnetic block (MBI);
with two 4 mm safety jacks;
ignition voltage: approx. 250 V;
dimensions: approx. 160 x 120 x 65 mm

DE500-1A Fork support

For parallel suspension of DE500-1P electroscope leaves;
fork mounted on a support with a 4 mm socket; may be mounted on a crocodile clip with plug;
L = 76 mm, D = 6 mm

DE500-1P Electroscope leaves, pair

Used in combination with fork support DE500-1A in the assembly of a simple electroscope;
length: 124 mm,
width: 15 mm

P3520-1A Electroscope SE

For electrostatics experiments and for displaying potential;
aluminium strip with a notch for balancing the robust pointer (L = 140 mm) made from alumium; mounted with very little friction;
height: approx. 160 mm

Additionaly recommended:
P3911-3H Insulating block with socket

DE502-1E Electroscope (Kolbe type)

For experiments in the field of electrostatics and for displaying voltages;
very sensitively fine mounted pointer,
4 mm safety socket with capacitor plate,
metal housing with grounding socket,
glass cover on sides;
pointer-L = 130 mm,
dimensions of housing:
170 x 50 x 180 mm

DE500-2E Discharger

For easy, insulated charge transfer;
aluminium rod (L = 300 mm) mounted on and insulated from an acrylic rod

MB550-1E Electrometer amplifier, magnetic

Measurement accessory for detecting very small charges;
used, in combination with a measuring instrument having a range of 3 V or 3 mA, as an electrometer;
"IN"- safety jack for connecting a conducting sphere with plug;
grounding jack;
reset button; ON / OFF switch;
two safety jacks for connecting a measuring instrument;
LED displaying operating mode;
input voltage 12 V DC through hollow jack, supplied by external power supply 12 V / 2 A, P3130-1P;
dimensions: approx. 84 x 84 x 39 mm

DE722-1H Static voltmeter "inno"

Demonstration meter for measuring high electrostatic voltages;
unlike mechanical electroscopes, **this instrument delivers exact and clear quantitative readings as well as the polarity of the charge**;
the value measured can be frozen using the hold switch.

Technical data:
2 ½-digit LED display; digit height 26 mm
measuring range: 0 - 18.0 kV
reset button for resetting instrument to zero
accuracy: better than 2% for 0 - 10 kV
throw switch: ON / OFF
throw switch: measure (sample) - freeze measured value (hold)
measurement input provided by means of specially insulated 4 mm safety jack, 4 mm safety jack for ground connection
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm hollow DC jack for 6 V/500 mA external power supply P3120-6N
case: green ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 483 g

- Display of accurate quantities
- Indication of polarity

DE722-1C Coulomb Meter „inno"

Demonstration meter used in electrostatics for measuring charges;

Technical data:
3 ½-digit LED display;
digit height 26 mm
measuring range: ±1999nC
reset button for resetting instrument to zero

accuracy: better than 1%
droop rate: better than 5 digits / min
throw switch: ON / OFF
4 mm safety jacks: measurement input (IN) and common ground (COM)
power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm hollow DC jack for 6 V/500 mA external power supply P3120-6N
case: green ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 380 g

P3127-1V High-voltage power supply, 18 kV, "inno", magnetic

Continuously variable high-voltage power supply for experiments in electrostatics;

Output: 0 - + 18 kV, continuously variable, max. 0.5 mA

voltage indicator:
7-segment LED display, digit height 20 mm;
power supply: 4 x 1.5 V mignon cells (included)
or 5.5 mm hollow DC jack for 6 V / 500 mA external power supply P3120-6N
green ABS plastic case labelled in yellow,
10 strong neodymium magnets are inset in the rear panel for mounting the device magnetically
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 970 g

Recommended accessory:

P3120-6N Mains transformer 6 V DC / 500 mA
P3120-5B S-shaped assembly platform

DE525-3B Van de Graaff generator II

Used for generating very high DC voltages
in electrostatics experiments:

- Spark length up to 150 mm
  (even at high humidity)
- Conducting sphere with
  insulated handle included
- Motor- or hand-driven

Diameter of removable conducting sphere: 280 mm;
supplied with conductor sphere on support (D = approx. 100 mm, support L= approx. 300 mm), paper bush, pointed wheel and fixed-voltage transformer;
Input voltage: 230 V AC/50 - 60 Hz;
dimensions: 380 x 230 x 700 mm; mass: approx. 4.5 kg

Experiment: Charging the human body via a Van de Graaff generator

DE522-1F Paper bush

For demonstrating how charges of the same polarity repel each other, bush consisting of strips of paper (L = 210 mm, B = 10 mm), mounted on a 4 mm plug

DE522-2B Line of streamers

For displaying an electrical field; a number of strips of paper (L = 200 mm, B = 10 mm) attached to a rubber band (L = 350 mm), clasp at the ends of the band, may be mounted on conducting spheres with a diameter of 200 - 300 mm

DE519-1I Insulating mat

Rubber mat for insulating persons and apparatus from the ground;
dimensions:
400 x 400 mm

DE520-1W Pointed wheel

For demonstrating discharge from points;
four bent points on a bearing cup and a needle on a 4 mm plug;
diameter: 85 mm

DE523-1A Wimshurst machine

Electrical influence machine for generating very high DC voltages;

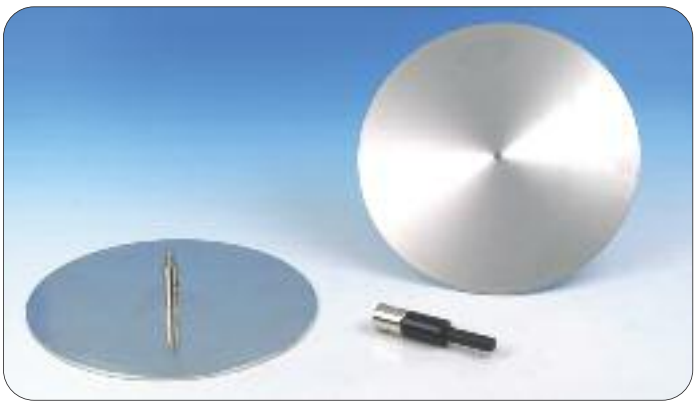
Spark length: max. 70 mm; voltage: max. 160 kV;

disc diameter: 300 mm;
dimensions: 350 x 200 x 390 mm

DE530-2K Hollow plastic sphere with metal surface and cord

For demonstrating electrostatic induction as well as the forces acting in an electrical field, very low-weight plastic ball with a metallic surface, D = 50 mm

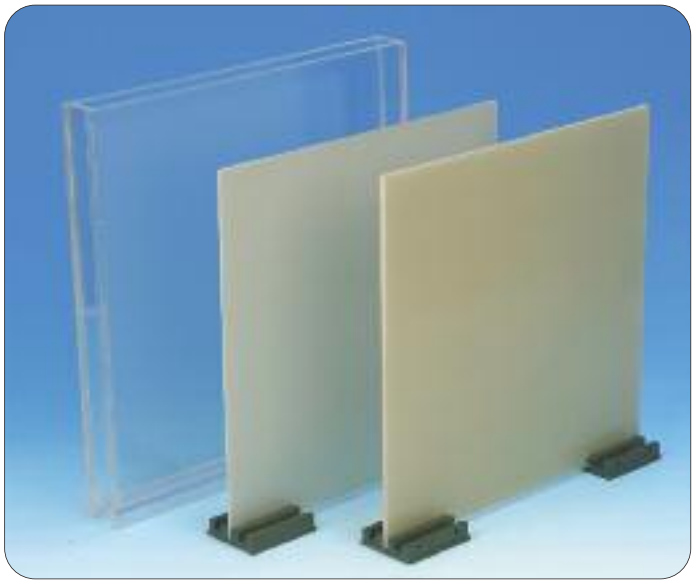
DE530-1K Capacitor plate on threaded rod, pair



Used as a capacitor in apparatus assemblies and in order to investigate the relationship between charge, voltage and capacitance;
two aluminium discs (D = 200 mm),
each mounted on a threaded rod and with a 4 mm jack;
may be mounted on screw post DS406-2N (not included)

DE531-1P Plate capacitor, large

Used as a capacitor in apparatus assemblies in order to investigate the relationship between charge, voltage and capacitance, as well as to measure dielectric constants;
two square aluminium plates with two 4 mm jacks, mounted on and insulated from their respective sliders;
for mounting on support stand bases using NTL universal profile rails;
plate size: 200 x 200 mm
(surface area = 400 cm²)



DE531-1D Dielectric plates

For use as dielectrics in plate capacitors;
two plastic plates of different thicknesses ;
dimensions: 200 x 200 mm

DE531-2K Dielectric cell

Cell for using water as a dielectric in plate capacitors;
dimensions: 240 x 240 x 28 mm

DG505-1H Connecting lead for high voltages

Extremely flexible silicon connecting lead with a double insulating jacket and two specially insulated 4 mm plugs;
cross-section: 1 mm²
jacket thickness: approx. 8 mm
length: 100 cm

Conducting spheres

For electrostatics experiments; plastic spheres galvanically coated with a metallic surface; with 4 mm plug

DE520-2I Conducting sphere, D = 25 mm

DE520-4K Conducting sphere, D = 50 mm

DE520-2K Conducting sphere, D = 80 mm

DE520-1B Faraday cup

For investigating the distribution of charge around a hollow metal body;
hollow aluminium cylinder,
with 4 mm plug;
height: 140 mm, diameter: 90 mm

DE515-1M Model car, metal

For examining the distribution of charge on a car (outside and inside);
model car with metal body and rubber wheels; one door removed to insert a conducting sphere on an insulating support;
dimensions: approx. 160 x 70 x 70 mm

DE515-1K Insulating rod, long

For examining the charge potential inside a model car;
insulating rod with 4 mm bushes on both fronts;
support rod length: 250 mm

Additionaly recommended:
DE520-2I Conducting sphere, D = 25 mm

DE536-1D Electrostatics cylinder

For demonstrating, with the aid of styrofoam beads, how charges are transported as well as how an air cleaner works;
acrylic cylinder with removable lid, 4 mm jack and point electrode;
may be mounted on the capacitor plate of DE530-1K or between the plates of capacitor DE531-1P
diameter: 200 mm; height: 60 mm

DE540-1A Styrofoam beads, set

Used with electrostatics cylinder DE536-1D for demonstrating "dancing" beads; diameter: 6 - 10 mm

DE540-2A Anti-static spray, tin

Used on the surface of materials to prevent interference caused by electrostatic charges; volume: 200 ml

DE521-4C "Cavendish" hemispheres

For use in setting up a spherical capacitor and, together with the 50-mm conducting sphere, for investigating the effect of electrostatic induction;
two plastic hemispheres galvanically coated with a metallic surface,
with 4 mm plug;
diameter: 80 mm

DE520-1K Conductor, cone-shaped

For demonstrating how the charge in a body moves toward the extremities; hollow, cone-shaped metal body, with a 4 mm plug for attaching to insulating support DE521-4S;
diameter: 50 mm; length: 100 mm

DE520-1F Faraday cage

Metal mesh cage with a hook, used to shield objects from electrical fields; diameter: 240 mm, height: 300 mm

DE520-1U Wire grid mat

Used as an additional shield with the Faraday cage; wire grid mat on a frame; dimensions: 320 x 320 mm

DE524-1F Field line apparatus set

For displaying electrical field lines using an overhead projector

Set consisting of:
Four acrylic plates with scratch-resistant electrode strips of various shapes; two 4 mm sockets on each plate; dimensions: 120 x 160 mm;
one dish surrounded by a metal electrode with a 4 mm socket, D = 90 mm

DE524-2R Castor oil, 100 ml, in a plastic bottle

DE524-2G Semolina grains, 100 ml, in a plastic bottle

Recommended power supply:

P3127-1V High-voltage power supply, 18 kV, "inno", magnetic

Experiment: Faraday cage at work

P9103-4KE Experiment manual Electrostatics, b/w booklet

Experiment topics:

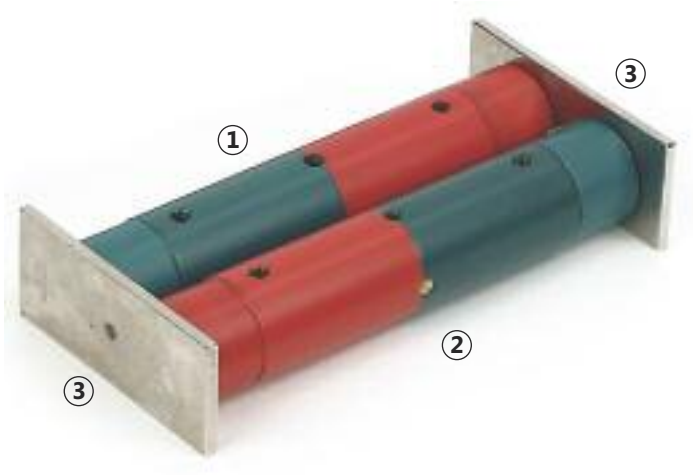
ESD 1.01	Electrical charging by means of friction
ESD 1.02	Two kinds of electrical charges
ESD 1.03	Display of both types of electrical charging (polarity tester)
ESD 2.01	Measuring electrostatic charge with the electroscope
ESD 2.02	Measuring electrostatic charge with the static voltmeter
ESD 2.03	Model of an electroscope
ESD 2.04	Neutralisation of electrical charges
ESD 2.05	Charging on conductor and non-conductor
ESD 3.01	Experiments using the Van de Graaff generator (5 experiments)
ESD 3.02	Experiments using the Wimshurst machine (5 experiments)
ESD 4.01	Electrostatic induction (4 experiments)
ESD 4.02	Location of a charge - Cavendish hemispheres
ESD 4.03	Location of a charge - Faraday cup
ESD 4.04	Faraday cage
ESD 4.05	Radius of curvature and charge concentration
ESD 4.06	Electrostatic wind - movement of charge to the point
ESD 4.07	Forces in the homogenous magnetic field (5 experiments)
ESD 5.01	Capacitance of a plate capacitor (2 experiments)
ESD 5.02	Influence of dielectrics on a plate capacitor

The majority of NTL magnets are made of neodymium. For the purposes of comparison here is the energy product (quality) of different materials for permanent magnets:

Material	Material grade	Energy product
Hard ferrite, sintered	(HF20 - 32)	approx. 25 kJ/m³
AlNiCo	(500)	approx. 34 kJ/m³
Samarium cobalt	(SmCo5)	approx. 160 kJ/m³
Neodymium iron boron	(NdFeB, N35)	approx. 260 kJ/m³

DE407-1C Button magnets large, pair, "neo"

Material: neodymium;
poles covered with red or green plastic cap;
H = 12 mm, D = 24 mm



①**DE411-1N** Bar magnet, with tapped hole, "neo"

Material: neodymium; poles covered with red or green plastic cap; central soft iron cylinder with tapped hole M6;
L = 126 mm, D = 24 mm

②**DE410-1N** Bar magnet with bearing cup, "neo"

Material: neodymium; poles covered with red or green plastic cap; central soft iron cylinder with bearing cups allows virtually friction-free pivoting on frame with pivot bearings DE420-2R, or bearing pin on base DE300-1N;
L = 126 mm, D = 24 mm

③**DE455-1N** Pole plates with pins, pair

Nickel-plated iron yokes; dimensions: 68 x 28 mm

DP410-2S Bar magnet, on support, "neo"

Material: neodymium;
poles covered with red or green plastic cap;
central soft iron cylinder,
permanently mounted support
(L = 35 mm, D = 10 mm);
total length = 68 mm, D = 24 mm

DE407-1A Button magnets small, pair, "neo"

Material: neodymium;
poles covered with red or green plastic cap;
H = 5 mm, D = 13 mm

DE420-2R Frame with pivot bearings on support

For demonstrating the magnetic field of a current-carrying conductor; may be used for mounting cylindrical bar magnet DE410-1N to pivot with little friction between the two needle bearings of the frame; the upper and lower brackets of the frame are insulated and have two 4 mm jacks each for connecting a power supply; dimensions: 160 x 65 mm; support: L = 70 mm, D = 10 mm

DE405-2R Tube for floating magnets

Acrylic tube (L = 240 mm) with a slot;
serves to guide two bar magnets (DE410/411-1N), when used as "floating magnets";

iron shield plate DE432-1E (D = 80 mm) may be used as a base

DE409-2U U-Magnet, large, "neo"

Material: neodymium;
poles are labelled red and green, with iron yoke, **inside distance between poles: 68 mm,**
arm cross-section: 30 x 10 mm;
free length of arms: 101 mm;
total length = 130 mm;
total width = 88 mm

DE412-1B Block magnets, pair, "neo"

Material: neodymium; poles covered with red or green plastic cap; soft iron block with M6 tapping at centre;
dimensions: 28 x 28 x 18 mm

DE456-1R Magnet holders, red-green, pair

For assembling a U-magnet on stand rails with variably spaced arms;
two metal holders,
red-green powder-coated, on sliders;
block magnets DE412-1B may also be secured in place using
set screw DE452-3N

U-magnet, variable

consisting of:

DS090-1K	1x	Claw base simple, L = 200 mm
DE456-1R	1x	Magnet holders, red-green, pair
DE412-1B	1x	Block magnets, pair

Use: Measuring the magnetic flux density of the variable U-magnet's field using teslameter DE722-1M

P3410-1K Bar magnet, round, 10 x 50 mm

Material: AlNiCO; poles labelled red and green;
D = 10 mm,
L = 50 mm

P3911-1L Pole plate SE, 60 x 25 mm

DE410-1M Bar magnets, round, 15 x 80 mm, pair

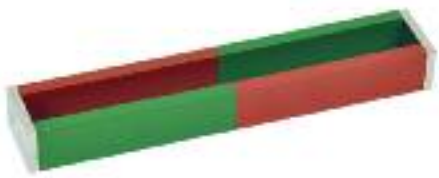
Material: AlNiCo, poles labelled red and green,
D = 15 mm,
L = 80 mm, with pole plates

DE409-2S Bar magnets, 80 mm, AlNiCo, pair

Material: AlNiCO;
poles labelled red and green,
two iron yokes;
supplied in styrofoam storage box;
dimensions: 80 x 20 x 6 mm

DE409-1S Bar magnets, 160 mm, AlNiCo, pair

Material: AlNiCO;
poles labelled red and green, two iron yokes;
supplied in styrofoam storage box;
dimensions:
160 x 20 x 6 mm



DE300-1D Pivot bearing on base

For rotatable mounting of friction rods and bar magnets;
plastic base with support mounted on low-friction needle bearing;
base diameter: 60 mm

DE460-1E Block magnet 82 x 42 mm

Material: ferrite;
magnetised according to height;
embedded in a red-green plastic casing for identifying the poles and protecting against breakage;
dimensions: 82 x 42 x 18 mm

DE420-1E Ring magnet

Material: ferrite;
embedded in a red-green plastic casing for identifying the poles and protecting against breakage;
outside diameter = 63 mm,
inside diameter = 30 mm

DE405-1H Base for floating magnets

Acrylic tube on a base;
accepts ring magnets DE420-1E;
height: 180 mm
(ring magnets not included)

DE400-1E Loadstone

Unfinished natural magnet;
weight: approx. 150 g
(comparable to a nut)

DE420-1P Magnetic needle, 100 mm

Steel needle with central bearing cup;
coloured poles;
L = 100 mm

DE420-1D Magnetic needle, demo

Steel needle with central bearing cap,
bent tips with red or green pole
markings;
L = 200 mm

DE300-1N Bearing pin on base

Steel needle mounted on an acrylic
base;
for rotatable mounting of magnetic
needles or cylindrical bar magnets;
height: 55 mm

DE420-2W Compass rose

For use, in combination with
the bearing pin on base and
magnetic needle or bar
magnet, in setting up a
demonstration compass;
plastic disc showing degrees
scale and compass rose;
D = 140 mm

Set up: Magnetic compass

DE420-1XS Plotting compass, D = 20 mm, set of 20

For selective recording of magnetic field lines;
20 fine-mounted, arrow-shaped magnetic needles in enclosed,
transparent plastic capsule, set in vacuum-formed cup; the
compasses can also be removed individually;
diameter of capsule:
20 mm,
length of magnetic
needle:
approx. 15 mm,
base plate external
dimensions:
approx.
145 x 120 mm

DE420-1XE Plotting compass, D = 20 mm

For selective recording of magnetic field lines;
fine-mounted, arrow-shaped magnetic
needle in enclosed, transparent plastic
capsule;
diameter of capsule: 20 mm;
length of magnetic needle: approx. 15 mm

DE422-1Z Plotting compass, "demo"

For selective recording of magnetic
field lines, highly recommended for
projection;
sensitively mounted magnetic
needle in oil-filled, transparent
plastic capsule;
diameter of capsule: 39 mm;
length of magnetic needle: 35 mm

P3410-5M Pocket compass

Magnetic needle, mounted
with very little friction, in a
black plastic case, transparent
cover, scale at bottom;
D = 40 mm

DE420-1K Compass

Simple field compass, oil-filled;
includes a sighting device,
mirror cover, transparent case
and carrying cord;
dimensions: 110 x 70 mm

DE420-2I Dip needle 02, Oerstedt - bracket

For determining the direction of the earth's magnetic field and for measuring magnetic inclination, as proof of the magnetic field in a current-carrying conductor;
very sensitively fine-mounted magnetic needle;
transparent round scale with 1° gradation;
mounted for horizontal turning; metal frame with two 4 mm bushes and transparent angle scale on front; mounted on large base plate with support rod;
dimensions: approx. 200 x 125 x 200 mm;
length of magnetic needle: 100 mm

DE421-2N Polarity indicator

For determining the lines of force around a magnetic body;
colour-marked magnetic needle, pivot-mounted in a bracket;
length of magnetic needle: approx. 100 mm

DE300-1S Iron filings

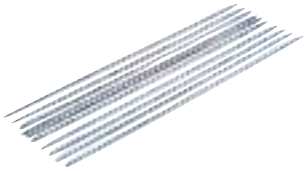
Plastic shaker with lid; volume: approx. 250 g

DE410-2E Iron fillings collector

For easily collecting iron powder, filings or nails with the aid of a strong ferrite magnet;
D = 70 mm, H = 180 mm

DE430-1S Knitting needles, set

Set of 10; material: nickel-plated iron, L = 200 mm



DP410-1N Nails, small, in box

For demonstrating the magnetic force of a permanent or electromagnet;
nails in impact-resistant box with lid;
contents: approx. 440 g

DE432-1E Shield plate, iron

Iron disc, nickel-plated; D = 80 mm

DE432-2A Shield plate, aluminium

Aluminium disc, D = 80 mm

DE432-2M Magnetic and non-magnetic material

Set of six metal discs, D = 25 mm
Materials: Al, brass, Cu, Fe, Pb, Zn

DS102-3S C-hook, threaded

DS412-2K Bead chain, short

Experiment: A magnet used as a compass

DE431-1S Steel rod

L = 240 mm, D = 10 mm

DE431-1W Soft iron rod

L = 240 mm, D = 10 mm

DE431-4S Threaded rods, set

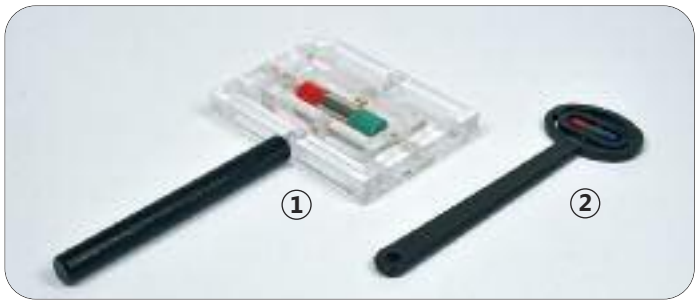
Threaded rods, set of 4; L = 60 mm, D = 10 mm

P3413-1P Magnetic field plate "compact"

For showing the shape of magnetic field lines around a permanent magnet; suitable for overhead projector; iron filings in a viscous medium; airtight in a sealed acrylic cuvette; dimensions: 155 x 90 x 10 mm

Recommended accessory:

2 pcs. **P3410-1K** Bar magnet, round, 10 x 50 mm
2 pcs. **P3911-1L** Pole plate SE, 60 x 25 mm
1 pcs. **P3410-1L** Support plate for bar magnets, transparent



①**P3410-2K** Magnetic field sensor, large, "neo"

For detecting the spatial distribution of magnetic fields; strong neodymium bar magnet, 10 x 38 mm; mounted on transparent gimbals; on metal support rod

②**P3410-2C** Magnetic field sensor, SE

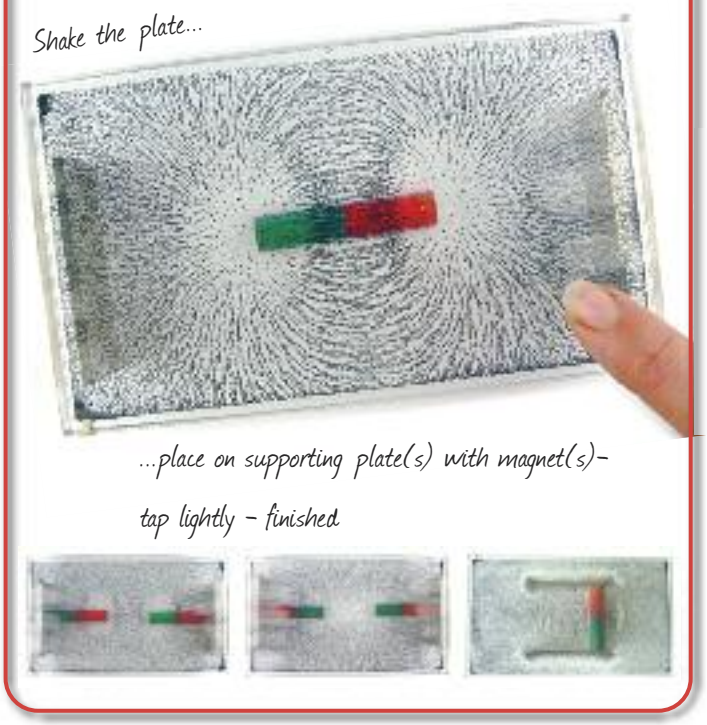
For detecting the spatial distribution of magnetic fields; small ferrite bar magnet, L = 19 mm; mounted on gimbals; with handle

DE420-3D Magnetic field model, three-dimensional

For spatially depicting a bar magnet's field; acrylic housing filled with a special liquid and iron filings; hole at centre for inserting a round bar magnet up to 15 mm in diameter; dimensions: 126 x 102 x 102 mm

Recommended magnet:
P3410-1K Bar magnet, round, 10 x 50 mm

This plate enables 'clean' experimenting, saving a large amount of time. It is very robust and therefore ideally suited to student experiments.



DW470-1R Axle for ring magnets

Holds two ring magnets DE420-1E for use as a magnet roll in experiments on the propagation of longitudinal waves or elastic collisions (NTL universal stand rails may be used as ball track); acrylic cylinder with two plastic rings (red and green) and two plastic caps (red and green) for fastening the ring magnets to the axle

Experiment: Propagation of longitudinal waves or elastic collisions

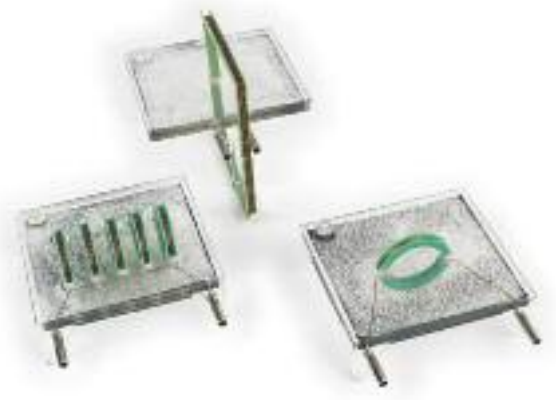
DE413-1S Rods for dia-, para- and ferromagnetism

Set of 3; L = 40 mm, material: nickel, acrylic, iron

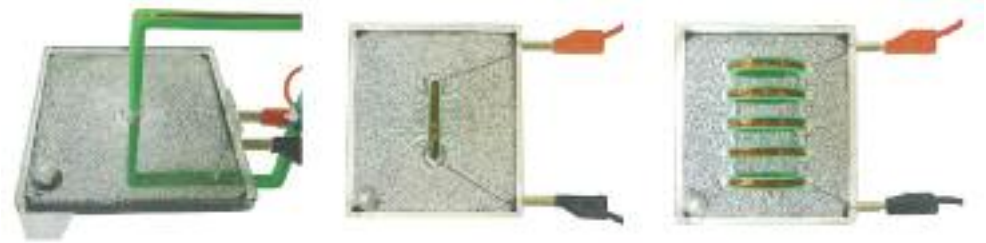
P3413-1L Magnetic field - conductor models, set of 3

For depicting the magnetic field surrounding current carrying conductors of various shapes, suitable for overhead projector; iron filings in a viscose medium, in a sealed, airtight acrylic cuvette;
3 conductor models, straight, looped and coiled in shape, embedded in temperature-resistant nylon profiles;
connector terminals for accepting 4 mm safety plugs;
projection surface dimensions: 106 x 106 mm

Recommended power supply:
P3120-1B Rechargeable battery, "inno", 6 V / 10 Ah

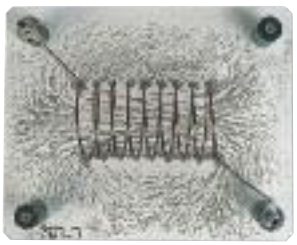


These models enable 'clean' experimenting, saving a large amount of time.



If the conductor models are supplied using a suitable battery or power supply unit, exceptional results can be obtained that can also be shown on a projector.

Conductor models for depicting the magnetic field around current-carrying conductors;
suitable for overhead projector; two 4 mm jacks for a power supply; dimensions: 185 x 150 mm



DE450-1A Straight conductor on acrylic base

DE450-1B Conductor loop on acrylic base

Additionaly recommended:

DE422-1Z Plotting compass "demo"

DE450-1C Coil on acrylic base

Coil with nine turns, diameter of one turn: 50 mm

DE450-2A Parallel straight conductors on acrylic base

DE420-2DN Magnet model, cubical

117 freely pivoting magnetic needles, mounted between 2 acrylic sheets, suitable for overhead projection;
additional acrylic supporting plate for objects to avoid magnetic resetting of the needles in case that very strong magnets are used;
length of magnetic needles: 10 mm;
dimensions:
150 x 150 x 40 mm;
(delivered without bar magnet)

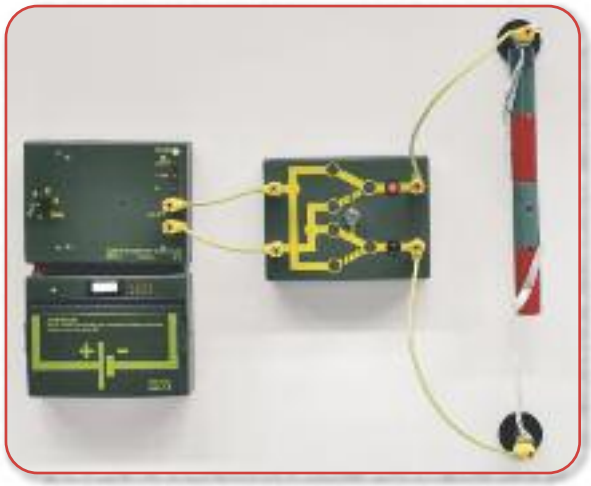
DE453-1H Helmholtz coils, pair

Pair of coils for generating a homogeneous magnetic field; insulated coils of wire encased in an acrylic frame on a support (D = 10 mm), spacing bracket with notches for placing the coils at a precise distance apart;
number of turns:
145 turns each;
max. current: 5 A;
diameter of coils:
approx. 300 mm

(Holders not included)

DE440-1M Metal band, 5 m

Flexible metal band conducting electricity, for use in experiments on the forces in parallel current carrying conductors or on current carrying conductors in motion within magnetic fields;
length: 5 m, width: 10 mm



Experiment: Force caused by a flexible current-carrying conductor within the magnetic field of bar magnets – magnetic panel assembly

DS406-1G Fork with pivots

Insulated u-shaped bracket fixed to a slider by means of a clamping screw; for pivotal mounting of bearing bridge DE454-2P; one of the aluminium arms contains a fixed needle bearing and a 4 mm jack (also suitable for safety plugs), while the other arm contains an adjustable, threaded needle bearing and a 4 mm jack;
length of arms: 94 mm;
width between the needle bearings: approx. 95 mm

DE454-2P Bearing bridge

Bridge and distributor, made of acrylic, with three pairs of 4 mm sockets; one hole and clamping screw for fastening it to a support rod 10 mm in diameter; bearing cups at the ends of the bridge allow it to be mounted to rotate on fork with pivots DS406-1G;
dimensions: 92 x 20 x 20 mm

DE453-1S Coil with 150 turns

Laboratory coil with 150 turns, mounted on an acrylic cylinder, contains two bearings cups and two 4 mm jacks on the side; suitable for rotatable mounting in fork with pivots DS406-1G
max. current: 5 A;
diameter: 70 mm

DE451-3A Aluminium rod with plug, L = 200 mm, D = 6 mm

For use in pairs in order to suspend and conduct electricity to the coil with 150 turns (DE453-1S) or to the ring with gap (DE451-2O) mounted on bearing bridge DE454-2P

DE451-2A Aluminium rod with plug, L = 30 mm, D = 6 mm

For use in pairs in order to conduct electricity to the coil with 150 turns (DE453-1S) mounted on bearing bridge DE454-2P

DE451-2B Rolling bar, aluminium

For demonstrating Lorentz force; the direction of current causes the direction of movement;
D = 8 mm, L = 80 mm

DE451-2O Ring with gap (for Lenz's law)

For demonstrating the force caused by a current-carrying conductor in a magnetic field;
rigid aluminium ring with a gap, including two 4 mm jacks;

dimensions:
60 x 60 mm

DE451-2G Ring, complete (for Lenz's law)

For demonstrating the braking effect of a short-circuit ring in a magnetic field;
rigid, closed aluminium ring with two 4 mm jacks;

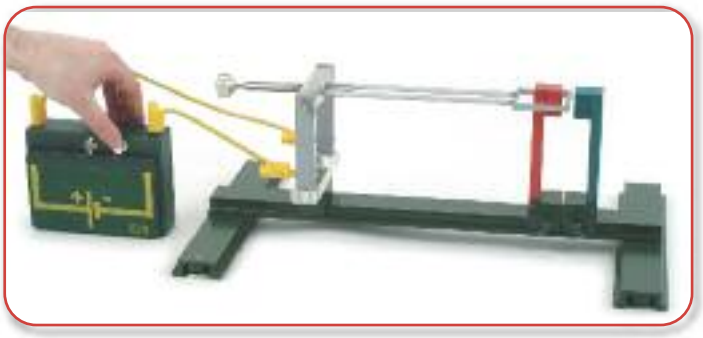
dimensions:
60 x 60 mm

DE452-3N Clamping screw, large

For use as an adjustable weight compensation in combination with threaded rods from DE431-4S;
M6 thread;
diameter: 24 mm

DE411-1S Yoke on support

Used to anchor U-shaped electromagnets, support (10 x 35 mm) with tapped hole for screwing in C-hook DS102-3S when suspending weights;
dimensions:
120 x 28 x 10 mm



Experiment: Force caused by a current-carrying conductor in a magnetic field

DE452-1D Moving iron meter, coil accessory

For demonstrating how a moving iron meter works;
may be inserted in coils DE453-ff;
pointer mounted to rotate in an acrylic cylinder;
length: 65 mm
diameter: 30 mm

DS407-1Z Pointer with plug

Can be attached to the coil with 150 turns;
aluminium tube with a 4 mm plug at one end and the other end pointed;
L = 84 mm, D = 6 mm

DS407-1S Scale on support

For indicating the relative position of the pointer with plug DS407-1Z;
plastic base with printed scale on support (35 x 10 mm);
dimensions: 140 x 74 mm

Experiment: Moving coil

Experiment: Model of a moving iron meter

1 DE451-1S Bell gong, mounted

For assembling a big sized model electric bell;
bell gong (D = 70 mm) permanently mounted on an aluminium bracket with two 4 mm plugs;
bracket length: 80 mm

2 DE451-1K Contact pin on slider, short

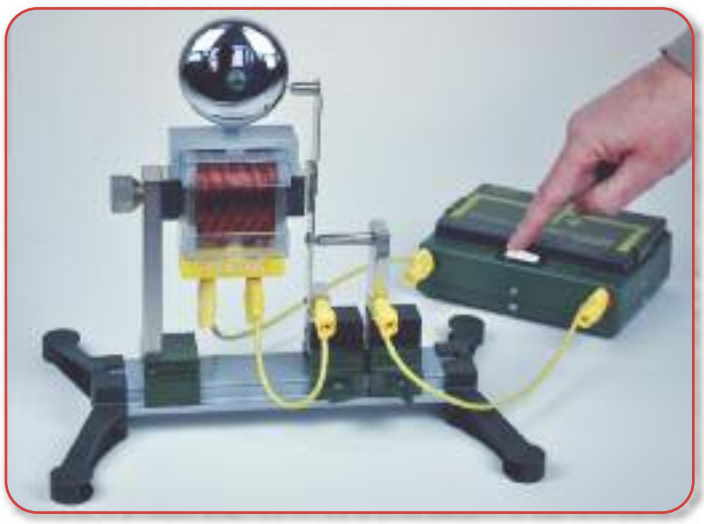
For assembling a model relay with a make contact; metal arm with short pin and wolfram contact; mounted on a sliding saddle;
pin length: 6 mm

3 DE451-1W Striker on slider

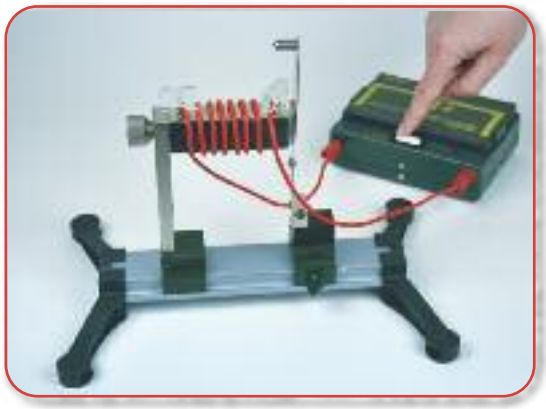
For assembling a model relay with a break and a make contact or a model electric bell; length: 185 mm, width: 25 mm

4 DE451-2L Contact pin on slider, long

For assembling a model relay with a break contact or a model electric bell; metal arm with pin and wolfram contact; mounted on a sliding saddle; pin length: 39 mm



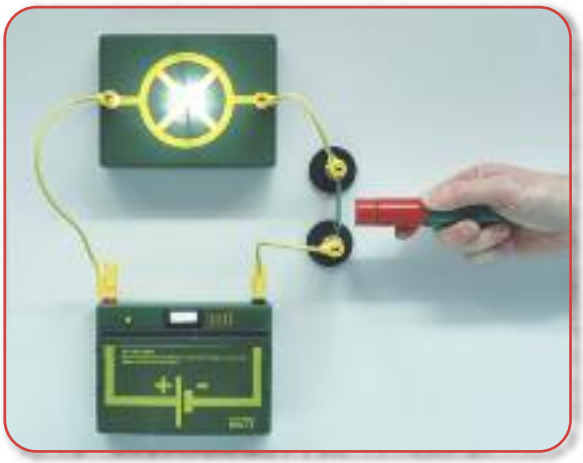
Experiment: Model of an electric bell



Experiment: Principle of the electromagnet

DE451-1R Reed relay

Make-contact (contactor) is encased in a glass tube, exposed wire ends may be clamped into screw posts DS406-2N or crocodile clips; length: 65 mm, tube diameter: 5 mm



Experiment: Model of a Reed relay - contactor (make-contact) closed by means of a bar magnet

P3711-5A Carbon granule microphone, "compact" model

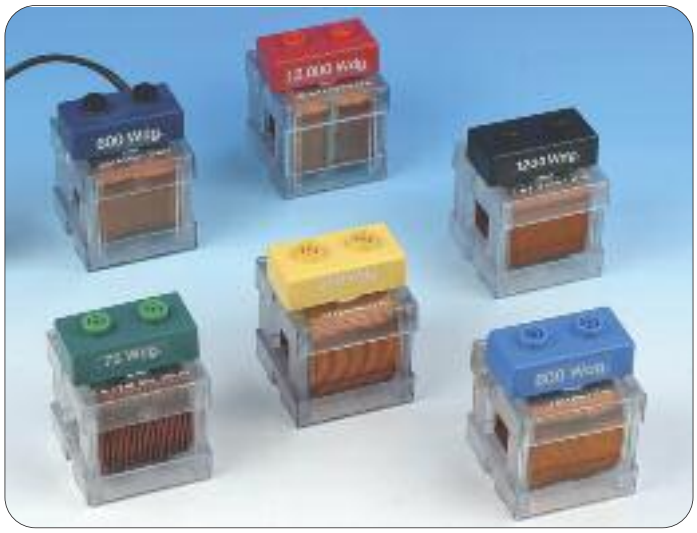
For demonstrating how a carbon granule microphone works; transparent, elastic, plastic case filled with carbon granules and sealed with a lid; two permanently mounted 4 mm jacks on the sides; dimensions: 65 x 47 x 22 mm

DE451-1L Flat spring, long, with pin bushing

For demonstrating the principle of a speaker; steel flat spring with two slits and central sleeve for 4 mm plug; dimensions: 300 x 25 mm

Laboratory coils

Coils encased in transparent high-impact plastic; capable of sustaining heavy loads; connection by way of 4 mm safety jacks, embedded in coloured lids, which prevent bodily contact; individual specifications such as number of turns, direction of the winding, effective resistance, inductivity and the maximum continuous current are given on the coil; opening 31 x 31 mm



DE453-1B Coil "demo" with 75 turns, green

Max. current: 15 A; effective resistance: 0.75 Ohm;
inductivity: 0.13 mH

DE453-1C Coil "demo" with 300 turns, yellow

Max. current: 5 A; effective resistance: 1.3 Ohm;
inductivity: 3 mH

DE453-1D Coil "demo" with 600 turns, blue

Max. current: 2 A; effective resistance: 4 Ohm;
inductivity: 10 mH

DE453-1E Coil "demo" with 1200 turns, black

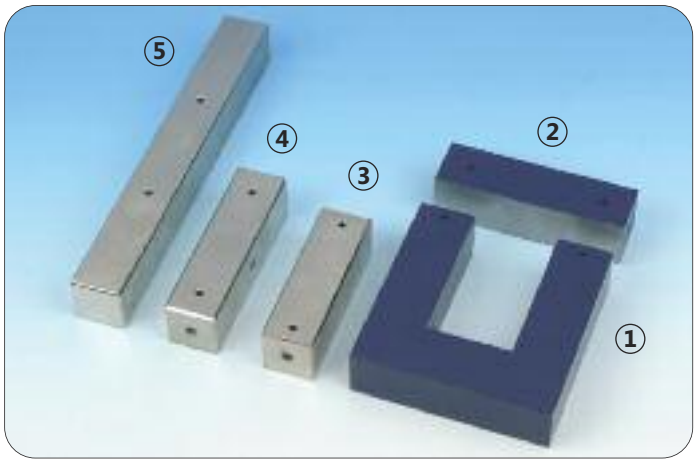
Max. current: 1 A; effective resistance: 17 Ohm;
inductivity: 38 mH

DE453-1F Coil "demo" with 12000 turns, red

Transparent plastic case prevents contact with the coil winding;
max. current: 100 mA; effective resistance: 1 kOhm;
inductivity: 4 H

DE453-1W Coil for mains power, 600 turns, blue

Transparent plastic case prevents contact with the coil winding;
integrated overheating protection; permanent, two-pole power cord with Europlug for connection to 230 V / 50 - 60 Hz;
fuse holder with fine wire fuse;
max. current: 2 A;
effective resistance: 4 Ohm;
inductivity: 10 mH



1 DE452-2B U-shaped core, laminated

For a transformer assembly demonstration;
welded transformer plates, powder-coated, with polished front surfaces;
protruding arm length: 70 mm; arms 45 mm apart;
cross-section: 30 x 29 mm; dimensions: 105 x 110 x 30 mm

2 DE452-3B Iron core, short, laminated

Used as a yoke for laminated u-shaped cores; welded transformer plates with a polished contact surface;
powder-coated; cross-section: 30 x 29 mm, length: 105 mm

3 DE452-1N Iron core, solid, L = 92 mm

Rectangular steel core for coils "demo";
two tapped holes on the side for attaching to red-green magnet holder (DE456-1R) or plain metal magnet holder (DE456-1N) using DE452-3N clamping screw; two 4 mm holes for fixing a mounted coil using flat plugs (DE454-1F);
cross-section: 28 x 28 mm; length: 92 mm

4 DE452-2N Iron core, solid, L = 105 mm

Designed like DE452-1N, but 105 mm long

5 DE453-3N Iron core, solid, L = 216 mm

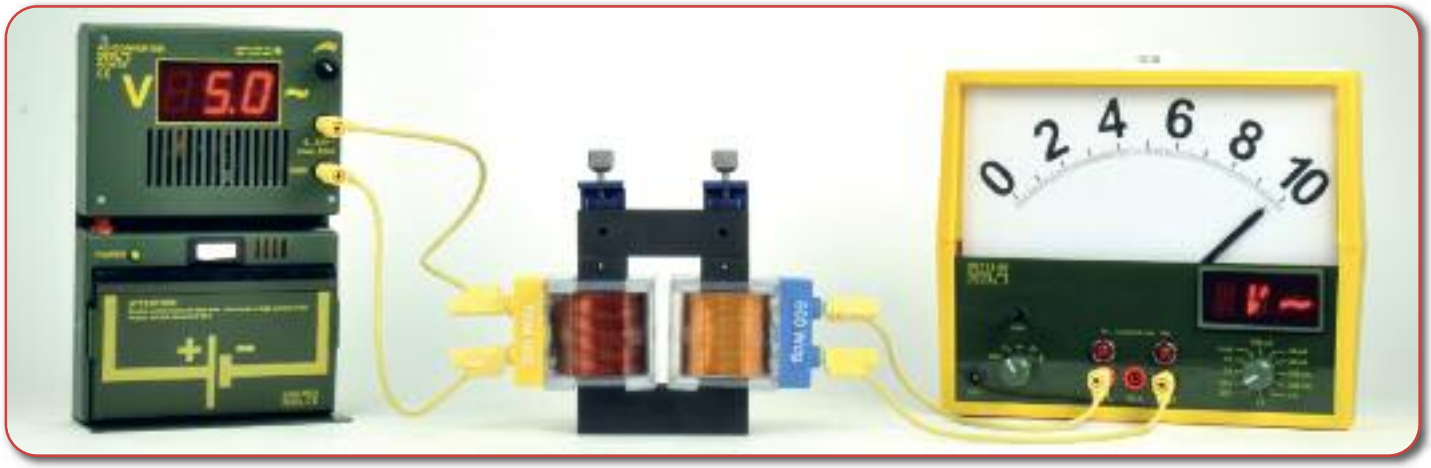
Designed like DE452-1N, but 216 mm long

DE452-4B Vice grips

For securing an iron core on a U-shaped core;
aluminium L-profile with a pin to be inserted in the U-shaped core and a screw for clamping the iron core to the U-shaped core
(2 vice grips required per U-core)

DS500-2G U-shaped core holder on saddle

For securing a U-shaped core on NTL support bases;
U-shaped aluminium profile with a clamping screw, on sliding saddle;
powder-coated



Experiment: Transformer not under load

DS407-2G Coil holder with plug pins

For holding a coil with an inserted iron core;
aluminium U-bracket on support,
D = 10 mm, green powder-coated,
two 4 mm plug pins for holding coils DE453-ff with iron cores DE452-ff inserted, two clamping screws for fixing the coils in place;
dimensions: 80 x 80 x 25 mm

DS407-3G Coil holder with slot

For holding a coil without an inserted iron core;
aluminium U-bracket on support,
D = 10 mm, green powder-coated,
two clamping screws for fixing the coils in place, additional gap in the lateral wall for holding a coil with iron core sideways;
dimensions: 80 x 80 x 25 mm

DS407-1G Fork with plugs

May be used to allow coil with inserted iron core to rotate in pivot bearings DS402-ff;
narrow aluminium U-bracket on support, with two 4 mm plug pins;
dimensions: 80 x 28 x 25 mm

DS407-1M Fork with plugs and screw

May be used for fixing a bar magnet (e.g. DE411-1N), to rotate in pivot bearings DS402-ff;
narrow aluminium U-bracket on support, with two 4 mm plug pins and a long clamping screw;
dimensions: 80 x 28 x 25

DE456-1N Magnet holders, plain metal, pair

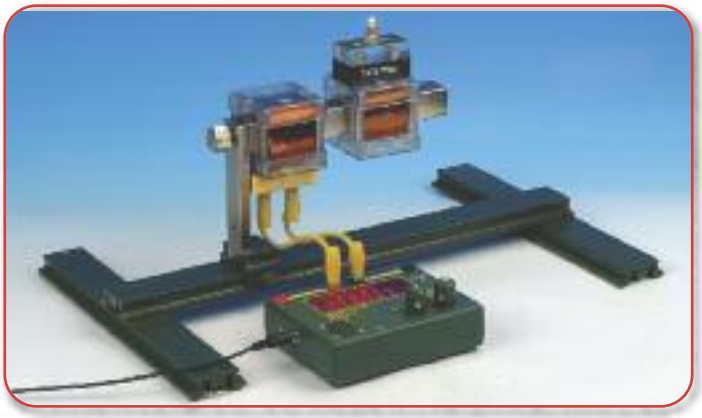
Two plain metal holders mounted on sliders,
with holes for fastening solid or laminated iron cores by means of clamping screws DE452-3N;
height: 124 mm, width: 28 mm

DE452-3N Clamping screw, large

For use as an adjustable weight compensation in combination with threaded rods from DE431-4S;
M6 thread; diameter: 24 mm

DE454-1F Flat plug

For fastening coils in place on iron cores,
plate 6 mm in width with a 4 mm plug pin



Experiment: Energy transfer by way of induction

1 DE453-1A Coil with 5 turns

High-current coil for generating very large amounts of current, in order to melt metals by induction heat or to spot weld sheet metals;
two 4 mm holes, with knurled head screws for securing in place iron nails up to 4 mm in diameter, on support (10 x 35 mm) for fastening the coil to sliding saddles;
max. current: 120 A

2 DE453-2A Sheet metal strips, set

For demonstrating spot welding using the coil with 5 turns (DE453-1A);
set of 20;
dimensions: 60 x 20 mm

3 DE300-1F Iron nails, set

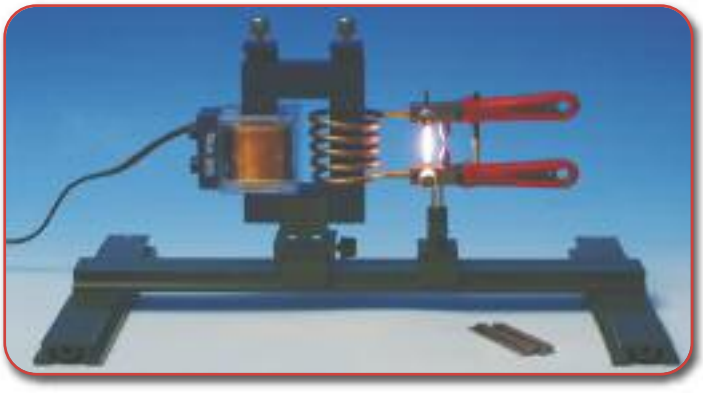
For experiments in melting metals using the coil with 5 turns (DE453-1A); Set of 20; length: 80 mm

4 DE453-2S Melting groove on support

Used as a secondary coil with one turn in high-current experiments in melting metals;
circular aluminium groove mounted on a support;
D (inside) = 43 mm, L = 240 mm

5 DE453-2B Rings of tin

Material to be melted in melting groove DE453-2S;
set of 5



Experiment: High-current transformer - melting an iron nail

DE453-9L Long-distance line, set of 2

Two resistance wires with black plastic insulation;
exposed wire ends may be clamped into screw posts DS406-2N or crocodile clips;
length: approx. 60 cm

DE453-3A Light bulb socket, E10, for coils

For induction experiments involving rotating coils;
acrylic block with E10 socket and two 4 mm plug pins

Experiment: Creation of induced voltage in a coil

DE453-3B Holder for tubular fluorescent lamp

For demonstrating the opening and closing current on the transformer;
acrylic block with two spring clamps and two 4 mm plug pins

Additionaly recommended:
P3320-9B Fluorescent lamp SE

DE455-2R Free-fall tube, acrylic, L = 250 mm

For use in induction experiments, in connection with button magnets DE407-1C or bar magnets DE410-1N or DE411-1N;
L = 250 mm, D = 26/30 mm

DE459-1L Induction flashlight

An LED flashlight requiring no batteries - it charges when shaken! Based on Faraday's law of induction, shaking the flashlight causes a magnet to pass back and forth through a coil, thus charging up a capacitor; 30 seconds of shaking provide five minutes of light; transparent, high-impact, waterproof housing; highly visible LED;
dimensions: 285 x 54 mm

DE453-3L Coil with 50 turns

For measuring the strength of the magnetic field on a coil of differing winding densities;
coil around acrylic tube, winding density may be varied by means of a slider, with a 4 mm socket;
max. current: 10 A, length: 495 mm

DE453-4S Induction coils, set of 3

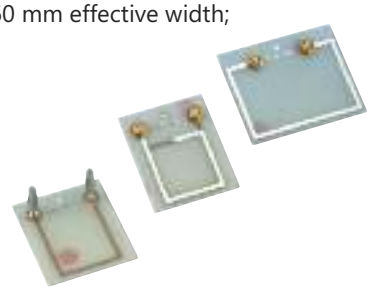
For quantitative induction experiments in combination with the coil with 50 turns DE453-3L;
coil length: 130 mm each;

Set consisting of:
1x Coil with 150 turns - 6 cm² cross-sectional area;
1x Coil with 150 turns - 12 cm² cross-sectional area;
1x Coil with 3 x 50 turns - 18 cm² cross-sectional area;
connection: 4 mm safety jacks on each coil

DE451-2S Circuit boards for current balance, set of 3

For demonstrating the force (Lorentz force) of a magnetic field acting on a current-carrying conductor;

Set consisting of:
1x Circuit board with 1 turn, 30 mm effective width;
1x Circuit board with 2 turns, 30 mm effective width;
1x Circuit board with 1 turn, 60 mm effective width;
connection: two 4 mm plugs



DE455-1N Pole plates with pins, pair

Nickel-plated iron yokes;
may be placed on
block magnets DE412-1B;
dimensions: 68 x 28 x 2 mm

Experiment: Current balance with a variable u-magnet, for measuring Lorentz force as a function of amperage, magnetic flux density and conductor length - magnetic panel assembly

DE454-2N Pole shoes, pair

For assembling within limited space an electromagnet with a homogeneous magnetic field, may be placed on a u-shaped core; nickel-plated iron cores with smooth front surfaces;
front surface: 1.5 cm², length: 50 mm

DE455-1P Pole plates, pair

Especially suited to assembling a current balance using electromagnets, for generating a homogeneous magnetic field; may be placed on u-shaped cores; nickel-plated iron core with smooth front surfaces (68 x 28 mm)

DE451-5A Current balance bracket

To demonstrate the Ampere - definition with the straight conductor DE451-6A; for minimum-friction rotatable mounting the bracket is inserted into the bearing bracket DE454-2P, and this is supported in the fork with pivot DS406-1G; aluminium bracket with two 4 mm plugs, L = 300 mm

DE450-3S Eddy current (Waltenhof) pendulum plate

For demonstrating how eddy currents brake the motion of variously shaped bodies within the magnetic field; aluminium plate, one half slotted, with a tapped hole for screwing in the pendulum rod DE450-1N; dimensions: 104 x 78 x 6 mm

DE450-1N Pendulum rod, L = 230 mm

Metal rod (D = 4 mm) with a threaded end for screwing into the Waltenhof pendulum plate; the other end is tapered to a diameter of 10 mm, so that it may be fixed into a slider-mounted pivot bearing with a through hole (DS402-3B); length: 230 mm

Experiment: Eddy current pendulum within the magnetic field of the variable U-magnet

DE453-3T Thomson ring

Quadratic aluminium tube; inner dimensions: 30 x 30 mm

Experiment: Magnetic (Thomson) cannon

DE454-5A Eddy current tube

Slotted aluminium tube for demonstrating Lenz's law; the magnetic field of a magnet in motion within the tube causes an opposing force; the slit in the tube allows the falling body to be observed; length: 500 mm

required accessory:

DE407-1C Button magnets large, pair, "neo"

Material: neodymium, H = 12 mm, D = 24 mm

DE454-5F Free-fall body

For comparisons with the round button magnet; iron cylinder with tapped hole, nickel-plated; D = 25 mm

DE740-2M Motor / Generator unit, demo

Large, ready-to-use working model of a motor / generator. Thanks to the open front design, students can clearly see how the parts of the model work even from a large distance. Power is supplied by elastic carbon brushes on the commutator or slip rings.
The removable rotor (length: 356 mm) runs on two ball bearings. On the bottom there is a large drive pulley with a crank and belt.
Comes with two plastic-coated plate magnets, 82 x 42 x 18 mm.
Dimensions: 360 x 110 x 180 mm

My rotor is 356 mm long

consisting of the following parts:

DE741-1M 1x Motor / Generator unit, demo, ground plate

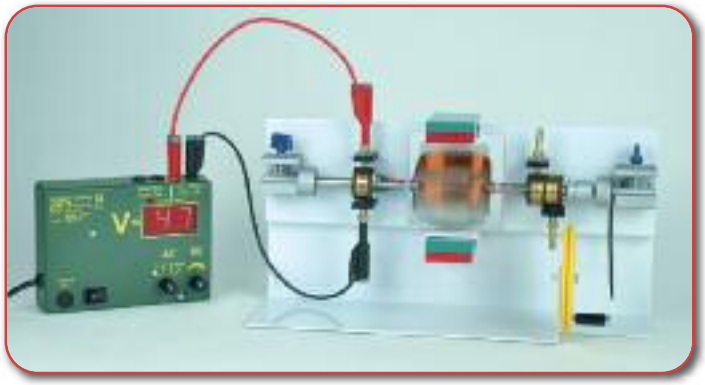
With brushes and boss heads for mounting the rotor, drive pulley with belt

DE460-1A 1x Two-pole rotor

For assembling functional models of electric machines; double T-shaped anchor piece, with an iron core, mounted on a metal shaft with ball bearings; two solid, brass slip rings; two-piece brass collector (commutator); total length: 356 mm

DE460-1E 2x Block magnet 82 x 42 mm

Strong ferrite magnet, embedded in a red-green plastic casing; dimensions: 82 x 42 x 18 mm



Experiment: Electric motor with two pole rotor

P3806-1M Motor / Generator model "compact"

Small, compact working model of an electric motor/generator. The open design permits transparent display of the functions.
Motor: The permanent magnet can be replaced with an electromagnet, enabling operation with DC and AC. Naturally it is also possible to run the model either as a series or as a shunt motor.

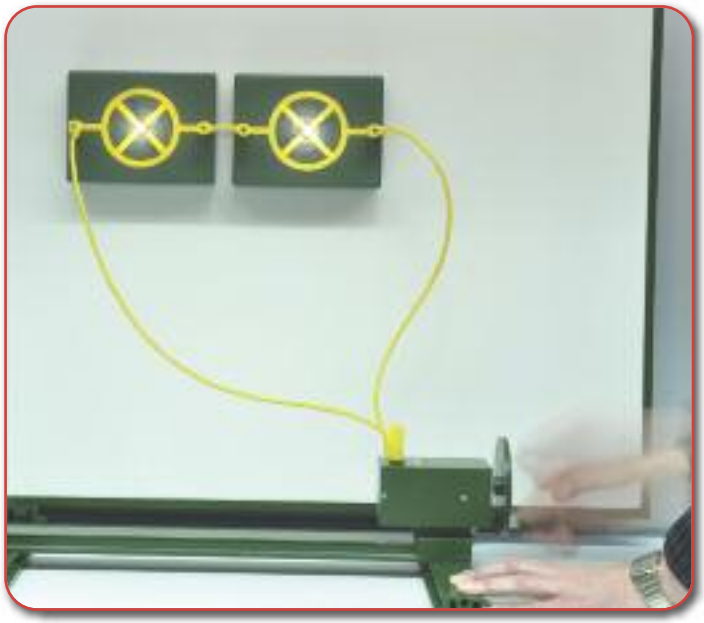
Voltage supply: DC mode: 1.5 - 5 V: AC mode: 6 - 9 V
Generator: As there is a drive belt connected to the base plate, this model can also be used as a generator. The voltage being generated can be read on both 4 mm bushes.
Dimensions: 140 x 90 x 100 mm

DS403-1G Geared motor

Electric motor with metal gears and high torque in aluminium case; drive shaft with permanently mounted aluminium pulley with groove and M6 tapping for attaching crank pin when used as a generator.

Drive pulley
diameter: 100 mm;
green powder-coated printed with circle sectors in yellow;
case mounted on sliding saddle of special aluminium profile with clamping screw for mounting and fastening onto large support base rail support or stand rails

Nominal voltage: 6 V DC (3 - 12 V)
Current consumption idling: 570 mA DC
Speed: approx. 0 - 250 rpm
Case dimensions: 128 x 60 x 60 mm



Experiment: Work and power of a generator, light bulbs wired in series and parallel

DS402-2N Crank pin, L = 50 mm

Solid metal pin with M6 thread and plastic roller used as a handle;
15 mm in diameter, length: 50 mm

P3821-1G Hand generator Profi, with cable

Simple DC power supply, conversion from mechanical to electrical energy;
high quality DC motor design with transmission in transparent housing;
sturdy drive crank;
cable with two 4 mm-plugs;
voltage output:
0 - 4 V DC

DE460-1F Bicycle dynamo

Classic model of a bicycle dinamo;
additional two 4 mm bushes to connect with connecting leads;
drive pulley with groove, on rod

DE723-1W Wattmeter "inno"

Demonstration instrument for measuring power in low-voltage circuits;

Technical data:
Display: 3 ½-digit LED display; digit height 26 mm
Types of measurement: true power (W), work/energy (Ws)
measurement limits: 20 V_{eff}, 2 A_{eff}
accuracy: better than 1.5%
Input: 4 mm safety jacks (pair)
power supply: 4 x 1.5 V mignon cells (included)
or 5.5 mm hollow DC jack for 6 V / 500 mA
external power supply P3120-6N

case: green ABS plastic with yellow labelling
dimensions: approx. 160 x 120 x 45 mm
weight: approx. 450 g

ELECTRICITY S1 “inno“

DE718-1SE Experiment manual "Electricity S1 - inno", booklet

DE718-1CE Experiment manual "Electricity S1 - inno", CD-ROM

Basic circuits, conductors and non-conductors
ELI 001 Electrical circuits
ELI 002 Double-throw switches
ELI 004 Conductors and non-conductors - solids
ELI 005 Voltage
ELI 006 Voltage sources in series circuits
ELI 007 Voltage sources in parallel circuits
ELI 008 Terminal voltage
ELI 009 Voltage drop across a light bulb
ELI 010 Amperage
ELI 011 Voltage sources in series circuits – short-circuit current
ELI 012 Voltage sources in parallel circuits - short-circuit current
ELI 013 Voltage sources in series circuits - amperage measurement
ELI 014 Voltage sources in parallel circuits - amperage measurement
ELI 017 The human body as an electrical conductor
ELI 019 Closing a circuit by grounding - electrical resistance

Electrical resistance
ELI 020 Ohm's law
ELI 021 Application of Ohm's law
ELI 022 Measuring resistance with an ohmmeter
ELI 023 Resistance of wires
ELI 025 Iron wire is not an ohmic resistor
ELI 026 Iron wire is a PTC conductor
ELI 027 A light bulb is a PTC conductor
ELI 028 Ohmic resistors in series circuits
ELI 029 Ohmic resistors in parallel circuits
ELI 030 Resistors in mixed circuits
ELI 031 Voltage divider
ELI 032 Variable resistor
ELI 033 Model of a potentiometer
ELI 036 Regulating lighting using a potentiometer
ELI 037 Model of a fader
ELI 038 Potentiometer not under load
ELI 039 Potentiometer under load
ELI 040 Light bulbs in parallel circuits (loads)
ELI 041 Light bulbs in series circuits
ELI 042 Internal resistance of a voltmeter
ELI 043 Internal resistance of an ammeter
ELI 044 Internal resistance of a voltage source
ELI 045 Expanding the measuring range of a voltmeter
ELI 046 Expanding the measuring range of an ammeter
ELI 047 Wheatstone bridge circuit

Thermal effects of electrical current - heat energy from electrical energy
ELI 048 Converting electrical energy into heat energy
ELI 049 Heat build-up with various thicknesses of wires
ELI 050 Short circuits are a fire hazard
ELI 051 Fuses prevent fire hazards
ELI 052 The incandescent effect of a filament
ELI 055 Model of a bi-metallic fuse
ELI 056 Bi-metallic thermostat
ELI 057 Model of a bi-metallic fire alarm

Work and power
ELI 059 Work and power of electrical current
ELI 061 Model of an immersion heater (electricity at work)
ELI 065 Mechanical work and power of electrical current

Chemical effects of electrical current - electrochemistry
ELI 066 An electrochemical cell
ELI 067 Voltaic cell

Magnetic effect of electrical current
ELI 073 Creating a magnet with the aid of electrical current
ELI 074 Oersted's experiment (electrical current creates a magnetic field)
ELI 075 Magnetic field line patterns
ELI 077 Magnetic field of a current-carrying coil
ELI 078 Determining the poles of a current-carrying coil using a permanent magnet
ELI 079 Magnetic force of a current-carrying coil
ELI 082 Magnetic force of a current-carrying coil depending on amperage
ELI 083 Magnetic force of a current-carrying coil depending on number of turns
ELI 088 The principle of the electromagnet
ELI 091 Opening and closing a circuit with the aid of a bar magnet
ELI 092 The Reed relay

Uses of electromagnetism
ELI 093 Model of a relay with break-contact
ELI 094 Model of a relay with make-contact
ELI 095 Model of a relay with break- and make-contact
ELI 096 Wagner's hammer
ELI 097 AC buzzer
ELI 098 Electric bell

Kinetic energy from electrical energy
ELI 104 A current-carrying coil in a magnetic field - moving coil
ELI 109 Forces between parallel current-carrying conductors
ELI 114 Principle of an electric motor
ELI 115 How slip rings work
ELI 116 How commutators work
ELI 117 Simple electromotor with two-pole rotor

Electroacoustics
ELI 124 How an electrodynamic loudspeaker works - sound generation
ELI 125 How an electrodynamic microphone works

Electromagnetic induction
ELI 128 Induced voltage in conductor loops
ELI 129 Creation of induced voltage in a coil
ELI 130 Interaction of a fixed coil and a moving magnet as well as a fixed magnet and a moving coil
ELI 131 Dependence of induced voltage on the number of turns of a coil
ELI 132 Dependence of induced voltage on the velocity of movement
ELI 134 Induced voltage and shunting
ELI 135 Energy transfer and induction
ELI 155 Electromagnetic induction - periodic changes in the magnetic field
ELI 156 Interaction of a rotating magnet and a rotating coil
ELI 158 Bicycle dynamo
ELI 160 Simple AC generator
ELI 164 DC motor with two-pole rotor
ELI 165 DC generator under load
ELI 170 A coil under DC voltage
ELI 175 A coil under AC voltage
ELI 177 How a transformer works
ELI 178 Voltage transformation in a non-loaded transformer
ELI 181 Amperage is also transformed
ELI 186 Melting nails
ELI 187 Arc wielding
ELI 188 Model of an induction smelting furnace
ELI 189 Magnetic (Thomson) cannon

Conversion of energy
ELI 192 Generator - work and power
ELI 195 Converting mechanical energy into thermal energy

ELECTRICITY S2 “inno“

DE718-2SE Experiment manual "Electricity S2 - inno", booklet

DE718-2CE Experiment manual "Electricity S2 - inno", CD-ROM

Basic circuits, conductors and non-conductors
ELI 003 Two-way circuits
ELI 015 Conductors and non-conductors - liquids
ELI 016 Conductivity of gases
ELI 018 The human body in contact with water as an electrical conductor

Electrical resistance
ELI 024 Specific resistance of wires
ELI 034 Sliding resistor as a variable barrier resistor
ELI 035 Sliding resistor as a variable voltage divider

Thermal effects of electrical current - heat energy from electrical energy
ELI 053 Overloading causes fire hazards - fuses
ELI 054 Model of a hot-wire instrument
ELI 058 Principle of the thermocouple element

Work and power
ELI 060 Power of an electric motor
ELI 062 Heat radiation and amperage
ELI 063 Thermal equivalent of electricity
ELI 064 Water equivalent

Chemical effects of electrical current - electrochemistry
ELI 068 Electrolysis
ELI 069 Galvanising
ELI 070 Lead battery
ELI 071 An electrolytic rectifier
ELI 072 Voltage experiment series

Magnetic effect of electrical current
ELI 076 Force caused by a flexible current-carrying conductor within the inhomogeneous magnetic field of a bar magnet
ELI 080 Effect of the magnetic force of a current-carrying coil
ELI 081 Mutual effect of a permanent magnet and an electromagnet on each other
ELI 084 Measuring the magnetic field of a current-carrying coil
ELI 085 Measuring the magnetic field of a current-carrying coil as a function of amperage
ELI 086 Measuring the magnetic field of a current-carrying coil as a function of the number of turns
ELI 087 Measuring the magnetic field of a current-carrying coil as a function of the coil's length
ELI 089 An electromagnetic force apparatus
ELI 090 Model of a hoisting magnet

Uses of electromagnetism
ELI 099 Model of a magnetic fuse

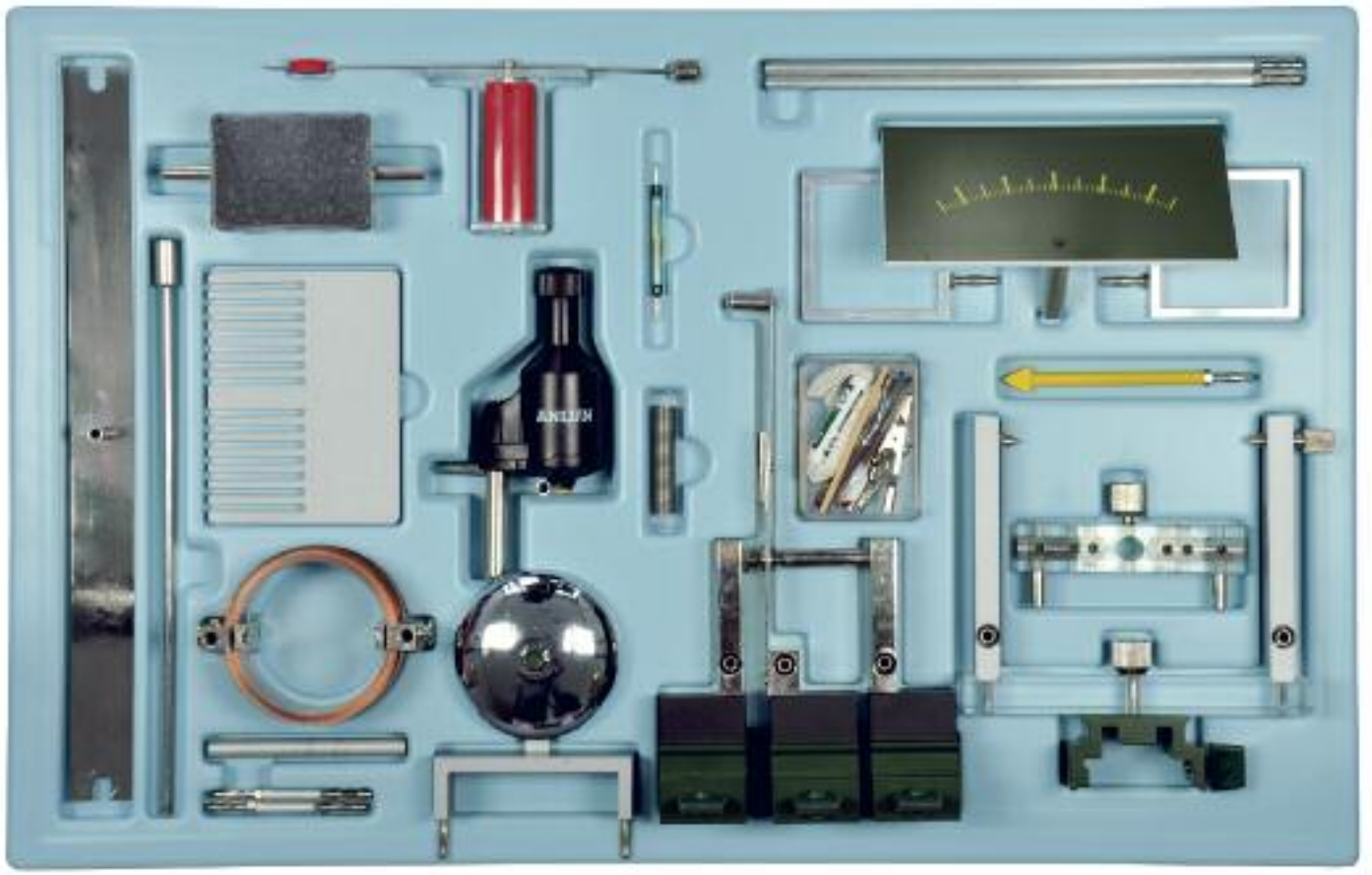
Kinetic energy from electrical energy
ELI 100 Force on a current-carrying conductor in a magnetic field - conductor swing
ELI 101 Lorentz force - a catapult
ELI 102 Force on a straight, current-carrying conductor parallel to a magnetic field
ELI 103 Testing for Lorentz force in a metal disc rotating in a magnetic field
ELI 105 Principle of a moving-iron instrument
ELI 106 Model of a moving-iron instrument
ELI 107 Model of a simple soft-iron instrument
ELI 108 Model of a galvanometer
ELI 110 Forces between current-carrying coils
ELI 111 Definition of an ampere
ELI 112 Current balance - qualitative view
ELI 113 Current balance - quantitative view
ELI 118 Simple electromotor with drum armature
ELI 119 Series-wound electric motor
ELI 120 Shunt-wound electric motor

Electroacoustics
ELI 121 Model of a carbon granule microphone
ELI 122 Model of a telephone
ELI 123 Model of an electromagnetic loudspeaker
ELI 126 Telecommunication
ELI 127 Wireless telecommunication - electromagnetic waves

Electromagnetic induction
ELI 133 Dependence of induced voltage on the force of a magnetic field
ELI 136 Shielding by means of a short-circuit coil
ELI 137 Voltage is not always induced
ELI 138 Induced voltage and effective coil surface area
ELI 139 Demonstrating the earth's magnetic field by induction
ELI 140 Dependence of induced voltage on the velocity with which a magnetic field changes
ELI 141 Independence of induced voltage on the coil's surface area
ELI 142 Dependence of induced voltage on the number of turns
ELI 143 Lenz's law
ELI 144 Lenz's law applied
ELI 145 Stopping movement by means of induced current
ELI 146 Induction and movement
ELI 147 Eddy currents
ELI 148 Eddy current (Waltenhof) pendulum
ELI 149 Eddy current brake
ELI 150 Arago's experiment
ELI 151 Creating a rotating field - shaded-pole effect
ELI 152 Reversing a rotating field
ELI 153 AC electrictiy meter
ELI 154 Heating by means of eddy currents
ELI 157 Revolving field generator with a permanent magnet rotor
ELI 159 Speedometer - model of a bicycle tachometer
ELI 161 Revolving armature generator with a permanent magnet as stator
ELI 162 Revolving armature generator with an electromagnetic stator
ELI 163 Revolving field generator with an electromagnetic rotor
ELI 166 DC generator with drum armature
ELI 167 DC generator with an electromagnet stator
ELI 168 Self-exciting AC generator
ELI 169 DC motor drives a DC generator - DC generator powers a DC motor
ELI 171 Self-induction when switching on direct current
ELI 172 Turn-off surges caused by self-induction
ELI 173 Opening and closing current
ELI 174 Braking effect due to self-induction
ELI 176 AC resistance of a coil
ELI 179 Voltage transformation in a loaded transformer
ELI 180 Primary amperage in a non-loaded and loaded transformer
ELI 182 Transformer with aluminium ring
ELI 183 Transformer with solid iron core (heat build-up - voltage drop)
ELI 184 Horn-shaped lightning arrester
ELI 185 Model of an arc lamp
ELI 190 High-voltage transmission lines
ELI 191 Model of a fault current cut-out

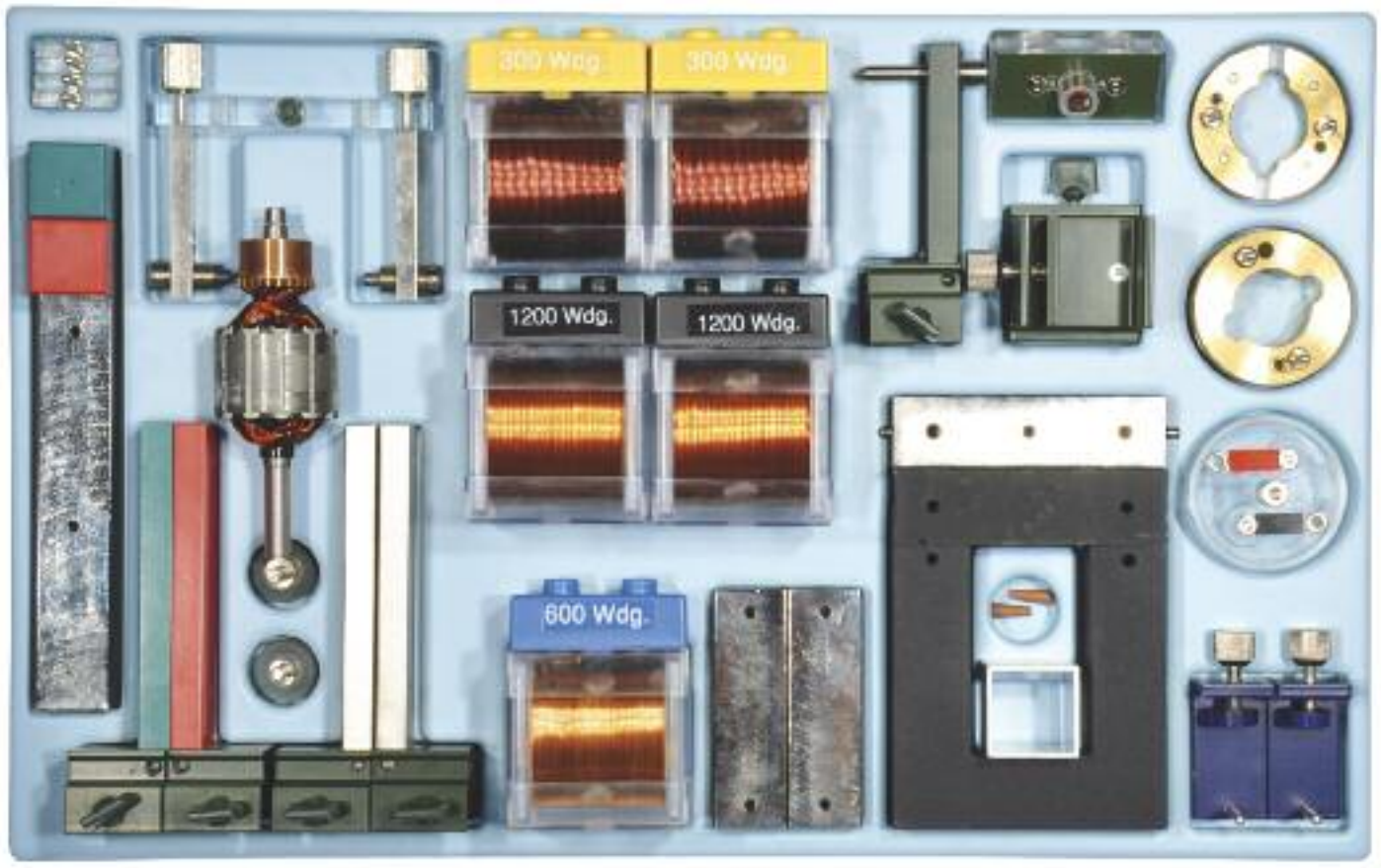
Conversion of energy
ELI 193 Motor drives a generator - generator powers a motor
ELI 194 Converting mechanical energy into electrical energy - doing work by lifting a weight
ELI 196 Converting electrical energy into mechanical energy

DE715-6E Electricity set 6, "inno"



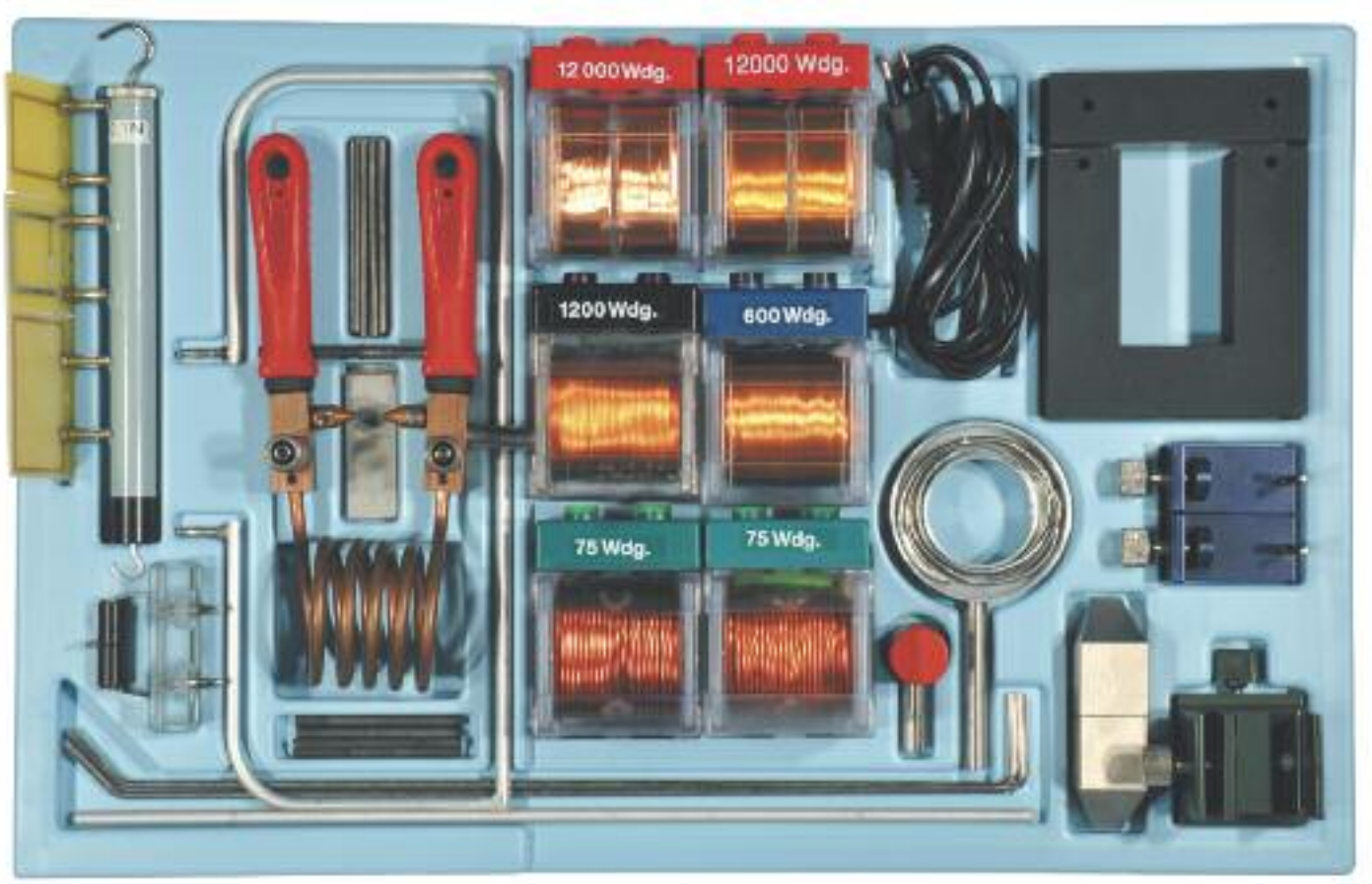
DE450-1N	1x	Pendulum rod, L = 230 mm
DE450-3S	1x	Eddy current (Waltenhof) pendulum plate, 104 x 78 x 6 mm
DE451-1K	1x	Contact pin on slider, short
DE451-1L	1x	Flat spring, long, L = 300 mm
DE451-1R	1x	Reed relay
DE451-1S	1x	Bell gong, mounted
DE451-1W	1x	Striker on slider
DE451-2A	2x	Aluminium rod with plug, L=30 mm, D=6 mm
DE451-2B	1x	Rolling bar, aluminium
DE451-2G	1x	Ring, complete (for Lenz’s law)
DE451-2L	1x	Contact pin on slider, long
DE451-2O	1x	Ring with gap (for Lenz’s law)
DE451-3A	2x	Aluminium rod with plug, L=200 mm, D=6 mm
DE452-1D	1x	Moving iron meter, coil accessory
DE453-1S	1x	Coil with 150 turns, D = 70 mm
DE454-2P	1x	Bearing bridge, 92 x 20 x 20 mm
DE460-1F	1x	Bicycle dynamo
DS406-1G	1x	Fork with pivots
DS407-1S	1x	Scale on support
DS407-1Z	1x	Pointer with plug
P3711-5A	1x	Carbon granule microphone, "compact" model
P1130-1N	1x	Coil spring 10 N
P3310-1A	2x	Crocodile clip, plain metal
P3325-1A	1x	Conductors and non-conductors, set
DE440-1M	1x	Metal band, L = 5 m
P7910-6E	1x	Box insert Electricity set 6 "inno"
P7806-1G	1x	Storage box II large, with cover

DE715-7E Electricity set 7, "inno"

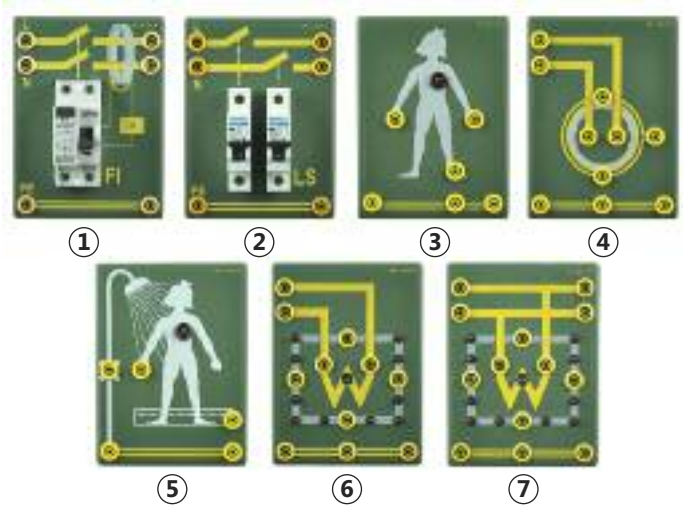


DE412-1B	1x	Block magnets, pair, “neo” 28 x 28 x 18 mm
DE452-1N	2x	Iron core, solid, 92 x 28 x 28 mm
DE452-2B	1x	U-shaped core, laminated, 105 x 110 x 30 mm
DE452-2N	1x	Iron core, solid, 105 x 28 x 28 mm
DE452-3B	1x	Iron core, short, laminated, 105 x 30 x 29 mm
DE452-3N	2x	Clamping screw, large
DE452-4B	2x	Vice grip pliers
DE452-5N	2x	Threaded bolts, short
DE453-1C	2x	Coil "demo" with 300 turns, yellow, for iron cores 30 x 30 mm
DE453-1D	1x	Coil "demo" with 600 turns, blue, for iron cores 30 x 30 mm
DE453-1E	2x	Coil "demo" with 1200 turns, black, for iron cores 30 x 30 mm
DE453-2F	1x	Slip-ring adapter
DE453-2G	1x	Commutator adapter
DE453-2P	1x	Coil adapter
DE453-3A	1x	Light bulb socket, E10, for coils
DE453-3N	1x	Iron core, solid, 216 x 28 x 28 mm
DE453-4G	1x	Carbon brush holder
DE454-1F	4x	Flat plug, 4 mm
DE456-1N	1x	Magnet holders, plain metal, pair
DE456-1R	1x	Magnet holders, red-green, pair
DE460-1T	1x	Drum armature
DS407-1T	1x	Support with pivot
DS500-2G	1x	U-shaped core holder on slider
P1410-1S	2x	Stopper, "mini"
DE453-3T	1x	Thomson ring
P7910-7E	1x	Box insert Electricity set 7 "inno"
P7806-1G	1x	Storage box II large, with cover

DE715-8E Electricity set 8, "inno"



DE300-1F	1x	Iron nails, L = 80 mm, set of 20
DE411-2M	1x	Magnet on support, neodymium
DE451-2S	1x	Circuit boards for current balance, set of 3
DE451-5A	1x	Current balance bracket
DE451-6A	1x	Straight conductor, L = 395 mm
DE452-2B	1x	U-shaped core, laminated, 105 x 110 x 30 mm
DE452-3B	1x	Iron core, short, laminated, 105 x 30 x 29 mm
DE452-4B	2x	Vice grip pliers
DE453-1A	1x	Coil, 5 turns, for iron cores 30 x 30 mm
DE453-1B	2x	Coil "demo" with 75 turns, green, for iron cores 30 x 30 mm
DE453-1E	1x	Coil "demo" with 1200 turns, black, for iron cores 30 x 30 mm
DE453-1F	2x	Coil "demo" with 12000 turns, red, for iron cores 30 x 30 mm
DE453-1W	1x	Mains coil, 600 turns, 230 V AC
DE453-2A	1x	Sheet metal strips, set of 20
DE453-2B	1x	Rings of tin
DE453-2E	1x	Electrodes for Jacob's ladder, pair
DE453-2S	1x	Melting groove on support, D = 10 mm
DE453-3B	1x	Holder for tubular fluorescent lamp
DE453-4K	1x	Carbon electrodes, set of 2
DE454-2N	1x	Pole shoes, pair
DM130-1A	1x	Precision dynamometer 0.1 N, grey
DS500-2G	1x	U-shaped core holder on slider
P3320-9B	1x	Fluorescent lamp SE
P7910-8E	1x	Box insert Electricity set 8 "inno"
P7806-1G	1x	Storage box II large, with cover



1 DE721-1F MBI "Fault current switch"

Two-pole fault current cut-out switch; fault current: 20 mA, max. current: 25 A; **operating voltage: 6 - 7 V AC**

2 DE721-1L MBI "Automatic circuit breaker"

Circuit breaker for phase and neutral line

3 DE721-1M MBI "Model of human body"

Red signal lamp and buzzer alarm

4 DE721-1S MBI "Mains - plug"

Safety socket including phase, neutral and ground lines

5 DE721-1D MBI "Shower"

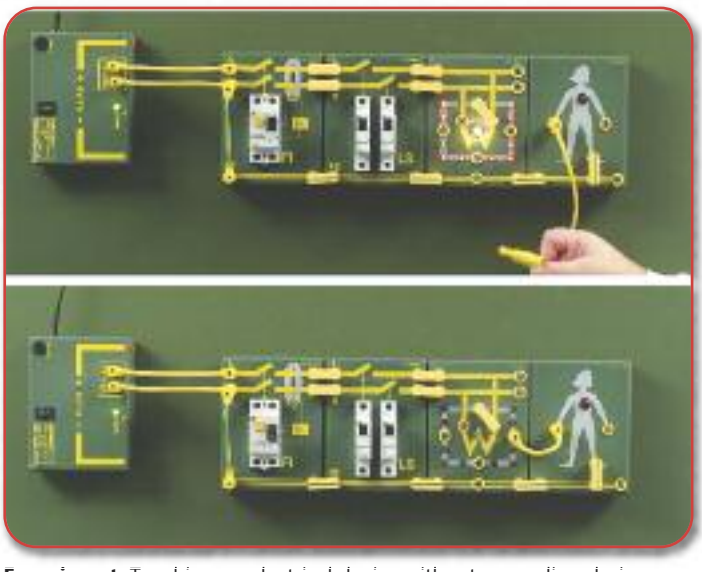
For experiments on potential equalisation

MBIs "Electrical appliance"

Ten red warning LEDs that light up when the housing short-circuits; includes one E10 socket for a 6V / 50 mA light bulb to indicate the operating mode

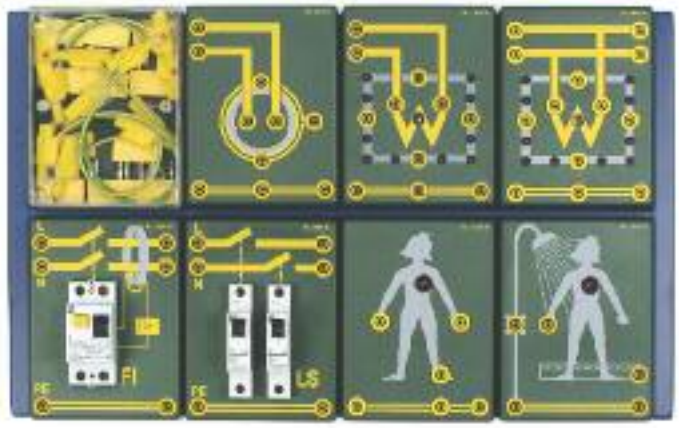
6 DE721-1V MBI "Electrical appliance 1"

7 DE721-2V MBI "Electrical appliance 2"



Experiment: Touching an electrical device without grounding during a short circuit causes the fault current switch to break the circuit immediately

DE715-9G Electricity set 9, Safety "inno"



DE721-1F	1x	MBI "Fault current switch"
DE721-1L	1x	MBI "Automatic circuit breaker"
DE721-1S	1x	MBI "Mains - plug"
DE721-1M	1x	MBI "Model of human body"
DE721-1D	1x	MBI "Shower"
DE721-1V	1x	MBI "Electrical appliance 1"
DE721-2V	1x	MBI "Electrical appliance 2"
DG500-5A	3x	Jumper plug, yellow
DG500-5B	5x	Jumper plug, yellow / green
DG500-5G	2x	Jumper plug with connector terminal, yellow
DG500-6G	1x	Safety connecting leads, yellow / green, set of 6
P7840-1B	1x	Box insert MBI bottom
P7806-1G	1x	Storage box II large, with cover

Experiments on the topic of:

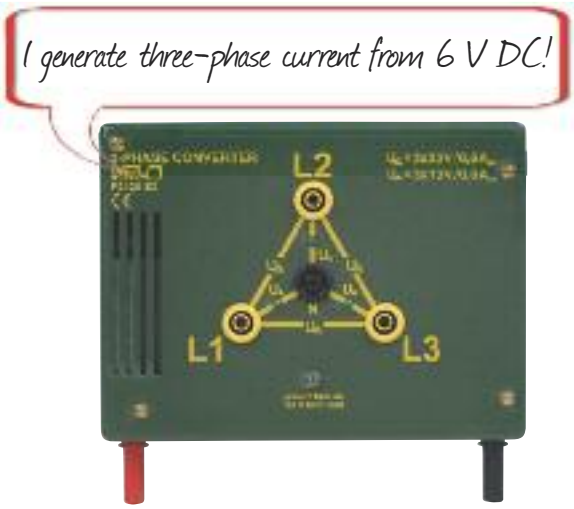
Working safely with electricity

DE715-9SE Experiment manual "Fault Current System", booklet

DE715-9CE Experiment manual "Fault Current System",CD-ROM

EFI 001	Overloading and fuses
EFI 002	Short circuits
EFI 003	Resistance of the human body
EFI 004	The human body in circuits
EFI 005	Touching one contact can be lethal
EFI 006	Touching one contact through a housing short circuit
EFI 007	Lethal errors
EFI 008	Site insulation
EFI 009	Protective separation
EFI 010	Protective grounding
EFI 011	Grounded receptacle outlet
EFI 012	Disadvantages of protective grounding
EFI 013	Death in the shower - potential equalisation
EFI 014	Earth leakage safety switch (fault current switch)
EFI 015	Advantages of a fault current switch
EFI 016	Testing a fault current switch

P3120-3D Three-phase converter "inno"



Serves as a three-phase power supply –
requires no three-phase mains connection!
Output:
3 x 23 V_{eff}, 500 mA, 70 Hz (in a delta connection),
3 x 13 V_{eff}, 500 mA, 70 Hz (in a star connection);
3 pcs. 3 mm LEDs indicate power supply status;
power supply: 6 - 15 V DC, stabilised, min. 5 A;
case: green ABS plastic with yellow labelling;
dimensions: approx. 160 x 120 x 45 mm; weight: approx. 570 g

Recommended power supply:
P3120-1N Fixed voltage transformer "inno" or
P3120-1B 6 V / 10 Ah Rechargeable battery "inno"

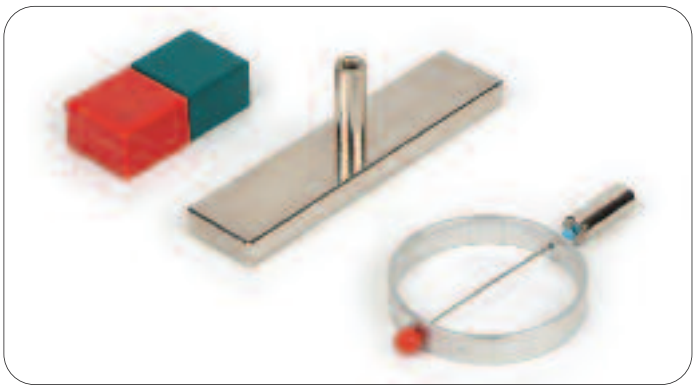
DE720-3D MBI Delta connection

DE720-4S MBI Star connection

With integrated amplifier

Experiment:
Star connection - amperage at the star point (magnetic panel assembly)

Required accessories for carrying out experiments involving three-phase current:



DE412-1B Block magnets, pair, "neo"

Material: neodymium; poles covered with red or green plastic cap; soft iron block with M6 tapping at centre;
dimensions: 28 x 28 x 18 mm

DE411-1S Yoke on support

Used to anchor U-shaped electromagnets;
support (10 x 35 mm) with tapped hole for screwing in C-hook DS102-3S when suspending weights;
dimensions: 120 x 28 x 10 mm

DE454-3A Aluminium ring, pivoting, on support, D = 60 mm

To be used for three-phase experiments in horizontal or vertical position;
minimum friction bearing aluminium ring on the needle axis;
on support (D = 10 mm)

DE411-2M Magnet on support, "neo", one-sided

To demonstrate the principle of a three-phase generator;
material: neodymium; poles covered with red or green plastic cap, with assymetric mounted rod;
magnet: L = 35 mm, D = 24 mm

DE421-2N Polarity indicator

For determining the direction of the magnetic field around a magnetic body; magnetic needle, labelled red and green, pivot-mounted in a bracket;
length of needle: 100 mm

Not shown:

DE309-1S Light bulb, 4 V / 40 mA, E10, set of 5

DE309-5S Light bulb, 12 V / 100 mA, E10, set of 5

DE309-6S Light bulb, 24 V / 100 mA, E10, set of 5

Required accessories for carrying out experiments involving linear motors:

DE453-4L Coil accessory for linear motor

For demonstrating how a linear motor works; including coil body (L = 115 mm, D = 30 mm); winding, terminals and three lightweight connecting leads (L = approx. 100 cm) with 4 mm safety plugs; two 4 mm plug pins for mounting on dynamics trolley, demo (DM300-2A)

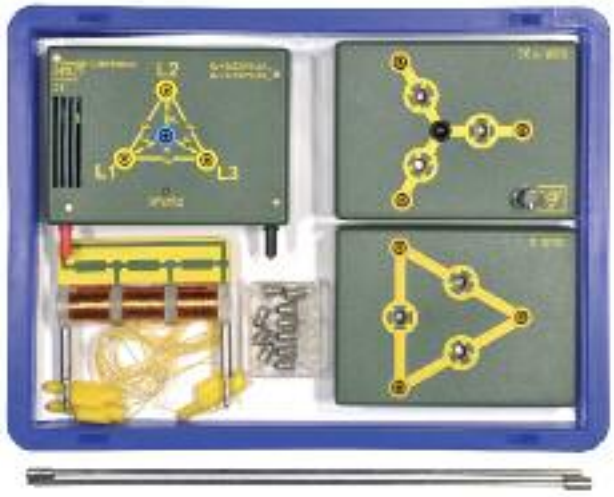
DE453-5L Iron rod, segmented, L = 810 mm

Two joinable iron rods; nickel-plated;
total length = 810 mm, D = 5 mm, D at ends = 10 mm

DM300-2A Dynamics trolley, demo, 50 g

Experiment: Linear motor

DE716-10 Electricity set 10, three-phase current "inno"



P3120-3D	1x	Three-phase converter "inno"
DE720-3D	1x	MBI Delta connection
DE720-4S	1x	MBI Star connection, with integrated amplifier
DE453-4L	1x	Coil accessory for linear motor
DE453-5L	1x	Iron rod, segmented, L = 810 mm
DE309-5S	1x	Light bulb, 12 V / 100 mA, E10, set of 5
DE309-6S	1x	Light bulb, 24 V / 100 mA, E10, set of 5
P7806-1K	1x	Storage box II small, with cover

Experiments on the topic of:

Three-phase current

DE716-1SE Experiment manual "Three-Phase Current", booklet

DE716-1CE Experiment manual "Three-Phase Current",CD-ROM

ETI 001	Three-phase current generator - generating three-phase current
ETI 002	Three-phase current - measuring voltage
ETI 003	Star connection - amperage at the star point
ETI 004	Delta connection
ETI 005	Principle of the three-phase synchronous motor
ETI 006	Three-phase synchronous motor
ETI 007	Principle of the three-phase asynchronous motor
ETI 008	Three-phase asynchronous motor
ETI 009	Linear motor

P3135-3F Three-phase generator with digital display, "demo"

Powerful three-phase function generator featuring digitally synthesised output, low distortion and almost perfect relative shifting of output phases, regardless of the frequency and type of load; **requires no three-phase mains connection!**

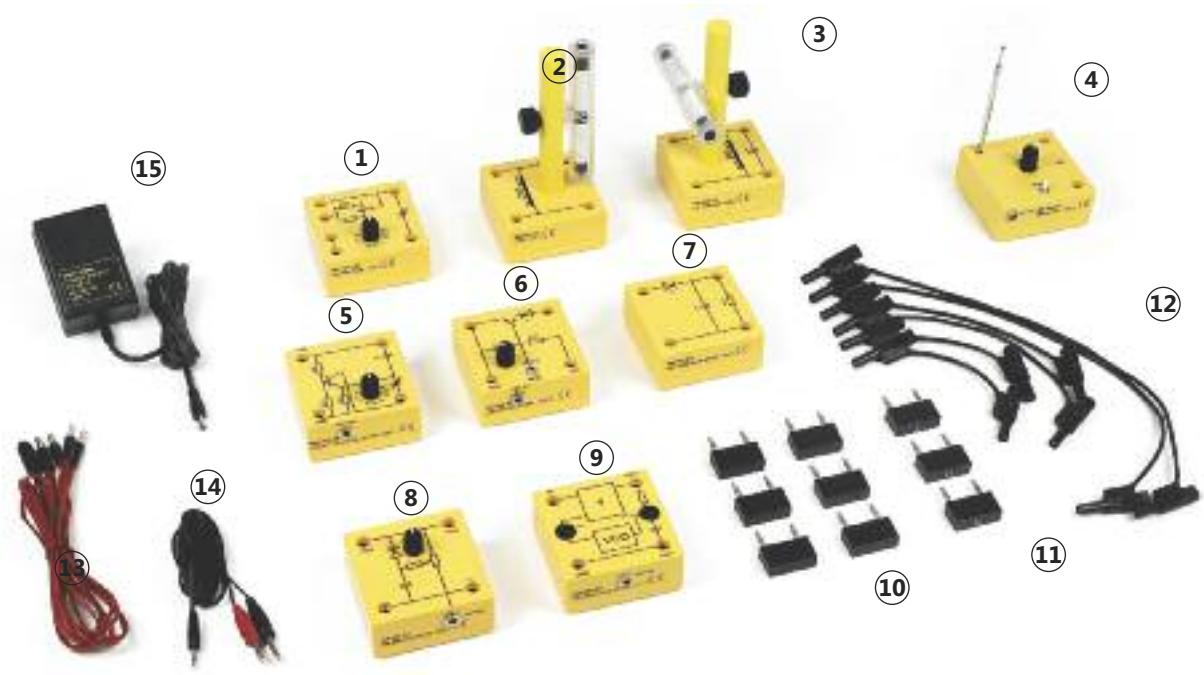
Technical data:
Output:
Star: 3 x 23 V_{eff}, max. 1 A, 1.4 As (peak)
Delta: 3 x 40 V_{eff}, max. 1 A, 1,4 As (peak)
Frequency range: 0.01 - 1000 Hz in five sub-ranges
Waveforms: sine, triangle, square and sawtooth
Digital display: LED frequency display; digit height: 26 mm
Overload protection: all output terminals are permanently protected against short circuiting and stable against inductive charge.

Voltage source: 24 V AC, min. 6 A
Dimensions: 260 x 150 x 210 mm; weight: 3.0 kg

The **"compact" radio system** allows basic experiments in radio transmission technology to be carried out. The size of the modules, fitted with neodymium magnets on the back panel, allows them to be used both in demo and student experiments. In order to avoid all possible conflicts with telecommunications authorities, all of the experiments are performed in the 13 - 26 kHz frequency range (wave length is approx. 10 - 20 km).

All magnetic "compact" modules (MBCs) are manufactured from yellow ABS plastic and stick to steel panels thanks to built-in neodymium magnets.
Module size: 84 x 84 x 39 mm

MB360-1A Radio set "compact"



1 **MB360-1R** MBR RC circuit

100 Ohm and 1 kOhm resistors (selected by toggle switch) wired in front of a capacitor;
dial for selecting any of 11 capacitance levels (39 - 270 nF)

2 **MB360-2R** MBR Coil

900 µH coil, germanium diode and rotatable ferrite antenna (12 cm long), with a knob for fixing it in place on the mast; together with MB360-1R this module is used to generate a high-frequency signal and to transmit the resulting electromagnetic waves

3 **MB360-3R** MBR LC circuit

Parallel-resonant circuit consisting of a 900 µH coil and a 100 nF capacitor; the ferrite antenna (12 cm long) with a knob for fixing it in place on the mast, enables reception of the electromagnetic waves transmitted by MB360-2R

4 **MB360-9R** MBR FM receiver

Electronic circuit for receiving a local FM radio station; scan button for selecting stations; including a telescopic antenna and two 4 mm jacks; used in combination with the LF amplifier "compact" (MB270-2V) and MBC loudspeaker (MB240-1L) modules for assembling a complete FM radio;
including a DC hollow jack for a 12V DC power supply

5 **MB360-4R** MBR Colpitts oscillator

Electronic circuit (oscillator) for generating oscillations: a capacitive voltage divider produces in-phase feedback voltage (positive feedback); dial for setting the variable capacitor to one of 11 levels (39 - 270 nF);
including a DC hollow jack for a 12 V DC power supply

6 **MB360-5R** MBR AM modulator

Electronic circuit for amplitude-modulating the oscillations produced by MB360-1R and MB360-2R; a 0 - 10 kOhm variable resistor allows adjustment of the resistance in the emitter base section of the transistor circuit in order to set the operating point; external modulation voltage may be supplied by means of 3.5 mm phone jack;
including a DC hollow jack for a 12 V DC power supply

7 **MB360-6R** MBR AM demodulator

Germanium diode with a 100 kOhm resistor and a parallel 10 nF capacitor wired in after it; for demodulating the amplitude-modulated signals received from MB360-3R

8 **MB360-7R** MBR FM modulator

Electronic circuit for frequency-modulating the high-frequency signal generated by Colpitts oscillator MB360-4R; modulation is performed by a variable capacitance diode with tuning knob;
including a DC hollow jack for a 12 V DC power supply

9 MB360-8R MBR FM demodulator

Electronic control system that synchronises the frequency and phase of an oscillator with an input signal; system consists of a voltage-controlled oscillator (VCO), a phase detector (j) and a filter, the latter for demonstrating that the frequency-modulated signal received from MB360-3R has been demodulated; including a DC hollow jack for a 12 V DC power supply

10 P3712-1S 6x Jumper plug, black

11 P3712-2S 3x Jumper plug with connector terminal, black

12 P3711-1V 1x Connecting leads with safety plugs, black, set of 6

13 DP130-4A 1x Junction cable, 4 DC plugs

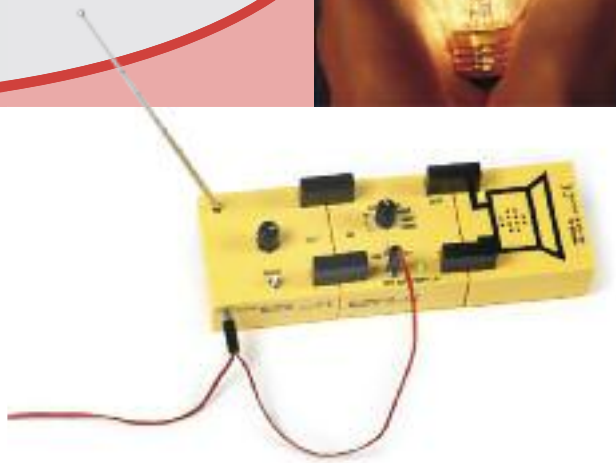
14 DP130-1K 1x Adapter cable, 3.5 mm phone plug to 2x 4 mm plugs

15 P3130-1P 1x Mains transformer 12 V DC / 2 A

Output voltage: 12 V DC / 24 VA
supplied by 5.5 mm hollow DC plug;
voltage source: 100 - 240 V AC / 50 - 60 Hz

Recommended accessory:

P3120-3F Function generator SE
MB270-2V NF amplifier "compact"
MB240-1L MBC Loudspeaker
DP130-3M Connecting cable for modulation
P3210-1P Multi-Multimeter, analogue, automatic fuse
DE750-3A Oscilloscope, two-channel, 30 MHz



Experiment: Using the FM receiver (MB360-9R), LF amplifier (MB270-2V) and loudspeaker (MB240-1L) modules, an FM radio can be assembled for receiving FM radio transmissions.

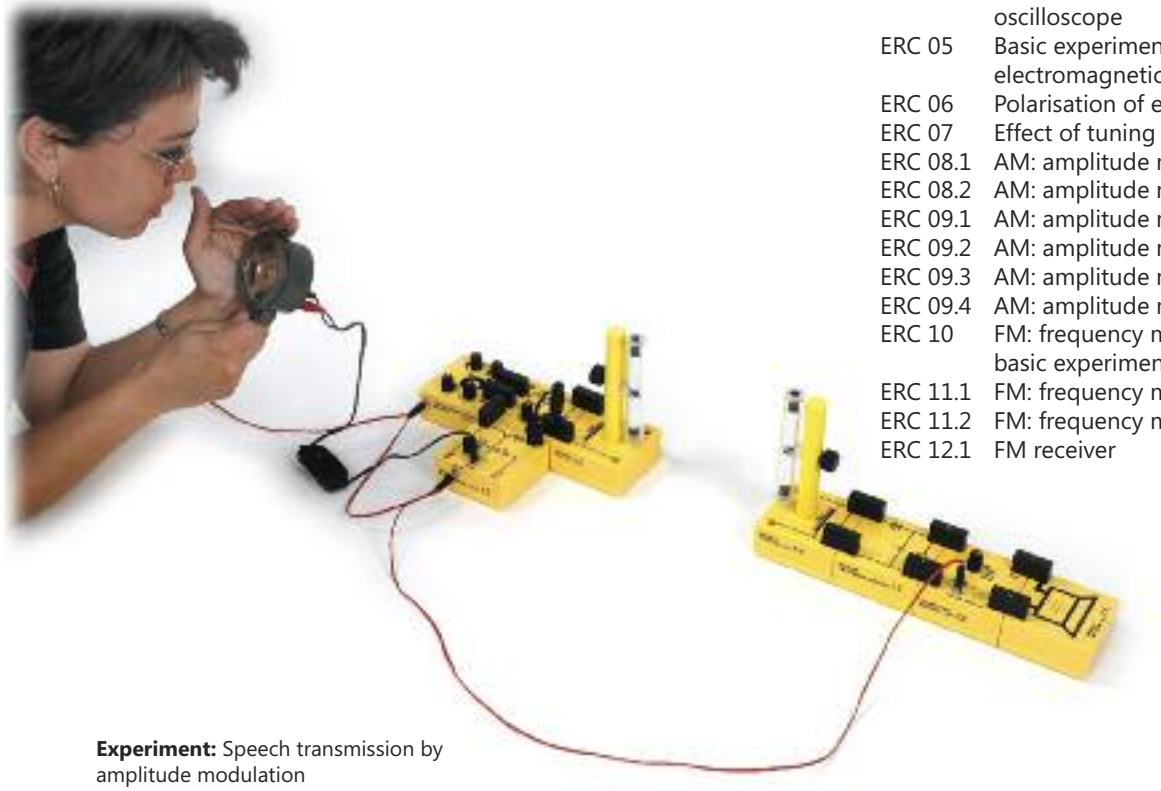
Experiments on the topic of:

Radio

MB360-1SE Experiment manual "Radio", booklet

MB360-1CE Experiment manual "Radio", CD-ROM

ERC 01.1 Resonance compared with input - voltmeter
ERC 01.2 Resonance compared with input - oscilloscope
ERC 02 Resonance during adjustment
ERC 03.1 Quality of a resonant circuit - voltmeter
ERC 03.2 Quality of a resonant circuit - oscilloscope
ERC 04.1 Self-excited oscillator (Colpitts circuit) - voltmeter
ERC 04.2 Self-excited oscillator (Colpitts circuit) - oscilloscope
ERC 05 Basic experiment in transmission of electromagnetic waves
ERC 06 Polarisation of electromagnetic waves
ERC 07 Effect of tuning
ERC 08.1 AM: amplitude modulation (DC) - voltmeter
ERC 08.2 AM: amplitude modulation (DC) - oscilloscope
ERC 09.1 AM: amplitude modulation (AC) – basic experiment
ERC 09.2 AM: amplitude modulation (AC) – oscilloscope
ERC 09.3 AM: amplitude modulation (AC) – player
ERC 09.4 AM: amplitude modulation (AC) – microphone
ERC 10 FM: frequency modulation - basic experiment with the capacitance diode
ERC 11.1 FM: frequency modulation - voltmeter
ERC 11.2 FM: frequency modulation - oscilloscope
ERC 12.1 FM receiver



Experiment: Speech transmission by amplitude modulation

This **logic system for demo and student experiments** facilitates dealing with the basic concepts of digital technology. All modules are manufactured from yellow ABS plastic and stick to steel panels thanks to built-in neodymium magnets. Dimensions of the elements: 310 x 220 x 27 mm

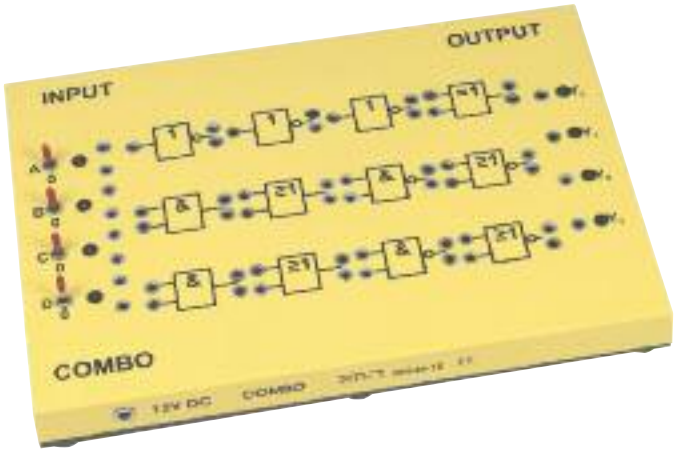
DE940-0A MPL Numerical Systems

This panel is used to demonstrate the number systems used in information technology (binary and hexadecimal numbers).
Range: 0 - 255 or 8 bits.
Toggle switches are used to activate the displays showing the particular number entered. Input may be entered either as decimal or binary numbers with a toggle switch for mode selection. Decimal numbers are shown on a a three-digit, seven-segment LED displays (26 mm).

See following page for a list of possible experiments.

Additionally required:
P3130-1P Mains transformer 12 V DC / 2A

DE945-1E MPL Combo



For introduction to basic logical expressions, combining logic gates, circuit design of EXOR gates, De Morgan's law, full and half adders, verifying the laws of Boolean algebra, coder and decoder circuits and RS flip flops (instructions for 30 example circuits).

This panel includes the following logic gates:

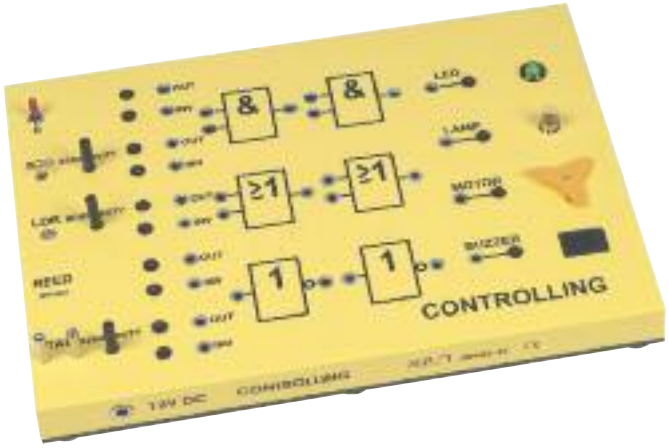
- 2 AND gates	- 2 NOR gates
- 2 OR gates	- 1 EXOR gates
- 2 NAND gates	- 3 NOT gates

Input: four toggle switches with 5 mm LEDs;
output: four 5 mm LEDs with 4 mm jacks
Additional devices, such as a logic analyser, may be connected by means of the 4 mm jacks.

See following page for a list of possible experiments.

Additionally required:
P3130-1P Mains transformer 12 V DC / 2 A
3x **P3310-2S** Connecting leads, 25 cm, black, set of 6

DE945-2E MPL Controlling



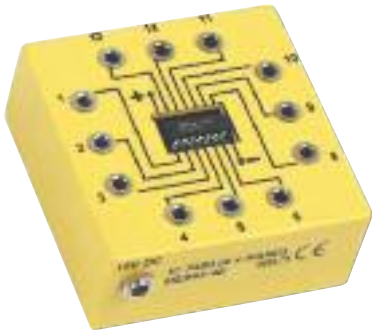
This panel is used to demonstrate practical applications of digital technology in electronic and electromechanical control systems, such as motor control, a model of an alarm system and other circuits (instructions for 12 example circuits).

Input may be selected from five different, independent signal sources: a toggle switch; an NTC thermistor, used as a temperature sensor; an LDR, used as a light detector; a Reed relay contact (gas-filled magnetic switch);
and a pressure-sensitive contact.
All output is accessible either as a direct or inverted signal and the current state is displayed in each case by an LED.
Output terminals are protected against short-circuiting and suited to being directly connected to the logic gates.
Logic gates: 2 NOT gates, 2 AND gates and 2 OR gates.
Four control elements are available for each output signal:
an LED (5 mm, green), an E10 light bulb, a drive motor and an electromechanical buzzer.
Current output state is displayed by LEDs.
Additional devices, such as a logic analyser, may be connected by means of the 4 mm jacks.

See following page for a list of possible experiments.

Additionally required:
1x **P3130-1P** Mains transformer 12 V DC / 2 A
2x **P3310-2S** Connecting leads, 25 cm, black, set of 6
1x **P3410-1K** Bar magnet, round, 10 x 50 mm
1x **P3320-1I** Light bulb, 10 V / 50 mA, E10

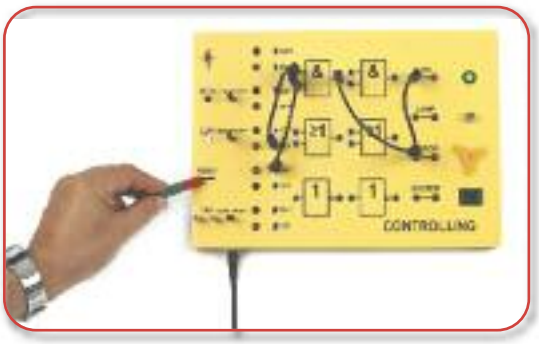
DE943-4E IC-7400 (4 x NAND)



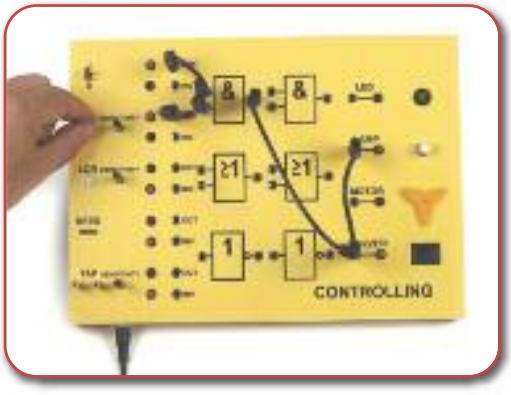
This industry-standard IC (IC 7400) may be controlled by means of 12x 4 mm jacks.
Integrated Schmitt trigger circuits allow for a variety of digital and analogue signal sources to be directly connected to it (ON-OFF or Reed switch, NTC, PTC, LDR etc.).
This module is designed to demonstrate the relationship between simple logic gates and industrial applications of integrated circuits.

See following for a list of possible experiments.

Additionally required:
1x **DE945-1E** MPL Combo, or
1x **DE945-2E** MPL Controlling
1x **P3130-1P** Mains transformer 12 V DC / 2 A
1x **DP130-4A** Junction cable, 4 DC plugs
2x **P3310-2S** Connecting leads, 25 cm, black, set of 6
1x **P3410-1K** Bar magnet, round, 10 x 50 mm
1x **P3320-1I** Light bulb, 10 V / 50 mA, E10



Experiment: Motor control



Experiment: Fire detector (AND from 2 NAND)

Experiments on the topic of LOGIC

DE949-1SE Experiment manual "Logic", b/w booklet

DE949-1CE Experiment manual "Logic", CD-ROM

MPL Numerical Systems DE940-0A (4 experiments):

EIC 0.01	Decimal number system
EIC 0.02	Binary number system
EIC 0.03	Hexadecimal number system
EIC 0.04	Converting between number systems

MPL COMBO DE945-1E (30 experiments):

EIC 1.1.01	NOT gate
EIC 1.1.02	AND gate
EIC 1.1.03	OR gate
EIC 1.1.04	NAND gate
EIC 1.1.05	NAND gate from AND and NOT gates
EIC 1.1.06	NOR gate
EIC 1.1.07	NOR gate from OR and NOT gates
EIC 1.1.08	EXOR gate
EIC 1.1.09	EXOR gate 1 (with AND gate)
EIC 1.1.10	EXOR gate 2 (with OR gate)
EIC 1.1.11	NOT gate from NAND gates
EIC 1.1.12	AND gate from NAND gates
EIC 1.1.13	OR gate from NAND gates
EIC 1.1.14	NOT gate from NOR gates
EIC 1.1.15	AND gate from NOR gates
EIC 1.1.16	OR gate from NOR gates
EIC 1.1.17	De Morgan 1 (NAND)
EIC 1.1.18	De Morgan 2 (NOR)
EIC 1.1.19	RS flip-flop from 2 NAND gates
EIC 1.1.20	RS flip-flop from 2 NOR gates
EIC 1.1.21	RS flip-flop (NAND) with a switch and cycle
EIC 1.1.22	RS flip-flop (NOR) with a switch and cycle
EIC 1.1.23	D flip-flop from NAND gates
EIC 1.1.24	D flip-flop from NOR gates
EIC 1.1.25	Half adder 1
EIC 1.1.26	Half adder 2
EIC 1.1.27	Half adder with EXOR gate
EIC 1.1.28	Full adder
EIC 1.1.29	Coder circuit (decimal - binary)
EIC 1.1.30	Decoder circuit (binary - decimal)

MPL CONTROLLING DE945-2E (12 experiments):

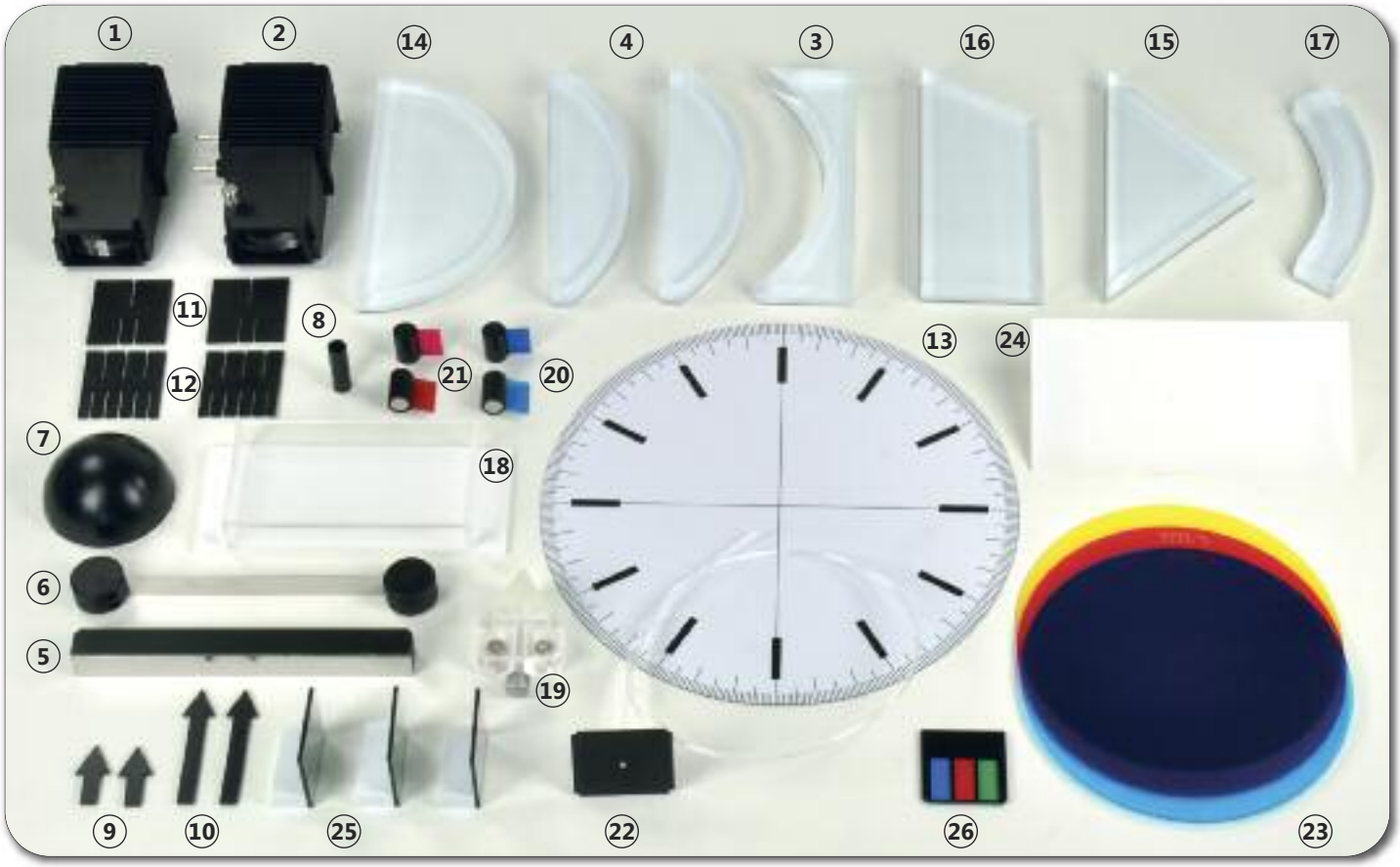
EIC 1.2.01	Door control
EIC 1.2.02	Motor control
EIC 1.2.03	Light control
EIC 1.2.04	Double security circuit
EIC 1.2.05	Heating control
EIC 1.2.06	Thermal protection
EIC 1.2.07	Fire detector
EIC 1.2.08	Air conditioning control
EIC 1.2.09	Alarm system 1
EIC 1.2.10	Alarm system 2
EIC 1.2.11	Washing machine control
EIC 1.2.12	Refrigerator

IC 7400 (4 x NAND) DE943-4E (6 experiments):

EIC 1.3.01	AND from 2 NANDs
EIC 1.3.02	NOT from 2 NANDs
EIC 1.3.03	NOR from 3 NANDs
EIC 1.3.04	OR from 3 NANDs
EIC 1.3.05	Fire detector (AND from 2 NANDs)
EIC 1.3.06	Light control (OR from 3 NANDs)

MAGNETIC PANEL OPTICS

This equipment set features magnetic parts that allow experiments in geometric optics to be demonstrated on metal panels in a clearly visible and understandable manner.



simple - fast - safe

- The large size of the model bodies (L = 200 mm) means that experiment results are easily visible even at large distances
- Large amount of time saved through fast assembly / dismantling
- The high luminosity of the xenon lamps makes the light beams visible on the white panel for up to 100 cm, even if the room is not darkened
- Using two separate lamps it is possible to demonstrate even umbrae and penumbrae

DL715-2A Magnetic Panel Optics, set 1

Consisting of:

1	DL090-1L	1x	Lamp for magnetic panel (02), xenon 6 V / 20 W
2	DL090-2L	1x	Lamp for magnetic panel (03), xenon 6 V / 20 W This lamp can be coupled to the lamp for magnetic panel (02) using two 4 mm plug pins
3	DL930-1A	1x	MPO Model body planoconcave
4	DL930-1B	2x	MPO Model body planoconvex
5	DL940-1A	1x	MPO Mirror, plane, L = 200 mm
6	DL940-1B	1x	Flexible mirror, magnetic
7	DL960-1G	1x	Hemispherical model for casting shadows, magnetic, D = 80 mm
8	DL960-1K	1x	Cylindrical model for casting shadows, magnetic, D = 12 mm
9	DL970-1A	2x	Arrow, L = 80 mm, magnetic
10	DL970-1B	2x	Arrow, L = 40 mm, magnetic
11	P5111-2A	2x	Shutter with 1 + 2 slits (02)
12	P5111-2B	2x	Shutter with 3 + 5 slits (02)
	P7920-1O	1x	Box insert MPO set 1

Ordering information

DL720-2G Magnetic Panel Optics (MPO) – complete (02)

Consisting of:

DL715-2A 1x Magnetic Panel Optics, set 1
DL715-1B 1x Magnetic Panel Optics, set 2
DL715-1C 1x Magnetic Panel Optics, set 3

DL720-1CE 1x Experiment manual MPO, CD-ROM
(see following page for a list of possible experiments)

Additionally recommended:

DS103-1A 1x Assembly panel, complete

DL715-1B Magnetic Panel Optics, set 2

Consisting of:

13	DL920-1A	1x	MPO Optical disc, D = 300 mm
14	DL930-1C	1x	MPO Model body hemisphere, R = 100 mm
15	DL930-1D	1x	MPO Model body prism, L = 200 mm, H = 100 mm
16	DL930-1E	1x	MPO Model body trapezoid, L = 200 mm, 60° / 30°
17	DL930-1L	1x	Optical fibre, c-shaped, magnetic
18	DL935-1K	1x	Cell, magnetic, 200 x 100 x 25 mm
19	DL950-1A	1x	MPO Prism Flint-glass, n = 1.62
20	DL980-1G	2x	Colour filter blue, magnetic
21	DL980-1R	2x	Colour filter red, magnetic
	P7920-2O	1x	Box insert MPO set 2
	P7806-1G	1x	Storage box II big, with cover

DL715-1C Magnetic Panel Optics, set 3

Consisting of:

22	DL931-1L	1x	Optical fibre, flexible
23	DL203-1S	1x	Colour filter discs, subtractive, set of 3, D = 195 mm
24	DL930-1K	1x	MPO Projection wedge, 200 x 100 mm
25	DL941-1A	1x	Mirrors, demo, magnetic, set of 3, 50 x 50 mm
26	DL980-1D	1x	Three-colour filter, additive

DS103-1A Assembly panel, complete

Consisting of:

DS101-1G 1x Support base, large, L = 500 mm
DS103-1P 1x Panel, green / white, 90 x 62 cm
DS600-6G 1x Board holders, pair, magnetic

Recommended accessory:
DS500-1G 2x Screw clamp, jaw width approx. 50 mm

The experiments listed below are possible with the complete DL720-2G magnetic panel optics.

DL720-1SE Experiment manual MPO (magnet panel optics), booklet b/w

DL720-1CE Experiment manual MPO (magnet panel optics), CD-ROM

Diffusion of Light

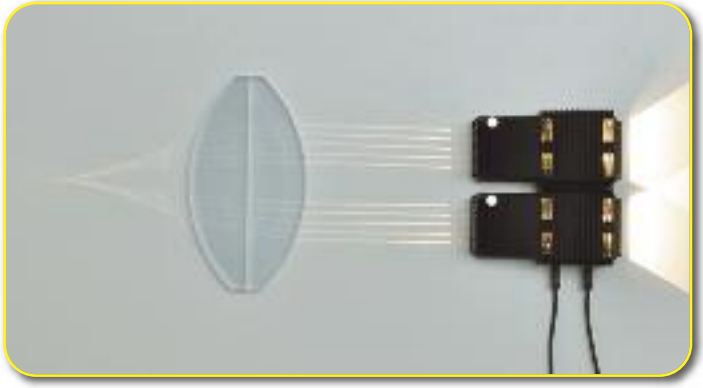
OPI 001 Light spreads in a straight line
OPI 002 Punctual sources of light produce sharp shadows
OPI 003 Diffuse sources light produce indistinct shadows
OPI 004 Eclipse of the moon (model)
OPI 005 Eclipse of the sun (model)

Reflection

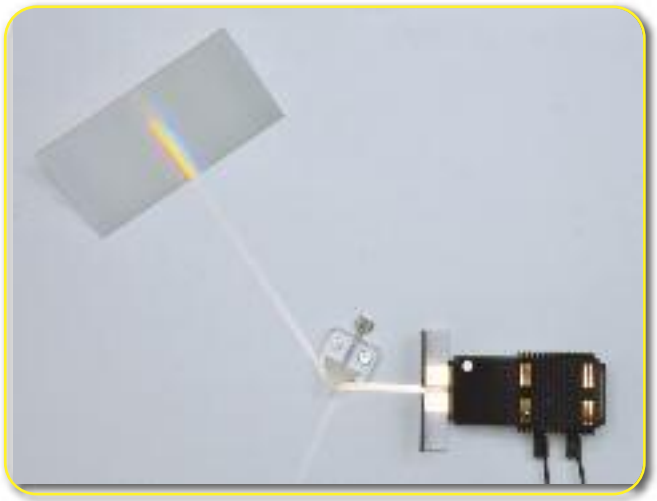
OPI 006 The Law of Reflection
OPI 007 A mirror is rotated
OPI 008 Regular reflection
OPI 009 Diffuse reflection of light - diffraction
OPI 010 Position of an image point on a plane mirror
OPI 011 Creating a virtual image on a smooth mirror
OPI 012 Concave mirror as a light collector
OPI 013 Model of a headlight
OPI 014 Path of rays in a concave mirror
OPI 015 Images in a concave mirror
OPI 016 Movement of rays in a convex mirror
OPI 017 Path of rays in a convex mirror
OPI 018 Path of rays when forming an image in a convex mirror

Refraction

OPI 019 Refraction of light viewed qualitatively
OPI 020 Angle of incidence and angle of refraction
OPI 021 Refraction from the perpendicular – total reflection in water
OPI 022 Refraction to the perpendicular
OPI 023 Calculating the index of refraction
OPI 024 Refraction from the perpendicular – total reflection in glass
OPI 025 Total reflection in a semi-circular body
OPI 026 Basic principle of a photoconductor
OPI 027 Photoconductor, flexible
OPI 028 The plane parallel plate
OPI 029 Refraction of light in a prism
OPI 030 Deviating prism
OPI 031 Inverting prism
OPI 032 Torricelli's prism



Experiment: Focal point position of a biconvex lens



Experiment: Colour dispersion

Lenses

OPI 033 Refractive effect of a convergent lens
OPI 034 Refractive effect of a divergent lens
OPI 035 Position of the focal point of a biconvex lens
OPI 036 Position of the focal point of a thin planoconvex lens
OPI 037 Position of the focal point of a thick planoconvex lens
OPI 038 Refractive effect of convergent and divergent lenses on diverging light rays
OPI 039 Lens systems
OPI 040 Special rays on a convergent lens
OPI 041 Special ray paths on a planoconvex lens
OPI 042 Special ray paths on a concave lens
OPI 043 Path of rays when forming an image on a convergent lens
OPI 044 Path of rays when forming an image on a divergent lens

The Eye

OPI 045 Ocular accommodation
OPI 046 Faulty vision and its correction – near-sightedness
OPI 047 Faulty vision and its correction – far-sightedness

Optical Instruments

OPI 048 Path of rays in a single lens reflex camera
OPI 049 Path of rays in a slide projector
OPI 050 Model of a magnifying glass
OPI 051 Model of a microscope
OPI 052 Model of an astronomical telescope
OPI 053 Model of a Galilean telescope

Colour

OPI 054 Dispersion of colour
OPI 055 Spectral colours cannot be further dispersed
OPI 056 Converging spectral colours to make white
OPI 057 Mixed colour of a partial spectrum
OPI 058 Complementary colours – colour theory
OPI 059 Subtractive mixture of colours
OPI 060 Additive mixture of colours

Recommended supplements for magnetic panel optics

DL110-1L Laser, single, magnetic

For tracking a single beam path on metal panels, even in daylight.
Technical data:
Diode laser, 635 nm
$P_{max.}$ <1 mW, Class II
Dimensions: 80 x 25 x 20 mm
Voltage supply:
3 V DC / 50 mA

DL110-5L Laser "duo", 5 beams, "inno"

For experiments in geometric optics in combination with optical model objects in the magnetic board optics set. 5 juxtaposed diode lasers use in-built cylindrical lenses to produce parallel, long-range light beams. On a light coated metal panel these are clearly visible even in daylight. A button enables 4 different switching positions for the 5 diode lasers;
comes with 3 V battery supply unit.

Technical data:
4 red diode lasers, 635 nm; 1 green diode laser, 532 nm
Pmax. each <1mW, class II
5 beams each separated by 18 mm
Dimensions: 112 x 63 x 32 mm
Voltage supply: 3 V DC/500 mA

P3320-1X Xenon lamp 6 V / 20 W

G4-Socket; replacement Xenon lamp 6 V / 20 W for lamp for magnetic panel (02) or (03)

Hollow bodies, magnetic

Acrylic model objects with an opening for adding liquids and featuring a contact surface, painted matt white in order to make the light rays passing through the object more clearly visible; thickness: 20 mm; length: 200 mm

DL935-1A MPO Hollow body, plano-convex

Radius: 140 mm

DL935-1B MPO Hollow body, plano-concave

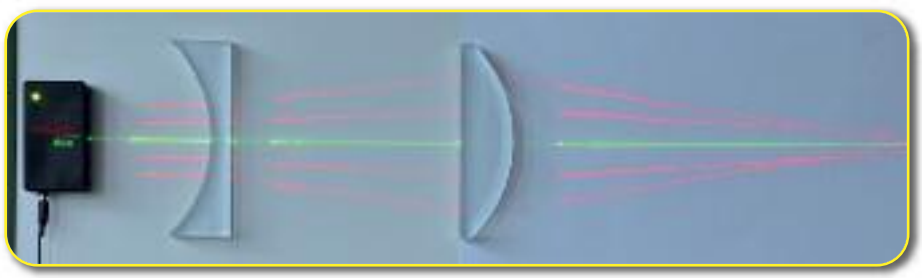
Radius: 140 mm

DL937-1K Circular cell

Used for demonstrating angles of incidence and refraction, when light rays pass from air to water and from water to air;
hollow circular cell made of acrylic; with an opening for adding liquids; labelled with a 360° scale;
diameter: 200 mm

DL513-2F Fluorescein sodium

Used for staining a liquid in order to make the light rays passing through it more easily visible;
bottle content: 25 g



Experiment: Lens systems

Experiment: Light ray refraction phenomena when passing from water to air at various angles

DL150-1A Optical bench, graduated, L = 1000 mm

Special aluminium profile with a cm and mm scale;
two clamping screws on the side for extending it using a rail bond or a joint link with scale DL150-2A;
length: 1000 mm

DS101-50 Stand rail, universal, L = 500 mm

Special aluminium profile; silver-coated;
can be used as a stand rail, rail track, ball track or optical bench;
side screws at ends for connecting two rails or attaching rail bases using a clamp saddle;
lengt: 500 mm

DS112-1G Rail claw, adjustable

Two rail claws attached to a special NTL profile provide a support base or stabilise the track or optical bench; fibre glass reinforced plastic with rubber feet; with metal cylinders and levelling screws;
length = 220 mm

P5310-1S Rail bond SE, universal

For connecting NTL rail profile (stand rails, track, optical bench);
NTL special aluminium profile, anodised, L = 80 mm

DL150-2A Joint link with scale, for optical bench

Used when doing optics experiments calling for light rays to travel at an angle; pivoting joint with a 180° scale; including a clamp socket on the pivot axis for receiving optics components on supports with a diameter of up to 10 mm;
total length: 225 mm

Sliding saddles for optical bench

Special aluminium profile with a clamp socket; may be mounted on and fixed to optical bench; clamp socket has a lengthwise and a transverse hole along with a set screw for clamping in rods up to 10 mm in diameter;
a gauging mark on the slider allows it to be precisely positioned on the optics bench

DL150-04 Sliding saddle for optical bench;
socket height: 40 mm

DL150-08 Sliding saddle for optical bench;
socket height: 80 mm

DL150-4A Sliding saddle, laterally adjustable

Special aluminium profile with rail adapter; simple sliding saddle with mm scale for slidable adjustment at right angles to the optical axis;
adjustment range: approx. 30 mm

DL150-5A Pivoting clamp

For mounting optical apparatus and components outside of the optical axis;
square aluminium rod with three holes and two knurled head screws;
suitable for supports of up to 10 mm in diameter;
dimensions: 80 x 20 x 20 mm

DS103-1T Platform on support, small

Metal plate; green powder-coated;
on support rod:
D = 10 mm, L = 30 mm;
dimensions:
165 x 125 mm

DL100-1E Lamp for experiments, xenon, 50 W, with fan

Very bright universal light source for optics experiments; G6.35 lamp base with 12 V / 50 W xenon bulb (included); mounted to pivot and shaft for lateral and axial adjustment of the lamp position; condenser lens with focal length of + 100 mm mounted on an adjustable and removable aluminium tube; metal case includes a hinged support for inclining the lamp; cooled by a built-in fan;
Voltage source: 12 V by means of two 4 mm jacks
Dimensions: approx. 300 x 60 x 85 mm

Replacement light bulbs:

P3320-1Y Xenon lamp 12 V / 50 W, for G6.35 socket

P3320-1S Halogen lamp, 12 V / 50 W, for G6.35 socket

P5111-1L Optics Lamp 02 - SE, 20 W Halogen

Experimental lamp in plastic housing; for use on table or on the optical bench with support; shutters can be inserted on both sides; movable condenser lens for divergent or parallel rays of light; cooling fins and slots eliminate risk of injury; no slipping or scratching due to 4 rubber pads on the bottom. Power supply: two 4 mm safety sockets;
lamp: halogen lamp 12 V / 20 W; horizontal spiral;
dimensions: 139 x 72 x 65 mm; weight: 182 g

Replacement light bulb:

P3320-1R Halogen lamp, 12 V / 20 W, for G4 socket

P5111-1G Stand rod "demo" for Lamps (02)

For positioning the optics lamp (02) on an optical bench, in the optical axis in demo experiments; rod made of stainless steel, longitudinally flattened; dimensions: 10 x 180 mm

P5110-2A Lamp 6 V / 3 W

6 V / 3 W light bulb in socket with baffle tube; connection via two 4 mm sockets; can be attached to the holder for lenses demo DL300-1D or holder for lenses SE P5310-2A

Replacement light bulb:

DE309-3T Light bulb, 6 V / 0,5 A, Socket E10

DT100-1H Halogen spot, 1000 W

Safety lamp for video recording; with fan for cooling and thermostat providing protection against overheating; handle on base support (D = 10 mm) may be pivoted 180°; with ON-OFF switch and fuse; 1000 W, 3400 K halogen lamp;
voltage source:
230 V / 50 - 60 Hz;
dimensions:
100 x 140 x 190 mm;
weight: 1300 g

DT100-1H1 Halogen replacement lamp, 1000 W

DT102-1S Halogen spot 100 W

Halogen spotlight, 100 W; socket E 27; scattering angle 30°; 3500 cd, D = 120 mm

DE312-1L Light bulb socket, E27, on support

E27 ceramic socket; power cord with mains plug, L = approx. 80 cm; on support: L = 160 mm, D = 10 mm

DE310-1B Light bulb, 6 V / 5 A, E14

Light bulb with extremely short filament (point source light)

DE312-1K Light bulb socket, E14, on support

Power cord with two 4 mm pin plugs; L = approx. 100 cm; support: L = 160 mm, D = 10 mm

DL101-1K Candle holder on support

Holds candles up to approx. 20 mm in diameter; with support, D = 10 mm, removable

DL101-2K Candles, set of 5

Candles, set of 5
Diameter: approx. 20 mm
Length: approx. 150 mm

Spectral lamps

Light sources, used when high illumination density and spectral purity are required;
Pico 9 base, 1 A operating current

DL102-HG Spectral lamp Hg

DL102-NA Spectral lamp Na

Additionally required:

DL102-3G Spectral lamp housing
DL102-3D Spectral lamp power supply

DL102-3G Spectral lamp housing

For housing and operating spectral lamp DL102-HG or DL102-NA with Pico 9 base; black metal housing with a small aperture, and with removable lid and front plate to facilitate changing bulbs; cooled by built-in fan; power supply cord with Terko plug; supplied with screw-on support rod (D = 10 mm);
dimensions: 78 x 78 x 236 mm

Note: Spectral lamp power supply **DL102-3D** is required in order to operate the lamp!

DL102-3D Spectral lamp power supply

With choke coil for operating spectral lamp DL102-HG or DL102-NA with Pico 9 base; plastic housing made of ABS; lamp for operational readiness; Terko outlet for voltage output.
Rated current: 1 A
Connection voltage: 230 V / 50 ... 60 Hz
Dimensions: 210 x 95 x 200 mm

Note: Spectral lamp housing **DL102-3G** is required in order to operate the lamp!

Spectral tubes

Used in investigating the line and band spectra of various gases and vapours; glass capillary tube with widened ends; metal caps hold the tubes and serve as electrical contacts;
tubes may be clamped in
spectral tube holder DL105-1H (not included);

Ignition voltage: approx. 3 - 6 kV (but operating voltage <5 kV)
No x-ray emission!
Dimensions: L = 220 mm, D = 15 mm; capillary tube-L = 75 mm

DL104-AR Spectral tube Ar

DL104-H2 Spectral tube H_2

DL104-HB Spectral tube H_2 - Balmer

DL104-HE Spectral tube He

DL104-HG Spectral tube Hg (with Argon)

DL104-N2 Spectral tube N_2

DL104-NE Spectral tube Ne

DL104-O2 Spectral tube O_2

Suitable power supply:

P3171-1A High-voltage power supply 10 kV
with digital display, "demo"

DL105-1H Spectral tube holder

Securely holds spectral tubes DL104-ff and ensures electrical contact; nickel-plated brass rod with 4 mm holes; one fixed and one slidable, insulated flat contact plate for holding the tubes; on support rod (D = 10 mm).
contacts from 190 to 260 mm apart
total length: approx. 350 mm

DL104-1A Slitted shade

Black powder-coated aluminium tube; fits over spectral tubes DL104-ff while allowing observation of the spectrum in the capillary;
dimensions: L = 190 mm, D = 20 mm

DL100-3L Laser 0.2 / 1.0 mW, linearly polarised, modulatable, magnetic

Class 2 educational laser for use as a high-intensity light source, especially in experiments on interference, diffraction and holography. Laser diode, with collimator optics, mounted in a "compact" magnetic module.

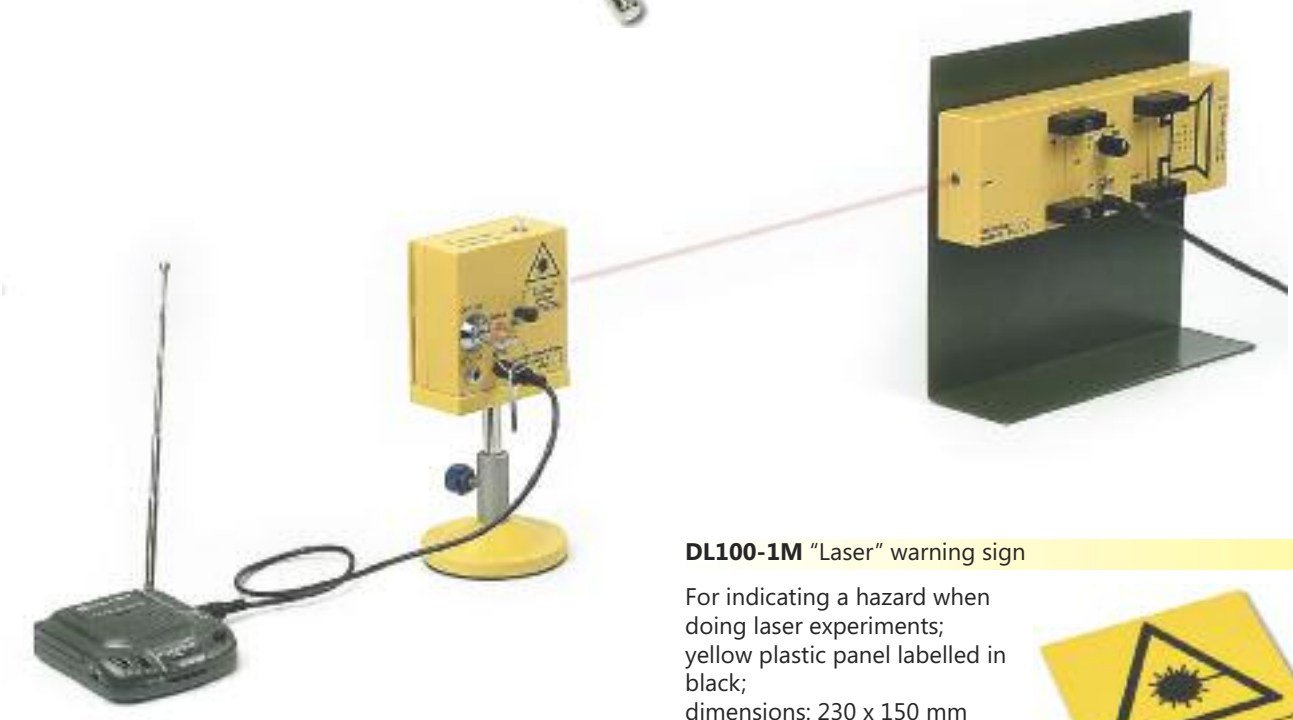
Wavelength: 635 nm; optical power output: 0.2 mW; continuous maximum power output of 1.0 mW, generated only while pressing the push button (or using remote control switch DE722-2W); beam divergence: < 0.5 mrad; **polarisation: linear; modulation input by means of phone jack;** operated using a built-in key switch; LED indicates operating mode; four strong neodymium magnets are built into the back plate for mounting the device on a metal panel; holder for "compact" components DS617-1H is required for mounting it on a support stand;
operating voltage: 9 V battery (supplied)
or 6 - 12 V DC, supplied through the 5.5 mm hollow jack (e.g. by mains transformer P3130-1P);
case dimensions: 84 x 84 x 39 mm

DS617-1H Holder for "compact" components

For magnetically securing "compact" components;
Metal L-bracket on support (D = 10 mm);
yellow powder-coated;
dimensions:
approx. 84 x 84 mm
support: D = 10 mm, L = 80 mm

DE722-2W Remote control for laser and stopwatch "inno"

Push button switch in plastic case;
connecting cord (L = approx. 150 cm) with phone plug;
dimensions: 21 x 80 mm



Experiment: Modulation of laser light

DL100-1M "Laser" warning sign

For indicating a hazard when doing laser experiments;
yellow plastic panel labelled in black;
dimensions: 230 x 150 mm

Lenses in frames, "demo", on support

Glass lenses in black plastic frames, on supports, frame labelled with the focal length.
Support: L = 90 mm, D = 10 mm
Distance from centre of lens to support end: 150 mm
Lens diameter: 50 mm, frame diameter: 120 mm

DL500-1G Lens "demo", f = +1000 mm

DL500-1F Lens "demo", f = +500 mm

DL500-1E Lens "demo", f = +300 mm

DL500-1D Lens "demo", f = +200 mm

DL500-1B Lens "demo", f = +100 mm

DL500-1A Lens "demo", f = +50 mm

DL500-2F Lens "demo", f = -500 mm

DL500-2E Lens "demo", f = -300 mm

DL500-2D Lens "demo", f = -200 mm

DL500-2B Lens "demo", f = -100 mm

DL500-4A Condenser lens, "demo", on support

Technical specifications as for DL500-ff,
except lens diameter = 100 mm and f = +150 mm

DL500-9V Lens, variable, "demo", on support

For demonstrating how the lens of the eye works; two pieces of highly transparent foil stretched over a watertight acrylic frame; includes an opening for filling with a syringe as well as a breathing valve; supplied with plastic syringe; to be filled with water.
Centre of lens and end of support 150 mm apart;
frame: 100 x 100 mm;
diameter of lenses (foil): 50 mm

DL300-1D Holder for lenses, "demo", on rod

Black plastic frame on a support with a round cutaway area (D = 50 mm) for holding lenses up to 50 mm in diameter; with two threaded aluminium clamping rings.

Support: L = 90 mm, D = 10 mm
Frame diameter: 120 mm
Distance from centre of frame to support end: 150 mm

DL402-1S Adjustable slit, "demo", on rod

For experiments in diffraction and interference;
precision slit diaphragm mounted to pivot on support; slit width may be set symmetrically from 0 to 5 mm.
Slit length: 30 mm
Support: L = 90 mm, D = 10 mm
Mount diameter: 120 mm
Distance from centre of mount to support end: 150 mm

DL400-1I Iris diaphragm, "demo", on support

Continuously variable blade aperture mounted in black plastic frame.
Aperture diameter: 2 - 30 mm
Support: L = 90 mm, D = 10 mm
Mount diameter: 120 mm
Distance from centre of mount to support end: 150 mm

DL499-1E Plug-in board

For maintaining a good overview, when storing optics components on supports; wooden block with 17 holes taking supports up to 10 mm in diameter;
dimensions: 600 x 140 x 40 mm

DL300-1E Holder for slides and diaphragms, "demo", on rod

Black plastic frame with a square cutaway area on a support; two spring clamps on one side, for holding slides and screens; a ring on the other side for holding the holder for slides and diaphragms, stackable (DL300-1F).

Support: L = 90 mm, D = 10 mm
Frame diameter: 120 m
Distance from centre of frame to support end: 150 mm

Screens and image objects

Made of plastic foil, in 50 x 50 mm slide mounts with glass covers; may be inserted in the holder for slides and diaphragms, on rod, "demo" (DL300-1E) or holder for slides and diaphragms, stackable (DL300-1F)

DL300-1F Holder for slides and diaphragms, stackable

Black plastic frame with a square cutaway area for holding slides and screens up to 50x50 mm; may be plugged into "demo" mounted lenses on supports (DL500-ff)
or "demo" lens holder on support (DL300-1D)

P5400-1K Round apertures, set of 3
Diameter of hole: 1, 3 and 8 mm

P5400-1E Slide with "L"

P5400-1F Slide with 4 drawings

P5400-1A Slide with 1 slit

P5400-1V Slide with adjustable slit

P5410-1G Circular aperture in mount, D = 20 mm

P5410-1H Circular disk in mount, D = 34 mm

To demonstrate the different focal length of lenses close to / remote from the axis;
frame made of black plastic; D = 52 mm; with slide with holes; may be plugged into "demo" mounted lenses on supports (DL500-ff) or holder for lenses, on rod (DL300-1D)

Experiment: Camera aperture

Prisms

DL515-1P Prism, crown glass

Angle of refraction: 60°; average index of refraction: 1.51;
average dispersion: 0.008; angle of dispersion: 0.75°;
base length: 32 mm; height: 32 mm

DL515-2P Prism, flint glass

Angle of refraction: 60°; average index of refraction: 1.62;
average dispersion: 0.017; angle of dispersion: 1.77°;
base length: 32 mm; height: 32 mm

DL515-3P Prism, 90°

Right-angle, equal-sided glass prism;
angle of refraction: 90° to 45°;
length of short sides: 45 mm; height: 45 mm

DL512-1R Prism table, "demo"

For mounting prisms on the optical bench;
plastic plate on a support with a clamp of adjustable height;
diameter: 60 mm;
max. clamp opening: 60 mm;
support length: 150 mm

DL511-1H Hollow prism

For investigating the index of refraction of liquids;
equal-sided, 60° prism
assembled from acrylic plates;
includes opening for filling and stopper;
base length: 60 mm;
height: 60 mm

DL516-1P Direct-vision prism

For spectral experiments with very little deflection of rays;
an Amici prism consisting of two crown glass and one flint glass prism;
angle of dispersion: 4.23°;
cross-section: 30 x 30 mm;
length: approx. 120 mm

DL516-1G Mount for direct-vision prism

For mounting direct-vision prism DL516-1P along on optical axis;
black plastic frame on a support, including a square screening tube and two plastic knurled head screws;
support: L = 90 mm, D = 10 mm;
frame diameter: 120 mm;
distance from centre of frame to support end: 150 mm

(direct-vision prism not included)

Experiment: Dispersion of white light by a direct-vision prism and recombining the spectral colours, yielding white, using a cylinder lens

DL601-1L Mirror, planar, 180 x 120 mm

P5600-3P Mirror, planar, 75 x 50 mm

Flat glass mirror with polished edges

DL610-1S Mirror on ball joint

Flat mirror in a frame on a support
(D = 10 mm, L = 40 mm)
with ball joint;
dimensions: 125 x 185 mm

DL601-1H Concave and convex mirror, "demo", on support

Concave and convex mirror mounted in black plastic frame on a support;
focal length: ± 200 mm;
mirror diameter: 100 mm;
support: L = 90 mm, D = 10 mm;
frame diameter: 120 mm;
distance from centre of frame to support end: 150 mm

DL600-1G Glass plate, 300 x 200 x 4 mm

DL600-1D Glass plate, 50 x 50 x 3 mm

Glass plate with polished edges

DL600-2A Screen, zinc sulphide

For demonstrating the presence of UV radiation;
metal screen, coated with zinc sulphide, on a support
(D = 10 mm, L = 85 mm);
dimensions: 100 x 80 mm

DL600-1S Screen, "demo", transparent

For observing spectra as well as interference and diffraction phenomena; durable, diffuse plastic foil in a black wooden frame; may be mounted in plate clamp on support DS404-1G or slider-stand, horizontal DS140-2R;
dimensions: 295 x 210 mm

DL600-1W Screen, "demo", white

White plastic plate in a black wooden frame; may be mounted in plate clamp on support DS404-1G or slider-stand, horizontal DS140-2R;
dimensions: 295 x 210 mm

DS404-1G Plate clamp on support

For clamping plates of max. 10 mm thickness; rubber-coated clamping jaw ensures safe yet surface-protective footing;
aluminium profile,
green powder-coated;
with support rod
D = 10 mm, L = 40 mm;
with M8 wing screw and clamping jaw

DS140-2R Slider stand, horizontal

Special aluminium profile with a clamp for holding round rods of up to 18 mm in diameter, square rods up to 12 x 12 mm and plates up to 16 mm thick; includes a set screw and wing screw;
L = 35 mm

DL401-1P Polarisation filter, "demo", on support

For creating linearly polarised light;
plastic foil between glass plates;
mounted in a frame pivoting
on a support;
scale: 0° to ± 90°;
filter diameter: 80 mm;
support: L = 90 mm, D = 10 mm;
frame diameter: 120 mm;
distance from centre of frame
to support end: 150 mm

P5420-1A Polarisation filter, SE, in mount

Plastic filter slide in mount with label;
can be attached to lens or holder "demo"
or lens holder SE;
D = 50 mm

P5420-3A Object for photoelastics

Simple model for
demonstration of the stress
distribution in elastic
deformation in polarised
light; acrylic glass body with
slotted and circular recess;
dimensions: 80 x 30 mm

DL401-6P Polarimeter tube

For demonstrating the
rotation of the plane of
polarisation by optically
active liquids such as a
sugar solution or carbon
disulphide; acrylic tube
sealed at both ends; with
an opening for filling;
D = 30 mm;
L = approx. 120 mm

P5420-2A Quartz, polarisation preparation

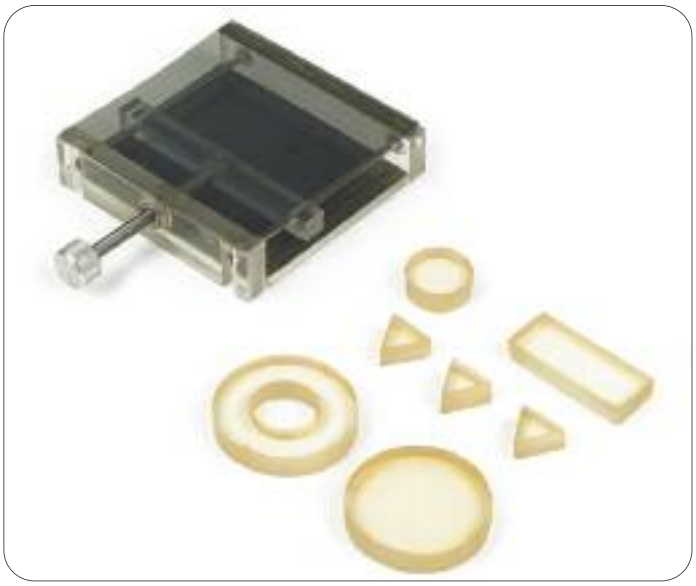
Solids for rotating the plane of polarisation
clockwise;
polished quartz disc; sectional area
perpendicular to the optical axis;
mounted on plastic plate 50 x 50 mm;
Quartz disk: D = 10 mm, thickness = 2 mm

DL404-1K Calcite

For demonstrating double refraction;
piece of natural, unfinished calcite;
dimensions: approx. 25 x 20 x 10 mm

DL401-3P Polarisation filter set "jumbo", D = 200 mm

For creating linearly
polarised light;
polarisation filters
mounted between glass
plates in a plastic frame
with a yellow pointer;
the polarisation filters
are mounted to pivot
on a U-profile;
slots allow the filters
to be spaced various
distances apart, e.g.
when doing the
experiment
"photoelastic analyses";
frame is green powder-
coated; U-profile includes a threaded rod for mounting it on the
optical bench;
diameter of the polarisation filters: approx. 200 mm;
accessories included: two test objects of epoxy material
(DL403-2S)



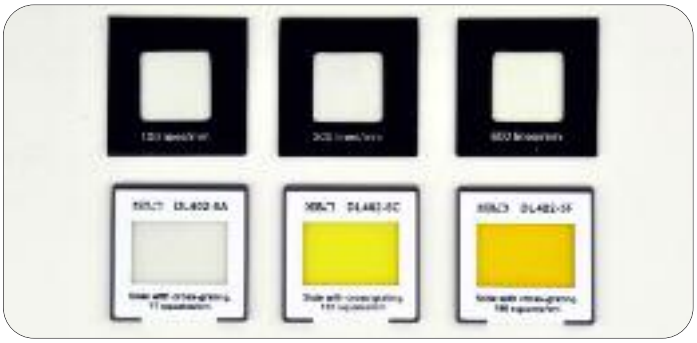
DL403-1P Polariscope

Overhead projector device for demonstrating, using polarised
light; the distribution of strain evident when test objects are
deformed elastically (photoelastic analysis);
acrylic frame with one fixed and one hinged polarisation filter;
screw clamp for applying pressure to the inserted epoxy test
object from set DL403-1S (not included);
dimensions: 100 x 100 mm

DL403-1S Test objects, set, for photoelastics

For demonstrating, using polarised light, the distribution of
strain evident when objects are deformed elastically;
may be used together with polariscope DL403-1P or "jumbo"
polarisation filter set DL401-3P.
Seven test objects made of epoxy material: 1 ring (D = 60 mm);
1 disc (D = 60 mm); 1 disc (D = 30 mm); 1 rectangle (60 x 25
mm); 3 triangles (20 mm sides), each 5 mm thick

Diffraction gratings



For diffraction and interference experiments; on film between glass plates 50 x 50 mm; attachable to the holder for slides and diaphragms, on rod, "demo" (DL300-1E) or holder for slides and diaphragms, stackable (DL300-1F)

P5820-1A Diffraction grating, 100 lines / mm

P5820-1B Diffraction grating, 300 lines / mm

P5820-1D Diffraction grating, 600 lines / mm

DL402-5A Slide with cross-grating, 77 squares / cm

DL402-5C Slide with cross-grating, 130 squares / cm

DL402-5F Slide with cross-grating, 180 squares / cm

DL402-5H Cross-grating, A4 transparency, 200 squares / mm

Experiment: Watching a candle flame through the cross-grating foil DL402-5H

DL408-1I Interference model

For observing interference phenomena using two transparent plastic sheets printed with concentric circles and parallel lines, laid one on top of the other and moved (may also be used with an overhead projector);
circle diameter: 173 mm;
sheet dimensions: 297 x 210 mm

DL405-2G Mica sheet

For demonstrating interference along thin layers;
dimensions: approx. 100 x 100 mm

DL406-1B Biprism

For demonstrating and studying interference of light caused by differing degrees of refraction;
height: 40 mm; length: 48 mm

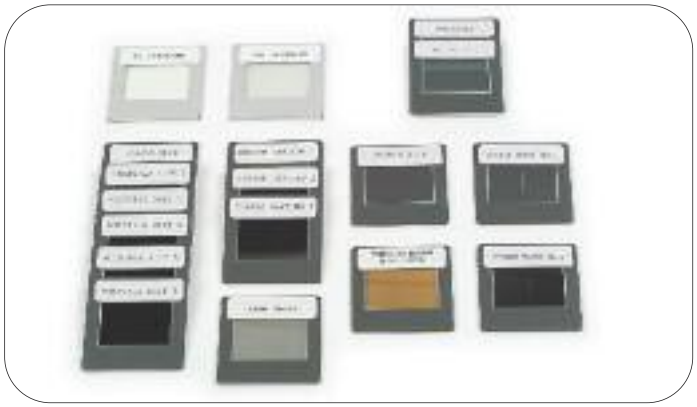
Laser - diffraction sets

Diffraction objects printed on foil mounted in slide frames for wave optics experiments using laser;
frame dimensions: 50 x 50 mm;
screen dimensions: 36 x 24 mm

DL402-1A Laser - diffraction set A

Set of 9 objects consisting of:

6 Slides with 1 to 6 slits (slits 0.06 mm wide and 0.2 mm apart)
3 Slides with line gratings:
40 Lines / cm (line width 0.2 mm)
40 Lines / cm (line width 0.1 mm)
80 Lines / cm (line width 0.03 mm)



DL402-1C Laser - diffraction set C

Set of 18 objects consisting of:

6 Slides with 1 to 6 slits (slits 0.06 mm wide and 0.2 mm apart)
3 Slides with line gratings:
40 Lines / cm (line width 0.2 mm)
40 Lines /cm (line width 0.1 mm)
80 Lines / cm (line width 0.03 mm)
1 Slide with line grating, 80 lines / mm
1 Slide with line grating, 300 lines / mm
1 Slide with a single slit (conically shaped)
1 Slide with a double slit (conically shaped)
1 Slide with wire grating, 300 squares / mm
1 Slide with apertures 0.3 / 0.4 / 0.6 and 1 mm in diameter
1 Hologram (transmission)
2 Polarisation filters

DL407-2F Fresnel mirror

For demonstrating the interference of light after being reflected from two mirror surfaces;
flexible, black planar mirror mounted in a frame; fine screw adjustment of angle of inclination;
mirror surface area dimensions:
130 x 32 mm

DL406-1N Newton's ring apparatus

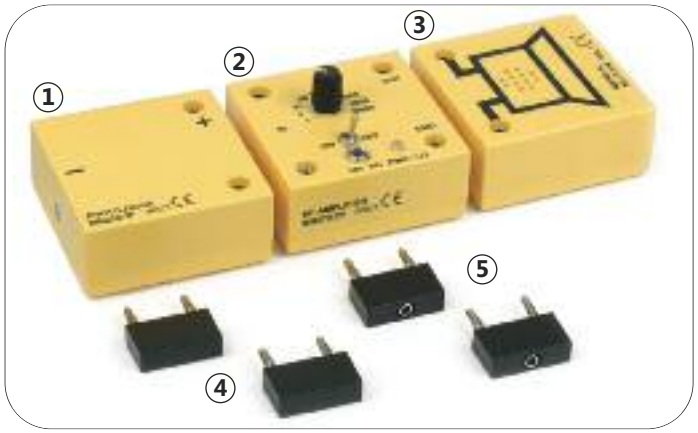
For generating Newton's rings by means of interference; a plano-convex lens mounted together with a glass plate in a metal frame embedded in a plastic mount on a support; angle of wedge may be varied by means of three knurled head screws.
Distance from centre of frame to support end: 150 mm

DL100-3L Laser 0.2 / 1.0 mW, linearly polarised, modulatable, magnetic

Wavelength: 635 nm
Optical power output: 0.2 /1.0 mW
Polarisation: linear
Modulation input

detailed technical description
see page 209

DL100-3R Laser receiver unit, set



Modular equipment set, suitable for a metal panel, for receiving and amplifying laser signals and for acoustically rendering modulated laser signals.

Set consisting of:

1 1x **MB220-2F** Photodiode, "compact", magnetic

For use in photosensitive measurements;
Silicon photo diode in planar technology with integrated optical filters in magnetic block "compact";
strictly logarithmic correlation between cell current and light intensity in the range of 102 - 105 lux.
Photo Sensitivity> 5.5 nA / lux
Spectral range: 350 - 775 nm
Radiation sensitive area: 2.71 x 2.71 mm (7.34 mm²)
Output via two 4 mm sockets

2 1x **MB270-2V** LF amplifier "compact", magnetic

For technical description see page 143

3 1x **MB240-1L** MBC Loudspeaker

Loudspeaker, 8 Ohm / 1 Watt, two 4 mm jacks

4 2x **P3712-1S** Jumper plug, black

5 2x **P3712-2S** Jumper plug with connector terminal, black

Required power supply:
P3130-1P Mains transformer 12 V DC / 2 A

DP130-3M Connecting cable for modulation

For connecting an audio device (e.g. radio, CD player, MP3 player) to laser DL100-3L in order to modulate it; connecting cord with 3.5 mm phone plug at each end; cable length: approx. 50 cm

DL931-1L Optical fibre, flexible

Round acrylic rod (D = 3 mm, L = 75 cm) with one end permanently attached to a black screen (50 x 50);
may be inserted in optics lamps or holders for slides

DL931-1K Holder for flexible optical fibre

Acrylic rod with through hole;
for holding the loose end of the flexible optical fibre DL931-1L;
L = 100 mm, D = 10 mm

DL610-2S Satellite mirror, large, with ball joint

Picture of a satellite including a built-in mirror for reflecting (laser) signals; photograph in a frame with a support mounted on a ball joint on the back;
(image provided for educational purposes courtesy of „ESA");
dimensions: 60 x 40 cm

Detail: Thanks to the ball joint on support attached to the back, the satellite mirror can quickly be brought into any desired position

Experiment: Modulation of laser light - optic fibre cable

Laser experiments:

DL100-9SE Experiment manual, "Laser light", book b/w

DL100-9CE Experiment manual, "Laser light", CD-ROM

Vibrations
OPL 005 Optic fibre cable

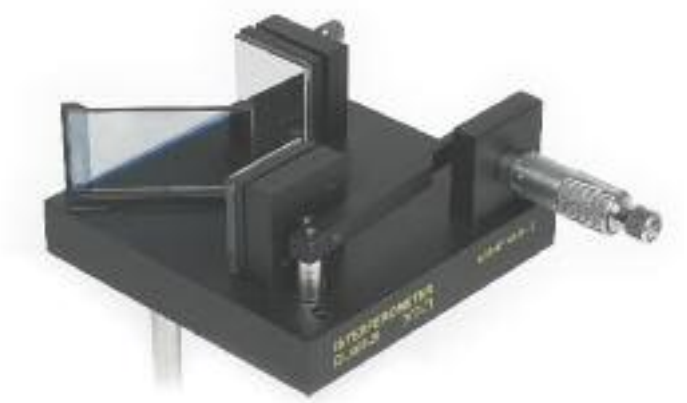
Wave optics
OPL 006 Diffraction by water drops
OPL 007 Black circles - estimating the size of spores
OPL 008 Pulling apart a point of light
OPL 009 Diffraction through a slit
OPL 010 Diffraction through a diaphragm
OPL 011 Diffraction through various objects
OPL 012 Diffraction through hair
OPL 013 Babinet's principle
OPL 014 Diffraction through a double slit
OPL 015 Diffraction through a grid
OPL 016 Diffraction through woven material
OPL 017 Measuring the wave length of laser light
OPL 018 Diffraction through a cross-grating - determining the grid constant
OPL 019 Interference in a bi-prism
OPL 020 Interference in Fresnel's mirror
OPL 021 Interference and Newton's rings
OPL 022 Measuring the capacity of a CD-ROM
OPL 023 Laser light may be polarised

Information transmission
OPL 026 Modulation of laser light
OPL 027 Modulation of laser light - optical fibre cable
OPL 028 Experimental model of satellite transmission

Michelson interferometer
OPL 029 Interferometer
OPL 030 Measuring the wavelength of laser light
OPL 031 Optical Doppler effect
OPL 032 Optical density in air - changed by heat
OPL 033 Optical density in air - carbon dioxide

Experiment: Measuring the wavelength of laser light

DL408-2I Michelson interferometer



Precision device for measuring phenomena such as light wavelength, index of refraction etc.;
apparatus consists of a metal base plate (120 x 120 mm, 2 cm thick) with two full mirrors (30 x 30 mm each) and a half-silvered mirror (50 x 30 mm) mounted on it according to the Michelson configuration.
The position of one of the full mirrors can be adjusted by means of a micrometer screw (0 - 10 mm, vernier 1 / 100 mm) and a lever arm (step-down gear ratio of 1:10), while the other full mirror, which is fixed, can be inclined by means of two screws; the half-silvered mirror is fixed in place;
the base plate has a hole for mounting round cell DL408-3K in order to measure the index of refraction of gases. The underside of the base plate has a tapped hole taking a 10 mm threaded support for mounting the device on the optics bench;
supplied with a solid plastic hood in order to protect all optical parts.

Lenses in frame, "demo", on support

Glass lenses in black plastic frames;
on supports; frame labelled with the focal length; support: L = 125 mm, D = 10 mm;
distance from centre of lens to support end: 150 mm;
lens diameter: 18 (32) mm;
frame diameter: 50 mm

DL500-0B Lens "demo", f = +20 mm

DL500-2A Lens "demo", f = -30 mm

DL408-3K Round cell for interferometer

For measuring the index of refraction of gases, used together with Michelson interferometer DL408-2I;
cell with two hose fittings and an M10 threaded support; with a plastic nut, for mounting the apparatus on the interferometer base plate;
cell diameter: 30 mm

Colour filters

Plastic foil in slide mounts;
frame dimensions:
50 x 50 mm;
aperture dimensions:
36 x 24 mm

DL200-1A Colour filter, red
DL200-2A Colour filter, green
DL200-3A Colour filter, blue

DL200-1B Colour filter, yellow
DL200-2B Colour filter, cyan
DL200-3B Colour filter, magenta

DL200-5B Colour filter, dark green
DL200-4B Colour filter, purple

DL215-1A Additive mixture of colour, "compact"

For demonstrating additive colour mixture simply and quickly; three super bright diode lights with condenser lens and movable lens tube with integrated imaging lens, can be adjusted for a **sharp image of approx. 15 to 90 cm**; diode lights in compact support plate, fully rotatable via ball joints; each lamp is switchable and dimmable, incl. white screen and power supply
screen surface area: 16 x 10.5 cm
dimensions: 17 x 15 x 22 cm

DL215-2S Screen, large, translucent

For large scale, translucent reproduction of optical illustrations; may be mounted in two slider stands horizontal DS140-2R
material: special plastics, white
dimensions: 49 x 49 cm

DL203-1S Colour filter discs, subtractive, set of 3

For fast and very clear explanation of subtractive mixture of colours, with no additional equipment; three plastic discs coated in yellow, magenta and cyan; diameter: each 195 mm

DL510-4D Foils for 4-colour print, set

The principle of four-colour printing (i.e. printing presses and colour copying machines) may be demonstrated by overlapping transparencies; set of four overhead projector transparencies in the colours yellow, cyan, magenta and black; includes a durable, acrylic base plate with metal tongues for holding the four transparencies;
transparency dimensions: 30 x 20 cm; base plate: 30 x 30 cm

DL510-3F Colour filters, additive, set

Set of four colour discs for demonstrating the additive mixture of primary colours by rotation; plastic discs printed in the colours blue-red, red-green, green-blue and red-green-blue; mounted using disc spindle DW220-1H; disc diameter: 190 mm; centre hole: 10 mm

DL510-SW Benham's disc

Colour perception results from the brain further processing signals received from the eye; colour signals are differentiated from black and white signals on the basis of a differing sequence of impulses; the illusion of colour lines is generated when, by rotating the disc, the black and white lines alternate quickly with each other; disc diameter: 190 mm; centre hole: 10 mm

DL510-1F Colour disc

For demonstrating additive colour mixture; plastic disc printed with sectors in various colours and including a centre hole for mounting it on disc spindle DW220-1H; disc diameter: 200 mm; centre hole: 10 mm

P5210-3A Colour strip

To demonstrate the body colours in combination with the colour filters DL200-ff; cardboard strip with 8 colour swatches, each 50 x 50 mm

DL512-1S Spectrometer and Goniometer, simple

For observing and measuring spectra; for measuring the angle of deflection from prisms and gratings and for determining visible dispersion and the index of refraction; rigidly mounted collimator tube (f = 150 mm) with an adjustable slit; swivelling platform (D = 170 mm) with a set screw; equipped with a scale in 1° graduations from 0 - 360°; adjacent vernier scale allows readings with a precision of 0.1° to be taken; telescope with set screw and fine adjustment may be swivelled around the platform; prism table with three levelling screws as well as tapped holes for mounting the holder for prisms or gratings (included);
Dimensions: height: 210 mm; length: 530 mm; weight: 4.5 kg

DL512-2G Spectrometer and Goniometer, precision

For observing and measuring spectra; for measuring the angle of deflection from prisms and gratings and for determining visible dispersion and the index of refraction; rigidly mounted collimator tube (f = 178 mm) with an adjustable slit; swivelling platform (D = 150 mm) with a set screw; precision of readings: 1°; telescope with set screw and fine adjustment may be swivelled around the platform; rotatable prism table with three levelling screws as well as tapped holes for mounting the holder for prisms or gratings (included); supplied in a wooden case; also included: prism and diffraction grating.
Dimensions: height: 275 mm; length: 580 mm; weight: 8 kg

Additionally required:

DL515-2P Prism, flint glass

and / or

P5820-1D Diffraction grating, 600 lines / mm

DL722-2L Lux meter "inno"

DL550-1T Pocket spectroscope

Handheld model for observing spectra in discharge tubes, Fraunhofer lines, flame tests and absorption spectra in liquids; optical system includes a built-in diffraction grating with 600 lines / mm, slit width: 0.2 mm;
dimensions: L = 115 mm; D = 25 mm

Demonstration instrument for measuring light intensity within a wide range; very easy to transport and magnetically mountable; the 26 mm LED display showing the measured value allows precise readings to be taken even at a great distance.

Technical data:
Display: 4 ½-digit LED display; digit height 26 mm
Measurements taken by an external sensor, connected by cable to the device
Measuring ranges: 20 / 200 / 2000 / 20000 Lux
Values expressed in candela according to the spectral sensitivity of the human eye
Power supply: 4 x 1.5 V mignon cells (included)
or 5.5-mm hollow DC jack for 6 V/500 mA
external power supply P3120-6N

Case: green ABS plastic with yellow labelling
Dimensions: approx. 160 x 120 x 45 mm; weight: approx. 400 g

DR991-1B Radioactivity, set

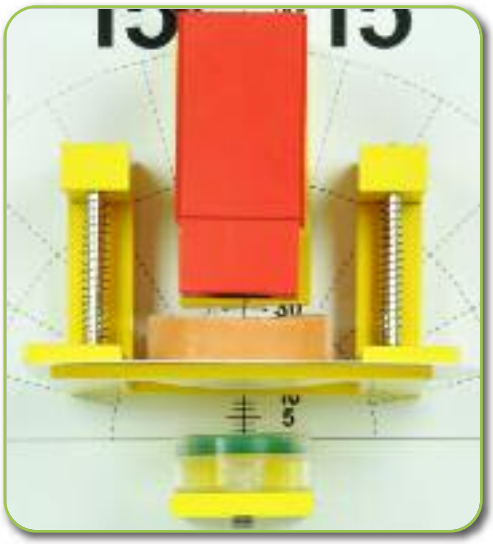
In solidly constructed NTL box, stored in predefined places

DR990-9CE Experiment manual, "Radioactivity", CD-ROM

DR990-9SE Experiment manual "Radioactivity", (booklet)

RAI 1.1 Measuring blank value
RAI 1.2 Identifying a radioactive source (natural radioactive substances)
RAI 2.1 Alpha radiation: identifying alpha radiation
RAI 2.2 Range of alpha radiation in air
RAI 2.3 Absorption of alpha radiation
RAI 3.1 Beta radiation
RAI 3.2 Behaviour of beta radiation in a magnetic field
RAI 3.3 Range of beta radiation in air
RAI 3.4 Absorption of beta radiation
RAI 3.5 Measuring the thickness of transparent plastic
RAI 3.6 External exposure to beta radiation
RAI 3.7 Beta radiation backscatter
RAI 4.0 General notes on gamma radiation
RAI 4.1 Range of gamma radiation in air: the inverse square law
RAI 4.2 Gamma radiation not deflected in a magnetic field
RAI 4.3 Gamma dosimetry
RAI 4.4 Absorption of gamma radiation
RAI 4.5 Detecting levels

RAI 3.6 External exposure to beta radiation



Detail image

DR991-1B Radioactivity, set

consisting of:

1 DR200-KC Potassium chloride, 250 g

The naturally occurring substance is the primordial radionuclide 40K, which is available to 0.0117 atomic percent in the element potassium; specific activity of 16.2 Bq / g at 40K;
250 g in plastic box with screw cap

2 DR201-1C Columbite

Naturally occurring, slightly radioactive solid solution, also called Niobite, contains the elements niobium and tantalum; is NOT notifiable in accordance with the Radiation Protection Ordinance!
Dimensions: L = 20 mm

3 DR250-1A Radiation absorption plates, set

Plates of various materials to the absorption of radiation;
materials: 10 x lead, 5 x steel, 5 x aluminum, 5 x acrylic;
plate dimensions : each 80 x 50 x 2 mm

4 DR212-1H Holder for absorption plates, magnetic

For vertical mounting of up to 10 absorption plates, magnetic, to metal panels or directly on the laboratory bench;
robust, variable clamping metal holder with 4 clamping springs, max. wingspan: 23 mm;
bottom side 4 built-in neodymium magnets;
window opening : 50 x 50 mm;
dimensions : width = 94 mm, height = 70 mm, depth = 54 mm

5 DR201-1R Radioactive preparation mount, magnetic

For vertical mounting of the radiation sources DR209-ff;
aluminum bracket with magnets and steel bolt in axle height;
H (total) = 50 mm, axle height = 35 mm

6 C3551-2T Test tube, graduated

For tests for level measurement with a radiation source and lead shot; thick-walled test tube with graduation, for clamping it into holder DR212-1H;
content: 25 ml; D (outer) = 20 mm, H = 160 mm

7 DM115-1A Lead (tare) shot, 250 g

Lead shot used as absorption or as weights for taring;
ball D = 2 mm; in plastic bottle; capacity 250 g

8 DR213-1A Adapter for deflection in radioactive substances

For investigating the behaviour of radiation in a magnetic field; metal mount for positioning button magnets DE407-1A in front of sources DR209-ff; the mount may be plugged directly into the preparation casing;
dimensions: D = 35 mm, L = 28 mm

9 DE407-1A Button magnets small, pair, "neo"

Material: neodymium; poles covered with red or green plastic cap; D = 13 mm, H = 5 mm

10 C6008-1B Container with lid, 80 ml, plastics, 50 x 50 x 40 mm

Transparent, impact-resistant plastic container with firmly closing lid

11 C7418-2A Knife for laboratory use, steel

For cutting off meat or meat slices as a substitute for human soft tissue; for determining the surface dose;
handy stainless steel blade with plastic handle, L = 150 mm

12 C7415-2Z Crucible tong

For low-contamination handling of radioactive sources DR209-ff; curved forceps made of steel and nickel-plated; L = 200 mm

P7906-1R Box insert Radioactivity, plastics

P7806-1K Storage box II small, with cover

DE722-1G Geiger-Mueller counter, "inno"

Demonstration instrument for measuring ionising radiation; very easy to transport and magnetically mountable; the 26 mm LED display allows precise readings to be taken even at a great distance.

Technical data:

Display:	4-digit LED display; digit height 26 mm
Switch:	ON / OFF

MODE switch:

- IMP setting: manual start and manual stop
- MAN setting: manual start, one measurement is taken during the interval set on the TIME switch
- AUTO setting: measurement cycle is repeated for the interval set on the TIME switch

TIME switch:	for the MAN and AUTO modes, a valid measurement interval of 1, 10 or 100 seconds may be selected
SPEAKER switch:	switches the speaker on or off
START switch:	starts and stops measurement in IMP mode and starts it in MAN mode
GATE LED:	indicates counter gate state

Analogue output through a 3.5 mm phone jack (10 mV / Hz), BNC jack for connecting tube DR291-1Z
Power supply: 4 x 1.5 V mignon cells (included) or 5.5 mm hollow DC jack for 6 V / 500 mA external power supply P3120-6N

Case:	green ABS plastic with yellow labelling
Dimensions:	160 x 120 x 45 mm; weight: approx. 475 g

DR260-1D Digital counter, universal

Universal digital demonstration counter for measuring time, frequency and pulse rates;

Display:
7 segment LED display, 6 digits; digit height 26 mm

Time measurement:
4 measuring ranges from 10 - 10,000 s times the value displayed; measurement can be controlled using any signal source or light gate demo; the two time value inputs may be combined logically in every possible way; adjustable signal threshold of time value inputs using potentiometer; light-emitting diodes for monitoring operation

Frequency measurement:
Fully automatic in 4 ranges from
10 - 10,000 Hz times the value displayed; signal may be monitored audibly by switching on loudspeaker

Pulse rate measurement:
Input for Geiger-Müller tube; anode voltage may be set in 12 steps from 325 to 600 V; measurements scaled down by 1 : 100 possible; signal may be monitored audibly by switching on loudspeaker

ABS plastic case with 2 recessed handles
Dimensions: 260 x 150 x 210 mm
Voltage source: 230 V / 50 - 60 Hz

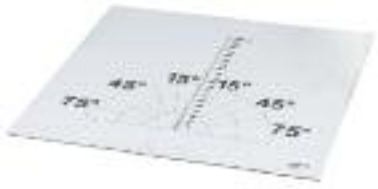
DR291-1Z Geiger-Mueller tube on magnetic base

For registering the presence of alpha, beta and gamma rays; tube in a red acrylic case (28 x 28 x 60 mm) and mounted on a support rod with a magnetic base (60 x 30 mm);
line marking centre; cord with BNC plug permanently attached; plastic lid to protect the end window.

Gas filling: Ne & halogen
End window made of mica, 9.1 mm in diameter
Plateau voltage: approx. 500 V
Dimensions: 30 x 60 x 49 mm
Axis height: 35 mm

DR210-1F Foil with scale, for radioactivity, magnetic

For use in radioactivity demonstration experiments on a magnetic panel; magnetised foil with a white coating, printed with a degree scale and a linear scale in mm and cm; dimensions: 300 x 300 mm



DR210-1P Scale for radioactivity, metal

For use in radioactivity experiments on the lab table; light blue powder-coated metal plate, printed with a degree scale and a linear scale in mm and cm; dimensions: 300 x 210 mm

DR270-1K Storage - case for radioactive sources, metal

Steel cabinet for safe storage of radioactive preparations in the lab storage room;
steel cabinet, painted yellow, with a cylinder lock;
one (fixed) shelf; labelled with the warning symbol;
dimensions: 215 x 85 x 287 mm

DR270-1S Warning sign "X-Rays"

For indicating the hazard when performing experiments with radioactive preparations; plastic panel, labelled with symbol and wording; dimensions: 230 x 150 mm

Radioactive substances

For investigating the properties of alpha, beta and gamma radiation

DR209-PO Po-210 preparation (alpha radiation), red

Emits alpha radiation (polonium-210) with activity (A) = 3.7 kBq; half-life: 138.40 days; emits alpha particles with a maximum energy level of 5.305 MeV

DR209-SR Sr-90 preparation (beta radiation), green

Emits beta radiation (strontium-90) with activity (A) = 3.7 kBq; nuclide decays to its daughter particle yttrium-90, which emits beta particles with a maximum energy level of 2.27 MeV; the half-life of Sr-90 is 28.9 years, and the Sr-90-Y-90 system also decays at this rate

DR209-CO Co-60 preparation (gamma radiation), orange

Emits gamma and beta radiation (cobalt-60) with activity (A) = 37 kBq; half-life: 5.258 years; in addition to beta radiation, which is absorbed by the radiation window, it emits gamma rays with an energy level of 1.17 and 1.33 MeV; this source is supplied with two lead-cylinders for protection of gamma radiation.

Preparation design
The radioactive substances, which are glued into plastic discs (D = 25 mm, H = 5 mm) with a small magnet at centre, are positioned in such a way that they are covered by a thin plastic coating or, in the case of polonium, by an adhesive metal foil in the area from which radioactivity is emitted. The plastic discs themselves are labelled by colour as well as with the radioactive warning symbol and the wording “radioactive material”. In addition, details on the type of radiation, activity and the half-life as well as the name of the radionuclide and of the product are given. The plastic discs are embedded in cylindrical acrylic cases (D = 30 mm, L = 12 mm). The acrylic cases have a small magnet on the back side, allowing them to be mounted quickly and easily e.g. using crucible tongs onto the magnetic mount for radioactive preparations (DR201-1R).
Preparations DR209-ff have been inspected and approved for school experiments, as attested to by an experts' report. Every delivery is accompanied by a copy of the report. These accompanying documents must be kept and presented upon request to authorities responsible for inspection. Guidelines and advice for handling, storing and experimenting with these preparations is contained in these documents as well as in radioactivity experiment manual DR990-9SE. The activity of the individual sources of radiation listed under DR209-ff is within the limits set forth by the regulation on radiation protection. All sources have been tested for tightness by the manufacturer, and thus all of them are without exception “sealed sources”. Prior to delivery, the user (i.e. the particular school or institution with an indication of authorised or responsible persons) must sign the “standard document pursuant to Council Regulation (EEC) No 1493/93” and submit it to the relevant competent authority in the receiving country. You may request this document from us. Sources can only be delivered upon receipt of a duly completed standard document.

DR420-1P Planck's constant compact apparatus

A great device:

With this device, **Plancks´s constant h** can easily be determined with a deviation of less than 10 %.
It is not required to darken the room !
Electron affinity can be calculated as well. The phenomenon is termed the **outer photoeffect**.
Electromagnetic radiation results in the release of electrons from a metal surface.
The device has a built-in photodiode, LEDs of various wavelengths are used as monochromatic light sources.
The emitted light passes through the opening of the ring-shaped anode and contacts the surface of the cathode. In the photoeffect, a photon transfers its entire energy (E = h * f) to an electron upon impact. Part of the energy is required to force the electron out of the metal surface (electron affinity). The remaining energy is then at the electron's disposal as kinetic energy.

$$E_{kin} = h \times f - \Phi$$

The critical voltage for the five available wavelengths is measured within this experiment.
All further calculations are based on this.

TECHNICAL SPECIFICATIONS		
Photocell	Material	Caesium (Cs)
Voltmeter	Display	3 ½ digit, LCD
	Precision	0.5% (typical)
Amperemeter	Display	3 ½ digit, LCD
	Precision	1% (typical)
Dimensions	W x H x D = 280 x 120 x 160 mm	
Weight	approx. 1 kg	

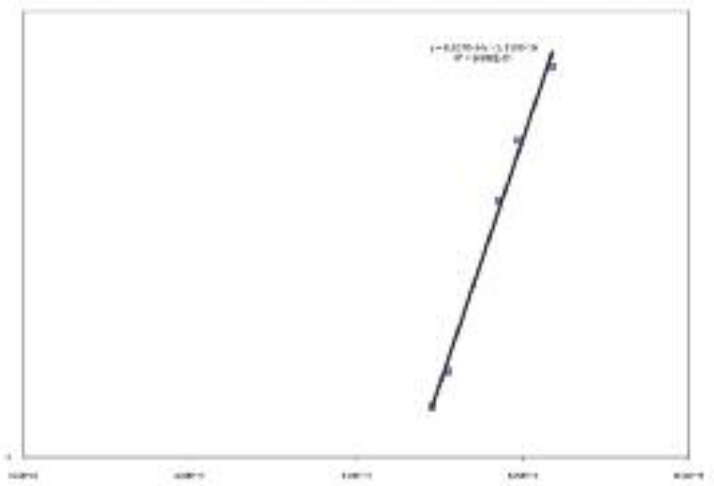
All required peripheral devices (voltmeter, nano-amperemeter) are integrated into the device.
The five light sources (LEDs with various precisely defined wavelengths) are supplied with power from the device.
Power supply through included fixed-voltage transformer.
Supplied with experiment manual as well as evaluation spreadsheet (Excel).

The evaluation of the experiment can be easily done by entering the values measured for the critical voltage in the columns of the Excel spreadsheet included.

simple

NAME	[m]	[V]	F [hZ]	E0 = U0 x e [J]	E = h x f - [J]
SAMPLE	6.11E-07	0.085	4.91E+14	1.36E-20	1.334E-20
	5.88E-07	0.145	5.10E+14	2.32E-20	2.606E-20
	5.25E-07	0.432	5.71E+14	6.912E-20	6.663E-20
	5.05E-07	0.533	5.94E+14	8.528E-20	8.162E-20
	4.72E-07	0.657	6.36E+14	1.0512E-19	1.091E-19

Afterwards, the inclination h and the axis intercept Φ can be read from the graph...



fast

...and the program then automatically calculates the deviation (error) from the theoretical value.

EXPERIMENTAL RESULTS	PLANCK'S CONSTANT [J.s]	ELECTRON WORK FUNCTION [J]
THEORETICAL	6.626E-34	3.120E-19
MEASUREMENT	6.607E-34	3.110E-19
ERROR	-0.29%	-0.32%

Of course, these parameters can be calculated manually as well, but this is much more time-consuming.

safe

DE453-3S Cathode ray tube with slit

For demonstrating the deflection of cathode rays in a magnetic field; vacuum glass tube with electrodes mounted on metal caps; slit diaphragm and fluorescent screen (approx. 75 x 35 mm); two horizontally aligned electrodes for deflecting the electron beam; with plastic base;
operating voltage: approx. 2-3 kV;
glass-tube length: approx. 270 mm, diameter: approx. 40 mm

Recommended power supply:
P3171-1A High-voltage power supply 10 kV with digital display, "demo"

DE453-3K Cathode ray tube with shadow cross

For demonstrating the linear propagation of cathode rays; vacuum glass tube with electrodes mounted on metal caps; metal cross (may be folded down); with plastic base;
glass tube length: approx. 230 mm, diameter: approx. 80 mm

Recommended power supply:
DE526-2F Spark coil 02

DR400-ZN Zinc plate for photoelectric effect

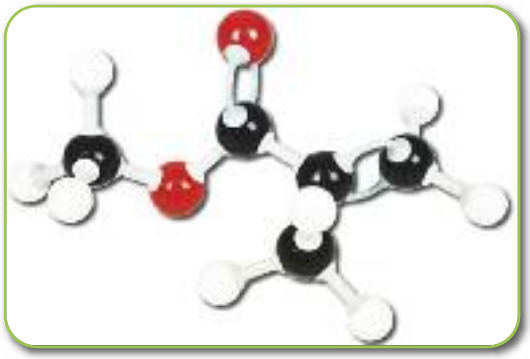
For demonstrating the photoelectric effect; polished zinc plate with 4 mm plug pin;
dimensions: 160 x 110 mm

DE453-3R Vacuum discharge tube (Pohl type)

For demonstrating how pressure affects the glow in a gas discharge tube; thick glass tube with central suction pipe with GJ 19/26; disc electrodes mounted on metal caps are placed at both ends to supply high voltage;
coupling piece of metal with flange DN 16 and ventilation valve; dimensions: L = approx. 650 mm, D = 36 mm

Molecule model sets

Round models of atoms and connecting pins made of solid plastic; in various colours and sizes;
supplied in a plastic box with a lid



C9020-01 Molecule model set 1 (student)

C9020-02 Molecule model set 2 (demo)

Component parts:

C9020-01	C9020-02	Description	Colour	D (mm)
20	40	Hydrogen	White	17
12	24	Carbon	Black	23
-	6	Carbon	Black	23
7	12	Oxygen	Red	23
2	4	Nitrogen	Blue	23
1	1	Sulphur	Yellow	23
-	4	Sulphur	Yellow	23
6	12	Halogen	Green	17
-	2	Metal	Grey	17
-	1	Metal	Grey	20
26	60	Connector	White	short
25	55	Connector	Grey	medium
10	25	Connector	Grey	long
1	1	Tool for removing connectors		
1	1	Storage box, plastic		

Atom button building sets

Round button models of atoms with caps that may be stuck together; made of hollow plastic; in various colours and sizes;
supplied in a plastic box with a lid

C9021-01 Atom button building set 1 (student)

C9021-02 Atom button building set 2 (demo)

Component parts:

C9021-01	C9021-02	Description	Colour	D (mm)
9	12	Carbon	Black	34
7	7	Oxygen	Red	34
6	5	Oxygen	Red	34
3	3	Nitrogen	Blue	34
2	2	Sulphur	Yellow	34
-	2	Phosphorus	Light brown	34
4	5	Chlorine	Green	34
-	4	Bromine	Brown	34
8	12	Carbon	Grey	34
-	4	Carbon	Grey	34
-	3	Nitrogen	Blue	34
-	4	Carbon	Black	34
30	46	Hydrogen	White	24
16	24	Caps		
1	1	Storage box, plastic		

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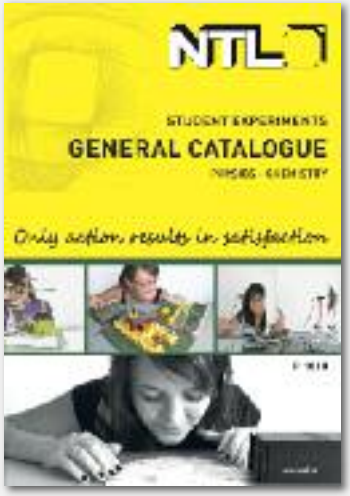

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